

PROJECT MANUAL

Elaine I. Sprauve Public Library and Museum Building

REM. EST.CONTANT & ENIGHED CRUZ BAY QTR
ST. JOHN, UNITED STATES VIRGIN ISLANDS



Derek Gabriel, Commissioner
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FOR

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DEPARTMENT OF PLANNING AND NATURAL RESOURCES
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UNITED STATES VIRGIN ISLANDS 00802

DIVISION 0 – PROCUREMENT AND CONTRACTING REQUIREMENTS

GOVERNMENT OF THE U. S. VIRGIN ISLANDS, DEPARTMENT OF PUBLIC WORKS

PROJECT NAME: Elaine I. Sprauve Public Library and Museum Building

Project Location, St. John, U.S. Virgin Islands

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GOVERNMENT OF THE U. S. VIRGIN ISLANDS, DEPARTMENT OF PUBLIC WORKS

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SECTION 01000 - SUMMARY

GOVERNMENT OF THE U. S. VIRGIN ISLANDS, DEPARTMENT OF PUBLIC WORKS

PROJECT NAME: Elaine I. Sprauve Public Library and Museum Building

Project Location, St. John, U.S. Virgin Islands

PART 1 GENERAL

1.1 PROJECT

Project Name:

OFFICE BUILDING RENOVATION, REM. EST. CONTANT & ENIGHED CRUZ
BAY QTR, ST. JOHN, U.S. VIRGIN ISLANDS

Owner's Name:

GOVERNMENT OF THE VIRGIN ISLANDS, DEPARTMENT OF PLANNING
AND NATURAL RESOURCES (DPNR)

Plan Designer's Name:

The Capital Improvement Projects Division of the Department of Public Works (CIP)

The complete Project consists of the renovation of the DPNR Office Building on St. John.. The construction shall include: demolition and construction of walls, floors, ceilings, doors, windows, electrical system, data system, security and painting as shown in the construction drawings prepared by CIP.

Owner will remove the following items before start of work:

1. N/A

B. SALVAGE BY CONTRACTOR

A. Contractor shall remove and store the following, for later reinstallation by Contractor, prior to start of work:

1. N. A.

C. WORK BY OTHERS

A. N.A.

D. OWNER FURNISHED PRODUCTS

A. Products furnished by Owner include the following categories:

1. OFCI:
Owner furnished Contractor installed.
2. OFCR:
Owner furnished Contractor rough-in:
3. OFOI:
Owner furnished Owner Installed.

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Owner Responsibilities for products in the following category:
OFCI

1. Arrange installation inspections required by regulatory agencies having jurisdiction.

Contractor's Responsibilities (for all categories unless otherwise noted): OFCR;

1. Coordinate installation of Owner furnished products with other portions of the Work.

2. Designate submittal and delivery date for each product affecting construction schedule.

3. Review submittals of Owner furnished products and verify rough-in requirements prior to installation for products in the following categories:

- a. OFCI

- b. OFCR

Notify Owner's Representative of discrepancies that would affect installation and rough-ins.

4. Promptly inspect products jointly with the Owner, record shortages, damaged or defective products listed in the following categories:

- a. OFCI

5. Protect products from damage after installation.

- a. The sink and the cabinetry in the Break Room are to remain.

6. Assemble, install connect, adjust, test and calibrate, and finish products listed in the following category:

- a. OFCI.

7. Provide mechanical, plumbing and electrical connections to Contractor installed products including installation of service fixtures for products listed in the following categories:

- a. OFCR

- b. OFCI.

8. Afford Owner's forces a reasonable opportunity for delivery and storage of their products and the execution of their work. Where required, Construction Manager shall properly connect his work to that installed by the Owner's forces.

9. Repair or replace items damaged by Construction Manager.

10. Receive and unload products at the site for products listed in the following categories:

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a. OFCI

b. OFCR.

11. Handle products at the site, including uncrating and storage for products listed in the following categories:

a. OFCI

b. OFCR.

E. CONTRACTOR FURNISHED PRODUCTS

A. Products furnished by Contractor consist of products listed in the following category:

1. CFCL.

Contractor's responsibilities:

1. As indicated in the Construction Documents.

F. OWNER OCCUPANCY

A. Owner intends to occupy the Project by the date stated in the Agreement as the contract completion date.

Cooperate with Adjacent Property Owners to minimize conflict and to facilitate the adjacent Land Owner's operations with the least amount of inconvenience.

Contractor shall take precautions to avoid excessive noise or vibration that would disturb Adjacent Property owners' operations. When directed by Owner, Contractor shall perform certain operations at designated time of day or night in order to minimize disturbance to Owner's operations.

Schedule the Work to accommodate Owner occupancy.

G. CONTRACTOR USE OF SITE AND PREMISES

A. Construction Operations are limited to areas permitted by Law, Ordinances, Permits and Contract Documents.

Arrange use of site and premises to allow:

1. Owner occupancy and operation.

2. Use of adjacent sites by the public.

Do not unreasonably encumber site or premises with materials or equipment.

Limit use of site and premises for Work and storage as follows:

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1. Maintain Owner and public access to existing building, parking, drives and walks at all times.
2. Restrict work and storage to construction areas indicated on Drawings.
3. Existing parking areas may not be used for storage.
4. Access site only as indicated on the Drawings.
5. Restrict parking to areas designated by the Owner.
6. Do not perform operations that would disrupt or delay Owner's daily operations.
7. Restrict construction personnel from access to other areas of the site and existing building, except as required to perform new and alterations work.

Assume full responsibility for protection and safekeeping of products stored on premises.

Relocate stored products which interfere with operations of Owner.

Do not load structure with weight that will endanger structure.

Emergency Building/Site Exits during Construction:

1. Keep all existing site exits open during construction period.
2. Provide barricade and signage in accordance with all requirements of the local building authorities during construction.

Utility Outages and Shutdown:

To be scheduled with the Owner's representative prior to implementing.

H. WORK SEQUENCE

A. Coordinate construction schedule and operations with Owner.

I. BID SCHEDULE

A. The Contract Scope is a Unit Price offer to include the entire Scope Of Work described in the Contract Documents. The Contractor shall complete the Bid Schedule included in the Contract Documents and submit it with their bid. The Bid Schedule is representative of a breakdown of major scope items. Items shown in the Contract Documents, but not specifically shown in the Bid Schedule are also included in the Contract Cost.

PART 2 PRODUCTS- NOT USED

PART 3 EXECUTION- NOT USED

END OF SECTION

SECTION 01000 - SUMMARY

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SECTION 01039-COORDINATION AND MEETINGS

GOVERNMENT OF THE U. S. VIRGIN ISLANDS, DEPARTMENT OF PUBLIC WORKS

PROJECT NAME: Elaine I. Sprauve Public Library and Museum Building

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PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Coordination and project conditions.

Field engineering.

Preconstruction meeting.

Site mobilization meeting.

Progress meeting.

Pre-installation meetings.

Equipment electrical characteristics and components.

Examination.

Preparation.

Cutting and Patching.

Alteration project procedures.

A. RELATED SECTIONS (NOT USED)

B. COORDINATION AND PROJECT CONDITIONS

A. Coordinate scheduling, submittals, and Work of the various sections of the Specifications to ensure an efficient and orderly sequence of construction elements.

Verify all existing utility locations.

C. FIELD ENGINEERING

A. Contractor shall locate and protect all survey control and reference points, and shall accurately replace and have verified by the Engineer any such point, which is damaged or moved, at his own expense.

Control datum for survey is as that shown on Drawings. The survey shall establish certain reference points and benchmarks in the immediate vicinity of the work areas. The Contractor shall lay out all additional lines and grades and otherwise do all layout and measurements necessary for the proper completion of the work.

Verify setbacks and easements; confirm drawings dimensions and elevations.

Provide field engineering services. Establish elevations, lines, and levels, utilizing recognized engineering survey practices.

SECTION 01039-COORDINATION AND MEETINGS

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~~The Contractor shall furnish assistance to the Engineer as requested to check the layout or~~
otherwise control the work. Such assistance shall be understood to include the provision of suitable manpower to assist the Engineer in taping measurements, holding a survey rod for checking grades and the like.

The Engineer reserves the right to inspect or check any of this work, and the Contractor shall not claim added compensation for any delay occasioned by required as a result of the Engineer's inspections.

D. PRECONSTRUCTION MEETING

A. Owner will schedule a meeting after Notice of Award.

Attendance Required:

Owner, Owner's Construction Representative, Designer, and Contractor.

Agenda:

1. Submission of list of testing agency and other parties providing services on the project.
2. Procedures and processing of field decisions, submittals, and substitutions, applications for payments, pricing request, Change Orders, and Contract closeout procedures.
3. Procedures for layout of the project, establishing controls, limits of right-of-way and easements.
4. Scheduling.

Contractor will record minutes and distribute copies to participants and those affected by decisions made.

E. SITE MOBILIZATION MEETING

A. Owner's Representative may schedule a meeting at the project site prior to construction start-up.

Attendance Required:

Owner's Representative/Engineer, Contractor's Superintendent, and major Subcontractors.

Agenda:

1. Use of the site by Owner and Contractor.
2. Owner's requirements. Features to remain.
3. Construction facilities provided by Contractor.
4. Temporary utilities provided by Contractor.

SECTION 01039-COORDINATION AND MEETINGS

GOVERNMENT OF THE U. S. VIRGIN ISLANDS, DEPARTMENT OF PUBLIC WORKS

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5. Security and housekeeping procedures

6. Schedules.
7. Application for payment procedures.
8. Procedures for testing.
9. Procedures for maintaining record documents.

Contractor will record minutes and distribute copies to participants and those affected by decisions made.

F. PROGRESS MEETINGS

- A. Schedule and administer meetings throughout the progress of the Work at weekly intervals or intervals agreed to by Owner's Representative and Contractor.

Owner's Representative will make arrangements for meetings, prepare agenda with copies for participants, and preside at meetings.

Attendance Required:

Job superintendent, major Subcontractors suppliers, and Owner's Representative as appropriate to agenda topics for each meeting.

Agenda:

1. Review minutes of previous meetings.
2. Review of Work progress.
3. Field observations, problems, and decisions.
4. Identification of problems which impede planned progress.
5. Review of submittals schedule and status of submittals.
6. Review of off-site fabrication and delivery schedules.
7. Maintenance of progress schedule.
8. Corrective measures to regain projected schedule.
9. Planned progress during succeeding work period.
10. Coordination of projected progress.
11. Maintenance of quality and work standards.
12. Effect of proposed changes on progress schedule and coordination.
13. Other business relating to Work.

SECTION 01039-COORDINATION AND MEETINGS

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~~Owner's Representative will record minutes and distribute copies to participants and those~~
affected by decisions made.

PART 2 - **PRODUCTS (NOT USED)**

PART 3 - **EXECUTION (NOT USED)**

**END OF
SECTION**

SECTION 01045-CUTTING AND PATCHING

GOVERNMENT OF THE U. S. VIRGIN ISLANDS, DEPARTMENT OF PUBLIC WORKS

PROJECT NAME: Elaine I. Sprauve Public Library and Museum Building

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PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of Contract, including General and Supplementary Conditions and other Division- 1 Specification Sections, apply to this Section.

A. SUMMARY

- A. This Section specifies administrative and procedural requirements for cutting and patching.

Refer to other Sections for specific requirements and limitations applicable to cutting and patching individual parts of the Work.

1. Requirements of this Section apply to mechanical and electrical installations. Refer to Division- 23 and Division- 26 Sections for other requirements and limitations applicable to cutting and patching mechanical and electrical installations.
2. Demolition of selected portions of the building for alterations is included in Section "Selective Demolition."

B. SUBMITTALS

- A. Cutting and Patching Proposal:

Where approval of procedures for cutting and patching is required before proceeding, submit a proposal describing procedures well in advance of the time cutting and patching will be performed and request approval to proceed. Include the following information, as applicable, in the proposal:

1. Describe the extent of cutting and patching required and how it is to be performed indicate why it cannot be avoided.
2. Describe anticipated results in terms of changes to existing construction; include changes to structural elements and operating components as well as changes in the building's appearance and other significant visual elements.
3. List products to be used and firms or entities that will perform Work.
4. Indicate dates when cutting and patching is to be performed.
5. List utilities that will be disturbed or affected, including those that will be relocated and those that will be temporarily out-of-service. Indicate how long service will be disrupted.

SECTION 01045-CUTTING AND PATCHING

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6. Where cutting and patching involves addition of reinforcement to structural elements, submit details and engineering calculations to show how reinforcement is integrated with the original structure.
7. Approval by the Owner/Owner's Representative to proceed with cutting and patching does not waive the Owner/Owner's Representative's right to later require complete removal and replacement of a part of the Work found to be unsatisfactory.

C. QUALITY ASSURANCE

A. Requirements for Structural Work:

Do not cut and patch structural elements in a manner that would reduce their load-carrying capacity or load-deflection ratio.

1. Obtain approval of the cutting and patching pricing proposal before cutting and patching the following structural elements:
 - a. Foundation construction
 - b. Bearing and retaining walls
 - c. Structural concrete
 - d. Structural steel
 - e. Lintels
 - f. Timber and primary wood framing
 - g. Miscellaneous structural metals
 - h. Exterior curtain wall construction

Operational and Safety Limitations:

Do not cut and patch operating elements or safety related components in a manner that would result in reducing their capacity to perform as intended, or result in increased maintenance, or decreased operational life or safety.

1. Obtain approval of the cutting and patching pricing proposal before cutting and patching the following operating elements or safety related systems:
 - a. Shoring, bracing, and sheeting.
 - b. Water, moisture, or vapor barriers.
 - c. Membranes and flashings.
 - d. Electrical wiring systems.

SECTION 01045-CUTTING AND PATCHING

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Visual Requirements:

Do not cut and patch construction exposed on the exterior or in occupied spaces, in a manner that would, in the Owner's Representative's opinion, reduce the building's aesthetic qualities, or result in visual evidence of cutting and patching. Remove and replace Work cut and patched in a visually unsatisfactory manner.

1. If possible retain the original installer or fabricator to cut and patch the following categories of exposed Work, or if it is not possible to engage the original installer or fabricator, engage another recognized experienced and specialized firm:
 - a. Processed concrete finishes
 - b. Stonework and stone masonry
 - c. Ornamental metal

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Use materials that are identical to existing materials. If identical materials are not available or cannot be used where exposed surfaces are involved, use materials that match existing adjacent surfaces to the fullest extent possible with regard to visual effect. Use materials whose installed performance will equal or surpass that of existing materials.

PART 3 - EXECUTION

3.1 INSPECTION

- A. Before cutting existing surfaces, examine surfaces to be cut and patched and conditions under which cutting and patching is to be performed. Take corrective action before proceeding, if unsafe or unsatisfactory conditions are encountered.
 1. Before proceeding, meet at the site with parties involved in cutting and patching, including mechanical and electrical trades. Review areas of potential interference and conflict. Coordinate procedures and resolve potential conflicts before proceeding.

B. PREPARATION

- A. Temporary Support:

Provide temporary support of Work to be cut.

Protection:

Protect existing construction during cutting and patching to prevent damage.

Provide protection from adverse weather conditions for portions of the Project that might be exposed during cutting and patching operations.

SECTION 01045-CUTTING AND PATCHING

GOVERNMENT OF THE U. S. VIRGIN ISLANDS, DEPARTMENT OF PUBLIC WORKS

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Avoid interference with use of adjoining areas or interruption of free passage to adjoining areas.

Take all precautions necessary to avoid cutting existing pipe, conduit or ductwork serving the building, but scheduled to be removed or relocated until provisions have been made to bypass them.

C. PERFORMANCE

A. General:

Employ skilled workmen to perform cutting and patching. Proceed with cutting and patching at the earliest feasible time and complete without delay.

1. Cut existing construction to provide for installation of other components or performance of other construction activities and the subsequent fitting and patching required to restore surfaces to their original condition.

Cutting:

Cut existing construction using methods least likely to damage elements to be retained or adjoining construction. Where possible review proposed procedures with the original installer; comply with the original installer's recommendations.

1. In general, where cutting is required use hand or small power tools designed for sawing or grinding, not hammering and chopping. Cut holes and slots neatly to size required with minimum disturbance of adjacent surfaces. Temporarily cover openings when not in use.
2. To avoid marring existing finished surfaces, cut or drill from the exposed or finished side into concealed surfaces.
3. Cut through concrete and masonry using a cutting machine such as a carborundum saw or diamond core drill.
4. Comply with requirements of applicable Sections of Division-2 where cutting and patching requires excavating and backfilling.
5. By-pass utility services such as pipe or conduit, before cutting, where services are shown or required to be removed, relocated or abandoned. Cut-off pipe or conduit in walls or partitions to be removed. Cap, valve or plug and seal the remaining portion of pipe or conduit to prevent entrance of moisture or other foreign matter after by-passing and cutting.

Patching:

Patch with durable seams that are as invisible as possible. Comply with specified tolerances.

1. Where feasible, inspect and test patched areas to demonstrate integrity of the installation.

SECTION 01045-CUTTING AND PATCHING

GOVERNMENT OF THE U. S. VIRGIN ISLANDS, DEPARTMENT OF PUBLIC WORKS

PROJECT NAME: Elaine I. Sprauve Public Library and Museum Building

Project Location, St. John, U.S. Virgin Islands

2. Restore exposed finishes of patched areas and extend finish restoration into retained adjoining construction in a manner that will eliminate evidence of patching and refinishing.

D. CLEANING

- A. Thoroughly clean areas and spaces where cutting and patching is performed or used as access. Remove completely paint, mortar, oils, putty and items of similar nature. Thoroughly clean piping, conduit and similar features before painting or other finishing is applied. Restore damaged pipe covering to its original condition.

END OF SECTION

SECTION 01095 – REFERENCE STANDARDS AND DEFINITIONS

GOVERNMENT OF THE U. S. VIRGIN ISLANDS, DEPARTMENT OF PUBLIC WORKS

PROJECT NAME: Elaine I. Sprauve Public Library and Museum Building

Project Location, St. John, U.S. Virgin Islands

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division I Specification Sections, apply to this Section.

A. DEFINITIONS

A. General:

Basic Contract definitions are included in the Conditions of the Contract.

Indicated:

The term indicated refers to graphic representations, notes, or schedules on Drawings, or other Paragraphs of Schedules in the Specifications, and similar requirements in the Contract Documents. Terms such as shown, noted, scheduled, and specified are used to help the reader locate the reference. There is no limitation on location.

Directed:

Terms such as directed, requested, authorized, selected, approved, required and permitted mean directed by the Owner's Representative, requested by the Owner's Representative, and similar phrases.

Approved:

The term approved, when used in conjunction with the Owner's Representative's action on the Contractor's submittals, applications, and requests, is limited to the Owner's Representative's duties and responsibilities as stated in the Conditions of the Contract.

Regulations:

The term regulations includes laws, ordinances, statutes, and lawful orders issued by authorities having jurisdiction, as well as rules, conventions, and agreements within the construction industry that control performance of the Work.

Furnish:

The term furnish means supply and deliver to the Project site, ready for unloading, unpacking, assembly, installation, and similar operations.

Install:

The term describes operations at the Project site including the actual unloading, unpacking, assembly, erection, placing, anchoring, applying, working to dimension, and finishing, curing, protecting, cleaning, and similar operations.

Provide:

The term provide means to furnish and install, complete and ready for the intended use.

Installer:

SECTION 01095 – REFERENCE STANDARDS AND DEFINITIONS

GOVERNMENT OF THE U. S. VIRGIN ISLANDS, DEPARTMENT OF PUBLIC WORKS

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~~An installer is the Contractor or another entity engaged by the Contractor, either as~~
an employee, subcontractor, or contractor of lower tier, to perform a particular construction activity, including installation, erection, application, and similar operations. Installers are required to be experienced in the operations they are engaged to perform.

Trades:

Using terms such as carpentry is not intended to imply that certain construction activities must be performed by accredited or unionized individuals of a corresponding generic name, such as carpenter. It also does not imply that requirements specified apply exclusively to tradespersons of the corresponding generic name.

Project site:

The space available to the Contractor for performing construction activities either exclusively or in conjunction with others performing other work as part of the Project. The extent of the Project site is shown on the Drawings and may or may not be identical with the description of the land on which the Project is to be built.

Testing Agencies:

A testing agency is an independent entity engaged to perform specific inspections or tests, either at the Project site or elsewhere, or to reports on and, if required, to interpret results of those inspections or tests.

Owner's Representative:

Agent authorized to act on behalf of the Owner.

B. SPECIFICATION FORMAT AND CONTENT EXPLANATION

A. Specification Format:

These Specifications are organized into Divisions and Sections based on the Construction Specification Institute's 50 - Division Format and MASTER FORMAT numbering system.

Specification Content:

This Specification uses certain conventions regarding the style of language and the intended meaning of certain terms, words, and phrases when used in particular situations or circumstances. These conventions are explained as follows:

1. Abbreviated Language:

Language used in Specifications and other Contract Documents is abbreviated. Words and meanings shall be interpreted as appropriate. Words that are implied, but not stated, shall be interpolated as the sense requires. Singular words will be interpreted as plural and plural words interpreted as singular where applicable as the context of the Contract Documents indicate.

SECTION 01095 – REFERENCE STANDARDS AND DEFINITIONS

GOVERNMENT OF THE U. S. VIRGIN ISLANDS, DEPARTMENT OF PUBLIC WORKS

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~~2 Imperative and streamlined language is used generally in the Specifications~~

Requirements expressed in the imperative mood are to be performed by the Contractor. At certain locations in the Text, subject language is used for clarity to describe responsibilities that must be fulfilled indirectly by the Contractor, or by other means when so noted.

- a. The words "shall be" are implied wherever a colon (;) is used within a sentence or phrase.

C. INDUSTRY STANDARDS

A. Applicability of Standards:

Except where the Contract Documents include more stringent requirements, applicable construction industry standards have the same force and effect as if bound or copied directly into the Contract Documents to the extent referenced. Such standards are made a part of the Contract Documents by reference.

Publication Dates:

Comply with the standards in effect as of the date of the Contract Documents.

Conflicting Requirements:

Where compliance with two or more standard is specified and where the standards may establish different or conflicting requirements for minimum quantities or quality levels, refer requirements that are different but apparently equal and other uncertainties to the Owner's Representative for a decision before proceeding.

1. Minimum Quantity or Quality Levels:

The quantity or quality level shown or specified shall be the minimum provided or performed. The actual installation may comply exactly with the minimum quantity or quality specified, or it may exceed the minimum within reasonable limits. To comply with these requirements, indicated numeric values are minimum or maximum, as appropriate, for the context of the requirements. Refer uncertainties to the Owner's Representative for a decision before proceeding.

Copies of Standards:

Each entity engaged in construction on the project is required to be familiar with industry standards applicable to its construction activity. Copies of applicable standards are not bound with the Contract Documents.

1. Where copies of standards are needed to perform a required construction activity, the Contractor shall obtain copies directly from the publication source.

Abbreviations and Names:

Trade association names and titles of general standards are frequently abbreviated. Where such acronyms or abbreviations are used in the Specifications or other Contract Documents, they mean the recognized name of the trade association, standards-generating organization, authority having jurisdiction, or other entity applicable to the context of the Text provision. Refer to the "Encyclopedia of Associations," published by Gale Research Co., available in most libraries.

D. SUBMITTALS

SECTION 01095 – REFERENCE STANDARDS AND DEFINITIONS

GOVERNMENT OF THE U. S. VIRGIN ISLANDS, DEPARTMENT OF PUBLIC WORKS

PROJECT NAME: Elaine I. Sprauve Public Library and Museum Building

Project Location, St. John, U.S. Virgin Islands

A. Permits, Licenses, and Certificates

For the Owner's records, submit copies of permits, licenses, certifications, inspection reports, releases, jurisdictional settlements, notices, receipts for fee payments, judgments, and similar documents, correspondence, and records established in conjunction with compliance with standards and regulations bearing upon performance of the Work.

PART 2 - PRODUCTS (NOT APPLICABLE)

PART 3 - EXECUTION (NOT APPLICABLE)

END OF SECTION

SECTION 01200 – PRICE AND PAYMENT PROCEDURES

GOVERNMENT OF THE U. S. VIRGIN ISLANDS, DEPARTMENT OF PUBLIC WORKS

PROJECT NAME: Elaine I. Sprauve Public Library and Museum Building

Project Location, St. John, U.S. Virgin Islands

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Procedures for preparation and submittal of applications for progress payments.

Documentation of changes in Contract Sum and Contract Time.

Change procedures.

Procedures for preparation and submittal of application for final payment.

A. **RELATED SECTIONS:** N/A

B. SCHEDULE OF VALUES

A. Submit a printed schedule on AIA Form G703 -Application and Certificate for Payment Continuation Sheet.

Submit Schedule of Values in duplicate within 15 days after date of Owner-Contractor Agreement.

Format:

Utilize the Table of Contents of this Project Manual. Identify each line item with number and title of the specification Section. Identify site mobilization, bonds, and insurance, and site demobilization.

Revise schedule to list approved Change Orders, with each Application for Payment.

C. APPLICATIONS FOR PROGRESS PAYMENT

A. Payment Period:

Submit at intervals stipulated in the Agreement.

Present required information as typewritten/computer-generated form.

Form:

`including continuation sheets when required.

D. For each item, provide a column for listing each of the following:

1. Item Number
2. Description of Work
3. Scheduled Values
4. Previous Applications
5. Work in Place and Stored Materials under this Application
6. Total Completed and Stored to Date of Application

SECTION 01200 – PRICE AND PAYMENT PROCEDURES

GOVERNMENT OF THE U. S. VIRGIN ISLANDS, DEPARTMENT OF PUBLIC WORKS

PROJECT NAME: Elaine I. Sprauve Public Library and Museum Building

Project Location, St. John, U.S. Virgin Islands

7. Percentage of Completion

8. Balance to Finish

9. Retainage

Execute certification by signature of authorized officer.

Use data from approved Schedule of Values. Provide dollar value in each column for each line item for portion of work performed and for stored Products.

List each authorized Change Order as a separate line item, listing Change Order number and dollar amount as for an original time of Work.

Submit two copies of each Application for Payment.

Include the following with the application:

1. Transmittal Letter as specified for Submittals in Section 01300.
2. Construction progress schedule, revised and current as specified in Section 01300.
3. Current construction photographs specified in Section 01300.
4. Partial release of liens from major Subcontractors and Vendors.
5. Affidavits attesting to off-site stored products.

When Owner's Representative requires substantiating information, submit data justifying dollar amounts in question. Provide one copy of data with cover letter for each copy of submittal. Show application number and date, and line item by number and description.

D. MODIFICATION PROCEDURES

A. Owner's Representative will advise of minor changes in the Work not involving an adjustment to Contract Sum or Contract Time as authorized by the Conditions of the Contract by issuing supplemental instructions on AIA Form G710.

Construction Change Directive:

Owner's Representative may issue a document, signed by Owner, instructing Construction Manager to proceed with a change in the Work, for subsequent inclusion in a Change Order.

1. The document will describe changes in the Work, and will designate method of determining any change in Contract Sum or Contract Time.
2. Promptly execute the change in Work.

Pricing Request:

SECTION 01200 – PRICE AND PAYMENT PROCEDURES

GOVERNMENT OF THE U. S. VIRGIN ISLANDS, DEPARTMENT OF PUBLIC WORKS

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~~Owner's Representative may issue a document which includes a detailed description~~ of a proposed change with supplementary or revised Drawings and specifications, a change in Contract Time for executing the change with a stipulation of any overtime work required and the period of time during which the requested price will be considered valid. Construction Manager shall prepare and submit a fixed price quotation within 15 days.

Computation of Change in Contract Amount:

1. For change requested by Owner's Representative for work falling under a fixed price contract, the amount will be based on Construction Manager's price quotation.
2. For change requested by Construction Manager, the amount will be based on the Construction Manager's request for a Change Order as approved by Owner.
3. For pre-determined unit prices and quantities, the amount will be based on the fixed unit prices.
4. For change ordered by Owner's Representative without a quotation from the Construction Manager, the amount will be determined by Owner's Representative based on the Construction Manager's substantiation of costs as specified for Time and Material Work.

Substantiation of Costs:

Provide full information required for evaluation.

1. Provide the following data:
 - a. Quantities of products, labor, and equipment
 - b. Taxes, insurance, and bonds
 - c. Overhead and profit
 - d. Justification for any change in Contract Time
 - e. Credit for deletions from Contract, similarly documented
2. Support each claim for additional costs with additional information:
 - a. Origin and date of claim
 - b. Dates and times work was performed, and by whom
 - c. Time records and wage rates paid
 - d. Invoices and receipts for products, equipment, and subcontracts, similarly documented

SECTION 01200 – PRICE AND PAYMENT PROCEDURES

GOVERNMENT OF THE U. S. VIRGIN ISLANDS, DEPARTMENT OF PUBLIC WORKS

PROJECT NAME: Elaine I. Sprauve Public Library and Museum Building

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~~3. For Time and Material Work submit itemized account and supporting data after~~

completion of change, within time limits indicated in the Conditions of the Contract.

Execution of Change Orders:

Owner's Representatives will issue Change Orders for signatures of parties as provided in the Conditions of the Contract on AIA G701.

After execution of Change Order, promptly revise Schedules of Values and Application for Payment forms to record each authorized Change Order as a separate line item and adjust the Contract Sum.

Promptly revise Progress Schedules to reflect any change in Contract Time, revise sub-schedules to adjust times for other items of work affected by the change, and resubmit.

E. APPLICATION FOR FINAL PAYMENT

A. Prepare Application for Final Payment as specified for progress payments, identifying total adjusted Contract Sum, previous payments, and sum remaining due.

Application for Final Payment will not be considered until the following have been accomplished:

1. All closeout procedures specified in Section 01700

PART 2 - PRODUCTS-NOT USED

PART 3 - EXECUTION-NOT USED

END OF SECTION

SECTION 01300 – SUBMITTALS

GOVERNMENT OF THE U. S. VIRGIN ISLANDS, DEPARTMENT OF PUBLIC WORKS

PROJECT NAME: Elaine I. Sprauve Public Library and Museum Building

Project Location, St. John, U.S. Virgin Islands

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Project coordination

Preconstruction meeting

Progress meetings

Progress photographs

A. RELATED SECTIONS

A. Section 01700-Execution Requirements:
Additional coordination requirements.

Section 01780-Closeout Submittals:
Project record documents.

B. PROJECT COORDINATION

A. Contractor:

The Contractor shall be responsible for overall project coordination between subcontractors and trade contractors.

Cooperate with the Contractor in allocation of mobilization areas of site; for field offices and storage, for personnel access, traffic, and parking facilities.

During construction, coordinate use of site and facilities through the Contractor.

Comply with Contractor procedures for intra-project communications; submittals, reports and records, schedules, coordination drawings, and recommendations; and resolution of ambiguities and conflicts. Particular attention should be given to the Contractor's subcontractor safety policy.

Comply with instructions of the Contractor for use of temporary utilities and construction facilities.

Coordinate field engineering and layout work under instructions of the Contractor.

The Contractor to make the following types of submittals to Owner's Representative:

1. Requests for Interpretation
2. Requests for Substitution
3. Shop Drawings, Product Data, and Samples
4. Test and Inspection Reports
5. Manufacturer's Instructions and Field Reports

SECTION 01300 – SUBMITTALS

GOVERNMENT OF THE U. S. VIRGIN ISLANDS, DEPARTMENT OF PUBLIC WORKS

PROJECT NAME: Elaine I. Sprauve Public Library and Museum Building

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~~6. Applications for Payment and Change Order requests~~

- 7. Progress Schedules
- 8. Coordination of Drawings
- 9. Closeout Submittals

PART 2 - PRODUCTS (NOT USED)

PART 3 – EXECUTION

3.1 PRECONSTRUCTION MEETING

A. Contractor will schedule a meeting after Notice of Award and prior to mobilization.

Attendance Required:

- 1. Owner:
Owner's Representative and invited Consultants
- 2. Contractor:
Project Manager and Job Superintendent
- 3. Major Sub-contractors as requested by the Owner and Contractor.

Minimum Agenda:

- 1. Execution of Owner-Contractor Agreement.
- 2. Submission of executed bonds and insurance certificates.
- 3. Submission of progress schedule.
- 4. Procedures and processing of field decisions, submittals and substitutions, applications for payments, pricing requests, Change Orders, and Contract closeout procedures.
- 5. Use of premises by Owner and Contractor.
- 6. Construction facilities and controls provided by Owner.
- 7. Temporary utilities provided by Owner.
- 8. Survey and construction layout.
- 9. Security and housekeeping procedures.
- 10. Schedules.
- 11. Application for payment procedures.
- 12. Procedures for testing.

SECTION 01300 – SUBMITTALS

GOVERNMENT OF THE U. S. VIRGIN ISLANDS, DEPARTMENT OF PUBLIC WORKS

PROJECT NAME: Elaine I. Sprauve Public Library and Museum Building

Project Location, St. John, U.S. Virgin Islands

13. Procedures for maintaining record documents

14. Scheduling.

15. Scheduling activities of Material Testing.

Contractor shall record minutes and distribute copies within five days after meeting to participants, with one copy to Owner's Representative, Owner, participants, and those affected by decisions made.

B. PROGRESS MEETINGS

A. Contractor shall schedule and administer meetings throughout the progress of the Work at maximum bi-monthly intervals. A representative from each major trade contractor shall be required to attend these meetings, as requested by the Owner's Representative.

The Contractor shall make arrangements for meetings, prepare agenda with copies for participants, and preside at meetings.

Attendance Required:

1. Contractor, Project Manager and Job Superintendent.
2. Owner's Representative.
3. Engineer/Architect.
4. Major Sub-contractors as appropriate to agenda topics for each meeting.

Minimum Agenda:

1. Review minutes of previous meetings.
2. Review of Work progress.
3. Field observations, problems, and decisions.
4. Identification of problems which impede planned progress.
5. Review of submittals schedule and status of submittals.
6. Maintenance of progress schedule.
7. Corrective measures to regain projected schedules.
8. Planned progress during succeeding work period.
9. Maintenance of quality and work standards.
10. Effect of proposed changes on progress schedule and coordination.
11. Other business relating to Work.

SECTION 01300 – SUBMITTALS

GOVERNMENT OF THE U. S. VIRGIN ISLANDS, DEPARTMENT OF PUBLIC WORKS

PROJECT NAME: Elaine I. Sprauve Public Library and Museum Building

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~~Contractor shall record minutes and distribute copies within five days after meeting to~~
participants, with one copy to Owner's Representative, Owner, participants, and those affected
by decisions made.

C. PROGRESS PHOTOGRAPHS

A. Provide photographs of site and construction throughout progress of Work produced by an experienced photographer, acceptable to Owner's Representative.

Take photographs on date for each application for a payment and as follows:

1. Completed demolition and Site clearing.
2. Excavations.
3. Foundations.
4. Utility Installation – depth, alignment, stub-outs
5. Final completion.

Views:

1. Provide non-aerial photographs from three cardinal views at each specified time, until Date of Substantial Completion.
2. Consult with Owner's Representative for instructions on views required.
3. Provide factual presentation.
4. Provide correct exposure and focus, high resolution and sharpness, maximum depth of field, and minimum distortion.

Each Photo:

Full color, jpeg format

1. Provide 3 sets on separate USB sticks
Size:
5 MB file
2. Identify each photo on file name. Identify name of Project, contract number, phase, date and orientation of view.

Deliver USB sticks with Application for Payment and transmittal letter specified in this Section.

END OF SECTION

SECTION 01325 – CONSTRUCTION PROGRESS SCHEDULE
GOVERNMENT OF THE U. S. VIRGIN ISLANDS, DEPARTMENT OF PUBLIC WORKS
PROJECT NAME: Elaine I. Sprauve Public Library and Museum Building
Project Location, St. John, U.S. Virgin Islands

PART 1 – GENERAL

1.1 SECTION INCLUDES

A. Preliminary schedule.

Construction progress schedule, bar chart type.

A. RELATED SECTIONS (NOT APPLICABLE)

B. SUBMITTALS

A. Within 10 days after date established in Notice To Proceed, submit preliminary schedule defining planned operations for the first 30 days of Work, with a general outline for remainder of Work, in Microsoft Project format on a USB stick.

If preliminary schedule requires revision after review, submit by email in the Microsoft Project format a revised schedule within 10 days.

Within 30 days after review of preliminary schedule, submit draft of proposed complete schedule by email in the Microsoft Project format for review.

Within 10 days after joint review, submit complete schedule by email in the Microsoft Project format.

Submit updated paper schedule with each Application for Payment.

Submit the number of opaque reproductions that the Contractor requires, plus four copies which will be retained by the Owner's Representative.

G. Submit under transmittal letter form specified in Section 01300.

C. QUALITY ASSURANCE

A. Scheduler:

Contractor's personnel specialist Consultant specializing in CPM scheduling with two years minimum experience in scheduling construction work of a complexities comparable to this Project, and having use of computer facilities capable of delivering by email a detailed graphic schedule in Microsoft Project format within 48 hours of request.

D. SCHEDULE FORMAT

A. Listings:

In chronological order according to the start date for each activity. Identify each activity with the applicable Specification Section number.

Hard Copy Sheet Size:

Multiples of 8-1/2 x 11 inches.

Scale and Spacing:

SECTION 01325 – CONSTRUCTION PROGRESS SCHEDULE
GOVERNMENT OF THE U. S. VIRGIN ISLANDS, DEPARTMENT OF PUBLIC WORKS
PROJECT NAME: Elaine I. Sprauve Public Library and Museum Building
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To allow for notations and revisions

Software Format:
Microsoft Project

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION

3.1 PRELIMINARY SCHEDULE

A. Prepare preliminary schedule in the form of a horizontal bar chart.

A. CONTENT

A. Show complete sequence of construction by activity, with dates for beginning and completion of each element of construction.

Identify each item by Specification Section number.

Identify Work of separate stages and other logically grouped activities.

Provide separate schedule of submittal dates for shop drawings, product data, and dates reviewed submittals will be required from the Owner's Representative. Indicate decision dates for selection of finishes.

Provide legend for symbols and abbreviations used.

B. BAR CHARTS

A. Include a separate bar for each major portion of Work or operation.

C. REVIEW AND EVALUATION OF SCHEDULE

A. Participate in joint review and evaluation of schedule with Owner's Representative at each submittal.

Evaluate project status to determine work behind schedule and work ahead of schedule.

After review, revise as necessary as result of review, and resubmit within 10 days.

D. UPDATING SCHEDULE

A. Maintain schedules to record actual start and finish dates of completed activities.

Indicate progress of each activity to date of revision, with projected completion date of each activity.

Annotate diagrams to graphically depict current status of Work.

Identify activities modified since previous submittal, major changes in Work, and other identifiable changes.

SECTION 01325 – CONSTRUCTION PROGRESS SCHEDULE
GOVERNMENT OF THE U. S. VIRGIN ISLANDS, DEPARTMENT OF PUBLIC WORKS
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Indicate changes required to maintain Date of Substantial Completion

E. DISTRIBUTION OF SCHEDULE

- A. Distribute copies of updated schedules to Contractor's project site file, to Subcontractors, Suppliers, Engineer/Architect, Owner's Representative, and other concerned parties.

Instruct recipients to promptly report, in writing, problems anticipated by projections shown in schedules.

END OF SECTION

SECTION 01400 – QUALITY CONTROL

GOVERNMENT OF THE U. S. VIRGIN ISLANDS, DEPARTMENT OF PUBLIC WORKS

PROJECT NAME: Elaine I. Sprauve Public Library and Museum Building

Project Location, St. John, U.S. Virgin Islands

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Quality assurance- control of installation

Tolerances

References and standards

Mock-up

Inspecting and testing laboratory services

Manufacturers' field services

A. RELATED SECTIONS

A. Section 01000 General Specifications:

Contractor's Shop and Working Drawings.

B. QUALITY ASSURANCE - CONTROL OF INSTALLATION

A. Monitor quality control over suppliers, manufacturers, Products, services, site conditions, and workmanship, to produce Work of specified quality.

Comply with manufacturers' instructions, including each step in sequence.

Should manufacturers' instructions conflict with Contract Documents, request clarification from Owner's Representative/Engineer before proceeding.

Comply with specified standards as minimum quality for the Work except where more stringent tolerances, codes, or specified requirements indicate higher standards or more precise workmanship.

Perform Work by persons qualified to produce required and specified quality.

Verify that field measurements are as indicated on shop drawings or as instructed by the manufacturer.

Secure Products in place with positive anchorage devices designed and sized to withstand stresses, vibration physical distortion, or disfigurement.

C. TOLERANCES

A. Monitor fabrication and installation tolerance control of Products to produce acceptable Work. Do not permit tolerances to accumulate.

Comply with manufacturers' tolerances conflict with Contract Documents, request clarification from Owner's Representative/Engineer before proceeding.

Adjust Products to appropriate dimensions; position before securing Products in place.

SECTION 01400 – QUALITY CONTROL

GOVERNMENT OF THE U. S. VIRGIN ISLANDS, DEPARTMENT OF PUBLIC WORKS

PROJECT NAME: Elaine I. Sprauve Public Library and Museum Building

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D. REFERENCES AND STANDARDS

- A. For Products or workmanship specified by association, trade, or other consensus standards, complies with requirements of the standard, except when more rigid requirements are specified or are required by applicable codes.

Conform to reference standard by date of issue current on date of Contract Documents, except where a specific date is established by code.

Obtain copies of standards where required by product Specification Sections.

Neither the contractual relationships, duties, nor responsibilities of the parties in Contract, nor those of the Owner's Representative/Engineer shall be altered from the Contract Documents by mention or inference otherwise in any reference document.

E. MOCK UP (NOT USED)

F. INSPECTION AND TESTING LABORATORY SERVICES

- A. Owner may appoint, employ, and pay for specified services of an independent firm to perform construction testing services.

The independent firm will perform testing and other services specified in individual sections and as required by the Owner.

Testing reports will be submitted by the independent firm to the Owner indicating services and indicating compliance or non-compliance with the Contract Documents.

Cooperate with independent firm; furnish safe access and assistance by incidental labor as requested.

1. Notify Owner's Representative and/or independent firm 48 hours prior to expected time for operations requiring services. These operations include, but are not necessarily limited to:

- a. Cast-in-place concrete placement.
- b. Bituminous pavement construction.

G. INSPECTION SERVICES

- A. Owner may appoint, employ, and pay for specified services of an independent firm to perform observation.

The independent firm will perform observations and other services specified in individual Specification Sections and as required by the Owner.

Reports will be submitted by the independent firm to the Owner, in duplicate, indicating observations and indicating compliance or non-compliance with Contract Documents.

Cooperate with independent firm; furnish safe access and assistance by incidental labor as requested.

SECTION 01400 – QUALITY CONTROL

GOVERNMENT OF THE U. S. VIRGIN ISLANDS, DEPARTMENT OF PUBLIC WORKS

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Project Location, St. John, U.S. Virgin Islands

- ~~1. Notify Owner's Representative and /or independent firm 48 hours prior to expected time for operations requiring services.~~

Observations do not relieve Contractor to perform Work to the contract requirements.

H. MANUFACTURERS' FIELD SERVICES

- A. When specified in individual Specification Sections, require material or Product suppliers or manufacturers to provide qualified staff personnel to observe site conditions, conditions of surfaces and installation, quality of workmanship, as applicable, and to initiate instructions when necessary.

Submit qualifications of observer to Owner 30 days in advance of required observations. Observer subject to approval of Owner.

Report observations and site decisions or instructions given to applicators or installers that are supplemental or contrary to manufacturers' written instructions.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Verify that existing site conditions and substrate surfaces are acceptable for subsequent Work. Beginning new Work means acceptance of existing conditions.

Verify that existing substrate is capable of structural support or attachment of new Work being applied or attached.

Examine and verify specific conditions described in individual Specification Sections.

Verify that utility services are available, of the correct characteristics, and in the correct locations.

A. PREPARATION

- A. Clean substrate surfaces prior to applying next material or substance.

Seal cracks or openings of substrate prior to applying next material or substance.

Apply manufacturer required or recommended substrate primer, sealer, or conditioner prior to applying any new material or substance in contact or bond.

END OF SECTION

SECTION 01600 – MATERIAL AND EQUIPMENT HANDLING
GOVERNMENT OF THE U. S. VIRGIN ISLANDS, DEPARTMENT OF PUBLIC WORKS
PROJECT NAME: Elaine I. Sprauve Public Library and Museum Building
Project Location, St. John, U.S. Virgin Islands

PART 1 - GENERAL

1.1 REQUIREMENTS INCLUDED

A. Products

Transportation and Handling

Storage and Protection

Product Options

Products List

Substitutions

A. RELATED REQUIREMENTS

A. Section 01400- Quality Control:
Submittal of manufacturer's data

Section 01700- Contract Closeout:
Operation and maintenance data

PART 2 - PRODUCTS

2.1 GENERAL

A. Products include the material, equipment, and systems used on this Project.

Comply with the Specifications and referenced standards as minimum requirements.

Components required to be supplied in quantity within a Specification Section shall be the same, and shall be interchangeable.

A. TRANSPORTATION AND HANDLING

A. Transport products by methods that will avoid product damage and deliver them in undamaged condition in the manufacturer's unopened containers or packaging.

Provide equipment and personnel to handle unloading and storage of the products by methods to prevent soiling or damage.

Promptly inspect the shipments to assure that the products comply with requirements, the quantities are correct, and the products are undamaged.

B. STORAGE AND PROTECTION

A. Store products in accordance with the manufacturer's instructions, with intact and legible seals and labels.

SECTION 01600 – MATERIAL AND EQUIPMENT HANDLING
GOVERNMENT OF THE U. S. VIRGIN ISLANDS, DEPARTMENT OF PUBLIC WORKS
PROJECT NAME: Elaine I. Sprauve Public Library and Museum Building
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~~For exterior storage of fabricated products, place on sloped supports above ground. Cover the~~
products subject to deterioration with an impervious sheet covering; provide ventilation to avoid condensation.

Store loose granular materials on solid surfaces in a well-drained area. Prevent mixing of the materials with foreign matter.

Arrange storage to provide access for inspection. Periodically inspect to assure that products are undamaged, and are maintained under required conditions.

C. PRODUCT OPTIONS

A. Products specified by Reference Standards or by Description Only: Furnish any product meeting those standards.

Products specified by Naming One or More Manufacturers with a Provision for Substitutions: Submit a request for substitution for any manufacturer not specifically named.

Products specified by Naming Several Manufacturers.

Products of named manufacturers meeting Specifications: No options, no substitutions will be allowed.

D. PRODUCTS LIST

A. Within 15 days after the date of Owner-Contractor Agreement, submit a complete list of major proposed for use, with name of the manufacturer, trade name, and model number of each product.

E. SUBSTITUTIONS

A. Only within 15 days after date of the Agreement will the Owner's Representative/Engineer consider requests from the Contractor for substitutions. Subsequently, substitutions will be considered only when a product becomes unavailable due to no fault of the Contractor.

Document each request with complete data substantiating the compliance of the proposed substitution with the Contractor Documents.

The request constitutes a representation that the Contractor:

1. Has investigated proposed product and determined that it meets or exceeds, in all respects, the specified product.
2. Will provide the same warranty for substitution as for the specified product.
3. Will coordinate installation and make other changes which may be required for the Work to be complete in all respects.
4. Waives claims for additional cost which may subsequently become apparent.

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~~5 Substitutions will not be considered when they are indicated or implied on shop~~
drawing or product data submittals without separate written request, or when
acceptance will require substantial revision of the Contract Documents.

Substitutions will not be considered when they are indicated or implied on shop drawings or
product data submittals without separate written request, or when acceptance will require
substantial revision of the Contract Documents.

The Owner's Representative/Engineer will determine acceptability of the proposed substitution,
and will notify the Contractor of acceptance or rejection in writing within a reasonable time.

Only one request for the substitution will be considered for each product. When substitution is
not accepted, provide the specified product.

F. SYSTEM DEMONSTRATION

A. Prior to the final inspection, demonstrate operation of the entire system to the Owner.

PART 3 - EXECUTION (NOT USED)

END OF SECTION

SECTION 01620 – TRANSPORTATION AND HANDLING

GOVERNMENT OF THE U. S. VIRGIN ISLANDS, DEPARTMENT OF PUBLIC WORKS

PROJECT NAME: Elaine I. Sprauve Public Library and Museum Building

Project Location, St. John, U.S. Virgin Islands

PART 1 - GENERAL

- A. The Contractor shall provide transportation of all equipment, materials and products furnished under these Contract Documents to the site of the Work. In addition, the Contractor shall provide preparation for shipment and storage, unloading, handling and re-handling, short-term storage, extended storage, storage facilities, maintenance and protection during storage, preparation for installation, and all other work and incidental items necessary or convenient to the Contractor for the satisfactory prosecution and completion of the Work.

PART 2 - TRANSPORTATION

- A. All equipment shall be suitably boxed, crafted, or otherwise protected during transportation.

PART 3 - HANDLING

- A. All materials, and products shall be carefully handled to prevent damage or excessive deflections during unloading or transportation. All equipment, materials, and products damaged during transportation or handling shall be repaired or replaced by the Contractor at no additional cost to the Authority prior to being incorporated into the Work.

Lifting and handling drawings and instructions furnished by the manufacturer or supplier shall be strictly followed. Spreader bars or lifting beams shall be used when the distances between lifting points exceeds that permitted by standard industry practice. Slings and chains shall be padded as required to prevent damage to protective coatings and finishes.

Under no circumstances shall equipment or products such as pipe, structural steel, castings, reinforcement, lumber, piles, poles, etc., be thrown or rolled off of trucks onto the ground. Tossing of pipes and pipe fittings and accessories is an unacceptable practice. Items tossed shall be inspected by the Owner's Representative/Engineer and/or Architect. If the Owner's Representative determines that the product has been comprised, Contractor shall replace product at no additional cost to Owner.

Items such as non-metallic pipe, non-metallic conduit, flagpoles, and lighting poles shall be handled using non-metallic slings or straps. Under no circumstance shall chains or steel cables be used to transport or handle non-metallic products.

END OF SECTION

SECTION 01630 – STORAGE AND PROTECTION

GOVERNMENT OF THE VIRGIN ISLANDS, DEPARTMENT OF PLANNING AND NATURAL
RESOURCES, OFFICE BUILDING RENOVATION
REM. EST. CONTANT & ENIGHED CRUZ BAY QTR, ST. JOHN, U.S. VIRGIN ISLANDS

PART 1 - GENERAL

- A. Equipment shall be received, inspected, unloaded, handled, stored, maintained, and protected by the Contractor in a suitable location on or off site, if necessary, until such time as installation is required.

Storage and protection of Contractor-furnished equipment shall be strict conformance with the requirements of the Section entitled "General Equipment Stipulations" of these Specifications.

PART 2 - STORAGE

- A. The Contractor shall be responsible for providing satisfactory storage facilities that are acceptable to the Owner's Representative/Engineer. In the event that satisfactory facilities cannot be provided on site, satisfactory warehouse, acceptable to the Owner's Representative/Engineer, will be provided by the Contractor for such time until the materials and products can be accommodated at the site.

Materials, and products that are stored in a satisfactory warehouse acceptable to the Owner's Representative/Engineer will be eligible for progress payments as though they had been delivered to the job site.

The Contractor shall be responsible for the maintenance and protection of all equipment, materials, and products placed in storage and shall bear all costs of storage, preparation for transportation, transportation, re-handling, and preparation for installation.

Equipment and products stored outdoors shall be supported above the ground on suitable wooden blocks or braces arranged to prevent excessive deflection or bending between supports. Items such as pipe, structural steel, and sheet construction products shall be stored with one end elevated to facilitate drainage.

Unless otherwise permitted in writing by the Owner's Representative/Engineer, building products such as rough lumber, plywood, concrete block, and structural tile may be stored outdoors under a properly secured waterproof covering.

Tarpaulins and other coverings shall be supported above the stored equipment or materials on wooden strips to provide ventilation under the cover and minimize condensation. Tarpaulins and covers shall be arranged to prevent ponding of water.

PVC pipe, if stored outside, shall be suitably protected from sunlight (UV) by covering with a tarp or exterior paint. Such covering shall be completed and continual.

PART 3 - EXTENDED STORAGE (NOT USED)

END OF SECTION

SECTION 01700 – CONTRACT CLOSEOUT
GOVERNMENT OF THE U. S. VIRGIN ISLANDS, DEPARTMENT OF PUBLIC WORKS
PROJECT NAME: Elaine I. Sprauve Public Library and Museum Building
Project Location, St. John, U.S. Virgin Islands

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of Contract, including General and Supplementary Conditions and other Division - 1 Specification Sections, apply to this Section.

A. SUMMARY

- A. This Section specifies administrative and procedural requirements for project closeout, including but not limited to:
1. Inspection procedures.
 2. Project record document submittal
 3. Operating and maintenance manual submittal.
 4. Submittal of warranties.
 5. Final cleaning.

Closeout requirements for specific construction activities are included in the appropriate Sections in Divisions 2 through 16, including all Mechanical, Electrical and Plumbing Specifications.

B. SUBSTANTIAL COMPLETION

- A. Preliminary Procedures:
Before requesting inspection for certification of Substantial Completion, complete the following. List exceptions in the request.
1. In the Application for Payment that coincides with, or first follows, the date Substantial Completion is claimed, show 100 percent completion for the portion of the Work claimed as substantially complete. Include supporting documentation for completion as indicated in these Contract Documents and a statement showing an accounting of changes to the Contract Sum.
 - a. If 100 percent completion cannot be shown, include a list of incomplete items, the value of incomplete construction, and reasons the Work is not complete.
 2. Advise Owner of pending insurance change-over requirements.
 3. Submit specific warranties, workmanship bonds, maintenance agreements, final certifications and similar documents.
 4. Obtain and submit releases enabling the Owner unrestricted use of the Work and access to services and utilities; include permits and similar releases.
 5. Deliver tools, extra stock, and similar items.

SECTION 01700 – CONTRACT CLOSEOUT

GOVERNMENT OF THE U. S. VIRGIN ISLANDS, DEPARTMENT OF PUBLIC WORKS

PROJECT NAME: Elaine I. Sprauve Public Library and Museum Building

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Inspection Procedures:

On receipt of a request for inspection, the Owner will either proceed with inspection or advise the Contractor of unfilled requirements. The Owner will prepare the Certificate of Substantial Completion following inspection, or advise the Contractor of construction that must be completed or corrected before the certificate will be issued.

1. The Owner will repeat inspection when requested and assured that the Work has been substantially completed.
2. Results of the completed inspection will form the basis of requirements for final acceptance.

C. FINAL ACCEPTANCE

A. Preliminary Procedures:

Before requesting final inspection for certification of final acceptance and final payment, complete the following. List exceptions in the request.

1. Submit the final payment request with releases and supporting documentation not previously submitted and accepted. Include certificates of insurance for products and completed operations where required.
2. Submit an updated final statement, accounting for final additional changes to the Contract Sum.
3. Submit a certified copy of the Owner's final inspection list of items to be completed or corrected, stating that each item has been completed or otherwise resolved for acceptance, and the list has been endorsed and dated by the Owner's Representative.
4. Submit consent of surety to final payment.
5. Submit a final liquidated damages settlement statement.
6. Submit evidence of final, continuing insurance coverage complying with insurance requirements.

Re-inspection Procedure:

The Owner will re-inspect the Work upon receipt of notice that the Work, including inspection list items from earlier inspections, has been completed, except items whose completion has been delayed because of circumstances acceptable to the Owner's Representative.

1. Upon completion of re-inspection, the Owner's Representative will prepare a certificate of final acceptance, or notify the Contractor of Work that is incomplete or of obligations that have not been fulfilled but are required for final acceptance.
2. If necessary, re-inspection will be repeated.

D. RECORD DOCUMENT SUBMITTALS

A. General:

SECTION 01700 – CONTRACT CLOSEOUT

GOVERNMENT OF THE U. S. VIRGIN ISLANDS, DEPARTMENT OF PUBLIC WORKS

PROJECT NAME: Elaine I. Sprauve Public Library and Museum Building

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~~Do not use record documents for construction purposes; protect from deterioration and~~
loss in a secure, fire-resistive location; provide access to record documents for the Owner's reference during normal working hours.

Record Drawings:

Maintain a clean, undamaged set of blue or black line white-prints of Contract Drawings and Shop Drawings. Mark the set to show the actual installation where the installation varies substantially from the Work as originally shown. Mark whichever drawing is most capable of showing conditions fully and accurately; where Shop Drawings are used, record a cross-reference at the corresponding location on the Contract Drawings. Give particular attention to concealed elements that would be difficult to measure and record at a later date.

1. Mark record sets with red erasable pencil; use other colors to distinguish between variations in separate categories of the Work.
2. Mark new information that is important to the Owner, but was not shown on Contract Drawings or Shop Drawings.
3. Note related Change Order numbers where applicable.
4. Organize record drawing sheets into manageable sets, bind with durable paper cover sheets, and print suitable titles, dates and other identification on the cover of each set.

Record Specifications:

Maintain one complete copy of the Project Manual, including addenda, and one copy of other written construction documents such as Change Orders and modifications issued in printed form during construction. Mark these documents to show substantial variations in actual Work performed in comparison with the text of the Specifications and modifications. Give particular attention to substitutions, selection of options and similar information on elements that are concealed or cannot otherwise be readily discerned later by direct observation. Note related record drawing information and Product Data.

1. Upon completion of the Work, submit record Specifications to the Owner's Representative for the Owner's records.

Record Product Data:

Maintain one copy of each Product Data submittal. Mark these documents to show significant variations in actual Work performed in comparison with information submitted. Include variations in products delivered to the site, and from the manufacturer's installation instructions and recommendations. Give particular attention to concealed products and portions of the Work which cannot otherwise be readily discerned later by direct observation. Note related Change Orders and mark-up of record drawings and Specifications.

1. Upon completion of mark-up, submit complete set of record Product Data to the Owner's Representative for the Owner's records.

Record Sample Submitted:

SECTION 01700 – CONTRACT CLOSEOUT

GOVERNMENT OF THE U. S. VIRGIN ISLANDS, DEPARTMENT OF PUBLIC WORKS

PROJECT NAME: Elaine I. Sprauve Public Library and Museum Building

Project Location, St. John, U.S. Virgin Islands

~~Immediately prior to the date or dates of Substantial Completion, the Contractor will~~
meet at the site with the Owner's Representative and the Owner's personnel to determine which of the submitted Samples that have been maintained during progress of the Work are to be transmitted to the Owner for record purposes. Comply with delivery to the Owner's Sample storage area.

Miscellaneous Record Submittals:

Refer to other Specification Sections for requirements of miscellaneous record-keeping and submittals in connection with actual performance of the Work. Immediately prior to the date or dates of Substantial Completion, complete miscellaneous records and place in good order, properly identified and bound or filed, ready for continued use and reference. Submit to the Owner's Representative for the Owner's records.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION

3.1 CLOSEOUT PROCEDURES

- A. Operating and Maintenance Instructions: Arrange for each installer of equipment that requires regular maintenance to meet with the Owner's personnel to provide instruction in proper operation and maintenance. If installers are not experienced in procedures, provide instruction by manufacturer's representatives. Include a detailed review of the following items:

1. Record documents
2. Spare parts and materials
3. Tools
4. Cleaning
5. Warranties and bonds

B. FINAL CLEANING

A. General:

General cleaning during construction is required by the General Conditions and included in Section "Temporary Facilities".

Cleaning:

Employ experienced workers or professional cleaners for final cleaning. Clean each surface or unit to the condition expected in a normal, commercial building cleaning and maintenance program. Comply with manufacturer's instructions.

1. Complete the following cleaning operations before requesting inspection for Final Acceptance.
 - a. Remove labels that are not permanent labels.

SECTION 01700 – CONTRACT CLOSEOUT

GOVERNMENT OF THE U. S. VIRGIN ISLANDS, DEPARTMENT OF PUBLIC WORKS

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~~b. Clean exposed exterior hard surfaced finishes to a dust free condition, free of stains, film and similar foreign substances.~~

c. Clean the site, including landscape development areas, of rubbish, litter and other foreign substances. Sweep paved areas broom clean; remove stains, spills and other foreign deposits. Rake grounds that are neither paved nor planted, to a smooth even-textured surface.

Removal of Protection:

Remove temporary protection and facilities installed for protection of the Work during construction.

Compliance:

Comply with regulations of authorities having jurisdiction and safety standards for cleaning. Do not burn waste materials. Do not bury debris or excess materials on the Owner's property. Do not discharge volatile, harmful or dangerous materials into drainage systems. Remove waste materials from the site and dispose of in a lawful manner.

1. Where extra materials of value remaining after completion of associated Work have become the Owner's property, arrange for disposition of these materials as directed.

END OF SECTION

SECTION 01710 – CLEANUP

GOVERNMENT OF THE U. S. VIRGIN ISLANDS, DEPARTMENT OF PUBLIC WORKS

PROJECT NAME: Elaine I. Sprauve Public Library and Museum Building

Project Location, St. John, U.S. Virgin Islands

PART 1 -GENERAL

- A. During its progress, the Work and the adjacent areas affected thereby shall be kept cleaned up and all rubbish, surplus materials, and unneeded construction equipment shall be removed and all damage repaired so that the public and property owners will be inconvenienced as little as possible.

Where material or debris has washed or flowed into or been placed in existing watercourses, ditches, gutters, drains, pipe structures, as a result of Work done under this contract, or elsewhere during the course of the Contractor's operations, such material or debris shall be entirely removed and satisfactorily disposed of during the progress of the Work, and the ditches, channels, drains, pipes, structures, and work, etc., shall upon completion of the Work, be left in a clean and neat condition.

On or before the completion of the Work, the Contractor shall, unless otherwise especially directed or permitted in writing, tear down and remove all temporary buildings and structures built by him; shall remove all temporary works, tools, and machinery or other construction equipment furnished by him; shall remove, acceptably disinfect, and cover all organic matter and material containing organic matter in, under, and around privies, houses, and other buildings used by him; shall remove all rubbish from any grounds which he has occupied; and shall leave the roads and all parts of the premises and adjacent property affected by his operations in a neat and satisfactory condition.

Upon completion of the Work, the Contractor shall remove from the sites of the subsurface explorations all of his plant, machinery, tools, equipment, temporary work, and surplus materials; shall, unless otherwise directed or permitted in writing, remove all rubbish from any grounds which he has occupied; and shall leave the roads and all parts of the premises and adjacent property affected by his operations in a neat and satisfactory condition.

The Contractor shall thoroughly clean all materials installed by him and his subcontractors, and on completion of the Work shall deliver it undamaged and in fresh and new-appearing condition.

The Contractor shall restore or replace, when and as directed, any public or private property damaged by his Work, equipment, or employees, to a condition at least equal to that existing immediately prior to the beginning of operations. To this end, the Contractor shall do as required all necessary highway or driveway, walk, and landscaping work. Suitable materials, equipment, and methods shall be used for such restoration. The restoration of existing property or structures shall be done as promptly as practicable as work progresses and shall not be left until the end of the contract period.

The Contractor shall submit a Waste Plan and secure a Waste permit from the VI Waste Management Authority

END OF SECTION

SECTION 01730 – GUARANTEES AND WARRANTIES
GOVERNMENT OF THE U. S. VIRGIN ISLANDS, DEPARTMENT OF PUBLIC WORKS
PROJECT NAME: Elaine I. Sprauve Public Library and Museum Building
Project Location, St. John, U.S. Virgin Islands

PART 1 - GENERAL

- A. The Contractor shall warrant all materials, products, and workmanship provided by the Contractor under the Contract for a period of twelve (12) months after the date of final acceptance of the Work by the Owner.

If, during the warranty period: (a) Any materials or products furnished and/or installed by the Contractor are found to be defective in service by reason on the Contractor's faulty process, structural and/or mechanical design or Specifications; or (b) Any materials, or products furnished by the Contractor shall, as soon as possible after receipt of such defective materials or products, or replace such defective materials or products.

PART 2 - START-UP OF OPERABLE COMPONENTS

- A. Because of the need to maintain operation during construction, it will be necessary to accept operable components of the project at various times prior to the completion and final acceptance of the entire project.

A component of the project, as used herein, shall include all associated structures, paving, piping, etc.

When a component of the project has been completed, checked out, and made ready for operation, the Contractor shall notify the Owner's Representative/Engineer in writing that the component is substantially complete and request an inspection for substantial completion. The Owner will schedule the inspection within ten (10) days of the Contractor's request. If he concurs in the Contractor's statement, the Owner's Representative/Engineer will notify the Contractor in writing that the component is accepted as substantially complete. At the same time, the Owner's Representative/Engineer will submit to the Contractor a list of items that must be completed or corrected before final acceptance can be given.

If a component of the project is needed in order to maintain operation during construction and if it has been accepted as substantially complete, the Contractor shall start up the component when directed by the Owner. Once the component has achieved stable and satisfactory operation (minimum 95 percent availability over a 7- day period), the Contractor shall request beneficial occupancy by the Owner. The Department, if they concur in the Contractor's statement, that stable and satisfactory operation has been achieved, will notify the Contractor in writing within ten (10) days that he is assuming beneficial occupancy of the component.

On the date that the Department assumes beneficial occupancy, the following shall occur:

1. The one-year warranties for the component specified in Part 1-A of this section will begin
2. The Owner will assume responsibility for operating and maintaining the component

END OF SECTION

SECTION 01780 – CLOSE OUT SUBMITTALS

GOVERNMENT OF THE U. S. VIRGIN ISLANDS, DEPARTMENT OF PUBLIC WORKS

PROJECT NAME: Elaine I. Sprauve Public Library and Museum Building

Project Location, St. John, U.S. Virgin Islands

PART 1 - GENERAL

1.1 RELATED DOCUMENTS:

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 1 Specification Sections, apply to this Section.

A. SECTION INCLUDES:

- A. Project Record Document submittal.

Operation and Maintenance manuals.

Warranties, Bonds, Extra Stock, Permits, and Manuals.

B. SUBMITTALS:

- A. Project Record Documents:

Submit documents to Owner. The following submittal procedure shall occur prior to Final Acceptance.

1. Submit original copy of as-built drawings (Drawings & Specifications) to Owner for review.
2. Compile and organize any drawings or schedules in the Project Manual onto sheets of the same size as the Contract Drawings and into electronic files to submit with other record documents.
3. Contractor will be notified within 15 work days if the submitted documents are acceptable.
4. Should the submittal be unacceptable for any reason, the Contractor shall make requested modifications and resubmit to the Owner. Continue to resubmit as necessary until the submittal is acceptable.
5. Upon acceptance of the submittal, Owners Engineer will, within 30 work days, incorporate the Contractor's as-built drawings into the Owner's Engineer's original Contract Documents.

Warranties, Bonds, Extra Stock, and Permits:

1. Obtain and assemble executed certificates, warranties, bonds, receipts for extra stock, and permits signed by any authorities having jurisdiction. These may be tabbed in the front of the General Operation and Maintenance Manual provided they do not over-fill the binder.
2. Verify that documents are in proper form and contain full information.
3. Include originals of each in operation and maintenance manual, indexed separately on Table of Contents.

SECTION 01780 – CLOSE OUT SUBMITTALS

GOVERNMENT OF THE U. S. VIRGIN ISLANDS, DEPARTMENT OF PUBLIC WORKS

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~~4. Co-execute submittals when required.~~

5. Submittal of warranties, bonds, extra stock and permit manual to match submittal requirements.
6. Provide Table of Contents neatly typed, in complete and orderly sequence. Include complete information for each of the following:
 - a. Product or work item;
 - b. Firm, with name of principal, address, and telephone number;
 - c. Scope;
 - d. Date of beginning of warranty or service and maintenance contract;
 - e. Duration of warranty or service maintenance contract;
 - f. Proper procedure in case of failure;
 - g. Instances which might affect validity of warranty or bond; and
 - h. Contractor, name or responsible principal, address, and telephone number.
7. Make submittals within ten days after Date of Substantial Completion.
8. For items of Work for which acceptance is delayed beyond Date of Substantial Completion, submit within ten days after acceptance, listing the date of acceptance as the beginning of the warranty period.

PART 2 - PRODUCTS

2.1 PROJECT RECORD DOCUMENTS:

- A. Project Record Documents include the following:
 1. Marked-up copies of Contract Drawings.
 2. Marked-up copies of Project Manuals (Specifications and Detail Book, as applicable), all volumes.
 3. Addenda.
 4. Reviewed and marked-up copies of shop drawings and product data.
 5. Newly prepared drawings.
 6. Change Orders, RFIs and other modifications to the Contract issued in printed form during construction.

SECTION 01780 – CLOSE OUT SUBMITTALS

GOVERNMENT OF THE U. S. VIRGIN ISLANDS, DEPARTMENT OF PUBLIC WORKS

PROJECT NAME: Elaine I. Sprauve Public Library and Museum Building

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~~7. Owner's Representative's Clarifications and Pricing Request with all supporting documentation.~~

8. Field Authorizations.

9. Record Samples.

10. Field records for variable and concealed conditions.

11. Record information on Work that is recorded only schematically.

12. Manufacturer's instruction for assembly, installation, and adjusting.

13. Other miscellaneous record documents as listed below and applicable.

a. Field records on excavations and foundations.

b. Field records on underground construction and similar work.

c. Survey showing locations and elevations of underground lines.

d. Invert elevations of drainage piping.

e. Surveys establishing building lines and levels.

f. Authorized measurements utilizing unit prices or allowances.

g. Records of plant treatment.

h. Ambient and substrate condition tests.

i. Certifications received in lieu of labels on bulk products.

j. Batch mixing and bulk delivery records.

k. Testing and qualification of tradesmen.

l. Documented qualification of installation firms and/or personnel.

m. Load and performance testing.

n. Inspections and certifications by governing authorities.

o. Leakage and water-penetration tests.

p. Final inspection and correction procedures.

PART 3 -EXECUTION

3.1 PROJECT RECORD DOCUMENTS:

A. Maintenance of Documents and Samples:

SECTION 01780 – CLOSE OUT SUBMITTALS

GOVERNMENT OF THE U. S. VIRGIN ISLANDS, DEPARTMENT OF PUBLIC WORKS

PROJECT NAME: Elaine I. Sprauve Public Library and Museum Building

Project Location, St. John, U.S. Virgin Islands

- ~~1. Store and maintain in field office apart from the Contract Documents used~~
for construction, one complete set of record documents and samples which are used to record as-built conditions.
2. Do not use Project Record Documents for construction purposes; protect from deterioration and loss in a secure fire-resistant location. Maintain record documents in good order and in a clean, dry, legible condition.
3. Make record documents and samples available at all times for review by Owner's Representative and the Owner.
4. Record actual revisions to the Work concurrent with construction progress.
5. Ensure entries are complete and accurate, enabling future reference by Owner.
 - a. Following each month Progress Schedule Meeting, Contractor shall meet with all major subcontractors whose work is in progress at the site, including, but not limited to mechanical, plumbing, electrical, security, fire protection, civil, and as otherwise designated, to review all "as-built" revisions on the day-by-day working set of "Project Record Copy" and verify installed record information from the previous month is properly recorded on the day-by-day "Project Record Copy," with all revisions and pertinent information clearly indicated.

Record Drawings and Shop Drawings:

A clean, undamaged set of Contract Drawings including coordination drawings and shop drawings shall be kept at the job site as "as-built" record documents. Record "as-built" drawings shall be comprised of all sheets contained in the Contract Drawings, as well as all special equipment or system drawings.

1. Mark the set to show the actual installation where the installation varies substantially from the Work as originally shown. Mark whichever drawings that show conditions fully and accurately. Where shop drawings, RFIs or other communication record are used to identify a change, record a cross-reference at the corresponding location on the Contract.
2. Drawings:
Give particular attention to concealed elements that would be difficult to measure and record at a later date. Items required to be marked include, but are not limited to, the following:

SECTION 01780 – CLOSE OUT SUBMITTALS

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~~a. Indicate field changes of dimension and detail.~~

- b. RFIs.
 - c. Depths of foundations below the First Floor.
 - d. Horizontal and vertical measurements of underground services and utilities, referenced to the building or other permanent construction.
 - e. Note changes of directions and locations, by dimensions and Elevations, as utilities are actually installed.
 - f. Show measured locations of construction-concealed internal utilities and appurtenances referenced to visible and accessible features of the structure.
 - g. Record accurate locations of piping, valves, and the like.
 - h. Revisions to electrical circuitry.
 - i. Indicate details not on original Contract Drawings.
 - j. "X-out" conditions not constructed and appropriately annotate "note constructed" to convey the actual "as-constructed" condition.
- 3. Mark record sets in a clear, legible manner, using red ink (no pencils); use other colors to distinguish between variations in separate categories of the work. Use 'whiteout' to erase errors.
 - 4. Mark new information that is important to the Owner, but which was not shown on the Contract Documents or Shop Drawings.
 - 5. Show Addenda items, Change Orders, RFI, or other means of communication used in the construction process.
 - 6. Show and date revisions to drawings with a "cloud" drawn around the revision.
 - 7. Organize record drawing sheets in manageable sets, bind with durable paper cover sheets, and print suitable titles, dates, and other identification on the cover of each set. Where shop drawings, RFIs, or other communication record is used as a reference, include a copy of it as part of the Record Drawings.
 - 8. Shop Drawings:
 - a. Maintain as record documents; legibly annotate to record changes made after review.

SECTION 01780 – CLOSE OUT SUBMITTALS

GOVERNMENT OF THE U. S. VIRGIN ISLANDS, DEPARTMENT OF PUBLIC WORKS

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~~b. Include subcontractor reproducible shop drawings including as a~~
minimum where applicable to the project, and others as deemed appropriate. Record Drawing shop drawings shall be easily reproducible; as appropriate and approved by the Owner.

Project Manual(s):

During the construction period, maintain one complete copy of the Project Manual(s), including Specifications, Detail Book(s), addenda, and one copy of other written Construction Documents, such as Change Orders, and RFIs issued in printed form during construction.

1. Legibly mark these documents in red ink to show substantial variations in actual work performed in comparison with the text of the Specification and modifications. Give particular attention to substations, selection of options, and similar information on elements that are concealed or cannot otherwise be readily discerned later by direct observation. Note related Record Drawing information and product data. Record at each product section description of actual products installed, including the following:
 - a. Product substitutions or alternates utilized.
 - b. Changes made by Addenda and modifications.
2. Mark Detail Book schedules, details, etc., to indicate the actual installation where the installation varies from the indicated in the Detail Book and modification issued. Complete information in accordance with paragraph for all detail drawings.
3. Each prime contractor (Subcontractor) is responsible for marking up Sections that contain its own Work.
4. General Contractor shall be responsible for collecting marked-up Sections that contain its own work.
5. General Contractor shall be responsible for submitting the complete set of record Specifications as specified.

Record Product Data:

1. Maintain one copy of each data Submittal, and mark-up variations in actual work in comparison with submitted information. Include both variations in product as delivered to the site, and variations from manufacturer's instruction and recommendations for installation.
2. Give particular attention to concealed products and portions of the work which cannot otherwise be readily discerned at a later date by direct observation. Note related Change Orders and mark- up of Record Drawings and Project Manuals.
3. Note related Change Orders and mark-up of record Drawings, where applicable.

SECTION 01780 – CLOSE OUT SUBMITTALS

GOVERNMENT OF THE U. S. VIRGIN ISLANDS, DEPARTMENT OF PUBLIC WORKS

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~~4. Upon completion of mark-up, submit complete set to Owner's Representative for Owner's records.~~

5. Where record Product Data is required as part of maintenance manuals, submit marked-up Product Data as an insert in the manual instead of submittal as record Product Data.
6. Each prime contractor (Subcontractor) shall be responsible for marking up and submitting record Product Data for its own Work.
7. Insofar as possible, insert record product data in individual sub-sections of O&M Manuals. Refer to 3.05 below.

Record Sample Submittal:

Immediately prior to date(s) of substantial completion, Owner's Engineer will meet with Contractor at site, and will determine which (if any) of submitted samples maintained by Contractor during progress of the work are to be transmitted to Owner for record purposes. Comply with *NE's* instructions for packaging, identification marking, and delivery to Owner's sample storage place.

Miscellaneous Record Submittals:

Refer to paragraph above for listing of miscellaneous record documents and to other Sections of these specifications for requirements of miscellaneous record-keeping and submittals in connection with actual performance of the work. Immediately prior to date of Substantial Completion, complete miscellaneous records and place in good order, properly identified and bound or filed, ready for continued use and reference. Submit to the Owner for their records.

B. OPERATION AND MAINTENANCE DATA- GENERAL:

A. For Each Product:

List names, addresses and telephone numbers of Subcontractors and suppliers, including local source of supplies.

Product Data:

Mark each sheet to clearly identify specific products and component parts, and data applicable to installation. Delete inapplicable information.

Drawings:

Supplement product data to illustrate relations of component parts of systems, to show control and flow diagrams. Do not use Project Record Documents as maintenance drawings.

Typed Text:

As required to supplement product data. Provide logical sequence of instructions for each procedure, incorporating manufacturer's instructions.

C. OPERATION AND MAINTENANCE DATA FOR EQUIPMENT AND SYSTEMS: (NOT USED)

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~~D. OPERATION AND MAINTENANCE DATA FOR MATERIALS AND FINISHES: (NOT USED)~~

E. OPERATION AND MAINTENANCE MANUALS: (NOT USED)

F. WARRANTIES, BONDS, AND PERMIT MANUAL:

A. Project Warranty-General:

1. If, within one (1) year after the Date of Substantial Completion of the Work, or designated portion thereof, or within such longer period of time as may be prescribed by law or by the terms of any applicable special warranty required by the Contract Documents, any of the Work is found to be defective or not in accordance with the Contract Documents, the Contractor, and where applicable, his subcontractor that portion of the work, shall correct it promptly after receipt of a written notice from the Owner or Owner's Representative to do so. This obligation shall survive Termination of the Contract. The Owner will give such notice promptly after discovery of the condition.
2. Refer to Section 01 78 36 for administrative and procedural requirements for tracking project warranty issues subsequent to date of Substantial Completion.

Categories of Specific Warranties:

1. Warranties on the work are in several categories, including those of General Conditions, and including (but not necessarily limited to) the following specific categories related to individual units of work specified in the technical sections of these specifications.
 - a. Special Project Warranty (Guarantee):

A warranty specifically written and signed by Contractor for a defined portion of the work; and, where required, countersigned by subcontractor, installer, manufacturer or other entity engaged by Contractor.
 - b. Specified Product Warranty:

A warranty which is required by contract documents, to be provided for a manufactured product incorporated into the work; regardless of whether manufacturer has published warranty without regard for specific incorporation of product into the work, or has written and executed warranty as a direct result of contract document requirements.
 - c. Coincidental Product Warranty:

A warranty which is not specifically required by contract documents (other than as specified in this section); but which is available on a product incorporated into the work, by virtue of the fact that manufacturer of product has published warranty in connection with

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~~purchases and uses of product without regard for specific applications~~
except as otherwise limited by terms of warrantee.

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2. ~~Refer to individual sections for the determination of units of work which~~
are required to be specifically or individually warranted, and for the specific requirements and terms of those warranties (or guarantees).

Disclaimer and Limitations:

Manufacturer's disclaimers and limitations on product warranties do not relieve the Contractor of the warranty on the Work that incorporates the products.

Manufacturer's disclaimers and limitations on product warranties do not relieve suppliers, manufacturers, and subcontractors required to countersign special warranties with the Contractor.

General Limitations:

It is recognized the specific warranties are intended primarily to protect the Owner against failure of the work to perform as required, and against deficient, defective, and faulty materials and workmanship, regardless of sources.

Related Damages and Losses:

1. General:

In connection with Contractor's correction of warranted work which has failed, remove and replace other work of project which has been damaged as a result of such failure, or must be removed and replaced to provide access for correction of warranted work.

2. Consequential Damages:

Except as otherwise indicated or required by governing regulations, Special project warranties and product warranties are not extended to cover damage to building contents (other than work of Contract), which occurs as a result of failure of warranted work.

Except for items put into use with Owner's permission, leave date of beginning of time of warranty until the Date of Substantial completion is determined.

Reinstatement of Warranty Period:

Except as otherwise indicated, when work covered by a special project warranty or product warranty has failed and has been corrected by replacement or restoration, reinstate warranty by written endorsement for the time period starting on the date of acceptance of replaced or restored work and ending upon date original warranty would have expired if there had been no failure, with an equitable adjustment for depreciation.

Replacement Cost, Obligations:

Upon determination that Work covered by a warranty has failed, replace or rebuild the Work to an acceptable condition complying with requirements of Contract Documents. Contractor shall be responsible for the cost of replacing or restoring defective Work regardless of whether the Owner has benefited from use of the Work through a portion of anticipated useful service life.

Owner's Recourse:

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~~Expressed warranties made to the Owner are in condition addition to implied~~
warranties and shall not limit the duties, obligations, right, and remedies
otherwise available under the law. Expressed warranty periods shall not be
interpreted as limitations on the time in which the Owner can enforce such
other duties, obligations, rights, or remedies.

Rejection of Warranties:

Owner reserves the right, at time of final acceptance or thereafter, to reject
coincidental product warranties submitted by the Contractor, which in opinion
of Owner tend to detract from or confuse interpretation of requirements of
Contract Documents.

Contractor's Procurement Obligations:

Do not purchase, subcontract for, or allow others to purchase or sub-contract
for materials or units of work for project where a special project warranty,
specified product warranty, certification or similar commitment is required,
until it has been determined that entities required to countersign such
commitments are willing to do so.

Co-execute warranties when required. Provide originals of each for inclusion in each
operation and maintenance manual.

Retain warranties and bonds until time specified for submittal.

END OF SECTION

DIVISION 2-EXISTING CONDITIONS

GOVERNMENT OF THE U. S. VIRGIN ISLANDS, DEPARTMENT OF PUBLIC WORKS

PROJECT NAME: Elaine I. Sprauve Public Library and Museum Building
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SECTION 02282 – TERMITE CONTROL

GOVERNMENT OF THE U. S. VIRGIN ISLANDS, DEPARTMENT OF PUBLIC WORKS

PROJECT NAME: Elaine I. Sprauve Public Library and Museum Building

Project Location, St. John, U.S. Virgin Islands

PART 1 - GENERAL

1.1 SUMMARY

A. Provide boric acid based wood applied treatment for primary termite control, as herein specified.

B. Limits of termite treatment are as follows:

1. Boric acid product application will be provided to wood structural components in contact with foundations and application to bath traps, plumbing penetration and certain foundation areas.

B. REFERENCES

A. General:

1. Standards listed by reference, including revisions by issuing authority, form a part of this specification section to the extent indicated. Standards listed are identified by issuing authority, authority abbreviation, designation number, title or other designation established by issuing authority. Standards subsequently referenced herein are referred to by issuing authority abbreviation and standard designation.

B. American Wood-Preservers' Association (AWPA); AWPA Standard M4-01: Standard for the Care of Preservative-Treated Wood Products; 2001.

1. Requires that a preservative be applied to any end cut to protect exposed wood not protected by pressure treatment (as in sill plates) to meet international building code requirements.

C. International Residential Code (IRC) sections that mandate AWPA's *Standard M4* for end cut treatment:

1. Section R319: Protection Against Decay
2. Section R319.1.1 Field Treatment [of End Cuts]
3. Section R320: Protection Against Subterranean Termites
4. Section R320.1.2 Field Treatment [of End Cuts]; 2006.

D. U.S. Green Building Council:

1. LEED® for Homes Rating System, SS 5: Nontoxic Pest Control; 2008
 - a. Green building program assigns a maximum of two program points for the use of nontoxic pest control methods, including a barrier treatment of all cellulosic building material with a borate product.

C. SYSTEM DESCRIPTION

SECTION 02282 – TERMITE CONTROL

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A. Performance Requirements:

1. Provides structural termite protection when applied according to the applicable sections of the U.S. Environmental Protection Agency registered label.

D. RELATED DOCUMENTS

- A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division-1 Specification sections, apply to work of this section.

E. SUBMITTALS

- A. Product Data:

1. Submit applicable manufacturer's technical data and application.

F. QUALITY ASSURANCE

- A. In addition to requirements of these specifications, comply with manufacturer's instructions and recommendations for work, including preparation of structure and application.

Engage a professional pest control operator, licensed in accordance with regulations of governing authorities and trained in the application of boric acid wood applied termiticide treatment solution.

G. JOB CONDITIONS

- A. Restrictions:

1. Treatment will be performed when access to all structural wood members and foundations is available. This is normally at the "dried-in" stage of construction when all structural wood and sheathing is in place and prior to installation of drywall, insulation, mechanical systems and electrical wiring. Comply with handling and application instructions of the product.

H. SPECIFIC PRODUCT WARRANTY

- A. Furnish written warranty certifying that the applied boric acid based treatment will prevent infestation of subterranean termites and, that if subterranean termite activity is discovered during warranty period, Contractor will re-treat structure and repair or replace damage caused by termite infestation.

PART 2 - PRODUCTS

2.1 BORIC ACID TERMITICIDE, INSECTICIDE & FUNGICIDE

A. Termiticide requirements:

1. Boric acid based primary termiticide treatment that complies with requirements of authorities having jurisdiction over such an application.

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~~2. Boric acid based treatment shall be provided in a concentrated formulation that dilutes with water or foaming agent.~~

3. Provide quantity required for application at the label volume and rate for the maximum termiticide concentration allowed for each specific use according to the registered label.

PART 3 - EXECUTION

3.1 MANUFACTURER'S INSTRUCTIONS

A. Compliance:

1. Comply with product data, including product literature, technical bulletins and U.S. EPA registered label.

B. APPLICATION

A. Site Preparation:

1. Remove foreign matter that could decrease thoroughness of treatment, such as sawdust, away from treatment surfaces. Move building materials that block or prevent product application to required treatment areas.

Application Rates:

1. Apply treatment by label directions to include:

The treatment of all structural wood and sill plates within 24 inches of contact with the foundation. Apply a second application to wood within treated area when only one or two surfaces are exposed.

The treatment of all cellulosic sheathing within 24 inches of the foundation.

The treatment of the concrete slab a minimum of 2 inches out from the wooden sill plate.

The treatment of open bath traps at 8-16 ounces of treatment solution per square foot of bath trap with the additional treatment of a 12 inch wide band of treatment solution on the slab area surrounding the bath trap.

The treatment of all pipe and plumbing penetrations with the treatment solution to a height of two feet and extending at least 6 inches out horizontally from the penetration onto slab surface.

The treatment of the inside surface of crawlspace concrete or concrete block walls extending vertically up two feet from the soil.

The treatment of the inside surface of basement concrete or concrete block walls extending vertically up two feet from the slab.

Treat abutting slab areas and expansion joints to cover at least six inches of slab surface out from each side of joint or abutting slab connection.

SECTION 02282 – TERMITE CONTROL

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~~The treatment of termite trails and nests on interior walls.~~

END OF SECTION

SECTION 024119 – SELECTIVE DEMOLITION

GOVERNMENT OF THE U. S. VIRGIN ISLANDS, DEPARTMENT OF PUBLIC WORKS

PROJECT NAME: Elaine I. Sprauve Public Library and Museum Building

Project Location, St. John, U.S. Virgin Islands

PART 1 - GENERAL

1.1 SCOPE

- A. Demolition – Galvanize Roofing, Gazebo structure, ceiling, Interior sheeting (wall), Existing AC units (window units, wall mount split, compressors etc), window shades, rugs, wall light fixtures, surface mounted electrical and plumbing lines (interior and exterior).
- B. Disposal - All item of demolition, all remaining items desks, lamps, rugs, office equipment, chairs, bookcases, wall mounts, trash in office, in lower level storage areas on both sides of building and the collected bagged trash at bottom of wood stairs,

1.2 ELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions (and Division 01 Specification Sections, apply to this Section.

Specifications throughout all Divisions of the Project Manual are directly applicable to this Section, and this Section is directly applicable to them.

A. REFERENCE STANDARDS

- A. The latest published edition of a reference shall be applicable to this Project unless identified by a specific edition date.

All reference amendments adopted prior to the effective date of this Contract shall be applicable to this Project.

All materials, installation and workmanship shall comply with all applicable requirements and standards.

B. SUBMITTALS

- A. Record Documents:

- 1. Schedule indicating proposed sequence of operations for selective demolition Work to Owner's Representative for review prior to start of Work. Include coordination for shutoff, capping, and continuation of utility services as required, together with details for dust and noise control protection.
 - a. Provide detailed sequence of demolition and removal Work to ensure uninterrupted progress of Owner's on-site operations.
 - b. Coordinate with Owner's continuing occupation of portions of existing building and with Owner's partial occupancy of completed new addition.
 - c. Photographs of existing conditions of structure surfaces, equipment, and adjacent improvements that might be misconstrued as damage related to removal operations. File with Owner's Representative prior to start of Work.

C. PROJECT CONDITIONS

SECTION 024119 – SELECTIVE DEMOLITION

GOVERNMENT OF THE U. S. VIRGIN ISLANDS, DEPARTMENT OF PUBLIC WORKS

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- A. Owner will occupy portions of the building immediately adjacent to areas of selective demolition. Conduct selective demolition Work in manner that will minimize need for disruption of Owner's normal operations. Provide minimum of 72 hours advance notice to Owner of demolition activities that will affect Owner's normal operations.

Owner assumes no responsibility for actual condition of items or structures to be demolished.

1. Conditions existing at time of inspection for bidding purposes will be maintained by Owner insofar as practicable. However, minor variations within structure may occur by Owner's removal and salvage operations prior to start of selective demolition Work.

Promptly repair damages caused to adjacent facilities by demolition Work.

Conduct selective demolition operations and debris removal to ensure minimum interference with roads, streets, walks, and other adjacent occupied or used facilities.

1. Do not close, block, or otherwise obstruct streets, walks, or other occupied or used facilities without written permission from authorities having jurisdiction. Provide alternate routes around closed or obstructed traffic ways if required by governing regulations.

Do not use cutting torches for removal until Work area is cleared of flammable materials. At concealed spaces, such as interior of ducts and pipe spaces, verify condition of hidden space before starting flame cutting operations. Maintain portable fire suppression devices during flame cutting operations.

Maintain existing utilities indicated to remain in service and protect them against damage during demolition operations.

1. Do not interrupt utilities serving occupied or used facilities, except when authorized in writing by authorities having jurisdiction. Provide temporary services during interruptions to existing utilities, as acceptable to governing authorities.
2. Maintain fire protection services during selective demolition operations.
3. Use water sprinkling, temporary enclosures, and other methods to limit dust and dirt migration. Comply with governing regulations pertaining to environmental protection.
 - a. Do not use water when it may create hazardous or objectionable conditions such as flooding and pollution.

PART 2 PRODUCTS

2.1 GENERAL

- A. All materials shall meet or exceed all applicable referenced standards, federal, state and local requirements, and conform to codes and ordinances of authorities having jurisdiction.

A. MATERIAL OWNERSHIP

SECTION 024119 – SELECTIVE DEMOLITION

GOVERNMENT OF THE U. S. VIRGIN ISLANDS, DEPARTMENT OF PUBLIC WORKS

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- A. Except for items or materials indicated to be reused, salvaged, or otherwise indicated to remain the Owner's property, demolished materials shall become the Contractor's property and shall be removed from the Site with further disposition of the Contractor's option.

Historical items, relics, and similar objects including, but not limited to, cornerstones and their contents, commemorative plaques and tablets, antiques, and other items of interest or value to the Owner, which may be encountered during demolition, remain the Owner's property. Carefully remove and salvage each item or object in a manner to prevent damage and deliver promptly to the Owner.

PART 3 - EXECUTION

3.1 PREPARATION

- A. Provide interior and exterior shoring, bracing, or support to prevent movement, settlement, or collapse of areas to be demolished and adjacent facilities to remain.

Cease operations and notify Owner's Representative immediately if safety of structure appears to be endangered. Take precautions to support structure until determination is made for continuing operations.

Locate, identify, stub off, and disconnect utility services that are not indicated to remain.

1. Provide bypass connections as necessary to maintain continuity of service to occupied areas of building. Provide minimum of 72 hours advance notice to Owner if shutdown of service is necessary during changeover.

B. INSTALLATION

- A. Installation shall meet or exceed all applicable federal, state and local requirements, referenced standards and conform to codes and ordinances of authorities having jurisdiction.

All installation shall be in accordance with manufacturer's published recommendations.

C. DEMOLITION

- A. Perform selective demolition Work in a systematic manner. Use such methods as required to complete Work indicated on Drawings in accordance with demolition schedule and governing regulations.

Demolish concrete and masonry in small sections. Cut concrete and masonry at junctures with construction to remain using power driven masonry saw or hand tools; do not use power driven impact tools.

Locate demolition equipment throughout structure and promptly remove debris to avoid imposing excessive loads on supporting walls, floors, or framing.

Provide services for effective air and water pollution controls as required by local authorities having jurisdiction.

SECTION 024119 – SELECTIVE DEMOLITION

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Demolish foundation walls to a depth of not less than 12 inches below existing ground surface. Demolish and remove below grade wood or metal construction. Break up below grade concrete slabs.

For interior slabs on grade, use removal methods that will not crack or structurally disturb adjacent slabs or partitions. Use power saw where possible.

Completely fill below grade areas and voids resulting from demolition Work. Provide fill consisting of approved earth, gravel, or sand, free of trash and debris, stones over 6 inches in diameter, roots, or other organic matter.

Remove culvert or sewer pipe for reuse by careful excavation of all material on the top and sides so that the pipe will not be damaged. Removal of sewer appurtenances shall be included for removal with the pipe. Remove pipe which are unsatisfactory for reuse, and dispose of, off the Project Site.

Concrete parts of structures below the permanent ground-line shall be neatly squared off with reinforcement cut off close to the concrete.

Dismantle steel structures or steel portions of structures in sections determined by the Owner's Representative.

1. The sections shall be of such weight and dimensions which permit convenient handling, hauling and storing.
2. Rivet and bolts connecting steel rail members, steel beams or girder spans and steel stringers of truss spans will be removed by cutting the heads with a cold cut then punching or drilling by a method that will not injure the member for reuse.
3. The removal of rivets and bolts from connections will not be required unless specifically indicated.
4. Unless otherwise specified, the Contractor shall have the option of dismantling these members by flame cutting immediately adjacent to the connection.
5. Flame-cutting will not be permitted when Drawings call for the structural unit to be salvaged in such a manner as to permit re-erection. In such cases, all members shall be carefully dismantled without damage, match marked with paint, and all rivets and bolts removed from the connections.

Remove brick and stone structures by sledging the masonry into removal sizes. Portions of such structures below the permanent ground-line, which will not in any manner interfere with the proposed construction, may be left in place, but removal shall be carried at least two feet below the permanent ground-line and neatly squared off.

If unanticipated mechanical, electrical, or structural elements that conflict with intended function or design are encountered, investigate and measure both nature and extent of the conflict. Submit report to Owner's Representative in written, accurate detail. Pending receipt of directive from Owner's Representative, rearrange selective demolition schedule as necessary to continue overall job progress without undue delay.

SECTION 024119 – SELECTIVE DEMOLITION

GOVERNMENT OF THE U. S. VIRGIN ISLANDS, DEPARTMENT OF PUBLIC WORKS

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D. EXCAVATION AND BACKFILL

A. Back-fill to the level of the original ground-line, all excavation made in, and all openings below, the natural ground-line caused by the removal of old structures or portions thereof.

That portion of the back-fill which will support any portion of the roadbed or paving shall be placed in layers of the same thickness as those required subgrade preparation.

1. Material in each layer shall be wetted uniformly, if required, and shall be compacted to the density required in the adjoining embankment. In places inaccessible to blading and rolling equipment, mechanical or hand tampers shall be used to obtain the required compaction.

2. Place that portion of the back-fill which will not support any portion of the roadbed or paving in such a manner, and compact, to preclude settling.

E. DISPOSAL OF DEMOLISHED MATERIALS

Remove from building Site debris, rubbish, and other materials resulting from demolition operations. Transport and legally dispose off Site.

1. If hazardous materials are encountered during demolition operations, comply with applicable regulations, laws, and ordinances concerning removal, handling, and protection against exposure or environmental pollution.

2. Burning of removed materials is not permitted on the Project Site.

F. CLEANUP AND REPAIR

A. Upon completion of demolition Work, remove tools, equipment, and demolished materials from the Project Site. Remove protections and leave interior areas broom clean.

1. Repair demolition performed in excess of that required. Return elements of construction and surfaces to remain to condition existing prior to start operations. Repair adjacent construction or surfaces soiled or damaged by selective demolition Work.

END OF SECTION

SECTION 028500- MOLD REMEDIATION

GOVERNMENT OF THE U. S. VIRGIN ISLANDS, DEPARTMENT OF PUBLIC WORKS

PROJECT NAME: Elaine I. Sprauve Public Library and Museum Building

Project Location, St. John, U.S. Virgin Islands

PART 1 - GENERAL

1.1 SCOPE OF WORK

A. The Scope of work is as follows:

1. Remove all ceiling tile and grid systems, including all HVAC flex ducting and branch lines back to main trunk ducting;
2. Remove all drywall wall systems and associated framing and office doors throughout;
3. Remove all electrical conduit back to panel-boxes in mechanical rooms;
4. Treat remaining intact plaster wall and ceiling surfaces with antimicrobial solution and Mold inhibitor (main hallways and stairwells throughout);
5. Molding, plaster ceilings and walls, decorative columns, and light fixtures are intended to be salvaged and should be properly cleaned and preserved when possible;
6. Each Work Area/Floor is to be fully contained, placed under negative pressure with HEPA filtration, with adequate commercial de-humidifiers installed for the duration of the Mold Remediation;
7. Mold Air Clearance criterion will be inside general and concentrations being like-kind to outside readings at time of testing; and
8. Contractor is to provide a detailed Work Plan and Sequence regarding their approach to both the asbestos and Mold scopes of work.

The Mold Remediation Contractor shall be aware of all conditions of the Project and is responsible for verifying quantities and locations of all Work to be performed. Failure to do so shall not relieve the Mold Remediation Contractor of its obligation to furnish all labor, Personal Protection Equipment, and materials necessary to perform the Work.

All Work shall be performed in strict accordance with the Project Documents and all governing codes, rules, regulations and guidelines. Where conflicts occur between the Project Documents and applicable codes, rules, regulations and guidelines, the more stringent shall apply.

Working hours shall be as required and approved by the Owner. Mold removal activities including, but not limited to, mold remediation area preparation, gross removal activities, cleaning activities, waste removal, etc. may need to be performed during 'off-hours' (including nights and weekends). In addition, multiple mobilizations may be required to perform the work identified in this project. The Mold Remediation Contractor shall coordinate all Work with the facility and Owner's representative regarding scheduling.

B. SUBMITTALS

A. Pre-Work Submittals:

SECTION 028500- MOLD REMEDIATION

GOVERNMENT OF THE U. S. VIRGIN ISLANDS, DEPARTMENT OF PUBLIC WORKS

PROJECT NAME: Elaine I. Sprauve Public Library and Museum Building

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1. Within 7 days prior to the pre-construction conference, the Mold Remediation Contractor shall submit 3 copies of the documentation listed below:

Valid Mold Remediation Contractor license.

Mold Remediation Work Plan. List of procedures proposed for use in performance of the work, when required:

1. List all mold remediation areas and containments, including the quantities of materials to be cleaned or removed in each area or containment,
2. Locations and types of all decontamination enclosures,
3. Entrances and exits to each mold remediation area and/or containments,
4. Type of remediation activity, technique for each mold remediation area and/or containment,
5. Procedures to be utilized for any cleaning and disinfecting solutions, and the proposed list of EPA registered biocides, disinfectants and microbial coatings to be utilized on the project,
6. Mold remediation project notification signs to be displayed at all accessible entrances to mold remediation areas,
7. Number and location of High Efficiency Particulate Air (HEPA) filters and exhaust locations to the outside, with calculations for determining the number of HEPA filters, based on a minimum of 4 air changes per hour,
8. Procedures for temporary dehumidification of mold remediation area in accordance with contract documents, including section 2.10 of this Part
9. Location of water and electric connections for each mold remediation area,

Waste removal procedures and transport routes from the mold remediation area to the waste storage container.

1. Note: Proposed work plan shall include marked-up drawing(s) of the project mold remediation area(s) indicating proposed locations for decontamination units, negative air exhaust, dehumidification units (inside mold remediation area), waste dumpster, contractor parking, equipment storage, remediation area entrance/exit points, and water and electrical supply.

Safety Data Sheets (SDS)

1. Provide an SDS on the EPA registered products selected for use on this project. Substitution of alternative products is not permitted without authorization.

Progress Schedule:

SECTION 028500- MOLD REMEDIATION

GOVERNMENT OF THE U. S. VIRGIN ISLANDS, DEPARTMENT OF PUBLIC WORKS

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1. Provide an estimate of manpower to be utilized and the time required for completion of each major mold remediation area. Include estimated size, number of crews and work shifts.

Project Close-out Submittals:

1. Within 30 days of the completion of each remediation phase, the Contractor shall submit one hard copy of the documents listed below and one copy to the environmental consultant for review and approval and one set to be distributed to the facility prior to Contractor's final payment.

Daily Project Logs.

Provide the Contractor's Acknowledgement Statement (Appendix A) that lists all Workers used in the performance of the Project.

C. PRE-CONSTRUCTION CONFERENCE

- A. Prior to start of preparatory Work under the Contract, the Mold Remediation Contractor shall attend a pre-construction conference attended by the Owner, Facility Personnel, and Environmental Consultant.

Agenda for this conference shall include but not limited to:

1. Mold Remediation Contractor's scope of Work,
2. Review of pre-work submittals and on-site documentation,
3. Review of Work procedures including:
 - a. Job site preparation,
 - b. Pre-cleaning of surfaces,
 - c. Handling of moveable objects,
 - d. Mold remediation area containment, including non-moveable objects
 - e. Removal methods and decontamination,
 - f. Final inspection and clearance preparation,
4. Building occupant notifications,
5. Environmental Consultant's duties, functions, and authority,
6. Temporary utilities,
7. Waste handling procedures and storage for disposal.

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In conjunction with the conference the Mold Remediation Contractor shall accompany the Owner and Environmental Consultant on a pre-construction walk-through documenting existing conditions of finishes and furnishings, review overall Work Procedures, location of fire exits, fire protection equipment, water supply and temporary electric tie-in.

D. APPLICABLE GUIDANCE DOCUMENTS, REGULATIONS AND COMPLIANCE

A. The Mold Remediation Contractor shall comply with the following guidance documents and regulations, pertaining to Work practices, protection of Workers, authorized visitors to the site and property adjacent to the Work, except where more stringent requirements are specified.

Guidance Documents:

1. United States Environmental Protection Agency (EPA) Mold Remediation in Schools and Commercial Buildings, EPA 402-K-01-001.

Federal Regulations:

1. 29 CFR 1910.134, Respiratory Protection Standard (OSHA)
2. 29 CFR 1926, Construction Industry (OSHA)
3. 29 CFR 1926.417 and 1926.702, Lockout Tag-out (OSHA)
4. 29 CFR 1926.451 to 1926.1060, Fall Protection (OSHA)
5. 29 CFR 1910.1200, Hazard Communication Standard (OSHA)

E. NOTICES

A. The Mold Remediation Contractor shall provide and coordinate with the Environmental Consultant and the Owner, regarding notification to the occupants and other Contractors in the affected area(s) of the mold presence, description of the remedial measures to be taken and a timetable for completion. Notification signage shall be posted at all accessible entrances to the remediation areas.

F. RECORD KEEPING

A. The Mold Remediation Contractor shall maintain a Daily Project Log consisting of a three ring binder. Prior to Mold Remediation Contractor demobilization, a copy of the completed daily project log shall be provided to the owner's on-site representative. During the active remediation, a copy shall be provided daily to the Environmental Consultant. The Daily Project Log shall be utilized each day to document the following information:

1. Date and time of the project,
2. Name of Project Manager/Project Supervisor,
3. List of mold abatement workers,

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4. Brief description of daily work activities,

5. Each remediation area shall have a daily sign in and sign out sheet, and the completed daily sign in/out sheets shall be maintained in the daily progress log,

G. PROJECT SUPERVISOR:

A. The Mold Remediation Contractor shall designate a full-time Project Supervisor who is qualified Mold Abatement Worker Supervisor to enter the mold remediation areas. The Project Supervisor must be able to read and write English fluently, as well as communicate in the primary language of the Workers.

The Project Supervisor shall maintain a Daily Project Log and transmit a copy daily to the Environmental Consultant.

The Project Supervisor shall be responsible for the performance of the Work and shall represent the Mold Remediation Contractor in all respects at the Project site. The Supervisor shall be the primary point of contact for the Environmental Consultant.

H. PROJECT MONITORING & ASSESSOR INSPECTIONS

A. The Owner shall engage the services of an Environmental Consultant who shall serve as the Owner's Representative in regard to the performance of the mold remediation Project and provide direction as required throughout the remediation.

The Mold Remediation Contractor is required to ensure cooperation of its personnel with the Environmental Consultant for the inspection, monitoring, and clearance requirements. The Mold Remediation Contractor shall comply with all direction given by the Environmental Consultant during the course of the Project.

The Environmental Consultant shall review and approve or disapprove all submittals (pre-work, on-site, closeout), shop drawings and schedules.

The Environmental Consultant shall provide visual inspections prior to the start of work and final clearance inspection of the mold remediation areas.

The Environmental Consultant shall provide bulk and air sampling services when required for the Project.

I. RESPIRATORY PROTECTION

A. Select respirators based upon the anticipated exposure with a minimum acceptable half-face negative pressure respirator for all mold remediation areas, and choose from those approved by the National Institute for Occupational Safety and Health (NIOSH).

Respirators shall be individually fit-tested to personnel. Fit-tested respirators shall be permanently marked to identify the individual fitted, and use shall be limited to that individual.

No respirators shall be issued to personnel without such personnel participating in a respirator training program.

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High Efficiency Particulate Air (HEPA) respirator filters shall be approved by NIOSH and shall conform to the OSHA requirements in 29 CFR 1910.134.

A storage area for respirators shall be provided by the Mold Remediation Contractor in a clean area of the personnel decontamination enclosure where they will be kept in a clean environment.

The Mold Remediation Contractor shall provide and make available a sufficient quantity of respirator filters so that filter changes can be made as necessary during the work day.

Filters used with negative pressure air purifying respirators shall not be used any longer than one eight (8) hour work day. Any loose respirator filters found within the mold remediation area, must be disposed of appropriately.

Any authorized visitor, Worker, or supervisor found in the Mold Remediation Area not wearing the required respiratory protection shall be removed from the Project site and not be permitted to return.

The Contractor shall have at least two (2) Powered Air Purifying Respirators stored on site designated for authorized visitors use. Appropriate respirator filters for authorized visitors shall be made available by the Contractor.

J. TRAINING

A. As required by applicable federal and state laws/regulations, prior to assignment to mold remediation work, provide yearly fit test and instruct each employee with regard to use of respirators, and protective clothing,

Instruct each worker regarding site-specific safety measures and emergency egress procedures,

Provide hazard communication (HAZCOM) training regarding the potential for exposure to microbials (e.g., mold, bacteria, and fungi), cleaning agents, anti-fungal coatings, and any other hazard(s) expected to be encountered during the mold remediation work. The training shall include how to recognize materials contaminated with mold, bacteria, and fungi; signs and symptoms of and hazards associated with exposure to mold, fungal, and bacterial contamination; how to prevent contamination outside the mold remediation area; and how employees can protect themselves from the expected exposures. Other identified hazard(s) shall be similarly addressed.

K. TEMPORARY UTILITIES

A. Shut down and lock out all electrical power to the Mold Remediation Areas.

Where available, obtain power from the Owner's existing system or provide temporary 120-240 volt, single phase, three wire, 100 amp electric service with Ground Fault Circuit Interrupters (GFCI) for all electric requirements within the Mold Remediation Area.

1. Where available, obtain from Owner's existing system. Otherwise provide power from other sources (i.e. generator).
2. Provide temporary wiring and "weatherproof" receptacles in sufficient quantity and location to serve all HEPA equipment and tools.

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3. Provide wiring and receptacles as required by the Environmental Consultant for project monitoring and air sampling equipment (pumps, fans, leaf blowers, etc.), if necessary for intended tasks.

4. All power to the Mold Remediation Area shall be brought in from outside the area through GFCT's at the source.

Provide temporary lighting with "weatherproof" fixtures for all mold remediation areas including decontamination areas.

1. The entire Mold Remediation Area shall be kept illuminated at all times.

2. Provide lighting as required by the Environmental Consultant for the purposes of performing required inspections.

All temporary devices and wiring used in the Mole Remediation Area shall be capable of decontamination procedures including HEPA vacuuming and wet-wiping.

Utilize domestic water service, if available, from Owner's existing system.

PART 2 - PRODUCTS

2.1 PROTECTIVE CLOTHING

A. Provide personnel utilized during the Project with disposable protective whole body clothing, head coverings, gloves and foot coverings. Provide disposable plastic or rubber gloves to protect hands. Cloth gloves may be worn inside the plastic or rubber for comfort, but shall not be used alone. Make sleeves secure at the wrists and make foot coverings secure at the ankles by the use of tape, or provide disposable coverings with elastic wrists or tops.

The Mold Remediation Contractor shall not under any circumstances permit any person to enter the mold remediation areas without the appropriate protective clothing and equipment. The Mold Remediation Contractor shall provide protective clothing for use by the Environmental Consultant. The Mold Remediation Contractor shall furnish as many sets as required for full-time monitoring.

Eye protection and hard hats shall be provided and made available for all personnel entering any Mold Remediation Area.

Authorized visitors shall be provided with suitable protective clothing, headgear, eye protection, and footwear whenever they enter the Mold Remediation Area.

A. HEPA FILTER EQUIPMENT

A. All negative air filtrations units and vacuum units shall be equipped with a High Efficiency Particulate Air filters.

B. CLEANING & DISINFECTING AGENTS

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- A. Provide standard detergents to be used for cleaning and that shall be diluted in water and used in a manner as directed by manufacturer labeling.

If approved for use by the Owner and Environmental Consultant in writing, any disinfecting agents shall be utilized as directed by manufacturer labeling.

C. ANTI-FUNGAL COATING

- A. Provide anti-fungal coating approved for use by the Owner and Environmental Consultant in writing.

D. POLYETHYLENE SHEETING

- A. A. Provide fire-retardant polyethylene sheeting film in the largest sheet size possible to minimize seams, 6-mil thick.

E. DUCT TAPE

- A. Provide duct tape with an adhesive that is formulated to stick aggressively to sheet polyethylene and other surfaces where it will be used to create a seal.

F. DISPOSAL BAGS

- A. Provide unlabeled, 6-mil thick, leak-tight polyethylene bags.

G. BARRIER TAPE

- A. Provide yellow or red plastic caution tape 3 inches wide. "Asbestos" or "Lead" wording on the tape is not permitted.

H. DECONTAMINATION AREA

- A. The Contractor shall provide a decontamination space for the purpose of separating each mold remediation area from the non-remediation areas of the building. This space/area provides for entering the remediation area, returning to the clean environment, cleaning of persons and equipment, and movement of properly-contained waste material.

I. WARNING SIGNAGE

- A. Provide signage with a minimum size of 8-1/2 inches by 11 inches with a white background on which is printed in large type with wording in the format shown below:

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MOLD REMEDIATION

DO NOT ENTER

AUTHORIZED PERSONNEL ONLY

RESPIRATORS AND PROTECTIVE CLOTHING

ARE REQUIRED IN THIS AREA

PART 3 - EXECUTION

3.1 GENERAL REQUIREMENTS

- A. The scope of work includes removal of visual fungal growth on contaminated materials. The Mold Remediation Contractor shall generate a Mold Remediation Work Plan based upon the contract documents. The Work Plan shall be submitted and approved prior to its implementation. The remediation procedures shall be identified in the Work Plan for each remediation mold remediation area based on the size, complexity and remediation methods required.

The following submittals, documentation, and postings shall be maintained on-site by the Mold Remediation Contractor during remediation activities at a location approved by the Environmental Consultant:

1. Project documents (specifications and drawings.)
2. Approved Mold Remediation Work Plan
3. Building Occupant Notification.
4. Applicable laws and regulations.
5. Safety Data Sheets of supplies/chemicals used on the Project.
6. Disposal Site/Landfill Permit from applicable regulatory agency.
7. List of emergency telephone numbers.
8. Daily Project Log.
9. Entry/Exit Logs.

The following documentation shall be maintained on-site by the Environmental Consultant during abatement activities:

1. Project Monitor Daily Log
2. Assessor's Written Report

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3. Completed Assessor Post-Remediation Visual Clearance Inspection Summaries

B. CONTAINMENT BARRIERS

- A. When containment of the mold remediation areas is not necessary, dust suppression methods shall be utilized.

When containment of the mold remediation area is required, the Mold Remediation Contractor must be careful not to disturb fungal contaminated building materials while isolating mold remediation areas to prevent the release of fungal spores. Pre-cleaning of interior surfaces shall be completed prior to the erection of the containment. Moveable objects within the mold remediation area shall be discarded or HEPA vacuumed, wet-wiped and removed from the area or isolated from the work. Workers shall wear respirators when required, while installing isolation barriers if fungal contaminated surfaces (walls or surfaces with visible settled dusts) are likely to be disturbed. The Mold Remediation Contractor shall completely isolate the mold remediation areas for the duration of the work by sealing off all walls, floors, openings, and fixtures in the mold remediation areas including, but not limited to, heating and ventilation supply air ducts and diffusers and return air ducts and grilles (HVAC system totally de-energized - no HVAC system airflow into or out of mold remediation area), return air grilles, common return air plenums, doorways, corridors, windows, skylights, and lighting with polyethylene sheeting held securely in place as described in this section. The containment must be constructed to prevent the spread of mold to areas outside the containment. Warning signage shall be posted at all accessible containment barrier locations.

Containment Entry and Exit Procedures shall be established as required for the work.

Personnel, equipment and waste decontamination procedures shall be established as required for the work.

C. NEGATIVE PRESSURE

- A. The Mold Remediation Contractor shall establish a negative air pressure differential inside the indoor enclosed mold remediation areas. Negative Pressure Systems shall be exhausted to the exterior of the building. The Mold Remediation Contractor shall ensure that negative air pressure differential is maintained the Environmental Consultant has determined that the mold remediation area has passed the final inspection. If the length of the exhaust will exceed 25ft, include adequate measures in the Mold Remediation Work Plan to maintain the required air changes (e.g. booster fans, increased exhaust tube diameter, interior exhaust to unoccupied area, etc.). See current federal asbestos regulations for accepted practices regarding extending length of negative air ventilation exhaust.

D. WORK PROCEDURES

- A. All waste shall be decontaminated and/or removed under containment. As waste is removed, it shall be placed into a disposal container promptly. Disposal procedures, at a minimum, shall consist of single bagging using 6-mil polyethylene bags or single wrapped with 6-mil polyethylene sheeting. Bags shall be taped to form an airtight seal. Waste from HEPA-filtered vacuums shall be single bagged in 6-mil polyethylene bags.

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The Mold Remediation Contractor shall keep the site and mold remediation area free from accumulations of bagged material or rubbish caused by its operations and free from any flammable materials or other source of fire hazard.

All visually contaminated materials and adjacent visually uncontaminated material shall be cleaned and/or removed under full containment unless specified otherwise.

Cleaning and disinfecting agents shall be utilized to clean all remaining surfaces within the mold remediation area(s).

In the event that areas adjoining the enclosed project area become or are suspected of becoming contaminated with spores as a result of the Mold Remediation Contractor's work, the Mold Remediation Contractor shall thoroughly clean the affected areas. These areas shall be subject to detailed visual inspection and potentially post-remediation clearance sampling by the Environmental Consultant.

E. CLEARANCE PREPARATION

A. When containment areas are not utilized, the mold remediation area and areas used by remedial workers for egress shall be cleaned.

When containment is utilized, all mold remediation area surfaces and layers of polyethylene barrier sheeting shall be cleaned. If negative pressure is utilized, the negative air machines shall remain in operation until notified by the Environmental Consultant of satisfactory clearance.

F. POST-REMEDIATION CLEARANCE INSPECTIONS

A. After all visible accumulations of material and debris are removed the Mold Remediation Contractor shall notify the Environmental Consultant Assessor for a post-remediation final clearance visual inspection/assessment. The Mold Remediation Contractor and Environmental Consultant shall conduct a thorough visual inspection of the mold remediation area. The Environmental Consultant shall inspect the remaining building materials for the presence of moisture, utilizing a moisture meter to test porous materials. If during this inspection, any visible dust, debris and/or water damage is observed, visible mold growth is present on any surface, and/or moisture elevated above material-specific levels is detected for any impacted building material within the mold remediation area, the Mold Remediation Contractor shall remove, re-clean, and/or dehumidify as required. The Mold Remediation Contractor shall pay all associated costs for the re-cleaning dehumidification, and additional post-remediation verification inspection and any sampling services.

Post-remediation verification sampling (if requested by the Owner) shall proceed only upon written notice of successful post-remediation visual clearance issued by the Environmental Consultant (Mold Assessor).

Application of any anti-fungal coating shall proceed only upon receipt written notice of successful post-remediation verification visual inspection (and post-remediation verification sampling, if requested by Owner) issued by the Environmental Consultant. The anti-fungal coating shall not be applied prior to the post-remediation verification process.

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Breakdown of containment shall proceed only upon receipt of clearance issued by the Environmental Consultant Assessor and completion of anti-fungal coating application. No person shall remove or dismantle any containment structures or materials from a project site prior to receipt by the mold remediation contractor of satisfactory clearance as determined by the licensed mold assessment firm and described in the NYS DOL mold law.

The post-remediation Assessor inspection/assessment shall also include verification that the underlying cause of the mold has been remediated so that it is reasonably certain that the mold will not return to the remediated area.

G. POST-REMEDIATION VERIFICATION SAMPLING(IF REQUESTED BY OWNER)

- A. The Environmental Consultant may conduct post-remediation air or dust sampling, at discretion of owner. Samples shall be analyzed by an AIHA accredited microbiological laboratory.

H. RESTORATION OF UTILITIES, FIRESTOPPING AND FINISHES

- A. After final clearance, remove locks and restore electrical and HVAC systems. All temporary power shall be disconnected, power lockouts removed and power restored. All temporary plumbing shall be removed.

Finishes damaged by the Mold Remediation Contractor including, but not limited to, plaster/paint damage due to duct tape and spray adhesives, and floor tile lifted due to wet or humid conditions, shall be restored and/or replaced prior to final payment. All foam and expandable foam products and materials used to seal mold remediation area openings shall be completely removed upon completion of remediation activities.

All penetrations through fire rated construction shall be fire stopped using materials and systems tested in accordance with ASTM E814 on Projects where re-insulation is part of the required work.

END OF SECTION

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DIVISION 5- METALS

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SECTION 05300 – COLD FORMED METAL FRAMING

GOVERNMENT OF THE U. S. VIRGIN ISLANDS, DEPARTMENT OF PUBLIC WORKS

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PART 1. GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division I Specification Sections, apply to this Section.

1.2 SUMMARY

- A. This Section includes the following:
1. Exterior non-load-bearing curtain-wall framing.
 2. Ceiling joist framing.
 3. Gypsum sheathing and air-infiltration barriers.

1.3 DEFINITIONS

- A. Minimum Uncoated Steel Thickness:
Minimum uncoated thickness of cold-formed framing delivered to the Project site shall be not less than 95 percent of the thickness used in the cold-formed framing design. Lesser thicknesses shall be permitted at bends due to cold forming.
- B. Producer:
Entity that produces steel sheet coil fabricated into cold-formed members.

1.4 SUBMITTALS

- A. Product Data:
For each type of cold-formed metal framing product and accessory indicated.
- B. Shop Drawings:
Show layout, spacing, sizes, thicknesses, and types of cold-formed metal framing; fabrication; and fastening and anchorage details, including mechanical fasteners. Show reinforcing channels, opening framing, supplemental framing, strapping, bracing, bridging, splices, accessories, connection details, and attachment to adjoining Work.
1. For cold-formed metal framing indicated to comply with design loads, include structural analysis data signed and sealed by the qualified professional engineer responsible for their preparation.
- C. Mill certificates signed by steel sheet producer or test reports from a qualified independent testing agency indicating steel sheet complies with requirements.
- D. Welding Certificates:
Copies of certificates for welding procedures and personnel.
- E. Qualification Data:
For firms and persons specified in "Quality Assurance" Article to demonstrate their capabilities and experience. Include lists of completed projects with project names and addresses, names and addresses of Project Managers and owners, and other information specified.

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F. Product Test Reports:

From a qualified testing agency indicating that each of the following complies with requirements, based on comprehensive testing of current products:

1. Expansion anchors.
2. Power-actuated anchors.
3. Mechanical fasteners.
4. Vertical deflection clips.
5. Miscellaneous structural clips and accessories.

G. Research/Evaluation Reports:

Evidence of cold-formed metal framing's compliance with building code in effect for Project, from a model code organization acceptable to authorities having jurisdiction.

1.5 QUALITY ASSURANCE

A. Installer Qualifications:

An experienced installer who has completed cold formed metal framing similar in material, design, and extent to that indicated for this Project and whose work has resulted in construction with a record of successful in service performance.

B. Engineering Responsibility:

Engage a qualified professional engineer to prepare design calculations, Shop Drawings, and other structural data.

C. Professional Engineer Qualifications:

A professional engineer who is legally qualified to practice in the Virgin Islands and who is experienced in providing engineering services of the kind indicated. Engineering services are defined as those performed for installations of cold-formed metal framing that are similar to those indicated for this Project in material, design, and extent.

D. Mill certificates signed by steel sheet producer or test reports from a qualified independent testing agency indicating steel sheet complies with requirements, including uncoated steel thickness, yield strength, tensile strength, total elongation, chemical requirements, ductility, and galvanized-coating thickness.

E. Testing Agency Qualifications:

An independent testing agency, acceptable to authorities having jurisdiction, qualified according to ASTM E 329 to conduct the testing indicated, as documented according to ASTM E 548.

F. Welding:

Qualify procedures and personnel according to AWS D 1.1, "Structural Welding Code--Steel," and AWS D1.3, "Structural Welding Code--Sheet Steel."

G. Fire-Test-Response Characteristics:

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~~Where metal framing is part of a fire resistance rated assembly, provide framing identical~~
to that of assemblies tested for fire resistance per ASTM E 119 by a testing and inspecting agency acceptable to authorities having jurisdiction.

1. Fire-Resistance Ratings:

Indicated by GA File Numbers in GA-600, "Fire Resistance Design Manual," or by design designations from UL's "Fire Resistance Directory" or from the listings of another testing and inspecting agency.

H. AISI Specifications:

Comply with AISI's "Specification for the Design of Cold Formed Steel Structural Members" or "Load and Resistance Factor Design Specification for Cold Formed Steel Structural Members" and the following for calculating structural characteristics of cold formed metal framing:

1. CCFSS Technical Bulletin:

"AISI Specification Provisions for Screw Connections."

I. Pre-installation Conference:

Conduct conference at Project site to comply with requirements in Division 1 Section "Project Meetings."

J. Engineering Criteria:

The maximum allowable deflection (due to wind load) of framing supporting masonry veneer walls shall be $L/720$. The maximum allowable lateral deflection of general interior partition framing shall be $L/240$. Engineering of interior metal stud systems shall accommodate a lateral load of 5 psf.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Protect cold-formed metal framing from corrosion, deformation, and other damage during delivery, storage, and handling.

B. Store cold-formed metal framing, protect with a waterproof covering, and ventilate to avoid condensation.

PART 2- PRODUCTS

2.1 MANUFACTURERS

A. Available Manufacturers:

Subject to compliance with requirements, manufacturers offering cold-formed metal framing that may be incorporated into the Work include, but are not limited to, the following:

B. Manufacturers:

Subject to compliance with requirements, provide cold-formed metal framing by one of the following:

1. Clark Steel Framing Industries.

2. Consolidated Systems, Inc.

3. Dale Industries, Inc.

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4. Dietrich Industries, Inc.
5. MarinoWare; Div. of Ware Industries, Inc.
6. Steel Construction Systems.
7. Super Stud Building Products, Inc.
8. Unimast, Inc.
9. Hexaport International Ltd.

2.2 MATERIALS

A. Steel Sheet:

ASTM A 653/A 653M, structural steel, zinc coated, of grade and coating as follows:

1. Grade:
50 (340), Class 1 or 2 50 (340), Class 3.
2. Coating:
G60 (ZI80) G90 (Z275).

2.3 NON-LOAD-BEARING CURTAIN-WALL FRAMING

A. Steel Studs:

Manufacturer's standard C-shaped steel studs, of web depths indicated, punched, with stiffened flanges, complying with ASTM C 955, and as follows:

1. Minimum Uncoated-Steel Thickness:
0.0538 inch (1.37 mm).
2. Flange Width:
1-5/8 inches (41 mm).

B. Steel Track:

Manufacturer's standard U-shaped steel track, of web depths indicated, not punched, with unstiffened flanges, complying with ASTM C 955, and as follows:

1. Minimum Uncoated Steel Thickness:
0.0538 inch (1.37 mm) Matching steel studs.
2. Flange Width:
1 -1/4 inches (32 mm).

C. Single Deflection Track:

Manufacturer's single, deep-leg, U-shaped steel track; not punched, with unstiffened flanges, of web depth to contain studs while allowing free vertical movement, with flanges designed to support horizontal and lateral loads, and as follows:

1. Minimum Uncoated-Steel Thickness:
0.0538 inch (1.37 mm).

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2. Flange Width:

2 1/2 (65 mm) 1/2 inch.

D. Double Deflection Tracks:

Manufacturer's double, deep-leg, U-shaped steel tracks, consisting of nested inner and outer tracks; not punched, with unstiffened flanges.

1. Outer Track:

Of web depth to allow free vertical movement of inner track, with flanges designed to support horizontal and lateral loads, and as follows:

- a. Minimum Uncoated-Steel Thickness: 0.0538 inch (1.37 mm).
- b. Flange Width: 2 inches (50 mm)

2. Inner Track:

Of web depth indicated, and as follows:

- a. Minimum Uncoated-Steel Thickness: 0.0538 inch (1.37 mm).
- b. Flange Width: 3-1/2 inches is typical.

E. Vertical Deflection Clips:

Manufacturer's standard bypass clips, capable of accommodating upward and downward vertical displacement of primary structure.

2.4 CEILING JOIST FRAMING

A. Steel Ceiling Joists:

Manufacturer's standard C-shaped steel sections, of web depths indicated, not punched, with stiffened flanges, complying with ASTM C 955, and as follows:

1. Minimum Uncoated-Steel Thickness: 0.0538 inch (1.37 mm).
2. Flange Width: 1-5/8 inches (41 mm), minimum.

2.5 FRAMING ACCESSORIES

A. Fabricate steel-framing accessories of the same material and finish used for framing members, with a minimum yield strength of 33,000 psi (230 MPa).

B. Provide accessories of manufacturer's standard thickness and configuration, unless otherwise indicated, as follows:

1. Supplementary framing.
2. Bracing, bridging, and solid blocking.
3. Web stiffeners.
4. End clips.
5. Foundation clips.

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6. Gusset plates

7. Stud kickers, knee braces, and girts.
8. Joist hangers and end closures.
9. Hole reinforcing plates.
10. Backer plates.

2.6 ANCHORS, CLIPS, AND FASTENERS

A. Steel Shapes and Clips:

ASTM A 240/A 666, Stainless Steel Type 316

B. Anchor Bolts:

ASTM A 240/A 666, Stainless Steel Type 316, threaded carbon-steel hex-headed bolts and carbon-steel nuts; and flat, hardened-steel washers.

C. Expansion Anchors:

Fabricated from corrosion-resistant materials, with capability to sustain, without failure, a load equal to 5 times design load, as determined by testing per ASTM E 488 conducted by a qualified independent testing agency.

D. Power-Actuated Anchors:

Fastener system of type suitable for application indicated, fabricated from corrosion resistant materials, with capability to sustain, without failure, a load equal to 10 times design load, as determined by testing per ASTM E 1190 conducted by a qualified independent testing agency.

E. Mechanical Fasteners:

Corrosion resistant-coated, self-drilling, self-threading steel drill screws.

1. Head Type:

Low-profile head beneath sheathing, manufacturer's standard elsewhere.

F. Welding Electrodes:

Comply with AWS standards.

2.7 MISCELLANEOUS MATERIALS

A. Galvanizing Repair Paint:

SSPC-Paint 20 or DOD-P-21035 ASTM A 780.

B. Nonmetallic, Non-shrink Grout:

Premixed, nonmetallic, noncorrosive, non-staining grout containing selected silica sands, Portland cement, shrinkage-compensating agents, and plasticizing and water-reducing agents, complying with ASTM C 1107, with fluid consistency and 30-minute working time.

C. Thermal Insulation:

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~~ASTM C 665, Type I, un-faced mineral fiber blankets produced by combining glass or slag fibers with thermosetting resins.~~

2.8 GYPSUM SHEATHING

A. Glass-Mat Gypsum Sheathing Board:

ASTM C 1177/C 1177M.

1. Type and Thickness:
Type X, 5/8 inch (15.9 mm) thick.
2. Size:
48 by 96 inches (1219 mm by 2438 mm).
3. Available Product:
Subject to compliance with requirements, a product that may be incorporated into the Work includes, but is not limited to, "Dens-Glass Gold" by Georgia-Pacific Corp.

2.9 SHEATHING ACCESSORIES

A. Air-Infiltration Barrier:

Asphalt-saturated organic felt, ASTM D 226, Type 1 (No. 15 asphalt felt), unperforated for use where cavity wall rigid insulation not installed with brick veneer or where EIFS systems not employed.

B. Fasteners:

Steel drill screws, ASTM C 954, in length recommended by sheathing manufacturer for thickness of sheathing board to be attached, with organic polymer or other corrosion-protective coating having a salt-spray resistance of more than 800 hours according to ASTM B 117.

2.10 FABRICATION

A. Fabricate cold-formed metal framing and accessories plumb, square, and true to line, and with connections securely fastened, according to manufacturer's written recommendations and requirements in this Section.

1. Fabricate framing assemblies using jigs or templates.
2. Cut framing members by sawing or shearing; do not torch cut.
3. Fasten cold-formed metal framing members by welding or screw fastening, as standard with fabricator. Wire tying of framing members is not permitted.
 - a. Comply with AWS D1.3 requirements and procedures for welding, appearance and quality of welds, and methods used in correcting welding work.
 - b. Locate mechanical fasteners and install according to Shop Drawings, with screw penetrating joined members by not less than three exposed screw threads.
4. Fasten other materials to cold -formed metal framing by welding, bolting, or screw fastening, according to Shop Drawings.

B. Reinforce, stiffen, and brace framing assemblies to withstand handling, delivery, and erection

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~~stresses. Lift fabricated assemblies to prevent damage or permanent distortion.~~

C. Fabrication Tolerances:

Fabricate assemblies level, plumb, and true to line to a maximum allowable tolerance variation of 1/8 inch in 10 feet (1:960) and as follows:

1. Spacing:

Space individual framing members no more than plus or minus 1/8 inch (3 mm) from plan location. Cumulative error shall not exceed minimum fastening requirements of sheathing or other finishing materials.

2. Squareness:

Fabricate each cold-formed metal framing assembly to a maximum out-of-square tolerance of 1/8 inch (3 mm).

PART 3- EXECUTION

3.1 EXAMINATION

- A. Examine supporting substrates and abutting structural framing for compliance with requirements for installation tolerances and other conditions affecting performance. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Grout bearing surfaces uniform and level to ensure full contact of bearing flanges or track webs on supporting concrete or masonry construction.

3.3 INSTALLATION, GENERAL

- A. Cold-formed metal framing may be shop or field fabricated for installation, or it may be field assembled.
- B. Install cold-formed metal framing according to ASTM C 1007, unless more stringent requirements are indicated.
- C. Install shop or field fabricated, cold-formed framing and securely anchor to supporting structure.
1. Bolt or weld wall panels at horizontal and vertical junctures to produce flush, even, true-to-line joints with maximum variation in plane and true position between fabricated panels not exceeding 1/16 inch (1.6 mm).
- D. Install cold-formed metal framing and accessories plumb, square, and true to line, and with connections securely fastened, according to manufacturer's written recommendations and requirements in this Section.
1. Cut framing members by sawing or shearing; do not torch cut.
2. Fasten cold-formed metal framing members by welding or screw fastening, as standard with fabricator. Wire tying of framing members is not permitted.
- a. Comply with AWS D1.3 requirements and procedures for welding, appearance and quality of welds, and methods used in correcting welding work.

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~~b. Locate mechanical fasteners and install according to Shop Drawings, with screw~~
penetrating joined members by not less than three exposed screw threads.

- E. Install framing members in one-piece lengths, unless splice connections are indicated for track or tension members.
- F. Install temporary bracing and supports to secure framing and support loads comparable in intensity to those for which structure was designed. Maintain braces and supports in place, undisturbed, until entire integrated supporting structure has been completed and permanent connections to framing are secured.
- G. Do not bridge building expansion and control joints with cold-formed metal framing. Independently frame both sides of joints.
- H. Install insulation in built-up exterior framing members, such as headers, sills, boxed joists, and multiple studs at openings, that are inaccessible on completion of framing work.
- I. Fasten hole reinforcing plate over web penetrations that exceed size of manufacturer's standard punched openings.
- J. Erection Tolerances:
Install cold-formed metal framing level, plumb, and true to line to a maximum allowable tolerance variation of 1/8 inch in 10 feet (1:960) and as follows:
 - 1. Space individual framing members no more than plus or minus 1/8 inch (3 mm) from plan location. Cumulative error shall not exceed minimum fastening requirements of sheathing or other finishing materials.

3.4 NON-LOAD-BEARING CURTAIN-WALL INSTALLATION

- A. Install continuous tracks sized to match studs. Align tracks accurately and securely anchor to supporting structure as indicated.
- B. Fasten both flanges of studs to top and bottom track, unless otherwise indicated. Space studs as follows:
 - 1. Stud Spacing:
16 inches (406 mm).
- C. Set studs plumb, except as needed for diagonal bracing or required for not plumb walls or warped surfaces and similar requirements.
- D. Isolate non-load-bearing steel framing from building structure to prevent transfer of vertical loads while providing lateral support.
 - 1. Install single deep-leg deflection tracks and anchor to building structure.
 - 2. Install double deep-leg deflection tracks and anchor outer track to building structure.
 - 3. Connect vertical deflection clips to bypassing infill studs and anchor to primary building structure.
- E. Install horizontal bridging in curtain-wall studs, spaced in rows indicated on Shop Drawings but not more than 54 inches (1370 mm) apart. Fasten at each stud intersection.

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1. Top Bridging for Single Deflection Track:
Install row of horizontal bridging within 12 inches (300 mm) of single deflection track. Install a combination of flat, taut, steel sheet straps of width and thickness indicated and stud or stud-track solid blocking of width and thickness matching studs. Fasten flat straps to stud flanges and secure solid blocking to stud webs or flanges.
 - a. Install solid blocking at centers indicated.
 2. Bridging:
Cold-rolled steel channel, welded or mechanically fastened to webs of punched studs.
 3. Bridging:
Combination of flat, taut, steel sheet straps of width and thickness indicated and stud-track solid blocking of width and thickness to match studs. Fasten flat straps to stud flanges and secure solid blocking to stud webs or flanges.
- F. Install miscellaneous framing and connections, including stud kickers, web stiffeners, clip angles, continuous angles, anchors, fasteners, and stud girts, to provide a complete and stable curtain wall framing system.

3.5 GYPSUM SHEATHING INSTALLATION

- A. General:
Install gypsum sheathing to comply with GA-253 and manufacturer's written instructions.
- B. Cut boards at penetrations, edges, and other obstructions of the work; fit tightly against abutting construction, except provide a 3/8-inch (9-mm) setback where non-load-bearing construction abuts structural elements.
- C. Coordinate sheathing installation with flashing and joint sealant installation so these materials are installed in the sequence and manner that prevent exterior moisture from passing through completed exterior wall assembly.
- D. Apply fasteners so screw heads bear tightly against face of sheathing boards but do not cut into facing.
- E. Do not bridge building expansion joints with sheathing; cut and space edges to match spacing of structural support elements.
- F. Vertical Installation:
Install 48-inch (1219-mm) 1200-mm wide gypsum sheathing boards vertically with vertical edges centered over flanges of steel studs. Abut ends and edges of each board with those of adjacent boards. Screw-attach boards at perimeter and within field of board to each steel stud at approximately 8 inches (200 mm) O.C. and set back a minimum of 3/8 inch (9 mm) from edges and ends of boards.
- G. Air-Infiltration Barrier Application:
Cover sheathing with air-infiltration barrier as follows:
1. Cut back air-infiltration barrier 1/2 inch (13 mm) on each side of break in supporting members at expansion- or control-joint locations.

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2. Apply asphalt-saturated organic felt horizontally with 2-inch (50-mm) overlap and 6-inch (150-mm) end lap; fasten to sheathing with corrosion-resistant staples.

3.6 FIELD QUALITY CONTROL

- A. Testing:
Owner will engage a qualified independent testing agency to perform field quality-control testing.
- B. Field and shop welds will be subject to inspection and testing.
- C. Testing agency will report test results promptly and in writing to Contractor and Project Manager.
- D. Remove and replace Work that does not comply with specified requirements.
- E. Additional testing and inspecting, at Contractor's expense, will be performed to determine compliance of corrected Work with specified requirements

3.7 REPAIRS AND PROTECTION

- A. Galvanizing Repairs:
Prepare and repair damaged galvanized coatings on fabricated and installed cold-formed metal framing with galvanized repair paint according to ASTM A 780 and manufacturer's written instructions.
- B. Touchup Painting:
Wire brush, clean, and paint scarred areas, welds, and rust spots on fabricated and installed prime-painted, cold-formed metal framing. Paint framing surfaces with same type of shop paint used on adjacent surfaces.
- C. Protect paper-surfaced gypsum sheathing that will be exposed to weather for more than 30 days by covering exposed exterior surface of sheathing with a securely fastened air-infiltration barrier. Apply covering immediately after sheathing is installed.
- D. Protect cutouts, corners, and joints in sheathing by filling with a flexible sealant or by applying tape recommended by sheathing manufacturer at time sheathing is applied.
- E. Provide final protection and maintain conditions, in a manner acceptable to manufacturer and Installer that ensure cold-formed metal framing is without damage or deterioration at time of Substantial Completion.

END OF SECTION

SECTION 05500 – MISCELLANEOUS METALWORK

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PART 1 - GENERAL

1.1 DESCRIPTION

A. Work included in this Section:

1. Provide all engineering, labor, materials, equipment, and services, etc., required to engineer, furnish, and install all miscellaneous metal work and related accessories as indicated on the Drawings, specified herein, or otherwise required for a complete and proper job.
2. The Work shall include, but shall not necessarily be limited to:
 - a. Miscellaneous structural steel.
 - b. Miscellaneous steel plates and angles.
 - c. Miscellaneous steel brake metal, pans, closures, trim, and other configurations.
 - d. Miscellaneous carpenter's iron as required.
 - e. Miscellaneous frames, brackets, and supports for hardware, window systems, and equipment including all mechanical, electrical, medical, athletic, and theatrical equipment. Including seismic bracing for all miscellaneous metal frames, stands, and supports.
 - f. Miscellaneous frames and supports for special doors, operable walls, mesh partitions, overhead supported toilet partitions.
 - g. Loose lintels and relieving angles not furnished under SECTION 05100: STRUCTURAL STEEL.
 - h. Steel handrails and guardrails.
 - i. Ladders.
 - j. Bollards.
 - k. Pit covers and frames.
 - l. Expansion joint covers.
 - m. Steel corner guards.
 - n. Trench drains.
 - o. Expanded steel treads and landings.
 - p. Abrasive nosing for concrete stairs.
 - q. Support frames for benches and counters.
 - r. Roof blocking fastening requirements.
 - s. Masonry wall top clips.
3. It shall be a requirement of the Work of this Section to thoroughly review all of the Contract

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~~Documents and provide any and all miscellaneous metal work required for a complete and proper job.~~

B. Related Work Specified Elsewhere:

1. SECTION 03300:
CAST-IN-PLACE CONCRETE
2. SECTION 04810:
UNIT MASONRY ASSEMBLIES
3. SECTION 05100:
STRUCTURAL STEEL
4. DIVISION 23:
MECHANICAL
5. DIVISION 26:
ELECTRICAL

1.2 SUBMITTALS

A. Product Data:

Submit product data for manufactured products specified herein.

B. Shop Drawings:

1. Submit shop drawings for each item or assembly. Shop drawings shall accurately and clearly show in detail the construction, sizes, gauges, dimensions, methods of assembly, supports, finishes, and all other pertinent data and information.
 - a. Submit stair, ladder, and railing shop drawings drawn at not less than 1/4" scale with components shown in related positions. Provide larger scale custom details, control details and dimensions not governed by job conditions. Show all required field measurements.
 - b. Submit lintel fabrication schedule including location, type, size, length, and finish (primed or galvanized coating class).

C. Certifications:

1. Submit manufacturer's certification that the stairs, platforms, railings, and ladders provided are in full compliance with the requirements of the Contract Documents, and are totally suitable for the proposed installations when installed in accordance with the shop drawings.
2. Submit certificates indicating that each welder has satisfactorily passed AWS qualification tests for welding processes involved and if pertinent, has undergone re-certification.
3. Steel fabricator's in-plant special inspections program including: registration of special inspections program, written procedural and quality control manuals and evidence of periodic auditing of fabrication practices by an approved inspection agency.

1.3 PRODUCT HANDLING

A. Deliver of Materials:

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~~Deliver, store and handle components in such a manner as to prevent damage to finished surfaces.~~

B. Storage of Materials:

Store components in a dry, clean location, away from uncured masonry and concrete.
Cover with tarpaulin or polyethylene sheeting.

1.4 QUALITY ASSURANCE

A. Welding Standards:

Comply with applicable provisions of ASW D1.1 "Structural Welding Code- Steel" and ASW D1.3 "Structural Welding Code Sheet Steel."

B. Stair and railing fabricator shall be a certified member of AISC who participates in a recognized quality assurance program and who is regularly inspected by an independent testing/inspection agency.

1. In the absence of the above requirements, the fabricator shall be required to hire and pay for an independent testing/inspection agency approved by the Owner, to monitor fabrication and perform random testing of all stairs and railing fabrication procedures.
2. The fabricator shall submit evidence to the Owner indicating satisfactory completion of projects of similar scope and that fabrication facilities are adequate to meet production requirements.

B. Fabricator's Qualifications:

Only fabricators that maintain an agreement with an approved independent inspection or quality control agency to conduct periodic in-plant inspections at the fabricator's plant, at a frequency that will assure the fabricator's conformance to the requirements of the inspection agency's approved quality control program will be approved for this project.

1.5 TESTING AND INSPECTIONS

A. General:

Stair and railing materials and fabrication procedures are subject to inspection and tests in mill, shop, and field, conducted by a qualified testing agency. Such inspections and tests shall not relieve the Contractor of responsibility for providing his own inspections, quality control and materials and fabrication procedures in compliance with specified requirements. Any non-compliant materials or fabricated components shall be removed and replaced.

B. The fabricator shall submit evidence of in-plant inspections in conformance with IBC "Structural Tests and Inspections- Inspection of Fabricators (1700).

C. Testing and inspection shall be formed as required by the building code, the Contract Documents or as otherwise directed by the Project Manager. The cost of field-testing and inspection shall be paid for by the Owner. If Work is found not to conform to the Contract Documents, the Contractor shall be responsible for the cost of all further testing.

D. The Contractor shall cooperate with and facilitate testing and inspection by the testing agency. The Contractor shall, at his own expense, furnish the testing agency stair and railing shop drawings.

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~~F. Shop and field bolted connections and shop and field welded connections shall be inspected~~

1.6 STRUCTURAL PERFORMANCE

A. Handrails and Guardrails:

Engineer, fabricate, and install handrails and guardrails to comply with requirements of ASTM E985. ASTM E894 and to withstand the following structural loads without exceeding the allowable design working stress of the materials involved including anchors and connections. Apply each load to produce the maximum stress in each of component.

1. Handrails shall be rigid, free of vibration and able to withstand a concentrated force of 200 pounds applied at any point in any direction and, but not simultaneously, a uniform load of 50 pounds per foot applied in any direction.
2. Top Guardrails Member shall be rigid and able to withstand a concentrated force of 200 pounds applied at any point and in any direction and, but not simultaneously, a uniform load of 50 pounds per foot applied in any direction, and a simultaneous uniform load of 100 pounds per foot applied vertically downward to the top of the guard.
 - a. Infill areas of guardrails shall be rigid and able to withstand a horizontal concentrated force of 200 pounds applied on one square foot at any point in the system including panels, intermediate rails, balusters, or other elements. This loading condition shall not be applied simultaneously with the other loading conditions for guardrails.
 - b. Guardrail System shall withstand stresses resulting from railing system loads specified above.

B. Ladders:

Engineer, manufacture and install ladders to support in excess of 300 pounds force concentrated live load.

1.7 WARRANTIES

A. Ladders:

Provide manufacturer's standard product warranty for ladders against material and manufacturing defects for five (5) years.

B. Color Galvanizing:

Provide manufacturer's standard product warrant against excessive corrosion, peeling, chipping, or other failure for a period of twenty (20) years.

PART 2- PRODUCTS ("Green")

2.1 GENERAL

A. Note:

It is the Owner's intent to use energy conserving, environmentally friendly materials to the greatest extent practical. The Contractor is therefore encouraged to use recycled steel products.

- B. Miscellaneous metal items shall be standard approved products, fabricated in accordance with best shop practices and, wherever possible, shop assembled, ready for erection.

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C. Metals shall be free from defects impairing strength, durability, or appearance and shall be best commercial quality for purposes specified. Metals shall be made with structural properties to safely sustain and withstand strains, stresses, to which they will be normally subjected.

D. Gauges herein specified are minimums and shall refer to U. S. Standard for sheet steel, plate iron, and steel.

2.2 MATERIALS

A. Steel Plates, Shapes and Bars:
ASTM A-36.

B. Sheet Steel:
Cold-rolled: ASTM A-366
Hot-rolled: ASTM A-569

C. Steel Tubing:
Cold-formed: ASTM A-500
Hot-formed: ASTM A-501

D. Steel Pipe:
ASTM A-53.

E. Fasteners:
Provide plated fasteners complying with ASTM A 240/A 666, Stainless Steel Type 316, for exterior use or where built into exterior walls. Select fasteners for the type, grade, and class required.

1. Bolts and Nuts:
ASTM A307, Grade A
ASTM A563.

2. Machine Screws:
ANSI B18.6.3.

3. Lag Bolts:
ANSI B18.2.1.

4. Plain Washers:
Round, carbon steel, ANSI B18.22.1.

5. Lock Washers:
Helical, spring type, carbon steel, ANSI B18.21.1.

6. Expansion Anchors:
Carbon steel components zinc-plated to comply with ASTM B633.

F. Note:
The fabricator shall no stamp, stencil, or otherwise place his identification on any portion of miscellaneous metals intended to remain exposed to view.

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2.3 PAINTING AND PROTECTIVE COATING

A. General:

All ferrous metal that is not stainless steel herein specified shall be properly cleaned and shop primed, except at the following locations:

1. Anchors that are built into masonry shall be coated with bituminous paint, unless specified to be galvanized.
2. Ferrous metal to be encased in concrete shall be left unpainted, unless specified or noted otherwise. Aluminum to be encased in concrete shall be coated with bituminous paint.
3. Where hot-dip galvanized metal is specified or shown, it shall not be shop primed.
4. Where sprayed-on fireproofing is specified or shown, metal shall not be shop primed.
5. Where metal is scheduled to receive ceramic tile finish it shall not be shop primed.

B. Surface Preparation:

1. Exterior steel shall meet requirements of the Steel Structures Painting Council, SS PC-SP6 Commercial Blast Cleaning Standard.
 2. Interior steel and steel to be fireproofed shall meet requirements of SS PC-SP3 Power Tool Cleaning Standard.
- C. Shop Primer for Ferrous Metal shall be Tnemec "37 H Chem Prime Universal Phenolic Primer," at 2.0- 3.0 mils DFT.
- D. For items that are not stainless steel. Galvanizing Repair Paint shall be high zinc content paint Tnemec 90-97.
- E. Bituminous Paint shall be cold-applied mastic complying with SSPC-Paint 12 except containing no asbestos fibers.

2.4 GALVANIZING

- A. All exterior steel, including lintels, rails, bollards, grates, frames, and all other steel that has any portion exposed to the weather, shall be hot-dip galvanized. Interior steel shall be hot-dip galvanized where so noted or specified. Hot-dip galvanized products shall not be shop primed.
- B. Products fabricated from rolled, pressed and forged steel shapes, plates, bars and strips shall be hot-dip galvanized in accordance with ASTM A-123, latest edition.
- C. Iron and steel hardware shall be hot-dip galvanized in accordance with ASTM A-153, latest edition.
- D. Assembled steel products shall be hot-dip galvanized in accordance with ASTM A-386, latest edition.
- E. The weight of coating shall be as designated in ASTM "Comparison of Coating Weight Requirements for Hot- Dip Galvanized Products" in accordance with the class and thickness of material.
- F. Where hot-dip galvanizing prior to completion of fabrication (cutting or welding operations)

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~~cannot be avoided, joints and cuts shall be finished with four (4) full coats of touch-up galvanizing~~
repair paint as recommended by the fabricator.

- G. Hot-dip galvanizing shall be done by a member of the American Galvanizers Association, Inc.
- H. All hot-dipped galvanized material shall be stamped to indicate ASTM designation and ounces per square foot of zinc coating required by the Specifications.
- I. A notarized affidavit of compliance to the galvanizing specified shall be submitted from the galvanizer upon request.
- J. The galvanizing bath shall contain high grade zinc and other early materials. Immediately before galvanizing the steel shall be immersed in a bath of zinc ammonium chloride. The use of wet kettle process is prohibited.

2.5 SHOP COATING OF GALVANIZED STEEL

- A. The following miscellaneous metal components shall receive factory applied architectural finish over hot-dip galvanizing:
 - 1. All exterior rails.
 - 2. All exterior bollards.
- B. Finish shall be "Primergalv" by Duncan Galvanizing, or approved equal. Colors shall be selected by the Project Manager from the manufacturer's full range of available colors. Coating shall maintain a pull-off strength of 500 psi when tested in accordance with ASTM D4541.
 - 1. Factory-Applied Universal Primer:

Where galvanized steel is specified to receive a factory primer for field applied topcoat, provide factory-applied polyamide epoxy primer over specially prepared galvanized steel, 2.0 mils dry film thickness minimum. Apply primer within 12 hours after galvanizing at the galvanizer's plant in a controlled environment meeting applicable environmental regulations, and as recommended by the coating manufacturer.
 - 2. Factory-Applied High-Performance Architectural Finish:

Where galvanized steel is specified to receive a factory applied architectural finish, provide factory-applied polyurethane color coating, 2.5 mils dry film thickness minimum, over primed galvanized steel as previously referenced. Apply coating at the galvanizer's plant, immediately after the application of the prime coat, in a controlled environment meeting applicable environmental regulations, and as recommended by coating manufacturer.

2.6 ROOF BLOCKING FASTENING REQUIREMENTS

- A. Perimeter roof blocking shall be secured to decking, structural steel, spaced steel angles, or plates, as indicated on the Drawings.
- B. The Contractor shall provide additional steel angles and plates to suit specific job conditions.
- C. Where joist or beams do not extend out of roof edge, provide single or back-to-back steel angles

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~~or steel plates welded to perimeter steel beams in configurations indicated on the Drawings or~~
otherwise required for support of blocking at 2'-0" O.C. intervals. Provide pre-drilled holes in steel for bolting of blocking at 24" O.C. with ½" bolts.

2.7 MASONRY WALL TOP CLIPS

- A. Provide steel clip angles at both sides of the tops of masonry walls secured to building structure, coordinate with the Work of Section 05100: Structural Steel. In general, size, spacing, and attachment of wall clips shall be determined by whether the wall is non-structural (architectural) or is a structural element (fire wall, load-bearing wall or shear wall for example) and shall be as indicated on the Drawings. Wall clips specified herein or partition top anchors specified in Section 04200: Unit Masonry and Mortar shall be provided for all masonry walls unless specifically indicated otherwise.

2.8 MISCELLANEOUS FRAMING AND SUPPORTS

- A. Provide steel framing and supports for applications indicated that are not a part of structural steel scope as required to complete the Work. Fabricate units to sizes, shapes, and profiles indicated and required to receive adjacent construction. Fabricate from steel shapes, plates, and steel bars of welded construction using mitered joints for field connections. Cut, drill, and tap units to receive hardware, hangers, and similar items. Equip units with integrally welded anchors for casting into concrete or building into masonry.

2.9 LADDERS

- A. Ladders shall be standard, 6063-T6 aluminum alloy, fixed ladders as manufactured by O'Keefe's Inc., or approved equal. Ladders shall have channel rails and 1-1/4" serrated square rungs spaced no more than twelve (12") inches on centers. Ladder shall be at least eighteen (18") inches clear between rails. Inclined ladders (ship's ladders) shall have 4-1/8" deep treads and handrails. All aluminum shall be mill finish. Provide floor and wall mounting brackets as required. All ladders shall be in strict compliance with OSHA/ANSI A14.3 standards. Ladders twenty (20') feet or more in height shall be equipped with platforms. Provide the following ladder models:

1. Interior pit and roof access: Series 500.
2. Exterior roof access: Series 502.
3. Exterior roof access with parapet: Series 503.

2.10 BOLLARDS

- A. Unless otherwise indicated on the Drawings, bollards shall be six (6") inches diameter galvanized steel pipe (to be filled with concrete). Bollards shall be not less than 6'-6" in length with 3'-6" exposed above finish grade.

2.11 PIT COVERS AND FRAMES

- A. Unless otherwise indicated on the Drawings, steel pit covers shall be 1/4" thick galvanized steel checker plate. Frames shall be appropriately sized galvanized steel angles with suitable stops and anchoring devices.

2.12 EXPANSION JOINT COVERS

- A. Metal expansion joint covers shall be manufactured by Balco Inc., CIS Construction Specialties, MM Systems Corp., or approved equal.

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2.13 TRENCH DRAINS

- A. Trench drain grates, covers, pans, and frames shall be heavy-duty, H20 wheel loading, cast iron grates and frames with an integral galvanized steel-formed pan. Units shall be 12-1/2" wide, Model No. TCMB-10/TGMB-10, as manufactured by McKinley, or approved equal.

2.14 METAL CHANNEL FRAMING SYSTEMS (UNISTRUT)

- A. Various building materials and equipment such as suspended lights and service columns shall be provided with concealed metal channel framing systems as required to permanently and safely anchor such items to suitable building primary structural components.
- B. Metal channel framing systems shall be Unistrut Metal Framing as manufactured by UNISTRUT Corporation, or approved equal. Framing shall be electrogalvanized steel. Systems shall be complete and shall be properly engineered, fabricated, and installed by the manufacturer or its authorized representative/installer. Installer shall have not less than five (5) years experience.
- C. The Work of Channel Framing systems shall include, but shall not necessarily be limited to:
 - 1. Field inspection to verify job conditions, dimensions, and suitability of primary structure to receive channel framing.
 - 2. Engineering of all channel framing, attachments between framing members, attachments between framing systems and building structure, and anchor points to receive attachments by the manufacturer of the building material or equivalent to be supported by the channel framing systems.
 - 3. Coordination of framing load capacity and anchor point types and locations with the requirements of the related material or equipment manufacturer.
 - 4. Submission of structural calculations including, but not limited to design criteria, stress and deflection analysis and selected framing, fittings and anchors prepared by a professional structural engineer licensed in the United States of America or the United States Virgin Islands.
 - 5. Submission of shop drawings.

2.15 LOOSE STEEL LINTELS

- A. Loose lintels shall be fabricated from A-36 steel from angles, shapes and masonry anchors of size and type scheduled for openings in masonry walls, unless otherwise indicated on the Drawings.
- B. All dimensions for locations of rails shall be field measured. Drawing dimensions shall be considered approximate and actual field conditions shall be ascertained before fabrication of rails.
- C. In general, heights of handrails shall be 2'-10" above step nosing. Heights of guardrails shall be 3'-6" above finish floor, unless otherwise noted on the Drawings. Handrails shall be mounted to provide 2-1/4" minimum clear space to walls or other surfaces at stairs and 1-1/2" minimum clear space at all other locations.
- D. Space intermediate balusters as indicated on the Drawings or as otherwise required providing maximum clear space between all members of less than four (4") inches. Guardrails shall not have an ornamental pattern that would provide a ladder effect. Space railing posts as indicated

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on the Drawings, and in accordance with railing engineering requirements

- E. In general, handrails at stairs shall extend a minimum of 12" beyond the top riser and at least 12" plus the width of one tread beyond the bottom riser. At the top, the handrail extension shall be parallel to the working surface. At the bottom, the handrail shall continue to slope for a distance of the width of one tread from the bottom riser, with the remainder parallel to the walking surface.
- F. In general, handrails at ramps shall be parallel to the walking surface at all locations and shall extend a minimum of 12" beyond the top of the ramp and at least 12" beyond the bottom of the ramp.
- G. Steel Railing Fittings shall be as per Julius Blum and Co., or approved equal. All fittings for exterior use shall be galvanized. Fittings shall be:
 - 1. Weld on caps:
No. 938
 - 2. Round slip flanges:
No. 611 and No. 1611
 - 3. Wall returns:
No. 665 and No. 1665
 - 4. Brackets:
No. 386 and No. 1386

PART 3- EXECUTION

3.1 VERIFYING CONDITIONS

- A. Coordinate all work with the work of other trades. Verify all field dimensions and that the work fits the work of other trades. Perform all cutting, fitting, and drilling required. Furnish all necessary templates and patterns required to build items into work of other trades. Provide holes and connections for the attachment of work of other trades.

3.2 GENERAL FABRICATION AND INSTALLATION

- A. Metal surfaces shall be clean and free from mill scale, flake rust, and rust pitting, well-formed and finished to shape and size, with sharp lines and angles and smooth surfaces. Shearing and punching shall leave clean true lines and surfaces. Weld or rivet permanent connections. Welds and flush rivets shall be finished flush and smooth on surfaces that will be exposed after installation. Welds shall be continuous unless otherwise noted. Welds shall not have voids or pockets and shall be ground to provide smooth transitions between metal surfaces. Do not use screws or bolts where they can be avoided; where used, heads shall be countersunk, screwed up tight and threads nicked to prevent loosening.
- B. Fastenings shall be concealed where practicable. Thickness of metal and details of assembly and supports shall give ample strength and stiffness. Joints exposed to weather shall be formed to exclude water. Provide holes and connections for the work of other trades.
- C. Castings shall be size determined by work type for which they form parts. Each member if possible shall be in one piece, make joints at moldings or fillets. Casting thickness shall be uniform, sufficient to ensure perfect workmanship, required strength for design use. Make castings clean, smooth, true to pattern, free from defects. Moldings, ornaments shall be rather

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~~more deeply cut than indicated to counteract flattening effects of casting, finishing; exactly~~
reproduce form, feeling of models. Edges shall be sharp, come from molds clean, smooth, perfect.

- D. Non-slip surfaces shall be made safe for foot traffic with non-slip abrasive embedded uniformly in wearing surface at casting time.
- E. Connections and accessories shall be adequate to safely sustain, withstand stresses, strains, to which they will be normally subjected.
 - 1. Connections to steel unless otherwise specified shall be steel.
 - 2. Connections to genuine wrought iron work shall be wrought iron or steel.
 - 3. Connections to cast iron, unless otherwise specified shall be steel.
 - 4. Bolts, nuts, screws for exterior work shall be electrogalvanized, unless otherwise noted.
- F. Furnish all standard screws, bolts, washers, and other such fastening devices as are necessary for attaching this work to other materials. Anchors and other connecting devices required in concrete or masonry shall be built-in as the work progresses. **NOTE:** Special attention shall be given to the firm and secure anchoring of overhead mounted materials and equipment.
- G. Do cutting, punching, drilling, tapping required for attachment of other work coming in contact with miscellaneous metal where indicated or where directions for same are given prior to or with review of shop drawings.
- H. Unless otherwise indicated, bolt, and screw heads shall be flat countersunk in exposed faces of ornamental or finished character; elsewhere as required. Cut off bolts, screws, etc., where exposed, flush with nuts, or other adjacent metal. Except as otherwise required, weld shop-assembled connections; welds, bolts, or machine screws may be used for field connections. Exposed fastenings shall be the same materials, color, and finish as metal to which they apply, unless otherwise required.
- I. Make up threaded connections tightly so that threads will be entirely concealed by fittings.
- J. Work to be built in with masonry shall be of form required for anchorage, or be provided with suitable anchors, expansion shields, toggle bolts, etc. as required for proper anchorage. Fastening to wood plugs in masonry shall not be permitted.
- K. Install all supporting members, fastening, framing, hangers, bracing, brackets, straps, bolts, angles, and the like required to set, connect work rigidly and properly to structural steel, masonry, other construction.
- L. All items shall be installed plumb, straight, square, level and in proper elevation, plane, location and alignment with other work.

3.3 STEEL RAILING FABRICATION AND INSTALLATION

- A. Fabricate handrails and railing systems to comply with the requirements indicated for design, dimensions, details, finish, member sizes and anchorage but not less than that required to support structural loads.
- B. Interconnect railing and handrail members by butt-welding or welding with internal connectors, unless otherwise indicated. At tee and cross intersections, cope ends of intersecting members to fit contour of pipe to joined end and weld all around. Form changes in direction of railings by

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~~welding fabricated flush elbow fittings, by radius bends as indicated, or by flush radius bends~~

Remove burrs and splatter.

- C. Form simple and compound curves by bending pipe in jigs to produce uniform curvature for each configuration required. Maintain cylindrical cross section of pipe throughout the entire bend without buckling, twisting, cracking or otherwise deforming.
- D. For components exposed to exterior or moist environments, provide weep holes or other means of evacuating entrapped water. All exterior rails, fittings and brackets shall be hot-dipped galvanized after fabrication.
- E. Provide wall returns at all ends to adjacent surfaces and secure as required. Close exposed ends by welding 3/16" thick steel plate in place, except where clearance of end of pipe and adjoining wall surface is less than 1/4", or unless otherwise detailed.
- F. Welds shall be continuous and thoroughly fused without undercutting or overlap. Grind exposed welds smooth to form a uniformly smooth surface.
- G. Provide miscellaneous steel for connection of rail supports as detailed on the Drawings. Do not support railing temporarily by any means that does not satisfy structural performance requirements.
- H. Set rails plumb and aligned. Set rails horizontal or parallel to rake of stairs. Support wall handrails on brackets, in accordance with railing engineering requirements. Space closer together if so indicated on the Drawings. Connect railing posts to stair framing to stair framing by direct welding, unless otherwise indicated.
- I. Install handrail brackets away from handrail ends and finish ends with return fittings. Use drill-in expansion anchors at concrete or masonry walls. Mount handrails only on gypsum board assemblies that have been reinforced to receive railing anchors.
- J. Provide expansion joints in railings at intervals not to exceed forty (40') feet. Provide slip joints with internal sleeves extending two (2") inches beyond the joint on either side. Fasten the internal sleeve securely on one side only. Locate expansion joints within six (6") inches of posts.
- K. Where railings are to be set in concrete, railing posts shall be set in 6" matching sleeves as follows: Clean dust and foreign matter from sleeves. Moisten interior of hole and surrounding surface with clean water. Mix fast setting cement with water and stir until a smooth, creamy consistency is produced. Pour mixture into annular space until it overflows the hole. Taper cement away from rails to promote proper drainage. Wipe off excess, leaving a build-up of approximately 1/8".

3.4 LADDERS

- A. All ladders shall be installed in strict accordance with the manufacturer's instructions, the American Standard Safety Code for Fixed Ladders and all applicable OSHA regulations.
- B. Completed ladder installations shall be rigid and free from vibration.
- C. Ladders in elevator pits shall extend not less than 3'-6" above outside finish floor level as required by OSHA and shall be located as recommended by the elevator manufacturer.
- D. Exterior roof ladders shall extend no less than 3'-6" above parapet walls or upper roof surfaces as applicable, and shall have looped returns as required by OSHA. Rungs shall be held off a minimum of 9" off adjacent wall.

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~~F. Interior roof hatch ladders shall extend from the floor to the roof surface. Rails shall extend to~~
just below the underside of the roof hatch.

F. Ladders twenty (20') feet or more in height shall be provided with cage closures as required by OSHA.

3.5 EXPANSION JOINT COVERS

A. Covers shall extend full width of openings.

B. Covers shall be installed level, plumb, and flush with finish surfaces, and shall be fastened with anchor shields and bolts in strict confidence with the manufacturer's instructions and recommendations.

C. Provide all corners, tees, transitions, etc., as required for a complete and proper job.

D. Provide fire rated expansion joint covers with all required safing insulation and fire stopping at fire rated locations. Entire assembly shall be installed in strict accordance with the manufacturer's instructions and tested assemblies.

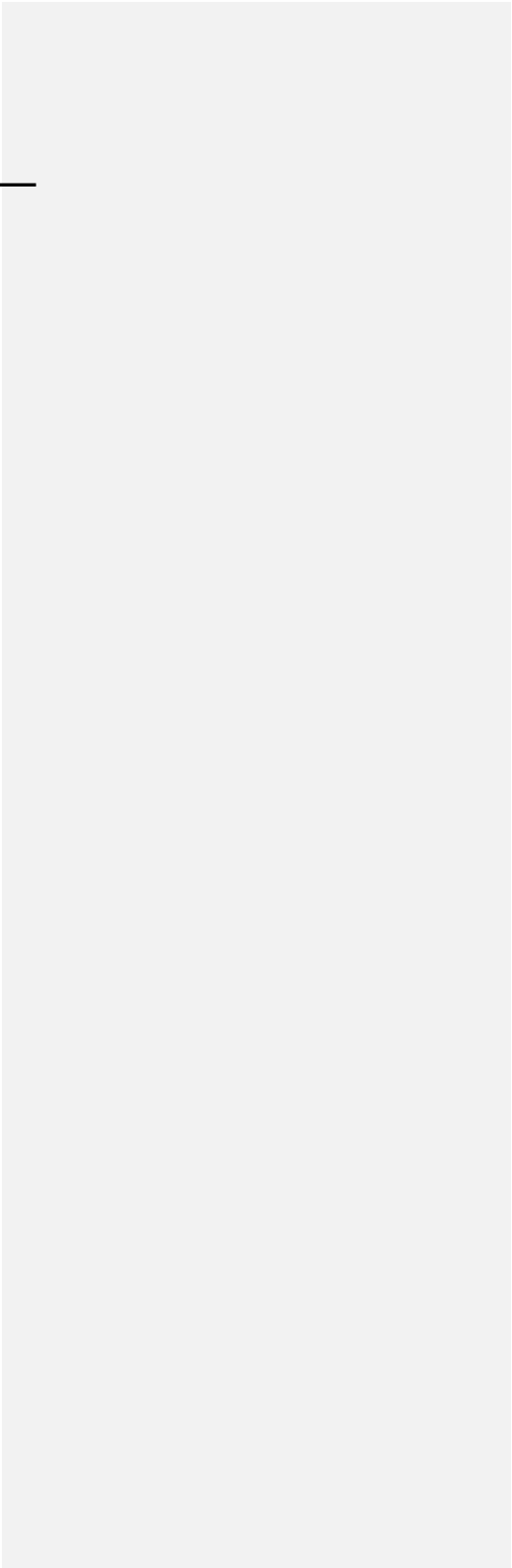
END OF SECTION

DIVISION 6- WOODS AND PLASTICS

GOVERNMENT OF THE U. S. VIRGIN ISLANDS, DEPARTMENT OF PUBLIC WORKS

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SECTION 06100 – ROUGH CARPENTRY

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PART 1- GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. This Section includes the following:
1. Framing with dimension lumber.
 2. Wood furring, grounds, nailers, and blocking.
 3. Subflooring.
 4. Underlayment.

1.3 DEFINITIONS

- A. Rough Carpentry:
Carpentry work not specified in other Sections and not exposed, unless otherwise specified.

1.4 SUBMITTALS

- A. General:
Submit each item in this Article according to the Conditions of the Contract and Division 1 Specification Sections.
- B. Product Data for the following products:
1. Underlayment.
 2. Construction adhesives.
- C. Material certificates for dimension lumber specified to comply with minimum allowable unit stresses. Indicate species and grade selected for each use and design values approved by the American Lumber Standards Committee's (ALSC) Board of Review.
- D. Wood treatment data as follows, including chemical treatment manufacturer's instructions for handling, storing, installing, and finishing treated materials:
1. For each type of preservative treated wood product, include certification by treating plant stating type of preservative solution and pressure process used, net amount of preservative retained, and compliance with applicable standards.
 2. For fire retardant treated wood products, include certification by treating plant that treated materials comply with specified standard and other requirements as well as data relative to bending strength, stiffness, and fastener-holding capacities of treated materials.
- E. Material test reports from a qualified independent testing agency indicating and interpreting

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~~test results relative to compliance of fire-retardant-treated wood products with requirements~~
indicated.

1.5 QUALITY ASSURANCE

A. Single-Source Responsibility for Fire-Retardant-Treated Wood:

Obtain each type of fire-retardant treated wood product from one source and by a single producer.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Keep materials under cover and dry. Protect from weather and contact with damp or wet surfaces. Stack lumber, plywood, and other panels. Provide for air circulation within and around stacks and under temporary coverings.

1. For lumber and plywood pressure treated with waterborne chemicals, place spacers between each bundle to provide air circulation.

PART 2- PRODUCTS

2.1 MANUFACTURERS

A. Available Manufacturers:

Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

1. Wood-Preservative-Treated Materials:
 - a. Baxter: J. H. Baxter Co.
 - b. Chemical Specialties, Inc.
 - c. Continental Wood Preservers, Inc.
 - d. Hickson Corp.
 - e. Hoover Treated Wood Products, Inc.
 - f. Osmose Wood Preserving, Inc.
2. Fire-Retardant-Treated Materials, Interior Type A:
 - a. Baxter: J. H. Baxter Co.
 - b. Chemical Specialties, Inc.
 - c. Continental Wood Preservers, Inc.
 - d. Hickson Corp.
 - e. Hoover Treated Wood Products, Inc.

2.2 LUMBER, GENERAL

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A. Lumber Standards:

Comply with DOC PS 20, "American Softwood Lumber Standard," and with applicable grading rules of inspection agencies certified by ALSC's Board of Review.

B. Inspection Agencies:

Inspection agencies, and the abbreviations used to reference them, include the following:

1. NELMA - Northeastern Lumber Manufacturers Association.
2. NLGA - National Lumber Grades Authority (Canadian).
3. RIS- Redwood Inspection Service.
4. SPIB - Southern Pine Inspection Bureau.
5. WCLIB- West Coast Lumber Inspection Bureau.
6. WWPB- Western Wood Products Association.

C. Grade Stamps:

Provide lumber with each piece factory marked with grade stamp of inspection agency evidencing compliance with grading rule requirements and identifying grading agency, grade, species, moisture content at time of surfacing, and mill.

D. Where nominal sizes are indicated, provide actual sizes required by DOC PS 20 for moisture content specified. Where actual sizes are indicated, they are minimum dressed sizes for dry lumber.

1. Provide dressed lumber, S4S, unless otherwise indicated.

2.3 WOOD-PRESERVATIVE-TREATED MATERIALS

A. General:

Where lumber or plywood is indicated as preservative treated or is specified to be treated, comply with applicable requirements of AWPAC2 (lumber) and AWPAC9 (plywood). Mark each treated item with the Quality Mark Requirements of an inspection agency approved by ALSC's Board of Review.

1. Do not use chemicals containing chromium or arsenic.

B. Pressure treat aboveground items with waterborne preservatives to a minimum retention of 0.25 lb./cu. ft. (4.0 kg/cu. m). After treatment, kiln-dry lumber and plywood to a maximum moisture content of 19 and 15 percent, respectively. Treat indicated items and the following:

1. Wood cants, nailers, curbs, equipment support bases, blocking, stripping, and similar members in connection with roofing, flashing, vapor barriers, and waterproofing.
2. Wood sills, sleepers, blocking, furring, stripping, and similar concealed members in contact with masonry or concrete.
3. Wood framing members less than 18 inches (460 mm) above grade.

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~~4. Wood floor plates installed over concrete slabs directly in contact with earth.~~

- C. Complete fabrication of treated items before treatment, where possible. If cut after treatment, apply field treatment complying with AWPAC M4 to cut surfaces. Inspect each piece of lumber or plywood after drying and discard damaged or defective pieces.

2.4 FIRE-RETARDANT-TREATED MATERIALS

A. General:

Where fire-retardant-treated wood is indicated, comply with applicable requirements of AWPAC C20 (lumber) and AWPAC C27 (plywood). Identify fire-retardant-treated wood with appropriate classification marking of UL; U.S. Testing; Timber Products Inspection, Inc.; or another testing and inspecting agency acceptable to authorities having jurisdiction.

1. Research or Evaluation Reports:

Provide fire-retardant-treated wood acceptable to authorities having jurisdiction and for which a current model code research or evaluation report exists that evidences compliance of fire-retardant-treated wood for application indicated.

B. Interior Type A:

For interior locations, use chemical formulation that produces treated lumber and plywood with the following properties under conditions present after installation:

1. Bending strength, stiffness, and fastener-holding capacities are not reduced below values published by manufacturer of chemical formulation under elevated temperature and humidity conditions simulating installed conditions when tested by a qualified independent testing agency.
2. No form of degradation occurs due to acid hydrolysis or other causes related to treatment.
3. Contact with treated wood does not promote corrosion of metal fasteners.

2.5 DIMENSION LUMBER

A. General:

Provide dimension lumber of grades indicated according to the ALSC National Grading Rule (NGR) provisions of the inspection agency indicated.

B. Framing Other than Non-Load-Bearing Partitions:

Provide framing of the following grade and species:

1. Grade:
No. 2.
2. Species:
Southern pine; SPIB.
3. Species:
Mixed southern pine; SPIB.
4. Species:
Any species above.

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2.6 MISCELLANEOUS LUMBER

- A. General:
Provide lumber for support or attachment of other construction, including rooftop equipment curbs and support bases, cant strips, bucks, nailers, blocking, furring, grounds, stripping, and similar members.
- B. Fabricate miscellaneous lumber from dimension lumber of sizes indicated and into shapes shown.
- C. Moisture Content:
19 percent maximum for lumber items not specified to receive wood preservative treatment.
- D. Grade:
For dimension lumber sizes, provide No. 3 or Standard grade lumber per ALSC's NGRs of any species. For board-size lumber, provide No.3 Common grade per NELMA, NLGA, or WWP; No.2 grade per SPIB; or Standard grade per NLGA, WCLIB or WWP of any species.

2.7 CONCEALED, PERFORMANCE-RATED STRUCTURAL-USE PANELS

- A. General:
Where structural-use panels are indicated for the following concealed types of applications, provide APA-performance-rated panels complying with requirements designated under each application for grade, span rating, exposure durability classification, and edge detail (where applicable).
1. Thickness:
Provide panels meeting requirements specified but not less than thickness indicated.
 2. Span Ratings:
Provide panels with span ratings required to meet "Code Plus" provisions of APA Form No. E30, "APA Design/Construction Guide: Residential & Commercial."
- B. Subflooring:
APA-rated sheathing.
1. Exposure Durability Classification: Exposure 1.
 2. Span Rating: As required to suit joist spacing indicated.

2.8 STRUCTURAL-USE PANELS FOR UNDERLAYMENT

- A. General:
Over smooth subfloors, provide underlayment not less than 1/4 inch (6.4 mm) thick. Over board or uneven subfloors, provide underlayment not less than 11/32 inch (8.7 mm) thick.
- B. Plywood Underlayment for Carpet:
For underlayment under 19/32 inch (15.1 mm) thick, provide plywood panels with fully sanded face and as follows:

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- I. Grade:
APA Underlayment Interior.

2.9 FASTENERS

- A. General:
Provide fasteners of size and type indicated that comply with requirements specified in this Article for material and manufacture.
- I. Where rough carpentry is exposed to weather, in ground contact, or in area of high relative humidity, provide fasteners of Type 304 stainless steel.
- B. Nails, Wire, Brads, and Staples:
FS FF-N-105.
- C. Power-Driven Fasteners:
CABO NER-272.
- D. Wood Screws:
ASME B18.6.1.
- E. Lag Bolts:
ASME B18.2.1. (ASME B18.2.3.8M)
- F. Bolts:
Steel bolts complying with ASTM A 307, Grade A (ASTM F 568, Property Class 4.6); with ASTM A 563 (ASTM A 563M) hex nuts and, where indicated, flat washers.

2.11 MISCELLANEOUS MATERIALS

- A. Adhesives for Field Gluing Panels to Framing: Formulation complying with APA AFG-01 that is approved for use with type of construction panel indicated by both adhesive and panel manufacturers.

PART 3- EXECUTION

3.1 INSTALLATION, GENERAL

- A. Discard units of material with defects that impair quality of rough carpentry and that are too small to use with minimum number of joints or optimum joint arrangement.
- B. Set rough carpentry to required levels and lines, with members plumb, true to line, cut, and fitted.
- C. Fit rough carpentry to other construction; scribe and cope as required for accurate fit. Correlate location of furring, nailers, blocking, grounds, and similar supports to allow attachment of other construction.
- D. Apply field treatment complying with AWP M4 to cut surfaces of preservative-treated lumber and plywood.
- E. Securely attach rough carpentry work to substrate by anchoring and fastening as indicated, complying with the following:

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~~1. CABO NER-272 for power-driven staples, P-nails, and allied fasteners.~~

2. Published requirements of metal framing anchor manufacturer.
 3. "Recommended Nailing Schedule" of referenced framing standard and with AFPA's "National Design Specifications for Wood Construction."
 4. "Table 23-1-Q--Nailing Schedule" of the Uniform Building Code.
 5. "Table 2305.2--Fastening Schedule" of the BOCA National Building Code.
 6. "Table 1705.1--Fastening Schedule," of the Standard Building Code.
- F. Use common wire nails, unless otherwise indicated. Use finishing nails for finish work. Select fasteners of size that will not fully penetrate members where opposite side will be exposed to view or will receive finish materials. Make tight connections between members. Install fasteners without splitting wood; predrill as required.
- G. Use stainless-steel nails where rough carpentry is exposed to weather, in ground contact, or in area of high relative humidity.
- H. Countersink nail heads on exposed carpentry work and fill holes with wood filler.

3.2 WOOD GROUNDS, NAILERS, BLOCKING, AND SLEEPERS

- A. Install wood grounds, nailers, blocking, and sleepers where shown and where required for screeding or attaching other work. Form to shapes shown and cut as required for true line and level of attached work. Coordinate locations with other work involved.
- B. Attach to substrates to support applied loading. Recess bolts and nuts flush with surfaces, unless otherwise indicated. Build into masonry during installation of masonry work. Where possible, anchor to form work before concrete placement.
- C. Install permanent grounds of dressed, preservative-treated, key-beveled lumber not less than 1-1/2 inches (38 mm) wide and of thickness required to bring face of ground to exact thickness of finish material. Remove temporary grounds when no longer required.

3.3 WOOD FRAMING, GENERAL

- A. Framing Standard:
Comply with AFPA's "Manual for Wood Frame Construction," unless otherwise indicated.
- B. Install framing members of size and at spacing indicated.
- C. Do not splice structural members between supports.

3.4 INSTALLATION OF STRUCTURAL-USE PANELS

- A. General:
Comply with applicable recommendations contained in APA Form No. E30, "APA Design/Construction Guide: Residential & Commercial," for types of structural-use panels and applications indicated.

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1. Comply with "Code Plus" provisions of above-referenced guide.
- B. Fastening Methods:
Fasten panels as indicated below:
 1. Combination Subflooring-Underlayment:
Glue and nail to framing throughout.
 - a. Space panels 1/8 inch (3 mm) at edges and ends.
 2. Subflooring:
Glue and nail to framing throughout.
 - a. Space panels 1/8 inch (3 mm) at edges and ends.
 3. Underlayment:
Nail to subflooring.
 - a. Space panels 1/32 inch (0.8 mm) at edges and ends.

END OF SECTION

SECTION 066116 – SOLID SURFACING FABRICATIONS

GOVERNMENT OF THE U. S. VIRGIN ISLANDS, DEPARTMENT OF PUBLIC WORKS

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PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

Specifications throughout all Divisions of the Project Manual are directly applicable to this Section, and this Section is directly applicable to them.

A. REFERENCE STANDARDS

- A. The latest published edition of a reference shall be applicable to this Project unless identified by a specific edition date.

All reference amendments adopted prior to the effective date of this Contract shall be applicable to this Project.

All materials, installation and workmanship shall comply with all applicable requirements and standards.

B. QUALITY ASSURANCE

- A. Fabricator Qualifications: All work of this section shall be fabricated and installed by a fabrication professional who has been accredited by the manufacturer of the solid surfacing materials. The fabricator shall be skilled in the knowledge and ability required to provide work in accordance with the manufacturer's "Fabrication and Installation Manual" and shall have a minimum of five (5) years of fabrication experience and shall have completed a minimum of five (5) fabrication projects of similar scope and size to the fabrication and installation work of this Project.

Source Quality Control: Obtain and provide materials from a single manufacturer of solid surfacing materials with not less than five (5) years of successful experience in supplying principal materials. Provide secondary and alternate materials only as recommended by the manufacturer of the primary materials.

Wherever possible, check dimensions of supporting structure at the Project Site by accurate field measurements before final submittal of shop drawings and fabrication of items. Where necessary, proceed without field measurements and coordinate installation tolerances to ensure proper fit of solid surfacing fabrications.

C. SUBMITTALS

- A. Samples:

SECTION 066116 – SOLID SURFACING FABRICATIONS

GOVERNMENT OF THE U. S. VIRGIN ISLANDS, DEPARTMENT OF PUBLIC WORKS

PROJECT NAME: Elaine I. Sprauve Public Library and Museum Building

Project Location, St. John, U.S. Virgin Islands

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- ~~1. Samples for initial selection purposes in form of manufacturer's color charts~~ consisting of actual pieces or sections of pieces showing full range of colors and patterns available for each type of solid surfacing material indicated.
 2. Samples for Verification Purposes: Submit three sets not less than 12 inches by 12 inches in size, of color, grade, and finish of each type of solid surfacing material required. Include the full range of exposed color and texture to be expected in the completed work. Architect's review will be for color and texture only. Compliance with all other requirements is the exclusive responsibility of the Contractor.
 3. Samples of fabricated backsplash/countertop and raised lip at toilet room countertops.
 4. Samples of fabricated toilet room thresholds.

Product Data:

1. Provide manufacturer's catalog cuts and descriptive information, including cleaning and maintenance requirements, on each product used.

Shop Drawings:

1. Submit cutting and setting drawings showing sizes, dimensions, sections, and profiles of solid surfacing material units, the arrangement, and provisions for jointing and other necessary details for reception of other work.
2. Submit drawings for the fabrication and installation of countertops with integral bowls. Indicate dimensions, size, and location of cutouts, and relation to plumbing work.

Record Documents:

1. Provide record approved product data, shop drawings, samples, and warranties.

D. DELIVERY, STORAGE AND HANDLING

- A. Protect solid surfacing material from damage during loading, shipment, delivery, and storage. Use non staining materials for blocking and packing. Stack and block solid surfacing material units at the Project Site in accordance with fabricator's recommendations.

E. WARRANTY

- A. Solid Surfacing Material Fabrication and Installation:

SECTION 066116 – SOLID SURFACING FABRICATIONS

GOVERNMENT OF THE U. S. VIRGIN ISLANDS, DEPARTMENT OF PUBLIC WORKS

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~~1. Provide manufacturer's standard ten (10) year limited warranty. The~~
manufacturer shall warrant that the materials provided under this Section shall not develop visible defects or otherwise fail due to manufacturing defects within a period of ten (10) years from the date of Substantial Completion of the Work.

PART 2 PRODUCTS

2.1 GENERAL

A. All materials shall meet or exceed all applicable referenced standards, federal, state and local requirements, and conform to codes and ordinances of authorities having jurisdiction.

A. MANUFACTURERS

A. The notes and schedules on the Drawings establish manufacturer, model/design, and color required for the Project. Provide the products listed unless Architect approves products of other manufacturer specifically for this Project.

B. FABRICATION

A. Fabrication shall be performed by a fabricator, accredited by the manufacturer, in accordance with manufacture's recommendations and reference manuals.

Shop fabricate components to greatest extent practicable to size and shapes indicated, in accordance with approved shop drawings.

Comply with the manufacturer's recommendations for the use of specific types of stationary equipment and stationary tools. Site fabrication and finishing processes shall be in accordance with the manufacturer's recommendations.

Form seams between components, unless otherwise indicated, using manufacturer's standard structural adhesive. Adhesive shall be color coordinated to match solid surfacing material color and shall form inconspicuous seams. Seams shall not be permitted along the long side of any areas of less than 36 inches across.

Provide factory cutouts for plumbing fittings and bath accessories as indicated on the drawings and as recommended by the solid surfacing manufacturer.

Cut and finish component edges with clean sharp returns. Rout radii and contours to exact template sizes, and as indicated on the drawings. Repair or reject defective or inaccurate work.

PART 3 -EXECUTION

3.1 INSTALLATION

SECTION 066116 – SOLID SURFACING FABRICATIONS

GOVERNMENT OF THE U. S. VIRGIN ISLANDS, DEPARTMENT OF PUBLIC WORKS

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~~A. Installation shall meet or exceed all applicable federal, state and local requirements,~~
referenced standards and conform to codes and ordinances of authorities having jurisdiction.

All installation shall be in accordance with manufacturer's published recommendations.

Prepare substrate plane, plumb and level, secure in place with all fasteners set flush. Shim supporting structure as required to provide an acceptable surface for attaching finish materials.

Install components plane, plumb and level, in accordance with approved shop drawings and product data.

Pre-fit finish material in place. Scribe material as required to provide proper fit with adjacent materials.

Provide additional support for material seams in both horizontal and vertical locations. Separation/release paper shall be provided between all supports and seams to prevent direct adhering of finish material to substrate.

Form field joints using manufacturer's recommended adhesive, with inconspicuous joints in finished work.

Prior to installing fabrications, make sure that substrate is clean and dry. Place silicone "dads" on substrate in accordance with manufacturer's recommendations.

A. CLEANING

A. At Substantial Completion remove temporary protection and thoroughly clean work in accordance with manufacturer's published care and maintenance guidelines.

Do not use wire brushes, acids, abrasive cleansers, or solutions which might cause discoloration or abrasion.

Clean by scrubbing with a soft cloth using liquid detergents and water as recommended by the manufacturer. Rinse with clean water. Repair joints where necessary.

END OF SECTION

DIVISION 7-THERMAL AND MOISTURE PROTECTION

GOVERNMENT OF THE VIRGIN ISLANDS, DEPARTMENT OF PLANNING AND NATURAL
RESOURCES, OFFICE BUILDING RENOVATION

REM. EST.CONTANT & ENIGHED CRUZ BAY QTR, ST.JOHN, U.S. VIRGIN ISLANDS

SECTION 070150.19 PREPARATION FOR REROOFING

GOVERNMENT OF THE U. S. VIRGIN ISLANDS, DEPARTMENT OF PUBLIC WORKS

PROJECT NAME: Elaine I. Sprauve Public Library and Museum Building

Project Location, St. John, U.S. Virgin Islands

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes

1. Roof tear-off.
2. Partial roof tear-off.
3. Temporary roofing membrane.
4. Roof re-cover preparation.
5. Removal of base flashings.

Related Sections

1. Section 02 41 15 "Electrical Demolition" for electrical equipment disconnection and reconnection.
2. Division 23 Sections for HVAC equipment removal and reinstallation.
3. Section 26 for Facility Lightning Protection disconnection and reconnection of lightning protection system.

B. UNIT PRICE - MEASUREMENT AND PAYMENT

A. Existing Insulation - Partial Removal:

1. Basis of Measurement: By the square foot.
2. Basis of Payment: Includes removal of existing insulation, replace with new insulation of specified thickness and in compliance with applicable roofing specification.

Repair Existing Deck:

1. Basis of Measurement: By the square foot.
2. Basis of Payment: Includes replacing corroded or rotted or substandard decking with new material of appropriate thickness and type.

New Insulation:

1. Basis of Measurement: By the square foot.
2. Basis of Payment: Includes complete removal of existing insulation, replace with new insulation of specified thickness and in compliance with applicable roofing specification.

C. REFERENCES

SECTION 070150.19 PREPARATION FOR REROOFING

GOVERNMENT OF THE U. S. VIRGIN ISLANDS, DEPARTMENT OF PUBLIC WORKS

PROJECT NAME: Elaine I. Sprauve Public Library and Museum Building

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A. Definitions

1. Roofing Terminology: Refer to ASTM D 1079 and glossary in NRCA's "The NRCA Roofing and Waterproofing Manual" for definition of terms related to roofing work in this section.
2. Existing Membrane Roofing System: [EPDM] [CSPE] [PVC] [TPO] roofing membrane, roof insulation, surfacing, and components and accessories between deck and roofing membrane.
3. Roof Re-cover Preparation: Existing roofing membrane that is to remain and be prepared for reuse.
4. Roof Tear-Off: Removal of existing membrane roofing system from deck.
5. Partial Roof Tear-Off: Removal of a portion of existing membrane roofing system from deck or removal of selected components and accessories from existing membrane roofing system.
6. Remove: Detach items from existing construction and legally dispose of them off-site unless indicated to be removed and reinstalled.
7. Existing to Remain: Existing items of construction that are not indicated to be removed.

D. ADMINISTRATIVE REQUIREMENTS

A. Reroofing Conference: Conduct conference at Project site.

1. Meet with A/E of Record; General Contractor, testing and inspecting agency representative; roofing system manufacturer's representative; deck installer; roofing installer including project manager, superintendent, and foreman; and installers whose work interfaces with or affects reroofing including installers of roof accessories and roof-mounted equipment.
2. Review methods and procedures related to roofing system tear-off and replacement including, but not limited to, the following:
 - a. Reroofing preparation, including membrane roofing system manufacturer's written instructions.
 - b. Temporary protection requirements for existing roofing system that is to remain during and after installation.
 - c. Existing roof drains and roof drainage during each stage of reroofing, and roof drain plugging and plug removal requirements.
 - d. Construction schedule and availability of materials, Installer's personnel, equipment, and facilities needed to make progress and avoid delays.
 - e. Existing deck removal procedures and Owner's Representative notifications.

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f. Condition and acceptance of existing roof deck and base flashing substrate for reuse.

g. Structural loading limitations of deck during reroofing.

h. Base flashings, special roofing details, drainage, penetrations, equipment curbs, and condition of other construction that will affect reroofing.

i. HVAC shutdown and sealing of air intakes.

j. Shutdown of fire-suppression, -protection, and -alarm and -detection systems.

k. Asbestos removal and discovery of asbestos-containing materials.

l. Governing regulations and requirements for insurance and certificates if applicable.

m. Existing conditions that may require notification of Architect before proceeding.

E. SUBMITTALS

A. Product Data:

1. For each type of product indicated.
2. Temporary Roofing: Include Product Data and description of temporary roofing system. If temporary roof will remain in place, submit surface preparation requirements needed to receive permanent roof, and submit a letter from roofing membrane manufacturer stating acceptance of the temporary membrane and that its inclusion will not adversely affect the roofing system's resistance to fire and wind [or its FM Global rating].

Test and Evaluation Reports.

1. Fastener pull-out test report.
2. Adhesive pull test report.

Field Quality Control Submittals:

1. Landfill Records: Indicate receipt and acceptance of hazardous wastes, such as asbestos-containing material, by a landfill facility licensed to accept hazardous wastes.

Special Procedure Submittals:

1. Photographs and Videotape: Show existing conditions of adjoining construction and site improvements, including exterior and interior finish surfaces that might be misconstrued as having been damaged by reroofing operations. Submit before work begins.

Qualification Statements:

SECTION 070150.19 PREPARATION FOR REROOFING

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1. For installer is approved by warrantor of existing roofing system.
-

F. QUALITY ASSURANCE

B. Installer Qualifications:

1. Installer of new membrane roofing system, approved by warrantor of existing roofing system to work on existing roofing.

Regulatory Requirements:

1. Comply with governing EPA notification regulations before beginning membrane roofing removal. Comply with hauling and disposal regulations of authorities having jurisdiction.

G. DELIVERY, STORAGE, AND HANDLING

A. Materials Ownership

1. Except for items or materials indicated to be reused, reinstalled, or otherwise indicated to remain Contractor's property, demolished materials shall become Construction Subcontractor's property and shall be removed from Project site.
2. Construction Drawings and Project Manual for existing roofing system are provided for Construction Subcontractor's reference. Construction Subcontractor is responsible for conclusions derived from existing documents.

Limit construction loads on roof to 20 psi rooftop equipment wheel loads and 100 psf for uniformly distributed loads.

Weather limitations:

1. Proceed with reroofing preparation only when existing and forecasted weather conditions permit work to proceed without water entering existing roofing system or building.

Hazardous Materials:

1. It is not expected that hazardous materials such as asbestos-containing materials will be encountered in the work.
2. If materials suspected of containing hazardous materials are encountered, do not disturb; immediately notify Owner's Representative. Hazardous materials will be removed under a separate contract.

H. WARRANTY

A. Existing Warranties:

Remove, replace, patch, and repair materials and surfaces cut or damaged during reroofing, by methods and with materials so as not to void existing roofing system warranty. Notify warrantor before proceeding.

SECTION 070150.19 PREPARATION FOR REROOFING

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1. Notify warrantor of existing roofing system on completion of reroofing, and obtain documentation verifying that existing roofing system has been inspected and warranty remains in effect. Submit documentation at Project Closeout.

PART 2 PRODUCTS

2.1 INFILL MATERIALS

- A. Use infill materials matching existing membrane roofing system materials unless otherwise indicated.

A. TEMPORARY ROOFING MATERIALS

- A. Design and selection of materials for temporary roofing and responsibilities of Construction Subcontractor.

Sheathing paper:

1. Red-rosin type, minimum 3 lb/100 sq. ft.

Base Sheet:

1. ASTM 4601, Type II, non-perforated, asphalt-impregnated and –coated, glass-fiber sheet.

B. RECOVER BOARDS

A. Recover Board:

1. ASTM C 1177/C 1177M, glass-mat, water resistant gypsum substrate; Type X, 5/8 inch thick.

Fasteners:

1. Factory-coated steel fasteners, No. 14, and metal or plastic plates listed in FM Approval's "Approval Guide," designated for fastening recover boards to deck.

C. AUXILIARY REROOFING MATERIALS

A. General:

1. Auxiliary reroofing preparation materials recommended by roofing system manufacturer for intended use and compatible with components of existing and new membrane roofing system.

Base Sheet Fasteners:

1. Capped head, factory-coated steel fasteners, listed in FM Approval's "Approval Guide."

Sheet Metal Flashing and Retrofit Flashing:

SECTION 070150.19 PREPARATION FOR REROOFING

GOVERNMENT OF THE U. S. VIRGIN ISLANDS, DEPARTMENT OF PUBLIC WORKS

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-
1. Metal flashing and retrofit flashing is specified in Section 07 6200, Sheet Metal Flashing and Trim.
-

PART 3 EXECUTION

3.1 PREPARATION

A. Protect existing membrane roofing system that is indicated not to be reroofed.

1. Loosely lay 1-inch minimum thick molded expanded polystyrene (MEPS) insulation over the roofing membrane in areas indicated. Loosely lay 15/32-inch plywood or OSB panels over MEPS. Extend MEPS past edges of plywood or OSB panels a minimum of 1 inch.
2. Limit traffic and material storage to areas of existing roofing membrane that have been protected.
3. Maintain temporary protection and leave in place until replacement roofing has been completed. Remove temporary protection on completion of reroofing.

Coordinate with Owner's Representative to shut down air-intake equipment in the vicinity of the work. Cover in-take louvers before proceeding with reroofing work that could affect indoor air quality or activate smoke detectors in the ductwork.

During removal operations, have sufficient and suitable materials on-site to facilitate rapid installation of temporary protection in the event of unexpected rain.

Maintain roof drains in functioning condition to ensure roof drainage at end of each workday. Prevent debris from entering or blocking roof drains and conductors. Use roof-drain plugs specifically designated for this purpose. Remove roof-drain plugs at end of each workday, when no work is taking place, or when rain is in forecast.

1. If roof drains are temporarily blocked or unserviceable due to roofing system removal or partial installation of new membrane roofing system, provide alternative drainage method to remove water and eliminate ponding. Do not permit water to enter into or under existing membrane roofing system components that are to remain.

Verify that rooftop utilities and service piping have been shut off before beginning the work.

B. ROOF TEAR-OFF

A. General:

1. Notify Owner's Representative each day of extent of roof tear-off proposed for that day and obtain authorization to proceed.

Remove accessories from roofing membrane. Store and protect accessories for reuse.

Remove protection mat and extruded-polystyrene insulation from protected roofing membrane.

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1. Discard extruded-polystyrene insulation that is wet and exceeds 8 lb/cu.ft.
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2. Store extruded-polystyrene insulation for reuse and protect from physical damage.

Roof Tear-Off:

1. Remove existing roofing membrane and other membrane roofing system components down to the deck.
2. Remove cover boards and substrate boards.
3. Remove fasteners from deck or cut fasteners off slightly above deck surface.

Partial Roof Tear-Off: Where indicated, remove existing roofing membrane and other membrane roofing system components down to the deck.

1. Remove cover boards and substrate boards.
2. Remove fasteners from deck or cut fasteners off slightly above deck surface.

C. DECK PREPARATION

A. Inspect deck after partial tear-off of membrane roofing system.

Verify that concrete substrate is visibly dry and free of moisture. Test for capillary moisture by plastic sheet method according to ASTM D 4263 or by pouring 1 pint of hot roofing asphalt on deck at start of each day's work and at start of each roof area or plane. Do not proceed with roofing work if moisture condenses under the plastic sheet or if asphalt test sample foams or can be easily and cleanly stripped after cooling.

If broken or loose fasteners that secure deck panels to one another or to structure are observed or if deck appears or feels inadequately attached, immediately notify Owner's Representative. Do not proceed with installation until directed by Owner's Representative.

If deck surface is not suitable for receiving new roofing or if structural integrity of deck is suspect, immediately notify Owner's Representative. Do not proceed with installation until directed by Owner's Representative.

Provide additional deck attachment as indicated on Drawings.

D. INFILL MATERIALS INSTALLATION

A. Immediately after removal of selected portions of existing membrane roofing system, and inspection and repair, if needed, of deck, fill in the tear-off areas to match existing membrane roofing system construction.

1. Installation of infill materials
2. Install new roofing membrane patch over roof infill area. If new roofing membrane is installed the same day tear-off is made, roofing membrane patch is not required.

E. TEMPORARY ROOFING MEMBRANE

SECTION 070150.19 PREPARATION FOR REROOFING

GOVERNMENT OF THE U. S. VIRGIN ISLANDS, DEPARTMENT OF PUBLIC WORKS

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A. Install approved temporary roofing membrane over area to be reroofed.

Remove temporary roofing membrane before installing new roofing membrane.

Prepare the temporary roof to receive new roofing membrane according to approved temporary roofing membrane proposal. Restore temporary roofing membrane to watertight condition. Obtain approval for temporary roof substrate from roofing membrane manufacturer and Owner's Representative before installing new roof.

F. ROOF RE-COVER PREPARATION

A. Remove blisters, ridges, buckles, mechanically attached roofing membrane fastener buttons projecting above the membrane, and other substrate irregularities from existing roofing membrane that inhibit new roofing membrane from conforming to substrate.

1. Remove loose aggregate from aggregate-surfaced built-up bituminous roofing with a power broom.
2. Scarify the surface of sprayed polyurethane foam as necessary to achieve a sufficiently uniform plane to receive new roofing membrane.
3. Broom clean existing substrate.
4. Coordinate with Owner's inspector to schedule times for tests and inspections.
5. Verify that existing substrate is dry before proceeding with installation. Spot check substrates with an electrical capacitance moisture-detection meter.
6. Remove materials that are wet and damp. Removal will be paid for by adjusting the contract sum according to unit prices included in the Contract Documents.

Remove blisters and areas of membrane not fully adhered.

G. EXISTING BASE FLASHINGS

A. Remove existing base flashings around parapets, curbs, walls, and penetrations.

1. Clean substrates of contaminants such as asphalt, sheet materials, dirt, and debris.

Do not damage metal counter flashings that are to remain. Replace metal counter flashings damaged during removal with counter flashings of same metal, weight or thickness, and finish.

Inspect parapet sheathing for deterioration and damage. If parapet sheathing has deteriorated, immediately notify Owner's Representative.

Remove existing parapet sheathing and replace with new pressure-preservative exterior fire-retardant-treated plywood sheathing, 19/32 inch thick. If parapet framing has deteriorated, immediately notify Owner's Representative.

1. Plywood parapet sheathing is specified in Section 06 1000 "Rough Carpentry"

H. FASTENER PULL-OUT TESTING

SECTION 070150.19 PREPARATION FOR REROOFING

GOVERNMENT OF THE U. S. VIRGIN ISLANDS, DEPARTMENT OF PUBLIC WORKS

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B. Perform fastener pull-out tests according to SPRI FX-1, and submit test report to Owner's Representative before installing new membrane roofing system.

1. Obtain Owner's Representative approval to proceed with specified fastening pattern. Owner's Representative may furnish revised fastening pattern commensurate with pull-out test results.

I. RECOVER BOARD INSTALLATION

- A. Install recover boards over roof membrane with long joints in continuous straight lines and end joints staggered between rows. Loosely butt recover boards together and fasten to deck.
1. Tape joints of recover boards if required by roofing membrane manufacturer.
 2. Fasten recover boards to resist wind-uplift pressure at corners, perimeter, and field of roof.
 3. Install additional fasteners near board corners and edges as necessary to attach boards to substrate and to adjacent boards.

J. DISPOSAL

- A. Collect demolished materials and place in containers. Promptly dispose of demolished materials. Do not allow demolished materials to accumulate on-site.
1. Storage or sale of demolished items and materials on-site is not permitted.

Transport and legally dispose of demolished materials off owner's property.

K. PROTECTION OF INSTALLED CONSTRUCTION

- A. Install temporary protection board over uncovered deck surfaces where materials or walkways are to be determined.

Install temporary sheeting up and over parapets and curbing. Retain sheeting in position with temporary fasteners.

Provide for surface drainage from sheeting to existing drainage facilities.

Do not permit traffic over unprotected or repaired deck surface.

END OF SECTION

SECTION 07270-AIR/WEATHER RESISTANT BARRIER

GOVERNMENT OF THE U. S. VIRGIN ISLANDS, DEPARTMENT OF PUBLIC WORKS

PROJECT NAME: Elaine I. Sprauve Public Library and Museum Building

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SECTION 07620 FLASHING AND SHEET METAL

GOVERNMENT OF THE U. S. VIRGIN ISLANDS, DEPARTMENT OF PUBLIC WORKS

PROJECT NAME: Elaine I. Sprauve Public Library and Museum Building
Project Location, St. John, U.S. Virgin Islands

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to work of this Section.

A. SUMMARY

- A. This Section includes the following:

1. Metal counter flashing and base flashing (if any)
2. Metal wall flashing and expansion joints
3. Built-in metal valleys, gutters, and scuppers
4. Gutters and downspouts (rain drainage)
5. Exposed metal trim/fascia units
6. Miscellaneous sheet metal accessories
7. Elastic expansion joints

Integral masonry flashings are specified as masonry work in sections of Division 4.

Roofing accessories installed integral with roofing membrane are specified in roofing system sections as roofing work.

Roof accessory units of premanufactured, set-on type are specified in Division 7 Section "Roof Accessories."

B. SUBMITTALS

- A. General:

Submit the following in accordance with Conditions of Contract and Division 1 Specification Sections.

Product data, Flashing, Sheet Metal, and Accessories:

Manufacturer's technical product data, installation instructions and general recommendations for each specified sheet material and fabricated product.

Samples of the following flashing, sheet metal, and accessory items:

1. 12-inch-long samples of factory-fabricated products exposed as finished work.
Provide complete with specified factor finish.

C. PROJECT CONDITIONS

SECTION 07620 FLASHING AND SHEET METAL

GOVERNMENT OF THE U. S. VIRGIN ISLANDS, DEPARTMENT OF PUBLIC WORKS

PROJECT NAME: Elaine I. Sprauve Public Library and Museum Building

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- A. Coordinate work of this section with interfacing and adjoining work for proper sequencing of each installation. Ensure best possible weather resistance and durability of work and protection of materials and finishes.

PART 2 - PRODUCTS

2.1 SHEET METAL FLASHING AND TRIM MATERIALS

A. Stainless Steel (07620.A):

AISI Type 302/304, complying with ASTM A 167, 2D annealed finish, soft, except where harder temper required for forming or performance; (20 gage) except as otherwise indicated.

Extruded Aluminum (07620.B):

Manufacturer's standard extrusions of sizes and profiles indicated, 60063-T52, AA-C22A41 clear anodized finish; 0.080-inch minimum thickness for primary legs of extrusions.

A. FABRICATED UNITS

A. General Metal Fabrication:

1. Shop-fabricate work to greatest extent possible.
2. Comply with details shown and with applicable requirements of SMACNA "Architectural Sheet Metal Manual" and other recognized industry practices.
3. Fabricate for waterproof and weather-resistant performance, with expansion provisions for running work, sufficient to permanently prevent leakage, damage, or deterioration of the work.
4. Form work to fit substrates.
5. Comply with material manufacturer instructions and recommendations for forming material.
6. Form exposed sheet metal work without excessive oil-canning, buckling, and tool marks, true to line and levels indicated, with exposed edges folded back to form hems.

Seams:

1. Fabricate nonmoving seams in sheet metal with flat-lock seams.
2. For metal other than aluminum, tin edges to be seamed, form seams, and solder.
3. Form aluminum seams with epoxy seam sealer; rivet joints for additional strength where required.

Expansion Provisions:

SECTION 07620 FLASHING AND SHEET METAL

GOVERNMENT OF THE U. S. VIRGIN ISLANDS, DEPARTMENT OF PUBLIC WORKS

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1. Where lapped or bayonet-type expansion provisions in work cannot be used or would not be sufficiently water/weatherproof, form expansion joints of intermeshing hooked flanges, not less than 1 inch deep, filled with mastic sealant (concealed within joints).

Sealant Joints:

1. Where movable, non-expansion type joints are indicated or required for proper performance of work, form metal to provide for proper installation of elastomeric sealant, in compliance with SMACNA standards.

Separations:

1. Provide for separation of metal from non-compatible metal or corrosive substrates by coating concealed surfaces at locations of contact, with bituminous coating or other permanent separation as recommended by manufacturer/fabricator.

Aluminum Extrusion Units:

1. Fabricate extruded aluminum running units with formed or extruded aluminum joint covers for installation behind main members where possible. Fabricate mitered and welded corner units.

B. ELASTIC EXPANSION JOINTS

A. General:

1. Provide factory-fabricated units of size and profile indicated complete with prefabricated corner units, intersection units, and splicing materials.
2. Provide complete with elastic sheet flashing forming the primary joint membrane, in a supported, "bellows" arrangement designed for securement to both sides of expansion joints. Underside of bellows insulated with adhesively applied, flexible, closed-cell rubber or plastic not less than 3/8-inch thick.

Type:

1. Metal flanged edges, 3 to 4 inches wide, formed to profiles as indicated to fit curbs and designed for nailing to curb substrate. Provide metal flanges in the following thicknesses:
 - a. Zinc-coated steel:
 - i. 22 or 24 gage
 - b. Looped Bellows Width:
 - i. 5 to 6 inches, exclusive of flanges

Available Manufacturers:

SECTION 07620 FLASHING AND SHEET METAL

GOVERNMENT OF THE U. S. VIRGIN ISLANDS, DEPARTMENT OF PUBLIC WORKS

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Subject to compliance with requirements, manufacturers offering products that may be incorporated in the Work include, but are not limited to, the following:

1. Afco Products, Inc.
2. Celotex Corporation
3. International Permalite/Roofing Components Group
4. Manville/Roofing Systems Division
5. Phoenix Building Products, Inc.
6. York Manufacturing, Inc.

PART 3 - EXECUTION

3.1 INSTALLATION REQUIREMENTS

A. General:

1. Except as otherwise indicated, comply with manufacturer's installation instructions and recommendations and with SMACNA "Architectural Sheet Metal Manual."
2. Anchor units of work securely in place by methods indicated, providing for thermal expansion of metal units; conceal fasteners where possible, and set units true to line and level as indicated.
3. Install work with laps, joints, and seams that will be permanently watertight and weatherproof.

Underlayment:

1. Where stainless steel or aluminum is to be installed directly on cementitious or wood substrates, install a slip sheet of red rosin paper and a course of polyethylene underlayment.

Bed flanges of work in a thick coat of bituminous roofing cement where required for waterproof performance.

Install reglets to receive counterflashing in manner and by methods indicated. Where shown in concrete, furnish reglets to trades of concrete work for installation as work of Division 3 sections. Where shown in masonry, furnish reglets to trades of masonry work, for installation as work of Division 4 sections.

Install counterflashing in reglets, either by snap-in seal arrangement or by welding in place for anchorage and filling reglet with mastic or elastomeric sealant, as indicated and depending on degree of sealant exposure.

SECTION 07620 FLASHING AND SHEET METAL

GOVERNMENT OF THE U. S. VIRGIN ISLANDS, DEPARTMENT OF PUBLIC WORKS

PROJECT NAME: Elaine I. Sprauve Public Library and Museum Building

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Install elastic flashing in accordance with manufacturer's recommendations. Where required, provide for movement at joints by forming loops or bellows in width of flashing. Locate cover or filler strips at joints to facilitate complete drainage of water from flashing. Seam adjacent flashing sheets with adhesive, seal and anchor edges in accordance with manufacturer's recommendations.

Nail flanges of expansion joint units to curb nailers, at maximum spacing of 6 inches O.C. Fabricate seams at joints between units with minimum 3-inch overlap, to form a continuous, waterproof system.

Install continuous gutter guards on gutters, arranged as hinged units to swing open for cleaning gutters. Install "beehive"-type strainer-guard at conductor heads, removable for cleaning downspouts.

B. CLEANING AND PROTECTION

A. Clean exposed metal surfaces, removing substances that might cause corrosion of metal or deterioration of finishes.

Protection:

Advise contractor of required procedures for surveillance and protection of flashings and sheet metal work during construction to ensure that work will be without damage or deterioration other than natural weathering at time of Substantial Completion.

END OF SECTION

SECTION 077123 ROOF GUTTERS AND DOWNSPOUTS

GOVERNMENT OF THE U. S. VIRGIN ISLANDS, DEPARTMENT OF PUBLIC WORKS

PROJECT NAME: Elaine I. Sprauve Public Library and Museum Building

Project Location, St. John, U.S. Virgin Islands

PART 1 - GENERAL

- A. The work shall consist of furnishing and installation of roof gutters and downspouts on existing buildings.

PART 2 - MATERIAL

- A. Roof gutters and downspouts may be made of aluminum or galvanized steel. Aluminum gutters shall have a minimum nominal thickness of 0.027 inches. Aluminum downspouts shall have a minimum nominal thickness of 0.020 inches. Galvanized steel gutters and downspouts shall be at least 28 gage. Dissimilar metals shall not be in contact with each other.

Roof gutters and downspouts may also made of plastic pipe. Plastic downspouts shall be Schedule 40 PVC, ASTM D-1785, and painted if exposed to direct sunlight.

No used materials shall be installed in this project.

Supports

1. Gutters shall be supported at a maximum spacing of 48 inches for galvanized steel or 32 inches for aluminum.
2. Gutters supported by spikes and ferrules shall be installed only where the existing rafters and fascia boards are sound and free from rotten wood.
3. Unsound fascia boards shall be replaced. If unsound wood exists in existing rafters, gussets made from new lumber may be attached to the existing rafters for supporting new fascia boards and the gutters.
4. Gutters shall be attached by means of hangers if sufficient backing is not available for the use of spikes and ferrules.
5. Downspouts shall be securely fastened at the top and bottom with intermediate supports that are a maximum of 10 feet apart.

PART 3 - INSTALLATION

- A. Gutters shall be installed with the minimum fall specified on the drawings. If the minimum fall is not specified on the drawings, gutters shall be installed with sufficient slope so they drain to the downspouts.

Gutters shall have the minimum cross section dimensions as shown on the drawings.

The opening in the gutter into the downspout shall equal the minimum downspout size shown on the drawings.

Where applicable, the connection between the downspouts and underground outlets will prevent contaminated surface water from entering outlet.

PROTECTION

SECTION 077123 ROOF GUTTERS AND DOWNSPOUTS

GOVERNMENT OF THE U. S. VIRGIN ISLANDS, DEPARTMENT OF PUBLIC WORKS

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1. Gutters and downspouts shall be installed so that they are protected from damage by livestock and equipment.

SECTION 077200 – ROOF ACCESSORIES

GOVERNMENT OF THE U. S. VIRGIN ISLANDS, DEPARTMENT OF PUBLIC WORKS

PROJECT NAME: Elaine I. Sprauve Public Library and Museum Building

Project Location, St. John, U.S. Virgin Islands

PART 1 GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

A. SUMMARY

B. Section Includes:

1. Roof curbs
2. Equipment supports
3. Roof hatches
4. Hatch-type heat and smoke vents
5. Dropout-type heat and smoke vents
6. Gravity ventilators
7. Pipe and duct supports
8. Pipe portals
9. Preformed flashing sleeves
10. Roof walkways

Related Sections:

1. Section 055000 "Miscellaneous Metal Work"
2. Section 076200 "Sheet Metal Flashing and Trim" for shop- and field-formed metal flashing, roof-drainage systems, roof expansion-joint covers, and miscellaneous sheet metal trim and accessories.
3. Section 230548 "Vibration and Seismic Controls for HVAC" for special curbs designed to accommodate seismic and vibration controls.
4. Section 233423 "HVAC Power Ventilators" for power roof-mounted ventilators.

B. COORDINATION

- A. Coordinate layout and installation of roof accessories with roofing membrane and base flashing and interfacing and adjoining construction to provide a leak proof, weathertight, secure, and noncorrosive installation.

Coordinate dimensions with rough-in information or Shop Drawings of equipment to be supported.

SECTION 077200 – ROOF ACCESSORIES

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C. ACTION SUBMITTALS

A. Product Data:

For each type of roof accessory.

1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes.

Shop Drawings:

For roof accessories.

1. Include plans, elevations, keyed details, and attachments to other work. Indicate dimensions, loadings, and special conditions. Distinguish between plant- and field-assembled work.

Samples:

For each exposed product and for each color and texture specified, prepared on Samples of size to adequately show color.

Delegated-Design Submittal:

For equipment supports and walkways indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

2. Detail mounting, securing, and flashing of roof-mounted items to roof structure. Indicate coordinating requirements with roof membrane system.
3. Wind-Restraint Details:
 - a. Detail fabrication and attachment of wind restraints. Show anchorage details and indicate quantity, diameter, and depth of penetration of anchors.

D. INFORMATIONAL SUBMITTALS

A. Coordination Drawings: Roof plans, drawn to scale, and coordinating penetrations and roof-mounted items. Show the following:

1. Size and location of roof accessories specified in this Section.
2. Method of attaching roof accessories to roof or building structure.
3. Other roof-mounted items including mechanical and electrical equipment, ductwork, piping, and conduit.
4. Required clearances.

Sample Warranties: For manufacturer's special warranties.

E. CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data:

For roof accessories to include in operation and maintenance manuals.

SECTION 077200 – ROOF ACCESSORIES

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F. WARRANTY

A. Special Warranty on Painted Finishes:

Manufacturer's standard form in which manufacturer agrees to repair finishes or replace roof accessories that show evidence of deterioration of factory-applied finishes within specified warranty period.

1. Fluoropolymer Finish:

Deterioration includes, but is not limited to, the following:

- a. Cracking, checking, peeling, or failure of paint to adhere to bare metal.

2. Finish Warranty Period:

15 years from date of Substantial Completion.

PART 2 PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

B. General Performance:

Roof accessories shall withstand exposure to weather and resist thermally induced movement without failure, rattling, leaking, or fastener disengagement due to defective manufacture, fabrication, installation, or other defects in construction.

Delegated Design:

Engage a qualified professional engineer, as defined in Section 014000 "Quality Requirements," to design equipment supports to comply with wind performance requirements, including comprehensive engineering analysis by a qualified professional engineer, using performance requirements and design criteria indicated.

Wind-Restraint Performance:

175 mph

A. EQUIPMENT SUPPORTS

C. Equipment Supports:

Internally reinforced perimeter Rail type metal equipment supports capable of supporting superimposed live and dead loads between structural supports, including equipment loads and other construction indicated on Drawings, spanning between structural supports; capable of meeting performance requirements; with welded or mechanically fastened and sealed corner joints, stepped integral metal cant raised the thickness of roof insulation, and integrally formed structure-mounting flange at bottom.

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1. Basis of Design Product:

Subject to compliance with requirements, provide product by one of the following:

- a. Adaptable Air Products
- b. AES Industries, Inc.
- c. Air Balance Inc.; a division of Mestek, Inc.
- d. Conn-Fab Sales, Inc.
- e. Custom Solution Roof and Metal Products.
- f. Greenheck Fan Corporation.
- g. KCC International, Inc.
- h. Lloyd Industries.
- i. Milcor Inc.; Commercial Products Group of Hart & Cooley, Inc.
- j. Pate Company (The).
- k. Plenums Incorporated.
- l. Roof Products and Systems (RPS); a division of Hart & Cooley, Inc.
- m. Roof Products, Inc.
- n. Thybar Corporation.

Size:

Coordinate dimensions with roughing-in information or Shop Drawings of equipment to be supported.

Supported Load Capacity:

Coordinate load requirements with items being supported by equipment supports

Material:

Aluminum-zinc alloy-coated steel sheet, 0.079 inch (2.01 mm) thick.

2. Finish:

Two-coat fluoropolymer

3. Color:

As indicated by manufacturer's designations.

Material:

Aluminum sheet, 0.125 inch (3.17 mm) thick.

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4. Finish:

Two-coat fluoropolymer or powder coat.

5. Color:

Light bronze.

Material:

Stainless-steel sheet, 0.078 inch (1.98 mm) thick.

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6. Finish:

Manufacturer's standard.

Construction:

7. Curb Profile:

Compatible with roofing system.

8. Insulation:

Factory insulated with 1-1/2 inch (38 mm) thick glass-fiber board insulation.

9. Liner:

Same material as equipment support, of manufacturer's standard thickness and finish.

10. Nailer:

Factory-installed continuous wood nailers 3-1/2 inches (90 mm) wide on top flange of equipment supports, continuous around support perimeter.

11. Wind Restraint Straps and Base Flange Attachment:

Provide wind restraint straps, welded strap connectors, and base flange attachment to roof structure at perimeter of curb of size and spacing required to meet wind uplift requirements.

12. Platform Cap:

Where portion of equipment support is not covered by equipment, provide weathertight platform cap formed from 3/4-inch (19-mm) thick plywood covered with metal sheet of same type, thickness, and finish as required for curb.

13. Metal Counterflashing:

Manufacturer's standard, removable, fabricated of same metal and finish as equipment support.

14. On ribbed or fluted metal roofs, form deck-mounting flange at perimeter bottom to conform to roof profile.

15. Fabricate equipment supports to minimum height of 12 inches (305 mm) above roofing surface unless otherwise indicated.

16. Sloping Roofs:

Where roof slope exceeds 1:48, fabricate each support with height to accommodate roof slope so that tops of supports are level with each other. Equip supports with water diverters or crickets on sides that obstruct water flow.

B. ROOF HATCH

D. Roof Hatches:

Metal roof-hatch units with lids and insulated double walled curbs, welded or mechanically fastened and sealed corner joints, continuous lid to curb counterflashing and weathertight perimeter gasketing, stepped

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~~integral metal cant raised the thickness of roof insulation, and~~
integrally formed deck-mounting flange at perimeter bottom.

1. Basis of Design Product:

Subject to compliance with requirements, provide Bristolite Daylighting Systems, Inc.; or comparable product by one of the following:

- a. Babcock-Davis
- b. Bilco Company (The)
- c. Pate Company (The)

Type and Size:

Double leaf lid, 72 by 96 inches (1830 by 2440 mm).

Loads:

Minimum 60 lbf/sq. ft. (2.9-kPa) external live load and internal hurricane uplift load.

Hatch Material:

Aluminum-zinc alloy coated steel sheet.

2. Thickness:

0.079 inch (2.01 mm)

3. Color:

As indicated by manufacturer's designations.

Hatch Material:

Aluminum sheet.

4. Thickness:

0.079 inch (2.01 mm)

5. Finish:

Two-coat fluoropolymer

6. Color:

Light bronze

Hatch Material:

Stainless-steel sheet.

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7. Thickness: 0.078 inch (1.98 mm)

8. Finish:

Manufacturer's standard.

Construction:

9. Insulation:

Cellulosic-fiber board.

a. R-Value: 12.0 according to ASTM C1363.

10. Nailer:

Factory-installed wood nailer continuous around hatch perimeter.

11. Hatch Lid:

Opaque, insulated, and double walled, with manufacturer's standard metal liner of same material and finish as outer metal lid.

12. Curb Liner:

Manufacturer's standard, of same material and finish as metal curb.

13. Fabricate curbs to minimum height of 12 inches (305 mm) above roofing surface unless otherwise indicated.

14. Sloping Roofs: Where slope or roof deck exceeds 1:48, fabricate curb with perimeter curb height that is constant. Equip hatch with water diverter or cricket on side that obstructs water flow.

Hatch-Lid Finish:

15. Outer Double-Dome Color:

Bronze tinted

16. Inner Double-Dome Color:

Bronze tinted

Hardware:

Spring operators, hold-open arm, stainless-steel spring latch with turn handles, stainless-steel butt or pintle type hinge system, and padlock hasps inside and outside.

17. Provide two-point latch on lids larger than 84 inches (2130 mm).

Safety Railing System:

Roof hatch manufacturer's standard system including rails, clamps, fasteners, safety barrier at railing opening, and accessories required for a complete installation; attached to roof hatch and complying with 29 CFR 1910.23 requirements and authorities having jurisdiction.

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18. Height:

42 inches (1060 mm) above finished roof deck.

19. Posts and Rails:

Galvanized steel pipe, 1-1/4 inches (31 mm) in diameter or galvanized steel tube, 1-5/8 inches (41 mm) in diameter.

20. Flat Bar:

Galvanized steel, 2 inches (50 mm) high by 3/8 inch (9 mm) thick.

21. Maximum Opening Size in rail:

System constructed to prevent passage of a sphere 21 inches (533 mm) in diameter, and no horizontal footholds.

22. Chain Pass way Barrier:

Galvanized proof coil chain with quick link on fixed end.

23. Post and Rail Tops and Ends:

Weather resistant, closed or plugged with prefabricated end fittings.

24. Provide weep holes or another means to drain entrapped water in hollow sections of handrail and railing members.

25. Fabricate joints exposed to weather to be watertight.

26. Fasteners:

Manufacturer's standard, finished to match railing system.

27. Finish:

Manufacturer's standard

a. Color:

As indicated by manufacturer's designations.

Ladder Assist Post:

Roof-hatch manufacturer's standard device for attachment to roof-access ladder.

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28. Operation:

Post locks in place on full extension; release mechanism returns post to closed position.

29. Height:

42 inches (1060 mm) above finished roof deck.

30. Material:

Stainless steel or Aluminum.

31. Post:

1-5/8 inch (41 mm) diameter pipe.

32. Finish:

Polished stainless steel, or powder coat for aluminum

a. Color:

As indicated by manufacturer's designations

C. HEAT AND SMOKE VENTS

E. Hatch Type Heat and Smoke Vents:

Manufacturer's standard, with single walled insulated curbs, welded or mechanically fastened and sealed corner joints, integral condensation gutter, and cap flashing. Fabricate with insulated double-walled lid and continuous weathertight perimeter lid gaskets, and equip with automatic self-lifting mechanisms and UL-listed fusible links rated at 165 F (74 C) fire-suppression system.

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1. Basis of Design Product:

Subject to compliance with requirements, provide product by one of the following:

- a. Babcock-Davis.
- b. Bilco Company (The).
- c. Bristolite Daylighting Systems, Inc

2. Type and Size:

Double-leaf lid, 72 by 96 inches (1830 by 2440 mm)

3. Loads:

Minimum 60-lbf/sq. ft. (2.9-kPa) external live load and internal hurricane uplift load.

- a. When release is actuated, lid shall open against 20-lbf/sq. ft. (0.95-kPa) wind load and lock in position.

4. Heat and Smoke Vent Standard:

Provide units that have been tested and listed to comply with UL793.

5. Curb, Framing, and Lid Material:

Aluminum zinc alloy coated steel sheet.

- a. Thickness:

0.079 inch (2.01 mm)

- b. Color:

As indicated by manufacturer's designations.

6. Curb, Framing, and Lid Material:

Aluminum sheet.

- a. Thickness:

0.079 inch (2.01 mm)

- b. Finish:

Two-coat fluoropolymer

- c. Color:

Light bronze

7. Construction:

- a. Insulation:

Cellulosic-fiber board

- i. R-Value: 12.0 according to ASTM C 1363.

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b. Nailer:

Factory-installed wood nailer continuous around hatch perimeter.

c. Hatch Lid:

Opaque, insulated, and double walled, with manufacturer's standard metal liner of same material and finish as outer metal lid.

d. Fabricate curbs to minimum height of **12 inches (305 mm)** above roofing surface unless otherwise indicated.

e. Sloping Roofs:

Where slope or roof deck exceeds 1:48, fabricate curb with perimeter curb height that is tapered to accommodate roof slope so that top surfaces of perimeter curb are level. Equip hatch with water diverter or cricket on side that obstructs water flow.

Dropout-Type Heat and Smoke Vents: Manufacturer's standard, gravity operated and automatic; with single walled insulated curbs and frame, welded or mechanically fastened and sealed corner joints, integral condensation gutter, cap flashing, and heat-sensitive dome glazing that will deform and drop out of vent opening according to heat and smoke vent standard indicated.

8. Basis of Design Product: Subject to compliance with requirements, provide product by one of the following:

- a. APC Dayliter; C/S Group.
- b. Construction Specialties, Inc.
- c. Pate Company (The)
- d. Plasteco, Inc.
- e. Bristolite Daylighting Systems, Inc.

9. Size:

48 by 48 inches (1219 by 1219 mm).

10. Loads:

Minimum **60-lbf/sq. ft. (1.9-kPa)** external live load and internal uplift load.

a. Dome Glazing:

Minimum 60-lbf/sq. ft. (1.9-kPa) external live load and internal uplift load.

11. Heat and Smoke Vent Standard: Provide units that have been tested and listed to comply with UL793.

12. Curb and Framing Material:

Aluminum sheet.

a. Thickness:

Manufacturer's standard thickness for vent size indicated.

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b. Finish:

Two-coat fluoropolymer.

c. Color:

Light bronze

13. Construction:

a. Insulation:

Manufacturer's standard.

b. Exterior Curb Liner:

Manufacturer's standard, of same material and finish as metal curb.

c. Fabricate curbs to minimum height of **12 inches (305 mm)** above roofing surface unless otherwise indicated.

d. Sloping Roofs: Where slope of roof deck exceeds 1:48, fabricate curb with perimeter curb height that is tapered to accommodate roof slope so that top surfaces of perimeter curb are level. Equip unit with water diverter or cricket on side that obstructs water flow.

14. Dome Glazing:

Single glazing of thickness capable of resisting indicated loads.

a. Single-Dome Color:

Bronze tinted, transparent.

15. Fall Protection Safety Structure:

Manufacturer's standard meeting impact load requirements of 29 CFR 1910.23 and authorities having jurisdiction and manually openable from exterior without special tools.

16. Hardware:

Manufacturer's standard, stainless-steel; with hinges, hold-open devices, and independent manual-release devices for **inside** operation of lids.

D. GRAVITY VENTILATORS

F. Low-Profile, Cylindrical-Style Gravity Ventilators: Manufacturer's standard, fabricated as indicated, with manufacturer's standard welded or sealed mechanical joints.

1. Basis of Design Product:

Subject to compliance with requirements, provide product by one of the following:

a. Active Ventilation Products, Inc.

b. Air Vent, Inc.: a Gibraltar Industries company.

c. Dur-Red Products.

d. Greenheck Fan Corporation.

e. Loren Cook Company.

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f. Metallic Products Corp.

g. Moffitt Corporation, Inc.

h. PennBarry.

i. Romlair Ventilator Co.

j. Safe Air of Illinois.

k. Thaler Metal Industries Ltd.

l. Vent Products Co., Inc.

2. Construction:

Integral base flange, vent cylinder, cylinder insect screen, and rain cap.

3. Insect Screens:

Manufacturer's standard mesh with rewirable frame.

4. Vent Cylinder, Base Flange, and Rain-Cap Material: Stainless-steel sheet, of manufacturer's standard thickness.

5. Finish:

As indicated by manufacturer's designations.

Louvered Penthouse-Style Gravity Ventilators:

Manufacturer's standard, fabricated as indicated, with manufacturer's standard welded or sealed mechanical joints.

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6. Basis of Design Product:

Subject to compliance with requirements, provide product by one of the following:

- a. Dur-Red Products.
- b. Greenheck Fan Corporation.
- c. Loren Cook Company.
- d. PennBarry.
- e. Romlair Ventilator Co.
- f. Safe Air of Illinois.
- g. Vent Products Co., Inc.

7. Insect Screens:

Manufacturer's standard mesh with rewirable frame.

8. Frame, Base Flange, Cap, and Louver Material: Stainless-steel sheet, of manufacturer's standard thickness.

9. Finish:

As indicated by manufacturer's designations

Turbine-Style Gravity Ventilators:

Manufacturer's standard, fabricated as indicated, with manufacturer's standard welded or sealed mechanical joints:

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10. Manufacturers:

Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

- a. Air Vent, Inc.; a Gibraltar company.
- b. Moffitt Corporation Inc.
- c. PennBarry.
- d. Romlair Ventilator Co.

11. Provide integral weathertight base cap, outlet duct, and rotating louvered turbine.

12. Insect Screens:

Manufacturer's standard mesh with rewirable frame.

13. Weathertight Base Cap, Outlet Duct, and Turbine Material:

Aluminum sheet, of manufacturer's standard thickness.

14. Finish:

As indicated by manufacturer's designations

E. PIPE AND DUCT SUPPORTS

G. Fixed-Height Cradle-Type Pipe Supports:

Polycarbonate pipe stand accommodating up to **1-1/2 inch (38 mm)** diameter pipe or conduit; with provision for pipe retainer and with manufacturer's support pad or deck plate as recommended for penetration-free installation over roof membrane type; as required for quantity of pipe runs and sizes.

Fixed-Height Roller-Bearing Pipe Supports:

Polycarbonate pipe stand with stainless-steel roller carrying assembly accommodating up to **7 inch (178 mm)** diameter pipe or conduit; with provision for pipe retainer and with manufacturer's support pad or deck plate as recommended for penetration-free installation over roof membrane type; as required for quantity of pipe runs and sizes.

Adjustable-Height Structure-Mounted Pipe Supports:

Extruded-aluminum tube, filled with urethane insulation; **2 inches (50 mm)** in diameter; accommodating up to **7-inch (178-mm)]** diameter pipe or conduit, with provision for pipe retainer; with aluminum baseplate, EPDM base seal, manufacturer's recommended hardware for mounting to structure or structural roof deck as indicated, stainless-steel roller and retainer, and extruded-aluminum carrier assemblies; as required for quantity of pipe runs and sizes.

Curb-Mounted Pipe Supports:

Galvanized steel support with welded or mechanically fastened and sealed corner joints integral metal cant, and integrally formed deck-mounting flange at perimeter bottom; with adjustable-height roller-

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bearing pipe support accommodating up to 20-inch (508-mm)

diameter pipe or conduit and with provision for pipe retainer; as required for quantity of pipe runs and sizes.

1. Manufacturers:

Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

- a. MIRO Industries, Inc.
- b. Pate Company (The).
- c. PHP Systems Design
- d. Thaler Metal Industries Ltd.

Duct Supports:

Extruded-aluminum, urethane-insulated supports, 2 inches (50 mm) in diameter; with manufacturer's recommended hardware for mounting to structure or structural roof deck.

2. Manufacturers:

Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

- a. Eberl Iron Works, Inc.
- b. Thaler Metal Industries, Ltd.

3. Finish:

Manufacturer's standard.

F. PIPE PORTALS

H. Curb-Mounted Pipe Portal:

Insulated roof-curb units with welded or mechanically fastened and sealed corner joints, straight sides, and integrally formed deck-mounting flange at perimeter bottom; with weathertight curb cover with single or multiple collared openings and pressure-sealed conically shaped EPDM protective rubber caps sized for piping indicated, with stainless-steel snap lock swivel clamps.

1. Manufacturers:

Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

- a. Roof Products and Systems (RPS); a division of Hart & Cooley, Inc.

Flashing Pipe Portal:

Formed aluminum membrane-mounting flashing flange and sleeve with collared opening and pressure-sealed conically shaped EPDM

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~~protective rubber cap sized for piping indicated, with stainless-steel
snap lock swivel clamps.~~

2. Manufacturers:

Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

- a. Roof Products and Systems (RPS); a division of Hart & Cooley, Inc.

G. PREFORMED FLASHING SLEEVES

- I. Exhaust Vent Flashing: Double-walled metal flashing sleeve or boot, insulation filled, with integral deck flange, 12 inches (300 mm) high, with removable metal hood and slotted metal collar.

1. Manufacturers:

Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

- a. Custom Solution Roof and Metal Products.
- b. Thaler Metal Industries, Ltd.

2. Metal:

Aluminum sheet, 0.063 inch (1.60 mm)

3. Diameter:

4 inches (100 mm)

4. Finish:

Manufacturer's standard

Vent Stack Flashing:

Metal flashing sleeve, uninsulated, with integral deck flange.

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5. Manufacturers:

Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

- a. Custom Solution Roof and Metal Products.
- b. Lifetime Tool & Building Products, LLC.
- c. Milcor; Commercial Products Group of Hart & Cooley, Inc.
- d. Thaler Metal Industries, Ltd.

6. Metal:

Aluminum sheet, 0.063 inch (1.60 mm) thick

7. Height:

7 inches (175 mm)

8. Diameter:

As indicated on Drawings

9. Finish:

Manufacturer's standard

Zinc-Coated (Galvanized) Steel Sheet:

ASTM A 653/A 653M, G90 (Z275) coating designation

10. Exposed Coil-Coated Finish:

Painted by the coil-coating process to comply with ASTM A 755/A 755M. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.

a. Two-Coat Fluoropolymer Finish:

AAMA 621. System consisting of primer and fluoropolymer color topcoat containing not less than 70 percent PVDF resin by weight.

11. Concealed Finish:

Pretreat with manufacturer's standard white or light-colored acrylic or polyester-backer finish consisting of prime coat and wash coat, with a minimum total dry film thickness of 0.5 mil (0.013 mm).

Aluminum-Zinc Alloy-Coated Steel Sheet:

ASTM A 792/A 792M, AZ50 (AZM150) coated.

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12. Exposed Coil-Coated Finish:

Painted by the coil-coating process to comply with ASTM A 755/A 755M. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.

a. Two-Coat Fluoropolymer Finish:

AAMA 621. System consisting of primer and fluoropolymer color topcoat containing not less than 70 percent PVDF resin by weight.

13. Concealed Finish:

Pretreat with manufacturer's standard white or light-colored acrylic or polyester-backer finish consisting of prime coat and wash coat, with a minimum total dry film thickness of **0.5 mil (0.013 mm)**.

Aluminum Sheet:

ASTM B 209 (ASTM B 209M), manufacturer's standard alloy for finish required, with temper to suit forming operations and performance required.

14. Exposed Coil-Coated Finish:

Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.

a. Two-Coat Fluoropolymer Finish:

AAMA 2605. System consisting of primer and fluoropolymer color topcoat containing not less than 70 percent PVDF resin by weight.

15. Concealed Finish:

Pretreat with manufacturer's standard white or light-colored acrylic or polyester-backer finish consisting of prime coat and wash coat, with a minimum total dry film thickness of **0.5 mil (0.013 mm)**.

Aluminum Extrusions and Tubes:

ASTM B 221/ASTM B 221M, manufacturer's standard alloy and temper for type of use, finished to match assembly where used; otherwise mill finished.

Stainless-Steel Sheet and Shapes:

ASTM A 666, Type 304.

Steel Shapes:

ASTM A 36/A 36M, hot-dip galvanized according to
ASTM A 123/A 123M unless otherwise indicated.

Steel Tube:

ASTM A 500/A 500M, round tube.

Galvanized-Steel Tube:

ASTM A 500/A 500M, round tube, hot-dip galvanized according to
ASTM A 123/A 123M.

Steel Pipe:

ASTM A 53/A 53M, galvanized.

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H. MISCELLANEOUS MATERIALS

J. General:

Provide materials and types of fasteners, protective coatings, sealants, and other miscellaneous items required by manufacturer for a complete installation.

Polycarbonate Glazing:

Thermoformable, monolithic polycarbonate sheets manufactured by extrusion process, burglar-resistance rated according to UL 972 with an average impact strength of **12 to 16 ft-lbf/in.** (**640 to 854 J/m**) of width when tested according to ASTM D 256, Method A (Izod).

Cellulosic-Fiber Board Insulation:

ASTM C 208, Type II, Grade 1, thickness as indicated.

Wood Nailers:

Softwood lumber, pressure treated with waterborne preservatives for aboveground use, acceptable to authorities having jurisdiction, containing no arsenic or chromium, and complying with AWPAC2; not less than **1-1/2 inches** (**38 mm**) thick.

Bituminous Coating:

Cold-applied asphalt emulsion complying with ASTM D 1187/D 1187M.

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Underlayment:

1. Felt:
ASTM D 226/D 226M, Type II (No. 30), asphalt-saturated organic felt, nonperforated.
2. Polyethylene Sheet:
6-mil (0.15-mm) thick polyethylene sheet complying with ASTM D 4397.
3. Slip Sheet:
Building paper, 3 lb/100 sq. ft. (0.16 kg/sq. m) minimum, rosin sized.
4. Self-Adhering, High-Temperature Sheet:
Minimum 30 to 40 mils (0.76 to 1.0 mm) thick, consisting of slip-resisting polyethylene-film top surface laminated to layer of butyl or SBS-modified asphalt adhesive, with release-paper backing; cold applied. Provide primer when recommended by underlayment manufacturer.
5. Fasteners:
Roof accessory manufacturer's recommended fasteners suitable for application and metals being fastened. Match finish of exposed fasteners with finish of material being fastened. Provide non removable fastener heads to exterior exposed fasteners. Furnish the following unless otherwise indicated:
6. Fasteners for Zinc-Coated or Aluminum-Zinc Alloy-Coated Steel:
Series 300 stainless steel according to ASTM A 153/A 153M.
7. Fasteners for Aluminum Sheet:
Series 300 stainless steel.
8. Fasteners for Stainless-Steel Sheet:
Series 300 stainless steel.

Gaskets:

Manufacturer's standard tubular or fingered design of neoprene, EPDM, PVC, or silicone or a flat design of foam rubber, sponge neoprene, or cork.

Elastomeric Sealant:

ASTM C 920, elastomeric polyurethane or silicone polymer sealant as recommended by roof accessory manufacturer for installation indicated; low modulus; of type, grade, class, and use classifications required to seal joints and remain watertight.

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I. GENERAL FINISH REQUIREMENTS

K. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.

Appearance of Finished Work: Noticeable variations in same piece are not acceptable. Variations in appearance of adjoining components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

PART 3 EXECUTION

3.2 EXAMINATION

L. Examine substrates, areas, and conditions, with Installer present, to verify actual locations, dimensions, and other conditions affecting performance of the Work.

Verify that substrate is sound, dry, smooth, clean, sloped for drainage, and securely anchored.

Verify dimensions of roof openings for roof accessories.

Proceed with installation only after unsatisfactory conditions have been corrected.

A. INSTALLATION

M. General:

Install roof accessories according to manufacturer's written instructions.

1. Install roof accessories level; plumb; true to line and elevation; and without warping, jogs in alignment, buckling, or tool marks.
2. Anchor roof accessories securely in place so they are capable of resisting indicated loads.
3. Use fasteners, separators, sealants, and other miscellaneous items as required to complete installation of roof accessories and fit them to substrates.
4. Install roof accessories to resist exposure to weather without failing, rattling, leaking, or loosening of fasteners and seals.

Metal Protection:

Protect metals against galvanic action by separating dissimilar metals from contact with each other or with corrosive substrates by painting contact surfaces with bituminous coating or by other permanent separation as recommended by manufacturer.

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5. Coat concealed side of stainless-steel roof accessories with bituminous coating
where in contact with wood, ferrous metal, or cementitious construction.

6. Underlayment: Where installing roof accessories directly on cementitious or wood substrates, install a course of underlayment and cover with manufacturer's recommended slip sheet.

7. Bed flanges in thick coat of asphalt roofing cement where required by manufacturers of roof accessories for waterproof performance.

Roof Curb Installation:

Install each roof curb so top surface is level

Equipment Support Installation:

Install equipment supports so top surfaces are level with each other

Roof-Hatch Installation:

8. Verify that roof hatch operates properly. Clean, lubricate, and adjust operating mechanism and hardware.

9. Attach safety railing system to roof-hatch curb.

10. Attach ladder-assist post according to manufacturer's written instructions.

Heat and Smoke Vent Installation:

11. Install heat and smoke vent so top perimeter surfaces are level.

12. Install and test heat and smoke vents and their components for proper operation according to NFPA 204.

Gravity Ventilator Installation:

Verify that gravity ventilators operate properly and have unrestricted airflow. Clean, lubricate, and adjust operating mechanisms.

Pipe Support Installation:

Comply with MSS SP-58 and MSS SP-89. Install supports and attachments as required to properly support piping. Arrange for grouping of parallel runs of horizontal piping, and support together.

13. Pipes of Various Sizes:

Space supports for smallest pipe size or install intermediate supports for smaller diameter pipes as specified for individual pipe hangers.

Preformed Flashing Sleeve and Flashing Pipe Portal Installation:

Secure flashing sleeve to roof membrane according to flashing-sleeve manufacturer's written instructions; flash sleeve flange to surrounding roof membrane according to roof membrane manufacturer's instructions.

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B. REPAIR AND CLEANING

N. Galvanized Surfaces:

Clean field welds, bolted connections, and abraded areas and repair galvanizing according to ASTM A 780/A 780M.

Touch up factory-primed surfaces with compatible primer ready for field painting.

Clean exposed surfaces according to manufacturer's written instructions.

Clean off excess sealants.

Replace roof accessories that have been damaged or that cannot be successfully repaired by finish touchup or similar minor repair procedures.

END OF SECTION

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PART 4 - GENERAL

4.3 SUMMARY

O. Section Includes:

1. The sealing of joints indicated on schedule at the end of this section.
2. The sealing of exterior joints, including:
 - a. Exterior face of building expansion joints.
 - b. Panel joints.
 - c. Coping joints.
 - d. Joints around perimeter of frame.
3. The sealing of interior joints including:
 - a. Joints around perimeter of frame.
 - b. Control joints in plaster.
 - c. Control joints in gypsum board.
 - d. Control joints in emu walls.

Joints of a nature similar to that of joints indicated on the schedule shall be sealed with the same sealer, whether indicated on drawings to be sealed or not.

4. Related Sections:

- a. Fire stopping/smoke stopping sealers:
Elsewhere in Division 7
- b. Joint sealers in roofing work:
Elsewhere in Division 7
- c. Joint sealers in waterproofing work:
Elsewhere in Division 7

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B. REFERENCES

P. ASTM C 719-93 - Standard Test Method for Adhesion and Cohesion of Elastomeric Joint Sealants Under Cyclic Movement (Hockman Cycle); 1993.

ASTM C 834-95- Standard Specification for Latex Sealants; 1995.

ASTM C 920-95- Standard Specifications for Elastomeric Joints Sealants 1995.

ASTM C 1193-91- Standard Guide for Use of Joint Sealants; 1991.

ASTM D 3405-78 - Standard Specification for Joint Sealants, Hot-poured for Concrete and Asphalt Pavements; 1978.

ASTM D 3406-85(91) - Standard Specification for Joint Sealant, Hot-Applied, Elastomeric -Type, for Portland cement Concrete Pavements 1985 (Reapproved 1991).

FS A-A-272- Caulking Compounds; 1980.

FS SS-S-200E- Sealants, Joint, Two-Component, Jet-Blast-Resistant, Cold-Applied, for Portland cement Concrete Pavement; 1984 (Amended 1988).

C. DEFINITIONS

Q. Substrates:

1. M-type substrates:
Concrete, concrete masonry units, brick, mortar and natural stone. The term "masonry" means brick, stone, and concrete masonry work.
2. G-type substrates:
Glass and transparent plastic glazing sheets
3. A-type substrates:
Metals, porcelain, glazed tile, and smooth plastics
4. O-type substrates:
Woods, unglazed tile; substrates not included under other categories

D. SUBMITTALS

R. Product Data:

1. Manufacturer's data on each joint sealer, with instruction for substrate preparation and installation.

Samples for Color Selection:

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2. Cured samples of actual products showing manufacturer's full range of colors.
(Products exposed to view only).

Certified Product Test Reports:

3. Independent testing agency reports showing compliance with all specified requirements.
4. Reports may be on tests conducted up to 24 months before submission, provided the products tested were aged specimens of the same formulation as that to be used.

Field Installation Test Reports.

Certificates:

For each sealer, provide manufacturer's certificates stating that the product complies with the specifications and is appropriate for the use it is being put to.

Installer's Preconstruction Inspection Report:

List all conditions detrimental to performance of joint sealer work.

E. QUALITY ASSURANCE

S. Field Installation Tests:

Before installation, test the adhesion of all sealers to actual substrates.

1. Seal at least 5-foot lengths of joints and cure properly. Try to pull sealer out of joint by hand, by method recommended by sealer manufacturer.
2. Select test joint representative of joints to be sealed by the product to be tested.
3. Perform tests for each type of sealer used on exterior and each type of elastomeric sealant used on interior.
4. Do tests in the presence of the Project Manager.

F. DELIVERY, STORAGE, AND HANDLING

T. Deliver materials in original containers or bundles with labels showing manufacturer, product name or designation, color, shelf life, and installation instructions.

G. PROJECT CONDITIONS

U. Environmental Limitations:

Do not install sealers if any of the following conditions exist.

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1. Air or substrate temperature exceeds the range recommended by sealer manufacturers.

2. Substrate is wet or damp.

Dimensional Limitations:

Do not install sealers if joint dimensions are less than or greater than that recommended by sealer manufacturer; notify alternative procedures.

H. WARRANTY

V. Submit written warranty signed by Contractor and installer guaranteeing correct failures in sealer work that occur within 10 years after substantial completion, without reducing or otherwise limiting any other rights to correction which the owner may have under the contract documents. Failure is defined as failure to remain weathertight due to faulty materials or workmanship. Correction is limited to replacement sealers.

PART 5 - PRODUCTS

5.4 MATERIALS - GENERAL

W. General:

Provide only products which are recommended and approved by their manufacturer for the specific use to which they are put and which comply with all requirements of the contract documents.

1. For each generic product, use only materials from one manufacturer.
2. Provide only materials which are compatible with each other and joint substrates.
3. Colors of exposed sealers:
As selected by the Owner's Representative from manufacturer's standard colors

B. ELASTOMERIC SEALANTS

X. Elastomeric Sealants General:

Chemically curing elastomeric sealants types indicated, complying with ASTM C 920, including specific type, Grade, Class, and Uses indicated, as well as all other requirements specified.

1. For M-type substrates:
Comply with requirements for Use M

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2. For G-type substrates:

Comply with requirements for Use G

3. For A-type substrates:

Comply with requirements for Use A

4. For 0-type substrates:

Comply with requirements for Use M. (minimum) and use 0 for the particular substrate.

Two-Part Pourable Polysulfide Sealant:

Type M, Grade P, Class 12-1/2 T

Medium Movement Silicone Sealant:

One- or two-part non-acid-curing, Grade NS, Class 25, Use NT, plus movement capability of more than 25 percent but less 50 in both extension and compression.

Silicone Sealant for Use T:

One-part, non-acid-curing, Grade NS, Class 25, Use T, Use M, plus movement capability of 50 percent in both extension and compression.

Multipart Pourable Urethane Sealant:

Type M, Grade P, Class 25, Use T

No sag Urethane Sealant for Use T:

Type S or M, Grade NS, Class 25, Use T

One-part No sag Urethane Sealant:

Type S, Grade P, Class 25, Use T

C. PAVING JOINT SEALANTS

Y. Two-Part Urethane Paving Sealant: Pourable, chemically curing (cold-applied) complying with FS SS-S-200:

1. Composition:

Urethane, with minimum capability of plus or minus 12-1/2 percent.

2. Composition:

Bitumen modified polymer; also complying with ASTM C 920, Type M, Grade P, Class 25, Use T

a. Composition:

Bitumen modified urethane.

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One-Part Urethane Paving Sealant:

Pourable, chemically curing (cold-applied), bitumen modified urethane; complying with FS SS-S-200.

PVC/Coal-Tar Paving Sealant (ASTM D 3406):

Hot-poured, one-part, polyvinyl chloride/coal tar blend; complying with ASTM D 3406.

Rubber/Asphalt Paving Sealant (ASTM D 3405):

Hot-poured, one-part, rubber/asphalt blend; complying with ASTM D 3405.

D. SOLVENT-RELEASE-CURING SEALANTS

Z. Butyl Sealant:

No sag, one part, solvent-release-curing; complying with FS A-A-272, Type III, no staining; paintable.

E. LATEX SEALANTS

AA. Acrylic-Latex Emulsion Sealant:

One-part, No sag, mildew-resistant, paintable; complying with ASTM C 834.

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F. SEALANT BACKERS

BB. Backers- General:

No staining; recommended or approved by sealant manufacturer for specific use.

Backers Rods:

Flexible, nonabsorbent, compressible polyurethane foam either open-cell or non-gassing closed-cell, unless otherwise restricted by sealant manufacturer; preformed to appropriate size and shape.

G. MISCELLANEOUS MATERIALS

CC. Primers:

As recommended by sealer manufacturer.

Cleaners:

As recommended by sealer manufacturer and not damaging to substrates.

Masking Tape:

Nonabsorbent, no staining.

Tooling Agents:

Approved by sealant manufacturer; no staining to sealant and substrate.

PART 6 - EXECUTION

6.5 EXAMINATION

DD. Examine joints for characteristics that may affect sealer performance including configuration and dimensions.

Do not begin joint sealer work until unsatisfactory conditions have corrected.

A. PREPARATION

EE.Cleaning:

Just before starting sealer installation, clean out joints accord with recommendations of sealer manufacturers and as follows:

1. Remove all material that could impair adhesion, including dust, dirt, coatings, paint, oil, and grease. Exception: Materials tested to show acceptable adhesion and compatibility.
2. Dry out damp and wet substrates thoroughly.

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3. Clean M-type and O-type substrates by suitable mechanical or chemical methods.
4. Remove loose particles by vacuuming or by blowing with oil-free compressed air.
5. Concrete: Remove laitance and form-release coatings.
6. Clean A-type and G-type substrates by chemical or other method which will not damage the substrate.
7. Use methods which will not leave residues that will impair adhesion.

Priming:

Prime substrates as recommended by sealer manufacturer.

Marking Tape:

Use masking tape to keep primers and sealers off of adjacent surfaces which would be damaged by contact or by cleanup. Remove tape as soon as practical.

Install fillers where needed to provide proper joint depth or support for sealant backers.

B. INSTALLATION

FF. Comply with sealer manufacturers' installation instructions and recommendations, except where more restrictive requirements are specified.

Gun Applied and Pourable Sealants:

Comply with recommendations of ASTM C 1193.

Backers:

Install backers at depth required to result in shape and depth of installed sealant which allows the most joint movement without failure.

1. Make backers continuous, without gaps, tears, or punctures. Do not stretch or twist backers.

Sealants:

Use methods recommended by manufacturer; completely fill the joint; make full contact with bond surfaces; tool no sag sealants to smooth surface eliminating air pockets.

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2. Use concave joint shape shown in Figure 5A in ASTM C 1193, where not otherwise indicated.

C. PROTECTION AND CLEANING

GG. Cleaning surfaces adjacent to joints as work progresses and before sealants set using methods and materials approved by manufacturers of sealers and of surfaces to be cleaned.

Protect joint sealers from contamination and damage.

Remove and replace damage sealers.

3.05 SCHEDULE OF JOINT SEALERS

HH. General:

Unless otherwise indicated, joints around perimeter of frames, where indicated to be sealed, are to be sealed using sealer specified for the substrate to the frame.

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Exterior Joints for Which No Other Sealer Is Indicated:

1. Use one of the following sealants:
 - a. Medium movement silicone sealant
 - b. One-part no sag urethane sealant
 - c. One-part no sag low-modulus urethane sealant
2. Backer:
Backer rod
3. Joint shape:
Concave joint configuration

Interior Joints for Which No Other Sealer Is Indicated:

4. Use one of the following sealants:
 - a. Acrylic-emulsion latex sealant
5. Backer:
Backer rod
6. Joint shape:
Concave joint Configuration

Exterior Joints Well Protected from Weather and Not Subject to Movement.

7. Use one of the following sealants:
 - a. Any sealer
8. Backer:
Backer rod.

Vehicular Paving Joints, Not Over 1-1/2 Percent Slope.

9. Use one of the following sealants:
 - a. Silicone sealant for Use T
 - b. Two-part cold-applied urethane paving sealant.
 - c. One-part cold-applied urethane paving sealant.
 - d. PVC/coal tar paving sealant (ASTM D 3406).

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e. Rubber-asphalt paving sealant (ASTM D 3405).

10. Use bond-breaker tape.

11. Backer: Joint filler specified elsewhere.

Interior Floor Joints And Pedestrian Paving Joints, Less than 1-1/2 Percent Slope:

12. Use one of the following sealants:

a. Two-part pourable polysulfide sealant.

b. Silicone sealant for Use T.

c. Two-part pourable urethane sealant.

d. Two-part no sag urethane sealant for Use T.

e. One-part pourable urethane sealant.

13. Backer:

Backer rod.

14. Joint shape:

Concave joint configuration.

END OF SECTION

SECTION 08110 – STEEL FRAMES

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- GENERAL

RELATED DOCUMENTS

Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

SUMMARY

A. This Section includes steel frames.

B. Related Sections:

The following Sections contain requirements that relate to this Section:

Division 8 Section "Flush Wood Doors" for hollow-core and solid-core wood doors installed in steel frames

Division 8 Section "Door Hardware" for door hardware and weather-stripping

Division 8 Section "Glazing" for glass in steel doors and sidelights

Division 9 Section "Gypsum Board Assemblies" for spot grouting frames in gypsum board partitions

Division 9 Section "Painting" for field painting primed doors and frames

SUBMITTALS

A. General:

Submit each item in this Article according to the Conditions of the Contract and Division I Specification Sections.

Product Data for each type of frame specified, including details of construction, materials, dimensions, hardware preparation, core, label compliance, sound ratings, profiles, and finishes.

Shop Drawings showing fabrication and installation of steel frames. Include details of each frame type, elevations of door design types, conditions at openings, details of construction, location and installation requirements of door and frame hardware and reinforcements, and details of joints and connections. Show anchorage and accessory items.

Door Schedule:

Submit schedule of frames using same reference numbers for details and openings as those on Contract Drawings.

1. Indicate coordination of glazing frames and stops with glass and glazing requirements.

QUALITY ASSURANCE

SECTION 08110 – STEEL FRAMES

GOVERNMENT OF THE U. S. VIRGIN ISLANDS, DEPARTMENT OF PUBLIC WORKS

PROJECT NAME: Elaine I. Sprauve Public Library and Museum Building

Project Location, St. John, U.S. Virgin Islands

-
- A. Provide doors and frames complying with ANSI/SDI 100 "Recommended Specifications for Standard Steel Doors and Frames" and as specified.

Fire-Rated Door Assemblies:

Units that comply with NFPA 80, are identical to door and frame assemblies tested for fire-test-response characteristics per ASTM E 152, and are labeled and listed by UL, Warnock Hersey, or another testing and inspecting agency acceptable to authorities having jurisdiction.

1. Oversize Fire-Rated Door Assemblies:

For units exceeding sizes of tested assemblies, provide certification by a testing agency acceptable to authorities having jurisdiction that doors conform to all standard construction requirements of tested and labeled fire-rated door assemblies except for size.

Temperature-Rise Rating:

Where indicated, provide doors that have a temperature-rise rating of 450 deg F (250 deg C) maximum in 30 minutes of fire exposure.

DELIVERY, STORAGE, AND HANDLING

- A. Deliver frames cardboard-wrapped or crated to provide protection during transit and job storage. Provide additional protection to prevent damage to finish of factory-finished frames.
- B. Inspect frames on delivery for damage. Minor damages may be repaired provided refinished items match new work and are acceptable to Owner's Representative; otherwise, remove and replace damaged items as directed.
- C. Store frames at building site under cover. Place units on minimum 4-inch (100-mm-) high wood blocking. Avoid using non-vented plastic or canvas shelters that could create a humidity chamber. If cardboard wrappers on doors become wet, remove cartons immediately. Provide minimum 1/4-inch (6- mm) spaces between stacked units to promote air circulation.

- PRODUCTS

1.1 MANUFACTURERS

A. Available Manufacturers:

Subject to compliance with requirements, manufacturers offering products that may be incorporated in the Work include, but are not limited to, the following:

1. Steel Frames:

Amweld Building Products, Inc.

Benchmark Commercial Doors.

Ceco Door Products.

Copco Door Co.

SECTION 08110 – STEEL FRAMES

GOVERNMENT OF THE U. S. VIRGIN ISLANDS, DEPARTMENT OF PUBLIC WORKS

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Curries Co.

Deansteel Manufacturing Co.

Fenestra Corp.

Kewanee Corp.

Mesker Door, Inc. j. Pioneer Industries.

Republic Builders Products.

Steelcraft.

MATERIALS

A. Hot-Rolled Steel Sheets and Strip:

Commercial-quality carbon steel, pickled and oiled, complying with ASTM A 569 (ASTM A 569M).

Cold-Rolled Steel Sheets:

Carbon steel complying with ASTM A 366 (ASTM A 366M), commercial quality, or ASTM A 620 (ASTM A 620M), drawing quality, special kilned.

Galvanized Steel Sheets:

Zinc-coated carbon steel complying with ASTM A 526 (ASTM A 526M), commercial quality, or ASTM A 642 (ASTM A 642M), drawing quality, hot-dip galvanized according to ASTM A 525, with A 60 or G 60 (ASTM A 525M, with Z 180 or ZF 180) coating designation, mill phosphatized.

Supports and Anchors:

Fabricated from not less than 0.0478-inch (1.2-mm) thick steel sheet; 0.0516 inch (1.3 mm) thick galvanized steel where used with galvanized steel frames.

Inserts, Bolts, and Fasteners:

Manufacturer's standard units. Where items are to be built into exterior walls, Type 305 or 316 stainless steel. Do not use hardened 410 stainless steel fasteners.

FRAMES

- A. Provide metal frames for doors, transoms, sidelights, borrowed lights, and other openings, according to ANSI/SDI 100, and of types and styles as shown on Drawings and schedules. Conceal fastenings, unless otherwise indicated. Fabricate frames of minimum 0.0478-inch (1.2-mm-) thick cold-rolled steel sheet.

1. Fabricate frames with mitered or coped and continuously welded corners.
2. Fabricate frames for interior openings over 48 inches (1220 mm) wide from 0.0598-inch (1.5- mm-) thick steel sheet.

SECTION 08110 – STEEL FRAMES

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3. Form exterior frames from 0.0785-inch (2.0-mm-) thick galvanized steel sheet.

Door Silencers:

Except on weather-stripped frames, drill stops to receive 3 silencers on strike jambs of single-door frames and 2 silencers on heads of double-door frames.

Plaster Guards:

Provide minimum 0.0179-inch (0.45-mm) thick steel plaster guards or mortar boxes at back of hardware cutouts where mortar or other materials might obstruct hardware operation and to close off interior of openings.

FABRICATION

A. Fabricate steel frame units to be rigid, neat in appearance, and free from defects, warp, or buckle. Where practical, fit and assemble units in manufacturer's plant. Clearly identify work that cannot be permanently factory assembled before shipment, to assure proper assembly at Project site. Comply with ANSI/SDI 100 requirements.

B. Fabricate exposed faces of panels, including stiles and rails of not flush units, from only cold-rolled steel sheet.

C. Tolerances:

Comply with SDI 117 "Manufacturing Tolerances Standard Steel Doors and Frames."

Fabricate concealed stiffeners, reinforcement, edge channels, louvers, and moldings from either cold- or hot-rolled steel sheet.

Galvanized Steel Panels, and Frames:

For the following locations, fabricate panels, and frames from galvanized steel sheet according to SDI 112.

1. At exterior locations

Exposed Fasteners:

Unless otherwise indicated, provide countersunk flat or oval heads for exposed screws and bolts.

Hardware Preparation:

Prepare frames to receive mortised and concealed hardware according to final door hardware schedule and templates provided by hardware supplier. Comply with applicable requirements of SDI 107 and ANSI A115 Series specifications for door and frame preparation for hardware.

1. For concealed overhead door closers, provide space, cutouts, reinforcing, and provisions for fastening in top rail of doors or head of frames, as applicable.

Reinforce frames to receive surface-applied hardware. Drilling and tapping for surface-applied hardware may be done at Project site.

SECTION 08110 – STEEL FRAMES

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Locate hardware as indicated on Shop Drawings or, if not indicated, according to the Door and Hardware Institute's (DHI) "Recommended Locations for Architectural Hardware for Standard Steel Doors and Frames."

Glazing Stops:

Minimum 0.0359 inch (0.9 mm) thick steel or 0.040 inch (1 mm) thick aluminum.

1. Provide non-removable stops on secure side of interior frames for glass, louvers, and other panels in frames.
2. Provide screw applied, removable, glazing beads on inside of glass, louvers, and other panels in doors.

FINISHES, GENERAL

- A. Comply with NAAMM's "Metal Finishes Manual" for recommendations relative to applying and designating finishes.
- B. Comply with SSPC-PA 1, "Paint Application Specification No. 1," for steel sheet finishes.
- C. Apply primers and organic finishes to frames after fabrication.

GALVANIZED STEEL SHEET FINISHES

A. Surface Preparation:

Clean surfaces with nonpetroleum solvent so that surfaces are free of oil or other contaminants. After cleaning, apply a conversion coating of the type suited to the organic coating applied over it. Clean welds, mechanical connections, and abraded areas, and apply galvanizing repair paint specified below to comply with ASTM A 780.

1. Galvanizing Repair Paint:

High-zinc-dust-content paint for galvanizing welds in galvanized steel, with dry film containing not less than 94 percent zinc dust by weight and complying with DOD-P-21035 or SSPC-Paint 20.

Factory Priming for Field-Painted Finish: Where field painting after installation is indicated, apply air-dried primer specified below immediately after cleaning and pretreatment.

1. Shop Primer:

Zinc dust, zinc-oxide primer paint complying with performance requirements of FS TT-P-641, Type II.

STEEL SHEET FINISHES

A. Surface Preparation:

Solvent-clean surfaces to comply with SSPC-SP 1 to remove dirt, oil, grease, and other contaminants that could impair paint bond. Remove mill scale and rust, if present, from

SECTION 08110 – STEEL FRAMES

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uncoated steel to comply with SSPC-SP 5 (White Metal Blast Cleaning) or SSPC-SP 8 (Pickling).

Pretreatment:

Immediately after surface preparation, apply a conversion coating of type suited to organic coating applied over it.

Factory Priming for Field Painted Finish:

Apply shop primer that complies with ANSI A224.1 acceptance criteria, is compatible with finish paint systems indicated, and has capability to provide a sound foundation for field-applied topcoats. Apply primer immediately after surface preparation and pretreatment.

- EXECUTION

1.1 INSTALLATION

A. General:

Install steel frames, and accessories according to Shop Drawings, manufacturer's data, and as specified.

Placing Frames:

Comply with provisions of SDI 105, unless otherwise indicated. Set frames accurately in position, plumbed, aligned, and braced securely until permanent anchors are set. After wall construction is completed, remove temporary braces and spreaders, leaving surfaces smooth and undamaged.

1. Except for frames located in existing concrete, masonry, or gypsum board assembly construction, place frames before constructing enclosing walls and ceilings.
2. In metal-stud partitions, install at least 3 wall anchors per jamb at hinge and strike levels. In steel stud partitions, attach wall anchors to studs with screws.
3. In in-place gypsum board partitions, install knock-down, slip-on, drywall frames.
4. Install fire-rated frames according to NFPA 80.

ADJUSTING AND CLEANING

A. Prime Coat Touchup:

Immediately after erection, sand smooth any rusted or damaged areas of prime coat and apply touchup of compatible air-drying primer.

Protection Removal:

Immediately before final inspection, remove protective wrappings from frames.

END OF SECTION

SECTION 08111 – STANDARD STEEL DOORS

GOVERNMENT OF THE U. S. VIRGIN ISLANDS, DEPARTMENT OF PUBLIC WORKS

PROJECT NAME: Elaine I. Sprauve Public Library and Museum Building

Project Location, St. John, U.S. Virgin Islands

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Standard steel doors.

Prefinished doors.

Related Sections:

1. Anchoring and grouting frames in masonry: Division 4.
2. Wood doors for installation in steel frames: Elsewhere in Division 8.
3. Door hardware: Elsewhere in Division 8.
4. Glass and Glazing: Elsewhere in Division 8.
5. Standard Steel Frames: Elsewhere in Division 8.

REFERENCES

- A. ASTM A 366/A 366M-96 -- Standard Specification for Steel, Sheet, Carbon, Cold-Rolled, Commercial Quality; 1996.
- B. ASTM A 525-93 - Standard Specification for General Requirements for Steel Sheet, Zinc-Coated (Galvanized) by the Hot-Dip Process; 1993.
- C. ASTM A 526/A 526M-90 - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) by the Hot-Dip Process, Commercial Quality; 1990.
- D. ASTM A 568/A 568M-95 - Standard Specification for Steel, Sheet, Carbon, and High-Strength, Low-Alloy, Hot-Rolled and Cold-Rolled, General Requirements for; 1995.
- E. ASTM A 569/A 569M-91a - Standard Specification for Steel, Carbon (0.15 Maximum, Percent), Hot-Rolled Sheet and Strip Commercial Quality; 1991.
- F. DHI A115 Series - Specifications for Steel Door and Frame Preparation for Hardware; 1980-94.
- G. SDI 100-1991 - Recommended Specifications: Standard Steel Doors and Frames; Steel Door Institute; 1991.

SUBMITTALS

A. Product Data:

SECTION 08111 – STANDARD STEEL DOORS

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Submit manufacturer's printed product information indicating compliance with specified requirements.

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Shop Drawings:

Submit drawings for fabrication and installation of standard steel doors, including the following information:

1. Details of construction, joints, and connections
2. Elevations of each opening type
3. Conditions at openings, including coordination with glass and glazing requirements
4. Location and installation requirements of door hardware and reinforcements
5. Schedule of openings coordinated with numbering system used in contract documents

Selection Samples:

Submit manufacturer's complete range of colors.

Verification Samples:

Submit painted metal samples, not less than 6 inches in least dimension, for each color selected for factory-finished work.

Quality Assurance Certification:

Submit manufacturer's certification that products have been constructed and tested in full compliance with ANSI/SDI 100. As applicable, include test reports for core construction and reinforcing methods not specifically designated as acceptable by ANSI/SDI 100.

QUALITY ASSURANCE

A. Quality Standard:

Comply with SDI 100.

DELIVERY, STORAGE, AND HANDLING

- A. Deliver products in crates or cartons suitable for storage at the site.
- B. Protect prefinished doors with additional plastic wrapping sealed to exclude moisture.
- C. Replace items damaged in delivery, unless damage is minor and can be repaired to match intact items, as determined by Owner's Representative.
- D. Store products under cover, raised above ground level, and stacked to prevent warping and to promote air circulation.
- E. Prevent moisture from accumulating and remove saturated packaging before products can be damaged.

- PRODUCTS

1.1 MATERIALS

SECTION 08111 – STANDARD STEEL DOORS

GOVERNMENT OF THE U. S. VIRGIN ISLANDS, DEPARTMENT OF PUBLIC WORKS

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A. Steel Sheets, Hot-Rolled:

ASTM A 569 and ASTM A 568, commercial quality, pickled and oiled.

Steel Sheets, Cold-Rolled:

ASTM A 366 and ASTM A 568, commercial quality, matte finish exposed, oiled.

Steel Sheets, Galvanized:

ASTM A 526 and ASTM A 525, commercial quality, A60 zinc-iron or G90 zinc coating, mill phosphatized.

Fasteners and Inserts:

Units standard with manufacturer.

Paint:

1. Primer:

Manufacturer's standard rust-inhibitive coating, suitable to receive finish coatings specified.

Finish coating:

Manufacturer's standard baked-on enamel, epoxy, or urethane.

WIRED GLASS

A. Wired Glass:

ASTM C 1036, Type II (patterned and wired glass, flat), Class I (clear), Quality q8 (glazing); 6.4 mm thick; of form and mesh pattern indicated below:

1. Polished Wired Glass:

Form 1 (wired, polished both sides), and as follows:

Mesh m2 (square).

FABRICATION

A. General:

Shop-fabricate assemblies to greatest extent possible, assuring that installed units will be without warp, twist, bow, or other defect in appearance or function.

Exposed Door Faces:

Fabricate from cold-rolled steel.

Edge Channels, Stiffeners, and Reinforcement:

Fabricate from cold-rolled or hot-rolled steel.

Exterior Doors:

Fabricate from hot-dip galvanized steel.

SECTION 08111 – STANDARD STEEL DOORS

GOVERNMENT OF THE U. S. VIRGIN ISLANDS, DEPARTMENT OF PUBLIC WORKS

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Seal top and bottom edges integrally with door construction or use minimum 16 gage steel channels to form flush closure.

Exposed Screws and Bolts:

Where required, provide only countersunk, flat stainless-steel Phillips-head fasteners.

Hardware Preparation:

Comply with DHI A115 series specifications for door preparation, using final hardware schedule and templates from hardware supplier.

1. Reinforcement:

Reinforce doors for field-installed exposed hardware items.

Locations:

Comply with final shop drawings.

Shop Painting:

1. Preparation:

Clean surfaces thoroughly before beginning painting operations, removing rust, scale, oil, grease, and other contaminants.

Primer:

Apply primer evenly to achieve full protection of all exposed surfaces.

Finish:

Spray scheduled doors electrostatically with finish coating to achieve smooth even coverage and nominal final thickness of 1.25 mils; bake as required to achieve durable finish.

STEEL DOORS

A. General:

Fabricate steel doors in accordance with requirements of SDI 100.

Exterior Doors:

1. Grade III, Extra Heavy-Duty, Model 2-Seamless

- EXECUTION

1.1 INSTALLATION

A. General:

Install steel doors to comply with manufacturer's recommendations.

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1. Comply with detailed installation requirements of final shop drawings.

Where vision panels are indicated, provide glazing area 7'-11 1/2" x 36", unless specifically shown otherwise on the drawings.

Door Installation:

General:

Comply with requirements and clearances specified in SDI 100.

ADJUST AND CLEAN

A. Touch-Up:

At locations where primer has been abraded or minor rusting has occurred, sand smooth and spray apply compatible primer.

Prefinished Doors:

Remove protective coverings from installed doors immediately prior to final inspection; clean up debris and remove from site.

Final Operating Adjustments:

Check hardware at all openings for proper operation of doors, making final corrections as required to assure that work of this section is complete and undamaged.

END OF SECTION

SECTION 08211 – FLUSH WOOD DOORS

GOVERNMENT OF THE U. S. VIRGIN ISLANDS, DEPARTMENT OF PUBLIC WORKS

PROJECT NAME: Elaine I. Sprauve Public Library and Museum Building

Project Location, St. John, U.S. Virgin Islands

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

SUMMARY

- A. This Section includes the following:
 - 1. Solid-core doors with wood-veneer faces
 - 2. Factory finishing flush wood doors
 - 3. Louvers for flush wood doors

Related Sections include the following:

- 1. Division 8 Section "Steel Frames" for hollow metal frames
- 2. Division 8 Section "Door Hardware"

SUBMITTALS

- A. Product Data:

For each type of door. Include details of core and edge construction, trim for openings, and louvers.

- 1. Include factory-finishing specifications.

Shop Drawings:

Indicate location, size, and hand of each door; elevation of each kind of door; construction details not covered in Product Data; location and extent of hardware blocking; and other pertinent data.

SECTION 08211 – FLUSH WOOD DOORS

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1. Indicate dimensions and locations of mortises and holes for hardware.
2. Indicate dimensions and locations of cutouts.
3. Indicate requirements for veneer matching.
4. Indicate doors to be factory finished and finish requirements.
5. Indicate fire ratings for fire doors.

Samples for Verification:

As follows:

SECTION 08211 – FLUSH WOOD DOORS

GOVERNMENT OF THE U. S. VIRGIN ISLANDS, DEPARTMENT OF PUBLIC WORKS

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1. Corner sections of doors approximately 8 by 10 inches (200 by 250 mm) with door faces and edgings representing the typical range of color and grain for each species of veneer and solid lumber required. Finish sample with same materials proposed for factory-finished doors.

Louver blade and frame sections, 6 inches (150 mm) long, for each material and finish specified.

Frames for light openings, 6 inches (150 mm) long, for each material, type, and finish required.

QUALITY ASSURANCE

A. Source Limitations:

Obtain flush wood doors through one source from a single manufacturer.

Quality Standard:

Comply with the following standard:

1. NWWDA Quality Standard:

NWWDA I.S.I-A, "Architectural Wood Flush Doors."

AWI Quality Standard:

AWI's "Architectural Woodwork Quality Standards" for grade of door, core, construction, finish, and other requirements.

Fire-Rated Wood Doors:

Doors complying with NFPA 80 that are listed and labeled by a testing and inspecting agency acceptable to authorities having jurisdiction, for fire ratings indicated, based on testing according to NFPA 252.

1. Test Pressure:

Test at atmospheric pressure.

DELIVERY, STORAGE, AND HANDLING

- A. Protect doors during transit, storage, and handling to prevent damage, soiling, and deterioration. Comply with requirements of referenced standard and manufacturer's written instructions.

1. Individually package doors in plastic bags or cardboard cartons.

2. Individually package doors in cardboard cartons and wrap bundles of doors in plastic sheeting.

Mark each door with individual opening numbers used on Shop Drawings. Use removable tags or concealed markings.

PROJECT CONDITIONS

SECTION 08211 – FLUSH WOOD DOORS

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A. Environmental Limitations:

Do not deliver or install doors until conditions for temperature and relative humidity have been stabilized and will be maintained in storage and installation areas during the remainder of the construction period to comply with requirements of the referenced quality standard for Project's geographical location.

WARRANTY

A. General Warranty:

Door manufacturer's warranty specified in this Article shall not deprive the Owner of other rights the Owner may have under other provisions of the Contract Documents and shall be in addition to, and run concurrent with, other warranties made by the Contractor under requirements of the Contract Documents.

Door Manufacturer's Warranty:

Submit written agreement on door manufacturer's standard form, signed by manufacturer, Installer, and Contractor, agreeing to repair or replace defective doors that have warped (bow, cup, or twist) more than 1/4 inch (6.35 mm) in a 42-by-84-inch (1067-by-2134-mm) section or that show telegraphing of core construction in face veneers exceeding 0.01 inch in a 3-inch (0.25 mm in a 75- mm) span, or do not comply with tolerances in referenced quality standard.

1. Warranty shall also include installation and finishing that may be required due to repair or replacement of defective doors.
2. Warranty shall be in effect during the following period of time after the date of Substantial Completion:

a. Solid-Core Interior Doors:

Life of installation.

- PRODUCTS

1.1 MANUFACTURERS

A. Available Manufacturers:

Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

1. Flush Wood Doors:

- a. Eggers Industries; Architectural Door Division.
- b. Mohawk Flush Doors, Inc.
- c. Weyerhaeuser Co.

Metal Louvers for Doors:

SECTION 08211 – FLUSH WOOD DOORS

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- a. Air Louvers, Inc.
- b. Anemostat Door Products.
- c. Construction Specialties, Inc.
- d. Leslie-Locke, Inc.

DOOR CONSTRUCTION, GENERAL

A. Doors for Transparent Finish:
Comply with the following requirements:

1. Grade:
Premium, with Grade AA faces.

Faces:
Red Oak.

Match between Veneer Leaves:
Red Oak.

Stiles:
Same as species face.

SOLID-CORE DOORS

A. Particleboard Cores:
Comply with the following requirements:

1. Particleboard:
ANSI A208.1, Grade LD-2.

Blocking:
Provide wood blocking at particleboard-core doors as follows:

- a. 5-inch (125-mm) top-rail blocking, at doors indicated to have closers
- b. 5-inch (125-mm) bottom-rail blocking, at exterior doors and doors indicated to have kick, mop, or armor plates
- c. 5-inch (125-mm) midrail blocking, at doors indicated to have exit devices

Exterior Doors:
Comply with the following requirements:

1. Core:
Glued-block core

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Construction:

Five or seven plies with stiles and rails bonded to core, then entire unit abrasive planed before veneering

Interior Veneer-Faced Doors:

Comply with the following requirements:

1. Core:

Particleboard core

Construction:

Five or seven plies with stiles and rails bonded to core, then entire unit abrasive planed before veneering.

Fire-Rated Doors:

Comply with the following requirements:

1. Construction:

Construction and core specified above for type of face indicated or manufacturer's standard mineral-core construction as required to provide fire rating indicated.

Blocking:

For mineral-core doors, provide composite blocking with improved screw-holding capability approved for use in doors of fire ratings indicated and as follows:

- a. 5-inch (125-mm) top-rail blocking.
- b. 5-inch (125-mm) bottom-rail blocking, at doors indicated to have kick, mop, or armor plates.
- c. 4-1/2-by-10-inch (114-by-250-mm) lock blocks.
- d. 5-inch (125-mm) mid-rail blocking, at doors indicated to have exit devices.
- e. As necessary to eliminate need for through-bolting hardware.

Edge Construction:

At hinge stiles, provide manufacturer's standard laminated-edge construction with improved screw-holding capability and split resistance and with outer stile matching face veneer.

LOUVERS AND LIGHT FRAMES

A. Metal Louvers:

As follows:

1. Blade Type:

Adjustable tythspring closer and 135 deg F (57 deg C) fusible link.

SECTION 08211 – FLUSH WOOD DOORS

GOVERNMENT OF THE U. S. VIRGIN ISLANDS, DEPARTMENT OF PUBLIC WORKS

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FACTORY FINISHING

A. General:

Comply with referenced quality standard's requirements for factory finishing.

Finish wood doors at factory

Transparent Finish:

Comply with requirements indicated for grade, finish system, staining effect, and sheen.

1. Grade:

Custom

Finish:

AWI System TR-4 conversion varnish

Staining:

Match building standard

Effect:

Match building standard

Sheen:

Match building standard

- EXECUTION

1.1 EXAMINATION

A. Examine installed door frames before hanging doors.

1. Verify that frames comply with indicated requirements for type, size, location, and swing characteristics and have been installed with plumb jambs and level heads.

2. Reject doors with defects.

Proceed with installation only after unsatisfactory conditions have been corrected.

INSTALLATION

A. Hardware:

For installation, see Division 8 Section "Door Hardware."

Manufacturer's Written Instructions:

Install wood doors to comply with manufacturer's written instructions, referenced quality standard, and as indicated.

SECTION 08211 – FLUSH WOOD DOORS

GOVERNMENT OF THE U. S. VIRGIN ISLANDS, DEPARTMENT OF PUBLIC WORKS

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1. Install fire-rated doors in corresponding fire rated frames according to NFPA 80.

Job-Fit Doors:

Align and fit doors in frames with uniform clearances and bevels as indicated below; do not trim stiles and rails in excess of limits set by manufacturer or permitted with fire-rated doors. Machine doors for hardware. Seal cut surfaces after fitting and machining.

1. Clearances:

Provide 1/8 inch (3.2 mm) at heads, jambs, and between pairs of doors. Provide 1/8 inch (3.2 mm) from bottom of door to top of decorative floor finish or covering. Where threshold is shown or scheduled, provide 1/4 inch (6.4 mm) from bottom of door to top of threshold.

- a. Comply with NFPA 80 for fire-rated doors.

Bevel non-fire-rated doors 1/8 inch in 2 inches (3-1/2 degrees) at Jock and hinge edges.

Bevel fire-rated doors 1/8 inch in 2 inches (3-1/2 degrees) on lock edge; trim stiles and rails only to extent permitted by labeling agency.

Factory-Finished Doors:

Restore finish before installation, if fitting or machining is required at Project site.

ADJUSTING AND PROTECTING

A. Operation:

Rehang or replace doors that do not swing or operate freely.

Finished Doors:

Refinish or replace doors damaged during installation.

Protect doors as recommended by door manufacturer to ensure that wood doors are without damage or deterioration at the time of Substantial Completion.

END OF SECTION

DIVISION 9 - FINISHES

GOVERNMENT OF THE U. S. VIRGIN ISLANDS, DEPARTMENT OF PUBLIC WORKS

PROJECT NAME: Elaine I. Sprauve Public Library and Museum Building

Project Location, St. John, U.S. Virgin Islands

PART 2 - GENERAL

2.2 RELATED DOCUMENTS

- B. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

SUMMARY

- C. This Section includes items known commercially as finish or door hardware that are required for swing, sliding, and folding doors, except special types of unique hardware specified in the same sections as the doors and door frames on which they are installed.

This Section includes the following:

2. Hinges
3. Continuous hinges
4. Pivots
5. Spring hinges
6. Key control system
7. Lock cylinders and keys
8. Lock and latch sets
9. Bolts
10. Exit devices
11. Push/Pull units
12. Closers
13. Overhead holders
14. Miscellaneous door control devices
15. Door trim units
16. Protection plates
17. Weather stripping for exterior doors
18. Sound stripping for interior doors

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19. Automatic drop seals (door bottoms)

20. Astragals or meeting seals on pairs of doors

21. Thresholds

Related Sections:

The following Sections contain requirements that relate to this Section:

22. Section 08110: Steel Doors and Frames

Section 08211: Flush Wood Doors

Section 08410: Metal-framed Storefronts

Section 08450: All-glass Entrances and Storefronts

Division 16: Electrical

Products furnished but not installed under this Section to include:

- 23. Cylinders for locks on hi-parting aluminum doors.
- 24. Cylinders for locks on frameless glass doors.
- 25. Final replacement cores and keys to be installed as directed by Owner.

REFERENCES

D. Standards of the following as referenced:

- 26. American National Standards Institute (ANSI)
- 27. Door and Hardware Institute (DHI)
- 28. Factory Mutual (FM)
- 29. National Fire Protection Association (NFPA)
- 30. Underwriters' Laboratories, Inc. (UL)
 - b. UL 10C - Fire Tests Door Assemblies
- 31. Warnock Hersey

Regulatory standards of the following as referenced:

- 32. Department of Justice, Office of the Attorney General, *Americans with Disabilities Act*, Public Law 110-325 (ADA)

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CABO/ANSI A117.1: Providing Accessibility and Usability for Physically Handicap People, 2017 edition

SUBMITTALS

E. General:

Submit the following in accordance with Conditions of Contract and Division 1 Specification sections.

Product data including manufacturers' technical product data for each item of door hardware, installation instructions, maintenance of operating parts and finishes, and other information necessary to show compliance with requirements. For items other than those scheduled in the "Headings" of Section 3, provide catalog information for the specified items and for those submitted.

Final hardware schedule coordinated with doors, frames, and related work to ensure proper size, thickness, hand, function, and finish of door hardware.

33. Final Hardware Schedule Content:

Based on hardware indicated, organize schedule into vertical format "hardware sets" indicating complete designations of every item required for each door or opening. Use specification heading numbers with any variations suffixed a, b, etc. Include the following information:

c. Type, style, function, size, and finish of each hardware item.

Name and manufacturer of each item.

Fastenings and other pertinent information.

Location of each hardware set cross-referenced to indications on Drawings both on floor plans and in door and frame schedule.

Explanation of all abbreviations, symbols, and codes contained in schedule.

Mounting locations for hardware.

Door and frame sizes and materials.

Keying information.

Wiring diagrams, riser diagrams and system descriptions fully detailing the function(s) of each electrically controlled opening.

Cross-reference numbers used within schedule deviating from those specified.

i. Column 1: State specified item and manufacturer.

Column 2: State prior approved substituted item and its manufacturer.

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34. Submittal Sequence:

Submit final schedule at earliest possible date, particularly where acceptance of hardware schedule must precede fabrication of other work that is critical in the Project construction schedule. Include with schedule the product data, samples, shop drawings of other work affected by door hardware, and other information essential to the coordinated review of schedule.

Keying Schedule:

Submit separate detailed schedule indicating clearly how the Owner's final instructions on lock functions and keying of locks has been fulfilled.

Samples of each type of exposed hardware unit in finish indicated and tagged with full description for coordination with schedule. Submit samples prior to submission of final hardware schedule.

35. Samples will be returned to the supplier. Units that are acceptable and remain undamaged through submittal, review, and field comparison process may, after final check of operation, be incorporated into the Work, within limitations of function and keying coordination requirements.

Templates for doors, frames, and other work specified to be factory prepared for the installation of door hardware. Check shop drawings of other work to confirm that adequate provisions are made for locating and installing door hardware to comply with indicated requirements.

Contract closeout submittals:

36. Operation and maintenance data: Complete information for installed door hardware

Warranty: Completed and executed warranty forms

QUALITY ASSURANCE

F. Single Source Responsibility:

Obtain each type of hardware (latch and locksets, hinges, closers, etc.) from a single manufacturer.

Supplier Qualifications:

A recognized architectural door hardware supplier, with warehousing facilities in the Project's vicinity, that has a record of successful in-service performance for supplying door hardware similar in quantity, type, and quality to that indicated for this Project and that employs an experienced Architectural Hardware Consultant (AHC) who is available to the Owner, Owner's Representative and Contractor, at reasonable times during the course of the Work, for consultation.

Coordination Meetings:

Supplier shall set up and attend the following:

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37. Supplier to meet with the Owner to finalize lock functions and keying requirements and to obtain final instructions in writing.

Supplier to meet with the installer prior to beginning of installation of door hardware.

Supplier to meet with the Owner, General Contractor, electrical and security contractors to coordinate all electrical hardware items. Supplier to provide riser diagrams and wiring diagrams as required by the General and sub-contractors.

Fire-Rated Openings:

Provide door hardware for fire-rated openings that complies with NFPA Standard No. 80 requirements of authorities having jurisdiction. Provide only items of door hardware that are listed and tested by UL or Warnock Hersey for given type/size opening and degree of label. Provide proper latching hardware, door closers, approved-bearing hinges and seals whether listed in the Hardware Schedule or not. All hardware shall comply with standards IBC 702 (2018) and UL 10 C.

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38. Where emergency exit devices are required on fire-rated doors, (with supplementary marking on doors' UL labels indicating "Fire Door to be equipped with Fire Exit Hardware"), provide UL label on exit devices indicating "Fire Exit Hardware".

PRODUCT HANDLING

- G. Tag each item or package separately with identification related to final hardware schedule and include basic installation instructions with each item or package.
- H. Packaging of door hardware is responsibility of supplier. As material is received by hardware supplier from various manufacturers, sort and repackage in containers clearly marked with appropriate hardware set number to match set numbers of approved hardware schedule. Two or more identical sets may be packed in same container.
- I. Inventory door hardware jointly with representatives of hardware supplier and hardware installer until each is satisfied that count is correct.
- J. Deliver individually packaged door hardware items promptly to place of installation (shop or Project site).
- K. Provide secure lock-up for door hardware delivered to the Project, but not yet installed. Control handling and installation of hardware items that are not immediately replaceable so that completion of the Work will not be delayed by hardware losses both before and after installation.

WARRANTY

- L. Special warranties:

39. Door Closers:

Ten-year period

Exit Devices:

Three-year period

Automatic Door Operators:

Two-year period

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Locks and Cylinders:

Three-year period

MAINTENANCE

M. Maintenance Tools and Instructions:

Furnish a complete set of specialized tools and maintenance instructions as needed for Owner's continued adjustment, maintenance, and removal and replacement of door hardware.

Parts kits:

Furnish manufacturers' standard parts kits for locksets, exit devices, and door closers.

- PRODUCTS

2.3 MANUFACTURED UNITS

(*Denotes manufacturer referenced in the Hardware Headings)

N. Hinges:

40. Acceptable manufacturers:

d. Ives*

Hager Companies

Bommer

Characteristics:

e. Templates: Provide only template-produced units

Screws: Provide Phillips flat-head screws complying with the following requirements:

ii. For metal doors and frames, install machine screws into drilled and tapped holes.

iii. For wood doors and frames, install threaded-to-the-head wood screws.

iv. For fire-rated wood doors, install #12 x 1-1/4 inch, threaded-to-the-head steel wood screws.

v. Finish screw heads to match surface of hinges or pivots.

Hinge pins: Except as otherwise indicated, provide hinge pins as follows:

vi. Out-Swing Exterior Doors: Non-removable pins.

Out-Swing Corridor Doors with Locks: Non-removable pins.

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Interior Doors: Non-rising pins.

Tips: Flat button and matching plug. Finished to match leafs.

Size: Except as otherwise indicated, size hinges as follows:

vii. Exterior Doors: Heavy weight, ball bearing, nonferrous, 5 x 4-1/2

Interior Doors:

Doors up to 3'-0" in width: Standard weight, ball bearing, 4-1/2 x 4-1/2

Doors over 3'-1" in width and labeled doors over 8'-0" in height: Heavy weight, ball bearing, 5 x 4-1/2.

Quantity:

Furnish one pair of hinges for all doors up to 5'-0" high. Furnish one hinge for each additional 2-1/2 feet or fraction thereof.

Continuous Hinges:

41. Acceptable manufacturers:

f. Select Products Ltd.*

g. Hager Companies

h. Markar Products

Characteristics:

i. Continuous geared hinges to be manufactured of extruded 6063 T6 aluminum alloy with anodized finish and concealed, self-lubricating thrust bearings.

Continuous barrel-type hinges to be manufactured of stainless steel with knuckles formed around a pin extending the entire length of the hinge.

Uncut hinges shall be non-handed, manufactured to template.

Hinges to be assembled in matching pairs. Fasteners supplied shall be 305 stainless steel.

Provide UL listed continuous hinges at fire doors. Continuous hinges at fire doors shall meet the required ratings without the use of auxiliary fused pins or studs.

Cylinders:

42. Acceptable manufacturers:

j. Schlage* Everest-D/Primus

k. Medeco

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1. Sargent ASSA V-I 0

Characteristics:

m. Standard System:

Except as otherwise indicated, provide new great grandmaster key system for Project. Allow for expansion to accommodate future rekeying of existing facilities and for future new construction.

At perimeter openings and elsewhere as shown, equip locksets with high-security, interchangeable core controlled access cylinders that comply with the performance requirements of ANSI A156.5, 1992, Grade I Operational.

Unless otherwise indicated, equip interior locksets with interchangeable core cylinders featuring patented, restricted keys and auxiliary locking pin. Patented key and cylinder design shall be valid until 2021.

Furnish temporary construction cores for all perimeter openings, electrical and mechanical room doors, and elsewhere as shown. Furnish final cores and keys for installation as directed by Owner.

Comply with Owner's instructions for great grandmaster keying and, except as otherwise indicated, provide individual change key for each lock that is not designated to be keyed alike with a group of related locks.

viii. Permanently inscribe each key with manufacturer's key symbol, and notation, "DO NOT DUPLICATE."

Permanently inscribe each cylinder, in a concealed location, with manufacturer's key symbol.

Key Material: Provide keys of nickel silver only.

Key and Core Quantity:

- ix. Furnish 3 change keys for each lock, not to exceed 10 change keys for each keyed alike group
- x. Furnish 4 control keys
- xi. Furnish 5 master keys for each master system
- xii. Furnish 5 grandmaster keys for each grandmaster system
- xiii. Furnish 5 great grandmaster keys for each great grandmaster system
- xiv. Furnish 10 construction master keys
- xv. Furnish 2 construction control keys

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xvi. Furnish 200 extra blanks for each keyway

xvii. Furnish 10 extra un-combinated cores for each keyway

Furnish 1 Framon KX-1 Code Machine with space cams, depth cams, vices and cutters as required to accommodate key system

Key Control software:

Schlage Sitemaster 200 for Windows or equivalent, preloaded with factory bitting, door numbers and keysets per instructions.

Deliver keys, extra cores, key control software and code machine to Owner.

Locksets, Latchsets, Deadbolts:

43. Acceptable manufacturers:

n. Schlage* L9000 Series, 07A Lever Design

Mortise Locksets and Latchsets: as scheduled.

o. Chassis: Cold-rolled steel, handing field-changeable without disassembly.

Latch bolts: 3/4-inch throw stainless steel anti-friction type

Lever Trim: Through-bolted, accessible design and independent break-away spindles.

Thumb turns: Accessible design not requiring pinching or twisting motions to operate.

Deadbolts: Stainless steel 1-inch throw.

Electric operation: Manufacturer-installed continuous duty solenoid.

Strikes: 16 gage curved stainless steel with 1" deep box construction, lips of sufficient length to clear trim and protect clothing.

Certifications:

xviii. ANSI A156.13, 1994, Grade 1 Operational, Grade 2 Security.

Attic Stock: (Deliver to owner)

xix. Furnish 2 passage lock bodies

xx. 2 privacy lock bodies

xxi. 5 office/classroom lock bodies

xxii. 2 storeroom lock bodies

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xxiii. 5 complete sets trim

xxiv. 10-cylinder housings

Manually Programmable Access Control Locks:

44. Acceptable manufacturers:

p. Schlage* PR05500 Series, 17 Lever design

Characteristics:

q. Access control locks shall be battery-powered, stand alone, keypad programmable with cylinder override.

r. Allow for a minimum of 120 three to eight digit user codes.

s. Certifications: ANSI/BHMA Grade 1

Exit Devices:

45. Acceptable manufacturers:

t. Von Duprin* 35A/98 Series

Characteristics:

u. Exit devices shall be "UL" listed for life safety. All exit devices for fire rated openings shall have "UL" labels for "Fire Exit Hardware."

v. Exit devices mounted on labeled wood doors shall be mounted on the door per the door manufacturer's requirements.

w. Trim shall be thru bolted to the lock stile case. Lever design to match locksets.

x. Exit devices shall be equipped with cylinder dogging feature in lieu of hex dogging.

y. Exit devices shall be made of brass, bronze, stainless steel, or aluminum material, powder coated, anodized, or plated to the standard architectural finishes to match the balance of the door hardware.

z. Provide glass bead conversion kits to shim exit devices on doors with raised glass heads.

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- aa. All series of exit devices shall incorporate a fluid damper, which decelerates the touchpad on its return stroke and eliminates noise associated with exit device operation. All exit devices shall be non-handed. Touchpad shall extend a minimum of 1/2 of the door width and shall extend to the height of the cross-rail housing for a "no pinch" operation. Plastic touchpads are not acceptable. All latch bolts to be the deadlocking type. Latch bolts shall have a self-lubricating coating to reduce wear. Plated or plastic-coated latch bolts are not acceptable. Plastic linkage and "dogging" components are not acceptable.
- bb. Lever trim shall be solid case material with a break-away feature to limit damage to the unit from vandalism.
- cc. Surface vertical rod devices shall be UL labeled for fire door applications without the use of bottom rod assemblies (LBR). Where bottom rods are required for security applications, the devices shall be UL labeled for fire doors applications with rod and latch guards by the device manufacturer.
- dd. Exit devices to include impact resistant, flush mounted end cap design to avoid damage due to carts and other heavy objects passing through an opening. End cap shall be of heavy-duty metal alloy construction and provide horizontal adjustment to provide alignment with device cover plate. When exit device end cap is installed, no raised edges will protrude.

Closers and Door Control Devices:

46. Acceptable manufacturers:

- ee. LCN Closers*

Characteristics:

- ff. Door closers shall have fully hydraulic, full rack and pinion action with a high strength cast iron cylinder.

All closers shall utilize a stable fluid withstanding temperature range of 120°F to -30°F without seasonal adjustment of closer speed to properly close the door. Closers for fire-rated doors shall be provided with temperature stabilizing fluid that complies with standards IBC 7-2 (2015) and UL 10C.

Spring power shall be continuously adjustable over the full range of closer sizes, and allow for reduced opening force for the physically handicapped. Spring power adjustment (LCN Fast™ Power Adjust) allows for quick and accurate power adjustment and visually shows closer power size settings by way of dial adjustment gauge located on closer spring tube. Hydraulic regulation shall be by tamper-proof, non-critical valves. Closers shall have separate adjustment for latch speed, general speed and back check.

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All closers shall have solid forged steel main arms (and forearms for parallel arm closers) and where specified shall have a cast-in solid stop on the closer shoe ("CUSH"). Where closer is mounted on the push side, use "EDA" type closers and where door travel must be limited, use "CUSH" or "SCUSH" type closers. Auxiliary stops are not required when push type closers are used.

Furnish all closers with full metal covers (MC).

Access- Free Manual Closers: Where manual closers are indicated for doors required to be accessible to the physically handicapped provide adjustable units comply with ADA and ANSI A-117.1 provisions for door opening force.

Closers to be installed to allow door swing as shown on plans. Doors swinging into exit corridors shall provide for corridor clear width as required by code. Where possible, mount closers inside rooms.

Powder coating finish to be certified to exceed 100 hours salt spray testing by ETL, an independent testing laboratory used by BHMA for ANSI certification.

Magnetic Door Holders to be heavy duty wall mounted with metal housing and complete mounting hardware. Provide 24V holding coils unless otherwise scheduled.

Attic Stock: Furnish 8 extra closer bodies as scheduled. Deliver attic stock to Owner.

Overhead Door Holders:

47. Acceptable manufacturers:

gg. Glynn Johnson*

Rixson Firemark

Characteristics:

hh. Provide heavy duty and medium duty, concealed door holders of stainless steel where scheduled.

ii. Concealed holders to be installed with the jamb bracket mortised flush with the bottom of the jamb. The arm and channel to be mortised into the door.

Floor Stops and Wall Bumpers:

48. Acceptable manufacturers:

jj. Ives*

kk. Rockwood Manufacturing

ll. Hager Companies

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Characteristics: Refer to Hardware Headings.

Door Bolts/Coordinators:

49. Acceptable manufacturers:

mm. Ives*

Rockwood Manufacturing

Hager Companies

Characteristics:

nn. Flush bolts to be forged brass 6-3/4" x 1", with 1 1/2" diameter bolts. Plunger to be supplied with milled surface one side that fits into a matching guide.

Provide dustproof type bottom strikes.

Plush Plates:

50. Acceptable manufacturers:

oo. Ives*

pp. Rockwood Manufacturing

qq. Hager Companies

Characteristics:

rr. Exposed Fasteners: Provide manufacturers standard exposed fasteners.

ss. Provide plates sized as shown in Hardware Headings.

Door Pulls & Pull Plates:

51. Acceptable manufacturers:

tt. Ives*

uu. Rockwood Manufacturing

vv. Hager Companies

Characteristics:

ww. Provide concealed thru-bolted trim on back to back mounted pulls, but not for single units.

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xx. Provide unit type and size as shown in Hardware Headings.

Push Pull Sets:

52. Acceptable manufacturers:

yy. Ives*

zz. Rockwood Manufacturing

aaa. Hager Companies

Characteristics:

bbb. Provide mounting systems as shown in Hardware Headings.

ccc. Provide Push/Pull sets of type and size as shown in Hardware Headings.

Protective Plates:

53. Acceptable manufacturers:

ddd. Ives*

Rockwood Manufacturing

Hager Companies

Characteristics:

eee. Provide manufacturers standard exposed fasteners for door trim units consisting of either machine screws or self-tapping screws.

fff. Materials: Stainless Steel, .050-inch US 18 gage

ggg. Fabricate protection plates not more than 2 inches less than door width on hinge side and not more than 1 inch less than door width on pull side.

hhh. Heights:

xxv. Kick plates to be 10 inches in height.

xxvi. Mop plates to be 10 inches in height.

xxvii. Armor plates to be 36 inches in height. Armor plates on fire doors to comply with NFPA 80.

Thresholds:

54. Acceptable manufacturers:

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iii. National Guard Products, Inc.*

jjj. Hager Companies

kkk. Pemko Manufacturing

Types: Indicated in Hardware Headings.

Door Seals/Gasketing:

55. Acceptable manufacturers:

lll. National Guard Products, Inc.*

Hager Companies

Pemko Manufacturing

Types: Indicated in Hardware Headings.

Silencers:

56. Acceptable manufacturers:

mmm. Hager Companies

nnn. Ives

ooo. Rockwood Manufacturing

Three each for single doors; two each for pairs of doors and four each for double egress doors.

Key Cabinet and System:

57. Acceptable manufacturers:

ppp. Telkee, Inc.* AWC-450-S

Provide a key control system including envelopes, labels, tags with self-locking key clips, receipt forms, 3-way visible card index, temporary markers, permanent markers, and standard metal cabinet, all as recommended by system manufacturer.

qqq. Provide complete cross index system set up by key control distributor, and place keys on markers and hooks in the cabinet as determined by the final key schedule.

rrr. Provide hinged-panel type cabinet for wall mounting.

MATERIALS AND FABRICATION

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O. Base Metals:

Produce hardware units of basic metal and forming method indicated, using manufacturer's standard metal alloy, composition, temper, and hardness, but in no case of lesser (commercially recognized) quality than specified for applicable hardware units by applicable ANSI/BHMA A156 series standards for each type of hardware item and with ANSI/BHMA A156.18 for finish designations indicated. Do not furnish "optional" materials or forming methods for those indicated, except as otherwise specified.

Fasteners:

Provide hardware manufactured to conform to published templates, generally prepared for machine screw installation.

58. Do not provide hardware that has been prepared for self-tapping sheet metal screws, except as specifically indicated.

Furnish screws for installation with each hardware item. Provide Phillips flat-head screws except as otherwise indicated. Finish exposed (exposed under any condition) screws to match hardware finish or, if exposed in surfaces of other work, to match finish of this other work as closely as possible including "prepared for paint" surfaces to receive painted finish.

Provide concealed fasteners for hardware units that are exposed when door is closed except to the extent no standard units of type specified are available with concealed fasteners.

Use thru bolts for installation of all exit devices, closers and overhead stops. Coordinate with wood doors and metal doors and frames. Where thru-bolts are used, as a means of reinforcing the work, provide sleeves for each thru-bolt or use sex screw fasteners.

HARDWARE FINISHES

- P. Match items to the manufacturer's standard color and texture finish for the latch and lock sets.

Provide finishes that match those established by ANSI or, if none established, match the Owner's Representative's sample.

Provide quality of finish, including thickness of plating or coating (if any), composition, hardness, and other qualities complying with manufacturer's standards, but in no case less than specified by referenced standards for the applicable units of hardware.

Provide protective lacquer coating on all exposed hardware finishes of brass, bronze, and aluminum, except as otherwise indicated. The suffix "-NL" is used with standard finish designations to indicate "no lacquer."

The designations used to indicate hardware finishes are those listed in ANSI/BHMA A156.18, "Materials and Finishes," including coordination with the traditional U.S. finishes shown by certain manufacturers for their products.

59. Hinges: 630 (US32D) Satin Stainless Steel

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- 60. Continuous Geared Hinges: 628 (US28) Clear Anodized Aluminum
- 61. Continuous Pinned Barrel Hinges: 630 (US32D) Satin Stainless Steel
- 62. Flush Bolts: 626 (US26D) Satin Chrome Plated Brass/Bronze
- 63. Locks: 630 (US32D) Satin Stainless Steel
- 64. Manually Programmable Access Control Locks: 626 (US26D) Satin Chrome Plated Brass/Bronze
- 65. Exit Devices: 628 (US28) chassis, 689 (powder coated) covers, and 630 (US32D) touchpads
- 66. Door Closers: 689 Powder Coat Aluminum
- 67. Push Plates: 630 (US32D) Satin Stainless Steel
- 68. Pull Plates: 630 (US32D) Satin Stainless Steel
- 69. Push Pull Sets: 630 (US32D) Satin Stainless Steel
- 70. Protective Plates: 630 (US32D) Satin Stainless Steel
- 71. Wall Stops: 630 (US32D) Satin Stainless Steel
- 72. Floor Stops: 626 (US26D) Satin Chrome Plated Brass/Bronze
- 73. Overhead Holders: 630 Satin Stainless Steel
- 74. Thresholds/Weather stripping: 627/628 (US27/US28) Aluminum

- EXECUTION

2.4 INSTALLATION

- Q. Mount hardware units at heights indicated in following applicable publications, except as specifically indicated or required to comply with governing regulations and except as otherwise directed by Owner's Representative.
 - 75. "Recommended Locations for Builders Hardware for Standard Steel Doors and Frames" by the Door and Hardware Institute.
 - 76. "Recommended Locations for Builders Hardware for Custom Steel Doors and Frames" by the Door and Hardware Institute.
 - 77. NWWDA Industry Standard I.S.1.7, "Hardware Locations for Wood Flush Doors."

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Install each hardware item in compliance with the manufacturer's instructions and recommendations. Where cutting and fitting is required to install hardware onto or into surfaces that are later to be painted or finished in another way, coordinate removal, storage, and reinstallation or application of surface protection with finishing work specified in the Division 9 Sections. Do not install surface-mounted items until finishes have been completed on the substrates involved.

Set units level, plumb, and true to line and location. Adjust and reinforce the attachment substrate as necessary for proper installation and operation.

Drill and countersink units that are not factory prepared for anchorage fasteners. Space fasteners and anchors in accordance with industry standards.

Set thresholds for exterior doors in full bed of butyl-rubber or polyisobutylene mastic sealant complying with requirements specified in Division 7 Section "Joint Sealers".

Weather Stripping and Seals:

Comply with manufacturer's instructions and recommendations to the extent installation requirements are not otherwise indicated.

ADJUSTING, CLEANING, AND DEMONSTRATING

- R. Adjust and check each operating item of hardware and each door to ensure proper operation or function of every unit. Replace units that cannot be adjusted to operate freely and smoothly or as intended for the application made.

78. Where door hardware is installed more than one month prior to acceptance or occupancy of a space or area, return to the installation during the week prior to acceptance or occupancy and make final check and adjustment of all hardware items in such space or area. Clean operating items as necessary to restore proper function and finish of hardware and doors. Adjust door control devices to function properly with final operation of heating and ventilating equipment.

Clean adjacent surfaces soiled by hardware installation.

Door Hardware Supplier's Field Service

79. Inspect door hardware items for correct installation and adjustment after complete installation of door hardware.

80. Instruct Owner's personnel in the proper adjustment and maintenance of door hardware and hardware finishes.

81. File written report of this inspection to the Owner's Representative.

Door Hardware Manufacturers' Field Service

DIVISION 9 - FINISHES

GOVERNMENT OF THE U. S. VIRGIN ISLANDS, DEPARTMENT OF PUBLIC WORKS

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82. Prior to project completion, representatives of the lock, exit device and overhead closer manufacturers shall inspect all units and certify that all units are installed in accordance with the manufacturer's instructions, and are regulated properly and functioning correctly.

A written report of the inspection results shall be provided to the Owner's Representative and shall include the appropriate certificates.

END OF SECTION

SECTION 09255 – GYPSUM BOARD ASSEMBLIES

GOVERNMENT OF THE U. S. VIRGIN ISLANDS, DEPARTMENT OF PUBLIC WORKS

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PART 3 - GENERAL

3.5 RELATED DOCUMENTS

Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

SUMMARY

S. This Section includes the following:

83. Non-load-bearing steel framing members for gypsum board assemblies.

84. Gypsum board assemblies attached to steel framing.

85. Cementitious backer units installed with gypsum board assemblies.

Related Sections:

The following Sections contain requirements that relate to this Section:

86. Division 6 Section "Rough Carpentry" for the following: Wood blocking and grounds.

Division 7 Section "Building Insulation" for thermal insulation.

Division 7 Section "Fire stopping" for fire stopping systems and fire-resistive-rated joint sealants.

Division 9 Section "Tile" for cementitious backer units installed as substrates for ceramic tile.

DEFINITIONS

T. Gypsum Board Construction Terminology:

Refer to ASTM C 11 and GA-505 for definitions of terms related to gypsum board assemblies not defined in this Section or in other referenced standards.

ASSEMBLY PERFORMANCE REQUIREMENTS

U. Sound Transmission Characteristics:

For gypsum board assemblies indicated to have STC ratings, provide materials and construction identical to those of assemblies whose STC ratings were determined per ASTM E 90 and classified per ASTM E 413 by a qualified independent testing agency.

SUBMITTALS

V. General:

Submit the following according to Conditions of the Contract and Division 1 Specification Sections.

Product data for each type of product specified.

Product certificates signed by manufacturers of gypsum board assembly components certifying that their products comply with specified requirements.

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QUALITY ASSURANCE

W. Fire-Test-Response Characteristics:

Where fire-rated gypsum board assemblies are indicated, provide materials and construction identical to those of assemblies tested for fire resistance per ASTM E 119 by an independent testing and inspecting agency acceptable to authorities having jurisdiction. Fire Resistance Ratings: As indicated by reference to GA File Numbers in GA-600 "Fire Resistance Design Manual" or to design designations in UL "Fire Resistance Directory" or in the listing of another testing and inspecting agency acceptable to authorities having jurisdiction.

Single-Source Responsibility for Steel Framing:

Obtain steel framing members for Gypsum board assemblies from a single manufacturer.

Single-Source Responsibility for Panel Products:

Obtain each type of Gypsum board and other panel products from a single manufacturer.

Single-Source Responsibility for Finishing Materials:

Obtain finishing materials from either the same manufacturer that supplies gypsum board and other panel products or from a manufacturer acceptable to gypsum board manufacturer.

DELIVERY, STORAGE, AND HANDLING

X. Deliver materials in original packages, containers, or bundles bearing brand name and identification of manufacturer or supplier.

Y. Store materials inside under cover and keep them dry and protected against damage from weather, direct sunlight, surface contamination, corrosion, construction traffic, and other causes. Neatly stack Gypsum panels flat to prevent sagging.

Z. Handle gypsum board to prevent damage to edges, ends, and surfaces. Do not bend or otherwise damage metal corner beads and trim.

PROJECT CONDITIONS

AA. Environmental Conditions, General:

Establish and maintain environmental conditions for applying and finishing gypsum board to comply with ASTM C 840 and with Gypsum board manufacturer's recommendations.

Room Temperatures:

For non-adhesive attachment of gypsum board to framing, do not exceed 95 deg F (35 deg C).

Ventilation:

Ventilate building spaces, as required, for drying joint treatment materials. Avoid drafts during hot dry weather to prevent finishing materials from drying too rapidly.

- PRODUCTS

3.6 MANUFACTURERS

BB. Available Manufacturers:

Subject to compliance with requirements, manufacturers offering products that may be incorporated in the Work include, but are not limited to, the following:

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87. Steel Framing and Furring:

sss. Alabama Metal Industries Corp.

ttt. Consolidated Systems, Inc.

uuu. Dale Industries, Inc.

vvv. Dietrich Industries, Inc.

www. Marino Industries Corp.

xxx. Gold Bond Building Products Div., National Gypsum Co.

yyy. Unimast Inc.

Grid Suspension Assemblies:

zzz. Chicago Metallic Corp.

National Rolling Mills Co.

USG Interiors, Inc.

Gypsum Board and Related Products:

aaaa. Domtar Gypsum.

bbbb. Georgia-Pacific Corp.

cccc. Gold Bond Building Products Div., National Gypsum Co.

STEEL FRAMING COMPONENTS FOR SUSPENDED AND FURRED CEILINGS

CC.General:

Provide components complying with ASTM C 754 for materials and sizes unless otherwise indicated.

Wire for Hangers and Ties: ASTM A 641, Class 1 zinc coating, soft temper.

Hanger Rods: Mild steel and zinc-coated or protected with rust-inhibitive paint.

Flat Hangers: Mild steel and zinc-coated or protected with rust-inhibitive paint.

Angle-Type Hangers:

Angles with legs not less than 7/8-inch-wide, formed from 0.0635-inch-thick galvanized steel sheet complying with ASTM A 446 Coating Designation G90, with bolted connections and 5/16-inch-diameter bolts.

Channels:

Cold-rolled steel, 0.05980-inch-minimum thickness of base (uncoated) metal and 7/16-inch-wide flanges, and as follows:

88. Carrying Channels: 2 inches deep, 590 lb per 1000 feet, unless otherwise indicated

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89. Carrying Channels: 1-1/2 inch deep, 475lb per 1000 feet, unless otherwise indicated

90. Furring Channels: 3/4 inch deep, 300 lb per 1000 feet, unless otherwise indicated

91. Finish: Rust-inhibitive paint, unless otherwise indicated

92. Finish: G-60 hot-dip galvanized coating per ASTM A 525 for framing for exterior soffits and where indicated

Steel Studs for Furring Channels:

ASTM C 645, with flange edges bent back 90 deg and doubled over to form 3/16-inch minimum lip (return), minimum thickness of base (uncoated) metal and minimum depth as follows:

93. Thickness: 0.0329 inch, unless otherwise indicated

Depth: As indicated

Protective Coating: G40 hot-dip galvanized coating per ASTM A 525

Steel Rigid Furring Channels:

ASTM C 645, hat-shaped, depth of 7/8 inch, and minimum thickness of base (uncoated) metal as follows:

94. Thickness: 0.0329 inch, unless otherwise indicated.

Protective Coating: G90 hot-dip galvanized coating per ASTM A 525.

Grid Suspension System for Interior Ceilings:

ASTM C 645, manufacturer's standard direct-hung grid suspension system composed of main beams and cross furring members that interlock to form a modular supporting network.

STEEL FRAMING FOR WALLS AND PARTITIONS

DD. General:

Provide steel framing members complying with the following requirements:

95. Component Sizes and Spacing:

As indicated but not less than that required to comply with ASTM C 754 under the following maximum deflection and lateral loading conditions: Maximum Deflection: L/240 at 5 lbf per sq. ft.

Protective Coating: G40 hot-dip galvanized coating per ASTM A 525.

Steel Studs and Runners:

ASTM C 645, with flange edges of studs bent back 90 deg and doubled over to form 3/16-inch-wide minimum lip (return) and complying with the following requirements for minimum thickness of base (uncoated) metal and for depth:

96. Thickness: 0.0270 inch unless otherwise indicated

97. Thickness: 0.0329 inch where indicated

98. Depth: 3-5/8 inches, unless otherwise indicated

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Depth: 6 inches where indicated

Depth: 2-1/2 inches where indicated

Depth: 1-5/8 inch where indicated

Depth: 4 inches where indicated

Steel Rigid Furring Channels:

ASTM C 645, hat-shaped, depth and minimum thickness of base (uncoated) metal as follows:

99. Depth: 7/8 inch.

Thickness: 0.0329 inch, unless otherwise indicated.

Fasteners for Metal Framing:

Provide fasteners of type, material, size, corrosion resistance, holding power, and other properties required to fasten steel framing and furring members securely to substrates involved; complying with the recommendations of gypsum board manufacturers for applications indicated.

GYPSUM BOARD PRODUCTS

EE. General:

Provide Gypsum Board of types indicated in maximum lengths available to minimize end-to-end butt joints. Thickness: Provide Gypsum Board in thicknesses indicated or, if not otherwise indicated, in 5/8 inch thicknesses to comply with ASTM C 840 for application system and support spacing indicated.

Gypsum Wallboard: ASTM C 36 and as follows:

100. Type: Type X required for all assemblies

Type: Sag-resistant type for ceiling surfaces

Edges: Tapered

Thickness: 5/8 inch unless otherwise indicated

Available Products:

Subject to compliance with requirements, products that may be incorporated in the Work where proprietary gypsum wallboard is indicated include, but are not limited to, the following:

dddd. Gyprock Fireguard C Gypsum Board, Domtar Gypsum.

eeee. Firestop Type C, Georgia-Pacific Corp.

ffff. Fire-Shield G, Gold Bond Building Products Div., National Gypsum Co.

gggg. SHEETROCK Brand Gypsum Panels, FIRECODE C Core, United States Gypsum Co.

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hhhh. SHEETROCK Brand Gypsum Panels, ULTRACODE Core, United States Gypsum Co.

Gypsum Backing Board for Multilayer Applications:

ASTM C 442 or, where backing board is not available from manufacturer, gypsum wallboard, ASTM C 36 and as follows:

101. Type: Type X required for all assemblies

Edges: Square, not tapered; or V-tongue and groove

Thickness: 5/8 inch unless otherwise indicated

Water-Resistant Gypsum Backing Board: ASTM C 630 and as follows:

102. Type: Regular, unless otherwise indicated

Type: Type X where required for fire-resistive-rated assemblies

Thickness: 5/8 inch, unless otherwise indicated

CEMENTITIOUS BACKER UNITS

FF. Provide cementitious backer units complying with ANSI A118.9, of thickness and width indicated below, and in maximum lengths available to minimize end-to-end butt joints.
Width: Manufacturer's standard width but not less than 32 inches.

Available Products:

Subject to compliance with requirements, cementitious backer units that may be incorporated in the Work include, but are not limited to, the following:

103. DomCrete Cementitious Tile-Backer Board, Domtar Gypsum.

104. Util-A-Crete Concrete Backer Board, FinPan, Inc.

105. Glas-crete Cementitious Backer Board, Glascrete, Inc.

106. Wonder-Board, Glascrete, Inc.

107. DUROCK Interior Cement Board, United States Gypsum Co.

TRIM ACCESSORIES

GG. Accessories for Interior Installation:

Corner beads, edge trim, and control joints complying with ASTM C 1047 and requirements indicated below:

108. Material:

Formed metal, plastic, or metal combined with paper, with metal complying with the following requirement:

iiii. Sheet steel zinc-coated by hot-dip process.

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jjjj. Sheet steel coated with zinc by hot-dip or electrolytic processes, or with aluminum or rolled zinc.

Shapes indicated below by reference to Fig. 1 designations in ASTM C 1047:

kkkk. Cornerbead on outside corners, unless otherwise indicated

llll. LC-bead with both face and back flanges; face flange formed to receive joint compound. Use LC-beads for edge trim unless otherwise indicated.

mmmm. L-bead with face flange only; face flange formed to receive joint compound. Use L-bead where indicated.

nnnn. U-bead with face and back flanges; face flange formed to be left without application of joint compound. Use U-bead where indicated.

oooo. One-piece control joint formed with V-shaped slot, with removable strip covering slot opening

JOINT TREATMENT MATERIALS

HH. General:

Provide joint treatment materials complying with ASTM C 475 and the recommendations of both the manufacturers of sheet products and of joint treatment materials for each application indicated.

Joint Tape for Gypsum Board:

Paper reinforcing tape, unless otherwise indicated. Use pressure-sensitive or staple-attached open-weave glass-fiber reinforcing tape with compatible joint compound where recommended by manufacturer of Gypsum Board and joint treatment materials for application indicated.

Joint Tape for Cementitious Backer Units:

Polymer-coated, open glass-fiber mesh.

Setting-Type Joint Compounds for Gypsum Board:

Factory-packaged, job-mixed, chemical-hardening powder products formulated for uses indicated.

109. Where setting-type joint compounds are indicated as a taping compound only or for taping and filling only, use formulation that is compatible with other joint compounds applied over it.

110. For prefilling gypsum board joints, use formulation recommended by Gypsum Board manufacturer for this purpose.

111. For filling joints and treating fasteners of water-resistant Gypsum backing board behind base for ceramic tile, use formulation recommended by the Gypsum Board manufacturer for this purpose.

112. For topping compound, use sandable formulation.

Drying-Type Joint Compounds for Gypsum Board:

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Factory-packaged vinyl-based products complying with the following requirements for formulation and intended use.

113. Ready-Mixed Formulation: Factory-mixed product

Job-Mixed Formulation: Powder product for mixing with water at Project site

Taping compound formulated for embedding tape and for first coat over fasteners and face flanges of trim accessories.

Topping compound formulated for fill (second) and finish (third) coats

All-purpose compound formulated for both taping and topping compounds.

Joint Compound for Cementitious Backer Unit:

Material recommended by cementitious backer unit manufacturer.

ACOUSTICAL SEALANT

II. Latex Acoustical Sealant:

Manufacturer's standard non-sag, paintable, non-staining latex sealant complying with ASTM C 834 and the following requirements:

114. Product is effective in reducing airborne sound transmission through perimeter joints and openings in building construction as demonstrated by testing representative assemblies per ASTM E 90.

115. Product has flame-spread and smoke-developed ratings of less than 25 per ASTM E 84.

Acoustical Sealant for Concealed Joints:

Manufacturer's standard nondrying, non-hardening, non-skinning, non-staining, gun applied, synthetic rubber sealant recommended for sealing interior concealed joints to reduce transmission of airborne sound.

Available Products:

Subject to compliance with requirements, acoustical sealants that may be incorporated in the Work include, but are not limited to, the following:

116. Acoustical Sealant:

pppp. AC-20 FTR Acoustical and Insulation Sealant, Pecora Corp.

qqqq. SHEETROCK Acoustical Sealant, United States Gypsum Co.

Acoustical Sealant for Concealed Joints:

rrrr. BA-98, Pecora Corp.

ssss. Tremco Acoustical Sealant, Tremco, Inc.

MISCELLANEOUS MATERIALS

JJ. General:

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Provide auxiliary materials for gypsum board construction that comply with referenced standards and recommendations of Gypsum Board manufacturer.

Laminating Adhesive: Special adhesive or joint compound recommended for laminating Gypsum panels.

Spot Grout: ASTM C 475, setting-type joint compound recommended for spot grouting hollow metal door frames.

Fastening Adhesive for Wood: ASTM C 557.

Fastening Adhesive for Metal: Special adhesive recommended for laminating Gypsum panels to steel framing.

Steel drill screws complying with ASTM C 1002 for the following applications:

117. Fastening Gypsum Board to steel members less than 0.03 inch thick.

118. Fastening Gypsum Board to wood members.

119. Fastening Gypsum Board to gypsum board.

Steel drill screws complying with ASTM C 954 for fastening gypsum board to steel members from 0.033 to 0.112 inch thick.

Corrosion-resistant-coated steel drill screws of size and type recommended by board manufacturer for fastening cementitious backer units.

Asphalt-Saturated Organic Felt: ASTM D 226, Type I (No. 15 asphalt felt), unperforated.

Sound Attenuation Blankets:

Unfaced mineral-fiber blanket insulation produced by combining mineral fibers of type described below with thermosetting resins to comply with ASTM C 665 for Type I (blankets without membrane facing):

Mineral-Fiber Type: Fibers manufactured from glass.

Polyethylene Vapor Retarder:

ASTM D 4397, thickness and maximum permeance rating as follows:

120. 4.0 mils, 0.19 perms.

121. 6.0 mils, 0.13 perms.

Vapor Retarder Tape:

Pressure-sensitive tape of type recommended by vapor retarder manufacturer for sealing joints and penetrations in vapor retarder.

- EXECUTION

3.7 EXAMINATION

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Examine substrates to which gypsum board assemblies attach or abut, installed hollow metal frames, cast-in-anchors, and structural framing with Installer present for compliance with requirements for installation tolerances and other conditions affecting performance of assemblies specified in this Section. Do not proceed with installation until unsatisfactory conditions have been corrected.

PREPARATION

KK. Ceiling Anchorages:

Coordinate installation of ceiling suspension systems with installation of overhead structural assemblies to ensure that inserts and other provisions for anchorages to building structure have been installed to receive ceiling hangers that will develop their full strength and at spacing required to support ceilings. Furnish concrete inserts and other devices indicated to other trades for installation well in advance of time needed for coordination with other construction.

INSTALLING STEEL FRAMING, GENERAL

LL. Steel Framing Installation Standard: Install steel framing to comply with ASTM C 754 and with ASTM C 840 requirements that apply to framing installation.

MM. Install supplementary framing, blocking, and bracing at terminations in Gypsum Board assemblies to support fixtures, equipment services, heavy trim, grab bars, toilet accessories, furnishings, or similar construction. Comply with details indicated and with recommendations of gypsum board manufacturer or, if none available, with "Gypsum Construction Handbook" published by United States Gypsum Co.

NN. Isolate steel framing from building structure at locations indicated to prevent transfer of loading imposed by structural movement. Comply with details shown on Drawings.

122. Where building structure abuts ceiling perimeter or penetrates ceiling.

123. Where partition framing and wall furring abut structure except at floor.

124. Provide slip- or cushioned-type joints as detailed to attain lateral support and avoid axial loading.

Do not bridge building expansion and control joints with steel framing or furring members. Independently frame both sides of joints with framing or furring members as indicated.

INSTALLING STEEL FRAMING FOR SUSPENDED AND FURRED CEILINGS

OO. Suspend ceiling hangers from building structural members and as follows:

125. Install hangers plumb and free from contact with insulation or other objects within ceiling plenum that are not part of supporting structural or ceiling suspension system. Splay hangers only where required to miss obstructions and offset resulting horizontal forces by bracing, counter-splaying, or other equally effective means.

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126. Where width of ducts and other construction within ceiling plenum produces hanger spacings that interfere with the location of hangers required to support standard suspension system members, install supplemental suspension members and hangers in form of trapezes or equivalent devices. Size supplemental suspension members and hangers to support ceiling loads within performance limits established by referenced standards.

127. Secure wire hangers by looping and wire-tying, either directly to structures or to inserts, eye-screws, or other devices and fasteners that are secure and appropriate for substrate, and in a manner that will not cause them to deteriorate or otherwise fail due to age, corrosion, or elevated temperatures.

128. Secure flat, angle, channel, and rod hangers to structure, including intermediate framing members, by attaching to inserts, eye-screws, or other devices and fasteners that are secure and appropriate for structure as well as for type of hanger involved, and in a manner that will not cause them to deteriorate or fail due to age, corrosion, or elevated temperatures.

129. Do not support ceilings directly from permanent metal forms. Furnish cast-in-place hanger inserts that extend through forms.

130. Do not attach hangers to steel deck tabs.

131. Do not attach hangers to steel roof deck. Attach hangers to structural members.

132. Do not connect or suspend steel framing from ducts, pipes or conduit.

Sway-brace suspended steel framing with hangers used for support.

Install suspended steel framing components in sizes and at spacing indicated but not less than that required by the referenced steel framing installation standard.

133. Wire Hangers: 0.1620-inch (8-gage) diameter, 4 feet O.C.

Carrying Channels (Main Runners): 1-1/2 inch, 4 feet O.C.

Rigid Furring Channels (Furring Members): 16 inches O.C.

Installation Tolerances:

Install steel framing components for suspended ceilings so that cross-furring members or grid suspension members are level to within 1/8 inch in 12 feet as measured both lengthwise on each member and transversely between parallel members.

Wire-tie or clip furring members to main runners and to other structural supports as indicated.

Grid Suspension System: Attach perimeter wall track or angle where grid suspension system meets vertical surfaces. Mechanically join main beam and cross-furring members to each other and butt-cut to fit into wall track.

For exterior soffits, install cross-bracing and additional framing to resist wind uplift according to details on Drawings.

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INSTALLING STEEL FRAMING FOR WALLS AND PARTITIONS

PP. Install runners (tracks) at floors, ceilings, and structural walls and columns where Gypsum Board stud assemblies abut other construction. Where studs are installed directly against exterior walls, install asphalt felt strips between studs and wall.

QQ. Installation Tolerances:

Install each steel framing and furring member so that fastening surfaces do not vary more than 1/8 inch from the plane formed by the faces of adjacent framing.

Extend partition framing full height to structural supports or substrates above suspended ceilings, except where partitions are indicated to terminate at suspended ceilings. Cut studs 1/2 inch short of full height. Continue framing over frames for doors and openings and frame around ducts penetrating partitions above ceiling to provide support for gypsum board. For STC-rated and fire-resistive-rated partitions requiring partitions to extend to the underside of floor/roof slabs and decks or other continuous solid structural surfaces to obtain ratings, install framing around structural and other members extending below floor/roof slabs and decks, as needed, to support gypsum board closures needed to make partitions continuous from floor to underside of solid structure.

Terminate partition framing at suspended ceilings where indicated.

Install steel studs and furring in sizes and at spacing indicated but not less than that required by the referenced steel framing installation standard to comply with maximum deflection and minimum loading requirements specified.

134. Single Layer Construction: Space studs at 24 inches O.C.

Single and Double-Layer Construction: Space studs at 24 inches O.C.

Install steel studs so that flanges point in the same direction and so that leading edges or ends of each gypsum board can be attached to open (unsupported) edges of stud flanges first.

Frame door openings to comply with details indicated, with GA-219, and with applicable published recommendations of gypsum board manufacturer. Attach vertical studs at jambs with screws either directly to frames or to jamb anchor clips on door frames; install runner track section (for cripple studs) at head and secure to jamb studs. Extend vertical jamb studs through suspended ceilings and attach to underside of floor or roof structure above.

Frame openings other than door openings to comply with details indicated or, if not indicated, in same manner as required for door openings. Install framing below sills of openings to match framing required above door heads.

Install thermal insulation as follows:

135. Erect insulation vertically and hold in place with Z-furring members spaced 24 inches O.C.

136. Except at exterior corners, securely attach narrow flanges of furring members to wall with concrete stub nails, screws designed for masonry attachment, or powder-driven fasteners spaced 24 inches O.C.

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137. At exterior corners, attach wide flange of furring members to wall with short flange extending beyond corner; on adjacent wall surface, screw attach short flange of furring channel to web of attached channel. Start from this furring channel with standard width insulation panel and continue in regular manner. At interior corners, space second member no more than 12 inches from corner and cut insulation to fit.

138. Until gypsum board is installed, hold insulation in place with 10-inch staples fabricated from 0.0625-inch (16-gage)-diameter tie wire and inserted through slot in web of member.

Install polyethylene vapor retarder where indicated to comply with the following requirements:

139. Extend vapor retarder to extremities of areas to be protected from vapor transmission. Secure in place with mechanical fasteners or adhesives. Extend vapor retarder to cover miscellaneous voids in insulated substrates, including those filled with loose mineral-fiber insulation.

140. Seal vertical joints in vapor retarders over framing by lapping not less than two wall studs. Fasten vapor retarders to framing at top, end, and bottom edges, at perimeter of wall openings, and at lap joints; space fasteners 16 inches O.C.

141. Seal joints in vapor retarders caused by pipes, conduits, electrical boxes and similar items penetrating vapor retarders with vapor retarder tape.

142. Repair any tears or punctures in vapor retarder immediately before concealing it with the installation of gypsum board or other construction.

APPLYING AND FINISHING GYPSUM BOARD, GENERAL

RR. Gypsum Board Application and Finishing Standards:

Install and finish Gypsum panels to comply with ASTM C 840 and GA-216.

Install sound attenuation blankets where indicated prior to installing gypsum panels unless blankets are readily installed after panels have been installed on one side.

Install ceiling board panels across framing to minimize the number of abutting end joints and avoid abutting end joints in the central area of each ceiling. Stagger abutting end joints of adjacent panels not less than one framing member.

Install wall/partition board panels to minimize the number of abutting end joints or avoid them entirely. Stagger abutting end joints not less than one framing member in alternate courses of board. At high walls, install panels horizontally with end abutting joints over studs and staggered.

Install Gypsum panels with face side out. Do not install imperfect, damaged, or damp panels. Butt panels together for a light contact at edges and ends with not more than 1/16 inch of open space between panels. Do not force into place.

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Locate both edge or end joints over supports, except in ceiling applications where intermediate supports or gypsum board back-blocking is provided behind end joints. Position adjoining panels so that tapered edges abut tapered edges, and field-cut edges abut field-cut edges and ends. Do not place tapered edges against cut edges or ends. Stagger vertical joints over different studs on opposite sides of partitions. Avoid joints at corners of framed openings where possible.

Attach gypsum panels to steel studs so that the leading edge or end of each panel is attached to open (unsupported) edges of stud flanges first.

Attach gypsum panels to framing provided at openings and cutouts.

Spot grout hollow metal door frames for solid core wood doors, hollow metal doors, and doors over 32 inches wide. Apply spot grout at each jamb anchor clip and immediately insert Gypsum panels into frames.

Form control joints and expansion joints at locations indicated and as detailed, with space between edges of adjoining Gypsum panels, as well as supporting framing behind Gypsum panels.

Cover both faces of steel stud partition framing with Gypsum panels in concealed spaces (above ceilings, etc.), except in chase walls that are braced internally.

143. Except where concealed application is indicated or required for sound, fire, air, or smoke ratings, coverage may be accomplished with scraps of not less than 8 sq. ft. in area.

144. Fit Gypsum panels around ducts, pipes, and conduits.

145. Where partitions intersect structural members projecting below underside of roof decks, cut gypsum panels to fit profile formed by coffers, joists, and other structural members; allow 1/4- to 1/2-inch-wide joints to install sealant.

Isolate perimeter of non-load-bearing gypsum board partitions at structural abutments as detailed and required. Provide 1/4-inch wide spaces at these locations and trim edges with U-bead edge trim where edges of gypsum panels are exposed. Seal joints between edges and abutting structural surfaces with acoustical sealant.

Where STC-rated gypsum board assemblies are indicated, seal construction at perimeters, behind control and expansion joints, openings, and penetrations with a continuous bead of acoustical sealant including a bead at both faces of the partitions. Comply with ASTM C 919 and manufacturer's recommendations for location of edge trim and closing off sound-flanking paths around or through Gypsum Board assemblies, including sealing partitions above acoustical ceilings.

Space fasteners in gypsum panels according to referenced gypsum board application and finishing standard and manufacturer's recommendations.

GYPSUM BOARD APPLICATION METHODS

SECTION 09255 – GYPSUM BOARD ASSEMBLIES

GOVERNMENT OF THE U. S. VIRGIN ISLANDS, DEPARTMENT OF PUBLIC WORKS

PROJECT NAME: Elaine I. Sprauve Public Library and Museum Building

Project Location, St. John, U.S. Virgin Islands

SS. Single-Layer Application:

Install Gypsum wallboard panels as follows:

- 146. On ceilings, apply Gypsum panels prior to wall/partition board application to the greatest extent possible and at right angles to framing, unless otherwise indicated.
- 147. On partitions/walls, apply gypsum panels vertically (parallel to framing), unless otherwise indicated, and provide panel lengths that will minimize end joints.
- 148. On partitions/walls, apply gypsum panels horizontally (perpendicular to framing), unless parallel application is required for fire-resistive-rated assemblies. Use maximum-length panels to minimize end joints.

Wall Tile Substrates:

For substrates indicated to receive thin-set ceramic tile and similar rigid applied wall finishes, comply with the following:

- 149. Install cementitious backer units at showers and where indicated to comply with ANSI A108.11.
- 150. Install Gypsum wallboard panels with tapered edges taped and finished to produce a flat surface except at showers and other locations indicated to receive water-resistant panels.

Double-Layer Application:

Install gypsum backing board for base layers and Gypsum Wallboard for face layers. On partitions/walls, apply base layers and face layers vertically (parallel to framing) with joints of base layers located over stud or furring member and face layer joints offset at least one stud or furring member with base layer joints. Stagger joints on opposite sides of partitions.

Single-Layer Fastening Methods:

Apply gypsum panels to supports as follows: Fasten with screws.

Double-Layer Fastening Methods:

Apply base layer of gypsum panels and face layer to base layer as follows:

- 151. Fasten base layers with screws and face layer with adhesive and supplementary fasteners.

INSTALLING TRIM ACCESSORIES

TT. General:

For trim accessories with back flanges, fasten to framing with the same Fasteners used to fasten gypsum board. Otherwise, fasten trim accessories according to accessory manufacturer's directions for type, length, and spacing of fasteners.

Install corner beads at external corners.

Install edge trim where edge of gypsum panels would otherwise be exposed or semi-exposed.

Provide edge trim type with face flange formed to receive joint compound except where other types are indicated.

- 152. Install LC-bead where gypsum panels are tightly abutted to other construction and back flange can be attached to framing or supporting substrate.

SECTION 09255 – GYPSUM BOARD ASSEMBLIES

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153. Install L-bead where edge trims can only be installed after gypsum panels are installed.

154. Install U-bead where indicated.

FINISHING GYPSUM BOARD ASSEMBLIES

UU. General:

Apply joint treatment at gypsum board joints (both directions); flanges of corner bead, edge trim, and control joints; penetrations; fastener heads, surface defects, and elsewhere as required to prepare gypsum board surfaces for decoration and levels of gypsum board finish indicated.

Prefill open joints, rounded or beveled edges, and damaged areas using setting type joint compound.

Apply joint tape over gypsum board joints except those with trim accessories having concealed face flanges not requiring taping to prevent cracks from developing in joint treatment at flange edges.

Apply joint tape over gypsum board joints and to trim accessories with concealed face flanges as recommended by trim accessory manufacturer and as required to prevent cracks from developing in joint compound at flange edges.

Levels of Gypsum Board Finish:

Provide the following levels of gypsum board finish per GA-214:

155. Level 1 for ceiling plenum areas, concealed areas, and where indicated, unless a higher level of finish is required for fire-resistive-rated assemblies and sound-rated assemblies.

156. Level 2 where water-resistant gypsum backing board panels form substrates for tile, and where indicated.

157. Level 3 for gypsum board surfaces indicated to receive medium- or heavy-textured finishes before painting.

158. Level 4 for gypsum board surfaces indicated to receive light-textured finishes, wallcoverings, and flat paints over light textures.

For level 4 gypsum board finish, embed tape in finishing compound plus two separate coats applied over joints, angles, fastener heads, and trim accessories using one of the following combinations of joint compounds (not including prefill), and sand between coats and after last coat.

Where level 3 gypsum board finish is indicated, apply joint compounds specified for first and second coat in addition to embedding coat.

Where level 2 gypsum board finish is indicated, apply joint specified for first coat in addition to embedding coat.

SECTION 09255 – GYPSUM BOARD ASSEMBLIES

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Where level 1 gypsum board finish is indicated, apply joint compound specified for embedding coat.

Finish cementitious backer units to comply with unit manufacturer's directions.

CLEANING AND PROTECTION

VV. Promptly remove any residual joint compound from adjacent surfaces.

WW. Provide final protection and maintain conditions, in a manner suitable to Installer that ensures gypsum board assemblies remain without damage or deterioration at time of Substantial Completion.

END OF SECTION

SECTION 09300 – TILES

GOVERNMENT OF THE U. S. VIRGIN ISLANDS, DEPARTMENT OF PUBLIC WORKS

PROJECT NAME: Elaine I. Sprauve Public Library and Museum Building

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PART 4 - GENERAL

4.8 SUMMARY

XX. Interior Tile:

159. Wall tile over tile backer board at wet areas.

160. Wall tile over concrete and concrete masonry units.

161. Floor tile over concrete slab.

162. Floor tile over plywood and wood decking.

Remodeling of existing tile work.

SUBMITTALS

YY. Submit for approval samples, product data, and mock-ups.

QUALITY ASSURANCE

ZZ. Comply with governing codes and regulations. Provide products of acceptable manufacturers which have been in satisfactory use in similar service for three years. Use experienced installers. Deliver, handle, and store materials in accordance with manufacturer's instructions.

Tile Materials: ANSI 118 series standard specifications.

Tile Installation:

ANSI 108 series standard specifications and Tile Council of America, Handbook for Ceramic Tile Installation.

- PRODUCTS

4.9 MATERIALS

AAA. Manufacturers of Tile:

American Olean, Dal-Tile, Summitville Tiles, United States Ceramic Tile Co. or approved equal.

Manufacturers of Setting Materials:

American Olean, Bostic Construction Products, Laticrete, Mapei Corp or approved equal.

Glazed Wall Tile:

163. Type: Interior type body, flat tile

Face: [4 by 8 inches]

Thickness: 5/16 inch nominal thickness

Face: Plain face with modified square edge.

SECTION 09300 – TILES

GOVERNMENT OF THE U. S. VIRGIN ISLANDS, DEPARTMENT OF PUBLIC WORKS

PROJECT NAME: Elaine I. Sprauve Public Library and Museum Building

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Unglazed Paver Tile:

- 164. Type: Porcelain flat tile
- 165. Size: As indicated
- 166. Thickness: 1/2 inch nominal
- 167. Face: Plain face with square edges.

Glazed Paver Tile:

- 168. Type: Porcelain flat tile
- 169. Size: As indicated
- 170. Thickness: 1/2 inch nominal
- 171. Face: Plain face with square edges.

Tile Accessories:

- 172. Matching trim units.
- 173. Marble thresholds.
- 174. Stone thresholds.
- 175. Ceramic toilet accessories.

Setting Materials:

- 176. Latex-Portland cement mortar, ANSI A118.
- Chemical-resistant epoxy adhesive, ANSI A118.

Grout:

- 177. Latex-Portland cement grout, ANSI A118.6.
- 178. Chemical-resistant epoxy grout, ANSI A118.

Setting Accessories:

- 179. Membrane waterproofing under tile.
- 180. Cementitious tile backer board.

Elastomeric Sealants:

- 181. One-part mildew-resistant silicone sealant for non-traffic areas.

SECTION 09300 – TILES

GOVERNMENT OF THE U. S. VIRGIN ISLANDS, DEPARTMENT OF PUBLIC WORKS

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~~182. Multi-part pourable urethane sealant for traffic areas.~~

183. Chemical-resistant sealant at chemical-resistant flooring.

- EXECUTION

4.10 INSTALLATION

BBB. Comply with Tile Council of America and ANSI Standard Specifications for Installation for substrate and installation required. Comply with manufacturer's instructions and recommendations.

CCC. Lay tile in grid pattern with alignment grids. Layout to provide uniform joint widths and to minimize cutting; do not use less than 1/2 tile units.

DDD. Provide sealant joints where recommended by TCA and approved by Owner's Representative.

EEE. Grout and cure, clean and protect.

SCHEDULE

FFF. Tile Schedule:

184. Toilet Room Walls:

Glazed wall tile over masonry or cementitious backer unit with thin-set latex modified cement mortar and latex-Portland cement grout.

Toilet Room Floors:

Unglazed paver tile over concrete slab or wood decking with chemical resistant adhesive, latex Portland cement mortar and chemical resistant grout.

Other Areas:

Glazed paver tile over concrete slab or wood decking with chemical resistant adhesive, latex Portland cement mortar and chemical resistant grout.

END OF SECTION

SECTION 09511 – ACOUSTICAL PANEL CEILINGS

GOVERNMENT OF THE U. S. VIRGIN ISLANDS, DEPARTMENT OF PUBLIC WORKS

PROJECT NAME: Elaine I. Sprauve Public Library and Museum Building

Project Location, St. John, U.S. Virgin Islands

PART 5 - GENERAL

5.11 SUMMARY

GGG. Related Documents:

185. Drawings and general provisions of the Subcontract apply to this Section.

186. Review these documents for coordination with additional requirements and information that apply to work under this Section.

Section Includes:

187. Acoustical surfaces including acoustic lay-in panels, grid systems, and required installation accessories.

Tie-in to existing grid system.

Seismic bracing of existing grid system.

Seismic safety wires for light fixtures.

Related Sections:

188. Division 01 Section "General Requirements."

189. Division 01 Section "Special Procedures."

190. Division 01 Section "Construction Waste Management."

191. Division 01 Section "Lateral Force Procedures".

192. Division 07 Section "Blanket Insulation" for acoustical insulation blankets in partitions and ceilings.

193. Division 09 Section "Painting" for field painting of lay-in panels.

194. Division 23 Sections for acoustical duct liners, sound insulated metal plenum walls, vibration isolating supports for mechanical equipment, fire sprinklers and similar items of mechanical equipment mounted on or in acoustical surfaces.

195. Division 26 Sections for:

tttt. Light fixtures, smoke detectors and similar items of electrical equipment mounted in or on acoustical surfaces.

uuuu. Furnishing and installation of safety wires for recessed lighting fixtures.

REFERENCES

SECTION 09511 – ACOUSTICAL PANEL CEILINGS

GOVERNMENT OF THE U. S. VIRGIN ISLANDS, DEPARTMENT OF PUBLIC WORKS

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HHH. General:

196. The following documents form part of the Specifications to the extent stated. Where differences exist between codes and standards, the one affording the greatest protection shall apply.

197. Unless otherwise noted, the referenced standard edition is the current one at the time of commencement of the Work.

198. Refer to Division 01 Section "General Requirements" for the list of applicable regulatory requirements.

ASTM International:

199. ASTM C635 - Metal Suspension Systems for Acoustical Tile and Lay-in Panel Ceilings.

200. ASTM C636- Installation of Metal Ceiling Suspension Systems -Acoustical Tile and Lay-in Panels.

California Building Code (CBC) - conform to combustibility requirements for materials.

CBC Chapters 16 and 25 and CBC Standard No. 25-2 for the design, details and specifications for lateral bracing requirements as modified by Division 01 Section "Lateral Force Procedures".

Ceilings & Interior Systems Construction Association:

201. Ceiling Systems Handbook

202. Guidelines for Seismic Restraint of Direct-Hung Suspended Ceiling Assemblies- Seismic Zones 3 & 4

UL- Underwriter's Laboratories System Ratings.

SUBMITTALS

III. Submit under provisions of Division 01 Section "General Requirements."

JJJ. Product Data:

203. Manufacturer's specifications, installation instructions and product data on metal grid system components, acoustical units, and all other products to be used.

204. Approved ICBO report for fasteners proposed to be used to attach acoustical ceilings to building superstructure.

Shop Drawings:

SECTION 09511 – ACOUSTICAL PANEL CEILINGS

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Show grid layout and dimensioning, panel layouts, lighting fixtures, air diffusers, grilles, and all other items exposed in acoustical ceilings, locations of seismic braces and hangers, and suspension, seismic and bracing details. Show details of junctions with other work or ceiling finishes, and special conditions.

Calculations showing that suspension systems will provide full compliance with seismic structural requirements of Division 01 Section "Lateral Force Procedures". Calculations shall be checked and sealed by a Civil or Structural Engineer licensed in the State of California.

Samples:

205. Acoustic panels of each type- 6 by 6 inches (150 by 150 mm) minimum.

206. Grid system components, including suspension system main runner, cross runner, edge trim, and all special shapes, in 12 inches (300 mm) lengths.

QUALITY ASSURANCE

KKK. Installer's Qualifications: 5 years minimum experience with and specializing in acoustical ceilings installations.

DELIVERY, STORAGE, AND HANDLING

LLL. Deliver materials to project site in original, undamaged, unopened containers bearing manufacturer's name, style, color and product number of each type of material.

MMM. Comply with manufacturer's recommendations for storage of materials to be used in the work.

ENVIRONMENTAL REQUIREMENTS

NNN. Unless otherwise required by the manufacturers of the materials, temperatures are to be maintained at 60 degrees F. or higher, and humidity at 20 to 40 percent, prior to, during and after installation.

SEQUENCING AND SCHEDULING

OOO. Do not install acoustical ceilings until building is enclosed, sufficient heat is provided, dust-generating activities have terminated, and overhead work is completed, tested and approved. Schedule installation of acoustic units after interior wet work is dry.

EXTRA MATERIALS

PPP. Upon completion of work, deliver stock of replacement materials of acoustical panels used in the work to the Project Manager. Furnish at least 3 percent extra panels, of full-size units of each type, color and pattern of acoustical panel installed. Package extra materials in manufacturer's standard, sealed, unopened boxes, labeled with manufacturer's name, style, number and color of unit, local distributor's name, address and telephone number, and locations where installed in Project.

- PRODUCTS

SECTION 09511 – ACOUSTICAL PANEL CEILINGS

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5.12 EXISTING MATERIALS

QQQ. Existing suspension system scheduled to remain is [steel] [aluminum], approximately 1 1/2 inch (38 mm) high by 3/4 (18 mm) wide, white exposed face, 2 by 2 feet (600 by 600 mm) grid, except where light fixtures occur. System is not seismically braced. New grid system shall meet and form positive structural connection with existing system, using clips and other devices as necessary, which shall be concealed from view. Final appearance shall appear to be one continuous grid system.

ACOUSTICAL PANEL (AP) MATERIALS

RRR. Type AP 1 panels are specified for offices and corridors where dusting and ease of cleaning are not Issues.

207. USG "Millennia", 3/4 inches (19 mm) thick, 24 by 24 inches (600 mm x 600 mm), square edge, white, mineral fiber, Class A, CAC range 35-39, NRC Range 0.65-0.75.

Type AP 2 panel is specified for computer rooms and laboratories where dusting and ease of cleaning are issues.

208. USG "Clean Room Class 100", Celotex, Capaul or equal, 5/8 inches (16 mm) thick, 24 by 24 inches (600 mm x 600 mm), vinyl wrapped moisture resistant mineral fiber, square edges, STC 40- 44.

vvvv. Class A material with a flame spread not exceeding 25 and a smoke developed rating not exceeding 50 when tested in accord with ASTM E84.

GRID SUSPENSION SYSTEM (GS)

SSS. Manufacturers:

209. Chicago Metallic Corp.

210. Donn, Eastern

211. National Rolling Mills.

212. Approved Equal

System Description:

Systems shall be of steel construction as per CBC Standard 25-2 and shall consist of main and cross runners, perimeter trim, connectors, hangers and all accessories necessary for the complete installation.

213. All systems shall permit the installation of recessed lighting fixtures upon the flanges of the systems and any form of splice or other obstruction which would inhibit or render such installation of fixtures difficult will not be permitted.

Each intersection, splice and perimeter joint shall meet all seismic requirements of CBC Standard 25-2.

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Finish:

Factory finished white baked enamel over bonderized, electro-zinc-coated steel.

Main and Cross Runners:

214. GS 1:

15/16-inch (23 mm) flange suspension system, heavy-duty steel, grid module to suit panel size. Include 15/16 inch (23 mm) wide perimeter trim members with shadow reveal.

GS 2:

9/16-inch (14 mm) flange narrow suspension system, intermediate duty steel, grid module to suit lay-in panel size. Include 9/16 inch (14 mm) wide perimeter trim members.

Connectors and Clips:

Manufacturer's standard

Hanger and Bracing Wires:

Fed. Spec. QQ-W-461, Class 1, galvanized and annealed, 12 gauge minimum

Fasteners:

Fasteners used for attachment of acoustical ceilings to building structure shall have an approved ICBO report.

Edge Sealer:

Latex adhesive designed for the purpose of sealing field-cut edges of acoustic panels, as manufactured by Kelly-Moore, Inc., or equal

- EXECUTION

5.13 EXAMINATION

TTT. Surfaces shall be dry and wet work completed prior to commencing installation. Inspect surfaces to receive acoustical work and report any defects. Starting work implies acceptance of surfaces and existing conditions.

UUU. Verify that plenum surfaces are free of dirt, dust and loose construction soil and that construction work is otherwise complete, equipment installed and that surfaces and openings which might provide "leaks" are sealed prior to commencing installation of ceiling assembly.

INSTALLATION

VVV. Coordinate installation with other trades whose work adjoins or combines with acoustical ceilings. Unless otherwise shown, equipment, fixtures, etc., applied on or within acoustical panels are to be located symmetrically with respect to both axes. Provide grid members required to accommodate lay-in air diffusers and similar items of mechanical equipment.

WWW. Except as otherwise specified to meet structural requirements, make installation of grid systems and acoustical materials in strict accordance with approved manufacturer's specifications or recommendations and Drawing details. Where details and/or these Specifications are in apparent conflict with manufacturer's recommendations, the more stringent requirement shall apply.

XXX. Grid Suspension Systems:

215. Structural Requirements:

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www. Brace [new and existing] suspension to comply with CBC requirements a governing resistance to lateral forces and uplift as modified by Division 01 Section "Lateral Force Procedures".

xxxx. Attachment to Building Superstructure: Install fasteners used to attach grid suspension system to building superstructure in accordance with the requirements of their approved ICBO report.

xxviii. Install suspension systems in flat, level plane unless otherwise shown, joints in exposed members tight and aligned without offsets. Direction of main runners, where not specifically indicated, shall be determined by fixture layout.

xxix. Unless closer spacing is required by manufacturer of system, space hanger wires along main runners at 4 feet (1.2 m) maximum. Provide special hangers as required where items above ceiling obstruct normal hanger wires.

xxx. Provide hold-down clips for lay-in panels where required to prevent lifting and flutter caused by air pressures.

xxxi. Install perimeter trim at wall and abutting vertical surfaces. Flange of trim shall be at the same level as flanges of main and cross runners.

xxxii. Level suspension systems to a tolerance of 1/8 inches (3 mm) in 12 feet (3.6 m).

Unless otherwise shown on reflected ceiling plans, align grid members and tile joints parallel to perimeter walls with pattern centered in room areas both directions.

Seal field-cut panel edges of Type AP 2 panels with edge sealer.

PROTECTION

YYY. Protect the finished installation from damage during balance of construction period. Remove any soiled or damaged items and replace with new before acceptance of Project by LBNL.

WASTE MANAGEMENT

ZZZ. Recycle unused acoustic ceiling tile in accordance with the requirements of Division 01 "Construction Waste Management."

END OF SECTION

09651- RESILIENT TILE FLOORING INCLUDING SOLID VINYL FLOOR TILE

GOVERNMENT OF THE U. S. VIRGIN ISLANDS, DEPARTMENT OF PUBLIC WORKS

PROJECT NAME: Elaine I. Sprauve Public Library and Museum Building

Project Location, St. John, U.S. Virgin Islands

PART 6 GENERAL

6.14 SUMMARY

AAAA. Section Includes: Resilient vinyl tile flooring

ACTION SUBMITTALS

BBBB. Product Data: For each type of product indicated.

Manufacturer Certifications:

216. Provide certification that accurately identifies the Original Equipment Manufacturer (OEM) of flooring furnished for this project including manufacturer's name, address and factory location.

yyyy. Suppliers of Private-Label flooring for this project must identify themselves as such and fully disclose the OEM information listed above.

All "manufacturer" requirements in these specifications must be complied with by the OEM, including warranties, certifications, qualifications, product data, test results, environmental requirements, performance data, etc.

Provide ISO 9001 certification for the OEM of the specified products.

Provide ISO 14001 certification for the OEM of the specified products.

Provide OSHAS 18001 certification for the OEM of the specified products.

Shop Drawings: Showing installation details and locations of borders, patterns, locations of any floor inserts and any seams.

Samples:

217. Manufacturer's color chart for selection of available floors

Color samples:

zzzz. Samples as requested

INFORMATIONAL SUBMITTALS

CCCC. Qualification Data:

218. For a qualified resilient flooring Manufacturer.

For a qualified resilient flooring Installer.

CLOSEOUT SUBMITTALS

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~~DDDD. Submit three copies of the following:~~

219. Manufacturer maintenance instructions.

Manufacturer material warranty.

Installer installation warranty.

QUALITY ASSURANCE

EEEE. Manufacturer Qualifications:

220. ISO 9001 Certified.

ISO 14001 Certified.

OHSAS 18001 Certified.

At least ten years active experience in the manufacture and marketing of commercial resilient flooring.

A provider of authorized installer training.

Installer Qualifications:

221. At least five years' experience in the installation of resilient flooring.

Experience on at least five projects of similar size, type and complexity as this project.

Employer of workers for this Project who are competent in techniques required by manufacturer for resilient flooring installation indicated.

Fire Test Characteristics: As determined by testing identical products according to ASTM E 648, Class 1, by a qualified testing agency acceptable to authorities having jurisdiction.

DELIVERY, STORAGE, AND HANDLING

FFFF. Store flooring and installation materials in protected dry spaces, with ambient temperatures maintained within range recommended by manufacturer, but not more than 85 deg F (29 deg C).

Store the indoor resilient tiles in an upright position on a smooth flat surface immediately upon delivery to Project.

FIELD CONDITIONS

GGGG. Product Installation:

222. Maintain temperatures during installation within range recommended by manufacturer.

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~~After installation, maintain temperatures within range recommended by manufacturer,~~
but not more than 85 deg F (29 deg C).

Prohibit traffic during flooring installation and for at least 48 hours after flooring installation.

Install flooring only after other finishing work, including painting and overhead work, has been completed.

WARRANTY

HHHH. Special Limited Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace flooring that fails within specified warranty period.

223. Material warranty must be direct from the product manufacturer.

aaaa. Material warranties from separate or third-party insurance providers are not valid.

Material warranties from private label distributors are not valid.

Failures include, but are not limited to, the following:

bbbbb. Material manufacturing defects.

Surface wear and deterioration to the point of wear-through.

Failure due to substrate moisture exposure not exceeding 92 percent relative humidity when tested according to ASTM F2170.

Warranty Period: 15 years.

Special Limited Warranty: Installer's standard form in which installer agrees to repair or replace flooring that fails due to poor workmanship or faulty installation within the specified warranty period.

224. Warranty Period: 15 years.

ENVIRONMENT AND INDOOR AIR QUALITY

III. Indoor Air Quality Certification:

225. Flooring products must be compliant with the volatile organic compound emissions criteria of the California Section 01350

Manufacturer Certification of Environmental Procedures:

226. Original Equipment Manufacturers (OEM) ISO 14001 Certification

COORDINATION

09651- RESILIENT TILE FLOORING INCLUDING SOLID VINYL FLOOR TILE

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~~JJJJ. Coordinate layout and installation of flooring with other equipment.~~

PRODUCTS

6.15 COMMERCIAL RESILIENT / VINYL TILE FLOORING

KKKK. Modular tile flooring a 6mm thick modular tile with dovetail connections/ or straight seam for heat welding. Includes a reinforced 2mm thick wear layer with pressed design, (2) fiberglass grids for extreme dimensional stability and 100% recycled interlayer and base. Protected by surface treatment for No Wax maintenance.

Product Description: Resilient / Vinyl Tile flooring as per ASTM F1700.

227. Overall Thickness: Not less than 0.24 inch (6.0 mm)

Wear-Layer Thickness: Not less than 0.08 inch (2.0 mm)

Adhesive Method: as recommended per manufacturer's installation instructions to ensure proper installation and performance.

100% REACH Compliant.

Applied Finish: Manufacturer's, factory-applied, permanent UV-cured.

Tile Size: GTI Connect 25.6'' x 25.6'' (650mm x 650mm)

GTI Control 25'' x 25'' (635mm x 635mm)

Color and Pattern:

ccccc. As selected by Owner from manufacturer's standard colors and patterns.

Performance Criteria:

228. Maximum Static Load:

ddddd. ASTM F970: Meets requirements

Rolling Loads: ASTM F2753, 500 cycles @ 100lbs: Excellent, no change

Indentation Hardness: ASTM D2240, 95

Chemical & Stain Resistance: EN 423, OK

Coefficient of Friction: ASTM D2047, 0.80 (DRY) / 0.82 (WET)

Fire Performance: ASTM E 648; Class 1

Slab Moisture Design Tolerance:

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~~cccc. Maximum relative humidity of 92 percent when tested according to ASTM F 2170.~~

Maximum moisture vapor emission rate of 10 pounds of water per 1000 sq. ft. in 24 hours when tested according to ASTM F1869.

EXECUTION

6.16 EXAMINATION

LLLL. Verify the Following:

229. The area in which the indoor resilient tile flooring will be installed is dry, weather-tight and in compliance with specified requirements.

Permanent heat, lighting and ventilation systems are installed and operable.

Other work, including overhead work, that could cause damage, dirt, dust or otherwise interrupt installation has been completed or suspended.

No foreign materials or objects are present on the substrate and that it is clean and ready for preparation and installation.

Tests to verify that the moisture vapor emission rate or substrate relative humidity is within the specified ranges.

The concrete slab surface deviation is no greater than 3/16 inch within 10 feet (4.5 mm within 3 m) as described in AC1117R.

PREPARATION

MMMM. Prepare substrates according to manufacturer's written recommendations to ensure proper adhesion of resilient flooring system.

Concrete Substrates: Prepare according to ASTM F 710.

230. Verify that substrates are dry and free of sealers, curing compounds and other additives. Remove coatings and other substances that are incompatible with adhesives using mechanical methods recommended by manufacturer.

Moisture Testing: Perform ASTM F 2170 relative humidity test and proceed with installation only after substrates have maximum relative humidity of 92 percent.

Use trowelable concrete based leveling and patching compound with the same moisture vapor tolerance as the adhesive to fill depressions, holes, cracks, grooves or other irregularities in substrate.

Place flooring and installation materials into spaces where they will be installed at least 48 hours before installation. Install flooring materials only after they have reached the same temperature as space where they are to be installed.

09651- RESILIENT TILE FLOORING INCLUDING SOLID VINYL FLOOR TILE

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~~Sand the surface of the concrete slab.~~

Sweep and then vacuum substrates immediately before installation. After cleaning, examine substrate for moisture, alkaline salts, grit, dust or other contamination. Proceed with installation only after unsatisfactory conditions have been corrected.

VINYL TILE FLOORING INSTALLATION

NNNN. General:

231. Comply with resilient tile flooring manufacturer's installation instructions.

Take necessary precautions to minimize noise, odors, dust and inconvenience during installation.

Fit flooring neatly and tightly to vertical surfaces, equipment anchors, floor outlets, and other interruptions of floor surface.

Extend flooring into toe spaces, door reveals, closets, and similar openings unless otherwise indicated.

Lay out flooring per manufacturer's recommendations.

CLEANING AND PROTECTION

OOOO. Perform the following operations after completing resilient flooring installation:

232. Remove marks and blemishes from flooring surfaces.

Sweep and then vacuum flooring.

Damp-mop flooring to remove soiling.

Protect flooring from abrasions, indentations, and other damage from subsequent operations and placement of equipment, during remainder of construction period.

END OF SECTION

PART 7 -

SECTION 099300 – STAINING AND TRANSPARENT FINISHING

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PART 8 GENERAL

8.17 RELATED DOCUMENTS

PPPP. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

SUMMARY

QQQQ. Section includes surface preparation and application of wood stains and transparent finishes.

233. Exterior Substrates:

ffff. Exposed framing.

Dressed lumber (finish carpentry or woodwork).

Wood-based panel products.

Wood decks and stairs.

Wood shingles and shakes (excluding roofs).

Interior Substrates:

ggggg. Exposed glued-laminated beams and columns.

Related Requirements: None

DEFINITIONS

RRRR. MPI Architectural Painting Specification Manual (MPI)

MPI Gloss Level 1: Not more than 5 units at 60 degrees and 10 units at 85 degrees, according to ASTM D 523.

MPI Gloss Level 4: 20 to 35 units at 60 degrees and not less than 35 units at 85 degrees, according to ASTM D 523.

MPI Gloss Level 5: 35 to 70 units at 60 degrees, according to ASTM D 523.

MPI Gloss Level 6: 70 to 85 units at 60 degrees, according to ASTM D 523.

MPI Gloss Level 7: More than 85 units at 60 degrees, according to ASTM D 523.

ACTION SUBMITTALS

SSSS. Product Data:

For each type of product. Include preparation requirements and application instructions.

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~~234. Include printout of current "MPI Approved Products List" for each product category specified, with the proposed product highlighted.~~

Indicate VOC content.

Sustainable Design Submittals:

235. Product Data: For paints and coatings, indicating VOC content.

Laboratory Test Reports:

For paints and coatings, indicating compliance with requirements for low-emitting materials.

Samples for Initial Selection:

For each type of product.

Samples for Verification:

For each type of finish system and in each color and gloss of finish required.

236. Submit Samples on representative samples of actual wood substrates, **8 inches (200 mm) square**.

Apply coats on Samples in steps to show each coat required for system.

Label each coat of each Sample.

Label each Sample for location and application area.

Product List:

Cross-reference to finish system and locations of application areas. Use same designations indicated on Drawings and in schedules. Include color designations.

MAINTENANCE MATERIAL SUBMITTALS

TTTT. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

237. Stains and Transparent Finishes: **5** percent, but not less than **1 gal. (3.8 L)** of each material and color applied.

QUALITY ASSURANCE

UUUU. Mockups:

Apply mockups of each finish system indicated and each color selected to verify preliminary selections made under Sample submittals, to demonstrate aesthetic effects, and to set quality standards for materials and execution.

238. Owner's Representative will select one surface to represent surfaces and conditions for application of each type of finish system and substrate.

hhhhh. Vertical and Horizontal Surfaces: Provide samples of at least 100 sq. ft. (9 sq. m).

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~~Other items. Owner's Representative will designate items or areas required.~~

Final approval of stain color selections will be based on mockups.

- iiii. If preliminary stain color selections are not approved, apply additional mockups of additional stain colors selected by Owner's Representative at no added cost to Owner.

DELIVERY, STORAGE, AND HANDLING

VVVV. Store materials not in use in tightly covered containers in well-ventilated areas.

239. Maintain containers in clean condition, free of foreign materials and residue.

Remove rags and waste from storage areas daily.

FIELD CONDITIONS

WWWW. Apply finishes only when temperature of surfaces to be finished and ambient air temperatures are under 95 deg F (35 deg C).

Do not apply finishes when relative humidity exceeds 85 percent, at temperatures less than 5 deg F (3 deg C) above the dew point, or to damp or wet surfaces.

Do not apply exterior finishes in rain, fog, or mist.

PRODUCTS

8.18 MANUFACTURERS

XXXX. Basis-of-Design Product:

Subject to compliance with requirements, provide a product by one of the following:

240. Benjamin Moore & Co.

Dunn-Edwards Corporation.

Frazee Paint; Comex Group.

Glidden Professional.

PPG Architectural Finishes, Inc.

Sherwin-Williams Company (The).

MATERIALS, GENERAL

YYYY. MPI Standards:

Products shall comply with MPI standards indicated and shall be listed in its "MPI Approved Products List."

Material Compatibility:

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~~241. Materials for use within each paint system shall be compatible with one another and substrates indicated, under conditions of service and application as demonstrated by manufacturer, based on testing and field experience.~~

For each coat in a paint system, products shall be recommended in writing by manufacturers of topcoat for use in paint system and on substrate indicated.

Low-Emitting Materials:

Interior paints and coatings shall comply with the testing and product requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers."

Stain Colors:

As selected by Owner's Representative from manufacturer's full range

EXECUTION

EXAMINATION

ZZZZ. Examine substrates and conditions, with Applicator present, for compliance with requirements for maximum moisture content and other conditions affecting performance of the Work.

Maximum Moisture Content of Exterior Wood Substrates:

15 percent, when measured with an electronic moisture meter.

Maximum Moisture Content of Interior Wood Substrates:

13 percent, when measured with an electronic moisture meter.

Verify suitability of substrates, including surface conditions and compatibility with existing finishes and primers.

Proceed with finish application only after unsatisfactory conditions have been corrected.

242. Beginning finish application constitutes Contractor's acceptance of substrates and conditions.

PREPARATION

AAAAA. Comply with manufacturer's written instructions and recommendations in "MPI Architectural Painting Specification Manual" applicable to substrates indicated.

Remove hardware, covers, plates, and similar items already in place that are removable. If removal is impractical or impossible because of size or weight of item, provide surface-applied protection before surface preparation and finishing.

243. After completing finishing operations, use workers skilled in the trades involved to reinstall items that were removed. Remove surface-applied protection if any.

Clean and prepare surfaces to be finished according to manufacturer's written instructions for each substrate condition and as specified.

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~~244. Remove dust, dirt, oil, and grease by washing with a detergent solution, rinse thoroughly with clean water and allow to dry. Remove grade stamps and pencil marks by sanding lightly. Remove loose wood fibers by brushing.~~

Remove mildew by scrubbing with a commercial wash formulated for mildew removal and as recommended by stain manufacturer.

Exterior Wood Substrates:

245. Scrape and clean knots, and apply coat of knot sealer before applying primer.

Prime edges, ends, faces, undersides, and backsides of wood.

jjjjj. For solid hide stained wood, stain edges and ends after priming.

For varnish-coated stained wood, stain edges and ends and prime with varnish.
Prime undersides and backsides with varnish.

Countersink stainless steel nails, if used, and fill with putty or plastic wood filler tinted to final color. Sand smooth when dried.

Interior Wood Substrates:

246. Scrape and clean knots, and apply coat of knot sealer before applying primer.

Apply wood filler paste to open-grain woods, as defined in "MPI Architectural Painting Specification Manual," to produce smooth, glasslike finish.

Sand surfaces exposed to view and dust off.

After priming, fill holes and imperfections in the finish surfaces with putty or plastic wood filler. Sand smooth when dry.

APPLICATION

BBBBB. Apply finishes according to manufacturer's written instructions and recommendations in "MPI Architectural Painting Specification Manual."

247. Use applicators and techniques suited for finish and substrate indicated.

Finish surfaces behind movable equipment and furniture same as similar exposed surfaces.

Do not apply finishes over labels of independent testing agencies or equipment name, identification, performance rating, or nomenclature plates.

Apply finishes to produce surface films without cloudiness, holidays, lap marks, brush marks, runs, ropiness, or other surface imperfections.

CLEANING AND PROTECTION

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~~CCCCC. At end of each workday, remove rubbish, empty cans, rags, and other discarded materials from Project site.~~

After completing finish application, clean spattered surfaces. Remove spattered materials by washing, scraping, or other methods. Do not scratch or damage adjacent finished surfaces.

Protect work of other trades against damage from finish application. Correct damage by cleaning, repairing, replacing, and refinishing, as approved by Architect, and leave in an undamaged condition.

At completion of construction activities of other trades, touch up and restore damaged or defaced finished wood surfaces.

EXTERIOR WOOD-FINISH-SYSTEM SCHEDULE

DDDDD. Wood Substrates:

Exposed framing.

248. Solid-Color, Water-Based Stain System MPI EXT 6.2B:

kkkkk. Prime Coat: Stain, exterior, water based, solid hide, matching topcoat.

Topcoat: Stain, exterior, water based, solid hide, MPI #16.

Water-Based Semitransparent Stain System MPI EXT 6.2P:

lllll. Prime Coat: Stain, exterior, water based, semitransparent, matching topcoat.

Topcoat: Stain, exterior, water based, semitransparent.

Wood Substrates:

Wood trim, architectural woodwork, doors, windows, wood board siding, and wood fences.

249. Solid-Color, Water-Based Stain System MPI EXT 6.3K:

mmmmm. Prime Coat: Stain, exterior, water based, solid hide, matching topcoat.

Topcoat: Stain, exterior, water based, solid hide, MPI #16.

Water-Based Semitransparent Stain System MPI EXT 6.3N:

nnnnn. Prime Coat: Stain, exterior, water based, semitransparent, matching topcoat.

Topcoat: Stain, exterior, water based, semitransparent.

Wood Substrates: Wood-based panel products.

250. Solid-Color, Water-Based Stain System MPI EXT 6.4A:

ooooo. Prime Coat: Stain, exterior, water based, solid hide, matching topcoat.

Topcoat: Stain, exterior, water based, solid hide, MPI #16.

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~~Water-Based Semitransparent Stain System MPI EXT 6.4L.~~

Prime Coat: Stain, exterior, water based, semitransparent, matching topcoat.

Intermediate Coat: Stain, exterior, water based, semitransparent, matching topcoat.

Topcoat: Stain, exterior, water based, semitransparent.

Wood Substrates:

Traffic surfaces including lumber decking and stairs.

251. Deck Stain System MPI EXT 6.5F:

ppppp. Prime Coat: Stain, for exterior wood decks, matching topcoat.

Top coat: Stain, for exterior wood decks, MPI #33.

Wood Substrates:

Wood shingles and shakes (excluding roofs).

252. Solid-Color, Water-Based Stain System MPI EXT 6.6D:

qqqqq. Prime Coat: Stain, exterior, water based, solid hide, matching topcoat.

Topcoat: Stain, exterior, water based, solid hide, MPI #16.

INTERIOR WOOD -FINISH-SYSTEM SCHEDULE

EEEEEE. Wood Substrates: Glued-laminated construction.

253. Solid-Color Latex Stain System MPI INT 6.1T:

rrrrr. Prime Coat: Stain, exterior, water based, solid hide, matching topcoat.

Topcoat: Stain, exterior, water based, solid hide, MPI #16.

Semitransparent Stain System MPI INT 6.1G:

sssss. Prime Coat: Stain, semitransparent, matching topcoat.

Topcoat: Stain, semitransparent, for interior wood, MPI #90.

END OF SECTION

SECTION 9900 – PAINTING

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PART 9 GENERAL

9.19 RELATED DOCUMENTS

FFFFF. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

SUMMARY

GGGGG. This Section includes surface preparation and field painting of the following:

254. Exposed interior items and surfaces.

Surface preparation, priming, and finish coats specified in this Section are in addition to shop priming and surface treatment specified in other Sections.

Paint exposed surfaces, except where the paint schedules indicate that a surface or material is not to be painted or is to remain natural. If the paint schedules do not specifically mention an item or a surface, paint the item or surface the same as similar adjacent materials or surfaces whether or not schedules indicate colors. If the schedules do not indicate color or finish, the Owner's Representative will select from standard colors and finishes available.

255. Painting includes field painting of exposed bare and covered pipes and ducts (including color coding), hangers, exposed steel and iron work, and primed metal surfaces of mechanical and electrical equipment.

Do not paint prefinished items, concealed surfaces, finished metal surfaces, operating parts, and labels.

256. Prefinished items include the following factory-finished components:

tttt. Architectural woodwork and casework.

Elevator equipment.

Finished mechanical and electrical equipment.

Light fixtures.

Distribution cabinets.

Concealed surfaces include walls or ceilings in the following generally inaccessible spaces:

uuuuu. Ceiling plenums.

Finished metal surfaces include the following:

vvvvv. Anodized aluminum

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wwwww. Stainless steel

xxxxx. Chromium plate

yyyyy. Copper

zzzzz. Bronze and brass

Operating parts include moving parts of operating equipment and the following:

aaaaa. Valve and damper operators

bbbbb. Linkages

ccccc. Sensing devices

ddddd. Motor and fan shafts

Labels:

Do not paint over Underwriters Laboratories (UL), Factory Mutual (FM), or other code required labels or equipment name, identification, performance rating, or nomenclature plates.

Related Sections include the following:

257. Division 5 Section "Structural Steel" for shop priming structural steel

258. Division 5 Section "Metal Fabrications" for shop priming ferrous metal

259. Division 6 Section "Interior Architectural Woodwork" for shop priming interior architectural woodwork

260. Division 8 Section "Steel Frames" for shop priming steel doors and frames

261. Division 9 Section "Gypsum Board Assemblies" for surface preparation for gypsum board

DEFINITIONS

HHHHH. General:

Standard coating terms defined in ASTM D 16 apply to this Section.

262. Flat refers to a lusterless or matte finish with a gloss range below 15 when measured at an 85-degree meter.

263. Eggshell refers to low-sheen finish with a gloss range between 5 and 20 when measured at a 60-degree meter.

264. Satin refers to low-sheen finish with a gloss range between 15 and 35 when measured at a 60-degree meter.

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265. Semi-gloss refers to medium-sheen finish with a gloss range between 30 and 65 when measured at a 60-degree meter.

266. Full gloss refers to high-sheen finish with a gloss range more than 65 when measured at a 60- degree meter.

SUBMITTALS

IIII. Product Data:

For each paint system specified. Include block fillers and primers.

267. Material List:

Provide an inclusive list of required coating materials. Indicate each material and cross-reference specific coating, finish system, and application. Identify each material by manufacturer's catalog number and general classification.

Manufacturer's Information:

Provide manufacturer's technical information, including label analysis and instructions for handling, storing, and applying each coating material proposed for use.

Certification by the manufacturer that products supplied comply with local regulations controlling use of volatile organic compounds (VOCs).

Samples for Verification:

Of each color and material to be applied, with texture to simulate actual conditions.

Qualification Data:

For firms and persons specified in the "Quality Assurance" Article to demonstrate their capabilities and experience. Include lists of completed projects with project names and addresses, names and addresses of Owner's Representative and owners, and other information specified.

QUALITY ASSURANCE

JJJJ. Applicator Qualifications:

Engage an experienced applicator who has completed painting system applications similar in material and extent to that indicated for this Project with a record of successful in- service performance.

Source Limitations:

Obtain block fillers, primers, and undercoat materials for each coating system from the same manufacturer as the finish coats.

DELIVERY, STORAGE, AND HANDLING

KKKKK. Deliver materials to the Project Site in manufacturer's original, unopened packages and containers bearing manufacturer's name and label, and the following information:

268. Product name or title of material

269. Product description (generic classification or binder type)

270. Manufacturer's stock number and date of manufacture

271. Contents by volume, for pigment and vehicle constituents

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272. Thinning instructions

273. Application instructions

274. Color name and number

275. VOC content

Store materials not in use in tightly covered containers in a well-ventilated area. Maintain containers used in storage in a clean condition, free of foreign materials and residue.

276. Keep storage area neat and orderly. Remove oily rags and waste daily. Take necessary measures to ensure that workers and work areas are protected from fire and health hazards resulting from handling, mixing, and application.

PROJECT CONDITIONS

LLLLL. Apply water-based paints only when the temperature of surfaces to be painted and surrounding air temperatures are below 90°F (32°C).

MMMMM. Apply solvent-thinned paints only when the temperature of surfaces to be painted and surrounding air temperatures are below 95°F (35°C).

NNNNN. Do not apply paint when the relative humidity exceeds 85 percent; or at temperatures less than 5°F (3°C) above the dew point; or to damp or wet surfaces.

277. Painting may continue during inclement weather if surfaces and areas to be painted are enclosed and within temperature limits specified by manufacturer during application and drying periods.

EXTRA MATERIALS

OOOOO. Furnish extra paint materials from the same production run as the materials applied in the quantities described below. Package paint materials in unopened, factory-sealed containers for storage and identify with labels describing contents. Deliver extra materials to the Owner.

278. Quantity:

Furnish the Owner with a 1-gallon can of each type of finish coat of each color, taken from lots furnished for the work.

- PRODUCTS

9.20 MANUFACTURERS

PPPPP. Available Products:

Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, products listed in the paint schedules.

Manufacturers Names:

The following manufacturers are referred to in the paint schedules by use of shortened versions of their names, which are shown in parentheses:

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279. Devoe & Reynolds Co. (Devoe).

Fuller-O'Brien Paints (Fuller).

Glidden Co. (The) (Glidden).

Benjamin Moore & Co. (Moore).

PPG Industries, Inc. (PPG).

Pratt & Lambert, Inc. (P & L).

Sherwin-Williams Co. (S-W).

Martin Seymour Co. (MS).

PAINT MATERIALS, GENERAL

QQQQQ. Material Compatibility:

Provide block fillers, primers, undercoats, and finish-coat materials that are compatible with one another and the substrates indicated under conditions of service and application, as demonstrated by manufacturer based on testing and field experience.

Material Quality:

Provide manufacturer's best-quality paint material of the various coating types specified. Paint-material containers not displaying manufacturer's product identification will not be acceptable.

280. Proprietary Names:

Use of manufacturer's proprietary product names to designate colors or materials is not intended to imply that products named are required to be used to the exclusion of equivalent products of other manufacturers. Furnish manufacturer's material data and certificates of performance for proposed substitutions.

Colors:

Match colors indicated by reference to manufacturer's color designations.

- EXECUTION

9.21 EXAMINATION

RRRRR. Examine substrates, areas, and conditions, with the Applicator present, under which painting will be performed for compliance with paint application requirements.

281. Do not begin to apply paint until unsatisfactory conditions have been corrected and surfaces receiving paint are thoroughly dry.

282. Start of painting will be construed as the Applicator's acceptance of surfaces and conditions within a particular area.

Coordination of Work:

Review other Sections in which primers are provided to ensure compatibility of the total system for various substrates. On request, furnish information on characteristics of finish materials to ensure use of compatible primers.

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283. Notify the Owner's Representative about anticipated problems using the materials specified over substrates primed by others.

PREPARATION

SSSSS. General:

Remove hardware and hardware accessories, plates, machined surfaces, lighting fixtures, and similar items already installed that are not to be painted. If removal is impractical or impossible because of the size or weight of the item, provide surface-applied protection before surface preparation and painting.

284. After completing painting operations in each space or area, reinstall items removed using workers skilled in the trades involved.

Cleaning:

Before applying paint or other surface treatments, clean the substrates of substances that could impair the bond of the various coatings. Remove oil and grease before cleaning.

285. Schedule cleaning and painting so dust and other contaminants from the cleaning process will not fall on wet, newly painted surfaces.

Surface Preparation:

Clean and prepare surfaces to be painted according to manufacturer's written instructions for each particular substrate condition and as specified.

286. Provide barrier coats over incompatible primers or remove and re-prime.

Ferrous Metals:

Clean un-galvanized ferrous metal surfaces that have not been shop coated; remove oil, grease, dirt, loose mill scale, and other foreign substances. Use solvent or mechanical cleaning methods that comply with the Steel Structures Painting Council's (SSPC) recommendations.

- eeeeee. Blast steel surfaces clean as recommended by paint system manufacturer and according to requirements of SSPC-SP 10.

- ffffff. Treat bare and sandblasted or pickled clean metal with a metal treatment wash coat before priming.

- gggggg. Touch up bare areas and shop-applied prime coats that have been damaged. Wire-brush, clean with solvents recommended by paint manufacturer, and touch up with the same primer as the shop coat.

Galvanized Surfaces:

Clean galvanized surfaces with nonpetroleum-based solvents so surface is free of oil and surface contaminants. Remove pretreatment from galvanized sheet metal fabricated from coil stock by mechanical methods.

Materials Preparation:

Mix and prepare paint materials according to manufacturer's written instructions.

287. Maintain containers used in mixing and applying paint in a clean condition, free of foreign materials and residue.

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Stir material before application to produce a mixture of uniform density. Stir as required during application. Do not stir surface film into material. If necessary, remove surface film and strain material before using.

Use only thinners approved by paint manufacturer and only within recommended limits.

Tinting:

Tint each undercoat a lighter shade to simplify identification of each coat when multiple coats of the same material are applied. Tint undercoats to match the color of the finish coat, but provide sufficient differences in shade of undercoats to distinguish each separate coat.

APPLICATION

TTTTT. General:

Apply paint according to manufacturer's written instructions. Use applicators and techniques best suited for substrate and type of material being applied.

288. Paint colors, surface treatments, and finishes are indicated in the schedules.

289. Do not paint over dirt, rust, scale, grease, moisture, scuffed surfaces, or conditions detrimental to formation of a durable paint film.

290. Provide finish coats that are compatible with primers used.

291. The term "exposed surfaces" includes areas visible when permanent or built-in fixtures, convactor covers, covers for finned-tube radiation, grilles, and similar components are in place. Extend coatings in these areas, as required, to maintain the system integrity and provide desired protection.

292. Paint surfaces behind movable equipment and furniture the same as similar exposed surfaces. Before the final installation of equipment, paint surfaces behind permanently fixed equipment or furniture with prime coat only.

293. Paint back sides of access panels and removable or hinged covers to match exposed surfaces.

294. Finish exterior doors on tops, bottoms, and side edges the same as exterior faces.

295. Sand lightly between each succeeding enamel or varnish coat.

Scheduling Painting:

Apply first coat to surfaces that have been cleaned, pretreated, or otherwise prepared for painting as soon as practicable after preparation and before subsequent surface deterioration.

296. The number of coats and the film thickness required are the same regardless of application method. Do not apply succeeding coats until the previous coat has cured as recommended by the manufacturer. If sanding is required to produce a smooth, even surface according to manufacturer's written instructions, sand between applications.

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Omit primer on metal surfaces that have been shop primed and touch up painted.

If undercoats, stains, or other conditions show through final coat of paint, apply additional coats until paint film is of uniform finish, color, and appearance. Give special attention to ensure edges, corners, crevices, welds, and exposed fasteners receive a dry film thickness equivalent to that of flat surfaces.

Allow sufficient time between successive coats to permit proper drying. Do not recoat surfaces until paint has dried to where it feels firm, does not deform or feel sticky under moderate thumb pressure, and where application of another coat of paint does not cause the undercoat to lift or lose adhesion.

Application Procedures:

Apply paints and coatings by brush, roller, spray, or other applicators according to manufacturer's written instructions.

297. Brushes:

Use brushes best suited for the type of material applied. Use brush of appropriate size for the surface or item being painted.

Rollers:

Use rollers of carpet, velvet back, or high-pile sheep's wool as recommended by the manufacturer for the material and texture required.

Spray Equipment:

Use airless spray equipment with orifice size as recommended by the manufacturer for the material and texture required.

Minimum Coating Thickness:

Apply paint materials no thinner than manufacturers recommended spreading rate. Provide the total dry film thickness of the entire system as recommended by the manufacturer.

Mechanical and Electrical Work:

Painting of mechanical and electrical work is limited to items exposed in equipment rooms and in occupied spaces.

Mechanical items to be painted include, but are not limited to, the following:

298. Piping, pipe hangers, and supports

299. Equipment supports

300. Accessory items

Electrical items to be painted include, but are not limited to, the following:

301. Conduit and fittings

Prime Coats:

Before applying finish coats, apply a prime coat of material, as recommended by the manufacturer, to material that is required to be painted or finished and that has not been prime coated by others. Recoat primed and sealed surfaces where evidence of suction spots or unsealed areas in first coat appears, to ensure a finish coat with no burn through or other defects due to insufficient sealing.

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Pigmented (Opaque) Finishes:

Completely cover surfaces as necessary to provide a smooth, opaque surface of uniform finish, color, appearance, and coverage. Cloudiness, spotting, holidays, laps, brush marks, runs, sags, ropiness, or other surface imperfections will not be acceptable.

Transparent (Clear) Finishes:

Use multiple coats to produce a glass-smooth surface film of even luster. Provide a finish free of laps, runs, cloudiness, color irregularity, brush marks, orange peel, nail holes, or other surface imperfections.

302. Provide satin finish for final coats.

Completed Work:

Match approved samples for color, texture, and coverage. Remove, refinish, or repaint work not complying with requirements.

CLEANING

UUUUU. Cleanup:

At the end of each workday, remove empty cans, rags, rubbish, and other discarded paint materials from the site.

303. After completing painting, clean glass and paint-spattered surfaces. Remove spattered paint by washing and scraping. Be careful not to scratch or damage adjacent finished surfaces.

PROTECTION

VVVVV. Protect work of other trades, whether being painted or not, against damage by painting. Correct damage by cleaning, repairing or replacing, and repainting, as approved by Owner's Representative.

WWWWW. Provide "Wet Paint" signs to protect newly painted finishes. Remove temporary protective wrappings provided by others to protect their work after completing painting operations.

304. At completion of construction activities of other trades, touch up and restore damaged or defaced painted surfaces. Comply with procedures specified in PDCA Pl.

EXTERIOR PAINT SCHEDULE

XXXXX. Ferrous Metal:

Provide the following finish systems over exterior ferrous metal. Primer is not required on shop-primed items.

305. Semi-gloss, Acrylic-Enamel Finish: 2 finish coats over a rust-inhibitive primer.

hhhhh. Primer:

Rust-inhibitive metal primer applied at spreading rate recommended by the manufacturer to achieve a total dry film thickness of not less than 1.3 mils (0.033 mm).

First and Second Coats:

Semi-gloss, exterior, acrylic-latex enamel applied at spreading rate recommended by the manufacturer to achieve a total dry film thickness of not less than 2.6 mils (0.066 mm).

SECTION 9900 – PAINTING

GOVERNMENT OF THE U. S. VIRGIN ISLANDS, DEPARTMENT OF PUBLIC WORKS

PROJECT NAME: Elaine I. Sprauve Public Library and Museum Building

Project Location, St. John, U.S. Virgin Islands

INTERIOR PAINT SCHEDULE

YYYYYY. Gypsum Board:

Provide the following finish systems over interior gypsum board surfaces:

306. Flat Acrylic Finish: 2 finish coats over a primer

Primer:

Latex-based, mildew inhibiting interior primer, such as Kilz2 or approved equal, applied at spreading rate recommended by the manufacturer to achieve a total dry film thickness of not less than 1.2 mils (0.031 mm).

Use only thinners approved by paint manufacturer and only within the recommended limits.

First and Second Coats:

Flat, acrylic-latex-based, interior paint applied at spreading rate recommended by the manufacturer to achieve a total dry film thickness of not less than 2.5 mils (0.064 mm).

Ferrous Metal:

Provide the following finish systems over ferrous metal:

307. Semi-gloss, Acrylic-Enamel Finish: One finish coat over an enamel undercoat and a primer

iiiii. Primer:

Quick-drying, rust-inhibitive, alkyd-based or epoxy-metal primer, as recommended by the manufacturer for this substrate, applied at spreading rate recommended by the manufacturer to achieve a total dry film thickness of not less than 1.5 mils (0.038 mm).

Undercoat:

Alkyd, interior enamel undercoat or semi-gloss, acrylic-latex, interior enamel, as recommended by the manufacturer for this substrate, applied at spreading rate recommended by the manufacturer to achieve a total dry film thickness of not less than 1.3 mils (0.033 mm).

Finish Coat:

Semi-gloss, acrylic-latex, interior enamel applied at spreading rate recommended by the manufacturer to achieve a total dry film thickness of not less than 1.3 mils (0.033 mm).

Zinc-Coated Metal:

Provide the following finish systems over zinc-coated metal:

308. Semi-gloss, Acrylic-Enamel Finish: 2 finish coats over a primer

jjjjj. Primer:

Galvanized metal primer applied at spreading rate recommended by the manufacturer to achieve a total dry film thickness of not less than 1.2 mils (0.031 mm).

First and Second Coats:

Semi-gloss, acrylic-latex, interior enamel applied at spreading rate recommended by the manufacturer to achieve a total dry film thickness of not less than 2.6 mils (0.066 mm).

Tinting:

Tint each undercoat a lighter shade to simplify identification of each coat when multiple coats of the same material are being applied. Tint undercoats to match the color of the finish coat, but provide sufficient difference in shade of undercoats to distinguish each separate coat.

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END OF SECTION

SECTION 9900 – PAINTING

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PART 10 • GENERAL

10.22 RELATED DOCUMENTS

ZZZZZ. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

SUMMARY

AAAAAA. This Section includes surface preparation and field painting of the following:

309. Exposed interior items and surfaces.

Surface preparation, priming, and finish coats specified in this Section are in addition to shop priming and surface treatment specified in other Sections.

Paint exposed surfaces, except where the paint schedules indicate that a surface or material is not to be painted or is to remain natural. If the paint schedules do not specifically mention an item or a surface, paint the item or surface the same as similar adjacent materials or surfaces whether or not schedules indicate colors. If the schedules do not indicate color or finish, the Owner's Representative will select from standard colors and finishes available.

310. Painting includes field painting of exposed bare and covered pipes and ducts (including color coding), hangers, exposed steel and iron work, and primed metal surfaces of mechanical and electrical equipment.

Do not paint prefinished items, concealed surfaces, finished metal surfaces, operating parts, and labels.

311. Prefinished items include the following factory-finished components:

kkkkkk. Architectural woodwork and casework.

Elevator equipment.

Finished mechanical and electrical equipment.

Light fixtures.

Distribution cabinets.

Concealed surfaces include walls or ceilings in the following generally inaccessible spaces:

llllll. Ceiling plenums.

Finished metal surfaces include the following:

mmmmmm. Anodized aluminum

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nnnnnn. Stainless steel

oooooo. Chromium plate

pppppp. Copper

qqqqqq. Bronze and brass

Operating parts include moving parts of operating equipment and the following:

rrrrr. Valve and damper operators

sssss. Linkages

ttttt. Sensing devices

uuuuuu. Motor and fan shafts

Labels:

Do not paint over Underwriters Laboratories (UL), Factory Mutual (FM), or other code required labels or equipment name, identification, performance rating, or nomenclature plates.

Related Sections include the following:

312. Division 5 Section "Structural Steel" for shop priming structural steel

313. Division 5 Section "Metal Fabrications" for shop priming ferrous metal

314. Division 6 Section "Interior Architectural Woodwork" for shop priming interior architectural woodwork

315. Division 8 Section "Steel Frames" for shop priming steel doors and frames

316. Division 9 Section "Gypsum Board Assemblies" for surface preparation for gypsum board

DEFINITIONS

BBBBBB. General:

Standard coating terms defined in ASTM D 16 apply to this Section.

317. Flat refers to a lusterless or matte finish with a gloss range below 15 when measured at an 85-degree meter.

318. Eggshell refers to low-sheen finish with a gloss range between 5 and 20 when measured at a 60-degree meter.

319. Satin refers to low-sheen finish with a gloss range between 15 and 35 when measured at a 60-degree meter.

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320. Semi-gloss refers to medium-sheen finish with a gloss range between 30 and 65 when measured at a 60-degree meter.

321. Full gloss refers to high-sheen finish with a gloss range more than 65 when measured at a 60- degree meter.

SUBMITTALS

CCCCC. Product Data:

For each paint system specified. Include block fillers and primers.

322. Material List:

Provide an inclusive list of required coating materials. Indicate each material and cross-reference specific coating, finish system, and application. Identify each material by manufacturer's catalog number and general classification.

Manufacturer's Information:

Provide manufacturer's technical information, including label analysis and instructions for handling, storing, and applying each coating material proposed for use.

Certification by the manufacturer that products supplied comply with local regulations controlling use of volatile organic compounds (VOCs).

Samples for Verification:

Of each color and material to be applied, with texture to simulate actual conditions.

Qualification Data:

For firms and persons specified in the "Quality Assurance" Article to demonstrate their capabilities and experience. Include lists of completed projects with project names and addresses, names and addresses of Owner's Representative and owners, and other information specified.

QUALITY ASSURANCE

DDDDDD. Applicator Qualifications:

Engage an experienced applicator who has completed painting system applications similar in material and extent to that indicated for this Project with a record of successful in- service performance.

Source Limitations:

Obtain block fillers, primers, and undercoat materials for each coating system from the same manufacturer as the finish coats.

DELIVERY, STORAGE, AND HANDLING

EEEEEE. Deliver materials to the Project Site in manufacturer's original, unopened packages and containers bearing manufacturer's name and label, and the following information:

323. Product name or title of material

324. Product description (generic classification or binder type)

325. Manufacturer's stock number and date of manufacture

326. Contents by volume, for pigment and vehicle constituents

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327. Thinning instructions

328. Application instructions

329. Color name and number

330. VOC content

Store materials not in use in tightly covered containers in a well-ventilated area. Maintain containers used in storage in a clean condition, free of foreign materials and residue.

331. Keep storage area neat and orderly. Remove oily rags and waste daily. Take necessary measures to ensure that workers and work areas are protected from fire and health hazards resulting from handling, mixing, and application.

PROJECT CONDITIONS

FFFFFF. Apply water-based paints only when the temperature of surfaces to be painted and surrounding air temperatures are below 90°F (32°C).

GGGGGG. Apply solvent-thinned paints only when the temperature of surfaces to be painted and surrounding air temperatures are below 95°F (35°C).

HHHHHH. Do not apply paint when the relative humidity exceeds 85 percent; or at temperatures less than 5°F (3°C) above the dew point; or to damp or wet surfaces.

332. Painting may continue during inclement weather if surfaces and areas to be painted are enclosed and within temperature limits specified by manufacturer during application and drying periods.

EXTRA MATERIALS

IIIIII. Furnish extra paint materials from the same production run as the materials applied in the quantities described below. Package paint materials in unopened, factory-sealed containers for storage and identify with labels describing contents. Deliver extra materials to the Owner.

333. Quantity:

Furnish the Owner with a 1-gallon can of each type of finish coat of each color, taken from lots furnished for the work.

- PRODUCTS

10.23 MANUFACTURERS

JJJJJJ. Available Products:

Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, products listed in the paint schedules.

Manufacturers Names:

The following manufacturers are referred to in the paint schedules by use of shortened versions of their names, which are shown in parentheses:

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334. Devoe & Raynolds Co. (Devoe).

Fuller-O'Brien Paints (Fuller).

Glidden Co. (The) (Glidden).

Benjamin Moore & Co. (Moore).

PPG Industries, Inc. (PPG).

Pratt & Lambert, Inc. (P & L).

Sherwin-Williams Co. (S-W).

Martin Seymour Co. (MS).

PAINT MATERIALS, GENERAL

KKKKKK. Material Compatibility:

Provide block fillers, primers, undercoats, and finish-coat materials that are compatible with one another and the substrates indicated under conditions of service and application, as demonstrated by manufacturer based on testing and field experience.

Material Quality:

Provide manufacturer's best-quality paint material of the various coating types specified. Paint-material containers not displaying manufacturer's product identification will not be acceptable.

335. Proprietary Names:

Use of manufacturer's proprietary product names to designate colors or materials is not intended to imply that products named are required to be used to the exclusion of equivalent products of other manufacturers. Furnish manufacturer's material data and certificates of performance for proposed substitutions.

Colors:

Match colors indicated by reference to manufacturer's color designations.

- EXECUTION

10.24 EXAMINATION

LLLLLL. Examine substrates, areas, and conditions, with the Applicator present, under which painting will be performed for compliance with paint application requirements.

336. Do not begin to apply paint until unsatisfactory conditions have been corrected and surfaces receiving paint are thoroughly dry.

337. Start of painting will be construed as the Applicator's acceptance of surfaces and conditions within a particular area.

Coordination of Work:

Review other Sections in which primers are provided to ensure compatibility of the total system for various substrates. On request, furnish information on characteristics of finish materials to ensure use of compatible primers.

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338. Notify the Owner's Representative about anticipated problems using the materials specified over substrates primed by others.

PREPARATION

MMMMMM. General:

Remove hardware and hardware accessories, plates, machined surfaces, lighting fixtures, and similar items already installed that are not to be painted. If removal is impractical or impossible because of the size or weight of the item, provide surface-applied protection before surface preparation and painting.

339. After completing painting operations in each space or area, reinstall items removed using workers skilled in the trades involved.

Cleaning:

Before applying paint or other surface treatments, clean the substrates of substances that could impair the bond of the various coatings. Remove oil and grease before cleaning.

340. Schedule cleaning and painting so dust and other contaminants from the cleaning process will not fall on wet, newly painted surfaces.

Surface Preparation:

Clean and prepare surfaces to be painted according to manufacturer's written instructions for each particular substrate condition and as specified.

341. Provide barrier coats over incompatible primers or remove and re-prime.

Ferrous Metals:

Clean un-galvanized ferrous metal surfaces that have not been shop coated; remove oil, grease, dirt, loose mill scale, and other foreign substances. Use solvent or mechanical cleaning methods that comply with the Steel Structures Painting Council's (SSPC) recommendations.

- vvvvvv. Blast steel surfaces clean as recommended by paint system manufacturer and according to requirements of SSPC-SP 10.

- wwwwww. Treat bare and sandblasted or pickled clean metal with a metal treatment wash coat before priming.

- xxxxxx. Touch up bare areas and shop-applied prime coats that have been damaged.

Wire-brush, clean with solvents recommended by paint manufacturer, and touch up with the same primer as the shop coat.

Galvanized Surfaces:

Clean galvanized surfaces with nonpetroleum-based solvents so surface is free of oil and surface contaminants. Remove pretreatment from galvanized sheet metal fabricated from coil stock by mechanical methods.

Materials Preparation:

Mix and prepare paint materials according to manufacturer's written instructions.

342. Maintain containers used in mixing and applying paint in a clean condition, free of foreign materials and residue.

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Stir material before application to produce a mixture of uniform density. Stir as required during application. Do not stir surface film into material. If necessary, remove surface film and strain material before using.

Use only thinners approved by paint manufacturer and only within recommended limits.

Tinting:

Tint each undercoat a lighter shade to simplify identification of each coat when multiple coats of the same material are applied. Tint undercoats to match the color of the finish coat, but provide sufficient differences in shade of undercoats to distinguish each separate coat.

APPLICATION

NNNNNN.General:

Apply paint according to manufacturer's written instructions. Use applicators and techniques best suited for substrate and type of material being applied.

343. Paint colors, surface treatments, and finishes are indicated in the schedules.

344. Do not paint over dirt, rust, scale, grease, moisture, scuffed surfaces, or conditions detrimental to formation of a durable paint film.

345. Provide finish coats that are compatible with primers used.

346. The term "exposed surfaces" includes areas visible when permanent or built-in fixtures, convactor covers, covers for finned-tube radiation, grilles, and similar components are in place. Extend coatings in these areas, as required, to maintain the system integrity and provide desired protection.

347. Paint surfaces behind movable equipment and furniture the same as similar exposed surfaces. Before the final installation of equipment, paint surfaces behind permanently fixed equipment or furniture with prime coat only.

348. Paint back sides of access panels and removable or hinged covers to match exposed surfaces.

349. Finish exterior doors on tops, bottoms, and side edges the same as exterior faces.

350. Sand lightly between each succeeding enamel or varnish coat.

Scheduling Painting:

Apply first coat to surfaces that have been cleaned, pretreated, or otherwise prepared for painting as soon as practicable after preparation and before subsequent surface deterioration.

351. The number of coats and the film thickness required are the same regardless of application method. Do not apply succeeding coats until the previous coat has cured as recommended by the manufacturer. If sanding is required to produce a smooth, even surface according to manufacturer's written instructions, sand between applications.

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Omit primer on metal surfaces that have been shop primed and touch up painted.

If undercoats, stains, or other conditions show through final coat of paint, apply additional coats until paint film is of uniform finish, color, and appearance. Give special attention to ensure edges, corners, crevices, welds, and exposed fasteners receive a dry film thickness equivalent to that of flat surfaces.

Allow sufficient time between successive coats to permit proper drying. Do not recoat surfaces until paint has dried to where it feels firm, does not deform or feel sticky under moderate thumb pressure, and where application of another coat of paint does not cause the undercoat to lift or lose adhesion.

Application Procedures:

Apply paints and coatings by brush, roller, spray, or other applicators according to manufacturer's written instructions.

352. Brushes:

Use brushes best suited for the type of material applied. Use brush of appropriate size for the surface or item being painted.

Rollers:

Use rollers of carpet, velvet back, or high-pile sheep's wool as recommended by the manufacturer for the material and texture required.

Spray Equipment:

Use airless spray equipment with orifice size as recommended by the manufacturer for the material and texture required.

Minimum Coating Thickness:

Apply paint materials no thinner than manufacturers recommended spreading rate. Provide the total dry film thickness of the entire system as recommended by the manufacturer.

Mechanical and Electrical Work:

Painting of mechanical and electrical work is limited to items exposed in equipment rooms and in occupied spaces.

Mechanical items to be painted include, but are not limited to, the following:

353. Piping, pipe hangers, and supports

354. Equipment supports

355. Accessory items

Electrical items to be painted include, but are not limited to, the following:

356. Conduit and fittings

Prime Coats:

Before applying finish coats, apply a prime coat of material, as recommended by the manufacturer, to material that is required to be painted or finished and that has not been prime coated by others. Recoat primed and sealed surfaces where evidence of suction spots or unsealed areas in first coat appears, to ensure a finish coat with no burn through or other defects due to insufficient sealing.

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Pigmented (Opaque) Finishes:

Completely cover surfaces as necessary to provide a smooth, opaque surface of uniform finish, color, appearance, and coverage. Cloudiness, spotting, holidays, laps, brush marks, runs, sags, ropiness, or other surface imperfections will not be acceptable.

Transparent (Clear) Finishes:

Use multiple coats to produce a glass-smooth surface film of even luster. Provide a finish free of laps, runs, cloudiness, color irregularity, brush marks, orange peel, nail holes, or other surface imperfections.

357. Provide satin finish for final coats.

Completed Work:

Match approved samples for color, texture, and coverage. Remove, refinish, or repaint work not complying with requirements.

CLEANING

OOOOOO.Cleanup:

At the end of each workday, remove empty cans, rags, rubbish, and other discarded paint materials from the site.

358. After completing painting, clean glass and paint-spattered surfaces. Remove spattered paint by washing and scraping. Be careful not to scratch or damage adjacent finished surfaces.

PROTECTION

PPPPPP. Protect work of other trades, whether being painted or not, against damage by painting. Correct damage by cleaning, repairing or replacing, and repainting, as approved by Owner's Representative.

QQQQQQ.Provide "Wet Paint" signs to protect newly painted finishes. Remove temporary protective wrappings provided by others to protect their work after completing painting operations.

359. At completion of construction activities of other trades, touch up and restore damaged or defaced painted surfaces. Comply with procedures specified in PDCA Pl.

EXTERIOR PAINT SCHEDULE

RRRRRR. Ferrous Metal:

Provide the following finish systems over exterior ferrous metal. Primer is not required on shop-primed items.

360. Semi-gloss, Acrylic-Enamel Finish: 2 finish coats over a rust-inhibitive primer.

yyyyyy. Primer:

Rust-inhibitive metal primer applied at spreading rate recommended by the manufacturer to achieve a total dry film thickness of not less than 1.3 mils (0.033 mm).

First and Second Coats:

Semi-gloss, exterior, acrylic-latex enamel applied at spreading rate recommended by the manufacturer to achieve a total dry film thickness of not less than 2.6 mils (0.066 mm).

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INTERIOR PAINT SCHEDULE

SSSSSS. Gypsum Board:

Provide the following finish systems over interior gypsum board surfaces:

361. Flat Acrylic Finish: 2 finish coats over a primer

Primer:

Latex-based, mildew inhibiting interior primer, such as Kilz2 or approved equal, applied at spreading rate recommended by the manufacturer to achieve a total dry film thickness of not less than 1.2 mils (0.031 mm).

Use only thinners approved by paint manufacturer and only within the recommended limits.

First and Second Coats:

Flat, acrylic-latex-based, interior paint applied at spreading rate recommended by the manufacturer to achieve a total dry film thickness of not less than 2.5 mils (0.064 mm).

Ferrous Metal:

Provide the following finish systems over ferrous metal:

362. Semi-gloss, Acrylic-Enamel Finish: One finish coat over an enamel undercoat and a primer

zzzzzz. Primer:

Quick-drying, rust-inhibitive, alkyd-based or epoxy-metal primer, as recommended by the manufacturer for this substrate, applied at spreading rate recommended by the manufacturer to achieve a total dry film thickness of not less than 1.5 mils (0.038 mm).

Undercoat:

Alkyd, interior enamel undercoat or semi-gloss, acrylic-latex, interior enamel, as recommended by the manufacturer for this substrate, applied at spreading rate recommended by the manufacturer to achieve a total dry film thickness of not less than 1.3 mils (0.033 mm).

Finish Coat:

Semi-gloss, acrylic-latex, interior enamel applied at spreading rate recommended by the manufacturer to achieve a total dry film thickness of not less than 1.3 mils (0.033 mm).

Zinc-Coated Metal:

Provide the following finish systems over zinc-coated metal:

363. Semi-gloss, Acrylic-Enamel Finish: 2 finish coats over a primer

aaaaaa. Primer:

Galvanized metal primer applied at spreading rate recommended by the manufacturer to achieve a total dry film thickness of not less than 1.2 mils (0.031 mm).

First and Second Coats:

Semi-gloss, acrylic-latex, interior enamel applied at spreading rate recommended by the manufacturer to achieve a total dry film thickness of not less than 2.6 mils (0.066 mm).

Tinting:

Tint each undercoat a lighter shade to simplify identification of each coat when multiple coats of the same material are being applied. Tint undercoats to match the color of the finish coat, but provide sufficient difference in shade of undercoats to distinguish each separate coat.

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END OF SECTION

DIVISION 10 – SPECIALTIES

GOVERNMENT OF THE U. S. VIRGIN ISLANDS, DEPARTMENT OF PUBLIC WORKS

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GENERAL

RELATED DOCUMENTS

Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

Specifications throughout all Divisions of the Project Manual are directly applicable to this Section, and this Section is directly applicable to them.

REFERENCE STANDARDS

A. The latest published edition of a reference shall be applicable to this Project unless identified by a specific edition date.

All reference amendments adopted prior to the effective date of this Contract shall be applicable to this Project.

All materials, installation and workmanship shall comply with all applicable requirements and standards.

QUALITY ASSURANCE

A. Installer Qualifications: Engage an experienced Installer who is an authorized representative of the manufacturer for both installation and maintenance of the type of markerboard units required for this Project.

Maintenance Proximity: Not more than four hours normal travel time from the Installer's place of business to the Project Site.

Fire Performance Characteristics: Provide fabric faced tackboards with surface burning characteristics indicated below, as determined by testing assembled materials composed of facings and backings identical to those required in this section, in accordance with ASTM E 84, by a testing organization acceptable to authorities having jurisdiction.

Flame Spread: 25 or less

Smoke Developed: 10 or less

Design Criteria:

The Drawings indicate sizes, profiles, and dimensional requirements of visual display boards. Other visual display boards having equal performance characteristics with deviations from indicated dimensions and profiles may be considered, provided that deviations do not change the design concept or intended performance. The burden of proof of equality is on the proposer.

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The Drawings indicate sizes, profiles, and dimensional requirements of visual display boards and are based on the specific type and model indicated. Other visual display boards having equal performance characteristics by other manufacturers may be considered, provided that deviations in dimensions and profiles are minor and do not change the design concept or intended performance as judged by the Architect. The burden of proof of equality is on the proposer.

SUBMITTALS

A. Product Data:

1. Submit manufacturer's product data and installation/maintenance instructions for all manufactured products and materials.

Include motor capacities, and individual panel weights for sliding markerboard or markerboard units. Include manufacturer's data substantiating that tackboard materials comply with requirements indicated.

In lieu of laboratory test reports, when permitted by the Architect, submit the manufacturer's certification that fabric faced cork tackboard materials furnished comply with requirements specified for flame spread ratings.

Samples:

1. Provide samples of each product for initial selection of colors, patterns, and textures, as required, and for verification of compliance with requirements indicated.

Samples for initial selection of color, pattern, and texture:

Porcelain Enamel Markerboard: Manufacturer's color charts consisting of actual sections of porcelain enamel finish showing the full range of colors available for each type of markerboard required.

Fabric faced Cork Tackboards: Manufacturer's color charts consisting of actual sections of fabric, showing the full range of colors, textures, and patterns available for each type of fabric faced cork tackboard indicated.

Cork Tackboards: Manufacturer's color charts consisting of actual sections of cork, showing the full range of colors, textures, and patterns available for each type of cork tackboard indicated.

Aluminum Trim and Accessories: Samples of each finish type and color, on 6-inch-long sections of extrusions and not less than 4 inch squares of sheet or plate, showing the full range of colors available.

Samples for verification of color, pattern, and texture selected, and compliance with requirements indicated.

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Markerboards, and Tackboards: Sample panels not less than 8-1/2 inches by 11 inches for each type of markerboard and tackboard indicated. Include a sample panel for each color, texture, and pattern required.

Aluminum Trim and Accessories: Samples of each finish type and color, on 6-inch-long sections of extrusions and not less than 4 inch squares of sheet or plate. Where finishes involve normal color and texture variations, include sets showing the full range of variations expected.

Display Track: Samples of each finish type and color, on 6-inch-long sections of extrusions.

Shop Drawings:

1. Provide shop drawings for each type of markerboard and tackboard required. Include sections of typical trim members and dimensioned elevations. Show anchors, grounds, reinforcement, accessories, layout, and installation details.

Wiring diagrams from the manufacturer for motor operated sliding markerboard panels.

Record Documents:

1. Provide record approved product data, samples, shop drawings, and warranties.

WARRANTY

- A. Porcelain Enamel Markerboard Warranty: Furnish the manufacturer's written warranty, agreeing to replace porcelain enamel markerboards that do not retain their original writing and erasing qualities, become slick and shiny, or exhibit crazing, cracking, or flaking, provided the manufacturer's instructions with regard to handling, installation, protection, and maintenance have been followed.

1. Warranty Period: 50 years.

PRODUCTS

GENERAL

- A. All materials shall meet or exceed all applicable referenced standards, federal, state and local requirements, and conform to codes and ordinances of authorities having jurisdiction.

MANUFACTURERS

- A. Subject to compliance with requirements, manufacturers offering products that may be incorporated in the Work include, but are not limited to, the following:
 1. Porcelain Enamel Markerboards:

DIVISION 10 – SPECIALTIES

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PolyVision Corp.

MooreCo /Best Rite Chalkboard Co.

Carolina Chalkboard Co.

Claridge Products and Equipment, Inc.

Weber Costello Co.

Egan Visual, Inc.

Magnetic Marker Boards:

PolyVision Corp.

MooreCo/Best Rite Chalkboard Co.

Claridge Products and Equipment, Inc.

Egan Visual, Inc.

Tackboards:

MooreCo /Best Rite Chalkboard Co.

Carolina Chalkboard Co.

Claridge Products and Equipment, Inc.

Weber Costello Co.

PolyVision Corp.

Egan Visual, Inc.

Display Track:

Egan Visual, Inc.

Horizontal Sliding Units:

MooreCo /Best Rite Chalkboard Co.

Claridge Products and Equipment, Inc.

PolyVision Corp.

Vertical Sliding Units:

Claridge Products and Equipment, Inc.

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.PolyVision

Wall Mounted Conference Units:

MooreCo /Best Rite Chalkboard Co.

Claridge Products and Equipment, Inc.

PolyVision Corp.

Egan Visual, Inc.

MATERIALS

A. Porcelain Enamel Markerboards: Provide balanced, high pressure laminated porcelain enamel markerboards of 3 ply construction consisting of face sheet, core material, and backing.

1. Face Sheet: Provide face sheet of 24 gage enameling grade steel especially processed for temperatures used in coating porcelain on steel. Coat the exposed face and exposed edges with a 3-coat process consisting of primer, ground coat, and color cover coat, and the concealed face with a 2 coat process consisting of primer and ground coat. Fuse cover and ground coats to steel at the manufacturer's standard firing temperatures, but not less than 1200 degrees F (649 degrees C).

Cover Coat: Provide the manufacturer's standard light-colored special writing surface with gloss finish intended for use with liquid felt tipped markers.

Core: Provide the manufacturer's standard 3/8-inch-thick, minimum, particleboard core material complying with the requirements of ANSI A208.1, Grade 1 M 1.

Core: Provide the manufacturer's standard 1/4-inch-thick tempered hardboard core material.

Core: Provide the manufacturer's standard 3/8-inch heavy kraft paper honeycomb core material.

Backing Sheet: Provide the manufacturer's standard 26 gage galvanized steel sheet backing.

Laminating Adhesive: Provide the manufacturer's standard moisture resistant thermoplastic type adhesive.

Magnetic Marker Boards: Provide coated steel marker boards that function as a magnetic bulletin board in addition to providing writing and erasing capabilities when used with liquid felt tipped markers.

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Fabric Faced Tackboards: Provide class A fabric on 1/4-inch-thick cork sheet. Provide fabric that has a flame spread rating of 25 or less when tested in accordance with ASTM E 84. Color and texture shall be as scheduled or as selected from the manufacturer's standards.

1. Backing: Make panels rigid by factory laminating cork face sheet under pressure to 1/4-inch-thick hardboard backing.

Cork Tackboards: Provide cork material face sheet with rigid backing panel. Provide color and texture as scheduled or as selected from the manufacturer's standards.

1. Surface: 1/4 inch thick self-healing natural cork with binder and homogeneous color throughout.

Backing: Make panels rigid by factory laminating cork face sheet under pressure to 1/4-inch-thick hardboard backing.

Display Tracks: Provide extruded wall mounted track for suspension of stationary markerboards and tackboards. Track system shall be designed for use with track mounted products by same manufacturer, and to facilitate easy removal and relocation of these items upon the track.

SLIDING UNITS

A. Horizontal Sliding Panels: Provide horizontal sliding markerboard and tackboard units. Fabricate panels from the manufacturer's standard components. Provide panels that operate smoothly under manual activation without vibration or chatter.

1. Provide the manufacturer's standard horizontal sliding hardware consisting of overhead extruded aluminum track with nylon ball bearing rollers and channel shaped bottom guides.

Vertical Sliding Panels: Provide vertical sliding markerboard and tackboard units. Fabricate units and housing from standard components of the size, thickness, and design required to impart sufficient strength for support of panels independently of support from walls.

1. Equip each sliding panel with ball bearing neoprene end rollers designed and fabricated to produce smooth and easy operation without rattles. Counterbalance each panel equally with lead counterweights on heavy duty aircraft type steel cable over ball bearing sheaves.

Electric Operation: Provide the manufacturer's standard motors of size and capacity recommended for operation of the size of sliding panels indicated. For panels weighing up to 200 pounds, use gear driven motors; for panels weighing over 200 pounds use motors with magnetic brakes to stop moving panel without coasting. Include limit switches for automatic stopping of panels at each end of travel. Coordinate wiring requirements and current characteristics of motors and operating system with the building electrical system.

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Operating Switch: Provide a momentary contact, 2 button operating switch with controls labeled "start" and "stop," located where indicated.

Operating Switch: Provide a constant pressure operating switch located where indicated.

Key Switch: Provide supplementary key switch in addition to the above switch. Furnish 2 keys for each sliding panel unit, keyed alike.

CONFERENCE UNITS

- A. Hinged Conference Units: Provide the manufacturer's standard wall mounted, two door conference unit, fabricated to size indicated, consisting of two door cabinet with perimeter frame, sides, and back, with interior writing surface and tackboard panels and pull-down projection screen. Provide unit completely assembled with concealed hangers. Comply with the following requirements for design and construction:

1. Cabinet: Provide the manufacturer's standard extruded aluminum perimeter frame, clear satin anodized, of profile indicated, with integral map rail and chalktray. Provide hinged door panels with a continuous extruded aluminum channel frame, finished to match cabinet, hung on full length piano hinges. Cover exterior surface of each door panel with manufacturer's standard grained vinyl covering.

Cabinet: Provide the manufacturer's standard red oak cabinet, with frame constructed of solid wood with integral chalktray. Construct hinged door panels with solid frame and finished red oak veneer exterior surface, hung on full length piano hinges.

Writing Surface: Provide manufacturer's standard porcelain enamel markerboard for liquid chalk markers, mounted on the inside back panel of the unit.

Bulletin Boards: Provide manufacturer's standard colored cork tackboard insert with map rail and spring clips attached to the inside surface of each door panel.

Projection Screen: Provide the manufacturer's standard 40 inch by 40 inch pull down matte white projection screen mounted above rear writing surface.

ACCESSORIES

- A. Metal Trim and Accessories: Fabricate frames and trim of not less than 0.062 inch thick aluminum alloy, size and shape as indicated, to suit type of installation. Provide straight, single length units wherever possible; keep joints to a minimum. Miter corners to a neat, hairline closure.

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1. Where the size of boards or other conditions exist that require support in addition to the normal trim, provide structural supports or modify the trim as indicated or as selected by the Architect from the manufacturer's standard structural support accessories to suit the condition indicated.

Field Applied Trim: Provide the manufacturer's standard snap on trim, with no visible screws or exposed joints.

Chalktray: Furnish manufacturer's standard continuous box type aluminum chalktray with slanted front and cast aluminum end closures for each markerboard.

Provide one box, 4 colors minimum, of liquid felt tip markers for each individual markerboard installed.

Map Rail: Furnish map rail at the top of each unit, complete with the following accessories:

Display Rail: Provide continuous cork display rail approximately 1 or 2 inches wide, as indicated, integral with the map rail.

End Stops: Provide one end stop at each end of the map rail.

Map Hooks: Provide 2 map hooks with flexible metal clips for each 4 feet of map rail or fraction thereof.

FABRICATION

- A. Porcelain Enamel Markerboards: Laminate facing sheet and backing sheet to core material under pressure with manufacturer's recommended flexible, waterproof adhesive.
- B. Assembly: Provide factory assembled markerboard and tackboard units, except where field assembled units are required.
 1. Make joints only where total length exceeds maximum manufactured length. Fabricate with the minimum number of joints, balanced around the center of the board, as acceptable to the Architect.

Provide the manufacturer's standard vertical joint system between abutting sections of markerboard.

Provide manufacturer's standard mullion trim at joints between markerboard and tackboard.

Unit Sizes: Provide markerboard and tackboard units in lengths shown on Drawings and, unless otherwise indicated, in a constant 42 inch height.

FINISHES

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- A. Comply with NAAMM "Metal Finishes Manual" for recommendations relative to application and designations of finishes.
- B. Finish designations prefixed by "AA" conform to the system established by the Aluminum Association for designating aluminum finishes.
- C. Class II Clear Anodized Finish: AA M12C22A31 (Mechanical Finish: as fabricated, nonspecular; Chemical Finish: etched, medium matte; Anodic Coating: Class II Architectural, clear film thicker than 0.4 mil).

Class II Color Anodized Finish: AA M12C22A32/A34 (Mechanical Finish: as fabricated, nonspecular; Chemical Finish: etched, medium matte; Anodic Coating: Class II Architectural, film thicker than 0.4 mil with integral color or electrolytically deposited color).

1. Color: Light bronze

Color: Medium bronze

Color: Dark bronze

Color: Black

Color: Match Architect's sample.

Color: As selected by Architect from within standard industry colors and color density range.

Baked Enamel Finish: AA C12C42R1x (Chemical Finish: cleaned with inhibited chemicals; Chemical Finish: chemical conversion coating, acid chromate fluoride phosphate pretreatment; Organic Coating: as specified below). Apply baked enamel in compliance with paint manufacturer's specifications for cleaning, conversion coating, and painting.

- 1. Organic Coating: Thermosetting modified acrylic enamel primer/topcoat system complying with AAMA 603.8 except with minimum dry film thickness of 1.5 mils, medium gloss.

Color: As indicated by reference to manufacturer's standard color designations.

Color: As selected by Owner's Representative from manufacturer's standard colors.

EXECUTION

1.1 INSTALLATION

- A. Installation shall meet or exceed all applicable federal, state and local requirements, referenced standards and conform to codes and ordinances of authorities having jurisdiction.

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- B. All installation shall be in accordance with manufacturer's published recommendations.
- C. Deliver factory built markerboard and tackboard units completely assembled in one piece without joints, wherever possible. Where dimensions exceed panel size, provide 2 or more pieces of equal length as acceptable to the Architect. When overall dimensions require delivery in separate units, prefit components at the factory, disassemble for delivery, and make final joints at the site. Use splines at joints to maintain surface alignment.
- D. Install units in locations and at mounting heights indicated and in accordance with the manufacturer's instructions. Keep perimeter lines straight, plumb, and level. Provide grounds, clips, backing materials, adhesives, brackets, anchors, trim, and accessories necessary for a complete installation.
- E. Coordinate job site assembled units with grounds, trim, and accessories. Join parts with a neat, precision fit.

ADJUST AND CLEAN

- A. Verify that accessories required for each unit have been properly installed and that operating units function properly.
- B. Clean units in accordance with the manufacturer's instructions. Break in markerboards only as recommended by the manufacturer.

END OF SECTION

SECTION 10800- TOILET AND BATH ACCESSORIES

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DIVISION10-SPECIALTIES

GOVERNMENT OF THE U. S. VIRGIN ISLANDS, DEPARTMENT OF PUBLIC WORKS

PROJECT NAME

Project Location, U.S. Virgin Islands

DIVISION 21-FIRE SUPPRESSION

GOVERNMENT OF THE U. S. VIRGIN ISLANDS, DEPARTMENT OF PUBLIC WORKS

PROJECT NAME

Project Location, U.S. Virgin Islands

SECTION 21131-WET PIPE SPRINKLER SYSTEMS

GOVERNMENT OF THE U. S. VIRGIN ISLANDS, DEPARTMENT OF PUBLIC WORKS

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PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Pipes, fittings, and specialties.
2. Fire-protection valves.
3. Fire-department connections.
4. Sprinklers.
5. Alarm devices.
6. Pressure gages.

B. Related Sections:

1. Divisions 22 and 26.

1.2 SYSTEM DESCRIPTIONS

A. Wet-Pipe Sprinkler System:

Automatic sprinklers are attached to piping containing water and that is connected to water supply through alarm valve. Water discharges immediately from sprinklers when they are opened. Sprinklers open when heat melts fusible link or destroys frangible device. Hose connections are included if indicated.

1.3 PERFORMANCE REQUIREMENTS

A. Standard-Pressure Piping System Component:

Listed for 175-psig (1200-kPa) minimum working pressure.

B. Delegated Design:

Design sprinkler system(s), including comprehensive engineering analysis by a qualified professional engineer, using performance requirements and design criteria indicated

C. Sprinkler system design shall be approved by authorities having jurisdiction.

1. Margin of Safety for Available Water Flow and Pressure:
10 percent, including losses through water service piping, valves, and backflow preventers
2. Sprinkler Occupancy Hazard Classifications:
 - a. Apparatus Room:
Ordinary Hazard, Group 1
 - b. Electrical Equipment Rooms:
Ordinary Hazard, Group 1

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- c. Storage Areas:
Ordinary Hazard, Group 1
 - d. Mechanical Equipment Rooms:
Ordinary Hazard, Group 1
 - e. Office and Public Areas:
Light Hazard
 - f. Fitness, communication and dorm rooms:
Light Hazard
 - g. Other Areas:
According to NFPA 13 recommendations unless otherwise indicated
3. Minimum Density for Automatic-Sprinkler Piping Design:
- a. Light Hazard Occupancy:
0.10 gpm over 1500 sq. ft. (4.1 mm/min. over 139 sq. m) area
 - b. Ordinary-Hazard, Group 1 Occupancy:
0.15 gpm over 1500 sq. ft. (6.1 mm/min. over 139 sq. m) area
 - c. Ordinary-Hazard, Group 2 Occupancy:
0.20 gpm over 1500 sq. ft. (8.1 mm/min. over 139 sq. m) area
4. Maximum Protection Area per Sprinkler:
Per UL listing
5. Total Combined Hose-Stream Demand Requirement:
According to NFPA 13 unless otherwise indicated:
- a. Light-Hazard Occupancies:
100 gpm (6.3 L/s) for 30 minutes
 - b. Ordinary-Hazard Occupancies:
250 gpm (15.75 L/s) for 60 to 90 minutes

1.4 SUBMITTALS

- A. Product Data:
For each type of product indicated.
- B. Shop Drawings:
For wet-pipe sprinkler systems. Include plans, elevations, sections, details, and attachments to other work.
 - 1. Wiring Diagrams:
For power, signal, and control wiring
- C. Delegated-Design Submittal:
For sprinkler systems indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the licensed professional engineer responsible for

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their preparation.

D. Qualification Data:

For qualified Installer

E. Approved Sprinkler Piping Drawings:

Working plans, prepared according to NFPA 13, that have been approved by authorities having jurisdiction, including hydraulic calculations if applicable.

F. Field Test Reports and Certificates:

Indicate and interpret test results for compliance with performance requirements and as described in NFPA 13. Include "Contractor's Material and Test Certificate for Aboveground Piping."

G. Field quality-control reports

H. Operation and maintenance data

1.5 QUALITY ASSURANCE

A. Installer Qualifications:

1. Installer's responsibilities include designing, fabricating, and installing sprinkler systems and providing professional engineering services needed to assume engineering responsibility. Base calculations on results of fire-hydrant flow test.

a. Engineering Responsibility:

Preparation of working plans, calculations, and field test reports by a licensed professional engineer.

B. Welding Qualifications:

Qualify procedures and operators according to ASME Boiler and Pressure Vessel Code.

C. Electrical Components, Devices, and Accessories:

Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

D. NFPA Standards:

Sprinkler system equipment, specialties, accessories, installation, and testing shall comply with the following:

1. NFPA 13, "Installation of Sprinkler Systems"

PART 2- PRODUCTS

2.1 PIPING MATERIALS

A. Comply with requirements in "Piping Schedule" Article for applications of pipe, tube, and fitting materials, and for joining methods for specific services, service locations, and pipe sizes.

2.2 STEEL PIPE AND FITTINGS

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- A. Standard Weight, Black-Steel Pipe:
ASTM A 53/A 53M, Grade B. Pipe ends may be factory or field formed to match joining method
- B. Thinwall Black-Steel Pipe:
ASTM A 135 or ASTM A 795/A 795M, threadable, with wall thickness less than Schedule 30 and equal to or greater than Schedule 10. Pipe ends may be factory or field formed to match joining method
- C. Black-Steel Pipe Nipples:
ASTM A 733, made of ASTM A 53/A 53M, standard-weight, seamless steel pipe with threaded ends
- D. Galvanized and Uncoated, Steel Couplings:
ASTM A 865, threaded
- E. Galvanized and Uncoated, Gray-Iron Threaded Fittings:
ASME B16.4, Class 125, standard pattern
- F. Malleable- or Ductile-Iron Unions:
UL 860
- G. Cast-Iron Flanges:
ASME 16.1, Class 125
- H. Steel Flanges and Flanged Fittings:
ASME B16.5, Class 150
- I. Steel Welding Fittings:
ASTM A 234/A 234M and ASME B16.9.
- J. Grooved-Joint, Steel-Pipe Appurtenances:
 - 1. Manufacturers:
Subject to compliance with requirements, provide products by one of the following:
 - a. Anvil International, Inc.
 - b. Tyco Fire & Building Products LP.
 - c. Victaulic Company.
 - 2. Pressure Rating:
175 psig (1200 kPa) minimum
 - 3. Galvanized and Uncoated, Grooved-End Fittings for Steel Piping:
ASTM A 47/A 47M, malleable-iron casting or ASTM A 536, ductile-iron casting; with dimensions matching steel pipe.
 - 4. Grooved-End-Pipe Couplings for Steel Piping:
AWWA C606 and UL 213, rigid pattern, unless otherwise indicated, for steel-pipe dimensions. Include ferrous housing sections, EPDM-rubber gasket, and bolts and nuts.

2.3 PIPING JOINING MATERIALS

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A. Pipe-Flange Gasket Materials:

AWWA C110, rubber, flat face, 118 inch (3.2 mm) thick

1. Class 125, Cast-Iron Flat-Face Flanges:

Full-face gaskets

B. Metal, Pipe-Flange Bolts and Nuts:

ASME B18.2.1, carbon steel unless otherwise indicated

C. Welding Filler Metals:

Comply with AWS D10.12M/D10.12 for welding materials appropriate for wall thickness and chemical analysis of steel pipe being welded.

2.4 LISTED FIRE-PROTECTION VALVES

A. General Requirements:

1. Valves shall be UL listed or FM approved.

2. Minimum Pressure Rating:

175 psig (1200 kPa)

B. Check Valves:

1. Manufacturers:

Subject to compliance with requirements, provide products by one of the following available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

a. Anvil International, Inc.

b. Milwaukee Valve Company

c. Mueller Co.; Water Products Division

d. NIBCO, INC.

e. Tyco Fire & Building Products LP.

f. Victaulic Company

g. Viking Corporation

2. Standard:

UL 312

3. Pressure Rating:

250 psig (1725 kPa) minimum

4. Type:

Swing check

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5. Body Material:

Cast iron

6. End Connections:

Flanged or grooved

C. Bronze OS&Y Gate Valves:

1. Manufacturers:

Subject to compliance with requirements, provide products by one of the following available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

a. Crane Co.; Crane Valve Group; Crane Valves

b. Crane Co.; Crane Valve Group; Stockham Division

c. Milwaukee Valve Company

d. NIBCO, INC.

e. United Brass Works, Inc.

2. Standard:

UL 262

3. Pressure Rating:

175 psig (1200 kPa)

4. Body Material:

Bronze

5. End Connections:

Threaded

D. Iron OS&Y Gate Valves:

1. Manufacturers:

Subject to compliance with requirements, provide products by one of the following available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

a. American Cast Iron Pipe Company; Waterous Company Subsidiary

b. Crane Co.; Crane Valve Group; Crane Valves

c. Crane Co.; Crane Valve Group; Stockham Division

d. Hammond Valve

e. Milwaukee Valve Company

f. Mueller Co.; Water Products Division

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g. NIBCO, INC.

h. Tyco Fire & Building Products LP.

2. Standard:
UL 262
3. Pressure Rating:
250 psig (1725 kPa) minimum
4. Body Material:
Cast or ductile iron
5. End Connections:
Flanged or grooved

E. Indicating-Type Butterfly Valves:

1. Manufacturers:
Subject to compliance with requirements, provide products by one of the following available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Anvil International, Inc.
 - b. Milwaukee Valve Company
 - c. NIBCO, INC.
 - d. Tyco Fire & Building Products LP.
 - e. Victaulic Company
2. Standard:
UL 1091
3. Pressure Rating:
175 psig (1200 kPa) minimum
4. Valves NPS 2 (DN 50) and Smaller:
 - a. Valve Type:
Ball or butterfly
 - b. Body Material:
Bronze
 - c. End Connections:
Threaded
5. Valves NPS 2-1/2 (DN 65) and Larger:

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- a. Valve Type:
Butterfly.
- b. Body Material:
Cast or ductile iron.
- c. End Connections:
Flanged, grooved, or wafer.
6. Valve Operation:
Integral electrical, 115-V ac, prewired, supervisory switch indicating device.

2.5 TRIM AND DRAIN VALVES

A. General Requirements:

1. Standard:
UL's "Fire Protection Equipment Directory" listing or "Approval Guide," published by FM Global, listing.
2. Minimum Pressure Rating:
175 psig (1200 kPa)

B. Ball Valves:

1. Manufacturers:
Subject to compliance with requirements, provide products by one of the following available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Anvil International, Inc.
 - b. Milwaukee Valve Company
 - c. NIBCO INC.
 - d. Tyco Fire & Building Products LP.
 - e. Victaulic Company

2.6 SPECIALTY VALVES

A. General Requirements:

1. Standard:
UL's "Fire Protection Equipment Directory" listing or "Approval Guide," published by FM Global, listing
2. Minimum Pressure Rating:
175 psig (1200 kPa)
3. Body Material:
Cast or ductile iron

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- 4. Size:
Same as connected piping

- 5. End Connections:
Flanged or grooved

B. Alarm Valves:

- 1. Manufacturers:
Subject to compliance with requirements, provide products by one of the following available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Reliable Automatic Sprinkler Co., Inc.
 - b. Tyco Fire & Building Products LP
 - c. Victaulic Company
 - d. Viking Corporation
- 2. Standard:
UL 193
- 3. Design:
For horizontal or vertical installation
- 4. Include trim sets for bypass, drain, electrical sprinkler alarm switch, pressure gages, retarding chamber, and fill-line attachment with strainer
- 5. Drip Cup Assembly:
Pipe drain without valves and separate from main drain piping
- 6. Drip Cup Assembly:
Pipe drain with check valve to main drain piping

C. Automatic (Ball Drip) Drain Valves:

- 1. Manufacturers:
Subject to compliance with requirements, provide products by one of the following available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Reliable Automatic Sprinkler Co., Inc.
 - b. Tyco Fire & Building Products LP.
- 2. Standard:
UL 1726
- 3. Pressure Rating:
175 psig (1200 kPa) minimum

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4. Type:
Automatic draining, ball check
5. Size:
NPS 3/4 (DN 20)
6. End Connections:
Threaded

2.7 SPRINKLER SPECIALTY PIPE FITTINGS

A. Branch Outlet Fittings:

1. Manufacturers:
Subject to compliance with requirements, provide products by one of the following available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Anvil International, Inc.
 - b. Tyco Fire & Building Products LP.
 - c. Victaulic Company
2. Standard:
UL 213
3. Pressure Rating:
175 psig (1200 kPa) minimum
4. Body Material:
Ductile-iron housing with EPDM seals and bolts and nuts
5. Type:
Mechanical-T and -cross fittings
6. Configurations:
Snap-on and strapless, ductile-iron housing with branch outlets
7. Size:
Of dimension to fit onto sprinkler main and with outlet connections as required to match connected branch piping
8. Branch Outlets:
Grooved, plain-end pipe, or threaded

B. Flow Detection and Test Assemblies:

1. Manufacturers:
Subject to compliance with requirements, provide products by one of the following available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

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- a. Reliable Automatic Sprinkler Co., Inc.
- b. Tyco Fire & Building Products LP
- c. Victaulic Company
2. Standard:
UL's "Fire Protection Equipment Directory" listing or "Approval Guide," published by FM Global, listing
3. Pressure Rating:
175 psig (1200 kPa) minimum
4. Body Material:
Cast- or ductile-iron housing with orifice, sight glass, and integral test valve
5. Size:
Same as connected piping
6. Inlet and Outlet:
Threaded

C. Branch Line Testers:

1. Manufacturers:
Subject to compliance with requirements, provide products by one of the following available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Elkhart Brass Mfg. Company, Inc.
 - b. Fire-End & Croker Corporation
 - c. Potter Roemer
2. Standard:
UL 199
3. Pressure Rating:
175 psig (1200 kPa) minimum
4. Body Material:
Brass
5. Size:
Same as connected piping
6. Inlet:
Threaded
7. Drain Outlet:
Threaded and capped

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8. Branch Outlet:
Threaded, for sprinkler

D. Sprinkler Inspector's Test Fittings:

1. Manufacturers:
Subject to compliance with requirements, provide products by one of the following available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Tyco Fire & Building Products LP.
 - b. Victaulic Company
 - c. Viking Corporation
2. Standard:
UL's "Fire Protection Equipment Directory" listing or "Approval Guide," published by FM Global, listing
3. Pressure Rating:
175 psig (1200 kPa) minimum
4. Body Material:
Cast- or ductile-iron housing with sight glass
5. Size:
Same as connected piping
6. Inlet and Outlet:
Threaded

E. Adjustable Drop Nipples:

1. Manufacturers:
Subject to compliance with requirements, provide products by one of the following available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - a. CECA, LLC.
 - b. Corcoran Piping System Co.
 - c. Merit Manufacturing; a division of Anvil International, Inc.
2. Standard:
UL 1474
3. Pressure Rating:
250 psig (1725 kPa) minimum
4. Body Material:

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Steel pipe with EPDM-rubber O-ring seals

5. Size:
Same as connected piping
6. Length:
Adjustable
7. Inlet and Outlet:
Threaded

2.8 SPRINKLERS

A. Manufacturers:

Subject to compliance with requirements, provide products by one of the following available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

1. Reliable Automatic Sprinkler Co., Inc.
2. Tyco Fire & Building Products LP
3. Victaulic Company
4. Viking Corporation

B. General Requirements:

1. Standard:
UL's "Fire Protection Equipment Directory" listing or "Approval Guide," published by FM Global, listing
2. Pressure Rating for Automatic Sprinklers:
175 psig (1200 kPa) minimum

C. Automatic Sprinklers with Heat-Responsive Element:

1. Early-Suppression, Fast-Response Applications:
UL 1767
2. Nonresidential Applications:
UL 199
3. Characteristics:
Nominal 1/2-inch (12.7-mm) orifice with Discharge Coefficient K of 5.6, and for "Ordinary" temperature classification rating unless otherwise indicated or required by application.

D. Sprinkler Finishes:

1. Chrome plated
2. Bronze

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3. Painted

E. Special Coatings:

1. Wax
2. Lead
3. Corrosion-resistant paint

F. Sprinkler Escutcheons:

Materials, types, and finishes for the following sprinkler mounting applications. Escutcheons for concealed, flush, and recessed-type sprinklers are specified with sprinklers.

1. Ceiling Mounting:
Chrome-plated steel, one piece, flat
2. Sidewall Mounting:
Chrome-plated steel, one piece, flat

G. Sprinkler Guards:

1. Manufacturers:
Subject to compliance with requirements, provide products by one of the following:
 - a. Reliable Automatic Sprinkler Co., Inc.
 - b. Tyco Fire & Building Products LP
 - c. Victaulic Company
 - d. Viking Corporation
2. Standard:
UL 199
3. Type:
Wire cage with fastening device for attaching to sprinkler

2.9 ALARM DEVICES

A. Water-Flow Indicators:

1. Manufacturers:
Subject to compliance with requirements, provide products by one of the following available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - a. ADT Security Services, Inc.
 - b. McDonnell & Miller; ITT Industries

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- c. Potter Electric Signal Company
- d. System Sensor; a Honeywell company
- e. Viking Corporation
- 2. Standard:
UL 346
- 3. Water-Flow Detector:
Electrically supervised
- 4. Components:
Two single-pole, double-throw circuit switches for isolated alarm and auxiliary contacts, 7 A, 125VAC and 0.25 A, 24VDC; complete with factory-set, field-adjustable retard element to prevent false signals and tamperproof cover that sends signal if removed.
- 5. Type:
Paddle operated
- 6. Pressure Rating:
250 psig (1725 kPa)
- 7. Design Installation:
Horizontal or vertical

B. Valve Supervisory Switches:

- 1. Manufacturers:
Subject to compliance with requirements, provide products by one of the following available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Fire-Lite Alarms, Inc.; a Honeywell company
 - b. Kennedy Valve; a division of McWane, Inc
 - c. Potter Electric Signal Company
 - d. System Sensor; a Honeywell company
- 2. Standard:
UL 346
- 3. Type:
Electrically supervised
- 4. Components:
Single-pole, double-throw switch with normally closed contacts
- 5. Design:
Signals that controlled valve is in other than fully open position

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2.10 PRESSURE GAGES

A. Manufacturers:

Subject to compliance with requirements, provide products by one of the following available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

1. AMETEK; U.S. Gauge Division
2. Ashcroft, Inc.
3. Brecco Corporation
4. WIKA Instrument Corporation

B. Standard:

UL 393

C. Dial Size:

3-1/2- to 4-1/2-inch (90 to 115 mm) diameter

D. Pressure Gage Range:

-0 to 250 psig (0 to 1725 kPa) minimum

E. Water System Piping Gage:

Include "WATER" label on dial face

PART 3 - EXECUTION

3.1 PIPING INSTALLATION

A. Locations and Arrangements:

Drawing plans, schematics, and diagrams indicate general location and arrangement of piping. Install piping as indicated, as far as practical.

1. Deviations from approved working plans for piping require written approval from authorities having jurisdiction. File written approval with Owner's Representative before deviating from approved working plans.

B. Piping Standard:

Comply with requirements for installation of sprinkler piping in NFPA 13.

- C. Use listed fittings to make changes in direction, branch takeoffs from mains, and reductions in pipe sizes.

- D. Install unions adjacent to each valve in pipes NPS 2 (DN 50) and smaller.

- E. Install flanges, flange adapters, or couplings for grooved-end piping on valves, apparatus, and equipment having NPS 2-112 (DN 65) and larger end connections.

- F. Install "Inspector's Test Connections" in sprinkler system piping, complete with shutoff valve, and sized and located according to NFPA 13.

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- G. Install sprinkler piping with drains for complete system drainage.
- H. Install sprinkler control valves, test assemblies, and drain risers adjacent to standpipes when sprinkler piping is connected to standpipes.
- I. Install automatic (ball drip) drain valve at each check valve for fire-department connection, to drain piping between fire-department connection and check valve. Install drain piping to spill over floor drain or to outside building.
- J. Install alarm devices in piping systems.
- K. Install hangers and supports for sprinkler system piping according to NFPA 13. Comply with requirements for hanger materials in NFPA 13.
- L. Install pressure gages on riser or feed main, at each sprinkler test connection, and at top of each standpipe. Include pressure gages with connection not less than NPS 1/4 (DN 8) and with soft metal seated globe valve, arranged for draining pipe between gage and valve. Install gages to permit removal.
- M. Fill sprinkler system piping with water.

3.2 JOINT CONSTRUCTION

- A. Install couplings, flanges, flanged fittings, unions, nipples, and transition and special fittings that have finish and pressure ratings same as or higher than system's pressure rating for aboveground applications unless otherwise indicated.
- B. Install unions adjacent to each valve in pipes NPS 2 (DN 50) and smaller.
- C. Install flanges, flange adapters, or couplings for grooved-end piping on valves, apparatus, and equipment having NPS 2-1/2 (DN 65) and larger end connections.
- D. Ream ends of pipes and tubes and remove burrs. Bevel plain ends of steel pipe.
- E. Remove scale, slag, dirt, and debris from inside and outside of pipes, tubes, and fittings before assembly.
- F. Flanged Joints:
Select appropriate gasket material in size, type, and thickness suitable for water service. Join flanges with gasket and bolts according to ASME B31.9.
- G. Threaded Joints:
Thread pipe with tapered pipe threads according to ASME B1.20.1. Cut threads full and clean using sharp dies. Ream threaded pipe ends to remove burrs and restore full ID. Join pipe fittings and valves as follows:
 - 1. Apply appropriate tape or thread compound to external pipe threads.
 - 2. Damaged Threads:
Do not use pipe or pipe fittings with threads that are corroded or damaged.

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H. Welded Joints:

Construct joints according to AWS D10.12M/D10.12, using qualified processes and welding operators according to "Quality Assurance" Article.

1. Shop weld pipe joints where welded piping is indicated. Do not use welded joints for galvanized-steel pipe.

I. Steel-Piping, Roll-Grooved Joints:

Roll rounded-edge groove in end of pipe according to AWWA C606

1. Assemble coupling with housing, gasket, lubricant, and bolts. Join steel pipe and grooved-end fittings according to AWWA C606 for steel-pipe grooved joints.

J. Dissimilar-Material Piping Joints:

Make joints using adapters compatible with materials of both piping systems.

3.3 VALVE AND SPECIALTIES INSTALLATION

- A. Install listed fire-protection valves, trim and drain valves, specialty valves and trim, controls, and specialties according to NFPA 13 and authorities having jurisdiction.

- B. Install listed fire-protection shutoff valves supervised open, located to control sources of water supply except from fire-department connections. Install permanent identification signs indicating portion of system controlled by each valve.

- C. Install check valve in each water-supply connection. Install backflow preventers instead of check valves in potable-water-supply sources.

D. Specialty Valves:

1. General Requirements:

Install in vertical position for proper direction of flow, in main supply to system.

2. Alarm Valves:

Include bypass check valve and retarding chamber drain-line connection.

3.4 SPRINKLER INSTALLATION

- A. Install sprinklers in suspended ceilings in center of acoustical ceiling panels.

3.5 IDENTIFICATION

- A. Install labeling and pipe markers on equipment and piping according to requirements in NFPA 13.

- B. Identify system components, wiring, cabling, and terminals. Comply with requirements for identification specified in Section 26 05 53 "Identification for Electrical Systems."

3.6 FIELD QUALITY CONTROL

- A. Perform tests and inspections.

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B. Tests and Inspections:

1. Leak Test:
After installation, charge systems and test for leaks. Repair leaks and retest until no leaks exist.
2. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.
3. Flush, test, and inspect sprinkler systems according to NFPA 13, "Systems Acceptance" Chapter.
4. Energize circuits to electrical equipment and devices.
5. Coordinate with fire-alarm tests. Operate as required.
6. Coordinate with fire-pump tests. Operate as required.
7. Verify that equipment hose threads are same as local fire-department equipment.

C. Sprinkler piping system will be considered defective if it does not pass tests and inspections.

D. Prepare test and inspection reports.

3.7 CLEANING

- A. Clean dirt and debris from sprinklers.
- B. Remove and replace sprinklers with paint other than factory finish.

3.8 PIPING SCHEDULE

- A. Piping between Fire-Department Connections and Check Valves: Galvanized, standard-weight steel pipe with grooved ends; grooved-end fittings; grooved-end-pipe couplings; and grooved joints.
- B. Sprinkler specialty fittings may be used, downstream of control valves, instead of specified fittings.
- C. Wet-pipe sprinkler system, NPS 2 (DN 50) and smaller, shall be one of the following:
 1. Standard-weight, black-steel pipe with threaded ends; uncoated, gray-iron threaded fittings; and threaded joints. (Schedule 40)
 2. Standard-weight, galvanized-steel pipe with threaded ends; galvanized, gray-iron threaded fittings; and threaded joints.(schedule 40)
- D. Standard-pressure, wet-pipe sprinkler system, NPS 2-1/2 to NPS 6 (DN 65 to DN 150), shall be one of the following:
 1. Thinwall black steel pipe with roll-grooved ends; uncoated, grooved end fittings for steel piping; grooved-end-pipe couplings for steel piping; and grooved joints.

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2. Thinwall black steel pipe with plain ends; welding fittings; and welded joints.

E. Sprinkler pipe for Apparatus Room. Only Galvanized pipe and fitting with as described on C and D above.

3.9 SPRINKLER SCHEDULE

A. Use sprinkler types in subparagraphs below for the following applications:

1. Rooms without Ceilings:
Upright sprinklers
2. Rooms with Suspended Ceilings:
Pendent, recessed, flush, and concealed sprinklers as indicated
3. Wall Mounting:
Sidewall sprinklers
4. Special Applications:
Extended-coverage, flow-control, and quick-response sprinklers where indicated

B. Provide sprinkler types in subparagraphs below with finishes indicated:

1. Concealed Sprinklers:
Rough brass, with factory-painted white cover plate
2. Flush Sprinklers:
Bright chrome, with painted white escutcheon
3. Recessed Sprinklers:
Bright chrome, with bright chrome escutcheon
4. Pendent and Sidewall Sprinklers:
Chrome plated in finished spaces exposed to view; rough bronze in unfinished spaces not exposed to view; wax coated where exposed to acids, chemicals, or other corrosive fumes.

END OF SECTION

DIVISION 22- PLUMBING

Government of the Virgin Islands, Department of Public Works

PROJECT NAME: Elaine I. Sprauve Library and Museum Building

Project Location: **St. John, U.S. Virgin Islands**

SECTION 220119- PLUMBING AND PIPING INSULATION

Government of the Virgin Islands, Department of Public Works

PROJECT NAME: Elaine I. Sprauve Library and Museum Building

Project Location: **St. John, U.S. Virgin Islands**

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes insulating the following plumbing piping services:

1. Hot water piping.
2. Recirculating hot water piping

1.2 ACTION SUBMITTALS

A. Product Data:

For each type of product indicated

B. Shop Drawings:

Include plans, elevations, sections, details, and attachments to other work

1. Detail application of protective shields, saddles, and inserts at hangers for each type of insulation and hanger.
2. Detail insulation application at pipe expansion joints for each type of insulation.
3. Detail insulation application at elbows, fittings, flanges, valves, and specialties for each type of insulation.
4. Detail removable insulation at piping specialties, equipment connections, and access panels.
5. Detail application of field-applied jackets.

1.3 INFORMATIONAL SUBMITTALS

A. Field quality control reports

1.4 QUALITY ASSURANCE

A. Surface-Burning Characteristics:

For insulation and related materials, as determined by testing identical products according to ASTM E 84 by a testing agency acceptable to authorities having jurisdiction. Factory label insulation and jacket materials and adhesive, mastic, tapes, and cement material containers, with appropriate markings of applicable testing agency.

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1. Insulation Installed Indoors: Flame-spread index of 25 or less, and smoke-developed index of 50 or less.

2. Insulation Installed Outdoors: Flame-spread index of 75 or less, and smoke-developed index of 150 or less.

B. Comply with the following applicable standards and other requirements specified for miscellaneous components:

1. Supply and Drain Protective Shielding Guards: ICC A117.1.

PART 2 - PRODUCTS

2.1 INSULATION MATERIALS

A. Comply with requirements in "Piping Insulation Schedule, General," "Indoor Piping Insulation Schedule."

B. Products shall not contain asbestos, lead, mercury, or mercury compounds.

C. Mineral Fiber, Preformed Pipe Insulation:

1. Products:

Subject to compliance with requirements, provide one of the following available products that may be incorporated into the Work include, but are not limited to, the following:

a. Johns Manville; Micro-Lok

b. Knauf Insulation; 1,000-Degree Pipe Insulation.

c. Manson Insulation Inc.; Alley-K

d. Owens Corning; Fiberglas Pipe Insulation

2. Type I, 850° F (454° C) Materials:

Mineral or glass fibers bonded with a thermosetting resin. Comply with ASTM C 547, Type I, Grade A, with factory applied ASJ. Factory applied jacket requirements are specified in "Factory Applied Jackets" Article.

2.2 INSULATING CEMENTS

A. Mineral Fiber; Hydraulic Setting, Insulating and Finishing Cement: Comply with ASTM C 449.

1. Products:

Subject to compliance with requirements, provide one of the following:

a. Ramco Insulation, Inc.

b. Ramcote 1200

c. Quik-Cote

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2.3 ADHESIVES

- A. Materials shall be compatible with insulation materials, jackets, and substrates and for bonding insulation to itself and to surfaces to be insulated, unless otherwise indicated.

B. Mineral Fiber Adhesive:

Comply with MIL-A-3316C, Class 2, Grade A.

1. Products:

Subject to compliance with requirements, provide one of the following available products that may be incorporated into the Work include, but are not limited to, the following:

- a. Childers Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; CP-127.
- b. Eagle Bridges- Marathon Industries; 225.
- c. Foster Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; 85-60 / 85-70.
- d. Mon-Eco Industries, Inc.; 22-25.

2. For indoor applications, adhesive shall have a VOC content of 80 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

3. Adhesive shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small Scale, Environmental Chambers."

C. ASJ Adhesive, and FSK Jacket Adhesive:

Comply with MIL-A-3316C, Class 2, Grade A for bonding insulation jacket lap seams and joints.

1. Products:

Subject to compliance with requirements, provide one of the following available products that may be incorporated into the Work include, but are not limited to, the following:

- a. Childers Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; CP-82
- b. Eagle Bridges- Marathon Industries; 225
- c. Foster Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; 85-20
- d. Mon-Eco Industries, Inc.; 22-25.

2. For indoor applications, adhesive shall have a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

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3. Adhesive shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small Scale, Environmental Chambers."

D. PVC Jacket Adhesive:

Compatible with PVC jacket.

1. Products:

Subject to compliance with requirements, provide one of the following available products that may be incorporated into the Work include, but are not limited to, the following:

- a. Dow Corning Corporation; 739, Dow Silicone.
 - b. Johns Manville; Zeston Perma-Weld, CEEL-TITE Solvent Welding Adhesive.
 - c. P.I.C. Plastics, Inc.; Welding Adhesive.
 - d. Speedline Corporation; Polyco VP Adhesive.
2. For indoor applications, adhesive shall have a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
 3. Adhesive shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small Scale, Environmental Chambers."

2.4 MASTICS

A. Materials shall be compatible with insulation materials, jackets, and substrates; comply with MIL-PRF-19565C, Type II.

1. For indoor applications, use mastics that have a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

B. Vapor Barrier Mastic:

Water based; suitable for indoor use on below-ambient services

2. Products:

Subject to compliance with requirements, provide one of the following available products that may be incorporated into the Work include, but are not limited to, the following:

- a. Foster Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; 30-80/30-90
- b. Vimasco Corporation; 749

3. Water Vapor Permeance:

ASTM E 96/E 96M, Procedure B, 0.013 perm (0.009 metric perm) at 43 mil (1.09 mm) dry film thickness

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4. Service Temperature Range: 32°F to 180°F (0°C to plus 82°C)
5. Solids Content: ASTM D 1644, 58 percent by volume and 70 percent by weight
6. Color: White.

2.5 FIELD APPLIED JACKETS

- A. Field applied jackets shall comply with ASTM C 921, Type I, unless otherwise indicated.
- B. PVC Jacket:
High impact resistant, UV resistant PVC complying with ASTM D 1784, Class 16354-C; thickness as scheduled; roll stock ready for shop or field cutting and forming. Thickness is indicated in field applied jacket schedules.
 1. Products:
Subject to compliance with requirements, provide one of the following available products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Johns Manville; Zeston
 - b. P.I.C. Plastics, Inc.; FG Series
 - c. Proto Corporation; LoSmoke
 - d. Speedline Corporation; SmokeSafe.
 2. Adhesive:
As recommended by jacket material manufacturer
 3. Color: White
 4. Factory fabricated fitting covers to match jacket if available; otherwise, field fabricate.
 - a. Shapes:
45° and 90°, short and long-radius elbows, tees, valves, flanges, unions, reducers, end caps, soil pipe hubs, traps, mechanical joints, and P-trap and supply covers for lavatories.

2.6 TAPES

- A. ASJ Tape:
White vapor retarder tape matching factory applied jacket with acrylic adhesive, complying with ASTM C 1136.
 1. Products:
Subject to compliance with requirements, provide one of the following available products that may be incorporated into the Work include, but are not limited to, the following:
 - a. ABI, Ideal Tape Division; 428 AWF ASJ

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PART 3 - EXECUTION

3.1 PREPARATION

- A. Surface Preparation:
Clean and dry surfaces to receive insulation. Remove materials that will adversely affect insulation application.
- B. Coordinate insulation installation with the trade installing heat tracing. Comply with requirements for heat tracing that apply to insulation.
- C. Mix insulating cements with clean potable water; if insulating cements are to be in contact with stainless steel surfaces, use demineralized water.

3.2 GENERAL INSTALLATION REQUIREMENTS

- A. Install insulation materials, accessories, and finishes with smooth, straight, and even surfaces; free of voids throughout the length of piping including fittings, valves, and specialties.
- B. Install insulation materials, forms, vapor barriers or retarders, jackets, and thicknesses required for each item of pipe system as specified in insulation system schedules.
- C. Install accessories compatible with insulation materials and suitable for the service. Install accessories that do not corrode, soften, or otherwise attack insulation or jacket in either wet or dry state.
- D. Install insulation with longitudinal seams at top and bottom of horizontal runs.
- E. Install multiple layers of insulation with longitudinal and end seams staggered.
- F. Do not weld brackets, clips, or other attachment devices to piping, fittings, and specialties.
- G. Keep insulation materials dry during application and finishing.
- H. Install insulation with tight longitudinal seams and end joints. Bond seams and joints with adhesive recommended by insulation material manufacturer.
- I. Install insulation with least number of joints practical.
- J. Where vapor barrier is indicated, seal joints, seams, and penetrations in insulation at hangers, supports, anchors, and other projections with vapor-barrier mastic.
 - 1. Install insulation continuously through hangers and around anchor attachments.
 - 2. For insulation application where vapor barriers are indicated, extend insulation on anchor legs from point of attachment to supported item to point of attachment to structure. Taper and seal ends at attachment to structure with vapor-barrier mastic.
 - 3. Install insert materials and install insulation to tightly join the insert. Seal insulation to insulation inserts with adhesive or sealing compound recommended by insulation material manufacturer.

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4. Cover inserts with jacket material matching adjacent pipe insulation. Install shields over jacket, arranged to protect jacket from tear or puncture by hanger, support, and shield.
- K. Apply adhesives, mastics, and sealants at manufacturer's recommended coverage rate and wet and dry film thicknesses.
- L. Install insulation with factory applied jackets as follows:
 1. Draw jacket tight and smooth.
 2. Cover circumferential joints with 3 inch (75 mm) wide strips, of same material as insulation jacket. Secure strips with adhesive and outward clinching staples along both edges of strip, spaced 4 inches (100 mm) O.C.
 3. Overlap jacket longitudinal seams at least 1 1/2 inches (38 mm). Install insulation with longitudinal seams at bottom of pipe. Clean and dry surface to receive self-sealing lap. Staple laps with outward clinching staples along edge at 4 inches (100 mm) O.C. Apply vapor barrier mastic over staples.
 4. Cover joints and seams with tape, according to insulation material manufacturer's written instructions, to maintain vapor seal.
 5. Where vapor barriers are indicated, apply vapor barrier mastic on seams and joints and at ends adjacent to pipe flanges and fittings.
- M. Cut insulation in a manner to avoid compressing insulation more than 75 percent of its nominal thickness.
- N. Finish installation with systems at operating conditions. Repair joint separations and cracking due to thermal movement.
- O. Repair damaged insulation facings by applying same facing material over damaged areas. Extend patches at least 4 inches (100 mm) beyond damaged areas. Adhere, staple, and seal patches like butt joints.
- P. For above-ambient temperature services, do not install insulation to the following:
 1. Vibration control devices
 2. Testing agency labels and stamps
 3. Nameplates and data plates
 4. Cleanouts

3.3 PENETRATIONS

- A. Insulation Installation at Roof Penetrations:

Install insulation continuously through roof penetrations.

 1. Seal penetrations with flashing sealant.

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2. For applications requiring only indoor insulation, terminate insulation above roof surface and seal with joint sealant. For applications requiring indoor and outdoor insulation, install insulation for outdoor applications tightly joined to indoor insulation ends. Seal joint with joint sealant.
 3. Extend jacket of outdoor insulation outside roof flashing at least 2 inches (50 mm) below top of roof flashing.
 4. Seal jacket to roof flashing with flashing sealant.
- B. Insulation Installation at Underground Exterior Wall Penetrations:
Terminate insulation flush with sleeve seal. Seal terminations with flashing sealant.
- C. Insulation Installation at Aboveground Exterior Wall Penetrations:
Install insulation continuously through wall penetrations.
1. Seal penetrations with flashing sealant.
 2. For applications requiring only indoor insulation, terminate insulation inside wall surface and seal with joint sealant. For applications requiring indoor and outdoor insulation, install insulation for outdoor applications tightly joined to indoor insulation ends. Seal joint with joint sealant.
 3. Extend jacket of outdoor insulation outside wall flashing and overlap wall flashing at least 2 inches (50 mm).
 4. Seal jacket to wall flashing with flashing sealant.
- D. Insulation Installation at Interior Wall and Partition Penetrations (That Are Not Fire Rated):
Install insulation continuously through walls and partitions.
- E. Insulation Installation at Fire Rated Wall and Partition Penetrations:
Install insulation continuously through penetrations of fire-rated walls and partitions.
1. Comply with requirements in Section 07 84 13 "Penetration Fire stopping" for fire stopping and fire resistive joint sealers.
- F. Insulation Installation at Floor Penetrations:
1. Pipe: Install insulation continuously through floor penetrations.
 2. Seal penetrations through fire-rated assemblies. Comply with requirements in Division 07.

3.4 GENERAL PIPE INSULATION INSTALLATION

- A. Requirements in this article generally apply to all insulation materials except where more specific requirements are specified in various pipe insulation material installation articles.
- B. Insulation Installation on Fittings, Valves, Strainers, Flanges, and Unions:

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1. Install insulation over fittings, valves, strainers, flanges, unions, and other specialties with continuous thermal and vapor-retarder integrity unless otherwise indicated.
 2. Insulate pipe elbows using preformed fitting insulation or mitered fittings made from same material and density as adjacent pipe insulation. Each piece shall be butted tightly against adjoining piece and bonded with adhesive. Fill joints, seams, voids, and irregular surfaces with insulating cement finished to a smooth, hard, and uniform contour that is uniform with adjoining pipe insulation.
 3. Insulate tee fittings with preformed fitting insulation or sectional pipe insulation of same material and thickness as used for adjacent pipe. Cut sectional pipe insulation to fit. Butt each section closely to the next and hold in place with tie wire. Bond pieces with adhesive.
 4. Insulate valves using preformed fitting insulation or sectional pipe insulation of same material, density, and thickness as used for adjacent pipe. Overlap adjoining pipe insulation by not less than two times the thickness of pipe insulation, or one pipe diameter, whichever is thicker. For valves, insulate up to and including the bonnets, valve stuffing-box studs, bolts, and nuts. Fill joints, seams, and irregular surfaces with insulating cement.
 5. Insulate strainers using preformed fitting insulation or sectional pipe insulation of same material, density, and thickness as used for adjacent pipe. Overlap adjoining pipe insulation by not less than two times the thickness of pipe insulation, or one pipe diameter, whichever is thicker. Fill joints, seams, and irregular surfaces with insulating cement. Insulate strainers so strainer basket flange or plug can be easily removed and replaced without damaging the insulation and jacket. Provide a removable reusable insulation cover. For below ambient services, provide a design that maintains vapor barrier.
 6. Insulate flanges and unions using a section of oversized preformed pipe insulation. Overlap adjoining pipe insulation by not less than two times the thickness of pipe insulation, or one pipe diameter, whichever is thicker.
 7. Cover segmented insulated surfaces with a layer of finishing cement and coat with a mastic. Install vapor barrier mastic for below-ambient services and a breather mastic for above-ambient services. Reinforce the mastic with fabric-reinforcing mesh. Trowel the mastic to a smooth and well-shaped contour.
 8. For services not specified to receive a field applied jacket except for flexible elastomeric and polyolefin, install fitted PVC cover over elbows, tees, strainers, valves, flanges, and unions. Terminate ends with PVC end caps. Tape PVC covers to adjoining insulation facing using PVC tape.
 9. Stencil or label the outside insulation jacket of each union with the word "union." Match size and color of pipe labels.
- C. Insulate instrument connections for thermometers, pressure gages, pressure temperature taps, test connections, flow meters, sensors, switches, and transmitters on insulated pipes. Shape insulation at these connections by tapering it to and around the connection with insulating cement and finish with finishing cement, mastic, and flashing sealant.

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D. Install removable insulation covers at locations indicated. Installation shall conform to the following:

1. Make removable flange and union insulation from sectional pipe insulation of same thickness as that on adjoining pipe. Install same insulation jacket as adjoining pipe insulation.
2. When flange and union covers are made from sectional pipe insulation, extend insulation from flanges or union long at least two times the insulation thickness over adjacent pipe insulation on each side of flange or union. Secure flange cover in place with stainless-steel or aluminum bands. Select band material compatible with insulation and jacket.
3. Construct removable valve insulation covers in same manner as for flanges, except divide the two part section on the vertical center line of valve body.
4. When covers are made from block insulation, make two halves, each consisting of mitered blocks wired to stainless-steel fabric. Secure this wire frame, with its attached insulation, to flanges with tie wire. Extend insulation at least 2 inches (50 mm) over adjacent pipe insulation on each side of valve. Fill space between flange or union cover and pipe insulation with insulating cement. Finish cover assembly with insulating cement applied in two coats. After first coat is dry, apply and trowel second coat to a smooth finish.
5. Unless a PVC jacket is indicated in field-applied jacket schedules, finish exposed surfaces with a metal jacket.
6. Surface being insulated.

3.5 INSTALLATION OF MINERAL-FIBER PREFORMED PIPE INSULATION

A. Insulation Installation on Straight Pipes and Tubes:

1. Secure each layer of preformed pipe insulation to pipe with wire or bands and tighten bands without deforming insulation materials.
2. Where vapor barriers are indicated, seal longitudinal seams, end joints, and protrusions with vapor barrier mastic and joint sealant.
3. For insulation with factory-applied jackets on above-ambient surfaces, secure laps with outward clinched staples at 6 inches (150 mm) O.C.
4. For insulation with factory applied jackets on below-ambient surfaces, do not staple longitudinal tabs. Instead, secure tabs with additional adhesive as recommended by insulation material manufacturer and seal with vapor-barrier mastic and flashing sealant.

B. Insulation Installation on Pipe Flanges:

1. Install preformed pipe insulation to outer diameter of pipe flange.
2. Make width of insulation section same as overall width of flange and bolts, plus twice the thickness of pipe insulation.

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3. Fill voids between inner circumference of flange insulation and outer circumference of adjacent straight pipe segments with mineral-fiber blanket insulation.
4. Install jacket material with manufacturer's recommended adhesive, overlap seams at least 1 inch (25 mm), and seal joints with flashing sealant.

C. Insulation Installation on Pipe Fittings and Elbows:

1. Install preformed sections of same material as straight segments of pipe insulation when available.
2. When preformed insulation elbows and fittings are not available, install mitered sections of pipe insulation, to a thickness equal to adjoining pipe insulation. Secure insulation materials with wire or bands.

D. Insulation Installation on Valves and Pipe Specialties:

1. Install preformed sections of same material as straight segments of pipe insulation when available.
2. When preformed sections are not available, install mitered sections of pipe insulation to valve body.
3. Arrange insulation to permit access to packing and to allow valve operation without disturbing insulation.
4. Install insulation to flanges as specified for flange insulation application.

3.6 FIELD APPLIED JACKET INSTALLATION

A. Where FSK jackets are indicated, install as follows:

1. Draw jacket material smooth and tight.
2. Install lap or joint strips with same material as jacket.
3. Secure jacket to insulation with manufacturer's recommended adhesive.
4. Install jacket with 1-1/2-inch (38-mm) laps at longitudinal seams and 3-inch- (75-mm-) wide joint strips at end joints.
5. Seal openings, punctures, and breaks in vapor-retarder jackets and exposed insulation with vapor barrier mastic.

B. Where PVC jackets are indicated, install with 1 inch (25 mm) overlap at longitudinal seams and end joints. Seal with manufacturer's recommended adhesive.

1. Apply two continuous beads of adhesive to seams and joints, one bead under lap and the finish bead along seam and joint edge.

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- C. Where metal jackets are indicated, install with 2-inch (50-mm) overlap at longitudinal seams and end joints. Overlap longitudinal seams arranged to shed water. Seal end joints with weatherproof sealant recommended by insulation manufacturer. Secure jacket with stainless steel bands 12 inches (300 mm) O.C. and at end joints.

3.7 FINISHES

- A. Insulation with ASJ, Glass-Cloth, or Other Paintable Jacket Material:
Paint jacket with paint system identified below and as specified in Section 099113 "Exterior Painting" and Section 099123 "Interior Painting."
 - 1. Flat Acrylic Finish:
Two finish coats over a primer that is compatible with jacket material and finish coat paint. Add fungicidal agent to render fabric mildew proof.
 - 2. Finish Coat Material:
Interior, flat, latex emulsion.
- B. Flexible Elastomeric Thermal Insulation:
After adhesive has fully cured, apply two coats of insulation manufacturer's recommended protective coating.
- C. Color:
Final color as selected by Owner's Representative. Vary first and second coats to allow visual inspection of the completed Work.
- D. Do not field paint aluminum or stainless-steel jackets.

3.8 FIELD QUALITY CONTROL

- A. Perform tests and inspections.
- B. Tests and Inspections:
 - 1. Inspect pipe, fittings, strainers, and valves, randomly selected by Owner's Representative, by removing field applied jacket and insulation in layers in reverse order of their installation. Extent of inspection shall be limited to three locations of straight pipe, three locations of threaded fittings, three locations of welded fittings, two locations of threaded strainers, two locations of welded strainers, three locations of threaded valves, and three locations of flanged valves for each pipe service defined in the "Piping Insulation Schedule, General" Article.
- C. All insulation applications will be considered defective Work if sample inspection reveals noncompliance with requirements.

3.9 PIPING INSULATION SCHEDULE, GENERAL

- A. Acceptable preformed pipe and tubular insulation materials and thicknesses are identified for each piping system and pipe size range. If more than one material is listed for a piping system, selection from materials listed is Contractor's option.

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B. Items Not Insulated:

Unless otherwise indicated, do not install insulation on the following:

1. Drainage piping located in crawl spaces.
2. Underground piping.
3. Chrome-plated pipes and fittings unless there is a potential for personnel injury.

3.10 INDOOR PIPING INSULATION SCHEDULE

A. Hot and Recirculated Hot Water:

Insulation shall be one of the following:

1. Flexible Elastomeric: 3/4 inch (19 mm) thick.
2. Mineral-Fiber, Preformed Pipe Insulation, Type 1:1/2 inch (13 mm) thick.

END OF SECTION

SECTION 220517- SLEEVES AND SEALS PLUMBING PIPE

Government of the Virgin Islands, Department of Public Works

PROJECT NAME: Elaine I. Sprauve Library and Museum Building

Project Location: **St. John, U.S. Virgin Islands**

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Sleeves.
2. Sleeve-seal systems.
3. Grout.

1.2 ACTION SUBMITTALS

A. Product Data:

For each type of product indicated.

PART 2 - PRODUCTS

2.1 SLEEVES

A. Galvanized-Steel Wall Pipes:

ASTM A 53/A 53M, Schedule 40, with plain ends and welded steel collar; zinc coated.

B. Galvanized Steel Pipe Sleeves:

ASTM A 53/A 53M, Type E, Grade B, Schedule 40, zinc coated, with plain ends.

C. PVC Pipe Sleeves:

ASTM D 1785, Schedule 40.

D. Galvanized Steel Sheet Sleeves:

0.0239-inch (0.6-mm) minimum thickness; round tube closed with welded longitudinal joint.

2.2 SLEEVE-SEAL SYSTEMS

A. Manufacturers:

Subject to compliance with requirements, provide products by one of the following available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

1. Advance Products & Systems, Inc.
2. CALPICO, Inc.
3. Metraflex Company (The)
4. Pipeline Seal and Insulator, Inc.
5. Proco Products, Inc.

B. Description:

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Modular sealing-element unit, designed for field assembly, for filling annular space between piping and sleeve.

1. Sealing Elements:

EPDM-rubber or NBR interlocking links shaped to fit surface of pipe. Include type and number required for pipe material and size of pipe.

2. Pressure Plates: Plastic.

3. Connecting Bolts and Nuts:

Carbon steel, with corrosion-resistant coating, of length required to secure pressure plates to sealing elements.

2.3 GROUT

A. Standard:

ASTM C 1107/C 1107M, Grade B, post hardening and volume adjusting, dry, hydraulic cement grout.

B. Characteristics: Nonshrink; recommended for interior and exterior applications.

C. Design Mix: 5000-psi (34.5-MPa), 28-day compressive strength.

D. Packaging: Premixed and factory packaged.

PART 3 - EXECUTION

3.1 SLEEVE INSTALLATION

A. Install sleeves for piping passing through penetrations in floors, partitions, roofs, and walls.

B. For sleeves that will have sleeve-seal system installed, select sleeves of size large enough to provide 1 inch (25-mm) annular clear space between piping and concrete slabs and walls.

1. Sleeves are not required for core-drilled holes.

C. Install sleeves in concrete floors, concrete roof slabs, and concrete walls as new slabs and walls are constructed.

1. Cut sleeves to length for mounting flush with both surfaces.

a. Exception:

Extend sleeves installed in floors of mechanical equipment areas or other wet areas 2 inches (50 mm) above finished floor level.

2. Using grout, seal the space outside of sleeves in slabs and walls without sleeve-seal system.

D. Install sleeves for pipes passing through interior partitions.

1. Cut sleeves to length for mounting flush with both surfaces.

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2. Install sleeves that are large enough to provide 1/4-inch (6.4-mm) annular clear space between sleeve and pipe or pipe insulation.

3. Seal annular space between sleeve and piping or piping insulation; use joint sealants appropriate for size, depth, and location of joint. Comply with requirements for sealants specified in Section 07 92 00 "Joint Sealants."

E. Fire Barrier Penetrations:

Maintain indicated fire rating of walls, partitions, ceilings, and floors at pipe penetrations. Seal pipe penetrations with fire stop materials. Comply with requirements for fire stopping specified in Div. 07.

3.2 SLEEVE-SEAL-SYSTEM INSTALLATION

A. Install sleeve seal systems in sleeves in exterior concrete walls and slabs on grade at service piping entries into building.

B. Select type, size, and number of sealing elements required for piping material and size and for sleeve ID or hole size. Position piping in center of sleeve. Center piping in penetration, assemble sleeve seal system components, and install in annular space between piping and sleeve. Tighten bolts against pressure plates that cause sealing elements to expand and make a watertight seal.

3.3 SLEEVE AND SLEEVE-SEAL SCHEDULE

A. Use sleeves and sleeve seals for the following piping-penetration applications:

1. Exterior Concrete Walls above Grade:

a. Piping Smaller Than NPS 6 (DN 150): Galvanized steel wall sleeves

b. Piping NPS 6 (DN 150) and Larger: Galvanized steel wall sleeves

2. Exterior Concrete Walls below Grade:

a. Piping Smaller Than NPS 6 (DN 150): Galvanized steel pipe sleeves with sleeve seal system.

i. Select sleeve size to allow for 1 inch (25-mm) annular clear space between piping and sleeve for installing sleeve seal system.

b. Piping NPS 6 (DN 150) and Larger: Galvanized steel pipe sleeves with sleeve seal system.

i. Select sleeve size to allow for 1 inch (25-mm) annular clear space between piping and sleeve for installing sleeve-seal system.

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3. Concrete Slabs-on-Grade:

- a. Piping Smaller Than NPS 6 (DN 150): Galvanized-steel-pipe sleeves with sleeve seal system.
 - i. Select sleeve size to allow for 1 inch (25-mm) annular clear space between piping and sleeve for installing sleeve seal system.
- b. Piping NPS 6 (DN 150) and Larger: Galvanized steel pipe sleeves with sleeve seal system.
 - i. Select sleeve size to allow for 1 inch (25-mm) annular clear space between piping and sleeve for installing sleeve seal system.

4. Concrete Slabs above Grade:

- a. Piping Smaller Than NPS 6 (DN 150): Galvanized steel pipe sleeves.
- b. Piping NPS 6 (DN 150) and Larger: Galvanized steel pipe sleeves.

5. Interior Partitions:

- a. Piping Smaller Than NPS 6 (DN 150): Galvanized-steel-pipe sleeves.
- b. Piping NPS 6 (DN 150) and Larger: Galvanized-steel-sheet sleeves.

END OF SECTION

SECTION 220518- ESCUTCHEONS FOR PLUMBING

Government of the Virgin Islands, Department of Public Works

PROJECT NAME: Elaine I. Sprauve Library and Museum Building

Project Location: **St. John, U.S. Virgin Islands**

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Escutcheons
2. Floor plates

1.2 ACTION SUBMITTALS

A. Product Data:

For each type of product indicated

PART 2 - PRODUCTS

2.1 ESCUTCHEONS

A. One-Piece, Cast-Brass Type:

With polished, chrome-plated finish and setscrew fastener

B. One-Piece, Deep-Pattern Type:

Deep-drawn, box-shaped brass with chrome-plated finish and spring-clip fasteners

C. One-Piece, Stamped-Steel Type:

With chrome-plated finish and spring-clip fasteners

2.2 FLOOR PLATES

A. One-Piece Floor Plates:

Cast-iron flange with holes for fasteners

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install escutcheons for piping penetrations of walls, ceilings, and finished floors.

B. Install escutcheons with ID to closely fit around pipe, tube, and insulation of piping and with OD that completely covers opening.

1. Escutcheons for New Piping:

- a. Piping with Fitting or Sleeve Protruding from Wall: One-piece, deep-pattern type
- b. Chrome Plated Piping: One-piece, cast-brass type with polished, chrome-plated finish
- c. Insulated Piping: One-piece, stamped-steel type

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- d. Bare Piping at Wall and Floor Penetrations in Finished Spaces: One-piece, cast-brass type with polished, chrome-plated finish
 - e. Bare Piping at Wall and Floor Penetrations in Finished Spaces: One-piece, stamped-steel type
 - f. Bare Piping at Ceiling Penetrations in Finished Spaces: One-piece, cast-brass type with polished, chrome-plated finish
 - g. Bare Piping at Ceiling Penetrations in Finished Spaces: One-piece, stamped-steel type
 - h. Bare Piping in Unfinished Service Spaces: One-piece, cast-brass type with rough-brass finish
 - i. l. Bare Piping in Unfinished Service Spaces: One-piece, stamped-steel type
 - j. Bare Piping in Equipment Rooms: One-piece, cast brass type with rough brass finish
 - k. Bare Piping in Equipment Rooms: One-piece, stamped steel type
- C. Install floor plates for piping penetrations of equipment-room floors.
- D. Install floor plates with ID to closely fit around pipe, tube, and insulation of piping and with OD that completely covers opening.
- 1. New Piping: One piece, floor plate type

3.2 FIELD QUALITY CONTROL

- A. Replace broken and damaged escutcheons and floor plates using new materials.

END OF SECTION

SECTION 220519 – METERS AND GAGES FOR PLUMBING PIPING

Government of the Virgin Islands, Department of Public Works

PROJECT NAME: Elaine I. Sprauve Library and Museum Building

Project Location: **St. John, U.S. Virgin Islands**

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Liquid-in-glass thermometers.
2. Thermowells.
3. Dial-type pressure gages.
4. Gage attachments.

1.2 ACTION SUBMITTALS

A. Product Data:

For each type of product indicated

1.3 INFORMATIONAL SUBMITTALS

A. Product certificates

1.4 CLOSEOUT SUBMITTALS

A. Operation and maintenance data

PART 2 - PRODUCTS

2.1 LIQUID-IN-GLASS THERMOMETERS

A. Metal-Case, Industrial-Style, Liquid-in-Glass Thermometers:

1. Manufacturers:

Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the following:

a. Weiss Instruments, Inc.

2. Standard: ASME B40.200

3. Case: Cast aluminum; 7-inch (178-mm) nominal size unless otherwise indicated

4. Case Form: Adjustable angle unless otherwise indicated

5. Tube: Glass with magnifying lens and blue or red organic liquid

6. Tube Background:

Non-reflective aluminum with permanently etched scale markings graduated in degrees Fahrenheit (degrees Celsius)

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7. Window: Glass

8. Stem: Aluminum and of length to suit installation

a. Design for Thermowell Installation: Bare stem

9. Connector: 1-1/4 inches (32 mm), with ASME B1.1 screw threads

10. Accuracy:

Plus or minus 1 percent of scale range or one scale division, to a maximum of 1.5 percent of scale range

2.2 THERMOWELLS

A. Thermowells:

1. Standard: ASME B40.200

2. Description: Pressure-tight, socket-type fitting made for insertion into piping tee fitting

3. Material for Use with Copper Tubing: CNR or CUNI

4. Material for Use with Steel Piping: CRES and CSA

5. Type: Stepped shank unless straight or tapered shank is indicated

6. External Threads:

NPS 1/2, NPS 3/4, or NPS 1, (DN 15, DN 20, or NPS 25,) ASME B1.20.1 pipe threads

7. Internal Threads: 1/2, 3/4, and 1 inch (13, 19, and 25 mm), with ASME B1.1 screw threads

8. Bore: Diameter required to match thermometer bulb or stem

9. Insertion Length: Length required to match thermometer bulb or stem

10. Lagging Extension: Include on thermowells for insulated piping and tubing

11. Bushings:

For converting size of thermowell's internal screw thread to size of thermometer connection

B. Heat Transfer Medium:

Mixture of graphite and glycerin.

2.3 PRESSURE GAGES

A. Direct-Mounted, Metal-Case, Dial-Type Pressure Gages:

1. Manufacturers:

Subject to compliance with requirements, provide products by one of the following available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

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- a. Terrice, H. O. Co.
 - b. Watts Regulator Co.; a div. of Watts Water Technologies, Inc.
 - c. Weiss Instruments, Inc.
2. Standard: ASME B40.100
 3. Case: Liquid filled type(s); cast aluminum or drawn steel; 4-1/2-inch (114-mm) nominal diameter
 4. Pressure Element Assembly: Bourdon tube unless otherwise indicated
 5. Pressure Connection:
Brass, with NPS 1/4 or NPS 1/2 (DN 8 or DN 15), ASME B1.20.1 pipe threads and bottom outlet type unless back-outlet type is indicated
 6. Movement: Mechanical, with link to pressure element and connection to pointer
 7. Dial: Non-reflective aluminum with permanently etched scale markings graduated in psi (kPa)
 8. Pointer: Dark colored metal
 9. Window: Glass
 10. Ring: Metal
 11. Accuracy: Grade A, plus or minus 1 percent of middle half of scale range

2.4 GAGE ATTACHMENTS

- A. Snubbers:
ASME B40.100, brass; with NPS 1/4 or NPS 1/2 (DN 8 or DN 15), ASME B1.20.1 pipe threads and porous metal type surge dampening device. Include extension for use on insulated piping.
- B. Valves:
Brass or stainless-steel needle, with NPS 1/4 or NPS 1/2 (DN 8 or DN 15), ASME B1.20.1 pipe threads.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install thermowells with socket extending to center of pipe and in vertical position in piping tees.
- B. Install thermowells of sizes required to match thermometer connectors. Include bushings if required to match sizes.
- C. Install thermowells with extension on insulated piping.

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- D. Fill thermowells with heat-transfer medium.
- E. Install direct-mounted thermometers in thermowells and adjust vertical and tilted positions.
- F. Install direct-mounted pressure gages in piping tees with pressure gage located on pipe at the most readable position.
- G. Install valve and snubber in piping for each pressure gage for fluids.
- H. Install thermometers in the following locations:
 - 1. Outlet of each water heater.
- I. Install pressure gages in the following locations:
 - 1. Building water service entrance into building
 - 2. Inlet and outlet of each pressure-reducing valve
 - 3. Suction and discharge of each Potable water pump
- J. Install meters and gages adjacent to machines and equipment to allow service and maintenance of meters, gages, machines, and equipment.
- K. Adjust faces of meters and gages to proper angle for best visibility.

3.2 THERMOMETER SCHEDULE

- A. Thermometers at inlet and outlet of each domestic water heater shall be the following:
 - 1. Industrial style, liquid in glass type
- B. Thermometer stems shall be of length to match thermowell insertion length.

3.3 THERMOMETER SCALE RANGE SCHEDULE

- A. Scale Range for Potable Cold Water Piping: 0 to 100°F (Minus 20 to plus 50°C)
- B. Scale Range for Potable Hot Water Piping: 0 to 250°F (0 to 150°C)

3.4 PRESSURE GAGE SCHEDULE

- A. Pressure gages at discharge of each water service into building shall be the following:
 - 1. Liquid-filled, direct mounted, metal case
- B. Pressure gages at inlet and outlet of each water pressure-reducing valve shall be the following:
 - 1. Liquid-filled, direct mounted, metal case
- C. Pressure gages at suction and discharge of each Potable water pump shall be the following:

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1. Liquid-filled direct mounted, metal case

3.5 PRESSURE GAGE SCALE-RANGE SCHEDULE

- A. Scale Range for Water Service Piping: 0 to 100 psi (0 to 600 kPa).
- B. Scale Range for Potable Water Piping: 0 to 100 psi (0 to 600 kPa).

END OF SECTION

SECTION 220523 – GENERAL DUTY VALVES FOR PLUMBING PIPING

Government of the Virgin Islands, Department of Public Works

PROJECT NAME: Elaine I. Sprauve Library and Museum Building

Project Location: **St. John, U.S. Virgin Islands**

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Brass ball valves
2. Bronze ball valves
3. Bronze swing check valves
4. Bronze gate valves
5. Iron gate valves
6. Bronze globe valves.

B. Related Sections:

1. Section 22 05 53 "Identification for Plumbing Piping and Equipment" for valve tags and schedules
2. Section 22 11 16 "Potable Water Piping" for valves applicable only to this piping
3. Section 22 13 19 "Sanitary Waste Piping Specialties" for valves applicable only to this piping

1.2 ACTION SUBMITTALS

A. Product Data: For each type of valve indicated

1.3 QUALITY ASSURANCE

A. ASME Compliance:

ASME B16.10 and ASME B16.34 for ferrous valve dimensions and design criteria.

B. NSF Compliance: NSF 61 for valve materials for potable water service.

PART 2 - PRODUCTS

2.1 GENERAL REQUIREMENTS FOR VALVES

A. Refer to valve schedule articles for applications of valves.

B. Valve Pressure and Temperature Ratings:

Not less than indicated and as required for system pressures and temperatures

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- C. Valve Sizes: Same as upstream piping unless otherwise indicated
- D. Valves in Insulated Piping: With 2-inch (50-mm) stem extensions and the following features:
 - 1. Gate Valves: With rising stem
 - 2. Ball Valves:
With extended operating handle of non-thermal-conductive material, and protective sleeve that allows operation of valve without breaking the vapor seal or disturbing insulation
 - 3. Butterfly Valves: With extended neck
- E. Valve-End Connections:
 - 1. Flanged: With flanges according to ASME B16.1 for iron valves
 - 2. Solder Joint: With sockets according to ASME B 16.18
 - 3. Threaded: With threads according to ASME B1.20.1

2.2 BRASS BALL VALVES

- A. Two-Piece, Full-Port, Brass Ball Valves with Brass Trim:
 - 1. Manufacturers:
Subject to compliance with requirements, provide products by one of the following:
 - a. Crane Co.; Crane Valve Group; Crane Valves
 - b. Crane Co.; Crane Valve Group; Jenkins Valves
 - c. Hammond Valve
 - d. Milwaukee Valve Company
 - e. NIBCO INC.
 - 2. Description:
 - a. Standard: MSS SP-110
 - b. SWP Rating: 150 psig (1035 kPa)
 - c. CWP Rating: 600 psig (4140 kPa)
 - d. Body Design: Two piece
 - e. Body Material: Forged brass
 - f. Ends: Threaded
 - g. Seats: PTFE or TFE

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h. Stem: Brass

i. Ball: Chrome-plated brass

j. Port: Full

2.3 BRONZE BALL VALVES

A. Two Piece, Full Port, Bronze Ball Valves with Bronze Trim:

1. Manufacturers:

Subject to compliance with requirements, provide products by one of the following available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

a. Crane Co.; Crane Valve Group; Crane Valves

b. Hammond Valve

c. NIBCO INC.

d. Watts Regulator Co.; a division of Watts Water Technologies, Inc.

2. Description:

a. Standard: MSS SP-110

b. SWP Rating: 150 psig (1035 kPa)

c. CWP Rating: 600 psig (4140 kPa)

d. Body Design: Two pieces

e. Body Material: Bronze

f. Ends: Threaded

g. Seats: PTFE or TFE

h. Stem: Bronze

i. Ball: Chrome-plated brass

j. Port: Full

2.4 BRONZE SWING CHECK VALVES

A. Class 125, Bronze Swing Check Valves with Bronze Disc:

1. Manufacturers:

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Subject to compliance with requirements, provide products by one of the following available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

- a. Crane Co.; Crane Valve Group; Jenkins Valves
- b. Hammond Valve
- c. Milwaukee Valve Company
- d. NIBCO INC.
- e. Watts Regulator Co.; a division of Watts Water Technologies, Inc.
- f. f. Zy-Tech Global Industries, Inc.

2. Description:

- a. Standard: MSS SP-80, Type 3
- b. CWP Rating: 200 psig (1380 kPa)
- c. Body Design: Horizontal flow
- d. Body Material: ASTM B 62, bronze
- e. Ends: Threaded
- f. Disc: Bronze

2.5 BRONZE GATE VALVES

A. Class 125, RS Bronze Gate Valves:

1. Manufacturers:

Subject to compliance with requirements, provide products by one of the following:

- a. Crane Co.; Crane Valve Group; Jenkins Valves
- b. Hammond Valve
- c. NIBCO INC.

2. Description:

- a. Standard: MSS SP-80, Type 2
- b. CWP Rating: 200 psig (1380 kPa)
- c. Body Material: ASTM B 62, bronze with integral seat and screw-in bonnet
- d. Ends: Threaded or solder joint

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- e. Stem: Bronze
- f. Disc: Solid wedge; bronze
- g. Packing: Asbestos free
- h. Hand wheel: Malleable iron, bronze, or aluminum.

PART 3 - EXECUTION

3.1 VALVE INSTALLATION

- A. Install valves with unions or flanges at each piece of equipment arranged to allow service, maintenance, and equipment removal without system shutdown.
- B. Locate valves for easy access and provide separate support where necessary.
- C. Install valves in horizontal piping with stem at or above center of pipe.
- D. Install valves in position to allow full stem movement.

3.2 ADJUSTING

- A. Adjust or replace valve packing after piping systems have been tested and put into service but before final adjusting and balancing. Replace valves if persistent leaking occurs.

3.3 GENERAL REQUIREMENTS FOR VALVE APPLICATIONS

- A. If valve applications are not indicated, use the following:
 - 1. Shutoff Service: Ball, butterfly, or gate valves
 - 2. Throttling Service: Ball, or butterfly valves
 - 3. Pump Discharge Check Valves:
 - a. NPS 2 (DN 50) and Smaller: Bronze swing check valves with bronze disc
 - b. NPS 2-1/2 (DN 65) and Larger for Potable Water: Iron swing check valves with lever and weight or with spring
- B. If valves with specified SWP classes or CWP ratings are not available, the same types of valves with higher SWP class or CWP ratings may be substituted.
- C. Select valves, except wafer types, with the following end connections:
 - 1. For Copper Tubing, NPS 2 (DN 50) and Smaller:
Threaded ends except where solder-joint valve end option is indicated in valve schedules below
 - 2. For Copper Tubing, NPS 2-1/2 to NPS 4 (DN 65 to DN 100):
Flanged ends except where threaded valve-end option is indicated in valve schedules below

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3. For Copper Tubing, NPS 5 (DN 125) and Larger:
Flanged ends

3.4 POTABLE, HOT AND COLD WATER VALVE SCHEDULE

A. Pipe NPS 2 (DN 50) and Smaller:

1. Bronze and Brass Valves: May be provided with solder-joint ends instead of threaded ends
2. Bronze Angle Valves: Class 125, bronze disc
3. Ball Valves: One-piece, full, brass trim
4. Bronze Swing Check Valves: Bronze disc
5. Bronze Gate Valves: Class 125, NRS
6. Bronze Globe Valves: Class 125, bronze disc

B. Pipe NPS 2-1/2 (DN 65) and Larger:

1. Iron Valves, NPS 2-1/2 to NPS 4 (DN 65 to NPS 100):
May be provided with threaded ends instead of flanged ends
2. Iron Swing Check Valves: Class 125, metal seats
3. Iron Gate Valves: Class 125, OS&Y
4. Iron Globe Valves: Class 125

END OF SECTION

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PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Metal pipe hangers and supports
2. Trapeze pipe hangers
3. Thermal-hanger shield inserts
4. Fastener systems
5. Pipe positioning systems
6. Equipment supports

1.2 PERFORMANCE REQUIREMENTS

A. Delegated Design:

Design trapeze pipe hangers and equipment supports, including comprehensive engineering analysis by a qualified professional engineer, using performance requirements and design criteria indicated.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product indicated.

B. Shop Drawings:

Show fabrication and installation details and include calculations for the following; include Product Data for components:

1. Trapeze pipe hangers
2. Equipment supports

1.4 INFORMATIONAL SUBMITTALS

A. Welding certificates

1.5 QUALITY ASSURANCE

A. Structural Steel Welding Qualifications:

Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code Steel."

B. Pipe Welding Qualifications:

Qualify procedures and operators according to ASME Boiler and Pressure Vessel Code.

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PART 2 - PRODUCTS

2.1 METAL PIPE HANGERS AND SUPPORTS

A. Carbon-Steel Pipe Hangers and Supports:

1. Description: MSS SP-58, Types 1 through 58, factory-fabricated components
2. Nonmetallic Coatings: Plastic coating, jacket, or liner
3. Padded Hangers: Hanger with fiberglass or other pipe insulation pad or cushion to support bearing surface of piping
4. Hanger Rods: Continuous thread rod, nuts, and washer made of stainless steel

B. Copper Pipe Hangers:

1. Description: MSS SP-58, Types 1 through 58, copper coated steel, factory-fabricated components
2. Hanger Rods: Continuous-thread rod, nuts, and washer made of copper-coated steel.

2.2 TRAPEZE PIPE HANGERS

A. Description:

MSS SP-69, Type 59, shop or field fabricated pipe-support assembly made from structural carbon-steel shapes with stainless steel hanger rods, nuts, saddles, and U-bolts.

2.3 FASTENER SYSTEMS

A. Mechanical Expansion Anchors:

Insert wedge type, stainless steel anchors, for use in hardened Portland cement concrete; with pull out, tension, and shear capacities appropriate for supported loads and building materials where used.

2.4 PIPE POSITIONING SYSTEMS

A. Description:

IAPMO PS 42, positioning system of metal brackets, clips, and straps for positioning piping in pipe spaces; for plumbing fixtures in commercial applications.

2.5 EQUIPMENT SUPPORTS

A. Description:

Welded, shop or field-fabricated equipment support made from structural carbon steel shapes

2.6 MISCELLANEOUS MATERIALS

- ##### **A. Structural Steel:** ASTM A 36/A 36M, carbon-steel plates, shapes, and bars; black and galvanized

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B. Grout:

ASTM C 1107, factory mixed and packaged, dry, hydraulic cement, non-shrink and nonmetallic grout; suitable for interior and exterior applications.

1. Properties: Non-staining, noncorrosive, and nongaseous.

2. Design Mix: 5000 psi (34.5-MPa), 28-day compressive strength.

PART 3 - EXECUTION

3.1 HANGER AND SUPPORT INSTALLATION

A. Metal Pipe-Hanger Installation:

Comply with MSS SP-69 and MSS SP-89. Install hangers, supports, clamps, and attachments as required to properly support piping from the building structure.

B. Metal Trapeze Pipe Hanger Installation:

Comply with MSS SP-69 and MSS SP-89. Arrange for grouping of parallel runs of horizontal piping, and support together on field fabricated trapeze pipe hangers.

1. Pipes of Various Sizes:

Support together and space trapezes for smallest pipe size or install intermediate supports for smaller diameter pipes as specified for individual pipe hangers.

2. Field fabricate from ASTM A 36/A 36M, carbon-steel shapes selected for loads being supported. Weld steel according to AWS D1.1/D1.1M.

C. Fastener System Installation:

1. Install mechanical expansion anchors in concrete, after concrete is placed and completely cured. Install fasteners according to manufacturer's written instructions.

D. Pipe Positioning System Installation:

Install support devices to make rigid supply and waste piping connections to each plumbing fixture.

E. Install hangers and supports complete with necessary attachments, inserts, bolts, rods, nuts, washers, and other accessories.

F. Equipment Support Installation: Fabricate from welded-structural-steel shapes.

G. Install hangers and supports to allow controlled thermal movement of piping systems, to permit freedom of movement between pipe anchors, and to facilitate action of expansion joints, expansion loops, expansion bends, and similar units.

H. Install lateral bracing with pipe hangers and supports to prevent swaying.

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- I. Install building attachments within concrete slabs or attach to structural steel. Install additional attachments at concentrated loads, including valves, flanges, and strainers, NPS 2-1/2 (DN 65) and larger and at changes in direction of piping. Install concrete inserts before concrete is placed; fasten inserts to forms and install reinforcing bars through openings at top of inserts.
- J. Load Distribution:
Install hangers and supports so that piping live and dead loads and stresses from movement will not be transmitted to connected equipment.
- K. Pipe Slopes:
Install hangers and supports to provide indicated pipe slopes and to not exceed maximum pipe deflections allowed by ASME B31.9 for building services piping.
- L. Insulated Piping:
 - 1. Attach clamps and spacers to piping.
 - a. Piping Operating above Ambient Air Temperature: Clamp may project through insulation.
 - b. Piping Operating below Ambient Air Temperature: Use thermal-hanger shield insert with clamp sized to match OD of insert.
 - c. Do not exceed pipe stress limits allowed by ASME B31.9 for building services piping.
 - 2. Install MSS SP-58, Type 39, protection saddles if insulation without vapor barrier is indicated. Fill interior voids with insulation that matches adjoining insulation.
 - a. Option:
Thermal-hanger shield inserts may be used. Include steel weight distribution plate for pipe NPS 4 (DN 100) and larger if pipe is installed on rollers.
 - 3. Install MSS SP-58, Type 40, protective shields on cold piping with vapor barrier. Shields shall span an arc of 180 degrees.
 - a. Option:
Thermal hanger shield inserts may be used. Include steel weight distribution plate for pipe NPS 4 (DN 100) and larger if pipe is installed on rollers.
 - 4. Shield Dimensions for Pipe:
Not less than the following:
 - a. NPS 1/4 to NPS 3-1/2 (DN 8 to DN 90): 12 inches (305 mm) long and 0.048 inch (1.22 mm) thick
 - b. NPS 4 (DN 100): 12 inches (305 mm) long and 0.06 inch (1.52 mm) thick
 - c. NPS 5 and NPS 6 (DN 125 and DN 150): 18 inches (457 mm) long and 0.06 inch (1.52 mm) thick

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d. NPS 8 to NPS 14 (DN 200 to DN 350): 24 inches (610 mm) long and 0.075 inch (1.91 mm) thick

e. NPS 16 to NPS 24 (DN 400 to DN 600): 24 inches (610 mm) long and 0.105 inch (2.67 mm) thick

5. Pipes NPS 8 (DN 200) and Larger:

Include wood or reinforced calcium silicate insulation inserts of length at least as long as protective shield

6. Thermal Hanger Shields: Install with insulation same thickness as piping insulation

3.2 EQUIPMENT SUPPORTS

A. Fabricate structural steel stands to suspend equipment from structure overhead or to support equipment above floor.

B. Grouting: Place grout under supports for equipment and make bearing surface smooth.

C. Provide lateral bracing, to prevent swaying, for equipment supports.

3.3 METAL FABRICATIONS

A. Cut, drill, and fit miscellaneous metal fabrications for trapeze pipe hangers and equipment supports.

B. Fit exposed connections together to form hairline joints. Field weld connections that cannot be shop welded because of shipping size limitations.

C. Field Welding:

Comply with AWS D1.1/D1.1M procedures for shielded, metal arc welding; appearance and quality of welds; and methods used in correcting welding work; and with the following:

1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.

2. Obtain fusion without undercut or overlap.

3. Remove welding flux immediately.

4. Finish welds at exposed connections so no roughness shows after finishing and so contours of welded surfaces match adjacent contours.

3.4 ADJUSTING

A. Hanger Adjustments:

Adjust hangers to distribute loads equally on attachments and to achieve indicated slope of pipe.

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- B. Trim excess length of continuous thread hanger and support rods to 1-1/2 inches (40 mm).

3.5 PAINTING

A. Touchup:

Clean field welds and abraded areas of shop paint. Paint exposed areas immediately after erecting hangers and supports. Use same materials as used for shop painting. Comply with SSPC-PA 1 requirements for touching up field-painted surfaces.

- 1. Apply paint by brush or spray to provide a minimum dry film thickness of 2.0 mils (0.05 mm).

B. Touchup:

Cleaning and touchup painting of field welds, bolted connections, and abraded areas of shop paint on miscellaneous metal are specified in Division 09.

C. Galvanized Surfaces:

Clean welds, bolted connections, and abraded areas and apply galvanizing-repair paint to comply with ASTM A 780.

3.6 HANGER AND SUPPORT SCHEDULE

- A. Specific hanger and support requirements are in Sections specifying piping systems and equipment.

- B. Comply with MSS SP-69 for pipe hanger selections and applications that are not specified in piping system Sections.

- C. Use hangers and supports with galvanized metallic coatings for piping and equipment that will not have field applied finish.

- D. Use nonmetallic coatings on attachments for electrolytic protection where attachments are in direct contact with copper tubing.

- E. Use carbon steel pipe hangers and supports and metal trapeze pipe hangers and attachments for general service applications.

- F. Use copper plated pipe hangers and copper or stainless steel attachments for copper piping and tubing.

- G. Use padded hangers for piping that is subject to scratching.

H. Horizontal Piping Hangers and Supports:

Unless otherwise indicated and except as specified in piping system Sections, install the following types:

- 1. Adjustable, Steel Clevis Hangers (MSS Type I):

For suspension of non-insulated or insulated, stationary pipes NPS 1/2 to NPS 30 (DN 15 to DN 750).

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2. Yoke Type Pipe Clamps (MSS Type 2):

For suspension of up to 1050°F (566°C), pipes NPS 4 to NPS 24 (DN 100 to DN 600), requiring up to 4 inches (100 mm) of insulation.

3. Carbon or Alloy Steel, Double Bolt Pipe Clamps (MSS Type 3):

For suspension of pipes NPS 3/4 to NPS 36 (DN 20 to DN 900), requiring clamp flexibility and up to 4 inches (100 mm) of insulation.

4. Adjustable, Steel Band Hangers (MSS Type 7):

For suspension of non-insulated, stationary pipes NPS 1/2 to NPS 8 (DN 15 to DN 200).

5. U-Bolts (MSS Type 24):

For support of heavy pipes NPS 1/2 to NPS 30 (DN 15 to DN 750).

6. Pipe Saddle Supports (MSS Type 36):

For support of pipes NPS 4 to NPS 36 (DN 100 to DN 900), with steel-pipe base stanchion support and cast iron floor flange or carbon-steel plate.

7. Pipe Stanchion Saddles (MSS Type 37):

For support of pipes NPS 4 to NPS 36 (DN 100 to DN 900), with steel pipe base stanchion support and cast iron floor flange or carbon steel plate, and with U-bolt to retain pipe.

8. Single Pipe Rolls (MSS Type 41):

For suspension of pipes NPS 1 to NPS 30 (DN 25 to DN 750), from two rods if longitudinal movement caused by expansion and contraction might occur.

9. Complete Pipe Rolls (MSS Type 44):

For support of pipes NPS 2 to NPS 42 (DN 50 to DN 1050) if longitudinal movement caused by expansion and contraction might occur but vertical adjustment is not necessary.

I. Vertical Piping Clamps:

Unless otherwise indicated and except as specified in piping system Sections, install the following types:

1. Extension Pipe or Riser Clamps (MSS Type 8):

For support of pipe risers NPS 3/4 to NPS 24 (DN 24 to DN 600)

2. Carbon or Alloy Steel Riser Clamps (MSS Type 42):

For support of pipe risers NPS 3/4 to NPS 24 (DN 20 to DN 600) if longer ends are required for riser clamps.

J. Hanger-Rod Attachments:

Unless otherwise indicated and except as specified in piping system Sections, install the following types:

1. Steel Turnbuckles (MSS Type 13): For adjustment up to 6 inches (150 mm) for heavy loads.

2. Steel Clevises (MSS Type 14): For 120 to 450°F (49 to 232°C) piping installations.

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K. Building Attachments:

Unless otherwise indicated and except as specified in piping system Sections, install the following types:

1. Steel or Malleable Concrete Inserts (MSS Type 18):

For upper attachment to suspend pipe hangers from concrete ceiling

2. Top Beam C-Clamps (MSS Type 19):

For use under roof installations with bar joist construction, to attach to top flange of structural shape

3. Side Beam or Channel Clamps (MSS Type 20): For attaching to bottom flange of beams, channels, or angles

4. Center Beam Clamps (MSS Type 21): For attaching to center of bottom flange of beams

5. Welded Beam Attachments (MSS Type 22):

For attaching to bottom of beams if loads are considerable and rod sizes are large

6. C-Clamps (MSS Type 23): For structural shapes

7. Welded Steel Brackets:

For support of pipes from below, or for suspending from above by using clip and rod. Use one of the following for indicated loads:

a. Light (MSS Type 31): 750 lb (340 kg)

b. Medium (MSS Type 32): 1500 lb (680 kg)

c. Heavy (MSS Type 33): 3000 lb (1360 kg)

8. Side Beam Brackets (MSS Type 34): For sides of steel or wooden beams

9. Plate Lugs (MSS Type 57): For attaching to steel beams if flexibility at beam is required.

L. Saddles and Shields:

Unless otherwise indicated and except as specified in piping system Sections, install the following types:

1. Steel Pipe Covering Protection Saddles (MSS Type 39):

To fill interior voids with insulation that matches adjoining insulation.

2. Protection Shields (MSS Type 40):

Of length recommended in writing by manufacturer to prevent crushing the insulation.

3. Thermal-Hanger Shield Inserts: For supporting insulated pipe.

M. Spring Hangers and Supports:

Unless otherwise indicated and except as specified in piping system Sections, install the following types:

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1. Spring Cushions (MSS Type 48): For light loads if vertical movement does not exceed 1-1/4 inches (32 mm).
 2. Spring Cushion Roll Hangers (MSS Type 49): For equipping Type 41, roll hanger with springs.
 3. Variable Spring Base Supports (MSS Type 52):
Preset to indicated load and limit variability factor to 25 percent to allow expansion and contraction of piping system from base support.
- N. Comply with MSS SP-69 for trapeze pipe hanger selections and applications that are not specified in piping system Sections.
- O. Use mechanical expansion anchors instead of building attachments where required in concrete construction.
- P. Use pipe positioning systems in pipe spaces behind plumbing fixtures to support supply and waste piping for plumbing fixtures.

END OF SECTION

SECTION 220548 – VIBRATION AND SEISMIC CONTROLS FOR PLUMBING, PIPING, AND EQUIPMENT

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PROJECT NAME: Elaine I. Sprauve Library and Museum Building

Project Location: **St. John, U.S. Virgin Islands**

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. This Section includes the following:
 - 1. Isolation pads
 - 2. Isolation mounts
 - 3. Restrained elastomeric isolation mounts
 - 4. Freestanding and restrained spring isolators
 - 5. Housed spring mounts
 - 6. Elastomeric hangers
 - 7. Spring hangers
 - 8. Spring hangers with vertical limit stops
 - 9. Pipe riser resilient supports
 - 10. Resilient pipe guides
 - 11. Seismic snubbers
 - 12. Restraining braces and cables
 - 13. Steel and inertia, vibration isolation equipment bases

1.3 DEFINITIONS

- A. IBC: 2018 International Building Code.
- B. ICC-ES: ICC-Evaluation Service.

1.4 PERFORMANCE REQUIREMENTS

- A. Wind-Restraint Loading:
 - 1. Basic Wind Speed: 175 miles/hours
 - 2. Building Classification Category: II

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3. Minimum 10 lb/sq.ft. (48.8 kg/sq.m) multiplied by the maximum area of the HVAC component projected on a vertical plane that is normal to the wind direction, and 45 degrees either side of normal.

B. Seismic-Restraint Loading:

1. Site Class as Defined in the IBC where essential facility and $S_1=0.371$: D
2. Assigned Seismic Use Group or Building Category as Defined in the IBC: IV
 - a. Component Importance Factor is 1.5.
 - b. Component Response Modification Factor is 2.5.
 - c. Component Amplification Factor is 2.5.
3. Design Spectral Response Acceleration at Short Periods (0.2 Second) is 1.1%
4. Design Spectral Response Acceleration at 1-Second Period is 1.8%

1.5 ACTION SUBMITTALS

A. Product Data: For each product indicated.

1. Include rated load, rated deflection, and overload capacity for each vibration isolation device.
2. Illustrate and indicate style, material, strength, fastening provision, and finish for each type and size of seismic restraint component used.
 - a. Tabulate types and sizes of seismic restraints, complete with report numbers and rated strength in tension and shear as evaluated by an evaluation service member of ICC-ES OSHPD.
 - b. Annotate to indicate application of each product submitted and compliance with requirements.
3. Interlocking Snubbers: Include ratings for horizontal, vertical, and combined loads.

B. Delegated Design Submittal:

For vibration isolation and seismic restraint calculations and details indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

1. Design Calculations:

Calculate static and dynamic loading due to equipment weight and operation, seismic and wind forces required to select vibration isolators, seismic and wind restraints, and for designing vibration isolation bases.

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- a. Coordinate design calculations with wind load calculations required for equipment mounted outdoors. Comply with requirements in other Sections for equipment mounted outdoors.

2. Riser Supports:

Include riser diagrams and calculations showing anticipated expansion and contraction at each support point, initial and final loads on building structure, spring deflection changes, and seismic loads. Include certification that riser system has been examined for excessive stress and that none will exist.

3. Vibration Isolation Base Details:

Detail overall dimensions, including anchorages and attachments to structure and to supported equipment. Include auxiliary motor slides and rails, base weights, equipment static loads, power transmission, component misalignment, and cantilever loads.

4. Seismic and Wind Restraint Details:

a. Design Analysis:

To support selection and arrangement of seismic and wind restraints. Include calculations of combined tensile and shear loads.

b. Details:

Indicate fabrication and arrangement. Detail attachments of restraints to the restrained items and to the structure. Show attachment locations, methods, and spacing. Identify components, list their strengths, and indicate directions and values of forces transmitted to the structure during seismic events. Indicate association with vibration isolation devices.

- c. Coordinate seismic restraint and vibration isolation details with wind-restraint details required for equipment mounted outdoors. Comply with requirements in other Sections for equipment mounted outdoors.

d. Preapproval and Evaluation Documentation:

By an evaluation service member of ICC-ES OSHPD, showing maximum ratings of restraint items and the basis for approval (tests or calculations).

1.6 INFORMATIONAL SUBMITTALS

A. Coordination Drawings:

Show coordination of seismic bracing for Plumbing piping and equipment with other systems and equipment in the vicinity, including other supports and seismic restraints.

B. Qualification Data:

For professional engineer: Copy of license

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- C. Welding certificates
- D. Field quality control test reports.
 - 1. Mason Industries
 - 2. Vibration Isolation.

1.7 QUALITY ASSURANCE

- A. Comply with seismic-restraint requirements in the IBC unless requirements in this Section are more stringent.
- B. Welding:
Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code Steel."
- C. Seismic restraint devices shall have horizontal and vertical load testing and analysis and shall bear anchorage preapproval OPA number from OSHPD, preapproved by ICC-ES, or preapproved by another agency acceptable to authorities having jurisdiction, showing maximum seismic restraint ratings. Ratings based on independent testing are preferred to ratings based on calculations. If preapproved ratings are not available, submittals based on independent testing are preferred. Calculations (including combining shear and tensile loads) to support seismic restraint designs must be signed and sealed by a qualified professional engineer.

PART 2 - PRODUCTS

2.1 VIBRATION ISOLATORS

- A. Basis of Design Product:
Subject to compliance with requirements, provide or a comparable product by one of the following:
 - 1. Ace Mounting Co., Inc.
 - 2. Isolation Technology, Inc.
 - 3. Kinetic Noise Control
- B. Pads:
Arranged in single or multiple layers of sufficient stiffness for uniform loading over pad area, molded with a nonslip pattern and galvanized steel baseplates, and factory cut to sizes that match requirements of supported equipment.
 - 1. Resilient Material: Oil and water-resistant neoprene rubber.
- C. Mounts:
Double deflection type, with molded, oil resistant rubber, hermetically sealed compressed fiberglass, or neoprene isolator elements with factory drilled, encapsulated top plate for

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bolting to equipment and with baseplate for bolting to structure. Color-code or otherwise identify to indicate capacity range.

1. Materials:

Cast ductile iron or welded steel housing containing two separate and opposing, oil resistant rubber or neoprene elements that prevent central threaded element and attachment hardware from contacting the housing during normal operation.

2. Neoprene:

Shock absorbing materials compounded according to the standard for bridge bearing neoprene as defined by AASHTO.

D. Restrained Mounts: All directional mountings with seismic restraint

1. Materials:

Cast, ductile iron, or welded steel housing containing two separate and opposing, oil-resistant rubber or neoprene elements that prevent central threaded element and attachment hardware from contacting the housing during normal operation.

2. Neoprene:

Shock absorbing materials compounded according to the standard for bridge bearing neoprene as defined by AASHTO.

E. Spring Isolators: Freestanding, laterally stable, open-spring isolators

1. Outside Spring Diameter: Not less than 80 percent of the compressed height of the spring at rated load

2. Minimum Additional Travel: 50 percent of the required deflection at rated load

3. Lateral Stiffness: More than 80 percent of rated vertical stiffness

4. Overload Capacity: Support 200 percent of rated load, fully compressed, without deformation or failure

5. Baseplates:

Factory drilled for bolting to structure and bonded to 1/4-inch (6-mm) thick, rubber isolator pad attached to baseplate underside. Baseplates shall limit floor load to 500 psig (3447 kPa)

6. Top Plate and Adjustment Bolt: Threaded top plate with adjustment bolt and cap screw to fasten and level equipment.

F. Restrained Spring Isolators:

Freestanding, steel, open-spring isolators with seismic or limit-stop restraint.

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1. Housing:

Steel with resilient vertical limit stops to prevent spring extension due to weight being removed; factory drilled baseplate bonded to 1/4-inch (6-mm) thick, neoprene or rubber isolator pad attached to baseplate underside; and adjustable equipment mounting and leveling bolt that acts as blocking during installation.

2. Restraint: Seismic or limit-stop as required for equipment and authorities having jurisdiction.

3. Outside Spring Diameter: Not less than 80 percent of the compressed height of the spring at rated load

4. Minimum Additional Travel: 50 percent of the required deflection at rated load

5. Lateral Stiffness: More than 80 percent of rated vertical stiffness

6. Overload Capacity: Support 200 percent of rated load, fully compressed, without deformation or failure

G. Housed Spring Mounts: Housed spring isolator with integral seismic snubbers

1. Housing: Ductile iron or steel housing to provide all direction seismic restraint

2. Base: Factory drilled for bolting to structure

3. Snubbers: Vertically adjustable to allow a maximum of 1/4-inch (6-mm) travel up or down before contacting a resilient collar.

H. Elastomeric Hangers:

Single or double deflection type, fitted with molded, oil resistant elastomeric isolator elements bonded to steel housings with threaded connections for hanger rods. Color code or otherwise identify to indicate capacity range.

I. Spring Hangers: Combination coil-spring and elastomeric-insert hanger with spring and insert in compression

1. Frame:

Steel, fabricated for connection to threaded hanger rods and to allow for a maximum of 30 degrees of angular hanger-rod misalignment without binding or reducing isolation efficiency.

2. Outside Spring Diameter: Not less than 80 percent of the compressed height of the spring at rated load

3. Minimum Additional Travel: 50 percent of the required deflection at rated load

4. Lateral Stiffness: More than 80 percent of rated vertical stiffness

5. Overload Capacity: Support 200 percent of rated load, fully compressed, without deformation or failure

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6. Elastomeric Element:

7. Molded, oil-resistant rubber or neoprene. Steel-washer-reinforced cup to support spring and bushing projecting through bottom of frame.

8. Self-centering hanger rod cap to ensure concentricity between hanger rod and support spring coil.

J. Spring Hangers with Vertical Limit Stop:

Combination coil spring and elastomeric insert hanger with spring and insert in compression and with a vertical limit stop.

1. Frame:

Steel, fabricated for connection to threaded hanger rods and to allow for a maximum of 30 degrees of angular hanger rod misalignment without binding or reducing isolation efficiency.

2. Outside Spring Diameter: Not less than 80 percent of the compressed height of the spring at rated load

3. Minimum Additional Travel: 50 percent of the required deflection at rated load

4. Lateral Stiffness: More than 80 percent of rated vertical stiffness

5. Overload Capacity: Support 200 percent of rated load, fully compressed, without deformation or failure.

6. Elastomeric Element: Molded, oil resistant rubber or neoprene

7. Adjustable Vertical Stop: Steel washer with neoprene washer "up-stop" on lower threaded rod

8. Self-centering hanger rod cap to ensure concentricity between hanger rod and support spring coil.

K. Pipe Riser Resilient Support:

All direction, acoustical pipe anchor consisting of 2 steel tubes separated by a minimum of 1/2-inch (13-mm) thick neoprene. Include steel and neoprene vertical limit stops arranged to prevent vertical travel in both directions. Design support for a maximum load on the isolation material of 500 psig (3.45 MPa) and for equal resistance in all directions.

L. Resilient Pipe Guides:

Telescopic arrangement of 2 steel tubes or post and sleeve arrangement separated by a minimum of 1/2-inch (13-mm) thick neoprene. Where clearances are not readily visible, a factory set guide height with a shear pin to allow vertical motion due to pipe expansion and contraction shall be fitted. Shear pin shall be capable of removal and reinsertion to allow for selection of pipe movement. Guides shall be capable of motion to meet location requirements.

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2.2 SEISMIC-RESTRAINT DEVICES

A. Basis of Design Product:

Subject to compliance with requirements, provide or a comparable product by one of the following:

1. Cooper B-Line. Inc.; a division of Cooper Industries
2. Hilti. Inc.
3. Kinetics Noise Control
4. Loos & Co.: Cableware Division
5. Mason Industries
6. TOLCO Incorporated; a brand of NIBCO INC.
7. Unistrut; Tyco International, Ltd .

B. General Requirements for Restraint Components:

Rated strengths, features, and applications shall be as defined in reports by an evaluation service member of ICC-ES.

1. Structural Safety Factor:

Allowable strength in tension, shear, and pullout force of components shall be at least four times the maximum seismic forces to which they will be subjected.

C. Channel Support System:

MFMA-3, shop or field fabricated support assembly made of slotted steel channels with accessories for attachment to braced component at one end and to building structure at the other end and other matching components and with corrosion-resistant coating; and rated in tension, compression, and torsion forces.

D. Restraint Cables:

ASTM A 603 galvanized steel cables with end connections made of steel assemblies with thimbles, brackets, swivel, and bolts designed for restraining cable service; and with a minimum of two clamping bolts for cable engagement.

E. Hanger Rod Stiffener:

Steel tube or steel slotted support system sleeve with internally bolted connections to hanger rod.

F. Bushings for Floor-Mounted Equipment Anchor Bolts:

Neoprene bushings designed for rigid equipment mountings, and matched to type and size of anchor bolts and studs.

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G. Resilient Isolation Washers and Bushings: One piece, molded, oil and water-resistant neoprene, with a flat washer face.

H. Mechanical Anchor Bolts:

Drilled in and stud wedge or female wedge type in zinc-coated steel for interior applications and stainless steel for exterior applications. Select anchor bolts with strength required for anchor and as tested according to ASTM E 488. Minimum length of eight times diameter.

PART 3 - EXECUTION

3.1 APPLICATIONS

A. Multiple Pipe Supports:

Secure pipes to trapeze member with clamps approved for application by an evaluation service member of ICC-ES.

B. Hanger Rod Stiffeners:

Install hanger rod stiffeners where indicated or scheduled on Drawings to receive them and where required to prevent buckling of hanger rods due to seismic forces.

C. Strength of Support and Seismic Restraint Assemblies:

Where not indicated, select sizes of components so strength will be adequate to carry present and future static and seismic loads within specified loading limits.

3.2 VIBRATION-CONTROL AND SEISMIC-RESTRAINT DEVICE INSTALLATION

A. Equipment Restraints:

1. Install resilient bolt isolation washers on equipment anchor bolts where clearance between anchor and adjacent surface exceeds 0.125 inches (3.2 mm).

2. Install seismic-restraint devices using methods approved by an evaluation service member of ICC-ES OSHPD providing required submittals for component.

B. Piping Restraints:

1. Comply with requirements in MSS SP-127.

2. Space lateral supports a maximum of 40 feet (12m) O.C., and longitudinal supports a maximum of 80 feet (24m) O.C.

3. Brace a change of direction longer than 12 feet (3.7 m).

C. Install cables so they do not bend across edges of adjacent equipment or building structure.

D. Install seismic restraint devices using methods approved by an evaluation service member of ICC-ES or OSHPD providing required submittals for component.

E. Install bushing assemblies for anchor bolts for floor mounted equipment, arranged to provide resilient media between anchor bolts and mounting hole in concrete base.

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F. Attachment to Structure:

If specific attachment is not indicated, anchor bracing to structure at flanges of beams, at upper truss chords of bar joists, or at concrete members.

G. Drilled in Anchors:

1. Identify position of reinforcing steel and other embedded items prior to drilling holes for anchors. Do not damage existing reinforcing or embedded items during coring or drilling. Notify the structural engineer if reinforcing steel or other embedded items are encountered during drilling. Locate and avoid pre-stressed tendons, electrical and telecommunications conduit, and gas lines.

2. Do not drill holes in concrete or masonry until concrete, mortar, or grout has achieved full design strength.

3. Wedge Anchors:

Protect threads from damage during anchor installation. Heavy duty sleeve anchors shall be installed with sleeve fully engaged in the structural element to which anchor is to be fastened.

4. Set anchors to manufacturer's recommended torque, using a torque wrench.

5. Install zinc coated steel anchors for interior and stainless steel anchors for exterior applications.

3.3 ACCOMMODATION OF DIFFERENTIAL SEISMIC MOTION

A. Install flexible connections in piping where they cross seismic joints, where adjacent sections or branches are supported by different structural elements, and where the connections terminate with connection to equipment that is anchored to a different structural element from the one supporting the connections as they approach equipment. Comply with requirements in Section 221116 "Potable Water Piping" for piping flexible connections.

3.4 FIELD QUALITY CONTROL

A. Perform tests and inspections.

B. Tests and Inspections:

1. Provide evidence of recent calibration of test equipment by a testing agency acceptable to authorities having jurisdiction.

2. Schedule test with Owner, through Owner's Representative, before connecting anchorage device to restrained component (unless post connection testing has been approved), and with at least seven days' advance notice.

3. Obtain Owner's Representative's approval before transmitting test loads to structure. Provide temporary load-spreading members.

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4. Test at least four of each type and size of installed anchors and fasteners selected by Owner's Representative.
 5. Test to 90 percent of rated proof load of device.
 6. Measure isolator restraint clearance.
 7. Measure isolator deflection.
 8. If a device fails test, modify all installations of same type and retest until satisfactory results are achieved.
- C. Remove and replace malfunctioning units and retest as specified above.
- D. Prepare test and inspection reports.

3.5 ADJUSTING

- A. Adjust isolators after piping system is at operating weight.
- B. Adjust limit stops on restrained spring isolators to mount equipment at normal operating height. After equipment installation is complete, adjust limit stops so they are out of contact during normal operation.
- C. Adjust active height of spring isolators.
- D. Adjust restraints to permit free movement of equipment within normal mode of operation.

3.6 PLUMBING VIBRATION-CONTROL AND SEISMIC-RESTRAINT DEVICE SCHEDULE

- A. Supported or Suspended Equipment:
1. Equipment Location: Pump room
 2. Isolator Type: Freestanding, laterally stable, open spring isolators
 3. Minimum Deflection: 2 inches (50 mm)
 4. Component Importance Factor: 1.5
 5. Component Response Modification Factor: 2.5
 6. Component Amplification Factor: 2.5

END OF SECTION

SECTION 220553 – IDENTIFICATION FOR PLUMBING PIPING AND EQUIPMENT

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PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Equipment labels
2. Warning signs and labels
3. Pipe labels

1.2 ACTION SUBMITTAL

Product Data: For each type of product indicated.

PART 2 - PRODUCTS

2.1 EQUIPMENT LABELS

A. Plastic Labels for Equipment:

1. Material and Thickness:

Multilayer, multicolor, plastic labels for mechanical engraving, 1/16 inch (1.6 mm) thick, and having predrilled holes for attachment hardware.

2. Letter Color: White

3. Background Color: Black

4. Maximum Temperature: Able to withstand temperatures up to 160°F (71°C)

5. Minimum Label Size:

Length and width vary for required label content, but not less than 2-1/2 by 3/4 inch (64 by 19 mm).

6. Minimum Letter Size:

1/4 inch (6.4 mm) for name of units if viewing distance is less than 24 inches (600 mm), 1/2 inch (13 mm) for viewing distances up to 72 inches (1830 mm), and proportionately larger lettering for greater viewing distances. Include secondary lettering two thirds to three fourths the size of principal lettering.

7. Adhesive: Contact type permanent adhesive, compatible with label and with substrate

B. Label Content:

Include equipment's Drawing designation or unique equipment number, Drawing numbers where equipment is indicated (plans, details, and schedules), plus the Specification Section number and title where equipment is specified.

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C. Equipment Label Schedule:

For each item of equipment to be labeled, on 8-1/2-by-11-inch (A4) bond paper. Tabulate equipment identification number and identify Drawing numbers where equipment is indicated (plans, details, and schedules), plus the Specification Section number and title where equipment is specified. Equipment schedule shall be included in operation and maintenance data.

2.2 WARNING SIGNS AND LABELS

A. Material and Thickness:

Multilayer, multicolor, plastic labels for mechanical engraving, 1/8 inch (3.2 mm) thick, and having predrilled holes for attachment hardware.

1. Letter Color: White

2. Background Color: Black or Red

3. Maximum Temperature: Able to withstand temperatures up to 160°F (71°C)

4. Minimum Label Size: Length and width vary for required label content, but not less than 2 1/2 by 3/4 inch (64 by 19 mm).

5. Minimum Letter Size:

1/4 inch (6.4 mm) for name of units if viewing distance is less than 24 inches (600 mm), 1/2 inch (13 mm) for viewing distances up to 72 inches (1830 mm), and proportionately larger lettering for greater viewing distances. Include secondary lettering two thirds to three fourths the size of principal lettering.

6. Fasteners: Stainless steel self-tapping screws

7. Adhesive: Contact type permanent adhesive, compatible with label and with substrate

8. Label Content: Include caution and warning information, plus emergency notification instructions.

2.3 PIPE LABELS

A. General Requirements for Manufactured Pipe Labels:

B. Preprinted, color-coded, with lettering indicating service, and showing flow direction

C. Pretension Pipe Labels:

D. Pre-coiled, semi-rigid plastic formed to cover full circumference of pipe and to attach to pipe without fasteners or adhesive

E. Self-Adhesive Pipe Labels:

F. Printed plastic with contact-type, permanent adhesive backing

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G. Pipe Label Contents:

H. Include identification of piping service using same designations or abbreviations as used on Drawings, pipe size, and an arrow indicating flow direction.

I. Flow Direction Arrows:

J. Integral with piping system service lettering to accommodate both directions, or as separate unit on each pipe label to indicate flow direction.

K. Lettering Size: At least 1 1/2 inches (38 mm) high

PART 3 - EXECUTION

3.1 PREPARATION

Clean piping and equipment surfaces of substances that could impair bond of identification devices, including dirt, oil, grease, release agents, and incompatible primers, paints, and encapsulants.

3.2 EQUIPMENT LABEL INSTALLATION

Install or permanently fasten labels on each major item of mechanical equipment. Locate equipment labels where accessible and visible.

3.3 PIPE LABEL INSTALLATION

A. Piping Color Coding: Painting of piping is specified in Division 09

B. Locate pipe labels where piping is exposed or above accessible ceilings in finished spaces; machine rooms; accessible maintenance spaces such as shafts, tunnels, and plenums; and exterior exposed locations as follows:

1. Near each valve and control device.
2. Near each branch connection, excluding short takeoffs for fixtures and terminal units.
Where flow pattern is not obvious, mark each pipe at branch.
3. Near penetrations through walls, floors, ceilings, and inaccessible enclosures.
4. At access doors, manholes, and similar access points that permit view of concealed piping.
5. Near major equipment items and other points of origination and termination.
6. Spaced at maximum intervals of 50 feet (15m) along each run. Reduce intervals to 25 feet (7.6 m) in areas of congested piping and equipment.
7. On piping above removable acoustical ceilings. Omit intermediately spaced labels.

C. Pipe Label Color Schedule:

1. Potable Water Piping:

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a. Background Color: Blue.

b. Letter Color: White.

2. Sanitary Waste and Storm Drainage Piping:

a. Background Color: Black

b. Letter Color: White

END OF SECTION

SECTION 221119 – POTABLE WATER PIPING SPECIALTIES

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PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Vacuum breakers.
2. Backflow preventers.
3. Water pressure-reducing valves.
4. Balancing valves.
5. Temperature-actuated, water mixing valves.
6. Strainers.
7. Hose bibs.
8. Wall hydrants.
9. Drain valves.
10. Water-hammer arresters.
11. Trap-seal primer valves.

1.2 ACTION SUBMITTALS

- A. Product Data: For each type of product.

1.3 INFORMATIONAL SUBMITTALS

- A. Field quality-control reports.

1.4 CLOSEOUT SUBMITTALS

- A. Operation and maintenance data.

PART 2 - PRODUCTS

2.1 GENERAL REQUIREMENTS FOR PIPING SPECIALTIES

- A. Potable-water piping and components shall comply with NSF 61 and NSF 14.

2.2 PERFORMANCE REQUIREMENTS

- A. Minimum Working Pressure for Potable Water Piping Specialties: 125 psig (860 kPa) unless otherwise indicated.

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2.3 VACUUM BREAKERS

A. Pipe Applied, Atmospheric-Type Vacuum Breakers:

1. Standard: ASSE 1001.
2. Size: NPS 1/4 to NPS 3 (ON 8 to ON 80), as required to match connected piping.
3. Body: Bronze.
4. Inlet and Outlet Connections: Threaded.
5. Finish: Rough bronze.

B. Hose Connection Vacuum Breakers:

1. Standard: ASSE 1011.
2. Body: Bronze, nonremovable, with manual drain.
3. Outlet Connection: Garden hose threaded complying with ASME B1.20.7.
4. Finish: Chrome or nickel plated.

2.4 BACKFLOW PREVENTERS

A. Intermediate Atmospheric Vent Backflow Preventers:

1. Standard: ASSE 1012.
2. Operation: Continuous-pressure applications.
3. Body: Bronze.
4. End Connections: Solder joint.
5. Finish: Rough bronze.

2.5 BALANCING VALVES

A. Memory Stop Balancing Valves:

1. Manufacturers:
Subject to compliance with requirements, provide products by one of the following
2. Available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Crane Co.; Crane Valve Group; Crane Valves.
 - b. Milwaukee Valve Company.

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c. NIBCO Inc.

3. Standard: MSS SP-1 10 for two-piece, copper-alloy ball valves
4. Pressure Rating: 400-psig (2760-kPa) minimum CWP
5. Size: NPS 2 (ON 50) or smaller
6. Body: Copper alloy
7. Port: Standard or full port
8. Ball: Chrome plated brass
9. Seats and Seals: Replaceable
10. End Connections: Solder joint or threaded
11. Handle: Vinyl covered steel with memory setting device

2.6 TEMPERATURE ACTUATED, WATER MIXING VALVES

A. Primary, Thermostatic, Water Mixing Valves:

1. Basis of -Design Product:

Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:

- a. Leonard Valve Company
 - b. Powers; a division of Watts Water Technologies, Inc.
 - c. Symmons Industries, Inc.
2. Standard: ASSE 1017
 3. Pressure Rating: 125 psig (860 kPa) minimum unless otherwise indicated

2.7 HOSE BIBS

A. Hose Bibs :

1. Standard: ASME A112.18.1 for sediment faucets
2. Body Material: Bronze
3. Seat: Bronze, replaceable
4. Supply Connections: NPS 1/2 or NPS 3/4 (DN 15 or DN 20) threaded or solder-joint inlet
5. Outlet Connection: Garden-hose thread complying with ASME B1.20.7

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6. Pressure Rating: 125 psig (860 kPa)

7. Vacuum Breaker:

Integral or field-installation, non-removable, drainable, hose-connection vacuum breaker complying with ASSE 1011

2.8 WALL HYDRANTS

A. Nonfreezing Wall Hydrants:

1. Standard: ASME A112.21.3M for concealed-outlet, self-draining wall hydrants
2. Pressure Rating: 125 psig (860 kPa)
3. Operation: Loose key
4. Casing and Operating Rod: Of length required to match wall thickness. Include wall clamp
5. Inlet: NPS 3/4 or NPS 1 (DN 20 or DN 25)
6. Outlet: Concealed, with integral vacuum breaker and garden hose thread complying with ASME B1.20.7
7. Box: Deep, flush mounted with cover
8. Box and Cover Finish: Chrome plated
9. Outlet: Exposed, with integral vacuum breaker and garden hose thread complying with ASME B1.20.7
10. Nozzle and Wall-Plate Finish: Polished nickel bronze
11. Operating Keys(s): Two with each wall hydrant

2.9 DRAIN VALVES

A. Ball-Valve-Type, Hose-End Drain Valves:

1. Standard: MSS SP-110 for standard-port, two-piece ball valves
2. Pressure Rating: 400-psig (2760-kPa) minimum CWP
3. Size: NPS 3/4 (DN 20)
4. Body: Copper alloy
5. Ball: Chrome-plated brass
6. Seats and Seals: Replaceable
7. Handle: Vinyl-covered steel

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8. Inlet: Threaded or solder joint

9. Outlet:

Threaded, short nipple with garden-hose thread complying with ASME B1.20.7 and cap with brass chain

2.10 WATER HAMMER ARRESTERS

A. Water Hammer Arresters:

1. Basis-of-Design Product:

Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:

- a. Precision Plumbing Products, Inc.
- b. Sioux Chief Manufacturing Company, Inc.
- c. Smith, Jay R. Mfg. Co.; Division of Smith Industries, Inc.

2. Standard: ASSE 1010 or PDI-WH 201

3. Type: Copper tube with piston

4. Size: ASSE 1010, Sizes AA and A through F, or PDI-WH 201, Sizes A through F

2.11 TRAP-SEAL PRIMER DEVICE

A. Supply Type, Trap-Seal Primer Device:

1. Manufacturers:

Subject to compliance with requirements, provide products by one of the following available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

- a. Precision Plumbing Products, Inc.
- b. Sioux Chief Manufacturing Company, Inc.
- c. Smith, Jay R. Mfg. Co.; Division of Smith Industries, Inc.
- d. Watts Water Technologies, Inc.; Watts Regulator Company.

2. Standard: ASSE 1018.

3. Pressure Rating: 125 psig (860 kPa) minimum

4. Body: Bronze

5. Inlet and Outlet Connections: NPS 1/2 (DN 15) threaded, union, or solder joint

6. Gravity Drain Outlet Connection: NPS 1/2 (DN 15) threaded or solder joint

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7. Finish: Chrome plated, or rough bronze for units used with pipe or tube that is not chrome finished

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install backflow preventers in each water supply to mechanical equipment and systems and to other equipment and water systems that may be sources of contamination. Comply with authorities having jurisdiction.
 1. Locate backflow preventers in same room as connected equipment or system.
 2. Install drain for backflow preventers with atmospheric vent drain connection with air-gap fitting, fixed air-gap fitting, or equivalent positive pipe separation of at least two pipe diameters in drain piping and pipe- o floor drain. Locate airgap device attached to or under backflow preventer. Simple air breaks are unacceptable for this application.
 3. Do not install bypass piping around backflow preventers.
- B. Install balancing valves in locations where they can easily be adjusted.
- C. Install temperature actuated, water mixing valves with check stops or shutoff valves on inlets and with shutoff valve on outlet.
 1. Install cabinet-type units recessed in or surface mounted on wall as specified.
- D. Install Y-pattern strainers for water on supply side of each solenoid valve and pump.
- E. Install water-hammer arresters in water piping according to POI-WH 201.
- F. Install supply-type, trap-seal primer valves with outlet piping pitched down toward drain trap a minimum of 1 percent, and connect to floor-drain body, trap, or inlet fitting. Adjust valve for proper flow.

3.2 CONNECTIONS

- A. Comply with requirements for ground equipment in Section 26 05 26 "Grounding and Bonding for Electrical Systems."
- B. Fire-retardant-treated-wood blocking is specified in Section 26 05 19 "Low Voltage Electrical Power Conductors and Cables" for electrical connections.

3.3 FIELD QUALITY CONTROL

- A. Potable water piping specialties will be considered defective if they do not pass tests and inspections.
- B. Prepare test and inspection reports.

3.4 ADJUSTING

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- A. Set field-adjustable pressure set points of water pressure reducing valves.
- B. Set field-adjustable flow set points of balancing valves.
- C. Set field-adjustable temperature set points of temperature-actuated, water mixing valves.

END OF SECTION

SECTION 221123 – POTABLE WATER PUMPS

Government of the Virgin Islands, Department of Public Works

PROJECT NAME: Elaine I. Sprauve Library and Museum Building

Project Location: **St. John, U.S. Virgin Islands**

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Horizontally mounted, in-line, close-coupled centrifugal pumps.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product indicated.

1.3 QUALITY ASSURANCE

A. Electrical Components, Devices, and Accessories:

Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

B. UL Compliance: Comply with UL 778 for motor operated water pump.

PART 2 - PRODUCTS

2.1 HORIZONTALLY MOUNTED, IN-LINE, CLOSE-COUPLED CENTRIFUGAL PUMPS

A. Basis of Design Product:

Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:

1. Armstrong Pumps Inc.
2. Bell & Gossett Domestic Pump; ITT Corporation
3. PACO Pumps; Grundfos Pumps Corporation, U.S.A.
4. Pentair Pump Group; Aurora Pump
5. TACO Incorporated

B. Description:

Factory assembled and tested, in-line, single-stage, close coupled, overhung impeller centrifugal pumps designed for installation with pump and motor shaft mounted horizontal.

C. Pump Construction:

1. Casing:

Radially split with threaded companion-flange connections for pumps with NPS 2 (DN 50) pipe connections and flanged connections for pumps with NPS 2-1/2 (DN 65) pipe connections.

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2. Impeller:

Statically and dynamically balanced, closed, and keyed to shaft

3. Shaft and Shaft Sleeve:

Steel shaft with deflector, with copper alloy shaft sleeve. Include water slinger on shaft between motor and seal.

4. Seal:

Mechanical, with carbon steel rotating ring, stainless steel spring, ceramic seat, and rubber bellows and gasket

5. Bearings:

Oil-lubricated; bronze-journal or ball type

6. Shaft Coupling:

Flexible, capable of absorbing torsional vibration and shaft misalignment

A. Motor:

Single speed, with grease-lubricated ball bearings; and resiliently or rigidly mounted to pump casing

B. Capacities and Characteristics:

1. Capacity: See drawings

2. Total Dynamic Head: See drawings

3. Casing Material: Cast iron.

4. Impeller Material: Stainless steel.

5. Minimum Working Pressure: 175 psig (1200 kPa).

6. Maximum Continuous Operating Temperature: 225°F (107°C).

7. Pump Control: Cistern flow switch

8. Pump Speed: See drawings

9. Motor Horsepower: See drawings

2.2 MOTORS

- A. Comply with NEMA designation, temperature rating, service factor, enclosure type, and efficiency requirements for motors specified in Section 220513 "Common Motor Requirements for Plumbing Equipment."

1. Motor Sizes:

Minimum size as indicated. If not indicated, large enough so driven load will not require motor to operate in service factor range above 1.0.

SECTION 221123 – POTABLE WATER PUMPS

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PART 3 - EXECUTION

3.1 PUMP INSTALLATION

- A. Comply with HI 1.4.
- B. Install in line, sealless centrifugal pumps with shaft horizontal unless otherwise indicated.
- C. Install horizontally mounted, in line, close-coupled centrifugal pumps with shaft horizontal.
 - 1. Comply with requirements for vibration isolation devices specified in Section 220548 "Vibration and Seismic Controls for Plumbing Piping and Equipment." Fabricate brackets or supports as required.

3.2 CONNECTIONS

- A. Comply with requirements for piping specified in Section 221116 "Potable Water Piping." Drawings indicate general arrangement of piping, fittings, and specialties.
- B. Install piping adjacent to pumps to allow service and maintenance.
- C. Connect Potable water piping to pumps. Install suction and discharge piping equal to or greater than size of pump nozzles.
 - 1. Install flexible connectors adjacent to pumps in suction and discharge piping of the following pumps:
 - a. Horizontally mounted, in-line, close-coupled centrifugal pumps.
 - b. Comply with requirements for flexible connectors specified in Section 221116 "Potable Water Piping."
 - 2. Install shutoff valve and strainer on suction side of each pump, and check, shutoff, and throttling valves on discharge side of each pump. Install valves same size as connected piping. Comply with requirements for valves specified in Section 220523 "General-Duty Valves for Plumbing Piping" and comply with requirements for strainers specified in Section 221119 "Potable Water Piping Specialties."
 - 3. Install pressure gage at suction of each pump and pressure gage at discharge of each pump. Install at integral pressure gage tapping where provided or install pressure gage connectors in suction and discharge piping around pumps. Comply with requirements for pressure gages and snubbers specified in Section 220519 "Meters and Gages for Plumbing Piping."

3.3 ADJUSTING

- A. Adjust Potable water pumps to function smoothly, and lubricate as recommended by manufacturer.
- B. Adjust initial temperature set points.
- C. Set field-adjustable switches and circuit breaker trip ranges as indicated.

SECTION 221123 – POTABLE WATER PUMPS

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END OF SECTION

SECTION 221316 – SANITARY WATER AND VENT PIPING

Government of the Virgin Islands, Department of Public Works

PROJECT NAME: Elaine I. Sprauve Library and Museum Building

Project Location: **St. John, U.S. Virgin Islands**

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Pipe, tube, and fittings
2. Specialty pipe fittings

1.2 ACTION SUBMITTALS

A. Product Data:

For each type of product indicated.

1.3 INFORMATIONAL SUBMITTALS

A. Field quality-control reports.

1.4 QUALITY ASSURANCE

- A. Piping materials shall bear label, stamp, or other markings of specified testing agency.
- B. Comply with NSF/ANSI 14, "Plastics Piping Systems Components and Related Materials," for plastic piping components. Include marking with "NSF-dwv" for plastic drain, waste, and vent piping and "NSF-sewer" for plastic sewer piping.

PART 2 - PRODUCTS

2.1 PIPING MATERIALS

- A. Comply with requirements in "Piping Schedule" Article for applications of pipe, tube, fitting materials, and joining methods for specific services, service locations, and pipe sizes.

2.2 HUB AND SPIGOT, CAST IRON SOIL PIPE AND FITTINGS

- A. Pipe and Fittings:
ASTM A 74, Service or extra heavy weight. Pipe and fitting shall be marked with the collective trademark.
- B. Gaskets: ASTM C 564, rubber

2.3 HUBLESS, CAST-IRON SOIL PIPE AND FITTINGS

- A. Pipe and Fittings:
ASTM A 888 or CISPI 301. Pipe and fitting shall be marked with the collective trade mark.
- B. CISPI, Hubless-Piping Couplings:
 1. Manufacturers:
Subject to compliance with requirements, provide products by one of the following:

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a. Cast Iron Soil Pipe Institute

b. Matco-Norca, Inc.

c. Tyler Pipe

d. Charlotte Piping Company

2. Standards: ASTM C I277 and CISPI 310

3. Description:

Stainless-steel corrugated shield with stainless-steel bands and tightening devices; and ASTM C 564, rubber sleeve with integral, center pipe stop.

C. Heavy-Duty, Hubless-Piping Couplings:

1. Manufacturers:

Subject to compliance with requirements, provide products by one of the following:

a. Cast Iron Soil Pipe Institute

b. Tyler Pipe

c. Charlotte Piping Company

2. Standards: ASTM C 1277 and ASTM C 1540

3. Description:

Stainless-steel shield with stainless-steel bands and tightening devices; and ASTM C 564, rubber sleeve with integral, center pipe stop.

2.4 COPPER TUBE AND FITTINGS

A. Copper DWV Tube:

ASTM B 306, drainage tube, drawn temper.

B. Copper Drainage Fittings: ASMEBI6.23, cast copper or ASMEBI6.29, wrought copper, solder joint fittings.

C. Copper Flanges: ASME B16.24, Class 150, cast copper with solder-joint end

1. Flange Gasket Materials:

ASME B16.21, full-face, flat, nonmetallic, asbestos-free, 1/8 inch (3.2 mm) maximum thickness unless thickness or specific material is indicated.

2. Flange Bolts and Nuts:

ASME B18.2.1, carbon steel unless otherwise indicated.

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D. Solder: ASTM B 32, lead free with ASTM B 813, water flushable flux.

2.5 ABS PIPE AND FITTINGS

A. Solid Wall ABS Pipe: ASTM D 2661, Schedule 40

B. ABS Socket Fittings: ASTM D 2661, made to ASTM D 3311, drain, waste, and vent patterns

C. Solvent Cement: ASTM D 2235

1. ABS solvent cement shall have a VOC content of 325 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

2. Solvent cement shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small Scale Environmental Chambers."

2.6 PVC PIPE AND FITTINGS

A. Solid Wall PVC Pipe: ASTM D 2665, drain, waste, and vent.

B. PVC Socket Fittings: ASTM D 2665, made to ASTM D 3311, drain, waste, and vent patterns and to fit Schedule 40 pipe.

C. Adhesive Primer: ASTM F 656

1. Adhesive primer shall have a VOC content of 550 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

2. Adhesive primer shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small Scale Environmental Chambers."

D. Solvent Cement: ASTM D 2564

1. PVC solvent cement shall have a VOC content of 510 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

2. Solvent cement shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small Scale Environmental Chambers."

2.7 SPECIALTY PIPE FITTINGS

A. Transition Couplings:

1. General Requirements:

Fitting or device for joining piping with small differences in OD's or of different materials. Include end connections same size as and compatible with pipes to be joined.

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2. Fitting-Type Transition Couplings: Manufactured piping coupling or specified piping system fitting
3. Shielded, No pressure Transition Couplings:
 - a. Manufacturers:
Subject to compliance with requirements, provide products by one of the following:
 - i. Fernco Inc.
 - ii. Approved Equal
 - b. Standard: ASTM C 1173
 - c. Description:
 - i. Elastomeric, sleeve type, reducing or transition pattern. Include shear ring and corrosion resistant metal tension band and tightening mechanism on each end.
 - d. Sleeve Materials:
 - i. For Cast-Iron Soil Pipes: ASTM C 564, rubber
 - ii. For Plastic Pipes: ASTM F 477, elastomeric seal or ASTM D 5926, PVC
 - iii. For Dissimilar Pipes: ASTM D 5926, PVC or other material compatible with pipe materials being joined.

PART 3 - EXECUTION

3.1 EARTH MOVING

- A. Comply with requirements for excavating, trenching, and backfilling specified in Division 31.

3.2 PIPING INSTALLATION

- A. Drawing plans, schematics, and diagrams indicate general location and arrangement of piping systems. Indicated locations and arrangements were used to size pipe and calculate friction loss, expansion, pump sizing, and other design considerations. Install piping as indicated unless deviations to layout are approved on coordination drawings.
- B. Install piping in concealed locations unless otherwise indicated and except in equipment rooms and service areas.
- C. Install piping indicated to be exposed and piping in equipment rooms and service areas at right angles or parallel to building walls. Diagonal runs are prohibited unless specifically indicated otherwise.
- D. Install piping above accessible ceilings to allow sufficient space for ceiling panel removal.
- E. Install piping at indicated slopes.

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- F. Install piping free of sags and bends.
- G. Install fittings for changes in direction and branch connections.
- H. Make changes in direction for soil and waste drainage and vent piping using appropriate branches, bends, and long-sweep bends. Sanitary tees and short-sweep 114 bends may be used on vertical stacks if change in direction of flow is from horizontal to vertical. Use long-turn, double Y-branch and 118-bend fittings if two fixtures are installed back to back or side by side with common drainpipe. Straight tees, elbows, and crosses may be used on vent lines. Do not change direction of flow more than 90 degrees. Use proper size of standard increasers and reducers if pipes of different sizes are connected. Reducing size of drainage piping in direction of flow is prohibited.
- I. Lay buried building drainage piping beginning at low point of each system. Install true to grades and alignment indicated, with unbroken continuity of invert. Place hub ends of piping upstream. Install required gaskets according to manufacturer's written instructions for use of lubricants, cements, and other installation requirements. Maintain swab in piping and pull past each joint as completed.
- J. Install soil and waste drainage and vent piping at the following minimum slopes unless otherwise indicated:
 - 1. Building Sanitary Drain: 2 percent downward in direction of flow for piping NPS 2 (DN 50) and smaller; 1 percent downward in direction of flow for piping NPS 3 (DN 80) and larger.
 - 2. Horizontal Sanitary Drainage Piping: 2 percent downward in direction of flow
 - 3. Vent Piping: 1 percent down toward vertical fixture vent or toward vent stack
- K. Install cast iron soil piping according to CISPI's "Cast Iron Soil Pipe and Fittings Handbook," Chapter IV, "Installation of Cast Iron Soil Pipe and Fittings."
- L. Install aboveground copper tubing according to CDA's "Copper Tube Handbook."
- M. Install aboveground ABS piping according to ASTM D 2661
- N. Install underground ABS and PVC piping according to ASTM D 2321
- O. Do not enclose, cover, or put piping into operation until it is inspected and approved by authorities having jurisdiction.
- P. Install sleeves for piping penetrations of walls, ceilings, and floors. Comply with requirements for sleeves specified in Section 22 05 17 "Sleeves and Sleeve Seals for Plumbing Piping."
- Q. Install sleeve seals for piping penetrations of concrete walls and slabs. Comply with requirements for sleeve seals specified in Section 22 05 17 "Sleeves and Sleeve Seals for Plumbing Piping."
- R. Install escutcheons for piping penetrations of walls, ceilings, and floors. Comply with requirements for escutcheons specified in Section 22 05 18 "Escutcheons for Plumbing Piping."

3.3 JOINT CONSTRUCTION

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- A. Join hub and spigot, cast iron soil piping with gasket joints according to CISPI's "Cast Iron Soil Pipe and Fittings Handbook" for compression joints.
- B. Join hubless, cast iron soil piping according to CISPI 310 and CISPI's "Cast Iron Soil Pipe and Fittings Handbook" for hubless-piping coupling joints.
- C. Join copper tube and fittings with soldered joints according to ASTM B 828. Use ASTM B 813, water flushable, lead-free flux and ASTM B 32 lead free alloy solder.
- E. Flanged Joints:
Align bolt holes. Select appropriate gasket material, size, type, and thickness. Install gasket concentrically positioned. Use suitable lubricants on bolt threads. Torque bolts in cross pattern.
- F. Plastic, No pressure Piping, Solvent Cement Joints:
Clean and dry joining surfaces. Join pipe and fittings according to the following:
 - 1. Comply with ASTM F 402 for safe-handling practice of cleaners, primers, and solvent cements.
 - 2. ABS Piping: Join according to ASTM D 2235 and ASTM D 2661 Appendixes.
 - 3. PVC Piping: Join according to ASTM D 2855 and ASTM D 2665 Appendixes.

3.4 SPECIALTY PIPE FITTING INSTALLATION

- A. Transition Couplings:
 - 1. Install transition couplings at joints of piping with small differences in OD's.
 - 2. In Drainage Piping: Shielded, no pressure transition couplings.

3.5 HANGER AND SUPPORT INSTALLATION

- A. Comply with requirements for pipe hanger and support devices and installation specified in Section 22 05 29 "Hangers and Supports for Plumbing Piping and Equipment."
- B. Support horizontal piping and tubing within 12 inches (300 mm) of each fitting, valve and coupling. Support vertical piping and tubing at base and at each floor.
- C. Rod diameter may be reduced one size for double-rod hangers, with 3/8-inch (10-mm) minimum rods.
- D. Install hangers for cast iron soil piping with the following maximum horizontal spacing and minimum rod diameters:
 - 1. Install supports for vertical cast-iron soil piping every 15 feet (4.5 m).
 - 2. Install supports for vertical and horizontal copper tubing every 10 feet (3 m).

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3. Support piping and tubing not listed above according to MSS SP-69 and manufacturer's written instructions.

3.6 CONNECTIONS

- A. Drawings indicate general arrangement of piping, fittings, and specialties.
- B. Connect soil and waste piping to exterior sanitary sewerage piping. Use transition fitting to join dissimilar piping materials.
- C. Where installing piping adjacent to equipment, allow space for service and maintenance of equipment.

3.7 IDENTIFICATION

- A. Identify exposed sanitary waste and vent piping. Comply with requirements for identification specified in Section 22 05 53 "Identification for Plumbing Piping and Equipment."

3.8 FIELD QUALITY CONTROL

- A. During installation, notify authorities having jurisdiction at least 24 hours before inspection must be made. Perform tests specified below in presence of authorities having jurisdiction.
 1. Roughing in Inspection:
Arrange for inspection of piping before concealing or closing in after roughing in and before setting fixtures.
 2. Final Inspection:
Arrange for final inspection by authorities having jurisdiction to observe tests specified below and to ensure compliance with requirements.
- B. Reinspection:
If authorities having jurisdiction find that piping will not pass test or inspection, make required corrections and arrange for reinspection.
- C. Reports: Prepare inspection reports and have them signed by authorities having jurisdiction.
- D. Test sanitary drainage and vent piping according to procedures of authorities having jurisdiction or, in absence of published procedures, as follows:
 1. Test for leaks and defects in new piping and parts of existing piping that have been altered, extended, or repaired. If testing is performed in segments, submit separate report for each test, complete with diagram of portion of piping tested.
 2. Leave uncovered and unconcealed new, altered, extended, or replaced drainage and vent piping until it has been tested and approved. Expose work that was covered or concealed before it was tested.
 3. Roughing in Plumbing Test Procedure:

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Test drainage and vent piping except outside leaders on completion of roughing in. Close openings in piping system and fill with water to point of overflow, but not less than 10 foot head of water (30 kPa). From 15 minutes before inspection starts to completion of inspection, water level must not drop. Inspect joints for leaks.

4. Finished Plumbing Test Procedure:

After plumbing fixtures have been set and traps filled with water, test connections and prove they are gastight and watertight. Plug vent stack openings on roof and building drains where they leave building. Introduce air into piping system equal to pressure of 1 inch wg (250 Pa). Use U-tube or manometer inserted in trap of water closet to measure this pressure. Air pressure must remain constant without introducing additional air throughout period of inspection. Inspect plumbing fixture connections for gas and water leaks.

5. Repair leaks and defects with new materials and retest piping, or portion thereof, until satisfactory results are obtained.

6. Prepare reports for tests and required corrective action.

3.9 CLEANING AND PROTECTION

- A. Clean interior of piping. Remove dirt and debris as work progresses.
- B. Protect drains during remainder of construction period to avoid clogging with dirt and debris and to prevent damage from traffic and construction work.
- C. Place plugs in ends of uncompleted piping at end of day and when work stops.

3.10 PIPING SCHEDULE

- A. Flanges and unions may be used on aboveground pressure piping unless otherwise indicated.
- B. Aboveground, soil and waste piping NPS 4 (DN 100) and smaller shall be any of the following:
 - 1. Solid-wall PVC pipe, PVC socket fittings, and solvent cemented joints. Service class, cast-iron soil pipe and fittings; gaskets; and gasketed joints.
 - 2. Hubless, cast-iron soil pipe and fittings; heavy duty hubless piping couplings; and coupled joints.
 - 3. Copper DWV tube, copper drainage fittings, and soldered joints.
- C. Aboveground, soil and waste piping NPS 5 (DN 125) and larger shall be any of the following:
 - 1. Solid-wall PVC pipe, PVC socket fittings, and solvent-cemented joints.
 - 2. Service class, cast-iron soil pipe and fittings; gaskets; and gasketed joints.
 - 3. Hubless, cast-iron soil pipe and fittings; CISPI hubless-piping couplings; and coupled joints.
- D. Above ground, vent piping NPS 4 (DN 100) and smaller shall be any of the following:

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1. Solid-wall PVC pipe, PVC socket fittings, and solvent-cemented joints.
 2. Service class, cast-iron soil pipe and fittings; gaskets; and gasketed joints.
 3. Hubless, cast-iron soil pipe and fittings; heavy-duty hubless-piping couplings; and coupled joints.
 4. Copper DWV tube, copper drainage fittings, and soldered joints.
- E. Underground, soil, waste, and vent piping NPS 4 (DN 100) and smaller shall be any of the following:
1. Service class, cast-iron soil piping; gaskets; and gasketed joints.
 2. Hubless, cast-iron soil pipe and fittings; heavy duty hubless-piping couplings; and coupled joints.
 3. Solid wall ABS pipe, ABS socket fittings, and solvent-cemented joints.
 4. Solid wall PVC pipe, PVC socket fittings, and solvent-cemented joints.
 5. Dissimilar Pipe-Material Couplings: Unshielded, no pressure transition couplings.
- F. Underground, soil and waste piping NPS 5 (DN 125) and larger shall be any of the following:
1. Service class, cast-iron soil piping; gaskets; and gasketed joints.
 2. Hubless, cast-iron soil pipe and fittings; heavy-duty hubless-piping couplings; coupled joints.
 3. Solid wall PVC pipe; PVC socket fittings; and solvent-cemented joints.
 4. Dissimilar Pipe-Material Couplings: Shielded, no pressure transition couplings.

END OF SECTION

SECTION 221319 – SANITARY WASTE PIPING SPECIALTIES

Government of the Virgin Islands, Department of Public Works

PROJECT NAME: Elaine I. Sprauve Library and Museum Building

Project Location: **St. John, U.S. Virgin Islands**

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes the following sanitary drainage piping specialties:

1. Cleanouts.
2. Floor drains.
3. Miscellaneous sanitary drainage piping specialties.

1.2 ACTION SUBMITTALS

A. Product Data:

For each type of product indicated. Include rated capacities, operating characteristics, and accessories for grease interceptors.

1.3 QUALITY ASSURANCE

A. Drainage piping specialties shall bear label, stamp, or other markings of specified testing agency.

PART 2 - PRODUCTS

2.1 CLEANOUTS

A. Exposed Cast Iron Cleanouts:

1. Available Manufacturers:

Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

- a. Josam Company; Josam Division
- b. Smith, Jay R. Mfg. Co.; Division of Smith Industries, Inc.
- c. Zurn Plumbing Products Group; Specification Drainage Operation

2. Standard: ASME A112.36.2M for cast iron for cleanout test tee

3. Size: Same as connected drainage piping

4. Body Material: Hubless, cast iron soil pipe test tee as required to match connected piping

5. Closure: Countersunk, plug

6. Closure Plug Size: Same as or not more than one size smaller than cleanout size.

B. Cast Iron Floor Cleanouts:

1. Available Manufacturers:

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Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

- a. Josam Company; Josam Division
 - b. Smith, Jay R. Mfg. Co.; Division of Smith Industries, Inc.
 - c. Zurn Plumbing Products Group; Specification Drainage Operation
2. Standard: ASME A112.36.2M for threaded, adjustable housing cleanout
 3. Size: Same as connected branch
 4. Type: Threaded, adjustable housing
 5. Body or Ferrule: Cast iron
 6. Clamping Device: Required
 7. Outlet Connection: Spigot
 8. Closure: Brass plug with straight threads and gasket
 9. Adjustable Housing Material: Cast iron with
 10. Frame and Cover Shape: Round
 11. Top Loading Classification: Extra Heavy Duty
 12. Riser: ASTM A 74, Service class, cast-iron drainage pipe fitting and riser to cleanout

C. Cast-Iron Wall Cleanouts:

1. Available Manufacturers:

Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

- a. Josam Company; Josam Division
 - b. Smith, Jay R. Mfg. Co.; Division of Smith Industries, Inc.
 - c. Zurn Plumbing Products Group; Specification Drainage Operation
2. Standard: ASME A112.36.2M. Include wall access
 3. Size: Same as connected drainage piping
 4. Body: Hubless, cast-iron soil pipe test tee as required to match connected piping
 5. Closure: Countersunk, plug
 6. Closure Plug Size: Same as or not more than one size smaller than cleanout size

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7. Wall Access: Round, stainless-steel cover plate with screw

8. Wall Access: Round, stainless-steel wall-installation frame and cover

2.2 FLOOR DRAINS

A. Cast Iron Floor Drains:

1. Available Manufacturers:

Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

- a. Josam Company; Josam Division
- b. Smith, Jay R. Mfg. Co.; Division of Smith Industries, Inc.
- c. Zurn Plumbing Products Group; Specification Drainage Operation
- d. Wade Inc.

2. Basis of Design Product:

Subject to compliance with requirements, provide the product indicated on Drawings or a comparable product by one of the following:

- a. Josam Company; Josam Division
- b. Smith, Jay R. Mfg. Co.; Division of Smith Industries, Inc.
- c. Zurn Plumbing Products Group; Specification Drainage Operation.
- d. Wade Inc.

3. Standard: ASME A112.6.3

4. Top Shape: Round

5. Trap Material: Cast iron

6. Trap Pattern: P-trap.

2.3 MISCELLANEOUS SANITARY DRAINAGE PIPING SPECIALTIES

A. Open Drains:

1. Description:

Shop or field fabricate from ASTM A 74, Service class, hub-and-spigot, cast-iron, soil-pipe fittings. Include P-trap, hub-and-spigot riser section; and where required, increaser fitting joined with ASTM C 564, rubber gaskets.

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2. Size: Same as connected waste piping with increaser fitting of size indicated.

B. Floor Drain, Trap-Seal Primer Fittings:

1. Description: Cast iron, with threaded inlet and threaded or spigot outlet, and trap-seal primer valve connection.

2. Size: Same as floor drain outlet with NPS 1/2 (DN 15) side inlet.

C. Air-Gap Fittings:

1. Standard: ASME A112.1.2, for fitting designed to ensure fixed, positive air gap between installed inlet and outlet piping.

2. Body: Bronze or cast iron

3. Inlet: Opening in top of body

4. Outlet: Same as inlet

5. Size: Same as connected waste piping and with inlet large enough for associated indirect waste piping

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install cleanouts in aboveground piping and building drain piping according to the following, unless otherwise indicated:

1. Size same as drainage piping up to NPS 4 (DN 100). Use NPS 4 (DN 100) for larger drainage piping unless larger cleanout is indicated.

2. Locate at each change in direction of piping greater than 45 degrees.

3. Locate at minimum intervals of 50 feet (15m) for piping NPS 4 (DN 100) and smaller and 100 feet (30 m) for larger piping.

4. Locate at base of each vertical soil and waste stack.

B. For floor cleanouts for piping below floors, install cleanout deck plates with top flush with finished floor.

C. For cleanouts located in concealed piping, install cleanout wall access covers, of types indicated, with frame and cover flush with finished wall.

D. Install floor drains at low points of surface areas to be drained. Set grates of drains flush with finished floor, unless otherwise indicated.

1. Position floor drains for easy access and maintenance.

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2. 2. Set floor drains below elevation of surrounding finished floor to allow floor drainage. Set with grates depressed according to the following drainage area radii:
 - a. Radius, 30 Inches (750 mm) or Less: Equivalent to 1 percent slope, but not less than 1/4- inch (6.35-mm) total depression
 - b. Radius, 30 to 60 Inches (750 to 1500 mm): Equivalent to 1 percent slope
 - c. Radius, 60 Inches (1500 mm) or Larger: Equivalent to 1 percent slope, but not greater than 1-inch (25-mm) total depression
 3. Install floor drain flashing collar or flange so no leakage occurs between drain and adjoining flooring. Maintain integrity of waterproof membranes where penetrated.
 4. Install individual traps for floor drains connected to sanitary building drain, unless otherwise indicated.
- E. Install roof flashing assemblies on sanitary stack vents and vent stacks that extend through roof.
- F. Install flashing fittings on sanitary stack vents and vent stacks that extend through roof.
- G. Assemble open drain fittings and install with top of hub 1 inch (25 mm) above floor.
- H. Install deep-seal traps on floor drains and other waste outlets, if indicated.
- I. Install floor drain, trap-seal primer fittings on inlet to floor drains that require trap-seal primer connection.
1. Exception: Fitting may be omitted if trap has trap-seal primer connection
 2. Size: Same as floor drain inlet
- J. Install air-gap fittings on draining type backflow preventers and on indirect waste piping discharge into sanitary drainage system.
- K. Install sleeve flashing device with each riser and stack passing through floors with waterproof membrane.
- L. Install vent caps on each vent pipe passing through roof.
- M. Install traps on plumbing specialty drain outlets. Omit traps on indirect wastes unless trap is indicated.

3.2 CONNECTIONS

- A. Comply with requirements in Section 22 13 16 "Sanitary Waste and Vent Piping" for piping installation requirements. Drawings indicate general arrangement of piping, fittings, and specialties.
- B. Install piping adjacent to equipment to allow service and maintenance.

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3.3 FLASHING INSTALLATION

- A. Fabricate flashing from single piece unless large pans, sumps, or other drainage shapes are required. Join flashing according to the following if required:
 - 1. Lead Sheets:
Burn joints of lead sheets 6.0-lb/sq. ft. (30-kg/sq.m), 0.0938-inch (2.4 mm) thickness or thicker. Solder joints of lead sheets 4.0-lb/sq. ft. (20-kg/sq. m), 0.0625-inch (1.6 mm) thickness or thinner.
- B. Install sheet flashing on pipes, sleeves, and specialties passing through or embedded in floors and roofs with waterproof membrane.
 - 1. Pipe Flashing:
Sleeve type, matching pipe size, with minimum length of 10 inches (250 mm), and skirt or flange extending at least 8 inches (200 mm) around pipe.
 - 2. Sleeve Flashing: Flat sheet, with skirt or flange extending at least 8 inches (200 mm) around sleeve.
 - 3. Embedded Specialty Flashing: Flat sheet, with skirt or flange extending at least 8 inches (200 mm) around specialty.
- C. Set flashing on floors and roofs in solid coating of bituminous cement.
- D. Secure flashing into sleeve and specialty clamping ring or device.
- E. Install flashing for piping passing through roofs with counterflashing or commercially made flashing fittings, according to Division 07 "Sheet Metal Flashing and Trim."
- F. Extend flashing up vent pipe passing through roofs and turn down into pipe, or secure flashing into cast iron sleeve having calking recess.

3.4 LABELING AND IDENTIFYING

- A. Equipment Nameplates and Signs:
Install engraved plastic-laminate equipment nameplate or sign on or near each grease interceptor.
- B. Distinguish among multiple units, inform operator of operational requirements, indicate safety and emergency precautions, and warn of hazards and improper operations, in addition to identifying unit. Nameplates and signs are specified in Section 22 05 53 "Identification for Plumbing Piping and Equipment."

3.5 PROTECTION

- A. Protect drains during remainder of construction period to avoid clogging with dirt or debris and to prevent damage from traffic or construction work.
- B. Place plugs in ends of uncompleted piping at end of each day or when work stops.

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END OF SECTION

SECTION 222623-PVC PRESSURE PIPE

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The Specifications contained this section are intended to cooperate with, to supplement, and to modify Section 611 Water Systems and other specifications of the "Standard Specifications for Construction of Roads and Bridges on Federal Highway Projects" (FP-14). In case of disagreement with any other section of this contract, the more stringent specification shall govern.

PART 1 - GENERAL

1.1 DESCRIPTION

- A. Provide and test polyvinylchloride (PVC) pipe as indicated and specified.

1.2 RELATED WORK

- A. Section 332222: Utility Excavation and Backfill.
- B. Section 03346: Cast-In-Place Concrete.

1.3 QUALITY ASSURANCE

- A. Provide labor necessary to assist the Engineer in inspecting pipe upon delivery. Remove rejected pipe immediately.
- B. Reject pipe of any manufacturer if more than five unsatisfactory joint assembly operations or "bell breaks" occur in 100 consecutive joints, even if the pipe conforms to ASTM Specifications. Remove unsatisfactory pipe of that manufacturer of same shipment from work site. Furnish pipe of another manufacturer conforming to these specifications.
- C. Perform tests in accordance with methods prescribed by ASTM and AWWA Specifications. Accept or reject based on the test results.

1.4 REFERENCES

- A. American Water Works Association (AWWA):
 - 1. Location C900-89: Polyvinylchloride (PVC) Pressure Pipe.
- B. American Society for Testing Materials (ASTM) Publications:
 - 1. D-2241-88: Specification for Polyvinylchloride (PVC) Pressure-Rated Pipe (SDR-35Series).
 - 2. D-1784-81: Specification for Rigid Polyvinylchloride (PVC) Compounds and Chlorinated Polyvinylchloride (CPVC) Compounds.
 - 3. D-1784-88: Specification for Polyvinylchloride (PVC) Plastic Pipe, Schedules 40, 80 and 120.
 - 4. D-2672-88: Specification for Joints for IPS PVC Pipe Using Solvent Cement.

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5. D-2855-83: Practice for Making Solvent-Cemented Joints with Polyvinylchloride (PVC) Pipe and Fittings.
6. D-3139-84: Specification for Joints for Plastic Pressure Pipes Using Flexible Elastomeric Seals.
7. F-402-88: Standard Practice for Safe Handling of Solvent Cements and Primers used for joining Thermoplastic Pipe and Fittings.

C. American National Standard Institute, Inc. (ANSI):

1. ANSI: A21.10-87: Standard for Ductile-Iron and Gray-Iron Fittings, 3-on. Through 48-in. for water and other liquids.

1.5 SUBMITTALS

A. Shop Drawings: Submit the following in accordance with Section 01000- General Specifications.

1. Shop Drawings and descriptive literature showing pipe dimensions, joints, joint gaskets, pipe stiffness, and other details for each size of pipe indicated.
2. Gasket and pipe manufacturer's printed joint assembly directions.
3. Certification with each delivery that pipe complies with this Specification.
4. Certified copies of test reports with each delivery, stating compliance with ASTM I794, ASTM I785, ASTM 2672, and AWWA C900.

PART 2 - PRODUCTS

2.1 PIPE, FITTINGS, AND SPECIALS

A. 4 Inches through 12 Inches:

1. Use elastomeric gasket joints. Do not use solvent-cement joints.
2. Use elastomeric gaskets of synthetic rubber; resistant to common ingredients of sewage and industrial wastes, including oils and groundwater, capable of enduring permanently under conditions of proposed use.
3. Thickness class, unless otherwise indicated or specified: Minimum Thickness Class 52.

PART 3 - EXECUTION

3.1 INSPECTION

A. Examine excavation before pipe replacement to ensure:

1. Excavation is complete to elevations and slopes indicated.
2. No obstruction exists to interfere with installation.

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3. Bottom is firm and dry.

- B. Inspect each pipe length and each fitting before installation. Remove defective pipe and fittings. Replace with sound pipe and fittings.

3.2 HANDLING

- A. Store until installation in a place acceptable to Engineer/Project Manager; keep place at ambient outdoor temperature.

1. Provide temporary shading.

2. Do not use covering causing temperature build-up.

- B. Handle into position to avoid damage in a manner acceptable to Engineer/Project Manager.

3.3 INSTALLATION

- A. Do not install non-straight pipe.

1. Do not allow pipe centerline to deviate from straight line drawn between ends, by more than 1/16 in. per feet of length.

2. Remove pipe failing to meet above requirements.

- B. Support pipe on compacted clean earth conforming to Section 332220. Do not permanently support on saddles, blocking or stones.

- C. Excavate bells and coupling holes so that only pipe barrel receives bearing pressure.

- D. Clear pipe units of debris and dirt before installation and keep clean until acceptance.

- E. Install to lines and grades indicated or required by Engineer/Project Manager.

- F. Maintain close joint with previously installed pipe. Match with adjoining pipe.

- G. Do not drive pipe down to required grade by; striking with shovel handle, timber, or the like.

- H. Elastomeric Gasket Joints:

1. Clean joint surfaces. Prepare joint surfaces according to manufacturer's recommendation. Push pipe until into place without damage to pipe or gasket. Use devices to force pipes together with minimum open recess inside and outside and tightly sealed joints. Avoid force that could wedge apart and split bell ends.

2. Do not pull or cramp joints without permission of the Engineer/Project Manager.

3. Remove unfittable pipes and replace with sound units.

4. Follow directions of joint material and pipe manufacturers when installing gaskets and joints to render them watertight and flexible.

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- I. Make solvent-cement joints in accordance with ASTM D2855. Observe precautions per ASTM F402.
- J. Close open ends of pipe and branches with PVC stoppers secured in place.
- K. After bedding pipe, place and compact clean earth between pipe and sides of trench. Use extra care to compact clean earth under lower half of pipe. Fill bell holes with clean earth and compact. Place and compact clean earth as indicated.
- L. Prevent pipe flotation in trench.
- M. Make open ends of pipe and branches watertight with temporary plugs when pipe installation not in progress.
- N. If water exists in trench, do not remove plug until making provisions to prevent water, earth, or other substances from entering pipe; then, resume work.
- O. Do not use pipeline as conductor for trench drainage.
- P. Restrainers:
Where indicated or necessary to prevent joints or sleeve couplings from pulling apart under pressure. Uni-flange Series 1500 or approved equal.
- Q. Cleaning:
 - 1. Prevent earth, water, and other material from entering pipeline.
 - 2. Clean pipeline upon completion.
 - 3. Remove all loose dirt and foreign material from interior of pipe before installation.

3.4 TESTING

- A. Clean pipe of dirt, dust, oil, grease, and other foreign material before pressure and leakage tests.
- B. Pressure and Leakage Tests:
 - 1. Conduct combined pressure and leakage test using procedures conforming to AWWA C600-Hydrostatic Testing. See Appendix A- End of Section 02623.

3.5 DISINFECTING AND FLUSHING

- A. Disinfect potable water lines using procedures and materials conforming to AWWA C651, Section 5.1; Tablet Method.
- B. Dosage to produce minimum of 25 mg/L after a minimum contact period of 24 hours. The following table shows the number of 5 g or 7 g chlorine tablets required for various pipe sizes:

| Pipe Diameter, in. | Pipe Length, ft. | No. of 5 g Tablets | No. of 7 g Tablets |
|--------------------|------------------|--------------------|--------------------|
| 4 | 20 | 1 | 1 |
| 6 | 20 | 1 | 1 |

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| | | | |
|--------------------|------------------|--------------------|--------------------|
| 8 | 20 | 2 | 2 |
| 10 | 20 | 3 | 2 |
| 12 | 20 | 4 | 3 |
| 14 | 20 | 5 | 4 |
| 16 | 20 | 7 | 5 |
| Pipe Diameter, in. | Pipe Length, ft. | No. of 5 g Tablets | No. of 7 g Tablets |
| 18 | 20 | 8 | 6 |
| 20 | 20 | 10 | 7 |
| 24 | 20 | 14 | 10 |
| 30 | 20 | 22 | 16 |

- C. After treatment, flush with clean water until residual chlorine content less than 0.2 ppm.
- D. Prevent contamination of water in existing water mains. Neutralize chlorine content of water used in disinfecting and flushing accordance with AWWA C651.

END OF SECTION

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APPENDIX A--HYDROSTATIC TESTING--

1. Warning:

The testing methods described in this section are specific for water-pressure testing. These procedures should not be applied for air-pressure testing because of the serious safety hazards involved.

2. Testing Restrictions:

- a. Test Pressure shall not be less than 1.50 times the working pressure at the highest point along the test section.
- b. Test Pressure shall not exceed pipe or thrust-resistant design pressures.
- c. The hydrostatic pressure shall be of at least 2-hour duration.
- d. Test pressure shall not vary by more than +/-5 psi (35 Mpa or 0.35 bar).
- e. Valves shall not be operated in either direction at differential pressure exceeding the rated valve working pressure. Use of a test pressure greater than the rated valve pressure can result in trapped test pressure between the gates of a double disc gate valve. For test at these pressures, the test setup should include provision, independent of the valve, to reduce the line pressure to the rated valve pressure on completion of the test. The valve can then be opened if desired.
- f. Test pressure shall not exceed the rated pressure of the valves when the pressure boundary of the test section includes closed, resilient seat gate valves or butterfly valves.
- g. Contractor shall not install more than 500 LF of water main prior to satisfactory hydrostatic testing results. Thereafter, the Contractor shall install and test in sections not longer than 500 LF. As much as possible, perform hydrostatic test on pipe that valved off on either ends.

3. Pressurization:

After the pipe has been laid, all newly laid pipe or any valved section thereof shall be subjected to an average hydrostatic pressure of 150 psi. Each valved section of pipe shall be slowly filled with water, and the specified test pressure, based on the elevation of the lowest point of the valve line or section under test and corrected to the elevation of the test gage, shall be applied by means of a pump connected to the pipe in a manner satisfactory to the Owner. Valves shall not be operated in either the opening or closing direction at differential pressures above the rated pressure. It is good practice to allow the system to stabilize at the test pressure before conducting the leakage test.

4. Air Removal:

Before applying the specified test pressure, air shall be expelled completely from the pipe, valves, and hydrants. If permanent air vents are not located at all high points, the Contractor shall install corporation cocks at such points so that the air can be expelled as the line is filled with water. After all the air has been expelled, the corporation cocks shall be

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closed and the test pressure applied. At the conclusion of the pressure test, the corporation cocks shall be removed and plugged or left in place at the discretion of the Owner.

5. Examination:

Any exposed pipe, fittings, valves, hydrants, and joints shall be examined carefully during the test. Any damaged or defective pipe, fittings, valves, hydrants, or joints that are discovered following the pressure test shall be repaired or replaced with sound material, and the test shall be repeated until it is satisfactory to the Owner.

6. Leakage Defined:

Leakage shall be defined as the quantity of water that must be supplied into the newly laid pipe or any valved section thereof to maintain pressure within 5 psi (35 Mpa or 0.35 bar) of the specified test pressure after the pipe has been filled with water and the air has been expelled. Leakage shall not be measured by a drop-in pressure in a test section over a period of time.

7. Allowable Leakage:

No pipe installation will be accepted if the leakage is greater than that determined by the formula:

$$L = [SD((P)^{0.5})] / [147,809] \text{ (Equation 1)}$$

WHERE:

L =allowable leakage, (gallons per hour)

S = length of pipe tested, (feet)

D =nominal pipe diameter, (inches)

P =average test pressure during the leakage test, (pounds per square inch (gage)).

This formula is based on an allowable leakage of 10.5 gallons per day per mile per inch of nominal diameter at a pressure of 150 psi. When testing against closed metal-seated valves, an additional leakage per closed valve of 0.0078 gph/in. of nominal valve size shall be allowed. When hydrants are in the test section, the test shall be made against closed hydrant valves.

8. Acceptance of Installation:

Acceptance shall be determined on the basis of allowable leakage. If any test of laid pipe discharges leakage greater than the allowed from Equation 1, the Contractor shall, at his own expense, locate and make approved repairs as necessary until the leakage is within the specified allowance. All visible leaks are to be repaired, regardless of the amount of leakage.

9. Modifications to Test Procedure:

Test procedure may be modified only if permitted by the Owner.

SECTION 223613 – SOLAR WATER PREHEATERS

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PART 1 GENERAL

1.1 REFERENCES

- A. The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by the basic designation only.
1. AMERICAN SOCIETY OF HEATING, REFRIGERATING AND AIR-CONDITIONING ENGINEERS, INC. (ASHRAE)
 - a. ASHRAE 90003 Active Solar Heating Design Manual
 - b. ASHRAE 90336 Guidance For Preparing Active Solar Heating Systems Operation and Maintenance Manuals
 - c. ASHRAE 90342 Active Solar Heating Systems Installation Manual
 - d. ASHRAE 93 Methods of Testing to Determine the Thermal Performance of Solar Collectors
 2. AMERICAN WATER WORKS ASSOCIATION (AWWA)
 - a. AWWA C651 Disinfecting Water Mains
 3. FACTORY MUTUAL ENGINEERING AND RESEARCH CORPORATION (FM)
 - a. FM P7825 Approval Guide
 4. NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)
 - a. NFPA 70 National Electrical Code
 5. SOLAR RATING AND CERTIFICATION CORPORATION (SRCC)
 - a. SRCC OG-300-91 Operating Guidelines and Minimum Standards For Certifying Solar Water Heating Systems

1.2 DEFINITIONS

- A. The term "solar" for the purposes of this specification, covers systems that intercept solar radiation and convert it to thermal energy. The thermal energy is collected by a heat transfer fluid and sent to a thermal energy storage tank for use.

1.3 SYSTEM DESCRIPTION

- A. Design Requirements

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1. Design, furnish and install new solar water heating (SHW) systems for the heating of domestic water. The solar water heating system offsets the use of natural gas, propane or electricity by preheating water before the conventional domestic hot water system. System types incorporating both freeze-protection and overheat protection are required. Freeze protection is not required if climate is non-freezing, but overheat protection required in all systems. Supplied equipment must be rated and warranted to withstand and operate under lowest-record-low and highest-record-high temperature for the location. It is often the intent to use the system for educational purposes related to the benefits and use of renewable energy, so appearance and quality are considerations in design decisions.
2. Solar collectors are to be mounted on the roof or on the ground as suitable for the type of SHW system and needs and limitation of the building and site. System must be of a type suitable to the climate of the site. For systems proposed not under passive control, control each system by a simple differential temperature controller. Provide a separate solar water heating system for each building unit designated. Each of the solar systems is to incorporate the existing electric water heating system as its auxiliary subsystem. If the existing electric water heater is in need of repair or replacement, the contractor may propose to repair or replace the electric water heater under the scope of this project.
3. Include with each system, components that consist of a solar collector array, array support structure, storage tank, interconnecting piping and fittings, tempering mixing valve, flush-and-fill valves, pressure relief valves, and as required by the system type, any necessary pumps, controls or heat exchangers, as well as all other accessories and equipment required for the proper operation of the solar system.
4. Include with system all labor, supervision, equipment inside and outside the building, tools, materials, and incidentals necessary to design, procure, install, checkout and place into operation a complete solar water heating system ready for use for the building.

B. Performance Requirements

1. Solar water heating systems must be safe, reliable, require no operator intervention for normal operation, be visually unobtrusive, and be designed and installed in accordance with all applicable codes. Design and size the system so that solar energy supplies approximately the percent of the annualized hot water demand ("Required Solar Fraction") specified in Table 1, below.

Table 1: Percent of annualized hot water demand to be met by solar hot water heating system in each location covered in this solicitation:

| Building | Location | Required Solar Fraction | Gallons per Day Demand | Hot Water Delivery Temperature | Avg. Main Water Temperature (F) |
|----------|----------|-------------------------|------------------------|--------------------------------|---------------------------------|
| | | 75% | | | |
| | | | | | |

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Any additional information provided regarding daily demand calculations, patterns of weekly or monthly variations in the load or descriptions of end uses of the hot water can be found in Appendix A.

1.4 SUBMITTALS

A. Submit the following.

1. Approval drawings and Data

a. Commercial Products Data with Performance Charts and Curves

Annotate descriptive data to show the specific model, type, and size of each item.

b. Solar System Design

Submit calculations of solar system performance leading to the proposed design. Submit reports resulting from the use of any design or performance simulation software used in the design.

c. Statements

Prior to installation, submit data showing that the Contractor has successfully designed and installed systems of the same type and design as specified herein and proposed by the contractor.

d. Drawings

Provide drawings for each system type and size containing a system schematic diagram; a collector layout and roof plan (or ground lay-out) noting reverse-return piping for the collector array; a system elevation; a schedule of operation and installation instructions; and a schedule of design information including collector length and width, recommended collector flow rate and pressure drop at that flow rate, number of collectors, number of collectors to be grouped per bank, gross area and net aperture area of collectors, collector fluid volume, collector filled weight, weight of support structure, and tilt angle of collectors from horizontal. Include in the drawings, complete wiring and schematic diagrams, proposed pipe pitch and any other details required to demonstrate that the system has been coordinated and will properly function as a unit. Show proposed layout and anchorage of equipment and appurtenances, and equipment relationship to other parts of the work, including clearances for maintenance and operation. Provide a detail of the joint connection between the solar collector mounting brackets and the roof membrane.

2. Final Drawings and Data

a. Instructions

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Submit proposed diagrams, instructions, and other sheets, including a system schematic, wiring and control diagrams, and a complete layout of the entire system for each system type to be installed. Include with the instructions, in typed form, condensed operating instructions explaining preventive maintenance procedures, methods of checking the system for normal safe operation and procedures for safely starting and stopping the system, methods of balancing and testing flow in the system, and methods of testing for control failure and proper system operation. Submit collector array structural design information sealed by a professional engineer.

b. Operating and Maintenance Manuals

Submit manuals that detail the step-by-step procedures required for system filling, startup, operation, and shutdown. Include in the manuals the manufacturer's name, model number, service manual, parts list, and brief descriptions of all equipment and their basic operating features. List routine maintenance procedures, possible breakdowns and repairs, recommended spare parts, troubleshooting guide, piping and equipment layout, balanced fluid flow rates, and simplified wiring and control diagrams of the system as installed.

c. Field Test Reports

i. Submit reports of piping hydraulic pressure test.

ii. Submit reports of water potability test.

iii. Submit results of system performance testing.

PART 2 - PRODUCTS

2.1 GENERAL EQUIPMENT REQUIREMENTS

A. Standard or Pre-approved Products

1. Furnish materials and equipment that are the standard products of a manufacturer regularly engaged in the manufacture of such products and which essentially duplicate items that have been in satisfactory use for at least 6 months prior to bid opening.

B. Nameplates

1. Secure to each major item of equipment the manufacturer's name, address, type or style, model or serial number, and catalog number on a plate.

2.2 PIPING SYSTEM

- A.** Provide a piping system complete with pipe, pipe fittings, valves, strainers, expansion loops, pipe hangers, inserts, supports, anchors, guides, sleeves, and accessories with this specification and the drawings. Pipe shall be designed to observe limits on flow velocity, pressure drop, and gauge pressure associated with the pipe type and characteristics.

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- B. Provide, install and test the piping. Provide piping flow rates below 5 feet per second. Piping shall be Type L or Type M copper tubing, ASTM B-88, with 95-5 tin-antimony soldered joints. If cold water piping supplying the SWH system is of another type, such as PVC, it shall be replaced within 10 feet of the SWH system with copper to avoid bulging and rupture due to proximity to the higher temperatures of the solar system.
- C. Pipe Insulation
 - 1. Furnish interior pipe insulation and coverings such as Armaflex, Insul-Tube, Rubatex, or approved equivalent. Provide outside array piping insulation with a capability of withstanding 250 degrees F, except that piping insulation within 1.5 feet of collector connections shall be capable of withstanding 400 degrees F. Protect outside piping insulation from water damage and ultraviolet degradation with a suitable outer coating manufactured for this purpose (aluminum, sunlight resistant PVC or approved equal).
- D. Calibrating Balancing Valves (for multiple collector banks)
 - 1. If systems are proposed with multiple collector banks, provide calibrated balancing valves suitable for 125 psig and 250 degrees F service. Furnish calibrated balancing valves with bronze body/brass ball construction with seat rings compatible with system fluid and differential readout ports across valve seat area. Provide readout ports fitted with internal insert of compatible material and check valve. Provide calibrated balancing valves with a memory stop feature to allow valve to be closed for service and reopened to set point without disturbing balance position, and with a calibrated nameplate to assure specific valve settings. Provide calibrated balancing valves and ball valves at the outlet of each collector bank. The balancing valves are specified to allow the array to be flow balanced. The ball valves are required to enable the array to be disconnected for maintenance or repair. This requirement for balancing valves is not applicable to systems of only one collector bank, where balance of flow is not an issue.
- E. Pressure Gauges
 - 1. Provide pressure gauges with throttling type needle valve or a pulsation dampener and shutoff valve. Furnish a 3-1/2 inch minimum dial size.
- F. Thermometers
 - 1. Supply thermometers with wells and separable bronze sockets.
- G. Pipe Hangers and Supports
 - 1. Support and hang piping so that the weight of the piping is not supported by drywall, siding, or other building members not designed to bear load. Support piping so that thermal expansion and contraction of pipe lengths is accommodated.
- H. Valves
 - 1. Provide valves compatible with the piping. Ball valves shall be used for shutoff, with full port, bronze body, bronze ball and teflon seat. Bronze hose-end gate valves shall be used for draining low points of piping.

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2.3 COLLECTOR SUBSYSTEM

A. Solar Collector Construction

1. The type of solar collector proposed shall be compatible with the proposed system type. Collectors shall be selected based on optimal cost and performance. Depending on the temperature requirements of the system, collector may be unglazed (low temperature), single or double glazed (mid temperature), or evacuated tube (high temperature) with selective or painted absorber surfaces. Furnish collectors of weather-tight construction and with an aluminum casing. Provide aluminum or stainless-steel mounting brackets and hinges. Furnish stainless steel assembly hardware including all bolts, washers, and nuts. Install collectors such that tubes on the absorber plate drain by gravity. Provide cover glazing completely replaceable from the front of the collector without disturbing the piping or adjacent collectors.

B. Collector Warranty

1. Provide a minimum 10-year warranty against the following: failure of manifold or riser tubing, joints or fittings; degradation of absorber plate selective surface; rusting or discoloration of collector hardware; and embrittlement of header manifold seals. Include with the warranty full repair or replacement of defective materials or equipment.

C. Solar Collector Performance

2. Plot thermal performance on the thermal efficiency curve in accordance with ASHRAE 93 showing the product of glazing transmittance and plate absorptivity and the thermal loss coefficient (btu/hr/F) of the solar collector. Show manufacturer's recommended volumetric flow rate and the design pressure drop at the recommended flow rate. Indicate the manufacturer's recommendations for the number of collectors to be joined per bank while providing for balanced flow and for thermal expansion considerations.

2.4 SOLAR COLLECTOR ARRAY

A. Net Absorber Area and Array Layout

1. Collector array shall be oriented so that all collectors face the same direction. Space collectors arranged in multiple rows so that no shading from other collectors is evident between 1000 hours and 1400 hours solar time on December 21. Collectors should be south-facing and a tilt equal to the local latitude, but other orientations may be considered for approval. Indicate minimum spacing between rows.

B. Piping

1. Connect interconnecting array piping between solar collectors, in a reverse-return configuration with approximately equal pipe length for any possible flow path. Indicate flow rate through the collector array. Provide each collector bank isolated by valves, with a pressure relief valve and with the capability of being drained. Locate manually operated air vents at system high points, and pitch array piping a minimum of 0.25 inch per foot so that piping can be drained by gravity. Supply calibrated balancing valves at the outlet of each collector bank as indicated.

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C. Supports for Solar Collector Array

1. Provide support structure for the collector array of aluminum, stainless steel, or other corrosion-resistant approved material . Furnish a support structure which secures the collector array at the proper tilt angle with respect to horizontal and orientation with respect to true south. Consideration should be made to mounting collectors parallel to the pitched roofs. The collector tilt angle may vary by +/- 25 degrees, and the azimuthal angle may vary by +/-45% from the optimal tilt and azimuth. Provide a support structure that will withstand the static weight of filled collectors and piping, wind, seismic, and other anticipated loads without damage. For heavy systems, such as integral storage collectors, provide structural reinforcement for the roof across at least four rafters and provide verification that the structural modifications proposed are satisfactory. Provide a support structure which allows access to all equipment for maintenance, repair, and replacement. Neoprene or EPDM washers shall separate all dissimilar metals. Depending on system type, supports for solar array could terminate in ballast blocks to avoid roof penetrations.

2.5 SOLAR PREHEAT STORAGE TANK

- A. Provide a cylindrical thermal energy storage solar preheat tank with a storage capacity of at least 1.5 gallons per square foot of collector area. Insulate each tank with fiberglass or foam with a loss coefficient of not more than 0.5 W/m²C. Protect the insulation by a PVC or steel jacket. Provide a tank rated at 100 lb/in² at 190 degrees Fahrenheit. Provide the interior of each tank with glass lining for potable service.

2.6 TRANSPORT SUBSYSTEM

A. Heat Exchanger (if required by system design)

1. For system designs requiring a heat exchanger, provide a minimum design pressure rating of 100 psi. Construct heat exchanger of 316 stainless steel, titanium, copper-nickel, or brass. Furnish heat exchanger with a capability of withstanding temperatures of at least 240 degrees F. Tube-in-tube copper side-arm heat exchangers are acceptable for appropriate system types.

B. Pumps (for active systems)

1. For active solar system designs requiring a pump, provide electrically-driven, single-stage, centrifugal type circulating pumps such as those manufactured by Grundfos, Hartel, March, Taco or approved equivalent. Support pumps on a concrete foundation or mounting intended for the purpose, or by the piping on which installed if appropriate to the size. Construct the pump shaft of corrosion resistant alloy steel with a mechanical seal. Provide stainless steel impellers and casings of bronze. Control motors with switches that can be activated by either the differential temperature controller or by manual override (Hand-Off-Automatic). Pumps shall be installed with isolation valves so the pump can be serviced without draining the system.

C. Heat Transfer Fluid

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1. Heat transfer fluid shall be compatible with all materials in the system. The nature and amount of heat transfer fluid will depend on the type of system proposed and the freeze conditions encountered at the site. Any anti-freeze, conditioners or corrosion inhibitors added to the heat transfer fluid must be non-toxic and intended for use in potable water systems.

2.7 CONTROL AND INSTRUMENTATION SUBSYSTEM

A. Differential Temperature Control Equipment (if required)

1. If the system design includes controls, furnish the differential temperature control equipment as a system from a single manufacturer. Furnish a solid-state electronic type controller complete with an integral transformer to supply low voltage. Controller accuracy shall be plus or minus 1 degree F. Supply controllers that are compatible with the thermistor temperature sensors. Provide differential controls with direct digital temperature readings of all temperatures sensed. Supply controls with a visual indicator when pumps are energized. Provide a controller that will identify open and short circuits on both the solar collector temperature sensor circuit and the storage tank sensor circuit.

B. Thermistor Temperature Sensors (if required)

1. Provide temperature sensors that are compatible with the differential temperature controller, with an accuracy of plus or minus 1 percent at 77 degrees F. Supply sensors that have passed an accelerated life test conducted by subjecting thermistor assemblies to a constant temperature of 400 degrees F or greater for a period of 1000 hours minimum with an accuracy of within plus or minus 1 percent as stated above. Furnish hermetically sealed type thermistors. Provide immersion wells or watertight threaded fittings for temperature sensors. Temperature sensors shall be mechanically attached to the surface they are measuring and wire to the sensor must be mechanically attached and protected along its length.

C. Tempering Valve (VERY IMPORTANT)

1. All systems installed under this procurement action **MUST** have a tempering or mixing valve to limit the temperature of the hot water supplied to the plumbing fixtures. The tempering valve is to be located downstream of the electric water heater and is to be set to a temperature suitable for the application.

2.8 ELECTRICAL WORK

- A. If pumps are required in the system design, provide electric motor-driven equipment complete with motor, motor starters, and controls. Provide electrical equipment and wiring in accordance with NFPA 70. Furnish motor starters complete with thermal overload protection and other appurtenances necessary for the motor control specified. Provide each motor of sufficient size to drive the equipment at the specified capacity without exceeding the nameplate rating of the motor.

2.9 PAINTING AND FINISHING

- A. Furnish equipment and component items, with the factory applied manufacturer's standard finish.

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PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install piping straight and true to bear evenly on hangers and supports. Do not hang piping from sheet rocked or suspended ceilings. Keep interior and ends of new piping thoroughly cleaned of foreign matter. Keep piping systems clean during installation by means of plugs or other approved methods. Discharge storage tank pressure and temperature relief valves into floor drains. Horizontal runs should be flat and vertical runs should be plumb. Install any multiple pipes in an order which does not require them to cross or interfere with each other or other building systems. Provide air vents with threaded plugs or caps. Install control and sensor wiring in conduit.
- B. System Flushing and Disinfection
 - 1. Flush and disinfect the piping system.
- C. Collector Subsystem
 - 1. Collector Array
 - a. Install solar collector array at the proper tilt angle, orientation, and elevation above roof. Install the solar collectors with the ability to be removed for maintenance, repair, or replacement.
 - 2. Array Piping
 - a. Install collector array piping in a reverse-return configuration so that path lengths of collector supply and return are of approximately equal length. Install air vents in the high points of the collector array piping. Provide proper pitch for draining of collector array.
 - 3. Array Support
 - a. Install array support in accordance with the recommendations of the collector manufacturer, and to withstand 180mph winds.
 - 4. Pipe Expansion
 - a. Provide for the expansion and contraction of supply and return piping with changes in the direction of the run of pipe or by expansion loops. Do not use expansion joints in the system piping.
 - 5. Valves
 - a. Install ball valves at the inlet and outlet of each bank of manifolded collectors. Install calibrated balancing valves at the outlet of each collector bank and mark final settings on each valve. Install a union adjacent to each ball valve. Balance flow through the collector piping with at least one balancing valve left in the open position. Locate tempering mixing valve downstream of auxiliary water heater to control hot water delivery temperature.

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6. Roof Penetrations

- a. All roof penetrations shall be made permanently waterproof. Copper or other approved flashing shall be used. Contractor shall provide a five year warranty on materials and labor, including consequential damages, for any roof leaks due to or arising out of the solar water heating system installation.

3.2 INSPECTION AND TESTING

A. Instructions

1. Provide instructions for each system type. Include in these instructions a system schematic, and wiring and control diagrams showing the complete layout of the solar system. Prepare condensed operating instructions explaining preventative maintenance procedures, balanced flow rates, methods of checking the system for normal safe operation, and procedures for safely starting and stopping the system, in typed form, framed as specified above, and posted beside the diagrams. Post the framed instructions before acceptance testing of each system.

B. Acceptance Testing and Final Inspection

- a. Maintain a written record of the results of all acceptance tests, to be submitted in booklet form. Provide the following tests:

C. Hydrostatic Test

- a. Hydrostatically test each system. Isolate valving and instrumentation not suitable for the intended test pressure.

D. Operational Test

1. Operationally test each system over a period of 48 consecutive hours with sufficient solar insolation to cause activation of the solar energy system during daylight hours.

E. Overall System Operations

1. Demonstrate each solar energy system will operate properly while unattended for a period of at least 72 hours. As required by system design, demonstrate the system controller will start the pumps after being warmed by the sun, and that it will properly shut down during cloudy weather or in the evening over a minimum of three complete cycles. It is permissible to manipulate the temperature of the storage tank by the introduction of cold water.

F. Temperature Sensor Diagnostics

1. As required by system design, demonstrate the controller will correctly identify open and short circuits on both the solar collector temperature sensor circuit and the storage tank sensor circuit.

3.3 FIELD TRAINING

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- A. Provide a field training course for operating and maintenance staff members after the system is functionally complete. Include in the training a discussion of the system design and layout and demonstrate routine operation, maintenance and troubleshooting procedures.
- B. Appendix A: Background Information Regarding the Building, Hot Water Requirements, and End Uses of Hot Water, including variations throughout the day, week and year.

END OF SECTION

SECTION 224000- PLUMBING FIXTURES

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PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Commercial Lavatories.
- B. Commercial Service Basins.
- C. Commercial Service Sinks.
- D. Commercial, Vitreous-China Water Closets.
- E. Toilet Seats.

1.2 RELATED SECTIONS:

- A. Section 23 05 00 - Common Work Results for HVAC.
- B. Section 22 10 00 - Plumbing Piping.
- C. Section 22 14 26.13 - Roof Drains.

1.3 REFERENCES

- A. American Society of Mechanical Engineers (ASME):
 - 1. ASME A112.18.1/CSA B125.1 - Plumbing Supply Fittings.
 - 2. ASME A112.18.2/CSA B125.2 - Plumbing Waste Fittings.
 - 3. ASME A112.18.6/CSA B125.6 - Flexible Water Connectors.
 - 4. ASME A112.19.1/CSA B45.2 - Enameled Cast Iron and Enameled Steel Plumbing Fixtures.
 - 5. ASME A112.19.2/CSA B45.1 - Vitreous China Plumbing Fixtures and Hydraulic Requirements for Water Closets and Urinals.
 - 6. ASME A112.19.5 / CSA B45.15 - Flush Valves and Spuds for Water Closets, Urinals, and Tanks.
 - 7. ASTM A1045 Standard Specification for Flexible Poly (Vinyl Chloride) (PVC) Gaskets used in Connection of Vitreous China Plumbing Fixtures to Sanitary Drainage Systems.
 - 8. ASME A112.4.3. - Plastic Fittings for Connecting Water Closets to the Sanitary Drainage System.
 - 9. ASME B1.20.1 - Pipe Threads, General Purpose, Inch.
- B. American Society of Safety Engineers (ASSE):

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1. ASSE 1037/ASME A112.1037/CSA B125.37 - Performance Requirements for Pressurized Flushing Devices for Plumbing Fixtures.

C. ASTM International (ASTM):

1. ASTM A1045 Standard Specification for Flexible Poly (Vinyl Chloride) (PVC) Gaskets used in Connection of Vitreous China Plumbing Fixtures to Sanitary Drainage Systems.

D. International Code Counsel:

1. ICC/ANSI A117.1 - Accessible and Usable Buildings and Facilities.

E. Plumbing and Drainage Institute:

1. PDI-WH 201 - Water Hammer Arresters.

1.4 SUBMITTALS

A. Submit under provisions of Section 01 30 00 - Administrative Requirements.

B. Product Data: Each fixture type.

1. Include dimensions, finishes, construction information, capacities, operation instructions and accessories.

C. Maintenance data for all products.

1. Repair kit information for all fixtures.

1.5 QUALITY ASSURANCE

A. Manufacturer Qualifications:

1. Minimum 5 years manufacturing similar products.

B. Regulatory Compliance Requirements:

1. Utility company supplying the water.
 - a. Backflow prevention.
2. Authorities having jurisdiction: Materials, installation, and testing.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Deliver and store products in manufacturer's unopened packaging bearing the brand name and manufacturer's identification until ready for installation.

1. Protect internal parts, valve ends, and specialties against corrosion, dirt, and damage.
2. Store valves set in closed position.

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3. Storage:

- a. Indoors: Higher than ambient dew point temperature.
- b. Outdoors: Watertight enclosures off ground.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Acceptable Manufacturers for Commercial Products:

- 1. Zurn Industries LLC, which is located at: 511 W. Freshwater Way; Milwaukee, WI 53204;
Toll Free Tel: 855-663-9876; Email: request info (zurn-info@zurn.com);
Web: www.zurn.com
- 2. Sloan
- 3. Kohler
- 4. Toto

B. Requests for substitutions will be considered in accordance with provisions of Section 01 60 00 - Product Requirements.

2.2 COMMERCIAL LAVATORIES

A. Single piece bowl and counter top

1. Manufacturers:

- a. Zurn
- b. Kohler
- c. American Standard
- d. Requests for substitutions will be considered in accordance with provisions of Section 01 60 00 - Product Requirements.

2. Lavatory Attributes:

- a. Standard: ASME A112.19.2/CSA B45.1.
- b. Nominal Size:
 - i. Oval, 22 by 18 inches (559 by 457 mm).
- c. Faucet-Hole Punching:
 - i. Three holes, 8-inch (203-mm) centers.

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d. Faucet-Hole Location:

i. Top.

e. Color: White.

f. Mounting Material:

i. Sealant.

ii. Undercounter mounting kit.

iii. Wall bracket.

iv. Chair Carrier (wheelchair accessible).

g. Support Fixture: ASME A112.6.1M, Type II, lavatory carrier.

i. Include rectangular, steel uprights.

B. Security Vitreous-China Wall Mounted Lavatories:

1. Manufacturers:

a. Zurn

b. Kohler

c. American Standard

d. Requests for substitutions will be considered in accordance with provisions of Section 01 60 00 - Product Requirements.

2. Lavatory Attributes:

a. Standard: ASME A112.19.2/CSA B45.1.

b. Material: Vitreous china.

c. Bowl: Oval or rectangular bowl, soap depression, and wall bracket.

d. Supply Valves: Factory-installed push-button, self-closing, chrome-plated brass faucets; Hot- and Cold-Water.

e. Drain: Grid with NPS 1-1/2 (DN 40) tailpiece.

3. Waste Fittings: ASME A112.18.2/CSA B125.2.

a. Trap NPS 1-1/4 (DN 32) minimum waste.

4. Support Fixture: ASME A112.6.1M, Type II lavatory carrier.

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2.3 COMMERCIAL SERVICE BASINS

C. Service Basin: Plastic, floor mounted.

1. Mounting: On floor and flush to wall.

2. Service Basin Attributes:

a. Standard: CSA B45.5/IAPMO Z124.

b. Material: Cast polymer.

c. Nominal Size:

i. 36 by 24 by 10 inches (915 by 915 by 255 mm).

d. Tiling Flange:

i. On one side.

e. Color: White.

f. Drain: With Grid

i. NPS 2 (DN 50).

D. Commercial: Floor-Mounted, Bottom-outlet, Top Spud:

1. Acceptable Manufacturers:

a. Zurn Industries, LLC

b. Kohler

c. American Standard

d. Substitutions allowed

2.4 TOILET SEATS

A. Properties:

1. Standard: IAPMO/ANSI Z124.5.

2. Acceptable Manufacturers:

a. Zurn Industries, LLC

b. Bemis

c. Kohler

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- d. American Standard
- e. Substitutions allowed
- 3. Material: Plastic.
- 4. Type:
 - a. Heavy duty.
- 5. Shape:
 - a. Elongated rim, open front.
- 6. Hinge:
 - a. Self-sustaining, check.
- 7. Hinge Material: Noncorrosive metal.
- 8. Seat Cover:
 - a. Not required.
- 9. Color: White.

2.5 COMMERCIAL URINALS

A. Stall, Washout Type:

- 1. Basis-of-Design: Zurn Industries, LLC; Substitutions allowed
- 2. Flushometer Valve:
 - a. Model Z6003AV Manual diaphragm.
 - b. Model Z6203 Manual Piston.
 - c. Sloan

B. Wall-Hung, Back Outlet, Blowout:

- 1. Basis-of-Design: Zurn Industries, LLC; ; Substitutions allowed
- 2. Flushometer Valve:
 - a. Model Z6003AV Manual diaphragm.
 - b. Model Z6203 Manual Piston.
 - c. Sloan

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C. Wall-Hung, Back Outlet, Siphon Jet, Accessible:

1. Acceptable Manufacturers

- a. Zurn Industries, LLC;
- b. American Standard
- c. Kohler
- d. Substitutions allowed

2. Flushometer Valve.

- a. Model Z6003AV Manual diaphragm.
- b. Substitutions allowed

D. Wall-Hung, Back Outlet, Washout, Accessible:

1. Acceptable Manufacturers

- a. Zurn Industries, LLC;
- b. American Standard
- c. Kohler
- d. Substitutions allowed

2. Flushometer Valve:

- a. Model Z6003AV Manual diaphragm.
- b. Model Z6203 Manual Piston.
- c. Sloan
- d. Substitutions allowed

A. Wall-Hung, Bottom Outlet, Washout or Wall-Hung, Bottom Outlet, Wash Down:

3. Acceptable Manufacturers

- a. Zurn Industries, LLC;
- b. American Standard
- c. Kohler
- d. Substitutions allowed

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4. Flushometer Valve:

- a. Model Z6003AV Manual diaphragm.
- b. Model Z6203 Manual Piston.
- c. Sloan
- d. ASME A112.6.1M, Type II, Urinal carrier, model Z1221 or Z1222.

5. Waste Fitting: Two-piece trap and swivel elbow and wall flange.

- a. Chrome plated brass.

6. Commercial Urinal Attributes:

- a. Standards: ASME A112.19.2/CSA B45.1.
- b. Material: Vitreous-china.
- c. Type: Siphon jet.
 - i. Extended shields.
- d. Strainer or Trap-way: With integral trap.
- e. Water Consumption:
 - i. 0.5 gal (1.9 L) per flush.
- f. Spud Size and Location: NPS 3/4 (DN 20);
 - i. Top.
- g. Outlet Size and Location: NPS 2 (DN 50); back.
- h. Color: White.

2.6 WATERLESS URINALS

A. Wall hung, back outlet, waterless, vitreous china, designed for liquid-trap-seal operation:

- 1. Basis-of-Design: Zurn Industries, LLC: Model Z5795. Substitutions allowed.
- 2. Waterless Urinal attributes:
 - a. Standard: ASME A112.19.2/CSA B45.1, without water.
 - b. Trap-Seal Method: Liquid seal.
 - c. Outlet Size: Flange, NPS 2 (DN 50).

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- i. Location: Back.
- d. Trap-Sealing Liquid: Proprietary.
- e. Color: White.
- 3. Waste Fitting:
 - a. Standard: ASME A112.18.2/CSA B125.2.
 - b. Size: NPS 2 (DN 50).
- 4. Mounting Fixture:
 - a. Model Z1221 - Plate Type System wall urinal.
 - b. Model Z1222 - Plate Type system with bearing plate.

2.7 COMMERCIAL LAVATORY FAUCETS

A. Sold Brass Manual Lavatory Faucets:

- 1. Basis-of-Design: Zurn Industries, LLC; Substitutions permitted.
 - a. Model Z811-XL Series 4 inch (102 mm) Centerset Quarter Turn Faucets.
 - b. Model Z812-XL Series 4 inch (102 mm) Centerset Quarter Turn Faucets.
 - c. Model Single Basin Z827-XL Series.
 - d. Substitutions are allowed

B. Solid Brass, Automatic Lavatory Faucets: electronic-sensor-operated:

- 1. Basis-of-Design: Zurn Industries, LLC; Substitutions permitted
 - a. Model Z6930-XL-CWB (automatic-type, hard-wired).
 - b. Model Z6913-XL-CWB (automatic-type, hard-wired).
 - c. Model Z6915-XL-CWB (automatic-type, hard-wired).
 - d. Model Z6920-XL (automatic-type, hard-wired).
 - e. Substitutions are allowed.
- 2. Standard:
 - a. ASME A112.18.1/CSA B125.1.
 - b. NSF/ANSI 61.

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3. General: Indicators: Hot- and cold-water.

4. Body: Commercial, solid brass.

a. 8-inch (203 mm) Centerset.

b. Widespread.

c. Single hole.

5. Finish: Polished chrome plate.

6. Maximum Flow Rate:

a. 1.5 gpm (5.7 L/m).

7. Mounting Type:

a. Back/wall, concealed.

8. Spout Type:

a. Rigid, gooseneck.

9. Spout Outlet:

a. Aerator.

2.8 SINK FAUCETS

A. Manual Type Mixing Valve: Commercial, Solid-Brass Faucets:

1. Basis-of-Design: Zurn Industries, LLC: Substitutions permitted.

a. Model Z811-XL Series.

b. Model Z812-XL Series.

c. Model Z825-XL.

d. Model Z827-XL.

e. Model Z831-XL.

2. Standards:

a. ASME A112.18.1/CSA B125.1

b. NSF/ANSI 61.

3. Include hot- and cold-water indicators; coordinate faucet inlets with supplies and fixture hole punchings; coordinate outlet with spout and sink receptor.

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4. Body Type:
 - a. Widespread.
5. Body Material: Solid brass.
6. Finish:
 - a. Chrome plated.
7. Maximum Flow Rate:
 - a. 1.5 gpm (5.7 L/m).
8. Handle(s):
 - a. Wrist blade, 4 inches (102 mm).
9. Mounting Type:
 - a. Deck, concealed.
10. Spout Type:
 - a. Swivel gooseneck.
11. Operation: Quarter Turn Heavy Duty Ceramic.
12. Vacuum Breaker: For hose outlet.
13. Spout Outlet:
 - a. Hose thread according to ASME B1.20.7.
14. Supply Fittings: Zurn - Model Z8808-XL.
15. Waste Fittings: Zurn.
 - a. Model Z8746 Series.
 - b. Model Z8743 Series.
 - c. Model Z8746 Series.

2.9 FAUCET SUPPLY FITTINGS

- A. Basis-of-Design: Zurn Industries, LLC; Substitutions permitted
 1. Model Z8808-XL.
 2. Standard:

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- a. ASME A112.18.1/CSA B125.1.
- b. NSF 61.
- 3. Supply Piping: Chrome-plated brass pipe or chrome-plated copper tube matching water-supply piping size. Include chrome-plated brass or stainless-steel wall flange.
- 4. Supply Stops: Chrome-plated brass, one-quarter-turn, ball-type or compression valve with inlet connection matching supply piping.
- 5. Operation:
 - a. Loose key.
 - b. Wheel-handle.
- 6. Risers:
 - a. NPS 3/8 (DN 10).
 - b. NPS 1/2 (DN 15).
 - c. Material:
 - i. Chrome-plate, rigid copper pipe.
 - ii. Chrome-plated, soft-copper flexible tube.
 - iii. ASME A112.18.6 / CSA B125.6, braided- or corrugated-stainless-steel flexible hose.

2.10 SINK AND LAVATORY WASTE FITTINGS

- A. Basis-of-Design: Zurn Industries, LLC: Drain:
 - 1. Model Z8746 Series Grid type with NPS 1-1/2 (DN 40) offset.
 - 2. Model Z8743 Series.
 - 3. Model Z8746 Series.
- B. Standard: ASME A112.18.2/CSA B125.2.
- C. Trap: Two-piece trap and swivel elbow and wall flange.
 - 1. Size: NPS 1-1/2 (DN 40).
 - 2. Stainless steel.
 - 3. Chrome plated brass.

2.11 URINAL FLUSHOMETER VALVES

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A. Lever-Handle, Diaphragm Flushometer Valves:

1. Manufacturers:

- a. Zurn 0.5 gal (1.9 L) per flush.
- b. Sloan
- c. Equivalent substitutions are acceptable

B. Lever-Handle, Piston Flushometer Valves:

1. Manufacturers:

- a. Zurn 0.5 gal (1.9 L) per flush.
- b. Sloan
- c. Equivalent substitutions are acceptable

2. Urinal Flushomatic Attributes:

- a. Standard: ASSE 1037/ASME A112.37/CSA B125.37.
- b. Maximum Pressure Rating: 125 psig (860 kPa).
- c. Features: Include integral check stop and backflow-prevention device.
- d. Material: Brass body with corrosion-resistant components.
- e. Exposed Flushometer-Valve Finish: Chrome plated.
- f. Panel Finish: Chrome plated or stainless steel.
- g. Style:
 - i. Concealed.
- h. Consumption: Per flush.
 - i. 0.5 gal. (1.9 L).
- i. Minimum Inlet:
 - i. NPS 3/4 (DN 20).
- j. Minimum Outlet:
 - i. NPS 1-1/4 (DN 32).

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2.12 WATER CLOSET FLUSHOMETER VALVES

A. Lever-Handle, Diaphragm Flushometer Valves:

1. Manufacturers:

- a. Zurn 1.0 gal (3.8 L) per flush.
- b. Sloan
- c. Substitutions are allowed

B. Lever-Handle, Push-Button, Diaphragm Flushometer Valves:

1. Manufacturers:

- a. Zurn 1.0 gal (3.8 L) per flush.
- b. Sloan
- c. Substitutions are allowed

C. Lever-Handle, Piston Flushometer Valves:

1. Basis-of-Design: Zurn Industries, LLC:

- a. Model Z6200-HET, 1.28 gal (4.8 L) per flush.
- b. Water Closet Flushometer Attributes:
 - i. Standard: ASSE 1037/ASME A112.37/CSA B125.37.
 - ii. Maximum Pressure Rating: 125 psig (860 kPa).
 - iii. Features: Include integral check stop and backflow-prevention device.
 - iv. Material: Brass body with corrosion-resistant components.
 - v. Exposed Flushometer-Valve Finish: Chrome plated.
 - vi. Panel Finish: Chrome plated or stainless steel.
 - vii. Style:
 - 1) Concealed.
 - viii. Consumption: Per flush.
 - 1) 1.28 gal. (4.8 L).
 - ix. Minimum Inlet: NPS 1 (DN 25).

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x. Minimum Outlet: NPS 1-1/4 (DN 32).

2.13 WATER CLOSET WASTE CARRIERS

A. Standard, Adjustable Blowout Style Water Closet Carriers:

1. Basis-of-Design: Zurn Industries, LLC; Substitutions are allowed:

a. Horizontal Waste Fitting:

i. Model Z1203-N.

b. Vertical Waste Fitting:

i. Model Z1204-N.

c. Water Closet Waste Carrier Attributes:

i. Standard: ASME A112.6.1M.

ii. Load Rating:

1) N = 300 lbs (136 kg).

iii. Waste-fitting to match drainage piping material and arrangement. Couplings gaskets, faceplate, and feet; Hardware to match fixture.

1) Wide space installation: Extension coupling.

iv. Connection Type:

1) No-Hub "N".

2) Hub and Spigot "H".

v. Flow Direction:

1) Right "R".

vi. Waste Pipe Diameter:

1) 3 in (76 mm).

vii. Faceplate: B (blowout style faceplate).

viii. Water Consumption: Per flush.

1) 1.28 gal (4.8 L)

ix. Water-Closet Mounting Height:

1) Handicapped/elderly according to ICC A117.1.

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x. Coupling/Waste Orifice Diameter: 3 in (76 mm).

xi. Foot Type:

1) Universal (standard or prefab installations).

xii. Material: Cast Iron.

2.14 SUPPORT FIXTURES

A. Lavatory, Support Fixtures:

1. Basis-of-Design: Zurn Industries, LLC; Substitutions are allowed:

a. Model Z1224 - Plate Type System; Lavatory Back Carrier.

- i. Lavatory support system with top support plate.
- ii. Dura-Coated rectangular steel uprights with welded feet.
- iii. Adjustable support plate., and mounting fasteners.

b. Model Z1231 - Concealed Arm System, with Alignment Truss Carrier.

- i. Lavatory support system with concealed arms.
- ii. Dura-Coated rectangular steel uprights with welded feet.
- iii. Cast iron adjustable headers, concealed arms, steel sleeves, alignment truss, and mounting fasteners.

c. Model Z1231-EZ - Concealed Arm System with Adjusting Bars Carrier.

- i. Lavatory support system with concealed arms.
- ii. Dura-Coated rectangular steel uprights with welded feet.
- iii. Cast iron adjustable headers, concealed arms, steel sleeves, adjusting bars, and mounting fasteners.

d. Model Z1231-EZR - Concealed Arm System with Adjustable Uprights and Header Plates.

- i. Wall Hung Lavatory Support System.
- ii. Dura-Coated upright supports; structural carbon-steel square tubing.
- iii. Welded steel plate mounting feet with separate bolt patterns:
- iv. Anchors complying with OSHPD spacing requirements.

1) 3/8 inch (10 mm).

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- v. Lower and upper EZ-installation plates, marked with an indexed ruler guide;
 - 1) Accurate adjustability, upright spacing, from 15 inch (381 mm) to 22 inch (560 mm).
- vi. Individual slotted header plates with integral welded arm sleeves.
 - 1) Provides 2 inch (51 mm) additional horizontal adjustment per plate.
 - 2) Total horizontal adjustment range is 11 inches (279 mm) to 26 inches (660 mm).
- vii. Arms: Dura-Coated cast iron with leveling screws and elastomeric locking devices.
- viii. Factory assembled: Uprights, EZ-installation plates, and header plates.
- ix. Complies with ASME Standard A112.6.1M at any adjustment position.

B. Urinal Support Fixtures:

- 1. Basis-of-Design: Zurn Industries, LLC; Substitutions are allowed:
 - a. Model Z1221 - Plate Type Systems wall urinal.
 - i. Dura-Coated rectangular steel uprights, welded feet, adjustable support plate, and mounting fasteners.
 - b. Model Z1222 - Plate Type system with bearing plate.
 - i. Dura-Coated carbon structural steel rectangular tubing uprights.
 - ii. Welded base feet, slotted floor anchor holes.
 - iii. Lower bearing plate, vertically adjustable to accommodate bearing jack placement.
 - iv. Upper Universal hanger plate, pre-notched for back spud inlet.
 - 1) Designed for various hardware positions and fixtures.
 - 2) Includes mounting fasteners and hardware.
 - 3) Carrier system exceeds load and deflection requirements as outlined in ASME Standard A112.6.1M.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Verification of Conditions: Examine areas and conditions under which Work is to be performed and identify conditions that may be detrimental to proper or timely completion.
 - 1. Rough-in for water-supply, sanitary drainage and vent piping systems: Verify locations; pipe and connection.

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- 2. Walls and partitions: Suitable thickness.
- B. Fixture and Valve Interiors: Clean and free of foreign matter, and corrosion. Remove packing used to prevent disc movement.
 - 1. Operate valves from fully open to fully closed positions.
 - 2. Verify guides and seats are clean and free of foreign matter, and corrosion.
- C. Threads on Valves Fittings and Fixtures: Inspect valve and mating pipe for form and cleanliness.
- D. Mating Flange Faces: Inspect for conditions that may cause leaking.
 - 1. Bolting: Proper size, length, and material.
 - 2. Gaskets: Proper size and material composition suitable for application; defect and damage free.
- E. Replace defective fixtures and valves with new.
- F. Do not proceed until unsatisfactory conditions have been corrected.

3.2 INSTALLATION

- A. All Fixtures: level and plumb.
 - 1. For children: install at height required.
- B. Attach all support framing to building substrate per manufacturer's written instructions.
- C. Wall-mounted fixtures: Install off-the-floor carrier supports. Install accessible, wall-mounted water closets according to ICC/ANSI A117.1.
- D. Water-supply piping: Ball or gate shutoff valves on supply to each fixture connected to domestic-water piping. See section 23 05 00 - Common Work Results for HVAC "Common Work Results for Plumbing Piping."
 - 1. Locations: easily accessible.
- E. Fixture drain outlets: Install trap and waste piping to be connected to sanitary drainage system.
- F. Escutcheons and wall flanges: Wall piping penetrations finished locations.
- G. Joints between fixtures and walls: Seal with silicone sealant:
 - 1. Sanitary, one-part, mildew-resistant. Match colors.
- H. Flushometers:
 - 1. Water-supply fitting on supply to water closet.
 - 2. Supply piping: Attach to supports or substrate in space behind fixture.

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3. Accessible water closets: Handle on lever-handle flushometer to be mounted on open side of water closet. Be sure actuators accessible to with disabilities.

3.3 FIELD QUALITY CONTROL

- A. Test and inspect per authorities having jurisdiction.
- B. Piping Tests: prior to covering and after curing and setting of concrete thrust blocks. Fill and pressurize pipeline to test pressure a minimum of 24 hours before testing.
 1. Use potable water.
- C. Hydrostatic Tests:
 1. Test Pressure: One-and-one-half times the working pressure for two hours.
 - a. Increase pressure at increments of 50-psig (350-kPa).
 - i. Inspect joints.
 - b. Maintain test pressure for one hour, minimum.
 - c. Decrease test pressure to zero psig (zero kPa).
 - d. Increase pressure at increments of 50-psig (350-kPa).
 - i. Inspect joints.
 - e. Maintain test pressure for one hour, minimum.
 - f. Allowable leakage: 2 quarts (1.89 L) per hour per 100 joints.
 2. Remake leaking joints with new materials and repeat test until leakage is within allowed limits.
- D. Prepare test and inspection reports.

3.4 IDENTIFICATION

- A. Comply with requirements for identification specified in Section 23 05 53 - Identification for HVAC Piping and Equipment "Identification for Plumbing Piping Systems."
- B. Comply with requirements for identification specified in Section 26 05 53- "Identification for Electrical Systems."

3.5 ADJUSTING

- A. Flow regulators: Proper flow of water through fixtures.
- B. Flushometer valves: Adjust water pressure.
- C. Replace damaged fixtures, fittings, and controls

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3.6 CLEANING

- A. Remove paint spots, dirt, and debris. Damaged finish to match original finish.
- B. Clean fixtures, according to manufacturer's written instructions.
- C. Provide protective covering for installed fixtures.
- D. Not to be used for temporary facilities without written approval by Owner.

END OF SECTION

SECTION 224000 – PLUMBING FIXTURES

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PART 1 - GENERAL

1.1 ACTION SUBMITTALS

- A. Product Data: For each type of product
- B. Shop Drawings: Include diagrams for power, signal, and control wiring.

1.2 INFORMATIONAL SUBMITTALS

- A. Coordination Drawings: Counter cutout templates for mounting of counter-mounted lavatories.

1.3 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data

PART 2 - PRODUCTS

2.1 PLUMBING FIXTURES

- A. For plumbing fixtures refer to schedules on drawings.

2.2 SUPPLY FITTINGS

- A. NSF Standard:
Comply with NSF/ANSI 61, "Drinking Water System Components-Health Effects," for supply fitting materials that will be in contact with potable water.
- B. Standard: ASME A112.18.1/CSA B125.1
- C. Supply Piping:
Chrome-plated copper tube matching water-supply piping size. Include chrome-plated brass or stainless-steel wall flange.
- D. Supply Stops: Ball-type or compression valve with inlet connection matching supply piping.
- E. Operation: Loose key
- F. Risers:
 - 1. NPS 112 (DN 15)
 - 2. Chrome-plated, rigid-copper pipe ASME A112.18.6.
 - 3. Brass trap and swivel elbow with 0.032-inch- (0.83-mm-); and chrome-plated brass.

PART 3 - EXECUTION

3.1 CONNECTIONS

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- A. Connect fixtures with water supplies, stops, and risers, and with traps, soil, waste, and vent piping. Use size fittings required to match fixtures.
- B. Comply with water piping requirements specified in Section 22 11 16 "Potable Water Piping."
- C. Comply with soil and waste piping requirements specified in Section 22 13 16 "Sanitary Waste and Vent Piping."

3.2 ADJUSTING

- A. Operate and adjust fixtures and controls.

3.3 CLEANING AND PROTECTION

- A. Clean fixtures, faucets and fittings with manufacturers' recommended cleaning methods and materials.
- B. Install protective covering for installed, sinks and fittings.
- C. Do not allow use of fixtures for temporary facilities unless approved in writing by Owner.
- D. After completing installation of fixtures, inspect and repair damaged finishes.

END OF SECTION

SECTION 224216 – COMMERCIAL SINKS AND FAUCETS

Government of the Virgin Islands, Department of Public Works

PROJECT NAME: Elaine I. Sprauve Library and Museum Building

Project Location: **St. John, U.S. Virgin Islands**

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Commercial sinks.

1.2 RELATED SECTIONS

- A. Division 22 Section "Domestic Water Piping Specialties."

1.3 REFERENCES

- A. American National Standards Institute (ANSI):

1. ANSI Z 124.3 - Plastic Lavatories.
2. ANSI Z 124.6 - Plastic Sinks.
3. ANSI/ICPA SS-1-2001 - Performance Standard for Solid Surface Materials.
4. ICC/ANSI A117.1 - Accessible And Usable Buildings And Facilities.

- B. ASME International (ASME):

1. ASME A112.18.1 - Plumbing Fixture Fittings.
2. ASME A112.18.2 - Plumbing Fixture Waste Fittings.
3. ASME A112.18.3M - Performance Requirements for Backflow Protection Devices and Systems in Plumbing Fixture Fittings.
4. ASME A112.19.1M - Enameled Cast Iron Plumbing Fixtures.
5. ASME A112.19.2M - Vitreous China Plumbing Fixtures.
6. ASME A112.19.4M - Porcelain Enameled Formed Steel Plumbing Fixtures.

- C. International Association of Plumbing and Mechanical Officials (IAPMO):

- D. Uniform Plumbing Code (cUPC).

- E. NSF International (NSF):

1. NSF 61 - Drinking Water System Components - Health Effects; Sections 1 through 9.

- F. Underwriters Laboratories, Inc.:

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1. UL 1951 - Electric Plumbing Accessories.

1.4 ACTION SUBMITTALS

- A. Product Data: For each product indicated.
- B. Wiring Diagram: For products requiring electrical power.
- C. LEED Submittals:
 1. Product Data for Credit WE 2 and Credit WE 3: Documentation indicating compliance with requirements.

1.5 INFORMATIONAL SUBMITTALS

- A. Counter cutouts and plumbing connections requirements.

1.6 CLOSEOUT SUBMITTALS

- A. Cleaning and maintenance data.

1.7 QUALITY ASSURANCE

- A. Comply with NSF 61.
- B. Electrical Components: Listed and labeled per NFPA 70, Article 100.

1.8 WARRANTY

- A. Special Manufacturer's Warranty: Provide manufacturer's standard form in which manufacturer agrees to repair or replace products that fail in materials or workmanship for a period of 10 years from date of shipping from manufacturer.

PART 2 PRODUCTS

2.1 COUNTERTOP-SUPPORTED SINKS

- A. Integral Solid Surface Sink: Constructed of solid surface material with integral bowl, contoured front apron, coved backsplash, with deck mounted faucets, and waste receptacle openings. Unit includes waste and supply connections to wall, concealed by high impact polymer trap cover.
- B. Basis of Design Manufacturer/Model: Bradley, TerreonRE Classroom Sink or approved equal.
 1. Bowl Size: 10 by 14 inch (254 by 356 mm), 8 inch (203 mm) deep.
 2. Deck Color: As selected by Owner's Representative from manufacturer's full line.

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3. Bowl Color: Match deck color.

C. Faucet: Gooseneck, 10 inches (254 mm) high, with infrared sensor metering control, with 110/24 VAC plug-in transformer.

1. Basis of Design Manufacturer/Model: Bradley, Aerada 1000 Series Gooseneck, or approved equal.

D. Soap Dispenser : 32 oz. (946 mL) plastic globe, with 4-inch (102 mm) spout.

2.2 SERVICE SINKS

A. Service Sinks: Enameled, cast-iron trap standard service sink, wall-mounting.

1. Size: 22 by 18 inches (560 by 460 mm).

2. Color: White.

B. Laundry Trays: Plastic, stand-mounted laundry tray.

1. Size: 25 by 22 inches (635 by 560 mm).

C. Faucet: Sink, fixture ledge mounted.

2.3 SINK FAUCETS

A. Sensor-Operated, Gooseneck Metering Faucet with Infrared Control, Vandal-resistant accessible faucet, meeting ASME A112.18.1/CSA B125. ADA/ANSI A117.1 compliant.

B. Basis of Design Manufacturer/Model: Bradley, Aerada 1000 Series Gooseneck, or approved equal.

1. Body: Polished chrome plated commercial solid forged brass spout base, with 4-inch (102 mm) centerset mounting with trim plate.

2. Aerator: Flow rate 0.5 gpm (0.032 L/s) at operating range of 20 to 80 psi (138 to 552 kPa). Provide installer-optional 1.6 gpm (0.100 L/s) laminar flow insert with plain spray ring and 2.2 gpm (0.139 L/s) aerator insert.

3. Water Supply: Manual mixing valve, deck mounted.

4. Sensor Module: Water-conserving, vandal-resistant sensor unit with programmable sensor range, with field-configurable timing turn-off delay and stationary object automatic timed cutoff.

5. Power Supply: Single faucet 110VAC/6VDC, 50/60Hz plug-in transformer with anti-theft bracket.

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Project Location: **St. John, U.S. Virgin Islands**

2.4 SUPPLY FITTINGS

A. NSF Standard: Comply with NSF/ANSI 61 for supply-fitting materials that will be in contact with potable water.

1. Standard: ASME A112.18.1/CSA B125.1.

2. Supply Piping: Chrome-plated brass pipe or chrome-plated copper tube matching water-supply piping size. Include chrome-plated brass or stainless-steel wall flange.

3. Supply Stops: Chrome-plated brass, one-quarter-turn, ball-type or compression valve with inlet connection matching supply piping.

4. Operation: Wheel handle.

B. Risers:

1. Size: NPS 3/8 (DN 10).

2. Type: ASME A112.18.6, braided or corrugated stainless-steel flexible hose.

2.5 WASTE FITTINGS

A. Standard: ASME A112.18.2/CSA B125.2.

B. Drain: Grid type with NPS 1-1/2 (DN 40) offset and straight tailpiece.

C. Trap:

1. Size: NPS 1-1/2 (DN 40).

2. Material: Stainless-steel, two-piece trap and swivel elbow with 0.012-inch- (0.30-mm-) thick stainless-steel tube to wall; and stainless-steel wall flange.

PART 3 EXECUTION

3.1 EXAMINATION

A. Examine roughing-in of water supply and sanitary drainage and vent piping systems to verify actual locations of piping connections before sink installation.

B. Examine walls, floors, and counters for suitable conditions where sinks will be installed.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

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- A. Install sinks level and plumb according to roughing-in drawings.
- B. Install supports, affixed to building substrate, for wall-hung sinks.
- C. Install accessible wall-mounted sinks at handicapped/elderly mounting height according to ICC/ANSI A117.1.
- D. Set floor-mounted sinks in leveling bed of cement grout.
- E. Install water-supply piping with stop on each supply to each sink faucet.
 - 1. Exception: Use ball, gate, or globe valves if supply stops are not specified with sink. Comply with valve requirements specified in Division 22 Section "General-Duty Valves for Plumbing Piping."
 - 2. Install stops in locations where they can be easily reached for operation.
- F. Install wall flanges or escutcheons at piping wall penetrations in exposed, finished locations. Use deep-pattern escutcheons if required to conceal protruding fittings. Comply with escutcheon requirements specified in Division 22 Section "Escutcheons for Plumbing Piping."
- G. Seal joints between sinks and counters, floors, and walls using sanitary-type, one-part, mildew-resistant silicone sealant. Match sealant color to fixture color. Comply with sealant requirements specified in Division 07 Section "Joint Sealants."
- H. Install protective shielding pipe covers and enclosures on exposed supplies and waste piping of accessible sinks. Comply with requirements in Division 22 Section "Plumbing Piping Insulation."

3.3 CONNECTIONS

- A. Connect sinks with water supplies, stops, and risers, and with traps, soil, waste, and vent piping. Use size fittings required to match fixtures.
- B. Comply with water piping requirements specified in Division 22 Section "Domestic Water Piping."
- C. Comply with soil and waste piping requirements specified in Division 22 Section "Sanitary Waste and Vent Piping."

3.4 ADJUSTING

- A. Operate and adjust sinks and controls. Replace damaged and malfunctioning sinks, fittings, and controls.
- B. Adjust water pressure at faucets to produce proper flow.

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Government of the Virgin Islands, Department of Public Works

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Project Location: **St. John, U.S. Virgin Islands**

3.5 CLEANING AND PROTECTION

- A. After completing installation of sinks, inspect and repair damaged finishes.
- B. Clean sinks, faucets, and other fittings with manufacturers' recommended cleaning methods and materials.
- C. Provide protective covering for installed sinks and fittings.
- D. Do not allow use of sinks for temporary facilities unless approved in writing by Owner.

END OF SECTION

DIVISION 23- HEATING, VENTILATION AND AIR CONDITIONING

GOVERNMENT OF THE U. S. VIRGIN ISLANDS, DEPARTMENT OF PUBLIC WORKS

PROJECT NAME: Elaine I. Sprauve Public Library and Museum Building

Project Location, St. John, U.S. Virgin Islands

GENERAL

SECTION INCLUDES

Commercial sinks.

RELATED SECTIONS

Division 22 Section "Domestic Water Piping Specialties."

REFERENCES

American National Standards Institute (ANSI):

ANSI Z 124.3 - Plastic Lavatories.

ANSI Z 124.6 - Plastic Sinks.

ANSI/ICPA SS-1-2001 - Performance Standard for Solid Surface Materials.

ICC/ANSI A117.1 - Accessible And Usable Buildings And Facilities.

ASME International (ASME):

ASME A112.18.1 - Plumbing Fixture Fittings.

ASME A112.18.2 - Plumbing Fixture Waste Fittings.

ASME A112.18.3M - Performance Requirements for Backflow Protection
Devices and Systems in Plumbing Fixture Fittings.

ASME A112.19.1M - Enameled Cast Iron Plumbing Fixtures.

ASME A112.19.2M - Vitreous China Plumbing Fixtures.

ASME A112.19.4M - Porcelain Enameled Formed Steel Plumbing Fixtures.

International Association of Plumbing and Mechanical Officials (IAPMO):

Uniform Plumbing Code (cUPC).

NSF International (NSF):

NSF 61 - Drinking Water System Components - Health Effects; Sections 1 through 9.

Underwriters Laboratories, Inc.:

UL 1951 - Electric Plumbing Accessories.

ACTION SUBMITTALS

Product Data: For each product indicated.

Wiring Diagram: For products requiring electrical power.

LEED Submittals:

1. Product Data for Credit WE 2 and Credit WE 3: Documentation indicating compliance with requirements.

INFORMATIONAL SUBMITTALS

Counter cutouts and plumbing connections requirements.

CLOSEOUT SUBMITTALS

Cleaning and maintenance data.

QUALITY ASSURANCE

Comply with NSF 61.

Electrical Components: Listed and labeled per NFPA 70, Article 100.

WARRANTY

Special Manufacturer's Warranty: Provide manufacturer's standard form in which manufacturer agrees to repair or replace products that fail in materials or workmanship for a period of 10 years from date of shipping from manufacturer.

PRODUCTS

COUNTERTOP-SUPPORTED SINKS

Integral Solid Surface Sink: Constructed of solid surface material with integral bowl, contoured front apron, coved backsplash, with deck mounted faucets, and waste receptacle openings. Unit includes waste and supply connections to wall, concealed by high impact polymer trap cover.

Basis of Design Manufacturer/Model: Bradley, TerreonRE Classroom Sink or approved equal.

Bowl Size: 10 by 14 inch (254 by 356 mm), 8 inch (203 mm) deep.

Deck Color: As selected by Owner's Representative from manufacturer's full line.

Bowl Color: Match deck color.

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Faucet: Gooseneck, 10 inch (254 mm) high, with infrared sensor metering control, with 110/24 VAC plug-in transformer.

Basis of Design Manufacturer/Model: Bradley, Aerada 1000 Series Gooseneck, or approved equal.

Soap Dispenser: 32 oz. (946 mL) plastic globe, with 4 inch (102 mm) spout.

SERVICE SINKS

Service Sinks: Enameled, cast-iron trap standard service sink, wall-mounting.

Size: 22 by 18 inches (560 by 460 mm).

Color: White.

Laundry Trays: Plastic, stand-mounted laundry tray.

Size: 25 by 22 inches (635 by 560 mm).

Faucet: Sink, fixture ledge-mounted.

SINK FAUCETS

Sensor-Operated, Gooseneck Metering Faucet with Infrared Control, Vandal-resistant accessible faucet, meeting ASME A112.18.1/CSA B125. ADA/ANSI A117.1 complaints.

Basis of Design Manufacturer/Model: Bradley, Aerada 1000 Series Gooseneck, or approved equal.

Body: Polished chrome plated commercial solid forged brass spout base, with 4 inch (102 mm) centerset mounting with trim plate.

Aerator: Flow rate 0.5 gpm (0.032 L/s) at operating range of 20 to 80 psi (138 to 552 kPa). Provide installer-optional 1.6 gpm (0.100 L/s) laminar flow insert with plain spray ring and 2.2 gpm (0.139 L/s) aerator insert.

Water Supply: Manual mixing valve, deck-mounted.

Sensor Module: Water-conserving, vandal-resistant sensor unit with programmable sensor range, with field-configurable timing turn-off delay and stationary object automatic timed cutoff.

Power Supply: Single faucet 110VAC/6VDC, 50/60Hz plug-in transformer with anti-theft bracket.

SUPPLY FITTINGS

NSF Standard: Comply with NSF/ANSI 61 for supply-fitting materials that will be in contact with potable water.

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Standard: ASME A112.18.1/CSA B125.1.

Supply Piping: Chrome-plated brass pipe or chrome-plated copper tube matching water-supply piping size. Include chrome-plated brass or stainless-steel wall flange.

Supply Stops: Chrome-plated brass, one-quarter-turn, ball-type or compression valve with inlet connection matching supply piping.

Operation: Wheel handle.

Risers:

Size: NPS 3/8 (DN 10).

Type: ASME A112.18.6, braided or corrugated stainless-steel flexible hose.

WASTE FITTINGS

Standard: ASME A112.18.2/CSA B125.2.

Drain: Grid type with NPS 1-1/2 (DN 40) offset and straight tailpiece.

Trap:

Size: NPS 1-1/2 (DN 40).

Material: Stainless-steel, two-piece trap and swivel elbow with 0.012-inch- (0.30-mm-) thick stainless-steel tube to wall; and stainless-steel wall flange.

EXECUTION**EXAMINATION**

Examine roughing-in of water supply and sanitary drainage and vent piping systems to verify actual locations of piping connections before sink installation.

Examine walls, floors, and counters for suitable conditions where sinks will be installed.

Proceed with installation only after unsatisfactory conditions have been corrected.

INSTALLATION

Install sinks level and plumb according to roughing-in drawings.

Install supports, affixed to building substrate, for wall-hung sinks.

Install accessible wall-mounted sinks at handicapped/elderly mounting height according to ICC/ANSI A117.1.

Set floor-mounted sinks in leveling bed of cement grout.

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Install water-supply piping with stop on each supply to each sink faucet.

Exception: Use ball, gate, or globe valves if supply stops are not specified with sink.
Comply with valve requirements specified in Division 22 Section "General-Duty Valves for Plumbing Piping."

Install stops in locations where they can be easily reached for operation.

Install wall flanges or escutcheons at piping wall penetrations in exposed, finished locations.
Use deep-pattern escutcheons if required to conceal protruding fittings. Comply with escutcheon requirements specified in Division 22 Section "Escutcheons for Plumbing Piping."

Seal joints between sinks and counters, floors, and walls using sanitary-type, one-part, mildew-resistant silicone sealant. Match sealant color to fixture color. Comply with sealant requirements specified in Division 07 Section "Joint Sealants."

Install protective shielding pipe covers and enclosures on exposed supplies and waste piping of accessible sinks. Comply with requirements in Division 22 Section "Plumbing Piping Insulation."

CONNECTIONS

Connect sinks with water supplies, stops, and risers, and with traps, soil, waste, and vent piping.
Use size fittings required to match fixtures.

Comply with water piping requirements specified in Division 22 Section "Domestic Water Piping."

Comply with soil and waste piping requirements specified in Division 22 Section "Sanitary Waste and Vent Piping."

ADJUSTING

Operate and adjust sinks and controls. Replace damaged and malfunctioning sinks, fittings, and controls.

Adjust water pressure at faucets to produce proper flow.

CLEANING AND PROTECTION

After completing installation of sinks, inspect and repair damaged finishes.

Clean sinks, faucets, and other fittings with manufacturers' recommended cleaning methods and materials.

Provide protective covering for installed sinks and fittings.

Do not allow use of sinks for temporary facilities unless approved in writing by Owner.

END OF SECTION

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SECTION 230513 – COMMON MOTOR REQUIREMENTS FOR HVAC EQUIPMENT

GOVERNMENT OF THE U. S. VIRGIN ISLANDS, DEPARTMENT OF PUBLIC WORKS

PROJECT NAME: Elaine I. Sprauve Public Library and Museum Building

Project Location, St. John, U.S. Virgin Islands

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes general requirements for single-phase and polyphase, general-purpose, horizontal, small and medium, squirrel cage induction motors for use on ac power systems up to 600 V and installed at equipment manufacturer's factory or shipped separately by equipment manufacturer for field installation.

1.2 COORDINATION

- A. Coordinate features of motors, installed units, and accessory devices to be compatible with the following:
1. Motor controllers
 2. Torque, speed, and horsepower requirements of the load
 3. Ratings and characteristics of supply circuit and required control sequence
 4. Ambient and environmental conditions of installation location

PART 2 • PRODUCTS

2.1 GENERAL MOTOR REQUIREMENTS

- A. Comply with NEMA MG 1 unless otherwise indicated.

2.2 MOTOR CHARACTERISTICS

- A. Duty:
Continuous duty at ambient temperature of 40°C and at altitude of 3300 feet (1000 m) above sea level.
- B. Capacity and Torque Characteristics:
Sufficient to start, accelerate, and operate connected loads at designated speeds, at installed altitude and environment, with indicated operating sequence, and without exceeding nameplate ratings or considering service factor.

2.3 POLYPHASE MOTORS

- A. Description:
NEMA MG 1, Design B, medium induction motor
- B. Efficiency:
Energy efficient, as defined in NEMA MG 1
- C. Service Factor:
1.15
- D. Multispeed Motors:
Variable torque.

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1. For motors with 2: 1 speed ratio, consequent pole, single winding.
 2. For motors with other than 2:1 speed ratio, separate winding for each speed.
- E. Rotor:
Random wound, squirrel cage.
- F. Bearings:
Grease-able, shielded, antifriction ball bearings suitable for radial and thrust loading
- G. Temperature Rise:
Match insulation rating
- H. Insulation:
Class F
- I. Code Letter Designation:
1. Motors 15 HP and Larger:
NEMA starting Code F or Code G
 2. Motors Smaller than 15 HP:
Manufacturer's standard starting characteristic.
- J. Enclosure Material:
Cast iron for motor frame sizes 324T and larger; rolled steel for motor frame sizes smaller than 324T

2.4 POLYPHASE MOTORS WITH ADDITIONAL REQUIREMENTS

- A. Motors Used with Reduced-Voltage and Multispeed Controllers:
Match wiring connection requirements for controller with required motor leads. Provide terminals in motor terminal box, suited to control method.
- B. Motors Used with Variable Frequency Controllers:
Ratings, characteristics, and features coordinated with and approved by controller manufacturer.
1. Windings:
Copper magnet wire with moisture-resistant insulation varnish, designed and tested to resist transient spikes, high frequencies, and short time rise pulses produced by pulse width modulated inverters.
 2. Energy- and Premium-Efficient Motors:
Class B temperature rise; Class F insulation
 3. Inverter-Duty Motors:
Class F temperature rise; Class H insulation
 4. Thermal Protection:
Comply with NEMA MG 1 requirements for thermally protected motors.

2.5 SINGLE-PHASE MOTORS

- A. Motors larger than 1/20 hp shall be one of the following, to suit starting torque and requirements

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of specific motor application:

1. Permanent-split capacitor
 2. Split phase
 3. Capacitor start, inductor run
 4. Capacitor start, capacitor run
- B. Multispeed Motors:
Variable-torque, permanent-split-capacitor type
- C. Bearings:
Pre-lubricated, antifriction ball bearings or sleeve bearings suitable for radial and thrust loading.
- D. Motors 1/20 HP and Smaller:
Shaded-pole type.
- E. Thermal Protection:
Internal protection to automatically open power supply circuit to motor when winding temperature exceeds a safe value calibrated to temperature rating of motor insulation. Thermal protection device shall automatically reset when motor temperature returns to normal range.

PART 3 - EXECUTION (Not Applicable)

END OF SECTION

SECTION 230517 – SLEEVES AND SLEEVE SEALS FOR HVAC PIPING

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PROJECT NAME: Elaine I. Sprauve Public Library and Museum Building

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PART 1 - GENERAL

1.1 SUMMARY

A. Section includes:

1. Sleeves,
2. Sleeve-seal systems,
3. Grout.

1.2 ACTION SUBMITTALS

A. Provide Data:

For each type of product indicated.

PART 2 - PRODUCTS

2.1 SLEEVES

A. Galvanized-Steel Pipe Sleeves:

ASTM A 53/A 53M, Type E, Grade B, Schedule 40, zinc coated, with plain ends

B. PVC-Pipe Sleeves:

ASTM D 1785, Schedule 40

2.2 SLEEVE-SEAL SYSTEMS

A. Manufacturers:

Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

1. Advance Products & Systems, Inc.
2. CALPICO, Inc.
3. Metraflex Company (The)
4. Pipeline Seal and Insulator, Inc.
5. Proco Products, Inc.

B. Description:

Modular sealing-element unit, designed for field assembly, for filling annular space between piping and sleeve.

1. Sealing Elements:

EPDM-Rubber interlocking links shaped to fit surface of pipe. Include type and number required for pipe material and size of pipe.

2. Connecting Bolts and Nuts:

Carbon steel, with corrosion-resistant coating. Stainless steel of length required to secure pressure plates to sealing elements.

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2.3 GROUT

- A. Standard:
ASTM C 1107/C 1107M, Grade B, post-hardening and volume-adjusting, dry, hydraulic cement grout
- B. Characteristics:
Non-shrink; recommended for interior and exterior applications
- C. Design Mix:
5000-psi (34.5-MPa), 28-day compressive strength
- D. Packaging:
Premixed and factory packaged.

PART 3 - EXECUTION

3.1 SLEEVE INSTALLATION

- A. Install sleeves for piping passing through penetrations in floors, partitions, roofs, and walls.
- B. For sleeves that will have sleeve-seal system installed, select sleeves of size large enough to provide 1-inch (25-mm) annular clear space between piping and concrete slabs and walls
 - 1. Sleeves are not required for core-drilled holes.
- C. Install sleeves in concrete floors, concrete roof slabs, and concrete walls as new slabs and walls are constructed.
 - 1. Cut sleeves to length for mounting flush with both surfaces.
 - a. Exception:
Extend sleeves installed in floors of mechanical equipment areas or other wet areas 2 inches (50 mm) above finished floor level.
 - 2. Using grout, seal the space outside of sleeves in slabs and walls without sleeve-seal system.
- D. Install sleeves for pipes passing through interior partitions.
 - 1. Cut sleeves to length for mounting flush with both surfaces.
 - 2. Install sleeves that are large enough to provide 1/4-inch (6.4 mm) annular clear space between sleeve and pipe or pipe insulation.
 - 3. Seal annular space between sleeve and piping or piping insulation; use joint sealants appropriate for size, depth, and location of joint. Comply with requirements for sealants specified in Section 07900 "Joint Sealers."
- E. Fire-Barrier Penetrations:
Maintain indicated fire rating of walls, partitions, ceilings, and floors at pipe penetrations. Seal pipe penetrations with firestop materials. Comply with requirements for fire stopping specified in Section 07210 "Building Insulation."

3.2 SLEEVE-SEAL SYSTEM INSTALLATION

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- A. Install sleeve-seal system in sleeves in exterior concrete walls and slabs-on-grade at service piping entries into building.
- B. Select type, size, and number of sealing elements required for piping material and size and for sleeve ID or hole size. Position piping in center of sleeve. Center piping in penetration, assemble sleeve seal system components, and install in annular space between piping and sleeve. Tighten bolts against pressure plates that cause sealing elements to expand and make a watertight seal.

3.3 SLEEVE AND SLEEVE-SEAL SCHEDULE

A. Use sleeves and sleeve seals for the following piping-penetration applications:

- 1. Exterior Concrete Walls above Grade:
 - a. Piping smaller than NPS 6 (DN 150):
Galvanized steel pipe sleeves.
 - b. Piping NPS 6 (DN 150) and larger:
Galvanized steel pipe sleeves.
- 2. Exterior Concrete Walls below Grade:
 - a. Piping smaller than NPS 6 (DN 150):
Galvanized steel pipe sleeves with sleeve seal system.
 - 1) Select sleeve size to follow for 1 inch (25 mm) annular clear space between piping and sleeve for installing sleeve seal system.
 - b. Piping NPS 6 (DN 150) and larger:
Galvanized-steel-pipe sleeves with sleeve-seal system.
 - 1) Select sleeve size to allow for 1 inch (25 mm) annular clear space between piping and sleeve for installing sleeve seal system.
- 3. Concrete Slabs-on-Grade:
 - a. Piping smaller than NPS 6 (DN 150): Galvanized steel pipe sleeves with sleeve seal system.
 - 1) Select sleeve size to allow for 1 inch (25 mm) annular clear space between piping and sleeve for installing sleeve seal system.
 - b. Piping NPS 6 (DN 150) and larger:
Galvanized-steel-pipe sleeves with sleeve seal system
 - 1) Select sleeve size to allow for 1 inch (25 mm) annular clear space between piping and sleeve for installing sleeve-seal system.
- 4. Concrete Slabs above Grade:
 - a. Piping smaller than NPS 6 (DN 150):
Galvanized-steel-pipe sleeves PVC-pipe sleeves.
 - b. Piping NPS 6 (DN 150) and larger:
Galvanized-steel-pipe sleeves PVC-pipe sleeves.

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5. Interior Partitions:

- a. Piping smaller than NPS 6 (DN 150):
Galvanized steel pipe sleeves
- b. Piping NPS 6 (DN 150) and larger:
Galvanized steel sheet sleeves

END OF SECTION

SECTION 230529 – HANGERS AND SUPPORTS FOR HVAC PIPING AND EQUIPMENT
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PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Metal pipe hangers and supports
2. Trapeze pipe hangers
3. Thermal-hanger shield inserts
4. Fastener systems
5. Equipment supports

1.2 PERFORMANCE REQUIREMENTS

A. Structural Performance:

Hangers and supports for HVAC piping and equipment shall withstand the effects of gravity loads and stresses within limits and under conditions indicated according to ASCE/SEI 7

1. Design supports for multiple pipes capable of supporting combined weight of supported systems, system contents, and test water.
2. Design equipment supports capable of supporting combined operating weight of supported equipment and connected systems and components.

B. Seismic Performance:

Comply with SECTION 220548 – VIBRATION AND SEISMIC CONTROLS FOR PLUMBING, PIPING, AND EQUIPMENT

1.3 ACTION SUBMITTALS

A. Product Data:

For each type of product indicated

PART 2 - PRODUCTS

2.1 METAL PIPE HANGERS AND SUPPORTS

A. Stainless Steel Pipe Hangers and Supports:

Comply with SECTION 05500 – MISCELLANEOUS METALWORK

1. Description:
MSS SP-58, Types 1 through 58, factory-fabricated components
2. Galvanized Metallic Coatings:
Pre-galvanized or hot dipped
3. Padded Hangers:
Hanger with fiberglass or other pipe insulation pad or cushion to support bearing surface of piping

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4. Hanger Rods:
Continuous thread rod, nuts, and washer made of stainless steel

B. Copper Pipe Hangers:

1. Description:
MSS SP-58, Types 1 through 58, copper coated steel, factory-fabricated components
2. Hanger Rods:
Continuous thread rod, nuts, and washer made of copper-coated steel.

2.2 TRAPEZE PIPE HANGERS

- A. Description:
MSS SP-69, Type 59, shop or field fabricated pipe support hanger rods, nuts, saddles, and U-bolts.

2.3 THERMAL-HANGER SHIELD INSERTS

- A. For Trapeze or Clamped Systems:
Shield shall cover entire circumference of pipe.
- B. For Clevis or Band Hangers:
Shield shall cover lower 180 degrees of pipe.

2.4 FASTENER SYSTEMS

- A. Powder-Actuated Fasteners: Threaded steel stud, for use in hardened Portland cement concrete with pull out, tension, and shear capacities appropriate for supported loads and building materials where used.
- B. Mechanical Expansion Anchors:
Insert wedge type, stainless steel anchors, for use in hardened Portland cement concrete; with pull-out, tension, and shear capacities appropriate for supported loads and building materials where used.

2.5 EQUIPMENT SUPPORTS

- A. Description:
Welded, shop or field fabricated equipment support made from structural carbon steel shapes.
Comply with SECTION 220548 – VIBRATION AND SEISMIC CONTROLS FOR PLUMBING, PIPING, AND EQUIPMENT

2.6 MISCELLANEOUS MATERIALS

- A. Structural Steel:
ASTM A 36/A 36M, carbon steel plates, shapes, and bars; black and galvanized.
- B. Grout:
ASTM C 1107, factory mixed and packaged, dry, hydraulic cement, non-shrink and nonmetallic grout; suitable for interior and exterior applications.
1. Properties: Non-staining, noncorrosive, and nongaseous

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2. Design Mix:
5000 psi (34.5 MPa), 28-day compressive strength

PART 3 - EXECUTION

3.1 HANGER AND SUPPORT INSTALLATION

A. Metal Pipe Hanger Installation:

Comply with MSS SP-69 and MSS SP-89. Install hangers, supports, clamps, and attachments as required to properly support piping from the building structure. Comply with SECTION 220548 – VIBRATION AND SEISMIC CONTROLS FOR PLUMBING, PIPING, AND EQUIPMENT

B. Metal Trapeze Pipe Hanger Installation:

Comply with MSS SP-69 and MSS SP-89. Arrange for grouping of parallel runs of horizontal piping, and support together on field fabricated trapeze pipe hangers. Comply with SECTION 220548 – VIBRATION AND SEISMIC CONTROLS FOR PLUMBING, PIPING, AND EQUIPMENT

1. Pipes of Various Sizes:

Support together and space trapezes for smallest pipe size or install intermediate supports for smaller diameter pipes as specified for individual pipe hangers.

2. Field fabricate from ASTM A 36/A 36M, carbon steel shapes selected for loads being supported. Weld steel according to AWS D1.1/D1.1 M.

C. Fastener System Installation:

1. Install powder actuated fasteners for use in lightweight concrete or concrete slabs less than 4 inches (100 mm) thick in concrete after concrete is placed and completely cured. Use operators that are licensed by powder actuated tool manufacturer. Install fasteners according to powder actuated tool manufacturer's operating manual.
2. Install mechanical expansion anchors in concrete after concrete is placed and completely cured. Install fasteners according to manufacturer's written instructions.

- D. Install hangers and supports complete with necessary attachments, inserts, bolts, rods, nuts, washers, and other accessories.

E. Equipment Support Installation:

Fabricate from welded structural steel shapes.

- F. Install hangers and supports to allow controlled thermal movement of piping systems, to permit freedom of movement between pipe anchors, and to facilitate action of expansion joints, expansion loops, expansion bends, and similar units.

- G. Install building attachments within concrete slabs or attach to structural steel. Install additional attachments at concentrated loads, including valves, flanges, and strainers, NPS 2-1/2 (DN 65) and larger and at changes in direction of piping. Install concrete inserts before concrete is placed; fasten inserts to forms and install reinforcing bars through openings at top of inserts.

H. Load Distribution:

Install hangers and supports so that piping live and dead loads and stresses from movement will not be transmitted to connected equipment.

I. Pipe Slopes:

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Install hangers and supports to provide indicated pipe slopes and to not exceed maximum pipe deflections allowed by ASME B31.9 for building services piping.

1. Comply with SECTION 220529 – HANGERS AND SUPPORTS FOR PLUMBING PIPING AND EQUIPMENT
2. Comply with SECTION 221316 – SANITARY WATER AND VENT PIPING

J. Insulated Piping:

1. Attach clamps and spacers to piping.
 - a. Piping Operating above Ambient Air Temperature:
Clamp may project through insulation.
 - b. Piping Operating below Ambient Air Temperature:
Use thermal hanger shield insert with clamp sized to match OD of insert.
 - c. Do not exceed pipe stress limits allowed by ASME B31.9 for building services piping and SECTION 220529 – HANGERS AND SUPPORTS FOR PLUMBING PIPING AND EQUIPMENT
 2. Install MSS SP-58, Type 39, protection saddles if insulation without vapor barrier is indicated. Fill interior voids with insulation that matches adjoining insulation.
 - a. Option:
Thermal hanger shield inserts may be used. Include steel weight distribution plate for pipe NPS 4 (DN 100) and larger if pipe is installed on rollers.
 3. Install MSS SP-58, Type 40, protective shields on cold piping with vapor barrier. Shields shall span an arc of 180 degrees.
 - a. Option:
Thermal-hanger shield inserts may be used. Include steel weight distribution plate for pipe NPS 4 (DN 100) and larger if pipe is installed on rollers.
3. Shield Dimensions for Pipe:
Not less than the following:
- a. NPS 114 to NPS 3-1/2 (DN 8 to DN 90):
12 inches (305 mm) long and 0.048 inch (1.22 mm) thick.
 - b. NPS 4 (DN 100):
12 inches (305 mm) long and 0.06 inch (1.52 mm) thick.
 - c. NPS 5 and NPS 6 (DN 125 and DN 150):
18 inches (457 mm) long and 0.06 inch (1.52 mm) thick.
 - d. NPS 8 to NPS 14 (DN 200 to DN 350):
24 inches (610 mm) long and 0.075 inch (1.91 mm) thick.
 - e. NPS 16 to NPS 24 (DN 400 to DN 600):
24 inches (610 mm) long and 0.105 inch (2.67 mm) thick.

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5. Pipes NPS 8 (DN 200) and Larger:

Include wood or reinforced calcium silicate insulation inserts of length at least as long as protective shield.

6. Thermal Hanger Shields:

Install with insulation same thickness as piping insulation.

3.2 EQUIPMENT SUPPORTS

- A. Fabricate structural steel stands to suspend equipment from structure overhead or to support equipment above floor.
- B. Grouting:
Place grout under supports for equipment and make bearing surface smooth.
- C. Provide lateral bracing, to prevent swaying, for equipment supports. Comply with SECTION 220548 – VIBRATION AND SEISMIC CONTROLS FOR PLUMBING, PIPING, AND EQUIPMENT

3.3 METAL FABRICATIONS

- A. Cut, drill, and fit miscellaneous metal fabrications for trapeze pipe hangers and equipment supports.
- B. Fit exposed connections together to form hairline joints. Field weld connections that cannot be shop welded because of shipping size limitations.
- C. Field Welding:
Comply with AWS D1.1/D1.1M procedures for shielded, metal arc welding; appearance and quality of welds; and methods used in correcting welding work; and with the following:
 - 1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
 - 2. Obtain fusion without undercut or overlap.
 - 3. Remove welding flux immediately.
 - 4. Finish welds at exposed connections so no roughness shows after finishing and so contours of welded surfaces match adjacent contours.

3.4 ADJUSTING

- A. Hanger Adjustments:
Adjust hangers to distribute loads equally on attachments and to achieve indicated slope of pipe.
- B. Trim excess length of continuous thread hanger and support rods to 1 1/2 inches (40 mm).

3.5 PAINTING

- A. Touchup:
Clean field welds and abraded areas of shop paint. Paint exposed areas immediately after erecting hangers and supports. Use same materials as used for shop painting for touching up field-painted surfaces.

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1. Apply paint by brush or spray to provide a minimum dry film thickness of 2.0 mils (0.05 mm).
- B. Touchup:
Cleaning and touchup painting of field welds, bolted connections, and abraded areas of shop paint on miscellaneous metal are specified in Division 9.
- C. Galvanized Surfaces:
Clean welds, bolted connections, and abraded areas and apply galvanizing-repair paint to comply with ASTM A 780 and Division 9.

3.6 HANGER AND SUPPORT SCHEDULE

- A. Specific hanger and support requirements are in SECTION 220529 – HANGERS AND SUPPORTS FOR PLUMBING PIPING AND EQUIPMENT.
- B. Comply with MSS SP-69 for pipe hanger selections and applications that are not specified in SECTION 220529 – HANGERS AND SUPPORTS FOR PLUMBING PIPING AND EQUIPMENT.
- C. Use hangers and supports with galvanized metallic coatings for piping and equipment that will not have field applied finish.
- D. Use nonmetallic coatings on attachments for electrolytic protection where attachments are in direct contact with copper tubing.
- E. Use carbon steel pipe hangers and supports and metal trapeze pipe hangers and attachments for general service applications.
- F. Use copper-plated pipe hangers and copper or stainless steel attachments for copper piping and tubing.
- G. Use thermal-hanger shield inserts for insulated piping and tubing.
- H. Horizontal Piping Hangers and Supports:
Unless otherwise indicated and except as specified in piping system Sections 220529 – HANGERS AND SUPPORTS FOR PLUMBING PIPING AND EQUIPMENT and 221316 – SANITARY WATER AND VENT PIPING, install the following types:
 1. Adjustable, Steel Clevis Hangers (MSS Type 1):
For suspension of uninsulated or insulated, stationary pipes NPS 1/2 to NPS 30 (DN 15 to DN 750).
 2. Yoke-Type Pipe Clamps (MSS Type 2):
For suspension of up to 1050°F (566°C), pipes NPS 4 to NPS 24 (DN 100 to DN 600), requiring up to 4 inches (100 mm) of insulation.
 3. Carbon or Alloy-Steel, Double-Bolt Pipe Clamps (MSS Type 3):
For suspension of pipes NPS 3/4 to NPS 36 (DN 20 to DN 900), requiring clamp flexibility and up to 4 inches (100 mm) of insulation.
 4. Adjustable, Steel Band Hangers (MSS Type 7):
For suspension of uninsulated, stationary pipes NPS 1/2 to NPS 8 (DN 15 to DN 200).

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5. U-Bolts (MSS Type 24):
For support of heavy pipes NPS 1/2 to NPS 30 (DN 15 to DN 750).
6. Pipe Saddle Supports (MSS Type 36): For support of pipes NPS 4 to NPS 36 (DN 100 to DN 900), with steel-pipe base stanchion support and cast-iron floor flange or carbon-steel plate.
7. Pipe Stanchion Saddles (MSS Type 37): For support of pipes NPS 4 to NPS 36 (DN 100 to DN 900), with steel-pipe base stanchion support and cast-iron floor flange or carbon-steel plate, and with U-bolt to retain pipe.
8. Single-Pipe Rolls (MSS Type 41): For suspension of pipes NPS 1 to NPS 30 (DN 25 to DN 750), from two rods if longitudinal movement caused by expansion and contraction might occur.
9. Complete Pipe Rolls (MSS Type 44): For support of pipes NPS 2 to NPS 42 (DN 50 to DN 1050) if longitudinal movement caused by expansion and contraction might occur but vertical adjustment is not necessary.
- I. Vertical Piping Clamps:
Unless otherwise indicated and except as specified in piping system Sections, install the following types:
 1. Extension Pipe or Riser Clamps (MSS Type 8):
For support of pipe risers NPS 3/4 to NPS 24 (DN 24 to DN 600).
 2. Carbon- or Alloy-Steel Riser Clamps (MSS Type 42):
For support of pipe risers NPS 3/4 to NPS 24 (DN 20 to DN 600) if longer ends are required for riser clamps.
- J. Hanger Rod Attachments: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
 1. Steel Turnbuckles (MSS Type 13):
For adjustment up to 6 inches (150 mm) for heavy loads.
 3. Steel Clevises (MSS Type 14):
For 120° to 450°F (49° to 232°C) piping installations.
- K. Building Attachments:
Unless otherwise indicated and except as specified in piping system Sections, install the following types:
 1. Steel or Malleable Concrete Inserts (MSS Type 18):
For upper attachment to suspend pipe hangers from concrete ceiling
 2. Top-Beam C-Clamps (MSS Type 19):
For use under roof installations with bar-joist construction, to attach to top flange of structural shape
 3. Side Beam or Channel Clamps (MSS Type 20):
For attaching to bottom flange of beams, channels, or angles
 4. Center-Beam Clamps (MSS Type 21):

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For attaching to center of bottom flange of beams

5. Welded Beam Attachments (MSS Type 22):
For attaching to bottom of beams if loads are considerable and rod sizes are large
6. C-Clamps (MSS Type 23):
For structural shapes
7. Welded-Steel Brackets:
For support of pipes from below, or for suspending from above by using clip and rod. Use one of the following for indicated loads:
 - a. Light (MSS Type 31):
750 lb (340 kg)
 - b. Medium (MSS Type 32):
1500 lb (680 kg)
 - c. Heavy (MSS Type 33):
3000 lb (1360 kg).
8. Side-Beam Brackets (MSS Type 34):
For sides of steel or wooden beams
9. Plate Lugs (MSS Type 57):
For attaching to steel beams if flexibility at beam is required
- L. Saddles and Shields:
Unless otherwise indicated and except as specified in piping system Sections, install the following types:
 1. Steel-Pipe-Covering Protection Saddles (MSS Type 39):
To fill interior voids with insulation that matches adjoining insulation.
 2. Protection Shields (MSS Type 40):
Of length recommended in writing by manufacturer to prevent crushing insulation
 3. Thermal-Hanger Shield Inserts:
For supporting insulated pipe
- M. Spring Hangers and Supports:
Unless otherwise indicated and except as specified in piping system Sections, install the following types:
 1. Spring Cushions (MSS Type 48):
For light loads if vertical movement does not exceed 1-1/4 inches (32 mm)
 2. Spring-Cushion Roll Hangers (MSS Type 49):
For equipping Type 41, roll hanger with springs
 3. Variable-Spring Base Supports (MSS Type 52):
Preset to indicated load and limit variability factor to 25 percent to allow expansion and contraction of piping system from base support.

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- N. Comply with MSS SP-69 for trapeze pipe-hanger selections and applications that are not specified in piping system Sections.
- O. Use mechanical expansion anchors instead of building attachments where required in concrete construction.

END OF SECTION

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PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes the following:

1. Isolation pads
2. Isolation mounts
3. Restrained elastomeric isolation mounts
4. Spring isolators
5. Housed spring mounts
6. Elastomeric hangers
7. Spring hangers
8. Spring hangers with vertical-limit stops
9. Pipe riser resilient supports
10. Resilient pipe guides
11. Air-mounting system
12. Restrained vibration isolation roof-curb rails
13. Seismic snubbers
14. Restraining braces and cables
15. Vibration isolation equipment bases

1.2 DEFINITIONS

- A. IBC:
International Building Code
- B. ICC-ES:
ICC-Evaluation Service
- C. OSHPD:
Office of Statewide Health Planning and Development for the State of California

1.3 PERFORMANCE REQUIREMENTS

A. Wind-Restraint Loading:

1. Basic Wind Speed:
175 mph

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2. Building Classification Category:
IV

3. Minimum 10 lb/sq. ft. (48.8 kg/sq. m) multiplied by the maximum area of the HVAC component projected on a vertical plane that is normal to the wind direction, and 45 degrees either side of normal.

1.4 ACTION SUBMITTALS

- A. Product Data:
For the following:

1. Include rated load, rated deflection, and overload capacity for each vibration isolation device.
2. Illustrate and indicate style, material, strength, fastening provision, and finish for each type and size of seismic-restraint component used.
3. Interlocking Snubbers:
Include ratings for horizontal, vertical, and combined loads.

- B. Delegated-Design Submittal:

For vibration isolation and seismic restraint details indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

1.5 INFORMATIONAL SUBMITTALS

- A. Coordination Drawings:
Show coordination of seismic bracing for HVAC piping and equipment with other systems and equipment in the vicinity, including other supports and seismic restraints.

1.6 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data:
For air mounting systems to include in operation and maintenance manuals.

1.7 QUALITY ASSURANCE

- A. Comply with seismic-restraint requirements in SECTION 220548 – VIBRATION AND SEISMIC CONTROLS FOR PLUMBING, PIPING, AND EQUIPMENT unless requirements in this Section are more stringent.

PART 2 - PRODUCTS

2.1 VIBRATION ISOLATORS

- A. Available Manufacturers:
Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
1. Ace Mounting Co., Inc.
 2. Amber/Booth Company. Inc.

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3. California Dynamic Corporation
4. Isolation Technology, Inc.
5. Kinetics Noise Control
6. Mason Industries
7. Vibration Eliminator Co., Inc.
8. Vibration Isolation
9. Vibration Mounting & Controls, Inc.

2.2 AIR MOUNTING SYSTEMS

- A. Available Manufacturers:
Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
1. California Dynamic Corporation
 2. Firestone Industrial Products Company
 3. Kinetics Noise Control
 4. Mason Industries
 5. Vibration Eliminator Co., Inc.

2.3 RESTRAINED VIBRATION ISOLATION ROOF CURB RAILS

- A. Available Manufacturers:
Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
1. Amber/Booth Company, Inc.
 2. California Dynamic Corporation
 3. Isolation Technology, Inc.
 4. Kinetic Noise Control
 5. Mason Industries
 6. Thybar Corporation
 7. Vibration Eliminator Co. Inc.
 8. Vibration Isolation.
 9. Vibration Mountings & Control's, Inc.

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2.4 VIBRATION ISOLATION EQUIPMENT BASES

A. Available Manufacturers:

Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

1. Amber/Booth Company, Inc.
2. California Dynamics Corporation
3. Isolation Technology, Inc.
4. Kinetics Noise Control
5. Mason Industries
6. Vibration Eliminator Co. Inc.
7. Vibration Isolation.
8. Vibration Mounting & Controls. Inc.

2.5 SEISMIC RESTRAINT DEVICES

A. Available Manufacturers:

Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

1. Amber/Booth Company. Inc.
2. California Dynamic Corporation
3. Cooper B-Line. Inc.; a division of Cooper Industries
4. Hilti, Inc.
5. Kinetic Noise Control
6. Loos & Co.; Cableware Division
7. Mason Industries
8. TOLCO Incorporated; a brand of NIBCO INC.
9. Unistrut; Tyco International, Ltd.

2.6 FACTORY FINISHES

A. Finish:

Manufacturer's standard prime-coat finish ready for field painting.

B. Finish:

Manufacturer's standard paint applied to factory assembled and tested equipment before shipping.

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1. Powder coating on springs and housings
2. All hardware shall be galvanized. Hot-dip galvanize metal components for exterior use.
3. Baked enamel or powder coat for metal components on isolators for interior use.
4. Color code or otherwise mark vibration isolation and seismic and wind control devices to indicate capacity range.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine areas and equipment to receive vibration isolation and seismic and wind control devices for compliance with requirements for installation tolerances and other conditions affecting performance.
- B. Examine roughing-in of reinforcement and cast-in-place anchors to verify actual locations before installation.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 APPLICATIONS

- A. Hanger Rod Stiffeners:
Install hanger rod stiffeners where indicated or scheduled on Drawings to receive them and where required to prevent buckling of hanger rods due to seismic forces.
- B. Strength of Support and Seismic Restraint Assemblies:
Where not indicated, select sizes of components so strength will be adequate to carry present and future static and seismic loads within specified loading limits.

3.3 VIBRATION-CONTROL AND SEISMIC-RESTRAINT DEVICE INSTALLATION

- A. Equipment Restraints:
 1. Install seismic snubbers on HVAC equipment mounted on vibration isolators. Locate snubbers as close as possible to vibration isolators and bolt to equipment base and supporting structure.
- B. Piping Restraints:
 1. Comply with requirements in MSS SP-127.
- C. Install cables so they do not bend across edges of adjacent equipment or building structure
- D. Install bushing assemblies for anchor bolts for floor mounted equipment, arranged to provide resilient media between anchor bolt and mounting hole in concrete base.
- E. Install bushing assemblies for mounting bolts for wall mounted equipment, arranged to provide resilient media where equipment or equipment-mounting channels are attached to wall.
- F. Attachment to Structure:
If specific attachment is not indicated, anchor bracing to structure at flanges of beams, at upper

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truss chords of bar joists, or at concrete members.

G. Drilled-in Anchors:

1. Identify position of reinforcing steel and other embedded items prior to drilling holes for anchors. Do not damage existing reinforcing or embedded items during coring or drilling. Notify the structural engineer if reinforcing steel or other embedded items are encountered during drilling. Locate and avoid pre-stressed tendons, electrical and telecommunications conduit, and gas lines.
2. Do not drill holes in concrete or masonry until concrete, mortar, or grout has achieved full design strength.
3. Wedge Anchors:
Protect threads from damage during anchor installation. Heavy duty sleeve anchors shall be installed with sleeve fully engaged in the structural element to which anchor is to be fastened.
4. Adhesive Anchors:
Clean holes to remove loose material and drilling dust prior to installation of adhesive. Place adhesive in holes proceeding from the bottom of the hole and progressing toward the surface in such a manner as to avoid introduction of air pockets in the adhesive.
5. Set anchors to manufacturer's recommended torque, using a torque wrench.
6. Install zinc-coated steel anchors for interior and stainless steel anchors for exterior applications.

3.4 ACCOMMODATION OF DIFFERENTIAL SEISMIC MOTION

- A. Install flexible connections in piping where they cross seismic joints, where adjacent sections or branches are supported by different structural elements, and where the connections terminate with connection to equipment that is anchored to a different structural element from the one supporting the connections as they approach equipment.
- B. Perform tests and inspections.
- C. Remove and replace malfunctioning units and retest as specified above.
- D. Prepare test and inspection reports.

3.5 ADJUSTING

- A. Adjust isolators after piping system is at operating weight.
- B. Adjust limit stops on restrained spring isolators to mount equipment at normal operating height. After equipment installation is complete, adjust limit stops so they are out of contact during normal operation.
- C. Adjust air-spring leveling mechanism.
- D. Adjust active height of spring isolators.
- E. Adjust restraints to permit free movement of equipment within normal mode of operation.

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END OF SECTION

**SECTION 230549 – VIBRATION AND SEISMIC CONTROLS FOR FIRE SUPPRESSION
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PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 21 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. This Section includes the following:

1. Isolation pads
2. Isolation mounts
3. Restrained elastomeric isolation mounts
4. Freestanding and restrained spring isolators
5. Housed spring mounts
6. Elastomeric hangers
7. Spring hangers
8. Spring hangers with vertical-limit stops
9. Pipe riser resilient supports
10. Resilient pipe guides
11. Restrained vibration isolation roof curb rails
12. Seismic snubbers
13. Restraining braces and cables
14. Steel and inertia, vibration isolation equipment bases

1.3 DEFINITIONS

- A. IBC:
International Building Code
- B. ICC-ES:
ICC-Evaluation Service

1.4 PERFORMANCE REQUIREMENTS

- A. Wind-Restraint Loading:

1. Basic Wind Speed:
175 miles/hours

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2. Building Classification Category:
IV

3. Minimum 10 lb/sq. ft. (48.8 kg/sq. m) multiplied by the maximum area of the HVAC component projected on a vertical plane that is normal to the wind direction, and 45 degrees either side of normal.

B. Seismic Restraint Loading:

1. Site Class as Defined in the IBC:
D

2. Assigned Seismic Use Group or Building Category as Defined in the IBC:
IV

a. Component Importance Factor:
1.5

b. Component Response Modification Factor:
2.5

c. Component Amplification Factor:
2.5

3. Design Spectral Response Acceleration at Short Periods (0.2 Second):
1.1%

4. Design Spectral Response Acceleration at 1-Second Period:
1.8%

1.5 ACTION SUBMITTALS

A. Product Data:

For the following:

1. Include rated load, rated deflection, and overload capacity for each vibration isolation device.

2. Illustrate and indicate style, material, strength, fastening provision, and finish for each type and size of seismic restraint component used.

a. Tabulate types and sizes of seismic restraints, complete with report numbers and rated strength in tension and shear as evaluated by an evaluation service member of ICC-ES OSHPD.

b. Annotate to indicate application of each product submitted and compliance with requirements.

3. Interlocking Snubbers:

Include ratings for horizontal, vertical, and combined loads.

B. Delegated Design Submittal:

For vibration isolation and seismic restraint details indicated to comply with performance

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requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

1. Design Calculations:

Calculate static and dynamic loading due to equipment weight and operation, seismic and wind forces required to select vibration isolators, seismic and wind restraints, and for designing vibration isolation bases.

- a. Coordinate design calculations with wind load calculations required for equipment mounted outdoors. Comply with requirements in other Sections for equipment mounted outdoors.

2. Riser Supports:

Include riser diagrams and calculations showing anticipated expansion and contraction at each support point, initial and final loads on building structure, spring deflection changes, and seismic loads. Include certification that riser system has been examined for excessive stress and that none will exist.

3. Vibration Isolation Base Details:

Detail overall dimensions, including anchorages and attachments to structure and to supported equipment. Include auxiliary motor slides and rails, base weights, equipment static loads, power transmission, component misalignment, and cantilever loads.

4. Seismic- and Wind-Restraint Details:

a. Design Analysis:

To support selection and arrangement of seismic and wind restraints. Include calculations of combined tensile and shear loads.

b. Details:

Indicate fabrication and arrangement. Detail attachments of restraints to the restrained items and to the structure. Show attachment locations, methods, and spacings. Identify components, list their strengths, and indicate directions and values of forces transmitted to the structure during seismic events. Indicate association with vibration isolation devices.

- c. Coordinate seismic restraint and vibration isolation details with wind-restraint details required for equipment mounted outdoors. Comply with requirements in other Sections for equipment mounted outdoors.

d. Preapproval and Evaluation Documentation:

By an evaluation service member of ICC-ES OSHPD, showing maximum ratings of restraint items and the basis for approval (tests or calculations).

1.6 INFORMATIONAL SUBMITTALS

A. Coordination Drawings:

Show coordination of seismic bracing for HVAC piping and equipment with other systems and equipment in the vicinity, including other supports and seismic restraints.

B. Qualification Data:

For testing agency

C. Welding certificates

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D. Field quality control test reports

1.7 QUALITY ASSURANCE

- A. Comply with seismic-restraint requirements in the IBC unless requirements in this Section are more stringent.
- B. Welding:
Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code-Steel."
- C. Seismic restraint devices shall have horizontal and vertical load testing and analysis and shall bear anchorage preapproval OPA number from OSHPD, preapproval by ICC-ES, or preapproval by another agency acceptable to authorities having jurisdiction, showing maximum seismic-restraint ratings. Ratings based on independent testing are preferred to ratings based on calculations. If preapproved ratings are not available, submittals based on independent testing are preferred. Calculations (including combining shear and tensile loads) to support seismic-restraint designs must be signed and sealed by a qualified professional engineer.

PART 2 - PRODUCTS

2.1 VIBRATION ISOLATORS

- A. Available Manufacturers:
Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - 1. Ace Mounting Co. Inc.
 - 2. Isolation Technology. Inc.
 - 3. Kinetic Noise Control
 - 4. Mason Industries
 - 5. Vibration Isolation
- B. Pads:
Arranged in single or multiple layers of sufficient stiffness for uniform loading over pad area, molded with a nonslip pattern and galvanized-steel baseplates, and factory cut to sizes that match requirements of supported equipment.
 - 1. Resilient Material:
Oil and water resistant neoprene rubber
- C. Mounts:
Double deflection type, with molded, oil-resistant rubber, hermetically sealed compressed fiberglass, or neoprene isolator elements with factory-drilled, encapsulated top plate for bolting to equipment and with baseplate for bolting to structure. Color-code or otherwise identify to indicate capacity range.
 - 1. Materials:

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Cast or ductile iron or welded steel housing containing two separate and opposing, oil resistant rubber or neoprene elements that prevent central threaded element and attachment hardware from contacting the housing during normal operation.

2. Neoprene:
Shock absorbing materials compounded according to the standard for bridge bearing neoprene as defined by AASHTO.

D. Restrained Mounts:

All direction mountings with seismic restraint.

1. Materials:
Cast or ductile iron or welded steel housing containing two separate and opposing, oil resistant rubber or neoprene elements that prevent central threaded element and attachment hardware from contacting the housing during normal operation.
2. Neoprene:
Shock absorbing materials compounded according to the standard for bridge bearing neoprene as defined by AASHTO.

E. Spring Isolators:

Freestanding, laterally stable, open-spring isolators

1. Outside Spring Diameter:
Not less than 80 percent of the compressed height of the spring at rated load.
2. Minimum Additional Travel:
50 percent of the required deflection at rated load.
3. Lateral Stiffness:
More than 80 percent of rated vertical stiffness.
4. Overload Capacity:
Support 200 percent of rated load, fully compressed, without deformation or failure.
5. Baseplates:
Factory drilled for bolting to structure and bonded to ¼ inch (6 mm) thick, rubber isolator pad attached to baseplate underside. Baseplates shall limit floor load to 500 psig (3447 kPa).
6. Top Plate and Adjustment Bolt:
Threaded top plate with adjustment bolt and cap screw to fasten and level equipment.

F. Restrained Spring Isolators:

Freestanding, steel, open spring isolators with seismic or limit stop restraint.

1. Housing:
Steel with resilient vertical limit stops to prevent spring extension due to weight being removed; factory drilled baseplate bonded to ¼ inch (6 mm) thick, neoprene or rubber isolator pad attached to baseplate underside; and adjustable equipment mounting and leveling bolt that acts as blocking during installation.
2. Restraint:
Seismic or limit stop as required for equipment and authorities having jurisdiction.

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3. Outside Spring Diameter:
Not less than 80 percent of the compressed height of the spring at rated load
 4. Minimum Additional Travel:
50 percent of the required deflection at rated load
 5. Lateral Stiffness:
More than 80 percent of rated vertical stiffness
 6. Overload Capacity:
Support 200 percent of rated load, fully compressed, without deformation or failure.
- G. Housed Spring Mounts:
Housed spring isolator with integral seismic snubbers.
1. Housing:
Ductile iron or steel housing to provide all direction seismic restraint.
 2. Base:
Factory drilled for bolting to structure
 3. Snubbers:
Vertically adjustable to allow a maximum of ¼ inch (6 mm) travel up or down before contacting a resilient collar.
- H. Elastomeric Hangers:
Single or double deflection type, fitted with molded, oil resistant elastomeric isolator elements bonded to steel housings with threaded connections for hanger rods. Color code or otherwise identify to indicate capacity range.
- I. Spring Hangers:
Combination coil-spring and elastomeric-insert hanger with spring and insert in compression.
1. Frame:
Steel, fabricated for connection to threaded hanger rods and to allow for a maximum of 30 degrees of angular hanger rod misalignment without binding or reducing isolation efficiency.
 2. Outside Spring Diameter:
Not less than 80 percent of the compressed height of the spring at rated load
 3. Minimum Additional Travel:
50 percent of the required deflection at rated load
 4. Lateral Stiffness:
More than 80 percent of rated vertical stiffness
 5. Overload Capacity:
Support 200 percent of rated load, fully compressed, without deformation or failure.
 6. Elastomeric Element:
Molded, oil resistant rubber or neoprene. Steel washer reinforced cup to support spring and bushing projecting through bottom of frame.

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7. Self-centering hanger rod cap to ensure concentricity between hanger rod and support spring coil.
- J. Spring Hangers with Vertical Limit Stop:
Combination coil spring and elastomeric-insert hanger with spring and insert in compression and with a vertical limit stop.
 1. Frame:
Steel, fabricated for connection to threaded hanger rods and to allow for a maximum of 30 degrees of angular hanger rod misalignment without binding or reducing isolation efficiency.
 2. Outside Spring Diameter:
Not less than 80 percent of the compressed height of the spring at rated load
 3. Minimum Additional Travel:
50 percent of the required deflection at rated load
 4. Lateral Stiffness:
More than 80 percent of rated vertical stiffness
 5. Overload Capacity:
Support 200 percent of rated load, fully compressed, without deformation or failure
 6. Elastomeric Element:
Molded, oil-resistant rubber or neoprene
 7. Adjustable Vertical Stop:
Steel washer with neoprene washer "up-stop" on lower threaded rod.
 8. Self-centering hanger rod cap to ensure concentricity between hanger rod and support spring coil.
- K. Pipe Riser Resilient Support:
 1. All direction, acoustical pipe anchor consisting of 2 steel tubes separated by a minimum of ½ inch (13 mm) thick neoprene.
 2. Include steel and neoprene vertical limit stops arranged to prevent vertical travel in both directions.
 3. Design support for a maximum load on the isolation material of 500 psig (3.45 MPa) and for equal resistance in all directions.
- L. Resilient Pipe Guides:
Telescopic arrangement of 2 steel tubes or post and sleeve arrangement separated by a minimum of ½ inch (13 mm) thick neoprene. Where clearances are not readily visible, a factory set guide height with a shear pin to allow vertical motion due to pipe expansion and contraction shall be fitted. Shear pin shall be removable and re-insert able to allow for selection of pipe movement. Guides shall be capable of motion to meet location requirements.

2.2 RESTRAINED VIBRATION ISOLATION ROOF CURB RAILS

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A. Available Manufacturers:

Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

1. Isolation Technology. Inc.
2. Kinetics Noise Control
3. Mason Industries
4. Vibration Isolation

B. General Requirements for Restrained Vibration Isolation Roof Curb Rails:

Factory assembled, fully enclosed, insulated, air- and watertight curb rail designed to resiliently support equipment and to withstand seismic and wind forces.

C. Lower Support Assembly:

Formed sheet metal section containing adjustable and removable steel springs that support upper frame. Upper frame shall provide continuous support for equipment and shall be captive to resiliently resist seismic and wind forces. Lower support assembly shall have a means for attaching to building structure and a wood nailer for attaching roof materials, and shall be insulated with a minimum of 2 inches (50 mm) of rigid, glass-fiber insulation on inside of assembly.

D. Spring Isolators:

Adjustable, restrained spring isolators shall be mounted on ¼ inch (6 mm) thick, elastomeric vibration isolation pads and shall have access ports, for level adjustment, with removable waterproof covers at all isolator locations. Isolators shall be located so they are accessible for adjustment at any time during the life of the installation without interfering with the integrity of the roof.

1. Restrained Spring Isolators:

Freestanding, steel, open-spring isolators with seismic or wind restraint

a. Housing:

Steel with resilient vertical limit stops and adjustable equipment mounting and leveling bolt

b. Outside Spring Diameter:

Not less than 80 percent of the compressed height of the spring at rated load

c. Minimum Additional Travel:

50 percent of the required deflection at rated load

d. Lateral Stiffness:

More than 80 percent of rated vertical stiffness

e. Overload Capacity:

Support 200 percent of rated load, fully compressed, without deformation or failure

3. Pads:

Arranged in single or multiple layers of sufficient stiffness for uniform loading over pad area, molded with a nonslip pattern and galvanized steel baseplates, and factory cut to sizes that

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match requirements of supported equipment.

- a. Resilient Material:
Oil and water resistant standard neoprene

E. Snubber Bushings:

All direction, elastomeric snubber bushings at least 1/4 inch (6 mm) thick

F. Water Seal:

Galvanized sheet metal with EPDM seals at corners, attached to upper support frame, extending down past wood nailer of lower support assembly, and counter flashed over roof materials.

2.3 VIBRATION ISOLATION EQUIPMENT BASES

A. Available Manufacturers:

Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

1. Isolation Technology, Inc.
2. Kinetic Noise Control
3. Mason Industries
4. Vibration Isolation

B. Steel Base:

Factory fabricated, welded, structural steel bases and rails.

1. Design Requirements:

Lowest possible mounting height with not less than 1 inch (25 mm) clearance above the floor. Include equipment anchor bolts and auxiliary motor slide bases or rails.

- a. Include supports for suction and discharge elbows for pumps.

2. Structural Steel:

Steel shapes, plates, and bars complying with ASTM A 36/A 36M. Bases shall have shape to accommodate supported equipment.

3. Support Brackets:

Factory welded steel brackets on frame for outrigger isolation mountings and to provide for anchor bolts and equipment support.

C. Inertia Base:

Factory fabricated, welded, structural-steel bases and rails ready for placement of cast in place concrete.

1. Design Requirements:

Lowest possible mounting height with not less than 1 inch (25 mm) clearance above the floor. Include equipment anchor bolts and auxiliary motor slide bases or rails.

- a. Include supports for suction and discharge elbows for pumps.

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2. Structural Steel:
Steel shapes, plates, and bars complying with ASTM A 36/A 36M. Bases shall have shape to accommodate supported equipment.
3. Support Brackets:
Factory welded steel brackets on frame for outrigger isolation mountings and to provide for anchor bolts and equipment support.
4. Fabrication:
Fabricate steel templates to hold equipment anchor bolt sleeves and anchors in place during placement of concrete. Obtain anchor-bolt templates from supported equipment manufacturer.

2.4 SEISMIC RESTRAINT DEVICES

A. Available Manufacturers:

Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

1. Cooper B- Line. Inc.; a division of Cooper Industries
2. Hilti, Inc.
3. Kinetics Noise Control
4. Loo& Co.; Cableware Division
5. Mason Industries
6. TOLCO Incorporated ; a brand of NIBCO INC.
7. Uni trut ; Tyco International, Ltd.

A. General Requirements for Restraint Components:

Rated strengths, features, and applications shall be as defined in reports by an evaluation service member of ICC-ES.

1. Structural Safety Factor:
Allowable strength in tension, shear, and pullout force of components shall be at least four times the maximum seismic forces to which they will be subjected.

B. Snubbers:

Factory fabricated using welded structural steel shapes and plates, anchor bolts, and replaceable resilient isolation washers and bushings.

1. Anchor bolts for attaching to concrete shall be seismic rated, drill in, and stud wedge or female wedge type
2. Resilient Isolation Washers and Bushings:
Oil and water resistant neoprene
3. Maximum ¼ inch (6 mm) air gap, and minimum ¼ inch (6 mm) thick resilient cushion

C. Channel Support System:

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MFMA-3, shop or field fabricated support assembly made of slotted steel channels with accessories for attachment to braced component at one end and to building structure at the other end and other matching components and with corrosion resistant coating; and rated in tension, compression, and torsion forces.

D. Restraint Cables:

ASTM A 603 galvanized steel cables with end connections made of steel assemblies with thimbles, brackets, swivel, and bolts designed for restraining cable service; and with a minimum of two clamping bolts for cable engagement.

E. Hanger Rod Stiffener:

Steel tube or steel slotted support system sleeve with internally bolted connections to hanger rod

F. Bushings for Floor Mounted Equipment Anchor Bolts:

Neoprene bushings designed for rigid equipment mountings, and matched to type and size of anchor bolts and studs.

G. Bushing Assemblies for Wall Mounted Equipment Anchorage:

Assemblies of neoprene elements and steel sleeves designed for rigid equipment mountings, and matched to type and size of attachment devices used.

H. Resilient Isolation Washers and Bushings:

One piece, molded, oil and water resistant neoprene, with a flat washer face

I. Mechanical Anchor Bolts:

Drilled in and stud wedge or female wedge type in zinc coated steel for interior applications and stainless steel for exterior applications. Select anchor bolts with strength required for anchor and as tested according to ASTM E 488. Minimum length of eight times diameter.

J. Adhesive Anchor Bolts:

Drilled in and capsule anchor system containing polyvinyl or urethane methacrylate based resin and accelerator, or injected polymer or hybrid mortar adhesive. Provide anchor bolts and hardware with zinc coated steel for interior applications and stainless steel for exterior applications. Select anchor bolts with strength required for anchor and as tested according to ASTM E 488.

2.5 FACTORY FINISHES

A. Finish:

Manufacturer's standard prime-coat finish ready for field painting.

B. Finish:

Manufacturer's standard paint applied to factory assembled and tested equipment before shipping.

1. Powder coating on springs and housings
2. All hardware shall be G90 galvanized. Hot dip galvanize metal components for exterior use.
3. Baked enamel or powder coat for metal components on isolators for interior use.
4. Color code or otherwise mark vibration isolation and seismic and wind control devices to indicate capacity range.

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PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine areas and equipment to receive vibration isolation and seismic and wind control devices for compliance with requirements for installation tolerances and other conditions affecting performance.
- B. Examine roughing-in of reinforcement and cast-in-place anchors to verify actual locations before installation.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 APPLICATIONS

- A. Multiple Pipe Supports:
Secure pipes to trapeze member with clamps approved for application by an evaluation service member of ICC-ES OSHPD.
- B. Hanger Rod Stiffeners:
Install hanger rod stiffeners where indicated or scheduled on Drawings to receive them and where required to prevent buckling of hanger rods due to seismic forces.
- C. Strength of Support and Seismic Restraint Assemblies:
Where not indicated, select sizes of components so strength will be adequate to carry present and future static and seismic loads within specified loading limits.

3.3 VIBRATION CONTROL AND SEISMIC RESTRAINT DEVICE INSTALLATION

- A. Comply with requirements in Section 077200 "Roof Accessories" for installation of roof curbs, equipment supports, and roof penetrations.
- B. Equipment Restraints:
 - 1. Install seismic snubbers on HVAC equipment mounted on vibration isolators. Locate snubbers as close as possible to vibration isolators and bolt to equipment base and supporting structure.
 - 2. Install resilient bolt isolation washers on equipment anchor bolts where clearance between anchor and adjacent surface exceeds 0.125 inch (3.2 mm).
 - 3. Install seismic restraint devices using methods approved by an evaluation service member of ICC-ES OSHPD providing required submittals for component.
- C. Piping Restraints:
 - 1. Comply with requirements in MSS SP-127.
 - 2. Space lateral supports a maximum of 40 feet (12m) O.C., and longitudinal supports a maximum of 80 feet (24 m) O.C.
 - 3. Brace a change of direction longer than 12 feet (3.7 m).

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- D. Install cables so they do not bend across edges of adjacent equipment or building structure.
- E. Install seismic-restraint devices using methods approved by an evaluation service member of ICC-ES OSHPD providing required submittals for component.
- F. Install bushing assemblies for anchor bolts for floor mounted equipment, arranged to provide resilient media between anchor bolt and mounting hole in concrete base.
- G. Install bushing assemblies for mounting bolts for wall mounted equipment, arranged to provide resilient media where equipment or equipment-mounting channels are attached to wall.
- G. Attachment to Structure:
If specific attachment is not indicated, anchor bracing to structure at flanges of beams, at upper truss chords of bar joists, or at concrete members.
- I. Drilled in Anchors:
 - 1. Identify position of reinforcing steel and other embedded items prior to drilling holes for anchors. Do not damage existing reinforcing or embedded items during coring or drilling. Notify the structural engineer if reinforcing steel or other embedded items are encountered during drilling. Locate and avoid pre-stressed tendons, electrical and telecommunications conduit, and gas lines.
 - 2. Do not drill holes in concrete or masonry until concrete, mortar, or grout has achieved full design strength.
 - 3. Wedge Anchors:
Protect threads from damage during anchor installation. Heavy-duty sleeve anchors shall be installed with sleeve fully engaged in the structural element to which anchor is to be fastened.
 - 4. Adhesive Anchors:
Clean holes to remove loose material and drilling dust prior to installation of adhesive. Place adhesive in holes proceeding from the bottom of the hole and progressing toward the surface in such a manner as to avoid introduction of air pockets in the adhesive.
 - 5. Set anchors to manufacturer's recommended torque, using a torque wrench.
 - 6. Install zinc-coated steel anchors for interior and stainless-steel anchors for exterior applications.

3.4 ACCOMMODATION OF DIFFERENTIAL SEISMIC MOTION

- A. Install flexible connections in piping where they cross seismic joints, where adjacent sections or branches are supported by different structural elements, and where the connections terminate with connection to equipment that is anchored to a different structural element from the one supporting the connections as they approach equipment. Comply with requirements in Section 232113 "Hydronic Piping" for piping flexible connections.

3.5 FIELD QUALITY CONTROL

- A. Perform tests and inspections.

- B. Tests and Inspections:

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1. Provide evidence of recent calibration of test equipment by a testing agency acceptable to authorities having jurisdiction.
 2. Schedule test with Owner, through Owner's Representative, before connecting anchorage device to restrained component (unless post connection testing has been approved), and with at least seven days' advance notice.
 3. Obtain Owner's Representative's approval before transmitting test loads to structure. Provide temporary load-spreading members.
 4. Test at least four of each type and size of installed anchors and fasteners selected by Owner's Representative.
 5. Test to 90 percent of rated proof load of device.
 6. Measure isolator restraint clearance.
 7. Measure isolator deflection.
 8. Verify snubber minimum clearances.
 9. Test and adjust air mounting system controls and safeties.
 10. If a device fails test, modify all installations of same type and retest until satisfactory results are achieved.
- C. Remove and replace malfunctioning units and retest as specified above.
- D. Prepare test and inspection reports

3.6. ADJUSTING

- A. Adjust isolators after piping system is at operating weight.
- B. Adjust limit stops on restrained spring isolators to mount equipment at normal operating height. After equipment installation is complete, adjust limit stops so they are out of contact during normal operation.
- C. Adjust air-spring leveling mechanism.
- D. Adjust active height of spring isolators.
- E. Adjust restraints to permit free movement of equipment within normal mode of operation.

3.7 DEMONSTRATION

- A. Engage a factory authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain air-mounting systems.

3.8 HVAC VIBRATION CONTROL AND SEISMIC RESTRAINT DEVICE SCHEDULE

- A. Supported or Suspended Equipment:

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1. Equipment Location:
Mechanical rooms
2. Pads:
Material:
Neoprene
3. Isolator Type:
Freestanding, laterally stable, open-spring isolators
4. Base Type:
Factory-fabricated, welded, structural steel bases and rails ready for placement of cast in place concrete
5. Minimum Deflection:
2 inches (50 mm)
6. Component Importance Factor:
1.5
7. Component Response Modification Factor:
2.5
8. Component Amplification Factor:
2.5

END OF SECTION

SECTION 230553 – IDENTIFICATION FOR HVAC PIPING AND EQUIPMENT

GOVERNMENT OF THE U. S. VIRGIN ISLANDS, DEPARTMENT OF PUBLIC WORKS

PROJECT NAME: Elaine I. Sprauve Public Library and Museum Building

Project Location, St. John, U.S. Virgin Islands

PART 1- GENERAL

1.1 SUMMARY

A. Section Includes:

1. Equipment labels
2. Warning signs and labels
3. Pipe labels
4. Duct labels

1.2 ACTION SUBMITTAL

A. Product Data:

For each type of product indicated.

PART 2 - PRODUCTS

2.1 EQUIPMENT LABELS

A. Plastic Labels for Equipment:

1. Material and Thickness:
Multilayer, multicolor, plastic labels for mechanical engraving, 1/8 inch (3.2 mm) thick, and having predrilled holes for attachment hardware.
2. Letter Color:
White
3. Background Color:
Black
4. Maximum Temperature:
Able to withstand temperatures up to 160°F (71°C).
5. Minimum Label Size:
Length and width vary for required label content, but not less than 2-1/2 by 3/4 inch (64 by 19 mm).
6. Minimum Letter Size:
1/4 inch (6.4 mm) for name of units if viewing distance is less than 24 inches (600 mm), 1/2 inch (13 mm) for viewing distances up to 72 inches (1830 mm), and proportionately larger lettering for greater viewing distances. Include secondary lettering two-thirds to three-fourths the size of principal lettering.
7. Fasteners:
Stainless-steel rivets
8. Adhesive:
Contact type permanent adhesive, compatible with label and with substrate.

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B. Label Content:

Include equipment's Drawing designation or unique equipment number, Drawing numbers where equipment is indicated (plans, details, and schedules), plus the Specification Section number and title where equipment is specified.

C. Equipment Label Schedule:

For each item of equipment to be labeled, on 8-1/2 by 11 inch (A4) bond paper. Tabulate equipment identification number and identify Drawing numbers where equipment is indicated (plans, details, and schedules), plus the Specification Section number and title where equipment is specified. Equipment schedule shall be included in operation and maintenance data.

2.2 WARNING SIGNS AND LABELS

A. Material and Thickness:

Multilayer, multicolor, plastic labels for mechanical engraving, 1/8 inch (3.2 mm) thick, and having predrilled holes for attachment hardware.

B. Letter Color:

White

C. Background Color:

Red

D. Maximum Temperature:

Able to withstand temperatures up to 160°F (71°C).

E. Minimum Label Size:

Length and width vary for required label content, but not less than 2-1/2 by 3/4 inch (64 by 19 mm).

F. Minimum Letter Size:

1/4 inch (6.4 mm) for name of units if viewing distance is less than 24 inches (600 mm), 1/2 inch (13 mm) for viewing distances up to 72 inches (1830 mm), and proportionately larger lettering for greater viewing distances. Include secondary lettering two-thirds to three-fourths the size of principal lettering.

G. Fasteners:

Stainless-steel rivets

H. Adhesive:

Contact type permanent adhesive, compatible with label and with substrate

I. Label Content:

Include caution and warning information, plus emergency notification instructions.

2.3 PIPE LABELS

A. General Requirements for Manufactured Pipe Labels:

Preprinted, color coded, with lettering indicating service, and showing flow direction.

B. Pre-tensioned Pipe Labels:

Pre-coiled, semi-rigid plastic formed to partially cover circumference of pipe and to attach to pipe without fasteners or adhesive.

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C. Self-Adhesive Pipe Labels:

Printed plastic with contact type, permanent adhesive backing

D. Pipe Label Contents:

Include identification of piping service using same designations or abbreviations as used on Drawings, pipe size, and an arrow indicating flow direction.

1. Flow Direction Arrows:

Integral with piping system service lettering to accommodate both directions, or as separate unit on each pipe label to indicate flow direction.

2. Lettering Size:

At least 1-1/2 inches (38 mm) high

2.4 DUCT LABELS

A. Material and Thickness:

Multilayer, multicolor, plastic labels for mechanical engraving, 1/16 inch (1.6 mm) thick, and having predrilled holes for attachment hardware.

B. Letter Color:

White

C. Background Color:

Black

D. Maximum Temperature:

Able to withstand temperatures up to 160°F (71°C).

E. Minimum Label Size:

Length and width vary for required label content, but not less than 2-1/2 by 3/4 inch (64 by 19 mm).

F. Minimum Letter Size:

1/4 inch (6.4 mm) for name of units if viewing distance is less than 24 inches (600 mm), 1/2 inch (13 mm) for viewing distances up to 72 inches (1830 mm), and proportionately larger lettering for greater viewing distances. Include secondary lettering two-thirds to three-fourths the size of principal lettering.

G. Adhesive:

Contact type permanent adhesive, compatible with label and with substrate.

H. Duct Label Contents:

Include identification of duct service using same designations or abbreviations as used on Drawings, duct size, and an arrow indicating flow direction.

1. Flow Direction Arrows:

Integral with duct system service lettering to accommodate both directions, or as separate unit on each duct label to indicate flow direction.

2. Lettering Size:

At least 1-1/2 inches (38 mm) high.

PART 3 - EXECUTION

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3.1 PREPARATION

- A. Clean piping and equipment surfaces of substances that could impair bond of identification devices, including dirt, oil, grease, release agents, and incompatible primers, paints, and encapsulates.

3.2 EQUIPMENT LABEL INSTALLATION

- A. Install or permanently fasten labels on each major item of mechanical equipment.
- B. Locate equipment labels where accessible and visible.

3.3 PIPE LABEL INSTALLATION

- A. Piping Color Coding:
Painting of piping is specified in division 9.
- B. Locate pipe labels where piping is exposed or above accessible ceilings in finished spaces; machine rooms; accessible maintenance spaces such as shafts, tunnels, and plenums; and exterior exposed locations as follows:
 - 1. Near each valve and control device.
 - 2. Near each branch connection, excluding short takeoffs for fixtures and terminal units. Where flow pattern is not obvious, mark each pipe at branch.
 - 3. Near penetrations through walls, floors, ceilings, and inaccessible enclosures.
 - 4. At access doors, manholes, and similar access points that permit view of concealed piping.
 - 5. Near major equipment items and other points of origination and termination.
 - 6. Spaced at maximum intervals of 50 feet (15m) along each run. Reduce intervals to 25 feet (7.6 m) in areas of congested piping and equipment.
 - 7. On piping above removable acoustical ceilings. Omit intermediately spaced labels.
- C. Pipe Label Color Schedule:
 - 1. Chilled Water Piping:
 - a. Background Color:
Blue
 - b. Letter Color:
White
 - 2. Condenser Water Piping:
 - a. Background Color:
Green
 - b. Letter Color:

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White

3. Hot Water Piping:

a. Background Color:
Red

b. Letter Color:
White

4. Refrigerant Piping:

a. Background Color:
Yellow

b. Letter Color:
Black

3.4 DUCT LABEL INSTALLATION

A. Install self-adhesive duct labels with permanent adhesive on air ducts in the following color codes:

1. Blue:
For cold air supply ducts
2. Yellow:
For hot-air supply ducts
3. Green:
For exhaust, outside, relief, return, and mixed-air ducts
4. ASME A13.1 Colors and Designs:
For hazardous material exhaust.

B. Locate labels near points where ducts enter into concealed spaces and at maximum intervals of 50 feet (15m) in each space where ducts are exposed or concealed by removable ceiling system.

END OF SECTION

SECTION 230593 – TEST, ADJUST, BALANCING HVAC
GOVERNMENT OF THE U. S. VIRGIN ISLANDS, DEPARTMENT OF PUBLIC WORKS
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PART 1 - GENERAL

1.1 SUMMARY

A. Section includes:

1. Balancing air systems:
 - a. Constant volume air systems.

1.2 DEFINITIONS

- A. AABC - Associated Air Balance Council.
- B. NEBB - National Environmental Balancing Bureau
- C. TAB - Testing, Adjusting, and Balancing
- D. TABB - Testing, Adjusting, and Balancing Bureau
- E. TAB SPECIALIST - An entity engaged to perform tab work.

1.3 ACTION SUBMITTALS

A. LEED SUBMITTALS:

1. Air balance report for prerequisite IEQ 1:
Documentation of work performed for ASHRAE 62.1, section 7.2.2 "Air Balancing."
2. TAB report for prerequisite EA 2:
Documentation of work performed for ASHRAE/IESNA 90.1, section 6.7.2.3 "System Balancing."

1.4 INFORMATIONAL SUBMITTALS

- A. Strategies and procedures plan:
Within 60 days of contractor's notice to proceed, submit TAB strategies and step by step procedures as specified in "Preparation" article.
- B. Certified TAB reports

1.5 QUALITY ASSURANCE

- A. TAB contractor qualifications:
Engage a TAB entity certified by AABC, NEBB or TABB.
 1. TAB field supervisor:
Employee of the tab contractor and Certified by AABC, NEBB or TABB.
 2. Tab technician:
Employee of the tab contractor and who is certified by AABC NEBB or TABB as a TAB technician.

SECTION 230593 – TEST, ADJUST, BALANCING HVAC

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B. Certify TAB field data reports and perform the following:

1. Review field data reports to validate accuracy of data and to prepare certified TAB reports.
2. Certify that the TAB team complied with the approved TAB plan and the procedures specified and referenced in this specification.

C. TAB report forms:

Use standard TAB contractor's forms approved by commissioning authority.

D. Instrumentation type, quantity, accuracy, and calibration:

As described in ASHRAE 111, section 5, "Instrumentation."

E. ASHRAE compliance:

Applicable requirements in ASHRAE 62.1, section 7.2.2 "Air Balancing."

F. ASHRAE/IESNA compliance:

Applicable requirements in ASHRAE/IESNA 90.1, Section 6.7.2.3- "System Balancing."

PART 2 - PRODUCTS (NOT APPLICABLE)

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine the contract documents to become familiar with project requirements and to discover conditions in systems' designs that may preclude proper TAB of systems and equipment.
- B. Examine systems for installed balancing devices, such as test ports, gage cocks, thermometer wells, flow control devices, balancing valves and fittings, and manual volume dampers. Verify that locations of these balancing devices are accessible.
- C. Examine the approved submittals for HVAC systems and equipment.
- D. Examine design data including HVAC system descriptions, statements of design assumptions for environmental conditions and systems' output, and statements of philosophies and assumptions about HVAC system and equipment controls.
- E. Examine ceiling plenums used for supply, return, or relief air to verify that they meet the leakage class of connected ducts as specified in Section 233113 "Metal Ducts" and are properly separated from adjacent areas. Verify that penetrations in plenum walls are sealed and fire-stopped if required.
- F. Examine equipment performance data including fan and pump curves.
 1. Relate performance data to project conditions and requirements, including system effects that can create undesired or unpredicted conditions that cause reduced capacities in all or part of a system.
 2. Calculate system effect factors to reduce performance ratings of HVAC equipment when installed under conditions different from the conditions used to rate equipment performance. To calculate system effects for air systems, use Tables and charts found in AMCA 201, "Fans and Systems," or in SMACNA's "HVAC Systems Duct Design." compare results with the design data and installed conditions.

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- G. Examine system and equipment installations and verify that field quality-control testing, cleaning, and adjusting specified in individual sections have been performed.
- H. Examine test reports specified in individual system and equipment sections.
- I. Examine HVAC equipment and filters and verify that bearings are greased, belts are aligned and tight, and equipment with functioning controls is ready for operation.
- J. Examine terminal units, such as variable air volume boxes, and verify that they are accessible and their controls are connected and functioning.
- K. Examine strainers. Verify that startup screens are replaced by permanent screens with indicated perforations.
- L. Examine three way valves for proper installation for their intended function of diverting or mixing fluid flows.
- M. Examine heat-transfer coils for correct piping connections and for clean and straight fins.
- N. Examine system pumps to ensure absence of entrained air in the suction piping.
- O. Examine operating safety interlocks and controls on HVAC equipment.
- P. Report deficiencies discovered before and during performance of TAB procedures. Observe and record system reactions to changes in conditions. Record default set points if different from indicated values.

3.2 PREPARATION

- A. Prepare a TAB plan that includes strategies and step by step procedures.
- B. Complete system-readiness checks and prepare reports. Verify the following:
 - 1. Permanent electrical-power wiring is complete.
 - 2. Automatic temperature-control systems are operational.
 - 3. Equipment and duct access doors are securely closed.
 - 4. Balance, smoke, and fire dampers are open.
 - 5. Isolating and balancing valves are open and control valves are operational.
 - 6. Ceilings are installed in critical areas where air pattern adjustments are required and access to balancing devices is provided.
 - 7. Windows and doors can be closed so indicated conditions for system operations can be met.

3.3 GENERAL PROCEDURES FOR TESTING AND BALANCING

- A. Perform testing and balancing procedures on each system according to the procedures contained in AABC's "National Standards for Total System Balance" ASHRAE 111 NEBB's "Procedural Standards for Testing, Adjusting, and Balancing of Environmental Systems" SMACNA's

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"HVAC Systems - Testing, Adjusting, and Balancing" and in this section.

1. Comply with requirements in ASHRAE 62.1, section 7.2.2 "Air Balancing."
- B. Cut insulation, ducts, pipes, and equipment cabinets for installation of test probes to the minimum extent necessary for TAB procedures.
 1. After testing and balancing, patch probe holes in ducts with same material and thickness as used to construct ducts.
 2. Install and join new insulation that matches removed materials. Restore insulation, coverings, vapor barrier, and finish according to Section 230713 "Duct Insulation," and section 230719 "HVAC piping insulation."
- C. Mark equipment and balancing devices, including damper-control positions, valve position indicators, fan-speed-control levers, and similar controls and devices, with paint or other suitable, permanent identification material to show final settings.
- D. Take and report testing and balancing measurements in inch-pound (ip) units.

3.4 GENERAL PROCEDURES FOR BALANCING AIR SYSTEMS

- A. Prepare test reports for both fans and outlets. Obtain manufacturer's outlet factors and recommended testing procedures. Crosscheck the summation of required outlet volumes with required fan volumes.
- B. Prepare schematic diagrams of systems' "as-built" duct layouts.
- C. Determine the best locations in main and branch ducts for accurate duct airflow measurements.
- D. Check airflow patterns from the outdoor air louvers and dampers and the return and exhaust air dampers through the supply fan discharge and mixing dampers.
- E. Locate start-stop and disconnect switches, electrical interlocks, and motor starters.
- F. Verify that motor starters are equipped with properly sized thermal protection.
- G. Check dampers for proper position to achieve desired airflow path. .
- H. Check for airflow blockages
- I. Check condensate drains for proper connections and functioning.
- J. Check for proper sealing of air handling unit components.
- K. Verify that air duct system is sealed as specified in Section 233113 "Metal Ducts."

3.5 PROCEDURES FOR CONSTANT VOLUME AIR SYSTEMS

- A. Adjust fans to deliver total indicated airflows within the maximum allowable fan speed listed by fan manufacturer.
 1. Measure total airflow.

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- a. Where sufficient space in ducts is unavailable for Pitot tube traverse measurements, measure airflow at terminal outlets and inlets and calculate the total airflow.
2. Measure fan static pressures as follows to determine actual static pressure:
 - a. Measure outlet static pressure as far downstream from the fan as practical and upstream from restrictions in ducts such as elbows and transitions.
 - b. Measure static pressure directly at the fan outlet or through the flexible connection.
 - c. Measure inlet static pressure of single inlet fans in the inlet duct as near the fan as possible, upstream from the flexible connection, and downstream from duct restrictions.
 - d. Measure inlet static pressure of double inlet fans through the wall of the plenum that houses the fan.
3. Measure static pressure across each component that makes up an air-handling unit, rooftop unit, and other air-handling and treating equipment.
 - a. Report the cleanliness status of filters and the time static pressures are measured.
4. Measure static pressures entering and leaving other devices, such as sound traps, heat recovery equipment, and air washers, under final balanced conditions.
5. Review record documents to determine variations in design static pressures versus actual static pressures. Calculate actual system effect factors. Recommend adjustments to accommodate actual conditions.
6. Obtain approval from commissioning authority for adjustment of fan speed higher or lower than indicated speed. Comply with requirements in sections for air handling units for adjustment of fans, belts, and pulley sizes to achieve indicated air handling unit performance.
7. Do not make fan speed adjustments that result in motor overload. Consult equipment manufacturers about fan speed safety factors. Modulate dampers and measure fan-motor amperage to ensure that no overload will occur. Measure amperage in full-cooling, full-heating, economizer, and any other operating mode to determine the maximum required brake horsepower.
- B. Adjust volume dampers for main duct, submain ducts, and major branch ducts to indicated airflows within specified tolerances.
 1. Measure airflow of submain and branch ducts.
 - a. Where sufficient space in submain and branch ducts is unavailable for Pitot tube traverse measurements, measure airflow at terminal outlets and inlets and calculate the total airflow for that zone.
 2. Measure static pressure at a point downstream from the balancing damper, and adjust volume dampers until the proper static pressure is achieved.
 3. Re-measure each submain and branch duct after all have been adjusted. Continue to adjust submain and branch ducts to indicated airflows within specified tolerances.
- C. Measure air outlets and inlets without making adjustments.

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1. Measure terminal outlets using a direct reading hood or outlet manufacturer's written instructions and calculating factors.
- D. Adjust air outlets and inlets for each space to indicated airflows within specified tolerances of indicated valves. Make adjustments using branch volume dampers rather than extractors and the dampers at air terminals.
 1. Adjust each outlet in same room or space to within specified tolerances of indicated quantities without generating noise levels above the limitations prescribed by the contract documents.
 2. Adjust patterns of adjustable outlets for proper distribution without drafts.

3.6 PROCEDURES FOR MOTORS

- A. Motors, 1/2 hp and larger:
Test at final balanced conditions and record the following data:
 1. Manufacturer's name, model number, and serial number
 2. Motor horsepower rating
 3. Motor rpm
 4. Efficiency rating
 5. Nameplate and measured voltage, each phase
 6. Nameplate and measured amperage, each phase
 7. Starter thermal-protection-element rating
- B. Motors driven by variable-frequency controllers: test for proper operation at speeds varying from minimum to maximum. Test the manual bypass of the controller to prove proper operation. Record observations including name of controller manufacturer, model number, serial number, and nameplate data.

3.7 PROCEDURES FOR CONDENSING UNITS

- A. Verify proper rotation of fans.
- B. Measure entering- and leaving-air temperatures.
- C. Record compressor data.

3.8 PROCEDURES FOR HEAT-TRANSFER COILS

- A. Measure, adjust, and record the following data for each refrigerant coil:
 1. Dry-bulb temperature of entering and leaving air
 2. Wet-bulb temperature of entering and leaving air
 3. Airflow

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4. Air pressure drop

5. Refrigerant suction pressure and temperature

3.9 TOLERANCES

A. Set HVAC system's air flow rates and water flow rates within the following tolerances:

1. Supply, return, and exhaust fans and equipment with fans:
Plus or minus 10 percent

2. Air outlets and inlets:
Plus or minus 10 percent.

3.10 REPORTING

A. Initial construction phase report:

Based on examination of the contract documents as specified in "examination" article, prepare a report on the adequacy of design for systems' balancing devices. Recommend changes and additions to systems' balancing devices to facilitate proper performance measuring and balancing. Recommend changes and additions to HVAC systems and general construction to allow access for performance measuring and balancing devices.

B. Status reports:

Prepare biweekly progress reports to describe completed procedures, procedures in progress, and scheduled procedures. Include a list of deficiencies and problems found in systems being tested and balanced. Prepare a separate report for each system and each building floor for systems serving multiple floors.

3.11 FINAL REPORT

A. General:

Prepare a certified written report; tabulate and divide the report into separate sections for tested systems and balanced systems.

1. Include a certification sheet at the front of the report's Binder, signed and sealed by the certified testing and balancing engineer.

2. Include a list of instruments used for procedures, along with Proof of calibration.

B. Final report contents:

In addition to certified field report data, include the following:

1. Fan curves

2. Manufacturers' test data

3. Field test reports prepared by system and equipment installers

4. Other information relative to equipment performance; do not include shop drawings and product data.

C. General report data:

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In addition to form titles and entries, include the following data:

1. Title page
2. Name and address of the tab contractor
3. Project name
4. Project location
5. Owner's representative's name and address
6. Engineer's name and address
7. Contractor's name and address
8. Report date
9. Signature of TAB supervisor who certifies the report
10. Table of contents with the total number of pages defined for each section of the report. Number each page in the report.
11. Summary of contents including the following:
 - a. Indicated versus final performance
 - b. Notable characteristics of systems
 - c. Description of system operation sequence if it varies from the contract documents.
12. Nomenclature sheets for each item of equipment
13. Data for terminal units, including manufacturer's name, type, size, and fittings
14. Notes to explain why certain final data in the body of reports vary from indicated values
15. Test conditions for fans and pump performance forms including the following:
 - a. Settings for outdoor, return, and exhaust air dampers
 - b. Conditions of filters
 - c. Cooling coil, wet- and dry-bulb conditions
 - d. Fan drive settings including settings and percentage of maximum pitch diameter
 - e. Other system operating conditions that affect performance.

3.12 ADDITIONAL TESTS

- A. Within 90 days of completing tab, perform additional tab to verify that balanced conditions are being maintained throughout and to correct unusual conditions.

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END OF SECTION

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PART 1- GENERAL

1.1 SUMMARY

A. Section includes insulating the following duct services:

1. Indoor, concealed supply air.

B. Related Sections:

1. Section 233113 "Metal Ducts".

1.2 ACTION SUBMITTALS

A. Product Data:

For each type of product indicated.

B. Shop Drawings:

Include plans, elevations, sections, details, and attachments to other work.

1. Detail application of protective shields, saddles, and inserts at hangers for each type of insulation and hanger.
2. Detail insulation application at elbows, fittings, dampers, specialties and flanges for each type of insulation.
3. Detail application of field-applied jackets.
4. Detail application at linkages of control devices

1.3 INFORMATIONAL SUBMITTALS

- A. Field quality control reports.

1.4 QUALITY ASSURANCE

A. Surface Burning Characteristics:

For insulation and related materials, as determined by testing identical products according to ASTM E 84, by a testing agency acceptable to authorities having jurisdiction. Factory label insulation and jacket materials and adhesive, mastic, tapes, and cement material containers, with appropriate markings of applicable testing agency.

1. Insulation Installed Indoors:
Flame spread index of 25 or less, and smoke developed index of 50 or less.

PART 2- PRODUCTS

2.1 INSULATION MATERIALS

- A. Comply with requirements in "Duct Insulation Schedule, General," and "Indoor Duct and Plenum Insulation Schedule" articles for where insulating materials shall be applied.

- B. Products shall not contain asbestos, lead, mercury, or mercury compounds.

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- C. Products that come in contact with stainless steel shall have a leachable chloride content of less than 50 ppm when tested according to ASTM C 871.
- D. Insulation materials for use on austenitic stainless steel shall be qualified as acceptable according to ASTM C 795.
- E. Foam insulation materials shall not use CFC or HCFC blowing agents in the manufacturing process.
- F. Mineral Fiber Blanket Insulation:
Mineral or glass fibers bonded with a thermosetting resin. Comply with ASTM C 553, Type II and ASTM C 1290, Type III with factory applied FSK jacket. Factory applied jacket requirements are specified in "Factory Applied Jackets" Article.
 - 1. Products:
Subject to compliance with requirements, provide one of the following available products that may be incorporated into the Work include, but are not limited to, the following:
 - a. CertainTeed Corp.; SoftTouch Duct Wrap.
 - b. Johns Manville; Microlite
 - c. Knauf Insulation; Friendly Feel Duct Wrap
 - d. Manson Insulation Inc.; Alley Wrap
 - e. Owens Coming; SOFTR All-Service Duct Wrap

2.2 ADHESIVES

- A. Materials shall be compatible with insulation materials, jackets, and substrates and for bonding insulation to itself and to surfaces to be insulated unless otherwise indicated.
- B. Mineral Fiber Adhesive:
Comply with Mil-A-3316C, Class 2, Grade A
 - 1. Products:
Subject to compliance with requirements, provide one of the following available products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Childers Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; CP-127
 - b. Eagle Bridges - Marathon Industries; 225
 - c. Foster Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; 85-60/85-70
 - d. Mon-Eco Industries, Inc.; 22-25
 - 2. For indoor applications, adhesive shall have a VOC content of 80 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

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3. Adhesive shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small Scale Environmental Chambers."

C. ASJ Adhesive, and FSK Jacket Adhesive:

Comply with Mil-A-3316C, Class 2, Grade A for bonding insulation jacket lap seams and joints.

1. Products:

Subject to compliance with requirements, provide one of the following available products that may be incorporated into the Work include, but are not limited to, the following:

- a. Childers Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; CP-82
- b. Eagle Bridges - Marathon Industries; 225
- c. Foster Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; 85-50
- d. Mon-Eco Industries, Inc.; 22-25.

2. For indoor applications, adhesive shall have a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

3. Adhesive shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small Scale Environmental Chambers."

2.3 MASTICS

- A. Materials shall be compatible with insulation materials, jackets, and substrates; comply with MIL-PRF-19565C, Type II.

1. For indoor applications, use mastics that have a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

B. Vapor Barrier Mastic:

Water based; suitable for indoor use on below ambient services

1. Products:

Subject to compliance with requirements, provide one of the following available products that may be incorporated into the Work include, but are not limited to, the following:

- a. Foster Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; 30-80/30-90
- b. Vimasco Corporation; 749

2. Water Vapor Permeance:

ASTM E 96/E 96M, Procedure B, 0.013 perm (0.009 metric perm) at 43 mil (1.09 mm) dry film thickness.

3. Service Temperature Range:

To plus 180°F (to plus 82°C).

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- 4. Solids Content:
ASTM D 1644, 58 percent by volume and 70 percent by weight

- 5. Color:
White.

- C. Breather Mastic:
Water based; suitable for indoor and outdoor use on above ambient services.

- 1. Products:
Subject to compliance with requirements, provide one of the following available products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Childers Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; CP-10
 - b. Eagle Bridges - Marathon Industries; 550
 - c. Foster Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; 46-50
 - d. Mon-Eco Industries, Inc.; 55-50
 - e. Vimasco Corporation; WC-1/WC-5
- 2. Water Vapor Permeance:
ASTM F 1249, 1.8 perms (1.2 metric perms) at 0.0625-inch (1.6-mm) dry film thickness.
- 3. Service Temperature Range:
To plus 180°F (to plus 82°C)
- 4. Solids Content:
60 percent by volume and 66 percent by weight
- 5. Color:
White.

2.4 SEALANTS

- A. FSK and Metal Jacket Flashing Sealants:

- 1. Products:
Subject to compliance with requirements, provide one of the following available products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Childers Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; CP-76
 - b. Eagle Bridges- Marathon Industries; 405
 - c. Foster Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; 95-44

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d. Mon-Eco Industries, Inc.; 44-05

2. Materials shall be compatible with insulation materials, jackets, and substrates.
3. Fire and water resistant, flexible, elastomeric sealant
4. Service Temperature Range:
To plus 250°F (to plus 121°C)
5. Color:
Aluminum
6. For indoor applications, use sealants that have a VOC content of 420 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
7. Sealants shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small Scale Environmental Chambers."

B. ASJ Flashing Sealants, and Vinyl and PVC Jacket Flashing Sealants:

1. Products:
Subject to compliance with requirements, provide one of the following available products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Childers Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; CP-76
2. Materials shall be compatible with insulation materials, jackets, and substrates.
3. Fire and water resistant, flexible, elastomeric sealant
4. Service Temperature Range:
To plus 250°F (to plus 121°C)
5. Color:
White
6. For indoor applications, sealants shall have a VOC content of 420 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24)
7. Sealants shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small Scale Environmental Chambers."

2.5 FACTORY APPLIED JACKETS

- A. Insulation system schedules indicate factory applied jackets on various applications. When factory applied jackets are indicated, comply with the following:
 1. ASJ:
White, kraft paper, fiberglass reinforced scrim with aluminum foil backing; complying with ASTM C 1136, Type I.

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2. ASJ-SSL:
ASJ with self-sealing, pressure sensitive, acrylic based adhesive covered by a removable protective strip; complying with ASTM C 1136, Type I.
3. FSK Jacket:
Aluminum foil, fiberglass reinforced scrim with kraft paper backing; complying with ASTM C 1136, Type II.
4. FSP Jacket:
Aluminum foil, fiberglass reinforced scrim with polyethylene backing; complying with ASTM C 1136, Type II.
5. Vinyl Jacket:
White vinyl with a permeance of 1.3 perms (0.86 metric perm) when tested according to ASTM E 96/E 96M, Procedure A, and complying with NFPA 90A and NFPA90B.

2.6 FIELD APPLIED FABRIC REINFORCING MESH

- A. Woven Polyester Fabric:
Approximately 1 oz./sq. yd. (34 g/sq. m) with a thread count of 10 strands by 10 strands/sq. in. (4 strands by 4 strands/sq. mm), in a Leno weave, for ducts.
1. Products:
Subject to compliance with requirements, provide one of the following available products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Foster Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; Mast-A-Fab
 - b. Vimasco Corporation; Elastafab 894

2.7 TAPES

- A. ASJ Tape:
White vapor retarder tape matching factory applied jacket with acrylic adhesive, complying with ASTM C 1136.
1. Products:
Subject to compliance with requirements, provide one of the following available products that may be incorporated into the Work include, but are not limited to, the following:
 - a. ABI, Ideal Tape Division; 428 AWF ASJ
 - b. Avery Dennison Corporation, Specialty Tapes Division; Passon 0836.
 - b. Compac Corporation; 104 and 105
 - d. Venture Tape; 1540 CW Plus, 1542 CW Plus, and 1542 CW Plus/SQ
 2. Width:
3 inches (75 mm)
 3. Thickness:

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11.5 mils (0.29 mm)

4. Adhesion:
90 ounces force/inch (1.0 N/mm) in width
5. Elongation:
2 percent
6. Tensile Strength:
40 lbf/inch (7.2 N/mm) in width
7. ASJ Tape Disks and Squares:
Precut disks or squares of ASJ tape

B. FSK Tape:

Foil face, vapor-retarder tape matching factory applied jacket with acrylic adhesive; complying with ASTM C 1136.

1. Products:
Subject to compliance with requirements, provide one of the following available products that may be incorporated into the Work include, but are not limited to, the following:
 - a. ABI, Ideal Tape Division; 491 AWF FSK
 - b. Avery Dennison Corporation, Specialty Tapes Division; Fasson 0827
 - c. Compac Corporation; 110 and 111
 - d. Venture Tape; 1525 CW NT, 1528 CW, and 1528 CW/SQ
2. Width:
3 inches (75 mm)
3. Thickness:
6.5 mils (0.16 mm)
4. Adhesion:
90 ounces force/inch (1.0 N/mm) in width
5. Elongation:
2 percent
6. Tensile Strength:
40 lbf/inch (7.2 N/mm) in width
7. FSK Tape Disks and Squares: Precut disks or squares of FSK tape

C. PVC Tape:

White vapor-retarder tape matching field-applied PVC jacket with acrylic adhesive; suitable for indoor and outdoor applications.

1. Products:
Subject to compliance with requirements, provide one of the following available products that may be incorporated into the Work include, but are not limited to, the following:

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- a. ABI, Ideal Tape Division; 370 White PVC tape
 - b. Compac Corporation; 130
 - c. Venture Tape; 1506 CW NS
2. Width:
2 inches (50 mm)
 3. Thickness:
6 mils (0.15 mm)
 4. Adhesion:
64 ounces force/inch (0.7 N/mm) in width
 5. Elongation:
500 percent
 6. Tensile Strength:
18 lbf/inch (3.3 N/mm) in width.
- D. Aluminum-Foil Tape:
Vapor retarder tape with acrylic adhesive
1. Products:
Subject to compliance with requirements, provide one of the following available products that may be incorporated into the Work include, but are not limited to, the following:
 - a. ABI, Ideal Tape Division; 488 AWF
 - b. Avery Dennison Corporation, Specialty Tapes Division; Fasson 0800.
 - c. Compac Corporation; 120
 - d. Venture Tape; 3520 CW
 2. Width:
2 inches (50 mm)
 3. Thickness:
3.7 mils (0.093 mm)
 4. Adhesion:
100 ounces force/inch (1 .1 N/mm) in width
 5. Elongation:
5 percent
 6. Tensile Strength:
34 lbf/inch (6.2 N/mm) in width

2.8 SECUREMENTS

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A. Aluminum Bands:

ASTM B 209 (ASTM B 209M), Alloy 3003, 3005, 3105, or 5005; Temper H-14, 0.020 inch (0.51 mm) thick, 1/2 inch (13 mm) wide with wing seal or closed seal.

1. Products:

Subject to compliance with requirements, provide one of the following available products that may be incorporated into the Work include, but are not limited to, the following:

- a. ITW Insulation Systems; Gerrard Strapping and Seals
- b. RPR Products, Inc.; Insul-Mate Strapping, Seals, and Springs

B. Insulation Pins and Hangers:

1. Metal, Adhesively Attached, Perforated Base Insulation Hangers:

Baseplate welded to projecting spindle that is capable of holding insulation, of thickness indicated, and securely in position indicated when self-locking washer is in place. Comply with the following requirements:

a. Products:

Subject to compliance with requirements, provide one of the following available products that may be incorporated into the Work include, but are not limited to, the following:

- 1) AGM Industries, Inc.; Tactoo Perforated Base Insul-Hangers
- 2) GEMCO; Perforated Base
- 3) Midwest Fasteners, Inc.; Spindle

b. Baseplate:

Perforated, galvanized carbon steel sheet, 0.030 inch (0.76 mm) thick by 2 inches (50 mm) square.

c. Spindle:

Stainless steel, fully annealed, 0.106 inch (2.6 mm) diameter shank, length to suit depth of insulation indicated.

d. Adhesive:

Recommended by hanger manufacturer. Product with demonstrated capability to bond insulation hanger securely to substrates indicated without damaging insulation, hangers, and substrates.

2. Nonmetal, Adhesively Attached, Perforated Base Insulation Hangers:

Baseplate fastened to projecting spindle that is capable of holding insulation, of thickness indicated, and securely in position indicated when self-locking washer is in place. Comply with the following requirements:

a. Products:

Subject to compliance with requirements, provide one of the following available products that may be incorporated into the Work include, but are not limited to, the following:

- 1) GEMCO; Nylon Hangers
- 2) Midwest Fasteners, Inc.; Nylon Insulation Hangers

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- b. Baseplate:
Perforated, nylon sheet, 0.030 inch (0.76 mm) thick by 1-1/2 inches (38 mm) in diameter
 - c. Spindle:
Nylon, 0.106 inch (2.6 mm) diameter shank, length to suit depth of insulation indicated, up to 2-1/2 inches (63 mm).
 - d. Adhesive:
Recommended by hanger manufacturer. Product with demonstrated capability to bond insulation hanger securely to substrates indicated without damaging insulation, hangers, and substrates.
3. Self-Sticking-Base Insulation Hangers:
Baseplate welded to projecting spindle that is capable of holding insulation, of thickness indicated, and securely in position indicated when self-locking washer is in place. Comply with the following requirements:
- a. Products:
Subject to compliance with requirements, provide one of the following available products that may be incorporated into the Work include, but are not limited to, the following:
 - 1) AGM Industries, Inc.; Tactoo Self-Adhering Insul-Hangers
 - 2) GEMCO; Peel & Press
 - 3) Midwest Fasteners, Inc.; Self Stick
 - b. Baseplate:
Galvanized carbon steel sheet, 0.030 inch (0.76 mm) thick by 2 inches (50 mm) square
 - c. Spindle:
Stainless steel, fully annealed, 0.106 inch (2.6 mm) diameter shank, length to suit depth of insulation indicated.
 - d. Adhesive backed base with a peel off protective cover
4. Insulation Retaining Washers:
Self-locking washers formed from 0.016 inch (0.41 mm) thick, stainless steel sheet, with beveled edge sized as required to hold insulation securely in place but not less than 1-1/2 inches (38 mm) in diameter.
- a. Products:
Subject to compliance with requirements, provide one of the following available products that may be incorporated into the Work include, but are not limited to, the following:
 - 1) AGM Industries, Inc.; RC-150
 - 2) GEMCO; R-150
 - 3) Midwest Fasteners, Inc.; WA-150
 - 4) Nelson Stud Welding; Speed Clips

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- b. Protect ends with capped self-locking washers incorporating a spring steel insert to ensure permanent retention of cap in exposed locations.

5. Nonmetal Insulation Retaining Washers:

Self-locking washers formed from 0.016 inch (0.41 mm) thick nylon sheet, with beveled edge sized as required to hold insulation securely in place but not less than 1-1/2 inches (38 mm) in diameter.

a. Manufacturers:

Subject to compliance with requirements, provide products by one of the following available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

1) GEMCO

2) Midwest Fasteners, Inc

C. Staples:

Outward clinching insulation staples, nominal 3/4 inch (19 mm) wide, stainless steel or Monel.

D. Wire:

0.062 inch (1.6 mm) soft annealed, galvanized steel

1. Manufacturers:

Subject to compliance with requirements, provide products by one of the following available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

a. C & F Wire.

2.9 CORNER ANGLES

A. PVC Corner Angles:

30 mils (0.8 mm) thick, minimum 1 by 1 inch (25 by 25 mm), PVC according to ASTM D 1784, Class 16354-C. White or color-coded to match adjacent surface.

B. Aluminum Corner Angles:

0.040 inch (1.0 mm) thick, minimum 1 by 1 inch (25 by 25 mm), aluminum according to ASTM B 209 (ASTM B 209M), Alloy 3003, 3005, 3105, or 5005; Temper H-14.

PART 3 - EXECUTION

3.1 PREPARATION

A. Surface Preparation:

Clean and dry surfaces to receive insulation. Remove materials that will adversely affect insulation application.

3.2 GENERAL INSTALLATION REQUIREMENTS

A. Install insulation materials, accessories, and finishes with smooth, straight, and even surfaces; free of voids throughout the length of ducts and fittings.

B. Install insulation materials, vapor barriers or retarders, jackets, and thicknesses required for each

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item of duct system as specified in insulation system schedules.

- C. Install accessories compatible with insulation materials and suitable for the service. Install accessories that do not corrode, soften, or otherwise attack insulation or jacket in either wet or dry state.
- D. Install insulation with longitudinal seams at top and bottom of horizontal runs.
- E. Install multiple layers of insulation with longitudinal and end seams staggered.
- F. Keep insulation materials dry during application and finishing.
- G. Install insulation with tight longitudinal seams and end joints. Bond seams and joints with adhesive recommended by insulation material manufacturer.
- H. Install insulation with least number of joints practical.
- I. Where vapor barrier is indicated, seal joints, seams, and penetrations in insulation at hangers, supports, anchors, and other projections with vapor-barrier mastic.
 - 1. Install insulation continuously through hangers and around anchor attachments.
 - 2. For insulation application where vapor barriers are indicated, extend insulation on anchor legs from point of attachment to supported item to point of attachment to structure. Taper and seal ends at attachment to structure with vapor barrier mastic.
 - 3. Install insert materials and install insulation to tightly join the insert. Seal insulation to insulation inserts with adhesive or sealing compound recommended by insulation material manufacturer.
- J. Apply adhesives, mastics, and sealants at manufacturer's recommended coverage rate and wet and dry film thicknesses.
- K. Install insulation with factory-applied jackets as follows:
 - 1. Draw jacket tight and smooth.
 - 2. Cover circumferential joints with 3 inch (75 mm) wide strips, of same material as insulation jacket. Secure strips with adhesive and outward clinching staples along both edges of strip, spaced 4 inches (100 mm) O.C.
 - 3. Overlap jacket longitudinal seams at least 1-1/2 inches (38 mm). Clean and dry surface to receive self-sealing lap. Staple laps with outward clinching staples along edge at 2 inches (50 mm) O.C.
 - a. For below ambient services, apply vapor-barrier mastic over staples.
 - 4. Cover joints and seams with tape, according to insulation material manufacturer's written instructions, to maintain vapor seal.
 - 5. Where vapor barriers are indicated, apply vapor-barrier mastic on seams and joints and at ends adjacent to duct flanges and fittings.
- L. Cut insulation in a manner to avoid compressing insulation more than 75 percent of its nominal

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thickness.

M. Finish installation with systems at operating conditions. Repair joint separations and cracking due to thermal movement.

N. Repair damaged insulation facings by applying same facing material over damaged areas. Extend patches at least 4 inches (100 mm) beyond damaged areas. Adhere, staple, and seal patches similar to butt joints.

3.3 PENETRATIONS

A. Insulation Installation at Roof Penetrations:

Install insulation continuously through roof penetrations.

1. Seal penetrations with flashing sealant.
2. For applications requiring only indoor insulation, terminate insulation above roof surface and seal with joint sealant. For applications requiring indoor and outdoor insulation, install insulation for outdoor applications tightly joined to indoor insulation ends. Seal joint with joint sealant.
3. Extend jacket of outdoor insulation outside roof flashing at least 2 inches (50 mm) below top of roof flashing.
4. Seal jacket to roof flashing with flashing sealant.

B. Insulation Installation at above ground Exterior Wall Penetrations:

Continuously through wall penetrations.

1. Seal penetrations with flashing sealant.. Install insulation.
2. For applications requiring only indoor insulation, terminate insulation inside wall surface and seal with joint sealant. For applications requiring indoor and outdoor insulation, install insulation for outdoor applications tightly joined to indoor insulation ends. Seal joint with joint sealant.
3. Extend jacket of outdoor insulation outside wall flashing and overlap wall flashing at least 2 inches (50 mm).
4. Seal jacket to wall flashing with flashing sealant.

C. Insulation Installation at Interior Wall and Partition Penetrations (That Are Not Fire Rated):

Install insulation continuously through walls and partitions.

D. Insulation Installation at Fire Rated Wall and Partition Penetrations:

Terminate insulation at fire damper sleeves for fire-rated wall and partition penetrations. Externally insulate damper sleeves to match adjacent insulation and overlap duct insulation at least 2 inches (50 mm).

1. Comply with requirements in Division 07 for fire stopping and fire resistive joint sealers.

E. Insulation Installation at Floor Penetrations:

1. Duct:

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For penetrations through fire rated assemblies, terminate insulation at fire damper sleeves and externally insulate damper sleeve beyond floor to match adjacent duct insulation. Overlap damper sleeve and duct insulation at least 2 inches (50 mm).

2. Seal penetrations through fire-rated assemblies. Comply with requirements in Division 07 for fire stopping and fire resistive joint sealers."

3.4 INSTALLATION OF MINERAL FIBER INSULATION

A. Blanket Insulation Installation on Ducts and Plenums:

Secure with adhesive and insulation pins.

1. Apply adhesives according to manufacturer's recommended coverage rates per unit area, for 100 percent coverage of duct and plenum surfaces.
2. Apply adhesive to entire circumference of ducts and to all surfaces of fittings and transitions.
3. Install either capacitor discharge weld pins and speed washers or cupped head, capacitor discharge weld pins on sides and bottom of horizontal ducts and sides of vertical ducts as follows:
 - a. On duct sides with dimensions 18 inches (450 mm) and smaller, place pins along longitudinal centerline of duct. Space 3 inches (75 mm) maximum from insulation end joints, and 16 inches (400 mm) O.C.
 - b. On duct sides with dimensions larger than 18 inches (450 mm), place pins 16 inches (400 mm) O.C. each way, and 3 inches (75 mm) maximum from insulation joints. Install additional pins to hold insulation tightly against surface at cross bracing.
 - c. Pins may be omitted from top surface of horizontal, rectangular ducts and plenums.
 - d. Do not over compress insulation during installation.
 - e. Impale insulation over pins and attach speed washers.
 - f. Cut excess portion of pins extending beyond speed washers or bend parallel with insulation surface. Cover exposed pins and washers with tape matching insulation facing.
4. For ducts and plenums with surface temperatures below ambient, install a continuous unbroken vapor barrier. Create a facing lap for longitudinal seams and end joints with insulation by removing 2 inches (50 mm) from one edge and one end of insulation segment. Secure laps to adjacent insulation section with 1/2-inch (13 mm) outward clinching staples, 1 inch (25 mm) O.C. Install vapor barrier consisting of factory or field applied jacket, adhesive, vapor barrier mastic, and sealant at joints, seams, and protrusions.
 - a. Repair punctures, tears, and penetrations with tape or mastic to maintain vapor barrier seal.
 - b. Install vapor stops for ductwork and plenums operating below 50°F (10°C) at 18 foot (5.5 m) intervals. Vapor stops shall consist of vapor barrier mastic applied in a Z-shaped pattern over insulation face, along butt end of insulation, and over the surface. Cover insulation face and surface to be insulated a width equal to two times the insulation thickness, but not less than 3 inches (75 mm).
5. Overlap un-faced blankets a minimum of 2 inches (50 mm) on longitudinal seams and end

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joints. At end joints, secure with steel bands spaced a maximum of 18 inches (450 mm) O.C.

6. Install insulation on rectangular duct elbows and transitions with a full insulation section for each surface. Install insulation on round and flat oval duct elbows with individually mitered gores cut to fit the elbow.
 7. Insulate duct stiffeners, hangers, and flanges that protrude beyond insulation surface with 6 inch (150 mm) wide strips of same material used to insulate duct. Secure on alternating sides of stiffener, hanger, and flange with pins spaced 6 inches (150 mm) O.C.
- B. Board Insulation Installation on Ducts and Plenums:
Secure with adhesive and insulation pins.
1. Apply adhesives according to manufacturer's recommended coverage rates per unit area, for 100 percent coverage of duct and plenum surfaces.
 2. Apply adhesive to entire circumference of ducts and to all surfaces of fittings and transitions.
 3. Install either capacitor-discharge-weld pins and speed washers or cupped-head, capacitor discharge weld pins on sides and bottom of horizontal ducts and sides of vertical ducts as follows:
 - a. On duct sides with dimensions 18 inches (450 mm) and smaller, place pins along longitudinal centerline of duct. Space 3 inches (75 mm) maximum from insulation end joints, and 16 inches (400 mm) O.C.
 - b. On duct sides with dimensions larger than 18 inches (450 mm), space pins 16 inches (400 mm) O.C. each way, and 3 inches (75 mm) maximum from insulation joints. Install additional pins to hold insulation tightly against surface at cross bracing.
 - c. Pins may be omitted from top surface of horizontal, rectangular ducts and plenums.
 - d. Do not over compress insulation during installation.
 - e. Cut excess portion of pins extending beyond speed washers or bend parallel with insulation surface. Cover exposed pins and washers with tape matching insulation facing.
 4. For ducts and plenums with surface temperatures below ambient, install a continuous unbroken vapor barrier. Create a facing lap for longitudinal seams and end joints with insulation by removing 2 inches (50 mm) from one edge and one end of insulation segment. Secure laps to adjacent insulation section with 1/2-inch (13-mm) outward clinching staples, 1 inch (25 mm) O.C. Install vapor barrier consisting of factory- or field applied jacket, adhesive, vapor barrier mastic, and sealant at joints, seams, and protrusions.
 - a. Repair punctures, tears, and penetrations with tape or mastic to maintain vapor barrier seal.
 - b. Install vapor stops for ductwork and plenums operating below 50°F (10°C) at 18 foot (5.5 m) intervals. Vapor stops shall consist of vapor barrier mastic applied in a Z-shaped pattern over insulation face, along butt end of insulation, and over the surface. Cover insulation face and surface to be insulated a width equal to two times the insulation thickness, but not less than 3 inches (75 mm).
 5. Install insulation on rectangular duct elbows and transitions with a full insulation section for each surface. Groove and score insulation to fit as closely as possible to outside and inside

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radius of elbows. Install insulation on round and flat-oval duct elbows with individually mitered gores cut to fit the elbow.

6. Insulate duct stiffeners, hangers, and flanges that protrude beyond insulation surface with 6 inch (150 mm) wide strips of same material used to insulate duct. Secure on alternating sides of stiffener, hanger, and flange with pins spaced 6 inches (150 mm) O.C.

3.5 FINISHES

A. Insulation with ASJ or Other Paintable Jacket Material:

Paint jacket with paint system identified below and as specified in Division 09.

1. Flat Acrylic Finish:

Two finish coats over a primer that is compatible with jacket material and finish coat paint. Add fungicidal agent to render fabric mildew proof.

a. Finish Coat Material:

Interior, flat, latex emulsion size.

B. Color:

Final color as selected by Owner's Representative. Vary first and second coats to allow visual inspection of the completed Work.

3.6 FIELD QUALITY CONTROL

A. Perform tests and inspections.

B. Tests and Inspections:

1. Inspect ductwork, randomly selected by Owner's Representative, by removing field applied jacket and insulation in layers in reverse order of their installation. Extent of inspection shall be limited to one location(s) for each duct system defined in the "Duct Insulation Schedule, General" Article.

C. All insulation applications will be considered defective Work if sample inspection reveals noncompliance with requirements.

3.7 DUCT INSULATION SCHEDULE, GENERAL

A. Plenums and Ducts Requiring Insulation:

1. Indoor, concealed supply air

B. Items Not Insulated:

1. Metal ducts with duct liner of sufficient thickness to comply with energy code and ASHRAE/IESNA 90.1.
2. Factory insulated flexible ducts
3. Factory insulated plenums and casings
4. Flexible connectors

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- 5. Vibration-control devices
- 6. Factory-insulated access panels and doors.

3.8 INDOOR DUCT AND PLENUM INSULATION SCHEDULE

- A. Concealed, Supply Air and Return Air Duct and Plenum Insulation:
Mineral fiber blanket, 1-1/2" inches (50 mm) thick and 1.0-lb/cu. ft. (16-kg/cu. m) nominal density R-6

END OF SECTION

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PART 1 - GENERAL

1.1 SUMMARY

A. Section includes insulating the following HVAC piping systems: Refrigerant suction and hot-gas piping, indoors and outdoors.

B. Related Sections:
Section 230713 "Duct Insulation."

1.2 ACTION SUBMITTALS

A. Product Data:
For each type of product indicated

B. Shop Drawings:
Include plans, elevations, sections, details, and attachments to other work.

1. Detail application of protective shields, saddles, and inserts at hangers for each type of insulation and hanger.
2. Detail application of field-applied jackets.
3. Detail application at linkages of control devices.

1.3 INFORMATIONAL SUBMITTALS

A. Field quality control reports

1.4 QUALITY ASSURANCE

A. Surface Burning Characteristics:
For insulation and related materials, as determined by testing identical products according to ASTM E 84, by a testing and inspecting agency acceptable to authorities having jurisdiction. Factory label insulation and jacket materials and adhesive, mastic, tapes, and cement material containers, with appropriate markings of applicable testing agency.

1. Insulation Installed Indoors:
Flame spread index of 25 or less, and smoke developed index of 50 or less.
2. Insulation Installed Outdoors:
Flame spread index of 75 or less, and smoke developed index of 150 or less.

PART 2 - PRODUCTS

2.1 INSULATION MATERIALS

- A. Products shall not contain asbestos, lead, mercury, or mercury compounds.
- B. Products that come in contact with stainless steel shall have a leachable chloride content of less than 50 ppm when tested according to ASTM C 871.
- C. Insulation materials for use on austenitic stainless steel shall be qualified as acceptable according to ASTM C 795.

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C. Flexible Elastomeric Insulation:

Closed cell, sponge or expanded rubber materials. Comply with ASTM C 534, Type I for tubular materials.

1. Products:

Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:

- a. Aeroflex USA, Inc.; Aerocel.
- b. Armacell LLC; AP Armaflex.
- c. K-Fiex USA; Insul-Lock, Insui-Tube, and K-FLEX LS.

2.2 INSULATING CEMENTS

A. Mineral Fiber, Hydraulic Setting Insulating and Finishing Cement:

Comply with ASTM C 449.

1. Products:

Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:

- a. Ramco Insulation, Inc.; Ramcote 1200 and Quik-Cote.
- b. Approved equal.

2.3 ADHESIVES

A. Materials shall be compatible with insulation materials, jackets, and substrates and for bonding insulation to itself and to surfaces to be insulated unless otherwise indicated.

B. Flexible Elastomeric Adhesive:

Comply with MIL-A-24179A, Type II, Class I.

1. Products:

Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:

- a. Aeroflex USA, Inc.; Aero seal
- b. Armacell LLC; Armaflex 520 Adhesive\
- c. Foster Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; 85-75
- d. K-Fiex USA; R-373 Contact Adhesive

2. For indoor applications, adhesive shall have a VOC content of 50 giL or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

3. Adhesive shall comply with the testing and product requirements of the California Department

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of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."

C. ASJ Adhesive, and FSK and PVDC Jacket Adhesive:

Comply with MIL-A-3316C, Class 2, Grade A for bonding insulation jacket lap seams and joints.

1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Childers Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; CP-82
 - b. Eagle Bridges -Marathon Industries; 225
 - c. Foster Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; 85-50
 - d. Mon-Eco Industries, Inc.; 22-25
2. For indoor applications, adhesive shall have a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
3. Adhesive shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small Scale Environmental Chambers."

D. PVC Jacket Adhesive:

Compatible with PVC jacket.

1. Products:
Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Dow Corning Corporation; 739, Dow Silicone
 - b. Johns Manville; Zeston Perma-Weld, CEEL-TITE Solvent Welding Adhesive
 - c. P.I.C. Plastics, Inc.; Welding Adhesive
 - d. Speedline Corporation; Polyco VP Adhesive
2. For indoor applications, adhesive shall have a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
3. Adhesive shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small Scale Environmental Chambers."

2.4 MASTICS

- A Materials shall be compatible with insulation materials, jackets, and substrates; comply with MIL-PRF-19565C, Type II.

1. For indoor applications, use mastics that have a VOC content of 50 g/L or less when

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calculated according to 40 CFR 59, Subpart D (EPA Method 24).

B. Vapor Barrier Mastic:

Water based; suitable for indoor use on below-ambient services.

1. Products:

Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:

a. Foster Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; 30-80/30-90

b. Vimasco Corporation; 749

2. Water-Vapor Permeance:

ASTM E 96/E 96M, Procedure B, 0.013 perm (0.009 metric perm) at 43-mil (1.09-mm) dry film thickness.

3. Service Temperature Range:

To plus 180°F (To plus 82°C).

4. Solids Content:

ASTM D 1644, 58 percent by volume and 70 percent by weight

5. Color:

White

C. Breather Mastic:

Water based; suitable for indoor and outdoor use on above ambient services.

1. Products:

Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:

a. Childers Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; CP-10

b. Eagle Bridges - Marathon Industries; 550

c. Foster Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; 46-50

d. Mon-Eco Industries, Inc.; 55-50

e. Vimasco Corporation; WC-1/WC-5

2. Water Vapor Permeance:

ASTM F 1249, 1.8 perms (1.2 metric perms) at 0.0625-inch (1.6-mm) dry film thickness

3. Service Temperature Range:

Minus 20 to plus 180 deg F (Minus 29 to plus 82 deg C)

4. Solids Content:

60 percent by volume and 66 percent by weight

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5. Color:
White

2.5 SEALANTS

A. Joint Sealants:

1. Materials shall be compatible with insulation materials, jackets, and substrates. Permanently flexible, elastomeric sealant.
 - a. Service Temperature Range:
To plus 300°F (To plus 149°C)
 - b. Color:
White or gray
2. For indoor applications, sealants shall have a VOC content of 420 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
3. Sealants shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small Scale Environmental Chambers."

B. FSK and Metal Jacket Flashing Sealants:

1. Products:
Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Childers Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; CP-76
 - b. Eagle Bridges- Marathon Industries; 405
 - c. Foster Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; 95-44
 - d. Mon-Eco Industries, Inc.; 44-05
2. Materials shall be compatible with insulation materials, jackets, and substrates.
3. Fire- and water-resistant, flexible, elastomeric sealant
4. Service Temperature Range:
To plus 250°F (To plus 121°C)
5. Color:
Aluminum
6. For indoor applications, sealants shall have a VOC content of 420 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24)

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7. Sealants shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small Scale Environmental Chambers."

C. ASJ Flashing Sealants, and Vinyl, PVDC, and PVC Jacket Flashing Sealants:

1. Products:
Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Childers Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; CP-76
2. Materials shall be compatible with insulation materials, jackets, and substrates
3. Fire and water resistant, flexible, elastomeric sealant
4. Service Temperature Range:
To plus 250°F (to plus 121°C)
5. Color:
White
6. For indoor applications, sealants shall have a VOC content of 420 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
7. Sealants shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small Scale Environmental Chambers."

2.6 FACTORY-APPLIED JACKETS

- A. Insulation system schedules indicate factory applied jackets on various applications. When factory applied jackets are indicated, comply with the following:
 1. ASJ:
White, kraft paper, fiberglass reinforced scrim with aluminum foil backing; complying with ASTM C 1136, Type I
 2. ASJ-SSL:
ASJ with self-sealing, pressure sensitive, acrylic based adhesive covered by a removable protective strip; complying with ASTM C 1136, Type I
 3. FSK Jacket:
Aluminum foil, fiberglass reinforced scrim with kraft paper backing; complying with ASTM C 1136, Type II
 4. FSP Jacket:
Aluminum foil, fiberglass reinforced scrim with polyethylene backing; complying with ASTM C 1136, Type II
 5. PVDC Jacket for Indoor Applications:
4-mil (0.10-mm) thick, white PVDC bi-axially oriented barrier film with a permeance at 0.02 perm (0.013 metric perm) when tested according to ASTM E 96/E 96M and with a flame

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spread index of 5 and a smoke developed index of 20 when tested according to ASTM E84

a. Products:

Subject to compliance with requirements, available product that may be incorporated into the Work include, but are not limited to, the following:

- 1) Dow Chemical Company (The); Saran 540 Vapor Retarder Film and Saran 560 Vapor Retarder Film

6. PVDC Jacket for Outdoor Applications:

6-mil (0.15-mm) thick, white PVDC bi-axially oriented barrier film with a permeance at 0.01 perm (0.007 metric perm) when tested according to ASTM E 96/E 96M and with a flame spread index of 5 and a smoke developed index of 25 when tested according to ASTM E84.

a. Products:

Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:

- 1) Dow Chemical Company (The); Saran 540 Vapor Retarder Film and Saran 560 Vapor Retarder Film.

7. PVDC-SSL Jacket:

PVDC jacket with a self-sealing, pressure sensitive, acrylic based adhesive covered by a removable protective strip.

b. Products:

Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:

- 1) Dow Chemical Company (The); Saran 540 Vapor Retarder Film and Saran 560 Vapor Retarder Film

8. Vinyl Jacket:

White vinyl with a permeance of 1.3 perms (0.86 metric perms) when tested according to ASTM E 96/E 96M, Procedure A, and complying with NFPA 90A and NFPA 90B

2.7 FIELD-APPLIED FABRIC-REINFORCING MESH

A. Woven Polyester Fabric:

Approximately 1 oz./sq. yd. (34 g/sq. m) with a thread count of 10 strands by 10 strands/sq. in. (4 strands by 4 strands/sq. mm), in a Leno weave, for pipe.

1. Products:

Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:

- a. Foster Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; Mast-A- Fab
- b. Vimasco Corporation; Elastafab 894

2.8 FIELD-APPLIED JACKETS

A. Field-applied jackets shall comply with ASTM C 921, Type I, unless otherwise indicated.

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B. FSK Jacket:

Aluminum foil face, fiberglass reinforced scrim with kraft paper backing

C. PVC Jacket:

High impact resistant, UV resistant PVC complying with ASTM D 1784, Class 16354-C; thickness as scheduled; roll stock ready for shop or field cutting and forming. Thickness is indicated in field- applied jacket schedules.

1. Products:

Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:

- a. Johns Manville; Zeston
- b. P.I.C. Plastics, Inc.; FG Series
- c. Proto Corporation; LoSmoke
- d. Speedline Corporation; SmokeSafe

2. Adhesive:

As recommended by jacket material manufacturer.

3. Color:

White

4. Factory fabricated fitting covers to match jacket if available; otherwise, field fabricate.

a. Shapes:

45 and 90 degree, short and long radius elbows, tees, valves, flanges, unions, reducers, end caps, soil-pipe hubs, traps, mechanical joints, and P-trap and supply covers for lavatories.

D. Aluminum Jacket:

Comply with ASTM B 209 (ASTM B 209M), Alloy 3003, 3005, 3105, or 5005, Temper H-14

1. Products:

Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:

- a. Childers Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; Metal Jacketing Systems.
- b. ITW Insulation Systems; Aluminum and Stainless Steel Jacketing
- c. RPR Products, Inc.; Insui-Mate.

2. Factory cut and rolled to size.

3. Finish and thickness are indicated in field-applied jacket schedules.

4. Moisture Barrier for Indoor Applications:

3-mil (0.075-mm-) thick, heat-bonded polyethylene and kraft paper.

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5. Moisture Barrier for Outdoor Applications:
3-mil (0.075-mm) thick, heat bonded polyethylene and kraft paper
6. Factory-Fabricated Fitting Covers:
 - a. Same material, finish, and thickness as jacket
 - b. Preformed 2-piece or gore, 45 and 90 degree, short and long radius elbows
 - c. Tee covers
 - d. Flange and union covers
 - e. End caps
 - f. Beveled collars.
 - g. Valve covers
 - h. Field fabricate fitting covers only if factory-fabricated fitting covers are not available
- E. Self-Adhesive Outdoor Jacket:
60-mil (1.5-mm) thick, laminated vapor barrier and waterproofing membrane for installation over insulation located aboveground outdoors; consisting of a rubberized bituminous resin on a cross-laminated polyethylene film covered with stucco-embossed aluminum-foil facing.
 1. Products:
Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Polyguard Products, Inc.; Alumaguard 60

2.9 TAPES

- A. ASJ Tape:
White vapor-retarder tape matching factory-applied jacket with acrylic adhesive, complying with ASTM C 1136.
 1. Products:
Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
 - a. ABI, Ideal Tape Division; 428 AWF ASJ
 - b. Avery Dennison Corporation, Specialty Tapes Division; Fasson 0836
 - c. Compac Corporation; 104 and 105
 - d. Venture Tape; 1540 CW Plus, 1542 CW Plus, and 1542 CW Plus/SQ.
 2. Width:
3 inches (75 mm)
 3. Thickness:

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11.5 mils (0.29 mm)

4. Adhesion:
90 ounces force/inch (1.0 N/mm) in width.
5. Elongation:
2 percent
6. Tensile Strength:
40 lbf/inch (7.2 N/mm) in width
7. ASJ Tape Disks and Squares:
Precut disks or squares of ASJ tape

B. PVC Tape:

White vapor retarder tape matching field applied PVC jacket with acrylic adhesive; suitable for indoor and outdoor applications.

1. Products:
Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
 - a. ABI, Ideal Tape Division; 370 White PVC tape
 - b. Compac Corporation; 130
 - c. Venture Tape; 1506 CW NS
2. Width:
2 inches (50 mm).
3. Thickness:
6 mils (0.15 mm)
4. Adhesion:
64 ounces force/inch (0.7 N/mm) in width
5. Elongation:
500 percent
6. Tensile Strength:
18 lbf/inch (3.3 N/mm) in width

C. Aluminum Foil Tape:

Vapor-retarder tape with acrylic adhesive

1. Products:
Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
 - a. ABI, Ideal Tape Division; 488 AWF
 - b. Avery Dennison Corporation, Specialty Tapes Division; Passon 0800

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- c. Compac Corporation; 120
- d. Venture Tape; 3520 CW
- 2. Width:
2 inches (50 mm)
- 3. Thickness:
3.7 mils (0.093 mm)
- 4. Adhesion:
100 ounces force/inch (1.1 N/mm) in width
- 5. Elongation:
5 percent
- 6. Tensile Strength:
34 lbf/inch (6.2 N/mm) in width

2.10 SECUREMENTS

- A. Aluminum Bands:
ASTM B 209 (ASTM B 209M), Alloy 3003, 3005, 3105, or 5005; Temper H-14, 0.020 inch (0.51 mm) thick, 1/2 inch (13 mm) wide with closed seal.
 - 1. Products:
Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
 - a. ITW Insulation Systems; Gerrard Strapping and Seals
 - b. RPR Products, Inc.; Insul-Mate Strapping, Seals, and Springs
- B. Staples:
Outward-clinching insulation staples, nominal 3/4-inch- (19-mm-) wide, stainless steel or Monel.
- C. Wire:
0.062-inch (1.6-mm) soft annealed, galvanized steel
 - 1. Manufacturers:
Subject to compliance with requirements, provide products by one of the following available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - a. C&FWire

PART 3 - EXECUTION

3.1 PREPARATION

- A. Surface Preparation:
Clean and dry surfaces to receive insulation. Remove materials that will adversely affect insulation application.

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- B. Coordinate insulation installation with the trade installing heat tracing. Comply with requirements for heat tracing that apply to insulation.
- C. Mix insulating cements with clean potable water; if insulating cements are to be in contact with stainless-steel surfaces, use demineralized water.

3.2 GENERAL INSTALLATION REQUIREMENTS

- A. Install insulation materials, accessories, and finishes with smooth, straight, and even surfaces; free of voids throughout the length of piping including fittings, valves, and specialties.
- B. Install insulation materials, forms, vapor barriers or retarders, jackets, and thicknesses required for each item of pipe system as specified in insulation system schedules.
- C. Install accessories compatible with insulation materials and suitable for the service. Install accessories that do not corrode, soften, or otherwise attack insulation or jacket in either wet or dry state.
- D. Install insulation with longitudinal seams at top and bottom of horizontal runs.
- E. Install multiple layers of insulation with longitudinal and end seams staggered.
- F. Do not weld brackets, clips, or other attachment devices to piping, fittings, and specialties.
- F. Keep insulation materials dry during application and finishing.
- H. Install insulation with tight longitudinal seams and end joints. Bond seams and joints with adhesive recommended by insulation material manufacturer.
- I. Install insulation with least number of joints practical.
- J. Where vapor barrier is indicated, seal joints, seams, and penetrations in insulation at hangers, supports, anchors, and other projections with vapor-barrier mastic.
 - 1. Install insulation continuously through hangers and around anchor attachments.
 - 2. For insulation application where vapor barriers are indicated, extend insulation on anchor legs from point of attachment to supported item to point of attachment to structure. Taper and seal ends at attachment to structure with vapor barrier mastic.
 - 3. Install insert materials and install insulation to tightly join the insert. Seal insulation to insulation inserts with adhesive or sealing compound recommended by insulation material manufacturer.
 - 4. Cover inserts with jacket material matching adjacent pipe insulation. Install shields over jacket, arranged to protect jacket from tear or puncture by hanger, support, and shield.
- K. Apply adhesives, mastics, and sealants at manufacturer's recommended coverage rate and wet and dry film thicknesses.
- L. Install insulation with factory applied jackets as follows:
 - 1. Draw jacket tight and smooth.

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2. Cover circumferential joints with 3-inch (75-mm) wide strips, of same material as insulation jacket. Secure strips with adhesive and outward clinching staples along both edges of strip, spaced 4 inches (100 mm) O.C.
 3. Overlap jacket longitudinal seams at least 1-1/2 inches (38 mm). Install insulation with longitudinal seams at bottom of pipe. Clean and dry surface to receive self-sealing lap. Staple laps with outward clinching staples along edge at 2 inches (50 mm) O.C.
 - a. For below ambient services, apply vapor barrier mastic over staples.
 4. Cover joints and seams with tape, according to insulation material manufacturer's written instructions, to maintain vapor seal.
 5. Where vapor barriers are indicated, apply vapor barrier mastic on seams and joints and at ends adjacent to pipe flanges and fittings.
- M. Cut insulation in a manner to avoid compressing insulation more than 75 percent of its nominal thickness.
- N. Finish installation with systems at operating conditions. Repair joint separations and cracking due to thermal movement.
- O. Repair damaged insulation facings by applying same facing material over damaged areas. Extend patches at least 4 inches (100 mm) beyond damaged areas. Adhere, staple, and seal patches similar to butt joints.
- P. For above ambient services, do not install insulation to the following:
1. Vibration control devices
 2. Testing agency labels and stamps
 3. Nameplates and data plates
 4. Manholes
 5. Hand holes
 6. Cleanouts.

3.3 PENETRATIONS

- A. Insulation Installation at Roof Penetrations:
Install insulation continuously through roof penetrations
1. Seal penetrations with flashing sealant
 2. For applications requiring only indoor insulation, terminate insulation above roof surface and seal with joint sealant. For applications requiring indoor and outdoor insulation, install insulation for outdoor applications tightly joined to indoor insulation ends. Seal joint with joint sealant.
 3. Extend jacket of outdoor insulation outside roof flashing at least 2 inches (50 mm) below top

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of roof flashing.

4. Seal jacket to roof flashing with flashing sealant.

B. Insulation Installation at Underground Exterior Wall Penetrations:

Terminate insulation flush with sleeve seal

1. Seal terminations with flashing sealant.

C. Insulation Installation at Aboveground Exterior Wall Penetrations:

Install insulation continuously through wall penetrations.

1. Seal penetrations with flashing sealant.
2. For applications requiring only indoor insulation, terminate insulation inside wall surface and seal with joint sealant. For applications requiring indoor and outdoor insulation, install insulation for outdoor applications tightly joined to indoor insulation ends. Seal joint with joint sealant.
3. Extend jacket of outdoor insulation outside wall flashing and overlap wall flashing at least 2 inches (50 mm).
4. Seal jacket to wall flashing with flashing sealant.

D. Insulation Installation at Interior Wall and Partition Penetrations (That Are Not Fire Rated):

Install insulation continuously through walls and partitions.

E. Insulation Installation at Fire Rated Wall and Partition Penetrations:

Install insulation continuously through penetrations of fire rated walls and partitions.

1. Comply with requirements in Section 078413 "Penetration Fire stopping" for fire stopping and fire resistive joint sealers.

F. Insulation Installation at Floor Penetrations:

1. Pipe:
Install insulation continuously through floor penetrations.
2. Seal penetrations through fire rated assemblies. Comply with requirements in Section 078413 "Penetration Fire Stopping."

3.4 GENERAL PIPE INSULATION INSTALLATION

- A. Requirements in this article generally apply to all insulation materials except where more specific requirements are specified in various pipe insulation material installation articles.

- B. Install removable insulation covers at locations indicated. Installation shall conform to the following:

1. Make removable flange and union insulation from sectional pipe insulation of same thickness as that on adjoining pipe. Install same insulation jacket as adjoining pipe insulation.
2. When flange and union covers are made from sectional pipe insulation, extend insulation from

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flanges or union long at least two times the insulation thickness over adjacent pipe insulation on each side of flange or union. Secure flange cover in place with stainless steel or aluminum bands. Select band material compatible with insulation and jacket.

3. Construct removable valve insulation covers in same manner as for flanges, except divide the two part section on the vertical center line of valve body.
4. When covers are made from block insulation, make two halves, each consisting of mitered blocks wired to stainless steel fabric. Secure this wire frame, with its attached insulation, to flanges with tie wire. Extend insulation at least 2 inches (50 mm) over adjacent pipe insulation on each side of valve. Fill space between flange or union cover and pipe insulation with insulating cement. Finish cover assembly with insulating cement applied in two coats. After first coat is dry, apply and trowel second coat to a smooth finish.
5. Unless a PVC jacket is indicated in field-applied jacket schedules, finish exposed surfaces with a metal jacket.

3.5 INSTALLATION OF FLEXIBLE ELASTOMERIC INSULATION

- A. Seal longitudinal seams and end joints with manufacturers recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.

B. Insulation Installation on Pipe Flanges:

1. Install pipe insulation to outer diameter of pipe flange.
2. Make width of insulation section same as overall width of flange and bolts, plus twice the thickness of pipe insulation.
3. Fill voids between inner circumference of flange insulation and outer circumference of adjacent straight pipe segments with cut sections of sheet insulation of same thickness as pipe insulation.
4. Secure insulation to flanges and seal seams with manufacturers recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.

C. Insulation Installation on Pipe Fittings and Elbows:

1. Install mitered sections of pipe insulation.
2. Secure insulation materials and seal seams with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.

D. Insulation Installation on Valves and Pipe Specialties:

1. Install preformed valve covers manufactured of same material as pipe insulation when available.
2. When preformed valve covers are not available, install cut sections of pipe and sheet insulation to valve body. Arrange insulation to permit access to packing and to allow valve operation without disturbing insulation.
3. Install insulation to flanges as specified for flange insulation application.

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4. Secure insulation to valves and specialties and seal seams with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.

3.6 FIELD APPLIED JACKET INSTALLATION

- A. Where PVC jackets are indicated, install with 1-inch (25-mm) overlap at longitudinal seams and end joints; for horizontal applications. Seal with manufacturers recommended adhesive.
 1. Apply two continuous beads of adhesive to seams and joints, one bead under lap and the finish bead along seam and joint edge.
- B. Where metal jackets are indicated, install with 2-inch (50-mm) overlap at longitudinal seams and end joints. Overlap longitudinal seams arranged to shed water. Seal end joints with weatherproof sealant recommended by insulation manufacturer. Secure jacket with stainless-steel bands 12 inches (300 mm) O.C. and at end joints.

3.7 FINISHES

- A. Pipe Insulation with ASJ or Other Paintable Jacket Material:
Paint jacket with paint system identified below and as specified in Section 09 91 13 "Exterior Painting" and Section 099123 "Interior Painting."
 1. Flat Acrylic Finish:
Two finish coats over a primer that is compatible with jacket material and finish coat paint. Add fungicidal agent to render fabric mildew proof.
 - a. Finish Coat Material:
Interior, flat, latex-emulsion size.
- B. Flexible Elastomeric Thermal Insulation:
After adhesive has fully cured, apply two coats of insulation manufacturer's recommended protective coating.
- C. Color:
Final color as selected by Owner's Representative. Vary first and second coats to allow visual inspection of the completed Work.
- D. Do not field paint aluminum or stainless steel jackets.

3.8 FIELD QUALITY CONTROL

- A. Perform tests and inspections.
- B. Tests and Inspections:
 1. Inspect pipe, fittings, strainers, and valves, randomly selected by Owner's Representative, by removing field applied jacket and insulation in layers in reverse order of their installation. Extent of inspection shall be limited to three locations of straight pipe, three locations of threaded fittings, three locations of welded fittings, two locations of threaded strainers, two locations of welded strainers, three locations of threaded valves, and three locations of flanged valves for each pipe service defined in the "Piping Insulation Schedule, General" Article.
- C. All insulation applications will be considered defective Work if sample inspection reveals

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noncompliance with requirements.

3.9 PIPING INSULATION SCHEDULE, GENERAL

- A. Acceptable preformed pipe and tubular insulation materials and thicknesses are identified for each piping system and pipe size range. If more than one material is listed for a piping system, selection from materials listed is Contractor's option.
- C. Items Not Insulated:
Unless otherwise indicated, do not install insulation on the following:
 - 1. Drainage piping located in crawl spaces.
 - 2. Chrome plated pipes and fittings unless there is a potential for personnel injury.

3.10 INDOOR PIPING INSULATION SCHEDULE

- A. Refrigerant Suction and Hot-Gas Piping and Flexible Tubing:
Flexible elastomeric, 1 inch (25 mm) thick.

3.11 OUTDOOR, ABOVEGROUND PIPING INSULATION SCHEDULE

- A. Refrigerant Suction and Hot-Gas Piping:
Insulation shall be the following:
 - 1. Flexible Elastomeric:
2 inches (50 mm) thick.

3.12 INDOOR, FIELD-APPLIED JACKET SCHEDULE

- A. Install jacket over insulation material. For insulation with factory applied jacket, install the field applied jacket over the factory applied jacket.
- B. If more than one material is listed, selection from materials listed is Contractor's option.
- C. Piping, Concealed:
 - 1. PVC:
20 mils (0.5 mm) thick.
- D. Piping, Exposed:
 - 1. PVC:
20 mils (0.5 mm) thick.

3.13 OUTDOOR, FIELD-APPLIED JACKET SCHEDULE

- A. Install jacket over insulation material. For insulation with factory-applied jacket, install the field-applied jacket over the factory-applied jacket.
- B. If more than one material is listed, selection from materials listed is Contractor's option.
- C. Piping, Concealed:

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1. PVC:
30 mils (0.8 mm) thick.

D. Piping, Exposed:

1. Aluminum, Smooth:
0.016 inch (0.41 mm) thick.

END OF SECTION

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PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes refrigerant piping used for air-conditioning applications.

1.2 PERFORMANCE REQUIREMENTS

A. Line Test Pressure for Refrigerant R-410A:

1. Suction Lines for Air-Conditioning Applications:
185 psig (1276 kPa)
2. Hot Gas and Liquid Lines:
325 psig (2241 kPa)

1.3 ACTION SUBMITTALS

A. Product Data:

For each type of valve and refrigerant piping specialty indicated. Include pressure drop based on manufacturer's test data.

B. Shop Drawings:

Show layout of refrigerant piping and specialties, including pipe, tube, and fitting sizes, flow capacities, valve arrangements and locations, slopes of horizontal runs, oil traps, double risers, wall and floor penetrations, and equipment connection details. Show interface and spatial relationships between piping and equipment.

1. Refrigerant piping indicated on Drawings is schematic only. Size piping and design actual piping layout, including oil traps, double risers, specialties, and pipe and tube sizes to accommodate, as a minimum, equipment provided, elevation difference between compressor and evaporator, and length of piping to ensure proper operation and compliance with warranties of connected equipment.

1.4 INFORMATIONAL SUBMITTALS

- A. Field quality control test reports.

1.5 CLOSEOUT SUBMITTALS

- A. Operation and maintenance data.

1.6 QUALITY ASSURANCE

- A. Comply with ASHRAE 15, "Safety Code for Refrigeration Systems."
- B. Comply with ASME B31.5, "Refrigeration Piping and Heat Transfer Components."

1.7 PRODUCT STORAGE AND HANDLING

- A. Store piping in a clean and protected area with end caps in place to ensure that piping interior and exterior are clean when installed.

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PART 2 - PRODUCTS

2.1 COPPER TUBE AND FITTINGS

- A. Copper Tube:
ASTM B 280, Type ACR
- B. Wrought Copper Fittings:
ASME B16.22
- C. Wrought Copper Unions:
ASME B16.22
- D. Solder Filler Metals:
ASTM B 32. Use 95-5 tin antimony or alloy HB solder to join copper socket fittings on copper pipe.
- E. Brazing Filler Metals:
AWS A5.8
- F. Flexible Connectors:
 - 1. Body:
Tin bronze bellows with woven, flexible, tinned bronze wire reinforced protective jacket.
 - 2. End Connections:
Socket ends
 - 3. Offset Performance:
Capable of minimum 3/4-inch (20-mm) misalignment in minimum 7-inch (180-mm) long assembly.
 - 4. Pressure Rating:
Factory test at minimum 500 psig (3450 kPa)
 - 5. Maximum Operating Temperature:
250°F (121°C).

2.2 VALVES AND SPECIALTIES

- A. Diaphragm Packless Valves:
 - 1. Body and Bonnet:
Forged brass or cast bronze; globe design with straight-through or angle pattern
 - 2. Diaphragm:
Phosphor bronze and stainless steel with stainless steel spring
 - 3. Operator:
Rising stem and hand wheel
 - 4. Seat:
Nylon

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5. End Connections:
Socket, union, or flanged

6. Working Pressure Rating:
500 psig (3450 kPa)

7. Maximum Operating Temperature:
275°F (135°C)

B. Packed Angle Valves:

1. Body and Bonnet:
Forged brass or cast bronze

2. Packing:
Molded stem, back seating, and replaceable under pressure

3. Operator:
Rising stem

4. Seat:
Nonrotating, self-aligning polytetrafluoroethylene

5. Seal Cap:
Forged brass or valox hex cap

6. End Connections:
Socket, union, threaded, or flanged

7. Working Pressure Rating:
500 psig (3450 kPa)

8. Maximum Operating Temperature:
275°F (135°C).

C. Check Valves:

1. Body:
Ductile iron, forged brass, or cast bronze; globe pattern

2. Bonnet:
Bolted ductile iron, forged brass, or cast bronze; or brass hex plug

3. Piston:
Removable polytetrafluoroethylene seat

4. Closing Spring:
Stainless steel

5. Manual Opening Stem:
Seal cap, plated-steel stem, and graphite seal

6. End Connections:

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Socket, union, threaded, or flanged

7. Maximum Opening Pressure:
0.50 psig (3.4 kPa)
8. Working Pressure Rating:
500 psig (3450 kPa)
9. Maximum Operating Temperature:
275°F (135°C)

D. Service Valves:

1. Body:
Forged brass with brass cap including key end to remove core
2. Core:
Removable ball type check valve with stainless steel spring
3. Seat:
Polytetrafluoroethylene
4. End Connections:
Copper spring
5. Working Pressure Rating:
500 psig (3450 kPa)

E. Solenoid Valves:

Comply with ARI 760 and UL 429; listed and labeled by an NRTL

1. Body and Bonnet:
Plated steel
2. Solenoid Tube, Plunger, Closing Spring, and Seat Orifice:
Stainless steel
3. Seat:
Polytetrafluoroethylene
4. End Connections:
Threaded
5. Electrical:
Molded, watertight coil in NEMA 250 enclosure of type required by location with 1/2-inch (16-GRC) conduit adapter, and 24-VAC coil
6. Working Pressure Rating:
400 psig (2760 kPa)
7. Maximum Operating Temperature:
240°F (116°C)

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8. Manual operator.

F. Safety Relief Valves:

Comply with ASME Boiler and Pressure Vessel Code; listed and labeled by an NRTL.

1. Body and Bonnet:

Ductile iron and steel, with neoprene O-ring seal

2. Piston, Closing Spring, and Seat Insert:

Stainless steel

3. Seat Disc:

Polytetrafluoroethylene

4. End Connections:

Threaded

5. Working Pressure Rating:

400 psig (2760 kPa)

6. Maximum Operating Temperature:

240°F (116°C).

G. Thermostatic Expansion Valves:

Comply with ARI 750

1. Body, Bonnet, and Seal Cap:

Forged brass or steel

2. Diaphragm, Piston, Closing Spring, and Seat Insert:

Stainless steel

3. Packing and Gaskets:

Non-asbestos

4. Capillary and Bulb:

Copper tubing filled with refrigerant charge

5. Suction Temperature:

40°F (4.4°C)

6. Superheat:

Adjustable

7. Reverse flow option (for heat-pump applications)

8. End Connections:

Socket, flare, or threaded union

9. Working Pressure Rating:

700 psig (4820 kPa).

H. Straight-Type Strainers:

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1. Body:
Welded steel with corrosion-resistant coating
 3. Screen:
100-mesh stainless steel
 4. End Connections:
Socket or flare
 5. Working Pressure Rating:
500 psig (3450 kPa)
 6. Maximum Operating Temperature:
275°F (135°C).
- I. Angle Type Strainers:
1. Body:
Forged brass or cast bronze
 2. Drain Plug:
Brass hex plug
 3. Screen:
100-mesh monel
 4. End Connections:
Socket or flare
 5. Working Pressure Rating:
500 psig (3450 kPa)
 6. Maximum Operating Temperature:
275°F (135°C)
- J. Moisture/Liquid Indicators:
1. Body:
Forged brass
 2. Window:
Replaceable, clear, fused glass window with indicating element protected by filter screen
 3. Indicator:
Color coded to show moisture content in ppm
 4. Minimum Moisture Indicator Sensitivity:
Indicate moisture above 60 ppm
 5. End Connections:
Socket or flare

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6. Working Pressure Rating:
500 psig (3450 kPa)
7. Maximum Operating Temperature:
240°F (116°C)
- K. Replaceable Core Filter Dryers:
Comply with ARI 730
 1. Body and Cover:
Painted steel shell with ductile-iron cover, stainless-steel screws, and neoprene gaskets
 2. Filter Media:
10 micron, pleated with integral end rings; stainless steel support
 3. Desiccant Media:
Activated alumina
 4. Designed for reverse flow (for heat-pump applications)
 5. End Connections:
Socket
 6. Access Ports:
NPS 1/4 (DN 8) connections at entering and leaving sides for pressure differential measurement
 7. Maximum Pressure Loss:
2 psig (14 kPa)
 8. Working Pressure Rating:
500 psig (3450 kPa)
 9. Maximum Operating Temperature:
240°F (116°C)
- L. Permanent Filter Dryers:
Comply with ARI 730.
 1. Body and Cover:
Painted steel shell
 2. Filter Media:
10 micron, pleated with integral end rings; stainless steel support
 3. Desiccant Media:
Activated alumina
 4. Designed for reverse flow (for heat-pump applications)
 5. End Connections:
Socket.

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6. Access Ports:
NPS 114 (DN 8) connections at entering and leaving sides for pressure differential measurement
7. Maximum Pressure Loss:
2 psig (14 k.Pa)
8. Working Pressure Rating:
500 psig (3450 k.Pa)
9. Maximum Operating Temperature:
240°F (116°C)
- M. Liquid Accumulators:
Comply with ARI 495
 1. Body:
Welded steel with corrosion resistant coating
 2. End Connections:
Socket or threaded
 3. Working Pressure Rating:
500 psig (3450 kPa)
 4. Maximum Operating Temperature:
275°F (135°C)

2.3 REFRIGERANTS

- A. Available Manufacturers:
Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 1. Atofina Chemicals, Inc.
 2. DuPont Company; Fluorochemicals Div.
 3. Honeywell, Inc.; Genetron Refrigerants
 4. INEOS Fluor Americas LLC.
- B. R-410a

PART 3- EXECUTION

3.1 PIPING APPLICATIONS

- A. Suction Lines NPS 1-1/2 (DN 40) and Smaller for Conventional Air Conditioning Applications:
Copper, Type ACR, annealed temper tubing and wrought copper fittings with soldered joints.
- B. Suction Lines NPS 4 (DN 100) and Smaller for Conventional Air Conditioning Applications:

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Copper, Type ACR, drawn temper tubing and wrought copper fittings with brazed or soldered joints.

C. Hot-Gas and Liquid Lines:

1. NPS 1-1/2 (DN 40) and Smaller:

Copper, Type ACR, annealed temper tubing and wrought copper fittings with soldered joints

2. NPS 1-1/2 (DN 40) and Smaller:

Copper, Type ACR, drawn temper tubing and wrought copper fittings with soldered joints.

D. Safety Relief Valve Discharge Piping:

Copper, Type ACR, drawn temper tubing and wrought copper fittings with soldered joints.

3.2 VALVE AND SPECIALTY APPLICATIONS

A. Install diaphragm packless valves in suction and discharge lines of compressor.

B. Install service valves for gage taps at strainers if they are not an integral part of strainers.

C. Install a check valve at the compressor discharge and a liquid accumulator at the compressor suction connection.

D. Except as otherwise indicated, install diaphragm packless valves on inlet and outlet side of filter dryers.

E. Install a full-sized, three-valve bypass around filter dryers.

F. Install solenoid valves upstream from each expansion valve. Install solenoid valves in horizontal lines with coil at top.

G. Install thermostatic expansion valves as close as possible to distributors on evaporators.

1. Install valve so diaphragm case is warmer than bulb.

2. Secure bulb to clean, straight, horizontal section of suction line using two bulb straps. Do not mount bulb in a trap or at bottom of the line.

3. If external equalizer lines are required, make connection where it will reflect suction-line pressure at bulb location.

H. Install safety relief valves where required by ASME Boiler and Pressure Vessel Code. Pipe safety relief valve discharge line to outside according to ASHRAE 15.

I. Install moisture/liquid indicators in liquid line at the inlet of the thermostatic expansion valve or at the inlet of the evaporator coil capillary tube.

K. Install strainers upstream from and adjacent to the following unless they are as an integral assembly for device being protected:

1. Solenoid valves

2. Thermostatic expansion valves

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3. Compressor

K. Install filter dryers in liquid line between compressor and thermostatic expansion valve, and in the suction line at the compressor.

L. Install flexible connectors at compressors.

3.3 PIPING INSTALLATION

A. Drawing plans, schematics, and diagrams indicate general location and arrangement of piping systems; indicated locations and arrangements were used to size pipe and calculate friction loss, expansion, pump sizing, and other design considerations. Install piping as indicated unless deviations to layout are approved on Shop Drawings.

B. Install refrigerant piping according to ASHRAE 15.

C. Install piping in concealed locations unless otherwise indicated and except in equipment rooms and service areas.

D. Install piping indicated to be exposed and piping in equipment rooms and service areas at right angles or parallel to building walls. Diagonal runs are prohibited unless specifically indicated otherwise.

E. Install piping above accessible ceilings to allow sufficient space for ceiling panel removal.

F. Install piping adjacent to machines to allow service and maintenance.

G. Install piping free of sags and bends.

H. Install fittings for changes in direction and branch connections.

I. Select system components with pressure rating equal to or greater than system operating pressure.

J. Install piping as short and direct as possible, with a minimum number of joints, elbows, and fittings.

K. Arrange piping to allow inspection and service of refrigeration equipment. Install valves and specialties in accessible locations to allow for service and inspection.

M. Install refrigerant piping in protective conduit where installed belowground.

N. Install refrigerant piping in rigid or flexible conduit in locations where exposed to mechanical injury.

O. Slope refrigerant piping as follows:

1. Install horizontal hot gas discharge piping with a uniform slope downward away from compressor.

2. Install horizontal suction lines with a uniform slope downward to compressor.

3. Install traps and double risers to entrain oil in vertical runs.

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- 4. Liquid lines may be installed level.
- P. When brazing or soldering, remove solenoid valve coils and sight glasses; also remove valve stems, seats, and packing, and accessible internal parts of refrigerant specialties. Do not apply heat near expansion-valve bulb.
- Q. Install piping with adequate clearance between pipe and adjacent walls and hangers or between pipes for insulation installation.
- R. Identify refrigerant piping and valves according to Section 230553 "Identification for HVAC Piping and Equipment."
- S. Install sleeves for piping penetrations of walls, ceilings, and floors. Comply with requirements for sleeves specified in Section 230517 "Sleeves and Sleeve Seals for HVAC Piping."
- T. Install sleeve seals for piping penetrations of concrete walls and slabs. Comply with requirements for sleeve seals specified in Section 230517 "Sleeves and Sleeve Seals for HVAC Piping."
- U. Install escutcheons for piping penetrations of walls, ceilings, and floors.

3.4 PIPE JOINT CONSTRUCTION

- A. Soldered Joints:
Construct joints according to ASTM B 828 or CDA's "Copper Tube Handbook."
- B. Brazed Joints:
Construct joints according to AWS's "Brazing Handbook," Chapter "Pipe and Tube."
 - 1. Use Type BcuP, copper phosphorus alloy for joining copper socket fittings with copper pipe.
 - 2. Use Type BA_g, cadmium free silver alloy for joining copper with bronze or steel.

3.5 HANGERS AND SUPPORTS

- A. Hanger, support, and anchor products are specified in Section 230529 "Hangers and Supports for HVAC Piping and Equipment."
- B. Install the following pipe attachments:
 - 1. Adjustable steel clevis hangers for individual horizontal runs less than 20 feet (6 m) long.
 - 2. Roller hangers and spring hangers for individual horizontal runs 20 feet (6 m) or longer.
 - 3. Pipe Roller:
MSS SP-58, Type 44 for multiple horizontal piping 20 feet (6 m) or longer, supported on a trapeze.
 - 4. Spring hangers to support vertical runs.
 - 5. Copper-clad hangers and supports for hangers and supports in direct contact with copper pipe.
- C. Install hangers for copper tubing with the following maximum spacing and minimum rod sizes:
 - 1. NPS 1/2 (DN 15):

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Maximum span, 60 inches (1500 mm); minimum rod size, 1/4 inch (6.4 mm)

2. NPS 5/8 (DN 18):
Maximum span, 60 inches (1500 mm); minimum rod size, 1/4 inch (6.4 mm)
3. NPS 1 (DN 25):
Maximum span, 72 inches (1800 mm); minimum rod size, 1/4 inch (6.4 mm)
4. NPS 1-1/4 (DN 32):
Maximum span, 96 inches (2400 mm); minimum rod size, 3/8 inch (9.5 mm)
5. NPS 1-1/2 (DN 40):
Maximum span, 96 inches (2400 mm); minimum rod size, 3/8 inch (9.5 mm)

D. Support multi-floor vertical runs at least at each floor.

3.6 FIELD QUALITY CONTROL

A. Perform tests and inspections and prepare test reports.

B. Tests and Inspections:

1. Comply with ASME B31.5, Chapter VI.
2. Test refrigerant piping and specialties. Isolate compressor, condenser, evaporator, and safety devices from test pressure if they are not rated above the test pressure.
3. Test high and low pressure side piping of each system separately at not less than the pressures indicated in Part 1 "Performance Requirements" Article.
 - a. Fill system with nitrogen to the required test pressure.
 - b. System shall maintain test pressure at the manifold gage throughout duration of test.
 - c. Test joints and fittings with electronic leak detector or by brushing a small amount of soap and glycerin solution over joints.
 - d. Remake leaking joints using new materials, and retest until satisfactory results are achieved.

3.7 SYSTEM CHARGING

A. Charge system using the following procedures:

1. Install core in filter dryers after leak test but before evacuation.
2. Evacuate entire refrigerant system with a vacuum pump to 500 micrometers (67 Pa). If vacuum holds for 12 hours, system is ready for charging.
3. Break vacuum with refrigerant gas, allowing pressure to build up to 2 psig (14 kPa).
4. Charge system with a new filter-dryer core in charging line.

3.8 ADJUSTING

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- A. Adjust thermostatic expansion valve to obtain proper evaporator superheat.
- B. Adjust high and low pressure switch settings to avoid short cycling in response to fluctuating suction pressure.
- C. Adjust set point temperature of air conditioning or chilled water controllers to the system design temperature.
- D. Perform the following adjustments before operating the refrigeration system, according to manufacturer's written instructions:
 - 1. Open shutoff valves in condenser water circuit.
 - 2. Verify that compressor oil level is correct.
 - 3. Open compressor suction and discharge valves.
 - 4. Open refrigerant valves except bypass valves that are used for other purposes.
 - 5. Check open compressor-motor alignment and verify lubrication for motors and bearings.
- E. Replace core of replaceable filter dryer after system has been adjusted and after design flow rates and pressures are established.

END OF SECTION

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1. GENERAL

1.1 SECTION INCLUDES

- i.
 - A. Above grade pipe, fittings, and joints for:
 - 1. Heating water piping systems.
 - 2. Chilled water piping systems.
 - 3. Heat pump water piping systems.
 - 4. Equipment drains and overflows.
 - B. Valves for:
 - 1. Heating water piping systems.
 - 2. Chilled water piping systems.
 - 3. Heat pump water piping systems.
 - 4. Equipment drains and overflows.

1.2 SYSTEM DESCRIPTION

- A. Where more than one piping system material is specified, ensure system components are compatible and joined to ensure the integrity of the system is not jeopardized. Provide necessary joining fittings. Ensure flanges, union, and couplings for servicing are consistently provided.
- ii.
 - B. Use unions, flanges, and couplings downstream of valves and at equipment or apparatus connections. Do not use direct welded or threaded connections to valves, equipment or other apparatus.
- iii.
 - C. Where connecting ferrous and non-ferrous piping materials, use full-port ball valves with bronze construction or a galvanized steel dielectric nipples with plastic liner to separate piping materials.
- iv.
 - D. Use gate, ball or butterfly valves for shut-off and to isolate equipment, part of systems, or vertical risers or as shown on plans.
- v.
 - E. Use ball or butterfly valves for throttling, bypass, or manual flow control services or as shown on plans.

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vi.

- F. Use lug end butterfly valves to isolate equipment.

vii.

1.3 REGULATORY REQUIREMENTS

- A. Conform to International Mechanical Code for installation of piping system.

viii.

- B. Welding Materials and Procedures:

- ix. Conform to ASME SEC 9 and applicable state and local labor regulations.

x.

- C. Welders shall be certified using AWS testing methods.

xi.

1.4 EXTRA MATERIALS

- A. Provide two repacking kits for each size and valve type.

xii.

2. PRODUCTS

2.1 STEEL PIPING, FITTINGS, AND JOINTS

- A. Applicable Systems:

xiii.

- 1. Heating water
- 2. Chilled water
- 3. Condenser water
- 4. Heat pump water

- B. Pipe:

- xiv. ASTM A53, Schedule 40, black steel.

xv.

- C. Fittings (2" and smaller):

xvi.

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1. Malleable Iron:

xvii. ASTM B16.3, Class 150, threaded

xviii.

2. Cast Iron:

xix. ASTM B16.4, Class 125, threaded

xx.

D. Fittings (2-1/2" and larger):

xxi.

1. ASTM B16.9, steel butt weld fittings. Bushings are not permitted, use standard reducing fittings.

E. Joints (2" and smaller):

xxii. Threaded. Joint compound must be rated for propylene glycol usage.

xxiii.

F. Joints (2-1/2" and larger):

xxiv.

1. AWS D1.1, welded.

G. Branch Tees:

xxv. Weld-O-Lets and Thread-O-Lets are acceptable for branch piping when main piping is 1" or larger than branch piping.

xxvi.

H. Saddle Tees:

xxvii. Are acceptable for branch piping when main piping is 2" or larger than branch piping

xxviii.

I. Unions (2" and smaller):

xxix. 150 psig malleable iron, threaded.

xxx.

J. Flanges (2-1/2" and larger):

xxxi. 150 psig forged steel, slip-on, 1/16 inch thick preformed neoprene gaskets.

xxxii.

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K. Steel (ferrous) piping, fittings and equipment shall not be used in process cooling water systems.

xxxiii.

2.2 COPPER TUBING, FITTINGS, AND JOINTS

A. Applicable Systems:

xxxiv.

1. Heating water
2. Chilled water
3. Condenser water
4. Heat pump water
5. Equipment drains and overflows

B. Pipe:

xxxv. ASTM B88, Type L, hard drawn

xxxvi.

C. Copper Tubing:

xxxvii. ASTM B88, Type DWV, hard drawn piping on equipment drains and overflows only.

xxxviii.

D. Fittings and Unions (2" and smaller):

xxxix. ASME B16.22 wrought copper and bronze:

xl.

1. Solder filler metals:
ASTM B32, lead-free alloys
2. Flux:
ASTM B813, water-flushable

E. Joints (All sizes):

xli.

1. Copper to copper:
AWS A5.8/A5.8M, BCuP-5 (15% silver), Copper-phosphorus alloy
2. Copper to bronze or steel:
AWS A5.8/A5.8M, BAg-1, Silver alloy (45% silver), non-corrosive flux

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F. Flanges (2-1/2" and larger):

- xlii. Bronze, 1/16 inch thick preformed neoprene gaskets.

xliii.

2.3 DIELECTRIC NIPPLE

- A. Electroplated steel nipple, complying with ASTM F 1545 and IAPMO PS 66.
Rated for 300 psig at 225°F.

- 1. Male threaded or grooved end connections.
- 2. Inert and noncorrosive propylene lining.

2.4 VALVES

A. CALIBRATED BALANCE VALVES:

xliv.

- 1. Pre-Set Balance Feature:
Valves to be designed to allow Installing Contractor to pre-set balance points for proportional system balance prior to system start-up in accordance with scheduled flow rates.
- 2. Valve Design and Construction:
All valves shall have a calibrated orifice or venturi section, two 1/4" threaded pressure tap ports with integral seals, and memory stop to retain the set position. Valves should be rated for 125 psig working pressure and 250 Deg. F maximum operating temperature.
- 3. Valves shall be selected based on flowrate, not on pipe size dimensions.
- 4. Preformed Insulation:
All valves to be provided with molded insulation to permit access for balance and read-out.

B. GATE VALVES:

xlv.

- 1. Up To and Including 2 Inches:
 - a. Bronze body, bronze trim, union bonnet, rising stem, lock shield stem hand wheel, inside screw with back seating stem, solid wedge disc, alloy seat rings, solder or threaded ends, Class 125, MSS SP-80. Add valve stem extensions to all valves that will be installed in insulated piping systems.
- 2. Over 2 Inches:
 - a. Iron body, bronze trim, bolted bonnet, rising stem, hand wheel, outside screw and yoke, solid wedge disc with bronze seat rings, flanged or grooved ends, Class

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125, MSS SP-70. Add valve stem extensions to all valves that will be installed in insulated piping systems.

- b. Chain wheel:
On valves 6" and larger and installed higher than 8-feet above finished floor, provide sprocket rim, brackets, and chain compatible with valve.

C. BALL VALVES:

xlvi.

- 1. Up To and Including 2 Inches:
 - a. Bronze two piece body, stainless steel full-port ball on all systems, "glass filled" Teflon seats and stuffing box ring, lever handle with balancing stops, solder or threaded ends. Include stem extensions on valves used in insulated piping systems.
 - b. Energy isolation ball valves shall be provided with lockable handle.

D. BUTTERFLY VALVES:

xlvi.

- 1. 2-1/2 Inches and Larger:
 - a. Body:
Cast or ductile iron with resilient replaceable EPDM seat, lug ends, extended neck.
 - b. Disc:
Aluminum bronze on closed systems and stainless steel on open systems.
 - c. Stem:
Stainless steel, extended on insulated systems as required to allow valve operation without damage to the insulation.
 - d. Operator (4" and smaller):
10 position lever handle with memory stop, gear drive.
 - e. Operator (6" and larger):
Hand wheel, gear drive.
 - f. Chain wheel:
On valves 6" and larger and installed higher than 8-feet above finished floor, provide sprocket rim, brackets, and chain compatible with valve.

E. SWING CHECK VALVES:

xlvi.

- 1. Up To and Including 2 Inches:

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- a. Bronze body, bronze trim, bronze rotating swing disc, with composition disc, solder or threaded ends.
- 2. Over 2 Inches:
 - a. Iron body, bronze trim, bronze or bronze faced rotating swing disc, renewable disc and seat, flanged ends.

F. SPRING LOADED CHECK VALVES:

- xlix.
 - 1. Iron body, bronze trim, split plate, hinged with stainless steel spring, resilient seal bonded to body, wafer or threaded lug ends.

3. EXECUTION

3.1 PREPARATION

- i.
 - A. Ream pipe and tube ends to full inside diameter using tools designed for this purpose. Remove burrs. Bevel or groove plain end ferrous pipe.
- ii.
 - B. Remove scale and dirt on inside and outside before assembly.
- iii.
 - C. Prepare piping connections to equipment with flanges or unions.
- liii.
 - D. Unions and flanges for servicing and disconnect are not required in installations with grooved mechanical joint couplings. (The couplings shall serve as disconnect points.)
- liv.
 - E. Keep open ends of pipe free from scale and dirt. Protect open ends with temporary plugs or caps.

3.2 INSTALLATION

- lv.
 - A. Where connecting ferrous and non-ferrous piping materials, use full-port ball valves with bronze construction or a galvanized steel dielectric nipples with plastic liner to separate piping materials.
- lvi.
 - B. Heating water connections to terminal units shall be copper (no steel).
- lvii.
 - C. Install all piping in accordance with ASME B31.9.

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lviii.

- D. Route piping in orderly manner, parallel to building structure, and maintain gradient.

lix.

- E. Install piping to conserve building space, and not interfere with use of space.

lx.

- F. Group piping whenever practical at common elevations.

lxi.

- G. Sleeve pipe passing through partitions, walls and floors as follows:
 - 1. Install schedule 40 pipe sleeves at fire rated walls and floors. Seal with UL approved fire stopping material as specified in Section 07840.
 - 2. Install minimum 18 gage pipe sleeves at non rated walls.
 - 3. Sleeves through floors should extend a minimum of 2” above finished floor.
 - 4. Sleeves through walls should be flush with the wall surface.
 - 5. All sleeves should be large enough to has insulated piping with crushing the insulation.

- H. Slope piping and arrange to drain at low points.

lxii.

- I. Install piping to allow for expansion and contraction without stressing pipe, joints, or connected equipment.

lxiii.

- J. Refer to Section 230529 and Section 230548 for installation of supports and hangers.

lxiv.

- K. Provide insulation clearance and access to valves and fittings in hangers and from structure and other equipment. Insulation shall be continuous through all hangers and supports. Refer to Section 230719.

lxv.

- L. Provide access where valves and fittings are not exposed. Coordinate size and location of access doors with General Contractor.

lxvi.

- M. Slope piping and arrange systems to drain at low points. Use eccentric reducers to maintain top of pipe level.

lxvii.

SECTION 232113 – HYDRONIC PIPING

GOVERNMENT OF THE U. S. VIRGIN ISLANDS, DEPARTMENT OF PUBLIC WORKS

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- N. Install unions on both sides of each control valve and on one side of all other valves. Install unions on the equipment side of final connections to each piece of equipment. Unions are not required at flanged valves or equipment or equipment or in grooved joint piping systems.

lxviii.

- O. Where pipe support members are welded to structural building framing, scrape, brush clean, and apply one coat of zinc rich primer to welds.

lxix.

- P. Prepare unfinished pipe, fittings, supports, and accessories, ready for finish painting.

lxx.

- Q. Install valves with stems upright or horizontal, not inverted.

lxxi.

- R. Provide insulated valve stem extensions on all valves installed in insulated piping systems.

lxxii.

- S. Install chain wheel operators on valves 4" and larger that are installed 8-feet above finished floor or greater. Extend chain down to maximum 5-feet above finished floor.

lxxiii.

- T. Pipe connections shall be installed with the branch piping connected to the top of the main/header. If this is not possible due to space constraints, a connection with the same vertical centerline is acceptable. Connections to the bottom of the main/header is not allowed.

lxxiv.

- U. Hydronic systems shall be designed and constructed with isolation valves at branch taps for all floors.

lxxv.

- V. Provide solid chrome plated steel escutcheons cover the sleeves and openings at walls and ceilings in exposed areas.

lxxvi.

- W. Process cooling water systems are to be constructed entirely of non-ferrous materials, including but not limited to, piping, pumps, filters, heat exchangers, valves, and air separators. The exception to this is that stainless steel pipe and fittings may be used.

3.3 SYSTEM FLUSHING, FILLING, PRESSURE TESTING AND CLEANING

- A. Flush, fill, pressure test and clean all new hydronic systems and parts of existing systems which have been altered, extended or repaired.

lxxvii.

SECTION 232113 – HYDRONIC PIPING

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- B. Flush and fill systems with all valves open to coils. Bleed air from coils and piping. Clean strainers. Refer to Section 232500.

lxxviii.

- C. Pressure Test Procedure:

lxxix.

1. Submit copy of pipe pressure test log for each section of piping tested.
2. Leave joints including welds uninsulated and exposed for examination during the test.
3. Provide temporary restraints for expansion joints which cannot sustain the reactions due to test pressure. If temporary restraints are not practical, isolate expansion joints from testing.
4. Isolate equipment that is not to be subjected to the test pressure from the piping. If a valve is used to isolate the equipment, its closure shall be capable of sealing against the test pressure without damage to the valve. Flanged joints at which blinds are inserted to isolate equipment need not be tested.
5. Install relief valve set at a pressure no more than 1/3 higher than the test pressure, to protect against damage by expansion of liquid or other source of overpressure during the test.
6. Subject piping system to a hydrostatic test pressure which at every point in the system is not less than 1.5 times the design pressure. The test pressure shall not exceed the maximum pressure for any vessel, pump, valve, or other component in the system under test.
7. After the hydrostatic test pressure has been applied for at least 12 hours, examine piping, joints, and connections for leakage. Eliminate leaks by tightening, repairing, or replacing components as appropriate, and repeat hydrostatic test until there are no leaks.

- D. Clean systems. Refer to Section 232500 for cleaning procedure.

END OF SECTION

SECTION 232500 – HVAC WATER TREATMENT SYSTEMS

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GENERAL

SUMMARY

- lxxx. Section includes:
1. Materials, components, equipment and chemicals for installation of complete HVAC water treatment.

RELATED SECTIONS

- lxxxi. Section 01300 – Submittal Procedures.
- lxxxii. Section 01710 – Cleanup
- lxxxiii. Section 01700 – Contract Closeout
- lxxxiv. Section 01780 - Closeout

REFERENCES

- A. American Society of Mechanical Engineers (ASME)
1. ASME Boiler and Pressure Vessel Code, Section VII.
- B. Health Canada / Workplace Hazardous Materials Information System (WHMIS)
- Materials Safety Data Sheets (MSDS)

SUBMITTALS

- lxxxv. Product Data:
- Submit manufacturer's printed product literature, specifications and datasheet in accordance with Section 01300 – Submittals. Include product characteristics, performance criteria, and limitations.
- a. Submit two copies of Workplace Hazardous Materials Information System (WHMIS) Material Safety Data Sheets (MSDS) in accordance with Section 01300 – Submittal Procedures.
- lxxxvi. Shop Drawings:
- Submit Shop drawings in accordance with Section 01300 – Submittal Procedures.
- lxxxvii. Quality assurance submittals: submit following in accordance with Section 01300 – Submittal Procedures.
- Certificates: Submit certificates signed by manufacturer certifying that materials comply with specified performance characteristics and physical properties.
- lxxxviii. Closeout submittals:
- Submit operation and maintenance data for incorporation into manual specified in Section 01700 – Contract Closeout
- Include the following:

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- a. Log sheets as recommended by Owner's Representative.

QUALITY ASSURANCE

- lxxxix. Health and Safety:
 - Do construction occupational health and safety in accordance with OSHA – Health and Safety Requirements.
- xc. Trades people to have journeyperson qualifications and training provided by the manufacturer.

DELIVERY, STORAGE, AND HANDLING

- xc. Packing, shipping, handling, and unloading:
 - Deliver, store, and handle in accordance with manufacturer's written instructions and Sections 01620 – Transportation and Handling, and 1630 – Storage and Protection.
- xcii. Waste Management and Disposal:
 - Construction/Demolition Waste Management and Disposal: separate waste materials for reuse and recycling in accordance with Section 01710 – Cleanup.

PRODUCTS

MANUFACTURER

- xciii. Equipment, chemicals, service by one supplier.

BYPASS POT FEEDERS

- xciv. Bypass filter feeders to be supplied and installed in the following systems:
 - Hot water heating system (electric).
 - Hot water heating system (gas).
 - Maximum working pressure:
 - 1378 kPa.
 - Tank shell:
 - 10 gauge steel
 - Tank head:
 - 9 gauge steel.
 - Cap: cast iron with Buna 'N' square O-ring seal. Cap to have wide mouth, easy open-easy close.
 - Vertical style with bottom dished in.
 - NPT female $\frac{3}{4}$ connections.
 - Provide each bypass feeder with a 30 micron filter bag to filter chemical before injection into closed loop heating systems.
 - Capacity: 38 L.

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SAMPLE COOLERS

- xcv. Sample coolers are to be provided for the following systems:
 - Hot water heating return system.
- xcvi. Stainless steel 316 coil with carbon steel.
- xcvii. Designed to allow removal of coil for inspection and cleaning.
- xcviii. Maximum working pressure of 10.33 MPa at 316°C.
- xcix. Tubing tail sample water connections of ¼ OD.
 - c. NPT ½ female connections for coolant water.

CHEMICAL FEED PIPING

- ci. Schedule 80 PVC with solvent welded joints.

CLOSED LOOP HOT WATER SYSTEMS CHEMICAL TREATMENT.

- cii. Prior to chemical treatment all closed looped heating piping systems to be mechanically cleaned in accordance with the requirements of Section 23 08 02 – Cleaning and Start-up of Mechanical Piping Systems.
- ciii. Chemical treatment to consist of a Molybdate based closed system treatment which shall protect the piping system by forming a thin film on the internal piping surfaces.
- civ. Solution to be added through bypass filter feeder specified previously.
- cv. Provide one (1) Molybdenum test kit to verify water treatment performance.
- cvi. Recommended start-up dosage to be in accordance with feed rate as determined by water treatment system supplier. For purpose of tendering consider 75-100ppm of Molybdate.
- cvii. Solution to arrive on site in sealed drums in liquid form. Contractor responsible to store the chemical in a cool, dry, well ventilated area.
- cviii. Product data:
 - Liquid
 - Clear pale yellow color
 - Zero degree Celcius freeze point
 - pH of 11.2
 - Specific gravity of 1.132
- cix. Provide one (1) year supply of chemical to protect systems from corrosion.

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LOW PRESSURE CHEMICAL TREATMENT

- cx. The low pressure steam chemical treatment system to consist of addition of a multi-blend chemical into the boiler feed water tank for purpose of scale and corrosion control.

- cxi. Chemical metering pump:

General:

Chemical metering pump to be positive displacement, diaphragm type pump. Output volume shall be adjustable while pump is in operation from zero to maximum capacity as indicated.

Adjustment to be made by readily accessible dial knobs, one for changing stroke length and the other for changing stroke frequency. Both knobs are to be located opposite the liquid handling end. On-off switch to be integral with frequency control, 'off' position to be below lowest frequency setting.

Chemical metering pump to be capable, without a hydraulically backed diaphragm, of injecting chemicals against pressures up to 1722 kPa.

Drive:

The pump drive totally enclosed with no exposed moving parts. Solid state electronic pulser fully encapsulated with quick connect terminals Electronics housed in chemical resistant enclosure at the rear of the pump for maximum protection against chemical spillage.

Provide pump with splash guard.

Automatic pressure relief

Chemical metering pump to automatically stop pulsating when discharge pressure exceeds pump pressure rating by not more than 35%.

Material:

Chemical metering pump housing to be of chemically resistant glass fiber reinforced thermoplastic. All exposed fasteners to be stainless steel. Pump head to be PVDF material capable of resisting the pumped chemical. Fittings and connections at pump head to be PVDF. Pump diaphragm to have a Teflon face while the liquid end seal rings to be of Polyprel.

Suction valves and tubing:

A total of 1.5 m of polyethylene suction tubing to be provided per pump complete with compression connections. A foot valve with integral one-piece strainer shall be provided for suction line.

Drive assembly output specifications:

Strokes per minute:
5 to 100.

Stroke length:
0-100% adjustable.

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Maximum recommended stroke length:
20%.

Output per stroke:
0.08 to 0.37 mL

cxii. Polyethylene solution tanks:

Self-supporting with 19 L graduations.

Ultra-violet light resistant construction.

189 liter capacity.

Cover of molded black rigid polyethylene with recess for mounting pump, agitator and liquid level switch.

Supply and install suction tube shield of PVC construction to prevent curling of suction tubing, keep foot valve at bottom of tank, and prevent suction tubing from wrapping around agitator shaft.

cxiii. Agitator:

For mounting on polyethylene solution tank.

Electrical:
115/1/60, 1.5 amps, 175 watts, 1/20 hp.

Shaft:
850 mm in length of stainless steel construction with a chemical resistant coating.

Impeller:
Stainless steel construction with a chemical resistant coating.

cxiv. Liquid level switch assembly:

Corrosion resistant switch assembly housing of glass reinforced polypropylene.

PVC float tube.

Foamed polypropylene float with encapsulated reed switch.

Float protector to prevent false activation due to turbulence and rough handling.

Low voltage (12 volts) transformer to reed switch for safety.

Pilot lights indicate low level and pump on.

For mounting on polyethylene solution tank.

Duplex receptacle on switch assembly housing. One receptacle for plug-in of metering pump and the other to drive an alarm device such as a light or a horn.

Electrical:
115/1/60, maximum load of 10 amps.

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cxv. Pressure relief valve:

Constructed of 316 Stainless Steel

Adjustable pressure range from 207 kPa to 689 kPa.

Inlet/Outlet pipe size:

½ NPT

Set pressure at factory:

As indicated

Capacity:

As indicated

Liquid service only.

Design shall utilize a self-cleaning ball check and seat. A spring guide shall assure proper spring loading and consistent relief capacity.

Relief pressure setting shall be easily changed by removing top cap and adjusting spring tension.

cxvi. Calibration column:

To enable field checking of chemical metering pump flow rate

PVC construction with slip on top cap

Calibration scale protected by Mylar lamination.

½ NPT female end connections

Vented to atmosphere

Capacity:

100 mL

Scale graduation increments:

1.0 mL

350 mm in length x 41 mm diameter

cxvii. Back pressure regulating valve:

Maintains minimum backpressure at pump discharge to prevent chemical tank siphonage as well as to protect pump from excessive flow/low head operating conditions.

316 stainless steel construction

Field adjustable set pressure to maximum of 344 kPa.

½ NPT female end connections

Maximum flow as indicated

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Teflon diaphragm

cxviii. Pulsation damper:

To be installed on discharge side of chemical metering positive displacement pump to remove pulsations caused by stop/start action of pump.

Equipped complete with liquid filled pressure gauge and air charging valve

Teflon bladder

Degree of dampening to be 95%

Damper size:

65.6 cubic centimeters.

Pressure rating:

2.06 MPa.

Connection size:

3/8 NPT female.

Provide complete with charging kit accessory package consisting of 2.4 m of 34.4 MPa rated charging hose with male 1/4 NPT fitting at one end for connection to nitrogen bottle regulator and charging adapter with purge valve and gauge at other end.

cxix. Corporation stop/Injection quill:

Utilized for injecting chemicals pumped by metering pumps into tanks and piping mains.

Corporation stop allows injection quill to be inserted or removed without having to drain or shutdown system.

Maximum working pressure of 1.033 MPa.

Quill 316 stainless steel construction.

Brass corporation stop with 3/4 NPT male connection.

Protection chain to prevent withdrawal of injection quill before corporation stop is closed.

cxx. The multi-blend chemical to be utilized in the low pressure steam system to be a complete internal water treatment system for scale and corrosion control in condensate lines and the boiler; include a neutralizing amine to protect the condensate system from carbonic acid corrosion; include molybdate to ensure passivation of ferrous metal surfaces and prevent oxygen pitting; include a phosphate/alkaline program to treat against hardness and scale in the feed water; and shall include a dispersant to reduce the deposition of particulate matter on heat transfer and equipment surfaces.

cxxi. Solution to be pumped into boiler feed tank by chemical metering pump specified previously.

cxxii. Provide a drop test kit containing all required equipment for P-Alkalinity, M-Alkalinity, Chlorides, Hardness, Phosphates, Sulfites, TDS and pH.

cxxiii. Recommended start-up dosage to be in accordance with feed rate as determined by water treatment system supplier. For purposes of tendering consider 75-100 PPM of molybdate.

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- cxxiv. Solution to arrive on site in sealed drums in liquid form. Contractor responsible to store the chemical in a cool, dry, well ventilated area.
- cxxv. Product data:
 - Liquid
 - Clear
 - Zero degree Celsius freeze point
 - pH of 12.4
 - Specific gravity of 1.152
- cxxvi. Provide one (1) year supply of chemical as required for chemical treatment of the low pressure system piping and equipment.

EXECUTION

INSTALLATION

- cxxvii. Install HVAC water treatment systems in accordance with ASME Boiler Code Section VII, and requirements and standards of authorities having jurisdiction, except where specified otherwise.
- cxxviii. Ensure adequate clearances to permit performance of servicing and maintenance of equipment.

CHEMICAL FEED PIPING

- cxxix. Install crosses at all changes in direction. Install plugs in unused connections.

WATER TREATMENT SERVICES

- cxxx. Provide water treatment monitoring and consulting services for period of one year after system start-up. Service to include:
 - Initial water analysis and treatment recommendations, if different from that specified.
 - System start-up assistance.
 - Operating staff training.
 - Provide necessary recording charts and log sheets for one year operation.
 - Provide necessary laboratory and technical assistance.
 - Instructions and advice to operating staff to be clear, concise and in writing.

START-UP

- cxix. Start up water treatment systems in accordance with manufacturer's instructions.

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COMMISSIONING

- xxxxii. Commissioning Agency: to be water treatment supplier.
- xxxxiii. Timing:
 - After start-up deficiencies rectified.
 - After start-up and before TAB of connected systems.
- xxxxiv. Pre-commissioning Inspections:
 - Verify:
 - Presence of test equipment, reagents, chemicals, details of specific tests to be performed, operating instructions.
 - Suitability of log book.
 - Currency and accuracy of raw water analysis.
 - Required quality of treated water.
- xxxxv. Commissioning procedures applicable to all Water Treatment Systems:
 - Establish, adjust as necessary and record all automatic controls and chemical feed rates.
 - Monitor performance continuously during commissioning of all connected systems and until acceptance of project.
 - Establish test intervals, regeneration intervals.
 - Record on approved report forms all commissioning procedures, test procedures, dates, times, quantities of chemicals added, raw water analysis, treated water analysis, test results, instrument readings, adjustments made, results obtained.
 - Establish, monitor and adjust automatic controls and chemical feed rates as necessary.
 - Visit project at specified intervals after commissioning is satisfactorily completed to verify that performance remains as set during commissioning (more often as required until system stabilizes at required level of performance).
 - Advise Owner's Representative in writing on all matters regarding installed water treatment systems.
- xxxxvi. Commissioning procedures closed circuit evaporative cooler water treatment system.
 - Responsibility of closed circuit evaporative cooler supplier.
- xxxxvii. Commissioning procedures closed circuit hydronic systems (water only):
 - Analyze water in system.
 - Based upon an assumed rate of loss approved by Owner's Representative, establish rate of chemical feed.

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Record types, quantities of chemicals applied.

xxxxviii. Training:

Commission systems, perform tests in presence of, and using assistance of, assigned O&M personnel.

xxxix. Certificates:

Upon completion, furnish certificates confirming satisfactory installation and performance.

cxl. Commissioning Reports:

To include system schematics, test results, test certificates, raw and treated water analyses, design criteria, all other data required by Owner's Representative.

cxli. Commissioning activities during Warranty Period:

Check out water treatment systems on regular basis and submit written report to Owner's Representative

EXTENDED SERVICES

cxlii. Provide costing to carry out a further four (4) years of water treatment in addition to the one (1) year already specified.

cxliii. Identify individual costing for each year.

END OF SECTION

SECTION 233113 – METAL DUCTS

GOVERNMENT OF THE U. S. VIRGIN ISLANDS, DEPARTMENT OF PUBLIC WORKS

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PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Rectangular ducts and fittings
2. Round ducts and fittings.
3. Sheet metal materials.
4. Sealants and gaskets.
5. Hangers and supports.

B. Related Sections:

1. Section 230593 "Testing, Adjusting, and Balancing for HVAC" for testing, adjusting, and balancing requirements for metal ducts.

1.2 PERFORMANCE REQUIREMENTS

A. Delegated Duct Design:

Duct construction, including sheet metal thicknesses, seam and joint construction, reinforcements, and hangers and supports, shall comply with SMACNA's "HVAC Duct Construction Standards Metal and Flexible" and performance requirements and design criteria indicated in "Duct Schedule" Article.

B. Structural Performance:

Duct hangers and supports shall withstand the effects of gravity loads and stresses within limits and under conditions described in SMACNA's "HVAC Duct Construction Standards Metal and Flexible".

C. Airstream Surfaces:

Surfaces in contact with the airstream shall comply with requirements in ASHRAE 62.1.

1.3 ACTION SUBMITTALS

A. Product Data:

For each type of product indicated.

B. Shop Drawings:

Fabrication, assembly, and installation, including plans, elevations, sections, components, and attachments to other work.

2. Factory and shop fabricated ducts and fittings.
3. Duct layout indicating sizes, configuration, and static-pressure classes.
4. Elevation of top of ducts.

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5. Dimensions of main duct runs from building grid lines.
6. Fittings.
7. Reinforcement and spacing.
8. Seam and joint construction.
9. Penetrations through fire-rated and other partitions.
10. Equipment installation based on equipment being used on Project.
11. Locations for duct accessories, including dampers, turning vanes, and access doors and panels.
12. Hangers and supports, including methods for duct and building attachment and vibration isolation.

1.4 INFORMATIONAL SUBMITTALS

A. Coordination Drawings:

Plans, drawn to scale, on which the following items are shown and coordinated with each other, using input from installers of the items involved:

1. Duct installation in congested spaces, indicating coordination with general construction, building components, and other building services. Indicate proposed changes to duct layout.
2. Suspended ceiling components
3. Structural members to which duct will be attached
4. Size and location of initial access modules for acoustical tile
5. Penetrations of smoke barriers and fire-rated construction
6. Items penetrating finished ceiling including the following:
 - a. Lighting fixtures
 - b. Air outlets and inlets
 - c. Speakers
 - d. Sprinklers
 - e. Access panels
 - f. Fire alarm devices

1.5 QUALITY ASSURANCE

A. ASHRAE Compliance:

Applicable requirements in ASHRAE 62.1, Section 5 "Systems and Equipment" and Section 7 "Construction and System Start up."

B. ASHRAE/IESNA Compliance:

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Applicable requirements in ASHRAE/IESNA 90.1, Section 6.4.4 "HVAC System Construction and Insulation."

PART 2 - PRODUCTS

2.1 RECTANGULAR DUCTS AND FITTINGS

A. General Fabrication Requirements:

Comply with SMACNA's "HVAC Duct Construction Standards Metal and Flexible" based on indicated static pressure class unless otherwise indicated.

B. Transverse Joints:

Select joint types and fabricate according to SMACNA's "HVAC Duct Construction Standards Metal and Flexible," Figure 2-1, "Rectangular Duct/Transverse Joints," for static pressure class, applicable sealing requirements, materials involved, duct support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards Metal and Flexible."

C. Longitudinal Seams:

Select seam types and fabricate according to SMACNA's "HVAC Duct Construction Standards Metal and Flexible," Figure 2-2, "Rectangular Duct/Longitudinal Seams," for static pressure class, applicable sealing requirements, materials involved, duct support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards Metal and Flexible."

D. Elbows, Transitions, Offsets, Branch Connections, and Other Duct Construction:

Select types and fabricate according to SMACNA's "HVAC Duct Construction Standards Metal and Flexible," Chapter 4, "Fittings and Other Construction," for static pressure class, applicable sealing requirements, materials involved, duct support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards Metal and Flexible."

2.2 ROUND DUCTS AND FITTINGS

A. General Fabrication Requirements:

Comply with SMACNA's "HVAC Duct Construction Standards Metal and Flexible," Chapter 3, "Round, Oval, and Flexible Duct," based on indicated static-pressure class unless otherwise indicated.

1. Manufacturers:

Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

- a. Lindab Inc.
- b. McGill AirFlow LLC
- c. SEMCO Incorporated
- d. Sheet Metal Connectors, Inc.
- e. Spiral Manufacturing Co., Inc.

B. Transverse Joints:

Select joint types and fabricate according to SMACNA's "HVAC Duct Construction Standards Metal and Flexible," Figure 3-I, "Round Duct Transverse Joints," for static-pressure class, applicable sealing requirements, materials involved, duct support intervals, and other provisions

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in SMACNA's "HVAC Duct Construction Standards Metal and Flexible."

1. Transverse Joints in Ducts Larger Than 60 Inches (1524 mm) in Diameter:
Flanged

C. Longitudinal Seams:

Select seam types and fabricate according to SMACNA's "HVAC Duct Construction Standards Metal and Flexible," Figure 3-2, "Round Duct Longitudinal Seams," for static pressure class, applicable sealing requirements, materials involved, duct support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards Metal and Flexible."

1. Fabricate round ducts larger than 90 inches (2286 mm) in diameter with butt welded longitudinal seams.

D. Tees and Laterals:

Select types and fabricate according to SMACNA's "HVAC Duct Construction Standards Metal and Flexible," Figure 3-5, "90 Degree Tees and Laterals," and Figure 3-6, "Conical Tees," for static pressure class, applicable sealing requirements, materials involved, duct support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards Metal and Flexible."

2.3 SHEET METAL MATERIALS

A. General Material Requirements:

Comply with SMACNA's "HVAC Duct Construction Standards Metal and Flexible" for acceptable materials, material thicknesses, and duct construction methods unless otherwise indicated. Sheet metal materials shall be free of pitting, seam marks, roller marks, stains, discolorations, and other imperfections.

B. Galvanized Sheet Steel: Comply with ASTM A 653/A 653M.

1. Galvanized Coating Designation:
G60 (Z180)
2. Finishes for Surfaces Exposed to View:
Mill phosphatized

B. Stainless Steel Sheets:

Comply with ASTM A 480/A 480M, Type 304 or 316, as indicated in the "Duct Schedule" Article; cold rolled, annealed, sheet. Exposed surface finish shall be No. 2B, No. 2D, No. 3, or No. 4 as indicated in the "Duct Schedule" Article.

C. Tie Rods:

Galvanized steel, 1/4-inch (6-mm) minimum diameter for lengths 36 inches (900 mm) or less; 3/8-inch (10-mm) minimum diameter for lengths longer than 36 inches (900 mm).

2.4 SEALANT AND GASKETS

A. General Sealant and Gasket Requirements:

Surface burning characteristics for sealants and gaskets shall be a maximum flame-spread index of 25 and a maximum smoke-developed index of 50 when tested according to UL 723; certified by an NRTL.

B. Two Part Tape Sealing System:

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1. Tape:
Woven cotton fiber impregnated with mineral gypsum and modified acrylic/silicone activator to react exothermically with tape to form hard, durable, airtight seal.
2. Tape Width:
3 inches (76 mm)
3. Sealant:
Modified styrene acrylic
4. Water resistant
5. Mold and mildew resistant
6. Maximum Static Pressure Class:
10-inch wg (2500 Pa), positive and negative
7. Service:
Indoor and outdoor
8. Service Temperature:
To plus 200°F (to plus 93°C)
9. Substrate:
Compatible with galvanized sheet steel (both PVC coated and bare), stainless steel, or aluminum
10. For indoor applications, sealant shall have a VOC content of 250 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
11. Sealant shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small Scale Environmental Chambers."

C. Water-Based Joint and Seam Sealant:

1. Application Method:
Brush on
2. Solids Content:
Minimum 65 percent
3. Shore A Hardness:
Minimum 20
4. Water resistant
5. Mold and mildew resistant
6. VOC:
Maximum 75 g/L (less water)
7. Maximum Static Pressure Class:
10-inch wg (2500 Pa), positive and negative

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8. Service:
Indoor or outdoor
9. Substrate:
Compatible with galvanized sheet steel (both PVC coated and bare), stainless steel, or aluminum sheets.
- D. Flanged Joint Sealant:
Comply with ASTM C 920
 1. General:
Single-component, acid-curing, silicone, elastomeric
 2. Type:
S
 3. Grade:
NS
 4. Class:
25
 5. Use:
0
 6. For indoor applications, sealant shall have a VOC content of 250 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
 7. Sealant shall comply with the testing and product requirements of the California Department of Health Services "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small Scale Environmental Chambers."
- E. Flange Gaskets:
Butyl rubber, neoprene, or EPDM polymer with polyisobutylene plasticizer.
- F. Round Duct Joint O-Ring Seals:
 1. Seal shall provide maximum leakage class of 3 cfm/100 sq. ft. at 1-inch wg (0.14 Lis per sq. m) and shall be rated for 10-inch wg (2500-Pa) static pressure class, positive or negative.
 2. EPDM O-ring to seal in concave bead in coupling or fitting spigot.
 3. Double lipped, EPDM O-ring seal, mechanically fastened to factory fabricated couplings and fitting spigots.

2.5 HANGERS AND SUPPORTS

- A. Hanger Rods for Noncorrosive Environments:
Cadmium-plated steel rods and nuts.
- B. Hanger Rods for Corrosive Environments:
Electrogalvanized, all thread rods or galvanized rods with threads painted with zinc-chromate primer after installation.

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- C. Strap and Rod Sizes:
Comply with SMACNA's "HVAC Duct Construction Standards Metal and Flexible," Table 5-1 (Table 5-1M), "Rectangular Duct Hangers Minimum Size," and Table 5-2, "Minimum Hanger Sizes for Round Duct."
- D. Steel Cables for Galvanized Steel Ducts:
Galvanized steel complying with ASTM A 603
- E. Steel Cables for Stainless Steel Ducts:
Stainless steel complying with ASTM A 492
- F. Steel Cable End Connections:
Cadmium plated steel assemblies with brackets, swivel, and bolts designed for duct hanger service; with an automatic locking and clamping device.
- G. Duct Attachments:
Sheet metal screws, blind rivets, or self-tapping metal screws; compatible with duct materials
- H. Trapeze and Riser Supports:
 - 1. Supports for Galvanized Steel Ducts:
Galvanized steel shapes and plates
 - 2. Supports for Stainless Steel Ducts:
Stainless steel shapes and plates

PART 3 - EXECUTION

3.1 DUCT INSTALLATION

- A. Drawing plans, schematics, and diagrams indicate general location and arrangement of duct system. Indicated duct locations, configurations, and arrangements were used to size ducts and calculate friction loss for air-handling equipment sizing and for other design considerations. Install duct systems as indicated unless deviations to layout are approved on Shop Drawings and Coordination Drawings.
- B. Install ducts according to SMACNA's "HVAC Duct Construction Standards Metal and Flexible" unless otherwise indicated.
- C. Install round ducts in maximum practical lengths.
- D. Install ducts with fewest possible joints.
- E. Install factory or shop fabricated fittings for changes in direction, size, and shape and for branch connections.
- F. Unless otherwise indicated, install ducts vertically and horizontally, and parallel and perpendicular to building lines.
- G. Install ducts close to walls, overhead construction, columns, and other structural and permanent enclosure elements of building.

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- H. Install ducts with a clearance of 1 inch (25 mm), plus allowance for insulation thickness.
- I. Route ducts to avoid passing through transformer vaults and electrical equipment rooms and enclosures.
- J. Where ducts pass through non fire rated interior partitions and exterior walls and are exposed to view, cover the opening between the partition and duct or duct insulation with sheet metal flanges of same metal thickness as the duct. Overlap openings on four sides by at least 1-1/2 inches (38 mm).
- L. Protect duct interiors from moisture, construction debris and dust, and other foreign materials. Comply with SMACNA's "IAQ Guidelines for Occupied Buildings Under Construction," Appendix G, "Duct Cleanliness for New Construction Guidelines."

3.2 INSTALLATION OF EXPOSED DUCTWORK

- A. Protect ducts exposed in finished spaces from being dented, scratched, or damaged.
- B. Trim duct sealants flush with metal. Create a smooth and uniform exposed bead. Do not use two part tape sealing system.
- C. Grind welds to provide smooth surface free of burrs, sharp edges, and weld splatter. When welding stainless steel with a No. 3 or 4 finish, grind the welds flush, polish the exposed welds, and treat the welds to remove discoloration caused by welding.
- D. Maintain consistency, symmetry, and uniformity in the arrangement and fabrication of fittings, hangers and supports, duct accessories, and air outlets.
- E. Repair or replace damaged sections and finished work that does not comply with these requirements.

3.3 DUCT SEALING

- A. Seal ducts for duct static pressure, seal classes, and leakage classes specified in "Duct Schedule" Article according to SMACNA's "HVAC Duct Construction Standards Metal and Flexible."
- B. Seal ducts to the following seal classes according to SMACNA's "HVAC Duct Construction Standards Metal and Flexible":
 - 1. Comply with SMACNA's "HVAC Duct Construction Standards Metal and Flexible."
 - 2. Outdoor, Supply Air Ducts:
Seal Class A
 - 3. Outdoor, Exhaust Ducts:
Seal Class C
 - 4. Outdoor, Return-Air Ducts:
Seal Class C
 - 5. Unconditioned Space, Supply Air Ducts in Pressure Classes 2-Inch wg (500 Pa) and Lower:
Seal Class B
 - 6. Unconditioned Space, Supply Air Ducts in Pressure Classes higher than 2-Inch wg (500 Pa):

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Seal Class A

7. Unconditioned Space, Exhaust Ducts:
Seal Class C

8. Unconditioned Space, Return Air Ducts:
Seal Class B

9. Conditioned Space, Supply Air Ducts in Pressure Classes 2-Inch wg (500 Pa) and lower:
Seal Class C

10. Conditioned Space, Supply Air Ducts in Pressure Classes Higher Than 2-Inch wg (500 Pa):
Seal Class B

11. Conditioned Space, Exhaust Ducts:
Seal Class B

12. Conditioned Space, Return Air Ducts:
Seal Class C

3.4 HANGER AND SUPPORT INSTALLATION

A. Comply with SMACNA's "HVAC Duct Construction Standards Metal and Flexible," Chapter 5, "Hangers and Supports."

B. Building Attachments:

Concrete inserts, powder actuated fasteners, or structural steel fasteners appropriate for construction materials to which hangers are being attached.

1. Where practical, install concrete inserts before placing concrete.
2. Install powder actuated concrete fasteners after concrete is placed and completely cured.
3. Use powder actuated concrete fasteners for standard weight aggregate concretes or for slabs more than 4 inches (100 mm) thick.
4. Do not use powder actuated concrete fasteners for lightweight-aggregate concretes or for slabs less than 4 inches (100 mm) thick.
5. Do not use powder actuated concrete fasteners for seismic restraints.

C. Hanger Spacing:

Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Table 5-1 (Table 5-1M), "Rectangular Duct Hangers Minimum Size," and Table 5-2, "Minimum Hanger Sizes for Round Duct," for maximum hanger spacing; install hangers and supports within 24 inches (610 mm) of each elbow and within 48 inches (1200 mm) of each branch intersection.

D. Hangers Exposed to View:

Threaded rod and angle or channel supports.

E. Support vertical ducts with steel angles or channel secured to the sides of the duct with welds, bolts, sheet metal screws, or blind rivets; support at each floor and at a maximum intervals of 16 feet (5 m).

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- F. Install upper attachments to structures. Select and size upper attachments with pull-out, tension, and shear capacities appropriate for supported loads and building materials where used.

3.5 CONNECTIONS

- A. Make connections to equipment with flexible connectors.
- B. Comply with SMACNA's "HVAC Duct Construction Standards Metal and Flexible" for branch, outlet and inlet, and terminal unit connections.

3.6 DUCT CLEANING

- A. Clean new and existing duct system(s) before testing, adjusting, and balancing.
- B. Use service openings for entry and inspection.
 - 1. Create new openings and install access panels appropriate for duct static pressure class if required for cleaning access. Provide insulated panels for insulated or lined duct. Patch insulation and liner as recommended by duct liner manufacturer.
 - 2. Disconnect and reconnect flexible ducts as needed for cleaning and inspection.
 - 3. Remove and reinstall ceiling to gain access during the cleaning process.
- C. Particulate Collection and Odor Control:
 - 1. When venting vacuuming system inside the building, use HEPA filtration with 99.97 percent collection efficiency for 0.3-micron sized (or larger) particles.
 - 2. When venting vacuuming system to outdoors, use filter to collect debris removed from HVAC system, and locate exhaust downwind and away from air intakes and other points of entry into the building.
- D. Clean the following components by removing surface contaminants and deposits:
 - 1. Air outlets and inlets (registers, grilles, and diffusers).
 - 2. Supply, return, and exhaust fans including fan housings, plenums (except ceiling supply and return plenums), scrolls, blades or vanes, shafts, baffles, dampers, and drive assemblies.
 - 3. Air handling unit internal surfaces and components including mixing box, coil section, air wash systems, spray eliminators, condensate drain pans, humidifiers and dehumidifiers, filters and filter sections, and condensate collectors and drains.
 - 4. Coils and related components.
 - 5. Return air ducts, dampers, actuators, and turning vanes except in ceiling plenums and mechanical equipment rooms.
 - 6. Supply air ducts, dampers, actuators, and turning vanes.
 - 7. Dedicated exhaust and ventilation components and makeup air systems.

- E. Mechanical Cleaning Methodology:

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1. Clean metal duct systems using mechanical cleaning methods that extract contaminants from within duct systems and remove contaminants from building.
2. Use vacuum collection devices that are operated continuously during cleaning. Connect vacuum device to downstream end of duct sections so areas being cleaned are under negative pressure.
3. Use mechanical agitation to dislodge debris adhered to interior duct surfaces without damaging integrity of metal ducts, duct liner, or duct accessories.
4. Clean fibrous glass duct liner with HEPA vacuuming equipment; do not permit duct liner to get wet. Replace fibrous glass duct liner that is damaged, deteriorated, or delaminated or that has friable material, mold, or fungus growth.
5. Clean coils and coil drain pans according to NADCA 1992. Keep drain pan operational. Rinse coils with clean water to remove latent residues and cleaning materials; comb and straighten fins.
6. Provide drainage and cleanup for wash down procedures.
7. Antimicrobial Agents and Coatings:
Apply EPA registered antimicrobial agents if fungus is present. Apply antimicrobial agents according to manufacturer's written instructions after removal of surface deposits and debris.

3.7 STARTUP

- A. Air Balance:
Comply with requirements in Section 230593 "Testing, Adjusting, and Balancing for HVAC."

3.8 DUCT SCHEDULE

- A. Fabricate ducts with galvanized sheet steel except as otherwise indicated and as follows:
 1. Laboratory exhaust ductwork:
Stainless steel
- B. Supply Ducts:
 1. Ducts Connected to Constant Volume Air-Handling Units:

Pressure Class:
Positive 2-inch wg (500 Pa).
 - b. Minimum SMACNA Seal Class:
A
 - c. SMACNA Leakage Class for Rectangular:
6
 - d. SMACNA Leakage Class for Round and Flat Oval:
6

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cxliv. Return Ducts:

1. Ducts Connected to Air Handling Units:

Pressure Class:

Positive or negative 2-inch wg (500 Pa).

b. Minimum SMACNA Seal Class:

A

c. SMACNA Leakage Class for Rectangular:

6

d. SMACNA Leakage Class for Round and Flat Oval:

6

D. Exhaust Ducts:

1. Ducts Connected to Fans Exhausting (ASHRAE 62.1, Class 1 and 2) Air:

a. Pressure Class:

Negative 2-inch wg (500 Pa).

b. Minimum SMACNA Seal Class:

A if negative pressure, and A if positive pressure

c. SMACNA Leakage Class for Rectangular:

12

d. SMACNA Leakage Class for Round and Flat Oval:

6

2. Ducts Connected to Fans Exhausting Laboratory and Process (ASHRAE 62.1, Class 3 and 4) Air:

a. Type 304, stainless steel sheet

b. Pressure Class:

Positive or negative 3-inch wg (750 Pa)

c. Minimum SMACNA Seal Class:

Welded seams, joints, and penetrations

d. SMACNA Leakage Class:

3

E. Outdoor-Air (Not Filtered, Heated, or Cooled) Ducts:

1. Ducts Connected to Air-Handling Units:

a. Pressure Class:

Positive or negative 2-inch wg (500 Pa)

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- b. Minimum SMACNA Seal Class:

A

- c. SMACNA Leakage Class for Rectangular:

6

- d. SMACNA Leakage Class for Round and Flat Oval:

3

F. Intermediate Reinforcement:

- 1. Galvanized Steel Ducts:

Galvanized steel

- 2. Stainless Steel Ducts:

- a. Exposed to Airstream:

Match duct material.

- b. Not Exposed to Airstream:

Match duct material.

G. Elbow Configuration:

- 1. Rectangular Duct:

Comply with SMACNA's "HVAC Duct Construction Standards Metal and Flexible," Figure 4-2, "Rectangular Elbows."

- a. Velocity 1000 fpm (5 m/s) or Lower:

- 1) Radius Type RE 1 with minimum 0.5 radius-to-diameter ratio

- 2) Mitered Type RE 4 without vanes

- b. Velocity 1000 to 1500 fpm (5 to 7.6 m/s):

- 1) Radius Type RE 1 with minimum 1.0 radius-to-diameter ratio.

- 2) Radius Type RE 3 with minimum 0.5 radius-to-diameter ratio and two vanes.

- 3) Mitered Type RE 2 with vanes complying with SMACNA's "HVAC Duct Construction Standards Metal and Flexible," Figure 4-3, "Vanes and Vane Runners," and Figure 4-4, "Vane Support in Elbows."

- c. Velocity 1500 fpm (7.6 m/s) or Higher:

- 1) Radius Type RE 1 with minimum 1.5 radius-to-diameter ratio.

- 2) Radius Type RE 3 with minimum 1.0 radius-to-diameter ratio and two vanes.

- 3) Mitered Type RE 2 with vanes complying with SMACNA's "HVAC Duct Construction Standards Metal and Flexible," Figure 4-3, "Vanes and Vane Runners," and Figure 4-4, "Vane Support in Elbows."

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2. Rectangular Duct:

Comply with SMACNA's "HVAC Duct Construction Standards Metal and Flexible," Figure 4-2, "Rectangular Elbows."

- a. Radius Type RE I with minimum 1.5 radius-to-diameter ratio.
- b. Radius Type RE 3 with minimum 1.0 radius-to-diameter ratio and two vanes.
- c. Mitered Type RE 2 with vanes complying with SMACNA's "HVAC Duct Construction Standards Metal and Flexible," Figure 4-3, "Vanes and Vane Runners," and Figure 4-4, "Vane Support in Elbows."

3. Round Duct:

Comply with SMACNA's "HVAC Duct Construction Standards Metal and Flexible," Figure 3-4, "Round Duct Elbows."

- a. Minimum Radius-to-Diameter Ratio and Elbow Segments:
Comply with SMACNA's "HVAC Duct Construction Standards Metal and Flexible," Table 3-1, "Mitered Elbows." Elbows with less than 90-degree change of direction have proportionately fewer segments.
 - 1) Velocity 1000 fpm (5 m/s) or Lower:
0.5 radius-to-diameter ratio and three segments for 90-degree elbow.
 - 2) Velocity 1000 to 1500 fpm (5 to 7.6 m/s):
1.0 radius-to-diameter ratio and four segments for 90-degree elbow.
 - 3) Velocity 1500 fpm (7.6 m/s) or Higher:
1.5 radius-to-diameter ratio and five segments for 90-degree elbow.
- 4) Radius-to Diameter Ratio:
1.5.
- b. Round Elbows, 12 Inches (305 mm) and Smaller in Diameter:
Stamped or pleated.
- c. Round Elbows, 14 Inches (356 mm) and Larger in Diameter:
Standing seam.

H. Branch Configuration:

1. Rectangular Duct:

Comply with SMACNA's "HVAC Duct Construction Standards Metal and Flexible," Figure 4-6, "Branch Connection."

- a. Rectangular Main to Rectangular Branch:
45-degree entry.
- b. Rectangular Main to Round Branch:
Spin in.

2. Round:

Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure

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3-5, "90 Degree Tees and Laterals," and Figure 3-6, "Conical Tees." Saddle taps are permitted in existing duct.

- a. Velocity 1000 fpm (5 m/s) or lower:
90-degree tap.
- b. Velocity 1000 to 1500 fpm (5 to 7.6 m/s):
Conical tap.
- c. Velocity 1500 fpm (7.6 m/s) or Higher:
45-degree lateral

END OF SECTION

SECTION 233300 – AIR DUCT ACCESSORIES

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PROJECT NAME: Elaine I. Sprauve Public Library and Museum Building

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PART 1- GENERAL

1.1 SUMMARY

A. Section Includes:

1. Backdraft and pressure relief dampers
2. Manual volume dampers
3. Control dampers
4. Fire dampers
5. Flange connectors
6. Turning vanes
7. Duct-mounted access doors
8. Flexible connectors
9. Flexible ducts
10. Duct accessory hardware

B. Related Requirements:

1. Section 233113 "Metal Ducts.

1.2 ACTION SUBMITTALS

A. Product Data:

For each type of product.

B. Shop Drawings:

For duct accessories. Include plans, elevations, sections, details and attachments to other work.

1. Detail duct accessories fabrication and installation in ducts and other construction. Include dimensions, weights, loads, and required clearances; and method of field assembly into duct systems and other construction. Include the following:
 - a. Special fittings
 - b. Manual volume damper installations
 - c. Control-damper installations
 - d. Fire-damper installations, including sleeves; and duct-mounted access doors.
 - e. Wiring Diagrams:
For power, signal, and control wiring

1.3 CLOSEOUT SUBMITTALS

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Operation and maintenance data.

PART 2- PRODUCTS

2.1 ASSEMBLY DESCRIPTION

- A. Comply with NFPA 90A, "Installation of Air Conditioning and Ventilating Systems," and with NFPA 90B, "Installation of Warm Air Heating and Air Conditioning Systems."
- B. Comply with SMACNA's "HVAC Duct Construction Standards Metal and Flexible" for acceptable materials, material thicknesses, and duct construction methods unless otherwise indicated. Sheet metal materials shall be free of pitting, seam marks, roller marks, stains, discolorations, and other imperfections.

2.2 MATERIALS

- A. Galvanized Sheet Steel:
Comply with ASTM A 653/A 653M
 - 1. Galvanized Coating Designation: G60 (Z180)
 - 2. Exposed Surface Finish:
Mill phosphatized
- B. Stainless Steel Sheets:
Comply with ASTM A 480/A 480M, Type 304, and having a No.2 finish.
- C. Aluminum Sheets:
Comply with ASTM B 209 (ASTM B 209M), Alloy 3003, Temper H14; with mill finish for concealed ducts and standard, l-side bright finish for exposed ducts.
- D. Extruded Aluminum:
Comply with ASTM B 221 (ASTM B 221M), Alloy 6063, Temper T6.
- E. Reinforcement Shapes and Plates:
Galvanized steel reinforcement where installed on galvanized sheet metal ducts; compatible materials for aluminum and stainless steel ducts.
- F. Tie Rods:
Galvanized steel, 1/4-inch (6-mm) minimum diameter for lengths 36 inches (900 mm) or less; 3/8-inch (10-mm) minimum diameter for lengths longer than 36 inches (900 mm).

2.3 BACKDRAFT AND PRESSURE RELIEF DAMPERS

- A. Manufacturers:
Subject to compliance with requirements, provide products by one of the following available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - 1. Air Balance Inc.; a division of Mestek, Inc.
 - 2. American Warming and Ventilating; a division of Mestek, Inc.
 - 3. Greenheck Fan Corporation

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4. Naffor Industries Inc.
5. Pottorff
6. Ruskin Company
- B. Description:
Gravity balanced
- C. Maximum Air Velocity:
2000 fpm (10 m/s)
- D. Maximum System Pressure:
3-inch wg (0.8 kPa)
- E. Frame:
Hat-shaped, 0.09-inch (2.4-mm) thick extruded aluminum, with welded comers or mechanically attached.
- F. Blades:
Multiple single piece blades, end pivoted, maximum 6-inch (150-mm) width, 0.050-inch (1.2-mm) thick extruded aluminum with sealed edges.
- G. Blade Action:
Parallel
- H. Blade Seals:
Extruded vinyl, mechanically locked
- I. Blade Axles:
 1. Material:
Galvanized steel
 2. Diameter:
0.20 inch (5 mm)
- J. Tie Bars and Brackets:
Aluminum
- K. Return Spring:
Adjustable tension
- L. Bearings:
Synthetic pivot bushings
- M. Accessories:
 1. Adjustment device to permit setting for varying differential static pressure
 2. Counterweights and spring assist kits for vertical airflow installations
 3. 90-degree stops

2.4 MANUAL VOLUME DAMPERS

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A. Standard, Steel, Manual Volume Dampers:

1. Manufacturers:

Subject to compliance with requirements, provide products by one of the following available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

- a. Air Balance Inc.; a division of Mestek, Inc.
- b. American Warming and Ventilating; a division of Mestek, Inc.
- c. Flexmaster U.S.A., Inc.
- d. McGill AirFlow LLC.
- e. Nailor Industries Inc.
- f. Pottorff.
- g. Ruskin Company.

2. Standard leakage rating, with linkage outside airstream

3. Suitable for horizontal or vertical applications

4. Frames:

- a. Hat-shaped, 0.094-inch (2.4-mm) thick, galvanized sheet steel
- b. Mitered and welded comers
- c. Flanges for attaching to walls and flangeless frames for installing in ducts

5. Blades:

- a. Multiple or single blade
- b. Parallel- or opposed-blade design
- c. Stiffen damper blades for stability
- d. Galvanized steel, 0.064 inch (1.62 mm) thick

6. Blade Axles:

Galvanized steel

7. Bearings:

- a. Molded synthetic
- b. Dampers in ducts with pressure classes of 3-inch wg (750 Pa) or less shall have axles the full length of damper blades and bearings at both ends of operating shaft.

8. Tie Bars and Brackets:

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Galvanized steel

B. Jackshaft:

1. Size:
0.5-inch (13-mm) diameter
2. Material:
Galvanized steel pipe rotating within pipe bearing assembly mounted on supports at each mullion and at each end of multiple-damper assemblies.
3. Length and Number of Mountings:
As required to connect linkage of each damper in multiple damper assembly.

C. Damper Hardware:

1. Zinc plated, die-cast core with dial and handle made of 3/32-inch (2.4-mm) thick zinc plated steel, and a 3/4-inch (19-mm) hexagon locking nut.
2. Include center hole to suit damper operating rod size.
3. Include elevated platform for insulated duct mounting.

2.5 CONTROL DAMPERS

A. Manufacturers:

Subject to compliance with requirements, provide products by one of the following available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

1. American Warming and Ventilating; a division of Mestek, Inc.
2. Arrow United Industries; a division of Mestek, Inc.
3. Greenheck Fan Corporation
4. Nailor Industries Inc.
5. Pottorff.
6. Ruskin Company
7. Young Regulator Company

B. Frames:

1. Hat shaped
2. 0.125-inch (3-mm) thick aluminum.

C. Blades:

1. Multiple blade with maximum blade width of 6 inches (152 mm)
2. Parallel and opposed blade design

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3. Aluminum
4. 0.0747-inch (1.9-mm) thick dual skin
5. Blade Edging:
Closed cell neoprene
- D. Blade Axles:
1/2-inch (13-mm) diameter; stainless steel; blade linkage hardware of zinc plated steel and brass;
ends sealed against blade bearings.
 1. Operating Temperature Range:
To plus 200°F (to plus 93°C)
- E. Bearings:
 1. Molded synthetic
 2. Dampers in ducts with pressure classes of 3-inch wg (750 Pa) or less shall have axles the full length of damper blades and bearings at both ends of operating shaft.
 3. Thrust bearings at each end of every blade

2.6 FIRE DAMPERS

- A. Manufacturers:
Subject to compliance with requirements, provide products by one of the following available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 1. Air Balance Inc.; a division of Mestek, Inc.
 2. Greenheck Fan Corporation
 3. Nailor Industries Inc.
 4. Pottorff
 5. Ruskin Company
- B. Type:
Dynamic; rated and labeled according to UL 555 by an NRTL.
- C. Closing rating in ducts up to 4-inch wg (1-kPa) static pressure class and minimum 2000-fpm (10-m/s) velocity.
- D. Fire Rating:
1-1/2 and 3 hours.
- E. Frame:
Curtain type with blades outside airstream and multiple blade type; fabricated with roll formed, 0.034-inch (0.85-mm) thick galvanized steel; with mitered and interlocking comers.

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F. Mounting Sleeve:

Factory or field installed, galvanized sheet steel

1. Minimum Thickness:

20 gage thick, as indicated, and of length to suit application.

2. Exception:

Omit sleeve where damper frame width permits direct attachment of perimeter mounting angles on each side of wall or floor; thickness of damper frame must comply with sleeve requirements.

G. Mounting Orientation:

Vertical or horizontal as indicated

H. Blades:

Roll formed, interlocking, 0.024-inch (0.61-mm) thick, galvanized sheet steel. In place of interlocking blades, use full length, 0.034-inch (0.85-mm) thick, galvanized steel blade connectors.

I. Horizontal Dampers:

Include blade lock and stainless steel closure spring.

J. Heat-Responsive Device:

Replaceable, 165°F (74°C) rated, fusible links.

2.7 FLANGE CONNECTORS

A. Manufacturers:

Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

1. Ductmate Industries, Inc.
2. Nexus PDQ; Division of Shilco Holdings Inc.
3. Ward Industries, Inc.; a division of Hart & Cooley, Inc.

B. Description:

Add on or roll formed, factory fabricated, slide on transverse flange connectors, gaskets, and components.

C. Material:

Galvanized steel

D. Gage and Shape:

Match connecting ductwork.

2.8 TURNING VANES

A. Manufacturers:

Subject to compliance with requirements, provide products by one of the following available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

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1. Ductmate Industries, Inc.
 2. Duro Dyne Inc.
 3. Elgen Manufacturing
 4. METALAIR, Inc.
- B. Manufactured Turning Vanes for Metal Ducts:
Curved blades of galvanized sheet steel; support with bars perpendicular to blades set; set into vane runners suitable for duct mounting.
1. Acoustic Turning Vanes:
Fabricate airfoil shaped aluminum extrusions with perforated faces and fibrous-glass fill.
- C. General Requirements:
Comply with SMACNA's "HVAC Duct Construction Standards Metal and Flexible"; Figures 4-3, "Vanes and Vane Runners," and 4-4, "Vane Support in Elbows."
- D. Vane Construction:
Double wall

2.9 DUCT-MOUNTED ACCESS DOORS

- A. Manufacturers:
Subject to compliance with requirements, provide products by one of the following available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
1. American Warming and Ventilating; a division of Mestek, Inc.
 2. Ductmate Industries, Inc.
 3. Flexmaster U.S.A., Inc.
 4. Greenheck Fan Corporation
 5. McGill AirFlow LLC.
 6. Nailor Industries Inc.
 7. Pottorff
- B. Duct Mounted Access Doors:
Fabricate access panels according to SMACNA's "HVAC Duct Construction Standards Metal and Flexible"; Figures 7-2 (7-2M), "Duct Access Doors and Panels," and 7-3, "Access Doors-Round Duct."
1. Door:
 - a. Double wall, rectangular
 - b. Galvanized sheet metal with insulation fill and thickness as indicated for duct pressure class.

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c. Vision panel

d. Hinges and Latches:
1-by-1 inch (25-by-25 mm) butt or piano hinge and cam latches.

e. Fabricate doors airtight and suitable for duct pressure class.

2. Frame:
Galvanized sheet steel, with bend-over tabs and foam gaskets

3. Number of Hinges and Locks:

a. Access Doors Less Than 12 Inches (300 mm) Square:
No hinges and two sash locks

b. Access Doors up to 18 Inches (460 mm) Square:
Continuous and two sash locks

c. Access Doors up to 24 by 48 Inches (600 by 1200 mm):
Three hinges and two compression latches

d. Access Doors Larger Than 24 by 48 Inches (600 by 1200 mm):
Four hinges and two compression latches with outside and inside handles.

2.10 FLEXIBLE CONNECTORS

A. Manufacturers:

Subject to compliance with requirements, provide products by one of the following available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

1. Ductmate Industries, Inc.

2. Duro Dyne Inc.

3. Elgen Manufacturing

B. Materials:

Flame retardant or noncombustible fabrics

C. Coatings and Adhesives:

Comply with UL 181, Class 1

D. Metal Edged Connectors:

Factory fabricated with a fabric strip 3-1/2 inches (89 mm) wide attached to two strips of 2-3/4-inch (70-mm) wide, 0.028-inch (0.7-mm) thick, galvanized sheet steel or 0.032-inch (0.8-mm) thick aluminum sheets. Provide metal compatible with connected ducts.

E. Indoor System, Flexible Connector Fabric:

Glass fabric double coated with neoprene

1. Minimum Weight:

26 oz./sq. yd. (880 g/sq. m)

2. Tensile Strength:

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480 lbf/inch (84 N/mm) in the warp and 360 lbf/inch (63 N/mm) in the filling

3. Service Temperature:
To plus 200°F (to plus 93°C).
- F. Outdoor System, Flexible Connector Fabric:
Glass fabric double coated with weatherproof, synthetic rubber resistant to UV rays and ozone.
 1. Minimum Weight:
24 oz./sq. yd. (810 g/sq. m)
 2. Tensile Strength:
530 lbf/inch (93 N/mm) in the warp and 440 lbf/inch (77 N/mm) in the filling.
 3. Service Temperature:
To plus 250°F (to plus 121°C).

2.11 FLEXIBLE DUCTS

- A. Manufacturers:
Subject to compliance with requirements, provide products by one of the following available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 1. Flexmaster U.S.A., Inc.
 2. McGill AirFlow LLC.
 3. Ward Industries, Inc.; a division of Hart & Cooley, Inc.
- B. Insulated, Flexible Duct:
UL 181, Class I, aluminum laminate and polyester film with latex adhesive supported by helically wound, spring steel wire; fibrous glass insulation; aluminized vapor barrier film.
 1. Pressure Rating:
10-inch wg (2500 Pa) positive and 1.0-inch wg (250 Pa) negative
 2. Maximum Air Velocity:
4000 fpm (20 m/s)
 3. Temperature Range:
To plus 210°F (to plus 99°C)
 4. Insulation R-value:
Comply with ASHRAEIESNA 90.1, R-6.0 minimum
- C. Flexible Duct Connectors:
 1. Clamps:
Nylon strap in sizes 3 through 18 inches (75 through 460 mm), to suit duct size
 2. Non-Clamp Connectors:
Liquid adhesive plus tape.

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2.12 DUCT ACCESSORY HARDWARE

A. Instrument Test Holes:

Cast iron or cast aluminum to suit duct material, including screw cap and gasket. Size to allow insertion of Pitot tube and other testing instruments and of length to suit duct insulation thickness.

B. Adhesives:

High strength, quick setting, neoprene based, waterproof, and resistant to gasoline and grease.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install duct accessories according to applicable details in SMACNA's "HVAC Duct Construction Standards Metal and Flexible" for metal ducts.

B. Install duct accessories of materials suited to duct materials; use galvanized steel accessories in galvanized steel and fibrous glass ducts, stainless steel accessories in stainless steel ducts, and aluminum accessories in aluminum ducts.

C. Install backdraft and/or control dampers at inlet of exhaust fans or exhaust ducts as close as possible to exhaust fan unless otherwise indicated.

D. Install volume dampers at points on supply, return, and exhaust systems where branches extend from larger ducts. Where dampers are installed in ducts having duct liner, install dampers with hat channels of same depth as liner, and terminate liner with nosing at hat channel.

1. Install steel volume dampers in steel ducts.

2. Install aluminum volume dampers in aluminum ducts.

E. Set dampers to fully open position before testing, adjusting, and balancing.

F. Install test holes at fan inlets and outlets and elsewhere as indicated.

G. Install fire and smoke dampers according to UL listing.

H. Install duct access doors on sides of ducts to allow for inspecting, adjusting, and maintaining accessories and equipment at the following locations:

1. On both sides of duct coils

2. At outdoor-air intakes and mixed-air plenums

3. At drain pans and seals

4. Downstream from manual volume dampers, control dampers, backdraft dampers, and equipment

5. Adjacent to and close enough to fire or smoke dampers, to reset or reinstall fusible links Access doors for access to fire or smoke dampers having fusible links shall be pressure relief access doors and shall be outward operation for access doors installed upstream from dampers and inward operation for access doors installed downstream from dampers.

6. At each change in direction and at maximum 50-foot (15-m) spacing

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7. Upstream or downstream from duct silencers
 8. Control devices requiring inspection
 9. Elsewhere as indicated
- I. Install access doors with swing against duct static pressure.
- J. Access Door Sizes:
1. One Hand or Inspection Access:
8 by 5 inches (200 by 125 mm)
 2. Two Hand Access:
12 by 6 inches (300 by 150 mm)
 3. Head and Hand Access:
18 by 10 inches (460 by 250 mm)
 4. Head and Shoulders Access:
21 by 14 inches (530 by 355 mm)
 5. Body Access:
25 by 14 inches (635 by 355 mm)
 6. Body plus Ladder Access:
25 by 17 inches (635 by 430 mm).
- K. Label access doors according to Section 230553 "Identification for HVAC Piping and Equipment" to indicate the purpose of access door.
- L. Install flexible connectors to connect ducts to equipment.
- M. Connect terminal units to supply ducts directly or with maximum 12-inch (300-mm) lengths of flexible duct. Do not use flexible ducts to change directions.
- N. Connect diffusers or light troffer boots to ducts with maximum 60-inch (1500-mm) lengths of flexible duct clamped or strapped in place.
- O. Connect flexible ducts to metal ducts with draw bands.
- P. Install duct test holes where required for testing and balancing purposes.

3.2 FIELD QUALITY CONTROL

- A. Tests and Inspections:
1. Operate dampers to verify full range of movement.
 2. Inspect locations of access doors and verify that purpose of access door can be performed.
 3. Inspect turning vanes for proper and secure installation.

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END OF SECTION

SECTION 233416 – CENTRIFUGAL HVAC FANS

GOVERNMENT OF THE U. S. VIRGIN ISLANDS, DEPARTMENT OF PUBLIC WORKS

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PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

For each product

1. Backward inclined centrifugal fans
2. Forward curved centrifugal fans

1.2 ACTION SUBMITTALS

A. Product Data:

1. Include rated capacities, furnished specialties, and accessories for each fan.
2. Certified fan performance curves with system operating conditions indicated
3. Certified fan sound-power ratings
4. Motor ratings and electrical characteristics, plus motor and electrical accessories
5. Material thickness and finishes, including color charts
6. Dampers, including housings, linkages, and operators.

B. Shop Drawings:

1. Include plans, elevations, sections, and attachment details.
2. Include details of equipment assemblies. Indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
3. Include diagrams for power, signal, and control wiring.
4. Design Calculations:
Calculate requirements for selecting vibration isolators and seismic restraints and for designing vibration isolation bases.
5. Vibration Isolation Base Details:
Detail fabrication, including anchorages and attachments to structure and to supported equipment. Include auxiliary motor slides and rails, and base weights.

1.3 INFORMATIONAL SUBMITTALS

A. Coordination Drawings:

Show fan room layout and relationships between components and adjacent structural and mechanical elements. Show support locations, type of support, and weight on each support. Indicate and certify field measurements.

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B. Field quality control reports.

1.4 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data:

For centrifugal fans to include in emergency, operation, and maintenance manuals.

1.5 MAINTENANCE MATERIAL SUBMITTALS

A. Spare Belts:

One set for each belt-driven unit

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. AMCA Compliance:

Comply with AMCA performance requirements and bear the AMCA-Certified Ratings Seal.

B. Capacities and Characteristics:

See Fan schedule on drawing

1. Vibration Isolators:

Spring isolators having a static deflection of 1 inch (25 mm)

2.2 BACKWARD INCLINED CENTRIFUGAL FANS

A. Manufacturers:

Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

1. Acme Engineering & Mfg. Corp.
2. Aerovent; a Twin City Fan company
3. Chicago Blower Corporation
4. CML Northern Blower Inc.
5. Howden Buffalo Inc.
6. Loren Cool. Company
7. Greenheck Corp.

B. Description:

1. Factory fabricated, assembled, tested, and finished, belt driven centrifugal fans consisting of housing, wheel, fan shaft, bearings, motor, drive assembly, and support structure.
2. Deliver fans as factory assembled units, to the extent allowable by shipping limitations.
3. Factory installed and wired disconnect switch

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C. Housings:

1. Formed panels to make curved scroll housings with shaped cutoff
2. Panel Bracing:
Steel angle or channel iron member supports for mounting and supporting fan scroll, wheel, motor, and accessories.
3. Horizontally split, bolted-flange housing
4. Spun inlet cone with flange
5. Outlet flange.

E. Backward Inclined Wheels:

1. Single width single inlet and double width double inlet construction with curved inlet flange, back plate, backward-inclined blades, and fastened to shaft with set screws.
2. Welded or riveted to flange and back plate; cast-iron or cast-steel hub riveted to back plate.

F. Shafts:

1. Statically and dynamically balanced and selected for continuous operation at maximum rated fan speed and motor horsepower, with adjustable alignment and belt tensioning.
2. Turned, ground, and polished hot rolled steel with keyway. Ship with protective coating of lubricating oil.
3. Designed to operate at no more than 70 percent of first critical speed at top of fan's speed range.

G. Grease-Lubricated Shaft Bearings:

1. Self-aligning, pillow block type, ball or roller bearings with adapter mount and two piece, cast iron housing.

H. Belt Drives:

1. Factory mounted, with adjustable alignment and belt tensioning
2. Service Factor Based on Fan Motor Size:
1.5.
3. Fan Pulleys:
Cast iron or cast steel with split, tapered bushing; dynamically balanced at factory
4. Motor Pulleys:
Adjustable pitch for use with motors through 5 hp; fixed pitch for use with larger motors. Select pulley so pitch adjustment is at the middle of adjustment range at fan design conditions.
5. Belts:
Oil resistant, non-sparking, and non-static; matched sets for multiple belt drives.
6. Belt Guards:

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Fabricate to comply with OSHA and SMACNA requirements of diamond mesh wire screen welded to steel angle frame or equivalent prime coated. Secure to fan or fan supports without short circuiting vibration isolation. Include provisions for adjustment of belt tension, lubrication, and use of tachometer with guard in place.

7. Motor Mount:
Adjustable for belt tensioning.

I. Accessories:

1. Access for Inspection, Cleaning, and Maintenance:
Comply with requirements in ASHRAE 62.1
2. Scroll Drain Connection:
NPS I (DN 25) steel pipe coupling welded to low point of fan scroll
3. Companion Flanges:
Rolled flanges for duct connections of same material as housing
4. Variable Inlet Vanes:
With blades supported at both ends with two permanently lubricated bearings of same material as housing. Variable mechanism terminating in single control lever with control shaft for double width fans.
5. Discharge Dampers:
Assembly with opposed blades constructed of two plates formed around and to shaft, channel frame, and sealed ball bearings; with blades linked outside of airstream to single control lever of same material as housing.
6. Inlet Screens:
Grid screen of same material as housing
7. Shaft Cooler:
Metal disk between bearings and fan wheel, designed to dissipate heat from shaft
8. Shaft Seals:
Airtight seals installed around shaft on drive side of single-width fans
9. Weather Cover:
Enameled-steel sheet with ventilation slots, bolted to housing.

2.3 SOURCE QUALITY CONTROL

A Sound Power Level Ratings:

Comply with AMCA 301, "Methods for Calculating Fan Sound Ratings from Laboratory Test Data." Factory test fans according to AMCA 300, "Reverberant Room Method for Sound Testing of Fans." Label fans with the AMCA-Certified Ratings Seal.

PART 3 - EXECUTION

3.1 INSTALLATION

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- A. Install centrifugal fans level and plumb.
- B. Disassemble and reassemble units, as required for moving to the final location, according to manufacturer's written instructions.
- C. Lift and support units with manufacturer's designated lifting or supporting points.
- D. Equipment Mounting:
Install centrifugal fans with Insert seismic restraint device. Comply with requirements for seismic restraint devices specified in Section 230548 "Vibration and Seismic Controls for HVAC Piping and Equipment."
- E. Curb Support:
Install roof curb on roof structure, level and secure, according to "The NRCA Roofing and Waterproofing Manual," Low-Slope Membrane Roofing Construction Details Section, Illustration "Raised Curb Detail for Rooftop Air Handling Units and Ducts." Install and secure centrifugal fans on curbs, and coordinate roof penetrations and flashing with roof construction. Secure units to curb support with anchor bolts.
- F. Unit Support:
Install centrifugal fans level on structural curbs. Coordinate wall penetrations and flashing with wall construction. Secure units to structural support with anchor bolts.
- G. Install units with clearances for service and maintenance.
- H. Label fans according to requirements specified in Section 230553 "Identification for HVAC Piping and Equipment."

3.2 CONNECTIONS

- A. Drawings indicate general arrangement of ducts and duct accessories. Make final duct connections with flexible connectors. Flexible connectors are specified in Section 233300 "Air Duct Accessories."
- B. Install ducts adjacent to fans to allow service and maintenance.
- C. Install piping from scroll drain connection, with trap with seal equal to 1.5 times specified static pressure, to nearest floor drain with pipe sizes matching the drain connection.

3.3 FIELD QUALITY CONTROL

- A. Perform the following tests and inspections:
 - 1. Verify that shipping, blocking, and bracing are removed.
 - 2. Verify that unit is secure on mountings and supporting devices and that connections to ducts and electrical components are complete. Verify that proper thermal overload protection is installed in motors, starters, and disconnect switches.
 - 3. Verify that cleaning and adjusting are complete.
 - 4. Disconnect fan drive from motor, verify proper motor rotation direction, and verify fan wheel

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free rotation and smooth bearing operation. Reconnect fan drive system, align and adjust belts, and install belt guards.

5. Adjust belt tension.
 6. Adjust damper linkages for proper damper operation.
 7. Verify lubrication for bearings and other moving parts.
 8. Verify that manual and automatic volume control and fire and smoke dampers in connected ductwork systems are in fully open position.
 9. See Section 230593 "Testing, Adjusting, and Balancing For HVAC" for testing, adjusting, and balancing procedures.
 10. Remove and replace malfunctioning units and retest as specified above.
- B. Test and adjust controls and safeties. Controls and equipment will be considered defective if they do not pass tests and inspections.
- C. Prepare test and inspection reports.

END OF SECTION

SECTION 233423 – HVAC POWER VENTILATORS

GOVERNMENT OF THE U. S. VIRGIN ISLANDS, DEPARTMENT OF PUBLIC WORKS

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PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. In-line centrifugal fans.

1.2 ACTION SUBMITTALS

A. Product Data:

For each type of product indicated.

B. Shop Drawings:

Include plans, elevations, sections, details, and attachments to other work.

1. Detail equipment assemblies and indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
2. Wiring Diagrams:
For power, signal, and control wiring.

1.3 CLOSEOUT SUBMITTALS

- A. Operation and maintenance data.

1.4 QUALITY ASSURANCE

A. Electrical Components, Devices, and Accessories:

Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

B. AMCA Compliance:

Fans shall have AMCA-Certified performance ratings and shall bear the AMCA- Certified Ratings Seal.

PART 2 - PRODUCTS

2.1 IN-LINE CENTRIFUGAL FANS

A. Basis of Design Product:

Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:

1. Greenheck Fan Corporation
2. Loren Cook Company
3. PennBarry

B. Housing:

Split, spun aluminum with aluminum straightening vanes, inlet and outlet flanges, and support bracket adaptable to floor, side wall, or ceiling mounting.

C. Direct-Drive Units:

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Motor mounted in airstream, factory wired to disconnect switch located on outside of fan housing.

D. Belt Driven Units:

Motor mounted on adjustable base, with adjustable sheaves, enclosure around belts within fan housing, and lubricating tubes from fan bearings extended to outside of fan housing.

E. Fan Wheels:

Aluminum, airfoil blades welded to aluminum hub

F. Accessories:

1. Variable-Speed Controller:

Solid state control to reduce speed from 100 to less than 50 percent.

2. Volume Control Damper:

Manually operated with quadrant lock, located in fan outlet

3. Companion Flanges:

For inlet and outlet duct connections

4. Fan Guards:

1/2 by 1-inch (13 by 25-mm) mesh of galvanized steel in removable frame. Provide guard for inlet or outlet for units not connected to ductwork.

5. Motor and Drive Cover (Belt Guard):

Epoxy-coated steel.

2.2 MOTORS

A. Comply with NEMA designation, temperature rating, service factor, enclosure type, and manufacturers' standard efficiency requirements for motors.

1. Motor Sizes:

Minimum size as indicated. If not indicated, large enough so driven load will not require motor to operate in service factor range above 1.0.

B. Enclosure Type:

Totally enclosed, fan cooled.

2.3 SOURCE QUALITY CONTROL

A. Certify sound power level ratings according to AMCA 301, "Methods for Calculating Fan Sound Ratings from Laboratory Test Data." Factory test fans according to AMCA 300, "Reverberant Room Method for Sound Testing of Fans." Label fans with the AMCA-Certified Ratings Seal.

B. Certify fan performance ratings, including flow rate, pressure, power, air density, speed of rotation, and efficiency by factory tests according to AMCA 210, "Laboratory Methods of Testing Fans for Aerodynamic Performance Rating." Label fans with the AMCA-Certified Ratings Seal.

PART 3- EXECUTION

3.1 INSTALLATION

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A. Support suspended units from structure using threaded steel rods and elastomeric hangers having a static deflection of 1 inch (25 mm). Vibration control devices furnished with fans.

B. Install units with clearances for service and maintenance.

C. Label units as indicated on plans.

3.2 CONNECTIONS

A. Drawings indicate general arrangement of ducts and duct accessories. Make final duct connections with flexible connectors. Flexible connectors are specified in Section 233300 "Air Duct Accessories."

B. Install ducts adjacent to power ventilators to allow service and maintenance.

C. Ground equipment according to "Grounding and Bonding for Electrical Systems."

D. Connect wiring according to Section 26 43 13 "Low-Voltage Electrical Power Conductors and Cables."

3.3 FIELD QUALITY CONTROL

A. Perform tests and inspections.

1. Manufacturer's Field Service:

Engage a factory authorized service representative to inspect components, assemblies, and equipment installations, including connections, and to assist in testing.

B. Tests and Inspections:

1. Verify that shipping, blocking, and bracing are removed.

2. Verify that unit is secure on mountings and supporting devices and that connections to ducts and electrical components are complete. Verify that proper thermal overload protection is installed in motors, starters, and disconnect switches.

3. Verify that cleaning and adjusting are complete.

4. Disconnect fan drive from motor, verify proper motor rotation direction, and verify fan wheel free rotation and smooth bearing operation. Reconnect fan drive system, align and adjust belts, and install belt guards.

5. Adjust damper linkages for proper damper operation.

6. Verify lubrication for bearings and other moving parts.

7. Verify that manual and automatic volume control and fire and smoke dampers in connected ductwork systems are in fully open position.

8. Disable automatic temperature control operators, energize motor and adjust fan to indicated rpm, and measure and record motor voltage and amperage.

9. Shut unit down and reconnect automatic temperature control operators.

10. Remove and replace malfunctioning units and retest as specified above.

SECTION 233423 – HVAC POWER VENTILATORS

GOVERNMENT OF THE U. S. VIRGIN ISLANDS, DEPARTMENT OF PUBLIC WORKS

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Project Location, St. John, U.S. Virgin Islands

C. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.

D. Prepare test and inspection reports.

3.4 ADJUSTING

A. Adjust damper linkages for proper damper operation.

B. Adjust belt tension.

C. Comply with requirements in Section 230593 "Testing, Adjusting, and Balancing for HVAC" for testing, adjusting, and balancing procedures.

D. Replace fan and motor pulleys as required to achieve design airflow.

E. Lubricate bearings.

END OF SECTION

SECTION 233713 – DIFFUSERS, REGISTERS AND GRILLES

GOVERNMENT OF THE U. S. VIRGIN ISLANDS, DEPARTMENT OF PUBLIC WORKS

PROJECT NAME: Elaine I. Sprauve Public Library and Museum Building

Project Location, St. John, U.S. Virgin Islands

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Rectangular and square ceiling diffusers
2. Louver face diffusers
3. Fixed face registers and grilles

B. Related Sections:

1. Division 08 for fixed and adjustable louvers and wall vents, whether or not they are connected to ducts.
2. Section 233300 "Air Duct Accessories" for fire and smoke dampers and volume-control dampers not integral to diffusers, registers, and grilles.

1.2 ACTION SUBMITTALS

A. Product Data:

For each type of product indicated, include the following:

1. Data Sheet:
Indicate materials of construction, finish, and mounting details; and performance data including throw and drop, static-pressure drop, and noise ratings.
2. Diffuser, Register, and Grille Schedule:
Indicate drawing designation, room location, quantity, model number, size, and accessories furnished.

B. Samples:

For each exposed product and for each color and texture specified

PART 2 - PRODUCTS

2.1 CEILING DIFFUSERS

A. Rectangular and Square Ceiling Diffusers:

1. Basis of Design Product:
Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:
 - a. Carnes
 - b. Nailor Industries Inc.
 - c. Price Industries
 - d. Titus

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2. Devices shall be specifically designed for variable-air-volume flows.

3. Material:
Aluminum.

4. Finish:
Baked enamel, color selected by Owner's Representative.

5. Face Size:
24 by 24 inches (600 by 600 mm).

6. Face Style:
Three cone.

7. Mounting:
T-bar.

8. Pattern:
Fixed.

B. Louver Face Diffuser:

1. Basis-of-Design Product:
Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:

- a. Carnes
- b. Nailor Industries Inc.
- c. Price Industries
- d. Titus

2. Devices shall be specifically designed for variable-air-volume flows.

3. Material:
Aluminum.

4. Finish:
Baked enamel, color selected by Owner's Representative.

2.2 REGISTERS AND GRILLES

A. Adjustable Bar Register:

1. Basis-of-Design Product:
Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:

- a. Carnes
- b. Nailor Industries Inc.

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c. Price Industries

d. Titus

2. Material:

Aluminum

3. Finish:

Baked enamel, color selected by Owner's Representative

4. Mounting:

Concealed

B. Adjustable Bar Grille:

1. Basis of Design Product:

Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:

a. Carnes

b. Nailor Industries Inc.

c. Price Industries

d. Titus

2. Material:

Aluminum

3. Finish:

Baked enamel, color selected by Owner's Representative

4. Mounting:

Concealed

C. Fixed Face Register:

1. Basis of Design Product:

Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:

a. Carnes

b. Nailor Industries Inc.

c. Price Industries

d. Titus

2. Material:

Aluminum

3. Finish:

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Baked enamel, color selected by Owner's Representative.

4. Mounting:
Concealed.

D. Fixed Face Grille:

1. Basis of Design Product:
Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:
 - a. Carnes
 - b. Nailor Industries Inc.
 - c. Price Industries
 - d. Titus
2. Material:
Aluminum
3. Finish:
Baked enamel, color selected by Owner's Representative
4. Face Arrangement:
1/2-by-1/2-by-1/2-inch (13-by-13-by-13-mm) grid core
5. Mounting:
Concealed

2.3 SOURCE QUALITY CONTROL

- A. Verification of Performance:
Rate diffusers, registers, and grilles according to ASHRAE 70, "Method of Testing for Rating the Performance of Air Outlets and Inlets."

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install diffusers, registers, and grilles level and plumb.
- B. Ceiling Mounted Outlets and Inlets:
Drawings indicate general arrangement of ducts, fittings, and accessories. Air outlet and inlet locations have been indicated to achieve design requirements for air volume, noise criteria, airflow pattern, throw, and pressure drop. Make final locations where indicated, as much as practical. For units installed in lay-in ceiling panels, locate units in the center of panel. Where architectural features or other items conflict with installation, notify Owner's Representative for a determination of final location.
- C. Install diffusers, registers, and grilles with airtight connections to ducts and to allow service and

SECTION 233713 – DIFFUSERS, REGISTERS AND GRILLES

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maintenance of dampers, air extractors, and fire dampers.

3.2 ADJUSTING

- A After installation, adjust diffusers, registers, and grilles to air patterns indicated, or as directed, before starting air balancing.

END OF SECTION

SECTION 236200 – PACKAGED COMPRESSOR AND CONDENSER UNITS

GOVERNMENT OF THE U. S. VIRGIN ISLANDS, DEPARTMENT OF PUBLIC WORKS

PROJECT NAME: Elaine I. Sprauve Public Library and Museum Building

Project Location, St. John, U.S. Virgin Islands

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes packaged, air-cooled, refrigerant compressor and condenser units.

1.2 ACTION SUBMITTALS

A. Product Data:

For each type of product indicated.

B. Shop Drawings:

For compressor and condenser units. Include plans, elevations, sections, details, and attachments to other work.

1. Wiring Diagrams: For power, signal, and control wiring.

1.3 QUALITY ASSURANCE

A. Electrical Components, Devices, and Accessories:

Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

- B. Fabricate and label refrigeration system according to ASHRAE 15, "Safety Standard for Refrigeration Systems."

C. ASHRAE/IESNA 90.1 Compliance:

Applicable requirements in ASHRAE/IESNA 90.1, Section 6, "Heating, Ventilating, and Air-Conditioning."

1.4 WARRANTY

A. Special Warranty:

Manufacturer's standard form in which manufacturer agrees to repair or replace components of compressor and condenser units that fail in materials or workmanship within specified warranty period.

1. Failures include, but are not limited to, the following:

a. Compressor failure

b. Condenser coil leak

2. Warranty Period:

Five years from date of Substantial Completion

3. Warranty Period (Compressor Only):

10 years from date of Substantial Completion

4. Warranty Period (Components Other Than Compressor):

Five years from date of Substantial Completion

PART 2 - PRODUCTS

SECTION 236200 – PACKAGED COMPRESSOR AND CONDENSER UNITS

GOVERNMENT OF THE U. S. VIRGIN ISLANDS, DEPARTMENT OF PUBLIC WORKS

PROJECT NAME: Elaine I. Sprauve Public Library and Museum Building

Project Location, St. John, U.S. Virgin Islands

2.1 Compressor and Condenser Units, Air-Cooled (1 To 5 Tons)

Manufacturers:

Carrier Corporation; Commercial HVAC Systems.

Daikin Manufacturing

Trane; a brand of Ingersoll Rand.

Description:

Packaged, factory assembled and tested, suitable for outdoor use; consisting of casing, compressors, condenser coils, condenser fans and motors, and unit controls.

Unit Casing:

Galvanized steel finished with baked enamel; with removable panels for access to controls, weep holes for water drainage, and mounting holes in base. Mount service valves, fittings, and gage ports on exterior of casing. Meet salt spray test in accordance with ASTM B117.

Nonfused disconnect switch, factory mounted and wired, for single external electrical power connection.

Compressor:

Scroll, hermetically sealed, with rubber vibration isolators.

Motor:

Two speed, and includes thermal- and current-sensitive overload devices, start capacitor, relay, and contactor.

Two-Speed Compressor:

Include manual-reset, high-pressure switch and automatic-reset, low-pressure switch.

Refrigerant:

R-410A or R-407C.

Condenser Coil:

Seamless copper-tube, aluminum-fin coil; circuited for integral liquid sub-cooler, with removable drain pan and brass service valves with service ports. Coating shall be epoxy or phenolic epoxy type rated for minimum 4000 hours salt spray resistance when tested in accordance with ASTM B117 and minimum 4000 hours humidity resistance when tested in accordance with ASTM D 2247, applied at least 1.2 mils thick.

Condenser Fan: Direct-drive, aluminum propeller fan; with permanently lubricated ball bearings, totally enclosed fan cooled motor with thermal-overload protection.

Accessories:

Cycle Protector:

Automatic-reset timer to prevent rapid compressor cycling.

Electronic programmable thermostat to control compressor and condenser unit and evaporator fan.

Filter-dryer.

High-Pressure Switch:

Automatic-reset switch cycles compressor off on high refrigerant pressure.

Liquid-line solenoid.

Low-Pressure Switch:

Automatic-reset switch cycles compressor off on low refrigerant pressure.

SECTION 236200 – PACKAGED COMPRESSOR AND CONDENSER UNITS

GOVERNMENT OF THE U. S. VIRGIN ISLANDS, DEPARTMENT OF PUBLIC WORKS

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Precharged and insulated suction and liquid tubing.

Sound Hood:

Wraps around sound attenuation cover for compressor.

Thermostatic expansion valve.

Time-Delay Relay:

Continues operation of evaporator fan after compressor shuts off.

Condenser coil hail guard.

2.2 COMPRESSOR AND CONDENSER UNITS, AIR COOLED, 6 TO 120 TONS (21 TO 422 kW)

A. Manufacturers:

Subject to compliance with requirements, provide products by one of the following or approved equal:

1. Carrier Corporation; Commercial HVAC Systems
2. McQuay International
3. Trane; a business of American Standard Companies
4. YORK; a Johnson Controls company

B. Description:

Factory assembled and tested, air cooled; consisting of casing, compressors, condenser coils, condenser fans and motors, and unit controls.

C. Compressor:

Hermetic scroll compressor designed for service with crankcase sight glass, crankcase heater, and back-seating service access valves on suction and discharge ports.

1. Capacity Control:

On-off compressor cycling.

D. Refrigerant:

R-410A.

E. Condenser Coil:

1. Seamless copper tube, aluminum fin coil, including sub-cooling circuit and back-seating liquid line service access valve.
2. Factory pressure test coils, then dehydrate by drawing a vacuum and fill with a holding charge of nitrogen or refrigerant.
3. Condenser coils shall be factory coated to prevent salt air corrosion of aluminum, fins. Coating shall be epoxy or phenolic epoxy type rated for minimum 4000 hours salt spray resistance when tested in accordance with ASTM B 117 and minimum 4000 hours humidity resistance when tested in accordance with ASTM D 2247, applied at least 1.2 mils thick.

F. Condenser Fan:

Propeller-type vertical discharge; either directly or belt driven. Include the following:

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1. Permanently lubricated, ball-bearing totally enclosed motors.
2. Separate motor for each fan.

3. Dynamically and statically balanced fan assemblies.

G. Operating and safety controls include the following:

1. Manual reset, high-pressure cutout switches
2. Automatic-reset, low-pressure cutout switches
3. Low oil pressure cutout switch
4. Compressor winding thermostat cutout switch
5. Three-leg, compressor-overload protection
6. Control transformer
7. Magnetic contactors for compressor and condenser fan motors
8. Timer to prevent excessive compressor cycling

H. Accessories:

1. Electronic programmable thermostat to control compressor and condenser unit and evaporator fan.
2. Gage Panel:
Package with refrigerant circuit suction and discharge gages
3. Part winding start timing relay, circuit breakers, and contactors

I. Unit Casings:

Designed for outdoor installation with weather protection for components and controls and with removable panels for required access to compressors, controls, condenser fans, motors, and drives. Additional features include the following:

1. Steel, galvanized or zinc coated, for exposed casing surfaces; treated and finished with manufacturer's standard paint coating.
2. Perimeter base rail with forklift slots and lifting holes to facilitate rigging.
3. Gasketed control panel door
4. Non-fused disconnect switch, factory mounted and wired, for single external electrical power connection.
5. Condenser coil grille.

J. Capacities and Characteristics:

1. Compressor and Condenser Unit:

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- a. See schedule on drawings.
- b. Condenser coils shall be factory coated to prevent salt air corrosion of aluminum, fins. Coating shall be epoxy or phenolic epoxy type rated for minimum 4000 hours salt spray resistance when tested in accordance with ASTM B 117 and minimum 4000 hours humidity resistance when tested in accordance with ASTM D 2247, applied at least 1.2 mils thick.

2.2 SOURCE QUALITY CONTROL

- A. Energy Efficiency:
Equal to or greater than prescribed by ASHRAE/IESNA 90.1, "Energy Efficient Design of New Buildings except Low-Rise Residential Buildings," Section 6, "Heating, Ventilating, and Air Conditioning."
- B. Testing Requirements:
Factory test sound power level ratings according to ARI 270

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install units level and plumb, firmly anchored with stainless steel anchor bolts in locations indicated; maintain manufacturer's recommended clearances.
- B. Install compressor and condenser units on PE mounting base.
- C. Install compressor and condenser units on concrete base. New bases will comply with concrete materials and installation requirements specified in Section 033000 "Cast in Place Concrete."
- D. Install roof mounting units on equipment supports specified in Section 077200 "Roof Accessories."
- E. Vibration Isolation:
Mount compressor and condenser units on rubber pads with a minimum deflection of 1/4 inch (6.35 mm). Vibration isolation devices and installation requirements are specified in Section 230548 "Vibration and Seismic Controls for HVAC Piping and Equipment."
- F. Maintain manufacturer's recommended clearances for service and maintenance.
- G. Loose Components:
Install electrical components, devices, and accessories that are not factory mounted.

3.2 CONNECTIONS

- A. Comply with requirements for piping in Section 232113 "Hydronic Piping." Drawings indicate general arrangement of piping, fittings, and specialties.
- B. Where installing piping adjacent to equipment, allow space for service and maintenance of equipment.

3.3 FIELD QUALITY CONTROL

- A. Perform tests and inspections.

SECTION 236200 – PACKAGED COMPRESSOR AND CONDENSER UNITS

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B. Tests and Inspections:

1. Perform each visual and mechanical inspection and electrical test. Certify compliance with test parameters.
 2. Leak Test:
After installation, charge system with refrigerant and oil and test for leaks. Repair leaks, replace lost refrigerant and oil, and retest until no leaks exist.
 3. Operational Test:
After electrical circuitry has been energized, start units to confirm proper motor operation and unit operation, product capability, and compliance with requirements.
 4. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.
 5. Verify proper airflow over coils.
- C. Verify that vibration isolation and flexible connections properly dampen vibration transmission to structure.

END OF SECTION

SECTION 236216- AIR COOLED CONDESING UNITS

GOVERNMENT OF THE U. S. VIRGIN ISLANDS, DEPARTMENT OF PUBLIC WORKS

PROJECT NAME: Elaine I. Sprauve Public Library and Museum Building

Project Location, St. John, U.S. Virgin Islands

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes split system air conditioning units consisting of separate evaporator fan and compressor condenser components.

1.2 ACTION SUBMITTALS

- A. Product Data:
For each type of product indicated.
- B. Shop Drawings:
Include plans, elevations, sections, details, and attachments to other work.
 - 1. Detail equipment assemblies and indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.

1.3 INFORMATIONAL SUBMITTALS

- A. Warranty:
Sample of special warranty.

1.4 CLOSEOUT SUBMITTALS

- A. Operation and maintenance data.

1.5 QUALITY ASSURANCE

- A. Electrical Components, Devices, and Accessories:
Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- B. ASHRAE Compliance:
 - 1. Fabricate and label refrigeration system to comply with ASHRAE 15, "Safety Standard for Refrigeration Systems."
 - 2. ASHRAE Compliance:
Applicable requirements in ASHRAE 62.1, Section 4 "Outdoor Air Quality," Section 5 "Systems and Equipment," Section 6 "Procedures," and Section 7 "Construction and System Start-up."
- C. ASHRAE/IESNA Compliance: Applicable requirements in ASHRAE/IESNA 90.1.

1.6 WARRANTY

- A. Special Warranty:
Manufacturer's standard form in which manufacturer agrees to repair or replace components of split system air conditioning units that fail in materials or workmanship within specified warranty period.
 - 1. Warranty Period:

SECTION 236216- AIR COOLED CONDESING UNITS

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- a. For Compressor:
Five year(s) from date of Substantial Completion.
- b. For Parts:
One year(s) from date of Substantial Completion.
- c. For Labor:
One year(s) from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Basis of Design Product:
Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:
 - 1. Carrier Corporation; Home Comfort and HVAC Building & Industrial Systems
 - 2. Daiken Air Conditioning Company
 - 3. Mitsubishi Electric & Electronics USA, Inc.; HVAC Advanced Products Division
 - 4. Trane; a business of American Standard companies
 - 5. YORK; a Johnson Controls company

2.2 INDOOR UNITS (5 TONS (18 kW) OR LESS)

- A. Wall-Mounted, Evaporator Fan Components:
 - 1. Cabinet:
Plastic or enameled steel with removable panels on front and ends in color selected by Owner's Representative, and discharge drain pans with drain connection.
 - 2. Refrigerant Coil:
Copper tube, with mechanically bonded aluminum fins and thermal expansion valve. Comply with ARI 210/240. Condenser coils shall be factory coated to prevent salt air corrosion of aluminum, fins. Coating shall be epoxy or phenolic epoxy type rated for minimum 4000 hours salt spray resistance when tested in accordance with ASTM B 117 and minimum 4000 hours humidity resistance when tested in accordance with ASTM D 2247, applied at least 1.2 mils thick.
 - 3. Fan:
Direct drive, centrifugal.
 - 4. Fan Motors:
 - a. Comply with NEMA designation, temperature rating, service factor, enclosure type, and efficiency requirements specified in Section 230513 "Common Motor Requirements for HVAC Equipment."
 - b. Multi-tapped, multi-speed with internal thermal protection and permanent lubrication.
 - c. Enclosure Type:

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Totally enclosed, fan cooled

- d. NEMA Premium (TM) efficient motors as defined in NEMA MG 1
- e. Controllers, Electrical Devices, and Wiring:
Comply with requirements for electrical devices and connections specified in electrical Sections.
- 5. Airstream Surfaces:
Surfaces in contact with the airstream shall comply with requirements in ASHRAE 62.1.
- 6. Condensate Drain Pans:
 - a. Fabricated with one percent slope in at least two planes to collect condensate from cooling coils (including coil piping connections, coil headers, and return bends) and humidifiers, and to direct water toward drain connection.
 - b. Drain Connection:
Located at lowest point of pan and sized to prevent overflow. Terminate with threaded nipple on both ends of pan.
- 7. Air Filtration Section:
 - a. General Requirements for Air Filtration Section:
 - 1) Comply with NFPA 90A
 - 2) Minimum Arrestance:
According to ASHRAE 52.1 and MERV according to ASHRAE 52.2.
 - 3) Filter Holding Frames:
Arranged for flat or angular orientation, with access doors on both sides of unit. Filters shall be removable from one side or lifted out from access plenum.
 - b. Permanent, cleanable filters.

2.3 OUTDOOR UNITS (5 TONS (18 kW) OR LESS)

A. Air Cooled, Compressor Condenser Components:

- 1. Casing:
Steel, finished with baked enamel in color selected by Owner's Representative, with removable panels for access to controls, weep holes for water drainage, and mounting holes in base. Provide brass service valves, fittings, and gage ports on exterior of casing.
- 2. Compressor:
Hermetically sealed with crankcase heater and mounted on vibration isolation device. Compressor motor shall have thermal and current sensitive overload devices, start capacitor, relay, and contactor.
 - a. Compressor Type:
Scroll.
 - b. Two speed compressor motor with manual reset high pressure switch and automatic reset

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low pressure switch.

c. Refrigerant Charge:
R-410A.

d. Refrigerant Coil:

Copper tube, with mechanically bonded aluminum fins and liquid sub-cooler. Comply with ARI 210/240. Condenser coils shall be factory coated to prevent salt air corrosion of aluminum, fins. Coating shall be epoxy or phenolic epoxy type rated for minimum 4000 hours salt spray resistance when tested in accordance with ASTM B 117 and minimum 4000 hours humidity resistance when tested in accordance with ASTM D 2247, applied at least 1.2 mils thick.

3. Heat-Pump Components:

Reversing valve and low-temperature-air cutoff thermostat

4. Fan:

Aluminum-propeller type, directly connected to motor

5. Motor:

Permanently lubricated, with integral thermal overload protection.

6. Low Ambient Kit:

Permits operation down to 45°F (7°C)

7. Mounting Base:

Polyethylene

2.4 ACCESSORIES

A. Thermostat:

Wired infrared functioning to remotely control compressor and evaporator fan, with the following features:

1. Compressor time delay.
2. 24-hour time control of system stop and start.
3. Liquid crystal display indicating temperature, set point temperature, time setting, operating mode, and fan speed.
4. Fan-speed selection including auto setting.

B. Automatic-reset timer to prevent rapid cycling of compressor.

C. Refrigerant Line Kits:

Soft annealed copper suction and liquid lines factory cleaned, dried, pressurized, and sealed; factory insulated suction line with flared fittings at both ends.

D. Drain Hose:

For condensate.

SECTION 236216- AIR COOLED CONDESING UNITS

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PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install units level and plumb. Anchor to concrete base with stainless steel anchors.
- B. Install evaporator fan components using manufacturer's standard mounting devices securely fastened to building structure.
- C. Install roof mounted, compressor condenser components on equipment supports specified in Section 07 and Drawings. Anchor units to supports with removable, stainless steel fasteners.
- D. Install and connect pre-charged refrigerant tubing to component's quick connect fittings. Install tubing to allow access to unit.

3.2 CONNECTIONS

- A. Piping installation requirements are specified in other Sections. Drawings indicate general arrangement of piping, fittings, and specialties.
- B. Where piping is installed adjacent to unit, allow space for service and maintenance of unit.

3.3 FIELD QUALITY CONTROL

- A. Perform tests and inspections.
 - 1. Manufacturer's Field Service:
Engage a factory authorized service representative to inspect components, assemblies, and equipment installations, including connections, and to assist in testing.
- B. Tests and Inspections:
 - 1. Leak Test:
After installation, charge system and test for leaks. Repair leaks and retest until no leaks exist.
 - 2. Operational Test:
After electrical circuitry has been energized, start units to confirm proper motor rotation and unit operation.
 - 3. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.
- C. Remove and replace malfunctioning units and retest as specified above. D. Prepare test and inspection reports.

3.4 DEMONSTRATION

- A. Train Owner's maintenance personnel to adjust, operate, and maintain units.

END OF SECTION

SECTION 236216- AIR COOLED CONDESING UNITS

` GOVERNMENT OF THE U. S. VIRGIN ISLANDS, DEPARTMENT OF PUBLIC WORKS

PROJECT NAME: Elaine I. Sprauve Public Library and Museum Building

Project Location, St. John, U.S. Virgin Islands

SECTION 230513 – COMMON MOTOR REQUIREMENTS FOR HVAC EQUIPMENT

Government of the Virgin Islands, Department of Public Works

PROJECT NAME

Project Location, U.S. Virgin Islands

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes general requirements for single-phase and polyphase, general-purpose, horizontal, small and medium, squirrel cage induction motors for use on ac power systems up to 600 V and installed at equipment manufacturer's factory or shipped separately by equipment manufacturer for field installation.

1.2 COORDINATION

- A. Coordinate features of motors, installed units, and accessory devices to be compatible with the following:
4. Motor controllers
 5. Torque, speed, and horsepower requirements of the load
 6. Ratings and characteristics of supply circuit and required control sequence
 4. Ambient and environmental conditions of installation location

PART 2 • PRODUCTS

2.1 GENERAL MOTOR REQUIREMENTS

- A. Comply with NEMA MG 1 unless otherwise indicated.

2.2 MOTOR CHARACTERISTICS

- C. Duty:
Continuous duty at ambient temperature of 40°C and at altitude of 3300 feet (1000 m) above sea level.
- D. Capacity and Torque Characteristics:
Sufficient to start, accelerate, and operate connected loads at designated speeds, at installed altitude and environment, with indicated operating sequence, and without exceeding nameplate ratings or considering service factor.

2.3 POLYPHASE MOTORS

- C. Description:
NEMA MG 1, Design B, medium induction motor
- D. Efficiency:
Energy efficient, as defined in NEMA MG 1
- C. Service Factor:
1.15
- N. Multispeed Motors:
Variable torque.

SECTION 230513 – COMMON MOTOR REQUIREMENTS FOR HVAC EQUIPMENT

Government of the Virgin Islands, Department of Public Works

PROJECT NAME

Project Location, U.S.Virgin Islands

1. For motors with 2: 1 speed ratio, consequent pole, single winding.
 2. For motors with other than 2:1 speed ratio, separate winding for each speed.
- O. Rotor:
Random wound, squirrel cage.
- P. Bearings:
Grease-able, shielded, antifriction ball bearings suitable for radial and thrust loading
- Q. Temperature Rise:
Match insulation rating
- H. Insulation:
Class F
- I. Code Letter Designation:
3. Motors 15 HP and Larger:
NEMA starting Code F or Code G
 4. Motors Smaller than 15 HP:
Manufacturer's standard starting characteristic.
- J. Enclosure Material:
Cast iron for motor frame sizes 324T and larger; rolled steel for motor frame sizes smaller than 324T

4.4 POLYPHASE MOTORS WITH ADDITIONAL REQUIREMENTS

- C. Motors Used with Reduced-Voltage and Multispeed Controllers:
Match wiring connection requirements for controller with required motor leads. Provide terminals in motor terminal box, suited to control method.
- D. Motors Used with Variable Frequency Controllers:
Ratings, characteristics, and features coordinated with and approved by controller manufacturer.
5. Windings:
Copper magnet wire with moisture-resistant insulation varnish, designed and tested to resist transient spikes, high frequencies, and short time rise pulses produced by pulse width modulated inverters.
6. Energy- and Premium-Efficient Motors:
Class B temperature rise; Class F insulation
7. Inverter-Duty Motors:
Class F temperature rise; Class H insulation
8. Thermal Protection:
Comply with NEMA MG 1 requirements for thermally protected motors.

4.5 SINGLE-PHASE MOTORS

- A. Motors larger than 1/20 hp shall be one of the following, to suit starting torque and requirements

SECTION 230513 – COMMON MOTOR REQUIREMENTS FOR HVAC EQUIPMENT

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of specific motor application:

- 4. Permanent-split capacitor
- 5. Split phase
- 6. Capacitor start, inductor run
- 4. Capacitor start, capacitor run

F. Multispeed Motors:

Variable-torque, permanent-split-capacitor type

G. Bearings:

Pre-lubricated, antifriction ball bearings or sleeve bearings suitable for radial and thrust loading.

H. Motors 1/20 HP and Smaller:

Shaded-pole type.

I. Thermal Protection:

Internal protection to automatically open power supply circuit to motor when winding temperature exceeds a safe value calibrated to temperature rating of motor insulation. Thermal protection device shall automatically reset when motor temperature returns to normal range.

PART 3 - EXECUTION (Not Applicable)

END OF SECTION

SECTION 230517 – SLEEVES AND SLEEVE SEALS FOR HVAC PIPING

GOVERNMENT OF THE U. S. VIRGIN ISLANDS, DEPARTMENT OF PUBLIC WORKS

PROJECT NAME: Elaine I. Sprauve Public Library and Museum Building

Project Location, St. John, U.S. Virgin Islands

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes:

1. Sleeves,
2. Sleeve-seal systems,
3. Grout.

1.2 ACTION SUBMITTALS

B. Provide Data:

For each type of product indicated.

PART 2 - PRODUCTS

2.1 SLEEVES

C. Galvanized-Steel Pipe Sleeves:

ASTM A 53/A 53M, Type E, Grade B, Schedule 40, zinc coated, with plain ends

D. PVC-Pipe Sleeves:

ASTM D 1785, Schedule 40

2.2 SLEEVE-SEAL SYSTEMS

B. Manufacturers:

Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

1. Advance Products & Systems, Inc.
2. CALPICO, Inc.
4. Metraflex Company (The)
4. Pipeline Seal and Insulator, Inc.
5. Proco Products, Inc.

C. Description:

Modular sealing-element unit, designed for field assembly, for filling annular space between piping and sleeve.

3. Sealing Elements:

EPDM-Rubber interlocking links shaped to fit surface of pipe. Include type and number required for pipe material and size of pipe.

4. Connecting Bolts and Nuts:

Carbon steel, with corrosion-resistant coating. Stainless steel of length required to secure

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pressure plates to sealing elements.

2.3 GROUT

- F. Standard:
ASTM C 1107/C 1107M, Grade B, post-hardening and volume-adjusting, dry, hydraulic cement grout
- G. Characteristics:
Non-shrink; recommended for interior and exterior applications
- H. Design Mix:
5000-psi (34.5-MPa), 28-day compressive strength
- I. Packaging:
Premixed and factory packaged.

PART 3 - EXECUTION

3.1 SLEEVE INSTALLATION

- A. Install sleeves for piping passing through penetrations in floors, partitions, roofs, and walls.
- B. For sleeves that will have sleeve-seal system installed, select sleeves of size large enough to provide 1-inch (25-mm) annular clear space between piping and concrete slabs and walls
 - 1. Sleeves are not required for core-drilled holes.
- C. Install sleeves in concrete floors, concrete roof slabs, and concrete walls as new slabs and walls are constructed.
 - 1. Cut sleeves to length for mounting flush with both surfaces.
 - a. Exception:
Extend sleeves installed in floors of mechanical equipment areas or other wet areas 2 inches (50 mm) above finished floor level.
 - 2. Using grout, seal the space outside of sleeves in slabs and walls without sleeve-seal system.
- D. Install sleeves for pipes passing through interior partitions.
 - 1. Cut sleeves to length for mounting flush with both surfaces.
 - 2. Install sleeves that are large enough to provide 1/4-inch (6.4 mm) annular clear space between sleeve and pipe or pipe insulation.
 - 3. Seal annular space between sleeve and piping or piping insulation; use joint sealants appropriate for size, depth, and location of joint. Comply with requirements for sealants specified in Section 07900 "Joint Sealers."
- J. Fire-Barrier Penetrations:
Maintain indicated fire rating of walls, partitions, ceilings, and floors at pipe penetrations. Seal pipe penetrations with firestop materials. Comply with requirements for fire stopping specified in Section 07210 "Building Insulation."

SECTION 230517 – SLEEVES AND SLEEVE SEALS FOR HVAC PIPING

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3.2 SLEEVE-SEAL SYSTEM INSTALLATION

- A. Install sleeve-seal system in sleeves in exterior concrete walls and slabs-on-grade at service piping entries into building.
- B. Select type, size, and number of sealing elements required for piping material and size and for sleeve ID or hole size. Position piping in center of sleeve. Center piping in penetration, assemble sleeve seal system components, and install in annular space between piping and sleeve. Tighten bolts against pressure plates that cause sealing elements to expand and make a watertight seal.

3.3 SLEEVE AND SLEEVE-SEAL SCHEDULE

- A. Use sleeves and sleeve seals for the following piping-penetration applications:
 - 1. Exterior Concrete Walls above Grade:
 - c. Piping smaller than NPS 6 (DN 150):
Galvanized steel pipe sleeves.
 - d. Piping NPS 6 (DN 150) and larger:
Galvanized steel pipe sleeves.
 - 2. Exterior Concrete Walls below Grade:
 - c. Piping smaller than NPS 6 (DN 150):
Galvanized steel pipe sleeves with sleeve seal system.
 - 1) Select sleeve size to follow for 1 inch (25 mm) annular clear space between piping and sleeve for installing sleeve seal system.
 - d. Piping NPS 6 (DN 150) and larger:
Galvanized-steel-pipe sleeves with sleeve-seal system.
 - 1) Select sleeve size to allow for 1 inch (25 mm) annular clear space between piping and sleeve for installing sleeve seal system.
 - 3. Concrete Slabs-on-Grade:
 - a. Piping smaller than NPS 6 (DN 150): Galvanized steel pipe sleeves with sleeve seal system.
 - 1) Select sleeve size to allow for 1 inch (25 mm) annular clear space between piping and sleeve for installing sleeve seal system.
 - c. Piping NPS 6 (DN 150) and larger:
Galvanized-steel-pipe sleeves with sleeve seal system
 - 1) Select sleeve size to allow for 1 inch (25 mm) annular clear space between piping and sleeve for installing sleeve-seal system.
 - 4. Concrete Slabs above Grade:
 - c. Piping smaller than NPS 6 (DN 150):
Galvanized-steel-pipe sleeves PVC-pipe sleeves.

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- d. Piping NPS 6 (DN 150) and larger:
Galvanized-steel-pipe sleeves PVC-pipe sleeves.

5. Interior Partitions:

- c. Piping smaller than NPS 6 (DN 150):
Galvanized steel pipe sleeves
- d. Piping NPS 6 (DN 150) and larger:
Galvanized steel sheet sleeves

END OF SECTION

SECTION 230529 – HANGERS AND SUPPORTS FOR HVAC PIPING AND EQUIPMENT
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PROJECT NAME: Elaine I. Sprauve Public Library and Museum Building
Project Location, St. John, U.S. Virgin Islands

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Metal pipe hangers and supports
2. Trapeze pipe hangers
3. Thermal-hanger shield inserts
4. Fastener systems
5. Equipment supports

1.2 PERFORMANCE REQUIREMENTS

B. Structural Performance:

Hangers and supports for HVAC piping and equipment shall withstand the effects of gravity loads and stresses within limits and under conditions indicated according to ASCE/SEI 7

1. Design supports for multiple pipes capable of supporting combined weight of supported systems, system contents, and test water.
2. Design equipment supports capable of supporting combined operating weight of supported equipment and connected systems and components.

B. Seismic Performance:

Comply with SECTION 220548 – VIBRATION AND SEISMIC CONTROLS FOR PLUMBING, PIPING, AND EQUIPMENT

1.3 ACTION SUBMITTALS

B. Product Data:

For each type of product indicated

PART 2 - PRODUCTS

2.1 METAL PIPE HANGERS AND SUPPORTS

A. Stainless Steel Pipe Hangers and Supports:

Comply with SECTION 05500 – MISCELLANEOUS METALWORK

5. Description:
MSS SP-58, Types 1 through 58, factory-fabricated components
6. Galvanized Metallic Coatings:
Pre-galvanized or hot dipped
7. Padded Hangers:
Hanger with fiberglass or other pipe insulation pad or cushion to support bearing surface of piping

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8. Hanger Rods:
Continuous thread rod, nuts, and washer made of stainless steel

B. Copper Pipe Hangers:

3. Description:
MSS SP-58, Types 1 through 58, copper coated steel, factory-fabricated components
4. Hanger Rods:
Continuous thread rod, nuts, and washer made of copper-coated steel.

2.2 TRAPEZE PIPE HANGERS

- B. Description:**
MSS SP-69, Type 59, shop or field fabricated pipe support hanger rods, nuts, saddles, and U-bolts.

2.3 THERMAL-HANGER SHIELD INSERTS

- C. For Trapeze or Clamped Systems:**
Shield shall cover entire circumference of pipe.
- D. For Clevis or Band Hangers:**
Shield shall cover lower 180 degrees of pipe.

2.4 FASTENER SYSTEMS

- A. Powder-Actuated Fasteners:** Threaded steel stud, for use in hardened Portland cement concrete with pull out, tension, and shear capacities appropriate for supported loads and building materials where used.
- C. Mechanical Expansion Anchors:**
Insert wedge type, stainless steel anchors, for use in hardened Portland cement concrete; with pull-out, tension, and shear capacities appropriate for supported loads and building materials where used.

2.5 EQUIPMENT SUPPORTS

- B. Description:**
Welded, shop or field fabricated equipment support made from structural carbon steel shapes. Comply with SECTION 220548 – VIBRATION AND SEISMIC CONTROLS FOR PLUMBING, PIPING, AND EQUIPMENT

2.6 MISCELLANEOUS MATERIALS

- C. Structural Steel:**
ASTM A 36/A 36M, carbon steel plates, shapes, and bars; black and galvanized.
- D. Grout:**
ASTM C 1107, factory mixed and packaged, dry, hydraulic cement, non-shrink and nonmetallic grout; suitable for interior and exterior applications.
1. Properties: Non-staining, noncorrosive, and nongaseous

SECTION 230529 – HANGERS AND SUPPORTS FOR HVAC PIPING AND EQUIPMENT

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3. Design Mix:
5000 psi (34.5 MPa), 28-day compressive strength

PART 3 - EXECUTION

3.1 HANGER AND SUPPORT INSTALLATION

C. Metal Pipe Hanger Installation:

Comply with MSS SP-69 and MSS SP-89. Install hangers, supports, clamps, and attachments as required to properly support piping from the building structure. Comply with SECTION 220548 – VIBRATION AND SEISMIC CONTROLS FOR PLUMBING, PIPING, AND EQUIPMENT

D. Metal Trapeze Pipe Hanger Installation:

Comply with MSS SP-69 and MSS SP-89. Arrange for grouping of parallel runs of horizontal piping, and support together on field fabricated trapeze pipe hangers. Comply with SECTION 220548 – VIBRATION AND SEISMIC CONTROLS FOR PLUMBING, PIPING, AND EQUIPMENT

5. Pipes of Various Sizes:

Support together and space trapezes for smallest pipe size or install intermediate supports for smaller diameter pipes as specified for individual pipe hangers.

2. Field fabricate from ASTM A 36/A 36M, carbon steel shapes selected for loads being supported. Weld steel according to AWS D1.1/D1.1 M.

C. Fastener System Installation:

1. Install powder actuated fasteners for use in lightweight concrete or concrete slabs less than 4 inches (100 mm) thick in concrete after concrete is placed and completely cured. Use operators that are licensed by powder actuated tool manufacturer. Install fasteners according to powder actuated tool manufacturer's operating manual.
2. Install mechanical expansion anchors in concrete after concrete is placed and completely cured. Install fasteners according to manufacturer's written instructions.

- D. Install hangers and supports complete with necessary attachments, inserts, bolts, rods, nuts, washers, and other accessories.

G. Equipment Support Installation:

Fabricate from welded structural steel shapes.

- F. Install hangers and supports to allow controlled thermal movement of piping systems, to permit freedom of movement between pipe anchors, and to facilitate action of expansion joints, expansion loops, expansion bends, and similar units.

- G. Install building attachments within concrete slabs or attach to structural steel. Install additional attachments at concentrated loads, including valves, flanges, and strainers, NPS 2-1/2 (DN 65) and larger and at changes in direction of piping. Install concrete inserts before concrete is placed; fasten inserts to forms and install reinforcing bars through openings at top of inserts.

R. Load Distribution:

Install hangers and supports so that piping live and dead loads and stresses from movement will not be transmitted to connected equipment.

S. Pipe Slopes:

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Install hangers and supports to provide indicated pipe slopes and to not exceed maximum pipe deflections allowed by ASME B31.9 for building services piping.

4. Comply with SECTION 220529 – HANGERS AND SUPPORTS FOR PLUMBING PIPING AND EQUIPMENT

5. Comply with SECTION 221316 – SANITARY WATER AND VENT PIPING

T. Insulated Piping:

1. Attach clamps and spacers to piping.
 - c. Piping Operating above Ambient Air Temperature:
Clamp may project through insulation.
 - d. Piping Operating below Ambient Air Temperature:
Use thermal hanger shield insert with clamp sized to match OD of insert.
 - c. Do not exceed pipe stress limits allowed by ASME B31.9 for building services piping and SECTION 220529 – HANGERS AND SUPPORTS FOR PLUMBING PIPING AND EQUIPMENT
2. Install MSS SP-58, Type 39, protection saddles if insulation without vapor barrier is indicated. Fill interior voids with insulation that matches adjoining insulation.
 - b. Option:
Thermal hanger shield inserts may be used. Include steel weight distribution plate for pipe NPS 4 (DN 100) and larger if pipe is installed on rollers.
3. Install MSS SP-58, Type 40, protective shields on cold piping with vapor barrier. Shields shall span an arc of 180 degrees.
 - b. Option:
Thermal-hanger shield inserts may be used. Include steel weight distribution plate for pipe NPS 4 (DN 100) and larger if pipe is installed on rollers.
6. Shield Dimensions for Pipe:
Not less than the following:
 - f. NPS 114 to NPS 3-1/2 (DN 8 to DN 90):
12 inches (305 mm) long and 0.048 inch (1.22 mm) thick.
 - g. NPS 4 (DN 100):
12 inches (305 mm) long and 0.06 inch (1.52 mm) thick.
 - h. NPS 5 and NPS 6 (DN 125 and DN 150):
18 inches (457 mm) long and 0.06 inch (1.52 mm) thick.
 - i. NPS 8 to NPS 14 (DN 200 to DN 350):
24 inches (610 mm) long and 0.075 inch (1.91 mm) thick.
 - j. NPS 16 to NPS 24 (DN 400 to DN 600):
24 inches (610 mm) long and 0.105 inch (2.67 mm) thick.

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7. Pipes NPS 8 (DN 200) and Larger:

Include wood or reinforced calcium silicate insulation inserts of length at least as long as protective shield.

8. Thermal Hanger Shields:

Install with insulation same thickness as piping insulation.

3.2 EQUIPMENT SUPPORTS

D. Fabricate structural steel stands to suspend equipment from structure overhead or to support equipment above floor.

E. Grouting:

Place grout under supports for equipment and make bearing surface smooth.

F. Provide lateral bracing, to prevent swaying, for equipment supports. Comply with SECTION 220548 – VIBRATION AND SEISMIC CONTROLS FOR PLUMBING, PIPING, AND EQUIPMENT

3.3 METAL FABRICATIONS

A. Cut, drill, and fit miscellaneous metal fabrications for trapeze pipe hangers and equipment supports.

B. Fit exposed connections together to form hairline joints. Field weld connections that cannot be shop welded because of shipping size limitations.

D. Field Welding:

Comply with AWS D1.1/D1.1M procedures for shielded, metal arc welding; appearance and quality of welds; and methods used in correcting welding work; and with the following:

1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
2. Obtain fusion without undercut or overlap.
3. Remove welding flux immediately.
4. Finish welds at exposed connections so no roughness shows after finishing and so contours of welded surfaces match adjacent contours.

3.4 ADJUSTING

B. Hanger Adjustments:

Adjust hangers to distribute loads equally on attachments and to achieve indicated slope of pipe.

B. Trim excess length of continuous thread hanger and support rods to 1 1/2 inches (40 mm).

3.5 PAINTING

D. Touchup:

Clean field welds and abraded areas of shop paint. Paint exposed areas immediately after erecting hangers and supports. Use same materials as used for shop painting for touching up field-painted surfaces.

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4. Apply paint by brush or spray to provide a minimum dry film thickness of 2.0 mils (0.05 mm).
- E. Touchup:
Cleaning and touchup painting of field welds, bolted connections, and abraded areas of shop paint on miscellaneous metal are specified in Division 9.
- F. Galvanized Surfaces:
Clean welds, bolted connections, and abraded areas and apply galvanizing-repair paint to comply with ASTM A 780 and Division 9.

3.6 HANGER AND SUPPORT SCHEDULE

- A. Specific hanger and support requirements are in SECTION 220529 – HANGERS AND SUPPORTS FOR PLUMBING PIPING AND EQUIPMENT.
- B. Comply with MSS SP-69 for pipe hanger selections and applications that are not specified in SECTION 220529 – HANGERS AND SUPPORTS FOR PLUMBING PIPING AND EQUIPMENT.
- C. Use hangers and supports with galvanized metallic coatings for piping and equipment that will not have field applied finish.
- D. Use nonmetallic coatings on attachments for electrolytic protection where attachments are in direct contact with copper tubing.
- E. Use carbon steel pipe hangers and supports and metal trapeze pipe hangers and attachments for general service applications.
- F. Use copper-plated pipe hangers and copper or stainless steel attachments for copper piping and tubing.
- G. Use thermal-hanger shield inserts for insulated piping and tubing.
- H. Horizontal Piping Hangers and Supports:
Unless otherwise indicated and except as specified in piping system Sections 220529 – HANGERS AND SUPPORTS FOR PLUMBING PIPING AND EQUIPMENT and 221316 – SANITARY WATER AND VENT PIPING, install the following types:
 10. Adjustable, Steel Clevis Hangers (MSS Type 1):
For suspension of uninsulated or insulated, stationary pipes NPS 1/2 to NPS 30 (DN 15 to DN 750).
 11. Yoke-Type Pipe Clamps (MSS Type 2):
For suspension of up to 1050°F (566°C), pipes NPS 4 to NPS 24 (DN 100 to DN 600), requiring up to 4 inches (100 mm) of insulation.
 12. Carbon or Alloy-Steel, Double-Bolt Pipe Clamps (MSS Type 3):
For suspension of pipes NPS 3/4 to NPS 36 (DN 20 to DN 900), requiring clamp flexibility and up to 4 inches (100 mm) of insulation.
 13. Adjustable, Steel Band Hangers (MSS Type 7):
For suspension of uninsulated, stationary pipes NPS 1/2 to NPS 8 (DN 15 to DN 200).

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14. U-Bolts (MSS Type 24):
For support of heavy pipes NPS 1/2 to NPS 30 (DN 15 to DN 750).
 6. Pipe Saddle Supports (MSS Type 36): For support of pipes NPS 4 to NPS 36 (DN 100 to DN 900), with steel-pipe base stanchion support and cast-iron floor flange or carbon-steel plate.
 7. Pipe Stanchion Saddles (MSS Type 37): For support of pipes NPS 4 to NPS 36 (DN 100 to DN 900), with steel-pipe base stanchion support and cast-iron floor flange or carbon-steel plate, and with U-bolt to retain pipe.
 8. Single-Pipe Rolls (MSS Type 41): For suspension of pipes NPS 1 to NPS 30 (DN 25 to DN 750), from two rods if longitudinal movement caused by expansion and contraction might occur.
 9. Complete Pipe Rolls (MSS Type 44): For support of pipes NPS 2 to NPS 42 (DN 50 to DN 1050) if longitudinal movement caused by expansion and contraction might occur but vertical adjustment is not necessary.
- II. Vertical Piping Clamps:
Unless otherwise indicated and except as specified in piping system Sections, install the following types:
1. Extension Pipe or Riser Clamps (MSS Type 8):
For support of pipe risers NPS 3/4 to NPS 24 (DN 24 to DN 600).
 5. Carbon- or Alloy-Steel Riser Clamps (MSS Type 42):
For support of pipe risers NPS 3/4 to NPS 24 (DN 20 to DN 600) if longer ends are required for riser clamps.
- J. Hanger Rod Attachments: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
1. Steel Turnbuckles (MSS Type 13):
For adjustment up to 6 inches (150 mm) for heavy loads.
 6. Steel Clevises (MSS Type 14):
For 120° to 450°F (49° to 232°C) piping installations.
- U. Building Attachments:
Unless otherwise indicated and except as specified in piping system Sections, install the following types:
1. Steel or Malleable Concrete Inserts (MSS Type 18):
For upper attachment to suspend pipe hangers from concrete ceiling
 6. Top-Beam C-Clamps (MSS Type 19):
For use under roof installations with bar-joist construction, to attach to top flange of structural shape
 7. Side Beam or Channel Clamps (MSS Type 20):
For attaching to bottom flange of beams, channels, or angles
 8. Center-Beam Clamps (MSS Type 21):

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For attaching to center of bottom flange of beams

5. Welded Beam Attachments (MSS Type 22):

For attaching to bottom of beams if loads are considerable and rod sizes are large

15. C-Clamps (MSS Type 23):

For structural shapes

16. Welded-Steel Brackets:

For support of pipes from below, or for suspending from above by using clip and rod. Use one of the following for indicated loads:

d. Light (MSS Type 31):
750 lb (340 kg)

e. Medium (MSS Type 32):
1500 lb (680 kg)

f. Heavy (MSS Type 33):
3000 lb (1360 kg).

17. Side-Beam Brackets (MSS Type 34):

For sides of steel or wooden beams

18. Plate Lugs (MSS Type 57):

For attaching to steel beams if flexibility at beam is required

V. Saddles and Shields:

Unless otherwise indicated and except as specified in piping system Sections, install the following types:

1. Steel-Pipe-Covering Protection Saddles (MSS Type 39):

To fill interior voids with insulation that matches adjoining insulation.

3. Protection Shields (MSS Type 40):

Of length recommended in writing by manufacturer to prevent crushing insulation

3. Thermal-Hanger Shield Inserts:

For supporting insulated pipe

W. Spring Hangers and Supports:

Unless otherwise indicated and except as specified in piping system Sections, install the following types:

4. Spring Cushions (MSS Type 48):

For light loads if vertical movement does not exceed 1-1/4 inches (32 mm)

5. Spring-Cushion Roll Hangers (MSS Type 49):

For equipping Type 41, roll hanger with springs

6. Variable-Spring Base Supports (MSS Type 52):

Preset to indicated load and limit variability factor to 25 percent to allow expansion and contraction of piping system from base support.

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- N. Comply with MSS SP-69 for trapeze pipe-hanger selections and applications that are not specified in piping system Sections.
- O. Use mechanical expansion anchors instead of building attachments where required in concrete construction.

END OF SECTION

SECTION 230548 – VIBRATION CONTROLS FOR HVAC PIPING AND EQUIPMENT
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PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes the following:

1. Isolation pads
2. Isolation mounts
3. Restrained elastomeric isolation mounts
4. Spring isolators
5. Housed spring mounts
6. Elastomeric hangers
7. Spring hangers
8. Spring hangers with vertical-limit stops
9. Pipe riser resilient supports
10. Resilient pipe guides
11. Air-mounting system
12. Restrained vibration isolation roof-curb rails
13. Seismic snubbers
14. Restraining braces and cables
15. Vibration isolation equipment bases

1.2 DEFINITIONS

- D. IBC:
International Building Code
- E. ICC-ES:
ICC-Evaluation Service
- F. OSHPD:
Office of Statewide Health Planning and Development for the State of California

1.3 PERFORMANCE REQUIREMENTS

A. Wind-Restraint Loading:

4. Basic Wind Speed:
176 mph

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5. Building Classification Category:
IV

3. Minimum 10 lb/sq. ft. (48.8 kg/sq. m) multiplied by the maximum area of the HVAC component projected on a vertical plane that is normal to the wind direction, and 45 degrees either side of normal.

1.4 ACTION SUBMITTALS

- C. Product Data:
For the following:

1. Include rated load, rated deflection, and overload capacity for each vibration isolation device.
2. Illustrate and indicate style, material, strength, fastening provision, and finish for each type and size of seismic-restraint component used.

6. Interlocking Snubbers:
Include ratings for horizontal, vertical, and combined loads.

- D. Delegated-Design Submittal:
For vibration isolation and seismic restraint details indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

1.5 INFORMATIONAL SUBMITTALS

- B. Coordination Drawings:
Show coordination of seismic bracing for HVAC piping and equipment with other systems and equipment in the vicinity, including other supports and seismic restraints.

1.6 CLOSEOUT SUBMITTALS

- B. Operation and Maintenance Data:
For air mounting systems to include in operation and maintenance manuals.

1.7 QUALITY ASSURANCE

- A. Comply with seismic-restraint requirements in SECTION 220548 – VIBRATION AND SEISMIC CONTROLS FOR PLUMBING, PIPING, AND EQUIPMENT unless requirements in this Section are more stringent.

PART 2 - PRODUCTS

2.1 VIBRATION ISOLATORS

- B. Available Manufacturers:
Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

1. Ace Mounting Co., Inc.
2. Amber/Booth Company. Inc.

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3. California Dynamic Corporation
4. Isolation Technology, Inc.
5. Kinetics Noise Control
6. Mason Industries
7. Vibration Eliminator Co., Inc.
8. Vibration Isolation
9. Vibration Mounting & Controls, Inc.

2.2 AIR MOUNTING SYSTEMS

B. Available Manufacturers:

Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

1. California Dynamic Corporation
2. Firestone Industrial Products Company
3. Kinetics Noise Control
4. Mason Industries
5. Vibration Eliminator Co., Inc.

2.3 RESTRAINED VIBRATION ISOLATION ROOF CURB RAILS

B. Available Manufacturers:

Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

1. Amber/Booth Company, Inc.
2. California Dynamic Corporation
3. Isolation Technology, Inc.
4. Kinetic Noise Control
5. Mason Industries
6. Thybar Corporation
7. Vibration Eliminator Co. Inc.
8. Vibration Isolation.
9. Vibration Mountings & Control's, Inc.

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2.4 VIBRATION ISOLATION EQUIPMENT BASES

B. Available Manufacturers:

Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

1. Amber/Booth Company, Inc.
2. California Dynamics Corporation
3. Isolation Technology, Inc.
4. Kinetics Noise Control
5. Mason Industries
6. Vibration Eliminator Co. Inc.
7. Vibration Isolation.
8. Vibration Mounting & Controls. Inc.

2.5 SEISMIC RESTRAINT DEVICES

C. Available Manufacturers:

Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

1. Amber/Booth Company. Inc.
2. California Dynamic Corporation
3. Cooper B-Line. Inc.; a division of Cooper Industries
4. Hilti, Inc.
5. Kinetic Noise Control
6. Loos & Co.; Cableware Division
7. Mason Industries
8. TOLCO Incorporated; a brand of NIBCO INC.
9. Unistrut; Tyco International, Ltd.

2.6 FACTORY FINISHES

A. Finish:

Manufacturer's standard prime-coat finish ready for field painting.

D. Finish:

Manufacturer's standard paint applied to factory assembled and tested equipment before shipping.

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1. Powder coating on springs and housings
2. All hardware shall be galvanized. Hot-dip galvanize metal components for exterior use.
3. Baked enamel or powder coat for metal components on isolators for interior use.
4. Color code or otherwise mark vibration isolation and seismic and wind control devices to indicate capacity range.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine areas and equipment to receive vibration isolation and seismic and wind control devices for compliance with requirements for installation tolerances and other conditions affecting performance.
- B. Examine roughing-in of reinforcement and cast-in-place anchors to verify actual locations before installation.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 APPLICATIONS

- C. Hanger Rod Stiffeners:
Install hanger rod stiffeners where indicated or scheduled on Drawings to receive them and where required to prevent buckling of hanger rods due to seismic forces.
- D. Strength of Support and Seismic Restraint Assemblies:
Where not indicated, select sizes of components so strength will be adequate to carry present and future static and seismic loads within specified loading limits.

3.3 VIBRATION-CONTROL AND SEISMIC-RESTRAINT DEVICE INSTALLATION

- B. Equipment Restraints:
 1. Install seismic snubbers on HVAC equipment mounted on vibration isolators. Locate snubbers as close as possible to vibration isolators and bolt to equipment base and supporting structure.
- B. Piping Restraints:
 1. Comply with requirements in MSS SP-127.
- C. Install cables so they do not bend across edges of adjacent equipment or building structure
- D. Install bushing assemblies for anchor bolts for floor mounted equipment, arranged to provide resilient media between anchor bolt and mounting hole in concrete base.
- E. Install bushing assemblies for mounting bolts for wall mounted equipment, arranged to provide resilient media where equipment or equipment-mounting channels are attached to wall.
- H. Attachment to Structure:
If specific attachment is not indicated, anchor bracing to structure at flanges of beams, at upper

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truss chords of bar joists, or at concrete members.

G. Drilled-in Anchors:

1. Identify position of reinforcing steel and other embedded items prior to drilling holes for anchors. Do not damage existing reinforcing or embedded items during coring or drilling. Notify the structural engineer if reinforcing steel or other embedded items are encountered during drilling. Locate and avoid pre-stressed tendons, electrical and telecommunications conduit, and gas lines.
2. Do not drill holes in concrete or masonry until concrete, mortar, or grout has achieved full design strength.
5. Wedge Anchors:
Protect threads from damage during anchor installation. Heavy duty sleeve anchors shall be installed with sleeve fully engaged in the structural element to which anchor is to be fastened.
6. Adhesive Anchors:
Clean holes to remove loose material and drilling dust prior to installation of adhesive. Place adhesive in holes proceeding from the bottom of the hole and progressing toward the surface in such a manner as to avoid introduction of air pockets in the adhesive.
5. Set anchors to manufacturer's recommended torque, using a torque wrench.
6. Install zinc-coated steel anchors for interior and stainless steel anchors for exterior applications.

3.4 ACCOMMODATION OF DIFFERENTIAL SEISMIC MOTION

- A. Install flexible connections in piping where they cross seismic joints, where adjacent sections or branches are supported by different structural elements, and where the connections terminate with connection to equipment that is anchored to a different structural element from the one supporting the connections as they approach equipment.
- B. Perform tests and inspections.
- C. Remove and replace malfunctioning units and retest as specified above.
- D. Prepare test and inspection reports.

3.5 ADJUSTING

- A. Adjust isolators after piping system is at operating weight.
- B. Adjust limit stops on restrained spring isolators to mount equipment at normal operating height. After equipment installation is complete, adjust limit stops so they are out of contact during normal operation.
- C. Adjust air-spring leveling mechanism.
- D. Adjust active height of spring isolators.
- E. Adjust restraints to permit free movement of equipment within normal mode of operation.

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END OF SECTION

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PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 21 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. This Section includes the following:

1. Isolation pads
2. Isolation mounts
3. Restrained elastomeric isolation mounts
4. Freestanding and restrained spring isolators
5. Housed spring mounts
6. Elastomeric hangers
7. Spring hangers
8. Spring hangers with vertical-limit stops
11. Pipe riser resilient supports
12. Resilient pipe guides
11. Restrained vibration isolation roof curb rails
12. Seismic snubbers
13. Restraining braces and cables
14. Steel and inertia, vibration isolation equipment bases

1.3 DEFINITIONS

- C. IBC:
International Building Code
- D. ICC-ES:
ICC-Evaluation Service

1.4 PERFORMANCE REQUIREMENTS

- A. Wind-Restraint Loading:

3. Basic Wind Speed:
175 miles/hours

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4. Building Classification Category:
IV

3. Minimum 10 lb/sq. ft. (48.8 kg/sq. m) multiplied by the maximum area of the HVAC component projected on a vertical plane that is normal to the wind direction, and 45 degrees either side of normal.

B. Seismic Restraint Loading:

1. Site Class as Defined in the IBC:
D

4. Assigned Seismic Use Group or Building Category as Defined in the IBC:
IV

a. Component Importance Factor:
1.5

b. Component Response Modification Factor:
2.5

c. Component Amplification Factor:
2.5

3. Design Spectral Response Acceleration at Short Periods (0.2 Second):
1.1%

4. Design Spectral Response Acceleration at 1-Second Period:
1.8%

1.5 ACTION SUBMITTALS

C. Product Data:
For the following:

1. Include rated load, rated deflection, and overload capacity for each vibration isolation device.

2. Illustrate and indicate style, material, strength, fastening provision, and finish for each type and size of seismic restraint component used.

a. Tabulate types and sizes of seismic restraints, complete with report numbers and rated strength in tension and shear as evaluated by an evaluation service member of ICC-ES OSHPD.

b. Annotate to indicate application of each product submitted and compliance with requirements.

5. Interlocking Snubbers:
Include ratings for horizontal, vertical, and combined loads.

D. Delegated Design Submittal:
For vibration isolation and seismic restraint details indicated to comply with performance

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requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

4. Design Calculations:

Calculate static and dynamic loading due to equipment weight and operation, seismic and wind forces required to select vibration isolators, seismic and wind restraints, and for designing vibration isolation bases.

- a. Coordinate design calculations with wind load calculations required for equipment mounted outdoors. Comply with requirements in other Sections for equipment mounted outdoors.

5. Riser Supports:

Include riser diagrams and calculations showing anticipated expansion and contraction at each support point, initial and final loads on building structure, spring deflection changes, and seismic loads. Include certification that riser system has been examined for excessive stress and that none will exist.

6. Vibration Isolation Base Details:

Detail overall dimensions, including anchorages and attachments to structure and to supported equipment. Include auxiliary motor slides and rails, base weights, equipment static loads, power transmission, component misalignment, and cantilever loads.

4. Seismic- and Wind-Restraint Details:

c. Design Analysis:

To support selection and arrangement of seismic and wind restraints. Include calculations of combined tensile and shear loads.

d. Details:

Indicate fabrication and arrangement. Detail attachments of restraints to the restrained items and to the structure. Show attachment locations, methods, and spacings. Identify components, list their strengths, and indicate directions and values of forces transmitted to the structure during seismic events. Indicate association with vibration isolation devices.

- c. Coordinate seismic restraint and vibration isolation details with wind-restraint details required for equipment mounted outdoors. Comply with requirements in other Sections for equipment mounted outdoors.

e. Preapproval and Evaluation Documentation:

By an evaluation service member of ICC-ES OSHPD, showing maximum ratings of restraint items and the basis for approval (tests or calculations).

1.6 INFORMATIONAL SUBMITTALS

C. Coordination Drawings:

Show coordination of seismic bracing for HVAC piping and equipment with other systems and equipment in the vicinity, including other supports and seismic restraints.

D. Qualification Data:

For testing agency

C. Welding certificates

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D. Field quality control test reports

1.7 QUALITY ASSURANCE

C. Comply with seismic-restraint requirements in the IBC unless requirements in this Section are more stringent.

D. Welding:
Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code-Steel."

C. Seismic restraint devices shall have horizontal and vertical load testing and analysis and shall bear anchorage preapproval OPA number from OSHPD, preapproval by ICC-ES, or preapproval by another agency acceptable to authorities having jurisdiction, showing maximum seismic-restraint ratings. Ratings based on independent testing are preferred to ratings based on calculations. If preapproved ratings are not available, submittals based on independent testing are preferred. Calculations (including combining shear and tensile loads) to support seismic-restraint designs must be signed and sealed by a qualified professional engineer.

PART 2 - PRODUCTS

2.1 VIBRATION ISOLATORS

M. Available Manufacturers:
Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

1. Ace Mounting Co. Inc.
2. Isolation Technology. Inc.
3. Kinetic Noise Control
4. Mason Industries
5. Vibration Isolation

N. Pads:
Arranged in single or multiple layers of sufficient stiffness for uniform loading over pad area, molded with a nonslip pattern and galvanized-steel baseplates, and factory cut to sizes that match requirements of supported equipment.

4. Resilient Material:
Oil and water resistant neoprene rubber

O. Mounts:
Double deflection type, with molded, oil-resistant rubber, hermetically sealed compressed fiberglass, or neoprene isolator elements with factory-drilled, encapsulated top plate for bolting to equipment and with baseplate for bolting to structure. Color-code or otherwise identify to indicate capacity range.

3. Materials:

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Cast or ductile iron or welded steel housing containing two separate and opposing, oil resistant rubber or neoprene elements that prevent central threaded element and attachment hardware from contacting the housing during normal operation.

4. Neoprene:

Shock absorbing materials compounded according to the standard for bridge bearing neoprene as defined by AASHTO.

P. Restrained Mounts:

All direction mountings with seismic restraint.

4. Materials:

Cast or ductile iron or welded steel housing containing two separate and opposing, oil resistant rubber or neoprene elements that prevent central threaded element and attachment hardware from contacting the housing during normal operation.

5. Neoprene:

Shock absorbing materials compounded according to the standard for bridge bearing neoprene as defined by AASHTO.

Q. Spring Isolators:

Freestanding, laterally stable, open-spring isolators

7. Outside Spring Diameter:

Not less than 80 percent of the compressed height of the spring at rated load.

8. Minimum Additional Travel:

50 percent of the required deflection at rated load.

9. Lateral Stiffness:

More than 80 percent of rated vertical stiffness.

10. Overload Capacity:

Support 200 percent of rated load, fully compressed, without deformation or failure.

11. Baseplates:

Factory drilled for bolting to structure and bonded to ¼ inch (6 mm) thick, rubber isolator pad attached to baseplate underside. Baseplates shall limit floor load to 500 psig (3447 kPa).

12. Top Plate and Adjustment Bolt:

Threaded top plate with adjustment bolt and cap screw to fasten and level equipment.

R. Restrained Spring Isolators:

Freestanding, steel, open spring isolators with seismic or limit stop restraint.

7. Housing:

Steel with resilient vertical limit stops to prevent spring extension due to weight being removed; factory drilled baseplate bonded to ¼ inch (6 mm) thick, neoprene or rubber isolator pad attached to baseplate underside; and adjustable equipment mounting and leveling bolt that acts as blocking during installation.

8. Restraint:

Seismic or limit stop as required for equipment and authorities having jurisdiction.

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9. Outside Spring Diameter:
Not less than 80 percent of the compressed height of the spring at rated load
 10. Minimum Additional Travel:
50 percent of the required deflection at rated load
 11. Lateral Stiffness:
More than 80 percent of rated vertical stiffness
 12. Overload Capacity:
Support 200 percent of rated load, fully compressed, without deformation or failure.
- S. Housed Spring Mounts:
Housed spring isolator with integral seismic snubbers.
4. Housing:
Ductile iron or steel housing to provide all direction seismic restraint.
 5. Base:
Factory drilled for bolting to structure
 6. Snubbers:
Vertically adjustable to allow a maximum of ¼ inch (6 mm) travel up or down before contacting a resilient collar.
- T. Elastomeric Hangers:
Single or double deflection type, fitted with molded, oil resistant elastomeric isolator elements bonded to steel housings with threaded connections for hanger rods. Color code or otherwise identify to indicate capacity range.
- U. Spring Hangers:
Combination coil-spring and elastomeric-insert hanger with spring and insert in compression.
7. Frame:
Steel, fabricated for connection to threaded hanger rods and to allow for a maximum of 30 degrees of angular hanger rod misalignment without binding or reducing isolation efficiency.
 8. Outside Spring Diameter:
Not less than 80 percent of the compressed height of the spring at rated load
 9. Minimum Additional Travel:
50 percent of the required deflection at rated load
 10. Lateral Stiffness:
More than 80 percent of rated vertical stiffness
 11. Overload Capacity:
Support 200 percent of rated load, fully compressed, without deformation or failure.
 12. Elastomeric Element:
Molded, oil resistant rubber or neoprene. Steel washer reinforced cup to support spring and bushing projecting through bottom of frame.

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7. Self-centering hanger rod cap to ensure concentricity between hanger rod and support spring coil.
- V. Spring Hangers with Vertical Limit Stop:
Combination coil spring and elastomeric-insert hanger with spring and insert in compression and with a vertical limit stop.
8. Frame:
Steel, fabricated for connection to threaded hanger rods and to allow for a maximum of 30 degrees of angular hanger rod misalignment without binding or reducing isolation efficiency.
9. Outside Spring Diameter:
Not less than 80 percent of the compressed height of the spring at rated load
10. Minimum Additional Travel:
50 percent of the required deflection at rated load
11. Lateral Stiffness:
More than 80 percent of rated vertical stiffness
12. Overload Capacity:
Support 200 percent of rated load, fully compressed, without deformation or failure
13. Elastomeric Element:
Molded, oil-resistant rubber or neoprene
14. Adjustable Vertical Stop:
Steel washer with neoprene washer "up-stop" on lower threaded rod.
8. Self-centering hanger rod cap to ensure concentricity between hanger rod and support spring coil.
- W. Pipe Riser Resilient Support:
 4. All direction, acoustical pipe anchor consisting of 2 steel tubes separated by a minimum of ½ inch (13 mm) thick neoprene.
 5. Include steel and neoprene vertical limit stops arranged to prevent vertical travel in both directions.
 6. Design support for a maximum load on the isolation material of 500 psig (3.45 MPa) and for equal resistance in all directions.
- X. Resilient Pipe Guides:
Telescopic arrangement of 2 steel tubes or post and sleeve arrangement separated by a minimum of ½ inch (13 mm) thick neoprene. Where clearances are not readily visible, a factory set guide height with a shear pin to allow vertical motion due to pipe expansion and contraction shall be fitted. Shear pin shall be removable and re-insert able to allow for selection of pipe movement. Guides shall be capable of motion to meet location requirements.

2.2 RESTRAINED VIBRATION ISOLATION ROOF CURB RAILS

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A. Available Manufacturers:

Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

1. Isolation Technology. Inc.
2. Kinetics Noise Control
3. Mason Industries
4. Vibration Isolation

H. General Requirements for Restrained Vibration Isolation Roof Curb Rails:

Factory assembled, fully enclosed, insulated, air- and watertight curb rail designed to resiliently support equipment and to withstand seismic and wind forces.

I. Lower Support Assembly:

Formed sheet metal section containing adjustable and removable steel springs that support upper frame. Upper frame shall provide continuous support for equipment and shall be captive to resiliently resist seismic and wind forces. Lower support assembly shall have a means for attaching to building structure and a wood nailer for attaching roof materials, and shall be insulated with a minimum of 2 inches (50 mm) of rigid, glass-fiber insulation on inside of assembly.

J. Spring Isolators:

Adjustable, restrained spring isolators shall be mounted on ¼ inch (6 mm) thick, elastomeric vibration isolation pads and shall have access ports, for level adjustment, with removable waterproof covers at all isolator locations. Isolators shall be located so they are accessible for adjustment at any time during the life of the installation without interfering with the integrity of the roof.

1. Restrained Spring Isolators:

Freestanding, steel, open-spring isolators with seismic or wind restraint

f. Housing:

Steel with resilient vertical limit stops and adjustable equipment mounting and leveling bolt

g. Outside Spring Diameter:

Not less than 80 percent of the compressed height of the spring at rated load

h. Minimum Additional Travel:

50 percent of the required deflection at rated load

i. Lateral Stiffness:

More than 80 percent of rated vertical stiffness

j. Overload Capacity:

Support 200 percent of rated load, fully compressed, without deformation or failure

6. Pads:

Arranged in single or multiple layers of sufficient stiffness for uniform loading over pad area, molded with a nonslip pattern and galvanized steel baseplates, and factory cut to sizes that

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match requirements of supported equipment.

- c. Resilient Material:
Oil and water resistant standard neoprene

K. Snubber Bushings:

All direction, elastomeric snubber bushings at least 1/4 inch (6 mm) thick

L. Water Seal:

Galvanized sheet metal with EPDM seals at corners, attached to upper support frame, extending down past wood nailer of lower support assembly, and counter flashed over roof materials.

2.3 VIBRATION ISOLATION EQUIPMENT BASES

D. Available Manufacturers:

Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

1. Isolation Technology. Inc.
2. Kinetic Noise Control
3. Mason Industries
4. Vibration Isolation

E. Steel Base:

Factory fabricated, welded, structural steel bases and rails.

4. Design Requirements:

Lowest possible mounting height with not less than 1 inch (25 mm) clearance above the floor. Include equipment anchor bolts and auxiliary motor slide bases or rails.

- a. Include supports for suction and discharge elbows for pumps.

5. Structural Steel:

Steel shapes, plates, and bars complying with ASTM A 36/A 36M. Bases shall have shape to accommodate supported equipment.

6. Support Brackets:

Factory welded steel brackets on frame for outrigger isolation mountings and to provide for anchor bolts and equipment support.

F. Inertia Base:

Factory fabricated, welded, structural-steel bases and rails ready for placement of cast in place concrete.

5. Design Requirements:

Lowest possible mounting height with not less than 1 inch (25 mm) clearance above the floor. Include equipment anchor bolts and auxiliary motor slide bases or rails.

- a. Include supports for suction and discharge elbows for pumps.

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6. Structural Steel:
Steel shapes, plates, and bars complying with ASTM A 36/A 36M. Bases shall have shape to accommodate supported equipment.
7. Support Brackets:
Factory welded steel brackets on frame for outrigger isolation mountings and to provide for anchor bolts and equipment support.
8. Fabrication:
Fabricate steel templates to hold equipment anchor bolt sleeves and anchors in place during placement of concrete. Obtain anchor-bolt templates from supported equipment manufacturer.

2.4 SEISMIC RESTRAINT DEVICES

B. Available Manufacturers:

Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

6. Cooper B- Line. Inc.; a division of Cooper Industries
2. Hilti, Inc.
3. Kinetics Noise Control
5. Loo& Co.; Cableware Division
5. Mason Industries
6. TOLCO Incorporated ; a brand of NIBCO INC.
7. Uni trut ; Tyco International, Ltd.

K. General Requirements for Restraint Components:

Rated strengths, features, and applications shall be as defined in reports by an evaluation service member of ICC-ES.

5. Structural Safety Factor:
Allowable strength in tension, shear, and pullout force of components shall be at least four times the maximum seismic forces to which they will be subjected.

L. Snubbers:

Factory fabricated using welded structural steel shapes and plates, anchor bolts, and replaceable resilient isolation washers and bushings.

1. Anchor bolts for attaching to concrete shall be seismic rated, drill in, and stud wedge or female wedge type
6. Resilient Isolation Washers and Bushings:
Oil and water resistant neoprene
3. Maximum ¼ inch (6 mm) air gap, and minimum ¼ inch (6 mm) thick resilient cushion

M. Channel Support System:

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MFMA-3, shop or field fabricated support assembly made of slotted steel channels with accessories for attachment to braced component at one end and to building structure at the other end and other matching components and with corrosion resistant coating; and rated in tension, compression, and torsion forces.

N. Restraint Cables:

ASTM A 603 galvanized steel cables with end connections made of steel assemblies with thimbles, brackets, swivel, and bolts designed for restraining cable service; and with a minimum of two clamping bolts for cable engagement.

O. Hanger Rod Stiffener:

Steel tube or steel slotted support system sleeve with internally bolted connections to hanger rod

P. Bushings for Floor Mounted Equipment Anchor Bolts:

Neoprene bushings designed for rigid equipment mountings, and matched to type and size of anchor bolts and studs.

Q. Bushing Assemblies for Wall Mounted Equipment Anchorage:

Assemblies of neoprene elements and steel sleeves designed for rigid equipment mountings, and matched to type and size of attachment devices used.

R. Resilient Isolation Washers and Bushings:

One piece, molded, oil and water resistant neoprene, with a flat washer face

S. Mechanical Anchor Bolts:

Drilled in and stud wedge or female wedge type in zinc coated steel for interior applications and stainless steel for exterior applications. Select anchor bolts with strength required for anchor and as tested according to ASTM E 488. Minimum length of eight times diameter.

T. Adhesive Anchor Bolts:

Drilled in and capsule anchor system containing polyvinyl or urethane methacrylate based resin and accelerator, or injected polymer or hybrid mortar adhesive. Provide anchor bolts and hardware with zinc coated steel for interior applications and stainless steel for exterior applications. Select anchor bolts with strength required for anchor and as tested according to ASTM E 488.

2.5 FACTORY FINISHES

C. Finish:

Manufacturer's standard prime-coat finish ready for field painting.

D. Finish:

Manufacturer's standard paint applied to factory assembled and tested equipment before shipping.

1. Powder coating on springs and housings
2. All hardware shall be G90 galvanized. Hot dip galvanize metal components for exterior use.
3. Baked enamel or powder coat for metal components on isolators for interior use.
4. Color code or otherwise mark vibration isolation and seismic and wind control devices to indicate capacity range.

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PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine areas and equipment to receive vibration isolation and seismic and wind control devices for compliance with requirements for installation tolerances and other conditions affecting performance.
- C. Examine roughing-in of reinforcement and cast-in-place anchors to verify actual locations before installation.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 APPLICATIONS

- D. Multiple Pipe Supports:
Secure pipes to trapeze member with clamps approved for application by an evaluation service member of ICC-ES OSHPD.
- E. Hanger Rod Stiffeners:
Install hanger rod stiffeners where indicated or scheduled on Drawings to receive them and where required to prevent buckling of hanger rods due to seismic forces.
- F. Strength of Support and Seismic Restraint Assemblies:
Where not indicated, select sizes of components so strength will be adequate to carry present and future static and seismic loads within specified loading limits.

3.3 VIBRATION CONTROL AND SEISMIC RESTRAINT DEVICE INSTALLATION

- B. Comply with requirements in Section 077200 "Roof Accessories" for installation of roof curbs, equipment supports, and roof penetrations.
- B. Equipment Restraints:
 - 1. Install seismic snubbers on HVAC equipment mounted on vibration isolators. Locate snubbers as close as possible to vibration isolators and bolt to equipment base and supporting structure.
 - 2. Install resilient bolt isolation washers on equipment anchor bolts where clearance between anchor and adjacent surface exceeds 0.125 inch (3.2 mm).
 - 3. Install seismic restraint devices using methods approved by an evaluation service member of ICC-ES OSHPD providing required submittals for component.
- C. Piping Restraints:
 - 1. Comply with requirements in MSS SP-127.
 - 2. Space lateral supports a maximum of 40 feet (12m) O.C., and longitudinal supports a maximum of 80 feet (24 m) O.C.
 - 3. Brace a change of direction longer than 12 feet (3.7 m).

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- D. Install cables so they do not bend across edges of adjacent equipment or building structure.
- E. Install seismic-restraint devices using methods approved by an evaluation service member of ICC-ES OSHPD providing required submittals for component.
- F. Install bushing assemblies for anchor bolts for floor mounted equipment, arranged to provide resilient media between anchor bolt and mounting hole in concrete base.
- G. Install bushing assemblies for mounting bolts for wall mounted equipment, arranged to provide resilient media where equipment or equipment-mounting channels are attached to wall.
- M. Attachment to Structure:
If specific attachment is not indicated, anchor bracing to structure at flanges of beams, at upper truss chords of bar joists, or at concrete members.
- I. Drilled in Anchors:
 - 1. Identify position of reinforcing steel and other embedded items prior to drilling holes for anchors. Do not damage existing reinforcing or embedded items during coring or drilling. Notify the structural engineer if reinforcing steel or other embedded items are encountered during drilling. Locate and avoid pre-stressed tendons, electrical and telecommunications conduit, and gas lines.
 - 2. Do not drill holes in concrete or masonry until concrete, mortar, or grout has achieved full design strength.
 - 7. Wedge Anchors:
Protect threads from damage during anchor installation. Heavy-duty sleeve anchors shall be installed with sleeve fully engaged in the structural element to which anchor is to be fastened.
 - 8. Adhesive Anchors:
Clean holes to remove loose material and drilling dust prior to installation of adhesive. Place adhesive in holes proceeding from the bottom of the hole and progressing toward the surface in such a manner as to avoid introduction of air pockets in the adhesive.
 - 5. Set anchors to manufacturer's recommended torque, using a torque wrench.
 - 6. Install zinc-coated steel anchors for interior and stainless-steel anchors for exterior applications.

3.4 ACCOMMODATION OF DIFFERENTIAL SEISMIC MOTION

- A. Install flexible connections in piping where they cross seismic joints, where adjacent sections or branches are supported by different structural elements, and where the connections terminate with connection to equipment that is anchored to a different structural element from the one supporting the connections as they approach equipment. Comply with requirements in Section 232113 "Hydronic Piping" for piping flexible connections.

3.5 FIELD QUALITY CONTROL

- A. Perform tests and inspections.

- B. Tests and Inspections:

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1. Provide evidence of recent calibration of test equipment by a testing agency acceptable to authorities having jurisdiction.
 2. Schedule test with Owner, through Owner's Representative, before connecting anchorage device to restrained component (unless post connection testing has been approved), and with at least seven days' advance notice.
 3. Obtain Owner's Representative's approval before transmitting test loads to structure. Provide temporary load-spreading members.
 4. Test at least four of each type and size of installed anchors and fasteners selected by Owner's Representative.
 5. Test to 90 percent of rated proof load of device.
 6. Measure isolator restraint clearance.
 7. Measure isolator deflection.
 8. Verify snubber minimum clearances.
 9. Test and adjust air mounting system controls and safeties.
 10. If a device fails test, modify all installations of same type and retest until satisfactory results are achieved.
- C. Remove and replace malfunctioning units and retest as specified above.
- D. Prepare test and inspection reports

3.6. ADJUSTING

- A. Adjust isolators after piping system is at operating weight.
- B. Adjust limit stops on restrained spring isolators to mount equipment at normal operating height. After equipment installation is complete, adjust limit stops so they are out of contact during normal operation.
- D. Adjust air-spring leveling mechanism.
- D. Adjust active height of spring isolators.
- E. Adjust restraints to permit free movement of equipment within normal mode of operation.

3.7 DEMONSTRATION

- A. Engage a factory authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain air-mounting systems.

3.8 HVAC VIBRATION CONTROL AND SEISMIC RESTRAINT DEVICE SCHEDULE

- B. Supported or Suspended Equipment:

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1. Equipment Location:
Mechanical rooms
7. Pads:
Material:
Neoprene
8. Isolator Type:
Freestanding, laterally stable, open-spring isolators
9. Base Type:
Factory-fabricated, welded, structural steel bases and rails ready for placement of cast in place concrete
10. Minimum Deflection:
2 inches (50 mm)
6. Component Importance Factor:
1.5
7. Component Response Modification Factor:
2.5
8. Component Amplification Factor:
2.5

END OF SECTION

SECTION 230553 – IDENTIFICATION FOR HVAC PIPING AND EQUIPMENT

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PART 1- GENERAL

4.1 SUMMARY

B. Section Includes:

1. Equipment labels
5. Warning signs and labels
6. Pipe labels
4. Duct labels

2.2 ACTION SUBMITTAL

B. Product Data:

For each type of product indicated.

PART 2 - PRODUCTS

2.1 EQUIPMENT LABELS

D. Plastic Labels for Equipment:

1. Material and Thickness:
Multilayer, multicolor, plastic labels for mechanical engraving, 1/8 inch (3.2 mm) thick, and having predrilled holes for attachment hardware.
5. Letter Color:
White
6. Background Color:
Black
7. Maximum Temperature:
Able to withstand temperatures up to 160°F (71°C).
9. Minimum Label Size:
Length and width vary for required label content, but not less than 2-1/2 by 3/4 inch (64 by 19 mm).
10. Minimum Letter Size:
1/4 inch (6.4 mm) for name of units if viewing distance is less than 24 inches (600 mm), 1/2 inch (13 mm) for viewing distances up to 72 inches (1830 mm), and proportionately larger lettering for greater viewing distances. Include secondary lettering two-thirds to three-fourths the size of principal lettering.
11. Fasteners:
Stainless-steel rivets
12. Adhesive:
Contact type permanent adhesive, compatible with label and with substrate.

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E. Label Content:

Include equipment's Drawing designation or unique equipment number, Drawing numbers where equipment is indicated (plans, details, and schedules), plus the Specification Section number and title where equipment is specified.

F. Equipment Label Schedule:

For each item of equipment to be labeled, on 8-1/2 by 11 inch (A4) bond paper. Tabulate equipment identification number and identify Drawing numbers where equipment is indicated (plans, details, and schedules), plus the Specification Section number and title where equipment is specified. Equipment schedule shall be included in operation and maintenance data.

2.2 WARNING SIGNS AND LABELS

J. Material and Thickness:

Multilayer, multicolor, plastic labels for mechanical engraving, 1/8 inch (3.2 mm) thick, and having predrilled holes for attachment hardware.

K. Letter Color:

White

L. Background Color:

Red

M. Maximum Temperature:

Able to withstand temperatures up to 160°F (71°C).

N. Minimum Label Size:

Length and width vary for required label content, but not less than 2-1/2 by 3/4 inch (64 by 19 mm).

O. Minimum Letter Size:

1/4 inch (6.4 mm) for name of units if viewing distance is less than 24 inches (600 mm), 1/2 inch (13 mm) for viewing distances up to 72 inches (1830 mm), and proportionately larger lettering for greater viewing distances. Include secondary lettering two-thirds to three-fourths the size of principal lettering.

P. Fasteners:

Stainless-steel rivets

Q. Adhesive:

Contact type permanent adhesive, compatible with label and with substrate

R. Label Content:

Include caution and warning information, plus emergency notification instructions.

2.3 PIPE LABELS

E. General Requirements for Manufactured Pipe Labels:

Preprinted, color coded, with lettering indicating service, and showing flow direction.

F. Pre-tensioned Pipe Labels:

Pre-coiled, semi-rigid plastic formed to partially cover circumference of pipe and to attach to pipe without fasteners or adhesive.

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G. Self-Adhesive Pipe Labels:

Printed plastic with contact type, permanent adhesive backing

H. Pipe Label Contents:

Include identification of piping service using same designations or abbreviations as used on Drawings, pipe size, and an arrow indicating flow direction.

3. Flow Direction Arrows:

Integral with piping system service lettering to accommodate both directions, or as separate unit on each pipe label to indicate flow direction.

4. Lettering Size:

At least 1-1/2 inches (38 mm) high

2.4 DUCT LABELS

C. Material and Thickness:

Multilayer, multicolor, plastic labels for mechanical engraving, 1/16 inch (1.6 mm) thick, and having predrilled holes for attachment hardware.

D. Letter Color:

White

C. Background Color:

Black

J. Maximum Temperature:

Able to withstand temperatures up to 160°F (71°C).

K. Minimum Label Size:

Length and width vary for required label content, but not less than 2-1/2 by 3/4 inch (64 by 19 mm).

L. Minimum Letter Size:

1/4 inch (6.4 mm) for name of units if viewing distance is less than 24 inches (600 mm), 1/2 inch (13 mm) for viewing distances up to 72 inches (1830 mm), and proportionately larger lettering for greater viewing distances. Include secondary lettering two-thirds to three-fourths the size of principal lettering.

M. Adhesive:

Contact type permanent adhesive, compatible with label and with substrate.

N. Duct Label Contents:

Include identification of duct service using same designations or abbreviations as used on Drawings, duct size, and an arrow indicating flow direction.

3. Flow Direction Arrows:

Integral with duct system service lettering to accommodate both directions, or as separate unit on each duct label to indicate flow direction.

4. Lettering Size:

At least 1-1/2 inches (38 mm) high.

PART 3 - EXECUTION

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3.1 PREPARATION

- A. Clean piping and equipment surfaces of substances that could impair bond of identification devices, including dirt, oil, grease, release agents, and incompatible primers, paints, and encapsulates.

3.2 EQUIPMENT LABEL INSTALLATION

- A. Install or permanently fasten labels on each major item of mechanical equipment.
- B. Locate equipment labels where accessible and visible.

3.3 PIPE LABEL INSTALLATION

- B. Piping Color Coding:
Painting of piping is specified in division 9.
- B. Locate pipe labels where piping is exposed or above accessible ceilings in finished spaces; machine rooms; accessible maintenance spaces such as shafts, tunnels, and plenums; and exterior exposed locations as follows:
 - 1. Near each valve and control device.
 - 2. Near each branch connection, excluding short takeoffs for fixtures and terminal units. Where flow pattern is not obvious, mark each pipe at branch.
 - 3. Near penetrations through walls, floors, ceilings, and inaccessible enclosures.
 - 4. At access doors, manholes, and similar access points that permit view of concealed piping.
 - 5. Near major equipment items and other points of origination and termination.
 - 6. Spaced at maximum intervals of 50 feet (15m) along each run. Reduce intervals to 25 feet (7.6 m) in areas of congested piping and equipment.
 - 7. On piping above removable acoustical ceilings. Omit intermediately spaced labels.
- C. Pipe Label Color Schedule:
 - 1. Chilled Water Piping:
 - a. Background Color:
Blue
 - d. Letter Color:
White
 - 2. Condenser Water Piping:
 - c. Background Color:
Green
 - d. Letter Color:

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White

3. Hot Water Piping:

c. Background Color:
Red

d. Letter Color:
White

4. Refrigerant Piping:

c. Background Color:
Yellow

d. Letter Color:
Black

3.4 DUCT LABEL INSTALLATION

B. Install self-adhesive duct labels with permanent adhesive on air ducts in the following color codes:

5. Blue:
For cold air supply ducts

6. Yellow:
For hot-air supply ducts

7. Green:
For exhaust, outside, relief, return, and mixed-air ducts

8. ASME A13.1 Colors and Designs:
For hazardous material exhaust.

B. Locate labels near points where ducts enter into concealed spaces and at maximum intervals of 50 feet (15m) in each space where ducts are exposed or concealed by removable ceiling system.

END OF SECTION

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PART 1 - GENERAL

1.1 SUMMARY

D. Section includes:

2. Balancing air systems:
 - a. Constant volume air systems.

1.2 DEFINITIONS

- A. AABC - Associated Air Balance Council.
- E. NEBB - National Environmental Balancing Bureau
- F. TAB - Testing, Adjusting, and Balancing
- D. TABB - Testing, Adjusting, and Balancing Bureau
- E. TAB SPECIALIST - An entity engaged to perform tab work.

1.3 ACTION SUBMITTALS

A. LEED SUBMITTALS:

3. Air balance report for prerequisite IEQ 1:
Documentation of work performed for ASHRAE 62.1, section 7.2.2 "Air Balancing."
4. TAB report for prerequisite EA 2:
Documentation of work performed for ASHRAE/IESNA 90.1, section 6.7.2.3 "System Balancing."

1.4 INFORMATIONAL SUBMITTALS

- C. Strategies and procedures plan:
Within 60 days of contractor's notice to proceed, submit TAB strategies and step by step procedures as specified in "Preparation" article.
- B. Certified TAB reports

1.5 QUALITY ASSURANCE

- G. TAB contractor qualifications:
Engage a TAB entity certified by AABC, NEBB or TABB.
3. TAB field supervisor:
Employee of the tab contractor and Certified by AABC, NEBB or TABB.
4. Tab technician:
Employee of the tab contractor and who is certified by AABC NEBB or TABB as a TAB technician.

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H. Certify TAB field data reports and perform the following:

1. Review field data reports to validate accuracy of data and to prepare certified TAB reports.
2. Certify that the TAB team complied with the approved TAB plan and the procedures specified and referenced in this specification.

I. TAB report forms:

Use standard TAB contractor's forms approved by commissioning authority.

J. Instrumentation type, quantity, accuracy, and calibration:

As described in ASHRAE 111, section 5, "Instrumentation."

K. ASHRAE compliance:

Applicable requirements in ASHRAE 62.1, section 7.2.2 "Air Balancing."

L. ASHRAE/IESNA compliance:

Applicable requirements in ASHRAE/IESNA 90.1, Section 6.7.2.3- "System Balancing."

PART 2 - PRODUCTS (NOT APPLICABLE)

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine the contract documents to become familiar with project requirements and to discover conditions in systems' designs that may preclude proper TAB of systems and equipment.
- B. Examine systems for installed balancing devices, such as test ports, gage cocks, thermometer wells, flow control devices, balancing valves and fittings, and manual volume dampers. Verify that locations of these balancing devices are accessible.
- C. Examine the approved submittals for HVAC systems and equipment.
- D. Examine design data including HVAC system descriptions, statements of design assumptions for environmental conditions and systems' output, and statements of philosophies and assumptions about HVAC system and equipment controls.
- E. Examine ceiling plenums used for supply, return, or relief air to verify that they meet the leakage class of connected ducts as specified in Section 233113 "Metal Ducts" and are properly separated from adjacent areas. Verify that penetrations in plenum walls are sealed and fire-stopped if required.
- G. Examine equipment performance data including fan and pump curves.
 2. Relate performance data to project conditions and requirements, including system effects that can create undesired or unpredicted conditions that cause reduced capacities in all or part of a system.
 2. Calculate system effect factors to reduce performance ratings of HVAC equipment when installed under conditions different from the conditions used to rate equipment performance. To calculate system effects for air systems, use Tables and charts found in AMCA 201, "Fans and Systems," or in SMACNA's "HVAC Systems Duct Design." compare results with the design data and installed conditions.

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- G. Examine system and equipment installations and verify that field quality-control testing, cleaning, and adjusting specified in individual sections have been performed.
- H. Examine test reports specified in individual system and equipment sections.
- I. Examine HVAC equipment and filters and verify that bearings are greased, belts are aligned and tight, and equipment with functioning controls is ready for operation.
- J. Examine terminal units, such as variable air volume boxes, and verify that they are accessible and their controls are connected and functioning.
- K. Examine strainers. Verify that startup screens are replaced by permanent screens with indicated perforations.
- L. Examine three way valves for proper installation for their intended function of diverting or mixing fluid flows.
- M. Examine heat-transfer coils for correct piping connections and for clean and straight fins.
- N. Examine system pumps to ensure absence of entrained air in the suction piping.
- O. Examine operating safety interlocks and controls on HVAC equipment.
- P. Report deficiencies discovered before and during performance of TAB procedures. Observe and record system reactions to changes in conditions. Record default set points if different from indicated values.

3.2 PREPARATION

- A. Prepare a TAB plan that includes strategies and step by step procedures.
- D. Complete system-readiness checks and prepare reports. Verify the following:
 - 7. Permanent electrical-power wiring is complete.
 - 8. Automatic temperature-control systems are operational.
 - 9. Equipment and duct access doors are securely closed.
 - 10. Balance, smoke, and fire dampers are open.
 - 11. Isolating and balancing valves are open and control valves are operational.
 - 12. Ceilings are installed in critical areas where air pattern adjustments are required and access to balancing devices is provided.
 - 7. Windows and doors can be closed so indicated conditions for system operations can be met.

3.3 GENERAL PROCEDURES FOR TESTING AND BALANCING

- A. Perform testing and balancing procedures on each system according to the procedures contained in AABC's "National Standards for Total System Balance" ASHRAE 111 NEBB's "Procedural Standards for Testing, Adjusting, and Balancing of Environmental Systems" SMACNA's

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"HVAC Systems - Testing, Adjusting, and Balancing" and in this section.

1. Comply with requirements in ASHRAE 62.1, section 7.2.2 "Air Balancing."
- C. Cut insulation, ducts, pipes, and equipment cabinets for installation of test probes to the minimum extent necessary for TAB procedures.
2. After testing and balancing, patch probe holes in ducts with same material and thickness as used to construct ducts.
2. Install and join new insulation that matches removed materials. Restore insulation, coverings, vapor barrier, and finish according to Section 230713 "Duct Insulation," and section 230719 "HVAC piping insulation."
- C. Mark equipment and balancing devices, including damper-control positions, valve position indicators, fan-speed-control levers, and similar controls and devices, with paint or other suitable, permanent identification material to show final settings.
- D. Take and report testing and balancing measurements in inch-pound (ip) units.

3.4 GENERAL PROCEDURES FOR BALANCING AIR SYSTEMS

- A. Prepare test reports for both fans and outlets. Obtain manufacturer's outlet factors and recommended testing procedures. Crosscheck the summation of required outlet volumes with required fan volumes.
- B. Prepare schematic diagrams of systems' "as-built" duct layouts.
- C. Determine the best locations in main and branch ducts for accurate duct airflow measurements.
- D. Check airflow patterns from the outdoor air louvers and dampers and the return and exhaust air dampers through the supply fan discharge and mixing dampers.
- E. Locate start-stop and disconnect switches, electrical interlocks, and motor starters.
- F. Verify that motor starters are equipped with properly sized thermal protection.
- G. Check dampers for proper position to achieve desired airflow path. .
- H. Check for airflow blockages
- O. Check condensate drains for proper connections and functioning.
- J. Check for proper sealing of air handling unit components.
- K. Verify that air duct system is sealed as specified in Section 233113 "Metal Ducts."

3.5 PROCEDURES FOR CONSTANT VOLUME AIR SYSTEMS

- A. Adjust fans to deliver total indicated airflows within the maximum allowable fan speed listed by fan manufacturer.
2. Measure total airflow.

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- b. Where sufficient space in ducts is unavailable for Pitot tube traverse measurements, measure airflow at terminal outlets and inlets and calculate the total airflow.
- 2. Measure fan static pressures as follows to determine actual static pressure:
 - d. Measure outlet static pressure as far downstream from the fan as practical and upstream from restrictions in ducts such as elbows and transitions.
 - e. Measure static pressure directly at the fan outlet or through the flexible connection.
 - f. Measure inlet static pressure of single inlet fans in the inlet duct as near the fan as possible, upstream from the flexible connection, and downstream from duct restrictions.
 - d. Measure inlet static pressure of double inlet fans through the wall of the plenum that houses the fan.
- 7. Measure static pressure across each component that makes up an air-handling unit, rooftop unit, and other air-handling and treating equipment.
 - b. Report the cleanliness status of filters and the time static pressures are measured.
- 8. Measure static pressures entering and leaving other devices, such as sound traps, heat recovery equipment, and air washers, under final balanced conditions.
- 9. Review record documents to determine variations in design static pressures versus actual static pressures. Calculate actual system effect factors. Recommend adjustments to accommodate actual conditions.
- 10. Obtain approval from commissioning authority for adjustment of fan speed higher or lower than indicated speed. Comply with requirements in sections for air handling units for adjustment of fans, belts, and pulley sizes to achieve indicated air handling unit performance.
- 7. Do not make fan speed adjustments that result in motor overload. Consult equipment manufacturers about fan speed safety factors. Modulate dampers and measure fan-motor amperage to ensure that no overload will occur. Measure amperage in full-cooling, full-heating, economizer, and any other operating mode to determine the maximum required brake horsepower.
- C. Adjust volume dampers for main duct, submain ducts, and major branch ducts to indicated airflows within specified tolerances.
 - 3. Measure airflow of submain and branch ducts.
 - b. Where sufficient space in submain and branch ducts is unavailable for Pitot tube traverse measurements, measure airflow at terminal outlets and inlets and calculate the total airflow for that zone.
 - 4. Measure static pressure at a point downstream from the balancing damper, and adjust volume dampers until the proper static pressure is achieved.
 - 3. Re-measure each submain and branch duct after all have been adjusted. Continue to adjust submain and branch ducts to indicated airflows within specified tolerances.
- C. Measure air outlets and inlets without making adjustments.

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1. Measure terminal outlets using a direct reading hood or outlet manufacturer's written instructions and calculating factors.
- E. Adjust air outlets and inlets for each space to indicated airflows within specified tolerances of indicated valves. Make adjustments using branch volume dampers rather than extractors and the dampers at air terminals.
2. Adjust each outlet in same room or space to within specified tolerances of indicated quantities without generating noise levels above the limitations prescribed by the contract documents.
2. Adjust patterns of adjustable outlets for proper distribution without drafts.

6.6 PROCEDURES FOR MOTORS

- D. Motors, 1/2 hp and larger:
Test at final balanced conditions and record the following data:
 7. Manufacturer's name, model number, and serial number
 8. Motor horsepower rating
 9. Motor rpm
 10. Efficiency rating
 11. Nameplate and measured voltage, each phase
 12. Nameplate and measured amperage, each phase
 7. Starter thermal-protection-element rating
- B. Motors driven by variable-frequency controllers: test for proper operation at speeds varying from minimum to maximum. Test the manual bypass of the controller to prove proper operation. Record observations including name of controller manufacturer, model number, serial number, and nameplate data.

3.7 PROCEDURES FOR CONDENSING UNITS

- A. Verify proper rotation of fans.
- E. Measure entering- and leaving-air temperatures.
- F. Record compressor data.

3.8 PROCEDURES FOR HEAT-TRANSFER COILS

- B. Measure, adjust, and record the following data for each refrigerant coil:
 5. Dry-bulb temperature of entering and leaving air
 6. Wet-bulb temperature of entering and leaving air
 7. Airflow

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8. Air pressure drop

5. Refrigerant suction pressure and temperature

3.9 TOLERANCES

B. Set HVAC system's air flow rates and water flow rates within the following tolerances:

3. Supply, return, and exhaust fans and equipment with fans:
Plus or minus 10 percent

4. Air outlets and inlets:
Plus or minus 10 percent.

3.10 REPORTING

C. Initial construction phase report:

Based on examination of the contract documents as specified in "examination" article, prepare a report on the adequacy of design for systems' balancing devices. Recommend changes and additions to systems' balancing devices to facilitate proper performance measuring and balancing. Recommend changes and additions to HVAC systems and general construction to allow access for performance measuring and balancing devices.

D. Status reports:

Prepare biweekly progress reports to describe completed procedures, procedures in progress, and scheduled procedures. Include a list of deficiencies and problems found in systems being tested and balanced. Prepare a separate report for each system and each building floor for systems serving multiple floors.

3.11 FINAL REPORT

D. General:

Prepare a certified written report; tabulate and divide the report into separate sections for tested systems and balanced systems.

3. Include a certification sheet at the front of the report's Binder, signed and sealed by the certified testing and balancing engineer.

4. Include a list of instruments used for procedures, along with Proof of calibration.

E. Final report contents:

In addition to certified field report data, include the following:

4. Fan curves

5. Manufacturers' test data

6. Field test reports prepared by system and equipment installers

4. Other information relative to equipment performance; do not include shop drawings and product data.

F. General report data:

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In addition to form titles and entries, include the following data:

9. Title page
10. Name and address of the tab contractor
11. Project name
12. Project location
13. Owner's representative's name and address
14. Engineer's name and address
15. Contractor's name and address
16. Report date
9. Signature of TAB supervisor who certifies the report
16. Table of contents with the total number of pages defined for each section of the report. Number each page in the report.
17. Summary of contents including the following:
 - c. Indicated versus final performance
 - d. Notable characteristics of systems
 - c. Description of system operation sequence if it varies from the contract documents.
18. Nomenclature sheets for each item of equipment
19. Data for terminal units, including manufacturer's name, type, size, and fittings
20. Notes to explain why certain final data in the body of reports vary from indicated values
21. Test conditions for fans and pump performance forms including the following:
 - e. Settings for outdoor, return, and exhaust air dampers
 - f. Conditions of filters
 - g. Cooling coil, wet- and dry-bulb conditions
 - h. Fan drive settings including settings and percentage of maximum pitch diameter
 - e. Other system operating conditions that affect performance.

3.12 ADDITIONAL TESTS

- A. Within 90 days of completing tab, perform additional tab to verify that balanced conditions are being maintained throughout and to correct unusual conditions.

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END OF SECTION

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PART 1- GENERAL

1.1 SUMMARY

B. Section includes insulating the following duct services:

1. Indoor, concealed supply air.

B. Related Sections:

1. Section 233113 "Metal Ducts".

1.2 ACTION SUBMITTALS

C. Product Data:

For each type of product indicated.

D. Shop Drawings:

Include plans, elevations, sections, details, and attachments to other work.

4. Detail application of protective shields, saddles, and inserts at hangers for each type of insulation and hanger.
5. Detail insulation application at elbows, fittings, dampers, specialties and flanges for each type of insulation.
6. Detail application of field-applied jackets.
4. Detail application at linkages of control devices

1.3 INFORMATIONAL SUBMITTALS

A. Field quality control reports.

1.4 QUALITY ASSURANCE

D. Surface Burning Characteristics:

For insulation and related materials, as determined by testing identical products according to ASTM E 84, by a testing agency acceptable to authorities having jurisdiction. Factory label insulation and jacket materials and adhesive, mastic, tapes, and cement material containers, with appropriate markings of applicable testing agency.

2. Insulation Installed Indoors:

Flame spread index of 25 or less, and smoke developed index of 50 or less.

PART 2- PRODUCTS

2.1 INSULATION MATERIALS

A. Comply with requirements in "Duct Insulation Schedule, General," and "Indoor Duct and Plenum Insulation Schedule" articles for where insulating materials shall be applied.

B. Products shall not contain asbestos, lead, mercury, or mercury compounds.

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- C. Products that come in contact with stainless steel shall have a leachable chloride content of less than 50 ppm when tested according to ASTM C 871.
- D. Insulation materials for use on austenitic stainless steel shall be qualified as acceptable according to ASTM C 795.
- E. Foam insulation materials shall not use CFC or HCFC blowing agents in the manufacturing process.
- F. Mineral Fiber Blanket Insulation:
Mineral or glass fibers bonded with a thermosetting resin. Comply with ASTM C 553, Type II and ASTM C 1290, Type III with factory applied FSK jacket. Factory applied jacket requirements are specified in "Factory Applied Jackets" Article.
- 2. Products:
Subject to compliance with requirements, provide one of the following available products that may be incorporated into the Work include, but are not limited to, the following:
 - a. CertainTeed Corp.; SoftTouch Duct Wrap.
 - b. Johns Manville; Microlite
 - c. Knauf Insulation; Friendly Feel Duct Wrap
 - d. Manson Insulation Inc.; Alley Wrap
 - e. Owens Coming; SOFTR All-Service Duct Wrap

2.2 ADHESIVES

- A. Materials shall be compatible with insulation materials, jackets, and substrates and for bonding insulation to itself and to surfaces to be insulated unless otherwise indicated.
- E. Mineral Fiber Adhesive:
Comply with Mil-A-3316C, Class 2, Grade A
- 3. Products:
Subject to compliance with requirements, provide one of the following available products that may be incorporated into the Work include, but are not limited to, the following:
 - d. Childers Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; CP-127
 - e. Eagle Bridges - Marathon Industries; 225
 - f. Foster Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; 85-60/85-70
 - d. Mon-Eco Industries, Inc.; 22-25
- 4. For indoor applications, adhesive shall have a VOC content of 80 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

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3. Adhesive shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small Scale Environmental Chambers."

F. ASJ Adhesive, and FSK Jacket Adhesive:

Comply with Mil-A-3316C, Class 2, Grade A for bonding insulation jacket lap seams and joints.

3. Products:

Subject to compliance with requirements, provide one of the following available products that may be incorporated into the Work include, but are not limited to, the following:

- d. Childers Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; CP-82
- e. Eagle Bridges - Marathon Industries; 225
- f. Foster Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; 85-50
- d. Mon-Eco Industries, Inc.; 22-25.

4. For indoor applications, adhesive shall have a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

3. Adhesive shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small Scale Environmental Chambers."

2.3 MASTICS

- D. Materials shall be compatible with insulation materials, jackets, and substrates; comply with MIL-PRF-19565C, Type II.

1. For indoor applications, use mastics that have a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

E. Vapor Barrier Mastic:

Water based; suitable for indoor use on below ambient services

6. Products:

Subject to compliance with requirements, provide one of the following available products that may be incorporated into the Work include, but are not limited to, the following:

- b. Foster Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; 30-80/30-90
- b. Vimasco Corporation; 749

7. Water Vapor Permeance:

ASTM E 96/E 96M, Procedure B, 0.013 perm (0.009 metric perm) at 43 mil (1.09 mm) dry film thickness.

8. Service Temperature Range:

To plus 180°F (to plus 82°C).

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- 9. Solids Content:
ASTM D 1644, 58 percent by volume and 70 percent by weight
- 10. Color:
White.
- F. Breather Mastic:
Water based; suitable for indoor and outdoor use on above ambient services.
- 6. Products:
Subject to compliance with requirements, provide one of the following available products that may be incorporated into the Work include, but are not limited to, the following:
 - e. Childers Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; CP-10
 - f. Eagle Bridges - Marathon Industries; 550
 - g. Foster Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; 46-50
 - h. Mon-Eco Industries, Inc.; 55-50
 - e. Vimasco Corporation; WC-1/WC-5
- 7. Water Vapor Permeance:
ASTM F 1249, 1.8 perms (1.2 metric perms) at 0.0625-inch (1.6-mm) dry film thickness.
- 8. Service Temperature Range:
To plus 180°F (to plus 82°C)
- 9. Solids Content:
60 percent by volume and 66 percent by weight
- 10. Color:
White.

2.4 SEALANTS

- B. FSK and Metal Jacket Flashing Sealants:
- 7. Products:
Subject to compliance with requirements, provide one of the following available products that may be incorporated into the Work include, but are not limited to, the following:
 - d. Childers Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; CP-76
 - e. Eagle Bridges- Marathon Industries; 405
 - f. Foster Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; 95-44

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d. Mon-Eco Industries, Inc.; 44-05

8. Materials shall be compatible with insulation materials, jackets, and substrates.

9. Fire and water resistant, flexible, elastomeric sealant

10. Service Temperature Range:

To plus 250°F (to plus 121°C)

11. Color:

Aluminum

12. For indoor applications, use sealants that have a VOC content of 420 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

7. Sealants shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small Scale Environmental Chambers."

B. ASJ Flashing Sealants, and Vinyl and PVC Jacket Flashing Sealants:

7. Products:

Subject to compliance with requirements, provide one of the following available products that may be incorporated into the Work include, but are not limited to, the following:

b. Childers Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; CP-76

8. Materials shall be compatible with insulation materials, jackets, and substrates.

9. Fire and water resistant, flexible, elastomeric sealant

10. Service Temperature Range:

To plus 250°F (to plus 121°C)

11. Color:

White

12. For indoor applications, sealants shall have a VOC content of 420 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24)

7. Sealants shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small Scale Environmental Chambers."

2.5 FACTORY APPLIED JACKETS

B. Insulation system schedules indicate factory applied jackets on various applications. When factory applied jackets are indicated, comply with the following:

6. ASJ:

White, kraft paper, fiberglass reinforced scrim with aluminum foil backing; complying with ASTM C 1136, Type I.

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7. ASJ-SSL:
ASJ with self-sealing, pressure sensitive, acrylic based adhesive covered by a removable protective strip; complying with ASTM C 1136, Type I.
8. FSK Jacket:
Aluminum foil, fiberglass reinforced scrim with kraft paper backing; complying with ASTM C 1136, Type II.
9. FSP Jacket:
Aluminum foil, fiberglass reinforced scrim with polyethylene backing; complying with ASTM C 1136, Type II.
10. Vinyl Jacket:
White vinyl with a permeance of 1.3 perms (0.86 metric perm) when tested according to ASTM E 96/E 96M, Procedure A, and complying with NFPA 90A and NFPA90B.

2.6 FIELD APPLIED FABRIC REINFORCING MESH

- B. Woven Polyester Fabric:
Approximately 1 oz./sq. yd. (34 g/sq. m) with a thread count of 10 strands by 10 strands/sq. in. (4 strands by 4 strands/sq. mm), in a Leno weave, for ducts.
2. Products:
Subject to compliance with requirements, provide one of the following available products that may be incorporated into the Work include, but are not limited to, the following:
 - b. Foster Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; Mast-A-Fab
 - b. Vimasco Corporation; Elastafab 894

2.7 TAPES

- E. ASJ Tape:
White vapor retarder tape matching factory applied jacket with acrylic adhesive, complying with ASTM C 1136.
3. Products:
Subject to compliance with requirements, provide one of the following available products that may be incorporated into the Work include, but are not limited to, the following:
 - c. ABI, Ideal Tape Division; 428 AWF ASJ
 - b. Avery Dennison Corporation, Specialty Tapes Division; Passon 0836.
 - d. Compac Corporation; 104 and 105
 - d. Venture Tape; 1540 CW Plus, 1542 CW Plus, and 1542 CW Plus/SQ
4. Width:
3 inches (75 mm)
3. Thickness:

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11.5 mils (0.29 mm)

8. Adhesion:
90 ounces force/inch (1.0 N/mm) in width

9. Elongation:
2 percent

10. Tensile Strength:
40 lbf/inch (7.2 N/mm) in width

11. ASJ Tape Disks and Squares:
Precut disks or squares of ASJ tape

F. FSK Tape:

Foil face, vapor-retarder tape matching factory applied jacket with acrylic adhesive; complying with ASTM C 1136.

3. Products:
Subject to compliance with requirements, provide one of the following available products that may be incorporated into the Work include, but are not limited to, the following:

- b. ABI, Ideal Tape Division; 491 AWF FSK
- b. Avery Dennison Corporation, Specialty Tapes Division; Fasson 0827
- d. Compac Corporation; 110 and 111
- d. Venture Tape; 1525 CW NT, 1528 CW, and 1528 CW/SQ

4. Width:
3 inches (75 mm)

3. Thickness:
6.5 mils (0.16 mm)

7. Adhesion:
90 ounces force/inch (1.0 N/mm) in width

8. Elongation:
2 percent

9. Tensile Strength:
40 lbf/inch (7.2 N/mm) in width

7. FSK Tape Disks and Squares: Precut disks or squares of FSK tape

G. PVC Tape:

White vapor-retarder tape matching field-applied PVC jacket with acrylic adhesive; suitable for indoor and outdoor applications.

2. Products:
Subject to compliance with requirements, provide one of the following available products that may be incorporated into the Work include, but are not limited to, the following:

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- a. ABI, Ideal Tape Division; 370 White PVC tape
 - b. Compac Corporation; 130
 - c. Venture Tape; 1506 CW NS
7. Width:
2 inches (50 mm)
8. Thickness:
6 mils (0.15 mm)
9. Adhesion:
64 ounces force/inch (0.7 N/mm) in width
10. Elongation:
500 percent
11. Tensile Strength:
18 lbf/inch (3.3 N/mm) in width.
- H. Aluminum-Foil Tape:
Vapor retarder tape with acrylic adhesive
3. Products:
Subject to compliance with requirements, provide one of the following available products that may be incorporated into the Work include, but are not limited to, the following:
- d. ABI, Ideal Tape Division; 488 AWF
 - e. Avery Dennison Corporation, Specialty Tapes Division; Fasson 0800.
 - f. Compac Corporation; 120
 - d. Venture Tape; 3520 CW
4. Width:
2 inches (50 mm)
3. Thickness:
3.7 mils (0.093 mm)
7. Adhesion:
100 ounces force/inch (1.1 N/mm) in width
8. Elongation:
5 percent
9. Tensile Strength:
34 lbf/inch (6.2 N/mm) in width

2.8 SECUREMENTS

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D. Aluminum Bands:

ASTM B 209 (ASTM B 209M), Alloy 3003, 3005, 3105, or 5005; Temper H-14, 0.020 inch (0.51 mm) thick, 1/2 inch (13 mm) wide with wing seal or closed seal.

2. Products:

Subject to compliance with requirements, provide one of the following available products that may be incorporated into the Work include, but are not limited to, the following:

- b. ITW Insulation Systems; Gerrard Strapping and Seals
- b. RPR Products, Inc.; Insul-Mate Strapping, Seals, and Springs

E. Insulation Pins and Hangers:

6. Metal, Adhesively Attached, Perforated Base Insulation Hangers:

Baseplate welded to projecting spindle that is capable of holding insulation, of thickness indicated, and securely in position indicated when self-locking washer is in place. Comply with the following requirements:

e. Products:

Subject to compliance with requirements, provide one of the following available products that may be incorporated into the Work include, but are not limited to, the following:

- 3) AGM Industries, Inc.; Tactoo Perforated Base Insul-Hangers
- 4) GEMCO; Perforated Base
- 3) Midwest Fasteners, Inc.; Spindle

f. Baseplate:

Perforated, galvanized carbon steel sheet, 0.030 inch (0.76 mm) thick by 2 inches (50 mm) square.

g. Spindle:

Stainless steel, fully annealed, 0.106 inch (2.6 mm) diameter shank, length to suit depth of insulation indicated.

h. Adhesive:

Recommended by hanger manufacturer. Product with demonstrated capability to bond insulation hanger securely to substrates indicated without damaging insulation, hangers, and substrates.

7. Nonmetal, Adhesively Attached, Perforated Base Insulation Hangers:

Baseplate fastened to projecting spindle that is capable of holding insulation, of thickness indicated, and securely in position indicated when self-locking washer is in place. Comply with the following requirements:

e. Products:

Subject to compliance with requirements, provide one of the following available products that may be incorporated into the Work include, but are not limited to, the following:

- 2) GEMCO; Nylon Hangers
- 2) Midwest Fasteners, Inc.; Nylon Insulation Hangers

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- f. Baseplate:
Perforated, nylon sheet, 0.030 inch (0.76 mm) thick by 1-1/2 inches (38 mm) in diameter
 - g. Spindle:
Nylon, 0.106 inch (2.6 mm) diameter shank, length to suit depth of insulation indicated, up to 2-1/2 inches (63 mm).
 - h. Adhesive:
Recommended by hanger manufacturer. Product with demonstrated capability to bond insulation hanger securely to substrates indicated without damaging insulation, hangers, and substrates.
8. Self-Sticking-Base Insulation Hangers:
Baseplate welded to projecting spindle that is capable of holding insulation, of thickness indicated, and securely in position indicated when self-locking washer is in place. Comply with the following requirements:
- d. Products:
Subject to compliance with requirements, provide one of the following available products that may be incorporated into the Work include, but are not limited to, the following:
 - 3) AGM Industries, Inc.; Tactoo Self-Adhering Insul-Hangers
 - 4) GEMCO; Peel & Press
 - 3) Midwest Fasteners, Inc.; Self Stick
 - e. Baseplate:
Galvanized carbon steel sheet, 0.030 inch (0.76 mm) thick by 2 inches (50 mm) square
 - f. Spindle:
Stainless steel, fully annealed, 0.106 inch (2.6 mm) diameter shank, length to suit depth of insulation indicated.
 - d. Adhesive backed base with a peel off protective cover
9. Insulation Retaining Washers:
Self-locking washers formed from 0.016 inch (0.41 mm) thick, stainless steel sheet, with beveled edge sized as required to hold insulation securely in place but not less than 1-1/2 inches (38 mm) in diameter.
- b. Products:
Subject to compliance with requirements, provide one of the following available products that may be incorporated into the Work include, but are not limited to, the following:
 - 4) AGM Industries, Inc.; RC-150
 - 5) GEMCO; R-150
 - 6) Midwest Fasteners, Inc.; WA-150
 - 4) Nelson Stud Welding; Speed Clips

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- b. Protect ends with capped self-locking washers incorporating a spring steel insert to ensure permanent retention of cap in exposed locations.

10. Nonmetal Insulation Retaining Washers:

Self-locking washers formed from 0.016 inch (0.41 mm) thick nylon sheet, with beveled edge sized as required to hold insulation securely in place but not less than 1-1/2 inches (38 mm) in diameter.

b. Manufacturers:

Subject to compliance with requirements, provide products by one of the following available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

2) GEMCO

2) Midwest Fasteners, Inc

F. Staples:

Outward clinching insulation staples, nominal 3/4 inch (19 mm) wide, stainless steel or Monel.

D. Wire:

0.062 inch (1.6 mm) soft annealed, galvanized steel

2. Manufacturers:

Subject to compliance with requirements, provide products by one of the following available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

a. C & F Wire.

2.9 CORNER ANGLES

B. PVC Corner Angles:

30 mils (0.8 mm) thick, minimum 1 by 1 inch (25 by 25 mm), PVC according to ASTM D 1784, Class 16354-C. White or color-coded to match adjacent surface.

B. Aluminum Corner Angles:

0.040 inch (1.0 mm) thick, minimum 1 by 1 inch (25 by 25 mm), aluminum according to ASTM B 209 (ASTM B 209M), Alloy 3003, 3005, 3105, or 5005; Temper H-14.

PART 3 - EXECUTION

3.1 PREPARATION

B. Surface Preparation:

Clean and dry surfaces to receive insulation. Remove materials that will adversely affect insulation application.

3.2 GENERAL INSTALLATION REQUIREMENTS

A. Install insulation materials, accessories, and finishes with smooth, straight, and even surfaces; free of voids throughout the length of ducts and fittings.

B. Install insulation materials, vapor barriers or retarders, jackets, and thicknesses required for each

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item of duct system as specified in insulation system schedules.

- C. Install accessories compatible with insulation materials and suitable for the service. Install accessories that do not corrode, soften, or otherwise attack insulation or jacket in either wet or dry state.
- D. Install insulation with longitudinal seams at top and bottom of horizontal runs.
- E. Install multiple layers of insulation with longitudinal and end seams staggered.
- G. Keep insulation materials dry during application and finishing.
- G. Install insulation with tight longitudinal seams and end joints. Bond seams and joints with adhesive recommended by insulation material manufacturer.
- H. Install insulation with least number of joints practical.
- L. Where vapor barrier is indicated, seal joints, seams, and penetrations in insulation at hangers, supports, anchors, and other projections with vapor-barrier mastic.
 - 2. Install insulation continuously through hangers and around anchor attachments.
 - 2. For insulation application where vapor barriers are indicated, extend insulation on anchor legs from point of attachment to supported item to point of attachment to structure. Taper and seal ends at attachment to structure with vapor barrier mastic.
 - 3. Install insert materials and install insulation to tightly join the insert. Seal insulation to insulation inserts with adhesive or sealing compound recommended by insulation material manufacturer.
- J. Apply adhesives, mastics, and sealants at manufacturer's recommended coverage rate and wet and dry film thicknesses.
- K. Install insulation with factory-applied jackets as follows:
 - 5. Draw jacket tight and smooth.
 - 6. Cover circumferential joints with 3 inch (75 mm) wide strips, of same material as insulation jacket. Secure strips with adhesive and outward clinching staples along both edges of strip, spaced 4 inches (100 mm) O.C.
 - 7. Overlap jacket longitudinal seams at least 1-1/2 inches (38 mm). Clean and dry surface to receive self-sealing lap. Staple laps with outward clinching staples along edge at 2 inches (50 mm) O.C.
 - b. For below ambient services, apply vapor-barrier mastic over staples.
 - 8. Cover joints and seams with tape, according to insulation material manufacturer's written instructions, to maintain vapor seal.
 - 5. Where vapor barriers are indicated, apply vapor-barrier mastic on seams and joints and at ends adjacent to duct flanges and fittings.
- L. Cut insulation in a manner to avoid compressing insulation more than 75 percent of its nominal

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thickness.

M. Finish installation with systems at operating conditions. Repair joint separations and cracking due to thermal movement.

N. Repair damaged insulation facings by applying same facing material over damaged areas. Extend patches at least 4 inches (100 mm) beyond damaged areas. Adhere, staple, and seal patches similar to butt joints.

3.3 PENETRATIONS

B. Insulation Installation at Roof Penetrations:

Install insulation continuously through roof penetrations.

4. Seal penetrations with flashing sealant.

2. For applications requiring only indoor insulation, terminate insulation above roof surface and seal with joint sealant. For applications requiring indoor and outdoor insulation, install insulation for outdoor applications tightly joined to indoor insulation ends. Seal joint with joint sealant.

4. Extend jacket of outdoor insulation outside roof flashing at least 2 inches (50 mm) below top of roof flashing.

4. Seal jacket to roof flashing with flashing sealant.

B. Insulation Installation at above ground Exterior Wall Penetrations:

Continuously through wall penetrations.

1. Seal penetrations with flashing sealant.. Install insulation.

5. For applications requiring only indoor insulation, terminate insulation inside wall surface and seal with joint sealant. For applications requiring indoor and outdoor insulation, install insulation for outdoor applications tightly joined to indoor insulation ends. Seal joint with joint sealant.

6. Extend jacket of outdoor insulation outside wall flashing and overlap wall flashing at least 2 inches (50 mm).

4. Seal jacket to wall flashing with flashing sealant.

F. Insulation Installation at Interior Wall and Partition Penetrations (That Are Not Fire Rated):

Install insulation continuously through walls and partitions.

G. Insulation Installation at Fire Rated Wall and Partition Penetrations:

Terminate insulation at fire damper sleeves for fire-rated wall and partition penetrations. Externally insulate damper sleeves to match adjacent insulation and overlap duct insulation at least 2 inches (50 mm).

1. Comply with requirements in Division 07 for fire stopping and fire resistive joint sealers.

H. Insulation Installation at Floor Penetrations:

2. Duct:

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For penetrations through fire rated assemblies, terminate insulation at fire damper sleeves and externally insulate damper sleeve beyond floor to match adjacent duct insulation. Overlap damper sleeve and duct insulation at least 2 inches (50 mm).

2. Seal penetrations through fire-rated assemblies. Comply with requirements in Division 07 for fire stopping and fire resistive joint sealers."

3.4 INSTALLATION OF MINERAL FIBER INSULATION

C. Blanket Insulation Installation on Ducts and Plenums:

Secure with adhesive and insulation pins.

7. Apply adhesives according to manufacturer's recommended coverage rates per unit area, for 100 percent coverage of duct and plenum surfaces.
8. Apply adhesive to entire circumference of ducts and to all surfaces of fittings and transitions.
9. Install either capacitor discharge weld pins and speed washers or cupped head, capacitor discharge weld pins on sides and bottom of horizontal ducts and sides of vertical ducts as follows:
 - f. On duct sides with dimensions 18 inches (450 mm) and smaller, place pins along longitudinal centerline of duct. Space 3 inches (75 mm) maximum from insulation end joints, and 16 inches (400 mm) O.C.
 - g. On duct sides with dimensions larger than 18 inches (450 mm), place pins 16 inches (400 mm) O.C. each way, and 3 inches (75 mm) maximum from insulation joints. Install additional pins to hold insulation tightly against surface at cross bracing.
 - h. Pins may be omitted from top surface of horizontal, rectangular ducts and plenums.
 - i. Do not over compress insulation during installation.
 - j. Impale insulation over pins and attach speed washers.
 - f. Cut excess portion of pins extending beyond speed washers or bend parallel with insulation surface. Cover exposed pins and washers with tape matching insulation facing.
10. For ducts and plenums with surface temperatures below ambient, install a continuous unbroken vapor barrier. Create a facing lap for longitudinal seams and end joints with insulation by removing 2 inches (50 mm) from one edge and one end of insulation segment. Secure laps to adjacent insulation section with 1/2-inch (13 mm) outward clinching staples, 1 inch (25 mm) O.C. Install vapor barrier consisting of factory or field applied jacket, adhesive, vapor barrier mastic, and sealant at joints, seams, and protrusions.
 - c. Repair punctures, tears, and penetrations with tape or mastic to maintain vapor barrier seal.
 - d. Install vapor stops for ductwork and plenums operating below 50°F (10°C) at 18 foot (5.5 m) intervals. Vapor stops shall consist of vapor barrier mastic applied in a Z-shaped pattern over insulation face, along butt end of insulation, and over the surface. Cover insulation face and surface to be insulated a width equal to two times the insulation thickness, but not less than 3 inches (75 mm).
11. Overlap un-faced blankets a minimum of 2 inches (50 mm) on longitudinal seams and end

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joints. At end joints, secure with steel bands spaced a maximum of 18 inches (450 mm) O.C.

12. Install insulation on rectangular duct elbows and transitions with a full insulation section for each surface. Install insulation on round and flat oval duct elbows with individually mitered gores cut to fit the elbow.
 7. Insulate duct stiffeners, hangers, and flanges that protrude beyond insulation surface with 6 inch (150 mm) wide strips of same material used to insulate duct. Secure on alternating sides of stiffener, hanger, and flange with pins spaced 6 inches (150 mm) O.C.
- D. Board Insulation Installation on Ducts and Plenums:
Secure with adhesive and insulation pins.
6. Apply adhesives according to manufacturer's recommended coverage rates per unit area, for 100 percent coverage of duct and plenum surfaces.
 7. Apply adhesive to entire circumference of ducts and to all surfaces of fittings and transitions.
 8. Install either capacitor-discharge-weld pins and speed washers or cupped-head, capacitor discharge weld pins on sides and bottom of horizontal ducts and sides of vertical ducts as follows:
 - f. On duct sides with dimensions 18 inches (450 mm) and smaller, place pins along longitudinal centerline of duct. Space 3 inches (75 mm) maximum from insulation end joints, and 16 inches (400 mm) O.C.
 - g. On duct sides with dimensions larger than 18 inches (450 mm), space pins 16 inches (400 mm) O.C. each way, and 3 inches (75 mm) maximum from insulation joints. Install additional pins to hold insulation tightly against surface at cross bracing.
 - h. Pins may be omitted from top surface of horizontal, rectangular ducts and plenums.
 - i. Do not over compress insulation during installation.
 - j. Cut excess portion of pins extending beyond speed washers or bend parallel with insulation surface. Cover exposed pins and washers with tape matching insulation facing.
 9. For ducts and plenums with surface temperatures below ambient, install a continuous unbroken vapor barrier. Create a facing lap for longitudinal seams and end joints with insulation by removing 2 inches (50 mm) from one edge and one end of insulation segment. Secure laps to adjacent insulation section with 1/2-inch (13-mm) outward clinching staples, 1 inch (25 mm) O.C. Install vapor barrier consisting of factory- or field applied jacket, adhesive, vapor barrier mastic, and sealant at joints, seams, and protrusions.
 - c. Repair punctures, tears, and penetrations with tape or mastic to maintain vapor barrier seal.
 - d. Install vapor stops for ductwork and plenums operating below 50°F (10°C) at 18 foot (5.5 m) intervals. Vapor stops shall consist of vapor barrier mastic applied in a Z-shaped pattern over insulation face, along butt end of insulation, and over the surface. Cover insulation face and surface to be insulated a width equal to two times the insulation thickness, but not less than 3 inches (75 mm).
 10. Install insulation on rectangular duct elbows and transitions with a full insulation section for each surface. Groove and score insulation to fit as closely as possible to outside and inside

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radius of elbows. Install insulation on round and flat-oval duct elbows with individually mitered gores cut to fit the elbow.

6. Insulate duct stiffeners, hangers, and flanges that protrude beyond insulation surface with 6 inch (150 mm) wide strips of same material used to insulate duct. Secure on alternating sides of stiffener, hanger, and flange with pins spaced 6 inches (150 mm) O.C.

3.5 FINISHES

C. Insulation with ASJ or Other Paintable Jacket Material:

Paint jacket with paint system identified below and as specified in Division 09.

6. Flat Acrylic Finish:

Two finish coats over a primer that is compatible with jacket material and finish coat paint. Add fungicidal agent to render fabric mildew proof.

d. Finish Coat Material:

Interior, flat, latex emulsion size.

D. Color:

Final color as selected by Owner's Representative. Vary first and second coats to allow visual inspection of the completed Work.

6.6 FIELD QUALITY CONTROL

A. Perform tests and inspections.

B. Tests and Inspections:

1. Inspect ductwork, randomly selected by Owner's Representative, by removing field applied jacket and insulation in layers in reverse order of their installation. Extent of inspection shall be limited to one location(s) for each duct system defined in the "Duct Insulation Schedule, General" Article.

C. All insulation applications will be considered defective Work if sample inspection reveals noncompliance with requirements.

3.7 DUCT INSULATION SCHEDULE, GENERAL

D. Plenums and Ducts Requiring Insulation:

1. Indoor, concealed supply air

B. Items Not Insulated:

1. Metal ducts with duct liner of sufficient thickness to comply with energy code and ASHRAE/IESNA 90.1.
7. Factory insulated flexible ducts
8. Factory insulated plenums and casings
9. Flexible connectors

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10. Vibration-control devices

6. Factory-insulated access panels and doors.

3.8 INDOOR DUCT AND PLENUM INSULATION SCHEDULE

D. Concealed, Supply Air and Return Air Duct and Plenum Insulation:

Mineral fiber blanket, 1-1/2" inches (50 mm) thick and 1.0-lb/cu. ft. (16-kg/cu. m) nominal density R-6

END OF SECTION

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PART 1 - GENERAL

1.1 SUMMARY

A. Section includes insulating the following HVAC piping systems: Refrigerant suction and hot-gas piping, indoors and outdoors.

B. Related Sections:
Section 230713 "Duct Insulation."

1.2 ACTION SUBMITTALS

A. Product Data:
For each type of product indicated

E. Shop Drawings:
Include plans, elevations, sections, details, and attachments to other work.

4. Detail application of protective shields, saddles, and inserts at hangers for each type of insulation and hanger.

5. Detail application of field-applied jackets.

6. Detail application at linkages of control devices.

1.3 INFORMATIONAL SUBMITTALS

A. Field quality control reports

1.4 QUALITY ASSURANCE

A. Surface Burning Characteristics:
For insulation and related materials, as determined by testing identical products according to ASTM E 84, by a testing and inspecting agency acceptable to authorities having jurisdiction. Factory label insulation and jacket materials and adhesive, mastic, tapes, and cement material containers, with appropriate markings of applicable testing agency.

3. Insulation Installed Indoors:
Flame spread index of 25 or less, and smoke developed index of 50 or less.

4. Insulation Installed Outdoors:
Flame spread index of 75 or less, and smoke developed index of 150 or less.

PART 2 - PRODUCTS

2.1 INSULATION MATERIALS

A. Products shall not contain asbestos, lead, mercury, or mercury compounds.

B. Products that come in contact with stainless steel shall have a leachable chloride content of less than 50 ppm when tested according to ASTM C 871.

C. Insulation materials for use on austenitic stainless steel shall be qualified as acceptable according to ASTM C 795.

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F. Flexible Elastomeric Insulation:

Closed cell, sponge or expanded rubber materials. Comply with ASTM C 534, Type I for tubular materials.

2. Products:

Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:

- a. Aeroflex USA, Inc.; Aerocel.
- b. Armacell LLC; AP Armaflex.
- c. K-Fiex USA; Insul-Lock, Insui-Tube, and K-FLEX LS.

2.2 INSULATING CEMENTS

E. Mineral Fiber, Hydraulic Setting Insulating and Finishing Cement:

Comply with ASTM C 449.

2. Products:

Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:

- a. Ramco Insulation, Inc.; Ramcote 1200 and Quik-Cote.
- b. Approved equal.

2.3 ADHESIVES

A. Materials shall be compatible with insulation materials, jackets, and substrates and for bonding insulation to itself and to surfaces to be insulated unless otherwise indicated.

F. Flexible Elastomeric Adhesive:

Comply with MIL-A-24179A, Type II, Class I.

3. Products:

Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:

- a. Aeroflex USA, Inc.; Aero seal
- e. Armacell LLC; Armaflex 520 Adhesive\
- f. Foster Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; 85-75
- d. K-Fiex USA; R-373 Contact Adhesive

4. For indoor applications, adhesive shall have a VOC content of 50 giL or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

3. Adhesive shall comply with the testing and product requirements of the California Department

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of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."

G. ASJ Adhesive, and FSK and PVDC Jacket Adhesive:

Comply with MIL-A-3316C, Class 2, Grade A for bonding insulation jacket lap seams and joints.

3. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
 - e. Childers Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; CP-82
 - f. Eagle Bridges -Marathon Industries; 225
 - g. Foster Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; 85-50
 - h. Mon-Eco Industries, Inc.; 22-25
4. For indoor applications, adhesive shall have a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
3. Adhesive shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small Scale Environmental Chambers."

H. PVC Jacket Adhesive:

Compatible with PVC jacket.

4. Products:
Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
 - d. Dow Corning Corporation; 739, Dow Silicone
 - e. Johns Manville; Zeston Perma-Weld, CEEL-TITE Solvent Welding Adhesive
 - f. P.I.C. Plastics, Inc.; Welding Adhesive
 - d. Speedline Corporation; Polyco VP Adhesive
5. For indoor applications, adhesive shall have a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
6. Adhesive shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small Scale Environmental Chambers."

2.4 MASTICS

- A Materials shall be compatible with insulation materials, jackets, and substrates; comply with MIL-PRF-19565C, Type II.

4. For indoor applications, use mastics that have a VOC content of 50 g/L or less when

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calculated according to 40 CFR 59, Subpart D (EPA Method 24).

E. Vapor Barrier Mastic:

Water based; suitable for indoor use on below-ambient services.

6. Products:

Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:

c. Foster Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; 30-80/30-90

d. Vimasco Corporation; 749

7. Water-Vapor Permeance:

ASTM E 96/E 96M, Procedure B, 0.013 perm (0.009 metric perm) at 43-mil (1.09-mm) dry film thickness.

8. Service Temperature Range:

To plus 180°F (To plus 82°C).

9. Solids Content:

ASTM D 1644, 58 percent by volume and 70 percent by weight

10. Color:

White

F. Breather Mastic:

Water based; suitable for indoor and outdoor use on above ambient services.

6. Products:

Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:

e. Childers Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; CP-1 0

f. Eagle Bridges - Marathon Industries; 550

g. Foster Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; 46-50

h. Mon-Eco Industries, Inc.; 55-50

e. Vimasco Corporation; WC-1/WC-5

7. Water Vapor Permeance:

ASTM F 1249, 1.8 perms (1.2 metric perms) at 0.0625-inch (1.6-mm) dry film thickness

8. Service Temperature Range:

Minus 20 to plus 180 deg F (Minus 29 to plus 82 deg C)

9. Solids Content:

60 percent by volume and 66 percent by weight

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10. Color:
White

2.5 SEALANTS

A. Joint Sealants:

1. Materials shall be compatible with insulation materials, jackets, and substrates. Permanently flexible, elastomeric sealant.
- c. Service Temperature Range:
To plus 300°F (To plus 149°C)
- d. Color:
White or gray
5. For indoor applications, sealants shall have a VOC content of 420 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
6. Sealants shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small Scale Environmental Chambers."

D. FSK and Metal Jacket Flashing Sealants:

8. Products:
Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
- e. Childers Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; CP-76
- f. Eagle Bridges- Marathon Industries; 405
- g. Foster Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; 95-44
- h. Mon-Eco Industries, Inc.; 44-05
9. Materials shall be compatible with insulation materials, jackets, and substrates.
10. Fire- and water-resistant, flexible, elastomeric sealant
11. Service Temperature Range:
To plus 250°F (To plus 121°C)
12. Color:
Aluminum
13. For indoor applications, sealants shall have a VOC content of 420 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24)

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14. Sealants shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small Scale Environmental Chambers."

E. ASJ Flashing Sealants, and Vinyl, PVDC, and PVC Jacket Flashing Sealants:

8. Products:
Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
 - b. Childers Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; CP-76
9. Materials shall be compatible with insulation materials, jackets, and substrates
10. Fire and water resistant, flexible, elastomeric sealant
11. Service Temperature Range:
To plus 250°F (to plus 121°C)
12. Color:
White
13. For indoor applications, sealants shall have a VOC content of 420 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
14. Sealants shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small Scale Environmental Chambers."

2.6 FACTORY-APPLIED JACKETS

- B. Insulation system schedules indicate factory applied jackets on various applications. When factory applied jackets are indicated, comply with the following:
 6. ASJ:
White, kraft paper, fiberglass reinforced scrim with aluminum foil backing; complying with ASTM C 1136, Type I
 7. ASJ-SSL:
ASJ with self-sealing, pressure sensitive, acrylic based adhesive covered by a removable protective strip; complying with ASTM C 1136, Type I
 8. FSK Jacket:
Aluminum foil, fiberglass reinforced scrim with kraft paper backing; complying with ASTM C 1136, Type II
 9. FSP Jacket:
Aluminum foil, fiberglass reinforced scrim with polyethylene backing; complying with ASTM C 1136, Type II
 10. PVDC Jacket for Indoor Applications:
4-mil (0.10-mm) thick, white PVDC bi-axially oriented barrier film with a permeance at 0.02 perm (0.013 metric perm) when tested according to ASTM E 96/E 96M and with a flame

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spread index of 5 and a smoke developed index of 20 when tested according to ASTM E84

b. Products:

Subject to compliance with requirements, available product that may be incorporated into the Work include, but are not limited to, the following:

- 2) Dow Chemical Company (The); Saran 540 Vapor Retarder Film and Saran 560 Vapor Retarder Film

6. PVDC Jacket for Outdoor Applications:

6-mil (0.15-mm) thick, white PVDC bi-axially oriented barrier film with a permeance at 0.01 perm (0.007 metric perm) when tested according to ASTM E 96/E 96M and with a flame spread index of 5 and a smoke developed index of 25 when tested according to ASTM E84.

c. Products:

Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:

- 1) Dow Chemical Company (The); Saran 540 Vapor Retarder Film and Saran 560 Vapor Retarder Film.

9. PVDC-SSL Jacket:

PVDC jacket with a self-sealing, pressure sensitive, acrylic based adhesive covered by a removable protective strip.

d. Products:

Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:

- 2) Dow Chemical Company (The); Saran 540 Vapor Retarder Film and Saran 560 Vapor Retarder Film

10. Vinyl Jacket:

White vinyl with a permeance of 1.3 perms (0.86 metric perms) when tested according to ASTM E 96/E 96M, Procedure A, and complying with NFPA 90A and NFPA 90B

2.7 FIELD-APPLIED FABRIC-REINFORCING MESH

G. Woven Polyester Fabric:

Approximately 1 oz./sq. yd. (34 g/sq. m) with a thread count of 10 strands by 10 strands/sq. in. (4 strands by 4 strands/sq. mm), in a Leno weave, for pipe.

2. Products:

Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:

- b. Foster Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; Mast-A- Fab

- b. Vimasco Corporation; Elastafab 894

2.8 FIELD-APPLIED JACKETS

- A. Field-applied jackets shall comply with ASTM C 921, Type I, unless otherwise indicated.

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H. FSK Jacket:

Aluminum foil face, fiberglass reinforced scrim with kraft paper backing

I. PVC Jacket:

High impact resistant, UV resistant PVC complying with ASTM D 1784, Class 16354-C; thickness as scheduled; roll stock ready for shop or field cutting and forming. Thickness is indicated in field- applied jacket schedules.

5. Products:

Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:

- d. Johns Manville; Zeston
- e. P.I.C. Plastics, Inc.; FG Series
- f. Proto Corporation; LoSmoke
- d. Speedline Corporation; SmokeSafe

6. Adhesive:

As recommended by jacket material manufacturer.

7. Color:

White

8. Factory fabricated fitting covers to match jacket if available; otherwise, field fabricate.

d. Shapes:

45 and 90 degree, short and long radius elbows, tees, valves, flanges, unions, reducers, end caps, soil-pipe hubs, traps, mechanical joints, and P-trap and supply covers for lavatories.

J. Aluminum Jacket:

Comply with ASTM B 209 (ASTM B 209M), Alloy 3003, 3005, 3105, or 5005, Temper H-14

7. Products:

Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:

- a. Childers Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; Metal Jacketing Systems.
- e. ITW Insulation Systems; Aluminum and Stainless Steel Jacketing
- f. RPR Products, Inc.; Insui-Mate.

8. Factory cut and rolled to size.

9. Finish and thickness are indicated in field-applied jacket schedules.

10. Moisture Barrier for Indoor Applications:

3-mil (0.075-mm-) thick, heat-bonded polyethylene and kraft paper.

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11. Moisture Barrier for Outdoor Applications:
3-mil (0.075-mm) thick, heat bonded polyethylene and kraft paper
12. Factory-Fabricated Fitting Covers:
 - b. Same material, finish, and thickness as jacket
 - b. Preformed 2-piece or gore, 45 and 90 degree, short and long radius elbows
 - d. Tee covers
 - e. Flange and union covers
 - e. End caps
 - f. Beveled collars.
 - h. Valve covers
 - h. Field fabricate fitting covers only if factory-fabricated fitting covers are not available
- K. Self-Adhesive Outdoor Jacket:
60-mil (1.5-mm) thick, laminated vapor barrier and waterproofing membrane for installation over insulation located aboveground outdoors; consisting of a rubberized bituminous resin on a cross-laminated polyethylene film covered with stucco-embossed aluminum-foil facing.
2. Products:
Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Polyguard Products, Inc.; Alumaguard 60

2.9 TAPES

- D. ASJ Tape:
White vapor-retarder tape matching factory-applied jacket with acrylic adhesive, complying with ASTM C 1136.
8. Products:
Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
 - e. ABI, Ideal Tape Division; 428 AWF ASJ
 - f. Avery Dennison Corporation, Specialty Tapes Division; Fasson 0836
 - g. Compac Corporation; 104 and 105
 - h. Venture Tape; 1540 CW Plus, 1542 CW Plus, and 1542 CW Plus/SQ.
9. Width:
3 inches (75 mm)
10. Thickness:

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11.5 mils (0.29 mm)

11. Adhesion:
90 ounces force/inch (1.0 N/mm) in width.
 12. Elongation:
2 percent
 13. Tensile Strength:
40 lbf/inch (7.2 N/mm) in width
 14. ASJ Tape Disks and Squares:
Precut disks or squares of ASJ tape
- E. PVC Tape:
White vapor retarder tape matching field applied PVC jacket with acrylic adhesive; suitable for indoor and outdoor applications.
7. Products:
Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
 - c. ABI, Ideal Tape Division; 370 White PVC tape
 - d. Compac Corporation; 130
 - c. Venture Tape; 1506 CW NS
 8. Width:
2 inches (50 mm).
 9. Thickness:
6 mils (0.15 mm)
 10. Adhesion:
64 ounces force/inch (0.7 N/mm) in width
 11. Elongation:
500 percent
 12. Tensile Strength:
18 lbf/inch (3.3 N/mm) in width
- F. Aluminum Foil Tape:
Vapor-retarder tape with acrylic adhesive
7. Products:
Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
 - d. ABI, Ideal Tape Division; 488 AWF
 - e. Avery Dennison Corporation, Specialty Tapes Division; Passon 0800

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- f. Compac Corporation; 120
- d. Venture Tape; 3520 CW
- 8. Width:
2 inches (50 mm)
- 9. Thickness:
9.7 mils (0.093 mm)
- 10. Adhesion:
100 ounces force/inch (1.1 N/mm) in width
- 11. Elongation:
5 percent
- 12. Tensile Strength:
34 lbf/inch (6.2 N/mm) in width

2.10 SECUREMENTS

- D. Aluminum Bands:
ASTM B 209 (ASTM B 209M), Alloy 3003, 3005, 3105, or 5005; Temper H-14, 0.020 inch (0.51 mm) thick, 1/2 inch (13 mm) wide with closed seal.
- 2. Products:
Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
 - c. ITW Insulation Systems; Gerrard Strapping and Seals
 - d. RPR Products, Inc.; Insul-Mate Strapping, Seals, and Springs
- E. Staples:
Outward-clinching insulation staples, nominal 3/4-inch- (19-mm-) wide, stainless steel or Monel.
- F. Wire:
0.062-inch (1.6-mm) soft annealed, galvanized steel
- 2. Manufacturers:
Subject to compliance with requirements, provide products by one of the following available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - a. C&FWire

PART 3 - EXECUTION

3.1 PREPARATION

- C. Surface Preparation:
Clean and dry surfaces to receive insulation. Remove materials that will adversely affect insulation application.

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- B. Coordinate insulation installation with the trade installing heat tracing. Comply with requirements for heat tracing that apply to insulation.
- C. Mix insulating cements with clean potable water; if insulating cements are to be in contact with stainless-steel surfaces, use demineralized water.

3.2 GENERAL INSTALLATION REQUIREMENTS

- A. Install insulation materials, accessories, and finishes with smooth, straight, and even surfaces; free of voids throughout the length of piping including fittings, valves, and specialties.
 - B. Install insulation materials, forms, vapor barriers or retarders, jackets, and thicknesses required for each item of pipe system as specified in insulation system schedules.
 - C. Install accessories compatible with insulation materials and suitable for the service. Install accessories that do not corrode, soften, or otherwise attack insulation or jacket in either wet or dry state.
 - D. Install insulation with longitudinal seams at top and bottom of horizontal runs.
 - F. Install multiple layers of insulation with longitudinal and end seams staggered.
 - F. Do not weld brackets, clips, or other attachment devices to piping, fittings, and specialties.
 - L. Keep insulation materials dry during application and finishing.
 - H. Install insulation with tight longitudinal seams and end joints. Bond seams and joints with adhesive recommended by insulation material manufacturer.
 - I. Install insulation with least number of joints practical.
 - M. Where vapor barrier is indicated, seal joints, seams, and penetrations in insulation at hangers, supports, anchors, and other projections with vapor-barrier mastic.
- 5. Install insulation continuously through hangers and around anchor attachments.
 - 6. For insulation application where vapor barriers are indicated, extend insulation on anchor legs from point of attachment to supported item to point of attachment to structure. Taper and seal ends at attachment to structure with vapor barrier mastic.
 - 7. Install insert materials and install insulation to tightly join the insert. Seal insulation to insulation inserts with adhesive or sealing compound recommended by insulation material manufacturer.
 - 8. Cover inserts with jacket material matching adjacent pipe insulation. Install shields over jacket, arranged to protect jacket from tear or puncture by hanger, support, and shield.
- K. Apply adhesives, mastics, and sealants at manufacturer's recommended coverage rate and wet and dry film thicknesses.
- M. Install insulation with factory applied jackets as follows:
 - 6. Draw jacket tight and smooth.

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7. Cover circumferential joints with 3-inch (75-mm) wide strips, of same material as insulation jacket. Secure strips with adhesive and outward clinching staples along both edges of strip, spaced 4 inches (100 mm) O.C.
8. Overlap jacket longitudinal seams at least 1-1/2 inches (38 mm). Install insulation with longitudinal seams at bottom of pipe. Clean and dry surface to receive self-sealing lap. Staple laps with outward clinching staples along edge at 2 inches (50 mm) O.C.
 - b. For below ambient services, apply vapor barrier mastic over staples.
9. Cover joints and seams with tape, according to insulation material manufacturer's written instructions, to maintain vapor seal.
10. Where vapor barriers are indicated, apply vapor barrier mastic on seams and joints and at ends adjacent to pipe flanges and fittings.
- M. Cut insulation in a manner to avoid compressing insulation more than 75 percent of its nominal thickness.
- N. Finish installation with systems at operating conditions. Repair joint separations and cracking due to thermal movement.
- O. Repair damaged insulation facings by applying same facing material over damaged areas. Extend patches at least 4 inches (100 mm) beyond damaged areas. Adhere, staple, and seal patches similar to butt joints.
- P. For above ambient services, do not install insulation to the following:
 7. Vibration control devices
 8. Testing agency labels and stamps
 9. Nameplates and data plates
 10. Manholes
 11. Hand holes
 12. Cleanouts.

3.3 PENETRATIONS

- G. Insulation Installation at Roof Penetrations:

Install insulation continuously through roof penetrations

 5. Seal penetrations with flashing sealant
 6. For applications requiring only indoor insulation, terminate insulation above roof surface and seal with joint sealant. For applications requiring indoor and outdoor insulation, install insulation for outdoor applications tightly joined to indoor insulation ends. Seal joint with joint sealant.
 7. Extend jacket of outdoor insulation outside roof flashing at least 2 inches (50 mm) below top

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of roof flashing.

8. Seal jacket to roof flashing with flashing sealant.

H. Insulation Installation at Underground Exterior Wall Penetrations:

Terminate insulation flush with sleeve seal

2. Seal terminations with flashing sealant.

I. Insulation Installation at Aboveground Exterior Wall Penetrations:

Install insulation continuously through wall penetrations.

4. Seal penetrations with flashing sealant.
5. For applications requiring only indoor insulation, terminate insulation inside wall surface and seal with joint sealant. For applications requiring indoor and outdoor insulation, install insulation for outdoor applications tightly joined to indoor insulation ends. Seal joint with joint sealant.
6. Extend jacket of outdoor insulation outside wall flashing and overlap wall flashing at least 2 inches (50 mm).

4. Seal jacket to wall flashing with flashing sealant.

J. Insulation Installation at Interior Wall and Partition Penetrations (That Are Not Fire Rated):

Install insulation continuously through walls and partitions.

K. Insulation Installation at Fire Rated Wall and Partition Penetrations:

Install insulation continuously through penetrations of fire rated walls and partitions.

2. Comply with requirements in Section 078413 "Penetration Fire stopping" for fire stopping and fire resistive joint sealers.

L. Insulation Installation at Floor Penetrations:

3. Pipe:

Install insulation continuously through floor penetrations.

4. Seal penetrations through fire rated assemblies. Comply with requirements in Section 078413 "Penetration Fire Stopping."

3.4 GENERAL PIPE INSULATION INSTALLATION

- A. Requirements in this article generally apply to all insulation materials except where more specific requirements are specified in various pipe insulation material installation articles.

- D. Install removable insulation covers at locations indicated. Installation shall conform to the following:

6. Make removable flange and union insulation from sectional pipe insulation of same thickness as that on adjoining pipe. Install same insulation jacket as adjoining pipe insulation.
7. When flange and union covers are made from sectional pipe insulation, extend insulation from

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flanges or union long at least two times the insulation thickness over adjacent pipe insulation on each side of flange or union. Secure flange cover in place with stainless steel or aluminum bands. Select band material compatible with insulation and jacket.

8. Construct removable valve insulation covers in same manner as for flanges, except divide the two part section on the vertical center line of valve body.
9. When covers are made from block insulation, make two halves, each consisting of mitered blocks wired to stainless steel fabric. Secure this wire frame, with its attached insulation, to flanges with tie wire. Extend insulation at least 2 inches (50 mm) over adjacent pipe insulation on each side of valve. Fill space between flange or union cover and pipe insulation with insulating cement. Finish cover assembly with insulating cement applied in two coats. After first coat is dry, apply and trowel second coat to a smooth finish.
10. Unless a PVC jacket is indicated in field-applied jacket schedules, finish exposed surfaces with a metal jacket.

3.5 INSTALLATION OF FLEXIBLE ELASTOMERIC INSULATION

- A. Seal longitudinal seams and end joints with manufacturers recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.

E. Insulation Installation on Pipe Flanges:

5. Install pipe insulation to outer diameter of pipe flange.
6. Make width of insulation section same as overall width of flange and bolts, plus twice the thickness of pipe insulation.
7. Fill voids between inner circumference of flange insulation and outer circumference of adjacent straight pipe segments with cut sections of sheet insulation of same thickness as pipe insulation.
8. Secure insulation to flanges and seal seams with manufacturers recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.

F. Insulation Installation on Pipe Fittings and Elbows:

3. Install mitered sections of pipe insulation.
4. Secure insulation materials and seal seams with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.

G. Insulation Installation on Valves and Pipe Specialties:

5. Install preformed valve covers manufactured of same material as pipe insulation when available.
6. When preformed valve covers are not available, install cut sections of pipe and sheet insulation to valve body. Arrange insulation to permit access to packing and to allow valve operation without disturbing insulation.
7. Install insulation to flanges as specified for flange insulation application.

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8. Secure insulation to valves and specialties and seal seams with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.

3.6 FIELD APPLIED JACKET INSTALLATION

- E. Where PVC jackets are indicated, install with 1-inch (25-mm) overlap at longitudinal seams and end joints; for horizontal applications. Seal with manufacturers recommended adhesive.
 1. Apply two continuous beads of adhesive to seams and joints, one bead under lap and the finish bead along seam and joint edge.
- F. Where metal jackets are indicated, install with 2-inch (50-mm) overlap at longitudinal seams and end joints. Overlap longitudinal seams arranged to shed water. Seal end joints with weatherproof sealant recommended by insulation manufacturer. Secure jacket with stainless-steel bands 12 inches (300 mm) O.C. and at end joints.

3.7 FINISHES

- D. Pipe Insulation with ASJ or Other Paintable Jacket Material:
Paint jacket with paint system identified below and as specified in Section 09 91 13 "Exterior Painting" and Section 099123 "Interior Painting."
 2. Flat Acrylic Finish:
Two finish coats over a primer that is compatible with jacket material and finish coat paint. Add fungicidal agent to render fabric mildew proof.
 - b. Finish Coat Material:
Interior, flat, latex-emulsion size.
 - E. Flexible Elastomeric Thermal Insulation:
After adhesive has fully cured, apply two coats of insulation manufacturer's recommended protective coating.
 - F. Color:
Final color as selected by Owner's Representative. Vary first and second coats to allow visual inspection of the completed Work.
- D. Do not field paint aluminum or stainless steel jackets.

3.8 FIELD QUALITY CONTROL

- A. Perform tests and inspections.
- B. Tests and Inspections:
 2. Inspect pipe, fittings, strainers, and valves, randomly selected by Owner's Representative, by removing field applied jacket and insulation in layers in reverse order of their installation. Extent of inspection shall be limited to three locations of straight pipe, three locations of threaded fittings, three locations of welded fittings, two locations of threaded strainers, two locations of welded strainers, three locations of threaded valves, and three locations of flanged valves for each pipe service defined in the "Piping Insulation Schedule, General" Article.
- C. All insulation applications will be considered defective Work if sample inspection reveals

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noncompliance with requirements.

3.9 PIPING INSULATION SCHEDULE, GENERAL

- A. Acceptable preformed pipe and tubular insulation materials and thicknesses are identified for each piping system and pipe size range. If more than one material is listed for a piping system, selection from materials listed is Contractor's option.
- G. Items Not Insulated:
Unless otherwise indicated, do not install insulation on the following:
 - 7. Drainage piping located in crawl spaces.
 - 8. Chrome plated pipes and fittings unless there is a potential for personnel injury.

3.10 INDOOR PIPING INSULATION SCHEDULE

- B. Refrigerant Suction and Hot-Gas Piping and Flexible Tubing:
Flexible elastomeric, 1 inch (25 mm) thick.

3.11 OUTDOOR, ABOVEGROUND PIPING INSULATION SCHEDULE

- B. Refrigerant Suction and Hot-Gas Piping:
Insulation shall be the following:
 - 2. Flexible Elastomeric:
2 inches (50 mm) thick.

3.12 INDOOR, FIELD-APPLIED JACKET SCHEDULE

- A. Install jacket over insulation material. For insulation with factory applied jacket, install the field applied jacket over the factory applied jacket.
- B. If more than one material is listed, selection from materials listed is Contractor's option.
- C. Piping, Concealed:
 - 2. PVC:
20 mils (0.5 mm) thick.
- D. Piping, Exposed:
 - 2. PVC:
20 mils (0.5 mm) thick.

3.13 OUTDOOR, FIELD-APPLIED JACKET SCHEDULE

- A. Install jacket over insulation material. For insulation with factory-applied jacket, install the field-applied jacket over the factory-applied jacket.
- B. If more than one material is listed, selection from materials listed is Contractor's option.
- C. Piping, Concealed:

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2. PVC:
30 mils (0.8 mm) thick.

H. Piping, Exposed:

2. Aluminum, Smooth:
0.016 inch (0.41 mm) thick.

END OF SECTION

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PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes refrigerant piping used for air-conditioning applications.

1.2 PERFORMANCE REQUIREMENTS

- A. Line Test Pressure for Refrigerant R-410A:

3. Suction Lines for Air-Conditioning Applications:
185 psig (1276 kPa)
4. Hot Gas and Liquid Lines:
325 psig (2241 kPa)

1.3 ACTION SUBMITTALS

- C. Product Data:

For each type of valve and refrigerant piping specialty indicated. Include pressure drop based on manufacturer's test data.

- D. Shop Drawings:

Show layout of refrigerant piping and specialties, including pipe, tube, and fitting sizes, flow capacities, valve arrangements and locations, slopes of horizontal runs, oil traps, double risers, wall and floor penetrations, and equipment connection details. Show interface and spatial relationships between piping and equipment.

1. Refrigerant piping indicated on Drawings is schematic only. Size piping and design actual piping layout, including oil traps, double risers, specialties, and pipe and tube sizes to accommodate, as a minimum, equipment provided, elevation difference between compressor and evaporator, and length of piping to ensure proper operation and compliance with warranties of connected equipment.

1.4 INFORMATIONAL SUBMITTALS

- A. Field quality control test reports.

1.5 CLOSEOUT SUBMITTALS

- A. Operation and maintenance data.

1.6 QUALITY ASSURANCE

- A. Comply with ASHRAE 15, "Safety Code for Refrigeration Systems."
- B. Comply with ASME B31.5, "Refrigeration Piping and Heat Transfer Components."

1.7 PRODUCT STORAGE AND HANDLING

- A. Store piping in a clean and protected area with end caps in place to ensure that piping interior and exterior are clean when installed.

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PART 2 - PRODUCTS

8.1 COPPER TUBE AND FITTINGS

- H. Copper Tube:
ASTM B 280, Type ACR
- I. Wrought Copper Fittings:
ASME B16.22
- J. Wrought Copper Unions:
ASME B16.22
- K. Solder Filler Metals:
ASTM B 32. Use 95-5 tin antimony or alloy HB solder to join copper socket fittings on copper pipe.
- L. Brazing Filler Metals:
AWS A5.8
- M. Flexible Connectors:
 - 6. Body:
Tin bronze bellows with woven, flexible, tinned bronze wire reinforced protective jacket.
 - 7. End Connections:
Socket ends
 - 8. Offset Performance:
Capable of minimum 3/4-inch (20-mm) misalignment in minimum 7-inch (180-mm) long assembly.
 - 9. Pressure Rating:
Factory test at minimum 500 psig (3450 kPa)
 - 10. Maximum Operating Temperature:
250°F (121°C).

2.2 VALVES AND SPECIALTIES

- N. Diaphragm Packless Valves:
 - 1. Body and Bonnet:
Forged brass or cast bronze; globe design with straight-through or angle pattern
 - 8. Diaphragm:
Phosphor bronze and stainless steel with stainless steel spring
 - 9. Operator:
Rising stem and hand wheel
 - 10. Seat:
Nylon
 - 11. End Connections:

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Socket, union, or flanged

12. Working Pressure Rating:
500 psig (3450 kPa)

13. Maximum Operating Temperature:
275°F (135°C)

O. Packed Angle Valves:

9. Body and Bonnet:
Forged brass or cast bronze

10. Packing:
Molded stem, back seating, and replaceable under pressure

11. Operator:
Rising stem

12. Seat:
Nonrotating, self-aligning polytetrafluoroethylene

13. Seal Cap:
Forged brass or valox hex cap

14. End Connections:
Socket, union, threaded, or flanged

15. Working Pressure Rating:
500 psig (3450 kPa)

16. Maximum Operating Temperature:
275°F (135°C).

P. Check Valves:

7. Body:
Ductile iron, forged brass, or cast bronze; globe pattern

8. Bonnet:
Bolted ductile iron, forged brass, or cast bronze; or brass hex plug

9. Piston:
Removable polytetrafluoroethylene seat

10. Closing Spring:
Stainless steel

11. Manual Opening Stem:
Seal cap, plated-steel stem, and graphite seal

12. End Connections:
Socket, union, threaded, or flanged

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7. Maximum Opening Pressure:
0.50 psig (3.4 kPa)

10. Working Pressure Rating:
500 psig (3450 kPa)

11. Maximum Operating Temperature:
275°F (135°C)

Q. Service Valves:

6. Body:
Forged brass with brass cap including key end to remove core

7. Core:
Removable ball type check valve with stainless steel spring

8. Seat:
Polytetrafluoroethylene

9. End Connections:
Copper spring

10. Working Pressure Rating:
500 psig (3450 kPa)

R. Solenoid Valves: Comply with ARI 760 and UL 429; listed and labeled by an NRTL

8. Body and Bonnet:
Plated steel

9. Solenoid Tube, Plunger, Closing Spring, and Seat Orifice:
Stainless steel

10. Seat:
Polytetrafluoroethylene

11. End Connections:
Threaded

12. Electrical:
Molded, watertight coil in NEMA 250 enclosure of type required by location with 1/2-inch (16-GRC) conduit adapter, and 24-VAC coil

13. Working Pressure Rating:
400 psig (2760 kPa)

14. Maximum Operating Temperature:
240°F (116°C)

8. Manual operator.

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S. Safety Relief Valves:

Comply with ASME Boiler and Pressure Vessel Code; listed and labeled by an NRTL.

7. Body and Bonnet:

Ductile iron and steel, with neoprene O-ring seal

8. Piston, Closing Spring, and Seat Insert:

Stainless steel

9. Seat Disc:

Polytetrafluoroethylene

10. End Connections:

Threaded

11. Working Pressure Rating:

400 psig (2760 kPa)

12. Maximum Operating Temperature:

240°F (116°C).

T. Thermostatic Expansion Valves:

Comply with ARI 750

10. Body, Bonnet, and Seal Cap:

Forged brass or steel

11. Diaphragm, Piston, Closing Spring, and Seat Insert:

Stainless steel

12. Packing and Gaskets:

Non-asbestos

13. Capillary and Bulb:

Copper tubing filled with refrigerant charge

14. Suction Temperature:

40°F (4.4°C)

15. Superheat:

Adjustable

16. Reverse flow option (for heat-pump applications)

17. End Connections:

Socket, flare, or threaded union

18. Working Pressure Rating:

700 psig (4820 kPa).

U. Straight-Type Strainers:

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1. Body:
Welded steel with corrosion-resistant coating
 9. Screen:
100-mesh stainless steel
 10. End Connections:
Socket or flare
 11. Working Pressure Rating:
500 psig (3450 kPa)
 12. Maximum Operating Temperature:
275°F (135°C).
- V. Angle Type Strainers:
7. Body:
Forged brass or cast bronze
 8. Drain Plug:
Brass hex plug
 9. Screen:
100-mesh monel
 10. End Connections:
Socket or flare
 11. Working Pressure Rating:
500 psig (3450 kPa)
 12. Maximum Operating Temperature:
275°F (135°C)
- W. Moisture/Liquid Indicators:
8. Body:
Forged brass
 9. Window:
Replaceable, clear, fused glass window with indicating element protected by filter screen
 10. Indicator:
Color coded to show moisture content in ppm
 11. Minimum Moisture Indicator Sensitivity:
Indicate moisture above 60 ppm
 12. End Connections:
Socket or flare
 13. Working Pressure Rating:

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500 psig (3450 kPa)

14. Maximum Operating Temperature:
240°F (116°C)

X. Replaceable Core Filter Dryers:
Comply with ARI 730

10. Body and Cover:
Painted steel shell with ductile-iron cover, stainless-steel screws, and neoprene gaskets
11. Filter Media:
10 micron, pleated with integral end rings; stainless steel support
12. Desiccant Media:
Activated alumina
13. Designed for reverse flow (for heat-pump applications)
14. End Connections:
Socket
15. Access Ports:
NPS 1/4 (DN 8) connections at entering and leaving sides for pressure differential measurement
16. Maximum Pressure Loss:
2 psig (14 kPa)
17. Working Pressure Rating:
500 psig (3450 kPa)
18. Maximum Operating Temperature:
240°F (116°C)

Y. Permanent Filter Dryers:
Comply with ARI 730.

10. Body and Cover:
Painted steel shell
11. Filter Media:
10 micron, pleated with integral end rings; stainless steel support
12. Desiccant Media:
Activated alumina
13. Designed for reverse flow (for heat-pump applications)
14. End Connections:
Socket.

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- 15. Access Ports:
NPS 1/4 (DN 8) connections at entering and leaving sides for pressure differential measurement
- 16. Maximum Pressure Loss:
2 psig (14 k.Pa)
- 17. Working Pressure Rating:
500 psig (3450 k.Pa)
- 18. Maximum Operating Temperature:
240°F (116°C)
- Z. Liquid Accumulators:
Comply with ARI 495
- 5. Body:
Welded steel with corrosion resistant coating
- 6. End Connections:
Socket or threaded
- 7. Working Pressure Rating:
500 psig (3450 kPa)
- 8. Maximum Operating Temperature:
275°F (135°C)

2.3 REFRIGERANTS

- B. Available Manufacturers:
Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - 4. Atofina Chemicals, Inc.
 - 5. DuPont Company; Fluorochemicals Div.
 - 6. Honeywell, Inc.; Genetron Refrigerants
 - 4. INEOS Fluor Americas LLC.
- B. R-410a

PART 3- EXECUTION

3.1 PIPING APPLICATIONS

- E. Suction Lines NPS 1-1/2 (DN 40) and Smaller for Conventional Air Conditioning Applications:
Copper, Type ACR, annealed temper tubing and wrought copper fittings with soldered joints.
- F. Suction Lines NPS 4 (DN 100) and Smaller for Conventional Air Conditioning Applications:
Copper, Type ACR, drawn temper tubing and wrought copper fittings with brazed or soldered

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joints.

G. Hot-Gas and Liquid Lines:

1. NPS 1-1/2 (DN 40) and Smaller:
Copper, Type ACR, annealed temper tubing and wrought copper fittings with soldered joints
3. NPS 1-1/2 (DN 40) and Smaller:
Copper, Type ACR, drawn temper tubing and wrought copper fittings with soldered joints.

H. Safety Relief Valve Discharge Piping:

Copper, Type ACR, drawn temper tubing and wrought copper fittings with soldered joints.

3.2 VALVE AND SPECIALTY APPLICATIONS

- A. Install diaphragm packless valves in suction and discharge lines of compressor.
- B. Install service valves for gage taps at strainers if they are not an integral part of strainers.
- C. Install a check valve at the compressor discharge and a liquid accumulator at the compressor suction connection.
- D. Except as otherwise indicated, install diaphragm packless valves on inlet and outlet side of filter dryers.
- E. Install a full-sized, three-valve bypass around filter dryers.
- F. Install solenoid valves upstream from each expansion valve. Install solenoid valves in horizontal lines with coil at top.
- N. Install thermostatic expansion valves as close as possible to distributors on evaporators.
 3. Install valve so diaphragm case is warmer than bulb.
 4. Secure bulb to clean, straight, horizontal section of suction line using two bulb straps. Do not mount bulb in a trap or at bottom of the line.
 3. If external equalizer lines are required, make connection where it will reflect suction-line pressure at bulb location.
- H. Install safety relief valves where required by ASME Boiler and Pressure Vessel Code. Pipe safety relief valve discharge line to outside according to ASHRAE 15.
- I. Install moisture/liquid indicators in liquid line at the inlet of the thermostatic expansion valve or at the inlet of the evaporator coil capillary tube.
- N. Install strainers upstream from and adjacent to the following unless they are as an integral assembly for device being protected:
 3. Solenoid valves
 4. Thermostatic expansion valves

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3. Compressor

K. Install filter dryers in liquid line between compressor and thermostatic expansion valve, and in the suction line at the compressor.

L. Install flexible connectors at compressors.

3.3 PIPING INSTALLATION

A. Drawing plans, schematics, and diagrams indicate general location and arrangement of piping systems; indicated locations and arrangements were used to size pipe and calculate friction loss, expansion, pump sizing, and other design considerations. Install piping as indicated unless deviations to layout are approved on Shop Drawings.

B. Install refrigerant piping according to ASHRAE 15.

C. Install piping in concealed locations unless otherwise indicated and except in equipment rooms and service areas.

D. Install piping indicated to be exposed and piping in equipment rooms and service areas at right angles or parallel to building walls. Diagonal runs are prohibited unless specifically indicated otherwise.

E. Install piping above accessible ceilings to allow sufficient space for ceiling panel removal.

G. Install piping adjacent to machines to allow service and maintenance.

G. Install piping free of sags and bends.

H. Install fittings for changes in direction and branch connections.

I. Select system components with pressure rating equal to or greater than system operating pressure.

J. Install piping as short and direct as possible, with a minimum number of joints, elbows, and fittings.

K. Arrange piping to allow inspection and service of refrigeration equipment. Install valves and specialties in accessible locations to allow for service and inspection.

M. Install refrigerant piping in protective conduit where installed belowground.

N. Install refrigerant piping in rigid or flexible conduit in locations where exposed to mechanical injury.

P. Slope refrigerant piping as follows:

1. Install horizontal hot gas discharge piping with a uniform slope downward away from compressor.

4. Install horizontal suction lines with a uniform slope downward to compressor.

5. Install traps and double risers to entrain oil in vertical runs.

4. Liquid lines may be installed level.

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- P. When brazing or soldering, remove solenoid valve coils and sight glasses; also remove valve stems, seats, and packing, and accessible internal parts of refrigerant specialties. Do not apply heat near expansion-valve bulb.
- Q. Install piping with adequate clearance between pipe and adjacent walls and hangers or between pipes for insulation installation.
- R. Identify refrigerant piping and valves according to Section 230553 "Identification for HVAC Piping and Equipment."
- S. Install sleeves for piping penetrations of walls, ceilings, and floors. Comply with requirements for sleeves specified in Section 230517 "Sleeves and Sleeve Seals for HVAC Piping."
- T. Install sleeve seals for piping penetrations of concrete walls and slabs. Comply with requirements for sleeve seals specified in Section 230517 "Sleeves and Sleeve Seals for HVAC Piping."
- U. Install escutcheons for piping penetrations of walls, ceilings, and floors.

3.4 PIPE JOINT CONSTRUCTION

- C. Soldered Joints:
Construct joints according to ASTM B 828 or CDA's "Copper Tube Handbook."
- D. Brazed Joints:
Construct joints according to AWS's "Brazing Handbook," Chapter "Pipe and Tube."
 - 4. Use Type BcuP, copper phosphorus alloy for joining copper socket fittings with copper pipe.
 - 2. Use Type BA_g, cadmium free silver alloy for joining copper with bronze or steel.

3.5 HANGERS AND SUPPORTS

- A. Hanger, support, and anchor products are specified in Section 230529 "Hangers and Supports for HVAC Piping and Equipment."
- B. Install the following pipe attachments:
 - 5. Adjustable steel clevis hangers for individual horizontal runs less than 20 feet (6 m) long.
 - 6. Roller hangers and spring hangers for individual horizontal runs 20 feet (6 m) or longer.
 - 7. Pipe Roller:
MSS SP-58, Type 44 for multiple horizontal piping 20 feet (6 m) or longer, supported on a trapeze.
 - 8. Spring hangers to support vertical runs.
 - 5. Copper-clad hangers and supports for hangers and supports in direct contact with copper pipe.
- C. Install hangers for copper tubing with the following maximum spacing and minimum rod sizes:
 - 7. NPS 1/2 (DN 15):
Maximum span, 60 inches (1500 mm); minimum rod size, 1/4 inch (6.4 mm)

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8. NPS 5/8 (DN 18):
Maximum span, 60 inches (1500 mm); minimum rod size, 1/4 inch (6.4 mm)
9. NPS 1 (DN 25):
Maximum span, 72 inches (1800 mm); minimum rod size, 1/4 inch (6.4 mm)
10. NPS 1-1/4 (DN 32):
Maximum span, 96 inches (2400 mm); minimum rod size, 3/8 inch (9.5 mm)
11. NPS 1-1/2 (DN 40):
Maximum span, 96 inches (2400 mm); minimum rod size, 3/8 inch (9.5 mm)

D. Support multi-floor vertical runs at least at each floor.

5.6 FIELD QUALITY CONTROL

A. Perform tests and inspections and prepare test reports.

B. Tests and Inspections:

1. Comply with ASME B31.5, Chapter VI.
5. Test refrigerant piping and specialties. Isolate compressor, condenser, evaporator, and safety devices from test pressure if they are not rated above the test pressure.
6. Test high and low pressure side piping of each system separately at not less than the pressures indicated in Part 1 "Performance Requirements" Article.
 - a. Fill system with nitrogen to the required test pressure.
 - b. System shall maintain test pressure at the manifold gage throughout duration of test.
 - c. Test joints and fittings with electronic leak detector or by brushing a small amount of soap and glycerin solution over joints.
 - d. Remake leaking joints using new materials, and retest until satisfactory results are achieved.

3.7 SYSTEM CHARGING

C. Charge system using the following procedures:

4. Install core in filter dryers after leak test but before evacuation.
5. Evacuate entire refrigerant system with a vacuum pump to 500 micrometers (67 Pa). If vacuum holds for 12 hours, system is ready for charging.
6. Break vacuum with refrigerant gas, allowing pressure to build up to 2 psig (14 kPa).
4. Charge system with a new filter-dryer core in charging line.

3.8 ADJUSTING

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- A. Adjust thermostatic expansion valve to obtain proper evaporator superheat.
- B. Adjust high and low pressure switch settings to avoid short cycling in response to fluctuating suction pressure.
- C. Adjust set point temperature of air conditioning or chilled water controllers to the system design temperature.
- E. Perform the following adjustments before operating the refrigeration system, according to manufacturer's written instructions:
 - 1. Open shutoff valves in condenser water circuit.
 - 2. Verify that compressor oil level is correct.
 - 3. Open compressor suction and discharge valves.
 - 4. Open refrigerant valves except bypass valves that are used for other purposes.
 - 5. Check open compressor-motor alignment and verify lubrication for motors and bearings.
- E. Replace core of replaceable filter dryer after system has been adjusted and after design flow rates and pressures are established.

END OF SECTION

SECTION 232500 – HVAC WATER TREATMENT SYSTEMS

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GENERAL

SUMMARY

- i. Section includes:
 2. Materials, components, equipment and chemicals for installation of complete HVAC water treatment.

RELATED SECTIONS

- ii. Section 01300 – Submittal Procedures.
- iii. Section 01710 – Cleanup
- iv. Section 01700 – Contract Closeout
- v. Section 01780 - Closeout

REFERENCES

- A. American Society of Mechanical Engineers (ASME)
 2. ASME Boiler and Pressure Vessel Code, Section VII.
- D. Health Canada / Workplace Hazardous Materials Information System (WHMIS)
Materials Safety Data Sheets (MSDS)

SUBMITTALS

- vi. Product Data:
Submit manufacturer's printed product literature, specifications and datasheet in accordance with Section 01300 – Submittals. Include product characteristics, performance criteria, and limitations.
 - b. Submit two copies of Workplace Hazardous Materials Information System (WHMIS) Material Safety Data Sheets (MSDS) in accordance with Section 01300 – Submittal Procedures.
- vii. Shop Drawings:
Submit Shop drawings in accordance with Section 01300 – Submittal Procedures.
- viii. Quality assurance submittals: submit following in accordance with Section 01300 – Submittal Procedures.
Certificates: Submit certificates signed by manufacturer certifying that materials comply with specified performance characteristics and physical properties.
- ix. Closeout submittals:
Submit operation and maintenance data for incorporation into manual specified in Section 01700 – Contract Closeout
Include the following:

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- b. Log sheets as recommended by Owner's Representative.

QUALITY ASSURANCE

- x. Health and Safety:
Do construction occupational health and safety in accordance with OSHA – Health and Safety Requirements.
- xi. Trades people to have journey person qualifications and training provided by the manufacturer.

DELIVERY, STORAGE, AND HANDLING

- xii. Packing, shipping, handling, and unloading:
Deliver, store, and handle in accordance with manufacturer's written instructions and Sections 01620 – Transportation and Handling, and 1630 – Storage and Protection.
- xiii. Waste Management and Disposal:
Construction/Demolition Waste Management and Disposal: separate waste materials for reuse and recycling in accordance with Section 01710 – Cleanup.

PRODUCTS

MANUFACTURER

- xiv. Equipment, chemicals, service by one supplier.

BYPASS POT FEEDERS

- xv. Bypass filter feeders to be supplied and installed in the following systems:
 - Hot water heating system (electric).
 - Hot water heating system (gas).
 - Maximum working pressure:
1378 kPa.
 - Tank shell:
10 gauge steel
 - Tank head:
9 gauge steel.
 - Cap: cast iron with Buna 'N' square O-ring seal. Cap to have wide mouth, easy open-easy close.
 - Vertical style with bottom dished in.
 - NPT female $\frac{3}{4}$ connections.
 - Provide each bypass feeder with a 30 micron filter bag to filter chemical before injection into closed loop heating systems.
 - Capacity: 38 L.

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SAMPLE COOLERS

- xvi. Sample coolers are to be provided for the following systems:

Hot water heating return system.

- xvii. Stainless steel 316 coil with carbon steel.
- xviii. Designed to allow removal of coil for inspection and cleaning.
- xix. Maximum working pressure of 10.33 MPa at 316°C.
- xx. Tubing tail sample water connections of ¼ OD.
- xxi. NPT ½ female connections for coolant water.

CHEMICAL FEED PIPING

- xxii. Schedule 80 PVC with solvent welded joints.

CLOSED LOOP HOT WATER SYSTEMS CHEMICAL TREATMENT.

- xxiii. Prior to chemical treatment all closed looped heating piping systems to be mechanically cleaned in accordance with the requirements of Section 23 08 02 – Cleaning and Start-up of Mechanical Piping Systems.
- xxiv. Chemical treatment to consist of a Molybdate based closed system treatment which shall protect the piping system by forming a thin film on the internal piping surfaces.
- xxv. Solution to be added through bypass filter feeder specified previously.
- xxvi. Provide one (1) Molybdenum test kit to verify water treatment performance.
- xxvii. Recommended start-up dosage to be in accordance with feed rate as determined by water treatment system supplier. For purpose of tendering consider 75-100ppm of Molybdate.
- xxviii. Solution to arrive on site in sealed drums in liquid form. Contractor responsible to store the chemical in a cool, dry, well ventilated area.
- xxix. Product data:
- Liquid
- Clear pale yellow color
- Zero degree Celcius freeze point
- pH of 11.2
- Specific gravity of 1.132
- xxx. Provide one (1) year supply of chemical to protect systems from corrosion.

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LOW PRESSURE CHEMICAL TREATMENT

- xxxi. The low pressure steam chemical treatment system to consist of addition of a multi-blend chemical into the boiler feed water tank for purpose of scale and corrosion control.

- xxxii. Chemical metering pump:

General:

Chemical metering pump to be positive displacement, diaphragm type pump. Output volume shall be adjustable while pump is in operation from zero to maximum capacity as indicated.

Adjustment to be made by readily accessible dial knobs, one for changing stroke length and the other for changing stroke frequency. Both knobs are to be located opposite the liquid handling end. On-off switch to be integral with frequency control, 'off' position to be below lowest frequency setting.

Chemical metering pump to be capable, without a hydraulically backed diaphragm, of injecting chemicals against pressures up to 1722 kPa.

Drive:

The pump drive totally enclosed with no exposed moving parts. Solid state electronic pulser fully encapsulated with quick connect terminals Electronics housed in chemical resistant enclosure at the rear of the pump for maximum protection against chemical spillage.

Provide pump with splash guard.

Automatic pressure relief

Chemical metering pump to automatically stop pulsating when discharge pressure exceeds pump pressure rating by not more than 35%.

Material:

Chemical metering pump housing to be of chemically resistant glass fiber reinforced thermoplastic. All exposed fasteners to be stainless steel. Pump head to be PVDF material capable of resisting the pumped chemical. Fittings and connections at pump head to be PVDF. Pump diaphragm to have a Teflon face while the liquid end seal rings to be of Polyprel.

Suction valves and tubing:

A total of 1.5 m of polyethylene suction tubing to be provided per pump complete with compression connections. A foot valve with integral one-piece strainer shall be provided for suction line.

Drive assembly output specifications:

Strokes per minute:
5 to 100.

Stroke length:
0-100% adjustable.

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Maximum recommended stroke length:
20%.

Output per stroke:
0.08 to 0.37 mL

xxxiii. Polyethylene solution tanks:

Self-supporting with 19 L graduations.

Ultra-violet light resistant construction.

189 liter capacity.

Cover of molded black rigid polyethylene with recess for mounting pump, agitator and liquid level switch.

Supply and install suction tube shield of PVC construction to prevent curling of suction tubing, keep foot valve at bottom of tank, and prevent suction tubing from wrapping around agitator shaft.

xxxiv. Agitator:

For mounting on polyethylene solution tank.

Electrical:
115/1/60, 1.5 amps, 175 watts, 1/20 hp.

Shaft:
850 mm in length of stainless steel construction with a chemical resistant coating.

Impeller:
Stainless steel construction with a chemical resistant coating.

xxxv. Liquid level switch assembly:

Corrosion resistant switch assembly housing of glass reinforced polypropylene.

PVC float tube.

Foamed polypropylene float with encapsulated reed switch.

Float protector to prevent false activation due to turbulence and rough handling.

Low voltage (12 volts) transformer to reed switch for safety.

Pilot lights indicate low level and pump on.

For mounting on polyethylene solution tank.

Duplex receptacle on switch assembly housing. One receptacle for plug-in of metering pump and the other to drive an alarm device such as a light or a horn.

Electrical:
115/1/60, maximum load of 10 amps.

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xxxvi. Pressure relief valve:

Constructed of 316 Stainless Steel

Adjustable pressure range from 207 kPa to 689 kPa.

Inlet/Outlet pipe size:

½ NPT

Set pressure at factory:

As indicated

Capacity:

As indicated

Liquid service only.

Design shall utilize a self-cleaning ball check and seat. A spring guide shall assure proper spring loading and consistent relief capacity.

Relief pressure setting shall be easily changed by removing top cap and adjusting spring tension.

xxxvii. Calibration column:

To enable field checking of chemical metering pump flow rate

PVC construction with slip on top cap

Calibration scale protected by Mylar lamination.

½ NPT female end connections

Vented to atmosphere

Capacity:

100 mL

Scale graduation increments:

1.0 mL

350 mm in length x 41 mm diameter

xxxviii. Back pressure regulating valve:

Maintains minimum backpressure at pump discharge to prevent chemical tank siphonage as well as to protect pump from excessive flow/low head operating conditions.

316 stainless steel construction

Field adjustable set pressure to maximum of 344 kPa.

½ NPT female end connections

Maximum flow as indicated

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Teflon diaphragm

xxxix. Pulsation damper:

To be installed on discharge side of chemical metering positive displacement pump to remove pulsations caused by stop/start action of pump.

Equipped complete with liquid filled pressure gauge and air charging valve

Teflon bladder

Degree of dampening to be 95%

Damper size:

65.6 cubic centimeters.

Pressure rating:

2.06 MPa.

Connection size:

3/8 NPT female.

Provide complete with charging kit accessory package consisting of 2.4 m of 34.4 MPa rated charging hose with male 1/4 NPT fitting at one end for connection to nitrogen bottle regulator and charging adapter with purge valve and gauge at other end.

xl. Corporation stop/Injection quill:

Utilized for injecting chemicals pumped by metering pumps into tanks and piping mains.

Corporation stop allows injection quill to be inserted or removed without having to drain or shutdown system.

Maximum working pressure of 1.033 MPa.

Quill 316 stainless steel construction.

Brass corporation stop with 3/4 NPT male connection.

Protection chain to prevent withdrawal of injection quill before corporation stop is closed.

xli. The multi-blend chemical to be utilized in the low pressure steam system to be a complete internal water treatment system for scale and corrosion control in condensate lines and the boiler; include a neutralizing amine to protect the condensate system from carbonic acid corrosion; include molybdate to ensure passivation of ferrous metal surfaces and prevent oxygen pitting; include a phosphate/alkaline program to treat against hardness and scale in the feed water; and shall include a dispersant to reduce the deposition of particulate matter on heat transfer and equipment surfaces.

xlii. Solution to be pumped into boiler feed tank by chemical metering pump specified previously.

xliii. Provide a drop test kit containing all required equipment for P-Alkalinity, M-Alkalinity, Chlorides, Hardness, Phosphates, Sulfites, TDS and pH.

xliv. Recommended start-up dosage to be in accordance with feed rate as determined by water treatment system supplier. For purposes of tendering consider 75-100 PPM of molybdate.

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- xliv. Solution to arrive on site in sealed drums in liquid form. Contractor responsible to store the chemical in a cool, dry, well ventilated area.
- xlvi. Product data:
 - Liquid
 - Clear
 - Zero degree Celsius freeze point
 - pH of 12.4
 - Specific gravity of 1.152
- xlvii. Provide one (1) year supply of chemical as required for chemical treatment of the low pressure system piping and equipment.

EXECUTION

INSTALLATION

- xlvi. Install HVAC water treatment systems in accordance with ASME Boiler Code Section VII, and requirements and standards of authorities having jurisdiction, except where specified otherwise.
- xlix. Ensure adequate clearances to permit performance of servicing and maintenance of equipment.

CHEMICAL FEED PIPING

- 1. Install crosses at all changes in direction. Install plugs in unused connections.

WATER TREATMENT SERVICES

- li. Provide water treatment monitoring and consulting services for period of one year after system start-up. Service to include:
 - Initial water analysis and treatment recommendations, if different from that specified.
 - System start-up assistance.
 - Operating staff training.
 - Provide necessary recording charts and log sheets for one year operation.
 - Provide necessary laboratory and technical assistance.
 - Instructions and advice to operating staff to be clear, concise and in writing.

START-UP

- lii. Start up water treatment systems in accordance with manufacturer's instructions.

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COMMISSIONING

- liii. Commissioning Agency: to be water treatment supplier.
- liv. Timing:
 - After start-up deficiencies rectified.
 - After start-up and before TAB of connected systems.
- lv. Pre-commissioning Inspections:
 - Verify:
 - Presence of test equipment, reagents, chemicals, details of specific tests to be performed, operating instructions.
 - Suitability of log book.
 - Currency and accuracy of raw water analysis.
 - Required quality of treated water.
- lvi. Commissioning procedures applicable to all Water Treatment Systems:
 - Establish, adjust as necessary and record all automatic controls and chemical feed rates.
 - Monitor performance continuously during commissioning of all connected systems and until acceptance of project.
 - Establish test intervals, regeneration intervals.
 - Record on approved report forms all commissioning procedures, test procedures, dates, times, quantities of chemicals added, raw water analysis, treated water analysis, test results, instrument readings, adjustments made, results obtained.
 - Establish, monitor and adjust automatic controls and chemical feed rates as necessary.
 - Visit project at specified intervals after commissioning is satisfactorily completed to verify that performance remains as set during commissioning (more often as required until system stabilizes at required level of performance).
 - Advise Owner's Representative in writing on all matters regarding installed water treatment systems.
- lvii. Commissioning procedures closed circuit evaporative cooler water treatment system.
 - Responsibility of closed circuit evaporative cooler supplier.
- lviii. Commissioning procedures closed circuit hydronic systems (water only):
 - Analyze water in system.
 - Based upon an assumed rate of loss approved by Owner's Representative, establish rate of chemical feed.

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Record types, quantities of chemicals applied.

lix. Training:

Commission systems, perform tests in presence of, and using assistance of, assigned O&M personnel.

lx. Certificates:

Upon completion, furnish certificates confirming satisfactory installation and performance.

lxi. Commissioning Reports:

To include system schematics, test results, test certificates, raw and treated water analyses, design criteria, all other data required by Owner's Representative.

lxii. Commissioning activities during Warranty Period:

Check out water treatment systems on regular basis and submit written report to Owner's Representative

EXTENDED SERVICES

lxiii. Provide costing to carry out a further four (4) years of water treatment in addition to the one (1) year already specified.

lxiv. Identify individual costing for each year.

END OF SECTION

SECTION 233113 – METAL DUCTS

GOVERNMENT OF THE U. S. VIRGIN ISLANDS, DEPARTMENT OF PUBLIC WORKS

PROJECT NAME: Elaine I. Sprauve Public Library and Museum Building

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PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Rectangular ducts and fittings
2. Round ducts and fittings.
3. Sheet metal materials.
4. Sealants and gaskets.
5. Hangers and supports.

B. Related Sections:

1. Section 230593 "Testing, Adjusting, and Balancing for HVAC" for testing, adjusting, and balancing requirements for metal ducts.

1.2 PERFORMANCE REQUIREMENTS

D. Delegated Duct Design:

Duct construction, including sheet metal thicknesses, seam and joint construction, reinforcements, and hangers and supports, shall comply with SMACNA's "HVAC Duct Construction Standards Metal and Flexible" and performance requirements and design criteria indicated in "Duct Schedule" Article.

E. Structural Performance:

Duct hangers and supports shall withstand the effects of gravity loads and stresses within limits and under conditions described in SMACNA's "HVAC Duct Construction Standards Metal and Flexible".

F. Airstream Surfaces:

Surfaces in contact with the airstream shall comply with requirements in ASHRAE 62.1.

1.3 ACTION SUBMITTALS

C. Product Data:

For each type of product indicated.

D. Shop Drawings:

Fabrication, assembly, and installation, including plans, elevations, sections, components, and attachments to other work.

2. Factory and shop fabricated ducts and fittings.
3. Duct layout indicating sizes, configuration, and static-pressure classes.
4. Elevation of top of ducts.
5. Dimensions of main duct runs from building grid lines.

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6. Fittings.

7. Reinforcement and spacing.
8. Seam and joint construction.
9. Penetrations through fire-rated and other partitions.
10. Equipment installation based on equipment being used on Project.
11. Locations for duct accessories, including dampers, turning vanes, and access doors and panels.
12. Hangers and supports, including methods for duct and building attachment and vibration isolation.

1.4 INFORMATIONAL SUBMITTALS

B. Coordination Drawings:

Plans, drawn to scale, on which the following items are shown and coordinated with each other, using input from installers of the items involved:

1. Duct installation in congested spaces, indicating coordination with general construction, building components, and other building services. Indicate proposed changes to duct layout.
2. Suspended ceiling components
3. Structural members to which duct will be attached
4. Size and location of initial access modules for acoustical tile
5. Penetrations of smoke barriers and fire-rated construction
6. Items penetrating finished ceiling including the following:
 - a. Lighting fixtures
 - b. Air outlets and inlets
 - c. Speakers
 - d. Sprinklers
 - e. Access panels
 - f. Fire alarm devices

1.5 QUALITY ASSURANCE

C. ASHRAE Compliance:

Applicable requirements in ASHRAE 62.1, Section 5 "Systems and Equipment" and Section 7 "Construction and System Start up."

D. ASHRAE/IESNA Compliance:

Applicable requirements in ASHRAE/IESNA 90.1, Section 6.4.4 "HVAC System Construction and Insulation."

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PART 2 - PRODUCTS

2.1 RECTANGULAR DUCTS AND FITTINGS

- E. General Fabrication Requirements:
Comply with SMACNA's "HVAC Duct Construction Standards Metal and Flexible" based on indicated static pressure class unless otherwise indicated.
- F. Transverse Joints:
Select joint types and fabricate according to SMACNA's "HVAC Duct Construction Standards Metal and Flexible," Figure 2-1, "Rectangular Duct/Transverse Joints," for static pressure class, applicable sealing requirements, materials involved, duct support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards Metal and Flexible."
- G. Longitudinal Seams:
Select seam types and fabricate according to SMACNA's "HVAC Duct Construction Standards Metal and Flexible," Figure 2-2, "Rectangular Duct/Longitudinal Seams," for static pressure class, applicable sealing requirements, materials involved, duct support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards Metal and Flexible."
- H. Elbows, Transitions, Offsets, Branch Connections, and Other Duct Construction:
Select types and fabricate according to SMACNA's "HVAC Duct Construction Standards Metal and Flexible," Chapter 4, "Fittings and Other Construction," for static pressure class, applicable sealing requirements, materials involved, duct support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards Metal and Flexible."

2.2 ROUND DUCTS AND FITTINGS

- E. General Fabrication Requirements:
Comply with SMACNA's "HVAC Duct Construction Standards Metal and Flexible," Chapter 3, "Round, Oval, and Flexible Duct," based on indicated static-pressure class unless otherwise indicated.
- 2. Manufacturers:
Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Lindab Inc.
 - b. McGill AirFlow LLC
 - c. SEMCO Incorporated
 - d. Sheet Metal Connectors, Inc.
 - e. Spiral Manufacturing Co., Inc.
- F. Transverse Joints:
Select joint types and fabricate according to SMACNA's "HVAC Duct Construction Standards Metal and Flexible," Figure 3-I, "Round Duct Transverse Joints," for static-pressure class, applicable sealing requirements, materials involved, duct support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards Metal and Flexible."
- 2. Transverse Joints in Ducts Larger Than 60 Inches (1524 mm) in Diameter:
Flanged

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G. Longitudinal Seams:

Select seam types and fabricate according to SMACNA's "HVAC Duct Construction Standards Metal and Flexible," Figure 3-2, "Round Duct Longitudinal Seams," for static pressure class, applicable sealing requirements, materials involved, duct support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards Metal and Flexible."

1. Fabricate round ducts larger than 90 inches (2286 mm) in diameter with butt welded longitudinal seams.

H. Tees and Laterals:

Select types and fabricate according to SMACNA's "HVAC Duct Construction Standards Metal and Flexible," Figure 3-5, "90 Degree Tees and Laterals," and Figure 3-6, "Conical Tees," for static pressure class, applicable sealing requirements, materials involved, duct support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards Metal and Flexible."

2.3 SHEET METAL MATERIALS

G. General Material Requirements:

Comply with SMACNA's "HVAC Duct Construction Standards Metal and Flexible" for acceptable materials, material thicknesses, and duct construction methods unless otherwise indicated. Sheet metal materials shall be free of pitting, seam marks, roller marks, stains, discolorations, and other imperfections.

- B. Galvanized Sheet Steel: Comply with ASTM A 653/A 653M.

3. Galvanized Coating Designation:
G60 (Z180)

4. Finishes for Surfaces Exposed to View:
Mill phosphatized

H. Stainless Steel Sheets:

Comply with ASTM A 480/A 480M, Type 304 or 316, as indicated in the "Duct Schedule" Article; cold rolled, annealed, sheet. Exposed surface finish shall be No. 2B, No. 2D, No. 3, or No. 4 as indicated in the "Duct Schedule" Article.

I. Tie Rods:

Galvanized steel, 1/4-inch (6-mm) minimum diameter for lengths 36 inches (900 mm) or less; 3/8-inch (10-mm) minimum diameter for lengths longer than 36 inches (900 mm).

2.4 SEALANT AND GASKETS

B. General Sealant and Gasket Requirements:

Surface burning characteristics for sealants and gaskets shall be a maximum flame-spread index of 25 and a maximum smoke-developed index of 50 when tested according to UL 723; certified by an NRTL.

B. Two Part Tape Sealing System:

11. Tape:

Woven cotton fiber impregnated with mineral gypsum and modified acrylic/silicone activator to react exothermically with tape to form hard, durable, airtight seal.

12. Tape Width:

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3 inches (76 mm)

- 13. Sealant:
 - Modified styrene acrylic
- 14. Water resistant
- 15. Mold and mildew resistant
- 16. Maximum Static Pressure Class:
 - 10-inch wg (2500 Pa), positive and negative
- 17. Service:
 - Indoor and outdoor
- 18. Service Temperature:
 - To plus 200°F (to plus 93°C)
- 19. Substrate:
 - Compatible with galvanized sheet steel (both PVC coated and bare), stainless steel, or aluminum
- 20. For indoor applications, sealant shall have a VOC content of 250 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
- 11. Sealant shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small Scale Environmental Chambers."

C. Water-Based Joint and Seam Sealant:

- 10. Application Method:
 - Brush on
- 11. Solids Content:
 - Minimum 65 percent
- 12. Shore A Hardness:
 - Minimum 20
- 13. Water resistant
- 14. Mold and mildew resistant
- 15. VOC:
 - Maximum 75 g/L (less water)
- 16. Maximum Static Pressure Class:
 - 10-inch wg (2500 Pa), positive and negative
- 17. Service:
 - Indoor or outdoor
- 18. Substrate:
 - Compatible with galvanized sheet steel (both PVC coated and bare), stainless steel, or

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aluminum sheets.

J. Flanged Joint Sealant:

Comply with ASTM C 920

2. General:

Single-component, acid-curing, silicone, elastomeric

2. Type:

S

4. Grade:

NS

4. Class:

25

5. Use:

0

12. For indoor applications, sealant shall have a VOC content of 250 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

7. Sealant shall comply with the testing and product requirements of the California Department of Health Services "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small Scale Environmental Chambers."

K. Flange Gaskets:

Butyl rubber, neoprene, or EPDM polymer with polyisobutylene plasticizer.

L. Round Duct Joint O-Ring Seals:

3. Seal shall provide maximum leakage class of 3 cfm/100 sq. ft. at 1-inch wg (0.14 Lis per sq. m) and shall be rated for 10-inch wg (2500-Pa) static pressure class, positive or negative.

4. EPDM O-ring to seal in concave bead in coupling or fitting spigot.

3. Double lipped, EPDM O-ring seal, mechanically fastened to factory fabricated couplings and fitting spigots.

2.5 HANGERS AND SUPPORTS

H. Hanger Rods for Noncorrosive Environments:

Cadmium-plated steel rods and nuts.

I. Hanger Rods for Corrosive Environments:

Electrogalvanized, all thread rods or galvanized rods with threads painted with zinc-chromate primer after installation.

J. Strap and Rod Sizes:

Comply with SMACNA's "HVAC Duct Construction Standards Metal and Flexible," Table 5-1 (Table 5-1M), "Rectangular Duct Hangers Minimum Size," and Table 5-2, "Minimum Hanger Sizes for Round Duct."

K. Steel Cables for Galvanized Steel Ducts:

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Galvanized steel complying with ASTM A 603

- L. Steel Cables for Stainless Steel Ducts:
Stainless steel complying with ASTM A 492
- M. Steel Cable End Connections:
Cadmium plated steel assemblies with brackets, swivel, and bolts designed for duct hanger service; with an automatic locking and clamping device.
- N. Duct Attachments:
Sheet metal screws, blind rivets, or self-tapping metal screws; compatible with duct materials
- H. Trapeze and Riser Supports:
 - 3. Supports for Galvanized Steel Ducts:
Galvanized steel shapes and plates
 - 4. Supports for Stainless Steel Ducts:
Stainless steel shapes and plates

PART 3 - EXECUTION

3.1 DUCT INSTALLATION

- A. Drawing plans, schematics, and diagrams indicate general location and arrangement of duct system. Indicated duct locations, configurations, and arrangements were used to size ducts and calculate friction loss for air-handling equipment sizing and for other design considerations. Install duct systems as indicated unless deviations to layout are approved on Shop Drawings and Coordination Drawings.
- B. Install ducts according to SMACNA's "HVAC Duct Construction Standards Metal and Flexible" unless otherwise indicated.
- C. Install round ducts in maximum practical lengths.
- D. Install ducts with fewest possible joints.
- E. Install factory or shop fabricated fittings for changes in direction, size, and shape and for branch connections.
- F. Unless otherwise indicated, install ducts vertically and horizontally, and parallel and perpendicular to building lines.
- G. Install ducts close to walls, overhead construction, columns, and other structural and permanent enclosure elements of building.
- H. Install ducts with a clearance of 1 inch (25 mm), plus allowance for insulation thickness.
- I. Route ducts to avoid passing through transformer vaults and electrical equipment rooms and enclosures.
- J. Where ducts pass through non fire rated interior partitions and exterior walls and are exposed to view, cover the opening between the partition and duct or duct insulation with sheet metal flanges of same metal thickness as the duct. Overlap openings on four sides by at least 1-1/2 inches (38

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- L. Protect duct interiors from moisture, construction debris and dust, and other foreign materials. Comply with SMACNA's "IAQ Guidelines for Occupied Buildings Under Construction," Appendix G, "Duct Cleanliness for New Construction Guidelines."

3.2 INSTALLATION OF EXPOSED DUCTWORK

- A. Protect ducts exposed in finished spaces from being dented, scratched, or damaged.
- B. Trim duct sealants flush with metal. Create a smooth and uniform exposed bead. Do not use two part tape sealing system.
- C. Grind welds to provide smooth surface free of burrs, sharp edges, and weld splatter. When welding stainless steel with a No. 3 or 4 finish, grind the welds flush, polish the exposed welds, and treat the welds to remove discoloration caused by welding.
- D. Maintain consistency, symmetry, and uniformity in the arrangement and fabrication of fittings, hangers and supports, duct accessories, and air outlets.
- E. Repair or replace damaged sections and finished work that does not comply with these requirements.

3.3 DUCT SEALING

- A. Seal ducts for duct static pressure, seal classes, and leakage classes specified in "Duct Schedule" Article according to SMACNA's "HVAC Duct Construction Standards Metal and Flexible."
- B. Seal ducts to the following seal classes according to SMACNA's "HVAC Duct Construction Standards Metal and Flexible":
 - 13. Comply with SMACNA's "HVAC Duct Construction Standards Metal and Flexible."
 - 14. Outdoor, Supply Air Ducts:
Seal Class A
 - 15. Outdoor, Exhaust Ducts:
Seal Class C
 - 16. Outdoor, Return-Air Ducts:
Seal Class C
 - 17. Unconditioned Space, Supply Air Ducts in Pressure Classes 2-Inch wg (500 Pa) and Lower:
Seal Class B
 - 18. Unconditioned Space, Supply Air Ducts in Pressure Classes higher than 2-Inch wg (500 Pa):
Seal Class A
 - 19. Unconditioned Space, Exhaust Ducts:
Seal Class C
 - 20. Unconditioned Space, Return Air Ducts:
Seal Class B
 - 21. Conditioned Space, Supply Air Ducts in Pressure Classes 2-Inch wg (500 Pa) and lower:

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Seal Class C

- 22. Conditioned Space, Supply Air Ducts in Pressure Classes Higher Than 2-Inch wg (500 Pa):
Seal Class B
- 23. Conditioned Space, Exhaust Ducts:
Seal Class B
- 24. Conditioned Space, Return Air Ducts:
Seal Class C

3.4 HANGER AND SUPPORT INSTALLATION

- A. Comply with SMACNA's "HVAC Duct Construction Standards Metal and Flexible," Chapter 5, "Hangers and Supports."
- B. Building Attachments:
Concrete inserts, powder actuated fasteners, or structural steel fasteners appropriate for construction materials to which hangers are being attached.
 - 7. Where practical, install concrete inserts before placing concrete.
 - 8. Install powder actuated concrete fasteners after concrete is placed and completely cured.
 - 9. Use powder actuated concrete fasteners for standard weight aggregate concretes or for slabs more than 4 inches (100 mm) thick.
 - 10. Do not use powder actuated concrete fasteners for lightweight-aggregate concretes or for slabs less than 4 inches (100 mm) thick.
 - 11. Do not use powder actuated concrete fasteners for seismic restraints.
- F. Hanger Spacing:
Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Table 5-1 (Table 5-1M), "Rectangular Duct Hangers Minimum Size," and Table 5-2, "Minimum Hanger Sizes for Round Duct," for maximum hanger spacing; install hangers and supports within 24 inches (610 mm) of each elbow and within 48 inches (1200 mm) of each branch intersection.
- G. Hangers Exposed to View:
Threaded rod and angle or channel supports.
- E. Support vertical ducts with steel angles or channel secured to the sides of the duct with welds, bolts, sheet metal screws, or blind rivets; support at each floor and at a maximum intervals of 16 feet (5 m).
- F. Install upper attachments to structures. Select and size upper attachments with pull-out, tension, and shear capacities appropriate for supported loads and building materials where used.

3.5 CONNECTIONS

- A. Make connections to equipment with flexible connectors.
- B. Comply with SMACNA's "HVAC Duct Construction Standards Metal and Flexible" for branch, outlet and inlet, and terminal unit connections.

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3.6 DUCT CLEANING

- A. Clean new and existing duct system(s) before testing, adjusting, and balancing.
- B. Use service openings for entry and inspection.
 - 1. Create new openings and install access panels appropriate for duct static pressure class if required for cleaning access. Provide insulated panels for insulated or lined duct. Patch insulation and liner as recommended by duct liner manufacturer.
 - 2. Disconnect and reconnect flexible ducts as needed for cleaning and inspection.
 - 3. Remove and reinstall ceiling to gain access during the cleaning process.
- C. Particulate Collection and Odor Control:
 - 1. When venting vacuuming system inside the building, use HEPA filtration with 99.97 percent collection efficiency for 0.3-micron sized (or larger) particles.
 - 2. When venting vacuuming system to outdoors, use filter to collect debris removed from HVAC system, and locate exhaust downwind and away from air intakes and other points of entry into the building.
- D. Clean the following components by removing surface contaminants and deposits:
 - 3. Air outlets and inlets (registers, grilles, and diffusers).
 - 4. Supply, return, and exhaust fans including fan housings, plenums (except ceiling supply and return plenums), scrolls, blades or vanes, shafts, baffles, dampers, and drive assemblies.
 - 3. Air handling unit internal surfaces and components including mixing box, coil section, air wash systems, spray eliminators, condensate drain pans, humidifiers and dehumidifiers, filters and filter sections, and condensate collectors and drains.
 - 4. Coils and related components.
 - 5. Return air ducts, dampers, actuators, and turning vanes except in ceiling plenums and mechanical equipment rooms.
 - 12. Supply air ducts, dampers, actuators, and turning vanes.
 - 7. Dedicated exhaust and ventilation components and makeup air systems.
- H. Mechanical Cleaning Methodology:
 - 8. Clean metal duct systems using mechanical cleaning methods that extract contaminants from within duct systems and remove contaminants from building.
 - 9. Use vacuum collection devices that are operated continuously during cleaning. Connect vacuum device to downstream end of duct sections so areas being cleaned are under negative pressure.
 - 10. Use mechanical agitation to dislodge debris adhered to interior duct surfaces without damaging integrity of metal ducts, duct liner, or duct accessories.

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11. Clean fibrous glass duct liner with HEPA vacuuming equipment; do not permit duct liner to get wet. Replace fibrous glass duct liner that is damaged, deteriorated, or delaminated or that has friable material, mold, or fungus growth.
12. Clean coils and coil drain pans according to NADCA 1992. Keep drain pan operational. Rinse coils with clean water to remove latent residues and cleaning materials; comb and straighten fins.
13. Provide drainage and cleanup for wash down procedures.
14. Antimicrobial Agents and Coatings:
Apply EPA registered antimicrobial agents if fungus is present. Apply antimicrobial agents according to manufacturer's written instructions after removal of surface deposits and debris.

3.7 STARTUP

- C. Air Balance:
Comply with requirements in Section 230593 "Testing, Adjusting, and Balancing for HVAC."

3.8 DUCT SCHEDULE

- A. Fabricate ducts with galvanized sheet steel except as otherwise indicated and as follows:

2. Laboratory exhaust ductwork:
Stainless steel

- D. Supply Ducts:

1. Ducts Connected to Constant Volume Air-Handling Units:

Pressure Class:
Positive 2-inch wg (500 Pa).

- b. Minimum SMACNA Seal Class:
A

- c. SMACNA Leakage Class for Rectangular:
6

- d. SMACNA Leakage Class for Round and Flat Oval:
6

- lxv. Return Ducts:

1. Ducts Connected to Air Handling Units:

Pressure Class:
Positive or negative 2-inch wg (500 Pa).

- b. Minimum SMACNA Seal Class:
A

- d. SMACNA Leakage Class for Rectangular:

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- d. SMACNA Leakage Class for Round and Flat Oval:

6

D. Exhaust Ducts:

- 1. Ducts Connected to Fans Exhausting (ASHRAE 62.1, Class 1 and 2) Air:

- c. Pressure Class:

Negative 2-inch wg (500 Pa).

- d. Minimum SMACNA Seal Class:

A if negative pressure, and A if positive pressure

- c. SMACNA Leakage Class for Rectangular:

12

- d. SMACNA Leakage Class for Round and Flat Oval:

6

- 2. Ducts Connected to Fans Exhausting Laboratory and Process (ASHRAE 62.1, Class 3 and 4) Air:

- d. Type 304, stainless steel sheet

- e. Pressure Class:

Positive or negative 3-inch wg (750 Pa)

- f. Minimum SMACNA Seal Class:

Welded seams, joints, and penetrations

- d. SMACNA Leakage Class:

3

E. Outdoor-Air (Not Filtered, Heated, or Cooled) Ducts:

- 1. Ducts Connected to Air-Handling Units:

- b. Pressure Class:

Positive or negative 2-inch wg (500 Pa)

- b. Minimum SMACNA Seal Class:

A

- e. SMACNA Leakage Class for Rectangular:

6

- f. SMACNA Leakage Class for Round and Flat Oval:

3

F. Intermediate Reinforcement:

- 2. Galvanized Steel Ducts:

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Galvanized steel

2. Stainless Steel Ducts:

- c. Exposed to Airstream:
Match duct material.
- d. Not Exposed to Airstream:
Match duct material.

H. Elbow Configuration:

2. Rectangular Duct:

Comply with SMACNA's "HVAC Duct Construction Standards Metal and Flexible," Figure 4-2, "Rectangular Elbows."

a. Velocity 1000 fpm (5 m/s) or Lower:

- 1) Radius Type RE 1 with minimum 0.5 radius-to-diameter ratio
- 2) Mitered Type RE 4 without vanes

b. Velocity 1000 to 1500 fpm (5 to 7.6 m/s):

- 1) Radius Type RE 1 with minimum 1.0 radius-to-diameter ratio.
- 2) Radius Type RE 3 with minimum 0.5 radius-to-diameter ratio and two vanes.
- 3) Mitered Type RE 2 with vanes complying with SMACNA's "HVAC Duct Construction Standards Metal and Flexible," Figure 4-3, "Vanes and Vane Runners," and Figure 4-4, "Vane Support in Elbows."

c. Velocity 1500 fpm (7.6 m/s) or Higher:

- 1) Radius Type RE 1 with minimum 1.5 radius-to-diameter ratio.
- 2) Radius Type RE 3 with minimum 1.0 radius-to-diameter ratio and two vanes.
- 3) Mitered Type RE 2 with vanes complying with SMACNA's "HVAC Duct Construction Standards Metal and Flexible," Figure 4-3, "Vanes and Vane Runners," and Figure 4-4, "Vane Support in Elbows."

2. Rectangular Duct:

Comply with SMACNA's "HVAC Duct Construction Standards Metal and Flexible," Figure 4-2, "Rectangular Elbows."

- a. Radius Type RE I with minimum 1.5 radius-to-diameter ratio.
- b. Radius Type RE 3 with minimum 1.0 radius-to-diameter ratio and two vanes.
- c. Mitered Type RE 2 with vanes complying with SMACNA's "HVAC Duct Construction Standards Metal and Flexible," Figure 4-3, "Vanes and Vane Runners," and Figure 4-4, "Vane Support in Elbows."

3. Round Duct:

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Comply with SMACNA's "HVAC Duct Construction Standards Metal and Flexible," Figure 3-4, "Round Duct Elbows."

- d. Minimum Radius-to-Diameter Ratio and Elbow Segments:
Comply with SMACNA's "HVAC Duct Construction Standards Metal and Flexible," Table 3-1, "Mitered Elbows." Elbows with less than 90-degree change of direction have proportionately fewer segments.
 - 1) Velocity 1000 fpm (5 m/s) or Lower:
0.5 radius-to-diameter ratio and three segments for 90-degree elbow.
 - 2) Velocity 1000 to 1500 fpm (5 to 7.6 m/s):
1.0 radius-to-diameter ratio and four segments for 90-degree elbow.
 - 3) Velocity 1500 fpm (7.6 m/s) or Higher:
1.5 radius-to-diameter ratio and five segments for 90-degree elbow.
 - 4) Radius-to Diameter Ratio:
1.5.
- e. Round Elbows, 12 Inches (305 mm) and Smaller in Diameter:
Stamped or pleated.
- f. Round Elbows, 14 Inches (356 mm) and Larger in Diameter:
Standing seam.

H. Branch Configuration:

- 3. Rectangular Duct:
Comply with SMACNA's "HVAC Duct Construction Standards Metal and Flexible," Figure 4-6, "Branch Connection."
 - c. Rectangular Main to Rectangular Branch:
45-degree entry.
 - d. Rectangular Main to Round Branch:
Spin in.
- 4. Round:
Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 3-5, "90 Degree Tees and Laterals," and Figure 3-6, "Conical Tees." Saddle taps are permitted in existing duct.
 - e. Velocity 1000 fpm (5 m/s) or lower:
90-degree tap.
 - f. Velocity 1000 to 1500 fpm (5 to 7.6 m/s):
Conical tap.
 - g. Velocity 1500 fpm (7.6 m/s) or Higher:
45-degree lateral

END OF SECTION

SECTION 233300 – AIR DUCT ACCESSORIES

GOVERNMENT OF THE U. S. VIRGIN ISLANDS, DEPARTMENT OF PUBLIC WORKS

PROJECT NAME: Elaine I. Sprauve Public Library and Museum Building

Project Location, St. John, U.S. Virgin Islands

PART 1- GENERAL

1.1 SUMMARY

A. Section Includes:

1. Backdraft and pressure relief dampers
2. Manual volume dampers
3. Control dampers
4. Fire dampers
5. Flange connectors
6. Turning vanes
7. Duct-mounted access doors
8. Flexible connectors
9. Flexible ducts
10. Duct accessory hardware

B. Related Requirements:

1. Section 233113 "Metal Ducts.

1.2 ACTION SUBMITTALS

C. Product Data:

For each type of product.

D. Shop Drawings:

For duct accessories. Include plans, elevations, sections, details and attachments to other work.

1. Detail duct accessories fabrication and installation in ducts and other construction. Include dimensions, weights, loads, and required clearances; and method of field assembly into duct systems and other construction. Include the following:
 - a. Special fittings
 - b. Manual volume damper installations
 - c. Control-damper installations
 - d. Fire-damper installations, including sleeves; and duct-mounted access doors.
 - f. Wiring Diagrams:
For power, signal, and control wiring

1.3 CLOSEOUT SUBMITTALS

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Operation and maintenance data.

PART 2- PRODUCTS

2.1 ASSEMBLY DESCRIPTION

- A. Comply with NFPA 90A, "Installation of Air Conditioning and Ventilating Systems," and with NFPA 90B, "Installation of Warm Air Heating and Air Conditioning Systems."
- B. Comply with SMACNA's "HVAC Duct Construction Standards Metal and Flexible" for acceptable materials, material thicknesses, and duct construction methods unless otherwise indicated. Sheet metal materials shall be free of pitting, seam marks, roller marks, stains, discolorations, and other imperfections.

2.2 MATERIALS

- G. Galvanized Sheet Steel:
Comply with ASTM A 653/A 653M
- 3. Galvanized Coating Designation: G60 (Z180)
- 4. Exposed Surface Finish:
Mill phosphatized
- H. Stainless Steel Sheets:
Comply with ASTM A 480/A 480M, Type 304, and having a No.2 finish.
- I. Aluminum Sheets:
Comply with ASTM B 209 (ASTM B 209M), Alloy 3003, Temper H14; with mill finish for concealed ducts and standard, l-side bright finish for exposed ducts.
- J. Extruded Aluminum:
Comply with ASTM B 221 (ASTM B 221M), Alloy 6063, Temper T6.
- K. Reinforcement Shapes and Plates:
Galvanized steel reinforcement where installed on galvanized sheet metal ducts; compatible materials for aluminum and stainless steel ducts.
- L. Tie Rods:
Galvanized steel, 1/4-inch (6-mm) minimum diameter for lengths 36 inches (900 mm) or less; 3/8-inch (10-mm) minimum diameter for lengths longer than 36 inches (900 mm).

2.3 BACKDRAFT AND PRESSURE RELIEF DAMPERS

- I. Manufacturers:
Subject to compliance with requirements, provide products by one of the following available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - 1. Air Balance Inc.; a division of Mestek, Inc.
 - 2. American Warming and Ventilating; a division of Mestek, Inc.
 - 3. Greenheck Fan Corporation

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4. Naffor Industries Inc.
5. Pottorff
6. Ruskin Company
- J. Description:
Gravity balanced
- K. Maximum Air Velocity:
2000 fpm (10 m/s)
- L. Maximum System Pressure:
3-inch wg (0.8 kPa)
- M. Frame:
Hat-shaped, 0.09-inch (2.4-mm) thick extruded aluminum, with welded comers or mechanically attached.
- N. Blades:
Multiple single piece blades, end pivoted, maximum 6-inch (150-mm) width, 0.050-inch (1.2-mm) thick extruded aluminum with sealed edges.
- O. Blade Action:
Parallel
- P. Blade Seals:
Extruded vinyl, mechanically locked
- I. Blade Axles:
 2. Material:
Galvanized steel
 2. Diameter:
0.20 inch (5 mm)
- M. Tie Bars and Brackets:
Aluminum
- N. Return Spring:
Adjustable tension
- O. Bearings:
Synthetic pivot bushings
- M. Accessories:
 1. Adjustment device to permit setting for varying differential static pressure
 2. Counterweights and spring assist kits for vertical airflow installations
 3. 90-degree stops

2.4 MANUAL VOLUME DAMPERS

SECTION 233300 – AIR DUCT ACCESSORIES

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A. Standard, Steel, Manual Volume Dampers:

4. Manufacturers:

Subject to compliance with requirements, provide products by one of the following available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

- a. Air Balance Inc.; a division of Mestek, Inc.
- b. American Warming and Ventilating; a division of Mestek, Inc.
- c. Flexmaster U.S.A., Inc.
- d. McGill AirFlow LLC.
- e. Nailor Industries Inc.
- f. Pottorff.
- g. Ruskin Company.

2. Standard leakage rating, with linkage outside airstream

3. Suitable for horizontal or vertical applications

4. Frames:

- b. Hat-shaped, 0.094-inch (2.4-mm) thick, galvanized sheet steel
- b. Mitered and welded comers
- c. Flanges for attaching to walls and flangeless frames for installing in ducts

5. Blades:

- a. Multiple or single blade
- b. Parallel- or opposed-blade design
- c. Stiffen damper blades for stability
- d. Galvanized steel, 0.064 inch (1.62 mm) thick

7. Blade Axles:

Galvanized steel

7. Bearings:

- a. Molded synthetic
- b. Dampers in ducts with pressure classes of 3-inch wg (750 Pa) or less shall have axles the full length of damper blades and bearings at both ends of operating shaft.

9. Tie Bars and Brackets:

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Galvanized steel

B. Jackshaft:

1. Size:
0.5-inch (13-mm) diameter
5. Material:
Galvanized steel pipe rotating within pipe bearing assembly mounted on supports at each mullion and at each end of multiple-damper assemblies.
6. Length and Number of Mountings:
As required to connect linkage of each damper in multiple damper assembly.

C. Damper Hardware:

1. Zinc plated, die-cast core with dial and handle made of 3/32-inch (2.4-mm) thick zinc plated steel, and a 3/4-inch (19-mm) hexagon locking nut.
2. Include center hole to suit damper operating rod size.
3. Include elevated platform for insulated duct mounting.

2.5 CONTROL DAMPERS

B. Manufacturers:

Subject to compliance with requirements, provide products by one of the following available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

1. American Warming and Ventilating; a division of Mestek, Inc.
2. Arrow United Industries; a division of Mestek, Inc.
3. Greenheck Fan Corporation
4. Nailor Industries Inc.
5. Pottorff.
6. Ruskin Company
7. Young Regulator Company

B. Frames:

1. Hat shaped
2. 0.125-inch (3-mm) thick aluminum.

C. Blades:

1. Multiple blade with maximum blade width of 6 inches (152 mm)
2. Parallel and opposed blade design

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3. Aluminum
4. 0.0747-inch (1.9-mm) thick dual skin
6. Blade Edging:
Closed cell neoprene
- E. Blade Axles:
1/2-inch (13-mm) diameter; stainless steel; blade linkage hardware of zinc plated steel and brass;
ends sealed against blade bearings.
2. Operating Temperature Range:
To plus 200°F (to plus 93°C)
- E. Bearings:
 1. Molded synthetic
 2. Dampers in ducts with pressure classes of 3-inch wg (750 Pa) or less shall have axles the full length of damper blades and bearings at both ends of operating shaft.
 3. Thrust bearings at each end of every blade

2.6 FIRE DAMPERS

- C. Manufacturers:
Subject to compliance with requirements, provide products by one of the following available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 1. Air Balance Inc.; a division of Mestek, Inc.
 2. Greenheck Fan Corporation
 3. Nailor Industries Inc.
 4. Pottorff
 5. Ruskin Company
- D. Type:
Dynamic; rated and labeled according to UL 555 by an NRTL.
- C. Closing rating in ducts up to 4-inch wg (1-kPa) static pressure class and minimum 2000-fpm (10-m/s) velocity.
- K. Fire Rating:
1-1/2 and 3 hours.
- L. Frame:
Curtain type with blades outside airstream and multiple blade type; fabricated with roll formed, 0.034-inch (0.85-mm) thick galvanized steel; with mitered and interlocking comers.

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M. Mounting Sleeve:

Factory or field installed, galvanized sheet steel

3. Minimum Thickness:

20 gage thick, as indicated, and of length to suit application.

4. Exception:

Omit sleeve where damper frame width permits direct attachment of perimeter mounting angles on each side of wall or floor; thickness of damper frame must comply with sleeve requirements.

N. Mounting Orientation:

Vertical or horizontal as indicated

O. Blades:

Roll formed, interlocking, 0.024-inch (0.61-mm) thick, galvanized sheet steel. In place of interlocking blades, use full length, 0.034-inch (0.85-mm) thick, galvanized steel blade connectors.

P. Horizontal Dampers:

Include blade lock and stainless steel closure spring.

Q. Heat-Responsive Device:

Replaceable, 165°F (74°C) rated, fusible links.

2.7 FLANGE CONNECTORS

E. Manufacturers:

Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

1. Ductmate Industries, Inc.
2. Nexus PDQ; Division of Shilco Holdings Inc.
3. Ward Industries, Inc.; a division of Hart & Cooley, Inc.

F. Description:

Add on or roll formed, factory fabricated, slide on transverse flange connectors, gaskets, and components.

G. Material:

Galvanized steel

H. Gage and Shape:

Match connecting ductwork.

2.8 TURNING VANES

E. Manufacturers:

Subject to compliance with requirements, provide products by one of the following available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

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1. Ductmate Industries, Inc.
 2. Duro Dyne Inc.
 3. Elgen Manufacturing
 4. METALAIR, Inc.
- F. Manufactured Turning Vanes for Metal Ducts:
Curved blades of galvanized sheet steel; support with bars perpendicular to blades set; set into vane runners suitable for duct mounting.
3. Acoustic Turning Vanes:
Fabricate airfoil shaped aluminum extrusions with perforated faces and fibrous-glass fill.
- G. General Requirements:
Comply with SMACNA's "HVAC Duct Construction Standards Metal and Flexible"; Figures 4-3, "Vanes and Vane Runners," and 4-4, "Vane Support in Elbows."
- H. Vane Construction:
Double wall

2.9 DUCT-MOUNTED ACCESS DOORS

- C. Manufacturers:
Subject to compliance with requirements, provide products by one of the following available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
1. American Warming and Ventilating; a division of Mestek, Inc.
 2. Ductmate Industries, Inc.
 3. Flexmaster U.S.A., Inc.
 4. Greenheck Fan Corporation
 5. McGill AirFlow LLC.
 6. Nailor Industries Inc.
 7. Pottorff
- D. Duct Mounted Access Doors:
Fabricate access panels according to SMACNA's "HVAC Duct Construction Standards Metal and Flexible"; Figures 7-2 (7-2M), "Duct Access Doors and Panels," and 7-3, "Access Doors-Round Duct."
1. Door:
 - a. Double wall, rectangular
 - b. Galvanized sheet metal with insulation fill and thickness as indicated for duct pressure class.

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c. Vision panel

h. Hinges and Latches:
1-by-1 inch (25-by-25 mm) butt or piano hinge and cam latches.

e. Fabricate doors airtight and suitable for duct pressure class.

4. Frame:
Galvanized sheet steel, with bend-over tabs and foam gaskets

3. Number of Hinges and Locks:

f. Access Doors Less Than 12 Inches (300 mm) Square:
No hinges and two sash locks

g. Access Doors up to 18 Inches (460 mm) Square:
Continuous and two sash locks

h. Access Doors up to 24 by 48 Inches (600 by 1200 mm):
Three hinges and two compression latches

i. Access Doors Larger Than 24 by 48 Inches (600 by 1200 mm):
Four hinges and two compression latches with outside and inside handles.

2.10 FLEXIBLE CONNECTORS

G. Manufacturers:

Subject to compliance with requirements, provide products by one of the following available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

1. Ductmate Industries, Inc.

2. Duro Dyne Inc.

3. Elgen Manufacturing

H. Materials:

Flame retardant or noncombustible fabrics

I. Coatings and Adhesives:

Comply with UL 181, Class 1

J. Metal Edged Connectors:

Factory fabricated with a fabric strip 3-1/2 inches (89 mm) wide attached to two strips of 2-3/4-inch (70-mm) wide, 0.028-inch (0.7-mm) thick, galvanized sheet steel or 0.032-inch (0.8-mm) thick aluminum sheets. Provide metal compatible with connected ducts.

K. Indoor System, Flexible Connector Fabric:

Glass fabric double coated with neoprene

4. Minimum Weight:
26 oz./sq. yd. (880 g/sq. m)

5. Tensile Strength:

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480 lbf/inch (84 N/mm) in the warp and 360 lbf/inch (63 N/mm) in the filling

6. Service Temperature:
To plus 200°F (to plus 93°C).
- L. Outdoor System, Flexible Connector Fabric:
Glass fabric double coated with weatherproof, synthetic rubber resistant to UV rays and ozone.
4. Minimum Weight:
24 oz./sq. yd. (810 g/sq. m)
5. Tensile Strength:
530 lbf/inch (93 N/mm) in the warp and 440 lbf/inch (77 N/mm) in the filling.
6. Service Temperature:
To plus 250°F (to plus 121°C).

2.11 FLEXIBLE DUCTS

- C. Manufacturers:
Subject to compliance with requirements, provide products by one of the following available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 1. Flexmaster U.S.A., Inc.
 2. McGill AirFlow LLC.
 3. Ward Industries, Inc.; a division of Hart & Cooley, Inc.
- D. Insulated, Flexible Duct:
UL 181, Class I, aluminum laminate and polyester film with latex adhesive supported by helically wound, spring steel wire; fibrous glass insulation; aluminized vapor barrier film.
 5. Pressure Rating:
10-inch wg (2500 Pa) positive and 1.0-inch wg (250 Pa) negative
 6. Maximum Air Velocity:
4000 fpm (20 m/s)
 7. Temperature Range:
To plus 210°F (to plus 99°C)
 8. Insulation R-value:
Comply with ASHRAEIESNA 90.1, R-6.0 minimum
- C. Flexible Duct Connectors:
 3. Clamps:
Nylon strap in sizes 3 through 18 inches (75 through 460 mm), to suit duct size
 4. Non-Clamp Connectors:
Liquid adhesive plus tape.

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2.12 DUCT ACCESSORY HARDWARE

C. Instrument Test Holes:

Cast iron or cast aluminum to suit duct material, including screw cap and gasket. Size to allow insertion of Pitot tube and other testing instruments and of length to suit duct insulation thickness.

D. Adhesives:

High strength, quick setting, neoprene based, waterproof, and resistant to gasoline and grease.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install duct accessories according to applicable details in SMACNA's "HVAC Duct Construction Standards Metal and Flexible" for metal ducts.
- B. Install duct accessories of materials suited to duct materials; use galvanized steel accessories in galvanized steel and fibrous glass ducts, stainless steel accessories in stainless steel ducts, and aluminum accessories in aluminum ducts.
- C. Install backdraft and/or control dampers at inlet of exhaust fans or exhaust ducts as close as possible to exhaust fan unless otherwise indicated.
- D. Install volume dampers at points on supply, return, and exhaust systems where branches extend from larger ducts. Where dampers are installed in ducts having duct liner, install dampers with hat channels of same depth as liner, and terminate liner with nosing at hat channel.
 - 1. Install steel volume dampers in steel ducts.
 - 2. Install aluminum volume dampers in aluminum ducts.
- E. Set dampers to fully open position before testing, adjusting, and balancing.
- F. Install test holes at fan inlets and outlets and elsewhere as indicated.
- G. Install fire and smoke dampers according to UL listing.
- H. Install duct access doors on sides of ducts to allow for inspecting, adjusting, and maintaining accessories and equipment at the following locations:
 - 1. On both sides of duct coils
 - 2. At outdoor-air intakes and mixed-air plenums
 - 3. At drain pans and seals
 - 4. Downstream from manual volume dampers, control dampers, backdraft dampers, and equipment
 - 5. Adjacent to and close enough to fire or smoke dampers, to reset or reinstall fusible links Access doors for access to fire or smoke dampers having fusible links shall be pressure relief access doors and shall be outward operation for access doors installed upstream from dampers and inward operation for access doors installed downstream from dampers.
 - 6. At each change in direction and at maximum 50-foot (15-m) spacing

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7. Upstream or downstream from duct silencers
 8. Control devices requiring inspection
 9. Elsewhere as indicated
- I. Install access doors with swing against duct static pressure.
- J. Access Door Sizes:
1. One Hand or Inspection Access:
8 by 5 inches (200 by 125 mm)
 7. Two Hand Access:
12 by 6 inches (300 by 150 mm)
 8. Head and Hand Access:
18 by 10 inches (460 by 250 mm)
 9. Head and Shoulders Access:
21 by 14 inches (530 by 355 mm)
 10. Body Access:
25 by 14 inches (635 by 355 mm)
 11. Body plus Ladder Access:
25 by 17 inches (635 by 430 mm).
- K. Label access doors according to Section 230553 "Identification for HVAC Piping and Equipment" to indicate the purpose of access door.
- L. Install flexible connectors to connect ducts to equipment.
- M. Connect terminal units to supply ducts directly or with maximum 12-inch (300-mm) lengths of flexible duct. Do not use flexible ducts to change directions.
- N. Connect diffusers or light troffer boots to ducts with maximum 60-inch (1500-mm) lengths of flexible duct clamped or strapped in place.
- O. Connect flexible ducts to metal ducts with draw bands.
- P. Install duct test holes where required for testing and balancing purposes.

3.2 FIELD QUALITY CONTROL

- A. Tests and Inspections:
1. Operate dampers to verify full range of movement.
 2. Inspect locations of access doors and verify that purpose of access door can be performed.
 3. Inspect turning vanes for proper and secure installation.

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END OF SECTION

SECTION 233416 – CENTRIFUGAL HVAC FANS

GOVERNMENT OF THE U. S. VIRGIN ISLANDS, DEPARTMENT OF PUBLIC WORKS

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PART 1 - GENERAL

1.1 SUMMARY

B. Section Includes:

For each product

1. Backward inclined centrifugal fans
2. Forward curved centrifugal fans

1.2 ACTION SUBMITTALS

A. Product Data:

1. Include rated capacities, furnished specialties, and accessories for each fan.
2. Certified fan performance curves with system operating conditions indicated
3. Certified fan sound-power ratings
4. Motor ratings and electrical characteristics, plus motor and electrical accessories
5. Material thickness and finishes, including color charts
6. Dampers, including housings, linkages, and operators.

B. Shop Drawings:

1. Include plans, elevations, sections, and attachment details.
2. Include details of equipment assemblies. Indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
3. Include diagrams for power, signal, and control wiring.
6. Design Calculations:
Calculate requirements for selecting vibration isolators and seismic restraints and for designing vibration isolation bases.
7. Vibration Isolation Base Details:
Detail fabrication, including anchorages and attachments to structure and to supported equipment. Include auxiliary motor slides and rails, and base weights.

1.3 INFORMATIONAL SUBMITTALS

B. Coordination Drawings:

Show fan room layout and relationships between components and adjacent structural and mechanical elements. Show support locations, type of support, and weight on each support. Indicate and certify field measurements.

B. Field quality control reports.

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1.4 CLOSEOUT SUBMITTALS

B. Operation and Maintenance Data:

For centrifugal fans to include in emergency, operation, and maintenance manuals.

1.5 MAINTENANCE MATERIAL SUBMITTALS

B. Spare Belts:

One set for each belt-driven unit

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

C. AMCA Compliance:

Comply with AMCA performance requirements and bear the AMCA-Certified Ratings Seal.

D. Capacities and Characteristics:

See Fan schedule on drawing

9. Vibration Isolators:

Spring isolators having a static deflection of 1 inch (25 mm)

2.2 BACKWARD INCLINED CENTRIFUGAL FANS

A. Manufacturers:

Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

1. Acme Engineering & Mfg. Corp.
2. Aerovent; a Twin City Fan company
3. Chicago Blower Corporation
4. CML Northern Blower Inc.
5. Howden Buffalo Inc.
6. Loren Cool. Company
7. Greenheck Corp.

B. Description:

1. Factory fabricated, assembled, tested, and finished, belt driven centrifugal fans consisting of housing, wheel, fan shaft, bearings, motor, drive assembly, and support structure.
2. Deliver fans as factory assembled units, to the extent allowable by shipping limitations.
3. Factory installed and wired disconnect switch

C. Housings:

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1. Formed panels to make curved scroll housings with shaped cutoff

10. Panel Bracing:

Steel angle or channel iron member supports for mounting and supporting fan scroll, wheel, motor, and accessories.

3. Horizontally split, bolted-flange housing

4. Spun inlet cone with flange

5. Outlet flange.

E. Backward Inclined Wheels:

1. Single width single inlet and double width double inlet construction with curved inlet flange, back plate, backward-inclined blades, and fastened to shaft with set screws.

2. Welded or riveted to flange and back plate; cast-iron or cast-steel hub riveted to back plate.

F. Shafts:

1. Statically and dynamically balanced and selected for continuous operation at maximum rated fan speed and motor horsepower, with adjustable alignment and belt tensioning.

2. Turned, ground, and polished hot rolled steel with keyway. Ship with protective coating of lubricating oil.

3. Designed to operate at no more than 70 percent of first critical speed at top of fan's speed range.

G. Grease-Lubricated Shaft Bearings:

1. Self-aligning, pillow block type, ball or roller bearings with adapter mount and two piece, cast iron housing.

H. Belt Drives:

1. Factory mounted, with adjustable alignment and belt tensioning

2. Service Factor Based on Fan Motor Size:
1.5.

11. Fan Pulleys:

Cast iron or cast steel with split, tapered bushing; dynamically balanced at factory

12. Motor Pulleys:

Adjustable pitch for use with motors through 5 hp; fixed pitch for use with larger motors. Select pulley so pitch adjustment is at the middle of adjustment range at fan design conditions.

13. Belts:

Oil resistant, non-sparking, and non-static; matched sets for multiple belt drives.

14. Belt Guards:

Fabricate to comply with OSHA and SMACNA requirements of diamond mesh wire screen welded to steel angle frame or equivalent prime coated. Secure to fan or fan supports without short circuiting vibration isolation. Include provisions for adjustment of belt tension,

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lubrication, and use of tachometer with guard in place.

15. Motor Mount:

Adjustable for belt tensioning.

I. Accessories:

1. Access for Inspection, Cleaning, and Maintenance:

Comply with requirements in ASHRAE 62.1

10. Scroll Drain Connection:

NPS I (DN 25) steel pipe coupling welded to low point of fan scroll

11. Companion Flanges:

Rolled flanges for duct connections of same material as housing

12. Variable Inlet Vanes:

With blades supported at both ends with two permanently lubricated bearings of same material as housing. Variable mechanism terminating in single control lever with control shaft for double width fans.

13. Discharge Dampers:

Assembly with opposed blades constructed of two plates formed around and to shaft, channel frame, and sealed ball bearings; with blades linked outside of airstream to single control lever of same material as housing.

14. Inlet Screens:

Grid screen of same material as housing

15. Shaft Cooler:

Metal disk between bearings and fan wheel, designed to dissipate heat from shaft

16. Shaft Seals:

Airtight seals installed around shaft on drive side of single-width fans

17. Weather Cover:

Enameled-steel sheet with ventilation slots, bolted to housing.

2.3 SOURCE QUALITY CONTROL

A. Sound Power Level Ratings:

Comply with AMCA 301, "Methods for Calculating Fan Sound Ratings from Laboratory Test Data." Factory test fans according to AMCA 300, "Reverberant Room Method for Sound Testing of Fans." Label fans with the AMCA-Certified Ratings Seal.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install centrifugal fans level and plumb.

B. Disassemble and reassemble units, as required for moving to the final location, according to manufacturer's written instructions.

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- C. Lift and support units with manufacturer's designated lifting or supporting points.
- G. Equipment Mounting:
Install centrifugal fans with Insert seismic restraint device. Comply with requirements for seismic restraint devices specified in Section 230548 "Vibration and Seismic Controls for HVAC Piping and Equipment."
- H. Curb Support:
Install roof curb on roof structure, level and secure, according to "The NRCA Roofing and Waterproofing Manual," Low-Slope Membrane Roofing Construction Details Section, Illustration "Raised Curb Detail for Rooftop Air Handling Units and Ducts." Install and secure centrifugal fans on curbs, and coordinate roof penetrations and flashing with roof construction. Secure units to curb support with anchor bolts.
- I. Unit Support:
Install centrifugal fans level on structural curbs. Coordinate wall penetrations and flashing with wall construction. Secure units to structural support with anchor bolts.
- G. Install units with clearances for service and maintenance.
- H. Label fans according to requirements specified in Section 230553 "Identification for HVAC Piping and Equipment."

3.2 CONNECTIONS

- A. Drawings indicate general arrangement of ducts and duct accessories. Make final duct connections with flexible connectors. Flexible connectors are specified in Section 233300 "Air Duct Accessories."
- B. Install ducts adjacent to fans to allow service and maintenance.
- C. Install piping from scroll drain connection, with trap with seal equal to 1.5 times specified static pressure, to nearest floor drain with pipe sizes matching the drain connection.

3.3 FIELD QUALITY CONTROL

- A. Perform the following tests and inspections:
 - 1. Verify that shipping, blocking, and bracing are removed.
 - 2. Verify that unit is secure on mountings and supporting devices and that connections to ducts and electrical components are complete. Verify that proper thermal overload protection is installed in motors, starters, and disconnect switches.
 - 3. Verify that cleaning and adjusting are complete.
 - 4. Disconnect fan drive from motor, verify proper motor rotation direction, and verify fan wheel free rotation and smooth bearing operation. Reconnect fan drive system, align and adjust belts, and install belt guards.
 - 5. Adjust belt tension.

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6. Adjust damper linkages for proper damper operation.
 7. Verify lubrication for bearings and other moving parts.
 8. Verify that manual and automatic volume control and fire and smoke dampers in connected ductwork systems are in fully open position.
 9. See Section 230593 "Testing, Adjusting, and Balancing For HVAC" for testing, adjusting, and balancing procedures.
 10. Remove and replace malfunctioning units and retest as specified above.
- B. Test and adjust controls and safeties. Controls and equipment will be considered defective if they do not pass tests and inspections.
- C. Prepare test and inspection reports.

END OF SECTION

SECTION 233423 – HVAC POWER VENTILATORS

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PROJECT NAME: Elaine I. Sprauve Public Library and Museum Building

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PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. In-line centrifugal fans.

1.2 ACTION SUBMITTALS

C. Product Data:

For each type of product indicated.

D. Shop Drawings:

Include plans, elevations, sections, details, and attachments to other work.

1. Detail equipment assemblies and indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
3. Wiring Diagrams:
For power, signal, and control wiring.

1.3 CLOSEOUT SUBMITTALS

- A. Operation and maintenance data.

1.4 QUALITY ASSURANCE

C. Electrical Components, Devices, and Accessories:

Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

D. AMCA Compliance:

Fans shall have AMCA-Certified performance ratings and shall bear the AMCA- Certified Ratings Seal.

PART 2 - PRODUCTS

2.1 IN-LINE CENTRIFUGAL FANS

F. Basis of Design Product:

Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:

1. Greenheck Fan Corporation
2. Loren Cook Company
3. PennBarry

G. Housing:

Split, spun aluminum with aluminum straightening vanes, inlet and outlet flanges, and support bracket adaptable to floor, side wall, or ceiling mounting.

H. Direct-Drive Units:

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Motor mounted in airstream, factory wired to disconnect switch located on outside of fan housing.

I. Belt Driven Units:

Motor mounted on adjustable base, with adjustable sheaves, enclosure around belts within fan housing, and lubricating tubes from fan bearings extended to outside of fan housing.

J. Fan Wheels:

Aluminum, airfoil blades welded to aluminum hub

F. Accessories:

6. Variable-Speed Controller:

Solid state control to reduce speed from 100 to less than 50 percent.

7. Volume Control Damper:

Manually operated with quadrant lock, located in fan outlet

8. Companion Flanges:

For inlet and outlet duct connections

9. Fan Guards:

1/2 by 1-inch (13 by 25-mm) mesh of galvanized steel in removable frame. Provide guard for inlet or outlet for units not connected to ductwork.

10. Motor and Drive Cover (Belt Guard):

Epoxy-coated steel.

2.2 MOTORS

A. Comply with NEMA designation, temperature rating, service factor, enclosure type, and manufacturers' standard efficiency requirements for motors.

2. Motor Sizes:

Minimum size as indicated. If not indicated, large enough so driven load will not require motor to operate in service factor range above 1.0.

B. Enclosure Type:

Totally enclosed, fan cooled.

2.3 SOURCE QUALITY CONTROL

A. Certify sound power level ratings according to AMCA 301, "Methods for Calculating Fan Sound Ratings from Laboratory Test Data." Factory test fans according to AMCA 300, "Reverberant Room Method for Sound Testing of Fans." Label fans with the AMCA-Certified Ratings Seal.

B. Certify fan performance ratings, including flow rate, pressure, power, air density, speed of rotation, and efficiency by factory tests according to AMCA 210, "Laboratory Methods of Testing Fans for Aerodynamic Performance Rating." Label fans with the AMCA-Certified Ratings Seal.

PART 3- EXECUTION

3.1 INSTALLATION

SECTION 233423 – HVAC POWER VENTILATORS

GOVERNMENT OF THE U. S. VIRGIN ISLANDS, DEPARTMENT OF PUBLIC WORKS

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A. Support suspended units from structure using threaded steel rods and elastomeric hangers having a static deflection of 1 inch (25 mm). Vibration control devices furnished with fans.

B. Install units with clearances for service and maintenance.

C. Label units as indicated on plans.

3.2 CONNECTIONS

A. Drawings indicate general arrangement of ducts and duct accessories. Make final duct connections with flexible connectors. Flexible connectors are specified in Section 233300 "Air Duct Accessories."

B. Install ducts adjacent to power ventilators to allow service and maintenance.

C. Ground equipment according to "Grounding and Bonding for Electrical Systems."

D. Connect wiring according to Section 26 43 13 "Low-Voltage Electrical Power Conductors and Cables."

3.3 FIELD QUALITY CONTROL

A. Perform tests and inspections.

5. Manufacturer's Field Service:

Engage a factory authorized service representative to inspect components, assemblies, and equipment installations, including connections, and to assist in testing.

B. Tests and Inspections:

1. Verify that shipping, blocking, and bracing are removed.

2. Verify that unit is secure on mountings and supporting devices and that connections to ducts and electrical components are complete. Verify that proper thermal overload protection is installed in motors, starters, and disconnect switches.

3. Verify that cleaning and adjusting are complete.

4. Disconnect fan drive from motor, verify proper motor rotation direction, and verify fan wheel free rotation and smooth bearing operation. Reconnect fan drive system, align and adjust belts, and install belt guards.

5. Adjust damper linkages for proper damper operation.

6. Verify lubrication for bearings and other moving parts.

7. Verify that manual and automatic volume control and fire and smoke dampers in connected ductwork systems are in fully open position.

8. Disable automatic temperature control operators, energize motor and adjust fan to indicated rpm, and measure and record motor voltage and amperage.

9. Shut unit down and reconnect automatic temperature control operators.

10. Remove and replace malfunctioning units and retest as specified above.

SECTION 233423 – HVAC POWER VENTILATORS

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C. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.

D. Prepare test and inspection reports.

3.4 ADJUSTING

A. Adjust damper linkages for proper damper operation.

B. Adjust belt tension.

C. Comply with requirements in Section 230593 "Testing, Adjusting, and Balancing for HVAC" for testing, adjusting, and balancing procedures.

D. Replace fan and motor pulleys as required to achieve design airflow.

E. Lubricate bearings.

END OF SECTION

SECTION 233713 – DIFFUSERS, REGISTERS AND GRILLES

GOVERNMENT OF THE U. S. VIRGIN ISLANDS, DEPARTMENT OF PUBLIC WORKS

PROJECT NAME: Elaine I. Sprauve Public Library and Museum Building

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PART 1 - GENERAL

1.1 SUMMARY

B. Section Includes:

1. Rectangular and square ceiling diffusers
2. Louver face diffusers
3. Fixed face registers and grilles

B. Related Sections:

1. Division 08 for fixed and adjustable louvers and wall vents, whether or not they are connected to ducts.
2. Section 233300 "Air Duct Accessories" for fire and smoke dampers and volume-control dampers not integral to diffusers, registers, and grilles.

1.2 ACTION SUBMITTALS

C. Product Data:

For each type of product indicated, include the following:

1. Data Sheet:
Indicate materials of construction, finish, and mounting details; and performance data including throw and drop, static-pressure drop, and noise ratings.
6. Diffuser, Register, and Grille Schedule:
Indicate drawing designation, room location, quantity, model number, size, and accessories furnished.

D. Samples:

For each exposed product and for each color and texture specified

PART 2 - PRODUCTS

2.1 CEILING DIFFUSERS

A. Rectangular and Square Ceiling Diffusers:

1. Basis of Design Product:
Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:
 - a. Carnes
 - b. Nailor Industries Inc.
 - c. Price Industries
 - d. Titus
2. Devices shall be specifically designed for variable-air-volume flows.

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- 7. Material:
Aluminum.
- 8. Finish:
Baked enamel, color selected by Owner's Representative.
- 8. Face Size:
24 by 24 inches (600 by 600 mm).
- 9. Face Style:
Three cone.
- 10. Mounting:
T-bar.
- 16. Pattern:
Fixed.

B. Louver Face Diffuser:

- 2. Basis-of-Design Product:
Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:
 - a. Carnes
 - b. Nailor Industries Inc.
 - c. Price Industries
 - d. Titus
- 2. Devices shall be specifically designed for variable-air-volume flows.
- 5. Material:
Aluminum.
- 6. Finish:
Baked enamel, color selected by Owner's Representative.

2.2 REGISTERS AND GRILLES

A. Adjustable Bar Register:

- 5. Basis-of-Design Product:
Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:
 - a. Carnes
 - b. Nailor Industries Inc.
 - c. Price Industries

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d. Titus

6. Material:
Aluminum

7. Finish:
Baked enamel, color selected by Owner's Representative

8. Mounting:
Concealed

B. Adjustable Bar Grille:

5. Basis of Design Product:
Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:

- a. Carnes
- b. Nailor Industries Inc.
- c. Price Industries
- d. Titus

6. Material:
Aluminum

7. Finish:
Baked enamel, color selected by Owner's Representative

8. Mounting:
Concealed

C. Fixed Face Register:

5. Basis of Design Product:
Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:

- a. Carnes
- b. Nailor Industries Inc.
- c. Price Industries
- d. Titus

2. Material:
Aluminum

3. Finish:
Baked enamel, color selected by Owner's Representative.

4. Mounting:

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Concealed.

D. Fixed Face Grille:

6. Basis of Design Product:

Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:

- a. Carnes
- b. Nailor Industries Inc.
- c. Price Industries
- d. Titus

7. Material:

Aluminum

8. Finish:

Baked enamel, color selected by Owner's Representative

9. Face Arrangement:

1/2-by-1/2-by-1/2-inch (13-by-13-by-13-mm) grid core

10. Mounting:

Concealed

2.3 SOURCE QUALITY CONTROL

A. Verification of Performance:

Rate diffusers, registers, and grilles according to ASHRAE 70, "Method of Testing for Rating the Performance of Air Outlets and Inlets."

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install diffusers, registers, and grilles level and plumb.

B. Ceiling Mounted Outlets and Inlets:

Drawings indicate general arrangement of ducts, fittings, and accessories. Air outlet and inlet locations have been indicated to achieve design requirements for air volume, noise criteria, airflow pattern, throw, and pressure drop. Make final locations where indicated, as much as practical. For units installed in lay-in ceiling panels, locate units in the center of panel. Where architectural features or other items conflict with installation, notify Owner's Representative for a determination of final location.

C. Install diffusers, registers, and grilles with airtight connections to ducts and to allow service and maintenance of dampers, air extractors, and fire dampers.

3.2 ADJUSTING

SECTION 233713 – DIFFUSERS, REGISTERS AND GRILLES

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- A After installation, adjust diffusers, registers, and grilles to air patterns indicated, or as directed, before starting air balancing.

END OF SECTION

SECTION 236200 – PACKAGED COMPRESSOR AND CONDENSER UNITS

GOVERNMENT OF THE U. S. VIRGIN ISLANDS, DEPARTMENT OF PUBLIC WORKS

PROJECT NAME: Elaine I. Sprauve Public Library and Museum Building

Project Location, St. John, U.S. Virgin Islands

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes packaged, air-cooled, refrigerant compressor and condenser units.

1.2 ACTION SUBMITTALS

- A. Product Data:
For each type of product indicated.
- B. Shop Drawings:
For compressor and condenser units. Include plans, elevations, sections, details, and attachments to other work.
1. Wiring Diagrams: For power, signal, and control wiring.

1.3 QUALITY ASSURANCE

- B. Electrical Components, Devices, and Accessories:
Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- B. Fabricate and label refrigeration system according to ASHRAE 15, "Safety Standard for Refrigeration Systems."
- D. ASHRAE/IESNA 90.1 Compliance:
Applicable requirements in ASHRAE/IESNA 90.1, Section 6, "Heating, Ventilating, and Air-Conditioning."

1.4 WARRANTY

- F. Special Warranty:
Manufacturer's standard form in which manufacturer agrees to repair or replace components of compressor and condenser units that fail in materials or workmanship within specified warranty period.
1. Failures include, but are not limited to, the following:
- a. Compressor failure
 - b. Condenser coil leak
6. Warranty Period:
Five years from date of Substantial Completion
7. Warranty Period (Compressor Only):
10 years from date of Substantial Completion
8. Warranty Period (Components Other Than Compressor):
Five years from date of Substantial Completion

PART 2 - PRODUCTS

SECTION 236200 – PACKAGED COMPRESSOR AND CONDENSER UNITS

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3.1 Compressor and Condenser Units, Air-Cooled (1 To 5 Tons)

Manufacturers:

Carrier Corporation; Commercial HVAC Systems.

Daikin Manufacturing

Trane; a brand of Ingersoll Rand.

Description:

Packaged, factory assembled and tested, suitable for outdoor use; consisting of casing, compressors, condenser coils, condenser fans and motors, and unit controls.

Unit Casing:

Galvanized steel finished with baked enamel; with removable panels for access to controls, weep holes for water drainage, and mounting holes in base. Mount service valves, fittings, and gage ports on exterior of casing. Meet salt spray test in accordance with ASTM B117.

Nonfused disconnect switch, factory mounted and wired, for single external electrical power connection.

Compressor:

Scroll, hermetically sealed, with rubber vibration isolators.

Motor:

Two speed, and includes thermal- and current-sensitive overload devices, start capacitor, relay, and contactor.

Two-Speed Compressor:

Include manual-reset, high-pressure switch and automatic-reset, low-pressure switch.

Refrigerant:

R-410A or R-407C.

Condenser Coil:

Seamless copper-tube, aluminum-fin coil; circuited for integral liquid sub-cooler, with removable drain pan and brass service valves with service ports. Coating shall be epoxy or phenolic epoxy type rated for minimum 4000 hours salt spray resistance when tested in accordance with ASTM B117 and minimum 4000 hours humidity resistance when tested in accordance with ASTM D 2247, applied at least 1.2 mils thick.

Condenser Fan: Direct-drive, aluminum propeller fan; with permanently lubricated ball bearings, totally enclosed fan cooled motor with thermal-overload protection.

Accessories:

Cycle Protector:

Automatic-reset timer to prevent rapid compressor cycling.

Electronic programmable thermostat to control compressor and condenser unit and evaporator fan.

Filter-dryer.

High-Pressure Switch:

Automatic-reset switch cycles compressor off on high refrigerant pressure.

Liquid-line solenoid.

Low-Pressure Switch:

Automatic-reset switch cycles compressor off on low refrigerant pressure.

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Precharged and insulated suction and liquid tubing.

Sound Hood:

Wraps around sound attenuation cover for compressor.

Thermostatic expansion valve.

Time-Delay Relay:

Continues operation of evaporator fan after compressor shuts off.

Condenser coil hail guard.

2.2 COMPRESSOR AND CONDENSER UNITS, AIR COOLED, 6 TO 120 TONS (21 TO 422 kW)

A. Manufacturers:

Subject to compliance with requirements, provide products by one of the following or approved equal:

1. Carrier Corporation; Commercial HVAC Systems
2. McQuay International
3. Trane; a business of American Standard Companies
4. YORK; a Johnson Controls company

G. Description:

Factory assembled and tested, air cooled; consisting of casing, compressors, condenser coils, condenser fans and motors, and unit controls.

H. Compressor:

Hermetic scroll compressor designed for service with crankcase sight glass, crankcase heater, and back-seating service access valves on suction and discharge ports.

I. Capacity Control:

On-off compressor cycling.

I. Refrigerant:

R-410A.

E. Condenser Coil:

1. Seamless copper tube, aluminum fin coil, including sub-cooling circuit and back-seating liquid line service access valve.
2. Factory pressure test coils, then dehydrate by drawing a vacuum and fill with a holding charge of nitrogen or refrigerant.
3. Condenser coils shall be factory coated to prevent salt air corrosion of aluminum, fins. Coating shall be epoxy or phenolic epoxy type rated for minimum 4000 hours salt spray resistance when tested in accordance with ASTM B 117 and minimum 4000 hours humidity resistance when tested in accordance with ASTM D 2247, applied at least 1.2 mils thick.

F. Condenser Fan:

Propeller-type vertical discharge; either directly or belt driven. Include the following:

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1. Permanently lubricated, ball-bearing totally enclosed motors.
2. Separate motor for each fan.

3. Dynamically and statically balanced fan assemblies.

G. Operating and safety controls include the following:

1. Manual reset, high-pressure cutout switches
2. Automatic-reset, low-pressure cutout switches
3. Low oil pressure cutout switch
4. Compressor winding thermostat cutout switch
5. Three-leg, compressor-overload protection
6. Control transformer
7. Magnetic contactors for compressor and condenser fan motors
8. Timer to prevent excessive compressor cycling

H. Accessories:

1. Electronic programmable thermostat to control compressor and condenser unit and evaporator fan.
2. Gage Panel:
Package with refrigerant circuit suction and discharge gages
3. Part winding start timing relay, circuit breakers, and contactors

I. Unit Casings:

Designed for outdoor installation with weather protection for components and controls and with removable panels for required access to compressors, controls, condenser fans, motors, and drives. Additional features include the following:

1. Steel, galvanized or zinc coated, for exposed casing surfaces; treated and finished with manufacturer's standard paint coating.
2. Perimeter base rail with forklift slots and lifting holes to facilitate rigging.
3. Gasketed control panel door
4. Non-fused disconnect switch, factory mounted and wired, for single external electrical power connection.
5. Condenser coil grille.

J. Capacities and Characteristics:

1. Compressor and Condenser Unit:
 - c. See schedule on drawings.

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- d. Condenser coils shall be factory coated to prevent salt air corrosion of aluminum, fins. Coating shall be epoxy or phenolic epoxy type rated for minimum 4000 hours salt spray resistance when tested in accordance with ASTM B 117 and minimum 4000 hours humidity resistance when tested in accordance with ASTM D 2247, applied at least 1.2 mils thick.

2.2 SOURCE QUALITY CONTROL

- C. Energy Efficiency:
Equal to or greater than prescribed by ASHRAE/IESNA 90.1, "Energy Efficient Design of New Buildings except Low-Rise Residential Buildings," Section 6, "Heating, Ventilating, and Air Conditioning."
- D. Testing Requirements:
Factory test sound power level ratings according to ARI 270

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install units level and plumb, firmly anchored with stainless steel anchor bolts in locations indicated; maintain manufacturer's recommended clearances.
- B. Install compressor and condenser units on PE mounting base.
- C. Install compressor and condenser units on concrete base. New bases will comply with concrete materials and installation requirements specified in Section 033000 "Cast in Place Concrete."
- D. Install roof mounting units on equipment supports specified in Section 077200 "Roof Accessories."
- J. Vibration Isolation:
Mount compressor and condenser units on rubber pads with a minimum deflection of 1/4 inch (6.35 mm). Vibration isolation devices and installation requirements are specified in Section 230548 "Vibration and Seismic Controls for HVAC Piping and Equipment."
- F. Maintain manufacturer's recommended clearances for service and maintenance.
- G. Loose Components:
Install electrical components, devices, and accessories that are not factory mounted.

3.2 CONNECTIONS

- A. Comply with requirements for piping in Section 232113 "Hydronic Piping." Drawings indicate general arrangement of piping, fittings, and specialties.
- B. Where installing piping adjacent to equipment, allow space for service and maintenance of equipment.

3.3 FIELD QUALITY CONTROL

- A. Perform tests and inspections.
- B. Tests and Inspections:

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1. Perform each visual and mechanical inspection and electrical test. Certify compliance with test parameters.
 2. Leak Test:
After installation, charge system with refrigerant and oil and test for leaks. Repair leaks, replace lost refrigerant and oil, and retest until no leaks exist.
 3. Operational Test:
After electrical circuitry has been energized, start units to confirm proper motor operation and unit operation, product capability, and compliance with requirements.
 4. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.
 5. Verify proper airflow over coils.
- C. Verify that vibration isolation and flexible connections properly dampen vibration transmission to structure.

END OF SECTION

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PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes split system air conditioning units consisting of separate evaporator fan and compressor condenser components.

1.2 ACTION SUBMITTALS

- C. Product Data:
For each type of product indicated.
- D. Shop Drawings:
Include plans, elevations, sections, details, and attachments to other work.
 - 1. Detail equipment assemblies and indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.

1.3 INFORMATIONAL SUBMITTALS

- B. Warranty:
Sample of special warranty.

1.4 CLOSEOUT SUBMITTALS

- A. Operation and maintenance data.

1.5 QUALITY ASSURANCE

- B. Electrical Components, Devices, and Accessories:
Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- B. ASHRAE Compliance:
 - 1. Fabricate and label refrigeration system to comply with ASHRAE 15, "Safety Standard for Refrigeration Systems."
 - 2. ASHRAE Compliance:
Applicable requirements in ASHRAE 62.1, Section 4 "Outdoor Air Quality," Section 5 "Systems and Equipment," Section 6 "Procedures," and Section 7 "Construction and System Start-up."
- C. ASHRAE/IESNA Compliance: Applicable requirements in ASHRAE/IESNA 90.1.

1.6 WARRANTY

- B. Special Warranty:

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Manufacturer's standard form in which manufacturer agrees to repair or replace components of split system air conditioning units that fail in materials or workmanship within specified warranty period.

1. Warranty Period:
 - a. For Compressor:
Five year(s) from date of Substantial Completion.
 - b. For Parts:
One year(s) from date of Substantial Completion.
 - c. For Labor:
One year(s) from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- B. Basis of Design Product:
Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:
1. Carrier Corporation; Home Comfort and HVAC Building & Industrial Systems
 2. Daiken Air Conditioning Company
 3. Mitsubishi Electric & Electronics USA, Inc.; HVAC Advanced Products Division
 4. Trane; a business of American Standard companies
 5. YORK; a Johnson Controls company

2.2 INDOOR UNITS (5 TONS (18 kW) OR LESS)

- A. Wall-Mounted, Evaporator Fan Components:
4. Cabinet:
Plastic or enameled steel with removable panels on front and ends in color selected by Owner's Representative, and discharge drain pans with drain connection.
 5. Refrigerant Coil:
Copper tube, with mechanically bonded aluminum fins and thermal expansion valve. Comply with ARI 210/240. Condenser coils shall be factory coated to prevent salt air corrosion of aluminum, fins. Coating shall be epoxy or phenolic epoxy type rated for minimum 4000 hours salt spray resistance when tested in accordance with ASTM B 117 and minimum 4000 hours humidity resistance when tested in accordance with ASTM D 2247, applied at least 1.2 mils thick.
 6. Fan:
Direct drive, centrifugal.

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4. Fan Motors:

- a. Comply with NEMA designation, temperature rating, service factor, enclosure type, and efficiency requirements specified in Section 230513 "Common Motor Requirements for HVAC Equipment."
- b. Multi-tapped, multi-speed with internal thermal protection and permanent lubrication.
- c. Enclosure Type:
Totally enclosed, fan cooled
- d. NEMA Premium (TM) efficient motors as defined in NEMA MG 1
- j. Controllers, Electrical Devices, and Wiring:
Comply with requirements for electrical devices and connections specified in electrical Sections.

6. Airstream Surfaces:

Surfaces in contact with the airstream shall comply with requirements in ASHRAE 62.1.

6. Condensate Drain Pans:

- a. Fabricated with one percent slope in at least two planes to collect condensate from cooling coils (including coil piping connections, coil headers, and return bends) and humidifiers, and to direct water toward drain connection.
- b. Drain Connection:
Located at lowest point of pan and sized to prevent overflow. Terminate with threaded nipple on both ends of pan.

7. Air Filtration Section:

a. General Requirements for Air Filtration Section:

- 1) Comply with NFPA 90A
- 2) Minimum Arrestance:
According to ASHRAE 52.1 and MERV according to ASHRAE 52.2.
- 3) Filter Holding Frames:
Arranged for flat or angular orientation, with access doors on both sides of unit.
Filters shall be removable from one side or lifted out from access plenum.

b. Permanent, cleanable filters.

2.3 OUTDOOR UNITS (5 TONS (18 kW) OR LESS)

A. Air Cooled, Compressor Condenser Components:

8. Casing:

Steel, finished with baked enamel in color selected by Owner's Representative, with removable panels for access to controls, weep holes for water drainage, and mounting

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holes in base. Provide brass service valves, fittings, and gage ports on exterior of casing.

9. Compressor:

Hermetically sealed with crankcase heater and mounted on vibration isolation device. Compressor motor shall have thermal and current sensitive overload devices, start capacitor, relay, and contactor.

a. Compressor Type:

Scroll.

b. Two speed compressor motor with manual reset high pressure switch and automatic reset low pressure switch.

c. Refrigerant Charge:

R-410A.

d. Refrigerant Coil:

Copper tube, with mechanically bonded aluminum fins and liquid sub-cooler. Comply with ARI 210/240. Condenser coils shall be factory coated to prevent salt air corrosion of aluminum, fins. Coating shall be epoxy or phenolic epoxy type rated for minimum 4000 hours salt spray resistance when tested in accordance with ASTM B 117 and minimum 4000 hours humidity resistance when tested in accordance with ASTM D 2247, applied at least 1.2 mils thick.

10. Heat-Pump Components:

Reversing valve and low-temperature-air cutoff thermostat

11. Fan:

Aluminum-propeller type, directly connected to motor

12. Motor:

Permanently lubricated, with integral thermal overload protection.

13. Low Ambient Kit:

Permits operation down to 45°F (7°C)

14. Mounting Base:

Polyethylene

2.4 ACCESSORIES

B. Thermostat:

Wired infrared functioning to remotely control compressor and evaporator fan, with the following features:

1. Compressor time delay.

2. 24-hour time control of system stop and start.

3. Liquid crystal display indicating temperature, set point temperature, time setting,

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operating mode, and fan speed.

4. Fan-speed selection including auto setting.

B. Automatic-reset timer to prevent rapid cycling of compressor.

C. Refrigerant Line Kits:

Soft annealed copper suction and liquid lines factory cleaned, dried, pressurized, and sealed;
factory insulated suction line with flared fittings at both ends.

D. Drain Hose:

For condensate.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install units level and plumb. Anchor to concrete base with stainless steel anchors.

B. Install evaporator fan components using manufacturer's standard mounting devices securely fastened to building structure.

C. Install roof mounted, compressor condenser components on equipment supports specified in Section 07 and Drawings. Anchor units to supports with removable, stainless steel fasteners.

D. Install and connect pre-charged refrigerant tubing to component's quick connect fittings. Install tubing to allow access to unit.

3.2 CONNECTIONS

A. Piping installation requirements are specified in other Sections. Drawings indicate general arrangement of piping, fittings, and specialties.

B. Where piping is installed adjacent to unit, allow space for service and maintenance of unit.

3.3 FIELD QUALITY CONTROL

A. Perform tests and inspections.

2. Manufacturer's Field Service:

Engage a factory authorized service representative to inspect components, assemblies, and equipment installations, including connections, and to assist in testing.

B. Tests and Inspections:

3. Leak Test:

After installation, charge system and test for leaks. Repair leaks and retest until no leaks exist.

4. Operational Test:

After electrical circuitry has been energized, start units to confirm proper motor rotation

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and unit operation.

3. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.

C. Remove and replace malfunctioning units and retest as specified above. D. Prepare test and inspection reports.

3.4 DEMONSTRATION

A. Train Owner's maintenance personnel to adjust, operate, and maintain units.

Do not delete the following reference information.

THE FOLLOWING STATEMENT IS FOR LANL USE ONLY

This project specification section is based on LANL Master Specification
Section 23 8123 Rev. 1, dated November 21, 2017.

SECTION 23 8123

COMPUTER-ROOM AIR-CONDITIONERS

PART 1 - *****

PART 2 - LANL MASTER SPECIFICATION

PART 3 - This template must be edited for each project. In doing so, specifier must add job-specific requirements. Brackets are used in the text to indicate designer choices or locations where text must be supplied by the designer. Once the choice is made or text supplied, remove the brackets. The specifications must also be edited to delete specification items for processes, items, or designs that are not included in the project -- and specifier's notes such as these. This specification template is tailored to meet requirements contained in the LANL Engineering Standards Manual (ESM). To seek a variance from requirements of the ESM that are applicable, contact the ESM Mechanical [POC](#). Please contact POC with suggestions for improvement as well.

PART 4 - When assembling a specification package, include applicable specifications from all Divisions, especially Division 1, General requirements.

PART 5 - This Specification is developed for ML-4 projects. For ML-1, 2, and 3 applications, additional requirements and independent reviews should be added if increased confidence in procurement or execution is desired; see ESM Chapter 1 Section Z10 Specifications and Quality sections.

PART 6 -

PART 7 - Seismic: If all CRAC units are not exempt from seismic design per ASCE 7 paragraph 13.1.4 then, prior to attempting to edit this Section to be Project-specific, refer to Sections 22 0548.23, *Vibration and Seismic Controls for Mechanical Systems*, and 01 8734, *Seismic Qualification of*

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Nonstructural Components (IBC), as applicable. In order to edit this section for job-specific seismic requirements, refer to author notes that begin with "Seismic." Also, see the Seismic Specification Guide for Mechanical Non-Structural Components for guidance on properly editing this section.

PART 8 - *****

PART 9 - GENERAL

9.1 SUMMARY

A. Section Includes:

1. Floor-mounted computer-room air conditioners, 6 tons and larger.
2. Floor-mounted computer-room air conditioners, 5 tons and smaller.
3. Ceiling-mounted computer-room air conditioners.

Seismic: If the CRACs are exempt from seismic design then delete both 1.2A and 1.2B

- Otherwise, see the seismic portion of the previous author note.

1.2 RELATED SECTIONS

D. Section 01 8734, *Seismic Qualification of Nonstructural Components (IBC)*, for requirements.

E. Section 22 0548.23, *Vibration and Seismic Controls for Mechanical Systems*, for [seismic-design criteria,] submittal requirements, devices for seismic restraint, and installation requirements for these devices.

9.2 PERFORMANCE REQUIREMENTS

- A. Supplier-provided control systems, including instruments, signal transmissions, panels, cabinets, and other control and instrumentation requirements shall be coordinated with the Control and Instrumentation Subcontractor. Some equipment controls are specified in other portions of the subcontract documents. As part of the work of this section, coordinate with these other suppliers and trades to provide a complete and working equipment controls.
- B. It is the responsibility of the bidder to read and conform to all articles of this specification, review all subcontract drawings of all divisions, and coordinate with all equipment suppliers of material specified under other sections of the specifications.
- C. HVAC fans and associated motors shall perform satisfactorily in the following service conditions:
 1. Elevation: 7500 feet above sea level.

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2. Maximum ambient temperature: 104 degrees F.
3. Minimum ambient temperature: Minus 20 degrees F.
4. 24-hour average temperature: not exceeding 86 degrees F.

Seismic: Delete D if CRAC(s) is/are exempt from seismic design. However, if paragraph applies:

- o edit it in accordance with content of 22 0548.23 and/or 01 8734
- o the "E" drawings for the controller shall also state that the controller is a Designated Seismic System

D. Seismic Performance Requirements

1. The unit(s) shall remain in place without separation of any parts when subjected to the design basis earthquake [per Section 01 8734, *Seismic Qualification of Nonstructural Components (IBC)*] [as represented by the seismic forces derived from the criteria indicated [on the Drawings] [in Section 22 0548.23, *Vibration and Seismic Controls for Mechanical Systems*]].

9.3 REFERENCES

- A. Air Conditioning, Heating, and Refrigeration Institute (AHRI):
 1. AHRI 210/240 – *Performance Rating of Unitary Air-Conditioning & Air-Source Heat Pump Equipment*.
 2. AHRI 340/360 – *Performance Rating of Commercial and Industrial Unitary Air-Conditioning and Air-Source Heat Pump Equipment*.
- B. American Society of Heating, Refrigerating and Air-Conditioning Engineers (ASHRAE):
 1. ASHRAE 15 – *Safety Standard for Refrigeration Systems*.
 2. ASHRAE 52.2 – *Method of Testing General Ventilation Air-Cleaning Devices for Removal Efficiency by Particle Size*
 3. ASHRAE 62.1-[2013] – *Ventilation for Acceptable Indoor Air Quality*.
 4. ASHRAE/ IESNA 90.1-[2013] – *Energy Standard for Buildings Except Low-Rise Residential Buildings*.
- C. American Society of Mechanical Engineers (ASME):
 1. ASME Section VIII – *Boiler and Pressure Vessel Code - Pressure Vessels*.
 2. ASME B31.9-[2014] – *Building Services Piping*
- D. National Electrical Manufacturers Association (NEMA):

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1. NEMA 250 – *Enclosures for Electrical Equipment (1000 Volts Maximum)*.

E. National Fire Protection Association (NFPA):

2. NFPA 70 – *National Electric Code*.

9.4 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Include material descriptions, dimensions of individual components and profiles, and finishes for computer-room air-conditioning units.
2. Include rated capacities, operating characteristics, electrical characteristics, and furnished specialties and accessories.

PART 10 - *****

PART 11 - Retain subparagraphs below for compliance with LEED submittals.

PART 12 - *****

A. Sustainable Design Submittals:

1. [Product Data for Credit EA 4: Documentation indicating that equipment and refrigerants comply.](#)
2. [Product Data for Prerequisite IEQ 1: Documentation indicating that units comply with ASHRAE 62.1.](#)

B. Shop Drawings: For computer-room air conditioners.

1. Include plans, elevations, sections, and attachment details.
2. Include details of equipment assemblies. Indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
3. Include diagrams for power, signal, and control wiring.

C. Color Samples: For unit cabinet, discharge grille, and exterior louver and for each color and texture specified.

12.2 INFORMATIONAL SUBMITTALS

- A. Coordination Drawings: Plans, elevations, and other details, drawn to scale, using input from installers of the items involved.
- B. Field quality-control reports.
- C. Sample Warranty: For special warranty.

12.3 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For computer-room air conditioners to include in emergency, operation, and maintenance manuals.
- B. Refrigeration Appliance Inventory Form: Complete form as required by LANL (e.g., procedure ENV-ES-QP-311.8).

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12.4 QUALITY ASSURANCE

- A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by any nationally recognized testing laboratory (NRTL) recognized under 29 CFR 1910.7.
- B. ASME Compliance: Fabricate and label water-cooled condenser shell to comply with ASME Boiler and Pressure Vessel Code: Section VIII, Pressure Vessels, Division 1.
- C. ASHRAE/ IESNA 90.1 Compliance: Energy Efficiency Rating (EER) not less than prescribed by ASHRAE/ IESNA 90.1 when used in combination with compressors and evaporator coils when tested in accordance with [AHRI 340/360] [AHRI 210/240].
- D. ASHRAE Compliance:
 - 1. Fabricate refrigeration system to comply with ASHRAE 15, Safety Standard for Refrigeration Systems.
 - 2. ASHRAE Compliance: Applicable requirements in ASHRAE 62.1, Section 4–Outdoor Air Quality, Section 5–Systems and Equipment, Section 6–Ventilation Rate Procedures, and Section 7– Construction and Startup.

12.5 DELIVERY, STORAGE, AND HANDLING

- A. Deliver computer room units on site in factory packing. Inspect for damage.
- B. Protect units from damage by storing away from computer room until floor or ceiling is installed.

12.6 COORDINATION

- A. Coordinate layout and installation of computer-room air conditioners and suspension system with other construction that penetrates ceilings or is supported by them, including light fixtures, HVAC equipment, fire-suppression system, and partition assemblies.
- B. Coordinate installation of computer-room air conditioners with computer-room access flooring installer.
- C. Coordinate sizes and locations of concrete bases with actual equipment provided.
- D. Coordinate sizes and locations of roof curbs, equipment supports, and roof penetrations with actual equipment provided.

12.7 EXTRA MATERIALS

- A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
 - 1. Fan Belts: Furnish [one] [] set of belt for each belt-driven fan.

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2. Filters: Furnish [one] [] set of filters for each unit.

12.8 WARRANTY

- A. Furnish five [] year manufacturer's warranty for entire unit.

PART 13 - PRODUCTS

13.1 MANUFACTURERS

For CRACs that are not exempt from seismic, if Project Spec includes 22 0548.23, and if mounting and/or anchorage devices are to be used that differ from those specified in 22 0548.23, they must be described herein (in PART 2).

- A. Subject to compliance with requirements, provide product indicated on Drawings or by one of the following

1. Compu-Aire, Inc.
2. Data Aire Inc.
3. Liebert Corporation.
4. Trane; an Ingersoll Rand brand.

13.2 FLOOR-MOUNTED UNITS, 6 TONS AND LARGER

- A. Description: Packaged, [water] [glycol] [air] cooled, factory assembled, pre-wired and pre-piped unit, consisting of cabinet, fans filters, humidifier and controls, reheat and heating coils.
- B. Assembly: [Up-flow] [Down-flow] air delivery, [draw-through] [or] [blow-through] configuration.
- C. Cabinet and Frame: Welded steel, braced for rigidity, and supporting compressors and other mechanical equipment and fittings.
 1. Doors and Access Panels: Galvanized steel with polyurethane gaskets, hinges, and concealed fastening devices.
 2. Insulation: Thermally and acoustically insulate cabinet interior with 1-inch-thick duct liner.
 3. Finish of Interior Surfaces: Surfaces in contact with the airstream shall comply with requirements in ASHRAE 62.1.
 4. Finish of Exterior Surfaces: Baked-on, textured vinyl enamel; color to match computer equipment.

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PART 14 - *****

PART 15 - Retain subparagraph below for downflow units, delete for upflow units installed on structural floor.

PART 16 - *****

1. Floor Stand: Welded tubular steel, with adjustable legs and vibration isolation pads.

B. Evaporator Fans and Motors:

1. Double-inlet, forward-curved centrifugal fan(s); statically and dynamically balanced [and with adjustable V-belt drive] [and direct drive.].
2. Motor: Drip proof, permanently lubricated ball bearing motor with built-in current and overload protection.
3. Drive: V-belt, with steel shaft with self-aligning ball bearings and cast-iron or steel sheaves, variable- and adjustable-pitch motor sheave, minimum of two matched belts, with drive rated at a minimum of two times the nameplate rating of motor.

PART 17 - *****

PART 18 - Retain first paragraph below for units with DX refrigerant coils.

PART 19 - *****

A. Refrigeration System:

PART 20 - *****

PART 21 - Retain one of the first three subparagraphs below for compressor type.

PART 22 - *****

1. Compressors: Semi-hermetic reciprocating; with suction-gas-cooled, 1750-rpm motors; thermal overloads; oil sight glass; suction-line strainer; and reversible oil pumps; with oil strainer, internal motor overload protection, resilient suspension system, crankcase heater, manual-reset high-pressure switch, and pump-down low-pressure switch.
*****OR*****
2. Compressors: Hermetic reciprocating; with oil strainer, internal motor overload protection, resilient suspension system, crankcase heater, manual-reset high-pressure switch, and pump-down low-pressure switch.
*****OR*****
3. Compressors: Hermetic scroll; with oil strainer, internal motor overload protection, resilient suspension system, crankcase heater, manual-reset high-pressure switch, and pump-down low-pressure switch.
4. Refrigeration Circuits: Two; each with hot-gas mufflers, thermal-expansion valve with external equalizer, liquid-line solenoid valve, liquid-line filter-dryer, sight glass with moisture indicator, service shutoff valves, charging valves, and charge of refrigerant.

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5. Refrigerant: [R-407C] [R-410A].
6. Refrigerant Evaporator Coil: Alternate-row or split-face-circuit, direct-expansion coil of seamless copper tubes expanded into aluminum fins.

a. Mount coil assembly over stainless-steel drain pan, complying with ASHRAE 62.1.

PART 23 - *****

PART 24 - Retain one of the first two subparagraphs below for integral, water cooled OR remote air-cooled refrigerant condenser.

PART 25 - *****

1. Integral, Water-Cooled Refrigerant Condenser: [Shell-and-tube type fabricated and labeled according to ASME Boiler and Pressure Vessel Code: Section VIII] with liquid-line stop valve and head-pressure-actuated, [two] [three]-way regulating valve. Terminate fluid connections outside cabinet.

a. Cooling Medium: [Water] [Glycol solution].

*******OR*******

2. Remote Air-Cooled Refrigerant Condenser: Corrosion-resistant cabinet, copper-tube aluminum-fin coils arranged for two circuits, multiple direct-drive propeller fans with permanently lubricated ball bearings, and single-phase motors with internal overload protection and integral electric control panel and disconnect switch. Control capacity by [cycling fans] [modulating fan speeds] [three-way refrigerant bypass with receiver and isolation valve].

PART 26 - *****

PART 27 - Retain paragraph below for units with chilled water coil and delete Refrigeration System paragraph above with DX refrigerant coil.

PART 28 - *****

- A. Hydronic Cooling Coil: Seamless copper tubes expanded into aluminum fins with modulating [two] [three]-way control valve.

1. Cooling Medium: Chilled Water
2. Control Valve: Class 125 body
 - a. **Maximum Pressure Drop: [3 psig] [5 psig] at design flow rate.**
 - b. **Close-Off (Differential) Pressure Rating: 100 percent of pressure differential across valve or 100 percent of total system (pump) head.**

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PART 29 - *****

PART 30 - Retain one of the first two paragraphs below for units with heating.

PART 31 - *****

- A. Electric-Resistance Heating Coil: Enclosed finned-tube electric elements arranged for minimum of three stages, with thermal safety switches, manual-reset overload protection, and branch-circuit overcurrent protection.
- *****OR*****
- B. Hot-Water Heating Coil: Seamless copper tubes expanded into aluminum fins with two-way modulating control valve and strainer.
1. Control Valve: Class 125 body.
 - a. **Maximum Pressure Drop: [3 psig] [5 psig] at design flow rate.**
 - b. **Close-Off (Differential) Pressure Rating: 100 percent of pressure differential across valve or 100 percent of total system (pump) head.**
 - c. **Listed item per ASME B31.9.**
- C. Disposable, Panel Filter: Pleated, lofted, nonwoven, reinforced cotton fabric; supported and bonded to welded-wire grid; enclosed in cardboard frame, [2-inch] [4 inch] nominal thickness, disposable, glass-fiber prefilter.
1. Initial Resistance: [0.30] [] inches wg. at 500 fpm face velocity
 2. Recommended Final Resistance: 1.0 inches wg.
 3. MERV (ASHRAE 52.2): 8 (Minimum).
- D. Infrared Humidifier: High-intensity quartz lamps mounted above stainless-steel evaporator pan, serviceable without disconnecting water, drain, or electrical connections; pre-piped and using condensate water from cooling coils with stainless-steel or brass float-valve mechanism; located in bypass airstream; with flush-cycle timer and solenoid drain valve.
- *****OR*****
- E. Evaporative Pan Humidifier: Stainless-steel pan and cover, serviceable without disconnecting water, drain, or electrical connections; pre-piped with stainless-steel or brass float-valve mechanism; electric-resistance heating coil; low-water-cutoff switch; flush-cycle timer; and solenoid drain valve.

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- F. Economizer: Provide economizer for free cooling, per ASHRAE 90.1-[2013], Section 6.5.1
- G. Integral Electrical Controls: Unit-mounted electrical enclosure with piano-hinged door, grounding lug, combination magnetic starters with overload relays, circuit breakers and cover interlock, and fusible control-circuit transformer.
- H. Disconnect Switch: Non-automatic, molded-case circuit breaker with handle accessible when panel is closed and capable of preventing access until switched to off position.
- I. Control System: For control system requirements, see Article 1.2.A. Refer to Section **25 5000, Integrated Automated Facility Controls**. All necessary controls shall be factory installed and wired.

PART 32 - *****

PART 33 - Retain one of the first two subparagraphs below for standard Electronic Controls System or Microprocessor Control System.

PART 34 - *****

- 1. Electronic-Control System: Solid state, with start button, stop button, temporary loss of power indicator, manual-reset circuit breakers, temperature control, humidity control, and monitor panel.

***** **[OR]** *****
- 2. Microprocessor-Control System: Continuously monitors operation of process cooling system; continuously displays room temperature and room relative humidity; sounds alarm on system malfunction and simultaneously displays problem. If more than one malfunction occurs, system displays fault in sequence with room temperature and continues to display fault when malfunction is cleared until system is reset.
 - a. **Push buttons shall stop and start process cooling system, silence audible alarm, test indicators, and display room's relative humidity.**
 - b. **BAS Interface: Factory-installed hardware and software to enable the BAS to monitor, control, and display unit status and alarms**

34.2 FLOOR-MOUNTED UNITS, **5 TONS** AND SMALLER

- A. Description: Self-contained, factory assembled, prewired, and pre-piped; consisting of cabinet, fan, filters, and controls.
- B. Assembly: [Up-flow] [Down-flow] air delivery, [draw-through] [or] [blow-through] configuration.
- C. Cabinet and Frame: Welded tubular-steel frame with removable steel panels with baked-enamel finish, insulated with **1-inch** thick duct liner.

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PART 35 - *****

PART 36 - Retain subparagraph below for downflow units, delete for upflow units installed on structural floor.

PART 37 - *****

1. Floor Stand: Welded tubular steel, with adjustable legs and vibration isolation pads.
2. Finish of Interior Surfaces: Surfaces in contact with the airstream shall comply with requirements in ASHRAE 62.1.

B. Evaporator Fans and Motors:

1. Forward-curved centrifugal fan(s); statically and dynamically balanced.
2. Motor: Drip proof, permanently lubricated ball bearing motor with built-in current and overload protection. Meet the requirements of IEEE 841.
3. Drive: V-belt, with steel shaft with self-aligning ball bearings and cast-iron or steel sheaves, variable- and adjustable-pitch motor sheave, minimum of two matched belts, with drive rated at a minimum of two times the nameplate rating of motor.

PART 38 - *****

PART 39 - Retain first paragraph below for units with DX refrigerant coils.

PART 40 - *****

A. Refrigeration System:

1. Compressor: Hermetic, with oil strainer, internal motor overload protection, resilient suspension system, and crankcase heater.
2. Refrigeration Circuit: Low-pressure switch, manual-reset high-pressure switch, thermal-expansion valve with external equalizer, sight glass with moisture indicator, service shutoff valves, charging valves, and charge of refrigerant.
3. Refrigerant: [R-407C] [R-410A].
4. Refrigerant Evaporator Coil: Direct-expansion coil of seamless copper tubes expanded into aluminum fins, with two circuits, each with solenoid valve.
 - a. **Mount coil assembly over stainless-steel drain pan complying with ASHRAE 62.1.**
5. Remote Air-Cooled Refrigerant Condenser: Integral, copper-tube aluminum-fin coil with [propeller] [centrifugal] fan, [direct] [belt] driven.
 - a. **Split system shall have suction- and liquid-line compatible fittings and refrigerant piping for field interconnection.**

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PART 41 - *****

PART 42 - Retain paragraph below for units with chilled water coil and delete Refrigeration System paragraph above with DX refrigerant coil.

PART 43 - *****

- A. Hydronic Cooling Coil: Seamless copper tubes expanded into aluminum fins with modulating [two] [three]-way control valve.

1. Cooling Medium: Chilled Water
2. Control Valve: Class 125 body
 - a. **Maximum Pressure Drop: [3 psig] [5 psig] at design flow rate.**
 - b. **Close-Off (Differential) Pressure Rating: 100 percent of pressure differential across valve or 100 percent of total system (pump) head.**
 - c. **Listed item per ASME B31.9.**

PART 44 - *****

PART 45 - Retain first paragraph below for units with heating.

PART 46 - *****

- G. Electric-Resistance Heating Coil: Finned-tube electric elements with contactor and high-temperature-limit switches.
- A. Filter: **2-inch** thick, disposable, glass-fiber media.
1. Initial Resistance: [0.30] [___] **inches wg.** at 500 fpm face velocity.
 2. Recommended Final Resistance: 1.0 **inches wg.**
 3. MERV (ASHRAE 52.2): 8 (Minimum).
- B. Infrared Humidifier: High-intensity quartz lamps mounted above stainless-steel evaporator pan, serviceable without disconnecting water, drain, or electrical connections; pre-piped and located in bypass airstream; with flush-cycle timer and solenoid drain valve.
- C. Disconnect Switch: Non-automatic, molded-case circuit breaker with handle accessible when panel is closed and capable of preventing access until switched to off position.
- D. Control System:
1. Unit-mounted panel with main fan contactor, compressor contactor, compressor start capacitor, control transformer with circuit breaker, solid-state temperature [and humidity] control modules, [humidity contactor, time-delay relay, heating contactor, and high-temperature thermostat]. Provide solid-state, wall-mounted control panel with start-stop switch, [adjustable humidity set point,] and adjustable temperature set point.

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2. For additional control requirements, see Article 1.2.A. Refer to Section 25 5000, *Integrated Automated Facility Controls*. All necessary controls shall be factory installed and wired.

46.2 CEILING-MOUNTED UNITS

- A. Description: Self-contained, [water] [glycol] [air] cooled, factory assembled, prewired, and pre-piped; consisting of cabinet, fan, filters, [humidifier,] and controls.
- B. Assembly: For horizontal ceiling mounting to fit T-bar ceiling opening of 24 by 48 inches.
- C. Cabinet: Galvanized steel with baked-enamel finish, insulated with 1/2-inch thick acoustic duct liner.
 1. Integral factory-supplied supply and return grille to fit ceiling grid kit of 24 by 48 inches, with filter.
 2. Finish of Interior Surfaces: Surfaces in contact with the airstream shall comply with requirements in ASHRAE 62.1.
- D. Supply-Air Fan: Forward curved, centrifugal, and directly driven by two-speed motor.

PART 47 - *****

PART 48 - Retain first paragraph below for units with DX refrigerant coils.

- A. Refrigeration System:
 1. Compressor: Hermetic, with oil strainer, internal motor overload protection, resilient suspension system, and crankcase heater.
 2. Refrigeration Circuit: Low-pressure switch, manual-reset high-pressure switch, thermal-expansion valve with external equalizer, sight glass with moisture indicator, service shutoff valves, charging valves, and charge of refrigerant.
 3. Refrigerant: [R-407C] [R-410A].
 4. Refrigerant Evaporator Coil: Direct-expansion coil of seamless copper tubes expanded into aluminum fins.
 - a. **Mount coil assembly over stainless-steel drain pan complying with ASHRAE 62.1.**

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PART 49 - *****

PART 50 - Retain one of the first two subparagraphs below for integral, water cooled OR remote air-cooled refrigerant condenser.

PART 51 - *****

1. Integral, Water-Cooled Refrigerant Condenser: [Coaxial, counterflow, tube-in-tube] [Braze-plate] type with liquid-line stop valve and head-pressure-actuated, water-regulating valve.
 - a. **Cooling Medium: [Water] [Glycol solution].**
***** [OR] *****
2. Remote Air-Cooled Refrigerant Condenser: Integral, copper-tube aluminum-fin coil with [propeller] [centrifugal] fan, direct driven.
3. Split system shall have suction- and liquid-line compatible fittings and refrigerant piping for field interconnection.

PART 52 - *****

PART 53 - Retain paragraph below for units with chilled water coil and delete Refrigeration System paragraph above with DX refrigerant coil.

PART 54 - *****

- A. Hydronic Cooling Coil: Seamless copper tubes expanded into aluminum fins with modulating [two] [three]-way control valve.
 1. Cooling Medium: Chilled Water
 2. Control Valve: Class 125 body
 - a. **Maximum Pressure Drop: [3 psig] [5 psig] at design flow rate.**
 - b. **Close-Off (Differential) Pressure Rating: 100 percent of pressure differential across valve or 100 percent of total system (pump) head.**

PART 55 - *****

PART 56 - Retain first paragraph below for units with heating.

PART 57 - *****

- A. Electric-Resistance Heating Coil: Finned-tube electric elements with contactor, dehumidification relay, and high-temperature-limit switches.
- B. Filter: **1-inch-** thick, disposable, glass-fiber media.
 1. Initial Resistance: [0.30] [___] **inches wg.** at 500 fpm face velocity
 2. Recommended Final Resistance: **1.0 inches wg.**
 3. MERV (ASHRAE 52.2): 8 Minimum.

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PART 58 - *****

PART 59 - Retain first paragraph below for units with humidifier.

PART 60 - *****

- A. Atomizing Humidifier: Centrifugal atomizer with stainless-steel pan, demister pad, and solenoid valve.
- B. Disconnect Switch: Non-automatic, molded-case circuit breaker with handle accessible when panel is closed and capable of preventing access until switched to off position.
- C. Control System:
 - 1. Unit-mounted panel with main fan contactor, compressor contactor, compressor start capacitor, control transformer with circuit breaker, solid-state temperature [and humidity] control modules, [humidity contactor, time-delay relay, heating contactor, and high-temperature thermostat]. Provide solid-state, wall-mounted control panel with start-stop switch, [adjustable humidity set point,] and adjustable temperature set point.
 - 2. For additional control requirements, see Article 1.2.A. Refer to Section 25 5000, *Integrated Automated Facility Controls*. All necessary controls shall be factory installed and wired.

60.2 FAN MOTORS

- A. Meet the requirements of IEEE 841.
- B. Motor Sizes: Minimum size as indicated on Drawings. If not indicated, large enough so driven loads will not require motor to operate in service factor range above 1.0.

60.3 CAPACITIES AND CHARACTERISTICS

See the Equipment Schedule on the Design Drawings.

As a minimum, the following information and performance characteristics shall be shown on the drawings as part of the equipment schedule.

- C. Manufacturer
- D. Model Number

PART 61 - *****

PART 62 - Retain first paragraph below for floor mounted units; delete for ceiling mounted units.

- C. Unit Configuration:

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1. [Upflow] [Downflow].
2. [Draw] [Blow] through.

B. Supply-Air Fan:

1. Number of Fans: [One] [Two].
2. Airflow: [] **cfm**.
3. Minimum Static Pressure: [] **inches wg**.
4. Motor Size: [] hp.

PART 63 - *****

**PART 64 - Retain first paragraph below for units with DX refrigerant coils
and retain subparagraphs as applicable.**

A. Refrigeration System:

1. Unit Energy Efficiency: [] COP or EER.
2. Refrigerant Compressor:
 - a. **Total Unit Cooling Capacity:** [] **Btu/h.**
 - b. **Sensible Unit Cooling Capacity:** [] **Btu/h.**
 - c. **Number of Compressors:** [One] [Two].
 - d. **Motor Size:** [] hp.
3. Refrigerant Evaporator Coil:
 - a. **Cooling Capacity:** [] **Btu/h.**
 - b. **Entering-Air Dry-Bulb Temperature:** [] **deg F.**
 - c. **Entering-Air Wet-Bulb Temperature:** [] **deg F.**
 - d. **Leaving-Air Dry-Bulb Temperature:** [] **deg F.**
 - e. **Leaving-Air Wet-Bulb Temperature:** [] **deg F.**
4. Water-Cooled Refrigerant Condenser:
 - a. **Cooling Capacity:** [] **Btu/h.**
 - b. **Condenser Water Flow:** [] **gpm.**
 - c. **Cooling Medium:** [Water] [].
 - d. **Entering-Water Temperature:** [] **deg F.**
 - e. **Fluid Pressure Drop:** [] **feet of head.**
5. Air-Cooled Refrigerant Condenser:
 - a. **Cooling Capacity:** [] **Btu/h.**
 - b. **Entering-Air Temperature:** [] **deg F.**
 - c. **Number of Condenser Fan Motors:** [].

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d. Condenser Fan Motors: [] hp.

B. Hydronic Heating Coil:

1. Cooling Coil Capacity: [] Btu/h.
2. Entering-Air Dry-Bulb Temperature: [] deg F.
3. Entering-Air Wet-Bulb Temperature: [] deg F.
4. Leaving-Air Dry-Bulb Temperature: [] deg F.
5. Leaving-Air Wet-Bulb Temperature: [] deg F.
6. Fluid Flow: [] gpm.
7. Entering-Fluid Temperature: [] deg F.
8. Fluid Pressure Drop: [] feet of head.
9. Cooling Medium: Chilled Water

C. Hydronic Heating Coil:

1. Total: [] Btu/h.
2. Entering-Air Dry-Bulb Temperature: [] deg F.
3. Leaving-Air Dry-Bulb Temperature: [] deg F.
4. Water Flow: [] gpm.
5. Entering-Water Temperature: [] deg F.
6. Leaving-Water Temperature: [] deg F.
7. Fluid Pressure Drop: [] feet of head.

D. Electric-Resistance Heating Coil:

1. Total Capacity: [] kW>.
2. Stages of Heating: [1] [2].

E. Humidifier:

1. Total: [] lb/h.
2. Input: [] Btu/h.

F. Electrical Characteristics:

1. Volts: [120] [208] [240] [277] [480].
2. Phase: [Single] [Three].
3. Hertz: 60.
4. Full-Load Amperes: [].
5. Minimum Circuit Ampacity: [].
6. Maximum Overcurrent Protection: [].

PART 65 - EXECUTION

SECTION

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For CRACs that are not exempt from seismic, if Project Spec includes 22 0548.23, and if requirements associated with installation, testing, and inspection of mounting and/or anchorage devices differ from those requirements in 22 0548.23, they must be described herein (in PART 3). Also, if this is applicable, identify special types of seismic-control devices required for each application using the same terminology used for those devices in PART 2.

65.1 EXAMINATION

- A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.
- B. Examine walls, floors, and roofs for suitable conditions where computer-room air conditioners will be installed.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

65.2 INSTALLATION

- A. Install computer-room air conditioners level and plumb, maintaining manufacturer's recommended clearances. [Coordinate with the computer room access floor installer].
- B. Computer-Room Air-Conditioner Mounting: Install using [elastomeric pads] [elastomeric mounts] [restrained spring isolators]. Suspended Computer-Room Air Conditioners: Install using continuous-thread hanger rods and [elastomeric hangers] [spring hangers] [spring hangers with vertical-limit stop] of size required to support weight of computer-room air conditioner.
 - 1. Fabricate brackets or supports as required. Comply with requirements for hangers and supports specified in 22 0548.23, *Vibration and Seismic Controls for Mechanical Systems*.

65.3 CONNECTIONS

- A. Drawings indicate general arrangement of piping, fittings, and specialties.
- B. Install piping adjacent to machine to allow service and maintenance.
- C. Water and Drainage Connections: Comply with applicable requirements Section 22 1100, *Facility Water Distribution*. Provide adequate connections for water-cooled units, condensate drain, and humidifier flushing system.
- D. Chilled- and Hot-Water Heating Piping: Comply with applicable requirements in Section 23 2113, *Hydronic Piping*. Provide shutoff valves in inlet and outlet piping to heating coils.

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- E. Condenser-Water Piping: Comply with applicable requirements in Section 23 2113, *Hydronic Piping*. Provide shutoff valves in water inlet and outlet piping on water-cooled units.
- F. Refrigerant Piping: Comply with applicable requirements in Section 23 2300, *Refrigerant Piping*. Provide shutoff valves and piping.

Seismic: Flexible connections (between the CRACs and other nonstructural components it's associated with) are one of the requirements for the exemption from seismic design. Ensure such connections are indicated on the drawings in the applicable location(s).

- G. Install flexible connections where shown on drawings.

65.4 FIELD QUALITY CONTROL

- A. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect, test, and adjust components, assemblies, and equipment installations, including connections.
- B. Tests and Inspections:
 - 1. Inspect for and remove shipping bolts, blocks, and tie-down straps.
 - 2. After installing computer-room air conditioners and after electrical circuitry has been energized, test for compliance with requirements.
 - 3. Operational Test: After electrical circuitry has been energized, start units to confirm proper motor rotation and unit operation.
 - 4. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.
 - 5. Adjust initial temperature and humidity set points.
 - 6. Set field-adjustable switches and circuit-breaker trip ranges as indicated.
 - 7. Test and record for maintenance of room conditions over continuous 24-hour period.
- C. Computer-room air conditioners will be considered defective if they do not pass tests and inspections.
- D. Prepare test and inspection reports.
- E. After startup service and performance test, change filters and flush humidifier.

END OF SECTION

SECTION

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Do not delete the following reference information.

THE FOLLOWING STATEMENT IS FOR LANL USE ONLY

This project specification section is based on LANL Master Specification
Section 23 8123 Rev. 1, dated November 21, 2017.

SECTION 23916 – SPLIT AIR CONDITIONER

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes split system air conditioning units consisting of separate evaporator fan and compressor condenser components.

1.2 ACTION SUBMITTALS

- E. Product Data:
For each type of product indicated.
- F. Shop Drawings:
Include plans, elevations, sections, details, and attachments to other work.
1. Detail equipment assemblies and indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.

1.3 INFORMATIONAL SUBMITTALS

- C. Warranty:
Sample of special warranty.

1.4 CLOSEOUT SUBMITTALS

- A. Operation and maintenance data.

1.5 QUALITY ASSURANCE

- C. Electrical Components, Devices, and Accessories:
Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- B. ASHRAE Compliance:
1. Fabricate and label refrigeration system to comply with ASHRAE 15, "Safety Standard for Refrigeration Systems."
 2. ASHRAE Compliance:
Applicable requirements in ASHRAE 62.1, Section 4 "Outdoor Air Quality," Section 5 "Systems and Equipment," Section 6 "Procedures," and Section 7 "Construction and

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System Start-up."

C. ASHRAE/IESNA Compliance: Applicable requirements in ASHRAE/IESNA 90.1.

1.6 WARRANTY

C. Special Warranty:

Manufacturer's standard form in which manufacturer agrees to repair or replace components of split system air conditioning units that fail in materials or workmanship within specified warranty period.

1. Warranty Period:

- a. For Compressor:
Five year(s) from date of Substantial Completion.
- b. For Parts:
One year(s) from date of Substantial Completion.
- c. For Labor:
One year(s) from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

C. Basis of Design Product:

Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:

1. Carrier Corporation; Home Comfort and HVAC Building & Industrial Systems
2. Daiken Air Conditioning Company
3. Mitsubishi Electric & Electronics USA, Inc.; HVAC Advanced Products Division
4. Trane; a business of American Standard companies
5. YORK; a Johnson Controls company

2.2 INDOOR UNITS (5 TONS (18 kW) OR LESS)

A. Wall-Mounted, Evaporator Fan Components:

7. Cabinet:
Plastic or enameled steel with removable panels on front and ends in color selected by Owner's Representative, and discharge drain pans with drain connection.
8. Refrigerant Coil:
Copper tube, with mechanically bonded aluminum fins and thermal expansion valve.

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Comply with ARI 210/240. Condenser coils shall be factory coated to prevent salt air corrosion of aluminum, fins. Coating shall be epoxy or phenolic epoxy type rated for minimum 4000 hours salt spray resistance when tested in accordance with ASTM B 117 and minimum 4000 hours humidity resistance when tested in accordance with ASTM D 2247, applied at least 1.2 mils thick.

9. Fan:
Direct drive, centrifugal.
4. Fan Motors:
 - a. Comply with NEMA designation, temperature rating, service factor, enclosure type, and efficiency requirements specified in Section 230513 "Common Motor Requirements for HVAC Equipment."
 - b. Multi-tapped, multi-speed with internal thermal protection and permanent lubrication.
 - c. Enclosure Type:
Totally enclosed, fan cooled
 - d. NEMA Premium (TM) efficient motors as defined in NEMA MG 1
 - k. Controllers, Electrical Devices, and Wiring:
Comply with requirements for electrical devices and connections specified in electrical Sections.
7. Airstream Surfaces:
Surfaces in contact with the airstream shall comply with requirements in ASHRAE 62.1.
6. Condensate Drain Pans:
 - a. Fabricated with one percent slope in at least two planes to collect condensate from cooling coils (including coil piping connections, coil headers, and return bends) and humidifiers, and to direct water toward drain connection.
 - b. Drain Connection:
Located at lowest point of pan and sized to prevent overflow. Terminate with threaded nipple on both ends of pan.
7. Air Filtration Section:
 - a. General Requirements for Air Filtration Section:
 - 1) Comply with NFPA 90A
 - 2) Minimum Arrestance:
According to ASHRAE 52.1 and MERV according to ASHRAE 52.2.
 - 3) Filter Holding Frames:
Arranged for flat or angular orientation, with access doors on both sides of unit. Filters shall be removable from one side or lifted out from access plenum.

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- b. Permanent, cleanable filters.

2.3 OUTDOOR UNITS (5 TONS (18 kW) OR LESS)

A. Air Cooled, Compressor Condenser Components:

15. Casing:

Steel, finished with baked enamel in color selected by Owner's Representative, with removable panels for access to controls, weep holes for water drainage, and mounting holes in base. Provide brass service valves, fittings, and gage ports on exterior of casing.

16. Compressor:

Hermetically sealed with crankcase heater and mounted on vibration isolation device. Compressor motor shall have thermal and current sensitive overload devices, start capacitor, relay, and contactor.

a. Compressor Type:

Scroll.

- b. Two speed compressor motor with manual reset high pressure switch and automatic reset low pressure switch.

c. Refrigerant Charge:

R-410A.

d. Refrigerant Coil:

Copper tube, with mechanically bonded aluminum fins and liquid sub-cooler. Comply with ARI 210/240. Condenser coils shall be factory coated to prevent salt air corrosion of aluminum, fins. Coating shall be epoxy or phenolic epoxy type rated for minimum 4000 hours salt spray resistance when tested in accordance with ASTM B 117 and minimum 4000 hours humidity resistance when tested in accordance with ASTM D 2247, applied at least 1.2 mils thick.

17. Heat-Pump Components:

Reversing valve and low-temperature-air cutoff thermostat

18. Fan:

Aluminum-propeller type, directly connected to motor

19. Motor:

Permanently lubricated, with integral thermal overload protection.

20. Low Ambient Kit:

Permits operation down to 45°F (7°C)

21. Mounting Base:

Polyethylene

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2.4 ACCESSORIES

- C. Thermostat:
Wired infrared functioning to remotely control compressor and evaporator fan, with the following features:
 - 1. Compressor time delay.
 - 2. 24-hour time control of system stop and start.
 - 3. Liquid crystal display indicating temperature, set point temperature, time setting, operating mode, and fan speed.
 - 4. Fan-speed selection including auto setting.
- B. Automatic-reset timer to prevent rapid cycling of compressor.
- C. Refrigerant Line Kits:
Soft annealed copper suction and liquid lines factory cleaned, dried, pressurized, and sealed; factory insulated suction line with flared fittings at both ends.
- D. Drain Hose:
For condensate.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install units level and plumb. Anchor to concrete base with stainless steel anchors.
- B. Install evaporator fan components using manufacturer's standard mounting devices securely fastened to building structure.
- C. Install roof mounted, compressor condenser components on equipment supports specified in Section 07 and Drawings. Anchor units to supports with removable, stainless steel fasteners.
- D. Install and connect pre-charged refrigerant tubing to component's quick connect fittings. Install tubing to allow access to unit.

3.2 CONNECTIONS

- A. Piping installation requirements are specified in other Sections. Drawings indicate general arrangement of piping, fittings, and specialties.
- B. Where piping is installed adjacent to unit, allow space for service and maintenance of unit.

3.3 FIELD QUALITY CONTROL

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A. Perform tests and inspections.

3. Manufacturer's Field Service:

Engage a factory authorized service representative to inspect components, assemblies, and equipment installations, including connections, and to assist in testing.

B. Tests and Inspections:

5. Leak Test:

After installation, charge system and test for leaks. Repair leaks and retest until no leaks exist.

6. Operational Test:

After electrical circuitry has been energized, start units to confirm proper motor rotation and unit operation.

3. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.

C. Remove and replace malfunctioning units and retest as specified above. D. Prepare test and inspection reports.

3.4 DEMONSTRATION

A. Train Owner's maintenance personnel to adjust, operate, and maintain units.

END OF SECTION

SECTION

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DIVISION 25 INTEGRATED AUTOMATION**SECTION FILES IN CIP PROJECT FILE**

SECTION

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DIVISION 25 INTEGRATED AUTOMATION

SECTION 250111 EMCS START UP

General

SUMMARY

1. Section Includes.
Methods and procedures for start-up, verification and commissioning, for building Energy Monitoring and Control System (EMCS) and includes:
 - Start-up testing and verification of systems
 - Check-out demonstration or proper operation of components.
 - On-site operational tests

RELATED SECTIONS

2. The contractor is to ensure that all related work is co-ordinated among all specification sections, as well as between all Divisions, and that the tender price includes all related work. The referenced sections below are for guidance only and are not necessarily a complete list of related sections.
3. Section 01 33 00 - Submittal Procedures.
4. Section 01 78 00 - Closeout Submittals.
5. Section 01 79 00.13 – Demonstration and Training for Building Commissioning.
6. Section 01 91 13.13 - Commissioning (Cx) Requirements.
7. Section 25 05 01 - EMCS: General Requirements.

DEFINITIONS

8. For additional acronyms and definitions refer to Section 25 05 01 - EMCS: General Requirements.
9. AEL (Average Effectiveness Level): ratio between total test period less any system downtime accumulated within that period and test period.
10. Downtime: results whenever EMCS is unable to fulfill required functions due to malfunction of equipment defined under responsibility of EMCS contractor. Downtime is measured by duration, in time, between time that Contractor is notified of failure and time system is restored to proper operating condition. Downtime not to include following:
 - Outage of main power supply in excess of back-up power sources, provided that:
 - Automatic initiation of back-up was accomplished.
 - Automatic shut-down and re-start of components was as specified.
 - Failure of communications link, provided that:

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Controller automatically and correctly operated in stand-alone mode.

Failure was not due to failure of any specified EMCS equipment.

Functional failure resulting from individual sensor inputs or output devices, provided that:

System recorded said fault.

Equipment defaulted to fail-safe mode.

AEL of total of all input sensors and output devices is at least 99 % during test period.

DESIGN REQUIREMENTS

11. Confirm with Owner's Representative that Design Criteria and Design Intent are still applicable.
12. Commissioning personnel to be fully aware of and qualified to interpret Design Criteria and Design Intent.

SUBMITTALS

13. Submittals in accordance with Section 01 33 00 - Submittal Procedures.
14. Final Report: submit report to Owner's Representative.
Include measurements, final settings and certified test results.
Bear signature of commissioning technician and supervisor
Report format to be approved by Owner's Representative before commissioning is started.
Revise "as-built" documentation, commissioning reports to reflect changes, adjustments and modifications to EMCS as set during commissioning and submit to Owner's Representative in accordance with Section 01 78 00 - Closeout Submittals.
Recommend additional changes and/or modifications deemed advisable in order to improve performance, environmental conditions or energy consumption.

CLOSEOUT SUBMITTALS

15. Provide documentation, O&M Manuals, and training materials of O&M personnel for review by Owner's Representative before interim acceptance in accordance with Section 01 78 00 - Closeout Submittals and Section 25 05 03 – EMCS: Project Record Documents.

COMMISSIONING

16. Do commissioning in accordance with Section 01 91 13 – General Commissioning (Cx) Requirements.
17. Carry out commissioning under direction of Owner's Representative and in presence of Owner's Representative and Commissioning Co-ordinator.
18. Inform, and obtain approval from, Owner's Representative in writing at least 14 days prior to commissioning or each test. Indicate:
Location and part of system to be tested or commissioned.
Testing/commissioning procedures, anticipated results.

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Names of testing/commissioning personnel.

19. Correct deficiencies, re-test in presence of Owner's Representative until satisfactory performance is obtained.

20. Acceptance of tests will not relieve Contractor from responsibility for ensuring that complete systems meet every requirement of Contract.

21. Load system with project software. Install software for access to EMCS via dial up modem at Owner's designated site and at Transportation and Works Office in St. John's for use during commissioning and for their use afterwards. Where high speed internet is available, use web browser software, compatible with Windows Vista with access via Internet Explorer (latest edition).

22. Perform tests as required.

COMPLETION OF COMMISSIONING

23. Commissioning to be considered as satisfactorily completed when objectives of commissioning have been achieved and reviewed by Owner's Representative and Commissioning Co-ordinator.

ISSUANCE OF FINAL CERTIFICATE OF COMPLETION

24. Final Certificate of Completion will not be issued until receipt of written approval indicating successful completion of specified commissioning activities including receipt of commissioning documentation.

Products

EQUIPMENT

25. Provide sufficient instrumentation to verify and commission the installed system. Provide two-way radios.

26. Instrumentation accuracy tolerances: higher order of magnitude than equipment or system being tested.

27. Independent testing laboratory to certify test equipment as accurate to within approved tolerances no more than 2 months prior to tests.

28. Locations to be approved, readily accessible and readable.

29. Application: to conform to normal industry standards.

Execution

PROCEDURES

SECTION

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30. Test each system independently and then in unison with other related systems.
31. Commission each system using procedures prescribed by the Commissioning Co-ordinator and/or Owner's Representative.
32. Commission integrated systems using procedures prescribed by Commissioning Co-ordinator and/or Owner's Representative.
33. Debug system software.
34. Optimize operation and performance of systems by fine-tuning PID values and modifying CDLs as required.
35. Test full scale emergency evacuation and life safety procedures including operation and integrity of smoke management systems under normal and emergency power conditions as applicable.

FIELD QUALITY CONTROL

36. Pre-Installation Testing.

General: consists of field tests of equipment just prior to installation.

Testing may be on site or at Contractor's premises as approved by Owner's Representative.

Configure major components to be tested in same architecture as designed system.

Include all required network and control components.

Equip each Building Controller with sensor and controlled device of each type (AI, AO, DI, DO).

Additional instruments to include:

DP transmitters.

VAV supply duct SP transmitters.

DP switches used for dirty filter indication and fan status.

In addition to test equipment, provide inclined manometer, digital micro-manometer, milli-amp meter, source of air pressure infinitely adjustable between 0 and 500 Pa, to hold steady at any setting and with direct output to milli-amp meter at source.

After setting, test zero and span in 10 % increments through entire range while both increasing and decreasing pressure.

Owner's Representative to mark instruments tracking within 0.5 % in both directions as "approved for installation".

Transmitters above 0.5 % error will be rejected.

DP switches to open and close within 2% of setpoint.

37. Completion Testing.

General: test after installation of each part of system and after completion of mechanical and electrical hook-ups, to verify correct installation and functioning.

Include following activities:

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Test and calibrate field hardware including stand-alone capability of each controller.
Verify each A-to-D convertor.
Test and calibrate each AI using calibrated digital instruments.
Test each DI to ensure proper settings and switching contacts.
Test each DO to ensure proper operation and lag time.
Test each AO to ensure proper operation of controlled devices.
Verify tight closure and signals.
Test operating software.
Test application software and provide samples of logs and commands.
Verify each CDL including energy optimization programs.
Debug software.
Blow out flow measuring and static pressure stations with high pressure air at 700 kPa.
Provide point verification list in table format including point identifier, point identifier expansion, point type and address, low and high limits and Engineering units. This document will be used in final startup testing.

Final Startup Testing: Upon satisfactory completion of tests, perform point-by-point test of entire system under direction of Owner's Representative and Commissioning Coordinator and provide:

2 technical personnel capable of re-calibrating field hardware and modifying software.
Detailed daily schedule showing items to be tested and personnel available.
Owner's Representative's acceptance signature to be on executive and applications programs.
Commissioning to commence during final startup testing.
O&M personnel to assist in commissioning procedures as part of training.
Commissioning to be supervised by qualified supervisory personnel and Owner's Representative.
Commission systems considered as life safety systems before affected parts of the facility are occupied.
Operate systems as long as necessary to commission entire project.
Monitor progress and keep detailed records of activities and results.

Final Operational Testing: to demonstrate that EMCS functions in accordance with contract requirements.

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Prior to beginning of 30 day test demonstrate that operating parameters (setpoints, alarm limits, operating control software, sequences of operation, trends, graphics and CDL's) have been implemented to ensure proper operation and operator notification in event of off-normal operation.

Repetitive alarm conditions to be resolved to minimize reporting of nuisance conditions.

Test to last at least 30 consecutive 24 hour days.

Tests to include:

Demonstration of correct operation of monitored and controlled points.

Operation and capabilities of sequences, reports, special control algorithms, diagnostics, software.

System will be accepted when:

EMCS equipment operates to meet overall performance requirements. Downtime as defined in this Section must not exceed allowable time calculated for this site.

Requirements of Contract have been met.

In event of failure to attain specified AEL during test period, extend test period on day-to-day basis until specified AEL is attained for test period.

Correct defects when they occur and before resuming tests.

Commissioning Co-ordinator and/or Owner's Representative to verify reported results.

ADJUSTING

38. Final adjusting: upon completion of commissioning as reviewed by Owner's Representative set and lock devices in final position and permanently mark settings.

DEMONSTRATION

39. Demonstrate to Commissioning Manager and/or Owner's Representative operation of systems including sequence of operations in regular and emergency modes, under normal and emergency conditions, start-up, shut-down interlocks and lock-outs in accordance with Section 01 91 13 – General Commissioning (Cx) Requirements.

END OF SECTION

SECTION

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DIVISION 25

SECTION 250112 – EMCS TRAINING

General

SUMMARY

1. Section Includes.

Requirements and procedures for training program, instructors and training materials, for building Energy Monitoring and Control System (EMCS) Work.

Related Sections

Section 01 33 00 - Submittal Procedures.

Section 25 05 01 - EMCS: General Requirements.

DEFINITIONS

2. CDL - Control Description Logic.

3. For additional acronyms and definitions refer to Section 25 05 01 - EMCS: General Requirements

SUBMITTALS

4. Submittals in accordance with Section 01 33 00 - Submittal Procedures and supplemented and modified by requirements of this Section.

5. Submit training proposal complete with hour-by-hour schedule including brief overview of content of each segment to Owner's Representative 30 days prior to anticipated date of beginning of training.

List name of trainer, and type of visual and audio aids to be used.

Show co-ordinated interface with other EMCS mechanical and electrical training programs.

6. Submit reports within one week after completion of Phase 1 and Phase 2 training program that training has been satisfactorily completed.

QUALITY ASSURANCE

7. Provide competent instructors thoroughly familiar with aspects of EMCS installed in facility.

8. Owner's Representative reserves right to approve instructors.

INSTRUCTIONS

9. Provide instruction to designated personnel in adjustment, operation, maintenance and pertinent safety requirements of EMCS installed.

10. Training to be project-specific.

TIME FOR INSTRUCTION

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11. Number of days of instruction to be as specified in this section (1 day = 7 hours including two 15 minute breaks and excluding lunch time).

TRAINING MATERIALS

12. Provide equipment, visual and audio aids, and materials for classroom training.
13. Supply manual for each trainee, describing in detail data included in each training program.
Review contents of manual in detail to explain aspects of operation and maintenance (O&M).

TRAINING PROGRAM

14. To be in 2 phases over 6 month period.
15. Phase 1: 2 day program to begin before 30 day test period at time mutually agreeable to Contractor, Owner's Representative and Commissioning Co-ordinator.
Train O&M personnel in functional operations and procedures to be employed for system operation.
Supplement with on-the-job training during 30 day test period.
Include overview of system architecture, communications, operation of computer and peripherals, report generation.
Include detailed training on operator interface functions for control of mechanical systems, CDL's for each system, and elementary preventive maintenance.
Introduction to Direct Digital Controls and BACnet protocol.
Identification of Control Components.
Review of DDC Network Diagram for building.
Review of shop drawings for building.
Detailed discussion of sequences of operation
Walk through of mechanical systems.
16. Phase 2: 5 day program to begin 8 weeks after acceptance for operators, equipment maintenance personnel and programmers.
Provide multiple instructors on pre-arranged schedule. Include at least

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Operator training: provide operating personnel, maintenance personnel and programmers with condensed version of Phase 1 training.

Equipment maintenance training: provide personnel with 2 days training within a 5 day period in maintenance of EMCS components, maintenance and calibration of sensors and controls.

Programmers: provide personnel with 2 days training within a 5 day period in following subjects in approximate percentages of total course shown:

- Software and architecture: 10%
- Application programs: 15%
- Controller programming: 50%
- Trouble shooting and debugging: 10%
- Colour graphic generation: 15%
- Display and interpret summaries
- Command points
- Modify points and point groups
- Define trend logs
- Schedule and print reports

ADDITIONAL TRAINING

17. List courses offered by name, duration and approximate cost per person per week. Note courses recommended for training supervisory personnel.

MONITORING OF TRAINING

18. Owner's Representative to monitor training program and may modify schedule and content.

Products (NOT USED)

EXECUTION (NOT USED)

END OF SECTION

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DIVISION 25 SECTION – 250501 COMMON REQUIREMENTS FOR ENERGY MONITORING AND CONTROL SYSTEMS

General SUMMARY

1. Section Includes.
Methods and procedures for start-up, verification and commissioning, for building Energy Monitoring and Control System (EMCS) and includes:
 - Start-up testing and verification of systems
 - Check-out demonstration or proper operation of components.
 - On-site operational tests

RELATED SECTIONS

2. The contractor is to ensure that all related work is co-ordinated among all specification sections, as well as between all Divisions, and that the tender price includes all related work. The referenced sections below are for guidance only and are not necessarily a complete list of related sections.
3. Section 01 33 00 - Submittal Procedures.
4. Section 01 78 00 - Closeout Submittals.
5. Section 01 79 00.13 – Demonstration and Training for Building Commissioning.
6. Section 01 91 13.13 - Commissioning (Cx) Requirements.
7. Section 25 05 01 - EMCS: General Requirements.

DEFINITIONS

8. For additional acronyms and definitions refer to Section 25 05 01 - EMCS: General Requirements.
9. AEL (Average Effectiveness Level): ratio between total test period less any system downtime accumulated within that period and test period.
10. Downtime: results whenever EMCS is unable to fulfill required functions due to malfunction of equipment defined under responsibility of EMCS contractor. Downtime is measured by duration, in time, between time that Contractor is notified of failure and time system is restored to proper operating condition. Downtime not to include following:
 - Outage of main power supply in excess of back-up power sources, provided that:
 - Automatic initiation of back-up was accomplished.
 - Automatic shut-down and re-start of components was as specified.
 - Failure of communications link, provided that:

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Controller automatically and correctly operated in stand-alone mode.

Failure was not due to failure of any specified EMCS equipment.

Functional failure resulting from individual sensor inputs or output devices, provided that:

System recorded said fault.

Equipment defaulted to fail-safe mode.

AEL of total of all input sensors and output devices is at least 99 % during test period.

DESIGN REQUIREMENTS

11. Confirm with Owner's Representative that Design Criteria and Design Intent are still applicable.
12. Commissioning personnel to be fully aware of and qualified to interpret Design Criteria and Design Intent.

SUBMITTALS

13. Submittals in accordance with Section 01 33 00 - Submittal Procedures.
14. Final Report: submit report to Owner's Representative.
Include measurements, final settings and certified test results.
Bear signature of commissioning technician and supervisor
Report format to be approved by Owner's Representative before commissioning is started.
Revise "as-built" documentation, commissioning reports to reflect changes, adjustments and modifications to EMCS as set during commissioning and submit to Owner's Representative in accordance with Section 01 78 00 - Closeout Submittals.
Recommend additional changes and/or modifications deemed advisable in order to improve performance, environmental conditions or energy consumption.

CLOSEOUT SUBMITTALS

15. Provide documentation, O&M Manuals, and training materials of O&M personnel for review by Owner's Representative before interim acceptance in accordance with Section 01 78 00 - Closeout Submittals and Section 25 05 03 – EMCS: Project Record Documents.

COMMISSIONING

16. Do commissioning in accordance with Section 01 91 13 – General Commissioning (Cx) Requirements.
17. Carry out commissioning under direction of Owner's Representative and in presence of Owner's Representative and Commissioning Co-ordinator.
18. Inform, and obtain approval from, Owner's Representative in writing at least 14 days prior to commissioning or each test. Indicate:
Location and part of system to be tested or commissioned.
Testing/commissioning procedures, anticipated results.

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Names of testing/commissioning personnel.

19. Correct deficiencies, re-test in presence of Owner's Representative until satisfactory performance is obtained.

20. Acceptance of tests will not relieve Contractor from responsibility for ensuring that complete systems meet every requirement of Contract.

21. Load system with project software. Install software for access to EMCS via dial up modem at Owner's designated site and at Transportation and Works Office in St. John's for use during commissioning and for their use afterwards. Where high speed internet is available, use web browser software, compatible with Windows Vista with access via Internet Explorer (latest edition).

22. Perform tests as required.

COMPLETION OF COMMISSIONING

23. Commissioning to be considered as satisfactorily completed when objectives of commissioning have been achieved and reviewed by Owner's Representative and Commissioning Co-ordinator.

ISSUANCE OF FINAL CERTIFICATE OF COMPLETION

24. Final Certificate of Completion will not be issued until receipt of written approval indicating successful completion of specified commissioning activities including receipt of commissioning documentation.

Products

EQUIPMENT

25. Provide sufficient instrumentation to verify and commission the installed system. Provide two-way radios.

26. Instrumentation accuracy tolerances: higher order of magnitude than equipment or system being tested.

27. Independent testing laboratory to certify test equipment as accurate to within approved tolerances no more than 2 months prior to tests.

28. Locations to be approved, readily accessible and readable.

29. Application: to conform to normal industry standards.

Execution

PROCEDURES

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30. Test each system independently and then in unison with other related systems.
31. Commission each system using procedures prescribed by the Commissioning Co-ordinator and/or Owner's Representative.
32. Commission integrated systems using procedures prescribed by Commissioning Co-ordinator and/or Owner's Representative.
33. Debug system software.
34. Optimize operation and performance of systems by fine-tuning PID values and modifying CDLs as required.
35. Test full scale emergency evacuation and life safety procedures including operation and integrity of smoke management systems under normal and emergency power conditions as applicable.

FIELD QUALITY CONTROL

36. Pre-Installation Testing.

General: consists of field tests of equipment just prior to installation.

Testing may be on site or at Contractor's premises as approved by Owner's Representative.

Configure major components to be tested in same architecture as designed system.

Include all required network and control components.

Equip each Building Controller with sensor and controlled device of each type (AI, AO, DI, DO).

Additional instruments to include:

DP transmitters.

VAV supply duct SP transmitters.

DP switches used for dirty filter indication and fan status.

In addition to test equipment, provide inclined manometer, digital micro-manometer, milli-amp meter, source of air pressure infinitely adjustable between 0 and 500 Pa, to hold steady at any setting and with direct output to milli-amp meter at source.

After setting, test zero and span in 10 % increments through entire range while both increasing and decreasing pressure.

Owner's Representative to mark instruments tracking within 0.5 % in both directions as "approved for installation".

Transmitters above 0.5 % error will be rejected.

DP switches to open and close within 2% of setpoint.

37. Completion Testing.

General: test after installation of each part of system and after completion of mechanical and electrical hook-ups, to verify correct installation and functioning.

Include following activities:

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Test and calibrate field hardware including stand-alone capability of each controller.
Verify each A-to-D convertor.
Test and calibrate each AI using calibrated digital instruments.
Test each DI to ensure proper settings and switching contacts.
Test each DO to ensure proper operation and lag time.
Test each AO to ensure proper operation of controlled devices.
Verify tight closure and signals.
Test operating software.
Test application software and provide samples of logs and commands.
Verify each CDL including energy optimization programs.
Debug software.
Blow out flow measuring and static pressure stations with high pressure air at 700 kPa.
Provide point verification list in table format including point identifier, point identifier expansion, point type and address, low and high limits and Engineering units. This document will be used in final startup testing.

Final Startup Testing: Upon satisfactory completion of tests, perform point-by-point test of entire system under direction of Owner's Representative and Commissioning Coordinator and provide:

2 technical personnel capable of re-calibrating field hardware and modifying software.
Detailed daily schedule showing items to be tested and personnel available.
Owner's Representative's acceptance signature to be on executive and applications programs.
Commissioning to commence during final startup testing.
O&M personnel to assist in commissioning procedures as part of training.
Commissioning to be supervised by qualified supervisory personnel and Owner's Representative.
Commission systems considered as life safety systems before affected parts of the facility are occupied.
Operate systems as long as necessary to commission entire project.
Monitor progress and keep detailed records of activities and results.

Final Operational Testing: to demonstrate that EMCS functions in accordance with contract requirements.

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Prior to beginning of 30 day test demonstrate that operating parameters (setpoints, alarm limits, operating control software, sequences of operation, trends, graphics and CDL's) have been implemented to ensure proper operation and operator notification in event of off-normal operation.

Repetitive alarm conditions to be resolved to minimize reporting of nuisance conditions.

Test to last at least 30 consecutive 24 hour days.

Tests to include:

Demonstration of correct operation of monitored and controlled points.

Operation and capabilities of sequences, reports, special control algorithms, diagnostics, software.

System will be accepted when:

EMCS equipment operates to meet overall performance requirements. Downtime as defined in this Section must not exceed allowable time calculated for this site.

Requirements of Contract have been met.

In event of failure to attain specified AEL during test period, extend test period on day-to-day basis until specified AEL is attained for test period.

Correct defects when they occur and before resuming tests.

Commissioning Co-ordinator and/or Owner's Representative to verify reported results.

ADJUSTING

38. Final adjusting: upon completion of commissioning as reviewed by Owner's Representative set and lock devices in final position and permanently mark settings.

DEMONSTRATION

39. Demonstrate to Commissioning Manager and/or Owner's Representative operation of systems including sequence of operations in regular and emergency modes, under normal and emergency conditions, start-up, shut-down interlocks and lock-outs in accordance with Section 01 91 13 – General Commissioning (Cx) Requirements.

END OF SECTION

SECTION

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DIVISION 25 INTERGRATED AUTOMATION

SECTION 250112 - ENERGY MONITORING AND CONTROL SYSTEMS TRAINING

General SUMMARY

1. Section Includes.
Requirements and procedures for training program, instructors and training materials, for building Energy Monitoring and Control System (EMCS) Work.

Related Sections

- Section 01 33 00 - Submittal Procedures.
Section 25 05 01 - EMCS: General Requirements.

DEFINITIONS

2. CDL - Control Description Logic.
3. For additional acronyms and definitions refer to Section 25 05 01 - EMCS: General Requirements

SUBMITTALS

4. Submittals in accordance with Section 01 33 00 - Submittal Procedures and supplemented and modified by requirements of this Section.
5. Submit training proposal complete with hour-by-hour schedule including brief overview of content of each segment to Owner's Representative 30 days prior to anticipated date of beginning of training.
List name of trainer, and type of visual and audio aids to be used.
Show co-ordinated interface with other EMCS mechanical and electrical training programs.
6. Submit reports within one week after completion of Phase 1 and Phase 2 training program that training has been satisfactorily completed.

QUALITY ASSURANCE

7. Provide competent instructors thoroughly familiar with aspects of EMCS installed in facility.
8. Owner's Representative reserves right to approve instructors.

INSTRUCTIONS

SECTION

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9. Provide instruction to designated personnel in adjustment, operation, maintenance and pertinent safety requirements of EMCS installed.

10. Training to be project-specific.

TIME FOR INSTRUCTION

11. Number of days of instruction to be as specified in this section (1 day = 7 hours including two 15 minute breaks and excluding lunch time).

TRAINING MATERIALS

12. Provide equipment, visual and audio aids, and materials for classroom training.

13. Supply manual for each trainee, describing in detail data included in each training program.

Review contents of manual in detail to explain aspects of operation and maintenance (O&M).

TRAINING PROGRAM

14. To be in 2 phases over 6 month period.

15. Phase 1: 2 day program to begin before 30 day test period at time mutually agreeable to Contractor, Owner's Representative and Commissioning Co-ordinator.

Train O&M personnel in functional operations and procedures to be employed for system operation.

Supplement with on-the-job training during 30 day test period.

Include overview of system architecture, communications, operation of computer and peripherals, report generation.

Include detailed training on operator interface functions for control of mechanical systems, CDL's for each system, and elementary preventive maintenance.

Introduction to Direct Digital Controls and BACnet protocol.

Identification of Control Components.

Review of DDC Network Diagram for building.

Review of shop drawings for building.

Detailed discussion of sequences of operation

Walk through of mechanical systems.

16. Phase 2: 5 day program to begin 8 weeks after acceptance for operators, equipment maintenance personnel and programmers.

Provide multiple instructors on pre-arranged schedule. Include at least

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Operator training: provide operating personnel, maintenance personnel and programmers with condensed version of Phase 1 training.

Equipment maintenance training: provide personnel with 2 days training within a 5 day period in maintenance of EMCS components, maintenance and calibration of sensors and controls.

Programmers: provide personnel with 2 days training within a 5 day period in following subjects in approximate percentages of total course shown:

- Software and architecture: 10%
- Application programs: 15%
- Controller programming: 50%
- Trouble shooting and debugging: 10%
- Colour graphic generation: 15%
- Display and interpret summaries
- Command points
- Modify points and point groups
- Define trend logs
- Schedule and print reports

ADDITIONAL TRAINING

17. List courses offered by name, duration and approximate cost per person per week. Note courses recommended for training supervisory personnel.

MONITORING OF TRAINING

18. Owner's Representative to monitor training program and may modify schedule and content.

Products (NOT USED)

EXECUTION (NOT USED)

END OF SECTION

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DIVISION 25 SECTION 250501 COMMON REQUIREMENTS FOR ENERGY MONITORING AND CONTROL SYSTEMS

PART 4 General

4.1 SUMMARY

A. Section Includes:

1. General requirements for building Energy Monitoring and Control System (EMCS) that are common to NMS EMCS Sections.

4.2 RELATED SECTIONS

1. The contractor is to ensure that all related work is co-ordinated among all specification sections, as well as between other Divisions, and that the tender price includes all related work. The referenced sections below are for guidance only and are not necessarily a complete list of related sections.
2. Section 01 33 00 – Submittal Procedures.
3. Section 01 35 29.06 – Health and Safety Requirements.
4. Section 01 74 21 – Construction/Demolition Waste Management and Disposal.
5. Section 01 91 13 – General Commissioning (Cx) Requirements.
6. Section 09 91 23 - Interior Painting.
7. Section 25 01 11 - EMCS: Start-up, Verification and Commissioning.
8. Section 25 01 12 - EMCS: Training.
9. Section 25 05 02 - EMCS: Submittals and Review Process.
10. Section 25 05 03 - EMCS: Project Record Documents.
11. Section 25 05 54 - EMCS: Identification.
12. Section 25 05 60 - EMCS: Field Installation.
13. Section 25 08 20 - EMCS: Warranty and Maintenance.
14. Section 25 10 01 - EMCS: Local Area Network (LAN).
15. Section 25 10 02 - EMCS: Operator Work Station (OWS).
16. Section 25 30 01 - EMCS: Building Controllers
17. Section 25 30 02 - EMCS: Field Control Devices.
18. Section 25 90 01 - EMCS: Site Requirements, Applications and Systems Sequences of Operation.

4.3 REFERENCES

A. American National Standards Institute (ANSI)

1. ANSI/ISA 5.5, Graphic Symbols for Process Displays.

B. American National Standards Institute (ANSI)/ Institute of Electrical and Electronics Engineers (IEEE).

1. ANSI/IEEE 260.1, American National Standard Letter Symbols Units of Measurement (SI Units, Customary Inch-Pound Units, and Certain Other

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Units).

- C. American Society of Heating, Refrigerating and Air-Conditioning Engineers, Inc. (ASHRAE).
 - 1. ASHRAE STD 135, BACNET - Data Communication Protocol for Building Automation and Control Network.
- D. Canadian Standards Association (CSA International).
 - 1. CAN/CSA-Z234.1, Canadian Metric Practice Guide.
- E. Consumer Electronics Association (CEA).
 - 1. CEA-709.1-B, Control Network Protocol Specification.
- F. Department of Justice Canada (Jus).
 - 1. Canadian Environmental Assessment Act (CEAA).
 - 2. Canadian Environmental Protection Act (CEPA).
- G. Health Canada/Workplace Hazardous Materials Information System (WHMIS).
 - 1. Material Safety Data Sheets (MSDS).
- H. Transport Canada (TC).
 - 1. Transportation of Dangerous Goods Act (TDGA).
- I. National Electrical Manufacturers Association (NEMA)

4.4 ACRONYMS, ABBREVIATIONS AND DEFINITIONS

- A. Acronyms used in EMCS.
 - 1. AEL - Average Effectiveness Level
 - 2. AI - Analog Input
 - 3. AO - Analog Output
 - 4. BACnet - Building Automation and Control Network
 - 5. BC(s) - Building Controller(s)
 - 6. BECC - Building Environmental Control Centre
 - 7. CAB - Canadian Automated Building (CAB) Protocol
 - 8. CAD - Computer Aided Design
 - 9. CDL - Control Description Logic
 - 10. CDS - Control Design Schematic
 - 11. COSV - Change of State or Value
 - 12. CPU - Central Processing Unit
 - 13. DI - Digital Input
 - 14. DO - Digital Output
 - 15. DP - Differential Pressure
 - 16. ECU - Equipment Control Unit
 - 17. EMCS - Energy Monitoring and Control System
 - 18. HVAC - Heating, Ventilation, Air Conditioning

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19. IDE - Interface Device Equipment
20. I/O - Input/Output
21. ISA - Industry Standard Architecture
22. LAN - Local Area Network
23. LCU - Local Control Unit
24. MCU - Master Control Unit
25. NC - Normally Closed
26. NO - Normally Open
27. OS - Operating System
28. O&M - Operation and Maintenance
29. OWS - Operator Work Station
30. PC - Personal Computer
31. PCI - Peripheral Control Interface
32. PCMCIA - Personal Computer Micro-Card Interface Adapter
33. PID - Proportional, Integral and Derivative.
34. RAM - Random Access Memory
35. ROM - Read Only Memory
36. SP - Static Pressure
37. TCU - Terminal Control Unit
38. USB - Universal Serial Bus
39. UPS - Uninterruptible Power Supply
40. WAN- Wide Area Network

4.5 DEFINITIONS

- A. Point: may be logical or physical.
 1. Logical points: values calculated by system such as setpoints, totals, counts, derived corrections and may include, but not limited to result of and statements in CDL's.
 2. Physical points: inputs or outputs which have hardware wired to controllers which are measuring physical properties, or providing status conditions of contacts or relays which provide interaction which related equipment (stop, start) and value or damper actuators.
- B. Point Name: composed of two parts, point identifier and point expansion.
 1. Point identifier: comprised of three descriptors, "area" descriptor, "system" descriptor and "point" descriptor, for which database to provide 25 character field for each point identifier. "System" is system that point is located on.
 - a. Area descriptor: building or part of building where point is located.
 - b. System descriptor: system that point is located on.
 - c. Point descriptor: physical logical point description. For point identifier "area", "system" and "point" will be shortforms or

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acronyms. Database must provide 25 character field for each point identifier.

2. Point expansion: comprised of three fields, one for each descriptor. Expanded form of shortform or acronym used in “area”, “system”, and “point” descriptors is placed into appropriate point expansion field. Database must provide 32 character field for each point expansion.
3. Bilingual systems to include additional point identifier expansion fields of equal capacity for each point name for second language.
 - a. System to support use of numbers and readable characters including blanks, periods or underscores to enhance user readability for each of the above strings.
- C. Point Object Type: points fall into following object types:
 1. AI (analog input)
 2. AO (analog output)
 3. DI (digital input)
 4. DO (digital output)
 5. Pulse inputs
- D. Symbols and engineering unit abbreviations utilized in displays: to ANSI/ISA S5.5.
 1. Printouts: to ANSI/IEEE 260.1.
 2. Refer also to Section 25 05 54 - EMCS: Identification.

4.6 SYSTEM DESCRIPTION

- A. Refer to control schematics, sequences of operation and related Divisions of specifications for system architecture.
- B. Work covered by sections referred to above consists of fully operational EMCS, including, but not limited to, following:
 1. Building Controllers.
 2. Control devices as listed in I/O point summaries and/or shown on the control drawings.
 3. OWS
 4. Data communications equipment necessary to affect EMCS data transmission system.
 5. Field control devices.
 6. Software/Hardware complete with full documentation.
 7. Complete operating and maintenance manuals.
 8. Training of personnel.
 9. Acceptance tests, technical support during commissioning, full documentation.
 10. Wiring interface co-ordination of equipment supplied by others.
 11. Miscellaneous work as specified in these sections and as indicated.
- C. Design Requirements:

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1. Design and provide conduit and wiring linking elements of system.
 2. Supply sufficient programmable controllers of types to meet project requirements. Quantity and points contents as reviewed prior to installation.
 3. Location of controllers as reviewed by Owner's Representative prior to installation.
 4. Provide utility and emergency power to EMCS.
 5. Metric references: in accordance with CAN/CSA Z234.1.
- D. Language Operating Requirements:
1. Provide English interface to system through operator selectable access codes.
 2. Use non-linguistic symbols for displays on graphic terminals wherever possible. Other information to be in English.
 3. Operating system executive: provide primary hardware-to-software interface specified as part of hardware purchase with associated documentation to be in English.
 4. System manager software: include in English system definition point database, additions, deletions or modifications, control loop statements, use of high level programming languages, report generator utility and other OS utilities used for maintaining optimal operating efficiency.
- E. Include, in English:
1. Input and output commands and messages from operator-initiated functions and field related changes and alarms as defined in CDL's or assigned limits (i.e. commands relating to day-to-day operating functions and not related to system modifications, additions, or logic re-definitions).
 2. Graphic "display" functions, point commands to turn systems on or off, manually override automatic control of specified hardware points. To be in English at specified OWS. Point name expansions in English.
 3. Reporting function such as trend log, trend graphics, alarm report logs, energy report logs, maintenance generated logs.
- F. The network design to be a fully distributed network, with each primary system having its own locally mounted dedicated controller. Any failure in the network shall **not** in any way affect the control of these primary systems. Connecting hardware points from one system to more than one controller is not acceptable. Any points associated with a system are to be connected to one dedicated controller. Each dedicated controller to have a locally mounted control and display device to allow the operator to view and adjust any point on the controller.
- G. All wiring associated with the EMCS communication network as well as all control wiring and conduit associated with the EMCS at 50 volts or less. Wire and conduit above 50 volts by Electrical Division.
- H. BACnet compliance: full compliance to the BACnet standard (ANSA/ASHRAE) 135, BACnet – A Data communication Protocol for Building Automation and Control Networks is mandatory. Down to the field device level, the EMCS system must meet BACnet standards for system architecture and administration, and use open communication protocols and user friendly programming and graphics. Install the EMCS installed to

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communicate at the supervisory layer to the WAN using the BACnet TCP/IP protocol implemented on Ethernet.

- I. The EMCS system for this facility to be accessible by designated personnel via the WAN for monitoring and programming purposes. The EMCS contractor to provide all the required hardware, software, gateways, etc. needed to permit connection of the EMCS to the WAN. This shall include all hardware, software, programming, start-up and commissioning required. The contractor to supply and install all the required hardware and software on the WAN file server to allow for this remote operation monitoring and programming to take place. The contractor to supply and install all the required hardware and software on the operator workstation(s) located in the Owner's facilities management department. In addition, a remote dial in access directly to the system shall be provided.

4.7 SUBMITTALS

- A. Make submittals in accordance with Section 01 33 00 - Submittal Procedures and 25 05 02 - EMCS: Submittals and Review Process.
- B. Submit for review:
 1. Equipment list and systems manufacturers within ten (10) working days after award of contract.
- C. Quality Control:
 1. Provide equipment and material from manufacturer's regular production, CSA certified, manufactured to standard quoted plus additional specified requirements.
 2. Where CSA certified equipment is not available submit such equipment to inspection authorities for special inspection and approval before delivery to site.
 3. Submit proof of compliance to specified standards with shop drawings and product data in accordance with Section 25 05 02 – EMCS: Submittals and Review Process. Label or listing of specified organization is acceptable evidence.
 4. In lieu of such evidence, submit certificate from testing organization, approved by third party Engineer registered in Canada, certifying that item was tested in accordance with their test methods and that item conforms to their standard/code.
 5. For materials whose compliance with organizational standards/codes/specifications is not regulated by organization using its own listing or label as proof of compliance, furnish certificate stating that material complies with applicable referenced standard or specification.
 6. Permits and fees: in accordance with general conditions of contract.
 7. Existing devices intended for re-use: submit test report.

4.8 QUALITY ASSURANCE

- A. Have local office for at least 5 years staffed by factory trained personnel capable of installing and providing instruction, routine maintenance and

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emergency service on systems.

- B. Provide record of successful previous installations submitting tender showing experience with similar installations utilizing computer-based systems.
- C. Have access to local supplies of essential parts and provide 7 year guarantee of availability of spare parts after obsolescence.
- D. Ensure factory qualified supervisory personnel continuously direct and monitor work and attend site meetings.
- E. Health and Safety:
 - 1. Do construction occupational health and safety in accordance with Section 01 35 29.06 - Health and Safety Requirements.
- F. Be able to provide factory trained personnel on site within two (2) working days notice or provide instructions on maintenance and emergency service on system.
- G. BACnet devices to bear BACnet testing laboratories BTL mark and listed on BACnet manufacturers association web site.

4.9 DELIVERY, STORAGE AND HANDLING

- A. Material Delivery Schedule: provide Owner's Representative with "Materials Delivery Schedule" within 2 weeks after award of contract.
- B. Waste Management and Disposal:
 - 1. Separate waste materials for reuse and recycling in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal.
 - 2. Remove from site and dispose of packaging materials at appropriate recycling facilities.
 - 3. Collect and separate for disposal paper, plastic, polystyrene and corrugated cardboard packaging material in appropriate on-site bins for recycling in accordance with Waste Management Plan.
 - 4. Separate for reuse and recycling and place in designated containers Steel, Metal, Plastic waste in accordance with Waste Management Plan.
 - 5. Place materials defined as hazardous or toxic in designated containers.
 - 6. Handle and dispose of hazardous materials in accordance with CEPA, TDGA, Regional, Municipal, and Provincial regulations.
 - 7. Label location of salvaged material's storage areas and provide barriers and security devices.
 - 8. Ensure emptied containers are sealed and stored safely.
 - 9. Divert unused metal materials from landfill to metal recycling facility as approved by Departmental Representative Owner's Representative.
 - 10. Fold up metal and plastic banding, flatten and place in designated area for recycling

4.10 EXISTING CONDITIONS - CONTROL COMPONENTS

- A. Utilize existing control wiring and piping as indicated.

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- B. Re-use field control devices that are usable in their original configuration provided that they conform to applicable codes, standards and specifications.
 - 1. Do not modify original design of existing devices without written permission from Owner's Representative.
 - 2. Provide for new, properly designed device where re-usability of components is uncertain.
- C. Inspect and test existing devices intended for re-use within 30 days of award of contract, and prior to installation of new devices.
 - 1. Furnish test report to Owner's Representative within 40 days of award of contract listing each component to be re-used and indicating whether it is in good order or requires repair by Owner.
 - 2. Failure to produce test report will constitute acceptance of existing devices by owner.
- D. Non-functioning items:
 - 1. Provide with report specification sheets or written functional requirements to support findings.
 - 2. Owner will repair or replace existing items judged defective yet deemed necessary for EMCS.
- E. Submit written request for permission to disconnect controls and to obtain equipment downtime before proceeding with Work.
- F. Assume responsibility for existing controls to be incorporated into EMCS after written receipt of approval from Owner's Representative.
 - 1. Be responsible for items repaired or replaced by Owner.
 - 2. Be responsible for repair costs due to negligence or abuse of equipment repaired or replaced by Owner.
 - 3. Responsibility for existing devices terminates upon final acceptance of EMCS or applicable portions of EMCS as approved by Owner's Representative.
- G. Remove existing controls not re-used or not required. Place in approved storage for disposition as directed

PART 5 Products

5.1 ACCEPTABLE SYSTEMS, MANUFACTURERS

- A. Proposed system to have communication capability utilizing BACnet Protocol.
- B. Panel to be NEMA rated to suit environmental requirements.
- C. Panels to have hinged doors equipped with standard keyed-alike cabinet locks, keyed to same key.
- D. Wiring within panels to be contained within properly sized rigid PVC slotted wall wire duct. All wiring within the wire duct to be concealed with a non-slip cover.
- E. Terminations for the connection of power wiring, communication wiring and field mounted devices to be at properly identified terminal blocks mounted within the control panel.

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- F. All control panels to be provided with an internally mounted 120 volt duplex power receptacle.
- G. All control panels to be identified with permanently mounted Lamecoid tags to identify the control panel and the systems served by the control panel. Submit schedule of labels with shop drawing submission.
- H. Provide low voltage transformers in panels or elsewhere as required.
- I. Provide adaptors between metric and imperial components.

PART 6 Execution

6.1 MANUFACTURER'S RECOMMENDATIONS

- A. Installation to be to manufacturer's recommendations. Provide printed copies of recommendations with shop drawings or product data.

6.2 PAINTING

- A. Painting to be in accordance with NEMA, supplemented as follows:
- B. Clean and touch up marred or scratched surfaces of factory finished equipment to match original finish.
- C. Restore to new condition, finished surfaces which have been damaged too extensively to be primed and touched up to make good.
- D. Clean and prime exposed hangers, racks, fastenings, and other support components.
- E. Paint all unfinished equipment installed indoors to NEMA.

END OF SECTION

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DIVISON 25 SECTION 250502 DRAWING AND REVIEW PROCESS FOR ENERGY MONITORING AND CONTROL SYSTEMS

PART 7 General

7.1 SUMMARY

- A. Section Includes.
 - 1. Methods and procedures for shop drawings submittals, preliminary and detailed review process include review meetings for building Energy Monitoring and Control System (EMCS).

7.2 RELATED SECTIONS

- 1. The contractor is to ensure that all related work is co-ordinated among all specification sections as well as between all Divisions, and that the tender price includes all related work. The referenced sections below are for guidance only and are not necessarily a complete list of related sections.
 - 1. Section 01 33 00 - Submittal Procedures.
 - 2. Section 25 01 11 - EMCS: Start-up, Verification and Commissioning.
 - 3. Section 25 05 01 - EMCS: General Requirements.

7.3 DEFINITIONS

- A. Acronyms and definitions: refer to Section 25 05 01 - EMCS: General Requirements.

7.4 DESIGN REQUIREMENTS

- A. Preliminary Design Review: to contain following contractor and systems information.
 - 1. Location of local office.
 - 2. Description and location of installing and servicing technical staff.
 - 3. Location and qualifications of programming design and programming support staff.
 - 4. List of spare parts.
 - 5. Location of spare parts stock.
 - 6. Names of sub-contractors and site-specific key personnel.
 - 7. Sketch of site-specific system architecture.
 - 8. Specification sheets for each item including memory provided, programming language, speed, type of data transmission.
 - 9. Descriptive brochures.
 - 10. Sample CDL and graphics (systems schematics).
 - 11. Response time for each type of command and report.
 - 12. Item-by-item statement of compliance.
 - 13. Proof of demonstrated ability of system to communicate utilizing BACnet protocol.

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7.5 SUBMITTALS

- A. Submittals in accordance with Section 01 33 00 - Submittal Procedures and coordinate with requirements in this Section.
- B. Submit preliminary design document within 30 working days after contract award for review by Owner's Representative.
- C. Shop Drawings to consist of 3 hard copies and 1 soft copy of design documents, shop drawings, product data and software.
- D. Hard copy to be completely indexed and coordinated package to assure compliance with contract requirements and arranged in same sequence as specification and cross-referenced to specification section and paragraph number.
- E. Soft copy to be in AutoCAD - latest version and Microsoft Word latest version format, or PDF structured using menu format for easy loading and retrieval on OWS.
- F. Submittals shall consist of:
 - 1. Data sheets of all products.
 - 2. Wiring and piping interconnection diagrams including panel and device power, and sources.
 - 3. List of materials of all proposed devices and equipment.
 - 4. Software documentation:
 - 5. Sequence of operation, in text form.
 - 6. Application programs.
 - 7. Point Schedules
 - 8. Controls schematics and system diagrams.
 - 9. Project installation schedule.
 - 10. Names of subtrades working for EMCS contractor.
 - 11. Mounting support details for components installed in airflow, waterflow and steam systems.
- G. Submit shop drawings in a package which contains the various schedules and drawings which completely describe the control system installed. At a minimum the shop drawing package to contain the following items described in Section 1.4.8 to 1.4.28 as follows:
- H. Network drawing showing the network connection of all network control units, programmable control units, terminal control units and operator workstations to indicate the location of each of these elements.
- I. Schematic control diagram for each system being controlled. Where there are typical systems a drawing to be provided for each system. This drawing to be on a AB size sheet (11 x 17) and shall include a title block which includes as a minimum the drawing title, drawing number, project title, contractor's name, contractor's address, contractor's phone and fax numbers, contractor's project number and a section to provide a record for revision information.
- J. The schematic control diagram to include a bill of materials which provides a list of all part numbers and descriptions for the control components on the drawing list to include field equipment as well as panel mounted components.
- K. The schematic control diagram to include a complete wiring diagram for all electrical

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connections, including motor starters, heating coils, coiling coils etc.

- L. The schematic control diagram to include a layout of the control panels for each system. This layout to show the mounting of all panel equipment, including transformers, power supplies, controllers, transducers, sensors, relays, contactors and any other panel mounted equipment.
- M. The contractor to include with the shop drawing submittal drawings, showing all wiring details for the connections of sensors, transducers, relays and contactors these details to show terminal numbers and be referenced to the appropriate schedules and drawings.
- N. The contractor to supply with the shop drawing package a complete point schedule to show every point connected to the system. This schedule to be in tabular format and provide the point identification, point type, wire tag, termination details reference, referenced drawings, device mounting location and device code numbers.
- O. The point schedule to provide at a minimum the following information on the software attributes of the point:
 - 1. Tag name – ex. EPT-1
 - 2. Point type – ex. AO-3
 - 3. System name – ex. A/C-1
 - 4. Object name – H-VLV.
 - 5. Expanded ID- Heating control valve
 - 6. Units of measurement - %.
- P. The point schedule to provide at a minimum the following information on the digital controller to which the point is connected:
 - 1. Controller type – ex. Unitary controller
 - 2. Controller address ex. 256.
 - 3. Cable destination – the termination at the controller, ex. AO-1.
 - 4. Terminal numbers – the termination at the controller.
- Q. The point schedule to provide at minimum the following information on the control panel:
 - 1. Panel identification
 - 2. Panel location
 - 3. Reference drawing
- R. The point schedule to provide at a minimum the following information on any intermediate device which may be associated with the point:
 - 1. Type of wiring or tubing used
 - 2. Device part number
 - 3. Location of the device.
 - 4. Reference details.
- S. The point schedule to provide at a minimum the following information on any field device which may be associated with the point;
 - 1. Type of wiring or tubing used

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2. Device part number
 3. Location of the devices
 4. Reference details
- T. The contractor to supply with the shop drawing package a complete room schedule, to show the equipment associated with the room controls. Schedule to be in tabular format and provide the room number and location, terminal unit number, part numbers for the terminal unit controller, sensors and actuators. Included on this schedule terminal unit type, size, minimum flow and maximum flow.
- U. Sequence of operation for each system controlled. Sequence to be in complete conformance with the sequence of operations included with this specification. Any changes require the approval of the Owner's Representative in writing. Sequence to include all modes of operation including fail safe, emergency and fire modes.
- V. Valve schedule including design flow, CV, size, type, actuator, pressure drop and maximum shut off pressure differential for each control valve.
- W. Damper schedule including design air flow, size, type actuator and torque requirements for each control damper.
- X. Provide one permanent, not fading, as built copy of each control drawing, enclosed by an aluminium frame with glass cover, or sealed by plastic laminate in rigid metal bound frame. To be installed at each respective control panel location.
- Y. Catalogue cut sheets of all equipment used. This includes, but is not limited to DDC panels, peripherals, sensors, actuators, dampers, control air system components, etc.
- Z. Range and scale information for all transmitters and sensors. This sheet to clearly indicate one device and any applicable options. Where more than one device to be used is on a single sheet, submit two sheets, individually marked.
- AA. Hardware data sheets for all operator workstations, local access panels, and portable operator terminals.
- BB. Software manuals for all applications programs to be provided as a part of the operator workstations, portable operator terminals, programming devices, and so forth for

7.6 PRELIMINARY SHOP DRAWING REVIEW

- A. Submit preliminary shop drawings within 30 working days of award of contract and include following:
1. Specification sheets for each item. To include manufacturer's descriptive literature, manufacturer's installation recommendations, specifications, drawings, diagrams, performance and characteristic curves, catalogue cuts, manufacturer's name, trade name, catalogue or model number, nameplate data, size, layout, dimensions, capacity, other data to establish compliance.
 2. Detailed system architecture showing all points associated with each controller including, signal levels, pressures where new EMCS ties into existing control equipment.
 3. Spare point capacity of each controller by number and type.
 4. Controller locations.
 5. Auxiliary control cabinet locations.

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6. Single line diagrams showing cable routings, conduit sizes, spare conduit capacity between control centre, field controllers and systems being controlled.
7. Valves: complete schedule listing including following information: designation, service, manufacturer, model, point ID, design flow rate, design pressure drop, required Cv, Valve size, actual Cv, spring range, pilot range, required torque, actual torque and close off pressure (required and actual).
8. Dampers: sketches showing module assembly, interconnecting hardware, operator locations, operator spring range, pilot range, required torque, actual torque.
9. Flow measuring stations: complete schedule listing designation, service, point ID, manufacturer, model, size, velocity at design flow rate, manufacturer, model and range of velocity transmitter.
10. Compressor schematic and sizing data.

7.7 DETAIL SHOP DRAWING REVIEW

- A. Submit detailed shop drawings within 60 working days after award of contract and before start of installation and include following:
 1. Corrected and updated versions (hard copy only) of submissions made during preliminary review.
 2. Wiring diagrams.
 3. Piping diagrams and hook-ups.
 4. Interface wiring diagrams showing termination connections and signal levels for equipment to be supplied by others.
 5. Shop drawings for each input/output point, sensors, transmitters, showing information associated with each particular point including:
 - a. Sensing element type and location.
 - b. Transmitter type and range.
 - c. Associated field wiring schematics, schedules and terminations.
 - d. Pneumatic schematics and schedules.
 - e. Complete Point Name Lists.
 - f. Setpoints, curves or graphs and alarm limits (high and low, 3 types critical, cautionary and maintenance), signal range.
 - g. Software and programming details associated with each point.
 - h. Manufacturer's recommended installation instructions and procedures.
 - i. Input and output signal levels or pressures where new systems ties into existing control equipment.
 6. Control schematics, narrative description, CDL's fully showing and describing automatic and manual procedure required to achieve proper operation of project, including under complete failure of EMCS.
 7. Graphic system schematic displays of air and water systems with point identifiers and textual description of system, and typical floor plans as

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- specified.
- 8. Complete system CDL's including companion English language explanations on same sheet but with different font and italics. CDL's to contain specified energy optimization programs.
- 9. Listing of and example of specified reports.
- 10. Listing of time of day schedules.
- 11. Mark up to-scale construction drawing to detail control room showing location of equipment and operator work space.
- 12. Type and size of memory with statement of spare memory capacity.
- 13. Full description of software programs provided.
- 14. Sample of "Operating Instructions Manual" to be used for training purposes.
- 15. Outline of proposed start-up and verification procedures. Refer to Section 25 01 11 – EMCS: Start-up, Verification and Commissioning.

7.8 QUALITY ASSURANCE

- A. Preliminary Design Review Meeting: Convene meeting within 45 working days of award of contract to:
 - 1. Undertake functional review of preliminary design documents, resolve inconsistencies.
 - 2. Resolve conflicts between contract document requirements and actual items (e.g.: points list inconsistencies).
 - 3. Review interface requirements of materials supplied by others.
 - 4. Review "Sequence of Operations".
- B. Contractor's factory trained programmer to attend meeting.
- C. Owner's Representative retains right to revise sequence or subsequent CDL prior to software finalization without cost to Owner.

PART 8 products (NOT used)

PART 9 EXECUTION (NOT USED)

END OF SECTION

SECTION

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DIVISION 25 INTERGRATED AUTOMATION

SECTUIB 250503 – OPERATIONS AND MAINTENANCE MANUAL FOR ENERGY MONITORING AND CONTROL SYSTEMS

General SUMMARY

1. Section Includes.
Requirements and procedures for final control diagrams and operation and maintenance (O&M) manual, for building Energy Monitoring and Control System (EMCS) Work.

RELATED SECTIONS

2. Section 01 78 00 - Closeout Submittals.
3. Section 25 01 11 - EMCS: Start-up, Verification and Commissioning.
4. Section 25 05 01 - EMCS: General Requirements.
5. Section 25 05 02 - EMCS: Submittals and Review Process.

DEFINITIONS

6. BECC - Building Environmental Control Centre.
7. OWS - Operator Work Station.
8. For additional acryonyms and definitions refer to Section 25 05 01 - EMCS: General Requirements

SUBMITTALS

9. Submittals in accordance with Section 01 78 00 - Closeout Procedures, supplemented and modified by requirements of this Section.
10. Submit Record Documents, As-built drawings, Operation and Maintenance Manual to Owner's Representative in English.
11. Provide soft copies and hard copies in hard-back, 50 mm 3 ring, D-ring binders. Binders to be 2/3 maximum full.
Provide index to full volume in each binder.
Identify contents of each manual on cover and spine.
Provide Table of Contents in each manual.
Assemble each manual to conform to Table of Contents with tab sheets placed before instructions covering subject.

AS-BUILTS

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12. Provide 1 copy of detailed shop drawings generated in Section 25 05 02 - EMCS: Submittals and Review Process and include:
Changes to contract documents as well as addenda and contract extras.
Changes to interface wiring.
Routing of conduit, wiring and control air lines associated with EMCS installation.
Locations of obscure devices to be indicated on drawings.
Listing of alarm messages.
Panel/circuit breaker number for sources of normal/emergency power.
Names, addresses, telephone numbers of each sub-contractor having installed equipment, local representative for each item of equipment, each system.
Test procedures and reports: provide records of start-up procedures, test procedures, checkout tests and final commissioning reports as specified in Section 25 01 11 - EMCS: Start-up, Verification and Commissioning.
Basic system design and full documentation on system configuration.

13. Submit for final review by Owner's Representative.

14. Provide before acceptance 4 hard and 1 soft copy incorporating changes made during final review.

O&M MANUALS

15. Custom design O&M Manuals (both hard and soft copy) to contain material pertinent to this project only, and to provide full and complete coverage of subjects referred to in this Section.
16. Provide 2 complete sets of hard and soft copies prior to system or equipment tests.
17. Include complete coverage in concise language, readily understood by operating personnel using common terminology of functional and operational requirements of system. Do not presume knowledge of computers, electronics or in-depth control theory.
18. Functional description to include:
Functional description of theory of operation.
Design philosophy.
Specific functions of design philosophy and system.
Full details of data communications, including data types and formats, data processing and disposition data link components, interfaces and operator tests or self-test of data link integrity.
Explicit description of hardware and software functions, interfaces and requirements for components in functions and operating modes.
Description of person-machine interactions required to supplement system description, known or established constraints on system operation, operating procedures currently implemented or planned for implementation in automatic mode.
19. System operation to include:
Complete step-by-step procedures for operation of system including required actions at

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each OWS.

Operation of computer peripherals, input and output formats.

Emergency, alarm and failure recovery.

Step-by-step instructions for start-up, back-up equipment operation, execution of systems functions and operating modes, including key strokes for each command so that operator need only refer to these pages for keystroke entries required to call up display or to input command.

20. Software to include:

Documentation of theory, design, interface requirements, functions, including test and verification procedures.

Detailed descriptions of program requirements and capabilities.

Data necessary to permit modification, relocation, reprogramming and to permit new and existing software modules to respond to changing system functional requirements without disrupting normal operation.

Software modules, fully annotated source code listings, error free object code files ready for loading via peripheral device

Complete program cross reference plus linking requirements, data exchange requirements, necessary subroutine lists, data file requirements, other information necessary for proper loading, integration, interfacing, program execution.

Software for each Controller and single section referencing Controller common parameters and functions.

21. Maintenance: document maintenance procedures including inspection, periodic preventive maintenance, fault diagnosis, repair or replacement of defective components, including calibration, maintenance, repair of sensors, transmitters, transducers, controller and interface firmware, plus diagnostics and repair/replacement of system hardware.

22. System configuration document:

Provisions and procedures for planning, implementing and recording hardware and software modifications required during operating lifetime of system.

Information to ensure co-ordination of hardware and software changes, data link or message format/content changes, sensor or control changes in event that system modifications are required.

23. Programmer control panel documentation: provide where panels are independently interfaced with BECC, including interfacing schematics, signal identification, timing diagrams, fully commented source listing of applicable driver/handler.

products (NOT USED)

EXECUTION (NOT USED)

END OF SECTION

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DIVISION 25 – INTEGRATED AUTOMATION

SECTION 250554 – IDENTIFICATION PROCEDURES FOR ENERGY MONITORING AND CONTROL SYSTEMS

General SUMMARY

1. Section Includes.
Requirements and procedures for identification of devices, sensors, wiring, tubing, conduit and equipment, for building Energy Monitoring and Control System (EMCS) Work and nameplates, materials, colours and lettering sizes.

RELATED SECTIONS

2. Section 01 33 00 - Submittal Procedures.
3. Section 25 05 01 - EMCS: General Requirements.

REFERENCES

4. Canadian Standards Association (CSA International).
CSA C22.1, The Canadian Electrical Code, Part I, Safety Standard for Electrical Installations.

DEFINITIONS

5. For acronyms and definitions refer to Section 25 05 01 - EMCS: General Requirements.

SYSTEM DESCRIPTION

6. Language Operating Requirements: provide identification for control items in English.

SUBMITTALS

7. Submittals in accordance with Section 01 33 00 - Submittal Procedures and Section 25 05 02 – EMCS: Submittals and Review Process supplemented and modified by requirements of this Section.
8. Submit to Owner's Representative for approval samples of nameplates, identification tags and list of proposed wording.

Products

NAMEPLATES FOR PANELS

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9. Identify by plastic laminate, 3 mm thick melamine, matt white finish, black core, square corners, lettering accurately aligned and engraved into core, mechanically attached with self-tapping screws.

10. Sizes: 25 x 67 mm minimum.

11. Lettering: minimum 7 mm high, black.

12. Inscriptions: machine engraved to identify function.

NAMEPLATES FOR FIELD DEVICES

13. Identify by plastic encased cards attached by plastic tie.

14. Sizes: 50 x 100 mm minimum.

15. Lettering: minimum 5 mm high produced from laser printer in black.

16. Data to include: point name and point address, make, model number.

17. Companion cabinet: identify interior components using plastic enclosed cards with point name and point address.

NAMEPLATES FOR ROOM SENSORS

18. Identify by stick-on labels using point identifier.

19. Location: as directed by Owner's Representative.

20. Letter size: to suit, clearly legible.

WARNING SIGNS

21. Equipment including motors, starters under remote automatic control: supply and install orange coloured signs warning of automatic starting under control of EMCS.

22. Sign to read: "Caution: This equipment is under automatic remote control of EMCS" as reviewed by Owner's Representative.

WIRING

23. Supply and install numbered tape markings on wiring at panels, junction boxes, splitters, cabinets and outlet boxes.

24. Colour coding: to CSA C22.1. Use colour coded wiring in communications cables, matched throughout system.

25. Power wiring: identify circuit breaker panel/circuit breaker number inside each EMCS panel.

PNEUMATIC TUBING

26. Numbered tape markings on tubing to provide uninterrupted tracing capability.

CONDUIT

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- 27. Colour code EMCS conduit.
- 28. Pre-paint box covers and conduit fittings.
- 29. Coding: use fluorescent orange paint and confirm colour with Owner's Representative during "Preliminary Design Review".

Execution

NAMEPLATES AND LABELS

- 30. Ensure that manufacturer's nameplates, CSA labels and identification nameplates are visible and legible at all times.

EXISTING PANELS

- 31. Correct existing nameplates and legends to reflect changes made during work.

END OF SECTION

SECTION

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DIVISION 25 INTERGRATED AUTOMATION

SECTION 250560 ENERGY MONITORING AND CONTROL SYSTEMS – FIELD INSTALLATION

General

RELATED SECTIONS

1. Section 01 11 00 – Summary of Work.
2. Section 01 73 00 – Execution Requirements.
3. Section 07 84 00 – Firestopping.
4. Section 21 05 01 – Common Work Results for Mechanical.
5. Section 21 07 19 – Thermal Insulation of Piping.
6. Section 22 13 16.13 – Sanitary Waste and Vent Piping – Cast Iron and Copper.
7. Section 23 05 05 – Installation of Pipework.
8. Section 23 05 29 – Hangers and Supports for HVAC Piping and Equipment.
9. Section 23 07 13 – Duct Insulation.
10. Section 23 21 13.02 – Hydronic Systems: Steel.
11. Section 23 23 00 – Copper Tubing and Fittings Refrigerant.
12. Section 25 05 01 – EMCS: General Requirements.
13. Section 26 05 00 – Common Work Results-Electrical.

REFERENCES

14. American National Standards Institute (ANSI)
ANSI/ASME B16.22, Wrought Copper and Copper Alloy Solder Joint Pressure Fittings.
ANSI C2, National Electrical Safety Code.
ANSI/NFPA 70, National Electrical Code.
15. Canadian Standards Association (CSA)
CSA C22.1, Canadian Electrical Code, Part 1.
CAN/CSA C22.3 No.1, Overhead Systems.
CSA C22.3 No. 7, Underground Systems.

SYSTEM DESCRIPTION

16. Electrical:
Provide power wiring from emergency power panels where emergency power is provided to EMCS field panels. If no emergency power provided, install UPS Device. Circuits to be for exclusive use of EMCS equipment. Panel breakers to be identified on

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panel legends tagged and locks applied to breaker switches.

Hard wiring between field control devices and EMCS field panels.

Communication wiring between EMCS field panels and OWS's including main control centre BECC.

Modify existing starters to provide for EMCS as indicated in I/O Summaries and as indicated.

Refer to wiring diagrams included as part of flow diagrams. Trace existing control wiring installation and provide updated wiring schematics including additions and/or deletions to control circuits for approval by Owner's Representative before commencing work.

All control wiring 50 V and less for equipment supplied by Division 25 will be the responsibility of Division 25- Integrated Automation Contractor. Conduit and wire associated with this is the responsibility of Division 25.

17. Pneumatic:

Pneumatic tubing, valves and fittings for field control devices.

18. Mechanical:

Pipe taps required for EMCS equipment will be supplied and installed by Mechanical Division.

Wells and control valves shall be supplied by EMCS Contractor and installed by Mechanical.

Installation of air flow stations, dampers, and other devices requiring sheet metal trades to be mounted by Mechanical. Costs to be carried by designated trade.

19. VAV Terminal Units.

Air flow probe for VAV boxes to be supplied and installed under Mechanical Division.

Air flow dp sensor, actuator and associated VAV controls to be supplied and installed by EMCS contractor. Tubing from air probe to dp sensor as well as installation and adjustment of air flow sensors and actuators to be the responsibility of EMCS contractor.

Coordinate air flow adjustments with balancing trade.

20. Structural:

Special steelwork as required for installation of work.

PERSONNEL QUALIFICATIONS

21. Qualified factory trained supervisory personnel to:

Continuously direct and monitor all work.

Attend site meetings.

EXISTING CONDITIONS

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22. Cutting and Patching: refer to Section 01 73 00 – Execution Requirements supplemented as specified herein.

23. Repair all surfaces damaged during execution of work.

24. Turn over to Owner's Representative existing materials removed from work not identified for re-use.

Products

PIPING

25. Domestic H&CWS: refer to Section 22 11 18-Domestic Water Piping Copper and Section 22 11 18.01 – Domestic Water Piping Plastic.

26. Sanitary, storm water: refer to Section 22 13 16.13 – Sanitary Waste and Vent Piping – Cast Iron and Copper, and Section 22 13 16.16 – Sanitary Waste and Vent Piping – Plastic.

27. Hot water heating, chilled water: refer to Section 23 21 13.02 – Hydronic Systems: Steel and Section 23 20 12 Pressure Piping – Plastic.

28. Condenser water: refer to Section 23 21 13 02– Hydronic Systems: Steel.

29. Refrigeration: refer to Section 23 23 00 - Refrigerant Piping.

30. Sleeves, escutcheons: refer to Section 23 05 05 – Installation of Pipework.

31. Hangers and supports: refer to Section 23 05 29– Hangers and Supports for HVAC Piping and Equipment.

32. Insulation: refer to Section 21 07 19 – Thermal Insulation for Piping and 23 07 13 – Thermal Insulation for Ducting.

SPECIAL SUPPORTS

33. Structural grade steel, primed and painted after construction and before installation.

PIPING FOR PNEUMATIC CONTROL SYSTEMS

34. Copper:

Tubing: Type L Hard Drawn

Fittings: wrought copper solder type to ANSI/ASME B16.22, and 95.5 antimonial tin solder. At instruments use compression fittings.

At panels and junction boxes where there is a transition from plastic to copper use bulkhead fittings.

35. Plastic:

Flame retardant, black PVC with minimum burst strength 1.3 MPa at 23EC installed in conduit.

Fittings: compression or barbed type as required.

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WIRING

- 36. As per requirements of Electrical Divisions.
- 37. For 50V and above copper conductor with chemically cross-linked thermosetting polyethylene insulation rated RW90 and 600V. Colour code to CSA 22.1.
- 38. For wiring under 50 volts use FT6 rated wiring where wiring is not run in conduit. All other cases use FT4 wiring.
- 39. Sizes:
120V Power supply: to match or exceed breaker, size #12 minimum.
Wiring for safeties/interlocks for starters, motor control centres, to be stranded, #14 minimum.
Field wiring to digital device: #18AWG or 20AWG stranded twisted pair.
Analog input and output: shielded #18 minimum solid copper or #20 minimum stranded twisted pair. Wiring must be continuous without joints.
More than 4 conductors: #22 minimum solid copper.
- 40. Terminations:
Terminate wires with screw terminal type connectors suitable for wire size, and number of terminations.

CONDUIT

- 41. As per requirements of Electrical Division.
- 42. Electrical metallic tubing to CSA C22.2 No. 03. Flexible and liquid tight flexible metal conduit to CSA C22.2 No.56. Rigid steel threaded conduit to CSA C22.2 No. 45.
- 43. Junction and pull boxes: welded steel.
Surface mounting cast FS: screw-on flat covers.
Flush mounting: covers with 25 mm minimum extension all round.
- 44. Cabinets: sheet steel, for surface mounting, with hinged door, latch lock, 2 keys, complete with perforated metal mounting backboard. Panels to be keyed alike for similar functions and or entire contract as approved.
- 45. Outlet boxes: 100 mm minimum, square.
- 46. Conduit boxes, fittings:
Bushings and connectors: with nylon insulated throats.
With push pennies to prevent entry of foreign materials.
- 47. Fittings for rigid conduit:
Couplings and fittings: threaded type steel.
Double locknuts and insulated bushings: use on sheet metal boxes.
Use factory "ells" where 90 degree bends required for 25 mm and larger conduits.

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48. Fittings for thin wall conduit:
Connectors and couplings: steel, set screw type.

WIRING DEVICES, COVER PLATES

49. Conform to CSA.
50. Receptacles:
Duplex: CSA type 5-15R.
Single: CSA type 5-15R.
Cover plates and blank plates: finish to match other plates in area.

SUPPORTS FOR CONDUIT, FASTENINGS, EQUIPMENT

51. Solid masonry, tile and plastic surfaces: lead anchors or nylon shields.
Hollow masonry walls, suspended drywall ceilings: toggle bolts.
52. Exposed conduits or cables:
50 mm diameter and smaller: one-hole steel straps.
Larger than 50 mm diameter: two-hole steel straps.
53. Suspended support systems:
Individual cable or conduit runs: support with 6 mm diameter threaded rods and support clips.
Two or more suspended cables or conduits: support channels supported by 6 mm diameter threaded rod hangers.

Execution

INSTALLATION

54. Install equipment, components so that manufacturer's and CSA labels are visible and legible after commissioning is complete.

PIPING

55. Domestic H&CWS: refer to Section 22 11 18 –Domestic Water Piping Copper.
56. Sanitary, storm water: refer to 22 13 16.13 – Sanitary Waste and Vent Piping – Cast Iron and Copper.
57. Hot water heating, chilled water: refer to Section 23 21 13.02 – Hydronic Systems: Steel.
58. Condenser water: refer to Section 23 21 13.02 – Hydronic Systems: Steel.
59. Refrigeration: refer to Section 23 23 00 - Copper Tubing and Fittings Refrigerant.
60. Insulation: refer to Section 21 07 19 – Thermal Insulation for Piping and 23 07 13 – Thermal Insulation for Ducting.

MECHANICAL PIPING

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61. Install piping in accordance with Section 23 05 05 – Installation of Pipework.

SUPPORTS

62. Install special supports as required and as indicated.

PNEUMATIC CONTROL SYSTEMS

63. General:

Install tubing in accessible concealed locations, straight, parallel and close to building structure with required grades for drainage and venting.

Install drip legs and drains at low points.

Tubing to be free from surface damage.

Tubing NOT to pass through or touch unheated ducts or enclosures.

Do not cover pneumatic tubing with insulation.

Test tubing, check joints after connection to system.

64. Copper tubing:

Not to come into contact with dissimilar metal. Use non-metallic stand-offs on air handling systems.

Install dielectric couplings where dissimilar metals are connected.

Plastic tubing:

Inaccessible locations: install plastic tubing in conduit.

Inside panels: install in tube trays or racks, or clip individually to back of panel.

Multiple tube bundles: install in tube trays, conduit or armoured flexible cable.

ELECTRICAL GENERAL

65. Do complete installation in accordance with requirements of:

Electrical Divisions, this specification.

CSA 22.1 Canadian Electrical Code, latest edition.

ANSI/NFPA 70.

ANSI C2.

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- 66. Fully enclose or properly guard electrical wiring, terminal blocks, high voltage (above 50 V) contacts and mark to prevent accidental injury.
- 67. Do underground installation to CAN/CSA C22.3 No.7, except where otherwise specified.
- 68. Conform to manufacturer's recommendations for storage, handling and installation.
- 69. Check factory connections and joints. Tighten where necessary to ensure continuity.
- 70. Install electrical equipment between 1000 and 2000 mm above finished floor wherever possible and adjacent to related equipment.
- 71. Protect exposed live equipment such as panel, mains, outlet wiring during construction for personnel safety.
- 72. Shield and mark live parts "LIVE 120 VOLTS" or other appropriate voltage.
- 73. Install conduits, and sleeves prior to pouring of concrete.
- 74. Holes through exterior wall and roofs: flash and make weatherproof.
- 75. Make necessary arrangements for cutting of chases, drilling holes and other structural work required to install electrical conduit, cable, pull boxes, outlet boxes.
- 76. Install cables, conduits and fittings which are to be embedded or plastered over, neatly and closely to building structure to minimize furring.

CONDUIT SYSTEM

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77. Communication wiring shall be installed in conduit. Provide complete conduit system to link Building Controllers to BECC. Conduit sizes to suit wiring requirements and to allow for future expansion capabilities specified for systems. Maximum conduit fills not to exceed 40%. Design drawings do not show conduit layout.
78. Install conduits parallel or perpendicular to building lines, to conserve headroom and to minimize interference.
79. Do not run exposed conduits in normally occupied spaces unless otherwise indicated or unless impossible to do otherwise. Obtain approval from Owner's Representative before starting such work. Provide complete conduit system to link field panels and devices with main control centre. Conduit size to match conductors plus future expansion capabilities as specified.
80. Locate conduits at least 150 mm from parallel steam or hot water pipes and at least 50 mm at crossovers.
81. Bend conduit so that diameter is reduced by less than 1/10th original diameter.
82. Field thread on rigid conduit to be of sufficient length to draw conduits up tight.
83. Limit conduit length between pull boxes to less than 30 m.
84. Use conduit outlet boxes for conduit up to 32 mm diameter and pull boxes for larger sizes.
85. Fastenings and supports for conduits, cables, and equipment:
Provide metal brackets, frames, hangers, clamps and related types of support structures as indicated and as required to support cable and conduit runs.
Provide adequate support for raceways and cables, sloped vertically to equipment.
Use supports or equipment installed by other trades for conduit, cable and raceway supports only after written approval from Owner's Representative.
86. Install polypropylene fish cord in empty conduits for future use.
87. Where conduits become blocked, remove and replace blocked sections.
88. Pass conduits through structural members only after receipt of Owner's Representative's written approval.
89. Conduits may be run in flanged portion of structural steel.
90. Group conduits wherever possible on suspended or surface channels.
91. Pull boxes:
Install in inconspicuous but accessible locations.
Support boxes independently of connecting conduits.
Fill boxes with paper or foam to prevent entry of construction material.
Provide correct size of openings. Reducing washers not permitted.

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Mark location of pull boxes on record drawings.

Identify AC power junction boxes, by panel and circuit breaker.

92. Install terminal blocks or strips indicated in cabinets to Electrical Division.

93. Install bonding conductor for 120 volt and above in conduit.

WIRING

94. Install multiple wiring in ducts simultaneously.

95. Do not pull spliced wiring inside conduits or ducts.

96. Use CSA certified lubricants of type compatible with insulation to reduce pulling tension.

97. Tests: use only qualified personnel. Demonstrate that:

Circuits are continuous, free from shorts, unspecified grounds.

Resistance to ground of all circuits is greater than 50 Megohms.

98. Provide Owner's Representative with test results showing locations, circuits, results of tests.

99. Remove insulation carefully from ends of conductors and install to manufacturer's recommendations. Accommodate all strands in lugs. Where insulation is stripped in excess, neatly tape so that only lug remains exposed.

100. Wiring in main junction boxes and pull boxes to terminate on terminal blocks only, clearly and permanently identified. Junctions or splices not permitted for sensing or control signal covering wiring.

101. Do not allow wiring to come into direct physical contact with compression screw.

102. Install ALL strands of conductor in lugs of components. Strip insulation only to extent necessary for installation.

WIRING DEVICES, COVER PLATES

103. Receptacles:

Install vertically in gang type outlet box when more than one receptacle is required in one location.

Cover plates:

Install suitable common cover plate where wiring devices are grouped.

Use flush type cover plates only on flush type outlet boxes.

STARTERS, CONTROL DEVICES

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- 104. Install and make control connections as indicated. Power connections above 50V by Electrical Division.
- 105. Install correct over-current devices.
- 106. Identify each control wire, terminal for external connections with permanent number marking identical to diagram.
- 107. Performance Verification:
Operate switches and controls to verify functioning.
Perform start and stop sequences of contactors and relays.
Check that interlock sequences, with other separate related starters, equipment and auxiliary control devices, operate as specified.

GROUNDING

- 108. Install complete, permanent, continuous grounding system for equipment, including conductors, connectors and accessories.
- 109. Install separate grounding conductors in conduit within building.
- 110. Install ground wire in all PVC ducts and in tunnel conduit systems.
- 111. Tests: perform ground continuity and resistance tests, using approved method appropriate to site conditions.

TESTS

- 112. General:
Perform following tests in addition to tests specified Section 25 08 20 - EMCS: Warranty and Maintenance.
Give 14 days written notice of intention to test.
Conduct in presence of Owner's Representative and authority having jurisdiction.
Conceal work only after tests satisfactorily completed.
Report results of tests to Owner's Representative in writing.
Preliminary tests:

Conduct as directed to verify compliance with specified requirements.

Make needed changes, adjustments, replacements.

Insulation resistance tests:

Megger all circuits, feeders, equipment for 120 - 600V with 1000V instrument. Resistance to ground to be more than required by Code before energizing.

Test insulation between conductors and ground, efficiency of grounding system to satisfaction of Owner's Representative and authority having jurisdiction.

IDENTIFICATION

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113. Refer to Section 25 05 54- EMCS: Identification.

END OF SECTION

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DIVISION 25 INTEGRATED AUTOMATION

SECTION 250820 WARRENTIES AN MAINTENANCE OF ENERGY AND MONTORING AND CONTROL SYSTEMS

General SUMMARY

1. Section Includes.
Requirements and procedures for warranty and activities during warranty period and service contracts, for building Energy Monitoring and Control System (EMCS).

RELATED SECTIONS

- Section 01 33 00 - Submittal Procedures.
- Section 01 78 00 - Closeout Submittals.
- Section 25 05 01 - EMCS: General Requirements.

REFERENCES

- Canada Labour Code (R.S., c. L-2)/Part I - Industrial Relations.
- Canadian Standards Association (CSA)
CSA Z204 – Guidelines for Managing Indoor Quality in Buildings

DEFINITIONS

2. OWS - Operator Work Station.
3. For additional acronyms and definitions refer to Section 25 05 01 - EMCS: General Requirements.

SUBMITTALS

4. Submittals in accordance with Section 01 33 00 - Submittal Procedures.
5. Submit detailed preventative maintenance schedule for system components to Owner's Representative.
6. Submit detailed inspection reports Owner's Representative.
7. Submit dated, maintenance task lists to Owner's Representative and include the following sensor and output point detail, as proof of system verification:
Point name and location.
Device type and range.
Measured value.
System displayed value.
Calibration detail
Indication if adjustment required,
Other action taken or recommended.

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8. Submit network analysis report showing results with detailed recommendations to correct problems found.

9. Records and logs: in accordance with Section 01 78 00 - Closeout Submittals. Maintain records and logs of each maintenance task on site. Organize cumulative records for each major component and for entire EMCS chronologically. Submit records to Owner's Representative, after inspection indicating that planned and systematic maintenance have been accomplished.

10. Revise and submit to Owner's Representative in accordance with Section 01 78 00 - Closeout Submittals "As-built drawings" documentation and commissioning reports to reflect changes, adjustments and modifications to EMCS made during warranty period.

MAINTENANCE SERVICE DURING WARRANTY PERIOD

11. Provide services, materials, and equipment to maintain EMCS for warranty period of one year after date of substantial completion. Provide detailed preventative maintenance schedule for system components as described in Submittal article.

12. Emergency Service Calls:
Initiate service calls when EMCS is not functioning correctly.
Qualified control personnel to be available during warranty period to provide service to "CRITICAL" components whenever required at no extra cost.
Furnish Owner's Representative with telephone number where service personnel may be reached at any time.
Service personnel to be on site ready to service EMCS after receiving request for service.
Perform work continuously until EMCS restored to reliable operating condition.

13. Operation: foregoing and other servicing to provide proper sequencing of equipment and satisfactory operation of EMCS based on original design conditions and as recommended by manufacturer.

14. Work requests: record each service call request, when received separately on approved form and include:
Serial number identifying component involved.
Location, date and time call received.
Nature of trouble.
Names of personnel assigned.
Instructions of work to be done.
Amount and nature of materials used.
Time and date work started.
Time and date of completion.

15. Provide system modifications in writing.
No system modification, including operating parameters and control settings, to be made without prior written approval of Owner's Representative.

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SERVICE CONTRACTS

16. Provide in-depth technical expertise and assistance to Owner's Representative and Commissioning Manager in preparation and implementation of service contracts and in-house preventive maintenance procedures. Service contracts duration is for the warranty period.

17. Service Contracts to include:
Annual verification of field points for operation and calibration.
4 visits per year.
2 responses to emergency calls during day, per year.
2 responses to emergency calls during silent hours, per year.
Silent hours defined as 1630 h – 0800 h and on weekends and statutory holidays.
Complete inventory of installed system.

Products (Not USED)

Execution

FIELD QUALITY CONTROL

18. Perform as minimum (3) three minor inspections and one major inspection (more often if required by manufacturer) per year. Provide detailed written report to Owner's Representative as described in Submittal article.

19. Perform inspections during regular working hours, 0800 to 1630 h, Monday through Friday, excluding statutory holidays.

20. Following inspections are minimum requirements and should not be interpreted to mean satisfactory performance:
Perform calibrations using test equipment having traceable, certifiable accuracy at minimum 50% greater than accuracy of system displaying or logging value.
Check and calibrate random sample of 10% field input/output devices in accordance with Canada Labour Code - Part I and CSA Z204.
Provide dated, maintenance task lists, as proof of execution of complete system verification.

21. Minor inspections to include, but not limited to:
Perform visual, operational checks to BC's, peripheral equipment, interface equipment and other panels.
Check equipment cooling fans as required.
Visually check for mechanical faults, air leaks and proper pressure settings on pneumatic components.
Review system performance with Operations Supervisor and/or Owner's Representative to discuss suggested or required changes.

22. Major inspections to include, but not limited to:
Minor inspection.
Clean OWS(s) peripheral equipment, BC(s), interface and other panels, micro-processor interior and exterior surfaces.
Check signal, voltage and system isolation of BC(s), peripherals, interface and other

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panels.

Verify calibration/accuracy of each input and output device and recalibrate or replace as required (as per 3.1. 3.2).

Provide mechanical adjustments, and necessary maintenance on printers.

Run system software diagnostics as required.

Install software and firmware enhancements to ensure components are operating at most current revision for maximum capability and reliability.

Perform network analysis and provide report as described in Submittal article.

23. Rectify deficiencies revealed by maintenance inspections and environmental checks.

24. Continue system debugging and optimization.

25. Testing/verification of occupancy and seasonal-sensitive systems to take place during four (4) consecutive seasons, after facility has been accepted, taken over and fully occupied.

Test weather-sensitive systems twice: first at near winter design conditions and secondly under near summer design conditions.

END OF SECTION

SECTION

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DIVISION 25 INTEGRATED AUTOMATION

SECTION 251001 LAN REQUIREMENTS FOR EMCS

General SUMMARY

1. Section Includes:
System requirements for Local Area Network (LAN) for Building Energy Monitoring and Control System (EMCS).
2. Related Sections:
Section 25 05 01 – EMCS: General Requirements.

REFERENCES

3. Canadian Standards Association (CSA International).
CSA T529, Telecommunications Cabling Systems in Commercial Buildings (Adopted ANSI/TIA/EIA-568-A with modifications.
CSA T530, Commercial Building Standard for Telecommunications Pathways and Spaces (Adopted ANSI/TIA/EIA – 569-A with modifications.
4. Institute of Electrical and Electronics Engineers (IEEE)/Standard for Information Technology – Telecommunications and information exchange between systems – Local and metropolitan area networks – Specific requirements.
IEEE Std 802.3TM, Part 3: Carrier sense multiple access with collision detection (CSMA/CD) access method and physical layer specifications.
5. Telecommunications Industries Association (TIA)/Electronic Industries Alliance (EIA).
TIA/EIA-568, Commercial Building Telecommunications Cabling Standards Set, Part 1 General Requirements, Part 2 Balanced Twisted- Pair Cabling Components, Part 3 Optical Fiber Cabling Components Standard.
TIA/EIA-569-A, Commercial Building Standard for Telecommunications Pathways and Spaces.
6. Treasury Board Information Technology Standard (TBITS).
TBITS 6.9, Profile for the Telecommunications Wiring System in Government Owned and Leased Buildings-Technical Specifications.

DEFINITIONS

7. Acronyms and definitions: refer to Section 25 05 01 – EMCS: General Requirements.

SYSTEM DESCRIPTION

8. Data communication network to link Operator Workstations and Master Control Units (MCU) in accordance with CSA T529, TIA/EIA-568, CSA T530 and TIA/EIA-569-A.
Provide reliable and secure connectivity of adequate performance between different sections segments of network.

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Allow for future expansion of network, with selection of networking technology and communication protocols.

9. Data communication network to included, but not limited to:

EMCS-LAN.

Modems.

Network interface cards.

Network management hardware and software.

Network components necessary for complete network.

DESIGN REQUIREMENTS

10. EMCS Local Area Network (EMCS-LAN).

High Speed, high performance, local area network over MS/TP with MCUs and OWSs communicate with each other directly on peer to peer basis in accordance with IEEE 802.3/Ethernet Standard.

EMCS-LAN to be: BACnet Protocol

Each EMCS-LAN to be capable of supporting at least 50 devices.

Support of combination of MCUs and OWSs directly connected to EMCS-LAN.

High speed data transfer rates for alarm reporting, quick report generation from multiple controllers, upload/download information between network devices. Bit rate to be 10 Megabits per second minimum.

Detection and accommodation of single or multiple failures of either OWSs, MCUs or network media. Operational equipment to continue to perform designated functions effectively in event of single or multiple failures.

Commonly available, multiple sourced, networking components and protocols to allow system to co-exist with other networking applications including office automation.

11. Dynamic Data Access.

LAN to provide capabilities for OWSs, either network resident or connected remotely to access point status and application report data or execute control functions for other devices via LAN.

Access to data to be based upon logical identification of building equipment.

12. Network Medium.

Network medium: twisted cable, shielded twisted cable, or fibre optic cable compatible with network protocol to be used within buildings. Fibre optic cable to be used between buildings.

PRODUCTS (NOT USED)

EXECUTION (NOT USED)

END OF SECTION

SECTION

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DIVISION 25 -INTEGRATED AUTOMATION

SECTION 251002 HARDWARD AND SOFTWARE FOR EMCS WORKSTATIONS

General

SUMMARY

1. Section includes:
Hardware and software requirements for an Operator Work Station (OWS) in a Building Energy Monitoring and Control System (EMCS).

RELATED SECTIONS

2. Section 25 05 01 – EMCS: General Requirements.
3. Section 25 05 02 – EMCS: Submittals and Review Process.
4. Section 25 05 03 – EMCS: Project Record Documents.
5. Section 25 30 01 – EMCS: Building Controllers.
6. Section 25 90 01 – EMCS: Site Requirements, Applications and Systems Sequences of Operation.

DEFINITIONS

7. Acronyms and definitions: refer to Section 25 05 01 - EMCS: General Requirements.
8. Remote Auxiliary OWS: performs identical user interface functions as primary OWS.

OWS SYSTEM DESCRIPTION

9. Consists of commercial personal computer (must be in current production) with sufficient memory and processor capacity to perform all functions specified.

SUBMITTALS

10. In accordance with Section 25 05 02 - EMCS: Submittals and Review Process.

ENVIRONMENTAL CONDITIONS

11. OWS to operate in conditions of 10 EC to 32 EC and 20 % to 90 % non-condensing RH.

MAINTENANCE

12. In accordance with Section 25 08 20 – EMCS: Warranty and Maintenance and Section 25 05 03 - EMCS: Project Records Documents.

Products

OWS HARDWARE

13. PC system to include:
Processor to be Intel i5 micro-processor, operating at clock speed of 2.2 GHz minimum, capable of supporting software necessary to perform functions specified in this section.

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System backplane bus (1066 Megahertz) to support PCI boards.

Internal clock

Uninterruptible clock having accuracy of plus or minus 5 seconds/ month, capable of deriving year/month/day/hour/minute/second.

Rechargeable batteries to provide minimum 48 h clock operation in event of power failure.

Asynchronous interfaces for connection to listed peripheral devices including LAN and remote devices.

14. Power supply unit to accept 120 V 60 Hz source and include line surge and low voltage protection for processor and its peripherals.

15. Include UPS to provide 30 minutes minimum operation of PC, CRT and communication and peripheral devices. This shall apply to fixed (non portable) OWS and peripherals.

OWS PC COMPONENTS

16. Components:

Processor: Intel™ i5`.

Operating System: Genuine Windows 7 Pro.

Monitors: Dell, 22" Widescreen flat panel.

Memory: 8 GB Dual Channel DDR3 SDRAM – 2 DIMMs.

Hard Drives: 1 Tb Serial ATA 3 Gb/s Hard Drive (7200 RPM) w/DataBurst Cache™.

CD or DVD Drive: 8x DVD+/-RW Drive.

Video Cards: Integrated.

Sound Cards: Integrated.

Network Card: Integrated Ethernet.

Office Productivity Software (Pre-Installed): Microsoft® Office – Includes MS WORD 2010, + more.

Keyboard: Dell USB Keyboard.

Mouse: Del Optical USB Mouse.

Hardware Support Services: 2 Year Next Business Day Onsite/In Home Service and Tech Support.

Power Protection: Belkin 7-Outlet Desktop Surge Protector.

Ports, Slots and Chassis:

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Externally Accessible:

Video: DVI/Display Port.

USB: 8 Ports (2 Front, 6 Back) + 1 Internal, with minimum of four (4) 3.0 ports.

Audio: Audio – Six back-panel connectors for line-in, line-out, microphone, rear surround, side surround, SPDIF interface in rear, two front-panel connectors for headphones/microphone, integrated 7.1 channel sound.
Additional Jacks: 1 front headphone jack and 1 front / 1 back microphone jack.

Network: Integrated Ethernet.

Integrated 10/100/1000 Gigabit network interface.

Expansion Slots.

Half-height PCIe x 1.

Half-height PCIe x 16 (Graphics).

Power Supply

275 Watt DC Power Supply.

Voltage: 200 to 240 V and 100 to 120 V at 50/60 Hz.

Backup battery: 3-V CR2032 lithium coin cell.

Chassis:

3.5" Bays: 2 bays (one external; one internal)

5.25 Bays: 1 Slimline bays.

Memory DIMM slots: 4 available.

Dimensions and Weight:

H: 31.5 cm (12.5")

W: 9.4 cm (3.7")

D: 36.5 cm (14.5")

Weight: 7.7 kg (16.4 lbs)

PRINTERS

17. Print to file.

CONTROL DESK CONSOLE

18. Capable of accommodating OWS and peripheral equipment specified with provision for operator desk work space.

19. Layout: to approval of Owner's Representative.

20. Desk: steel office type, standard sizes 1 m x 2 m, factory-made, computer type, for equipment mounting, with drawers on one side.
Keyboards to be in separate pull-out drawer.
Include above desk shelving to support contractor supplied manuals.

21. Chair: upholstered, swivel type, with adjustable arms back and seat, pneumatic seat height adjustment and 5 castors.

OPERATING SYSTEM (OS) OR EXECUTIVE

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- 22. To manage software operation of OWS.
OS to support complement of hardware terminals and software programs specified.
- 23. OS to be true multitasking operating environment. MS DOS or PC DOS based software platforms not permitted.
- 24. OWS Software to operate in a "Windows" based operating environment.
Software to be Windows 7 Pro.

OPERATOR'S CONTROL SOFTWARE

- 25. OWS is not to form part of real-time control functions either directly or indirectly or as part of communication link. Real-time control functions to reside in MCUs, LCUs, and TCUs with peer to peer communication occurring at MCU to MCU device level.
- 26. Time Synchronization Module.
System to provide Time Synchronization of real-time clocks in controllers.
System to perform this feature on regular scheduled basis and on operator request.
- 27. User Display Interface Module.
OWS software to support "Point Names" as defined in Section 25 05 01 - EMCS: General Requirements.
Upon operator's request in either text, graphic or table mode, system to present condition of single point, system, area, or connected points on system to OWS. Display analog values digitally to 1 place of decimal with negative sign as required. Update displayed analog values and status when new values received. Flag points in alarm by blinking, reverse video, different colour, bracketed or other means to differentiate from points not in alarm. For systems supporting COSV, refresh rate of screen data not to exceed 5 seconds from time of field change and system is to execute supervisory background scan every 20 seconds to verify point data value. For other systems, refresh rate not to exceed 5 seconds for points displayed. Initial display of new system graphic display (with up to 30 active points), including presentation of associated dynamic data not to exceed 8 seconds.
- 28. General Event Log Module: to record system activities occurring at OWS or elsewhere in the system including:
Operator Log-in from any user interface device.
Communication messages - errors, failures and recovery.
Event notifications and Alarms by category.
Record of Operator initiated commands.
- 29. The General Event Log:
Able to be archived as necessary to prevent loss of information. Archiving to occur automatically.
Hold minimum of 4 months' information and be readily accessible to operator.

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30. Operator Control Software Module: To support entry of information into system from keyboard and mouse, disk, or from another network device. Display of information to user: dynamic displays, textual displays, and graphic displays to display logging and trending of system information and following tasks:

Automatic logging of digital alarms and change of status messages.

Automatic logging of analog alarms.

System changes: alarm limits, set-points, alarm lockouts.

Display specific point values, states as selected.

Provide reports as requested and on scheduled basis when required.

Display graphics as requested, and on alarm receptions (user's option).

Display list of points within system.

Display list of systems within building.

Direct output of information to selected peripheral device.

On-line changes:

Alarm limits.

Setpoints.

Deadbands.

Control and change of state changes.

Time, day, month, year.

Control loop configuration changes for controller-based CDLs.

Control loop tuning changes.

Schedule changes.

Changes, additions, or deletions, of points, graphics, for installed and future systems.

According to assigned user privileges (password definition) the following functions to be supported:

Permit operator to terminate automatic (logic based) control and set value of field point to operator selected value. These values or settings to remain in effect until returned to automatic (logic based) control by the operator.

Requests for status, analog, graphic displays, logs, controls to be through user interface screens.

Software and tools utilized to generate, modify and configure building controllers to be installed and operational on the OWS.

31. Message Handling Module - and Error Messages: Message Handling Module to provide message handling for the following conditions:

Message and alarm buffering to be provided to prevent any loss of information.

Error detection correction and retransmission to be included to guarantee data integrity.

Informative messages to operator for data error occurrences, errors in keyboard entry, failure of equipment to respond to requests or commands, and failure of communications between EMCS devices.

32. Access Control to Field Equipment

Minimum 5 levels of password access protection to limit control, display, or data base manipulation capabilities. The following is preferred format of progression of password levels:

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Guest: No password data access and display only.

Operator Level: Full operational commands including automatic override.

Technician: Data base modifications.

Programmer: Data base generation.

Highest Level : System Administration - Password assignment, addition, modification.

User-definable, automatic log-off timers from 1 to 60 min. to prevent operators leaving devices on-line inadvertently. Default setting = 3 minutes.

33. Trend Data Module: Includes Historical data collection utility, Trend data utility, Control loop plot utility. Each utility to permit operator to add trend point, delete trend point, set scan rate.

Historical data collection utility: collect concurrently operator selected real or calculated point values at operator selectable rate 30-480 minutes. Samples to include for each time interval (time-stamped), minimum present value, maximum present value, and average present value for point selected. Rate to be individually selectable for each point. Data collection to be continuous operation, stored in temporary storage until removed from historical data list by operator. Temporary storage to have at least 6 month capacity. Trend data utility: continuously collect point object data variables for variables from building controllers as selected by operator, including at minimum; present value of the following point object types - DI, DO, AI, AO, AO set points value, calculated values. Trend data utility to have capacity to trend concurrently points at operator-selectable rate of 05 seconds to 3600 seconds, individually selectable for selected value, or use of COSV detection. Collected trend data to be stored on minimum 96 h basis in temporary storage until removed from trend data list by operator. Option to archive data before overwriting to be available.

Control Loop Plot Utility: For AO Points provide for the concurrent plotting of the measured value input - present value, present value of the output, and AO setpoint. The operator selectable sampling interval to be selectable between 1 second to 20 seconds. Plotting utility to scroll to left as the plot reaches right side of display window. Systems not supporting control loop plot as separate function must provide predefined groups of values. Each group to include values for one control loop display.

Trend data Module to include display of historical or trend data to OWS screen in X Y plot presentation. Plot utility to display minimum of 6 historical points or up to 6 trend points concurrently or 1 control loop plot. For display output of active trend data, display to automatically index to left when window becomes full. Provide plotting capabilities to display collected data based on range of selected value for (Y) component against time/date stamp of collected data for (X) component.

Provide separate reports for each trend utility. Provide operator feature to specify report type, by point name and for output device. Reports to include time, day, month, year, report title, and operator's initials. Implement reports using report module. Ensure trend data is exportable to third party spreadsheet or database applications for PCs.

34. Report Module: reports for energy management programs, function totalization, analog/pulse totalization and event totalization features available at MCU level. Refer also to Section 25 30 01 - EMCS: Building Controllers.

Reports to include time, day, month, year, report title, operator's initials.

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Software to provide capability to:

Generate and format reports for graphical and numerical display from real time and stored data.

Print and store reports as selected by operator.

Select and assign points used in such reports.

Sort output by area, system, as minimum.

Periodic/automatic report:

Generate specified report(s) automatically including options of start time and date, interval between reports (hourly, daily, weekly, monthly), output device. Software to permit modifying periodic/automatic reporting profile at any time.

Reports to include:

Power demand and duty cycle summary: see application program for same.

Disabled "Locked-out" point summary: include point name, whether disabled by system or by operator.

Run time summary: summary of accumulated running time of selected equipment. Include point name, run time to date, alarm limit setting. Run time to accumulate until reset individually by operator.

Summary of run time alarms: include point name, run time to date, alarm limit.

Summary of start/stop schedules: include start/stop times and days, point name.

Motor status summary.

Report types:

Dynamic reports: system to printout or display of point object data value requested by operator. System to indicate status at time of request, when displayed, updated at operator selected time interval. Provide option for operator selection of report type, by point name, and/or output device. Ensure reports are available for following point value combinations:

Points inaccessible from this OWS (total connected for this location), multiple "areas".

Area (points and systems in Area).

Area, system (points in system).

System (points by system type).

System point (points by system and point object type).

Area point (points by system and point object type).

Point (points by point object type).

Summary report: printout or display of point object data value selected by operator. Report header to indicate status at time of request. Ensure reports are available on same basis as dynamic reports. Provide option as to report type, point name, output device. Include preformatted reports as listed in Event/Alarm Module.

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35. Graphics Display Module: Graphics software utility to permit user to create, modify, delete, file, and recall graphics required by Section 25 90 01 - EMCS: Site Requirements, Applications and Systems Sequences of Operation.

Provide capacity for 100% expansion of system graphics. Graphic interface to provide user with multiple layered diagrams for site, building in plan view, floor furniture plan view and building systems, overlayed with dynamic data appropriately placed and permitting direct operator interaction. Graphic interface to permit operator to start and stop equipment, change set points, modify alarm limits, override system functions and points from graphic system displays by use of mouse or similar pointing device.

Display specific system graphics: provide for manual and/or automatic activation (on occurrence of an alarm). To include capability to call up and cancel display of any graphic picture.

Library of pre-engineered screens and symbols depicting standard air handling components (fans, coils, filters, dampers, VAV), complete mechanical system components (chillers, boilers, pumps), electrical symbols.

Graphic development, creation, modification package to use mouse and drawing utility to permit user to:

- Modify portion of graphic picture/schematic background.

- Delete graphic picture.

- Call up and cancel display of graphic picture.

- Define symbols.

- Position and size symbols.

- Define background screens.

- Define connecting lines, curves.

- Locate, orient, size descriptive text.

- Define, display colours of all elements.

- Establish co-relation between symbols or text and associated system points or other graphic displays.

User to be able to build graphic displays showing on-line point data from multiple MCU panels. Graphic displays to represent any logical grouping of system points or calculated data based upon building function, mechanical system, building layout, other logical grouping of points which aids operator in analysis of facility operation. Data to be refreshed on screen as "changed data" without redrawing of entire screen or row on screen.

Dynamic data (temperature, humidity, flow, status) to be shown in actual schematic locations, to be automatically updated to show current values without operator intervention.

Windowing environment to allow user to view several graphics simultaneously to permit analysis of building operation, system performance, display of graphic associated with alarm to be viewed without interrupting work in progress.

Utilize graphics package to generate system schematic diagrams as required in Section 25 90 01- EMCS: Site Requirements, Applications and Systems Sequences of Operation, and as directed by Owner's Representative. In addition provide graphics for schematic depicted on mechanical plan flow diagrams, point lists and system graphics. Provide graphic for floor depicting room sensors and control devices located in their actual location. For floor graphic include secondary diagram to show TCU-VAV box actuator and, flow sensor. Diagram to be single line schematic of ductwork as well as

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any associated heating coil or radiation valve. Owner's Representative to provide CAD. Provide display of TCU -VAV's in table form, include the following values as minimum; Space Temp, Setpoint, mode, actual flow, min flow setpoint, max flow setpoint, cooling signal value, and heating signal value. Table to be organized by rooms and floor groupings.

Provide complete directory of system graphics, including other pertinent information. Utilize mouse or pointing device to "point and click" to activate selected graphic.

Provide unique sequence of operation graphic or pop-up window for each graphic that is depicted on OWS. Provide access to sequence of operation graphic by link button on each system graphic. Provide translation of sequence of operation, a concise explanation of systems operation, from control descriptive logic into plain English language.

36. Event/Alarm Module : displays in window alarms as received and stored in General Event Log.

Classify alarms as "critical", "cautionary", "maintenance". Alarms and alarm classifications to be designated by personnel requiring password level.

Presentation of alarms to include features identified under applicable report definitions of report module paragraph.

Alarm reports:

Summary of points in critical, cautionary or maintenance alarm. Include at least point name, alarm type, current value, limit exceeded.

Analog alarm limit summary: include point name, alarm limits, deviation limits.

Summary of alarm messages: include associated point name, alarm description.

Software to notify operator of each occurrence of alarm conditions. Each point to have its own secondary alarm message.

EMCS to notify operator of occurrence of alarms originating at any field device within the following time periods of detection:

Critical - 5 seconds.

Cautionary - 10 seconds.

Maintenance - 10 seconds.

Display alarm messages in English.

Primary alarm message to include as minimum: point identifier, alarm classification, time of occurrence, type of alarm. Provide for initial message to be automatically presented to operator whenever associated alarm is reported. Assignment of secondary messages to point to be operator-editable function. Provide secondary messages giving further information (telephone lists, maintenance functions) on per point basis.

System reaction to alarms: provide alarm annunciation by dedicated window (activated to foreground on receipt of new alarm or event) of OWS with visual and audible hardware indication. Acknowledgement of alarm to change visual indicator from flashing to steady state and to silence audible device acknowledgement. Steady state to remain until alarm condition is corrected but must not impede reporting of new alarm conditions. Notification of any type of alarm not to impede notification of subsequent alarms or the function of Controller's/CDL. Random occurrence of alarms must not cause loss of any alarm or over-burden system. Acknowledgement of one alarm not to

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be considered as acknowledgement of any other alarms.

Controller network alarms: system supervision of controllers and communications lines to provide following alarms as minimum:

Controller not responding - where possible delineate between controller and communication line failure.

Controller responding - return to normal.

Controller communications bad - high error rate.

Controller communications normal - return to normal.

Digital/alarm status to be interrogated every 2 seconds as minimum or be direct interrupting non-polling type (COV). Annunciate each non-expected status with alarm message.

37. Archiving and Restoration Module.

Primary OWS to include services to store back-up copies of controller databases. Perform complete backup of OWS software and data files at time of system installation and at time of final acceptance. Provide backup copies before and after Controller's revisions or major modifications.

Provide continuous integrity supervision of controller data bases. When controller encounters database integrity problems with its data base, system to notify operator of need to download copy data base to restore proper operation.

Ensure data base back-up and downloading occurs over LAN without specialized operator technical knowledge. Provide operator with ability to manually download entire controller data base, or parts thereof as required.

38. CDL Generator and Modifier Module.

CDL Generator module to permit generation and modification of CDLs.

Provide standard reference modules for text based systems module that will permit modification to suit site specific applications. Module to include cut, paste, search and compare utilities to permit easy CDL modification and verification.

Provide full library of symbols used by manufacturer for system product installed accessible to operators for systems using graphical environment for creation of CDLs. Module to include graphic tools required to generate and create new object code for downloading to building controllers.

Module to permit testing of code before downloading to building controllers.

Execution

INSTALLATION REQUIREMENTS

39. Provide necessary power as required from local 120 V emergency power branch circuit panels for OWS's and peripheral equipment.

Install tamper locks on breakers of circuit panels.

Refer to UPS requirements stated under OWS Hardware in PART 2.

END OF SECTION

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DIVISION 25 INTEGRATED AUTOMATION

SECTION 253001 MATERIAS AND INSTLLATION AFOR AUTOMATIONCONTROLLERS

General SUMMARY

1. Section Includes:
Materials and installation for building automation controllers including:
 - Master Control Unit (MCU).
 - Local Control Unit (LCU)
 - Equipment Control Unit (ECU).
 - Terminal Control Unit (TCU).

RELATED SECTIONS

2. Section 25 05 01 - EMCS: General Requirements.
3. Section 25 05 02 - EMCS: Submittals and Review Process.
4. Section 25 05 03 - EMCS: Project Records Documents.
5. Section 25 30 02 - EMCS: Field Control Devices.
6. Section 25 90 01 – EMCS: Site Requirements, Applications and Systems Sequences of Operation.

REFERENCES

7. American Society of Heating, Refrigeration, and Air-Conditioning Engineers, Inc. (ASHRAE).
ASHRAE, Applications Handbook, SI Edition.
ASHRAE Standard 135 – BAC net – A Data Communications Protocol for Building Automation and Control Networks.
ASHRAE Standard 135.1 Method of Test Conformance to BAC net.
8. Canadian Standards Association (CSA)
C22.2 No.205, Signal Equipment.
9. Institute of Electrical and Electronics Engineers (IEEE)
IEEE C37.90.1, Surge Withstand Capabilities Test for Protective Relays and Relays Systems.

DEFINITIONS

10. Acronyms used in this section include: see Section 25 05 01 - EMCS: General Requirements.

SYSTEM DESCRIPTION

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11. General: Network of controllers comprising of MCU('s), LCU('s), ECU('s) or TCU('s) to be provided as indicated in System Architecture Diagram to support building systems and associated sequence(s) of operations as detailed in these specifications.

Provide sufficient controllers to meet intents and requirements of this section.

Controllers quantity, and point contents to be approved by Owner's Representative at time of preliminary design review.

12. Controllers: stand-alone intelligent Control Units:

Incorporate programmable microprocessor, non-volatile program memory, RAM, power supplies, as required to perform specified functions.

Incorporate communication interface ports for communication LANs to exchange information with other Controllers.

Capable of interfacing with operator interface device.

Execute its logic and control using primary inputs and outputs connected directly to its onboard input/output field terminations or slave devices, and without need with other controller. Secondary input used for reset such as outdoor air temperature may be located in other Controller(s).

DESIGN REQUIREMENTS

13. To include:

Scanning of AI and DI connected inputs for detection of change of value and processing the detection of alarm conditions.

Perform On-Off digital control of connected points, including the resulting required states generated through programmable logic output.

Perform Analog control using programmable logic, (including PID) with adjustable dead bands and deviation alarms.

Control of systems as described in sequence of operations.

Execution of optimization routines as listed in this section.

14. Total spare capacity for MCUs and LCUs: at least 25% of each point type distributed throughout the MCUs and LCUs.

15. Field Termination and Interface Devices.

To conform to CSA C22.2 No. 205.

Electronically interface sensors and control devices to processor unit.

Include, but not be limited to, following:

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Programmed firmware or logic circuits to meet functional and technical requirements.

Power supplies for operation of logic devices and associated field equipment.

Lockable wall cabinet.

Required communications equipment and wiring .

Leave controlled system in "fail-safe" mode in event of loss of communication with, or failure of, processor unit.

Input/Output interface to accept as minimum AI, AO, DI, DO functions as specified.

Wiring terminations: use conveniently located screw type or spade lug terminals.

AI interface equipment to:

Convert analog signals to digital format with 12 bit analog-to-digital resolution.

Provide for following input signal types and ranges:

4 - 20 mA;

0-10V DC

10 K ohm.

Meet IEEE C37.90.1 surge withstand capability.

Have common mode signal rejection greater than 60 dB to 60 Hz.

Where required, dropping resistors to be certified precision devices which complement accuracy of sensor and transmitter range specified.

AO interface equipment:

Convert digital data from controller processor to acceptable analog output signals using 12 bit digital-to-analog resolution.

Provide for following output signal types and ranges:

4 - 20 mA.

0 - 10 V DC.

Meet IEEE C37.90.1 surge withstand capability.

DI interface equipment:

Able to reliably detect contact change of sensed field contact and transmit condition to controller.

Meet IEEE C37.90.1 surge withstand capability.

Accept pulsed inputs up to 2 kHz.

DO interface equipment:

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Respond to controller processor output, switch respective outputs. Each DO hardware to be capable of switching up to 0.5 amps at 24 V AC.

Switch up to 5 amps at 220 V AC using optional interface relay.

16. Controller's and associated hardware and software: operate in conditions of 0°C to 44°C and 20 % to 90 % non-condensing RH.

17. Controllers (MCU, LCU): mount in wall mounted cabinet with hinged, keyed-alike locked door.

Provide for conduit entrance from top, bottom or sides of panel. ECUs to be mounted in equipment enclosures or separate enclosures.

Mounting details as approved by Owner's Representative for ceiling mounting.

18. Cabinets to provide protection from water dripping from above, while allowing sufficient airflow to prevent internal overheating.

19. Provide surge and low voltage protection for interconnecting wiring connections.

SUBMITTALS

20. Make Submittals in accordance with Section 01 33 00 – Submittal Procedures and Section 25 05 02 – EMCS: Submittals and Review Process.

Submit product data sheets for each product item proposed for this project.

MAINTENANCE PROCEDURES

21. Provided manufacturers recommended maintenance procedures for insertion in Section 25 05 03 – EMCS: Project Record Documents.

Products

MASTER CONTROL UNIT (MCU)

22. Primary function of MCU is to provide co-ordination and supervision of subordinate devices. Supervisory role shall include coordination of subordinate devices in the execution of optimization routines such as demand limiting or enthalpy control.

23. Include high speed communication LAN Port for Peer to Peer communications with OWS(s) and other MCU level devices. Include support for Open System Protocols, BACnet.

24. MCU shall have local I/O capacity as follows;
To have at least 16 I/O points of which minimum to be 2AO, 6AI, 4DI, 4DO.
LCU's to be added to support system functions as indicated in I/O Summary List.

25. Central Processor Unit (CPU)
Processor to consist of at minimum a 16 bit microprocessor capable of supporting software to meet specified requirements.
CPU idle time to be more than 30 % when system configured to maximum input and

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output with worst case program use.

Minimum addressable memory to be at manufacturer's discretion but to support at least all performance and technical specifications. Memory to include:

Non-volatile EEPROM to contain operating system, executive, application, sub-routine, other configurations definition software. Tape media not acceptable.

Battery backed (72 hr minimum capacity) RAM (to reduce the need to reload operating data in event of power failure) RAM to contain CDLs, application parameters, operating data or software that is required to be modifiable from operational standpoint such as schedules, setpoints, alarm limits, PID constants and CDL and hence modifiable on-line through operator panel or remote operator's interface. RAM to be downline loadable from OWS, CAB-Gateway, or locally installed floppy disk.

Include uninterruptible clock accurate to plus or minus 5 secs/month, capable of deriving month/day/hour/minute/second, with rechargeable batteries for minimum 72 hr operation in event of power failure.

26. Local Operator Terminal (OT)

OT to:

Have integral access/display panel where immediate access to OWS is not available.

Support operator's terminal for local command entry, instantaneous and historical data display, programs additions and modifications.

Simultaneously display minimum of 16 points with full English identification to allow operator to view single screen dynamic displays depicting entire mechanical systems.

Functions to include, but not be limited to, following:

Start and stop points.

Modify setpoints.

Modify PID loop setpoints.

Override PID control.

Change time/date.

Add/modify/start/stop weekly scheduling.

Add/modify setpoint weekly scheduling.

Enter temporary override schedules.

Define holiday schedules.

View analog limits.

Enter/modify analog warning limits.

Enter/modify analog alarm limits.

Enter/modify analog differentials.

OT to provide access to real and calculated points in controller to which it is connected or to any other controller in network. This capability not to be restricted to subset of predefined "global points" but to provide totally open exchange of data between OT and any other controller in network.

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Operator access to OTs to the same as OWS user password. Password changes to automatically be downloaded to controllers on network.

OT to provide prompting to eliminate need for user to remember command format or point names. Prompting to be consistent with user's password clearance and types of points displayed to eliminate possibility of operator error.

Identity of real or calculated points to be consistent with network devices. Use same point identifier as at OWS's for access of points at OT to eliminate cross-reference or look-up tables.

LOCAL CONTROL UNIT (LCU)

27. Provide multiple control functions for typical built-up and package HVAC, hydronic and electrical systems.

28. Minimum of 16 I/O points of which minimum be 4 AOs, 4 AIs, 4 DIs, 4 DOs.

29. Points of one Building System to be connected to one controller as listed in I/O Summary designations.

30. Microprocessor capable of supporting necessary software and hardware to meet specified requirements. As per MCU requirements (section 2.3.4) above with the following additions:

Include as minimum 2 interface ports for connection to local computer terminal.

Design so that shorts, opens or grounds on any input or output will not interfere with other input or output signals.

Physically separate line voltage (50V and over) circuits from DC logic circuits to permit maintenance on either circuit with minimum hazards to technician and equipment.

Include power supplies for operation of LCU and associated field equipment.

In event of loss of communications with, or failure of, MCU, LCU to continue to perform control. Controllers that use defaults or fail to open or close positions not acceptable.

Provide conveniently located screw type or spade lug terminals for field wiring.

LCU to have 25 % spare input and 25 % output point capacity without addition of cards, terminals, etc.

TERMINAL/EQUIPMENT CONTROL UNIT (TCU/ECU)

31. Microprocessor capable of supporting necessary software and hardware to meet TCU/ECU functional specifications.

The TCU definition to be consistent with those defined in ASHRAE HVAC Applications Handbook.

32. Controller to communicate directly with EMCS through EMCS LAN and provide access from EMCS OWS for setting occupied and unoccupied space temperature setpoints, flow setpoints, and associated alarm values, permit reading of sensor values, field control values (% open) and transmit alarm conditions to EMCS OWS.

33. VAV Terminal Controller

Microprocessor based controller with integral flow transducer, including software routines to execute PID algorithms, calculate airflow for integral flow transducer and

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measure temperatures as per I/O Summary required inputs. Sequence of operation to ASHRAE HVAC Applications Handbook.

Controller to support point definition; in accordance with section 25 05 01 – EMCS: General Requirements.

Controller to operate independent of network in case of communication failure.

Controller to include damper actuator and terminations for input and output sensors and devices.

SOFTWARE

34. General:

Include as minimum: operating system executive, communications, application programs, operator interface, and systems sequence of operation - CDL's.

To include "firmware" or instructions which are programmed into ROM, EPROM, EEPROM or other non-volatile memory.

Include initial programming of all Controllers, for entire system.

35. Program and data storage:

Store executive programs and site configuration data in ROM, EEPROM or other non-volatile memory.

Maintain CDL and operating data such as setpoints, operating constants, alarm limits in battery-backed RAM or EEPROM for display and modification by operator.

36. Programming languages:

Control Description Logic software to be programmed using English like or graphical, high level, general control language.

Structure software in modular fashion to permit simple restructuring of program modules if future software additions or modifications are required. GO TO constructs not allowed.

37. Operator terminal interface:

MCU to perform operating and control functions specified Section 25 10 02 - EMCS: Operator Work Stations (OWS), including:

Multi-level password access protection to allow user/manager to limit workstation control.

Alarm management: processing and messages.

Operator commands.

Reports.

Displays.

Point identification.

38. Pseudo or calculated points:

Software to have access to any value or status in controller or other networked controller so as to define and calculate pseudo point from other values/status of controller. When current pseudo point value is derived, normal alarm checks must be performed or value used to totalize.

Inputs and outputs for any process to be able to include data from controllers to permit development of network-wide control strategies. Processes also to permit operator to use results of one process as input to any number of other processes (eg. cascading).

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39. Control Description Logic (CDL):

Capable of generating on-line project-specific control loop algorithms (CDLs). CDLs to be software based, programmed into RAM or EEPROM and backed up to OWS. Owner must have access to these algorithms for modification or to be able to create new ones and to integrate these into CDLs on BC(s) from OWS.

Write CDL in high level language that allows algorithms and interlocking programs to be written simply and clearly. Use parameters entered into system (eg. setpoints) to determine operation of algorithm. Operator to be able to alter operating parameters on-line from OWS or BC(s) and to tune control loops.

Perform changes to CDL on-line.

Control logic to have access to values or status of all points available to controller including global or common values, allowing cascading or inter-locking control.

Energy optimization routines such as enthalpy control, supply temperature reset, etc. to be LCU or MCU resident functions and form part of CDL.

MCU to be able to perform following pre-tested control algorithms:

Two position control.

Proportional Integral and Derivative (PID) control.

Automatic control loop tuning.

Control software to provide the ability to define the time between successive starts for each piece of equipment to reduce cycling of motors.

Provide protection against excessive electrical-demand situations during start-up periods by automatically introducing time delays between successive start commands to heavy electrical loads.

Power Fail Restart: Upon detection of power failure system to verify availability of emergency power as determined by emergency power transfer switches and analyze controlled equipment to determine its appropriate status under emergency power conditions and start or stop equipment as defined by I/O Summary. Upon resumption of normal power as determined by emergency power transfer switches, MCU to analyze status of controlled equipment, compare with normal occupancy scheduling, turn equipment on or off as necessary to resume normal operation.

40. Event and Alarm management: The system to use a management by exception concept for Alarm Reporting. This is a system wide requirement. This approach will insure that only principal alarms are reported to OWS. Events which occur as a direct result of the primary event to be suppressed by the system and only events which fail to occur to be reported. Such event sequence to be identified in I/O Summary and sequence of operation. Examples of above are, operational temperature alarms limits which are exceeded when main air handler is stopped, or General Fire condition shuts air handlers down, only Fire alarm status shall be reported. The exception is, when an air handler which is supposed to stop or start fails to do so under the event condition.

41. Energy management programs: The following programs shall include specific summarizing reports, to include the date stamp indicating sensor details which activated and or terminated the feature.

MCU in coordination with subordinate LCU, TCU, ECU to provide for the following energy management routines:

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Time of day scheduling.
Calendar based scheduling.
Holiday scheduling.
Temporary schedule overrides.
Optimal start stop.
Night setback control.
Enthalpy (economizer) switchover.
Peak demand limiting.
Temperature compensated load rolling.
Fan speed/flow rate control.
Cold deck reset.
Hot deck reset.
Hot water reset.
Chilled water reset.
Condenser water reset.
Chiller sequencing.
Night purge.

Programs to be executed automatically without need for operator intervention and be flexible enough to allow customization.

Apply programs to equipment and systems as specified or requested by the Owner's Representative.

42. Function/Event Totalization: features to provide predefined reports which show daily, weekly, and monthly accumulating totals and which include high rate (time stamped) and low rate (time stamped) and accumulation to date for month.

MCUs to accumulate and store automatically run-time for binary input and output points.

MCU to automatically sample, calculate and store consumption totals on daily, weekly or monthly basis for user-selected analog or binary pulse input-type points.

MCU to automatically count events (number of times pump is cycled off and on) daily, weekly or monthly basis.

Totalization routine to have sampling resolution of 1 min or less for analog inputs.

Totalization to provide calculations and storage of accumulations up to 99,999.9 units (eg. kWh, litres, tonnes, etc.).

Store event totalization records with minimum of 9,999,999 events before reset.

User to be able to define warning limit and generate user-specified messages when limit reached.

LEVELS OF ADDRESS

- .1 Upon operator's request, EMCS to present status of any single 'point', 'system' or point group, entire 'area', or entire network on printer or OWS as selected by operator.

Display analog values digitally to 1 place of decimals with negative sign as required.

Update displayed analog values and status when new values received.

Flag points in alarm by blinking, reverse video, different colour, bracketed or other means to differentiate from points not in alarm.

Updates to be change-of-value (COV)-driven or if polled not exceeding 2 second intervals.

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POINT NAME SUPPORT

- .1 Controllers (MCU, LCU) to support point naming convention as defined in Section 25 05 01 – EMCS: General Requirements.

Execution

LOCATION

- .1 Location of Controllers to be approved by Owner's Representative.

INSTALLATION

- .1 Install Controllers in secure enclosures as indicated.
- .2 Provide necessary power from local 120 V branch circuit panel for equipment.
- .3 Install tamper locks on breakers of circuit breaker panel.
- .4 Use Uninterruptible Power Supply (UPS) and emergency power when equipment must operate in an emergency and co-ordinating mode.

END OF SECTION

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DIVISION 25 INTEGRATED AUTOMATION

SECTION 253001 FIELD CONTROL DEVICES

General

Related Sections

1. Section 33 56 13 - Aboveground Fuel Storage Tanks.
2. Section 25 05 02 - EMCS: Submittals and Review Process.
3. Section 25 05 03 - EMCS: Project Records Documents.

References

4. American National Standards Institute (ANSI)
ANSI C12.7, Requirements for Watthour Meter Sockets.
ANSI/IEEE C57.13, Requirements for Instrument Transformers.

5. Canadian Standards Association (CSA)
CSA Type 1 Enclosure
CSA Type 4X Enclosures
CSA Type 12 Enclosures

Submittals

6. Submit shop drawings and manufacturer's installation instructions in accordance with Section 25 05 02 - EMCS: Submittals and Review Process.
7. Include:
Information as specified for each device.
Manufacturer's detailed installation instructions.
8. Pre-Installation Tests
Submit samples at random from equipment shipped, as requested by Owner's Representative, for testing before installation. Replace devices not meeting specified performance and accuracy.
9. Manufacturer's Instructions
Submit manufacturer's installation instructions for specified equipment and devices.

Closeout Submittals

10. Submit operating and maintenance data for inclusion in operation and maintenance manual in accordance with Section 25 05 03 - EMCS: Project Records Documents.

Products

General

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11. Control devices of each category to be of same type and manufacturer.
12. External trim materials to be corrosion resistant. Internal parts to be assembled in watertight, shockproof, vibration-proof, heat resistant assembly.
13. Operating conditions: 0 - 32 °C with 10 - 90 % RH (non-condensing) unless otherwise specified.
14. Terminations: use standard conduit box with slot screwdriver compression connector block unless otherwise specified.
15. Transmitters to be unaffected by external transmitters (eg. walkie talkies).
16. Account for hysteresis, relaxation time, maximum and minimum limits in applications of sensors and controls.
17. Outdoor installations: use weatherproof construction in CSA 4X enclosures.
18. Devices to be installed in user occupied space must not exceed Noise Criteria (NC) of 35. Noise generated by any device must not be detectable above space ambient conditions.

Temperature Sensors

19. General: except for VAV box control to be resistance or thermocouple type to following requirements:
Thermistors 10 K ohm, $\pm 0.2^\circ\text{C}$ accuracy, less than 0.1°C drift over 10 year span. Power supply 5 V dc, 10-35 Vdc, 24 Vac..
RTD's: 1000 ohm at 0°C (plus or minus 0.2 ohms) platinum element with strain minimizing construction, 3 integral anchored leadwires. Coefficient of resistivity: 0.00385 ohms/ohmEC.
Immersion wells: NPS 3/4, stainless steel spring loaded construction, with heat transfer compound compatible with sensor. Insertion length 100 mm as indicated.
20. Sensors:
Room type: wall mounting, in slotted type covers, LCD display °C or °F, with guard as indicated. Dual set point momentary push button, override switch.
Room type for VAV boxes: as for room type, above. Include setpoint adjustment, local indication, push button override for night set back function.
General purpose duct type: suitable for insertion into ducts at any angle, insertion length 460 mm.
Averaging duct type: continuous filament with minimum immersion length 6000 mm.
Bend probe at field installation time to 100 mm radius at any point along probe without degradation of performance.
Outside air type: complete with probe length 100 - 150 mm long, non-corroding shield to minimize solar and wind effects, threaded fitting for mating to 13 mm conduit, weatherproof construction in CSA 4X enclosure.
Immersion type: spring loaded probe, NPT 1/2 fitting insertion to suit pipe size.

Temperature Transmitters

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21. Requirements:

Input circuit: to accept 3-lead, 100 ohm at 0 deg C, platinum resistance detector type sensors.

Power supply: 575 ohms at 24 V DC into load of 575 ohms. Power supply effect less than 0.01 deg C per volt change.

Output signal: 4 - 20 mA into 500 ohm maximum load.

Input and output short circuit and open circuit protection.

Output variation: less than 0.2 % of full scale for supply voltage variation of plus or minus 10 %.

Combined non-linearity, repeatability, hysteresis effects: not to exceed plus or minus 0.5 % of full scale output.

Maximum current to 100 ohm RTD sensor: not to exceed 22.5 mA.

Integral zero and span adjustments.

Temperature effects: not to exceed plus or minus 1.0 % of full scale/ 50 °C.

Long term output drift: not to exceed 0.25 % of full scale/ 6 months.

Transmitter ranges: Select narrowest range to suit application from following:

Minus 50 °C to plus 50 °C, plus or minus 0.5 °C.

0 to 100 °C, plus or minus 0.5 °C.

0 to 50 °C, plus or minus 0.25 °C.

0 to 25 °C, plus or minus 0.1 °C.

10 to 35 °C, plus or minus 0.25°C.

Humidity Sensors

22. Requirements:

Range: 5 - 95 % RH minimum.

Operating temperature range: -40°C to 85°C.

Absolute accuracy:

Duct sensors: plus or minus 5 %.

Room sensors: plus or minus 2 % .

Sheath: stainless steel with integral shroud for specified operation in air streams of up to 10 m/s.

Maintenance: by simple field method such as washing with solvent or mild detergent solution so as to remove anticipated airborne contaminants.

Maximum sensor non-linearity: plus or minus 0.5% RH with defined curves.

Room sensors: wall mounted as indicated.

Duct mounted sensors: locate so that sensing element is between 1/3 and 2/3 distance across any duct dimension.

Sensors to be unaffected by external transmitters such as walkie-talkies. Demonstrate to Owner's Representative.

Power supply: 18-35 Vdc, 18-32 Vac with temperature sensor.

Humidity Transmitters

23. Requirements:

Input signal: from 1000 ohm RTD.

Output signal: 4 - 20 mA into 1000 ohm maximum load, 0-5 Vdc, 0-10 Vdc.

Input and output short circuit and open circuit protection.

Output accuracy: not to exceed 0.1 % of full span.

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Output linearity error: plus or minus 1.0 % maximum of full scale output.

Integral zero and span adjustment.

Temperature range: 0-70°C, -40°C to 85°C for outside air.

Long term output drift: not to exceed 0.25 % of full scale output/ 6 months.

Pressure/Current (P/I) Transmitters

24. Requirements:

Range: as indicated in I/O summaries.

Pressure sensing elements: bourdon tube, bellows or diaphragm type.

Internal materials: suitable for continuous contact with industrial standard instrument air, compressed air, water, steam, as applicable.

Output signal: 4 - 20 mA, 0-5V, 0-10V.

Output variations: ± 1 % full scale for supply voltage variations of plus or minus 10 %.

Combined non-linearity, repeatability, and hysteresis effects: not to exceed plus or minus 1 % of full scale output over entire range.

Integral zero and span adjustment.

Temperature effects: not to exceed plus or minus 1.5 % full scale/ 50 °C.

Over-pressure input protection to at least twice rated input pressure.

Output short circuit and open circuit protection.

Pressure ranges: see I/O Summaries.

Accuracy: plus or minus 1 % of full scale.

LCD Display.

Differential Pressure (kPa) Transmitters

25. Requirements:

Internal materials: suitable for continuous contact with industrial standard instrument air, compressed air, water, steam, as applicable.

Output signal: 4 - 20 mA, 0-5V, 0-10V.

Output variations: ± 1 % full scale for supply voltage variations of plus or minus 10 %.

Combined non-linearity, repeatability, and hysteresis effects: not to exceed plus or minus 1 % of full scale output over entire range.

Integral zero and span adjustment.

Temperature effects: not to exceed plus or minus 1.5 % full scale/ 50 °C.

Over-pressure input protection to at least twice rated input pressure.

Output short circuit and open circuit protection.

The unit to have a NPT connections. The enclosure shall be an integral part of the unit.

LCD Display.

Differential Pressure (Pa) Transmitters

26. Requirements:

Output signal: 4 - 20 mA in 400 ohms, 0-5V into 5K ohms minimum, 0-10 V into 10K ohms minimum.

Output variations: ± 1 % full scale for supply voltage variations of plus or minus 10%.

Integral zero and span adjustment.

Temperature effects: not to exceed plus or minus 3% full scale/ 50 °C.

Output short circuit and open circuit protection.

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The unit to have a NPT ½ conduit connection. The enclosure shall be an integral part of the unit.

Pressure ranges: see I/O Summaries.

LCD Display.

FAN SYSTEM STATIC PRESSURE SENSORS

27. As per 2.10

Fan System Static Pressure Transmitters

28. Requirements:

Output signal: 4 - 20 mA in 400 ohms, 0-5V into 5K ohms minimum, 0-10 V into 10K ohms minimum.

Output variations: $\pm 1\%$ full scale for supply voltage variations of plus or minus 10%.

Integral zero and span adjustment.

Temperature effects: not to exceed plus or minus 3% full scale/ 50 °C.

Output short circuit and open circuit protection.

The unit to have a NPT ½ conduit connection. The enclosure shall be an integral part of the unit.

Pressure ranges: see I/O Summaries.

LCD Display.

Duct System Velocity Pressure Sensors

29. Requirements:

Multipoint static and total pressure sensing element with self-averaging manifold with integral air equalizer and straightener section.

Maximum pressure loss: 37 Pa at 1000 m/s.

Accuracy: plus or minus 1 % of actual duct velocity.

Fan System Velocity Pressure Transmitters

30. Requirements:

Output signal: 4 - 20 mA linear into 500 ohm maximum load.

Calibrated span: not to exceed 25 % of duct velocity pressure at maximum flow.

Accuracy: 0.4 % of span.

Repeatability: within 0.1 % of output.

Linearity: within 0.5 % of span.

Deadband or hysteresis: 0.1 % of span.

External exposed zero and span adjustment.

The unit to have a NPT ½ conduit connection. The enclosure shall be an integral part of the unit.

Turbine Flow Meters

31. Requirements:

Flow range: as specified in I/O summaries.

Pressure rating: 1035 kPa (gauge) at 38 °C.

Temperature rating: 5 to 260 °C.

Repeatability: plus or minus 0.1 %.

Accuracy and linearity: plus or minus 0.5 %.

Flow rangability: at least 10:1.

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Output voltage: 30 to 300 mV peak-to-peak into 10 Kohm load.

Body material: brass, bronze or cast iron.

Ends:

NPS 2 and under: screwed or flanged

NPS 2 1/2 and over: flanged.

Frequency-to-DC Transmitters for Turbine Meters

32. Requirements:

Input: greater than 5000 ohm.

Range: greater than 100 mV less than 20 V peak-to-peak, 200 through 400 Hz.

Span adjustment: fully adjustable.

Zero adjustment: 0 to 10% of output.

Output: 4 to 20 mA into 500 ohm load.

Load effect: plus or minus 0.1 % of span zero to maximum load resistance.

Linearity and repeatability: plus or minus 0.05 % of span.

Power input: 24 V DC plus or minus 10 %.

Input, output and power input transformer isolated.

Enclosure: general purpose CSA 1.

Pressure and Differential Pressure Sensors and Switches

33. Requirements:

Range: as indicated in I/O summaries.

Pressure sensing elements: bourdon tube, bellows or diaphragm type.

Adjustable setpoint and differential.

Switch: snap action type, rated at 120V, 15 amps AC or 24 V DC.

Sensor assembly: to operate automatically and reset automatically when conditions return to normal. Over-pressure input protection to at least twice rated input pressure.

Accuracy: within 2% repetitive switching.

Provide sensor pressure and accuracy ratings:

Chilled and condenser water: 860 kPa.

Hot water: 860 kPa.

Low pressure steam, compressed air: 1050 kPa. Range: 0 to 200 kPa. Accuracy: plus or minus 3 kPa.

Medium pressure steam, compressed air: 1050 kPa. Range: 0 to 700 kPa. Accuracy: plus or minus 7 kPa.

High pressure steam: 2100 kPa. Range: 0 to 2100 kPa. Accuracy: plus or minus 14 kPa.

High temperature water: 2700 kPa. Range: 0-2700 kPa.

Accuracy: plus or minus 25 kPa.

For fan operation: Range: 0 to 3000 Pa. Adjustable differential: 10 to 300 Pa.

Provide sensors with isolation valve and snubber between sensor and pressure source on liquid service.

Sensors on steam and high temperature hot water service: provide pigtail syphon.

Temperature Switches

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34. Requirements:

Range: see I/O summaries.

Temperature sensor: liquid, vapour or bimetallic type. Operate automatically. Reset automatically, except as follows:

Freeze protection: manual reset. Optional if software does not auto restart.

Fire detection: manual reset. Optional if software does not auto restart.

Duct Heater: high limit manual reset in addition to automatic reset.

Adjustable setpoint and differential.

Accuracy: plus or minus 1 °C.

Snap action rating: 120V, 15 amps or 24V DC as required. Switch to be DPST for hardwire and EMCS connections.

Type as follows:

Room: for wall mounting on standard electrical box with or without protective guard as indicated.

Duct, general purpose: insertion length = 460 mm.

Thermowell: stainless steel, with compression fitting for NPS 3/4 thermowell. Immersion length: 100 mm.

Freeze detection: continuous element with 6000 mm insertion length, duct mounting, to detect coldest temperature in any 300 mm length.

Strap-on: with helical screw stainless steel clamp.

Tank Level Switches

35. Requirements:

Indicate high/low water level and to alarm.

For mounting on top of tank.

Maximum operating temperature: 120 °C.

Mechanical switch or snap action contacts rated 15 amp at 120 V.

Adjustable setpoint and differential.

Liquid Level Switches

36. Requirements:

Liquid level activated switch sealed in waterproof and shockproof enclosure.

Complete with float, flexible cord, weight. Instrument casing to be suitable for immersion in measured liquid.

N.O./N.C. Contacts rated at 15 amps at 120V AC. CSA approval for up to 250 volt 10 amps AC.

Wind Velocity Transmitters

37. Requirements:

3-cup anemometer and airfoil vane mounted on common vertical axis, designed for mast mounting.

Anemometer:

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Airfoil vane

Range: 0-160 km/h.
Threshold: 3.0 km/h.
Accuracy: +/- 2%.

Anemometer range: 0-360° with infinite resolution potentiometer with no loss of reading at transition point.
Starting threshold: 1.1 m/s.
Accuracy: +/- 0.5%.
Output signal: 4 to 20 mA into 500 ohm load.
Provide two output signals: velocity, direction.
Mast: aluminum, size and height as indicated. Provide at least 3 stainless steel guys, turnbuckles, anchor bolts. Follow manufacturers installation guidelines. Lightning protection as indicated on electrical drawings.

Solar Sensors

38. Monitor solar irradiation as indicated.
39. Pyranometer, black and white, producing proportional 0-50 mV signal. Include converter for 4-20 mA signal.

Current/Pneumatic (I/P) Transducers

40. Requirements:
Input range: 4 to 20 mA.
Output range: proportional 20-104 kPa.
Housing: dustproof or panel mounted.
Internal materials: suitable for continuous contact with industrial standard instrument air.
Combined non-linearity, repeatability, hysteresis effects: not to exceed plus or minus 2 % of full scale over entire range.
Integral zero and span adjustment.
Temperature effect: plus or minus 2.0 % full scale/ 50 °C or less.
Regulated supply pressure: 206 kPa maximum.
Air consumption: 16.5 ml/s maximum.
Integral gauge manifold c/w gauge (0-206 kPa).

Solenoid Control Air Valves

41. Coil: 120V AC or 24V DC, as indicated.
42. Complete with manual over-ride.
43. Shall have the capacity to pass .07 l/s air at 104 kPa differential.

Air Pressure Gauges

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44. Diameter: 38 mm minimum.

45. Range: zero to two times operating pressure of measured pressure media to nearest standard range.

Electrical Relays

46. Requirements:

Double voltage, DPDT, plug-in type with termination base.

Coils: rated for 120V AC or 24V DC. Other voltage: provide transformer.

Contacts: rated at 5 amps at 120 V AC.

Relay to have visual status indication

Solid State Relays

47. Requirements:

CSA approved.

Suitable to the application as recommended by manufacturer.

Voltage range: 75-265 VAC

Panel mounting.

Suitable for AC or DC loads.

Output surge absorbing element for inductive on/off loads.

Input capacitor/resistor circuit for pulse noise absorption.

For input inductive noise use twisted-pair wires for electromagnetic noise and shielded cable for static noise.

Current Transducers

48. Requirements:

Range: in accordance with Equipment Schedules.

Purpose: measure line current and produce proportional signal in one of following ranges:

4-20 mA DC.

0-5 volt DC.

0-10 volts DC.

2-10 volts DC.

Frequency insensitive from 10 - 80 hz.

Accuracy to 0.5% full scale.

Zero and span adjustments. Field adjustable range to suit motor applications.

Adjustable mounting bracket to allow for secure/safe mounting inside the MCC or starter enclosure.

Current Sensing Relays

49. Requirements:

Complete with metering transformer ranged to match load, plug-in base and shorting shunt to protect current transformer when relay is removed from socket.

Suitable for single or 3 phase metering into single relay.

To have adjustable latch level, adjustable delay on latch and minimum differential of 10 % of latch setting between latch level and release level.

3-Phase application: provide for discrimination between phases.

To have adjustable latch level to allow detection of worst case selection. To be powered

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from control circuit of motor starter being metered. Relay and base to be mounted in adjacent auxiliary cabinet only if control circuit power to be brought into auxiliary cabinet. Adjustments to be acceptable from auxiliary cabinet.

Relay contacts: capable of handling 10 amps at 240 V AC.

Control Dampers

50. Construction: blades, 152 mm wide, 1219 mm long, maximum. Modular maximum size, 1219 mm wide x 2438 mm high. Multiple sections to have stiffening mullions and jack shafts.

51. Materials

Frame: 2.3 mm minimum thickness galvanized steel.

Blades: galvanized steel with two sheets 0.5 mm thick or otherwise reinforced to ensure specified low leakage when fully closed.

Bearings: oil impregnated sintered bronze. Provide thrust bearings for vertical blades.

Linkage and shafts: zinc plated steel.

Seals: replaceable neoprene or stainless steel spring on sides, top, bottom of frame, along all blade edges and blade ends.

52. Performance:

Capacity: refer to I/O Summaries.

0.02 L/s.m² maximum allowable leakage against 1000 Pa static pressure.

Temperature range: minus 50°C to plus 100°C.

Arrangements: dampers mixing warm and cold air to be parallel blade, mounted at right angles to each other, with blades opening to mix air stream.

Pneumatic Control Damper Operators

53. Requirements:

Piston type with spring return for "fail-safe" in Normally Open or Normally Closed position, as indicated.

Operator: size so as to control dampers against maximum pressure or dynamic closing pressure (whichever is greater).

Adjustable spring and stroke external stops to limit strokes in either direction.

Full relay type positioner with interconnecting linkage for mechanical feedback of actual damper position.

Multiple section dampers over 1200 mm long: to be driven from both ends.

Electronic Control Damper Operators

54. Requirements

Push-pull proportional type as indicated.

Spring return for "fail-safe" in Normally Open or Normally Closed position as indicated.

Operator: size so as to control dampers against maximum pressure or dynamic closing pressure (whichever is greater).

Power requirements: 5 VA maximum at 24 V AC.

Operating range: 4-20 mA. 0-10 V DC, 2-10 V DC.

Control Valves

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55. Requirements:

NPS 2 and under: bronze with screwed ends.

NPS 2 1/2 and over: cast iron with flanged ends.

Trim: type 316 stainless steel.

Leakage: 0.5 % of rated flow maximum.

Two or three port as indicated. Normally Open or Normally Closed, as indicated.

Flow characteristics: linear or equal percentage as indicated.

Rangeability: 50:1 minimum.

Performance: Capacity refer to I/O Summaries and Valve Schedule.

Pneumatic Valve Actuators

56. Requirements:

Construction: steel, cast iron, aluminum.

Diaphragm: moulded Buna-N rubber, nylon reinforced.

Spring return to normal position.

Spring range adjustment and position indicator.

Electronic/Electric Valve Actuators

57. Requirements:

Construction: steel, cast iron, aluminum.

Control voltage: 0-5, 0-10, 2-10V DC, or 4-20 mA.

Positioning time: to suit application, 90 sec maximum.

Spring return to normal position as indicated.

Watt-hour Meters and Current Transformers

58. Requirements:

Include three phases, test and terminal blocks for watt-hour meter connections and connections to FID for monitoring of current. Provide three potentiometer transformers for 600 V 4 wire systems for watt-hour meter use. Accuracy: plus or minus 0.25 % of full scale. For chiller applications: To have instantaneous indicator with analog or digital display.

Watt-hour meter sockets: to ANSI C12.7.

Potentiometer and current transformers: to ANSI/IEEE C57.13.

Potential transformers: provide two primary fuses.

Demand meters: configure to measure demand at 15 minute intervals.

Surface Water Detectors

59. Requirements:

Provide alarm on presence of water on floor.

Expendable cartridge sensor.

Internal waterproof switch.

One set of dry contacts 2 amps at 24 V.

Unaffected by moisture in air.

Self-powered.

Panels

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60. Either free-standing or wall mounted enameled steel cabinets with hinged and key-locked front door.

61. To be modular multiple panels as required to handle requirements with additional space to accommodate future capacity as required by Owner's Representative without adding additional cabinets.

62. Panels to be lockable with same key.

Control Air Compressor Stations

63. Requirements: Provide 2 high pressure, compressors, receiver mounted, base mounted, each complete with belts, guards, intake muffler, replaceable cartridge intake cleaner, starter, pressure switches, alternator.

64. Capacity: size to maintain air pressure, meet all control air requirements on 25 % maximum running time.

65. Receiver: size to suit running time. Complete with automatic drain, pressure relief valve, pressure gauge ASME code rated for 1400 kPa.

66. Vibration isolation: 5 % transmissibility.

67. Refrigerated air drier:

2 continuous operating type, complete with refrigerant evaporator, mechanical condensate separator, installed with 2 isolating valves. Designed for 1400 kPa maximum operating pressure.

Capacity: sized for full capacity of air compressors, to reduce dewpoint to minus 10°C when dehydrating at 700 kPa. Maximum pressure drop 19 kPa at rated capacity.

Provide 2 filter and PRV assemblies, with isolating valves and filter element, having 99% efficiency in removal of 0.5 micron diameter solid particles and oil aerosols and with indication of degree of saturation. Piping to be such that one dryer is always in circuit and active.

Electronic VAV Terminal Control Box

68. Terminal box sized to deliver air quantities as per mechanical VAV Box Schedule.

69. Box complete with factory installed averaging air velocity sensor. Provide removable air flow sensor with minimum 4 point sensing with +/- 5% accuracy at 10 deg C to 35 deg C and 40 to 1000 l/s.

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70. Box to include direct damper shaft mounted actuator, of the non stall, full linear with position feedback type. Actuator to de-energize when at desired position.

71. Box to be complete with power transformer and control wiring to damper actuator and termination terminals for room sensors and other specified sensors and auxiliary devices.

72. Box to include VAV Controller as described in Section 25 30 01-EMCS: Building Controllers with appropriate mounting plate and protective cover.

Electronic Air flow Measurement Stations and Transmitters

73. Each station to contain an array of velocity sensing elements and straightening vanes inside a flanged sheet metal casing. The velocity sensing elements to be of the thermal, temperature compensated thermistor type, with linearizing means. The sensing elements to be distributed across the duct cross section in the quantity and pattern set forth for measurements and instruments of ASHRAE and SMACNA for the traversing of ducted air flows. The resistance to air flow through the airflow measurement station not to exceed 20 Pa gauge at an airflow of 10 m/s. Station construction suitable for operation at airflows of up to 25 m/s over a temperature range of 5 to 50 degrees C, and accuracy plus or minus 3 percent over a range of 0.625 to 12.5 m/s scaled to air volume.

74. Transmitters to produce a linear, temperature compensated 4-20 mAdc output corresponding to the required velocity pressure measurement. The transmitter to be a 2-wire, loop powered device with local indication where indicated. The output error of the transmitter not to exceed 0.5 percent of the calibrated measurement.

Fuel Tank Level Sensor

75. Provide suitable electronic, ULC approved oil tank level sensor to measure product and water level in oil tank specified in Section 33 56 13 – Aboveground Fuel Storage Tanks. Components in oil tank to be of stainless steel construction, electrical enclosures CSA rated. Float type probes to be provided with riser to suit oil tank c/w suitable tapping adaptor and S.S. guide tube with foot.

76. Sensor to communicate with EMCS system for oil and water level in tank.

execution. Installation

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77. Install field control devices, conduit and wire in accordance with manufacturers recommended methods, procedures and instructions. Wiring and conduit above 50 volts by electrical Division. Coordinate requirements with Electrical Contactor.

78. Temperature transmitters, humidity transmitters, current-to-pneumatic transducers, solenoid air valves, controllers, relays: install in CSA 2 enclosures or as required for specific applications. Provide for electrolytic isolation in all cases when dissimilar metals make contact.

79. Support field-mounted transmitters, sensors on pipe stands or channel brackets.

80. Install wall mounted devices on plywood panel properly attached to wall.

Temperature and Humidity Sensors

81. Stabilize to ensure minimum field adjustments or calibrations.

82. To be readily accessible and adaptable to each type of application so as to allow for quick easy replacement and servicing without special tools or skills.

83. Outdoor installation:
Protect from solar radiation and wind effects by stainless steel shields.
Install in CSA 4X enclosures.

84. Duct installations
Do not mount in dead air space.
Location to be within sensor vibration and velocity limits.
Securely mount extended surface sensor used to sense average temperature.
Thermally isolate elements from brackets and supports so as to respond to air temperature only.
Support sensor element separately from coils, filter racks.

85. Averaging duct type temperature sensors:
Sensor length to be not less than 1000 mm per square metre of duct cross-sectional area.
Use multiple sensors where single sensor does not meet minimum length ratio. Wire multiple sensors in series for freeze protection applications.
Wire multiple sensors separately for temperature measurement.
Use either software averaging algorithm to derive overall average for control purposes or separate inputs, based on site requirements.

86. Thermowells: install for piping installations. Where pipe diameter is less than well insertion length, locate well in elbow. Thermowell to restrict flow by less than 30%.

Panels

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87. Arrange for conduit and tubing entry from top, bottom or either side.

88. Use modular multiple panels if necessary to handle all requirements, with space for additional 20% PCU or FID if applicable without adding additional panels. Space to accommodate maximum capacity of associated controller (ECU, LCU, MCU, PCU, TCU).

89. Wiring and tubing within panels: locate in trays or individually clipped to back of panel.

90. Identify wiring and conduit clearly.

Magnehelic Pressure Indicators

91. Install adjacent to fan system static pressure sensor and duct system velocity pressure sensors (as approved by the Owner's Representative).

92. Locations to be as indicated or specified.

Pressure and Differential Pressure Switches

93. Install isolation valve and snubber on sensors between sensor and pressure source. In addition, protect sensing elements on steam and high temperature hot water service with pigtail syphon between valve and sensor.

I/P Transducers

94. Install air pressure gauge on outlet.

Pressure Gauges

95. Install on pneumatic systems only.

96. Install pressure gauges on pneumatic devices, I/P, pilot positioners, motor operators, switches, relays, valves, damper operators, valve actuators.

97. Install pressure gauge on output of controller and auxiliary cabinet pneumatic devices.

Air Pressure Gauges

98. Install on pneumatic systems only.

99. Install on pneumatic devices including I/P's, pilot positioners, motor operators.

Pneumatic Valve Actuators

100. Install full relay type positioner having interlocking linkage for mechanical feedback of actual valve position on all modulating valves except radiation and unit heaters.

Tank Level Switches

101. Mount in top of tank in threaded coupling.

Liquid Level Switches

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102. Suspend float in sump from flexible cord and with weight mounted not more than 50 mm above switch.

Identification

103. Identify field devices properly.

104. Refer to Section 25 05 54 - EMCS: Identification.

Air Flow Measuring Stations

105. Cap manifold until cleaning of ducts is completed.

Testing

106. Calibrate and test field devices for accuracy and performance. Submit report detailing tests performed, results obtained to Owner's Representative for approval. Owner's Representative will verify results at random. Provide testing equipment and manpower necessary for this verification.

Commissioning

107. Refer to Section 25 08 20 - EMCS: Warranty and Maintenance.

END OF SECTION

SECTION

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DIVISION 25 INTEGRATED AUTOMATION

SECTION 253003 VARIABLE FREQUENCY DRIVES FOR EMCS

GENERAL DESCRIPTION

1. This specification describes a high performance variable frequency drive (VFD) used to control the speed of a NEMA design B induction motor.
2. Load filters shall be supplied with all drives.
3. A building automation system serial communication module and EMCS communication card shall be supplied with all drives.

Related Sections

4. Section 01 33 00 - Submittal Procedure
5. Section 01 35 50 – Waste Management and Disposal.
6. Section 01 81 00 – Commissioning.

REFERENCES

7. Referenced Standards:
Institute of Electrical and Electronic Engineers (IEEE)
Standard 519 Guide for Harmonic Content and Control..
Underwriters laboratories (ULC)
UL508C Power Conversion Equipment
National Electrical Manufacturer's Association (NEMA)
ICS 7.0, AC Adjustable Speed Drivers
International ElectroTechnical Commission (IEC)
IEC 61800 Adjustable Speed Electrical Power Drive Systems
International Standards Organization (ISO)
ISO-9001 Quality Management Systems

SUBMITTALS

8. Submittals shall include the following information:
Outline dimensions, conduit entry locations and weight.
Customer connection and power wiring diagrams.
Complete technical product description include a complete list of options provided.
Compliance to IEEE 519 – harmonic analysis for particular jobsite including total harmonic voltage distortion and total harmonic current distortion (TDD).

The VFD manufacturer shall provide calculations; specific to this installation, showing total harmonic voltage distortion is less than 5%. Input line filters shall be sized and provided as required by the VFD manufacturer to ensure compliance with IEEE standard 519. All VFD's shall include a minimum of 5% impedance reactors, no exceptions.

In accordance with Section 01 33 00.

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QUALITY ASSURANCE

9. The VFD manufacturing facility shall be ISO 9001 certified. The VFD shall be UL listed, Canadian UL listed, CSA listed, IEEE listed, and NEMA listed.

10. All printed circuited boards shall be completely tested and burned-in before being assembled into the completed VFD. The VFD shall then be subjected to a preliminary functional test, burn-in, and computerized final test. The burn-in shall be at 40°C, at full rated load, or cycled load. Drive input power shall be continuously cycled for maximum stress and thermal variation. Conformal coating of boards shall be included for each drive.

11. The drive shall be designed to provide 250 000 hours mean time before failure (MTBF) when the specified preventative maintenance is performed.

12. VFD manufacturer shall have an analysis laboratory to evaluate the failure of any component. The failure analysis lab shall allow the manufacturer to perform complete electrical testing, x-ray components, and decap or delaminate components and analyze failures within the component.

PRODUCTS

VARIABLE FREQUENCY DRIVES

13. The VFD package as specified herein shall be enclosed in a NEMA Type 1 or optional NEMA 12 enclosure, completely assembled and tested by the manufacturer in an ISO9001 facility. The VFD tolerated voltage window shall allow the VFD to operate from a line of +30% nominal, and -35% nominal voltage as a minimum.

Environmental operating conditions: 0 to 40°C continuous duty. VFD's that can operate at 40° C intermittently (during a 24 hour period) are not acceptable and must be oversized. Altitude 0 to 1000m above sea level, less than 95% humidity, non-condensing.

Enclosure shall be type NEMA 1 and shall be UL listed as a plenum rated VFD. VFD's without these ratings are not acceptable.

14. All VFD's shall have the following standard features:

All VFD's shall have the same customer interface, including digital display, and keypad, regardless of horsepower rating. The keypad shall be removable, capable of remote mounting and allow for uploading and downloading of parameter settings as an aid for start-up of multiple VFD's.

The keypad shall include Hand-Off-Auto selections and manual speed control. The drive shall incorporate "bumpless transfer" of speed reference when switching between "Hand" and "Auto" modes. There shall be fault reset and "Help" buttons on the keypad. The Help button shall include "on-line" assistance for programming and troubleshooting.

There shall be a built-in time clock in the VFD keypad. The clock shall be used to date and time stamp faults and record operating parameters at the time of fault. The clock shall also be programmable to control start/stop functions, constant speeds, PID parameter sets and output relays.

The VFD's shall utilize pre-programmed application macros specifically designed to

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facilitate start-up. The Application Macros shall provide one command to reprogram all parameters and customer interfaces for a particular application to reduce programming time.

The VFD shall be capable of starting into a coasting load (forward or reverse) up to full speed and accelerate or decelerate to setpoint without safety tripping or component damage (flying start).

The VFD shall have the ability to automatically restart after an over-current, over-voltage, under-voltage, or loss of input signal protective trip. The number of restart attempts, trial time, and time between attempts shall be programmable.

The VFD shall have an integral 5% impedance reactor to reduce the harmonics to the power line and to add protection from AC line transients. The 5% impedance may be from dual (positive and negative DC bus) reactors, or 5% AC line reactors. VFD's with only one DC reactor shall add AC line reactors.

The VFD shall include a coordinated AC transient protection system consisting of 4-120 joule rated MOV's (phase to phase and phase to ground), a capacitor clamp, and 5% impedance reactors.

The VFD shall be capable of sensing a loss of load (broken belt / broken coupling) and signal the loss of load condition. The drive shall be programmable to signal this condition via a keypad warning, relay output and/or over the serial communications bus. Relay outputs shall include programmable time delays that will allow for drive acceleration from zero speed without signaling a false underload condition.

If the input reference (4-20mA or 2-10V) is lost, the VFD shall give the user the option of either (1) stopping and displaying a fault, (2) running at a programmable preset speed, (3) hold the VFD speed based on the last good reference received, or (4) cause a warning to be issued, as selected by the user. The drive shall be programmable to signal this condition via a keypad warning, relay output and/or over the serial communication bus.

15. All VFD's to have the following adjustments:

Two (2) PID Setpoint controllers shall be standard in the drive. Two (2) programmable analog inputs shall accept current or voltage signals.

Two (2) programmable analog outputs (0-20ma or 4-20 ma). The outputs may be programmed to output proportional to frequency, motor speed, output voltage, output current, motor torque, motor power (kW), DC bus voltage, active reference, and other data.

Six (6) programmable digital inputs. There shall be a run permissive circuit for damper or valve control. Regardless of the source of a run command (keypad, input contact closure, time-clock control, or serial communications) the VFD shall provide a dry contact closure that will signal the damper to open (VFD motor does not operate). When the damper is fully open, a normally open dry contact (end-switch) shall close. The closed end-switch is wired to a VFD digital input and allows VFD motor operation. Two separate safety interlock inputs shall be provided. When either safety is opened, the motor shall be commanded to coast to stop, and the damper shall be commanded to close. The keypad shall display "start enable 1 (or 2) missing". The safety status shall also be transmitted over the serial communications bus. All digital inputs shall be programmable to initiate upon an application or removal of 24VDC.

Three (3) programmable digital Form-C relay outputs. The relays shall include programmable on and off delay times and adjustable hysteresis. Default settings shall be for run, not faulted (fail safe), and run permissive. The relays shall be rated for

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maximum switching current 6 amps at 30 VDC and 250 VAC and 0.4 A at 120 VDC; Maximum voltage 300 VDC and 250 VAC; continuous current rating 2 amps RMS. Outputs shall be true form C type contacts; open collector outputs are not acceptable.

The VFD shall include a motor flux optimization circuit that will automatically reduce applied motor voltage to the motor to optimize energy consumption and audible motor noise.

The VFD shall include a carrier frequency control circuit that reduces the carrier frequency based on actual VFD temperature that allows the highest carrier frequency without derating the VFD or operating at high carrier frequency only at low speeds.

16. Serial Communications

The VFD shall have an RS-485 port as standard. The standard protocols shall be Modbus, Johnson Controls N2 bus, and Siemens Building Technologies FLN, protocols for LonWorks, BACnet, Profibus, Ethernet, and DeviceNet shall be available. Each individual drive shall have the protocol in the base VFD. The use of third party gateways and multiplexers is not acceptable. All protocols shall be “certified” by the governing authority. Use of non-certified protocols is not allowed.

Serial communication capabilities shall include, but not be limited to; run-stop control, speed set adjustment, proportional/integral/derivative PID control adjustments, current limit, accel/decel time adjustments, and lock and unlock the keypad. The drive shall have the capability of allowing the DDC to monitor feedback such as process variable feedback, output speed / frequency, current (in amps), % torque, power (kW), kilowatt hours (resettable), operating hours (resettable), and drive temperature. The EMCS shall also be capable of monitoring the VFD relay output status, digital input status, and all analog input and analog output values. All diagnostic warning and fault information shall be transmitted over the serial communications bus. Remote VFD fault reset shall be possible. The following additional status indications and settings shall be transmitted over the serial communications bus – keypad “Hand” or “Auto” selected, bypass selected, the ability to change the PID setpoint, and the ability to force the unit to bypass. The EMCS system shall also be able to monitor if the motor is running in the VFD mode or bypass mode (if bypass is specified) over serial communications. A minimum of 15 field parameters shall be capable of being monitored.

The VFD shall allow the EMCS to control the drive’s digital and analog outputs via the serial interface. This control shall be independent of any VFD function.

17. EMI / RFI filters. All VFD’s shall include EMI/RFI filters. The onboard filters shall allow the VFD assemblies to be CE Marked and the VFD shall meet product standard EN 61800-3 for the First Environment restricted level.

18. BYPASS FEATURES – Features to be furnished and mounted by the drive manufacturer. All features shall be UL Listed by the drive manufacturer as a complete assembly and carry a UL508 label.

A complete factory wired and tested bypass system consisting of an output contactor and bypass contactor. Overload protection shall be provided in both drive and bypass modes. Door interlocked, padlockable circuit breaker that will disconnect all input power from the drive and all internally mounted options.

Fast acting fuses exclusive to the VFD – fast acting fuses allow the VFD to disconnect from the line prior to clearing upstream branch circuit protection, maintaining bypass

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capability. Bypass designs, which have no such fuses, or that incorporate fuses common to both the VFD and the bypass will not be accepted. Three contactor bypass schemes are not acceptable.

The drive / bypass shall provide single-phase motor protection in both the VFD and bypass modes.

The following indicating lights (LED type) shall be provided. A test mode or push to test feature shall be provided.

- Power-on (Ready)
- Run enable (safeties) open
- Drive mode select damper opening
- Bypass mode selected
- Drive running
- Bypass running
- Drive fault
- Bypass fault
- Bypass H-O-A mode
- Automatic transfer to bypass selected
- Safety open
- Damper opening
- Damper end-switch made

The following relay (form C) outputs from the bypass shall be provided:

- System started
- System running
- Bypass override enabled
- Drive fault
- Bypass fault (motor overload or underload (broken belt))
- Bypass H-O-A position

The digital inputs for the system shall accept 24V or 115VAC (selectable). The bypass shall incorporate internally sourced power supply and not require an external control power source.

Dedicated digital input that will transfer motor from VFD mode to bypass mode upon dry contact closure for fireman's override. Two modes of operation are required.

One mode forces the motor to bypass operation and overrides both the VFD and bypass H-O-A switches and forces the motor to operate across the line (test mode). The system will only respond to the digital inputs and motor protections.

The second fireman's override mode remains as above, but will also defeat the overload and single-phase protection for bypass and ignore all keypad and digital inputs to the system (run until destruction).

The VFD shall include a "run permissive circuit" that will provide a normally open contact whenever a run command is provided (local or remote start command in VFD or bypass mode). The VFD system (VFD or bypass) shall not operate the motor until it receives a dry contact closure from a damper or valve end-switch. When the VFD system safety interlock (fire detector, freezestat, high static pressure switch, etc) opens, the motor shall coast to a stop and the run permissive contact shall open, closing the

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damper or valve.

Class 20 or 30 (selectable) electronic motor overload protection shall be included.

There shall be an internal switch to select manual or automatic bypass.

There shall be an adjustable current sensing circuit for the bypass to provide loss of load indication (broken belt) when in the bypass mode.

PART 3 – EXECUTION

INSTALLATION

19. Installation shall be the responsibility of the EMCS contractor. The contractor shall install the drive in accordance with the recommendations of the VFD manufacturer as outlined in the installation manual.

20. Power wiring shall be completed by the electrical contractor. Three copper conductors and a ground wire are required. Separate the input power wiring from the output power wiring in individual metallic conduit. Do not combine. Provide a separate metallic conduit for control wiring. The contractor shall complete all wiring in accordance with the recommendations of the VFD manufacturer as outlined in the installation manual.

START-UP

21. Certified factory start-up shall be provided for each drive by a factory authorized service center in accordance with Section 01 91 13 – Commissioning (Cx) Requirements and Section 26 05 00 Common Work Results - Electrical. A certified start-up form shall be filled out for each drive with a copy provided to the owner, and a copy kept on file at the manufacturer.

PRODUCT SUPPORT

22. Factory trained application engineering and service personnel that are thoroughly familiar with the VFD products offered shall be locally available at both the specifying and installation locations. A 24/365 technical support line shall be available on a toll-free line.

WARRANTY

23. Warranty shall be 24 months from the date of certified start-up, not to exceed 30 months from the date of shipment. The warranty shall include all parts, labor, travel time and expenses. There shall be 365/24 support available via a toll free phone number.

END OF SECTION

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DIVISION 25 INTEGRATED AUTOMATION

SECTION 259001 – SITE REQUIREMENTS, APPLICATIONS AND SYSTEM SEQUENCES OF OPERATION FOR EMCS

General

Design Documentation

1. Design documentation for each system to include, as a minimum:
Narrative type of Sequence of Operation.
Control Description Logic (CDL).
Input/Output Summary Schedules.
Schematics.

EMCS Language Design Criteria

2. Language: refer to Section 25 05 01 EMCS: General Requirements.
3. Levels of EMCS Language
Level 1: alarm and operational messages to convey alarm conditions or operational messages.
Level 2: full names of equipment and control points. The various systems, their equipment and components and all control points are named in accordance with this section.
Level 3: system, equipment, component and control point descriptors: unique, alphanumeric identifiers derived from full names of corresponding system component and control point.
Level 4: commands: represent various computer functions and routines.
 - Operational commands - relate to building operations and building system controls.
 - Computer system commands - relate to computer maintenance, upgrading or development software used to improve and maintain the application software for the building site.
Level 5: machine language. Languages specific to each manufacturer's product, used internally to perform its functions and routines.
4. Additional Equipment, Components and/or Control Points. Where additional equipment, components and/or control points are required on specific projects, the following procedures shall be adopted:
Full names of the equipment, component and control points shall be not more than 40 characters, including numerals.
SYSTEM descriptors shall be not more than 10 alphanumeric characters. INPUT and OUTPUT descriptors shall be not more than 10 alphanumeric characters. The letters shall be based upon the English/French language full name, and should, where possible, be the first letter of each word of the full name.

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5. The descriptor shall be unique.
6. Descriptors and expansions: table lists standardized system identifiers and point identifiers.

Table:

Identifiers and Expansions

| English Identifier (10 characters max) | English Expansion (40 characters max) |
|---|--|
| OAD | Outside air damper |
| OAT | Outside air temperature |
| OAHD | Outside air humidity |
| OAV | Outside air volume |
| RAD | Return air damper |
| RAT | Return air temperature |
| RAH | Return air humidity |
| RASP | Return air static pressure |
| MAD | ** Mixed air dampers ** |
| MAT | Mixed air temperature |
| MAPSP | Mixed air plenum static pressure |

** MAD shall be used for applications where outside air and return air dampers are controlled from one (1) only output signal.

| | |
|--------|-------------------------------------|
| EAD | Exhaust air damper |
| PPFD | Pre-filter pressure drop |
| PFALM | Pre-filter pressure drop alarm |
| FFPD | Final filter pressure drop |
| FFALM | Final filter pressure drop alarm |
| HCVLV | Heating coil valve |
| HCVLVC | Heating coil valve control |
| HCVLVS | Heating coil valve status |
| BPD | Heating coil face and bypass damper |
| HCFA | Heating coil freeze alarm |
| CCVLV | Cooling coil valve |
| CCVLVC | Cooling coil valve control |
| CCVLVS | Cooling coil valve status |
| SVLV | Steam valve |
| SVLVC | Steam valve control |
| SVLVS | Steam valve status |
| SF#-C | Supply fan # control |
| SF#-S | Supply fan # status |

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| | |
|-------------|--|
| SF#-VSD | Supply fan # VSD control |
| SF#-VSDF | Supply fan # VSD fault |
| SAV | Supply air volume |
| SAVC | Supply air volume control |
| SAT | Supply air temperature |
| SAH | Supply air humidity |
| SAVP | Supply air velocity pressure |
| SASP | Supply air static pressure |
| RF#-C | Return fan #control |
| RF#-S | Return fan # status |
| RF#-VSD | Return fan # VSD control |
| RF#-VSDF | Return fan # VSD fault |
| RAV | Return air volume |
| RAVC | Return air volume control |
| RAT | Return air temperature |
| RAH | Return air humidity |
| RAVP | Return air velocity pressure |
| RASP | Return air static pressure |
| EF#-C | Exhaust fan # control |
| EF#-S | Exhaust fan s# status |
| EXAT | exhaust air temperature |
| EXAV | exhaust air volume |
| Chiller #1: | |
| CH1F | flow rate |
| CH1LWT | leaving chilled water temperature |
| CH1LWP | Leaving chilled water pressure |
| CH1EWT | Entering chilled water temperature |
| CH1EWP | Entering chilled water pressure |
| CD1EWT | Entering condenser water temperature |
| CD1EWP | Entering condenser water pressure |
| CD1LWT | Leaving condenser water temperature |
| CD1LWP | Leaving condenser water pressure |
| CHP1F | Chilled water pump #1 flow rate |
| CHP1DP | Chilled water pump #1 discharge pressure |
| CHP1S | Chilled water pump #1 status |
| CP3C | Circulating pump #3 control |
| CP3F | Circulating pump #3 flow rate |
| CP3DP | Circulating pump #3 discharge pressure |
| CP3S | Circulating pump #3 status |
| HTA | High temperature alarm |
| LTA | Low temperature alarm |
| HTCO | High temperature cutout |

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| | |
|-------|--|
| LTCO | Low temperature cutout |
| HLA | High level alarm |
| LLA | Low level alarm |
| HLCO | High level cutout |
| LLCO | Low level cutout |
| | |
| HWF | Heating water flow rate |
| HWST | Heating water supply temperature |
| HWRT | Heating water return temperature |
| | |
| STP | Steam pressure |
| STF | Steam flow rate |
| | |
| RM-T | Room temperature |
| RM-H | Room humidity |
| RM-SP | Room static pressure (add reference point) |

Examples of specific space conditions:

| | |
|--------------|---|
| RM-TNPER 2 | Space temperature, North Perimeter, 2 nd floor |
| RM-SPSPER 19 | Space static pressure, South Perimeter, 19th floor |
| RM-HEINT 9 | Space humidity, East Interior, 9th floor |
| | |
| AFS | Air Flow Switch |
| AFM | Air Flow Monitor |
| | |
| F | Flow |
| P | Pressure |
| ST | Supply temperature |
| RT | Return temperature |
| | |
| FA | Fire alarm |
| FTA | Fire trouble alarm |
| | |
| CW | Chilled water system |
| CD | Condenser Water System |
| HWH | Hot water heating system |
| RADN | Radiation system |
| | |
| CDR | Condensate return system |
| HPS | Steam - High pressure system |
| LPS | Steam - Low pressure system |
| | |
| DCW | Domestic cold water system |
| DHW | Domestic hot water system |
| DHWR | Domestic hot water system Recirculation |
| | |
| SANP | Sanitary sewage - pumped system |
| STMP | Storm water - pumped system |
| | |
| SPRD | Sprinkler - Dry pipe system |
| SPRW | Sprinkler - Wet pipe system |

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FSTP

Fire standpipe & hose system

VBA

Volume Box Control Assembly

I/O Summary Schedules

7. General:

The EMCS contractor shall provide a complete I/O summary schedule similar to the one listed below, listing and describing all I/O's in detail. Contractor's standard schedule may be used provided all relevant information is provided.

PCU no: identifies the PCU to which all points in the I/O Summary Schedule are wired.

Building/Area: unique label given to each building forming part of a multi-building facility.

Area/System Label: unique label given to each area of the building or to each system.

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Column 1: Point no: I/O Summary Schedule reference number.

Column 2: Point label: unique label for each point in the system. Point labels may be repeated for other buildings or systems.

Column 3: Description: describes the point label in expanded terms.

Column 4: Type: (eg. AI, AO, DI, DO).

Column 5: Eng. Units: Describes the engineering units used (eg. for AI, AO: C, kPa, Amp Volt. For DI, DO: OFF, ON).

Column 6: Access level: Defines the level of access for varying complexity of functions. Usually associated with password feature. Usually assigned value between 0 (lowest) and 4 (highest).

Column 7: Sensor type: describes in 2 or 3 words.

Column 8: Assoc. Point: Identifies/ describes points for purposes of alarm suppression, software interlocks.

Column 9: Type: defines the type of alarm (eg. CR = CRITICAL, CA = CAUTIONARY, M = MAINTENANCE).

Column 10: DI/DO, NO/NC: defines the NORMAL condition of alarm. (NC = NORMALLY CLOSED. NO = NORMALLY OPEN).

Column 11: Limits: Defines alarm levels (eg. L2 = Low alarm, Level2. H1 = High alarm, Level1).

Column 12: Alarm Mess: Defines alarm message number. This number is related to pre-composed message detailing the problem and describing the required action.

Column 13: Maint Mess: defines maintenance message number. This number as related to pre-composed message detailing the problem and describing the required action.

Column 14: Set Point: Defines the design set-point of the control loop.

Column 15: Dead band: defines the range above or below the set-point at which no change in output signal is to occur.

Column 16: Dev alarm limit: defines the limit on deviation of the measured value from the set-point (sometimes also referred to as the "error limit").

Column 17: NC/NO: defines NORMAL condition when de-energized. NC - NORMALLY CLOSED. NO = NORMALLY OPEN. DA/RA: defines the form of action. DA = direct acting. RA = REVERSE ACTING.

Column 18: Contacts: NO/NC: defines NORMAL condition when de-energized. NC = NORMALLY CLOSED. NO = NORMALLY OPEN.

Column 19: Delay Succ starts: defines the time limits (usually in seconds). To prevent overheating of motors or equipment from frequent re-starting.

Column 20: Heavy motor delay: defines the time (usually up to 60seconds). To prevent heavy electrical load from simultaneous starting of large consumption equipment.

Column 21: auto-reset: A = AUTOMATIC. M=MANUAL.

Column 22: Programs:

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Examples of Applications Programs include: Night set-back; optimum start/stop; demand limiting (load shedding).
Optimization routines (eg. chiller optimization, supply air temperature optimization, enthalpy control) should be described as part of CDL's.
Parameters for all application programs should be provided separately as part of the design documentation (eg. the Systems Operation Manual).
Note requirements for computer totalization, recording, print-out of accumulated value of a point over a period of time. If totalization depends upon a number of analog points, include for pseudo energy points.
Run time totals: for calculation of operation of digital points.
Optimum start/stop: Example: HVAC unit to start before scheduled occupancy, based upon HVAC unit capacity, heat loss, interior and exterior environmental conditions, etc.

Schedule:

| INPUT/OUTPUT | SCHEDULE PCU NO. | | (see 1.3.2) |
|----------------------|------------------|--------------------------------------|--------------|
| PROJECT NO. | BLDG/AREA | | (see 1.3.3) |
| | | N A M E N A M E | (see 1.3.3) |
| PROJECT NAME | AREA/SYSTEM | | |
| POINT IDENTIFICATION | | | ALARMS |
| 3 | 4 | 6 | 7 |
| 9 | 1 | 0 | |
| I | T | S | T |
| e | y | e | y |
| s | p | n | p |
| c | e | s | e |
| r | | o | 0 |
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| | | I | (|
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| MESSA GES | | | | DI/DO |
|--------------|----|---|---|-------|
| | I | I | I | 2 |
| | 4 | 7 | 8 | C |
| | S | N | C | F |
| | e | O | o | e |
| | t- | / | n | a |
| | | N | t | v |
| | | C | , | y |
| | | | s | |
| | P | D | N | M |
| | o | A | O | c |
| | i | / | / | t |
| | n | R | N | c |
| | t | A | C | r |
| | M | | | |
| | O | | | |
| | / | | | |
| | M | | | |
| | A | | | |

CONTROL NARRATIVE SEQUENCE OF OPERATIONS

8. Typical Hospital AHU Operation:

The air-handling unit supply fan and associated return fan and exhaust fans shall normally operate on a preset daily schedule. When the unit is off, the outside air damper and exhaust air damper shall be closed, the return air damper shall be open, the heating coil valve shall be closed, the cooling coil valve shall be closed, the steam humidifier valve shall be closed, the heating coil pump shall be on. All temperatures and humidity sensors shall continue to monitor, but the high and low limits shall not alarm.

To start the system, the EMCS controller shall command the system on. The outside air damper shall open. When the outside air damper end switch is closed, the supply fan shall start. The return fan shall start after a slight time delay. The return, exhaust and outdoor air dampers shall modulate to maintain the minimum fresh air position (set at 25%). The supply and return fan VSD's shall be gradually ramped to maintain the static pressure setpoint. (Set point to be determined on site after air balancing.)

Should the supply or return fans current sensors fail to prove proper operation within a suitable time period after a start command (initially set at 60 seconds) an alarm signal shall be raised.

Minimum outside air shall be maintained at 25% of design airflow by a software algorithm using inputs from the systems air flow measuring station(s), averaging temperature sensors located in the mixed air and return air streams, and the outdoor temperature sensor. The outside air algorithm shall not permit mixed air temperature to drop below 12°C.

For all systems, the fresh air supply and return airflows shall be measured by flow measuring stations located in the ducts or fan inlets as indicated. Multiple flow stations on a systems fresh air supply or return will have to be totalized to obtain total system airflow.

For temperature control in heating mode, the EMCS controller shall modulate the mixed

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air dampers and heating coil valve in sequence to maintain the supply air temperature setpoint (initially set at 13°C).

For temperature control in the cooling mode, the EMCS controller shall modulate the mixed air dampers in the economizer mode to maintain the supply air temperature setpoint. When the outside air temperature rises above the economizer lock-out setpoint (initially set at 18°C), the outside air dampers shall revert to the minimum position to deliver 25% fresh air. On a further call for cooling, the EMCS controller shall modulate the cooling coil valve to maintain supply air setpoint.

If the outdoor temperature falls below the cooling lockout setpoint (initially set at 13°C), the EMCS controller prevents the cooling coil valve from opening.

If the outdoor temperature rises above the heating lockout setpoint (initially set at 18°C), the EMCS controller prevents the heating coil valve from opening.

The system shall alarm if the supply air temperature falls below the low temperature alarm setpoint (initially set at 10°C) or rises above the high temperature alarm setpoint (initially set at 25°C).

The systems EMCS controller shall employ a supply air temperature reset function which shall automatically reset the supply air temperature setpoint based on a statistical analysis of zone heating/cooling demands throughout the areas served by the system. The reset algorithm shall readjust leaving air temperature as necessary to maintain return relative humidity setpoint as sensed by the relative humidity sensors in the return air stream, and the relative humidity in Class 1 critical care areas below 60%.

Should the heating coil pump fail as sensed by the pumps current sensing relay, an alarm shall be raised to warn the operator of the failure and instruct him to bring the standby pump on-line. Flow switches shall also be installed in the hot water supply line to each AHU heating coil to monitor flow and signal an alarm should a no flow or low flow condition exist when ambient air temperatures are below freezing.

Prefilter bank and final filter bank status shall be monitored by the EMCS controller via differential pressure switches. An alarm signal to change filters shall be raised at a set differential pressure. (To be determined on site after air balancing.)

The supply and return fans variable speed drives (VSD's) shall receive their signal from the EMCS controller to adjust the speed of the fan motor to maintain the required static pressure in the system. The supply and return fan status shall be monitored via current sensing relays, and any VSD faults shall be monitored/alarmed by the EMCS controller. The EMCS controller will modulate the humidifier steam valve to maintain the return air humidity setpoint (initially set at 40% R.H.). The controller will signal the humidifier steam valve to close if the supply air humidity exceeds the supply air humidity high level setpoint of 85% R.H. or if the supply fan should fail (indicated by current sensing relay and differential pressure switch).

Some systems serve areas which have reduced or no occupancy during nights and weekends. These areas shall be scheduled to receive reduced or shut off airflows during these periods. Air flows to these areas shall be controlled via zone dampers and measured via airflow stations or by volume regulating boxes. The schedule of occupied/unoccupied periods shall be co-ordinated with the Owner. The zones to have occupied/unoccupied schedules include:

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Administration Area

Support Areas

Surgery Suite

Lab/D.I./Pharmacy Areas

E.R./Clinics Area

During reduced airflow hours, the duct pressure sensors, VAV boxes, duct airflow stations, zone dampers and supply/return fan variable speed drives to be utilized to maintain the required system airflows and differential pressures.

The air handling systems shall be required to operate in a fire mode of operation as signaled automatically via the fire alarm system or manually via the fire department control panel. In general, during the fire mode of operation, the following shall occur:

When a confirmed fire/smoke condition exists in a fire zone, as detected by the fire alarm system, the supply air to that zone shall be shut off by closing the smoke or combination fire/smoke dampers in the ducts supplying air to the zone or by shutdown of the supply fan (depending on the fire zone). Refer to fire alarm cause/affect chart.

Return and exhaust air from the affected zone shall be maintained. The return air damper in the air handling units mixing box shall go fully closed and the exhaust air damper shall go fully open to exhaust 100% of the return air to the outside. This will maintain the area under negative pressure.

For other fire zones not affected by the fire/smoke condition, (other than zones within the area of refuge), the air handling units serving these areas shall be shutdown.

For the area of refuge, the return/exhaust fans serving these zones shall be shutdown while the supply fan(s) shall be kept running to pressurize the space. Supply air shall be 100% outside air (i.e. the AHU's mixing box return damper shall go fully closed).

Should a fire/smoke condition occur within a fire zone inside the area of refuge, all smoke dampers in ducts feeding that zone shall close.

Should smoke be detected by the smoke detection in the air supply of an air handling unit, that unit shall be shut down and the smoke dampers in the area served by that unit shall close.

Miscellaneous Safeties and Alarms:

The supply and return fans shall stop and an alarm signal raised upon the following conditions:

Smoke detector senses smoke

Temperature low limit sensor detects temperature below 5°C

Supply duct static pressure exceeds +1000 Pa.

Return duct static pressure exceeds -1000 Pa.

9. Outside Air Units (Hospitals)

For AHUs which are 100% fresh air heat recovery units, basic unit control logic is the same as other units. However, these units shall employ a "cold corner" defrost control

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on the plate exchanger for freeze protection. A multi blade damper and modulating 24 V damper actuator are used to deflect cold air away from the cold corner based on the cold corner leaving air temperature. These units are also equipped with heat exchanger bypass dampers. These dampers to be controlled based on the heat exchanger leaving air temperature to prevent over-recovery. When the temperature leaving the heat exchanger on the supply air side exceeds its setpoint (initially set at 13°C), the bypass damper shall be modulated open.

These systems are interconnected by bypass ducts c/w a normally closed damper. Should one of the units be taken out of service, the bypass damper shall open to allow the operating unit to handle air from the "off" units duct system. The airflow monitors and motorized dampers in the supply and return ducts shall be utilized to proportion the available air.

Should one of the units be taken out of service, the corresponding interlocked return fan shall be shutdown (and visa versa). These units, which are operating in parallel, shall be provided with the necessary logic to ensure that each unit delivers 50% of the airflow despite minor variations in system pressures at each unit.

10. Room Temperature Control

Reheat or Radiation Only

In rooms served only by duct reheat coils or radiation, a drop in room temperature as sensed by the rooms wall mounted temperature controller, causes the radiation or reheat coil valve to modulate/open to maintain the space temperature setpoint. (Operator adjustable within defined limits.)

Space temperatures shall be set back during unoccupied periods by the EMCS system on a schedule to be approved by the owner. An override switch/pushbutton on the face of each room temperature controller shall permit a timed override of the night setback in each room.

Radiation and Reheat

In rooms served by both duct reheat coils and radiation, a drop in room temperature as sensed by the room wall mounted temperature controller, causes the radiation heating valve to open. On a further drop in room temperature, the reheat coil valve shall be modulated open to maintain the space temperature setpoint (operator adjustable within defined limits).

Space temperatures shall be set back during unoccupied periods by the EMCS system on a schedule to be approved by the Owner. An override switch/pushbutton on the face of each room temperature controller shall permit a timed override of the night setback in each room.

VAV Box Control with optional radiation/reheat

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In rooms served by VAV boxes, the box damper shall be closed if the associated air handling unit is off and reheat/radiation heater valves shall be open. Prior to start of the system, the VAV box damper shall open to its minimum position.

On a call for cooling, the VAV box controller shall modulate the damper open to maintain the space temperature setpoint (Operator adjustable within defined limits). On a call for heating, the VAV box controller shall modulate the damper to its minimum position. On a further call for heat, the controller shall open the room's radiation heating valve (if applicable) to maintain space temperature setpoint. If the temperature still remains below setpoint, the controller shall modulate the reheat coil valve (if applicable) to maintain room temperature setpoint.

For two position only boxes (occupied/unoccupied), the sequence of operation is similar to above. The operating position of the box shall be controlled centrally on a schedule by the EMCS system or by a local room occupancy switch.

Space temperatures shall be set back during unoccupied periods by the EMCS system on a schedule to be approved by the owner.

An override switch/pushbutton on the face of each room temperature controller shall permit a timed override of the night setback in each room.

Penthouse/Electrical Room Heating/Ventilation Control

When the room space temperature, as sensed by the wall mounted temperature controller, exceeds its setpoint of 24°C, the outside air damper shall open. On a further rise in room temperature, the exhaust fan shall start. On a drop in room temperature, the reverse sequence shall occur.

When the space temperature drops below the heating setpoint of 15°C, the unit heater control valve shall open and the unit heater fan shall start.

Unit Heater/Cabinet Heater Control Sequence

On a call for heat as sensed by the room temperature controller, the heater control valve shall open and the fan shall start.

Fan speed shall be manually adjustable from within cabinet enclosure (where applicable).

Hot Water Heating Heat Exchanger Control

One of the hot water heating primary pumps shall run continuously to circulate hot water through the primary heating loop. The pumps shall be alternated on a timed shared basis and the lag pump shall start should the lead pump fail.

The heat exchanger steam valves shall be modulated as required to maintain the leaving hot water temperature at its setpoint.

The leaving water temperature setpoint shall be reset based on an outside air temperature schedule.

The exchangers must be able to operate in parallel or in isolation should one of the exchanger circuits be down for maintenance.

Normal operation is for one heat exchanger to carry the load.

Main Secondary Heating Loop Temperature/Pressure Control

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One of the hot water heating secondary pumps shall run continuously to circulate hot water through the secondary heating loop. The three pumps shall be alternated on a time shared basis and the lag pump shall start should the lead pump fail.

One, two or three of the secondary pumps shall be run at a time as required to maintain the set differential pressure in the secondary loop as sensed by the differential pressure sensor. Sensor to be located near the far end of the heating loop.

The hot water mixing valve shall be modulated as required to maintain the hot water supply temperature at its setpoint. The setpoint of the hot water supply temperature shall be reset based on an outside air temperature schedule.

Reheat/Perimeter Heating Loop Temperature Control

(Typical for Administration/Support Area, Central Area, Patient Area)

One of the two dedicated hot water heating pumps shall run continuously to circulate hot water through the heating loop. The pumps shall be alternated on a time shared basis and the lag pump shall start should the lead pump fail.

The hot water mixing valve shall be modulated as required to maintain the hot water supply temperature at its setpoint. The setpoint of the hot water supply temperature shall be reset based on an outside air temperature schedule.

High Pressure Steam Boilers

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Each coil tube steam boiler is provided with its own factory installed control panel and each boiler can be operated in a stand alone mode.

However, normal operation is for all three boilers to interface with the EMCS system for operating setpoints, firing rates and lead/lag control sequencing. Each boiler shall have four points communicating with the EMCS, (for pressure, enable, firing rate and common alarm).

The operators shall be able to change lead boilers, set point and sequence patterns at the local control panel (located near the boilers) or via the operator workstation.

The system shall be controlled full modulation 4-20 mA for the firing rate and the logic shall determine the most efficient rate of firing prior to selecting the next boiler in sequence.

On a boiler trip or alarm condition, the lead/lag system shall automatically start the next boiler in the sequence and alarm the trip condition.

Status and elapsed time shall be provided for call for heat, low fire and maximum firing rate.

The lead/lag system shall incorporate the ability for each boiler to be run under local (boiler) control panel only for testing purposes.

The lead/lag system shall reset to commissioned operating conditions in the event of power interruption and automatically re-start and control the boilers to return to normal operation.

Domestic Hot Water Heat Exchanger Control

One of the domestic hot water pumps shall run continuously to circulate DHW from the tanks through the heat exchanger and back to tanks. The pumps shall be alternated on a timed schedule and the lag pump shall start should the lead pump fail.

The heat exchanger steam valves shall be modulated as required to maintain the leaving water temperature at its setpoint of 70°C.

The exchangers must be able to operate in parallel (normal) or in isolation should one of the exchanger circuits be down for maintenance. Normal operation is for one of the heat exchangers to operate to carry the load.

Isolation Room Controls

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A volumetric air control system shall be used to control airflow offset, airflow tracking between supply and exhaust air variable volume boxes, provide stable room pressure and room environment, monitor room air pressure and environmental conditions and be capable of communications link with the EMCS.

Volumetric control shall be capable of direct pressure reset applications.

Isolation room control system to be complete with a EMCS based volumetric controller, velocity sensors for both supply and exhaust air flow, room pressure sensors to monitor pressure between both isolation room/anteroom and anteroom/hospital space, remote alarm panel, filter alarms for HEPA filters, and integration with room temperature control loop.

Volumetric control shall receive signal from velocity sensors to regulate flow via control regulation of variable volume box dampers. Volumetric control to reset airflow differential setpoint through the direct pressure reset control loop.

Room pressure sensor to be a through the wall device with one end monitoring the space and the other monitoring either the anteroom or the adjacent building corridor. Wall mounted room monitor controller shall receive differential pressure readings from each room pressure sensor at frequent intervals and display current value on the LCD display.

Room monitor controller shall be complete with LCD display, key switch control for change in containment state (positive (+), negative (-), or neutral (no isolation), check and reset control, set point adjustment and alarm mute. Unit shall be complete with sensor cable.

Sequence of Operation:

When room monitor/controller is in the positive (+) room pressurization mode, (Protective Isolation) volumetric controller to adjust supply and exhaust air volume boxes to maintain a 10% higher supply than exhaust airflow differential.

When room monitor/controller is in the negative (-) room pressurization mode Infectious Isolation) volumetric controller to adjust supply and exhaust air volume boxes to maintain a 10% higher exhaust than supply airflow differential.

When room monitor/controller is in the neutral (no isolation) mode, volumetric controller to adjust supply and exhaust airflow to maintain a 0% airflow differential.

Filter alarm signal to sound when static differential pressure across the supply airflow HEPA filter exceeds setpoint (initially set at 300 pa).

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Reheat coil valve to be modulated as required to maintain isolation room space temperature as sensed by room temperature sensor. Space temperature to be set back to an unoccupied setpoint (initially set at 18°C) when the room is not in use.

Isolation control to signal building automation system when any alarm condition exists.

Physiotherapy Area In-floor Radiation Temperature Control

The heating water circulation pump shall be commanded to run when the space temperature controller calls for heating. Failure of the pump shall raise an alarm.

The three way mixing valve shall modulate to maintain the supply water temperature to the in-floor heating loop at its setpoint (initially set at 35°C) as sensed by the water temperature sensor. Should the supply water temperature ever reach a high limit of 50°C, an alarm shall be raised and the three way valve shall revert to its normal position (preventing any hot water from entering the in-floor loop).

The two-way heating valve shall modulate as required to satisfy the space temperature setpoint.

Library/Work Room In-floor Radiation Temperature Control

The heating water circulation pump shall be commanded to run when any of the space temperature controllers call for heating. Failure of the pump shall raise an alarm.

The three way mixing valve shall modulate to maintain the supply water temperature to the in-floor heating loop at its setpoint (initially set at 38°C) as sensed by the water temperature sensor. Should the supply water temperature reach a high limit of 50°C, an alarm shall be raised and the three way valve return to its normal position (preventing any hot water from entering the in-floor loop).

The modular heating loop valves shall be modulated as required to maintain the space temperature setpoint as sensed by the room temperature controller.

Miscellaneous Equipment Alarm/Status Points

The following equipment shall be monitored by the EMCS: (Refer also to I/O list)

Deaerator control panel (common alarm)

Surge tank control panel (common alarm)

Air compressor control panel (common alarm)

High pressure steam header (pressure status/alarm)

Low pressure steam header (pressure status/alarm)

Data room air conditioning unit (common alarm)

Domestic cold water pressure status.

Domestic water filters differential pressure.

Medical Gas Common Alarms

Patient Area In-floor Radiant Heating Loop Temperature Control

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One of the two dedicated hot water heating pumps shall run continuously to circulate hot water through the heating loop during the heating system. Above a preset outside air temperature (initially set at 20°C), both pumps shall be off. During operation, both pumps shall be alternated on a run time shared basis, and the lag pump shall start should the lead pump fail.

The hot water mixing valve shall be modulated as required to maintain the supply temperature of the in-floor radiant heating loop at its setpoint (initially set at 35°C).

Patient Area Rooms (with in-Floor Radiation) Temperature Control

The modular heating loop valve serving the room shall be opened on a drop in room temperature as sensed by the room wall mounted temperature controller. On a further drop in room temperature, the reheat coil valve shall be modulated open to maintain the space temperature set point (operator adjustable within defined limits).

Boiler Room Ventilation/Combustion Air

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This heating and ventilation unit provides combustion and ventilation air to the boiler room. The units supply fan shall be commanded to start when any one of the three boilers are operating or on a call for space cooling as sensed by the space temperature sensor. The units heating coil pump shall be interlocked to start when the fan starts.

Prior to start up, the pressure relief dampers in the boiler room shall open. The EMCS system shall incorporate logic to modulate the fresh air and return dampers as required to satisfy the combustion air requirements with 1, 2 or 3 boilers running or the ventilation/cooling requirements to satisfy space temperature.

For temperature control, the EMCS controller shall modulate the heating coil valve to maintain the supply air temperature setpoint (initially set at 15°C). Should the outside air temperature be below 3°C, the heating coil pump shall run (whether the fan is running or not) and the heating coil valve shall go fully open and the units face and by-pass dampers shall modulate to maintain the supply air temperature setpoint.

Should the heating coil pump fail, an alarm shall be raised to notify the operator to manually change over to the spare pump. Should the supply air temperature drop below 5°C, the unit shall be shut down and an alarm raised. A flow switch shall also be installed in the hot water supply line to the AHU heating coil to monitor flow and signal an alarm should a no flow or low flow condition exist when ambient air temperatures are below freezing.

Should the H&V unit fail to run or be down for maintenance, the boiler room relief damper shall open as required to provide cooling (heat relief) or permit combustion air into the room when one or more of the boilers are running.

The units filter bank shall be monitored by the EMCS system via a differential pressure switch. An alarm signal to change the filters shall be raised at a set differential pressure.

Critical Care Area Environmental Control Sequence

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Each critical care area room, including OR's, LDRP's, Recovery, CCU rooms, Special Procedure, Endoscopy, Nursery, shall be provided with approved, flush mounted, polished stainless steel monitoring/alarm panels mounted within the space at a location approved by the Owner's Representative. Panel shall have concealed continuous hinges and keyed cylinder lock. Panels shall display room temperature, humidity and pressurization, contain an occupancy override push button, and temperature/humidity setpoint switches, and abnormal temperature/humidity, pressurization indicators.

Occupied Mode:

Supply/Return air flow rates, as sensed by the velocity sensors in the volume control boxes are maintained constant and independent of duct status pressure fluctuations by a volume regulating damper in the volume control boxes.

A subtract software algorithm maintains a constant difference between the supply and return airflows equal to the difference in the design airflows shown on the floor plans.

An alarm shall be raised should flow rates depart from setpoint by more than 5%. A flashing pilot light on the room panel shall alert room users to an abnormal airflow condition.

On a drop in room temperature, the reheat coil valve shall modulate to maintain the setpoint space temperature as sensed by the room temperature sensor. OR's and LDRP's to have a "Full Heat" push button in the panel to permit full open operation of the heating control valve.

A room humidity transmitter shall control the output of the booster humidifier serving the space. A duct mounted humidity transmitter located downstream of the booster humidifier shall act as a humidity high limit shut off to close the steam valve should the duct relative humidity reach 80%.

(In the CCU suite, only one booster humidifier is provided in the common duct serving the suite and the humidity transmitter shall be mounted in the common return duct).

For rooms provided with HEPA filters on the supply air, a differential pressure switch shall be used to signal an alarm when the HEPA filter pressure drop reaches the change out pressure.

Unoccupied Mode:

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Supply airflow shall be reduced to 25% of their design valves. "Full Heat" and humidifiers shall be deactivated, and reheat coils controlled as normal to provide space heating. Return airflows shall be reduced to the supply airflow rate minus the airflow offset. Unoccupied space temperatures shall be 20°C.

Pre-Occupancy Mode:

At a pre-determined time in advance of occupancy, airflows shall increase to their design airflows, humidifiers shall be reactivated, and reheat coils shall be controlled to bring the space temperature to its normal occupied setpoint. "Full Heat" switches shall remain deactivated.

Gas Scavenging Air Pressure Alarm

Each room provided with a gas scavenging exhaust tube shall incorporate a static pressure switch in the general exhaust duct at the point where the scavenging tube is connected. The switch shall be field set to signal an alarm should the negative pressure in the duct drops below the set value. The alarm shall be signaled locally in the room and at the main EMCS control console.

Cafeteria/Servery Air Volume Control

The cafeteria/servery area is provided with a constant volume of supply air during the occupied periods. A volume control box is employed on the return air duct from the space to control the return air volume. When the kitchen exhaust hood fan is off, all the air is returned via the return air system. When the kitchen exhaust hood fan is on, the volume control box on the return air duct shall reduce the return air flow by the amount of air exhausted. This shall maintain the pressure balance in the cafeteria/servery area. The volume control box shall be interlocked with the exhaust hood fan.

Lab Multi-Purpose Room Pressure Control

The Lab multi-purpose room contains a bio-safety cabinet (BSC) that is used intermittently. The BSC recirculates 70% of its air through an internal HEPA filter, but 30% of the air is exhausted via roof fan. This fan shall be interlocked to run whenever the BSC fan is running. A volume control box shall be utilized on the return air duct from the room to reduce the return airflow rate when exhaust fan is on. The return air shall be reduced by an amount equal to the exhaust air rate. This shall maintain a proper pressure balance for the room. Supply air to the room shall be maintained at a constant flow rate by a volume control box.

Chemo Prep/I.V. Additives Room Environmental Control Sequence

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Chemo Prep Room and I.V. Additives Room in the Pharmacy area are treated as clean rooms and must be maintained under positive pressure when in use. Each room must be provided with a pressure monitoring status and alarm panel in the adjacent ante-room.

Supply and return air flow rates, as sensed by the velocity sensors in the volume control boxes are maintained constant and independent of duct status pressure fluctuations by a volume regulating damper in the volume control boxes.

A subtract software algorithm maintains a constant difference between the supply and return airflows equal to the difference in the design airflows shown on the floor plans.

For the Chemo Prep Room, which contains a Bio Safety Cabinet (BSC) which shall be interlocked with its exhaust fan, the volume control boxes on supply and return shall modulate to maintain an adequate make-up air supply to the room while still keeping the room at a slight positive pressure (initially set at 25 pa), as monitored by the static pressure transmitters.

An alarm shall be raised should the room's positive static pressure be lost for any extended time. Time delays shall be incorporated to prevent nuisance alarms due to opening/closing of the door. A flashing pilot light on the room's alarm panel shall indicate an abnormal airflow/pressure condition.

On a drop in room temperature, the reheat coil valve shall modulate to maintain the set point space temperature as sensed by the room temperature sensor.

Fuel Oil Tank Monitoring/Fuel Metering

The fuel oil tank shall be provided with suitable level probes to measure oil and water levels.

The EMCS system shall monitor both oil and water levels in the tank and signal alarms at set high/low oil levels, high water level.

The EMCS system shall incorporate the necessary software to monitor fuel consumption based on fuel tank level changes over time and provide reports of fuel consumption over any given time period. Fuel consumption to be reconciled with fuel deliveries. The EMCS shall provide automatic fuel delivery reports after every fill up.

The EMCS system shall also provide for a local (outside adjacent the oil tank) audible and visual alarm of high oil levels to help prevent overfilling. Alarm components outside to be housed in NEMA 4X enclosure.

The EMCS system shall also monitor the vacuum pressure in the interstitial space on the tank and signal an alarm on low vacuum pressure.

Input/Output Point Summary Table

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11. The input/output table summarizes the Input/Output (I/O) points for the various systems as outlined within the EMCS specifications and control schematic drawings. However, the tables are not all inclusive as they do not list the typical room temperature sensors, reheat coil valves, radiator valves, unit heater/force flow valves, terminal unit control assemblies, infloor heating manifold loop valves, etc. The number and location of these devices can be found on the floor plans and/or listed in relevant schedules. All points and field devices required to accomplish the specified sequence of operation shall be provided. Any discrepancies in I/O counts between the points list, specs and drawings shall be reported to the Owner's Representative.

Chiller Interface

12. The EMCS system shall interface with the common chiller management panel supplied with the chillers to track all the basic chiller/condenser functions monitored by that panel. The EMCS shall be able to map a minimum of 32 I/O points per chiller/condenser. Coordinate with the chiller supplier for details of points monitored and hook up requirements.

Products (Not applicable)

Execution (Not applicable)

END OF SECTION

SECTION

GOVERNMENT OF THE U. S. VIRGIN ISLANDS, DEPARTMENT OF PUBLIC WORKS

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DIVISION 26 ELECTRICAL

SECTION 260500

PART 1- GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division I Specification Sections, apply to this Section.

1.2 SUMMARY

- A. This Section includes the following electrical materials and methods:

1. Supporting devices for electrical components
2. Electrical Identification
3. Touchup painting

1.3 SUBMITTALS

- A. General:

Submit each item in this Article according to the Conditions of the Contract and Division 1 Specification Sections.

- B. Product Data for each type of product specified.

- C. Samples of color, lettering style, and other graphic representation required for each identification product for Project.

1.4 QUALITY ASSURANCE

- A. Comply with NFPA 70 for components and installation.

- B. Listing and Labeling:

Provide products specified in this Section that are listed and labeled.

1. The Terms "Listed and Labeled":
As defined in the National Electrical Code, Article 100.
2. Listing and Labeling Agency Qualifications A "Nationally Recognized Testing Laboratory" (NRTL) as defined in OSHA Regulation 1910.7.

1.5 SEQUENCING AND SCHEDULING

- A. Coordinate electrical equipment installation with other building components.
- B. Arrange for chases, slots, and openings in building structure during progress of construction to allow for electrical installations.
- C. Coordinate installing required supporting devices and set sleeves in poured in place concrete

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and other structural components as they are constructed.

- D. Sequence, coordinate, and integrate installing electrical materials and equipment for efficient flow of the Work.
- E. Coordinate connecting electrical service to components furnished under other Sections. Refer to Division 15.
- F. Coordinate requirements for access panels and doors where electrical items requiring access are concealed by finished surfaces. Access panels and doors are specified in Division 8 Section "Access Doors."
- G. Coordinate installing electrical identification after completion of finishing where identification is applied to field finished surfaces.

PART 2 - PRODUCTS

2.1SUPPORTING DEVICES

- A. Channel and angle support systems, hangers, anchors, sleeves, brackets, fabricated items, and fasteners are designed to provide secure support from the building structure for electrical components.
 - 1. Material:
Stainless steel, except as otherwise indicated
 - 2. Metal Items for Use Outdoors or in Damp Locations:
Stainless steel, except as otherwise indicated
- B. Steel channel supports have 9/16-inch (14-mm) diameter holes at a maximum of 8 inches (203 mm) O.C., in at least 1 surface.
 - 1. Fittings and accessories mate and match with channels and are from the same manufacturer.
- C. Nonmetallic Channel and Angle Systems:
Structural grade, factory formed, fiberglass resin channels and angles with 9/16-inch (14-mm) diameter holes at a maximum of 8 inches (203 mm) O.C., in at least 1 surface.
 - 1. Fittings and accessories mate and match with channels or angles and are from the same manufacturer.
 - 2. Fitting and Accessory Material:
Same as channels and angles, except metal items may be stainless steel.
- D. Raceway and Cable Supports:
Manufactured clevis hangers, riser clamps, straps, threaded C-clamps with retainers, ceiling trapeze hangers, wall brackets, and spring steel clamps or "click" type hangers.
- E. Cable Supports for Vertical Conduit:
Factory fabricated assembly consisting of threaded body and insulating wedging plug for non-armored electrical cables in riser conduits. Plugs have number and size of conductor

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gripping holes as required to suit individual risers. Body constructed of malleable iron casting with hot dip galvanized finish.

- F. Expansion Anchors:
Carbon-steel wedge or sleeve type.

- G. Toggle Bolts:
All-steel springhead type.

- H. Powder-Driven Threaded Studs:
Heat-treated steel.

2.2 ELECTRICAL IDENTIFICATION

- A. Manufacturer's Standard Products:
Where more than one type is listed for a specified application, selection is Installer's option, but provide single type for each application category. Use colors prescribed by ANSI A13.1, NFPA 70, and these Specifications.
- B. Raceway and Cable Labels:
Conform to ANSI A13.1, Table 3, for minimum size of letters for legend and minimum length of color field for each raceway or cable size.
1. Type:
Preprinted, flexible, self-adhesive, vinyl. Legend is over-laminated with a clear, weather and chemical resistant coating.
 2. Color:
Black legend on orange field
 3. Legend:
Indicates voltage
- C. Colored Adhesive Marking Tape for Raceways, Wires, and Cables:
Self-adhesive vinyl tape not less than 3 mils thick by 1 inch wide (0.08 mm thick by 25 mm wide)
- D. Engraved, Plastic Laminated Labels, Signs, and Instruction Plates:
Engraving stock, melamine plastic laminate punched for mechanical fasteners 1/16-inch (1.6-mm) minimum thick for signs up to 20 sq. in. (129 sq. cm), 1/8 inch (3.2 mm) thick for larger sizes. Engraved legend in black letters on white face.
- E. Interior Warning and Caution Signs:
Preprinted, aluminum, baked enamel finish signs, punched for fasteners, with colors, legend, and size appropriate to the application.
- F. Fasteners for Plastic Laminated and Metal Signs:
Self-tapping stainless steel screws or No. 10/32 stainless steel machine screws with nuts and flat and lock washers.

2.3 TOUCHUP PAINT

SECTION

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A. For Equipment:

Provided by equipment manufacturer and selected to match equipment finish.

B. For Non-equipment Surfaces:

Matching type and color of undamaged, existing adjacent finish.

C. For Galvanized Surfaces:

Zinc-rich paint recommended by item manufacturer.

PART 3 - EXECUTION

3.1 EQUIPMENT INSTALLATION REQUIREMENTS

- A. Install components and equipment to provide the maximum possible headroom where mounting heights or other location criteria are not indicated.
- B. Install items level, plumb, and parallel and perpendicular to other building systems and components. Install equipment to facilitate service, maintenance, and repair or replacement of components.
- C. Connect for ease of disconnecting, with minimum interference with other installations.
- D. Give right of way to raceways and piping systems installed at a required slope.

3.2 ELECTRICAL SUPPORTING METHODS

- A. Damp Locations and Outdoors:
Stainless steel materials or nonmetallic, U-channel system components.
- B. Dry Locations:
Steel materials.
- C. Support Clamps for PVC Raceways:
Click type clamp system.
- D. Conform to manufacturer's recommendations for selecting supports.
- E. Strength of Supports:
Adequate to carry all present and future loads, times a safety factor of at least 4; 200-lb (90-kg) minimum design load.

3.3 INSTALLATION

- A. Install wires in raceway according to manufacturer's written instructions and NECA's "Standard of Installation."
- B. Conductor Splices:
Keep to the minimum and comply with the following:
 - 1. Install splices and taps that possess equivalent or better mechanical strength and insulation ratings than un-spliced conductors.

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2. Use splice and tap connectors that are compatible with conductor material.
- C. Connect outlets and components to wiring systems and to ground as indicated and instructed by manufacturer. Tighten connectors and terminals, including screws and bolts, according to equipment manufacturer's published torque tightening values for equipment connectors. Where manufacturer's torqueing requirements are not indicated, tighten connectors and terminals according to tightening requirements specified in UL 486A.
- D. Install devices to securely and permanently fasten and support electrical components.
- E. Raceway Supports:
Comply with NFPA 70 and the following requirements:
 1. Conform to manufacturer's recommendations for selecting and installing supports.
 2. Install individual and multiple raceway hangers and riser clamps to support raceways. Provide U bolts, clamps, attachments, and other hardware necessary for hanger assembly and for securing hanger rods and conduits.
 3. Support parallel runs of horizontal raceways together on trapeze- or bracket-type hangers.
 4. Spare Capacity:
Size supports for multiple conduits so capacity can be increased by a 25 percent minimum in the future.
 5. Support individual horizontal raceways with separate, malleable iron pipe hangers or clamps.
 6. Hanger Rods:
1/4-inch (6-mm) diameter or larger threaded steel, except as otherwise indicated.
 7. Spring Steel Fasteners:
Specifically designed for supporting single conduits or tubing. May be used in lieu of malleable iron hangers for 1-1/2-inch (38-mm) and smaller raceways serving lighting and receptacle branch circuits above suspended ceilings and for fastening raceways to channel and slotted angle supports.
 8. In vertical runs, arrange support so the load produced by the weight of the raceway and the enclosed conductors is carried entirely by the conduit supports, with no weight load on raceway terminals.
- F. Vertical Conductor Supports:
Install simultaneously with conductors.
- G. Miscellaneous Supports:
Install metal channel racks for mounting cabinets, panelboards, disconnects, control enclosures, pull boxes, junction boxes, transformers, and other devices except where components are mounted directly to structural features of adequate strength.
- H. In open overhead spaces, cast boxes threaded to raceways need not be separately supported, except where used for fixture support; support sheet-metal boxes directly from the building structure or by bar hangers. Where bar hangers are used, attach the bar to raceways on

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opposite sides of the box and support the raceway with an approved fastener not more than 24 inches (610 mm) from the box.

I. Fire stopping:

Apply to cable and raceway penetrations of fire-rated floor and wall assemblies. Perform fire stopping as specified in Division 7 Section "Fire stopping" to reestablish the original fire resistance rating of the assembly at the penetration.

J. Fastening:

Unless otherwise indicated, securely fasten electrical items and their supporting hardware to the building structure. Perform fastening according to the following:

1. Fasten by means of wood screws or screw-type nails on wood; toggle bolts on hollow masonry units; concrete inserts or expansion bolts on concrete or solid masonry; and by machine screws, welded threaded studs," or spring tension clamps on steel.
2. Threaded studs driven by a powder charge and provided with lock washers and nuts may be used instead of expansion bolts, machine screws, or wood screws.
3. Welding to steel structure may be used only for threaded studs, not for conduits, pipe straps, or any other items.
4. In partitions of light steel construction use sheet-metal screws.
5. Select fasteners so the load applied to any fastener does not exceed 25 percent of the proof test load.

K. Install identification devices where required.

1. Install labels where indicated and at locations for best convenience of viewing without interference with operation and maintenance of equipment.
2. Coordinate names, abbreviations, colors, and other designations used for electrical identification with corresponding designations indicated on the Contract Documents or required by codes and standards. Use consistent designations throughout the Project.
3. Self-Adhesive Identification Products: Clean surfaces of dust, loose material, and oily films before applying.
4. Identify raceways and cables of certain systems with color banding as follows:
 - a. Bands:
Colored adhesive marking tape. Make each color band 2 inches (51 mm) wide, completely encircling conduit, and place adjacent bands of 2-color markings in contact, side by side.
 - b. Locate bands at changes in direction, at penetrations of walls and floors, at 50-foot (15-m) maximum intervals in straight runs, and at 25 feet (8 m) in congested areas.
 - c. Colors:
As follows:

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- 1) Fire-Alarm System:
Red.
- 2) Security System:
Blue and yellow.
- 3) Telecommunications System:
Green and yellow.
5. Tag or label power circuits for future connection and circuits in raceways and enclosures with other circuits. Identify source and circuit numbers in each cabinet, pull box, junction box, and outlet box. Color coding may be used for voltage and phase indication.

3.4 TOUCHUP PAINTING

- A. Thoroughly clean damaged areas and provide primer, intermediate, and finish coats to suit the degree of damage at each location.
- B. Follow paint manufacturer's written instructions for surface preparation and for timing and application of successive coats.

END OF SECTION

SECTION 260510- COMMON WORK RESULTS FOR ELECTRICAL

GOVERNMENT OF THE U. S. VIRGIN ISLANDS, DEPARTMENT OF PUBLIC WORKS

PROJECT NAME: Elaine I. Sprauve Public Library and Museum Building

Project Location, St. John, U.S. Virgin Islands

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Sleeves for raceways and cables
2. Sleeve seals
3. Grout
4. Common electrical installation requirements

1.2 SUBMITTALS

A. Product Data:

For sleeve seals

PART 2 - PRODUCTS

2.1 SLEEVES FOR RACEWAYS AND CABLES

A. Steel Pipe Sleeves:

ASTM A 53/A 53M, Type E, Grade B, Schedule 40, galvanized steel, plain ends

B. Cast Iron Pipe Sleeves:

Cast or fabricated "wall pipe," equivalent to ductile iron pressure pipe, with plain ends and integral water stop, unless otherwise indicated.

C. Sleeves for Rectangular Openings:

Galvanized sheet steel

1. Minimum Metal Thickness:

- a. For sleeve cross section rectangle perimeter less than 50 inches (1270 mm) and no side more than 16 inches (400 mm), thickness shall be 0.052 inch (1.3 mm).
- b. For sleeve cross section rectangle perimeter equal to, or more than, 50 inches (1270 mm) and 1 or more sides equal to, or more than, 16 inches (400 mm), thickness shall be 0.138 inch (3.5 mm).

2.2 SLEEVE SEALS

A. Description:

Modular sealing device, designed for field assembly, to fill annular space between sleeve and raceway or cable.

1. Manufacturers:

Subject to compliance with requirements

2. Basis of Design Product:

Subject to compliance with requirements, provide or comparable product by one of the following:

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- a. ~~Advance Products & Systems, Inc.~~
 - b. Calpico, Inc.
 - c. Metraflex Co.
 - d. Pipeline Seal and Insulator, Inc.
3. Sealing Elements:
EPDM, NBR interlocking links shaped to fit surface of cable or conduit. Include type and number required for material and size of raceway or cable.
 4. Pressure Plates:
Stainless steel. Include two for each sealing element.
 5. Connecting Bolts and Nuts:
Stainless steel of length required to secure pressure plates to sealing elements. Include one for each sealing element.

2.3 GROUT

- A. Nonmetallic, Shrinkage Resistant Grout:
ASTM C 1107, factory packaged, nonmetallic aggregate grout, noncorrosive, no staining, mixed with water to consistency suitable for application and a 30-minute working time.

PART 3 - EXECUTION

3.1 COMMON REQUIREMENTS FOR ELECTRICAL INSTALLATION

- A. Comply with NECA I.
- B. Measure indicated mounting heights to bottom of unit for suspended items and to center of unit for wall mounting items.
- C. Headroom Maintenance:
If mounting heights or other location criteria are not indicated, arrange and install components and equipment to provide maximum possible headroom consistent with these requirements.
- D. Equipment:
Install to facilitate service, maintenance, and repair or replacement of components of both electrical equipment and other nearby installations. Connect in such a way as to facilitate future disconnecting with minimum interference with other items in the vicinity.
- E. Right of Way:
Give to piping systems installed at a required slope.

3.2 SLEEVE INSTALLATION FOR ELECTRICAL PENETRATIONS

- A. Electrical penetrations occur when raceways, cables, wire ways, cable trays, or busways penetrate concrete slabs, concrete or masonry walls, or fire-rated floor and wall assemblies.
- B. Concrete Slabs and Walls:
Install sleeves for penetrations unless core drilled holes or formed openings are used. Install

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sleeves during erection of slabs and walls.

- C. Use pipe sleeves unless penetration arrangement requires rectangular sleeved opening.
- D. Fire Rated Assemblies:
Install sleeves for penetrations of fire rated floor and wall assemblies unless openings compatible with firestop system used are fabricated during construction of floor or wall.
- E. Cut sleeves to length for mounting flush with both surfaces of walls.
- F. Extend sleeves installed in floors 2 inches (50 mm) above finished floor level.
- G. Size pipe sleeves to provide 1/4-inch (6.4-mm) annular clear space between sleeve and raceway or cable, unless indicated otherwise.
- H. Seal space outside of sleeves with grout for penetrations of concrete and masonry.
 - 1. Promptly pack grout solidly between sleeve and wall so no voids remain. Tool exposed surfaces smooth; protect grout while curing.
- I. Interior Penetrations of Non-Fire Rated Walls and Floors:
Seal annular space between sleeve and raceway or cable, using joint sealant appropriate for size, depth, and location of joint. Comply with requirements in Division 07 Section "Joint Sealants."
- J. Fire Rated Assembly Penetrations:
Maintain indicated fire rating of walls, partitions, ceilings, and floors at raceway and cable penetrations. Install sleeves and seal raceway and cable penetration sleeves with firestop materials. Comply with requirements in Division 07 Section "Penetration Fire stopping."
- K. Roof Penetration Sleeves:
Seal penetration of individual raceways and cables with flexible boot type flashing units applied in coordination with roofing work.
- L. Aboveground, Exterior Wall Penetrations:
Seal penetrations using steel pipe sleeves and mechanical sleeve seals. Select sleeve size to allow for 1-inch (25-mm) annular clear space between pipe and sleeve for installing mechanical sleeve seals.
- M. Underground, Exterior Wall Penetrations:
Install cast-iron pipe sleeves. Size sleeves to allow for 1-inch (25-mm) annular clear space between raceway or cable and sleeve for installing mechanical sleeve seals.

3.3 SLEEVE-SEAL INSTALLATION

- A. Install to seal exterior wall penetrations.
- B. Use type and number of sealing elements recommended by manufacturer for raceway or cable material and size. Position raceway or cable in center of sleeve. Assemble mechanical sleeve seals and install in annular space between raceway or cable and sleeve. Tighten bolts against pressure plates that cause sealing elements to expand and make watertight seal.

3.4 FIRE STOPPING

- A. Apply fire stopping to penetrations of fire rated floor and wall assemblies for electrical

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installations to restore original fire resistance rating of assembly. Fire stopping materials and installation requirements are specified in Division 07 Section "Penetration Fire Stopping."

END OF SECTION

SECTION 260519- LOW VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES

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PROJECT NAME: Elaine I. Sprauve Public Library and Museum Building

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PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes the following:

1. Building wires and cables rated 600 V and less
2. Connectors, splices, and terminations rated 600 V and less
3. Sleeves and sleeve seals for cables

1.2 SUBMITTALS

A. Product Data:

For each type of product indicated.

B. Field quality control test reports.

1.3 QUALITY ASSURANCE

A. Electrical Components, Devices, and Accessories:

Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

B. Comply with NFPA 70.

PART 2 - PRODUCTS

2.1 CONDUCTORS AND CABLES

A. Copper Conductors:

Comply with NEMA WC 70.

B. Conductor Insulation:

Comply with NEMA WC 70 for Types THW and THHN-THWN.

2.2 CONNECTORS AND SPLICES

A. Available Manufacturers:

Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

1. AFC Cable Systems, Inc.
2. Hubbell Power Systems, Inc.
3. 0-ZJGedney; EGS Electrical Group LLC
4. 3M; Electrical Products Division
5. Tyco Electronics Corp.

SECTION 260519- LOW VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES

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B. Description:

Factory-fabricated connectors and splices of size, ampacity rating, material, type, and class for application and service indicated.

2.3 SLEEVES FOR CABLES

A. Steel Pipe Sleeves:

ASTM A 53/A 53M, Type E, Grade B, Schedule 40, galvanized steel, plain ends.

- B.** Coordinate sleeve selection and application with selection and application of fire stopping specified in Division 07 Section "Penetration Fire stopping."

2.4 SLEEVE SEALS

A. Basis of Design Product:

Subject to compliance with requirements, provide or a comparable product by one of the following:

1. Advance Products & Systems, Inc.
2. Calpico, Inc.
3. Metraflex Co.
4. Pipeline Seal and Insulator, Inc.
5. Hilti, Inc.

B. Description:

Modular sealing device, designed for field assembly, to fill annular space between sleeve and cable.

1. Sealing Elements:
EPDM, NBR interlocking links shaped to fit surface of cable or conduit. Include type and number required for material and size of raceway or cable.
2. Pressure Plates:
Stainless steel. Include two for each sealing element.
3. Connecting Bolts and Nuts:
Stainless steel of length required to secure pressure plates to sealing elements. Include one for each sealing element.

PART 3 - EXECUTION

3.1 CONDUCTOR MATERIAL APPLICATIONS

A. Feeders:

Copper. Solid for No. 10 AWG and smaller; stranded for No. 8 AWG and larger.

B. Branch Circuits:

Copper. Solid for No. 10 AWG and smaller; stranded for No. 8 AWG and larger.

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3.2 CONDUCTOR INSULATION AND MULTICONDUCTOR CABLE APPLICATIONS AND WIRING METHODS

- A. Service Entrance:
Type THW, single conductors in raceway
- B. Feeders Concealed in Ceilings, Walls, Partitions, and Crawlspace:
Type THHN-THWN, single conductors in raceway
- C. Branch Circuits Concealed in Ceilings, Walls, and Partitions:
Type THHN-THWN, single conductors in raceway.

3.3 INSTALLATION OF CONDUCTORS AND CABLES

- A. Conceal cables in finished walls, ceilings, and floors, unless otherwise indicated.
- B. Use manufacturer approved pulling compound or lubricant where necessary; compound used must not deteriorate conductor or insulation. Do not exceed manufacturer's recommended maximum pulling tensions and sidewall pressure values.
- C. Use pulling means, including fish tape, cable, rope, and basket weave wire/cable grips that will not damage cables or raceway.
- D. Support cables according to Division 26 Sections "Hangers and Supports for Electrical Systems."
- E. Identify and color code conductors and cables according to Division 26 Section "Identification for Electrical Systems."
- F. Tighten electrical connectors and terminals according to manufacturer's published torque tightening values. If manufacturer's torque values are not indicated, use those specified in UL 486A and UL 486B.
- G. Make splices and taps that are compatible with conductor material and that possess equivalent or better mechanical strength and insulation ratings than un-spliced conductors.
- I. Use oxide inhibitor in each splice and tap conductor for aluminum conductors.
- H. Wiring at Outlets:
Install conductor at each outlet, with at least 12 inches (300 mm) of slack.

3.4 FIRESTOPPING

- A. Apply fire stopping to electrical penetrations of fire rated floor and wall assemblies to restore original fire resistance rating of assembly according to Division 07 Section "Penetration Fire stopping."

3.5 FIELD QUALITY CONTROL

- A. Perform tests and inspections and prepare test reports.
- B. Tests and Inspections:
 - 1. After installing conductors and cables and before electrical circuitry has been energized, test

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service entrance and feeder conductors for compliance with requirements.

2. Perform each visual and mechanical inspection and electrical test stated in NETA Acceptance Testing Specification. Certify compliance with test parameters.
 3. Infrared Scanning:
 - After Substantial Completion, but not more than 60 days after Final Acceptance, perform an infrared scan of each splice in cables and conductors No. 3 AWG and larger. Remove box and equipment covers so splices are accessible to portable scanner.
 - a. Follow up Infrared Scanning:

Perform an additional follow-up infrared scan of each splice 11 months after date of Substantial Completion.
 - b. Instrument:

Use an infrared scanning device designed to measure temperature or to detect significant deviations from normal values. Provide calibration record for device.
 - c. Record of Infrared Scanning:

Prepare a certified report that identifies splices checked and that describes scanning results. Include notation of deficiencies detected, remedial action taken, and observations after remedial action.
- C. Test Reports:
Prepare a written report to record the following:
1. Test procedures used
 2. Test results that comply with requirements
 3. Test results that do not comply with requirements and corrective action taken to achieve compliance with requirements.
- D. Remove and replace malfunctioning units and retest as specified above.

END OF SECTION

SECTION 260526- GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS

GOVERNMENT OF THE U. S. VIRGIN ISLANDS, DEPARTMENT OF PUBLIC WORKS

PROJECT NAME: Elaine I. Sprauve Public Library and Museum Building

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PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes methods and materials for grounding systems and equipment.

1.2 SUBMITTALS

- A. Product Data:
For each type of product indicated.
- B. Field quality-control test reports.

1.3 QUALITY ASSURANCE

- A. Electrical Components, Devices, and Accessories:
Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.
- B. Comply with UL 467 for grounding and bonding materials and equipment.

PART 2 - PRODUCTS

2.1 CONDUCTORS

- A. Insulated Conductors:
Copper wire or cable insulated for 600 V unless otherwise required by applicable Code or authorities having jurisdiction.
- B. Bare Copper Conductors:
1. Solid Conductors:
ASTM B 3
 2. Stranded Conductors:
ASTM B 8
 3. Tinned Conductors:
ASTM B 33
 4. Bonding Cable:
28 kcmil, 14 strands of No. 17 AWG conductor, 1/4 inch (6 mm) in diameter
 5. Bonding Conductor:
No. 4 or No. 6 AWG, stranded conductor
 6. Bonding Jumper:
Copper tape, braided conductors, terminated with copper ferrules; 1-5/8 inches (41 mm) wide and 1/16 inch (1.6 mm) thick.
 7. Tinned Bonding Jumper:
Tinned copper tape, braided conductors, terminated with copper ferrules; 1-5/8 inches (41

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mm) wide and 1/16 inch (1.6 mm) thick.

2.2 CONNECTORS

- A. Listed and labeled by a nationally recognized testing laboratory acceptable to authorities having jurisdiction for applications in which used, and for specific types, sizes, and combinations of conductors and other items connected.
- B. Bolted Connectors for Conductors and Pipes:
Copper or copper alloy, bolted pressure type, with at least two bolts
 - 1. Pipe Connectors:
Clamp type, sized for pipe.
- C. Welded Connectors:
Exothermic welding kits of types recommended by kit manufacturer for materials being joined and installation conditions.

2.3 GROUNDING ELECTRODES

- A. Ground Rods:
Copper clad steel; 3/4 inch by 10 feet (19 mm by 3 m) in diameter

PART 3- EXECUTION

3.1 APPLICATIONS

- A. Conductors:
Install solid conductor for No. 8 AWG and smaller, and stranded conductors for No. 6 AWG and larger, unless otherwise indicated.
- B. Underground Grounding Conductors:
Install bare copper conductor, No. 2/0 AWG minimum. Bury at least 24 inches (600 mm) below grade.
- C. Isolated Grounding Conductors:
Green colored insulation with continuous yellow stripe. On feeders with isolated ground, identify grounding conductor where visible to normal inspection, with alternating bands of green and yellow tape, with at least three bands of green and two bands of yellow.
- D. Conductor Terminations and Connections:
 - 1. Pipe and Equipment Grounding Conductor Terminations:
Bolted connectors
 - 2. Underground Connections:
Welded connectors except at test wells and as otherwise indicated.
 - 3. Connections to Ground Rods at Test Wells:
Bolted connectors
 - 4. Connections to Structural Steel:

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Welded connectors

3.2 EQUIPMENT GROUNDING

- A. Install insulated equipment grounding conductors with the following items, in addition to those required by NFPA 70:
1. Feeders and branch circuits
 2. Lighting circuits
 3. Receptacle circuits
 4. Single phase motor and appliance branch circuits
 5. Three phase motor and appliance branch circuits
 6. Flexible raceway runs
 7. Armored and metal-clad cable runs
 8. Busway Supply Circuits:
Install insulated equipment grounding conductor from grounding bus in the switchgear, switchboard, or distribution panel to equipment grounding bar terminal on bus way.
 9. Computer and Rack Mounted Electronic Equipment Circuits:
Install insulated equipment grounding conductor in branch circuit runs from equipment area power panels and power distribution units.
- B. Air Duct Equipment Circuits:
Install insulated equipment grounding conductor to duct mounted electrical devices operating at 120 V and more, including air cleaners, heaters, dampers, humidifiers, and other duct electrical equipment. Bond conductor to each unit and to air duct and connected metallic piping.
- C. Water Heater and Heat Tracing Cables:
Install a separate insulated equipment grounding conductor to each electric water heater and heat-tracing cable. Bond conductor to heater units, piping, connected equipment, and components.
- D. Isolated Grounding Receptacle Circuits:
Install an insulated equipment grounding conductor connected to the receptacle grounding terminal. Isolate conductor from raceway and from panelboard grounding terminals. Terminate at equipment grounding conductor terminal of the applicable derived system or service, unless otherwise indicated.
- E. Isolated Equipment Enclosure Circuits:
For designated equipment supplied by a branch circuit or feeder, isolate equipment enclosure from supply circuit raceway with a nonmetallic raceway fitting listed for the purpose. Install fitting where raceway enters enclosure, and install a separate insulated equipment grounding conductor. Isolate conductor from raceway and from panelboard grounding terminals. Terminate at equipment grounding conductor terminal of the applicable derived system or service, unless otherwise indicated.

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F. Signal and Communication Equipment:

For telephone, alarm, voice and data, and other communication equipment, provide No. 4 AWG minimum insulated grounding conductor in raceway from grounding electrode system to each service location, terminal cabinet, wiring closet, and central equipment location.

1. Service and Central Equipment Locations and Wiring Closets:

Terminate grounding conductor on a 1/4-by-2-by-12-inch (6-by-50-by-300-mm) grounding bus.

2. Terminal Cabinets:

Terminate grounding conductor on cabinet grounding terminal.

G. Metal Poles Supporting Outdoor Lighting Fixtures:

Install grounding electrode and a separate insulated equipment grounding conductor in addition to grounding conductor installed with branch circuit conductors.

3.3 INSTALLATION

A. Grounding Conductors:

Route along shortest and straightest paths possible, unless otherwise indicated or required by Code. Avoid obstructing access or placing conductors where they may be subjected to strain, impact, or damage.

B. Ground Rods:

Drive rods until tops are 2 inches (50 mm) below finished floor or final grade, unless otherwise indicated.

1. Interconnect ground rods with grounding electrode conductor below grade and as otherwise indicated. Make connections without exposing steel or damaging coating, if any.

2. For grounding electrode system, install at least three rods spaced at least one-rod length from each other and located at least the same distance from other grounding electrodes, and connect to the service grounding electrode conductor.

C. Test Wells:

Ground rod driven through drilled hole in bottom of hand hole. Hand holes are specified in Division 26 Section "Underground Ducts and Raceways for Electrical Systems," and shall be at least 12 inches (300 mm) deep, with cover.

1. Test Wells:

Install at least one test well for each service, unless otherwise indicated. Install at the ground rod electrically closest to service entrance. Set top of test well flush with finished grade or floor.

D. Bonding Straps and Jumpers:

Install in locations accessible for inspection and maintenance, except where routed through short lengths of conduit.

1. Bonding to Structure:

Bond straps directly to basic structure, taking care not to penetrate any adjacent parts.

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2. Bonding to Equipment Mounted on Vibration Isolation Hangers and Supports:
Install so vibration is not transmitted to rigidly mounted equipment.
3. Use exothermic-welded connectors for outdoor locations, but if a disconnect type connection is required, use a bolted clamp.

E. Grounding and Bonding for Piping:

1. Metal Water Service Pipe:
Install insulated copper grounding conductors, in conduit, from building's main service equipment, or grounding bus, to main metal water service entrances to building. Connect grounding conductors to main metal water service pipes, using a bolted clamp connector or by bolting a lug-type connector to a pipe flange, using one of the lug bolts of the flange. Where a dielectric main water fitting is installed, connect grounding conductor on street side of fitting. Bond metal grounding conductor conduit or sleeve to conductor at each end.
2. Water Meter Piping:
Use braided type bonding jumpers to electrically bypass water meters. Connect to pipe with a bolted connector.
3. Bond each above ground portion of gas piping system downstream from equipment shutoff valve.

E. Bonding Interior Metal Ducts:

Bond metal air ducts to equipment grounding conductors of associated fans, blowers, electric heaters, and air cleaners. Install bonding jumper to bond across flexible duct connections to achieve continuity.

3.4 FIELD QUALITY CONTROL

A. Testing Agency:

Engage a qualified testing and inspecting agency to perform the following field tests and inspections and prepare test reports.

B. Perform the following tests and inspections and prepare test reports:

1. After installing grounding system but before permanent electrical circuits have been energized, test for compliance with requirements.
2. Test completed grounding system at each location where a maximum ground resistance level is specified, at service disconnect enclosure grounding terminal, and at ground test wells.
 - a. Measure ground resistance not less than two full days after last trace of precipitation and without soil being moistened by any means other than natural drainage or seepage and without chemical treatment or other artificial means of reducing natural ground resistance.
 - b. Perform tests by fall of potential method according to IEEE 81.

C. Report measured ground resistances that exceed the following values:

1. Power and Lighting Equipment or System with Capacity 500 kVA and Less:
5 ohms

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2. Power and Lighting Equipment or System with Capacity 500 to 1000 kVA:
3 ohms
 3. Power and Lighting Equipment or System with Capacity More Than 1000 kVA:
3 ohms
 4. Power Distribution Units or Panelboards Serving Electronic Equipment:
2 ohm(s)
- D. Excessive Ground Resistance:
If resistance to ground exceeds specified values, notify Owner's Representative promptly and include recommendations to reduce ground resistance.

END OF SECTION

SECTION 260529- HANGERS AND SUPPORTS FOR ELECTRICAL SYSTEMS

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PART 1 - GENERAL

1.1 SUMMARY

A. Section includes:

1. Hangers and supports for electrical equipment and systems.
2. Construction requirements for concrete bases.

1.2 PERFORMANCE REQUIREMENTS

A. Delegated Design:

Design supports for multiple raceways, including comprehensive engineering analysis by a qualified professional engineer, using performance requirements and design criteria indicated.

B. Design supports for multiple raceways capable of supporting combined weight of supported systems and its contents.

C. Design equipment supports capable of supporting combined operating weight of supported equipment and connected systems and components.

D. Rated Strength:

Adequate in tension, shear, and pullout force to resist maximum loads calculated or imposed for this Project, with a minimum structural safety factor of five times the applied force.

1.3 SUBMITTALS

A. Product Data:

For steel slotted support systems

B. Shop Drawings:

Show fabrication and installation details and include calculations for the following:

1. Trapeze hangers. Include Product Data for components.
2. Steel slotted channel systems. Include Product Data for components.
3. Equipment supports

C. Welding certificates

1.4 QUALITY ASSURANCE

A. Welding:

Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code Steel."

B. Comply with NFPA 70.

PART 2 - PRODUCTS

2.1 SUPPORT, ANCHORAGE, AND ATTACHMENT COMPONENTS

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A. Steel Slotted Support Systems:

Comply with MFMA-4, factory fabricated components for field assembly.

1. Manufacturers:

Subject to compliance with requirements, provide products by one of the following:

- a. Allied Tube & Conduit
- b. Cooper B-Line, Inc.; a division of Cooper Industries
- c. ERICO International Corporation
- d. GS Metals Corp.
- e. Thomas & Betts Corporation
- f. Unistrut; Tyco International, Ltd.
- g. Wesanco, Inc.

2. Metallic Coatings:

Hot-dip galvanized after fabrication and applied according to MFMA-4.

3. Nonmetallic Coatings:

Manufacturer's standard PVC, polyurethane, or polyester coating applied according to MFMA-4.

4. Painted Coatings:

Manufacturer's standard painted coating applied according to MFMA-4.

5. Channel Dimensions:

Selected for applicable load criteria.

B. Raceway and Cable Supports:

As described in NECA 1 and NECA 101.

C. Conduit and Cable Support Devices:

Steel hangers, clamps, and associated fittings, designed for types and sizes of raceway or cable to be supported.

D. Support for Conductors in Vertical Conduit:

Factory fabricated assembly consisting of threaded body and insulating wedging plug or plugs for non-armored electrical conductors or cables in riser conduits. Plugs shall have number, size, and shape of conductor gripping pieces as required to suit individual conductors or cables supported. Body shall be malleable iron.

E. Structural Steel for Fabricated Supports and Restraints:

ASTM A 36/A 36M, steel plates, shapes, and bars; black and galvanized.

F. Mounting, Anchoring, and Attachment Components:

Items for fastening electrical items or their supports to building surfaces include the following:

1. Powder-Actuated Fasteners:

Threaded steel stud, for use in hardened Portland cement concrete, steel, or wood, with

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tension, shear, and pullout capacities appropriate for supported loads and building materials where used.

a. **Manufacturers:**

Subject to compliance with requirements, provide products by one of the following:

- 1) Hilti, Inc.
- 2) ITW Ramset/Red Head; a division of Illinois Tool Works, Inc.
- 3) MKT Fastening, LLC
- 4) Simpson Strong-Tie Co., Inc.; Masterset Fastening Systems Unit

2. **Mechanical Expansion Anchors:**

Insert wedge type, stainless steel, for use in hardened Portland cement concrete with tension, shear, and pullout capacities appropriate for supported loads and building materials in which used.

a. **Manufacturers:**

Subject to compliance with requirements, provide products by one of the following:

- 1) Cooper B-Line, Inc.; a division of Cooper Industries.
- 2) Empire Tool and Manufacturing Co., Inc.
- 3) Hilti, Inc.
- 4) ITW Ramset/Red Head; a division of Illinois Tool Works, Inc.
- 5) MKT Fastening, LLC.

3. **Concrete Inserts:**

Steel or malleable iron, slotted support system units similar to MSS Type 18; complying with MFMA-4 or MSS SP-58.

4. **Clamps for Attachment to Steel Structural Elements:**

MSS SP-58, type suitable for attached structural element.

5. **Through Bolts:**

Structural type, hex head, and high strength. Comply with ASTM A 325.

6. **Toggle Bolts:**

All steel springhead type

7. **Hanger Rods:**

Threaded steel

2.2 FABRICATED METAL EQUIPMENT SUPPORT ASSEMBLIES

A. **Description:**

Welded or bolted, structural steel shapes, shop or field fabricated to fit dimensions of supported equipment.

B. **Materials:**

Comply with requirements in Division 05 Section "Metal Fabrications" for steel shapes and

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plates.

PART 3 - EXECUTION

3.1 APPLICATION

- A. Comply with NECA I and NECA 101 for application of hangers and supports for electrical equipment and systems except if requirements in this Section are stricter.
- B. Maximum Support Spacing and Minimum Hanger Rod Size for Raceway:
Space supports for EMT and IMC, as required by NFPA 70. Minimum rod size shall be 1/4 inch (6 mm) in diameter.
- C. Multiple Raceways or Cables:
Install trapeze type supports fabricated with steel slotted support system, sized so capacity can be increased by at least 25 percent in future without exceeding specified design load limits.
 - 1. Secure raceways and cables to these supports with two-bolt conduit clamps.
- D. Spring steel clamps designed for supporting single conduits without bolts may be used for 1-1/2 inch (38 mm) and smaller raceways serving branch circuits and communication systems above suspended ceilings and for fastening raceways to trapeze supports.

3.2 SUPPORT INSTALLATION

- A. Comply with NECA 1 and NECA 101 for installation requirements except as specified in this Article.
- B. Raceway Support Methods:
In addition to methods described in NECA I, EMT and IMC may be supported by openings through structure members, as permitted in NFPA 70.
- C. Strength of Support Assemblies:
Where not indicated, select sizes of components so strength will be adequate to carry present and future static loads within specified loading limits. Minimum static design load used for strength determination shall be weight of supported components plus 200 lb (90 kg).
- D. Mounting and Anchorage of Surface Mounted Equipment and Components:
Anchor and fasten electrical items and their supports to building structural elements by the following methods unless otherwise indicated by code:
 - 1. To Wood:
Fasten with lag screws or through bolts
 - 2. To New Concrete:
Bolt to concrete inserts
 - 3. To Masonry:
Approved toggle type bolts on hollow masonry units and expansion anchor fasteners on solid masonry units.
 - 4. To Existing Concrete:
Expansion anchor fasteners

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5. Instead of expansion anchors, powder actuated driven threaded studs provided with lock washers and nuts may be used in existing standard weight concrete, 4 inches (100 mm) thick or greater. Do not use for anchorage to lightweight-aggregate concrete or for slabs less than 4 inches (100 mm) thick.
 6. To Steel:
Welded threaded studs complying with AWS D1.1/D1.1M, with lock washers and nuts
 7. To Light Steel:
Sheet metal screws
 8. Items Mounted on Hollow Walls and Nonstructural Building Surfaces:
Mount cabinets, panelboards, disconnect switches, control enclosures, pull and junction boxes, transformers, and other devices on slotted channel racks attached to substrate.
- E. Drill holes for expansion anchors in concrete at locations and to depths that avoid reinforcing bars.

3.3 INSTALLATION OF FABRICATED METAL SUPPORTS

- A. Comply with installation requirements in Division 05 Section "Metal Fabrications" for site fabricated metal supports.
- B. Cut, fit, and place miscellaneous metal supports accurately in location, alignment, and elevation to support and anchor electrical materials and equipment.
- C. Field Welding:
Comply with AWS D1.1/D1.1M

3.4 CONCRETE BASES

- A. Construct concrete bases of dimensions indicated but not less than 4 inches (100 mm) larger in both directions than supported unit, and so anchors will be a minimum of 10 bolt diameters from edge of the base.
- B. Use 3000-psi (20.7-MPa), 28-day compressive strength concrete. Concrete materials, reinforcement, and placement requirements are specified in Division 03 Section "Cast-in-Place Concrete."
- C. Anchor equipment to concrete base.
 1. Place and secure anchorage devices. Use supported equipment manufacturer's setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
 2. Install anchor bolts to elevations required for proper attachment to supported equipment.
 3. Install anchor bolts according to anchor bolt manufacturer's written instructions.

3.5 PAINTING

- A. Touchup:
Clean field welds and abraded areas of shop paint. Paint exposed areas immediately after erecting hangers and supports. Use same materials as used for shop painting. Comply with SSPC-PA 1 requirements for touching up field painted surfaces.

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1. Apply paint by brush or spray to provide minimum dry film thickness of 2.0 mils (0.05 mm).
- B. Touchup:
Comply with requirements in Division 09 Painting Sections for cleaning and touchup painting of field welds, bolted connections, and abraded areas of shop paint on miscellaneous metal.
- C. Galvanized Surfaces:
Clean welds, bolted connections, and abraded areas and apply galvanizing repair paint to comply with ASTM A 780.

END OF SECTION

SECTION 260533- RACEWAY AND BOXES FOR ELECTRICAL SYSTEMS
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PART 1- GENERAL

1.1 SUMMARY

- A. This Section includes raceways, fittings, boxes, enclosures, and cabinets for electrical wiring.
- B. See Division 26 Section "Underground Ducts and Raceways for Electrical Systems" for exterior duct banks and manholes, and underground hand holes, boxes, and utility construction.

1.2 SUBMITTALS

- A. Product Data:
For surface raceways, wire ways and fittings, floor boxes, hinged cover enclosures, and cabinets.
- B. Shop Drawings:
For custom enclosures and cabinets. Include plans, elevations, sections, details, and attachments to other work.

1.3 QUALITY ASSURANCE

- A. Electrical Components, Devices, and Accessories:
Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.
- B. Comply with NFPA 70.

PART 2 - PRODUCTS

2.1 METAL CONDUIT AND TUBING

- A. Rigid Steel Conduit:
ANSI C80.1
- B. IMC:
ANSI C80.6
- C. EMT:
ANSI C80.3
- D. FMC:
Zinc coated steel.
- E. LFMC:
Flexible steel conduit with PVC jacket.
- F. Fittings for Conduit (Including all Types and Flexible and Liquid tight), EMT, and Cable:
NEMA FB 1; listed for type and size raceway with which used, and for application and environment in which installed.
 - 1. Conduit Fittings for Hazardous (Classified) Locations:
Comply with UL 886.
 - 2. Fittings for EMT:
Steel, compression type

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2.2 NONMETALLIC CONDUIT AND TUBING

- A. ENT:
NEMA TC 13
- B. RNC:
NEMA TC 2, unless otherwise indicated.
- C. LFNC:
UL 1660
- D. Fittings for ENT and RNC:
NEMA TC 3; match to conduit or tubing type and material.
- E. Fittings for LFNC:
UL 514B

2.3 METAL WIREWAYS

- A. Manufacturers:
Subject to compliance with requirements, provide products by one of the following:
 - 1. Cooper B-Line, Inc.
 - 2. Hoffman.
 - 3. Square D; Schneider Electric
- B. Description:
Sheet metal sized and shaped as indicated, NEMA 250, Type 1 or 3R, unless otherwise indicated.
- C. Fittings and Accessories:
Include couplings, offsets, elbows, expansion joints, adapters, hold down straps, end caps, and other fittings to match and mate with wire ways as required for complete system.
- D. Wire way Covers:
Screw cover type
- E. Finish:
Manufacturer's standard enamel finish

2.4 NON-METALLIC WIREWAYS

- A. Manufacturers:
Subject to compliance with requirements, provide products by one of the following:
 - 1. Hoffman
 - 2. Lamson & Sessions; Carlon Electrical Products
- B. Description:
PVC plastic, extruded and fabricated to size and shape indicated, with snap-on cover and mechanically coupled connections with plastic fasteners.

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C. Fittings and Accessories:

Include couplings, offsets, elbows, expansion joints, adapters, hold down straps, end caps, and other fittings to match and mate with wire ways as required for complete system.

2.5 SURFACE RACEWAYS

A. Surface Metal Raceways:

Galvanized steel with snap-on covers. Prime coating, ready for field painting.

1. Manufacturers:

Subject to compliance with requirements, provide products by one of the following:

- a. Thomas & Betts Corporation
- b. Walker Systems, Inc.; Wiremold Company
- c. Wiremold Company; Electrical Sales Division

B. Surface Non-metallic Raceways:

Two piece construction, manufactured of rigid PVC with texture and color selected by Owner's Representative from manufacturer's standard colors.

1. Manufacturers:

Subject to compliance with requirements, provide products by one of the following:

- a. Butler Manufacturing Company; Walker Division
- b. Enduro Systems, Inc.; Composite Products Division
- c. Hubbell Incorporated; Wiring Device-Kellems Division
- d. Lamson & Sessions; Carlon Electrical Products
- e. Panduit Corp.
- f. Walker Systems, Inc.; Wiremold Company
- g. Wiremold Company (The); Electrical Sales Division

2.6 BOXES, ENCLOSURES, AND CABINETS

A. Sheet Metal Outlet and Device Boxes:

NEMA OS 1.

B. Cast-Metal Outlet and Device Boxes:

NEMA FB 1, ferrous alloy, Type FD, with gasketed cover.

C. Nonmetallic Outlet and Device Boxes:

NEMA OS 2.

D. Metal Floor Boxes:

Cast metal, fully adjustable, rectangular

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- E. Nonmetallic Floor Boxes:
Nonadjustable, round
- F. Small Sheet Metal Pull and Junction Boxes:
NEMA OS I.
- G. Cast-Metal Access, Pull, and Junction Boxes:
NEMA FB 1, galvanized, cast iron with gasketed cover.
- H. Hinged Cover Enclosures:
NEMA 250, Type 1, with continuous hinge cover with flush latch, unless otherwise indicated.
 - 1. Metal Enclosures:
Steel, finished inside and out with manufacturer's standard enamel.
 - 2. Nonmetallic Enclosures:
Plastic
- I. Cabinets:
 - 1. NEMA 250, Type 1, galvanized steel box with removable interior panel and removable front, finished inside and out with manufacturer's standard enamel.
 - 2. Hinged door in front cover with flush latch and concealed hinge.
 - 3. Key latch to match panelboards.
 - 4. Metal barriers to separate wiring of different systems and voltage.
 - 5. Accessory feet where required for freestanding equipment.

PART 3- EXECUTION

3.1 RACEWAY APPLICATION

- A. Outdoors:
Apply raceway products as specified below, unless otherwise indicated:
 - 1. Exposed Conduit:
Rigid steel conduit
 - 2. Concealed Conduit, Aboveground:
Rigid steel conduit, EMT
 - 3. Underground Conduit:
RNC, Type EPC-40-PVC, direct buried
 - 4. Connection to Vibrating Equipment (Including Transformers and Hydraulic, Pneumatic, Electric Solenoid, or Motor-Driven Equipment):
LFMC
 - 5. Boxes and Enclosures, Aboveground:
NEMA 250, Type 3R

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B. Comply with the following indoor applications, unless otherwise indicated:

1. Exposed, Not Subject to Physical Damage:
EMT
 2. Exposed, Not Subject to Severe Physical Damage:
EMT
 3. Exposed and Subject to Severe Physical Damage:
Rigid steel conduit. Includes raceways in the following locations:
 - a. Loading dock.
 - b. Corridors used for traffic of mechanized carts, forklifts, and pallet-handling units.
 - c. Mechanical rooms.
 4. Concealed in Ceilings and Interior Walls and Partitions:
EMT
 5. Connection to Vibrating Equipment (Including Transformers and Hydraulic, Pneumatic, Electric Solenoid, or Motor Driven Equipment):
FMC, except use LFMC in damp or wet locations.
 6. Damp or Wet Locations:
Rigid steel conduit
 7. Raceways for Optical Fiber or Communications Cable:
EMT
 8. Boxes and Enclosures:
NEMA 250, Type 1, except use NEMA 250, Type 4, nonmetallic in damp or wet locations
- C. Minimum Raceway Size:
3/4-inch (21-mm) trade size
- D. Raceway Fittings:
Compatible with raceways and suitable for use and location.

1. Rigid and Intermediate Steel Conduit:
Use threaded rigid steel conduit fittings, unless otherwise indicated.

3.2 INSTALLATION

- A. Comply with NECA 1 for installation requirements applicable to products specified in Part 2 except where requirements on Drawings or in this Article are stricter.
- B. Keep raceways at least 6 inches (150 mm) away from parallel runs of flues and steam or hot-water pipes. Install horizontal raceway runs above water and steam piping.
- C. Complete raceway installation before starting conductor installation.
- D. Support raceways as specified in Division 26 Section "Hangers and Supports for Electrical

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Systems."

- E. Arrange stub-ups so curved portions of bends are not visible above the finished slab.
- F. Install no more than the equivalent of three 90-degree bends in any conduit run except for communications conduits, for which fewer bends are allowed.

G. Conceal conduit and EMT within finished walls, ceilings, and floors, unless otherwise indicated.

H. Raceways Embedded in Slabs:

- 1. Run conduit larger than 1-inch (27-mm) trade size, parallel or at right angles to main reinforcement. Where at right angles to reinforcement, place conduit close to slab support.
 - 2. Arrange raceways to cross building expansion joints at right angles with expansion fittings.
 - 3. Change from ENT to RNC, Type EPC-40-PVC, rigid steel conduit, or IMC before rising above the floor.
- I. Raceway Terminations at Locations Subject to Moisture or Vibration:
Use insulating bushings to protect conductors, including conductors smaller than No. 4 AWG.
- J. Install pull wires in empty raceways. Use polypropylene or monofilament plastic line with not less than 200-lb (90-kg) tensile strength. Leave at least 12 inches (300 mm) of slack at each end of pull wire.

K. Raceways for Optical Fiber and Communications Cable:
Install as follows:

- 1. 3/4-Inch (19-mm) Trade Size and Smaller:
Install raceways in maximum lengths of 50 feet (15m).
 - 2. 1-Inch (25-mm) Trade Size and Larger:
Install raceways in maximum lengths of 75 feet (23m).
 - 3. Install with a maximum of two 90-degree bends or equivalent for each length of raceway unless Drawings show stricter requirements. Separate lengths with pull or junction boxes or terminations at distribution frames or cabinets where necessary to comply with these requirements.
- L. Install raceway sealing fittings at suitable, approved, and accessible locations and fill them with listed sealing compound. For concealed raceways, install each fitting in a flush steel box with a blank cover plate having a finish similar to that of adjacent plates or surfaces. Install raceway sealing fittings at the following points:
- 1. Where conduits pass from warm to cold locations, such as boundaries of refrigerated spaces.
 - 2. Where otherwise required by NFPA 70.

M. Expansion-Joint Fittings for RNC:

Install in each run of aboveground conduit that is located where environmental temperature change may exceed 30°F (17°C), and that has straight-run length that exceeds 25 feet (7.6 m).

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1. Install expansion joint fittings for each of the following locations, and provide type and quantity of fittings that accommodate temperature change listed for location:
 - a. Outdoor Locations Not Exposed to Direct Sunlight:
125°F (70°C) temperature change.
 - b. Outdoor Locations Exposed to Direct Sunlight:
155°F (86°C) temperature change
 - c. Indoor Spaces Connected with the Outdoors without Physical Separation:
125°F (70°C) temperature change
 - d. Attics:
135°F (75°C) temperature change
 2. Install fitting(s) that provide expansion and contraction for at least 0.00041 inch per foot of length of straight run per degree Fahrenheit (0.06 mm per meter of length of straight run per degree Celsius) of temperature change.
 3. Install each expansion joint fitting with position, mounting, and piston setting selected according to manufacturer's written instructions for conditions at specific location at the time of installation.
- N. Flexible Conduit Connections:
Use maximum of 72 inches (1830 mm) of flexible conduit for recessed and semi recessed lighting fixtures, equipment subject to vibration, noise transmission, or movement; and for transformers and motors.
1. Use LFMC in damp or wet locations subject to severe physical damage.
 2. Use LFMC or LFNC in damp or wet locations not subject to severe physical damage.
- O. Recessed Boxes in Masonry Walls:
Saw-cut opening for box in center of cell of masonry block, and install box flush with surface of wall.
- P. Set metal floor boxes level and flush with finished floor surface.
- Q. Set nonmetallic floor boxes level. Trim after installation to fit flush with finished floor surface.

3.3 FIRESTOPPING

- A. Apply fire stopping to electrical penetrations of fire rated floor and wall assemblies to restore original fire resistance rating of assembly. Fire stopping materials and installation requirements are specified in Division 07 Section "Penetration Fire stopping."

3.4 PROTECTION

- A. Provide final protection and maintain conditions that ensure coatings, finishes, and cabinets are without damage or deterioration at time of Substantial Completion.
1. Repair damage to galvanized finishes with zinc-rich paint recommended by manufacturer.

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END OF SECTION

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PART 1 GENERAL

1.1 - SUMMARY:

- A. This Section includes underground conduits and ducts, duct banks, manholes and other underground utility structures.
- B. Related Sections: The following Sections contain requirements that relate to this Section:
 - 1. Division 2 Section "Earthwork" for general requirements for excavation, backfill and related items for ducts, manholes and hand holes.
 - 2. Division 3 Section "Cast-In-Place Concrete" for cast-in-place concrete requirements.
 - 3. Division 7 Section "Sheet Membrane Waterproofing" for waterproofing of manholes and hand holes.
 - 4. Division 7 Section "Bituminous Damp proofing" for damp proofing of manholes and hand holes.

1.2 - DEFINITIONS:

- A. Duct Bank: 2 or more conduits or other raceway installed underground in the same trench or concrete envelope.
- B. Manhole: An underground utility structure, large enough for a person to enter, connecting with ducts to afford facilities for installing and maintaining cables.
- C. Vault: An underground utility structure, large enough for a person to enter, connecting with ducts to afford facilities for installing, operating, and maintaining equipment and wiring.

1.3 - SUBMITTALS:

- A. General: Submit the following according to Conditions of the Contract and Division 1 Specification Sections.
- B. Product data for metal accessories for manholes and hand holes, conduit and duct, duct bank materials, and miscellaneous components.
- C. Shop drawings showing details and design calculations for precast manholes and hand holes, including reinforcing steel. Stamp drawings with seal of registered professional structural engineer.
- D. Certificate for concrete and steel used in underground precast concrete utility structures, according to ASTM C 858.
- E. Inspection report for factory inspections, according to ASTM C 1037.
- F. Coordination drawings showing duct profiles and coordination with other utilities and underground structures. Include plans and sections drawn to accurate scale.

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- G. Qualification data for firms and persons specified in "Quality Assurance" Article to demonstrate their capabilities and experience. Include list of completed projects with project names, addresses, names of Owner's Representative and Owner, and other information specified.
- H. Field test reports indicating and interpreting test results relative to compliance with performance requirements of "Field Quality Control" Article in Part 3 of this Section.
- I. Record Documents: Show dimensioned locations of underground ducts, hand holes, and manholes.

1.4 - QUALITY ASSURANCE:

- A. Manufacturer Qualifications: Firm experienced in manufacturing underground precast concrete utility structures of types and sizes required and similar to those indicated for this Project. Firm must have a record of successful in-service performance.
- B. Comply with NFPA 70 "National Electrical Code" and ANSI C2 "National Electrical Safety Code" for components and installation.
- C. Listing and Labeling: Provide products specified in this Section that are listed and labeled.
 - 1. The Terms "Listed" and "Labeled": As defined in the "National Electrical Code," Article 100.
 - 2. Listing and Labeling Agency Qualifications: A "Nationally Recognized Testing Laboratory" (NRTL) as defined in OSHA Regulation 1910.7.
- D. Coordinate layout and installation of ducts, manholes, and hand holes with final arrangement of other utilities as determined in the field.
- E. Coordinate elevations of duct bank entrances into manholes with final profiles of conduits as determined by coordination with other utilities and underground obstructions. Revise locations and elevations from those indicated as required to suit field conditions and ensure duct runs drain to manholes, and as approved by the Owner's Representative.

1.5 - DELIVERY, STORAGE, AND HANDLING:

- A. Deliver ducts to site with ends capped. Store nonmetallic ducts with supports to prevent bending, warping and deforming.
- B. Store precast concrete units at site as recommended by manufacturer to prevent physical damage. Arrange so identification markings are visible.
- C. Lift and support precast concrete units only at designated lifting or supporting points.

PART 2 - PRODUCTS

2.1 - MANUFACTURERS:

- A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering the specified products that may be incorporated in the Work include, but are not limited to, the following:

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1. Precast Division; Carder Concrete Products.
2. Christy Concrete Products, Inc.
3. Elmhurst-Chicago Stone Co.
4. Riverton Concrete Products.
5. A. Rotondo & Sons, Inc.
6. Rotondo/Penn-Cast, Inc.
7. Smith-Midland Corp.
8. Utility Vault Co.
9. Wausau Concrete Co.

D. Frames and Covers:

1. Campbell Foundry Co.
2. East Jordan Iron Works, Inc.
3. McKinley Iron Works, Inc.
4. Neenah Foundry Co.

E. Nonmetallic Ducts:

1. Arnco Corp.
2. Breeze-Illinois, Inc.
3. CANTEX, Inc.
4. Carlon; Lamson & Sessions Company.
5. Pipe and Plastic Group; Certaineed Products Corp.
6. Cole-Flex Corp.
7. Electri-Flex Co.
8. Spiraduct, Inc.

2.2 - CONDUIT AND DUCT:

- A. Rigid Steel Conduit: ANSI C80.1, galvanized.
- B. Plastic-Coated Rigid Steel Conduit and Fittings: NEMA RN 1.
- C. Rigid Plastic Conduit: NEMA TC 2, Schedule 40 PVC, rated for use with 90 deg C conductors under all installation conditions.
- D. PVC Conduit and Tubing Fittings: NEMA TC 3.
- E. Rigid Plastic Underground Conduit: UL 651A, Type EB PVC.

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2.3 - UNDERGROUND PRECAST CONCRETE UTILITY STRUCTURES:

- A. Precast Units: Interlocking, mating sections, complete with accessory items, hardware, and features as indicated. Include concrete knockout panels for conduit entrance and sleeve for ground rod.
- B. Design structure according to ASTM C 858.
- C. Structural Design Loading: ASTM C 857, Class A-16.
- D. Fabricate according to ASTM C 858.
- E. Joint Sealant: Continuous extrusion of asphaltic butyl material with adhesion, cohesion, flexibility, and durability properties necessary to withstand the maximum hydrostatic pressures at the installation location with the ground water level at grade.
- F. Source Quality Control: Inspect structures according to ASTM C 1037.

2.4 - ACCESSORIES:

- A. Duct Supports: Rigid PVC spacers selected to provide minimum duct spacings and concrete cover depths indicated, while supporting ducts during concreting.
- B. Frames and Covers: Cast iron with cast-in legend "LECTRIC." Machine cover-to-frame bearing surfaces.
- C. Sump Frame and Grate: Comply with FS RR-F-621, Type VII for frame and Type I for cover.
- D. Pulling Eyes in Walls: Eyebolt with reinforcing bar fastening insert. 2 inch (50 mm) diameter eye, 1 inch (25 mm) by 4 inch (100 mm) bolt. Working load embedded in 6 inch (150 mm), 4000 psi (27.6MPa) concrete: 13,000 pounds minimum tension.
- E. Pulling and Lifting Irons in Floor: 7/8 inch-diameter (21 mm), hot-dipped galvanized, bent steel rod, stress relieved after forming, and fastened to reinforced rod. Exposed triangular opening. Ultimate yield strength: 40,000 pounds shear and 60,000 pounds tension.
- F. Bolting Inserts for Cable Stanchions: Flared, threaded inserts of noncorrosive, chemical resistant, nonconductive thermoplastic material; 1/2 inch (12 mm) internal diameter by 2-3/4 inches (68 mm) deep, flared to 1-1/4 inch (30 mm) minimum at base. Tested ultimate pull-out strength: 12,000 pounds minimum.
- G. Expansion Anchors for Installation After Concrete is Cast: Zinc-plated carbon steel wedge type with stainless-steel expander clip 1/2 inch (12 mm) bolt size, 5300-pound rated pull-out strength, and 6800- pound rated shear strength minimum.
- H. Cable Stanchions: Hot-rolled, hot-dipped galvanized "T" section steel, 2-1/4 inch (56 mm) size, punched with 14 holes on 1-1/2 inch (35 mm) centers for cable arm attachment.
- I. Cable Arms: 3/16-inch (5 mm) thick hot-rolled, hot-dipped galvanized sheet steel pressed to

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channel shape, approximately two 12 inches (300 mm) wide by 14 inches (350 mm) long and arranged for secure mounting in horizontal position at any position on cable stanchions.

- J. Cable Support Insulators: High glaze, wet-process porcelain arranged for mounting on cable arms.
- K. Ground Rods: Solid copper clad steel, 3/4 inch (18 mm) diameter by 10-feet (3 m) length.
- L. Ground Wire: Stranded bare copper, No. 6 AWG minimum.
- M. Ladder: UL-listed, non-metallic, specifically designed for electrical manhole use. Minimum length equal to the distance from the deepest manhole floor to grade. Ladder shall be permanently installed in manhole.
- N. Raceway Sealing Compound: Non-hardening, safe for human skin contact, not deleterious to cable insulation, workable at temperatures as low as 35 degrees F (1 degrees C), withstands temperature of 300 degrees F (149 degrees C) without slump, and adheres to clean surfaces of plastic ducts, metallic conduits, conduit coatings, concrete, masonry, lead, cable sheaths, cable jackets, insulation materials, and the common metals.

2.5 - CONSTRUCTION MATERIALS:

- A. Damp proofing: Conform to Division 7 Section "Bituminous Damp proofing."
- B. Waterproofing: Conform to Division 7 Section "Sheet Membrane Waterproofing."
- C. Brick: Conform to ASTM C 55, concrete brick Type I, Grade N.
- D. Mortar: Conform to ASTM C 270, Type M, except for quantities less than 2.0 cu. foot (60 L), where packaged mix complying with ASTM C 387, Type M may be used.
- E. Concrete: Conform to Division 3 Section "Cast-In-Place Concrete" for concrete and reinforcing.
 - 1. Strength: 3000 psi (20.7 MPa) minimum 28-day compressive strength.
 - 2. Aggregate For Duct Encasement: 3/8 inch (10 mm) maximum size.

PART 3 - EXECUTION

3.1 - APPLICATION:

- A. Underground Ducts For Electrical Utility Service: Plastic conduit encased in "RED" colored concrete.
- B. Manholes: Underground precast concrete utility structures.

3.2 - EXAMINATION:

- A. Examine site to receive ducts and manholes for compliance with installation tolerances and other conditions affecting performance of the underground ducts and manholes. Do not proceed with installation until unsatisfactory conditions have been corrected.

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3.3 - EARTHWORK:

- A. Excavation and Backfill: Conform to Division 2 Section "Earthwork," but do not use heavy-duty, hydraulic-operated compaction equipment.
- B. Restore surface features at areas disturbed by excavation, and reestablish original grades except as otherwise indicated. Replace removed sod as soon as possible after backfilling is completed. Restore all areas disturbed by trenching, storing of dirt, cable laying, and other work. Restore vegetation and include necessary top soiling, fertilizing, liming, seeding, sodding, sprigging, or mulching. Perform according to Division 2 Section "Landscape Work."
- C. Warning Tape: Tape specifically manufactured for marking and locating underground utilities. Tape shall be polyethylene film, 6 inches wide, 0.004 inches thick and a minimum strength of 1,750 psi. Tape shall carry continuous inscription naming the specific utility. Color shall be:
 - 1. Electric – Red
- D. Tape for nonmetallic utility lines shall have foil backing or wires sufficient for detection by metal detector to a depth of 3 feet. Tape to be run continuously from manhole to manhole and have 3 feet slack rolled up at each end.
- E. Restore disturbed paving. Refer to "Cutting and Patching" in Division 1.

3.4 - CONDUIT AND DUCT INSTALLATION:

- A. Install nonmetallic conduit and duct as indicated according to manufacturer's written instructions.
- B. Slope: Pitch ducts minimum of 4 inches per 100 feet (1:300) to drain toward manholes away from buildings and equipment. Slope ducts from a high point in runs between 2 manholes to drain in both directions.
- C. Curves and Bends: Use manufactured elbows for stub-ups at equipment and at building entrances. Use manufactured long sweep bends. Use only factory fittings for elbows, bends or offsets. Field bending is not permitted. Risers to grade to be PVC coated steel elbows.
- D. Make joints in ducts and fittings watertight according to manufacturer's instructions. Stagger couplings so those of adjacent ducts do not lie in the same plane.
- E. Duct entrances to Manholes and Handholes: Space end bells approximately 12 inches (250 mm) on center for 6-inch ducts and varied proportionately for other duct sizes. Change from regular spacing to end-bell spacing 10 feet (3 m) from the end bell without reducing duct line slope and without forming a trap in the line. Grout end bells into manhole walls from both sides to provide watertight entrances.
- F. Building Entrances: Transition from underground duct to conduit 10 feet (3 m) minimum outside the building wall. Use fittings manufactured for the purpose. Follow appropriate installation instructions below.
 - 1. Concrete-Encased Ducts: Install reinforcing in duct banks passing through disturbed earth near buildings and other excavations. Coordinate duct bank with structural design to support duct bank at wall without reducing structural or watertight integrity of building wall.

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2. Waterproofed Wall and Floor Entrances: Install a watertight entrance-sealing device with the sealing gland assembly on the inside. Anchor device into masonry construction with 1 or more integral flanges. Secure membrane waterproofing to the device to make permanently watertight.
- G. Concrete-Encased Nonmetallic Ducts: Support on plastic separators coordinated with duct size and required duct spacing, and install according to the following:
1. Separator Installation: Space separators close enough to prevent sagging and deforming of ducts, and secure separators to the earth and to ducts to prevent floating during concreting. Do not use tie wires or reinforcing steel that may form conductive or magnetic loops around ducts or duct groups.
 2. Concreting: Spade concrete carefully during pours to prevent voids under and between conduits and at exterior surface of envelope. Do not use power-driven agitating equipment unless specifically designed for duct bank application. Pour each run of envelope between manholes or other terminations in 1 continuous operation. When more than one pour is necessary, terminate each pour in a vertical plane and install 3/4-inch (18 mm) reinforcing rod dowels extending 18 inches (450 mm) into the concrete on both sides of joint near the corners of the envelope.
 3. Reinforcing: Reinforce duct banks where they cross disturbed earth and where indicated.
 4. Forms: Use the walls of the trench to form the side walls of the duct bank where the soil is self-supporting and concrete envelope can be poured without soil inclusions, otherwise, use forms.
 5. Minimum Clearances Between Ducts: 3 inches between ducts and exterior envelope wall, 2 inches between ducts for like services, and 4 inches between power and signal ducts.
 6. Depth: Except as otherwise indicated, install top of duct bank at least 36 inches below finished grade.
- H. Stub-Ups: Use rigid steel conduit for stub-ups to equipment. For equipment mounted on outdoor concrete pads, extend steel conduit a minimum of 5 feet (1.5 m) from edge of pad. Install insulated grounding bushings on the terminations. Couple steel conduits to the ducts with adapters designed for the purpose and then encase coupling with 3 inches (75 mm) of concrete.
- I. Sealing: Provide temporary closure at terminations of ducts that are wired under this Project. Seal spare ducts at terminations. Use sealing compound and plugs to withstand at least 15 psi hydrostatic pressure.
1. Provide nylon pull string with printed footage indicators having not less than 200 pounds tensile strength. Leave not less than 12 inches of slack at each end of the pull string. Identify with tags at each end the origin and destination of each empty conduit and indicate same on all empty or spare conduits on the as-built drawings.
- J. Pulling Cord: Install 100-pound-test nylon cord in ducts, including spares.
- K. Install raceway sealing fittings in accordance with the manufacturer's written instructions. Locate fittings at suitable, approved, accessible locations and fill them with UL-listed sealing compound. For concealed raceways, install each fitting in a flush steel box with a blank cover plate having a

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finish similar to that of adjacent plates or surfaces. Install raceway sealing fittings at the following points and elsewhere as indicated:

1. Where conduits enter through a foundation wall or stub-up through a slab on grade floor.
 2. Where required by the NEC.
- L. Install raceway/duct sealing compound inside of all underground raceways that stub into a building through a foundation wall or through a slab on grade floor.

3.5 - UNDERGROUND UTILITY STRUCTURE INSTALLATION:

- A. Elevation: Install manholes with roof top at least 15 inches below finished grade.
- B. Drainage: Install drains in bottom of units where indicated. Arrange to coordinate with drainage provisions indicated or specified.
- C. Access: Install cast-iron frame and cover. For manholes, use 30 inch cover except as indicated. Install brick chimney to support frame and cover and to connect cover with roof opening. Provide moisture-tight masonry joints and waterproof grouting for cast-iron frame to chimney. Set frames in paved areas and traffic ways flush with finished grade.
- D. Waterproofing: Apply waterproofing to exterior surfaces of units. Apply according to Division 7 Section "Sheet Membrane Waterproofing." After ducts have been connected and grouted, and prior to backfilling, waterproof joints and connections and touch up abrasions and scars. Waterproof exterior of manhole chimneys after brick mortar has cured at least 3 days.
- E. Hardware: Install removable hardware, including pulling eyes, cable stanchions, cable arms, and insulators, as required for installation and support of cable and conductors and as indicated.
- F. Hardware: Furnish removable hardware, including pulling eyes, cable stanchions, cable arms, and insulators, for installation under another Contract. For each manhole furnish 1 stanchion for each 30 linear inches of interior floor perimeter. In addition, furnish 1 arm for each stanchion, 3 insulators for each arm, and a total of 3 pulling eyes. Furnish materials complete with associated fasteners, packaged with protective covering for storage and with identification labels clearly describing contents.
- G. Field-Installed Bolting Anchors: Do not drill deeper than 3-7/8 inches (96 mm) for anchor bolts installed in the field. Use a minimum of 2 anchors for each cable stanchion.
- H. Grounding: Install ground rod through floor in each structure with top protruding 4 inches above floor. Seal the floor opening against water penetration with waterproof non-shrink grout. Ground exposed metal components and hardware with bare copper ground conductor. Train conductors neatly around corners. Install on walls and roof using cable clamps secured with expansion anchors.
- I. Precast Concrete Underground Structure Installation: Install as indicated, according to manufacturer's written instructions and ASTM C 891.
1. Install units plumb and level and with orientation and depth coordinated with arrangement of connecting ducts to minimize bends and deflections required for proper entrances.

SECTION 260543- UNDERGROUND DUCTS AND RACEWAYS FOR ELECTRICAL SYSTEMS

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2. Support units on a level bed of crushed stone or gravel, graded from the 1-inch sieve to the No. 4 sieve and compacted to same density as adjacent undisturbed earth.

3.6 - FIELD QUALITY CONTROL:

- A. Testing: Demonstrate capability and compliance with requirements upon completion of installation of underground duct and utility structures.
 1. Grounding: Test manhole grounding to ensure electrical continuity of bonding and grounding connections. Measure ground resistance at each ground rod and report results. Use an instrument specifically designed for ground-resistance measurements.
 2. Duct Integrity: Rod ducts with a ball type mandrel 1/4 inch smaller in diameter than internal diameter of ducts. Where rodding indicates obstructions in ducts, remove the obstructions and retest. The Contractor shall notify prior to commencing integrity testing to request observation of procedures.
 3. Water Tightness: Make internal inspection of manholes 3 months after completion of construction for indications of water ingress. Where leakage is noted, remove water and seal leak sources. Reinspect after 2 months and reseal remaining leak sources. Repeat process at 2 month intervals until leaks are corrected.
- B. Correct installations where possible, and retest to demonstrate compliance. Otherwise, remove and replace defective products and retest.

3.7 - CLEANING:

- A. Pull brush through full lengths of ducts. Use round bristle brush with a diameter 1/2 inch greater than internal diameter of duct.
- B. Clean internal surfaces of manholes including sump. Remove foreign material.

END OF SECTION

SECTION 260548- VIBRATION AND SEISMIC CONTROLS FOR ELECTRICAL SYSTEMS
GOVERNMENT OF THE U. S. VIRGIN ISLANDS, DEPARTMENT OF PUBLIC WORKS
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PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. This Section includes the following:

1. Isolation pads
2. Spring isolators
3. Restrained spring isolators
4. Channel support systems
5. Restraint cables
6. Hanger rod stiffeners
7. Anchorage bushings and washers

- B. Related Sections include the following:

1. Section 260529 "Hangers and Supports for Electrical Systems" for commonly used electrical supports and installation requirements.

1.3 DEFINITIONS

- A. The IBC:
International Building Code
- B. ICC-ES:
ICC-Evaluation Service

1.4 PERFORMANCE REQUIREMENTS

- A. Seismic-Restraint Loading:

1. Site Class as Defined in the IBC:
D
2. Assigned Seismic Use Group or Building Category as Defined in the IBC:
 - a. Occupancy Category:
IV
 - b. Seismic Design Category:
D

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- c. Component Importance Factor:
1.5
- d. Component Response Modification Factor:
2.5
- e. Component Amplification Factor:
1.5 for fixed equipment. 2.5. for flexible components
- 3. Design Spectral Response Acceleration at Short Periods (0.2 Second):
1.1%
- 4. Design Spectral Response Acceleration at 1.0-Second Period:
1.8%

1.5 ACTION SUBMITTALS

A. Product Data:

For the following:

- 1. Include rated load, rated deflection, and overload capacity for each vibration isolation device.
- 2. Illustrate and indicate style, material, strength, fastening provision, and finish for each type and size of seismic-restraint component used.
 - a. Tabulate types and sizes of seismic restraints, complete with report numbers and rated strength in tension and shear as evaluated by an evaluation service member of ICC-ES acceptable to authorities having jurisdiction.
 - b. Annotate to indicate application of each product submitted and compliance with requirements.
- 3. Restrained Isolation Devices:
Include ratings for horizontal, vertical, and combined loads.

B. Delegated Design Submittal:

For vibration isolation and seismic restraint details indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

- 1. Design Calculations:
Calculate static and dynamic loading due to equipment weight and operation, seismic forces required to select vibration isolators and seismic restraints.
 - a. Coordinate design calculations with wind load calculations required for equipment mounted outdoors. Comply with requirements in other electrical Sections for equipment mounted outdoors.
- 2. Indicate materials and dimensions and identify hardware, including attachment and anchorage devices.
- 3. Field fabricated supports

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4. Seismic Restraint Details:

- a. **Design Analysis:**
To support selection and arrangement of seismic restraints. Include calculations of combined tensile and shear loads.
- b. **Details:**
Indicate fabrication and arrangement. Detail attachments of restraints to the restrained items and to the structure. Show attachment locations, methods, and spacing. Identify components, list their strengths, and indicate directions and values of forces transmitted to the structure during seismic events. Indicate association with vibration isolation devices.
- c. **Preapproval and Evaluation Documentation:**
By an evaluation service member of ICC-ES acceptable to authorities having jurisdiction, showing maximum ratings of restraint items and the basis for approval (tests or calculations).

1.6 INFORMATIONAL SUBMITTALS

- A. **Coordination Drawings:**
Show coordination of seismic bracing for electrical components with other systems and equipment in the vicinity, including other supports and seismic restraints.
- B. **Qualification Data:**
For professional engineer and testing agency
- C. Field quality control test reports

1.7 QUALITY ASSURANCE

- A. Comply with seismic restraint requirements in the IBC unless requirements in this Section are more stringent.
- B. Seismic restraint devices shall have horizontal and vertical load testing and analysis and shall bear anchorage preapproval OPA number from OSHPD, preapproval by ICC-ES, or preapproval by another agency acceptable to authorities having jurisdiction, showing maximum seismic-restraint ratings. Ratings based on independent testing are preferred to ratings based on calculations. If preapproved ratings are not available, submittals based on independent testing are preferred. Calculations (including combining shear and tensile loads) to support seismic restraint designs must be signed and sealed by a qualified professional engineer.
- C. Comply with NFPA 70.

PART 2 - PRODUCTS

2.1 VIBRATION ISOLATORS

- A. **Available Manufacturers:**
Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

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1. Ace Mountings Co., Inc.
 2. Amber/Booth Company, Inc.
 3. California Dynamics Corporation
 4. Isolation Technology, Inc.
 5. Kinetics Noise Control
 6. Mason Industries
 7. Vibration Eliminator Co., Inc.
 8. Vibration Isolation
 9. Vibration Mountings & Controls, Inc.
- B. Pads:
Arrange in single or multiple layers of sufficient stiffness for uniform loading over pad area, molded with a nonslip pattern and galvanized steel baseplates, and factory cut to sizes that match requirements of supported equipment.
1. Resilient Material:
Oil and water resistant neoprene.
- C. Spring Isolators:
Freestanding, laterally stable, open spring isolators
1. Outside Spring Diameter:
Not less than 80 percent of the compressed height of the spring at rated load
 2. Minimum Additional Travel:
50 percent of the required deflection at rated load
 3. Lateral Stiffness:
More than 80 percent of rated vertical stiffness
 4. Overload Capacity:
Support 200 percent of rated load, fully compressed, without deformation or failure.
 5. Baseplates:
Factory drilled for bolting to structure and bonded to 1/4-inch (6-mm) thick, rubber isolator pad attached to baseplate underside. Baseplates shall limit floor load to 500 psig (3447 kPa).
 6. Top Plate and Adjustment Bolt:
Threaded top plate with adjustment bolt and cap screw to fasten and level equipment.
- D. Restrained Spring Isolators:
Freestanding, steel, open spring isolators with seismic or limit-stop restraint.
1. Housing:
Steel with resilient vertical limit stops to prevent spring extension due to weight being removed; factory drilled baseplate bonded to 1/4-inch (6-mm) thick, neoprene or rubber

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isolator pad attached to baseplate underside; and adjustable equipment mounting and leveling bolt that acts as blocking during installation.

2. Restraint:
Seismic or limit-stop as required for equipment and authorities having jurisdiction.
3. Outside Spring Diameter:
Not less than 80 percent of the compressed height of the spring at rated load.
4. Minimum Additional Travel:
50 percent of the required deflection at rated load.
5. Lateral Stiffness:
More than 80 percent of rated vertical stiffness.
6. Overload Capacity:
Support 200 percent of rated load, fully compressed, without deformation or failure.

2.2 SEISMIC-RESTRAINT DEVICES

A. Available Manufacturers:

Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

1. Amber/Booth Company, Inc.
2. California Dynamics Corporation
3. Cooper B-Line, Inc.; a division of Cooper Industries
4. Hilti Inc.
5. Loos & Co.; Seismic Earthquake Division
6. Mason Industries
7. TOLCO Incorporated; a brand of NIBCO INC.
8. Unistrut; Tyco International, Ltd.

B. General Requirements for Restraint Components:

Rated strengths, features, and application requirements shall be as defined in reports by an evaluation service member of ICC-ES acceptable to authorities having jurisdiction.

1. Structural Safety Factor:
Allowable strength in tension, shear, and pullout force of components shall be at least four times the maximum seismic forces to which they will be subjected.

C. Channel Support System:

MFMA-3, shop or field fabricated support assembly made of slotted steel channels with accessories for attachment to braced component at one end and to building structure at the other end and other matching components and with corrosion-resistant coating; and rated in tension, compression, and torsion forces.

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D. Restraint Cables:

ASTM A 492 stainless-steel cables with end connections made of steel assemblies with thimbles, brackets, swivels, and bolts designed for restraining cable service; and with a minimum of two clamping bolts for cable engagement.

E. Hanger Rod Stiffener:

Steel tube or steel slotted support system sleeve with internally bolted connections to hanger rod. Do not weld stiffeners to rods.

F. Bushings for Floor Mounted Equipment Anchor:

Neoprene bushings designed for rigid equipment mountings, and matched to type and size of anchors and studs.

G. Bushing Assemblies for Wall Mounted Equipment Anchorage:

Assemblies of neoprene elements and steel sleeves designed for rigid equipment mountings, and matched to type and size of attachment devices.

H. Resilient Isolation Washers and Bushings:

One-piece, molded, oil and water resistant neoprene, with a flat washer face.

I. Mechanical Anchor:

Drilled in and stud wedge or female wedge type in zinc coated steel for interior applications and stainless steel for exterior applications. Select anchors with strength required for anchor and as tested according to ASTM E 488. Minimum length of eight times diameter.

J. Adhesive Anchor:

Drilled in and capsule anchor system containing polyvinyl or urethane methacrylate based resin and accelerator, or injected polymer or hybrid mortar adhesive. Provide anchor bolts and hardware with zinc coated steel for interior applications and stainless steel for exterior applications. Select anchor bolts with strength required for anchor and as tested according to ASTM E 488.

2.3 FACTORY FINISHES

A. Finish:

Manufacturer's standard prime-coat finish ready for field painting.

B. Finish:

Manufacturer's standard paint applied to factory assembled and tested equipment before shipping.

1. Powder coating on springs and housings
2. All hardware shall be galvanized. Stainless steel components for exterior use.
3. Baked enamel or powder coat for metal components on isolators for interior use.
4. Color code or otherwise mark vibration isolation and seismic control devices to indicate capacity range.

PART 3 - EXECUTION

3.1 EXAMINATION

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- A. Examine areas and equipment to receive vibration isolation and seismic control devices for compliance with requirements for installation tolerances and other conditions affecting performance.
- B. Examine roughing in of reinforcement and cast in place anchors to verify actual locations before installation.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 APPLICATIONS

- A. Multiple Raceways or Cables:
Secure raceways and cables to trapeze member with clamps approved for application by an evaluation service member of ICC-ES acceptable to authorities having jurisdiction.
- B. Hanger Rod Stiffeners:
Install hanger rod stiffeners where indicated or scheduled on Drawings to receive them and where required to prevent buckling of hanger rods due to seismic forces.
- C. Strength of Support and Seismic Restraint Assemblies:
Where not indicated, select sizes of components so strength will be adequate to carry present and future static and seismic loads within specified loading limits.

3.3 SEISMIC-RESTRAINT DEVICE INSTALLATION

- A. Equipment and Hanger Restraints:
 - 1. Install restrained isolators on electrical equipment.
 - 2. Install resilient, bolt-isolation washers on equipment anchor bolts where clearance between anchor and adjacent surface exceeds 0.125 inch (3.2 mm).
 - 3. Install seismic restraint devices using methods approved by an evaluation service member of ICC-ES acceptable to authorities having jurisdiction providing required submittals for component.
- B. Install bushing assemblies for mounting bolts for wall mounted equipment, arranged to provide resilient media where equipment or equipment-mounting channels are attached to wall.
- C. Attachment to Structure:
If specific attachment is not indicated, anchor bracing to structure at flanges of beams, at upper truss chords of bar joists, or at concrete members.
- D. Drilled-in Anchors:
 - 1. Identify position of reinforcing steel and other embedded items prior to drilling holes for anchors. Do not damage existing reinforcing or embedded items during coring or drilling. Notify the structural engineer if reinforcing steel or other embedded items are encountered during drilling. Locate and avoid pre-stressed tendons, electrical and telecommunications conduit, and gas lines.
 - 2. Do not drill holes in concrete or masonry until concrete, mortar, or grout has achieved full design strength.

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3. Wedge Anchors:
Protect threads from damage during anchor installation. Heavy duty sleeve anchors shall be installed with sleeve fully engaged in the structural element to which anchor is to be fastened.
4. Adhesive Anchors:
Clean holes to remove loose material and drilling dust prior to installation of adhesive. Place adhesive in holes proceeding from the bottom of the hole and progressing toward the surface in such a manner as to avoid introduction of air pockets in the adhesive.
5. Set anchors to manufacturer's recommended torque, using a torque wrench.
6. Install zinc coated steel anchors for interior and stainless steel anchors for exterior applications.

3.4 ACCOMMODATION OF DIFFERENTIAL SEISMIC MOTION

- A. Install flexible connections in runs of raceways, cables, wire ways, cable trays, and busways where they cross seismic joints, where adjacent sections or branches are supported by different structural elements, and where they terminate with connection to equipment that is anchored to a different structural element from the one supporting them as they approach equipment.

3.5 FIELD QUALITY CONTROL

- A. Testing Agency:
Engage a qualified testing agency to perform tests and inspections and prepare test reports.
- B. Perform tests and inspections.
- C. Tests and Inspections:
 1. Provide evidence of recent calibration of test equipment by a testing agency acceptable to authorities having jurisdiction.
 2. Schedule test with Owner, through Owner's Representative, before connecting anchorage device to restrained component (unless post connection testing has been approved), and with at least seven days' advance notice.
 3. Obtain Owner's Representative approval before transmitting test loads to structure. Provide temporary load spreading members.
 4. Test at least four of each type and size of installed anchors and fasteners selected by Owner's Representative.
 5. Test to 90 percent of rated proof load of device.
 6. Measure isolator restraint clearance.
 7. Measure isolator deflection.
 8. Verify snubber minimum clearances.
 9. If a device fails test, modify all installations of same type and retest until satisfactory results are achieved.

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D. Remove and replace malfunctioning units and retest as specified above.

E. Prepare test and inspection reports.

3.6 ADJUSTING

A. Adjust isolators after isolated equipment is at operating weight.

B. Adjust limit stops on restrained spring isolators to mount equipment at normal operating height.
After equipment installation is complete, adjust limit stops so they are out of contact during normal operation.

C. Adjust active height of spring isolators.

D. Adjust restraints to permit free movement of equipment within normal mode of operation.

END OF SECTION

SECTION 260553- IDENTIFICATION FOR ELECTRICAL SYSTEMS
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PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Identification for raceways
2. Identification of power and control cables
3. Identification for conductors
4. Underground line warning tape
5. Warning labels and signs
6. Instruction signs
7. Equipment identification labels
8. Miscellaneous identification products

1.2 SUBMITTALS

A. Product Data:

For each electrical identification product indicated.

1.3 QUALITY ASSURANCE

- A. Comply with ANSI A13.1.
- B. Comply with NFPA 70.
- C. Comply with 29 CFR 1910.144 and 29 CFR 1910.145.
- D. Comply with ANSI Z535.4 for safety signs and labels.
- E. Adhesive-attached labeling materials, including label stocks, laminating adhesives, and inks used by label printers, shall comply with UL 969.

PART 2 -PRODUCTS

2.1 POWER RACEWAY IDENTIFICATION MATERIALS

- A. Comply with ANSI A13.1 for minimum size of letters for legend and for minimum length of color field for each raceway size.
- B. Self-Adhesive Vinyl Labels for Raceways Carrying Circuits at 600 V or Less:
Preprinted, flexible label laminated with a clear, weather and chemical resistant coating and matching wraparound adhesive tape for securing ends of legend label.
- C. Snap Around Labels for Raceways Carrying Circuits at 600 V or Less:
Slit, pre-tensioned, flexible, pre-printed, color coded acrylic sleeve, with diameter sized to suit diameter of raceway or cable it identifies and to stay in place by gripping action.

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- D. Snap Around, Color Coding Bands for Raceways Carrying Circuits at 600 V or Less:
Slit, pre-tensioned, flexible, solid colored acrylic sleeve, 2 inches (50 mm) long, with diameter sized to suit diameter of raceway or cable it identifies and to stay in place by gripping action.
- E. Write On Tags:
Polyester tag, 0.010 inch (0.25 mm) thick, with corrosion resistant grommet and cable tie for attachment to conductor or cable.
 - 1. Marker for Tags:
Permanent, waterproof, black ink marker recommended by tag manufacturer.

2.2 POWER AND CONTROL CABLE IDENTIFICATION MATERIALS

- A. Comply with ANSI A13.1 for minimum size of letters for legend and for minimum length of color field for each raceway and cable size.
- B. Self-Adhesive Vinyl Labels:
Preprinted, flexible label laminated with a clear, weather and chemical resistant coating and matching wrap around adhesive tape for securing ends of legend label.
- C. Write On Tags:
Polyester tag, 0.010 inch (0.25 mm) thick, with corrosion resistant grommet and cable tie for attachment to conductor or cable.
 - 1. Marker for Tags:
Permanent, waterproof, black ink marker recommended by tag manufacturer.
- D. Snap Around Labels:
Slit, pre-tensioned, flexible, preprinted, color coded acrylic sleeve, with diameter sized to suit diameter of raceway or cable it identifies and to stay in place by gripping action.
- E. Snap Around, Color Coding Bands:
Slit, pre-tensioned, flexible, solid colored acrylic sleeve, 2 inches (50 mm) long, with diameter sized to suit diameter of raceway or cable it identifies and to stay in place by gripping action.

2.3 CONDUCTOR IDENTIFICATION MATERIALS

- A. Color Coding Conductor Tape:
Colored, self-adhesive vinyl tapes not less than 3 mils (0.08 mm) thick by 1 to 2 inches (25 to 50 mm) wide.
- B. Self-Adhesive Vinyl Labels:
Preprinted, flexible label laminated with a clear, weather and chemical resistant coating and matching wraparound adhesive tape for securing ends of legend label.
- C. Marker Tapes:
Vinyl or vinyl cloth, self-adhesive wraparound type, with circuit identification legend machine printed by thermal transfer or equivalent process.
- D. Write On Tags:
Polyester tag, 0.010 inch (0.25 mm) thick, with corrosion-resistant grommet and cable tie for attachment to conductor or cable.

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1. Marker for Tags: Permanent, waterproof, black ink marker recommended by tag manufacturer.

2.4 WARNING LABELS AND SIGNS

- A. Comply with NFPA 70 and 29 CFR 1910.145.
- B. Self-Adhesive Warning Labels:
Factory printed, multicolor, pressure sensitive adhesive labels, configured for display on front cover, door, or other access to equipment unless otherwise indicated.
- C. High Density Polyethylene (HDPE) Warning Signs:
 1. Preprinted Dual Color Routed HDPE signs, punched or drilled for fasteners, with colors, legend, and size required for application.
 2. 1/4-inch (6.4-mm) grommets in corners for mounting.
 3. Nominal size, 7 by 10 inches (180 by 250 mm).
- D. Warning label and sign shall include, but are not limited to, the following legends:
 1. Multiple Power Source Warning:
"DANGER - ELECTRICAL SHOCK HAZARD - EQUIPMENT HAS MULTIPLE POWER SOURCES."
 2. Workspace Clearance Warning:
"WARNING - OSHA REGULATION - AREA IN FRONT OF ELECTRICAL EQUIPMENT MUST BE KEPT CLEAR FOR 36 INCHES (915 MM)."

2.5 INSTRUCTION SIGNS

- A. Routed, Dual Color HDPE, minimum 1/2 inch thick for signs up to 20 sq. inches (129 sq. m) and 3/4 inch thick for larger sizes.
 1. Routed legend with black letters on white face.
 2. Punched or drilled for mechanical fasteners.
 3. Framed with mitered acrylic molding and arranged for attachment at applicable equipment.

2.6 MISCELLANEOUS IDENTIFICATION PRODUCTS

- A. Paint:
Comply with requirements in Division 09 painting Sections for paint materials and application requirements. Select paint system applicable for surface material and location (exterior or interior).
- B. Fasteners for Labels and Signs:
Self-tapping, stainless steel screws or stainless steel machine screws with nuts and flat and lock washers.

PART 3- EXECUTION

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3.1 INSTALLATION

- A. Location:
Install identification materials and devices at locations for most convenient viewing without interference with operation and maintenance of equipment.
- B. Apply identification devices to surfaces that require finish after completing finish work.
- C. Self-Adhesive Identification Products:
Clean surfaces before application, using materials and methods recommended by manufacturer of identification device.
- D. Attach signs and plastic labels that are not self-adhesive type with mechanical fasteners appropriate to the location and substrate.
- E. System Identification Color Coding Bands for Raceways and Cables:
Each color coding band shall completely encircle cable or conduit. Place adjacent bands of two-color markings in contact, side by side. Locate bands at changes in direction, at penetrations of walls and floors, at 50-foot (15-m) maximum intervals in straight runs, and at 25-foot (7.6-m) maximum intervals in congested areas.
- F. Underground Line Warning Tape:
During backfilling of trenches install continuous underground line warning tape directly above line at 6 to 8 inches (150 to 200 mm) below finished grade. Use multiple tapes where width of multiple lines installed in a common trench or concrete envelope exceeds 16 inches (400 mm) overall.
- G. Painted Identification:
Comply with requirements in Division 09 painting Sections for surface preparation and paint application.

3.2 IDENTIFICATION SCHEDULE

- A. Accessible Raceways and Metal Clad Cables, 600 V or Less, for Service, Feeder, and Branch Circuits More Than 30 A, and 120 V to ground:
Install labels at 10-foot (3-m) maximum intervals.
- B. Accessible Raceways and Cables within Buildings:
Identify the covers of each junction and pull box of the following systems with self-adhesive vinyl labels with the wiring system legend and system voltage. System legends shall be as follows:
 - 1. Emergency Power
 - 2. Power
 - 3. UPS
- C. Power Circuit Conductor Identification, 600 V or Less:
For conductors in vaults, pull and junction boxes, manholes, and hand holes, use color-coding conductor tape to identify the phase.
 - 1. Color Coding for Phase and Voltage Level Identification, 600 V or Less:
Use colors listed below for ungrounded service feeder and branch-circuit conductors.

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- a. Color shall be factory applied or field applied for sizes larger than No. 8 AWG, if authorities having jurisdiction permit.
- b. Colors for 208/120-V Circuits:
 - 1) Phase A:
Black
 - 2) Phase B:
Red
 - 3) Phase C:
Blue
- c. Colors for 480/277-V Circuits:
 - 1) Phase A:
Brown
 - 2) Phase B:
Orange
 - 3) Phase C:
Yellow
- D. Install instructional sign including the color code for grounded and ungrounded conductors using adhesive film type labels.
- E. Conductors to Be Extended in the Future:
Attach write on tags or marker tape to conductors and list source.
- F. Auxiliary Electrical Systems Conductor Identification:
Identify field installed alarm, control, and signal connections.
 - 1. Identify conductors, cables, and terminals in enclosures and at junctions, terminals, and pull points. Identify by system and circuit designation.
 - 2. Use system of marker tape designations that is uniform and consistent with system used by manufacturer for factory installed connections.
 - 3. Coordinate identification with Project Drawings, manufacturer's wiring diagrams, and the Operation and Maintenance Manual.
- G. Locations of Underground Lines:
Identify with underground-line warning tape for power, lighting, communication, and control wiring and optical fiber cable.
 - 1. Install underground line warning tape for both direct buried cables and cables in raceway.
- H. Workspace Indication:
Install floor marking tape to show working clearances in the direction of access to live parts. Workspace shall be as required by NFPA 70 and 29 CFR 1926.403 unless otherwise indicated. Do not install at flush mounted panelboards and similar equipment in finished spaces.

SECTION 260553- IDENTIFICATION FOR ELECTRICAL SYSTEMS
GOVERNMENT OF THE U. S. VIRGIN ISLANDS, DEPARTMENT OF PUBLIC WORKS
PROJECT NAME: Elaine I. Sprauve Public Library and Museum Building
Project Location, St. John, U.S. Virgin Islands

- I. Warning Labels for Indoor Cabinets, Boxes, and Enclosures for Power and Lighting:
Self-adhesive warning labels
 - 1. Comply with 29 CFR 1910.145.
 - 2. Identify system voltage with black letters and an orange background.
 - 3. Apply to exterior of door, cover, or other access.
 - 4. For equipment with multiple power or control sources, apply to door or cover of equipment including, but not limited to, the following:
 - a. Power transfer switches
 - b. Controls with external control power connections
- J. Operating Instruction Signs:
Install instruction signs to facilitate proper operation and maintenance of electrical systems and items to which they connect. Install instruction signs with approved legend where instructions are needed for system or equipment operation.
- K. Emergency Operating Instruction Signs:
Install instruction signs with white legend and a red background with minimum 3/8-inch (10-mm) high letters for emergency instructions at equipment used for power transfer.
- L. Equipment Identification Labels:
On each unit of equipment, install unique designation label that is consistent with wiring diagrams, schedules, and the Operation and Maintenance Manual. Apply labels to disconnect switches and protection equipment, central or master units, control panels, control stations, terminal cabinets, and racks of each system. Systems include power, lighting, control, communication, signal, monitoring, and alarm systems unless equipment is provided with its own identification.
 - 1. Labeling Instructions:
 - a. Indoor Equipment:
Self-adhesive, engraved, laminated acrylic or melamine label. Unless otherwise indicated, provide a single line of text with 1/2-inch (13-mm) high letters on 1-1/2-inch (38-mm) high label; where two lines of text are required, use labels 2 inches (50 mm) high.
 - b. Outdoor Equipment:
Engraved, laminated acrylic or melamine label.
 - c. Elevated Components:
Increase sizes of labels and letters to those appropriate for viewing from the floor.
 - d. Unless provided with self-adhesive means of attachment, fasten labels with appropriate mechanical fasteners that do not change the NEMA or NRTL rating of the enclosure.
 - 2. Equipment to Be Labeled:
 - a. Panel-boards:
Typewritten directory of circuits in the location provided by panel board manufacturer.

SECTION 260553- IDENTIFICATION FOR ELECTRICAL SYSTEMS

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Panel board identification shall be self-adhesive, engraved, laminated acrylic or melamine label.

- b. Enclosures and electrical cabinets
- c. Access doors and panels for concealed electrical items
- d. Switchgear
- e. Switchboards
- f. Emergency system boxes and enclosures
- g. Enclosed switches
- h. Enclosed circuit breakers
- 1. Enclosed controllers
- j. Variable-speed controllers
- k. Push-button stations
- l. Power transfer equipment
- m. Contactors
- n. Power-generating units
- o. Monitoring and control equipment
- p. UPS equipment

END OF SECTION

SECTION 260923- LIGHTING CONTROL DEVICES

GOVERNMENT OF THE U. S. VIRGIN ISLANDS, DEPARTMENT OF PUBLIC WORKS

PROJECT NAME: Elaine I. Sprauve Public Library and Museum Building

Project Location, St. John, U.S. Virgin Islands

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Occupancy and Vacancy Sensor Control

B. Related Sections:

1. Section 262416 - Panelboards
2. Section 262726 - Wiring Devices:
Lighting Controls
3. Section 265100 - Interior Lighting Fixtures, Lamps And Ballasts:
Fluorescent lighting ballasts controlled by central dimming control system.

1.2 REFERENCES

A. American National Standards Institute/Institute of Electrical and Electronic Engineers (ANSI/IEEE):

1. C62.41-1991 -Recommended Practice for Surge Voltages in Low-Voltage AC Power Circuits.

B. ASTM International (ASTM):

1. D4674-02a Standard Test Method for Accelerated Testing for Color Stability of Plastics Exposed to Indoor Fluorescent Lighting and Window-Filtered Daylight.

C. International Electro-technical Commission (IEC).

1. IEC 801-2 Electrostatic Discharge Testing Standard.
2. IEC/EN 60669-2-1 Switches for household and similar fixed electrical installations- electronic switches.

D. International Organization for Standardization (ISO):

1. 9001:2000- Quality Management Systems.

E. National Electrical Manufacturers Association (NEMA)

1. WD1 (R2005) - General Color Requirements for Wiring Devices.

F. Underwriters Laboratories, Inc. (UL):

1. 94 - Flammability Rating
2. 916 - Energy Management Equipment.
3. 508 (2005) - Standard for Industrial Control Equipment.
4. 244A- Appliance Controls

SECTION 260923- LIGHTING CONTROL DEVICES

GOVERNMENT OF THE U. S. VIRGIN ISLANDS, DEPARTMENT OF PUBLIC WORKS

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5. 935 (2005) - Fluorescent Ballasts

1.3 SYSTEM DESCRIPTION

- A. Permanently installed
 1. Ceiling mounted occupancy sensors
 2. Wall switch occupancy sensors
 3. Power packs

1.4 ACTION SUBMITTALS

- A. Product Data:
For each type of product.
- B. Shop Drawings:
Show installation details for occupancy and light level sensors.
- C. Interconnection diagrams showing field installed wiring.
- D. Include diagrams for power, signal, and control wiring.

1.5 INFORMATIONAL SUBMITTALS

- A. Field quality control reports.

1.6 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data:
For each type of lighting control device to include in emergency, operation, and maintenance manuals.
- B. QUALITY ASSURANCE
- C. Manufacturer:
Minimum 10 years experience in manufacture of architectural lighting controls.
- D. Manufacturer's Quality System:
Registered to ISO 9001:2000 Quality Standard, including in-house engineering for product design activities.
- E. PROJECT CONDITIONS
- F. Do not install equipment until following conditions can be maintained in spaces to receive equipment:
 1. Ambient temperature:
Under 40 degrees C (32 degrees to 104 degrees F).
 2. Relative humidity: Maximum 90 percent, non-condensing.

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3. Lighting control system must be protected from dust during installation.

1.7 WARRANTY

- A. Provide manufacturer's 1 year parts warranty.
- B. Maintenance Material submittals
- C. Make ordering of new equipment for expansions, replacements, and spare parts available to end user.
- D. Make new replacement parts available for minimum of ten years from date of manufacture.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Basis of Design Product:
Lutron Occupancy Sensors. Subject to compliance with requirements, provide product indicated or comparable product by one of the following:
 1. Bryant Electric; a Hubbell company
 2. Cooper Industries, Inc.
 3. Hubbell Building Automation, Inc.
 4. Leviton Mfg. Company Inc.
 5. Lutron Electronics Co., Inc.
 6. Sensor Switch, Inc.
 7. Square D; a brand of Schneider Electric.
 8. Watt Stopper.

2.2 GENERAL

- A. Provide system software and hardware that is designed, tested, manufactured, and warranted by a single manufacturer.
- B. Architectural Lighting Controls:
Ten year operational life while operating continually at any temperature in an ambient temperature range of 0°C (32°F) to 40°C (104°F) and 90 percent non-condensing relative humidity.
- C. Designed and tested to withstand discharges without impairment of performance when subjected to discharges of 15,000 volts per IEC 801-2.

2.3 SENSOR PERFORMANCE REQUIREMENTS

- A. Sensing mechanism:

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1. Dual technology:
 - a. Utilize multiple segmented lens, with internal grooves to eliminate dust and residue buildup.
 - b. Utilize an operating frequency of 32k Hz or 40 kHz that shall be crystal controlled to operate within plus or minus 0.005 percent tolerance.
- B. Field adjustable controls for time delay and sensitivity to override any adaptive features.
- C. Power failure memory:
 1. Controls incorporate non-volatile memory. Should power be interrupted and subsequently restored, settings and learned parameters saved in protected memory shall not be lost.
- D. Designed and tested to withstand discharges without impairment of performance when subjected to discharges of 15,000 volts per IEC 801-2.

2.4 WIRED CEILING AND WALL MOUNT SENSORS

- A. Product: LOS-CDT-500R-WH, LOS-CDT-1000R-WH, LOS-CDT-2000R-WH.
- B. Provide all necessary mounting hardware and instructions.
- C. Sensors shall be Class 2 devices.
- D. Indicate viewing directions on mounting bracket for all Ceiling mount sensors.
- E. Provide customizable mask to block off unwanted viewing areas for all ceiling mounted sensors using infrared technology.
- F. Provide swivel mount base for all wall mount sensors.
- G. Provide an internal additional isolated relay with Normally Open, Normally Closed and Common outputs for use with HVAC control, Data Logging and other control options.

2.5 IN-WALL OCCUPANCY SENSORS

- A. Digital wall box no-neutral switch with occupancy/vacancy sensor
 1. Product:
MS-OPS6M-DV
 2. Switch shall be rated at 120/277 Volts 6 amps Lighting / 120 Volts 3 amps Fan Loads and shall not require a neutral connection in wall box.
 - a. Rated life:
Minimum 100,000 cycles.
 - b. Load switched in manner that prevents arcing at mechanical contacts when power is applied to load circuits.
 - c. Fully rated output continuous duty for inductive, capacitive, and resistive loads.

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3. Utilize Infrared as its sensing mechanism coupled with Lutron XCT™ Technology for sensing fine motions. Signal processing technology detects fine motion, passive infrared (PIR) signals without the need to change the sensor's sensitivity threshold.
4. Occupancy/vacancy sensor can be programmed to operate as an occupancy sensor (automatic-on and automatic-off functionality) or a vacancy sensor (manual-on and automatic-off functionality).
5. Provide adjustable timeout for 15, 30 minutes.
6. Provide ambient light sensor to prevent lights from turning on automatically if ambient light in room is higher than selected setting. Three settings shall be available to for selection by the user.
7. Provide ability when switch is manually turned off, to prevent sensor from turning lights back on automatically while room remains occupied. Once room is vacated, auto-on feature returns to normal operation after timeout duration has exhausted.
8. Utilize air gap off, activated when user selects "off" at any control to disconnect the load from line supply eliminating any leakage current.
9. Protect your switch from power surges during a storm or from other equipment from within the building.
10. Design and test switches to withstand line-side surges without impairment to performance when subjected to surges of 6,000 volts, 200 amps per ANSI/IEEE C62.41 C.
11. This ensures product design life time under all installation conditions. For example products which are not de-rated when installed in a multi-gang installation may experience a reduced design lifetime because of an increased temperature rise.
12. Capable of operating at the rated capacity; this includes modified capacities for ganging configurations which require the removal of fins. Operation at rated capacity shall be possible across the full ambient temperature range, without shortening design lifetime.
13. Provide frequency compensation to assure switching capability on 50 or 60Hz lines.
14. Switches to be listed to UL 20, UL 508, ULI472, CSA C22.2 #14, NOM-003-SCFI

2.6 SENSOR POWER PACKS

- A. Product:
PP-277H
- B. Plenum rated.
- C. Control wiring between sensors and control units shall be Class 2, 18-24 AWG, stranded U.L. Classified, TEFLON jacketed cable suitable for use in plenums.
- D. Integrated, self-contained unit consisting internally of an isolated load switching control relay and a power supply to provide low-voltage power (PP-SH does not supply power).

2.7 SOURCE QUALITY CONTROL

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- A. Perform full-function testing on 100 percent of all system components and panel assemblies at the factory.

PART 3- EXECUTION

3.1 INSTALLATION

- A. Install equipment in accordance with manufacturer's installation instructions.
- B. Provide complete installation of system in accordance with Contract Documents.
- C. Provide equipment at locations and in quantities indicated on Drawings. Provide any additional equipment required to provide control intent.

3.2 SERVICE AND SUPPORT

A. Startup and Programming

- 1. Provide factory-certified field service engineer to a site visit to ensure proper system installation and operation under following parameters:
 - a. Qualifications for factory-certified field service engineer:
 - 1) Minimum experience of 2 years training in the electrical/electronic field.
 - 2) Certified by the equipment manufacturer on the system installed.
 - b. Make a visit upon completion of installation of lighting control system:
 - 1) Verify connection and location of controls.
 - 2) Verify system operation control by control, zone by zone.
 - 3) Verify proper integration of manufacturers interfacing equipment.
 - 4) Obtain sign-off on system functions.

B. Tech Support

- 1. Provide factory direct technical support hotline 24 hours per day, 7 days per week.

3.3 MAINTENANCE

- A. Capable of providing on-site service support within 24 hours anywhere in continental United States and within 72 hours worldwide except where special visas are required.
- B. Offer renewable service contract on yearly basis, to include parts, factory labor, and annual training visits. Make service contracts available up to ten years after date of system startup.

END OF SECTION

SECTION 262416 - PANELBOARDS

GOVERNMENT OF THE U. S. VIRGIN ISLANDS, DEPARTMENT OF PUBLIC WORKS

PROJECT NAME: Elaine I. Sprauve Public Library and Museum Building

Project Location, St. John, U.S. Virgin Islands

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes distribution panelboards and lighting and appliance branch-circuit panelboards.

1.2 SUBMITTALS

- A. Product Data:
For each type of product indicated
- B. Shop Drawings:
For each panelboard and related equipment.
 - 1. Include dimensioned plans, elevations, sections, and details. Show tabulations of installed devices, equipment features, and ratings.
 - 2. Detail enclosure types and details for types other than NEMA 250, Type 1.
 - 3. Detail bus configuration, current, and voltage ratings.
 - 4. Short-circuit current rating of panel boards and overcurrent protective devices.
 - 5. Include evidence of NRTL listing for series rating of installed devices.
 - 6. Detail features, characteristics, ratings, and factory settings of individual overcurrent protective devices and auxiliary components.
 - 7. Include wiring diagrams for power, signal, and control wiring.
 - 8. Include time-current coordination curves for each type and rating of overcurrent protective device included in panelboards.
- C. Field quality-control reports.
- D. Panelboard schedules for installation in panelboards.
- E. Operation and maintenance data.

1.3 QUALITY ASSURANCE

- A. Electrical Components, Devices, and Accessories:
Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- B. Comply with NEMA PB 1.
- C. Comply with NFPA 70.

1.4 WARRANTY

- A. Special Warranty:
Manufacturer's standard form in which manufacturer agrees to repair or replace transient voltage suppression devices that fail in materials or workmanship within specified warranty period.

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1. Warranty Period:

Five years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 GENERAL REQUIREMENTS FOR PANELBOARDS

A. Enclosures:

Flush-mounted cabinets.

1. Rated for environmental conditions at installed location.

a. Indoor Dry and Clean Locations:
NEMA 250, Type I

b. Outdoor Locations:
NEMA 250, Type 3R

c. Kitchen Wash-Down Areas:
NEMA 250, Type 4X

d. Other Wet or Damp Indoor Locations:
NEMA 250, Type 3

2. Front:

Secured to box with concealed trim clamps. For surface-mounted fronts, match box dimensions; for flush-mounted fronts, overlap box.

3. Hinged Front Cover:

Entire front trim hinged to box and with standard door within hinged trim cover.

4. Directory Card:

Inside panelboard door, mounted in transparent card holder.

B. Incoming Mains Location:

Top and bottom.

C. Phase, Neutral, and Ground Buses:

Hard-drawn copper, 98 percent conductivity

D. Conductor Connectors:

Suitable for use with conductor material and sizes.

1. Material:

Hard-drawn copper, 98 percent conductivity

2. Main and Neutral Lugs:

Compression type

3. Ground Lugs and Bus Configured Terminators:

Compression type

4. Feed-Through Lugs:

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Compression type, suitable for use with conductor material. Locate at opposite end of bus from incoming lugs or main device.

- 5. Sub-feed (Double) Lugs:
Compression type suitable for use with conductor material. Locate at same end of bus as incoming lugs or main device.
- E. Service Equipment Label:
NRTL labeled for use as service equipment for panelboards with one or more main service disconnecting and overcurrent protective devices.
- F. Future Devices:
Mounting brackets, bus connections, filler plates, and necessary appurtenances required for future installation of devices.
- G. Panelboard Short-Circuit Current Rating:
Fully rated to interrupt symmetrical short-circuit current available at terminals.

2.2 DISTRIBUTION PANELBOARDS

- A. Basis of Design Product:
Subject to compliance with requirements, provide a comparable product by one of the following:
 - 1. Eaton Electrical Inc.; Cutler-Hammer Business Unit
 - 2. General Electric Company; GE Consumer & Industrial- Electrical Distribution
 - 3. Siemens Energy & Automation, Inc.
 - 4. Square D; a brand of Schneider Electric
- B. Panelboards:
NEMA PB 1, power and feeder distribution type
- C. Doors:
Secured with vault-type latch with tumbler lock; keyed alike.
- D. Mains:
Circuit breaker.
- E. Branch Overcurrent Protective Devices:
For Circuit-Breaker Frame Sizes 125 A and Smaller:
Bolt-on circuit breakers.
- F. Branch Overcurrent Protective Devices:
For Circuit-Breaker Frame Sizes Larger Than 125 A:
Bolt-on circuit breakers; plug-in circuit breakers where individual positive-locking device requires mechanical release for removal.
- G. Branch Overcurrent Protective Devices:
Fused switches

2.3 LIGHTING AND APPLIANCE BRANCH-CIRCUIT PANELBOARDS

SECTION 262416 - PANELBOARDS

GOVERNMENT OF THE U. S. VIRGIN ISLANDS, DEPARTMENT OF PUBLIC WORKS

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A. Basis of Design Product:

Subject to compliance with requirements, provide a comparable product by one of the following:

1. Eaton Electrical Inc.; Cutler-Hammer Business Unit
2. General Electric Company; GE Consumer & Industrial - Electrical Distribution
3. Siemens Energy & Automation, Inc.
4. Square D; a brand of Schneider Electric

B. Panelboards:

NEMA PB 1, lighting and appliance branch-circuit type

C. Mains:

Circuit breaker

D. Branch Overcurrent Protective Devices:

Bolt-on circuit breakers, replaceable without disturbing adjacent units.

E. Contactors in Main Bus:

NEMA ICS 2, Class A, electrically held, general-purpose controller, with same short-circuits interrupting rating as panelboard.

1. External Control-Power Source:
24-V control circuit.

F. Doors:

Concealed hinges; secured with flush latch with tumbler lock; keyed alike

G. Column-Type Panelboards:

Narrow gutter extension, with cover, to overhead junction box equipped with ground and neutral terminal buses.

2.4 DISCONNECTING AND OVERCURRENT PROTECTIVE DEVICES

A. Basis of Design Product:

Subject to compliance with requirements, provide or comparable product by one of the following:

1. Eaton Electrical Inc.; Cutler-Hammer Business Unit
2. General Electric Company; GE Consumer & Industrial- Electrical Distribution
3. Siemens Energy & Automation, Inc.
4. Square D; a brand of Schneider Electric

B. Molded-Case Circuit Breaker (MCCB):

Comply with UL 489, with 100% rating to meet available fault currents.

1. Thermal-Magnetic Circuit Breakers:

Inverse time-current element for low-level overloads, and instantaneous magnetic trip element for short circuits. Adjustable magnetic trip setting for circuit breaker frame sizes 250 A and

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larger.

2. Adjustable Instantaneous-Trip Circuit Breakers:
Magnetic trip element with front-mounted, field adjustable trip setting.
3. Electronic trip circuit breakers with RMS sensing; field replaceable rating plug or field replicable electronic trip; and the following field adjustable settings:
 - a. Instantaneous trip.
 - b. Long and short time pickup levels.
 - c. Long and short time adjustments.
 - d. Ground-fault pickup level, time delay, and I^2t response.
4. Current-Limiting Circuit Breakers:
Frame sizes 400 A and smaller; let through ratings less than NEMA FU 1, RK-5.
5. GFCI Circuit Breakers:
Single and two pole configurations with Class A ground-fault protection (6-mA trip).
6. Ground-Fault Equipment Protection (GFEP) Circuit Breakers:
Class B ground-fault protection (30-mA trip).
7. Arc-Fault Circuit Interrupter (AFCI) Circuit Breakers:
Comply with UL 1699; 120/240-V, single pole configuration.
8. Molded-Case Circuit-Breaker (MCCB) Features and Accessories:
 - a. Standard frame sizes, trip ratings, and number of poles.
 - b. Lugs:
Compression Mechanical style, suitable for number, size, trip ratings, and conductor materials.
 - c. Application Listing:
Appropriate for application; Type SWD for switching fluorescent lighting loads.
 - d. Ground-Fault Protection:
Integrally mounted relay and trip unit with adjustable pickup and time-delay settings, push-to-test feature, and ground-fault indicator.
 - e. Communication Capability:
Circuit-breaker mounted communication module with functions and features compatible with power monitoring and control system specified in Division 26 Section "Electrical Power Monitoring and Control."
 - f. Shunt Trip:
24-V trip coil energized from separate circuit, set to trip at 75 percent of rated voltage.
 - g. Handle Padlocking Device:
Fixed attachment, for locking circuit-breaker handle in on or off position.

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- h. Handle Clamp:
Loose attachment, for holding circuit-breaker handle in on position.

- C. Fused Switch:
NEMA KS I, Type HD; clips to accommodate specified fuses; lockable handle

- l. Fuses, and Spare-Fuse Cabinet:
Comply with requirements specified in Division 26 Section "Fuses."

2.5 ACCESSORY COMPONENTS AND FEATURES

- A. Portable Test Set:
For testing functions of solid-state trip devices without removing from panelboard. Include relay and meter test plugs suitable for testing panelboard meters and switchboard class relays.

PART 3 --EXECUTION

3.1 INSTALLATION

- A. Receive, inspect, handle, store and install panelboards and accessories according to NECA 407.
- B. Mount top of trim 72 inches (1829 mm) above finished floor unless otherwise indicated.
- C. Mount panel board cabinet plumb and rigid without distortion of box. Mount recessed panelboards with fronts uniformly flush with wall finish and mating with back box.
- D. Install overcurrent protective devices and controllers not already factory installed.
 - 1. Set field-adjustable, circuit-breaker trip ranges
- E. Install filler plates in unused spaces.
- F. Stub four 1-inch (27-GRC) empty conduits from panelboard into accessible ceiling space or space designated to be ceiling space in the future. Stub four 1-inch (27-GRC) empty conduits into raised floor space or below slab not on grade.
- G. Arrange conductors in gutters into groups and bundle and wrap with wire ties.
- H. Comply with NECA I.

3.2 IDENTIFICATION

- A. Identify field installed conductors, interconnecting wiring, and components; provide warning signs complying with Division 26 Section "Identification for Electrical Systems."
- B. Create a directory to indicate installed circuit loads and incorporating Owner's final room designations. Obtain approval before installing. Use a computer or typewriter to create directory; handwritten directories are not acceptable.
- C. Panelboard Nameplates:
Label each panelboard with a nameplate complying with requirements for identification specified in Division 26 Section "Identification for Electrical Systems."
- D. Device Nameplates:

SECTION 262416 - PANELBOARDS

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Label each branch circuit device in distribution panelboards with a nameplate complying with requirements for identification specified in Division 26 Section "Identification for Electrical Systems."

3.3 FIELD QUALITY CONTROL

A. Perform tests and inspections.

B. Acceptance Testing Preparation:

1. Test insulation resistance for each panelboard bus, component, connecting supply, feeder, and control circuit.
2. Test continuity of each circuit.

C. Tests and Inspections:

1. Perform each visual and mechanical inspection and electrical test stated in NETA Acceptance Testing Specification. Certify compliance with test parameters.
2. Correct malfunctioning units on-site, where possible, and retest to demonstrate compliance; otherwise, replace with new units and retest.

D. Panelboards will be considered defective if they do not pass tests and inspections.

E. Prepare test and inspection reports, including a certified report that identifies panelboards included and that describes scanning results. Include notation of deficiencies detected, remedial action taken, and observations after remedial action.

END OF SECTION

SECTION 262713- ELECTRICITY METERING

GOVERNMENT OF THE U. S. VIRGIN ISLANDS, DEPARTMENT OF PUBLIC WORKS

PROJECT NAME: Elaine I. Sprauve Public Library and Museum Building

Project Location, St. John, U.S. Virgin Islands

PART 1- GENERAL

1.1 SUMMARY

- A. Section includes equipment for electricity metering by utility company.

1.2 SUBMITTALS

- A. Product Data:
For each type of product indicated.
- B. Shop Drawings:
Dimensioned plans and sections or elevation layouts and wiring diagrams.
- C. Field quality control reports.
- D. Operation and Maintenance Data:
In addition to items specified in Division 01 Section "Operation and Maintenance Data," include the following:
 - 1. Application and operating software documentation
 - 2. Software licenses
 - 3. Software service agreement
 - 4. Hard copies of manufacturer's operating specifications, design user's guides for software and hardware, and PDF files on CD-ROM of the hard-copy Submittal.

1.3 QUALITY ASSURANCE

- A. Electrical Components, Devices, and Accessories:
Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

PART 2 - PRODUCTS

2.1 EQUIPMENT FOR ELECTRICITY METERING BY UTILITY COMPANY

- A. Meters will be furnished by Contractor and approval by utility company.
- B. Current-Transformer Cabinets:
Comply with requirements of electrical-power utility company.
- C. Meter Sockets:
Comply with requirements of electrical-power utility company.
- D. Meter Sockets:
Steady state and short circuit current ratings shall meet indicated circuit ratings.

2.2 EQUIPMENT FOR ELECTRICITY METERING BY OWNER

- A. Basis of Design Product:
Subject to compliance with requirements, provide product by one of the following:

SECTION 262713- ELECTRICITY METERING

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1. National Meter Industries
 2. Osaki Meter Sales, Inc.
 3. SquareD; a brand of Schneider Electric
 4. E-Mon digital metering
 5. All meters must be approved by utility company prior to purchase.
- B. Kilowatt-hour Meter:
Electronic three phase meters, measuring electricity used
1. Voltage and Phase Configuration:
Meter shall be designed for use on circuits with voltage rating and phase configuration indicated for its application.
 2. Display:
LCD with characters not less than 0.25 inch (6 mm) high, indicating accumulative kilowatt-hours and current kilowatt load. Retain accumulated kilowatt-hour in a nonvolatile memory, until reset.
 3. Display:
Digital electromechanical counter, indicating accumulative kilowatt-hours.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Comply with equipment installation requirements in NECA 1.
- B. Install meters, raceways and equipment according to utility company's written requirements. Provide empty conduits for metering leads and extend grounding connections as required by utility company.
- C. Install modular meter center according to NECA 400 switchboard installation requirements.
- D. Comply with requirements for identification specified in Division 26 Section "Identification for Electrical Systems."
 1. Series Combination Warning Label:
Self-adhesive type, with text as required by NFPA 70

3.2 FIELD QUALITY CONTROL

- A. Perform tests and inspections.
- B. Tests and Inspections:
 1. Connect a load of known kilowatt rating, 1 .5 kW minimum, to a circuit supplied by metered feeder.

SECTION 262713– ELECTRICITY METERING

GOVERNMENT OF THE U. S. VIRGIN ISLANDS, DEPARTMENT OF PUBLIC WORKS

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2. Turn off circuits supplied by metered feeder and secure them in off condition.
 3. Run test load continuously for eight hours minimum, or longer, to obtain a measurable meter indication. Use test-load placement and setting that ensures continuous, safe operation.
 4. Check and record meter reading at end of test period and compare with actual electricity used, based on test load rating, duration of test, and sample measurements of supply voltage at test load connection. Record test results.
- C. Electricity metering will be considered defective if it does not pass tests and inspections.
- D. Prepare test and inspection reports.

END OF SECTION

SECTION 262726 – WIRING DEVICES

GOVERNMENT OF THE U. S. VIRGIN ISLANDS, DEPARTMENT OF PUBLIC WORKS

PROJECT NAME: Elaine I. Sprauve Public Library and Museum Building

Project Location, St. John, U.S. Virgin Islands

PART 1 --GENERAL

1.1 SUMMARY

A. This Section includes the following:

1. Receptacles, receptacles with integral GFCI, and associated device plates.
2. Wall switch and exterior occupancy sensors.

1.2 SUBMITTALS

A. Product Data:

For each type of product indicated

B. Shop Drawings:

List of legends and description of materials and process used for pre-marking wall plates.

C. Operation and Maintenance Data:

For wiring devices to include in all manufacturers' packing label warnings and instruction manuals that include labeling conditions.

1.3 QUALITY ASSURANCE

A. Electrical Components, Devices, and Accessories:

Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

B. Comply with NFPA 70.

PART 2- PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers' Names:

Shortened versions (shown in parentheses) of the following manufacturers' names are used in other Part 2 articles:

1. Cooper Wiring Devices; a division of Cooper Industries, Inc. (Cooper)
2. Hubbell Incorporated; Wiring Device-Kellems (Hubbell)
3. Leviton Mfg. Company Inc. (Leviton)
4. Pass & Seymour/Legrand; Wiring Devices & Accessories (Pass & Seymour)

2.2 GENERAL WIRING-DEVICE REQUIREMENTS

A. Wiring Devices, Components, and Accessories:

Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

SECTION 262726 – WIRING DEVICES

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B. Comply with NFPA 70.

C. Devices that are manufactured for use with modular plug-in connectors may be substituted under the following conditions:

1. Connectors shall comply with UL 2459 and shall be made with stranded building wire.

2. Devices shall comply with the requirements in this Section.

D. All 125V and 250V, 20A receptacles shall be listed as weather resistant type per 2008 NEC 406.8, Receptacles in Damp and Wet Locations.

2.3 STRAIGHT BLADE RECEPTACLES

A. Convenience Receptacles, 125 V, 20 A:

Comply with NEMA WD 1, NEMA WD 6 configuration 5-20R, and UL498.

1. Products:

Subject to compliance with requirements, provide one of the following:

a. Cooper; 5351 (single), 5352 (duplex)

b. Hubbell; HBL5351 (single), CR5352 (duplex)

c. Leviton; 5891 (single), 5352 (duplex)

d. Pass & Seymour; 5381 (single), 5352 (duplex)

2.4 GFCI RECEPTACLES

A. General Description:

Straight blade, non-feed through type. Comply with NEMA WD 1, NEMA WD 6, UL 498, and UL 943, Class A, and include indicator light that is lighted when device is tripped.

B. Duplex GFCI Convenience Receptacles, 125 V, 20 A:

1. Available Products:

Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the following:

a. Cooper; GF20

b. Pass & Seymour; 2084

2.5 SNAP SWITCHES

A. Comply with NEMA WD 1 and UL 20.

B. Switches, 120/277 V, 20 A:

1. Products:

Subject to compliance with requirements, provide one of the following:

a. Cooper:

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2221 (single pole), 2222 (two pole), 2223 (three way), 2224 (four way)

- b. Hubbell:
CS1221 (single pole), CS1222 (two pole), CS1223 (three way), CS1224 (four way)
- c. Leviton:
1221-2 (single pole), 1222-2 (two pole), 1223-2 (three way), 1224-2 (four way)
- d. Pass & Seymour:
20AC1 (single pole), 20AC2 (two pole), 20AC3 (three way), 20AC4 (four way)

C. Pilot Light Switches, 20 A:

- 1. Products:
Subject to compliance with requirements, provide one of the following:
 - a. Cooper:
2221PL for 120 V and 277 V
 - b. Hubbell:
HPL1221PL for 120 V and 277 V
 - c. Leviton:
1221-PLR for 120 V, 1221-7 PLR for 277 V
 - d. Pass & Seymour; PS20AC1-PLR for 120 V
- 2. Description:
Single pole, with neon-lighted handle, illuminated when switch is "ON."

D. Key Operated Switches, 120/277 V, 20 A:

- 1. Products:
Subject to compliance with requirements, provide one of the following:
 - a. Cooper:
2221L
 - b. Hubbell:
HBL 1221L
 - c. Leviton:
1221-2L
 - d. Pass & Seymour:
PS20AC1-L
- 2. Description:
Single pole, with factory supplied key in lieu of switch handle.

E. Single Pole, Double Throw, Momentary Contact, Center Off Switches, 120/277 V, 20 A; for use with mechanically held lighting contactors.

- 1. Products:

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Subject to compliance with requirements, provide one of the following:

- a. Cooper:
1995
 - b. Hubbell:
HBL1557
 - c. Leviton:
1257
 - d. Pass & Seymour:
1251
- F. Key-Operated, Single-Pole, Double-Throw, Momentary Contact, Center-Off Switches, 120/277 V, 20 A; for use with mechanically held lighting contactors, with factory supplied key in lieu of switch handle.
1. Products:
Subject to compliance with requirements, provide one of the following:
- a. Cooper:
1995L
 - b. Hubbell:
HBL1557L.
 - c. Leviton:
1257L.
 - d. Pass & Seymour:
1251L

2.6 WALL PLATES

A. Single and combination types to match corresponding wiring devices.

- 1. Plate Securing Screws:
Metal with head color to match plate finish.
 - 2. Material for Finished Spaces:
Smooth, high-impact thermoplastic.
 - 3. Material for Unfinished Spaces:
Smooth, high-impact thermoplastic.
 - 4. Material for Damp Locations:
Thermoplastic with spring loaded lift cover, and listed and labeled for use in "wet locations."
- B. Wet Location, Weatherproof Cover Plates:
NEMA 250, complying with type 3R weather resistant thermoplastic with lockable cover.

2.7 FLOOR SERVICE FITTINGS

A. Type:

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Modular, flush type, dual service units suitable for wiring method used

- B. Compartments:
Barrier separates power from voice and data communication cabling
- C. Service Plate:
Rectangular, solid brass with satin finish
- D. Power Receptacle:
NEMA WD 6 configuration 5-20R, gray finish, unless otherwise indicated
- E. Voice and Data Communication Outlet:
Blank cover with bushed cable opening

2.8 FINISHES

- A. Color:
TBD by the Owner's Representative. Plates and screw heads shall match device color.
- 1. Wiring Devices Connected to Normal Power System:
White, unless otherwise indicated or required by NFPA 70 or device listing
- 2. Wiring Devices Connected UPS Power System:
Red
- 3. TVSS Devices:
Blue.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Comply with NECA 1, including the mounting heights listed in that standard, unless otherwise noted.
- B. Coordination with Other Trades:
 - 1. Take steps to insure that devices and their boxes are protected. Do not place wall finish materials over device boxes and do not cut holes for boxes with routers that are guided by riding against outside of the boxes.
 - 2. Keep outlet boxes free of plaster, drywall joint compound, mortar, cement, concrete, dust, paint, and other material that may contaminate the raceway system, conductors, and cables.
 - 3. Install device boxes in brick or block walls so that the cover plate does not cross a joint unless the joint is troweled flush with the face of the wall.
 - 4. Install wiring devices after all wall preparation, including painting, is complete.
- C. Conductors:
 - 1. Do not strip insulation from conductors until just before they are spliced or terminated on devices.

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2. Strip insulation evenly around the conductor using tools designed for the purpose. Avoid scoring or nicking of solid wire or cutting strands from stranded wire.
3. The length of free conductors at outlets for devices shall meet provisions of NFPA 70, Article 300, without pigtails.

D. Device Installation:

1. Replace all devices that have been in temporary use during construction or that show signs that they were installed before building finishing operations were complete.
2. Keep each wiring device in its package or otherwise protected until it is time to connect conductors.
3. Do not remove surface protection, such as plastic film and smudge covers, until the last possible moment.
4. Connect devices to branch circuits using pigtails that are not less than 6 inches (152 mm) in length.
5. Use side wiring with binding-head screw terminals. Wrap solid conductor tightly clockwise, 2/3 to 3/4 of the way around terminal screw.
6. Use a torque screwdriver when a torque is recommended or required by the manufacturer.
7. When conductors larger than No. 12 AWG are installed on 15 or 20-A circuits, splice No. 12 AWG pigtails for device connections.
8. Tighten unused terminal screws on the device.
9. When mounting into metal boxes, remove the fiber or plastic washers used to hold device mounting screws in yokes, allowing metal-to-metal contact.
10. Every room shall have lighting control device whether indicated or not on plans.
11. Install a motor rated service switch at each connection to 120V fan motors whether indicated or not on plans.
12. Receptacles installed outdoors shall be GFCI type and have rain tight "In-Use" cover.
13. Adjust outlet heights in ceramic tile walls to be entirely in or entirely out of the tile. Outlets to be horizontal to most space conditions.
14. Coordinate device mounting with Architectural drawings prior to rough-in.
15. Device and Plate Color:
 - a. White:
Devices connected to Normal Power Circuit.
 - b. Gray:
Device connected to UPS Power Circuit.
 - c. Red:

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Devices connected to Emergency Power Circuit.

E. Receptacle Orientation:

1. Install ground pin of vertically mounted receptacles up, and on horizontally mounted receptacles to the right.

F. Device Plates:

Do not use oversized or extra deep plates. Repair wall finishes and remount outlet boxes when standard device plates do not fit flush or do not cover rough wall opening.

G. Dimmers:

1. Install dimmers within terms of their listing.
2. Verify that dimmers used for fan speed control are listed for that application.
3. Install unshared neutral conductors on line and load side of dimmers according to manufacturers' device listing conditions in the written instructions.

H. Arrangement of Devices:

1. Unless otherwise indicated, mount flush, with long dimension vertical and with grounding terminal of receptacles on top.
2. Group adjacent switches under single, multi-gang wall plates.
3. Align vertically receptacles, light switches and fire alarm devices when shown near each other.

3.2 IDENTIFICATION

A. Comply with Division 26 Section "Identification for Electrical Systems."

1. Receptacles:

Identify panelboard and circuit number from which served. Use hot, stamped or engraved machine printing with black-filled lettering on face of plate, and durable wire markers or tags inside outlet boxes.

3.3 FIELD QUALITY CONTROL

A. Perform tests and inspections and prepare test reports.

1. Test Instruments:

Use instruments that comply with UL 1436.

2. Test Instrument for Convenience Receptacles:

Digital wiring analyzer with digital readout or illuminated LED indicators of measurement.

B. Tests for Convenience Receptacles:

1. Line Voltage:

Acceptable range is 105 to 132V.

2. Percent Voltage Drop under 15-A Load:

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A value of 6 percent or higher is not acceptable.

3. Ground Impedance:
Values of up to 2 ohms are acceptable.
4. GFCI Trip:
Test for tripping values specified in UL 1436 and UL 943
5. Using the test plug, verify that the device and its outlet box are securely mounted.
6. The tests shall be diagnostic, indicating damaged conductors, high resistance at the circuit breaker, poor connections, inadequate fault current path, defective devices, or similar problems. Correct circuit conditions, remove malfunctioning units and replace with new, and retest as specified above.

END OF SECTION

SECTION 262813 – FUSES

GOVERNMENT OF THE U. S. VIRGIN ISLANDS, DEPARTMENT OF PUBLIC WORKS

PROJECT NAME: Elaine I. Sprauve Public Library and Museum Building

Project Location, St. John, U.S. Virgin Islands

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

Cartridge fuses rated 600 VAC and less for use in control circuits enclosed switches, enclosed controllers and motor-control centers.

1.2 SUBMITTALS

A. Product Data:

For each type of product indicated.

B. Operation and maintenance data

1.3 QUALITY ASSURANCE

A. Electrical Components, Devices, and Accessories:

Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

B. Comply with NEMA FU 1 for cartridge fuses.

C. Comply with NFPA 70.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers:

Subject to compliance with requirements, provide products by one of the following available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

1. Cooper Bussmann, Inc.

2. Edison Fuse, Inc.

3. Ferraz Shawmut, Inc.

4. Littelfuse, Inc.

2.2 CARTRIDGE FUSES

A. Characteristics:

NEMA FU 1, nonrenewable cartridge fuses with voltage ratings consistent with circuit voltages.

PART 3 - EXECUTION

3.1 FUSE APPLICATIONS

A. Motor Branch Circuits:

Class RK5, time delay

SECTION 262813 – FUSES

GOVERNMENT OF THE U. S. VIRGIN ISLANDS, DEPARTMENT OF PUBLIC WORKS

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- B. Control Circuits:
Class CC, fast acting

3.2 INSTALLATION

- A. Install fuses in fusible devices. Arrange fuses so rating information is readable without removing fuse.

3.3 IDENTIFICATION

- A. Install labels complying with requirements for identification specified in Division 26 Section "Identification for Electrical Systems" and indicating fuse replacement information on inside door of each fused switch and adjacent to each fuse block and holder.

END OF SECTION

SECTION 262816 – ENCLOSED SWITCHES AND CIRCUIT BREAKERS
GOVERNMENT OF THE U. S. VIRGIN ISLANDS, DEPARTMENT OF PUBLIC WORKS
PROJECT NAME: Elaine I. Sprauve Public Library and Museum Building
Project Location, St. John, U.S. Virgin Islands

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Fusible switches
2. Non-fusible switches
3. Shunt trip switches
4. Molded case circuit breakers (MCCBs)
5. Enclosures

1.2 DEFINITIONS

A. NC:

Normally closed.

B. NO:

Normally open.

C. SPDT:

Single pole, double-throw

1.3 SUBMITTALS

A. Product Data:

For each type of enclosed switch, circuit breaker, accessory, and component indicated

B. Shop Drawings:

For enclosed switches and circuit breakers. Include plans, elevations, sections, details, and attachments to other work.

1. Wiring Diagrams:

For power, signal, and control wiring

C. Field quality-control reports

D. Operation and maintenance data

1.4 QUALITY ASSURANCE

A. Electrical Components, Devices, and Accessories:

Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

B. Comply with NFPA 70.

PART 2 - PRODUCTS

SECTION 262816 – ENCLOSED SWITCHES AND CIRCUIT BREAKERS
GOVERNMENT OF THE U. S. VIRGIN ISLANDS, DEPARTMENT OF PUBLIC WORKS
PROJECT NAME: Elaine I. Sprauve Public Library and Museum Building
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2.1 FUSIBLE SWITCHES

- A. Basis-of-Design Product: Subject to compliance with requirements, provide a comparable product by one of the following:
1. Eaton Electrical Inc.; Cutler-Hammer Business Unit
 2. General Electric Company; GE Consumer & Industrial - Electrical Distribution
 3. Siemens Energy & Automation, Inc.
 4. SquareD; a brand of Schneider Electric
- B. Type GD, General Duty, Single Throw, 240-VAC, 800 A and Smaller:
UL 98 and NEMA KS 1, horsepower rated, with cartridge fuse interiors to accommodate indicated fuses, lockable handle with capability to accept two padlocks, and interlocked with cover in closed position.
- C. Type HD, Heavy Duty, Single Throw, 240 and 600-VAC, 1200 A and Smaller:
UL 98 and NEMA KS 1, horsepower rated, with clips or bolt pads to accommodate indicated fuses, lockable handle with capability to accept three padlocks, and interlocked with cover in closed position.
- D. Type HD, Heavy Duty, Six Pole, Single Throw, 240 and 600-VAC, 200 A and Smaller:
UL 98 and NEMA KS 1, horsepower rated, with clips or bolt pads to accommodate indicated fuses, lockable handle with capability to accept three padlocks, and interlocked with cover in closed position.
- E. Type HD, Heavy Duty, Double Throw, 240 and 600-VAC, 1200 A and Smaller:
UL 98 and NEMA KS 1, horsepower rated, with clips or bolt pads to accommodate indicated fuses, lockable handle with capability to accept three padlocks, and interlocked with cover in closed position.
- F. Accessories:
1. Equipment Ground Kit:
Internally mounted and labeled for copper and aluminum ground conductors.
 2. Neutral Kit:
Internally mounted; insulated, capable of being grounded and bonded; labeled for copper and aluminum neutral conductors.
 3. Class R Fuse Kit:
Provides rejection of other fuse types when Class R fuses are specified
 4. Lugs:
Suitable for number, size, and conductor material
 5. Service Rated Switches:
Labeled for use as service equipment.

2.2 SHUNT TRIP SWITCHES

SECTION 262816 – ENCLOSED SWITCHES AND CIRCUIT BREAKERS
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A. Basis of Design Product:

Subject to compliance with requirements, provide product indicated on Drawings or/a comparable product by one of the following:

1. Cooper Bussmann, Inc.
2. Ferraz Shawmut, Inc.
3. Littelfuse, Inc.

B. General Requirements:

Comply with ASME A17.1, UL 50, and UL 98, with 200-kA interrupting and short-circuit current rating when fitted with Class I fuses.

C. Switches:

Three pole, horsepower rated, with integral shunt trip mechanism and Class J fuse block; lockable handle with capability to accept three padlocks; interlocked with cover in closed position.

D. Control Circuit:

120-VAC; obtained from integral control power transformer, with primary and secondary fuses, with a control power transformer of enough capacity to operate shunt trip, connected pilot, and indicating and control devices.

E. Accessories:

1. Oil tight key switch for key-to-test function.
2. Oil tight ON pilot light
3. Isolated neutral lug
4. Mechanically interlocked auxiliary contacts that change state when switch is opened and closed.
5. Form C alarm contacts that change state when switch is tripped.
6. Three pole, double throw, fire safety and alarm relay; 120-VA or 24-VDC coil voltage.
7. Three pole, double throw, fire alarm voltage monitoring relay complying with NFPA 72.

2.3 MOLDED-CASE CIRCUIT BREAKERS

A. Basis of Design Product:

Subject to compliance with requirements, provide product indicated on Drawings or/a comparable product by one of the following:

1. Eaton Electrical Inc.; Cutler-Hammer Business Unit
2. General Electric Company; GE Consumer & Industrial - Electrical Distribution
3. Siemens Energy & Automation, Inc.

SECTION 262816 – ENCLOSED SWITCHES AND CIRCUIT BREAKERS
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4. Square D; a brand of Schneider Electric
- B. General Requirements:
Comply with UL 489, NEMA AB 1, and NEMA AB 3, with interrupting capacity to comply with available fault currents.
- C. Thermal-Magnetic Circuit Breakers:
Inverse time-current element for low level overloads and instantaneous magnetic trip element for short circuits. Adjustable magnetic trip setting for circuit-breaker frame sizes 250 A and larger.
- D. Electronic Trip Circuit Breakers:
Field replaceable rating plug, RMS sensing, with the following field adjustable settings:
 1. Instantaneous trip
 2. Long and short time pickup levels
 3. Long and short time adjustments
 4. Ground-fault pickup level, time delay, and I^2t response
- E. Current-Limiting Circuit Breakers:
Frame sizes 400 A and smaller, and let-through ratings less than NEMA FU 1, RK-5
- F. Features and Accessories:
 1. Standard frame sizes, trip ratings, and number of poles.
 2. Lugs:
Suitable for number, size, trip ratings, and conductor material
 3. Application Listing:
Appropriate for application; Type SWD for switching fluorescent lighting loads
 4. Ground-Fault Protection:
Comply with UL 1053; integrally mounted, self-powered type with mechanical ground-fault indicator; relay with adjustable pickup and time-delay settings, push-to- test feature, internal memory, and shunt trip unit; and three phase, zero sequence current transformer/sensor.
 5. Shunt Trip:
Trip coil energized from separate circuit, with coil-clearing contact
 6. Auxiliary Contacts:
Two SPDT switches with "a" and "b" contacts; "a" contacts mimic circuit breaker contacts, "b" contacts operate in reverse of circuit breaker contacts.
 7. Alarm Switch:
One NC contact that operates only when circuit breaker has tripped

2.4 ENCLOSURES

SECTION 262816 – ENCLOSED SWITCHES AND CIRCUIT BREAKERS
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- A. Enclosed Switches and Circuit Breakers:
NEMA AB 1, NEMA KS 1, NEMA 250, and UL 50, to comply with environmental conditions at installed location.
- 1. Indoor, Dry and Clean Locations:
NEMA 250, Type 1
- 2. Outdoor Locations:
NEMA 250, Type 3R
- 3. Kitchen Wash Down Areas:
NEMA 250, Type 4X
- 4. Other Wet or Damp, Indoor Locations:
NEMA 250, Type 3
- 5. Indoor Locations Subject to Dust, Falling Dirt, and Dripping Noncorrosive Liquids:
NEMA 250, Type 12

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install individual wall mounted switches and circuit breakers with tops at uniform height unless otherwise indicated.
- B. Temporary Lifting Provisions:
Remove temporary lifting eyes, channels, and brackets and temporary blocking of moving parts from enclosures and components.
- C. Install fuses in fusible devices.
- D. Comply with NECA 1.

3.2 IDENTIFICATION

- A. Comply with requirements in Division 26 Section "Identification for Electrical Systems."
- 1. Identify field installed conductors, interconnecting wiring, and components; provide warning signs.
- 2. Label each enclosure with engraved metal or laminated-plastic nameplate.

3.3 FIELD QUALITY CONTROL

- A Perform tests and inspections.
- B. Acceptance Testing Preparation:
 - 1. Test insulation resistance for each enclosed switch and circuit breaker, component, connecting supply, feeder, and control circuit.
 - 2. Test continuity of each circuit.

SECTION 262816 – ENCLOSED SWITCHES AND CIRCUIT BREAKERS
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C. Tests and Inspections:

1. Perform each visual and mechanical inspection and electrical test stated in NETA Acceptance Testing Specification. Certify compliance with test parameters.
 2. Correct malfunctioning units on-site, where possible, and retest to demonstrate compliance; otherwise, replace with new units and retest.
- D. Enclosed switches and circuit breakers will be considered defective if they do not pass tests and inspections.
- E. Prepare test and inspection reports, including a certified report that identifies enclosed switches and circuit breakers and that describes scanning results. Include notation of deficiencies detected, remedial action taken, and observations after remedial action.

END OF SECTION

SECTION 264313 – TRANSIENT VOLTAGE SUPPRESSION FOR LOW VOLTAGE ELECTRICAL POWER

GOVERNMENT OF THE U. S. VIRGIN ISLANDS, DEPARTMENT OF PUBLIC WORKS

PROJECT NAME: Elaine I. Sprauve Public Library and Museum Building

Project Location, St. John, U.S. Virgin Islands

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes field-mounted TVSS for low-voltage (120 to 600 V) power distribution and control equipment.

1.2 ACTION SUBMITTALS

- A. Product Data:
For each type of product indicated. Include rated capacities, operating weights, electrical characteristics, furnished specialties, and accessories.

1.3 INFORMATIONAL SUBMITTALS

- A. Field quality control reports
- B. Warranties:
Sample of special warranties

1.4 CLOSEOUT SUBMITTALS

- A. Operation and maintenance data

1.5 QUALITY ASSURANCE

- A. Electrical Components, Devices, and Accessories:
Listed and labeled as defined in NFPA 70, by a testing agency, and marked for intended location and application.
- B. Comply with IEEE C62.41.2 and test devices according to IEEE C62.45.
- C. Comply with NEMA LS 1.
- D. Comply with UL 1449 latest edition.
- E. Comply with NFPA 70.

1.6 WARRANTY

- A. Special Warranty:
Manufacturer's standard form in which manufacturer agrees to repair or replace components of surge suppressors that fail in materials or workmanship within specified warranty period.
- 1. Warranty Period:
Five years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 SERVICE ENTRANCE SUPPRESSORS

- A. Basis of Design Product:
Subject to compliance with requirements, provide or comparable product by one of the following:

SECTION 264313 – TRANSIENT VOLTAGE SUPPRESSION FOR LOW VOLTAGE ELECTRICAL POWER

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1. ABB USA
2. AC Data Solutions
3. Advanced Protection Technologies Inc. (APT)
4. Atlantic Scientific
5. Current Technology Inc.; Danaher Power Solutions
6. Danaher Power Solutions; United Power Products
7. Eaton Electrical Inc.; Cutler-Hammer Business Unit
8. General Electric Company; GE Consumer & Industrial - Electrical Distribution
9. Intermatic, Inc.
10. LEA International
- II. Leviton Mfg. Company Inc.
12. Liebert Corporation; a division of Emerson Network Power
13. Northern Technologies, Inc.; a division of Emerson Network Power
14. Siemens Energy & Automation, Inc.
15. Square D; a brand of Schneider Electric
16. Surge Suppression Incorporated.

B. Surge Protection Devices:

1. Non-modular
2. LED indicator lights for power and protection status
3. Comply with UL I4491 latest edition
4. Fuses, rated at 200-kA interrupting capacity
5. Fabrication using bolted compression lugs for internal wiring
6. Integral disconnect switch
7. Redundant suppression circuits
8. Arrangement with copper bus bars and for bolted connections to phase buses, neutral bus, and ground bus
9. Arrangement with wire connections to phase buses, neutral bus, and ground bus

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10. LED indicator lights for power and protection status
- C. Peak Single-Impulse Surge Current Rating:
320 kA per mode/640 kA per phase.
- D. Minimum single impulse current ratings, using 8-by-20-mic.sec waveform described in IEEE C62.41.2:
 1. Line to Neutral:
70,000 A.
 2. Line to Ground:
70,000 A.
 3. Neutral to Ground:
50,000 A.
- E. Protection modes and UL 1449 SVR for grounded wye circuits with 480Y/277 V, 208Y/120 V, 3 phase, 4 wire circuits shall be as follows:
 1. Line to Neutral:
800 V for 480Y/277 V, 400 V for 208Y/120 V
 2. Line to Ground:
800 V for 480Y/277 V, 400 V for 208Y/120 V
 3. Neutral to Ground:
800 V for 480Y/277 V, 400 V for 208Y/120 V
- F. Protection modes and UL 1449 SVR for 240/120 V, single phase, 3 wire circuits shall be as follows:
 1. Line to Neutral:
400 V
 2. Line to Ground:
400 V
 3. Neutral to Ground:
400 V
- G. Protection modes and UL 1449 SVR for 240/120-V, 3 phase, 4 wire circuits with high leg shall be as follows:
 1. Line to Neutral:
400 V, 800 V from high leg
 2. Line to Ground:
400 V
 3. Neutral to Ground:
400 V

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H. Protection modes and UL 1449 SVR for 240 V, 480 V, or 600 V, 3 phase, 3 wire, delta circuits shall be as follows:

1. Line to Line:
2000 V for 480 V, 1000 V for 240 V
2. Line to Ground:
2000 V for 480 V, 1000 V for 240 V

2.2 PANELBOARD SUPPRESSORS

A. Basis of Design Product:

Subject to compliance with requirements, provide or comparable product by one of the following:

1. ABB USA
2. AC Data Solutions
3. Advanced Protection Technologies Inc. (APT)
4. Atlantic Scientific
5. Current Technology Inc.; Danaher Power Solutions
6. Danaher Power Solutions; United Power Products
7. Eaton Electrical Inc.; Cutler-Hammer Business Unit
8. General Electric Company; GE Consumer & Industrial - Electrical Distribution
9. Intermatic, Inc.
10. LEA International
11. Leviton Mfg. Company Inc.
12. Liebert Corporation; a division of Emerson Network Power
13. Northern Technologies, Inc.; a division of Emerson Network Power
14. Siemens Energy & Automation, Inc.
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16. Surge Suppression Incorporated.

B. Surge Protection Devices:

1. Non-modular
2. LED indicator lights for power and protection status

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3. Comply with UL 1449 latest edition
 4. Fuses, rated at 200-kA interrupting capacity
 5. Fabrication using bolted compression lugs for internal wiring
 6. Integral disconnect switch
 7. Redundant suppression circuits
 8. Arrangement with wire connections to phase buses, neutral bus, and ground bus
 9. LED indicator lights for power and protection status
- C. Peak Single-Impulse Surge Current Rating:
160 kA per mode/320 kA per phase
- D. Minimum single impulse current ratings, using 8-by-20 micro-sec waveform described in IEEE C62.41.2:
1. Line to Neutral:
70,000 A
 2. Line to Ground:
70,000 A
 3. Neutral to Ground:
50,000 A
- E. Protection modes and UL 1449 SVR for grounded wye circuits with 480Y/277 V, 208Y/120 V, 3-phase, 4-wire circuits shall be as follows:
1. Line to Neutral:
800 V for 480Y/277 V, 400 V for 208Y/120 V
 2. Line to Ground:
800 V for 480Y/277 V, 400 V for 208Y/120 V
 3. Neutral to Ground:
800 V for 480Y/277 V, 400 V for 208Y/120 V
- F. Protection modes and UL 1449 SVR for 240/120 V, single phase, 3-wire circuits shall be as follows:
1. Line to Neutral:
400 V
 2. Line to Ground:
400 V
 3. Neutral to Ground:
400 V

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G. Protection modes and UL 1449 SVR for 240/120-V, 3 phase, 4 wire circuits with high leg shall be as follows:

1. Line to Neutral:
400 V, 800 V from high leg
2. Line to Ground:
400 V
3. Neutral to Ground:
400 V

H. Protection modes and UL 1449 SVR for 240 V, 480 V, or 600 V, 3 phase, 3 wire, delta circuits shall be as follows:

1. Line to Line:
2000 V for 480 V, 1000 V for 240 V
2. Line to Ground:
2000 V for 480 V, 1000 V for 240 V

2.3 ENCLOSURES

- A. Indoor Enclosures:
NEMA 250 Type 1
- B. Outdoor Enclosures:
NEMA 250 Type 3R

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install TVSS devices at service entrance on load side, with ground lead bonded to service entrance ground.
- B. Install TVSS devices for panelboards and auxiliary panels with conductors or buses between suppressor and points of attachment as short and straight as possible. Do not exceed manufacturer's recommended lead length. Do not bond neutral and ground.
 1. Provide multiple, 30 A circuit breakers as a dedicated disconnecting means for TVSS unless otherwise indicated.

3.2 FIELD QUALITY CONTROL

- A. Perform tests and inspections.
 1. Manufacturer's Field Service:
Engage a factory authorized service representative to inspect components, assemblies, and equipment installations, including connections, and to assist in testing.
- B. Tests and Inspections:
 1. Perform each visual and mechanical inspection and electrical test stated in NETA ATS, "Surge

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Arresters, Low-Voltage Surge Protection Devices" Section. Certify compliance with test parameters.

2. After installing TVSS devices but before electrical circuitry has been energized, test for compliance with requirements.

3. Complete startup checks according to manufacturer's written instructions.

C. TVSS device will be considered defective if it does not pass tests and inspections.

D. Prepare test and inspection reports.

3.3 STARTUP SERVICE

A. Do not energize or connect service entrance equipment, panelboards to their sources until TVSS devices are installed and connected.

B. Do not perform insulation resistance tests of the distribution wiring equipment with the TVSS installed. Disconnect before conducting insulation resistance tests, and reconnect immediately after the testing is over.

3.4 DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner's maintenance personnel to maintain TVSS devices.

END OF SECTION

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PART 1 - GENERAL

1.1 DESCRIPTION:

- A. This section specifies the furnishing, installation, and connection of the interior lighting systems. The terms “lighting fixture,” “fixture,” and “luminaire” are used interchangeably.

1.2 RELATED WORK

- A. Section 017419, CONSTRUCTION WASTE MANAGEMENT:
Disposal of lamps.
- B. Section 024100, DEMOLITION:
Removal and disposal of lamps and ballasts.//
- C. Section 130541, SEISMIC RESTRAINT REQUIREMENTS FOR NON-STRUCTURAL COMPONENTS:
Requirement for seismic restraint for nonstructural components.
- D. Section 260511, REQUIREMENTS FOR ELECTRICAL INSTALLATIONS:
Requirements that apply to all sections of Division 26.
- E. Section 260519, LOW-VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES:
Low-voltage conductors.
- F. Section 260526, GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS:
Requirements for personnel safety and to provide a low impedance path to ground for possible ground fault currents.
- G. Section 262726, WIRING DEVICES:
Wiring devices used for control of the lighting systems.

1.3 QUALITY ASSURANCE

- A. Quality Assurance shall be in accordance with Paragraph, QUALIFICATIONS (PRODUCTS AND SERVICES) in Section 260511, REQUIREMENTS FOR ELECTRICAL INSTALLATIONS.

1.4 SUBMITTALS

- A. Submit in accordance with Paragraph, SUBMITTALS in Section 260511, REQUIREMENTS FOR ELECTRICAL INSTALLATIONS, and the following requirements:
1. Shop Drawings:
 - a. Submit the following information for each type of lighting fixture designated on the LIGHTING FIXTURE SCHEDULE, arranged in order of lighting fixture designation.
 - b. Material and construction details, include information on housing and optics system.
 - c. Physical dimensions and description.
 - d. Wiring schematic and connection diagram.

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- e. Installation details.
 - f. Energy efficiency data.
 - g. Photometric data based on laboratory tests complying with IES Lighting Measurements testing and calculation guides.
 - h. Lamp data including lumen output (initial and mean), color rendition index (CRI), rated life (hours), and color temperature (degrees Kelvin).
 - i. Ballast data including ballast type, starting method, ambient temperature, ballast factor, sound rating, system watts, and total harmonic distortion (THD).
 - j. For LED lighting fixtures, submit US DOE LED Lighting Facts label, and IES L70 rated life.
2. Manuals:
- a. Submit, simultaneously with the shop drawings, complete maintenance and operating manuals, including technical data sheets, wiring diagrams, and information for ordering replacement parts.
 - b. If changes have been made to the maintenance and operating manuals originally submitted, submit updated maintenance and operating manuals two weeks prior to the final inspection.
3. Certifications:
- Two weeks prior to final inspection, submit the following.
- a. Certification by the Contractor that the interior lighting systems have been properly installed and tested.

1.5 APPLICABLE PUBLICATIONS

- A. Publications listed below (including amendments, addenda, revisions, supplements, and errata) form a part of this specification to the extent referenced. Publications are referenced in the text by designation only.
- B. American Society for Testing and Materials (ASTM):
C635/C635M REV A-13 Manufacture, Performance, and Testing of Metal Suspension Systems for Acoustical Tile and Lay-in Panel Ceilings
- C. Environmental Protection Agency (EPA):
40 CFR 261 Identification and Listing of Hazardous Waste
- D. Federal Communications Commission (FCC):
CFR Title 47, Part 15 Radio Frequency Devices
- E. Illuminating Engineering Society of North America (IESNA):
LM-79-08 Electrical and Photometric Measurements of Solid-State Lighting Products
LM-80-15 Measuring Lumen Maintenance of LED Light Sources
LM-82-12 Characterization of LED Light Engines and LED Lamps for Electrical and Photometric Properties as a Function of Temperature

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F. Institute of Electrical and Electronic Engineers (IEEE):

C62.41-91(R1995) Surge Voltages in Low Voltage AC Power Circuits

G. International Code Council (ICC):

IBC-15..... International Building Code

H. National Electrical Manufacturer's Association (NEMA):

C78.376-14 Chromaticity of Fluorescent Lamps
C82.1-04(R2015) Lamp Ballasts – Line Frequency Fluorescent Lamp Ballasts
C82.2-02(R2016) Method of Measurement of Fluorescent Lamp Ballasts
C82.4-17 Lamp Ballasts - Ballasts for High-Intensity Discharge and Low-
Pressure Sodium (LPS) Lamps (Multiple-Supply Type)
C82.11-17 Lamp Ballasts - High Frequency Fluorescent Lamp Ballasts
LL 9-11 Dimming of T8 Fluorescent Lighting Systems
SSL 1-16 Electronic Drivers for LED Devices, Arrays, or Systems

I. National Fire Protection Association (NFPA):

70-17 National Electrical Code (NEC)
101-18 Life Safety Code

J. Underwriters Laboratories, Inc. (UL):

496-17 Lampholders
844-12 Luminaires for Use in Hazardous (Classified) Locations
924-16 Emergency Lighting and Power Equipment
1598-08 Luminaires
1574-04..... Track Lighting Systems
2108-15... Low-Voltage Lighting Systems
8750-15... Light Emitting Diode (LED) Light Sources for Use in Lighting
Products

PART 2 - PRODUCTS

2.1 LIGHTING FIXTURES

A. Shall be in accordance with NFPA, UL, as shown on drawings, and as specified.

B. Sheet Metal:

1. Shall be formed to prevent warping and sagging. Housing, trim and lens frame shall be true, straight (unless intentionally curved), and parallel to each other as designed.
2. Wire ways and fittings shall be free of burrs and sharp edges, and shall accommodate internal and branch circuit wiring without damage to the wiring.
3. When installed, any exposed fixture housing surface, trim frame, door frame, and lens frame shall be free of light leaks.
4. Hinged door frames shall operate smoothly without binding. Latches shall function easily by finger action without the use of tools.

C. Ballasts and lamps shall be serviceable while the fixture is in its normally installed position. Ballasts shall not be mounted to removable reflectors or wire way covers unless so specified.

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E. Recessed fixtures mounted in an insulated ceiling shall be listed for use in insulated ceilings.

F. Mechanical Safety:

Lighting fixture closures (lens doors, trim frame, hinged housings, etc.) shall be retained in a secure manner by captive screws, chains, aircraft cable, captive hinges, or fasteners such that they cannot be accidentally dislodged during normal operation or routine maintenance.

G. Metal Finishes:

1. The manufacturer shall apply standard finish (unless otherwise specified) over a corrosion-resistant primer, after cleaning to free the metal surfaces of rust, grease, dirt and other deposits. Edges of pre-finished sheet metal exposed during forming, stamping or shearing processes shall be finished in a similar corrosion resistant manner to match the adjacent surface(s). Fixture finish shall be free of stains or evidence of rusting, blistering, or flaking, and shall be applied after fabrication.

2. Interior light reflecting finishes shall be white with not less than 85 percent reflectance, except where otherwise shown on the drawing.

3. Exterior finishes shall be as shown on the drawings.

H. Lighting fixtures shall have a specific means for grounding metallic wire ways and housings to an equipment grounding conductor.

I. Light Transmitting Components for Fluorescent Fixtures:

1. Shall be 100 percent virgin acrylic.

2. Flat lens panels shall have not less than 3 mm (1/8 inch) of average thickness.

3. Unless otherwise specified, lenses, reflectors, diffusers, and louvers shall be retained firmly in a metal frame by clips or clamping ring in such a manner as to allow expansion and contraction without distortion or cracking.

J. Lighting fixtures in hazardous areas shall be suitable for installation in Class and Division areas as defined in NFPA 70.

K. Compact fluorescent fixtures shall be manufactured specifically for compact fluorescent lamps with ballast integral to the fixture. Assemblies designed to retrofit incandescent fixtures are prohibited except when specifically indicated for renovation of existing fixtures.

2.2 BALLASTS

A. Linear Fluorescent Lamp Ballasts:

Multi-voltage (120 – 277V), electronic rapid-start type, designed for type and quantity of lamps indicated. Ballasts shall be designed for full light output unless dimmer or bi-level control is indicated. Ballasts shall include the following features:

1. Lamp end-of-life detection and shutdown circuit (T5 lamps only).

2. Automatic lamp starting after lamp replacement.

2. Sound Rating:
Class A.

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3. Total Harmonic Distortion (THD):
10 percent or less.
 5. Transient Voltage Protection: IEEE C62.41.1 and IEEE C62.41.2, Category A or better.
 6. Operating Frequency:
20 kHz or higher.
 7. Lamp Current Crest Factor:
1.7 or less.
 8. Ballast Factor:
0.87 or higher unless otherwise indicated.
 9. Power Factor:
0.98 or higher.
 10. EMR/RFI Interference:
Comply with CFR Title 47 Part 18 for limitations on electromagnetic and radio-frequency interference for non-consumer equipment.
 11. To facilitate multi-level lamp switching, lamps within fixture shall be wired with the outermost lamp at both sides of the fixture on the same ballast, the next inward pair on another ballast and so on to the innermost lamp (or pair of lamps). Within a given room, each switch shall uniformly control the same corresponding lamp (or lamp pairs) in all fixture units that are being controlled.
 12. Where three-lamp fixtures are indicated, unless switching arrangements dictate otherwise, utilize a common two-lamp ballast to operate the center lamp in pairs of adjacent units that are mounted in a continuous row. The ballast fixture and slave-lamp fixture shall be factory wired with leads or plug devices to facilitate this circuiting. Individually mounted fixtures and the odd fixture in a row shall utilize a single-lamp ballast for operation of the center lamp.
 13. Dimming ballasts shall be as per above, except dimmable from 100% to 5% of rated lamp lumens. Dimming ballasts shall be fully compatible with the dimming controls.
- B. Low-Frequency Linear T8 Fluorescent Lamp Ballasts (allowed for Surgery Suites, Critical Care Units, and Animal Labs):
Multi-voltage (120 – 277V), hybrid electronic-electromagnetic rapid-start type, designed for type and quantity of lamps indicated. Ballast shall be designed for full light output. Ballasts shall include the following features:
1. Automatic lamp starting after lamp replacement.
 2. Sound Rating:
Class A
 3. Total Harmonic Distortion (THD):
20 percent or less
 4. Transient Voltage Protection:
IEEE C62.41.1 and IEEE C62.41.2, Category A or better

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5. Operating Frequency:
60 Hz
 6. Lamp Current Crest Factor:
1.7 or less
 7. Ballast Factor:
0.85 or higher unless otherwise indicated
 8. Power Factor:
0.90 or higher
 1. Interference:
Comply with CFR Title 47 Part 18 for limitations on electromagnetic and radio-frequency interference for non-consumer equipment.
 10. To facilitate multi-level lamp switching, lamps within fixture shall be wired with the outermost lamp at both sides of the fixture on the same ballast, the next inward pair on another ballast and so on to the innermost lamp (or pair of lamps). Within a given room, each switch shall uniformly control the same corresponding lamp (or lamp pairs) in all fixture units that are being controlled.
 11. Where three-lamp fixtures are indicated, unless switching arrangements dictate otherwise, utilize a common two-lamp ballast to operate the center lamp in pairs of adjacent units that are mounted in a continuous row. The ballast fixture and slave-lamp fixture shall be factory wired with leads or plug devices to facilitate this circuiting. Individually mounted fixtures and the odd fixture in a row shall utilize a single-lamp ballast for operation of the center lamp.
- C. Compact Fluorescent Lamp Ballasts:
Multi-voltage (120 – 277V), electronic programmed rapid-start type, designed for type and quantity of lamps indicated. Ballast shall be designed for full light output unless dimmer or bi-level control is indicated. Ballasts shall include the following features:
1. Lamp end of life detection and shutdown circuit
 2. Automatic lamp starting after lamp replacement
 3. Sound Rating:
Class A
 4. Total Harmonic Distortion (THD):
10 percent or less
 5. Transient Voltage Protection:
IEEE C62.41.1 and IEEE C62.41.2, Category A or better
 6. Operating Frequency:
20 kHz or higher
 7. Lamp Current Crest Factor:
1.7 or less
 8. Ballast Factor:
0.95 or higher unless otherwise indicated

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9. Power Factor:
0.98 or higher
2. Interference:
Comply with CFR Title 47 Part 18 for limitations on electromagnetic and radio-frequency interference for non-consumer equipment.
11. Dimming ballasts shall be as per above, except dimmable from 100% to 5% of rated lamp lumens. Dimming ballasts shall be fully compatible with the dimming controls.
- D. Ballasts for HID fixtures:
Multi-tap voltage (120 – 480V) electromagnetic ballast for high intensity discharge lamps. Include the following features unless otherwise indicated:
 1. Ballast Circuit:
Constant-wattage autotransformer or regulating high power factor type
 2. Minimum Starting Temperature:
32 F (0 C) for single-lamp ballasts
 3. Rated Ambient Operating Temperature:
104 F (40 C)
 4. Open-circuit operation that will not reduce average life.
 5. Low-Noise Ballasts:
Manufacturers' standard epoxy-encapsulated models designed to minimize audible fixture noise.
- E. Electronic ballast for HID metal-halide lamps shall include the following features unless otherwise indicated:
 1. Minimum Starting Temperature:
32 degree F (0 degree C) for single-lamp ballasts
 2. Rated Ambient Operating Temperature:
130 degree F (54 degree C).
 3. Lamp end of life detection and shutdown circuit
 4. Sound Rating:
Class A.
 5. Total Harmonic Distortion (THD):
20 percent or less.
 6. Transient Voltage Protection:
IEEE C62.41.1 and IEEE C62.41.2, Category A or better.
 7. Lamp Current Crest Factor:
1.5 or less
 8. Power Factor:

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0.90 or higher

6. Interference:
Comply with CFR Title 47 Part 18 for limitations on electromagnetic and radio-frequency interference for non-consumer equipment.
7. Protection:
Resettable thermal

2.3 FLUORESCENT EMERGENCY BALLAST

- A. Self-contained, modular, battery-inverter unit, factory mounted within lighting fixture housing and compatible with ballast.
 1. Emergency Connection:
Operate one fluorescent lamp(s) continuously at an output of 1100 lumens each. Connect unswitched circuit to battery inverter unit and switched circuit to fixture ballast.
 2. Test Push Button and Indicator Light:
Visible and accessible without opening fixture or entering ceiling space
 - a. Push Button:
Push to test type, in unit housing, simulates loss of normal power and demonstrates unit operability.
 - b. Indicator Light:
LED indicates normal power on. Normal glow indicates trickle charge; bright glow indicates charging at end of discharge cycle.
 3. Battery:
Sealed, maintenance-free, nickel-cadmium type
 4. Charger:
Fully automatic, solid state, constant current type with sealed power transfer relay
 5. Integral Self-Test:
Automatically initiates test of unit emergency operation at required intervals. Test failure is annunciated by an integral audible alarm and a flashing LED.

2.4 EMERGENCY LIGHTING UNIT

- A. Complete, self-contained unit with batteries, battery charger, one or more local or remote lamp heads with lamps, under-voltage relay, and test switch.
 1. Enclosure:
Shall be impact resistant thermoplastic. Enclosure shall be suitable for the environmental conditions in which installed.
 2. Lamp Heads:
Horizontally and vertically adjustable, mounted on the face of the unit, except where otherwise indicated.
 3. Lamps:
Shall be sealed beam LED, rated not less than 12 watts at the specified DC voltage.

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4. Battery:
Shall be maintenance free nickel cadmium. Minimum normal life shall be minimum of 10 years.
5. Battery Charger:
Dry type full-wave rectifier with charging rates to maintain the battery in fully-charged condition during normal operation, and to automatically recharge the battery within 12 hours following a 1-1/2 hour continuous discharge.
6. Integral Self-Test:
Automatically initiates test of unit emergency operation at required intervals. Test failure is annunciated by an integral audible alarm and a flashing LED.

2.5 LAMPS

A. Linear and U-shaped T5 and T8 Fluorescent Lamps:

1. Except as indicated below, lamps shall be low-mercury energy saving type, have a color temperature between 3500° and 5000°K, a Color Rendering Index (CRI) equal or greater than 80, average rated life equal to or greater than 24,000 hours when used with an instant start ballast and 30,000 hours when used with a programmed or rapid start ballast (based on 3 hour starts), and be suitable for use with dimming ballasts, unless otherwise indicated.
2. Lamps shall comply with EPA Toxicity Characteristic Leachate Procedure (TCLP) requirements.

B. Compact Fluorescent Lamps:

1. T4, CRI 80 (minimum), color temperature 3500°K, average rated life equal to or greater than 12,000 hours (based on 3 hour starts), and suitable for use with dimming ballasts, unless otherwise indicated.
2. Lamps shall comply with EPA Toxicity Characteristic Leachate Procedure (TCLP) requirements.

2.6 RADIO-INTERFERENCE-FREE FLUORESCENT FIXTURES

These fixtures are for use in **Animal Labs, Operating Rooms, Intensive Care Units**, and similar areas.

- A. Shall be specially designed for suppressing radio-frequency energy produced within the fixtures, and shall comply with Department of Defense MIL-STD-461F and IEC IP65.
- B. Lenses shall have metal mesh to prevent or reduce radio-frequency interference. The effective light transmittance of the lenses shall be a minimum of 75 percent.
- C. Fixture finish shall be anti-microbial.
- D. Provide RFI line filters integral to the fixtures and wired in series with the supply circuit conductors.
- E. Ballasts shall be as specified in this Section.

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2.7 WALL MOUNTED FLUORESCENT BEDLIGHT FIXTURES

Designer shall coordinate control requirements with **patient bed control arrangement**. Provide wiring diagram on the drawings.

- A. Fixtures shall be lensed.
- B. Fixtures shall be rated for 120 Volt operation, and be powered through the patient wall unit per Section 10 25 13, PATIENT BED SERVICE WALLS.
- C. Provide 4 position, pull cord switch to control the upward and downward portion of the light separately and simultaneously. Include an off position, except in single bed rooms where the switch shall energize and de-energize the downward light only. In the single bed rooms, provide a 2-position pull cord switch for "on-off" control of the downward lamps.
- D. Provide low-voltage relays and switching integration with patient bed controls.

2.8 X-RAY FILM ILLUMINATORS

Verify if X-ray Film Illuminators are to be used. Current practice is typically PACS.

- A. Shall be the high-intensity type, flush-mounted in the walls. Multiples of the basic unit may be combined in a common housing.
- B. Shall have the following features:
 - 1. Fluorescent lighting, designed to provide uniform diffusion of the light.
 - 2. Box dimensions approximately 530 mm (21 inches) high, 355 mm (14 inches) wide and 100 mm (4 inches) deep.
 - 3. Housing shall be steel. Trim shall be stainless steel and shall extend approximately 40 mm (1-1/2 inches) from the edges of the housing.
 - 4. Viewing panel shall thermoplastic, not less than 3 mm (1/8 inch) thick.
 - 5. Viewing panel shall have adequate dimensions so the films will not overlap the frame and will be positioned with respect to the light source for even illumination without shadows.
 - 6. An ON-OFF double-pole, double-throw switch.

2.9 LED EXIT LIGHT FIXTURES

- A. Exit light fixtures shall meet applicable requirements of NFPA and UL.
- B. Housing and door shall be die-cast aluminum.
- C. For general purpose exit light fixtures, door frame shall be hinged, with latch. For vandal-resistant exit light fixtures, door frame shall be secured with tamper-resistant screws.
- D. Finish shall be satin or fine-grain brushed aluminum.
- E. There shall be no radioactive material used in the fixtures.
- F. Fixtures:

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1. Inscription panels shall be cast or stamped aluminum a minimum of 2.25 mm (0.090 inch) thick, stenciled with 150 mm (6 inch) high letters, baked with red color stable plastic or fiberglass. Lamps shall be luminous Light Emitting Diodes (LED) mounted in center of letters on red color stable plastic or fiberglass.
2. Double-Faced Fixtures:
Provide double-faced fixtures where required or as shown on drawings.
3. Directional Arrows:
Provide directional arrows as part of the inscription panel where required or as shown on drawings. Directional arrows shall be the "chevron-type" of similar size and width as the letters and meet the requirements of NFPA 101.

H. Voltage:
Multi-voltage (120 – 277V)

2.10 LED LIGHT FIXTURES

A. General:

1. LED light fixtures shall be in accordance with IES, NFPA, UL, as shown on the drawings, and as specified.
2. LED light fixtures shall be Reduction of Hazardous Substances (RoHS)-compliant.
3. LED drivers shall include the following features unless otherwise indicated:
 - a. Minimum efficiency: 85% at full load.
 - b. Minimum Operating Ambient Temperature: -20° C. (-4° F.)
 - c. Input Voltage: 120 - 277V (±10%) at 60 Hz.
 - d. Integral short circuit, open circuit, and overload protection.
 - e. Power Factor: ≥ 0.95 .
 - f. Total Harmonic Distortion: $\leq 20\%$.
 - g. Comply with FCC 47 CFR Part 15.
4. LED modules shall include the following features unless otherwise indicated:
 - a. Comply with IES LM-79 and LM-80 requirements.
 - b. Minimum CRI 80 and color temperature 3000° K unless otherwise specified in LIGHTING FIXTURE SCHEDULE.
 - c. Minimum Rated Life: 50,000 hours per IES L70.
 - d. Light output lumens as indicated in the LIGHTING FIXTURE SCHEDULE.

B. LED Downlights:

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1. Housing, LED driver, and LED module shall be products of the same manufacturer.

C. LED Troffers:

1. LED drivers, modules, and reflector shall be accessible, serviceable, and replaceable from below the ceiling.
2. Housing, LED driver, and LED module shall be products of the same manufacturer.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Installation shall be in accordance with the NEC, manufacturer's instructions, and as shown on the drawings or specified.
- B. Align, mount, and level the lighting fixtures uniformly.
- C. Wall-mounted fixtures shall be attached to the studs in the walls, or to a 20 gauge metal backing plate that is attached to the studs in the walls. Lighting fixtures shall not be attached directly to gypsum board.
- D. Lighting Fixture Supports:
 1. Shall provide support for all of the fixtures. Supports may be anchored to channels of the ceiling construction, to the structural slab or to structural members within a partition, or above a suspended ceiling.
 2. Shall maintain the fixture positions after cleaning and re-lamping.
 3. Shall support the lighting fixtures without causing the ceiling or partition to deflect.
 4. Hardware for recessed lighting fixtures:
 - a. All fixture mounting devices connecting fixtures to the ceiling system or building structure shall have a capacity for a horizontal force of 100 percent of the fixture weight and a vertical force of 400 percent of the fixture weight.
 - b. Mounting devices shall clamp the fixture to the ceiling system structure (main grid runners or fixture framing cross runners) at four points in such a manner as to resist spreading of these supporting members. Each support point device shall utilize a screw or approved hardware to "lock" the fixture housing to the ceiling system, restraining the fixture from movement in any direction relative to the ceiling. The screw (size No. 10 minimum) or approved hardware shall pass through the ceiling member (T-bar, channel or spline), or it may extend over the inside of the flange of the channel (or spline) that faces away from the fixture, in a manner that prevents any fixture movement.
 - c. In addition to the above, the following is required for fixtures exceeding 9 kg (20 pounds) in weight.
 - 1) Where fixtures mounted in ASTM Standard C635 "Intermediate Duty" and "Heavy Duty" ceilings and weigh between 9 kg and 25 kg (20 pounds and 56 pounds), provide

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two 12 gauge safety hangers hung slack between diagonal corners of the fixture and the building structure.

2) Where fixtures weigh over 25 kg (56 pounds), they shall be independently supported from the building structure by approved hangers. Two-way angular bracing of hangers shall be provided to prevent lateral motion.

d. Where ceiling cross runners are installed for support of lighting fixtures, they must have a carrying capacity equal to that of the main ceiling runners and be rigidly secured to the main runners.

7. Surface mounted lighting fixtures:

a. Fixtures shall be bolted against the ceiling independent of the outlet box at four points spaced near the corners of each unit. The bolts (or stud-clips) shall be minimum 6 mm (1/4 inch) bolt, secured to main ceiling runners and/or secured to cross runners. Non-turning studs may be attached to the main ceiling runners and cross runners with special non-friction clip devices designed for the purpose, provided they bolt through the runner, or are also secured to the building structure by 12 gauge safety hangers. Studs or bolts securing fixtures weighing in excess of 25 kg (56 pounds) shall be supported directly from the building structure.

b. Where ceiling cross runners are installed for support of lighting fixtures, they must have a carrying capacity equal to that of the main ceiling runners and be rigidly secured to the main runners.

c. Fixtures less than 6.8 kg (15 pounds) in weight and occupying less than 3715 sq cm (two square feet) of ceiling area may, when designed for the purpose, be supported directly from the outlet box when all the following conditions are met.

1) Screws attaching the fixture to the outlet box pass through round holes (not key-hole slots) in the fixture body.

2) The outlet box is attached to a main ceiling runner (or cross runner) with approved hardware.

3) The outlet box is supported vertically from the building structure.

d. Fixtures mounted in open construction shall be secured directly to the building structure with approved bolting and clamping devices.

8. Single or double pendant-mounted lighting fixtures:

a. Each stem shall be supported by an approved outlet box mounted swivel joint and canopy which holds the stem captive and provides spring load (or approved equivalent) dampening of fixture oscillations. Outlet box shall be supported vertically from the building structure.

9. Outlet boxes for support of lighting fixtures (where permitted) shall be secured directly to the building structure with approved devices or supported vertically in a hung ceiling from the building structure with a nine gauge wire hanger, and be secured by an approved device to a main ceiling runner or cross runner to prevent any horizontal movement relative to the ceiling.

E. Furnish and install the new lamps as specified for all lighting fixtures installed under this project, and for all existing lighting fixtures reused under this project.

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- F. The electrical and ceiling trades shall coordinate to ascertain that approved lighting fixtures are furnished in the proper sizes and installed with the proper devices (hangers, clips, trim frames, flanges, etc.), to match the ceiling system being installed.
- G. Bond lighting fixtures to the grounding system as specified in Section 260526, GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS.
- H. At completion of project, replace all defective components of the lighting fixtures at no cost to the Government.
- I. Dispose of lamps per requirements of Section 017419, CONSTRUCTION WASTE MANAGEMENT, and Section 024100, DEMOLITION.

3.2 ACCEPTANCE CHECKS AND TESTS

A. Perform the following:

1. Visual Inspection:

- a. Verify proper operation by operating the lighting controls.
- b. Visually inspect for damage to fixtures, lenses, reflectors, diffusers, and louvers. Clean fixtures, lenses, reflectors, diffusers, and louvers that have accumulated dust, dirt, or fingerprints during construction.

2. Electrical tests:

- a. Exercise dimming components of the lighting fixtures over full range of dimming capability by operating the control devices(s) in the presence of the //Resident Engineer// //COTR//. Observe for visually detectable flicker over full dimming range, and replace defective components at no cost to the Government.
- b. Burn-in all lamps that require specific aging period to operate properly, prior to occupancy by Government. Burn-in period to be 40 hours minimum, unless specifically recommended otherwise by the lamp manufacturer. Burn-in dimmed fluorescent and compact fluorescent lamps for at least 100 hours at full voltage, unless specifically recommended otherwise by the lamp manufacturer. Replace any lamps and ballasts which fail during burn-in.

3.3 FOLLOW-UP VERIFICATION

- A. Upon completion of acceptance checks and tests, the Contractor shall show by demonstration in service that the lighting systems are in good operating condition and properly performing the intended function.

END OF

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SECTION

SECTION 270500 – COMMON WORK RESULTS FOR COMMUNICATIONS

GOVERNMENT OF THE U. S. VIRGIN ISLANDS, DEPARTMENT OF PUBLIC WORKS

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PART 1 - GENERAL

1.1 DESCRIPTION

This section specifies the furnishing, installation, and connection of exterior fixtures, poles, and supports. The terms “lighting fixtures”, “fixture” and “luminaire” are used interchangeably.

1.2 RELATED WORK

- A. Section 033000, CAST-IN-PLACE CONCRETE.
- B. Section 090600, SCHEDULE FOR FINISHES:
Finishes for exterior light poles and luminaires.
- C. Section 260511, REQUIREMENTS FOR ELECTRICAL INSTALLATIONS:
General electrical requirements and items that are common to more than one section of Division 26.
- D. Section 260519, LOW-VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES (600 VOLTS AND BELOW):
Low voltage power and lighting wiring.
- E. Section 260526, GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS:
Requirements for personnel safety and to provide a low impedance path for possible ground fault currents.
- F. Section 260533, RACEWAY AND BOXES FOR ELECTRICAL SYSTEMS:
Conduits, fittings, and boxes for raceway systems.
- G. Section 260541, UNDERGROUND ELECTRICAL CONSTRUCTION:
Underground handholes and conduits.
- H. Section 260923, LIGHTING CONTROLS:
Controls for exterior lighting.

1.3 QUALITY ASSURANCE

- A. Quality Assurance shall be in accordance with Paragraph, QUALIFICATIONS (PRODUCTS AND SERVICES) in Section 26 05 11, REQUIREMENTS FOR ELECTRICAL INSTALLATIONS.

1.4 SUBMITTALS

- A. Submit in accordance with Paragraph. SUBMITTALS in Section 260511, REQUIREMENTS FOR ELECTRICAL INSTALLATIONS, and the following requirements:
 - 1. Shop Drawings:
 - a. Submit the following information for each type of lighting fixture designated on the LIGHTING FIXTURE SCHEDULE, arranged in order of lighting fixture designation.
 - b. Material and construction details, include information on housing and optics system.
 - c. Physical dimensions and description.
 - d. Wiring schematic and connection diagram.

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- e. Installation details.
 - f. Energy efficiency data.
 - g. Photometric data based on laboratory tests complying with IES Lighting Measurements testing and calculation guides.
 - h. Lamp data including lumen output (initial and mean), color rendition index (CRI), rated life (hours), and color temperature (degrees Kelvin).
 - i. Ballast data including ballast type, starting method, ambient temperature, ballast factor, sound rating, system watts, and total harmonic distortion (THD).
 - j. For LED lighting fixtures, submit US DOE LED Lighting Facts label, and IES L70 rated life.
 - k. Submit site plan showing all exterior lighting fixtures with fixture tags consistent with Lighting Fixture Schedule as shown on drawings. Site plan shall show computer generated point-by-point illumination calculations. Include lamp lumen and light loss factors used in calculations.
2. Manuals:
- a. Submit, simultaneously with the shop drawings, complete maintenance and operating manuals, including technical data sheets, wiring diagrams, and information for ordering replacement parts.
 - b. If changes have been made to the maintenance and operating manuals originally submitted, submit updated maintenance and operating manuals two weeks prior to the final inspection.
3. Certifications:
- Two weeks prior to final inspection, submit the following.
- a. Certification by the Contractor that the exterior lighting systems have been properly installed and tested.

1.5 APPLICABLE PUBLICATIONS

- A. Publications listed below (including amendments, addenda, revisions, supplements, and errata) form a part of this specification to the extent referenced. Publications are referenced in the text by designation only.
- B. American Concrete Institute (ACI):
318-14 Building Code Requirements for Structural Concrete
- C. American National Standards Institute (ANSI):
H35.1/H35 1M-17..... American National Standard Alloy and Temper Designation Systems for Aluminum
- D. American Society for Testing and Materials (ASTM):
A123/A123M-17 Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products
A153/A153M-16..... Zinc Coating (Hot-Dip) on Iron and Steel Hardware
B108/B108M-15 Aluminum-Alloy Permanent Mold Castings
C1089-13 Spun Cast Prestressed Concrete Poles

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E. Illuminating Engineering Society of North America (IESNA):

- HB-9-00 Lighting Handbook
- RP-8-14 Roadway Lighting
- LM-72-97(R2010)..... Directional Positioning of Photometric Data
- LM-79-08..... Approved Method for the Electrical and Photometric Measurements of Solid-State Lighting Products
- LM-80-15..... Approved Method for Measuring Luminous Flux and Color Maintenance of LED Packages, Arrays and Modules
- TM-15-11 Luminaire Classification System for Outdoor Luminaires

F. National Electrical Manufacturers Association (NEMA):

- C81.61-17 Electrical Lamp Bases – Specifications for Bases (Caps) for Electric Lamps
- C136.3-14 For Roadway and Area Lighting Equipment – Luminaire Attachments
- ICS 2-00(R2005) Controllers, Contactors and Overload Relays Rated 600 Volts
- ICS 6-93(R2016) Enclosures

G. National Fire Protection Association (NFPA):

- 70-17 National Electrical Code (NEC)
- 101-18 Life Safety Code

H. Underwriters Laboratories, Inc. (UL):

- 496-17 Lampholders
- 773-16 Plug-In, Locking Type Photocontrols for Use with Area Lighting
- 773A-16 Nonindustrial Photoelectric Switches for Lighting Control
- 1598-08 Luminaires
- 8750-15.....Light Emitting Diode (LED) Equipment for Use in Lighting Products

1.6 DELIVERY, STORAGE, AND HANDLING

Provide manufacturer's standard provisions for protecting pole finishes during transport, storage, and installation. Do not store poles on ground. Store poles so they are at least 305 mm (12 inches) above ground level and growing vegetation. Do not remove factory-applied pole wrappings until just before installing pole.

PART 2 - PRODUCTS

2.1 GENERAL REQUIREMENTS

Luminaires, materials and equipment shall be in accordance with NEC, UL, ANSI, and as shown on the drawings and specified.

2.2 POLES

A. General:

1. Poles shall be as shown on the drawings, and as specified. Finish shall be as specified on the drawings.
2. The pole and arm assembly shall be designed for wind loading of 175 mph minimum, as required by wind loading conditions at project site, with an additional 30% gust factor and supporting luminaire(s) and accessories such as shields, banner arms, and banners that have the effective projected areas indicated. The effective projected area of the pole shall be applied at the height of the pole base, as shown on the drawings.

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3. Poles shall be //embedded// //anchor-bolt// type designed for use with underground supply conductors. Poles shall have hand hole having a minimum clear opening of 65 x 125 mm (2.5 x 5 inches). Hand hole covers shall be secured by stainless steel captive screws.
 4. Provide a steel-grounding stud opposite hand hole openings, designed to prevent electrolysis when used with copper wire.
 5. Provide a base cover that matches the pole in material and color to conceal the mounting hardware pole-base welds and anchor bolts.
 6. Hardware and Accessories:
All necessary hardware and specified accessories shall be the product of the pole manufacturer.
 7. Provide manufacturer's standard finish, as scheduled on the drawings. Where indicated on drawings, provide finishes as indicated in Section 090600, SCHEDULE FOR FINISHES.
- B. Types:
1. Concrete: Provide round or multi-sided concrete poles conforming to ASTM C1089 with integral cast bases. Poles shall have hollow core suitable as a raceway.

2.3 FOUNDATIONS FOR POLES

- A. Foundations shall be cast-in-place concrete, having 3000 psi minimum 28-day compressive strength.
- B. Foundations shall support the effective projected area of the specified pole, arm(s), luminaire(s), and accessories, such as shields, banner arms, and banners, under wind conditions previously specified in this section.
- C. Place concrete in spirally-wrapped treated paper forms for round foundations.
- D. Rub-finish and round all above-grade concrete edges to approximately 6 mm (0.25-inch) radius.
- E. Anchor bolt assemblies and reinforcing of concrete foundations shall be as shown on the drawings. Anchor bolts shall be in a welded cage or properly positioned by the tie wire to stirrups.
- F. Prior to concrete pour, install electrode per Section 260526, GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS.

2.4 LUMINAIRES

- A. Luminaires shall be weatherproof, heavy duty, outdoor types designed for efficient light utilization, adequate dissipation of lamp and ballast heat, and safe cleaning and re-lamping.
- B. Illumination distribution patterns, BUG ratings and cutoff types as defined by the IESNA shall be as shown on the drawings.
- C. Incorporate ballasts in the luminaire housing, except where otherwise shown on the drawings.
- D. Lenses shall be frame-mounted, heat-resistant, borosilicate glass, with prismatic refractors, unless otherwise shown on the drawings. Attach the frame to the luminaire housing by hinges or chain. Use heat and aging-resistant, resilient gaskets to seal and cushion lenses and refractors in luminaire doors.

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- E. Pre-wire internal components to terminal strips at the factory.
- F. Bracket-mounted luminaires shall have leveling provisions and clamp-type adjustable slip-fitters with locking screws.
- G. Materials shall be rustproof. Latches and fittings shall be non-ferrous metal.
- H. Provide manufacturer's standard finish, as scheduled on the drawings. Where indicated on drawings, match finish process and color of pole or support materials. Where indicated on drawings, provide finishes as indicated in Section 090600, SCHEDULE FOR FINISHES.
- J. Luminaires shall carry factory labels, showing complete, specific lamp and ballast information.

2.5 LAMPS

- A. Install the proper lamps in every luminaire installed as shown on the drawings.
- B. Lamps shall be general-service, LED outdoor lighting types.
- C. LED sources shall meet the following requirements:
 - 1. Operating temperature rating shall be up to 65 degrees C (150 degrees F).
 - 2. Correlated Color Temperature (CCT):
5700K
 - 3. Color Rendering Index (CRI):
≥ 85.
 - 4. The manufacturer shall have performed reliability tests on the LEDs luminaires complying with Illuminating Engineering Society (IES) LM79 for photometric performance and LM80 for lumen maintenance and L70 life.
- G. Mercury vapor lamps shall not be used.

2.9 LED DRIVERS

- A. LED drivers shall meet the following requirements:
 - 1. Drivers shall have a minimum efficiency of 85%.
 - 2. Input Voltage:
120 to 480 (±10%) volt.
 - 3. Power Supplies:
Class I or II output.
 - 4. Surge Protection:
The system must survive 250 repetitive strikes of "C Low" (C Low: 6kV/1.2 x 50 μs, 10kA/8 x 20 μs) waveforms at 1-minute intervals with less than 10% degradation in clamping voltage. "C Low" waveforms are as defined in IEEE/ASNI C62.41.2-2002, Scenario 1 Location Category C.

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5. Power Factor (PF):
 ≥ 0.90 .
6. Total Harmonic Distortion (THD):
 $\leq 20\%$.
7. Comply with FCC Title 47 CFR Part 18 Non-consumer RFI/EMI Standards.
8. Drivers shall be reduction of hazardous substances (ROHS)-compliant.

2.10 EXISTING LIGHTING SYSTEMS

- A. For modifications or additions to existing lighting systems, the new components shall be compatible with the existing systems.
- B. New poles and luminaires shall have approximately the same configurations, dimensions, lamping and reflector type as the existing poles and luminaires, except where otherwise shown on the drawings.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install lighting in accordance with the NEC, as shown on the drawings, and in accordance with manufacturer's recommendations.
- B. Pole Foundations:
 1. Excavate only as necessary to provide sufficient working clearance for installation of forms and proper use of tamper to the full depth of the excavation. Prevent surface water from flowing into the excavation. Thoroughly compact backfill with compacting arranged to prevent pressure between conductor, jacket, or sheath, and the end of conduit.
 2. Set anchor bolts according to anchor-bolt templates furnished by the pole manufacturer.
 3. Install poles as necessary to provide a permanent vertical position with the bracket arm in proper position for luminaire location.
 4. After the poles have been installed, shimmed, and plumbed, grout the spaces between the pole bases and the concrete base with non-shrink concrete grout material. Provide a plastic or copper tube, of not less than 9 mm (0.375-inch) inside diameter through the grout, tight to the top of the concrete base to prevent moisture weeping from the interior of the pole.
- C. Install lamps in each luminaire.
- D. Adjust luminaires that require field adjustment or aiming.

3.2 GROUNDING

Ground noncurrent-carrying parts of equipment, including metal poles, luminaires, mounting arms, brackets, and metallic enclosures, as specified in Section 260526, GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS. Where copper grounding conductor is connected to a metal other than copper, provide specially-treated or lined connectors suitable and listed for this purpose.

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3.3 ACCEPTANCE CHECKS AND TESTS

Verify operation after installing luminaires and energizing circuits.

END OF SECTION

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DIVISIO PART 1 - GENERAL

1.1 SUMMARY

A Section Includes:

Communications equipment coordination and installation.

2. Sleeves for pathways and cables.

3. Sleeve seals.

4. Grout.

5. Common communications installation requirements.

1.2 DEFINITIONS

A. EPDM: Ethylene-propylene-diene terpolymer rubber.

NBR: Acrylonitrile-butadiene rubber.

1.3 SUBMITTALS

A Product Data: For sleeve seals.

1.4 COORDINATION

A. Coordinate arrangement, mounting, and support of communications equipment:

To allow maximum possible headroom unless specific mounting heights that reduce headroom are indicated.

To provide for ease of disconnecting the equipment with minimum interference to other installations.

To allow right of way for pathways installed at required slope.

So connecting pathways, cables, wireways, cable trays, and busways will be clear of obstructions and of the working and access space of other equipment.

Coordinate installation of required supporting devices in cast-in-place concrete, masonry walls, and other structural components as they are constructed.

Coordinate location of access panels and doors for communications items that are behind finished surfaces or otherwise concealed.

Coordinate selection and application of Firestopping specified in Division 07 Section "Through-Penetration Firestop Systems."

PART 2 - PRODUCTS

2.1 SLEEVES FOR PATHWAYS AND CABLES

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A. Steel Pipe Sleeves:

ASTM A 53/A 53M, Type E, Grade B, Schedule 40, galvanized steel, plain ends.

B. Cast-Iron Pipe Sleeves:

Cast or fabricated "wall pipe," equivalent to ductile-iron pressure pipe, with plain ends and integral waterstop, unless otherwise indicated.

C. Sleeves for Rectangular Openings: Galvanized sheet steel.

I. Minimum Metal Thickness:

- a. For sleeve cross-section rectangle perimeter less than 50 inches (1270 mm) and no side more than 16 inches (400 mm), thickness shall be 0.052 inch (1.3 mm).
- b. For sleeve cross-section rectangle perimeter equal to, or more than, 50 inches (1270 mm) and 1 or more sides equal to, or more than, 16 inches (400 mm), thickness shall be 0.138 inch (3.5 mm).

2.2 SLEEVE SEALS

A. Description:

Modular sealing device, designed for field assembly, to fill annular space between sleeve and pathway or cable.

1. Basis of Design Product:

Subject to compliance with requirements, provide or/a comparable product by one of the following:

- a. Advance Products & Systems, Inc.
- b. Calpico, Inc.
- c. Metraflex Co.
- d. Pipeline Seal and Insulator, Inc.

2. Sealing Elements:

EPDM interlocking links shaped to fit surface of cable or conduit. Include type and number required for material and size of pathway or cable.

3. Pressure Plates: Stainless steel. Include two for each sealing element.

4. Connecting Bolts and Nuts:

Stainless steel of length required to secure pressure plates to sealing elements. Include one for each sealing element.

2.3 GROUT

A. Nonmetallic, Shrinkage Resistant Grout:

ASTM C 1107, factory packaged, nonmetallic aggregate grout, noncorrosive, non-staining, mixed with water to consistency suitable for application and a 30-minute working time.

PART 3- EXECUTION

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3.1 COMMON REQUIREMENTS FOR COMMUNICATIONS INSTALLATION

- A. Comply with NECA 1.
- B. Measure indicated mounting heights to bottom of unit for suspended items and to center of unit for wall mounting items.
- C. Headroom Maintenance: If mounting heights or other location criteria are not indicated, arrange and install components and equipment to provide maximum possible headroom consistent with these requirements.
- D. Equipment:
Install to facilitate service, maintenance, and repair or replacement of components of both communications equipment and other nearby installations. Connect in such a way as to facilitate future disconnecting with minimum interference with other items in the vicinity.
- E. Right of Way:
Give to piping systems installed at a required slope.

3.2 SLEEVE INSTALLATION FOR COMMUNICATIONS PENETRATIONS

- A. Communications penetrations occur when pathways, cables, wireways, or cable trays penetrate concrete slabs, concrete or masonry walls, or fire-rated floor and wall assemblies.
- B. Concrete Slabs and Walls:
Install sleeves for penetrations unless core drilled holes or formed openings are used. Install sleeves during erection of slabs and walls.
- C. Use pipe sleeves unless penetration arrangement requires rectangular sleeved opening.
- D. Fire Rated Assemblies:
Install sleeves for penetrations of fire rated floor and wall assemblies unless openings compatible with fire stop system used are fabricated during construction of floor or wall.
- E. Cut sleeves to length for mounting flush with both surfaces of walls.
- F. Extend sleeves installed in floors 2 inches (50 mm) above finished floor level.
- G. Size pipe sleeves to provide 1/4-inch (6.4-mm) annular clear space between sleeve and pathway or cable, unless indicated otherwise.
- H. Seal space outside of sleeves with grout for penetrations of concrete and masonry
 - 1. Promptly pack grout solidly between sleeve and wall so no voids remain. Tool exposed surfaces smooth; protect grout while curing.
- I. Interior Penetrations of Non-Fire Rated Walls and Floors:
Seal annular space between sleeve and pathway or cable, using joint sealant appropriate for size, depth, and location of joint. Comply with requirements in Division 07 Section "Joint Sealants."
- J. Fire Rated Assembly Penetrations:
Maintain indicated fire rating of walls, partitions, ceilings, and floors at pathway and cable penetrations. Install sleeves and seal pathway and cable penetration sleeves with fire stop

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materials. Comply with requirements in Division 07 Section "Penetration Firestopping."

K. Roof-Penetration Sleeves:

Seal penetration of individual pathways and cables with flexible boot-type flashing units applied in coordination with roofing work.

L. Above ground, Exterior Wall Penetrations:

Seal penetrations using steel pipe sleeves and mechanical sleeve seals. Select sleeve size to allow for 1-inch (25-mm) annular clear space between pipe and sleeve for installing mechanical sleeve seals.

M. Underground, Exterior Wall Penetrations:

Install cast iron pipe sleeves. Size sleeves to allow for 1-inch (25-mm) annular clear space between pathway or cable and sleeve for installing mechanical sleeve seals.

3.3 SLEEVE-SEAL INSTALLATION

A. Install to seal exterior wall penetrations.

B. Use type and number of sealing elements recommended by manufacturer for pathway or cable material and size. Position pathway or cable in center of sleeve. Assemble mechanical sleeve seals and install in annular space between pathway or cable and sleeve. Tighten bolts against pressure plates that cause sealing elements to expand and make watertight seal.

3.4 FIRE STOPPING

A. Apply fire stopping to penetrations of fire rated floor and wall assemblies for communications installations to restore original fire resistance rating of assembly. Firestopping materials and installation requirements are specified in Division 07 Section "Penetration Fire Stopping."

END OF SECTION

SECTION 270526 – GROUNDING & BONDING FOR COMMUNICATION SYSTEMS

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DIVISION 27 COMMUNICATION

PART 3 - GENERAL

TELECOMMUNICATIONS SERVICE ENTRANCE FACILITIES

Access to the telecommunications grounding system specified by ANSI/TIA/EIA-607-A is mandatory.

1.2 MAIN TELECOMMUNICATIONS EQUIPMENT ROOMS

- A. Access shall be made available to the telecommunications grounding system specified by ANSI/TIA/EIA – 607 - Commercial Building Grounding and Bonding Requirements for Telecommunications.

1.3 TELECOMMUNICATIONS ROOMS

- A. Access shall be made available to the telecommunications grounding system specified by ANSI/TIA/EIA – 607 - Commercial Building Grounding and Bonding Requirements for Telecommunications.

1.4 GROUNDING AND BONDING

- A. The National Electrical Code (NEC) provides grounding, bonding, and electrical protection requirements to ensure life safety. Modern telecommunications systems require an effective grounding infrastructure to ensure optimum performance of the wide variety of electronic information transport systems that may be used throughout the life of a building. The grounding and bonding requirements of ANSI/TIA/EIA-607 are intended to work in concert with the cabling topology specified in ANSI/TIA/EIA-568, and installed in pathways and spaces as specified in ANSI/TIA/EIA-569. The requirements of these standards, and of this manual, are in addition to the requirements of the NEC.
- B. Conduits for Backbone and Horizontal Cabling Pathways shall be bonded to the grounding electrode system per the NEC.
- C. All conduits shall be bonded to the grounding system as per NEC.
- D. Telecommunications grounding, bonding, and electrical protection at Territory facilities shall comply with the requirement of the NEC, ANSI/TIA/EIA-607, and the additional requirements stated herein.
- E. Telecommunications Main Grounding Busbar (TMGB)
 - 1. The TMGB shall be installed at an accessible and convenient location in each Entrance Facility.
 - 2. The TMGB shall be a pre-drilled copper busbar with standard NEMA bolt hole sizing and spacing. The busbar shall be ¼-inch thick x 4-inch wide, with length sized to accommodate ground connection of telecommunications racks, equipment, and shielded cables in the room, plus provision for 30% growth.
 - 3. The TMGB shall be bonded to the building main electrical service-grounding electrode. No other grounding point for the TMGB shall be allowed. The TMGB shall not be bonded independently to water pipe, structural steel or electrical

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conduit.

F. Telecommunications Ground Busbar (TGB)

1. The Telecommunications Grounding Busbar (TGB) shall be a pre-drilled copper busbar with standard NEMA bolt hole sizing and spacing. The busbar shall be ¼-inch thick x 2-inch wide, with length sized to accommodate ground connection of all telecommunications racks, equipment, and shielded cables in the room, plus provision for 30% growth. The TGB shall be installed in each of the Telecommunications Rooms.
2. The TGB's shall be bonded together. Refer to the Telecommunications Riser Diagram.

G. Equipment Racks, Equipment Cabinets and Cable Ladder Racks

Equipment racks, equipment cabinets, cable ladder racks and exposed non-current carrying metal parts of the telecommunications Structured Cabling System shall be bonded to the TMGB or TGB.

Each section of a cable ladder rack or tray, shall be bonded together by one of three ways:

Remove paint down to bare metal at the point where the rack section interconnection hardware is mounted. Bond the rack assembly to the TMGB or TGB with a #6 AWG ground wire unless noted otherwise.

Bond individual rack sections together using braided metal bonding straps or #6 AWG ground wires. The straps or ground wire shall be attached with bolts through holes drilled in the cable rack sections. The bolts must contact bare metal on the rack sections. Bond the rack assembly to the TMGB or TGB with a #6 AWG ground wire unless noted otherwise.

Bond individual rack sections to a #6 AWG ground cable unless noted otherwise run throughout the entire length of rack. The ground cable shall be bonded to the TMGB or TGB.

H. Grounding and Bonding of Backbone Cables

1. OSP copper backbone cables shall have the metallic cable shields bonded to the ground lug of the primary protector block at the entrance to each building.
2. Optical fiber cables that contain metallic shielding or metallic strength members must have those metallic components bonded to the TMGB at each end of the cable.
3. Inside plant copper or optical fiber backbone cables that contain metallic shielding shall have their shields bonded to the TMGB at each end.
4. The metallic shield of splices made to backbone cables shall be bonded together to maintain shield continuity.

PRODUCTS

2.1 TELECOMMUNICATIONS SERVICE ENTRANCE FACILITIES

GROUNDING AND BONDING
Service Entrance TMGB

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Provide a bond with a minimum of a # 6 AWG unless noted otherwise, green insulated ground wire from the TMGB to the main electrical service building ground.

Label grounding and bonding hardware and connections per ANSI/TIA/EIA 606-A.

The ground busbar assembly shall be copper, 1/4" x 4" x 23" with insulators and support bracket. Provide lugs for each Bonding Conductor (BC) and the Telecommunications Bonding Backbone (TBB). Hardware (bolts) shall be silicone bronze and lugs shall be copper alloy sized for connecting the BC and TBB to the TMGB and TGB.

Rack mounted equipment ground busbar shall be 3/16" x 3/4" x 18 5/16" for attachment to 19" mounting rails of equipment racks and cabinets. Provide splice plates for attachment to multiple equipment racks and cabinets, #6-32 silicon bronze screws, ground lugs and mounting hardware.

2.2 MAIN TELECOMMUNICATIONS EQUIPMENT ROOMS

A. GROUNDING AND BONDING

1. The TGB shall be bonded to the Main Electrical service building ground by means of a # 6 AWG unless noted otherwise, green insulated ground wire.
2. Label grounding and bonding hardware and connections per ANSI/TIA/EIA 606A.
3. The ground busbar assembly shall be copper, 1/4" x 4" x 13.5" with insulators and support bracket. Provide lugs for each BC and the TBB. Hardware (bolts) shall be silicone bronze and lugs shall be copper alloy sized for connecting the BC and TBB to the TMGB and TGB.
4. Rack mounted equipment ground busbar shall be 3/16" x 3/4" x 18 5/16" for attachment to 19" mounting rails of equipment racks and cabinets. Provide splice plates for attachment to multiple equipment racks and cabinets, #6-32 silicon bronze screws, ground lugs and mounting hardware.

2.3 ADMINISTRATION AND LABELING

- A. The BC shall be provided with a self adhesive, self laminating, mechanically printed label with a clear protective laminating over wrap or mechanically printed heat shrink tubing. The label shall be approved by the BIT/RCDD prior to application.
- B. The TGB and TMGB shall be provided with a copper, brass or 1/16" mechanically stamped tag, 3" square surface area minimum, legible and permanently affixed. The tag shall be approved by the BIT/RCDD prior to application.

2.4 GROUNDING

- A. Comply with requirements in Division 16 Section 16450 for grounding conductors and connectors.
- B. Telecommunications Main Bus Bar:

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1. Connectors: Mechanical type, cast silicon bronze, solderless compression-type wire terminals, and long-barrel, two-bolt copper alloy lugs for connection to ground bus bar.

Ground Bus Bar: Copper, minimum 1/4 inch thick by 4 inches wide with 9/32-inch holes spaced 1-1/8 inches apart.

Stand-Off Insulators: Comply with UL 891 for use in switchboards, 600 V. Lexan or PVC, impulse tested at 5000 V.

C. Comply with ANSI-J-STD-607-A.

D. Label grounding and bonding hardware and connections per ANSI/TIA/EIA-606-A.

EXECUTION

3.1 TELECOMMUNICATIONS SERVICE ENTRANCE FACILITIES

GROUNDING AND BONDING

The LVLTC shall install the grounding busbar as required by ANSI/TIA/EIA 607-A and the NEC.

Equipment racks, conduits, cable trays, ladder racks, etc. shall be bonded to the grounding busbar.

Bonding connectors and clamps shall be mechanical type made of silicon bronze.

Terminals shall be solderless compression type, copper long-barrel NEMA two bolts.

The LVLTC shall bond the shield of shielded cables to the grounding busbar per applicable code and manufacturers recommended practices.

Grounding and bonding shall be in accordance with ANSI/TIA/EIA-607-A and the NEC.

Labeling shall be in accordance with ANSI/TIA/EIA 606-A.

3.2 GROUNDING

- A. Install grounding according to the BICSI TDMM, "Grounding, Bonding, and Electrical Protection" Chapter.

Comply with ANSI-J-STD-607-A.

Locate grounding bus bar to minimize the length of bonding conductors. Fasten to wall allowing at least **2-inch** clearance behind the grounding bus bar. Connect grounding bus bar with a minimum No. 3/0 AWG grounding electrode conductor from grounding bus bar to suitable electrical building ground.

Bond metallic equipment to the grounding bus bar, using not smaller than No. 6 AWG equipment grounding conductor.

Bond the shield of shielded cable to the grounding bus bar in communications rooms and spaces.

3.5 ADMINISTRATION AND LABELING

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- A. The LVLTC shall permanently secure the label within six (6) inches from both ends of the BC.
- B. The LVLTC shall permanently secure the tag within six (6) inches from the TMGB and TGB.

END OF SECTION

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PART 1- GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Metal conduits and fittings.
2. Nonmetallic conduits and fittings.
3. Optical-fiber-cable pathways and fittings.
4. Metal wire ways and auxiliary gutters.
5. Nonmetallic wire ways and auxiliary gutters.
6. Surface pathways.
7. Boxes, enclosures, and cabinets.
8. Hand holes and boxes for exterior underground cabling.

B. Related Requirements:

1. Section 260543 "Underground Ducts and Raceways for Electrical Systems" for exterior duct banks, manholes, and underground utility construction.
2. Section 260533 "Raceways and Boxes for Electrical Systems" for conduits, wire ways, surface raceways, boxes, enclosures, cabinets, hand holes, and faceplate adapters serving electrical systems.
3. Section 280528 "Pathways for Electronic Safety and Security" for conduits, surface pathways, inner duct, boxes, and faceplate adapters serving electronic safety and security.
4. Rooms used for telecommunications, including Service Entrance Facilities (SEF), the Main Equipment Rooms (MER), and Telecommunication Rooms (TR) shall be dedicated to the sole use of Telecommunications. No other building facility equipment shall be housed in rooms used for telecommunications including, but not limited to, fire alarm systems, monitoring systems, security systems, janitorial services, supply storage, departmental storage, etc.

1.3 DEFINITIONS

A. ARC:

Aluminum rigid conduit

B. GRC:

Galvanized rigid steel conduit

C. IMC:

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Intermediate metal conduit

1.4 ACTION SUBMITTALS

A. Product Data:

For surface pathways, wireways and fittings, floor boxes, hinged-cover enclosures, and cabinets

B. LEED Submittals

1.5 INFORMATIONAL SUBMITTALS

A. Coordination Drawings:

Pathway routing plans, drawn to scale, on which the following items are shown and coordinated with each other, using input from installers of items involved:

1. Structural members in paths of pathway groups with common supports
2. HVAC and plumbing items and architectural features in paths of conduit groups with common supports

B. Qualification Data:

For professional engineer.

C. Source quality-control reports.

1.6 MAIN TELECOMMUNICATIONS EQUIPMENT ROOMS

- a. The Equipment Room shall be connected to the backbone pathway for cabling to the Telecommunications Entrance Facility and the Telecommunications Rooms.

1.7 BACKBONE PATHWAYS

- b. The TRs shall have vertical 4" ID minimum conduit sleeved holes to the TR above provided by Division 26. Each TR shall have 4" sleeves provided by Division 26 between them. If the TRs are offset, multiple 4" conduits between them shall be provided by Division 26. An extra minimum 1-inch metallic sleeve shall be provided by Division 26 for the vertical riser ground system.
- c. Sleeves provided by Division 26 will extend below the ceiling and above the floor 4" with a 2" clearance from the finished wall.
- d. Firestop material shall be installed in sleeves..

PART 2- PRODUCTS

2.1 METAL CONDUITS AND FITTINGS

A. Manufacturers:

Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

1. AFC Cable Systems, Inc.
2. Allied Tube & Conduit; a Tyco International Ltd. Co.

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3. Alpha Wire Company
 4. Anamet Electrical, Inc.
 5. Electri-Flex Company
 6. 0-ZJGedney; a brand of EGS Electrical Group
 7. Republic Conduit
 8. Southwire Company
 9. Thomas & Betts Corporation
 10. Western Tube and Conduit Corporation
 11. Wheatland Tube Company; a division of John Maneely Company
- B. General Requirements for Metal Conduits and Fittings:
1. Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
 2. Comply with TIA-569-B.
- D. GRC:
Comply with ANSI C80.1 and UL 6.
- D. ARC:
Comply with ANSI C80.5 and UL 6A.
- E. IMC:
Comply with ANSI C80.6 and UL 1242.
- F. PVC-Coated Steel Conduit:
PVC-coated rigid steel conduit
1. Comply with NEMA RN 1.
 2. Coating Thickness:
0.040 inch (1 mm), minimum
- G. EMT:
Comply with ANSI C80.3 and UL 797.
- H. Fittings for Metal Conduit:
Comply with NEMA FB I and UL 514B.
1. Conduit Fittings for Hazardous (Classified) Locations:
Comply with UL 886 and NFPA 70.
 2. Fittings for EMT:
 - a. Material:

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Steel

- b. Type:
Setscrew or compression

- 3. Expansion Fittings:
PVC or steel to match conduit type, complying with UL-467, rated for environmental conditions where installed, and including flexible external bonding jumper.
- 4. Coating for Fittings for PVC-Coated Conduit:
Minimum thickness of 0.040 inch (1 mm), width
- I. Joint Compound for IMC, GRC, or ARC:
Approved, as defined in NFPA 70, by authorities having jurisdiction for use in conduit assemblies, and compounded for use to lubricate and protect threaded conduit joints from corrosion and to enhance their conductivity.

2.2 NONMETALLIC CONDUITS AND FITTINGS

- A. Manufacturers:
Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - 1. AFC Cable Systems, Inc.
 - 2. Allied Tube & Conduit; a Tyco International Ltd. Co.
 - 3. Anamet Electrical, Inc.
 - 4. Arnco Corporation
 - 5. CANTEX Inc.
 - 6. CertainTeed Corp.
 - 7. Condux International, Inc.
 - 8. Electri-Flex Company
 - 9. Kraloy
 - 10. Lamson & Sessions; Carlon Electrical Products
 - 11. Niedax-Kleinhuis USA, Inc.
 - 12. RACO; a Hubbell company
 - 13. Thomas & Betts Corporation
- B. General Requirements for Nonmetallic Conduits and Fittings:
 - 1. Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

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2. Comply with TIA-569-B.
- C. RNC:
Type EPC-40-PVC, complying with NEMA TC 2 and UL 651 unless otherwise indicated.
- E. Rigid HDPE:
Comply with UL 651A.
- F. RTRC:
Comply with UL 1684A and NEMA TC 14.
- G. Fittings for RNC:
Comply with NEMA TC 3; match to conduit or tubing type and material.
- G. Solvent cements and adhesive primers shall have a VOC content of 510 and 550 g/L or less, respectively, when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
- H. Solvent cements and adhesive primers shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small Scale Environmental Chambers."

2.3 OPTICAL-FIBER-CABLE PATHWAYS AND FITTINGS

- A. Manufacturers:
Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 1. Alpha Wire Company.
 2. Arnco Corporation.
 3. Endot Industries Inc.
 4. IPEX.
- B. Description:
Comply with UL 2024; flexible type pathway, approved for plenum installation unless otherwise indicated.
 1. Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
 2. Comply with TIA-569-B.

2.4 METAL WIREWAYS AND AUXILIARY GUTTERS

- A. Manufacturers:
Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 1. Cooper B-Line, Inc.
 2. Hoffman; a Pentair company

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3. Mono-Systems, Inc.
4. Square D; a brand of Schneider Electric
- B. Description:
Sheet metal, complying with UL 870 and NEMA 250, Type 1 unless otherwise indicated, and sized according to NFPA 70.
 1. Metal wire ways installed outdoors shall be listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
 2. Comply with TIA-569-B.
- C. Fittings and Accessories:
Include covers, couplings, offsets, elbows, expansion joints, adapters, hold down straps, end caps, and other fittings to match and mate with wire ways as required for complete system.
- D. Wire way Covers:
Hinged type unless otherwise indicated
- E. Finish:
Manufacturer's standard enamel finish.

2.5 NONMETALLIC WIREWAYS AND AUXILIARY GUTTERS

- A. Manufacturers:
Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 1. Allied Moulded Products, Inc.
 2. Hoffman; a Pentair company
 3. Lamson & Sessions; Carlon Electrical Products
 4. Niedax-Kieinhuis USA, Inc.
- B. General Requirements for Nonmetallic Wireways and Auxiliary Gutters:
 1. Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
 2. Comply with TIA-569-B.
- C. Description:
Fiberglass polyester, extruded and fabricated to required size and shape, without holes or knockouts. Cover shall be gasketed with oil resistant gasket material and fastened with captive screws treated for corrosion resistance. Connections shall be flanged and have stainless steel screws and oil-resistant gaskets.
- D. Description:
PVC, extruded and fabricated to required size and shape, and having snap-on cover, mechanically coupled connections, and plastic fasteners.

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E. Fittings and Accessories:

Couplings, offsets, elbows, expansion joints, adapters, hold-down straps, end caps, and other fittings shall match and mate with wireways as required for complete system.

F. Solvent cements and adhesive primers shall have a VOC content of 510 and 550 g/L or less, respectively, when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

G. Solvent cements and adhesive primers shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small Scale Environmental Chambers."

2.6 SURFACE PATHWAYS

A General Requirements for Surface Pathways:

1. Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
2. Comply with TIA-569-B.

B. Surface Metal Pathways:

Galvanized steel with snap-on covers complying with UL 5. Prime coated, ready for field painting.

1. Manufacturers:

Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

- a. Mono-Systems, Inc.
- b. Niedax-Kleinhuis USA, Inc.
- c. Panduit Corp
- d. Wiremold / Legrand

C. Surface Nonmetallic Pathways:

Two or three piece construction, complying with UL 5A, and manufactured of rigid PVC with texture and color selected by Owner's Representative from manufacturer's standard colors. Product shall comply with UL-94 V-0 requirements for self-extinguishing characteristics.

1. Manufacturers:

Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

- a. Hubbell Incorporated; Wiring Device-Kellems Division
- b. Lamson & Sessions; Carlon Electrical Products
- c. Mono-Systems, Inc.
- d. Panduit Corp.
- e. Wiremold / Legrand

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2.7 BOXES, ENCLOSURES, AND CABINETS

A. Manufacturers:

Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

1. Adalet
2. Cooper Technologies Company; Cooper Crouse-Hinds
3. EGSI Appleton Electric
4. Erickson Electrical Equipment Company
5. Hoffman; a Pentair company
6. Hubbell Incorporated; Killark Division
7. Lamson & Sessions; Carlon Electrical Products
8. Milbank Manufacturing Co.
9. Molex; Woodhead Brand
10. Mono-Systems, Inc.
11. 0-ZJGedney; a brand of EGS Electrical Group
12. RACO; a Hubbell company
13. Robroy Industries
14. Spring City Electrical Manufacturing Company
15. Stahlin Non-Metallic Enclosures; a division of Robroy Industries
16. Thomas & Betts Corporation
17. Wiremold / Legrand

B. General Requirements for Boxes, Enclosures, and Cabinets:

1. Comply with TIA-569-B.
2. Boxes, enclosures and cabinets installed in wet locations shall be listed for use in wet locations.

C. Sheet Metal Outlet and Device Boxes:

Comply with NEMA OS 1 and UL 514A.

D. Cast Metal Outlet and Device Boxes:

Comply with NEMA FB 1, aluminum, Type FD, with gasketed cover.

E. Box extensions used to accommodate new building finishes shall be of same material as recessed

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box.

F. Metal Floor Boxes:

1. Material:
Cast metal
2. Type:
Fully adjustable
3. Shape:
Rectangular
4. Listing and Labeling:
Metal floor boxes shall be listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

G. Nonmetallic Floor Boxes:

Nonadjustable, rectangular

1. Listing and Labeling:
Nonmetallic floor boxes shall be listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

H. Small Sheet Metal Pull and Junction Boxes:

NEMA OS 1

I. Cast-Metal Access, Pull, and Junction Boxes:

Comply with NEMA FB 1 and UL 1773, cast aluminum with gasketed cover.

J. Device Box Dimensions:

4 inches square by 2-1/8 inches deep (100 mm square by 60 mm deep)

K. Gangable boxes are prohibited.

L. Nonmetallic Outlet and Device Boxes:

Comply with NEMA OS 2 and UL 514C.

M. Hinged Cover Enclosures:

Comply with UL 50 and NEMA 250, Type 1 with continuous hinge cover with flush latch unless otherwise indicated.

1. Metal Enclosures:
Steel, finished inside and out with manufacturer's standard enamel
2. Nonmetallic Enclosures:
 - a. Material:
Fiberglass
 - b. Finished inside with radio-frequency-resistant paint.
3. Interior Panels:
Steel; all sides finished with manufacturer's standard enamel.

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N. Cabinets:

1. NEMA 250, Type 1, galvanized-steel box with removable interior panel and removable front, finished inside and out with manufacturer's standard enamel.
2. Hinged door in front cover with flush latch and concealed hinge
3. Key latch to match panelboards.
4. Metal barriers to separate wiring of different systems and voltage.
5. Accessory feet where required for freestanding equipment
6. Nonmetallic cabinets shall be listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

2.8 HANDHOLES AND BOXES FOR EXTERIOR UNDERGROUND CABLING

A. General Requirements for Handholes and Boxes:

1. Boxes and handholes for use in underground systems shall be designed and identified as defined in NFPA 70, for intended location and application.
2. Boxes installed in wet areas shall be listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
3. Comply with TIA-569-B.

B. Polymer Concrete Handholes and Boxes with Polymer Concrete Cover:

Molded of sand and aggregate, bound together with polymer resin, and reinforced with steel, fiberglass, or a combination of the two.

1. Manufacturers:
Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Armorcast Products Company
 - b. Carson Industries, LLC.
 - c. CDR Systems Corporation; Hubbell Power Systems
 - d. New Basis
 - e. Oldcastle Precast, Inc.; Christy Concrete Products
 - f. Synertech Moulded Products; a division of Oldcastle Precast, Inc.
2. Standard:
Comply with SCTE 77.
3. Configuration:

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Designed for flush burial with open bottom unless otherwise indicated.

4. Cover:
Weatherproof, secured by tamper resistant locking devices and having structural load rating consistent with enclosure and handhole location.
 5. Cover Finish:
Nonskid finish shall have a minimum coefficient of friction of 0.50.
 6. Cover Legend:
Molded lettering, "COMMUNICATIONS"
 7. Conduit Entrance Provisions:
Conduit terminating fittings shall mate with entering ducts for secure, fixed installation in enclosure wall.
 8. Handholes 12 Inches Wide by 24 Inches Long (300 mm Wide by 600 mm Long) and Larger:
Have inserts for cable racks and pulling-in irons installed before concrete is poured.
- C. Fiberglass Handholes and Boxes:
Molded of fiberglass reinforced polyester resin, with frame and covers of polymer concrete.
1. Manufacturers:
Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Armorcast Products Company
 - b. Carson Industries LLC.
 - c. CDR Systems Corporation; Hubbell Power Systems
 - d. New Basis
 - e. Nordic Fiberglass, Inc.
 - f. Oldcastle Precast, Inc.; Christy Concrete Products
 - g. Synertech Moulded Products; a division of Oldcastle Precast, Inc.
 2. Standard:
Comply with SCTE 77.
 3. Color of Frame and Cover:
Gray
 4. Configuration:
Designed for flush burial with open bottom unless otherwise indicated.
 5. Cover:
Weatherproof, secured by tamper-resistant locking devices and having structural load rating consistent with enclosure and handhole location.
 6. Cover Finish:

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Nonskid finish shall have a minimum coefficient of friction of 0.50.

7. Cover Legend: Molded lettering, "COMMUNICATIONS"
8. Conduit Entrance Provisions:
Conduit-terminating fittings shall mate with entering ducts for secure, fixed installation in enclosure wall.
9. Handholes 12 Inches Wide by 24 Inches Long (300 mm Wide by 600 mm Long) and Larger:
Have inserts for cable racks and pulling-in irons installed before concrete is poured.

2.9 SOURCE QUALITY CONTROL FOR UNDERGROUND ENCLOSURES

- A. Handhole and Pull Box Prototype Test:
Test prototypes of handholes and boxes for compliance with SCTE 77. Strength tests shall be for specified tier ratings of products supplied.
 1. Tests of materials shall be performed by an independent testing agency.
 2. Strength tests of complete boxes and covers shall be by either an independent testing agency or manufacturer. A qualified registered professional engineer shall certify tests by manufacturer.
 2. Testing machine pressure gages shall have current calibration certification following ISO 9000 and ISO 10012, and traceable to NIST standards.

2.10 LADDER RACK

- A. Provide ladder rack and stand-offs for support of backbone cables passing vertically through TRs.
- B. Include connecting hardware and support hardware for a complete installation including, but not limited to, equipment rack to runway mounting plates, wall angle support brackets, butt splice swivels, junction splice connections and grounding kits.
- C. Ladder Rack:
 1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Cooper B-Line, Inc.
 - b. Ortronics, Inc.
 - c. Siemon Co.
 - d. Panduit Corp.
 - e. Hubbell
 - f. CommScope, Inc
 - g. Leviton

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2. Ladder Rack Materials: Types 304 and 316 stainless steel. Ladder rack shall be a tubular side bar type nominally 3/8" thick by 1-1/2" high (Minimum) with 1/2" x 1" welded rings spaced 9" on center.

- a. Ladder Racks: Nominally 18 inches wide, and a rung spacing of 9 inches.

2.11 STRUCTURED CABLING (HORIZONTAL) SUPPORTS

- A. Metallic J-hooks may be used for this project.
- B. Cable Support: NRTL labeled. Cable support brackets shall be designed to prevent degradation of cable performance and pinch points that could damage cable. Cable ties are not allowed.
 1. Comply with NFPA 70 and UL 2043 for fire-resistant and low-smoke-producing characteristics.
 2. Adjustable cable supports, plenum rated.

PART 3 - EXECUTION

3.1 PATHWAY APPLICATION

- A. Outdoors:
Apply pathway products as specified below unless otherwise indicated:
 1. Exposed Conduit:
RNC, Type EPC-40-PVC
 2. Concealed Conduit, Aboveground:
IMC, EMT
 3. Underground Conduit:
RNC, Type EPC-40-PVC, direct buried
 4. Boxes and Enclosures, Aboveground:
NEMA 250, Type 4
- B. Indoors:
Apply pathway products as specified below unless otherwise indicated:
 1. Exposed, Not Subject to Physical Damage:
EMT
 2. Exposed, Not Subject to Severe Physical Damage:
EMT
 3. Exposed and Subject to Severe Physical Damage:
GRC. Pathway locations include the following:
 - a. Loading dock
 - b. Corridors used for traffic of mechanized carts, forklifts, and pallet-handling units
 - c. Mechanical rooms

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d. Gymnasiums

4. Concealed in Ceilings and Interior Walls and Partitions:
EMT

5. Damp or Wet Locations:
GRC

6. Pathways for Optical Fiber or Communications Cable in Spaces Used for Environmental Air:
EMT

7. Pathways for Optical-Fiber or Communications-Cable Risers in Vertical Shafts:
EMT

8. Pathways for Concealed General-Purpose Distribution of Optical-Fiber or Communications Cable:
EMT

9. Boxes and Enclosures:
NEMA 250 Type I, except use NEMA 250 Type 4 nonmetallic in institutional and commercial kitchens and damp or wet locations.

C. Minimum Pathway Size:
1-inch (27-mm) trade size. Minimum size for optical fiber cables is 1 inch (27 mm).

D. Pathway Fittings:
Compatible with pathways and suitable for use and location

1. Rigid and Intermediate Steel Conduit:
Use threaded rigid steel conduit fittings unless otherwise indicated. Comply with NEMA FB 2.10.

2. PVC Externally Coated, Rigid Steel Conduits:
Use only fittings listed for use with this type of conduit. Patch and seal all joints, nicks, and scrapes in PVC coating after installing conduits and fittings. Use sealant recommended by fitting manufacturer and apply in thickness and number of coats recommended by manufacturer.

3. EMT:
Use setscrew or compression, steel fittings. Comply with NEMA FB 2.10.

E. Do not install aluminum conduits, boxes, or fittings in contact with concrete or earth.

F. Install surface pathways only where indicated on Drawings.

G. Do not install nonmetallic-conduit where ambient temperature exceeds 120°F (49°C).

3.2 INSTALLATION

A. Comply with NECA 1, NECA 101, and TIA-569-B for installation requirements except where requirements on Drawings or in this article are stricter. Comply with NECA 102 for aluminum pathways. Comply with NFPA 70 limitations for types of pathways allowed in specific occupancies and number of floors.

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- B. Keep pathways at least 6 inches (150 mm) away from parallel runs of flues and steam or hot-water pipes. Install horizontal pathway runs above water and steam piping.
- C. Complete pathway installation before starting conductor installation.
- D. Comply with requirements in Section 260529 "Hangers and Supports for Electrical Systems" for hangers and supports.
- E. Arrange stub-ups so curved portions of bends are not visible above finished slab.
- F. Install no more than the equivalent of two 90-degree bends in any pathway run. Support within 12 inches (300 mm) of changes in direction. Utilize long radius ells for all optical fiber cables.
- G. Conceal conduit and EMT within finished walls, ceilings, and floors unless otherwise indicated. Install conduits parallel or perpendicular to building lines.
- H. Support conduit within 12 inches (300 mm) of enclosures to which attached.
- I. Pathways Embedded in Slabs:
 - 1. Run conduit larger than 1-inch (27-mm) trade size, parallel or at right angles to main reinforcement. Where at right angles to reinforcement, place conduit close to slab support. Secure pathways to reinforcement at maximum 10-foot (3-m) intervals.
 - 2. Arrange pathways to cross building expansion joints at right angles with expansion fittings.
 - 3. Arrange pathways to keep a minimum of 1 inch (25 mm) of concrete cover in all directions.
 - 4. Do not embed threadless fittings in concrete unless specifically approved by Owner's Representative for each specific location.
 - 5. Change from ENT to IMC before rising above floor.
- J. Stub-ups to Above Recessed Ceilings:
 - 1. Use EMT, IMC, or RMC for pathways.
 - 2. Use a conduit bushing or insulated fitting to terminate stub-ups not terminated in hubs or in an enclosure.
- K. Threaded Conduit Joints, Exposed to Wet, Damp, Corrosive, or Outdoor Conditions:
Apply listed compound to threads of pathway and fittings before making up joints. Follow compound manufacturer's written instructions.
- L. Coat field cut threads on PVC coated pathway with a corrosion preventing conductive compound prior to assembly.
- M. Terminate threaded conduits into threaded hubs or with locknuts on inside and outside of boxes or cabinets. Install insulated bushings on conduits terminated with locknuts.
- N. Install pathways square to the enclosure and terminate at enclosures with locknuts. Install locknuts hand tight plus 1/4 turn more.

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- O. Do not rely on locknuts to penetrate nonconductive coatings on enclosures. Remove coatings in the locknut area prior to assembling conduit to enclosure to assure a continuous ground path.
- P. Cut conduit perpendicular to the length. For conduits of 2-inch (53-mm) trade size and larger, use roll cutter or a guide to ensure cut is straight and perpendicular to the length.
- Q. Install pull wires in empty pathways. Use polypropylene or monofilament plastic line with not less than 200-lb (90-kg) tensile strength. Leave at least 12 inches (300 mm) of slack at each end of pull wire. Cap underground pathways designated as spare above grade alongside pathways in use.
- R. Surface Pathways:
 - 1. Install surface pathway for surface telecommunications outlet boxes only where shown on Drawings.
 - 2. Install surface pathway with a minimum 2-inch (50-mm) radius control at bend points.
 - 3. Secure surface pathway with screws or other anchor-type devices at intervals not exceeding 48 inches (1200 mm) and with no less than two supports per straight pathway section. Support surface pathway according to manufacturer's written instructions. Tape and glue are not acceptable support methods.
- S. Pathways for Optical Fiber and Communications Cable:
Install pathways, metal and nonmetallic, rigid and flexible, as follows:
 - 1. 3/4-Inch (21-mm) Trade Size and Smaller:
Install pathways in maximum lengths of 50 feet (15m).
 - 2. 1-Inch (27-mm) Trade Size and Larger:
Install pathways in maximum lengths of 75 feet (23m).
 - 3. Install with a maximum of two 90-degree bends or equivalent for each length of pathway unless Drawings show stricter requirements. Separate lengths with pull or junction boxes or terminations at distribution frames or cabinets where necessary to comply with these requirements.
- T. Install pathway sealing fittings at accessible locations according to NFPA 70 and fill them with listed sealing compound. For concealed pathways, install each fitting in a flush steel box with a blank cover plate having a finish like that of adjacent plates or surfaces. Install pathway sealing fittings according to NFPA 70.
- U. Install devices to seal pathway interiors at accessible locations. Locate seals so no fittings or boxes are between the seal and the following changes of environments. Seal the interior of all pathways at the following points:
 - 1. Where conduits pass from warm to cold locations, such as boundaries of refrigerated spaces.
 - 2. Where an underground service pathway enters a building or structure.
 - 3. Where otherwise required by NFPA 70.
- V. Comply with manufacturer's written instructions for solvent welding PVC conduit and fittings.

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- W. Mount boxes at heights shown on Drawings. If mounting heights of boxes are not individually indicated, give priority to ADA requirements. Install boxes with height measured to top of box unless otherwise indicated.
- X. Recessed Boxes in Masonry Walls:
Saw-cut opening for box in center of cell of masonry block, and install box flush with surface of wall. Prepare block surface to provide a flat surface for a raintight connection between box and cover plate or supported equipment and box.
- Y. Horizontally separate boxes mounted on opposite sides of walls so they are not in the same vertical channel.
- Z. Support boxes of three gangs or more from more than one side by spanning two framing members or mounting on brackets specifically designed for the purpose.
- AA. Fasten junction and pull boxes to or support from building structure. Do not support boxes by conduits.
- BB. Set metal floor boxes level and flush with finished floor surface.
- CC. Set nonmetallic floor boxes level. Trim after installation to fit flush with finished floor surface.

3.3 INSTALLATION OF UNDERGROUND CONDUIT

A. Direct-Buried Conduit:

1. Excavate trench bottom to provide firm and uniform support for conduit. Prepare trench bottom as specified in Section 312000 "Earth Moving" for pipe less than 6 inches (150 mm) in nominal diameter.
2. Install backfill as specified in Section 312000 "Earth Moving."
3. After installing conduit, backfill and compact. Start at tie-in point, and work toward end of conduit run, leaving conduit at end of run free to move with expansion and contraction as temperature changes during this process. Firmly hand tamp backfill around conduit to provide maximum supporting strength. After placing controlled backfill to within 12 inches (300 mm) of finished grade, make final conduit connection at end of run and complete backfilling with normal compaction as specified in Section 312000 "Earth Moving."
4. Install manufactured duct elbows for stub-ups at poles and equipment and at building entrances through floor unless otherwise indicated. Encase elbows for stub-up ducts throughout length of elbow.
5. Install manufactured rigid steel conduit elbows for stub-ups at poles and equipment and at building entrances through floor.
 - a. Couple steel conduits to ducts with adapters designed for this purpose, and encase coupling with 3 inches (75 mm) of concrete for a minimum of 12 inches (300 mm) on each side of the coupling.
 - b. For stub-ups at equipment mounted on outdoor concrete bases and where conduits penetrate building foundations, extend steel conduit horizontally a minimum of 60 inches (1500 mm) from edge of foundation or equipment base. Install insulated grounding

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bushings on terminations at equipment.

6. **Warning Planks:**

Bury warning planks approximately 12 inches (300 mm) above direct-buried conduits, but a minimum of 6 inches (150 mm) below grade. Align planks along centerline of conduit.

7. **Underground Warning Tape:**

Comply with requirements in Section 260553 "Identification for Electrical Systems."

3.4 INSTALLATION OF UNDERGROUND HANDHOLES AND BOXES

A. Install handholes and boxes level and plumb and with orientation and depth coordinated with connecting conduits to minimize bends and deflections required for proper entrances.

B. Unless otherwise indicated, support units on a level bed of crushed stone or gravel, graded from 1/2-inch (12.5- mm) sieve to No. 4 (4.75-mm) sieve and compacted to same density as adjacent undisturbed earth.

C. Elevation:

In paved areas, set so cover surface will be flush with finished grade. Set covers of other enclosures 1 inch (25 mm) above finished grade.

3.5 SLEEVE AND SLEEVE-SEAL INSTALLATION FOR COMMUNICATIONS PENETRATIONS

A. Install sleeves and sleeve seals at penetrations of exterior floor and wall assemblies. Comply with requirements in Section 270544 "Sleeves and Sleeve Seals for Communications Pathways and Cabling."

3.6 FIRE STOPPING

A. Install fire stopping at penetrations of fire-rated floor and wall assemblies. Comply with requirements in Section 078413 "Penetration Fire Stopping."

3.7 PROTECTION

A. Protect coatings, finishes, and cabinets from damage or deterioration.

1. Repair damage to galvanized finishes with zinc-rich paint recommended by manufacturer.

3. Repair damage to PVC coatings or paint finishes with matching touchup coating recommended by manufacturer.

3.8 LADDER RACK

A. Install at 84" AFF per manufacturer's recommendations and secured to the top of equipment racks.

B. The ladder rack shall be supported at three foot intervals with triangular support brackets from the walls and securely attached to the equipment.

C. Cable radius waterfalls shall be attached to the ladder rack to maintain cable bending radius where cables enter and exit the ladder rack.

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- D. Cable shall be secured to the ladder rack using reusable Velcro type cable ties to arrange cables in logical bundles.
- E. Telecommunications grounding and bonding shall be in accordance with applicable codes and regulations. Comply with ANSI/TIA/EIA-607-A and the NEC.
- F. Comply with requirements for demarcation point, pathways, cabinets, and racks specified in Division 27 Section "Communications Equipment Room Fittings." Drawings indicate general arrangement of pathways and fittings.
- G. Ladder racks shall comply with NEMA VE2 and ANSI/TIA/EIA 569-B.

3.9 VERTICAL LADDER RACKS

- A. Vertical ladder rack shall be installed by the LVLTC.
- B. The vertical ladder rack shall be installed on the wall above/below sleeves from the floor to the ceiling above. Stand offs shall be installed as necessary to support the required ladder rack. The anchoring system provided shall be suitable for the type of wall and the weight to be supported by the ladder rack.

3.10 STRUCTURED CABLING (HORIZONTAL) SUPPORTS

- A. Metallic J-hooks may be used for this project.
- B. Provide adjustable cable supports for the structured cabling on 30-inch centers maximum.
- C. Provide Velcro type tie wraps for the structured cabling.
- D. The adjustable cable supports shall be rated to carry Category 6 cabling and sized not to exceed the manufacturer's recommended quantity of cables.

END OF SECTION

SECTION 271100 – COMMUNICATIONS EQUIPMENT ROOM FITTINGS

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GENERAL

1.1 RELATED DOCUMENTS

- A Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Telecommunications mounting elements
2. Backboards
3. Grounding

B. Related Sections:

Division 27 Section "Communications Backbone Cabling" for Structural Cabling associated with system panels and devices.

Division 27 Section "Communications Horizontal Cabling" for Structural Cabling associated with system panels and devices.

1.3 DEFINITIONS

A. BICSI:

Building Industry Consulting Service International

B. LAN:

Local area network

C. RCDD:

Registered Communications Distribution Designer

Ladder Rack:

A fabricated structure consisting of two longitudinal side rails connected by individual transverse members (rungs).

1.4 ACTION SUBMITTALS

A. Product Data:

For each type of product.

1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for equipment racks and cabinets.
2. Include rated capacities, operating characteristics, electrical characteristics, and furnished specialties and accessories.

B. Shop Drawings:

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For communications equipment room fittings. Include plans, elevations, sections, details, and attachments to other work.

1. Detail equipment assemblies and indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
2. Equipment Racks and Cabinets:
Include workspace requirements and access for cable connections.
4. Grounding:
Indicate location of grounding bus bar and its mounting detail showing standoff insulators and wall mounting brackets.

1.5 QUALITY ASSURANCE

A. Installer Qualifications:

Cabling Installer must have personnel certified by BICSI on staff.

1. Layout Responsibility:
Preparation of Shop Drawings shall be under the direct supervision of RCDD.
 2. Installation Supervision:
Installation shall be under the direct supervision of Registered Technician, who shall be present at all times when Work of this Section is performed at Project site.
 3. Field Inspector:
Currently registered by BICSI as RCDD to perform the on-site inspection.
- B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

Telecommunications Pathways and Spaces: Comply with ANSI/TIA/EIA-569-B.

Grounding: Comply with ANSI-J-STD-607-A.

1.6 PROJECT CONDITIONS

- C. Environmental Limitations: Do not deliver or install equipment frames and ladder racks until spaces are enclosed and weather-tight, wet work in spaces is complete and dry, and work above ceilings is complete. Floor tile shall be in place prior to mounting systems to the floor.

1.7 COORDINATION

- D. Coordinate layout and installation of communications equipment with Owner's telecommunications and LAN equipment and service suppliers. Coordinate service entrance arrangement with BIT.

Meet jointly with BIT/RCDD, Telco representatives, and Owner to exchange information and agree on details of equipment arrangements and installation interfaces.

Record agreements reached in meetings and distribute them to other participants.

Coordinate location of power raceways and receptacles with locations of communications equipment requiring electrical power to operate.

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PART 2 - PRODUCTS

2.1 BACKBOARDS

A. Backboards:

Plywood, fire-retardant treated, 3/4 by 48 by 96 inches (19 by 1220 by 2440 mm). Comply with requirements for plywood backing panels specified in Section 061000 "Rough Carpentry."

2.2 EQUIPMENT FRAMES

A. Manufacturers:

Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

1. ADC
2. Belden Inc.
3. Cooper B-Line
4. Emerson Network Power Connectivity Solutions
5. Hubbell Premise Wiring
6. Leviton Commercial Networks Division
7. Middle Atlantic Products, Inc.
8. Ortronics, Inc.
9. Panduit Corp.
10. Siemon Co. (The).
11. Tyco Electronics Corporation; AMP Products.

B. General Frame Requirements:

1. Distribution Frames:
Freestanding and wall-mounting, modular-steel units designed for telecommunications terminal support and coordinated with dimensions of units to be supported.
2. Module Dimension:
Width compatible with EIA 31 0-D standard, 19-inch (480-mm) panel mounting.
3. Finish:
Manufacturer's standard, baked-polyester powder coat.

Floor-Mounted Racks:

Vertical and horizontal cable management channels, top and bottom cable troughs, grounding lug.

Baked-polyester powder coat black finish.

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Modular Freestanding Cabinets:

Removable and lockable side panels.

Hinged and lockable front and rear doors.

Adjustable feet for leveling.

Screened ventilation openings in the front and rear doors.

Cable access provisions in the roof and base.

Grounding bus bar.

Roof or door mounted, 550-cfm fan with filter.

Power strip.

Baked-polyester powder coat black finish.

Cabinets keyed alike.

C. Cable Management for Equipment Frames:

1. Metal, with integral wire retaining fingers
2. Baked polyester powder coat finish
3. Vertical cable management panels shall have front and rear channels, with covers
4. Provide horizontal crossover cable manager at the top of each relay rack, with a minimum height of two rack units each.
5. Horizontal cable managers shall have extended covers to hide patch cables lacing into vertical cable managers.

2.3 GROUNDING

- A. Comply with requirements in Section 260526 "Grounding and Bonding for Electrical Systems" for grounding conductors and connectors.

B. Telecommunications Main Bus Bar:

1. Connectors:
Mechanical type, cast silicon bronze, solderless compression-type wire terminals, and long barrel, two bolt connection to ground bus bar.
2. Ground Bus Bar:
Copper, minimum 1/4 inch thick by 4 inches wide (6 mm thick by 100 mm wide) with 9/32-inch (7.14-mm) holes spaced 1-1/8 inches (28 mm) apart.
3. Stand-Off Insulators:
Comply with UL 891 for use in switchboards, 600 V. Lexan or PVC, impulse tested at 5000 V.

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C. Comply with J-STD-607-A.

2.4 LABELING

- A. Comply with TINEIA-606-A and UL 969 for a system of labeling materials, including label stocks, laminating adhesives, and inks used by label printers.

PART 3 - EXECUTION

3.1 ENTRANCE FACILITIES

- A. Contact telecommunications service provider and BIT to arrange for installation of demarcation point, protected entrance terminals, and a housing when so directed by service provider.
- B. Comply with requirements in Section 270528 "Pathways for Communications Systems" for materials and installation requirements for underground pathways.

3.2 INSTALLATION

- A. Comply with NECA 1.
- B. Comply with BICSI TDMM for layout and installation of communications equipment rooms.
- C. Bundle, lace, and train conductors and cables to terminal points without exceeding manufacturer's limitations on bending radii. Install lacing bars and distribution spools.
- D. Coordinate layout and installation of communications equipment with Owner's telecommunications and LAN equipment and service suppliers. Coordinate service entrance arrangement with local exchange carrier.
 - 1. Meet jointly with telecommunications and LAN equipment suppliers, local exchange carrier representatives, and Owner to exchange information and agree on details of equipment arrangements and installation interfaces.
 - 2. Record agreements reached in meetings and distribute them to other participants.
 - 3. Adjust arrangements and locations of distribution frames, cross-connects, and patch panels in equipment rooms to accommodate and optimize arrangement and space requirements of telephone switch and LAN equipment.
 - 4. Adjust arrangements and locations of equipment with distribution frames, cross-connects, and patch panels of cabling systems of other communications, electronic safety and security, and related systems that share space in the equipment room.
- E. Coordinate location of power raceways and receptacles with locations of communications equipment requiring electrical power to operate.

3.3 SLEEVE AND SLEEVE SEAL INSTALLATION FOR ELECTRICAL PENETRATIONS

- A. Install sleeves and sleeve seals at penetrations of exterior floor and wall assemblies. Follow requirements in Section 270544 "Sleeves and Sleeve Seals for Communications Pathways and Cabling."

3.4 FIRE STOPPING

SECTION 271100 – COMMUNICATIONS EQUIPMENT ROOM FITTINGS

GOVERNMENT OF THE U. S. VIRGIN ISLANDS, DEPARTMENT OF PUBLIC WORKS

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A. Comply with requirements in Section 078413 "Penetration Fire Stopping."

B. Comply with TIA-569-B, Annex A, "Fire stopping."

C. Comply with BICSI TDMM, "Fire stopping Systems" Article.

3.5 GROUNDING

A. Install grounding according to BICSI TDMM, "Grounding, Bonding, and Electrical Protection" Chapter.

B. Comply with J-STD-607-A

C. Locate grounding bus bar to minimize the length of bonding conductors. Fasten to wall allowing at least 2-inch (50-mm) clearance behind the grounding bus bar. Connect grounding bus bar with a minimum No. 4 AWG grounding electrode conductor from grounding bus bar to suitable electrical building ground.

D. Bond metallic equipment to the grounding bus bar, using not smaller than No. 6 AWG equipment grounding conductor.

1. Bond the shield of shielded cable to the grounding bus bar in communications rooms and spaces.

3.6 IDENTIFICATION

E. Identify system components, cabling, and cabling complying with ANSI/TIA/EIA-606-A. Comply with requirements in Division 26 Section 26010. Comply with requirements in Division 09 Section 09900 Painting for painting backboards. For fire-resistant plywood, do not paint over manufacturer's label. For paint additive coats on AC grade plywood, provide label on backboard.

See Division 27 Section "Communications Horizontal Cabling" for additional identification requirements. See Evaluations for discussion of TIA/EIA standard as it applies to this Section. Paint and label colors for equipment identification shall comply with ANSI/TIA/EIA-606-A.

Labels shall be preprinted or computer-printed type.

END OF SECTION

SECTION 271300 – COMMUNICATIONS BACKBONE CABLING

GOVERNMENT OF THE U. S. VIRGIN ISLANDS, DEPARTMENT OF PUBLIC WORKS

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PART 4 - GENERAL

RELATED DOCUMENTS

General provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

SUMMARY

Section Includes:

Pathways.

UTP cable.

50/125-micrometer, multimode optical fiber cabling.

Cable connecting hardware, patch panels, and cross-connects.

Cabling identification products.

8.3/125-micrometer, single mode optical fiber cabling.

DEFINITIONS

BICSI: Building Industry Consulting Service International.

Cross-Connect: A facility enabling the termination of cable elements and their interconnection or cross-connection.

EMI: Electromagnetic interference.

IDC: Insulation displacement connector.

LAN: Local area network.

RCDD: Registered Communications Distribution Designer.

UTP: Unshielded twisted pair.

BACKBONE CABLING DESCRIPTION

Backbone cabling system shall provide interconnections between Telecommunications rooms in the telecommunications cabling system structures. Cabling system consists of backbone cables, intermediate and main cross-connects mechanical terminations, and patch cables or jumpers used for backbone-to-backbone cross-connection.

Backbone cabling cross-connects shall be located in Telecommunications rooms. Bridged taps and splitters shall not be used as part of backbone cabling.

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PERFORMANCE REQUIREMENTS

General Performance: Backbone cabling system shall comply with transmission standards in ANSI/TIA/EIA-568-B.1, when tested according to test procedures of this standard.

SUBMITTALS

Product Data: For each type of product indicated.

Shop Drawings:

System Labeling Schedules: Electronic copy of labeling schedules, in software and format selected by Owner.

Cabling administration drawings and printouts.

Cabling diagrams to show typical cabling schematics including the following:

Cross-connects.

Patch panels.

Patch cables.

Cross-connects and patch panels. Detail mounting assemblies, and show elevations and physical relationship between the installed components.

Ladder rack layout, showing ladder rack route to scale, with relationship between the rack and adjacent structural, electrical, and mechanical elements. Include the following:

Vertical and horizontal offsets and transitions.

Clearances for access above and to side of ladder racks.

Vertical elevation of ladder racks above the floor or bottom of ceiling structure.

Load calculations to show dead and live loads as not exceeding manufacturer's rating for rack and its support elements.

Qualification Data: For Installer, qualified layout technician, installation supervisor, and field inspector.

Source quality-control reports.

Field quality-control reports.

Maintenance Data: For splices and connectors to include in maintenance manuals.

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Software and Firmware Operational Documentation:

Software operating and upgrade manuals.

Program Software Backup: On magnetic media or compact disk, complete with data files.

Device address list.

Printout of software application and graphic screens.

QUALITY ASSURANCE

Testing Agency Qualifications: An NRTL.

Testing Agency's Field Supervisor: Currently certified by BICSI as an RCDD to supervise on-site testing.

Surface-Burning Characteristics: As determined by testing identical products according to ASTM E-84 by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.

Flame-Spread Index: 25 or less.

Smoke-Developed Index: 50 or less.

Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

DELIVERY, STORAGE, AND HANDLING

Test cables upon receipt at Project site.

Test optical fiber cable to determine the continuity of the strand end to end. Use optical loss test set.

Retain test data and include the record in maintenance data.

Test each pair of UTP cable for open and short circuits.

PROJECT CONDITIONS

Environmental Limitations: Do not deliver or install cables and connecting materials until wet work in spaces is complete and dry, and temporary HVAC system is operating and maintaining ambient temperature and humidity conditions at occupancy levels during the remainder of the construction period. Floor tile shall be in place prior to mounting systems to the floor.

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COORDINATION

Coordinate layout and installation of telecommunications pathways and cabling with Owner's Representatives and BIT/RCDD.

SOFTWARE SERVICE AGREEMENT

Technical Support: Beginning with Substantial Completion, provide software support for two years.

Upgrade Service: Update software to latest version at Project completion. Install and program software upgrades that become available within two years from date of Substantial Completion. Upgrading software shall include operating system. Upgrade shall include new or revised licenses for use of software.

Provide 30 days' notice to Owner to allow scheduling and access to system and to allow Owner to upgrade computer equipment if necessary.

EXTRA MATERIALS

Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

Patch-Panel Units: 10% of each type.

Connectors and covers: 10% of each type.

PRODUCTS

EQUIPMENT FRAMES

Manufacturers: Subject to compliance with requirements, provide products by one of the following:

Cooper B-Line, Inc.

Leviton

Chatsworth (CPI)

CommScope, Inc

Siemon Co.

Panduit Corp.

Hubbell

General Frame Requirements:

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Equipment Frames: Freestanding, modular units designed for telecommunications terminal support and coordinated with dimensions of units to be supported.

Module Dimension: Width compatible with EIA 310 standard, 19-inch panel mounting.

Finish: Manufacturer's standard, baked-polyester black powder coat.

Floor-Mounted Racks: Modular-type, construction.

Vertical and horizontal cable management channels, top and bottom cable troughs, grounding lug.

Baked-polyester black powder coat finish.

Modular Freestanding Cabinets:

Removable and lockable side panels.

Hinged and lockable front and rear doors.

Adjustable feet for leveling.

Screened ventilation openings in the front and rear door.

Cable access provisions in the roof and base.

Grounding bus bar.

Roof or door mounted, 550-cfm fan with filter.

Power strip.

Baked-polyester black powder coat finish.

Cabinets keyed alike.

Cable Management for Equipment Frames:

Metal, with integral wire retaining fingers.

Baked-polyester black powder coat finish.

Vertical cable management panels shall have front and rear channels, with covers.

Provide horizontal crossover cable manager at the top of each relay rack, with a minimum height of two rack units each.

Horizontal cable managers shall have extended covers to hide patch cables lacing into vertical cable managers.

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UTP FEEDER CABLE

Manufacturers: Subject to compliance with requirements, provide products by one of the following:

Berk-Tek; a Nexans Company

Ortronics, Inc.

CommScope, Inc

Leviton

General Cable

Siemon Co.

Mohawk

ADC

Description: 100-ohm, see Drawings for number of pairs formed into 25-pair binder groups covered with a thermoplastic jacket.

Comply with ICEA S-90-661 for mechanical properties.

Comply with ANSI/TIA/EIA-568-B.1 for performance specifications.

Comply with ANSI/TIA/EIA-568-B.2.

Listed and labeled by an NRTL acceptable to authorities having jurisdiction as complying with UL 444 and NFPA 70 for the following types:

Communications, Riser Rated: Type CMR or CMP, complying with UL 1666.

UTP FEEDER CABLE HARDWARE

Manufacturers: Subject to compliance with requirements, provide products by one of the following:

Ortronics

CommScope, Inc

Leviton

Siemon

Hubbell

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Panduit

ADC

General Requirements for Cable Connecting Hardware: Comply with TIA/EIA-568-B.2, IDC type, with modules designed for punch-down caps or tools. Cables shall be terminated with connecting hardware of same category or higher. Connectivity solution shall be manufactured by the same company for an end-to-end solution.

Connecting Blocks (voice feeder only): 110-style IDC for Category 3. Provide blocks for the number of cables terminated on the block, plus 20 percent spare. Integral with connector bodies, including plugs and jacks where indicated.

Cross-Connect: Modular array of connecting blocks arranged to terminate building feeder cables and permit interconnection between cables.

Number of Terminals per Field: One for each conductor in assigned cables.

OPTICAL FIBER CABLE

Manufacturers: Subject to compliance with requirements, provide products by one of the following:

Berk-Tek; a Nexans Company.

Corning Cable Systems.

Mohawk, a division of Belden CDT.

Siemon Co.

CommScope, Inc

General Cable

Description: Multimode, 50/125-micrometer, number of strands as required, nonconductive dielectric, 900 UM tight buffered, optical fiber cable.

Comply with ICEA S-83-596 for mechanical properties.

Comply with ANSI/TIA/EIA-568-B.3 for performance specifications.

Comply with ANSI/TIA/EIA-492AAAA for detailed specifications .

Listed and labeled by an NRTL acceptable to authorities having jurisdiction as complying with UL 444, UL 1651, and NFPA 70 for the following types:

Riser Rated, Nonconductive: Type OFNR or OFNP, complying with UL 1666.

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Maximum Attenuation: 3.50 dB/km at 850 nm; 1.5 dB/km at 1300 nm.
Attenuation shall be measured in accordance with ANSI/EIA/TIA-455-46, 53 or 61.

Minimum Modal Bandwidth: 160 MHz-km at 850 nm; 500 MHz-km at 1300 nm.

Information transmission capacity shall be measured in accordance with ANSI/EIA/TIA-455-51 or 30, performed at 23 degrees Celsius \pm 5 degrees.

Bandwidth: 200 MHZ – km @ 850 nm; 800 MHZ – km @ 1300 nm.

Description: Single mode, 8.3/125-micrometer, number of strands as shown on drawings, nonconductive dielectric, 900 UM tight buffered, optical fiber cable.

Comply with ICEA S-83-596 for mechanical properties.

Comply with ANSI/TIA/EIA-568-B.3 for performance specifications.

Comply with ANSI/TIA/EIA-492BAAA for detailed specifications.

Listed and labeled by an NRTL acceptable to authorities having jurisdiction as complying with UL 444, UL 1651, and NFPA 70 for the following types:

Riser Rated, Nonconductive: Type OFNR or OFNP, complying with UL 1666.

Maximum Attenuation: 0.5 dB/km at 1310 nm and 0.5 dB/km at 1550 nm.

Mode Field Diameter: Between 8 and 10 microns, \pm 10%.

Dispersion: Zero dispersion wavelengths, 1310 nm \pm 10 nm, ANSI/TIA/EIA-455-169 or ANSI/TIA/EIA-455-175.

Cut-off wavelength shall be less than 1279 nm measured in accordance with ANSI/TIA/EIA-455-170.

Individual fiber tube colors per ANSI/TIA/EIA-606-A.

Jacket:

Jacket Color: Orange for multimode 50/125-micrometer cable and Yellow for single mode 8.3/125 micrometer cable.

Cable cordage jacket, fiber, unit, and group color shall be according to ANSI/TIA/EIA-598-B.

Imprinted with fiber count, fiber type, and aggregate length at regular intervals not to exceed 40 inches.

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OPTICAL FIBER CABLE HARDWARE

Manufacturers: Subject to compliance with requirements, provide products by one of the following:

Hubbell

Ortronics, Inc.

3M

ADC

Siemon Co.

Leviton

Panduit

CommScope, Inc

Cross-Connects and Patch Panels: Fiber panels shall be available in 1RU, 2RU and 4RU versions. Multi-mode and single mode fibers shall be terminated in separate enclosures.

Coordinate subparagraph below with Drawings for quantity of fields.

Number of Connectors per Field: One for each fiber of cable or cables assigned to field, plus spares and blank positions adequate to suit specified expansion criteria.

Patch Cables: Factory-made, dual-fiber patch cables in 1, 3 and 5 meter lengths.

Cable Connecting Hardware:

Comply with Optical Fiber Connector Intermateability Standards (FOCIS) specifications of ANSI/TIA/EIA-604-2, ANSI/TIA/EIA-604-3-A, and ANSI/TIA/EIA-604-12. Comply with ANSI/TIA/EIA-568-B.3.

Quick-connect, simplex and duplex, Type SC connectors. Insertion loss not more than 0.75 dB. Minimum return loss of 20 dB.

Type SFF connectors may be used in termination racks, panels, and equipment packages.

The connector shall have optical axial pull strength at 2.2N at 0 degree angle and 2.2N at 90 degree angle, with a maximum 0.5 dB increase in attenuation in accordance with ANSI/TIA/EIA-455-6B.

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IDENTIFICATION PRODUCTS

Comply with TIA/EIA-606-A and UL 969 for a system of labeling materials, including label stocks, laminating adhesives, and inks used by label printers.

SOURCE QUALITY CONTROL

Factory test cables on reels according to ANSI/TIA/EIA-568-B.1.

Factory test UTP cables according to ANSI/TIA/EIA-568-B.2.

Factory test optical fiber cables according to ANSI/TIA/EIA-526-14-A and ANSI/TIA/EIA-568-B.3.

Cable will be considered defective if it does not pass tests and inspections.

Prepare test and inspection reports.

Optical fiber cable strands shall be tested using an OTDR. Test results shall conform to ANSI/TIA/EIA-526-7 for single mode and ANSI/TIA/EIA-526-14A for multimode.

EXECUTION

ENTRANCE FACILITIES

Coordinate backbone cabling with the protectors and demarcation point provided by communications service entrance facilities provider with BIT/RCDD.

CABLING METHODS

Cabling Method: Install cables in raceways and ladder racks except within equipment racks and cabinets. Conceal raceway and cables except in unfinished spaces.

Comply with requirements for raceways and boxes specified in Division 26 Section 26050.

Cabling Method: Conceal conductors and cables in accessible ceilings, walls, and floors where possible.

Cabling within Enclosures: Bundle, lace, and train cables within enclosures. Connect to terminal points with no excess and without exceeding manufacturer's limitations on bending radii. Provide and use lacing bars and distribution spools.

INSTALLATION OF CABLES

Comply with NECA 1.

General Requirements for Cabling:

Comply with ANSI/TIA/EIA-568-B.1.

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Comply with BICSI ITSIM, Ch. 6, "Cable Termination Practices."

Install 110-style IDC termination hardware unless otherwise indicated.

Terminate all conductors; no cable shall contain un-terminated elements. Make terminations only at indicated outlets, terminals, cross-connects, and patch panels.

Cables shall not be spliced. Secure and support cables at intervals not exceeding 30 inches and not more than 6 inches from cabinets, boxes, fittings, outlets, racks, frames, and terminals.

Install lacing bars to restrain cables, to prevent straining connections, and to prevent bending cables to smaller radii than minimums recommended by manufacturer.

Bundle, lace, and train conductors to terminal points without exceeding manufacturer's limitations on bending radii, but not less than radii specified in BICSI ITSIM, "Cabling Termination Practices" Chapter. Use lacing bars and distribution spools.

Do not install bruised, kinked, scored, deformed, or abraded cable. Do not splice cable between termination, tap, or junction points. Remove and discard cable if damaged during installation and replace it with new cable.

In the communications equipment room, install a 25-foot- long service loop on each end of cable.

Pulling Cable: Comply with BICSI ITSIM, Ch. 4, "Pulling Cable." Monitor cable pull tensions.

UTP Cable Installation:

Comply with ANSI/TIA/EIA-568-B.2.

Do not untwist UTP cables more than 1/2 inch from the point of termination to maintain cable geometry.

Do not remove more than 1/2 inch of the outer jacket.

Optical Fiber Cable Installation:

Comply with ANSI/TIA/EIA-568-B.3.

Cable may be terminated on connecting hardware that is rack or cabinet mounted.

Open-Cable Installation:

Install cabling with horizontal and vertical cable guides in telecommunications spaces with terminating hardware and interconnection equipment.

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Cable shall not be run through structural members or in contact with pipes, ducts, or other potentially damaging items.

Group connecting hardware for cables into separate logical fields.

Separation from EMI Sources:

Comply with BICSI TDMM and ANSI/TIA/EIA-569-B recommendations for separating unshielded copper voice and data communication cable from potential EMI sources, including electrical power lines and equipment.

Separation between open communications cables or cables in nonmetallic raceways and unshielded power conductors and electrical equipment shall be as follows:

Electrical Equipment Rating Less Than 2 kVA: A minimum of 5 inches.

Electrical Equipment Rating between 2 and 5 kVA: A minimum of 12 inches.

Electrical Equipment Rating More Than 5 kVA: A minimum of 24 inches.

Separation between communications cables in grounded metallic raceways and unshielded power lines or electrical equipment shall be as follows:

Electrical Equipment Rating Less Than 2 kVA: A minimum of 2-1/2 inches.

Electrical Equipment Rating between 2 and 5 kVA: A minimum of 6 inches.

Electrical Equipment Rating More Than 5 kVA: A minimum of 12 inches.

Separation between communications cables in grounded metallic raceways and power lines and electrical equipment located in grounded metallic conduits or enclosures shall be as follows:

Electrical Equipment Rating Less Than 2 kVA: No requirement.

Electrical Equipment Rating between 2 and 5 kVA: A minimum of 3 inches.

Electrical Equipment Rating More Than 5 kVA: A minimum of 6 inches.

Separation between Communications Cables and Electrical Motors and Transformers, 5 kVA or HP and Larger: A minimum of 48 inches.

Separation between Communications Cables and Fluorescent Fixtures: A minimum of 12 inches.

FIRE STOPPING

Comply with requirements in Division 07 Section "Through-Penetration Firestop Systems." Comply with ANSI/TIA/EIA-569-B, Annex A, "Fire stopping."

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Comply with BICSI TDM, "Fire stopping Systems" Article.

IDENTIFICATION

Identify system components, cabling, and cabling complying with ANSI/TIA/EIA-606-A.
Comply with requirements for identification specified.

See Division 27 Section "Communications Horizontal Cabling" for additional identification requirements. See Evaluations for discussion about ANSI/TIA/EIA standard as it applies to this Section. Paint and label colors for equipment identification shall comply with ANSI/TIA/EIA-606-A.

Comply with requirements in Division 27 Section "Communications Horizontal Cabling" for cable and asset management software.

Cable Schedule: Install in a prominent location in each equipment room and cabling closet. List incoming and outgoing cables and their designations, origins, and destinations. Protect with rigid frame and clear plastic cover. Furnish an electronic copy of final comprehensive schedules for Project.

Cabling Administration Drawings: Show building floor plans with cabling administration-point labeling. Identify labeling convention and show labels for telecommunications closets, backbone pathways and cables, terminal hardware and positions, horizontal cables, work areas and workstation terminal positions, grounding buses and pathways, and equipment grounding conductors.

Cable and Wire Identification:

Label each cable within 6 inches of each termination and tap, where it is accessible in a cabinet or junction or outlet box, and elsewhere as indicated.

Each wire connected to building-mounted devices is not required to be numbered at device if color of wire is consistent with associated wire connected and numbered within panel or cabinet.

Label each terminal strip and screw terminal in each cabinet, rack, or panel.

Individually number cabling conductors connected to terminal strips and identify each cable or cabling group being extended from a panel or cabinet to a building-mounted device with name and number of particular device as shown.

Label each unit and field within distribution racks and frames.

Identification within Connector Fields in Equipment Rooms and Cabling Closets:
Label each connector and each discrete unit of cable-terminating and connecting hardware.

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Labels shall be preprinted or computer-printed type with printing area and font color that contrasts with cable jacket color but still complies with requirements in ANSI/TIA/EIA 606-A, for the following:

Cables use flexible vinyl or polyester that flexes as cables are bent.

FIELD QUALITY CONTROL

Perform tests and inspections.

Tests and Inspections:

Visually inspect UTP and optical fiber jacket materials for NRTL certification markings. Inspect cabling terminations in communications equipment rooms for compliance with color-coding for pin assignments, and inspect cabling connections for compliance with ANSI/TIA/EIA-568-B.1.

Visually inspect cable placement, cable termination, grounding and bonding, equipment and patch cables, and labeling of components.

Test UTP copper cabling for DC loop resistance, shorts, opens, intermittent faults, and polarity between conductors. Test operation of shorting bars in connection blocks. Test cables after termination but not cross-connection.

Test instruments shall meet or exceed applicable requirements in ANSI/TIA/EIA-568-B.2. Perform tests with a tester that complies with performance requirements in "Test Instruments (Normative)" Annex, complying with measurement accuracy specified in "Measurement Accuracy (Informative)" Annex. Use only test cables and adapters that are qualified by test equipment manufacturer for channel or link test configuration.

Optical Fiber Cable Tests:

Test instruments shall meet or exceed applicable requirements in ANSI/TIA/EIA-568-B.1. Use only test cables and adapters that are qualified by test equipment manufacturer for channel or link test configuration.

Link End-to-End Attenuation Tests:

Horizontal and multimode backbone link measurements: Test at 850 or 1300 nm in 1 direction according to ANSI/TIA/EIA-526-14-A, Method B, One Reference Jumper.

Attenuation test results for backbone links shall be less than 2.0 dB. Attenuation test results shall be less than that calculated according to equation in ANSI/TIA/EIA-568-B.1.

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Data for each measurement shall be documented. Data for submittals shall be printed in a summary report that is formatted similar to Table 10.1 in BICSI TDMM, or transferred from the instrument to the computer, saved as text files, and printed and submitted.

Remove and replace cabling where test results indicate that they do not comply with specified requirements.

End-to-end cabling will be considered defective if it does not pass tests and inspections.

Prepare test and inspection reports.

WARRANTY

The Structured Cabling System shall carry a manufacturer's 25 year product, labor and applications assurance warranty. Manufacturer and BIT/RCDD shall perform an end-to-end audit on infrastructure prior to releasing warranty.

END OF SECTION

SECTION 271300 – COMMUNICATIONS BACKBONE CABLING

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PART 5 - GENERAL

RELATED DOCUMENTS

Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

SUBMITTALS

Product Data:

For coaxial cable, include the following installation data:

Nominal OD.

Minimum bending radius.

Maximum pulling tension.

QUALITY ASSURANCE

Testing Agency Qualifications: An NRTL.

Testing Agency's Field Supervisor: Currently certified by BICSI as an RCDD to supervise on-site testing.

Surface-Burning Characteristics: As determined by testing identical products according to ASTM E 84 by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.

Flame-Spread Index: 25 or less.

Smoke-Developed Index: 50 or less.

Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

COAXIAL BACKBONE CABLING

Coaxial Backbone Cabling

Provide 2 GHz 75-ohm coaxial cable for Video and Broadband (CATV) applications.

PRODUCTS

COAXIAL BACKBONE CABLING

Manufacturers: Subject to compliance with requirements, provide products by one of the following:

Alpha Wire Company.

Belden CDT Inc.; Electronics Division.

Coleman Cable, Inc.

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Siemon Company.

General Cable

CommScope, Inc

General Coaxial Cable Requirements: Broadband type, recommended by cable manufacturer specifically for broadband data transmission applications. Coaxial cable and accessories shall have 75-ohm nominal impedance with a return loss of 20 dB maximum from 7 to 806 MHz.

RG-11/U: NFPA 70, Type CATV.

No. 14 AWG, solid, copper-covered steel conductor.

Gas-injected, foam-PE insulation.

Double shielded with 100 percent aluminum polyester tape and 60 percent aluminum braid.

Jacketed with sunlight-resistant, black PVC or PE.

Suitable for outdoor installations in ambient temperatures ranging from minus 40 to plus 85 deg C.

NFPA and UL compliance listed and labeled by an NRTL acceptable to authorities having jurisdiction as complying with UL 1655 and with NFPA 70, "Radio and Television Equipment" and "Community Antenna Television and Radio Distribution" Articles. Types are as follows:

CATV Riser Rated: Type CATVR or CATVP, complying with UL 1666.

Cables shall be 100 percent sweep tested for attenuation and signal return loss (SRL) throughout the entire frequency spectrum.

EXECUTION

COAXIAL BACKBONE CABLING

Coaxial backbone cables shall be installed by the LVLTC per the manufacturer's installation recommendations.

Coaxial backbone cables shall have no physical defects such as cuts, tears or bulges in the outer jacket. Coaxial backbone cables with defects shall be replaced.

The LVLTC shall install coaxial backbone cables in a neat and workmanlike manner per the BICSI Installation Manual. The LVLTC shall maintain the following clearances from EMI sources:

Power – 12 inches

Fluorescent Lights – 12 inches

Transformers – 36 inches

FIELD QUALITY CONTROL

Installed cables shall pass the testing requirements of ANSI/TIA/EIA-568-B.

SECTION 271300 – COMMUNICATIONS BACKBONE CABLING

GOVERNMENT OF THE U. S. VIRGIN ISLANDS, DEPARTMENT OF PUBLIC WORKS

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Test and Inspections:

Visually inspect coaxial cable jacket materials for NRTL certification markings.

Visually inspect cable placement, cable termination, grounding and bonding, equipment, and labeling of components.

Remove and replace cabling where test results indicate that they do not comply with specified requirements.

End-to-end cabling will be considered defective if it does not pass tests and inspections.

Prepare test and inspection reports.

END OF SECTION

SECTION 271300 – COMMUNICATIONS BACKBONE CABLING

GOVERNMENT OF THE U. S. VIRGIN ISLANDS, DEPARTMENT OF PUBLIC WORKS

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SECTION 280500 – COMMON WORK RESULTS FOR ELECTRONIC SAFETY AND SECURITY

GOVERNMENT OF THE U. S. VIRGIN ISLANDS, DEPARTMENT OF PUBLIC WORKS

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PART 6 - GENERAL

RELATED DOCUMENTS

Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

EXTRA MATERIALS

Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

Patch-Panel Units: 10% of each type.

Work Area outlets including covers and jacks: 10% of each type.

PRODUCTS

COAXIAL CABLE HARDWARE

Manufacturers: Subject to compliance with requirements, provide products by one of the following:

Aim Electronics

Leviton

Siemon

General Cable

CommScope, Inc

Coaxial-Cable Connectors: Type F connectors, 75 ohms.

Connectors shall be sized to fit the appropriate cable being installed.

Patch panels shall support F type connectors.

F type connectors shall meet or exceed the requirements of ANSI/SCTE 02 1997.

EXECUTION

TERMINATIONS

Splitter and tap ports shall be capped with 75 ohm terminators or a video display terminal as applicable.

END OF SECTION

SECTION 280500 – COMMON WORK RESULTS FOR ELECTRONIC SAFETY AND SECURITY

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PART 7 - GENERAL

RELATED DOCUMENTS

General provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

SUMMARY

Section Includes:

Pathways.

UTP cabling.

Cable connecting hardware, patch panels, and cross-connects.

Telecommunications outlet/connectors.

Cabling system identification products.

Cable management system.

Related Sections:

Division 27 Section "Communications Backbone Cabling" for voice and data cabling associated with system panels and devices.

DEFINITIONS

BICSI: Building Industry Consulting Service International.

Cross-Connect: A facility enabling the termination of cable elements and their interconnection or cross-connection.

EMI: Electromagnetic interference.

IDC: Insulation displacement connector.

LAN: Local area network.

Outlet/Connectors: A connecting device in the work area on which horizontal cable or outlet cable terminates.

RCDD: Registered Communications Distribution Designer.

UTP: Unshielded twisted pair.

HORIZONTAL CABLING DESCRIPTION

Horizontal cable and its connecting hardware provide the means of transporting signals between the telecommunications outlet/connector and the horizontal cross-connect located in the communications equipment room. This cabling and its connecting hardware are called "permanent link," a term that is used in the testing protocols.

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ANSI/TIA/EIA-568-B.1 requires that a minimum of two telecommunications outlet/connectors be installed for each work area.

Horizontal cabling shall contain no more than one transition point or consolidation point between the horizontal cross-connect and the telecommunications outlet/connector.

Bridged taps and splices shall not be installed in the horizontal cabling.

Splitters shall not be installed as part of the optical fiber cabling.

A work area is approximately 100 sq. ft., and includes the components that extend from the telecommunications outlet/connectors to the station equipment.

The maximum allowable horizontal cable length is 250 feet. This maximum allowable length does not include an allowance for the length of 16 feet to the workstation equipment. The maximum allowable length does not include an allowance for the length of 16 feet in the horizontal cross-connect.

PERFORMANCE REQUIREMENTS

General Performance: Horizontal cabling system shall comply with transmission standards in ANSI/TIA/EIA-568-B.1, when tested according to test procedures of this standard.

SUBMITTALS

Product Data: For each type of product indicated.

For UTP cable, include the following installation data for each type used:

Nominal OD.

Minimum bending radius.

Maximum pulling tension.

Shop Drawings:

System Labeling Schedules: Electronic copy of labeling schedules, in software and format selected by Owner.

System Labeling Schedules: Electronic copy of labeling schedules that are part of the cabling and asset identification system of the software.

Cabling administration drawings and printouts.

Cabling diagrams to show typical cabling schematics, including the following:

Cross-connects.

Patch panels.

Patch cables.

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Cross-connects and patch panels. Detail mounting assemblies, and show elevations and physical relationship between the installed components.

Samples: For workstation outlets, jacks, jack assemblies, in specified finish, one for each size and outlet configuration and faceplates for color selection and evaluation of technical features.

Qualification Data: For Installer, layout technician, installation supervisor, and field inspector.

Source quality-control reports.

Field quality-control reports.

Maintenance Data: For splices and connectors to include in maintenance manuals.

Software and Firmware Operational Documentation:

Software operating and upgrade manuals.

Program Software Backup: On magnetic media or compact disk, complete with data files.

Device address list.

Printout of software application and graphic screens.

QUALITY ASSURANCE

Testing Agency Qualifications: An NRTL.

Testing Agency's Field Supervisor: Currently certified by BICSI as an RCDD to supervise on-site testing.

Surface-Burning Characteristics: As determined by testing identical products according to ASTM E 84 by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.

Flame-Spread Index: 25 or less.

Smoke-Developed Index: 50 or less.

Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

DELIVERY, STORAGE, AND HANDLING

Test cables upon receipt at Project site.

Test each pair of UTP cable for open and short circuits.

PROJECT CONDITIONS

Environmental Limitations: Do not deliver or install cables and connecting materials until wet work in spaces is complete and dry, and temporary HVAC system is operating and maintaining ambient temperature and humidity conditions at occupancy levels during the remainder of the construction period.

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COORDINATION

Coordinate layout and installation of telecommunications pathways and cabling with BIT/RCDD and the Agency Representative.

Coordinate telecommunications outlet/connector locations with location of power receptacles at each work area.

SOFTWARE SERVICE AGREEMENT

Technical Support: Beginning with Substantial Completion, provide software support for two years.

Upgrade Service: Update software to latest version at Project completion. Install and program software upgrades that become available within two years from date of Substantial Completion. Upgrading software shall include operating system. Upgrade shall include new or revised licenses for use of software.

Provide 30 days' notice to Owner to allow scheduling and access to system and to allow Owner to upgrade computer equipment if necessary.

EXTRA MATERIALS

Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

Patch-Panel Units: 10% of each type.

Connecting Jacks: 10% of each type.

Device Plates: 10% of each type.

PRODUCTS

UTP CABLE

Manufacturers: Subject to compliance with requirements, provide products by one of the following:

Berk-Tek; a Nexans company.

ADC

Siemon Co.

Mohawk

Belden

CommScope, Inc

Description: 100-ohm, 4-pair UTP, 250 MHz certified cable, covered with a **Blue** thermoplastic jacket or as directed by the US Virgin Islands RCDD.

Comply with ICEA S-90-661 for mechanical properties.

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Comply with ANSI/TIA/EIA-568-B.1 for performance specifications.

Comply with ANSI/TIA/EIA-568-B.2, Category 6.

Listed and labeled by an NRTL acceptable to authorities having jurisdiction as complying with UL 444 and NFPA 70 for the following types:

Communications, Plenum Rated: Type CMP.

UTP CABLE HARDWARE

Manufacturers: Subject to compliance with requirements, provide products by one of the following:

Hubbell

Siemon Co.

ADC

Ortronics, Inc.

Panduit

Leviton

CommScope, Inc

General Requirements for Cable Connecting Hardware: Comply with ANSI/TIA/EIA-568-B.2, IDC type, with modules designed for punch-down caps or tools. Cables shall be terminated with connecting hardware of same category or higher.

Connecting Jack: 110-style IDC rated for Category 6. Integral with connector bodies, including plugs and jacks where indicated.

Cross-Connect: Modular array of connecting blocks arranged to terminate building cables and permit interconnection between cables.

Number of Terminals per Field: One for each conductor in assigned cables.

Patch Panel: Modular panels housing multiple-numbered jack units with IDC-type connectors at each jack for permanent termination of pair groups of installed cables. Patch panels shall support labels and colored icons. Patch panels must have rear management bar for strain relief of horizontal cables. Coordinate subparagraph below with Drawings for quantity of fields.

Number of Jacks per Field: One for each four-pair UTP cable indicated.

Jacks and Jack Assemblies: Modular, color-coded, eight-position modular receptacle units with integral IDC S310-type terminals. Jacks shall be universally wired, angled, have a rear strain relief cap, and protective color-matching rubber door.

Patch Cables:

Patch cables shall be 100% factory-made and tested four-pair cables available in 10 feet lengths not to exceed 33 feet, white in color. Patch cables shall be made by the same manufacturer

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as the installed system to ensure a full channel warranty. Work area patch cables shall have bend-relief-compliant boots to ensure Category 6 performance. Patch cables shall have latch guards to protect against snagging and terminated with an eight position modular plug at each end. Work area patch cables shall be provided for 100% of horizontal cables terminated.

(If Required) Analyzers and Supporting cable management hardware. This is the equipment that will provide the link between the network cabling system and the management software.

Analyzers: Must be available in multiple sizes to best fit port count per termination room. Analyzers are available in Master / Link or Standalone in both 1RU and 6RU. Expansion cards are available in multiples of 240 ports to expend the 6RU analyzer up to 1920 total ports.

I/O System Cables: System cables shall be used to connect the analyzers to patch panels, fiber enclosures, and sensor strips. When possible, single ended cables shall be used to eliminate excess slack. I/O cables shall be 26 AWG solid, non-plenum cables.

TELECOMMUNICATIONS OUTLET/CONNECTORS

Jacks: 100-ohm, balanced, twisted-pair connector; four-pair, eight-position modular. Comply with ANSI/TIA/EIA-568-B.1.

Workstation Outlets: Four port-connector assemblies mounted in single faceplate.

Plastic Faceplate: High-impact plastic. Coordinate color with Division 26 Section 26050 and Interior Designer.

For use with snap-in jacks accommodating any combination of UTP, optical fiber, and coaxial work area cables.

Flush mounting jacks, positioning the cable at a 45-degree angle.

Legend: Snap-in, clear-label covers and machine-printed paper inserts.

IDENTIFICATION PRODUCTS

Comply with ANSI/TIA/EIA-606-A and UL 969 for labeling materials, including label stocks, laminating adhesives, and inks used by label printers.

Comply with requirements in Division 26 Section 26010.

CABLE MANAGEMENT SYSTEM

Manufacturers: Subject to compliance with requirements, provide products by the following:

Description: Computer-based cable management system, with integrated database and graphic capabilities.

Document physical characteristics by recording the network, TIA/EIA details, and connections between equipment and cable.

Information shall be presented in database view, schematic plans, or technical drawings.

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Microsoft Visio Professional or AutoCAD drawing software shall be used as drawing and schematic plans software.

System shall interface with the following testing and recording devices:

Direct upload tests from circuit testing instrument into the personal computer.

Direct download circuit labeling into labeling printer.

SOURCE QUALITY CONTROL

Testing Agency: Engage a qualified testing agency to evaluate cables.

Factory test UTP and optical fiber cables on reels according to ANSI/TIA/EIA-568-B.1.

Factory test UTP cables according to ANSI/TIA/EIA-568-B.2.

Cable will be considered defective if it does not pass tests and inspections.

Prepare test and inspection reports.

EXECUTION

CABLING METHODS

Cabling Method: Install cables in raceways provided by Division 26 and adjustable cable straps except within cabinets, desks, and counters. Conceal cables except in unfinished spaces.

Install plenum cable in environmental air spaces, including plenum ceilings.

Comply with requirements for raceways and boxes specified in Division 26 Section 26050.

Cabling Method: Conceal conductors and cables in accessible ceilings, walls, and floors where possible.

Cabling within Enclosures: Bundle, lace, and train cables to terminal points with no excess and without exceeding manufacturer's limitations on bending radii. Provide and use lacing bars and distribution spools.

INSTALLATION OF CABLES

Comply with NECA 1.

General Requirements for Cabling:

Comply with ANSI/TIA/EIA-568-B.1.

Comply with BICSI ITSIM, Ch. 6, "Cable Termination Practices."

Install 110-style IDC termination hardware unless otherwise indicated.

Comply with the US Virgin Islands Telecommunications Distribution Manual.

Terminate conductors; no cable shall contain un-terminated elements. Make terminations only at indicated outlets, terminals, cross-connects, and patch panels.

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Cables may not be spliced. Secure and support cables at intervals not exceeding **30 inches** and not more than **6 inches** from cabinets, boxes, fittings, outlets, racks, frames, and terminals.

Install lacing bars to restrain cables, to prevent straining connections, and to prevent bending cables to smaller radii than minimums recommended by manufacturer.

Bundle, lace, and train conductors to terminal points without exceeding manufacturer's limitations on bending radii, but not less than radii specified in BICSI ITSM, "Cabling Termination Practices" Chapter. Install lacing bars and distribution spools.

Do not install bruised, kinked, scored, deformed, or abraded cable. Do not splice cable between termination, tap, or junction points. Remove and discard cable if damaged during installation and replace it with new cable.

In the communications equipment room, install a **10-foot-** long service loop on each end of cable.

Pulling Cable: Comply with BICSI ITSM, Ch. 4, "Pulling Cable." Monitor cable pull tensions.

UTP Cable Installation:

Comply with ANSI/TIA/EIA-568-B.2.

Do not untwist UTP cables more than **1/2 inch** from the point of termination to maintain cable geometry.

Do not remove more than 1/2 inch of jacket material.

Open-Cable Installation:

Install cabling with horizontal and vertical cable guides in telecommunications spaces with terminating hardware and interconnection equipment.

Suspend UTP cable not in a wire way or pathway a minimum of **8 inches** above ceilings by cable supports not more than **60 inches** apart.

Cable shall not be run through structural members or in contact with pipes, ducts, or other potentially damaging items.

Group connecting hardware for cables into separate logical fields.

Separation from EMI Sources:

Comply with BICSI TDMM and ANSI/TIA/EIA-569-A for separating structural cable from potential EMI sources, including electrical power lines and equipment.

Separation between open communications cables or cables in nonmetallic raceways and unshielded power conductors and electrical equipment shall be as follows:

Electrical Equipment Rating Less Than 2 kVA: A minimum of 5 inches.

Electrical Equipment Rating between 2 and 5 kVA: A minimum of 12 inches.

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Electrical Equipment Rating More Than 5 kVA: A minimum of 24 inches.

Separation between communications cables in grounded metallic raceways and unshielded power lines or electrical equipment shall be as follows:

Electrical Equipment Rating Less Than 2 kVA: A minimum of 2-1/2 inches.

Electrical Equipment Rating between 2 and 5 kVA: A minimum of 6 inches.

Electrical Equipment Rating More Than 5 kVA: A minimum of 12 inches.

Separation between communications cables in grounded metallic raceways and power lines and electrical equipment located in grounded metallic conduits or enclosures shall be as follows:

Electrical Equipment Rating Less Than 2 kVA: No requirement.

Electrical Equipment Rating between 2 and 5 kVA: A minimum of 3 inches.

Electrical Equipment Rating More Than 5 kVA: A minimum of 6 inches.

Separation between Communications Cables and Electrical Motors and Transformers, 5 kVA or HP and Larger: A minimum of 48 inches.

Separation between Communications Cables and Fluorescent Fixtures: A minimum of 12 inches.

FIRESTOPPING

Comply with requirements in Division 07 Section "Through-Penetration Firestop Systems."

Comply with ANSI/TIA/EIA-569-B, Annex A, "Firestopping."

Comply with BICSI TDMM, "Firestopping Systems" Article.

IDENTIFICATION

Identify system components, cabling, and cabling complying with ANSI/TIA/EIA-606-A. Comply with requirements for identification specified in Division 26 Section 26010.

Color-code cross-connect fields. Apply colors to telecommunications terminal backboards, connections, covers, and labels.

Using cable management system software specified in Part 2, develop Cabling Administration Drawings for system identification, testing, and management. Use unique, alphanumeric designation for each cable and label cable, jacks, connectors, and terminals to which it connects with same designation. At completion, cable and asset management software shall reflect as-built conditions.

Comply with requirements in Division 09 Section "Interior Painting" for painting backboards. For fire-resistant plywood, do not paint over manufacturer's label.

Paint and label colors for equipment identity shall comply with ANSI/TIA/EIA-606-A.

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Cable Schedule: Post in prominent location in each equipment room. List incoming and outgoing cables and their designations, origins, and destinations. Protect with rigid frame and clear plastic cover. Furnish an electronic copy of final comprehensive schedules for Project.

Cabling Administration Drawings: Show building floor plans with cabling administration-point labeling. Identify labeling convention and show labels for telecommunications rooms, backbone pathways and cables, terminal hardware and positions, horizontal cables, work areas and workstation terminal positions, grounding buses and pathways, and equipment grounding conductors. Follow convention of ANSI/TIA/EIA-606-A. Furnish electronic record of all drawings, in the latest version of AutoCad.

Cable and Wire Identification:

Label each cable within **6 inches** of each termination and tap, where it is accessible in a cabinet or junction or outlet box, and elsewhere as indicated.

Each wire connected to building-mounted devices is not required to be numbered at device if color of wire is consistent with associated wire connected and numbered within panel or cabinet.

Exposed Cables and Cables in Ladder Rack: Label each cable at intervals not exceeding **15 feet**.

Label each terminal strip and screw terminal in each cabinet, rack, or panel.

Individually number cabling conductors connected to terminal strips, and identify each cable or cabling group being extended from a panel or cabinet to a building-mounted device shall be identified with name and number of particular device as shown.

Label each unit and field within distribution racks and frames.

Identification within Connector Fields in Equipment Rooms and Cabling Closets: Label each connector and each discrete unit of cable-terminating and connecting hardware.

Labels shall be preprinted or computer-printed type with printing area and font color that contrasts with cable jacket color but still complies with requirements in ANSI/TIA/EIA-606-A.

Cables use flexible vinyl or polyester that flex as cables are bent.

FIELD QUALITY CONTROL

Perform tests and inspections.

Tests and Inspections:

Visually inspect UTP cable jacket materials for NRTL certification markings. Inspect cabling terminations in communications equipment rooms for compliance with color-coding for pin assignments, and inspect cabling connections for compliance with ANSI/TIA/EIA-568-B.1.

Visually confirm Category 6, marking of outlets, cover plates, outlet/connectors, and patch panels.

Visually inspect cable placement, cable termination, grounding and bonding, equipment and patch cables, and labeling of all components.

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UTP Performance Tests:

Perform the following tests according to ANSI/TIA/EIA-568-B.1 and ANSI/TIA/EIA-568-B.2:

Wire map.

Length (physical vs. electrical, and length requirements).

Insertion loss.

Near-end crosstalk (NEXT) loss.

Power sum near-end crosstalk (PSNEXT) loss.

Equal-level far-end crosstalk (ELFEXT).

Power sum equal-level far-end crosstalk (PSELFEXT).

Return loss.

Propagation delay.

Delay skew.

Final Verification Tests: Perform verification tests for UTP systems after the complete communications cabling and workstation outlet/connectors are installed.

Document data for each measurement. Data for submittals shall be printed in a summary report that is formatted similar to Table 10.1 in BICSI TDMM, or transferred from the instrument to the computer, saved as text files, and printed and submitted.

End-to-end cabling will be considered defective if it does not pass tests and inspections.

Prepare test and inspection reports.

DEMONSTRATION

Engage a factory-authorized service representative to train Owner's maintenance personnel in cable-plant management operations, including changing signal pathways for different workstations, rerouting signals in failed cables, and keeping records of cabling assignments and revisions when extending cabling to establish new workstation outlets. Include training in cabling administration software.

WARRANTY

The Structured Cabling System shall carry a manufacturer's 25 year product, labor and applications assurance warranty. Manufacturer and BIT/RCDD shall perform an end-to-end audit on infrastructure prior to releasing warranty

END OF SECTION

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DIVISION 27 COMMUNICATION SECTION 272000



SECTION 27 20 00 COMMUNICATION DISTRIBUTION SYSTEMS

Display hidden notes to specifier. (Don't know how? [Click Here](#))

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PART 8 - GENERAL

SECTION INCLUDES

Panels, enclosures, and covers.

Modules.

Patch panels.

Jacks.

Faceplates.

Accessories.

Couplers and adapters.

Fiber accessories.

Inline xDSL filters.

Modular plugs.

Patch cords.

Wall mount xDSL filters.

Contractor panel kits.

RELATED SECTIONS

Section 07 84 13 - Penetration Firestopping.

Section 26 05 00 - Common Work Results for Electrical.

Section 26 05 48 - Vibration and Seismic Controls for Electrical Systems.

Section 26 27 16 - Electrical Cabinets and Enclosures.

REFERENCES

American Council for Terminal Attachments (ACTA).

American National Standards Institute (ANSI):

ANSI T1.421 - In-Line Filter for Use with Voiceband Terminal Equipment Operating on the Same Wire Pair with High Frequency (up to 12 MHz) Devices.

Electronic Industries Alliance (EIA).

Federal Communications Commission (FCC):

Part 68 of the FCC rules (47 C.F.R. Part 68) - Governs the direct connection of Terminal Equipment (TE) to the Public Switched Telephone Network (PSTN), and to wireline carrier-owned facilities used to provide private line services.

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National Electrical Manufacturer Association (NEMA):

Society of Cable Engineers (SCTE):

ANSI/SCTE 02 - Specification for "F" Port, Female, Indoor.

Telecommunications General Requirements (GR):

GR-3123-CORE - Generic Requirements for Indoor Fiber Distribution Hubs.

GR-3125-CORE - Outdoor Fiber Distribution Hubs - new GR for FTTP.

Telecommunications Industry Association (TIA):

TIA 1096 - Telecommunications Telephone Terminal Equipment Connector Requirements for Connection of Terminal Equipment to the Telephone Network.

TIA/EIA 568-C.2 - Balanced Twisted-Pair Telecommunication Cabling and Components Standard.

Underwriters Laboratories (UL):

UL-94-V0 - Standard for Tests for Flammability of Plastic Materials for Parts in Devices and Appliances; burning stops within 10 seconds on a vertical specimen; drips of particles allowed if they are not inflamed.

UL 1863 - Standard for Communications-Circuit Accessories.

UL 2416 - Standard for Audio/Video, Information and Communication Technology Equipment Cabinet, Enclosure and Rack Systems.

Underwriters Laboratories Canada (ULC):

SUBMITTALS

Submit under provisions of Section 01 30 00 - Administrative Requirements.

Product Data:

Manufacturer's data sheets on each product to be used.

Preparation instructions and recommendations.

Storage and handling requirements and recommendations.

Installation methods.

Verification Samples: Submit two full size glass block units of each type, size, pattern and color.

Manufacturer's Certificates and Test Reports: Certify products meet or exceed specified requirements.

Test reports should be within 12 months of bid date.

QUALITY ASSURANCE

Manufacturer Qualifications: Company specializing in manufacturing products specified in this section with a minimum ten years documented experience.

Products: Listed and classified by Underwriters Laboratories, Inc. as suitable for the purpose specified and indicated.

Mock-Up: Prior to starting work assemble sample panels for Architect's inspection and acceptance. Build in locations acceptable to the Architect. Construct sample panels with required accessories. Provide special features as directed.

Build sample panels for each different situation.

Retain sample panels during construction as a standard for judging completed work. Do not alter, move, or destroy sample panels until work is completed or removal is authorized.

DELIVERY, STORAGE, AND HANDLING

Store products in manufacturer's unopened packaging until ready for installation.

Store and handle in strict compliance with manufacturer's written instructions and recommendations.

Protect from damage due to weather, excessive temperature, and construction operations.

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SEQUENCING

Ensure that products of this section are supplied to affected trades in time to prevent interruption of construction progress.

PROJECT CONDITIONS

Maintain environmental conditions (temperature, humidity, and ventilation) within limits recommended by manufacturer for optimum results. Do not install products under environmental conditions outside manufacturer's recommended limits.

WARRANTY

Provide manufacturers 10 Year limited Warranty.

PART 9 - PRODUCTS

MANUFACTURERS

Acceptable Manufacturer: Suttle, which is located at: 1001 E. Highway 212; Hector, MN 55342; Toll Free Tel: 800-852-8662; Tel: 320-848-6711; Fax: 320-848-6218; Email:[request info](mailto:request%20info@suttle.sales@suttlesolutions.com) (suttle.sales@suttlesolutions.com); Web:https://www.suttlesolutions.com/designers_specifiers

Substitutions: Not permitted.

Requests for substitutions will be considered in accordance with provisions of Section 01 60 00 - Product Requirements.

PANELS ENCLOSURES WITH COVERS

Basis of Design: MediaMAX Panels as manufactured and supplied by Suttle. For enhanced CAT6 and wireless connectivity and house ONT and residential gateways. Utilizes plastic components wherever possible to minimize wireless interference. Enclosure venting for heat dissipation. For greenfield and brownfield applications providing added space to secure gateways and next generation ONT and battery backup systems within new or existing media panels. Compatible with SOHO Access modules. Deep-lid covers allow use of space in front of and above wiring panels.

Part Number: MXE-15P-1G2. 15 in (381 mm) MediaMAX panel (empty).

Part Number: MXE-15C-1G2. 15 in (381 mm) MediaMAX panel hinged vented cover.

Part Number: MXE-15E-1G2. 15 in (381 mm) MediaMAX panel (empty) with hinged vented cover.

Part Number: MXE-15C-4G2. 15 in (381 mm) MediaMAX panel expanded hinged vented deep-lid cover, 4 in (102 mm) deep.

Part Number: MXE-30P-1G2. 30 in (762 mm) MediaMAX panel (empty).

Part Number: MXE-30C-1G2. 30 in (762 mm) MediaMAX panel hinged vented cover.

Part Number: MXE-30E-1G2. 30 in (762 mm) MediaMAX panel (empty) with hinged vented cover.

Part Number: MXE-30E-2G2. 30 in (762 mm) MediaMAX panel with hinged vented cover, equipment shelves, adjustable mounting brackets, cable tie-downs, mounting screws and installation instructions.

Part Number: MXE-30E-3G2. 30 in (762 mm) MediaMAX panel with hinged vented cover, MXM-521 Gateway Termination Module, equipment shelves, adjustable mounting brackets, cable tie-downs, mounting screws, and installation instructions.

Part Number: MXE-30C-4G2. 30 in (762 mm) MediaMAX panel expanded hinged vented deep-lid cover, 4 in (102 mm) deep.

Part Number: MXE-45P-1G2. 45 in (1143 mm) MediaMAX panel (empty).

Part Number: MXE-45C-1G2. 45 in (1143 mm) MediaMAX panel hinged vented cover.

Part Number: MXE-45E-1G2. 45 in (1143 mm) MediaMAX panel (empty) with hinged vented cover.

Part Number: MXE-45C-4G2. 45 in (1143 mm) MediaMAX panel expanded hinged vented deep-lid cover, 4 in (102 mm) deep.

Color: White.

Listed: UL 2416, Issue 2, and ULc.

Material: High impact, flame retardant thermoplastic, UL 94-V0 (indoor) rated.

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Project Location, St. John, U.S. Virgin Islands

Dimensions MXE-15 Series:

Enclosures (HxWxD): 15.36 x 14.25 x 4.0 in (390 x 362 x 102 mm).

Standard Covers (HxWxD): 17.8 x 17.5 x 1.11 (454 x 444 x 28 mm).

Deep Lid Covers (HxWxD): 17.8 x 17.5 x 4.21 (454 x 444 x 107 mm).

Dimensions MXE-30 Series:

Enclosures (HxWxD): 30.08 x 14.25 x 4.0 in (764 x 362 x 102 mm).

Standard Covers (HxWxD): 33.30 x 17.5 x 1.11 (846 x 444 x 28 mm).

Deep Lid Covers (HxWxD): 33.30 x 17.5 x 4.21 (846 x 444 x 107 mm).

Dimensions MXE-45 Series:

Enclosures (HxWxD): 46.36 x 14.25 x 4.0 in (1178 x 362 x 102 mm).

Standard Covers (HxWxD): 48.8 x 17.5 x 1.11 (1240 x 444 x 28 mm).

Deep Lid Covers (HxWxD): 48.8 x 17.5 x 4.21 (1240 x 444 x 107 mm).

Panel Accessories:

Part Number: MXE-ACC-1. 1 equipment shelf, 2 equipment brackets, 2 cable spools, 2 tie brackets, 4 cable ties, 12 screws.

Part Number: MXE-ACC-2. 2 equipment shelves, 4 equipment brackets, 1 hook & loop strap 30 in (762 mm), 4 cable ties, 16 screws.

Part Number: MXE-CCK. Cable connector kit.

Part Number: MXE-DMK. Door mounting kit.

Part Number: MXE-ESB. 1 equipment shelf, 1 tie bracket, 1 hook and loop strap, 30 in (762 mm), 6 screws, 6 push-pin fasteners.

Part Number: MXE-MDK. Microduct kit.

Part Number: SAE-CAN. AC outlet kit, non-surge protected.

Part Number: SAE-GMT8. 2.5 in (64 mm) rubber grommets for enclosure entry and exit holes; 8 rubber grommets.

Part Number: SAE-LOCK. Lock accessory kit.

Part Number: SAE-PS3. 3-outlet AC power-strip with 34 in (864 mm) cord.

Panel Features:

Housing Solution for Premise Equipment:

- 1.)Mount ONTs, gateways, battery backups and wiring modules in a single enclosure
- 2.)Unique mounting bracket and shelf design accepts wide variety of equipment dimensions.
- 3.)180 degree hinged cover for easy access.

Optimized for wireless connectivity: Plastic construction minimizes electrical interference to wireless components.

Improved heat dissipation and fire resistance design:

- 1.)Unique ventilation design improves airflow and heat dissipation.
- 2.)Material: High impact, flame retardant thermoplastic, UL 94-V0 (indoor) rated.
- 3.)Meets latest fire resistance criteria for in-wall installation (UL 2416, Issue 2, Section 12.5, Communications Equipment Racks, Cabinets and Enclosures).
- 4.)Meets applicable Telcordia Generic Requirements, GR-63, for indoor housings.

Modular design for new construction and retrofit:

- 1.)Multiple cable ports for fiber cable and micro-duct terminations and power outlet locations.
- 2.)Convenient cable-tie locations along cabinet sides.
- 3.)Modular door design allows for physical separation and security of equipment and modules.

Flexible future-proof design and light weight plastic reduce total cost of ownership:

- 1.)Designed to accommodate new GPON, G.hn and G.fast equipment.
- 2.)Accepts fiber, copper, coax cables and terminations.
- 3.)Nearly 40 percent lighter than equivalent metal enclosures.

Basis of Design: SOHO Access Home Networking Enclosures as manufactured and supplied by Suttle. Fast, flexible, and clean distribution management solution for voice, data, video, and audio connections. Feature-rich, rugged enclosures.

Part Number: SAE-28NY. 28 in (711 mm) high enclosure.

Dimensions (HxWxD): 28 x 14.25 x 3.75 in (711 x 362 x 95 mm).

Part Number: SAE-28DCNY. 28 in (711 mm) high enclosure with door cover.

Dimensions (HxWxD): 30.3 x 16.5 x 4.10 in (770 x 419 x 104 mm).

Part Number: SADC-28VZ. 28 in (711 x mm) high door cover.

Dimensions (HxWxD): 30.3 x 16.5 x 0.35 in (770 x 419 x 9 mm).

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Part Number: SAE-42NY. 42 in (1067 mm) high enclosure.
Dimensions (HxWxD): 42 x 14.25 x 3.75 in (1067 x 362 x 95 mm).
Part Number: SAE-42DDCNY. 42 in (1067 mm) high enclosure and door cover.
Dimensions (HxWxD): 44.3 x 16.5 x 4.10 in (1125 x 419 x 104 mm).
Part Number: SADDCC-1428. 42 in (1067 mm) high dual door cover.
Dimensions (HxWxD): 44.3 x 16.5 x 0.35 in (1067 x 419 x 9 mm).
Part Number: SAM-EPM Enclosure Partition Module
Panel Features:
Material: Steel. 16 gauge, 0.0598 in (1.519 mm).
1.)Finish: Powder coat.
Mounting: Flush mounted between sixteen inch centered studs or surface mounted via recessed mounting holes.
Numerous cable entry knock-outs.
Vertical and horizontal mounting hole pattern
Multiple cable tie attachment points.
UL listed for security alarm and fire signaling applications.
Enclosures ship with necessary installation hardware.
Door covers provide a knock-out for a security lock.
Not Fire Rated: Enclosures should not be installed in a fire rated wall.

MODULES

Basis of Design: Gateway Termination Module as manufactured and supplied by Suttle. Supports up to five CAT6 data outputs and four 2-line voice outputs. Cable terminations utilize tool-less IDCs for improved transmission. Allows for changes in wiring to be made quickly and easily with no tools. The signal is simply patched from the voice or data source to the desired outlet.
Part Number: MXM-521. CAT6 gateway termination module.
Listed: UL and ULc.
Input:
1.)Six RJ45 jacks.
2.)Two RJ14 jacks.
Output: Eight 4-pair tool-less IDCs.
Wiring: 568A and 568B.
Dimensions (HxWxD): 3.5 x 6.5 x 1 in (89 x 165 x 25 mm).
Part Number: SAM-D8. CAT5e data/voice networking module. Supports up to 8 outlets and are designed with front punch down terminations. Allows for changes in wiring to be made quickly and easily. The circuit is simply patched from the source to the desired outlet.
Listed: UL and ULc.
Input: Eight RJ45 jacks.
Output: Eight 4-pair 110 IDCs.
Wiring: 568A.
Dimensions (HxWxD): 3.5 x 6.5 x 1 in (89 x 165 x 25 mm).
Part Number: SAM-D8-C6. CAT6 data/voice networking module. Supports up to 8 outlets and are designed with front punch down terminations. Allows for changes in wiring to be made quickly and easily. The circuit is simply patched from the source to the desired outlet.
Listed: UL and ULc.
Input: Eight RJ45 jacks.
Output: Eight 4-pair 110 IDCs.
Wiring: 568A.
Dimensions (HxWxD): 3.5 x 6.5 x 1 in (89 x 165 x 25 mm).
Part Number: SAM-D8-TC5. CAT5e data/voice networking module. Supports up to 8 outlets and are designed with tool-less IDCs. Allows for changes in wiring to be made quickly and easily with no tools. The signal is simply patched from the source to the desired outlet.
Listed: UL and ULc.
Input: Eight RJ45 jacks.
Output: Eight 4-pair tool-less IDCs.
Wiring: 568A and 568B.
Dimensions (HxWxD): 3.5 x 6.5 x 1 in (89 x 165 x 25 mm).

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Part Number: SAM-D8-TC6. CAT6 data/voice networking module. Supports up to 8 outlets and are designed with tool-less IDCs. Allows for changes in wiring to be made quickly and easily with no tools. The signal is simply patched from the source to the desired outlet.

Listed: UL and ULc.

Input: Eight RJ45 jacks.

Output: Eight 4-pair tool-less IDCs.

Wiring: 568A and 568B.

Dimensions (HxWxD): 3.5 x 6.5 x 1 in (89 x 165 x 25 mm).

Basis of Design: MediaMAX Data Modules as manufactured and supplied by Suttle. Supports up to five CAT6 data outputs and four 2-line voice outputs. Cable terminations utilize tool-less IDCs for improved transmission. This module allows for changes in wiring to be made quickly and easily with no tools. The signal is simply patched from the voice or data source to the desired outlet.

Part Number: MXM-521. CAT6 Gateway Termination module.

Listed: UL and ULc.

Input:

1.)Six RJ45 jacks.

2.)Two RJ14 jacks.

Output: Eight 4-pair tool-less IDCs.

Wiring: 568A and 568B.

Dimensions (HxWxD): 3.5 x 6.5 x 1 in (89 x 165 x 25 mm).

Part Number: SAM-D8. CAT5e data/voice networking module. Supports up to 8 outlets and are designed with front punch down terminations. Allows for changes in wiring to be made quickly and easily. The circuit is simply patched from the source to the desired outlet.

Listed: UL and ULc.

Input: Eight RJ45 jacks.

Output: Eight 4-pair 110 IDCs.

Wiring: 568A.

Dimensions (HxWxD): 3.5 x 6.5 x 1 in (89 x 165 x 25 mm).

Part Number: SAM-D8-C6. CAT6 data/voice networking module. Supports up to 8 outlets and are designed with front punch down terminations. Allows for changes in wiring to be made quickly and easily. The circuit is simply patched from the source to the desired outlet.

Listed: UL and ULc.

Input: Eight RJ45 jacks.

Output: Eight 4-pair 110 IDCs.

Wiring: 568A.

Dimensions (HxWxD): 3.5 x 6.5 x 1 in (89 x 165 x 25 mm).

Part Number: SAM-D8-TC5. CAT5e data/voice networking module. Supports up to 8 outlets and are designed with tool-less IDCs. Allows for changes in wiring to be made quickly and easily with no tools. The signal is simply patched from the source to the desired outlet.

Listed: UL and ULc.

Input: Eight RJ45 jacks.

Output: Eight 4-pair tool-less IDCs.

Wiring: 568A and 568B.

Dimensions (HxWxD): 3.5 x 6.5 x 1 in (89 x 165 x 25 mm).

Part Number: SAM-D8-TC6. CAT6 data/voice networking module. Supports up to 8 outlets and are designed with tool-less IDCs. Allows for changes in wiring to be made quickly and easily with no tools. The signal is simply patched from the source to the desired outlet.

Listed: UL and ULc.

Input: Eight RJ45 jacks.

Output: Eight 4-pair tool-less IDCs.

Wiring: 568A and 568B.

Dimensions (HxWxD): 3.5 x 6.5 x 1 in (89 x 165 x 25 mm).

Basis of Design: MediaMAX Voice Modules as manufactured and supplied by Suttle.

Part Number: SAM-V8. 4 line in / 8 output Voice Distribution Module. Configured for up to 8 outlets each with up to 4 lines for basic telephone, fax, and modem service. Includes an RJ31X interface for security alarm system and one jack for testing and expansion.

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Listed: UL and ULc.

Input: 4-pair 110 IDC.

Output: 4-pair 110 IDC to 8 outlets.

Alarm: RJ31X jack allows alarm auto-dialing access to line 1.

Wiring: T568A.

Dimensions (HxWxD): 3.5 x 6.5 x 1 in (89 x 165 x 25 mm).

Part Number: SAM-V8M. 4 line in / 8 output Modular Voice Distribution Module. Configured for up to 8 RJ45 outlets for home run terminations, each with up to 4 lines for basic telephone, fax and modem service. Includes an RJ31X interface for a security/alarm system and one test jack to test the service provider line and internal lines.

Listed: UL and ULc.

Input: 4-pair 110 IDC.

Output: 8 RJ45 jacks.

Alarm: RJ31X jack allows alarm auto-dialing access to line 1.

Wiring: T568A.

Dimensions (HxWxD): 3.5 x 6.5 x 1 in (89 x 165 x 25 mm).

Part Number: SAM-V10. 4 line in / 10 output Voice Distribution Module. Configured for up to 10 outlets each with up to 4 lines of basic telephone, fax, and modem service. Includes an RJ31X interface for a security/alarm system and one expansion/test jack to either bridge service to a Voice Expansion Module or to test the service provider and internal lines.

Listed: UL and ULc.

Input: 4-pair 110 IDC.

Output: 4-pair 110 IDC to 10 outlets.

Test/Expansion: 1 RJ45.

Alarm: RJ31X jack allows alarm auto-dialing access to line 1.

Wiring: 568A.

Dimensions (HxWxD): 3.5 x 6.5 x 1 in (89 x 165 x 25 mm).

Part Number: SAM-MP4. 4 line input / 6 output multi-provider voice distribution module. Accepts up to four incoming lines, routes them to six locations, and offers a security system interface jack (for signal from an alarm panel) and test jacks for input and output.

Listed: UL and ULc.

Input: 1 x 4-pair 110 IDC and 4 x RJ11.

Output: 6 x 4-pair 110 IDC.

Alarm: RJ45 jack (dip switch) allows alarm auto-dialing access to line 1.

Wiring: T568A.

Dimensions (HxWxD): 3.5 x 6.5 x 1 in (89 x 165 x 25 mm).

Basis of Design: MediaMAX Video Modules as manufactured and supplied by Suttle. Video splitter modules provide high quality and reliable video distribution with industry approved, digital ready splitters that meet ANSI/SCTE standards. Angled mounting brackets maximize enclosure space, minimize cable strain, and facilitate better cable management and ease of installation.

Part Number: SAM-RF3. 1 x 3 RF splitter - 1 GHz.

Insertion Loss (Maximum): 7.0 dB.

Isolation (Minimum): 22 dB.

Return Loss In (Minimum): 20 dB.

Return Loss Out (Minimum): 20 dB.

Part Number: SAM-RF4. 1 x 4 RF splitter - 1G Hz.

Insertion Loss (Maximum): 8.0 dB.

Isolation (Minimum): 22 dB.

Return Loss In (Minimum): 20 dB.

Return Loss Out ((Minimum): 20 dB.

Part Number: SAM-RF6. 1 x 6 RF splitter - 1G Hz.

Insertion Loss (Maximum): 11.8 dB.

Isolation (Minimum): 22 dB.

Return Loss In (Minimum): 20 dB.

Return Loss Out ((Minimum): 20 dB.

Part Number: SAM-RF8. 1 x 8 RF splitter - 1G Hz.

Insertion Loss (Maximum): 12 dB.

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Isolation (Minimum): 20 dB.
Return Loss In (Minimum): 20 dB.
Return Loss Out ((Minimum): 20 dB.
Part Number: SAM-RFH3. 1 x 3 RF splitter - 3 GHz.
Insertion Loss (Maximum): 11.2 dB.
Isolation (Minimum): 22 dB.
Return Loss In (Minimum): 12 dB.
Return Loss Out ((Minimum): 11 dB.
Part Number: SAM-RFH4. 1 x 4 RF splitter - 3 GHz.
Insertion Loss (Maximum): 12.5 dB.
Isolation (Minimum): 20 dB.
Return Loss In (Minimum): 12 dB.
Return Loss Out ((Minimum): 12 dB.
Part Number: SAM-RFH6. 1 x 6 RF splitter - 3 GHz.
Insertion Loss (Maximum): 14.5 dB.
Isolation (Minimum): 22 dB.
Return Loss In (Minimum): 13 dB.
Return Loss Out ((Minimum): 13 dB.
Part Number: SAM-RFH8. 1 x 8 RF splitter - 3 GHz.
Insertion Loss (Maximum): 15 dB.
Isolation (Minimum): 20 dB.
Return Loss In (Minimum): 13 dB.
Return Loss Out ((Minimum): 12 dB.
Frequency Range: 5 to 2400 MHz.
RFI Shielding: 130 dB.
Operating Temperature: Minus 40 to 140 degrees F.
"F" Ports: Meet ANSI/SCTE 02.
Dimensions for SAM-RF3 (HxWxD): 3.0 x 6.5 x 2.0 in (76 x 165 x 51 mm).
Dimensions: (HxWxD): 2.75 x 6.5 x 2.8 in (70 x 165 x 71 mm).

Basis of Design: SOHO Access 8-port Universal Patch Module as manufactured and supplied by Suttle.
For custom patch configurations for patching phone, data, video or even fiber using SpeedStar connectors. A great solution for accommodating CorroShield corrosion protection jacks, or CAT6 jacks that aren't available in a typical patch panel.

Part number: SAM-SP8. 8-port universal patch panel.

Listed UL and ULc.

For use with SOHO Access Enclosures.

Phone, Data, Video, or even fiber patching on a single panel.

Mix and Match SpeedStar jacks to get exactly what is needed.

CAT6 capable with STAR6000C6 jacks.

Accepts SpeedStar CorroShield jacks for added corrosion protection in humid environments.

Dimensions (HxWxD): 3.5 x 6.5 x 3 in (89 x 165 x 76 mm).

Basis of Design: 3 in (76 mm) Blank Mounting Plate as manufactured and supplied by Suttle.

Part number: SAM-B.

Blank mounting plate for MediaMAX Panels and SOHO Access enclosures.

Includes double-stick adhesive foam and mounting pins.

Dimensions (HxW): 3 x 5.5 in (76 x 140 mm) mounting surface.

Basis of design: Push-Pin Replacement Kit (10 pieces) as manufactured and supplied by Suttle.

Part Number: SAM-NYL.

Replacement push-pins, plungers and grommets.

One package of 10 push-pins.

Tool-less push-pin fasteners.

Plastic composition does not interfere with wireless devices.

Quickly secure modules, brackets, and equipment shelves into MediaMAX Panels.

PATCH PANELS

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Basis of Design: Patch panel as manufactured and supplied by Suttle. Steel construction with rolled edges to eliminate flexing. Rear input connectors are 110 IDC, front output jacks are RJ-45. Connectors can be wired in either 568A or 568B configurations.

Part Number: STAR19110C6-12. 12-port, CAT6 patch panel, 568A/B wiring, wall-mount (bracket included) - 3.25 H x 10 W x 2 D in (83 H x 254 W x 51 D mm).

Part Number: STAR19110C6-24. 24-port, CAT6 patch panel, 568A/B wiring, 19 in (483 mm) rack-mountable - 1RU 19 in (483 mm) rack.

Part Number: STAR19110C6-48. 48-port, CAT6 patch panel, 568A/B wiring, 19 in (483 mm) rack-mountable - 2RU 19 in (483 mm) rack.

Part Number: STAR191RU-12B. 12-port blank patch panel accepts all SpeedStar Modular Jacks (Copper, Fiber and Coax) and includes an integrated cable management bracket.

Accessories:

1.)Part Number: STAR6000C6T. MediaMAX Jack - Tool-less Category 6 Jack

2.)Part Number: 2-7001. CAT5e Modular Data Jack

3.)Part Number: 2-7005. CAT3 Modular Voice Jack

4.)Part Number: STAR600V6-RC. CAT3 Modular Voice Jack with CorroShield gel.

5.)Part Number: STAR500F-C. 3GHz F81 Barrel Connector

6.)Part Number: STAR500SCGR-T. SC Fiber Adapter with trap door kit

Listed: UL and ULc.

Exceeds TIA/EIA-568-B Cat 6 performance specifications.

Supports bandwidth beyond 250 MHz.

Write-on label and number designations provide easy identification.

Rear cable management bar provides cable strain relief.

Multiple cable tie locations facilitate cable dressing.

Wiring: T568A or T568B.

Insertion: greater than 750 cycles.

Jack Housing: High impact, flame retardant thermoplastic, UL 94-V0 (indoor) rated.

IDC Blocks: Tin lead plated connector accepts 22-26 AWG solid UTP cable.

Contact Pressure: Greater than 0.22 lbs (100 grams).

Insulation Resistance: 500 megohms.

Contact Resistance: Less than 10 milliohms.

Voltage/Current: Less than 140 VDC at 1.5 amps.

Dielectric Withstand: greater than 1000 VAC RMS at 60Hz.

Safety: Complies with Part 68, FCC Rules.

JACKS

Basis of Design: SpeedStar CAT5e Modular Data Jack as manufactured and supplied by Suttle. Exceeds TIA/EIA 568-C.2 specifications for Category 5e component performance. For use with SpeedStar faceplates, bezels and surface mount housings. Termination requires use of a punch down installation tool. Available in a white housing, each jack comes with multi-color bezels for your installation.

Part Number: 2-7001. 8-Position, 8-Conductor Jack, 568A/B, 110 IDC Block.

Color: Green.

Color: Electrical ivory.

Color: Red.

Color: Yellow.

Color: Blue.

Color: Light almond.

Color: White.

Color: Orange.

Listed: UL and ULc.

Easy installation from rear of faceplate.

Compatible with SpeedStar products (bezels, faceplates, and surface mount housings).

Terminates with standard 110 termination tools.

Dust covers for IDC terminations.

Wiring: 568A or 568B.

Insertion Life: 750 insertions.

Housing: High impact, flame retardant thermoplastic, UL 94-V0 (indoor) rated.

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Contacts: 50 micro-inch (0.00127 mm) hard gold plating minimum with 100 micro-inch (0.00254 mm) nickel.

Contact Pressure: greater than 0.22 lbs (0.22 lbs (100 grams).

Contact Resistance: Less than 10 milliohms.

Insulation Resistance: Greater than 500 megohms.

Current/Voltage:

140 VDC at 1.5 amps (2-7001).

140 VDC at 2 amps (STAR600V6 and 8),

Dielectric Withstand: 1000 VAC RMS at 60Hz.

Basis of Design: SpeedStar CAT3 Modular Voice Jack as manufactured and supplied by Suttle. Provide a modular solution for delivering multiple lines of voice service. Jacks with CorroShield gel protects against corrosion that can lead to loss of service and costly service calls. For use with SpeedStar faceplates, bezels and surface mount housings. The jack terminates up to 3-pair of 22 to 26 AWG wire.

Part Number: 2-7005. 6-Position, 6-Conductor Jack, 110 IDC Block.

Part number: STAR600V6-RCB. 6-Position, 6-Conductor Jack with Corroshield gel, 110 IDC Block.

Color: Green.

Color: Electrical ivory.

Color: Red.

Color: Yellow.

Color: Blue.

Color: Light almond.

Color: White.

Color: Orange.

Listed: UL and ULc.

Easy installation from rear of faceplate.

Compatible with SpeedStar products (bezels, faceplates, and surface mount housings).

Terminates with standard 110 termination tools.

Dust covers for IDC terminations.

CorroShield gel equipped jacks protects from dust, moisture, and other components.

Gelguard gel in the CorroShield products, is a nonhazardous mixture per OSHA's Hazard Communications Standard (29 CFR 1910.1200). An MSDS is not required. A product safety bulletin is available upon request.

Wiring: USOC.

Insertion Life: 750 insertions.

Housing: High impact, flame retardant thermoplastic, UL 94-V0 rated.

Contacts: 50 micro-inch (0.00127 mm) hard gold plating minimum with 100 micro-inch (0.00254 mm) nickel.

IDC Blocks: Tin lead plated connector accepts 22-26 AWG solid and stranded UTP cable.

Wire Retention:

Horizontal AWG: 8 lbs (3.63 kg).

Vertical pullout force: 2 lbs (0.91 kg).

Contact Pressure: Greater than 0.22 lbs (0.22 lbs (100 grams).

Contact Resistance: Less than 10 milliohms.

Insulation Resistance: Greater than 500 megohms.

Current/Voltage:

140 VDC at 1.5 amps (2-7005).

140 VDC at 2 amps (STAR600V6 and 8).

Dielectric Withstand: 1000 VAC RMS at 60Hz minimum.

Basis of Design: SpeedStar SC Adapter with trap door as manufactured and supplied by Suttle. Provides instant coupling of fiber connectors within a miniature housing. The integrated spring-loaded trap door automatically closes when a SC connector is not connected or is removed, shielding potentially harmful laser light. Its design enables the adapter to be installed into any SpeedStar faceplate or housing allowing for the product to be integrated into many different form factors and a variety of different architectures.

Part Number: STAR500SCGR-T. SC adapter with trap door.

Part Number: STAR500HSC-T. SC adapter housing with trap door only, no SC adapter.

Color: Electrical ivory.

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Color: White.

Integrated trap door shields potentially harmful laser light.

SpeedStar design allows for use in a wide variety of products for maximum flexibility.

Materials: High impact flame retardant thermoplastic, UL 94-V0 (indoor) rated.

Connector Type: SC / SC simplex fiber coupler.

Cable Retention: Greater than 15 lbs (6.8 kg).

Back Reflection (typical - limit): 65 dB - minus 60 dB.

Insertion Loss (typical - limit): 0.1 dB - 0.3 dB.

Basis of Design: CAT6 Modular Data Jack as manufactured and supplied by Suttle. Performance exceeding TIA/EIA-568-C.2 channel and link standards. Provides quicker and easier wire termination.

Angled IDC connector pins aid in maintaining maximum Category 6 performance, providing a gas tight connection and improved cable retention.

Part Number: STAR6000C6. Category 6 jack, 8-position, 8-conductor module.

Part Number: STAR6000C6-SB. Category 6 jack, 8-position, 8-conductor module.

Color: Green.

Color: Electrical ivory.

Color: Red.

Color: Yellow.

Color: Blue.

Color: Light almond.

Color: White.

Color: Orange.

Listed: UL and ULc.

Terminates with standard 110 termination tools.

Modules are compatible with SpeedStar or Series 2000 line of bezels, faceplates and surface mount housings.

IDC Cap provides protective strain relief.

Easy installation from rear of faceplate.

Complies with Part 68 of the FCC Rules and the requirements adopted by the ACTA.

Wiring: 568A/568B color-coded labeling for easy wire identification.

Insertion Life: 750 insertions.

Housing: High impact, flame retardant thermoplastic, UL 94-V0 (indoor) rated.

Contacts: 100 micro-inch nickel with minimum 50 micro-inch of gold.

IDC Blocks: Tin lead plated connector accepts 22 to 26 AWG solid UTP cable.

Contact Pressure: Greater than 0.22 lbs (100 grams).

Contact Resistance: Less than 10 milliohms.

Insulation Resistance: Greater than 500 megohms.

Voltage/Current: 140 VDC at 2.0 amps.

Dielectric Withstand: 1000 VAC RMS at 60 Hz.

Basis of Design: MediaMAX Jack - Tool-less Category 6 Jack as manufactured and supplied by Suttle. Performance exceeding TIA/EIA-568-C.2 channel/link and component standards. Provides consistent, reliable, and easier wire termination. IDC with tool-less toggle connections aid in maintaining maximum

Category 6 performance, providing a gas tight connection and improved cable retention.

Part Number: STAR6000C6T. Category 6 jack, 8-position, 8-conductor module, tool-less IDC with 8 color-coded bezels.

Color: Green.

Color: Electrical ivory.

Color: Red.

Color: Yellow.

Color: Blue.

Color: Light almond.

Color: White.

Color: Orange.

Listed to UL and ULc.

Allows mounting to both SpeedStar and generic keystone wall plates.

Tool-less toggle eliminates individual wire punch-down and provides consistent IDC termination.

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Unique "dual-toggle" design helps preserve wire twist during assembly.
Jack installs easily from rear of wall plate.
Complies with TIA 1096 (formerly Part 68 of FCC Rules).
Material: High impact, flame retardant thermoplastic, UL 94-V0 (indoor) rated.
Individually packaged with assorted color-coded bezels.
No extra parts required for wire termination.
No excess wire trimming required.
Wiring: 568A or 568B color-coded labeling for easy wire identification.
Insertion Life: 750 insertions.
Contacts: 50 micro-inch nickel with minimum 50 micro-inch of gold.
IDC Blocks: Tool-less toggles.
Conductor size: 22 to 24 gauge.
Contact Pressure: Greater than 0.22 lbs (100 grams).
Contact Resistance: Less than 10 milliohms.
Insulation Resistance: Greater than 500 megohms.
Voltage/Current: 140 VDC at 2.0 amps.
Dielectric Withstand: 1000 VAC RMS at 60 Hz.

Basis of Design: MediaMAX Category 6A 10 Gig Data Jack as manufactured and supplied by Suttle.
Performance exceeding TIA/EIA-568-C.2 channel/link and component standards. Universal jack solution.
Color coding bezels for network identification. Punch down functionality reducing material cost while providing ease of set-up and installation.
Part Number: STAR6APDJ. Category 6A 10 Gig data jack, 8-position, 8-conductor jack, 568/B wiring, 110 DC connections, includes color-coded bezels.
Part Number: STAR6APDJ-BP. Package of 20 jacks and 25 white bezels - Bulk pack.
Part Number: STARBEZ. Package of 25 color-coded bezels. Package contains 25 of the same color bezels
Color: Green.
Color: Electrical ivory.
Color: Red.
Color: Yellow.
Color: Blue.
Color: Light almond.
Color: White.
Color: Orange.
Standards Compliance:
Listed to UL and ULc.
Part 68 of FCC Rules and requirements adopted by the ACTA.
Exceeds Category 6A TIA/EIA-568-C.2 specifications for channel and link performance.
Angled IDC Pins: Aid in maintaining maximum Cat 6A performance. Provides a gas tight connection and improved cable retention.
Termination Tools: Standard 110.
Compatible with Suttle SpeedStar bezels, faceplates and surface mount housings.
IDC Cap: Provides protective strain relief.
Easy installation from rear of faceplate
Wiring: 568A or 568B color-coded labels facilitate termination.
Insertion Life: 750 insertions.
Housing: High impact, flame retardant thermoplastic, UL 94V-0 (indoor) rated.
Contacts: 100 micro-inch nickel with minimum 50 micro-inch of gold.
IDC Blocks: Tin lead plated connector accepts 22-24 AWG solid UTP cable.
Contact Pressure: Greater than 0.22 lbs (100 grams).
Contact Resistance: Less than 20 milliohms.
Insulation Resistance: Greater than 500 megohms.
Pin to Pin Voltage: 1000 Volts DC or AC peak, 0.5 mA leakage current.
Pin to Shield Voltage: 1500 Volts DC or AC peak, 0.5 mA leakage current.
Fault Current:
600 Volts AC, 2.2 Amps, 50 to 60 Hz, 30 minutes.
700 Volts AC, 7.0 Amps, 50 to 60 Hz, 5 seconds.

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FACEPLATES

Downward Facing Plates:

Basis of Design: Downward Oriented Faceplates as manufactured and supplied by Suttle. Employs jacks mounted at a 90 degree downward allowing cables to be run down, and out, at a much lower risk to damage. Smooth, shatter-resistant faceplate protects installation from collateral damage.

Part Number: 2-6500. Single gang plate with 4 insert styles.

Part Number: 2-6501. Single gang plate with 2-port F81 insert, connectors not included.

Part Number: 2-6502. Single gang plate with 2-port SpeedStar insert, connectors not included.

Part Number: 2-6503. Single gang plate with CablePass feed-through insert.

Part Number: 2-6504. Single gang plate with F81/SpeedStar insert, connectors not included.

Part Number: 2-6522D. Double gang plate with 3-port SpeedStar insert, connectors not included.

Part Number: 2-6523D. Double gang plate with CablePass feed-through

Color: Electric ivory.

Color: White.

Listed: UL and ULc.

Accommodates:

1.)F81 barrel connectors.

2.)SpeedStar connectors.

3.)CablePass feed-through.

New construction or replacement of existing plates.

Material: High impact, flame retardant thermoplastic, UL 94-V0 (indoor) rated.

Dimensions:

1.)Single Gang (HxWxD): 5.04 x 3.13 x 1 in (128 x 80 x 25 mm).

2.)Double Gang (HxWxD): 5.04 x 5 x 1 in (128 x 127 25 mm).

Basis of Design: Fiber Interface Wall Plate as manufactured and supplied by Suttle. In-home fiber interconnect point in a compact single gang size. Allows flexibility in access and storage. Access options include inside connections or external connections at end or at an angle.

Part Number: CON-13X5-85. Single gang fiber wall plate with two covers, SC/APC adapter and splice holder inside with fiber storage.

Part Number: CON-13X6-85. Single gang fiber wall plate with two covers, a SC/APC adapter exiting the right side at an angle, and splice holder inside with fiber storage.

Part Number: CON-13X5-85U. Single gang fiber wall plate with two covers, SC/UPC adapter and splice holder inside with fiber storage.

Part Number: CON-44X7-50. Single gang fiber wall plate with one cover, SC/APC adapter one blank exiting the right side, and internal splice holder with fiber storage.

Part Number: CON-44X7-85. Single gang fiber wall plate with one cover, fiber adapter one blank exiting the right side, and internal splice holder with fiber storage.

Listed: UL and ULC.

Junction box mounting platform.

Fiber slack storage spool with up to 5 ft (1524 mm) of 0.118 in (3 mm) fiber slack storage.

Can be configured for fiber connection accessible from outside or protected inside the cover.

Snap on cover with security screw.

Vertical or horizontal distribution.

Angled or straight exit.

Material: High impact, flame retardant thermoplastic, UL 94-V0 (indoor) rated.

Dimensions (HxWxD): 4.9 x 3.5 x 1.2 in (124 x 89 x 30 mm).

Basis of Design: Convergence Wall Plate as manufactured and supplied by Suttle. For managing multiple cable types within a facility. Direct surface mounting on a wall or over an existing single or double gang junction box, with versions for managing connections with twisted pair wire (voice and data), coax cable or fiber cable. Ideal for managing inputs and outputs for FTTH deployments using desktop ONTs.

Compatible with SpeedStar connectors.

Part number: CON-2216. Configured for use with a coax splitter (1x2, 1x3, 2x2, 2x3) or ground block and an external SC/APC adapter port, internal fiber management spools, and blanks for two additional SpeedStar connectors (voice or data jacks).

Part number: CON-2221. Configured with 6 blank openings on bottom for use with SpeedStar connectors (voice and data jacks, SC/APC fiber adapter) and fiber management spools.

Color: Electrical Ivory.

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Color: White.

Standards Compliance:

1.) Listed: UL and ULc.

Distribution point for any combination of cabling (Fiber, Coax, Twisted Pair).

Configurations with slack management for up to 6 ft (1829 mm) of 900 im, 0.063 in (1.6 mm), 0.118 in (3 mm), and 0.189 in (4.8 mm) fiber optic cable.

Supports fiber adapters, voice jacks, data jacks and coax splitters or ground blocks together in a compact wall plate.

Convenient knockouts on cover and base.

Designed to use SpeedStar voice and data jacks.

Entry hole to allow a No. 10 AWG ground wire for coax devices (when configured for coax).

Slotted key mounting holes to prove easy installation onto a j-box.

Captive 3/8 in (9 mm) hex screw to secure the cover to the base with 216-tool.

Fiber Adapter: SC/APC.

Material: High impact, flame retardant thermoplastic, UL 94-V0 (indoor) rated.

Dimensions (HxWxD): 5.5 x 6.5 x 1.5 in (140 x 165 x 38 mm).

Basis of Design: Flush Mount Open Back Retrofit Box as manufactured and supplied by Suttle. Flush mount retrofit junction box with open back, rotating clamp arms.

Part Number: 147-2.

Flush mount.

Rotating clamp arms.

Open back.

For retrofit applications.

Flush Mounting Faceplates:

Basis of Design: SpeedStar Single and Double Gang Smooth Faceplates: as manufactured and supplied by Suttle. For use with SpeedStar modular multimedia connectors. Each housing provides simple snap-in connector installation. Mounts over standard J-box (mounting screws included).

Part Number: 2-2501. 1-port faceplate, single gang, smooth finish.

Part Number: 2-2502. 2-port faceplate, single gang, smooth finish.

Part Number: 2-2503. 3-port faceplate, single gang, smooth finish.

Part Number: 2-2504. 4-port faceplate, single gang, smooth finish.

Part Number: 2-2504A. Angled 4-port faceplate, single gang, smooth finish.

Part Number: 2-2506. 6-port faceplate, single gang, smooth finish.

Part Number: 2-2501M. 1-port faceplate, oversized, single gang, smooth finish.

Part Number: 2-2502M. 2-port faceplate, oversized, single gang, smooth finish.

Part Number: 2-2503M. 3-port faceplate, oversized, single gang, smooth finish.

Part Number: 2-2504M. 4-port faceplate, oversized, single gang, smooth finish.

Part Number: 2-2501-S. 1-port faceplate, single gang, stainless steel.

Color: Electrical Ivory.

Color: White.

Listed: UL and ULc

Material: High impact, flame retardant thermoplastic, UL 94-V0 (indoor) rated and 22 AWG stainless steel.

Dimensions (HxWxD):

1.) Single Gang: 4.57 x 2.81 in (116 x 71 mm).

2.) Oversized: 4.875 x 3.125 x 0.2 in (124 x 79 x 5 mm).

3.) Single Gang (Stainless): 4.5 x 2.75 x 0.29 (114 x 70 x 7 mm).

Basis of Design: SpeedStar Modular Multimedia Faceplates: as manufactured and supplied by Suttle.

Commercial-grade faceplates for use with Suttle's line of rear-loading snap-in multimedia modules and colored bezels. Rugged, textured faceplates feature top and bottom label locations for quick identification.

Part Number: STAR500S1. 1-port, single gang.

Part Number: STAR500S2. 2-port, single gang.

Part Number: STAR500S4. 4-port, single gang.

Part Number: STAR500S6. 6-port, single gang.

Part Number: STAR500AF. 4-port angled, single gang.

Color: Electrical Ivory.

Color: White.

Listed: UL and ULc.

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Standard or insert style faceplates for flexible configuration.

Fits standard NEMA boxes.

Material: High impact, flame retardant thermoplastic, UL 94-V0 (indoor) rated.

Dimensions (HxWxD): 4.72 x 2.75 x 0.63 in (120 x 70 x 16 mm).

Basis of Design: SpeedStar Mounting Frame, 2-Port as manufactured and supplied by Suttle. Fit standard floor and wall J-Box designs and utilize standard electrical faceplates. For use with Suttle's line of rear-loading snap-in multimedia modules and colored bezels.

Part Number: STAR1062. 2-port mounting frame.

Part Number: 860A. Duplex electrical style faceplate.

Color: Electrical Ivory.

Color: White.

Listed: UL and ULc.

Fits standard NEMA boxes and electrical faceplates.

Material: High impact, flame retardant thermoplastic, UL 94-V0 (indoor) rated.

Write on label designations for easy identification.

Available in 2 or 4-ports.

Modules snap-fit from the rear.

Inserts provide versatile module configuration options.

Basis of Design: SpeedStar Barrel Connector 3GHz F81 as manufactured and supplied by Suttle.

For SpeedStar faceplates and housings.

Type F connector.

Frequency Range: 5 to 3000 MHz.

Basis of Design: SpeedStar Blank Connector Insert as manufactured and supplied by Suttle.

Part Number: STAR500B.

Color: Electrical Ivory.

Color: White.

Fits SpeedStar faceplates, wall plates, and housings.

Basis of Design: Blank Faceplate, Single Gang as manufactured and supplied by Suttle. Flush mount design. Fits industry-standard J boxes. Includes color-matched mounting screws.

Part Number: 107. Single gang blank faceplate.

Part Number: 108. Double gang blank faceplate.

Color: Electrical Ivory.

Color: White.

Standards Compliance:

1.)Listed: UL and ULc.

2.)Conforms to NEMA and ANSI standards.

Material: High impact, flame retardant thermoplastic, UL 94-V0 (indoor) rated.

Basis of Design: SpeedStar Oversized Surface Mounting Box as manufactured and supplied by Suttle.

Countoured to match SpeedStar faceplates but oversized to accommodate most faceplates. Rear cable entry and mounting holes to fit most brackets and tear outs on top, bottom and sides for raceway entry.

Mounting over a standard outlet box requires a 43A bracket.

Part Number: STARMBD. SpeedStar single gang oversized mounting box; includes two mounting screws and one adhesive pad.

1.)Dimensions (HxWxD): 5.25 x 3.34 x 2.25 in (133 x 85 x 57 mm).

Part Number: STARMBDD. SpeedStar double gang oversized mounting box; includes two mounting screws and one adhesive pad.

1.)Dimensions (HxWxD): 5.25 x 5.34 x 2.25 in(133 x 136 x 57 mm).

Color: Electrical Ivory.

Color: Light almond.

Color: White.

Applications: Copper, coax and fiber.

Race way knockouts: 4 sides.

Faceplate Mounting: Threaded insert, 2 places.

Can be mounted on a flat surface.

Cable may be dressed on all sides, or through the back.

Supports STAR500S, STAR5501, STAR500AF, STAR5501MM and 107 faceplates.

1.)The outside contour matches SpeedStar face plates. However, the box is oversized to fit most conventional rectangular single gang faceplates.

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Complies with TIA/EIA 568-A Cable Bend Radius.

Basis of Design: Wall Jack Assembly as manufactured and supplied by Suttle. For use with wall mounted, 8-conductor modular telephone sets. The stainless steel cover assembly has two lugs, which mate with the corresponding keyhole slots in the telephone base plate or adapter. Includes a STAR600B Channel Six Performance Jack Module wired 568B and matching bezel. Exceeds TIA/EIA-568-B.2 specifications for Category 5e component performance.

Part Number: STAR630B8. 8-Position, 8-Conductor, 568B, 110 IDC Block jack module, stainless steel faceplate.

Listed: UL and ULc.

Terminates with standard 110 termination tools.

Dust covers for IDC terminations.

Wiring: 568B pinout.

Insertion Life: 750 insertions.

Housing: High impact, flame retardant thermoplastic, UL 94-V0 (indoor) rated.

Contacts: 50 micro-inch (0.00127 mm) hard gold plating minimum with 100 micro-inch (0.00254 mm) nickel.

Connection: Binding screws.

Contact Pressure: Greater than 0.22 lbs (100 grams).

Insulation Resistance: Greater than 500 megohms.

Contact Resistance: Less than 10 milliohms.

Current/voltage: Less than 140 VDC at 2 amps.

Basis of Design: SpeedStar Flush Mount Connector Kits as manufactured and supplied by Suttle.

Combine a faceplate with one or two voice grade, data, voice/data or gel filled, connectors with bezels.

Flush mounting smooth finished faceplates that are compatible with SpeedStar modular connectors.

Snap-in connector installation with colored bezels for identification. Mounts over standard J-box (mounting screws included).

Part Number: STAR2501-G1-52 Kit. 1-port faceplate with one gel filled STAR600V6-RCB voice grade connector. Electrical ivory.

Part Number: STAR2501-G1-85 Kit. 1-port faceplate with one gel filled STAR600V6-RCB voice grade connector. White.

Part Number: STAR2502-G2-52 Kit. 2-port faceplate with two gel filled STAR600V6-RCB voice grade connectors. Electrical ivory

Part Number: STAR2502-G2-85 Kit. 2-port faceplate with two gel filled STAR600V6-RCB voice grade connectors. White.

Part Number: STAR2501-V1-52 Kit. 1-port faceplate with one 2-7005 voice grade connector. Electrical ivory.

Part Number: STAR2501-V1-85 Kit. 1-port faceplate with one 2-7005 voice grade connector. White.

Part Number: STAR2502-V2-52 Kit. 2-port faceplate with two 2-7005 voice grade connectors. Electrical ivory.

Part Number: STAR2502-V2-85 Kit. 2-port faceplate with two 2-7005 voice grade connectors. White.

Part Number: STAR2501-D1-52 Kit. 1-port faceplate with one STAR6000C6T data connector. Electrical ivory.

Part Number: STAR2501-D1-85 Kit. 1-port faceplate with one STAR6000C6T data connector. White.

Part Number: STAR2502-D2-52 Kit. 2-port faceplate with two STAR6000C6T data connectors. Electrical ivory.

Part Number: STAR2502-D2-85 Kit. 2-port faceplate with two STAR6000C6T data connectors. White.

Part Number: STAR2502-DV-52 Kit. 2-port faceplate with one STAR6000C6T data and one 2-7005 voice grade connector. Electrical ivory.

Part Number: STAR2502-DV-85 Kit. 2-port faceplate with one STAR6000C6T data and one 2-7005 voice grade connector. White.

Surface Mount Faceplates:

Basis of Design: SpeedStar Barrel Connector 3GHz F81 as manufactured and supplied by Suttle.

For SpeedStar faceplates and housings.

Type F connector.

Frequency Range: 5 to 3000 MHz.

Basis of Design: SpeedStar Surface Mount Housings as manufactured and supplied by Suttle. Available in several configurations for use with Suttle's line of SpeedStar modular multimedia connectors. Snap-in

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connector installation with the use of versatile insert plates. Mounted with screws or double-sided adhesive pad.

Part Number: STAR558. 1- or 2-port surface mount housing.

1.)Dimensions (HxLxW): 1.17 x 2.70 x 2.50 in (30 x 69 x 64 mm).

Part Number: STAR107SM. Up to 3-port surface mount housing.

1.)Dimensions (HxLxW): 1.03 x 3.25 x 2.625 in (26 x 83 x 67 mm).

Part Number: STAR108SM. Up to 6-port surface mount housing.

1.)Dimensions (HxLxW): 1.03 x 6.17 x 2.625 in (26 x 157 x 67 mm).

Part Number: STARMMB. Up to 12-port surface mount housing.

1.)Dimensions (HxLxW): 1.20 x 5.60 x 6.75 in (30 x 142 x 171 mm).

Color: Electrical Ivory.

Color: Light almond.

Color: White.

Listed: UL and ULc.

Material: High impact, flame retardant thermoplastic, UL 94-V0 (indoor) rated.

Basis of design: Wall Mount Adaptort DSL Filter as manufactured and supplied by Suttle. Manage all connectivity in one plate. Smooth faceplate jacks visibly labeled "DATA" and "VIDEO" above each port respectively allowing user to distinguish between them.

Part Number: 2-5001-FC-C6. 2-port faceplate, single gang, one "Data" and one "Video" labeled port.

Smooth finish.

Color: Electrical Ivory.

Color: White.

Listed: UL and ULc.

Attractive one piece design.

Smooth, non-textured surface and rounded corners with painted head screws to match the faceplate.

Data jacks rated up to CAT6.

Connections to jacks are 110 IDC.

F connector 3GHz SCTE compliant.

Data Inputs: 8 conductor, CAT6.

Data Outputs: 110 IDC.

Video Inputs and Outputs: F81 barrel connectors.

1.)Standards: SCTE 02 compliant.

2.)Materials: Nickel plated free spinning brass.

3.)Frequency: 5-3000 MHz.

Wiring Data: TS68A.

Dimensions (LxW): 4.57 x 2.81 in (116 x 71 mm).

Basis of Design: Surface Mount Connector Kits as manufactured and supplied by Suttle. Combine a housing with one or two voice grade, data, voice/data or gel filled, connectors with bezels. Configurable for SpeedStar modular connectors. Attach using screws or double-sided adhesive pad. Includes snap-in 1 or 2 port insert plates for a custom installation.

Part Number: STAR558-G1-52 Kit. 1-port faceplate with one gel filled STAR600V6-RCB voice grade connector. Electrical ivory.

Part Number: STAR558-G1-85 Kit. 1-port faceplate with one gel filled STAR600V6-RCB voice grade connector. White.

Part Number: STAR558-G2-52 Kit. 2-port faceplate with two gel filled STAR600V6-RCB voice grade connectors. Electrical ivory

Part Number: STAR558-G2-85 Kit. 2-port faceplate with two gel filled STAR600V6-RCB voce grade connectors. White.

Part Number: STAR558-V1-52 Kit. 1-port faceplate with one 2-7005 voice grade connector. Electrical ivory.

Part Number: STAR558-V1-85 Kit. 1-port faceplate with one 2-7005 voice grade connector. White.

Part Number: STAR558-V2-52 Kit. 2-port faceplate with two 2-7005 voice grade connectors. Electrical ivory.

Part Number: STAR558-V2-85 Kit. 2-port faceplate with two 2-7005 voice grade connectors. White.

Part Number: STAR558-D1-52 Kit. 1-port faceplate with one STAR6000C6T data connector. Electrical ivory.

Part Number: STAR558-D1-85 Kit. 1-port faceplate with one STAR6000C6T data connector. White.

Part Number: STAR558-D2-52 Kit. 2-port faceplate with two STAR6000C6T data connectors. Electrical

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ivory.

Part Number: STAR558-D2-85 Kit. 2-port faceplate with two STAR6000C6T data connectors. White.

Part Number: STAR558-DV-52 Kit. 2-port faceplate with one STAR6000C6T data and one 2-7005 voice grade connector. Electrical ivory.

Part Number: STAR558-DV-85 Kit. 2-port faceplate with one STAR6000C6T data and one 2-7005 voice grade connector. White.

Basis of Design: MediaMAX Decorator Faceplates as manufactured and supplied by Suttle. Designed to match and enhance modern look designs while reducing the number of assembly components.

Standards Compliance: Listed to UL and ULc.

Simple snap-in connector installation.

Mount over standard J-box or low voltage bracket.

Compatible with all SpeedStar connectors.

Compatible with all SpeedStar color bezels for color coding.

Materials: UL 94V-O Thermoplastic

Dimensions: Single Gang (H W x D): 4.57 x 2.81 x 0.2 inch (116 x 71 x 5 mm)

Screw-On, One-Piece White Faceplates:

1.)Part Number: FD-11-SCR-85. 1-port MediaMAX faceplate, single gang.

2.)Part Number: FD-12-SCR-85. 2-port MediaMAX faceplate, single gang.

3.)Part Number: FD-14-SCR-85. 4-port MediaMAX faceplate, single gang.

Snap-On Two-Piece White Faceplates:

1.)Part Number: FD-11-SNO-85. 1-port MediaMAX faceplate, single gang.

2.)Part Number: FD-12-SNO-85. 2-port MediaMAX faceplate, single gang.

3.)Part Number: FD-14-SNO-85. 4-port MediaMAX faceplate, single gang.

ACCESSORIES

Couplers and Adapters:

Basis of Design: 2-line Split and Bridge Inline Adapter as manufactured and supplied by Suttle. Four-conductor to 2/2/4-conductor, designed for connecting two items to an existing 2-line modular jack separating each line out to the center pair on its own jack while allowing a third item access to both lines.

Part Number: 173.

Labeling: L1 / L2 / L1 and L2.

Basis of Design: Inline T Adapters - 267 Series as manufactured and supplied by Suttle. Connect two telephones or associated equipment items to an existing modular jack. Allow for quick connection of two devices at a single jack location without rewiring.

Part Number: 267A4. 2 for 1 inline modular adapter, 4-conductor to 4/4-conductor.

Part Number: 267A. 2 for 1 inline modular adapter, 4-conductor to 6/6-conductor.

Part Number: 267B. Inline modular adapter, single 4-contact jack wired for termination of 2 lines.

Part Number: 267C. Inline modular adapter, Voice labeled: PHONE, Data labeled: MODEM.

Part Number: 267E. 2 for 1 inline modular adapter, 6-conductor to 6/6-conductor.

Listed: UL and ULc.

Modifies circuitry without rewiring.

Allows multiple connections from a single modular jack.

Material: High impact, flame retardant thermoplastic, UL 94-V0 (indoor) rated.

Contact Pressure: Greater than 0.22 lbs (100 grams).

Insulation Resistance: Greater than 500 megaohms.

Contact Resistance: Less than 10 milliohms.

Current/Voltage: 140 VDC at 2 Amps.

Basis of Design: 4-line Split Inline Adapter as manufactured and supplied by Suttle. Eight-conductor to 4/4-conductor, splits eight conductor premise wiring into two, four-conductor modular outputs.

Part Number: 400E.

Input: RJ61.

Output: RJ14.

Labeling: PAIR 1 and 2 / PAIR 3 and 4.

Basis of Design: 2 for 1, 8-conductor Inline Adapter as manufactured and supplied by Suttle. Eight-conductor plug to 8/8-conductor jacks, designed for connecting two items to an existing modular jack.

Part Number: 400S-50.

Input: RJ61.

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Output: RJ61.

Basis of Design: 4-line Split Coupling Adapter as manufactured and supplied by Suttle. Four-line split coupling modular adapter, 8-conductor to 4/4-conductor, designed for splitting 4-lines on an 8-position jack into 2-lines on two 6-position jacks.

Part Number: 450A.

4 voice lines.

Input: RJ61 jack.

Output: RJ14 jack.

Labeling: PAIR 1 and 2 / PAIR 3 and 4.

Basis of Design: Telephony Couplers as manufactured and supplied by Suttle. An in-line device for connecting and/or extending two modular plug-ended line cords. Extends modular circuits without the hassle and expense of hardwired connecting blocks.

Part Number: 159MC-4. 4-conductor coupler, reverse wiring, ivory housing.

Part Number: 159MC-6. 6-conductor coupler, reverse wiring, ivory housing.

Part Number: 159MC-8A. 8-conductor coupler, straight wiring, gray housing.

Part Number: 159MC-8B. 8-conductor coupler, reverse wiring, gray housing.

Listed: UL and ULc.

Reverse or straight through wiring.

Material: High impact, flame retardant thermoplastic, UL 94-V0 (indoor) rated.

Contacts: Spring tempered phosphor-bronze 0.018 inch (0.46 mm) diameter 50 micro-inch (0.00127 mm) hard gold plating minimum 100 micro-inch (0.00254 mm) underplate with sulfamate nickel.

Contact Pressure: 0.22 lbs (0.22 lbs (100 grams) minimum.

Insulation Resistance: 500 megaohms.

Contact Resistance: 10 milliohms maximum.

Voltage/Current: 140 VDC at 2 amps.

Fiber Accessories:

Basis of Design: SpeedStar SC Adapter with trap door as manufactured and supplied by Suttle. Adapter provides instant coupling of fiber connectors within a miniature housing. The integrated spring-loaded trap door automatically closes when a SC connector is not connected or is removed, shielding potentially harmful laser light. Enables the adapter to be installed into any SpeedStar faceplate or housing allowing for the product to be integrated into many different form factors and a variety of different architectures.

Part number: STAR500SCGR-T SpeedStar SC adapter with trap door.

Part number: STAR500HSC-T SpeedStar SC adapter housing with trap door only, no SC adapter.

Color: Electrical Ivory.

Color: White.

Integrated trap door shields potentially harmful laser light.

Design allows for use in a wide variety of products for maximum flexibility.

Material: High impact, flame retardant thermoplastic, UL 94-V0 (indoor) rated.

Connector Type: SC / SC simplex fiber coupler.

Cable Retention: Greater than 15 lbs (6.8 kg).

Back Reflection (typical - limit): 65 dB to minus 60 dB.

Insertion Loss (typical - limit): 0.1 dB to 0.3 dB.

Inline xDSL Filters:

Basis of Design: 1-line wall mount adapter DSL filter - Ivory as manufactured and supplied by Suttle.

Allows residential alarm panels to take control of the main phone line via the RJ31X or RJ38X connector.

Blocks DSL service to the alarm panel while providing uninterrupted DSL service to the household telephone wiring. Designed to plug into a RJ31X jack, including other similar jacks up to RJ38X.

Part Number: 900A.

Standards Compliance:

1.) Listed: UL and ULc.

2.) Part 68 of FCC Rules and requirements adopted by the ACTA.

Customer installable.

Automated alarm dialer compatible high-speed Internet device.

Stop-Band Isolation: Greater than 25 dB from 25 kHz to 1.2 MHz.

REN: 0.2 B (AC).

DC Resistance: Tip to tip, ring to ring; less than 20 Ohms.

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Loading Capacity on Port: Less than 60 nF.

Attenuation Distortion: Less than 0.4 dB.

Dimensions (LxHxD): 3.0 x 1.0 x 0.8 in (76 x 25 x 20 mm).

Basis of Design: 2-Line Inline DSL Filter as manufactured and supplied by Suttle. Connects between the wall jack and voice device (e.g. phone, fax, answering machine, Caller ID) providing a single filtered jack. Eliminates erratic impedance from telephone equipment that interferes with DSL communications.

Part Number: 900LCC-2F-50.

Standards Compliance:

1.) Listed: UL and ULc.

2.) Part 68 of FCC Rules and requirements adopted by the ACTA.

3.) ANSI T1. 421.

4.) Material: High impact, flame retardant thermoplastic, UL 94-V0 (indoor) rated.

Two filtered lines (pins 3 and 4, 2 and 5).

Compatible with ADSL, ADSL2 plus, VDSL2 to 30 MHz (data only).

Filter Topology: 2-pole low pass.

Contacts (plug and jacks): Minimum 50 micro-inch (0.00127 mm) of gold and nickel.

Customer installable.

Dielectric Withstand: 1000 VDC for 1 minute.

REN: 0.1B (ac).

Series DC Resistance: Less than 20 ohms (T to R with telephone port shorted).

Loading Capacity: 16 nF (T to R).

DC Loop Current: Operates from 0 to 90 mA.

Off-Hook Insertion Loss: Less than 0.2 dB at 1 KHz.

Off-Hook Insertion Loss Distortion: Less than 0.5 dB (200 Hz to 4KHz).

Off-Hook Impedance Distortion:

1.) ERL greater than 9 dB.

2.) SRL-LO greater than 13 dB.

3.) SRL-HI greater than 3 dB.

Envelope Delay: Less than 100 us (300 Hz to 2.8 kHz).

Stopband Attenuation:

1.) Greater than or equal to 21 dB at 25 to 50 kHz.

2.) Greater than or equal to 25 dB at 50 kHz to 30 MHz.

Dimensions (HxWxD): 1 x 3.1 x 0.8 in (25 x 79 x 20 mm).

Basis of Design: Single-Line Inline DSL Filter as manufactured and supplied by Suttle. Connects between the wall jack and voice device (e.g. phone, fax, answering machine, Caller ID) providing a single filtered jack. Eliminates erratic impedance from telephone equipment that interferes with DSL communications.

Part Number: 900LCC-50.

Standards Compliance:

1.) Listed UI and ULc.

2.) Complies with Part 68 of the FCC Rules and the requirements adopted by the ACTA.

3.) ANSI T1. 421.

4.) Material: High impact, flame retardant thermoplastic, UL 94-V0 (indoor) rated.

Compatible with ADSL, ADSL2 plus, VDSL2 to 30 MHz (Data Only).

Filter topology: 2-pole low pass.

Contacts (Plug and Jacks): Minimum 50 micro-inch of gold and nickel.

Customer installable.

Dielectric Withstand: 1000 VDC for 1 minute.

REN: 0.1B (ac).

Series DC Resistance: 20 ohms max. (T to R with telephone port shorted).

Loading Capacity: 6 nF (T to R).

DC Loop Current: Operates from 0 to 90 mA.

Off-Hook Insertion Loss: Less than 0.2 dB at 1 KHz.

Off-Hook Insertion Loss Distortion: Less than 0.5 dB (200 Hz to 4 KHz).

Off-Hook Impedance Distortion:

1.) ERL greater than 9 dB.

2.) SRL-LO greater than 13 dB.

3.) SRL-HI greater than 3 dB.

Envelope Delay: Less than 100 us (300 Hz to 2.8 kHz).

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Stopband Attenuation:

1.) Greater than or equal to 21 dB at 25 kHz to 50 kHz.

2.) Greater than or equal to 25 dB at 50 kHz to 30 MHz.

Dimensions (HxWxD): 1.24 x 3.82 x .76 in (31 x 97 x 19 mm).

Basis of Design: 2-Line Inline Adapter DSL Filter as manufactured and supplied by Suttle. Connects between the wall jack and voice device (e.g. phone, fax, answering machine, Caller ID) providing a filtered jack and an unfiltered jack. Filters eliminate erratic impedance from telephone equipment that interfere with DSL communications.

Part Number: 900LCCS-2F-50.

Standards Compliance:

1.) Listed UL and ULc.

2.) Part 68 of the FCC Rules and the requirements adopted by the ACTA.

3.) ANSI T1. 421.

Flame retardant thermoplastic per UL-94-V0.

Two filtered lines through one jack (pins 3 and 4, 2 and 5) and unfiltered signal through the other jack.

Compatible with ADSL, ADSL2 plus, VDSL2 to 30 MHz (data only).

Filter topology: 2-pole low pass.

Contacts (plug and jacks) minimum 50 micro-inch (0.00127 mm) of gold and nickel.

Customer installable.

Dielectric Withstand: 1 000 VDC for 1 minute.

REN: 0.1B (ac).

Series DC Resistance: 20 ohms max. (T to R with telephone port shorted).

Loading Capacity: 16 nF (T to R).

DC Loop Current: Operates from 0 to 90 mA.

Off-Hook Insertion Loss: Less than 0.2 dB at 1 KHz.

Off-Hook Insertion Loss Distortion: Less than 0.5 dB (200 Hz to 4 KHz).

Off-Hook Impedance Distortion:

1.) ERL greater than 9 dB.

2.) SRL-LO greater than 13 dB.

3.) SRL-HI greater than 3 dB.

Envelope Delay: Less than 100 us (300 Hz to 2.8 kHz).

Stopband Attenuation:

1.) Greater than or equal to 21 dB at 25 kHz to 50 kHz.

2.) Greater than or equal to 25 dB at 50 kHz to 30 MHz.

Dimensions (HxWxD): 1.62 x 2.65 x 0.93 in (41 x 67 x 24 mm).

Basis of Design: 1-line ADSL/ADSL2 plus Filter with Unfiltered Jack as manufactured and supplied by Suttle. Plugs into a wall jack providing separate ports for filtered voice (POTS) and high-speed ADSL data signals. The filter/splitter has two jacks: one (unfiltered) for a DSL modem and another (filtered) for a voice-grade device (phone, fax, answering machine, etc.) It keeps the voice-grade devices from interfering with the performance of the DSL modem, and keeps noise from the data signal off the voice devices.

Part Number: 900LCCS-50.

Standards Compliance:

1.) Listed UL and ULc.

2.) Complies with Part 68 of the FCC Rules and the requirements adopted by the ACTA.

3.) ANSI T1. 421.

4.) Material: High impact, flame retardant thermoplastic, UL 94-V0 (indoor) rated.

Compatible with ADSL and ADSL2 plus.

Filter Topology: 2-pole low pass.

Contacts (Plug and Jacks) Minimum 50 micro-inch of gold and nickel.

Customer installable.

Dielectric Withstand: 1000 VDC for 1 minute.

REN: 0.1B (ac).

Series DC Resistance: 20 ohms max. (T to R with telephone port shorted).

Loading Capacity: 16 nF (T to R).

DC Loop Current: Operates from 0 to 90 mA.

Off-Hook Insertion Loss: Less than 0.2 dB at 1 KHz.

Off-Hook Insertion Loss Distortion: Less than 0.5dB (200 Hz to 4 KHz).

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Off-Hook Impedance Distortion:

- 1.) ERL greater than 9 dB.
- 2.) SRL-LO greater than 13 dB.
- 3.) SRL-HI greater than 3 dB.

Envelope Delay: Greater than 100 us (300 Hz to 2.8 kHz).

Stopband Attenuation:

- 1.) Greater than or equal to 21 dB at 25 kHz to 50 kHz.
- 2.) Greater than or equal to 25 dB at 50 kHz to 30 MHz.

Dimensions (HxWxD): 1.30 x 4.33 x .76 in (33 x 110 x 19 mm).

Basis of Design: 2-line filtered and auxiliary DSL jack as manufactured and supplied by Suttle. Connects between the wall jack and voice device (e.g. phone, fax, answering machine, Caller ID) providing both an unfiltered DSL jack for DSL connection and a filtered jack for a single line of voice device communications. Filters isolate telephone equipment impedances from ADSL, delivering high bandwidth ADSL transmission capabilities.

Part Number: 900LCS-2F-50E.

Standards Compliance:

- 1.) FCC registered; complies with Part 68.
- 2.) Material: High impact, flame retardant thermoplastic, UL 94-V0 (indoor) rated.

Compatible with ADSL, ADSL2 plus, VDSL2 to 30 MHz (data only).

Customer installable.

Filter topology: 2-pole low pass.

Contacts (Plug and Jacks) Minimum 50 micro-inch of gold and nickel.

Two filtered lines through one jack (pins 3 and 4, 2 and 5) and unfiltered signal through the other jack.

Small, compact design.

Customer installable.

Dielectric Withstand: 1000 VDC for 1 minute.

REN: 0.1B (ac).

Series DC Resistance: 20 ohms max. (T to R with telephone port shortened).

Loading Capacity: 40 nF (T to R).

DC Loop Current: Operates from 0 to 90 mA.

Off-hook Insertion Loss: Less than 0.2 dB at 1 KHz.

Off-hook Insertion Loss Distortion: Less than 0.5 dB (200 Hz to 4 KHz).

Off-Hook Impedance Distortion:

- 1.) Network Port:
 - a.) ERL: greater than 10 dB.
 - b.) SRL-LO: greater than 12 dB.
 - c.) SRL-HI: greater than 5 dB.

- 2.) Phone Port:

- a.) ERL: greater than 9 dB.
- b.) SRL-LO: greater than 13 dB.
- c.) SRL-HI: greater than 3 dB.

- 3.) Envelope Delay: Less than 100 us (300 Hz to 2.8 kHz).

Basis of Design: 1-line filtered and auxiliary DSL jack as manufactured and supplied by Suttle. Connects between the wall jack and voice device (e.g. phone, fax, answering machine, Caller ID) providing both an unfiltered DSL jack for DSL connection and a filtered jack for a single line of voice device communications. Filters isolate telephone equipment impedances from ADSL, delivering high bandwidth ADSL transmission capabilities.

Part Number: 900LCS-2F-50E.

Part Number: 900LCS-50ETX. Spanish labels (1 per pack).

Part Number: 04AG-003L000 Spanish labels (2 per pack).

Standards Compliance:

- 1.) FCC registered; complies with Part 68.
- 2.) Material: High impact, flame retardant thermoplastic, UL 94-V0 (indoor) rated.

Filter Topology: 2-pole low pass.

Contacts: Plug and Jacks - Minimum 50 micro-inch of gold and nickel.

Small, compact design.

Customer installable.

Dielectric Withstand: 1000 VDC for 1 minute.

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REN: 0.1B (ac).

Series DC Resistance: 20 ohms max. (T to R with telephone port shortened).

Loading Capacity: 40 nF (T to R).

DC Loop Current: Operates from 0 to 90 mA.

Off-hook Insertion Loss: Less than 0.2 dB at 1 KHz.

Off-hook Insertion Loss Distortion: Less than 0.5 dB (200 Hz to 4 KHz).

Off-Hook Impedance Distortion:

1.)Network Port:

a.)ERL: greater than 10 dB.

b.)SRL-LO: greater than 12 dB.

c.)SRL-HI: greater than 5 dB.

2.)Phone Port:

a.)ERL: greater than 9 dB.

b.)SRL-LO: greater than 13 dB.

c.)SRL-HI: greater than 3 dB.

3.)Envelope Delay: Less than 100 us (300 Hz to 2.8 kHz).

Modular Plugs:

Basis of Design: 4-position, 4-conductor Modular Plug as manufactured and supplied by Suttle. Meets FCC Part 68 requirements.

Part Number: 264. For handset cords.

Basis of Design: 6-position, 4-conductor Modular Plug as manufactured and supplied by Suttle. Meets FCC Part 68 requirements.

Part Number: 266. For stranded wire.

Basis of Design: 6-position, 4-conductor Modular Plug for Solid Wire as manufactured and supplied by Suttle. Meets FCC Part 68 requirements.

Part Number: 266-4S. For solid wire only.

Basis of Design: 6-position, 6-conductor Modular Plug as manufactured and supplied by Suttle. Meets FCC Part 68 requirements.

Part Number: 266-6. For stranded wire.

Basis of Design: 8-position, 8-conductor Keyed Modular Plug as manufactured and supplied by Suttle. Meets FCC Part 68 requirements.

Part Number: 266-8K. For stranded wire. Keyed plug.

Basis of Design: 8-position, 8-conductor Non-Keyed Modular Plug as manufactured and supplied by Suttle. Meets FCC Part 68 requirements.

Part Number: 266-8NK. For stranded wire. Non-Keyed plug.

Patch Cords:

Basis of Design: CAT6 Patch Cords as manufactured and supplied by Suttle. Suttle Category 6 rated patch cords offer the higher performance specifications needed for Gigabit Ethernet (1000-Base-T) applications. They feature connectors with improved strain relief and anti-snap latches and are available in a variety of lengths and colors.

Part Number: STAR661-04. CAT6, 200 Mhz Patch Cord; 4 ft (1.2 m) length.

Part Number: STAR661-08. CAT6, 200 Mhz Patch Cord; 4 ft (1.2 m) length.

Part Number: STAR661-12. CAT6, 200 Mhz Patch Cord; 4 ft (1.2 m) length.

Color: Red.

Color: Yellow.

Color: Blue.

Enhanced strain relief at connectors.

Anti-snap latches.

Supports broadband video and high-speed ATM applications.

Backwards compatible with Cat 5 legacy products.

Meets Cat 6 transmission requirements in EIA/TIA 568-C standard.

Mechanical, electrical and clearance specifications meet FCC Rules and Regulations, Part 68 Subpart F.

Listed: UL and ULc.

Dielectric Withstand: Greater than 1000 VAC RMS at 60 Hz.

Insulation Resistance: Greater than 500 megaohms.

Contact Resistance: Less than 20 milliohms.

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Contact Materials: 50 micro-inch (0.00127 mm) gold over 100 micro-inch (0.00254 mm) nickel.

Current Rating: 1.5 A at 68 degrees F (20 Degrees C).

1.)Per IEC Publication 512-3, Test 5b.

Conductors: 4 twisted pair, 24 AWG stranded copper.

Insulation: Flame retardant polyethylene.

Jacket: PVC.

Plastic Plug: High impact, flame retardant thermoplastic, UL 94-V0 (indoor) rated.

Wall Mount xDSL Filters:

Basis of Design: Tool-less xDSL Flush Mount Splitter as manufactured and supplied by Suttle. Mount directly onto a junction box replacing the first telephone jack in the subscriber's premise to isolate the voice signal from the xDSL signals. The splitter circuitry is integrated directly onto the back of the wall plate providing a smooth streamlined installation. The splitter is equipped with tool-less IDCs for connecting to the home wiring as well as two labeled jack ports for connecting the modem and a phone device. This tool-less flush mount splitter is also compatible with VDSL pair bonding with inputs for 2 lines.

Part Number: 2-1019-IP-52. Elec Ivory.

Part Number: 2-1019-IP-85. White.

Tool-less IDC inputs for fast installation.

Tool-less IDC outputs for daisy-chaining.

Two jacks, filtered and unfiltered, labeled: "VOICE" and "DATA."

Ring Trip Mitigation circuitry needed with IPTV services.

May be installed without mounting brackets.

Operates with ADSL, ADSL2 plus and VDSL2 systems up to and including profile 30A.

Compatible with VDSL pair-bonding.

DC Loop Current: 0 to 100 mA.

DC Loop Voltage: 0 to -60 V.

DC Resistance: Less than or equal to 25 Ohms.

Insertion Loss: Less than 0.5 dB.

Attenuation Distortion: Less than 1.0 dB.

Delay Distortion: Less than 200 us.

xDSL Band Attenuation:

1.)Greater than 65 dB at 30 kHz to 300 kHz.

2.)Greater than 55 dB at 300 kHz to 30 MHz.

Return Loss:

1.)6 dB ERL.

2.)5 dB SRL-Low.

3.)3 dB SRL-High.

Longitudinal Balance: Greater than 57 dB.

Basis of Design: 1-Line Wall Mount Adapter DSL Filter as manufactured and supplied by Suttle. Mounts to existing wall mount phone jacks providing an unfiltered jack for DSL connections plus one or two filtered lines for voice device communications (e.g. phone, fax, answering machine, Caller ID box) via two auxiliary phone jacks. Filters isolate telephone equipment impedances from ADSL signals, delivering high bandwidth ADSL transmission capabilities.

Part Number: 630LCCU-50. Ivory.

Part Number: 630LCCU-52. Electrical Ivory.

Part Number: 630LCCU-64. Light Almond.

Part Number: 630LCCU-85. White.

Standards Compliance:

1.)Listed: UL.

2.)Part 68 of FCC Rules and requirements adopted by the ACTA.

3.)ANSI T1.421.

4.)Material: High impact, flame retardant thermoplastic, UL 94-V0 (indoor) rated.

Compatible with ADSL and ADSL2 plus.

Filter Topology: 2-pole low pass.

Contacts (Plug and Jacks): Minimum 50 micro-inch (0.00127 mm) of gold and nickel.

Customer installable.

Dielectric Withstand: 1000 VDC for 1 minute.

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REN: 0.1B (ac).

Series DC Resistance: Less than 20 ohms (T to R with telephone port shorted).

Loading Capacity: 6 nF (T to R).

DC Loop Current: Operates from 0 to 90 mA.

Off-Hook Insertion Loss: Less than 0.2 dB at 1 KHz.

Off-Hook Insertion Loss Distortion: Less than 0.5 dB (200 to 4 KHz).

Off-Hook Impedance Distortion:

1.)ERL: Greater than 9 dB.

2.)SRL-LO: Greater than 13 dB.

3.)SRL-HI: Greater than 3dB.

Envelope Delay: Less than 100 us (300 Hz - 2.8 kHz).

Stopband Attenuation:

1.)21 dB at 25 to 50 kHz.

2.)25 dB at 50 kHz to 30MHz.

Basis of Design: 2-Line Wall Mount Adapter DSL Filter as manufactured and supplied by Suttle. Mounts to existing wall mount phone jacks providing an unfiltered jack for DSL connections plus one or two filtered lines for voice device communications (e.g. phone, fax, answering machine, Caller ID box) via two auxiliary phone jacks. Filters isolate telephone equipment impedances from ADSL signals, delivering high bandwidth ADSL transmission capabilities.

Part Number: 630LCCU-2F-50. Ivory.

Part Number: 630LCCU-2F-52. Electrical Ivory.

Part Number: 630LCCU-2F-64. Light Almond.

Part Number: 630LCCU-2F-85. White.

Standards Compliance:

1.)Listed: UL.

2.)Part 68 of FCC Rules and requirements adopted by the ACTA.

3.)ANSI T1.421.

4.)Material: High impact, flame retardant thermoplastic, UL 94-V0 (indoor) rated.

Compatible with ADSL and ADSL2 Plus.

Filter Topology: 2-pole low pass.

Contacts (Plug and Jacks): Minimum 50 micro-inch (0.00127 mm) of gold and nickel.

Customer installable.

Dielectric Withstand: 1000 VDC for 1 minute.

REN: 0.1B (ac).

Series DC Resistance: Less than 20 ohms (T to R with telephone port shorted).

Loading Capacity: 6 nF (T to R).

DC Loop Current: Operates from 0 to 90 mA.

Off-Hook Insertion Loss: Less than 0.2 dB at 1 KHz.

Off-Hook Insertion Loss Distortion: Less than 0.5 dB (200 to 4 KHz).

Off-Hook Impedance Distortion:

1.)ERL: Greater than 9 dB.

2.)SRL-LO: Greater than 13 dB.

3.)SRL-HI: Greater than 3dB.

Envelope Delay: Less than 100 us (300 Hz - 2.8 kHz).

Stopband Attenuation:

1.)21 dB at 25 to 50 kHz.

2.)25 dB at 50 kHz to 30MHz.

CONTRACTOR PANEL KITS

Basis or Design: MediaMax Contractor Kits as manufactured and supplied by Suttle.

Standards Compliance: UL listed.

Plastic Enclosures: CAT6

Smart: CAT6 and COAX.

1.)Kit Number: MXE-15FK-TC6. 15 inch () panel

a.)Panel: MXE-15P-1G2.

b.)Hinged Vented Cover: MXE-15C-1G2.

c.)Mounting Kit: MXE-ACC-1. CPE. 1 equipment shelf, 2 equipment brackets, 2 cable spools, 2 tie

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brackets, 4 cable ties, 12 screws

d.)Data:

1.)STAR6000C6T: CAT6 Tool-less data jack, 1 Gig, 250MHz bandwidth, 8-position, 8-conductor, 568A/B, tool-less IDC, includes colored bezels. Quantity of 8.

2.)SAM-SP8: 8 - Port patch module

e.)Video:

1.)SAM-RFH4: 1 x 4 COAX RF splitter module, 3GHz

2.)STAR500F-C-85: F81 COAX connector, 3GHz. Quantity of 4.

f.)Faceplates:

1.)FD-12-SCR: 2 Port faceplate, screw-on. Quantity of 4.

2.)Kit Number: MXE-30FK-TC6

a.)Panel: MXE-30P-1G2.

b.)Hinged Vented Cover: MXE-30C-1G2.

c.)Mounting Kit: MXE-ACC-1. CPE. 1 equipment shelf, 2 equipment brackets, 2 cable spools, 2 tie brackets, 4 cable ties, 12 screws

d.)Data:

1.)STAR6000C6T: CAT6 Tool-less data jack, 1 Gig, 250MHz bandwidth, 8-position, 8-conductor, 568A/B, tool-less IDC, includes colored bezels. Quantity of 16.

2.)SAM-SP8: 8 - Port patch module

e.)Video:

1.)SAM-RFH8: 1 x 8 COAX RF splitter module, 3GHz

2.)STAR500F-C-85: F81 COAX connector, 3GHz. Quantity of 8

f.)Faceplates:

1.)FD-12-SCR: 2 Port faceplate, screw-on. Quantity of 8.

3.)Kit Number: MXE-45FK-TC6

a.)Panel: MXE-45P-1G2.

b.)Hinged Vented Cover: MXE-45C-1G2.

c.)Mounting Kit: MXE-ACC-1. CPE. 1 equipment shelf, 2 equipment brackets, 2 cable spools, 2 tie brackets, 4 cable ties, 12 screws

d.)Data:

1.)STAR6000C6T: CAT6 Tool-less data jack, 1 Gig, 250MHz bandwidth, 8-position, 8-conductor, 568A/B, tool-less IDC, includes colored bezels. Quantity of 16.

2.)SAM-SP8: 8 - Port patch module

e.)Video:

1.)SAM-RFH8: 1 x 8 COAX RF splitter module, 3GHz

2.)STAR500F-C-85: F81 COAX connector, 3GHz. Quantity of 8

f.)Faceplates:

1.)FD-12-SCR: 2 Port faceplate, screw-on. Quantity of 8.

Connected: CAT6 and Limited COAX

1.)Kit Number: MXE-15FK-T6

a.)Panel: MXE-15P-1G2.

b.)Hinged Vented Cover: MXE-15C-1G2.

c.)Mounting Kit: MXE-ACC-1. CPE. 1 equipment shelf, 2 equipment brackets, 2 cable spools, 2 tie brackets, 4 cable ties, 12 screws

d.)Data:

1.)STAR6000C6T: CAT6 Tool-less data jack, 1 Gig, 250MHz bandwidth, 8-position, 8-conductor, 568A/B, tool-less IDC, includes colored bezels. Quantity of 8.

2.)SAM-SP8: 8 - Port patch module

e.)Video:

1.)STAR500F-C-85: F81 COAX connector, 3GHz. Quantity of 2.

f.)Faceplates:

1.)FD-11-SCR: 1 - Port faceplate, screw-on. Quantity of 3.

2.)FD-12-SCR: 2 Port faceplate, screw-on. Quantity of 1.

2.)Kit Number: MXE-30FK-T6

a.)Panel: MXE-30P-1G2.

b.)Hinged Vented Cover: MXE-30C-1G2.

c.)Mounting Kit: MXE-ACC-1. CPE. 1 equipment shelf, 2 equipment brackets, 2 cable spools, 2 tie brackets, 4 cable ties, 12 screws

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d.)Data:

1.)STAR6000C6T: CAT6 Tool-less data jack, 1 Gig, 250MHz bandwidth, 8-position, 8-conductor, 568A/B, tool-less IDC, includes colored bezels. Quantity of 16.

2.)SAM-SP8: 8 - Port patch module

e.)Video:

1.)SAM-RFH4: 1 x 4 COAX RF splitter module, 3GHz

2.)STAR500F-C-85: F81 COAX connector, 3GHz. Quantity of 4.

f.)Faceplates:

1.)FD-11-SCR: 1 - Port faceplate, screw-on. Quantity of 4.

2.)FD-12-SCR: 2 Port faceplate, screw-on. Quantity of 4.

3.)Kit Number: MXE-45FK-T6

a.)Panel: MXE-45P-1G2.

b.)Hinged Vented Cover: MXE-45C-1G2.

c.)Mounting Kit: MXE-ACC-1. CPE. 1 equipment shelf, 2 equipment brackets, 2 cable spools, 2 tie brackets, 4 cable ties, 12 screws

d.)Data:

1.)STAR6000C6T: CAT6 Tool-less data jack, 1 Gig, 250MHz bandwidth, 8-position, 8-conductor, 568A/B, tool-less IDC, includes colored bezels. Quantity of 16.

2.)SAM-SP8: 8 - Port patch module

e.)Video:

1.)SAM-RFH4: 1 x 4 COAX RF splitter module, 3GHz

2.)STAR500F-C-85: F81 COAX connector, 3GHz. Quantity of 4.

f.)Faceplates:

1.)FD-11-SCR: 1 - Port faceplate, screw-on. Quantity of 4.

2.)FD-12-SCR: 2 Port faceplate, screw-on. Quantity of 4.

Basic: COAX and Limited CAT6

1.)Kit Number: MXE-15FK-CT

a.)Panel: MXE-15P-1G2.

b.)Hinged Vented Cover: MXE-15C-1G2.

c.)Mounting Kit: MXE-ACC-1. CPE. 1 equipment shelf, 2 equipment brackets, 2 cable spools, 2 tie brackets, 4 cable ties, 12 screws

d.)Data:

1.)STAR6000C6T: CAT6 Tool-less data jack, 1 Gig, 250MHz bandwidth, 8-position, 8-conductor, 568A/B, tool-less IDC, includes colored bezels. Quantity of 4.

2.)SAM-SP8: 8 - Port patch module

e.)Video:

1.)SAM-RFH4: 1 x 4 COAX RF splitter module, 3GHz

2.)STAR500F-C-85: F81 COAX connector, 3GHz. Quantity of 4.

f.)Faceplates:

1.)FD-11-SCR: 1 - Port faceplate, screw-on. Quantity of 2.

2.)FD-12-SCR: 2 Port faceplate, screw-on. Quantity of 2.

2.)Kit Number: MXE-30FK-CT

a.)Panel: MXE-30P-1G2.

b.)Hinged Vented Cover: MXE-30C-1G2.

c.)Mounting Kit: MXE-ACC-1. CPE. 1 equipment shelf, 2 equipment brackets, 2 cable spools, 2 tie brackets, 4 cable ties, 12 screws

d.)Data:

1.)STAR6000C6T: CAT6 Tool-less data jack, 1 Gig, 250MHz bandwidth, 8-position, 8-conductor, 568A/B, tool-less IDC, includes colored bezels. Quantity of 6.

2.)SAM-SP8: 8 - Port patch module

e.)Video:

1.)SAM-RFH8: 1 x 8 COAX RF splitter module, 3GHz

2.)STAR500F-C-85: F81 COAX connector, 3GHz. Quantity of 8

f.)Faceplates:

1.)FD-11-SCR: 1 - Port faceplate, screw-on. Quantity of 5.

2.)FD-12-SCR: 2 Port faceplate, screw-on. Quantity of 3.

3.)Kit Number: MXE-45FK-CT

a.)Panel: MXE-45P-1G2.

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- b.)Hinged Vented Cover: MXE-45C-1G2.
- c.)Mounting Kit: MXE-ACC-1. CPE. 1 equipment shelf, 2 equipment brackets, 2 cable spools, 2 tie brackets, 4 cable ties, 12 screws
- d.)Data:
 - 1.)STAR6000C6T: CAT6 Tool-less data jack, 1 Gig, 250MHz bandwidth, 8-position, 8-conductor, 568A/B, tool-less IDC, includes colored bezels. Quantity of 6.
 - 2.)SAM-SP8: 8 - Port patch module
- e.)Video:
 - 1.)SAM-RFH8: 1 x 8 COAX RF splitter module, 3GHz
 - 2.)STAR500F-C-85: F81 COAX connector, 3GHz. Quantity of 8
- f.)Faceplates:
 - 1.)FD-11-SCR: 1 - Port faceplate, screw-on. Quantity of 5.
 - 2.)FD-12-SCR: 2 Port faceplate, screw-on. Quantity of 3.
- Plastic Enclosures: CAT6A
- Smart: CAT6A and COAX.
- 1.)Kit Number: MXE-15FK-TCA
- a.)Panel: MXE-15P-1G2.
- b.)Hinged Vented Cover: MXE-15C-1G2.
- c.)Mounting Kit: MXE-ACC-1. CPE. 1 equipment shelf, 2 equipment brackets, 2 cable spools, 2 tie brackets, 4 cable ties, 12 screws
- d.)Data:
 - 1.)STAR6APDJ: CAT6A 10 Gig data jack, 10-Gig, 500MHz bandwidth, 8-position, 8-conductor, 568A/B wiring, standard 110 IDC, includes colored bezels. Quantity of 8.
 - 2.)SAM-SP8: 8 - Port patch module
- e.)Video:
 - 1.)SAM-RFH4: 1 x 4 COAX RF splitter module, 3GHz
 - 2.)STAR500F-C-85: F81 COAX connector, 3GHz. Quantity of 4.
- f.)Faceplates:
 - 1.)FD-12-SNO: 2 Port faceplate, snap-on. Quantity of 4.
 - 2.)Kit Number: MXE-30FK-TCA
- a.)Panel: MXE-30P-1G2.
- b.)Hinged Vented Cover: MXE-30C-1G2.
- c.)Mounting Kit: MXE-ACC-1. CPE. 1 equipment shelf, 2 equipment brackets, 2 cable spools, 2 tie brackets, 4 cable ties, 12 screws
- d.)Data:
 - 1.)STAR6APDJ: CAT6A 10 Gig data jack, 10-Gig, 500MHz bandwidth, 8-position, 8-conductor, 568A/B wiring, standard 110 IDC, includes colored bezels. Quantity of 16.
 - 2.)SAM-SP8: 8 - Port patch module
- e.)Video:
 - 1.)SAM-RFH8: 1 x 8 COAX RF splitter module, 3GHz
 - 2.)STAR500F-C-85: F81 COAX connector, 3GHz. Quantity of 8
- f.)Faceplates:
 - 1.)FD-12-SNO: 2 Port faceplate, snap-on. Quantity of 8.
 - 3.)Kit Number: MXE-45FK-TCA
- a.)Panel: MXE-45P-1G2.
- b.)Hinged Vented Cover: MXE-45C-1G2.
- c.)Mounting Kit: MXE-ACC-1. CPE. 1 equipment shelf, 2 equipment brackets, 2 cable spools, 2 tie brackets, 4 cable ties, 12 screws
- d.)Data:
 - 1.)STAR6APDJ: CAT6A 10 Gig data jack, 10-Gig, 500MHz bandwidth, 8-position, 8-conductor, 568A/B wiring, standard 110 IDC, includes colored bezels. Quantity of 16.
 - 2.)SAM-SP8: 8 - Port patch module
- e.)Video:
 - 1.)SAM-RFH8: 1 x 8 COAX RF splitter module, 3GHz
 - 2.)STAR500F-C-85: F81 COAX connector, 3GHz. Quantity of 8
- f.)Faceplates:
 - 1.)FD-12-SNO: 2 Port faceplate, snap-on. Quantity of 8.
- Connected: CAT6A and Limited COAX

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- 1.)Kit Number: MXE-15FK-T6A
- a.)Panel: MXE-15P-1G2.
- b.)Hinged Vented Cover: MXE-15C-1G2.
- c.)Mounting Kit: MXE-ACC-1. CPE. 1 equipment shelf, 2 equipment brackets, 2 cable spools, 2 tie brackets, 4 cable ties, 12 screws
- d.)Data:
 - 1.)STAR6APDJ: CAT6A 10 Gig data jack, 10-Gig, 500MHz bandwidth, 8-position, 8-conductor, 568A/B wiring, standard 110 IDC, includes colored bezels. Quantity of 8.
 - 2.)SAM-SP8: 8 - Port patch module
- e.)Video:
 - 1.)STAR500F-C-85: F81 COAX connector, 3GHz. Quantity of 2.
- f.)Faceplates:
 - 1.)FD-11-SNO: 1 Port faceplate, snap-on. Quantity of 3.
 - 2.)FD-12-SNO: 2 Port faceplate, snap-on. Quantity of 1.
- 2.)Kit Number: MXE-30FK-T6A
- a.)Panel: MXE-30P-1G2.
- b.)Hinged Vented Cover: MXE-30C-1G2.
- c.)Mounting Kit: MXE-ACC-1. CPE. 1 equipment shelf, 2 equipment brackets, 2 cable spools, 2 tie brackets, 4 cable ties, 12 screws
- d.)Data:
 - 1.)STAR6APDJ: CAT6A 10 Gig data jack, 10-Gig, 500MHz bandwidth, 8-position, 8-conductor, 568A/B wiring, standard 110 IDC, includes colored bezels. Quantity of 16.
 - 2.)SAM-SP8: 8 - Port patch module
- e.)Video:
 - 1.)SAM-RFH4: 1 x 4 COAX RF splitter module, 3GHz
 - 2.)STAR500F-C-85: F81 COAX connector, 3GHz. Quantity of 4.
- f.)Faceplates:
 - 1.)FD-11-SNO: 1 Port faceplate, snap-on. Quantity of 4.
 - 2.)FD-12-SNO: 2 Port faceplate, snap-on. Quantity of 4.
- 3.)Kit Number: MXE-45FK-T6A
- a.)Panel: MXE-45P-1G2.
- b.)Hinged Vented Cover: MXE-45C-1G2.
- c.)Mounting Kit: MXE-ACC-1. CPE. 1 equipment shelf, 2 equipment brackets, 2 cable spools, 2 tie brackets, 4 cable ties, 12 screws
- d.)Data:
 - 1.)STAR6APDJ: CAT6A 10 Gig data jack, 10-Gig, 500MHz bandwidth, 8-position, 8-conductor, 568A/B wiring, standard 110 IDC, includes colored bezels. Quantity of 16.
 - 2.)SAM-SP8: 8 - Port patch module
- e.)Video:
 - 1.)SAM-RFH4: 1 x 4 COAX RF splitter module, 3GHz
 - 2.)STAR500F-C-85: F81 COAX connector, 3GHz. Quantity of 4.
- f.)Faceplates:
 - 1.)FD-11-SNO: 1 Port faceplate, snap-on. Quantity of 4.
 - 2.)FD-12-SNO: 2 Port faceplate, snap-on. Quantity of 4.
- Basic: COAX and Limited CAT6A
- 1.)Kit Number: MXE-15FK-CTA
- a.)Panel: MXE-15P-1G2.
- b.)Hinged Vented Cover: MXE-15C-1G2.
- c.)Mounting Kit: MXE-ACC-1. CPE. 1 equipment shelf, 2 equipment brackets, 2 cable spools, 2 tie brackets, 4 cable ties, 12 screws
- d.)Data:
 - 1.)STAR6APDJ: CAT6A 10 Gig data jack, 10-Gig, 500MHz bandwidth, 8-position, 8-conductor, 568A/B wiring, standard 110 IDC, includes colored bezels. Quantity of 8.
 - 2.)SAM-SP8: 8 - Port patch module
- e.)Video:
 - 1.)SAM-RFH4: 1 x 4 COAX RF splitter module, 3GHz
 - 2.)STAR500F-C-85: F81 COAX connector, 3GHz. Quantity of 4.
- f.)Faceplates:

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- 1.)FD-11-SNO: 1 Port faceplate, snap-on. Quantity of 2.
 - 2.)FD-12-SNO: 2 Port faceplate, snap-on. Quantity of 2.
 - 2.)Kit Number: MXE-30FK-CTA
 - a.)Panel: MXE-30P-1G2.
 - b.)Hinged Vented Cover: MXE-30C-1G2.
 - c.)Mounting Kit: MXE-ACC-1. CPE. 1 equipment shelf, 2 equipment brackets, 2 cable spools, 2 tie brackets, 4 cable ties, 12 screws
 - d.)Data:
 - 1.)STAR6APDJ: CAT6A 10 Gig data jack, 10-Gig, 500MHz bandwidth, 8-position, 8-conductor, 568A/B wiring, standard 110 IDC, includes colored bezels. Quantity of 8.
 - 2.)SAM-SP8: 8 - Port patch module
 - e.)Video:
 - 1.)SAM-RFH8: 1 x 8 COAX RF splitter module, 3GHz
 - 2.)STAR500F-C-85: F81 COAX connector, 3GHz. Quantity of 8
 - f.)Faceplates:
 - 1.)FD-11-SNO: 1 Port faceplate, snap-on. Quantity of 5.
 - 2.)FD-12-SNO: 2 Port faceplate, snap-on. Quantity of 3.
 - 3.)Kit Number: MXE-45FK-CTA
 - a.)Panel: MXE-45P-1G2.
 - b.)Hinged Vented Cover: MXE-45C-1G2.
 - c.)Mounting Kit: MXE-ACC-1. CPE. 1 equipment shelf, 2 equipment brackets, 2 cable spools, 2 tie brackets, 4 cable ties, 12 screws
 - d.)Data:
 - 1.)STAR6APDJ: CAT6A 10 Gig data jack, 10-Gig, 500MHz bandwidth, 8-position, 8-conductor, 568A/B wiring, standard 110 IDC, includes colored bezels. Quantity of 8.
 - 2.)SAM-SP8: 8 - Port patch module
 - e.)Video:
 - 1.)SAM-RFH8: 1 x 8 COAX RF splitter module, 3GHz
 - 2.)STAR500F-C-85: F81 COAX connector, 3GHz. Quantity of 8
 - f.)Faceplates:
 - 1.)FD-11-SNO: 1 Port faceplate, snap-on. Quantity of 5.
 - 2.)FD-12-SNO: 2 Port faceplate, snap-on. Quantity of 3.
- Metal Enclosures: CAT6
Smart: CAT6 and COAX.
- 1.)Kit Number: SAE-28NMK-TC6
 - a.)Panel: SAE-28.
 - b.)Metal Door Cover: SADC-28.
 - c.)Mounting Kit: SAE-ACC-1. CPE. 1 equipment shelf, 30" hook & loop strap, 2 cable spools, 2 tie brackets, 4 cable ties, 12 screws
 - d.)Data:
 - 1.)STAR6000C6T: CAT6 Tool-less data jack, 1 Gig, 250MHz bandwidth, 8-position, 8-conductor, 568A/B, tool-less IDC, includes colored bezels. Quantity of 16.
 - 2.)SAM-SP8: 8 - Port patch module
 - e.)Video:
 - 1.)SAM-RFH8: 1 x 8 COAX RF splitter module, 3GHz
 - 2.)STAR500F-C-85: F81 COAX connector, 3GHz. Quantity of 8
 - f.)Faceplates:
 - 1.)FD-12-SCR: 2 Port faceplate, screw-on. Quantity of 8.
 - 2.)Kit Number: SAE-42NMK-TC6
 - a.)Panel: SAE-42.
 - b.)Metal Door Cover: SADC-42.
 - c.)Mounting Kit: SAE-ACC-1. CPE. 1 equipment shelf, 30" hook & loop strap, 2 cable spools, 2 tie brackets, 4 cable ties, 12 screws
 - d.)Data:
 - 1.)STAR6000C6T: CAT6 Tool-less data jack, 1 Gig, 250MHz bandwidth, 8-position, 8-conductor, 568A/B, tool-less IDC, includes colored bezels. Quantity of 16.
 - 2.)SAM-SP8: 8 - Port patch module
 - e.)Video:

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- 1.)SAM-RFH8: 1 x 8 COAX RF splitter module, 3GHz
- 2.)STAR500F-C-85: F81 COAX connector, 3GHz. Quantity of 8
- f.)Faceplates:
 - 1.)FD-12-SCR: 2 Port faceplate, screw-on. Quantity of 8.Connected: CAT6 and Limited COAX
- 1.)Kit Number: SAE-28NMK-T6
 - a.)Panel: SAE-28.
 - b.)Metal Door Cover: SADC-28.
 - c.)Mounting Kit: SAE-ACC-1. CPE. 1 equipment shelf, 30" hook & loop strap, 2 cable spools, 2 tie brackets, 4 cable ties, 12 screws
 - d.)Data:
 - 1.)STAR6000C6T: CAT6 Tool-less data jack, 1 Gig, 250MHz bandwidth, 8-position, 8-conductor, 568A/B, tool-less IDC, includes colored bezels. Quantity of 16.
 - 2.)SAM-SP8: 8 - Port patch module
 - e.)Video:
 - 1.)SAM-RFH4: 1 x 4 COAX RF splitter module, 3GHz
 - 2.)STAR500F-C-85: F81 COAX connector, 3GHz. Quantity of 4.
 - f.)Faceplates:
 - 1.)FD-11-SCR: 1 - Port faceplate, screw-on. Quantity of 4.
 - 2.)FD-12-SCR: 2 Port faceplate, screw-on. Quantity of 4.
 - 2.)Kit Number: SAE-42NMK-T6
 - a.)Panel: SAE-42.
 - b.)Metal Door Cover: SADC-42.
 - c.)Mounting Kit: SAE-ACC-1. CPE. 1 equipment shelf, 30" hook & loop strap, 2 cable spools, 2 tie brackets, 4 cable ties, 12 screws
 - d.)Data:
 - 1.)STAR6000C6T: CAT6 Tool-less data jack, 1 Gig, 250MHz bandwidth, 8-position, 8-conductor, 568A/B, tool-less IDC, includes colored bezels. Quantity of 16.
 - 2.)SAM-SP8: 8 - Port patch module
 - e.)Video:
 - 1.)SAM-RFH4: 1 x 4 COAX RF splitter module, 3GHz
 - 2.)STAR500F-C-85: F81 COAX connector, 3GHz. Quantity of 4.
 - f.)Faceplates:
 - 1.)FD-11-SCR: 1 - Port faceplate, screw-on. Quantity of 4.
 - 2.)FD-12-SCR: 2 Port faceplate, screw-on. Quantity of 4.Basic: COAX and Limited CAT6
 - 1.)Kit Number: SAE-28NMK-CT
 - a.)Panel: SAE-28.
 - b.)Metal Door Cover: SADC-28.
 - c.)Mounting Kit: SAE-ACC-1. CPE. 1 equipment shelf, 30" hook & loop strap, 2 cable spools, 2 tie brackets, 4 cable ties, 12 screws
 - d.)Data:
 - 1.)STAR6000C6T: CAT6 Tool-less data jack, 1 Gig, 250MHz bandwidth, 8-position, 8-conductor, 568A/B, tool-less IDC, includes colored bezels. Quantity of 6.
 - 2.)SAM-SP8: 8 - Port patch module
 - e.)Video:
 - 1.)SAM-RFH8: 1 x 8 COAX RF splitter module, 3GHz
 - 2.)STAR500F-C-85: F81 COAX connector, 3GHz. Quantity of 8
 - f.)Faceplates:
 - 1.)FD-11-SCR: 1 - Port faceplate, screw-on. Quantity of 5.
 - 2.)FD-12-SCR: 2 Port faceplate, screw-on. Quantity of 3.
 - 2.)Kit Number: SAE-42NMK-CT
 - a.)Panel: SAE-42.
 - b.)Metal Door Cover: SADC-42.
 - c.)Mounting Kit: SAE-ACC-1. CPE. 1 equipment shelf, 30" hook & loop strap, 2 cable spools, 2 tie brackets, 4 cable ties, 12 screws
 - d.)Data:
 - 1.)STAR6000C6T: CAT6 Tool-less data jack, 1 Gig, 250MHz bandwidth, 8-position, 8-conductor, 568A/B,

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tool-less IDC, includes colored bezels. Quantity of 6.

2.)SAM-SP8: 8 - Port patch module

e.)Video:

1.)SAM-RFH8: 1 x 8 COAX RF splitter module, 3GHz

2.)STAR500F-C-85: F81 COAX connector, 3GHz. Quantity of 8

f.)Faceplates:

1.)FD-11-SCR: 1 - Port faceplate, screw-on. Quantity of 5.

2.)FD-12-SCR: 2 Port faceplate, screw-on. Quantity of 3.

Metal Enclosures: CAT6A

Smart: CAT6A and COAX.

1.)Kit Number: SAE-28NMK-TC6A

a.)Panel: SAE-28.

b.)Metal Door Cover: SADC-28.

c.)Mounting Kit: SAE-ACC-1. CPE. 1 equipment shelf, 30" hook & loop strap, 2 cable spools, 2 tie brackets, 4 cable ties, 12 screws

d.)Data:

1.)STAR6APDJ: CAT6A 10 Gig data jack, 10-Gig, 500MHz bandwidth, 8-position, 8-conductor, 568A/B wiring, standard 110 IDC, includes colored bezels. Quantity of 16.

2.)SAM-SP8: 8 - Port patch module

e.)Video:

1.)SAM-RFH8: 1 x 8 COAX RF splitter module, 3GHz

2.)STAR500F-C-85: F81 COAX connector, 3GHz. Quantity of 8

f.)Faceplates:

1.)FD-12-SNO: 2 Port faceplate, snap-on. Quantity of 8.

2.)Kit Number: SAE-42NMK-TC6A

a.)Panel: SAE-42.

b.)Metal Door Cover: SADC-42.

c.)Mounting Kit: SAE-ACC-1. CPE. 1 equipment shelf, 30" hook & loop strap, 2 cable spools, 2 tie brackets, 4 cable ties, 12 screws

d.)Data:

1.)STAR6APDJ: CAT6A 10 Gig data jack, 10-Gig, 500MHz bandwidth, 8-position, 8-conductor, 568A/B wiring, standard 110 IDC, includes colored bezels. Quantity of 16.

2.)SAM-SP8: 8 - Port patch module

e.)Video:

1.)SAM-RFH8: 1 x 8 COAX RF splitter module, 3GHz

2.)STAR500F-C-85: F81 COAX connector, 3GHz. Quantity of 8

f.)Faceplates:

1.)FD-12-SNO: 2 Port faceplate, snap-on. Quantity of 8.

Connected: CAT6A and Limited COAX

1.)Kit Number: SAE-28NMK-T6A

a.)Panel: SAE-28.

b.)Metal Door Cover: SADC-28.

c.)Mounting Kit: SAE-ACC-1. CPE. 1 equipment shelf, 30" hook & loop strap, 2 cable spools, 2 tie brackets, 4 cable ties, 12 screws

d.)Data:

1.)STAR6APDJ: CAT6A 10 Gig data jack, 10-Gig, 500MHz bandwidth, 8-position, 8-conductor, 568A/B wiring, standard 110 IDC, includes colored bezels. Quantity of 16.

2.)SAM-SP8: 8 - Port patch module

e.)Video:

1.)SAM-RFH4: 1 x 4 COAX RF splitter module, 3GHz

2.)STAR500F-C-85: F81 COAX connector, 3GHz. Quantity of 4.

f.)Faceplates:

1.)FD-11-SNO: 1 Port faceplate, snap-on. Quantity of 4.

2.)FD-12-SNO: 2 Port faceplate, snap-on. Quantity of 4.

2.)Kit Number: SAE-42NMK-T6A

a.)Panel: SAE-42.

b.)Metal Door Cover: SADC-42.

c.)Mounting Kit: SAE-ACC-1. CPE. 1 equipment shelf, 30" hook & loop strap, 2 cable spools, 2 tie

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brackets, 4 cable ties, 12 screws

d.)Data:

1.)STAR6APDJ: CAT6A 10 Gig data jack, 10-Gig, 500MHz bandwidth, 8-position, 8-conductor, 568A/B wiring, standard 110 IDC, includes colored bezels. Quantity of 16.

2.)SAM-SP8: 8 - Port patch module

e.)Video:

1.)SAM-RFH4: 1 x 4 COAX RF splitter module, 3GHz

2.)STAR500F-C-85: F81 COAX connector, 3GHz. Quantity of 4.

f.)Faceplates:

1.)FD-11-SNO: 1 Port faceplate, snap-on. Quantity of 4.

2.)FD-12-SNO: 2 Port faceplate, snap-on. Quantity of 4.

Basic: COAX and Limited CAT6A

1.)Kit Number: SAE-28NMK-CTA

a.)Panel: SAE-28.

b.)Metal Door Cover: SADC-28.

c.)Mounting Kit: SAE-ACC-1. CPE. 1 equipment shelf, 30" hook & loop strap, 2 cable spools, 2 tie

brackets, 4 cable ties, 12 screws

d.)Data:

1.)STAR6APDJ: CAT6A 10 Gig data jack, 10-Gig, 500MHz bandwidth, 8-position, 8-conductor, 568A/B wiring, standard 110 IDC, includes colored bezels. Quantity of 6.

2.)SAM-SP8: 8 - Port patch module

e.)Video:

1.)SAM-RFH8: 1 x 8 COAX RF splitter module, 3GHz

2.)STAR500F-C-85: F81 COAX connector, 3GHz. Quantity of 8

f.)Faceplates:

1.)FD-11-SNO: 1 Port faceplate, snap-on. Quantity of 5.

2.)FD-12-SNO: 2 Port faceplate, snap-on. Quantity of 3.

2.)Kit Number: SAE-42NMK-CTA

a.)Panel: SAE-42.

b.)Metal Door Cover: SADC-42.

c.)Mounting Kit: SAE-ACC-1. CPE. 1 equipment shelf, 30" hook & loop strap, 2 cable spools, 2 tie

brackets, 4 cable ties, 12 screws

d.)Data:

1.)STAR6APDJ: CAT6A 10 Gig data jack, 10-Gig, 500MHz bandwidth, 8-position, 8-conductor, 568A/B wiring, standard 110 IDC, includes colored bezels. Quantity of 6.

2.)SAM-SP8: 8 - Port patch module

e.)Video:

1.)SAM-RFH8: 1 x 8 COAX RF splitter module, 3GHz

2.)STAR500F-C-85: F81 COAX connector, 3GHz. Quantity of 8

f.)Faceplates:

1.)FD-11-SNO: 1 Port faceplate, snap-on. Quantity of 5.

2.)FD-12-SNO: 2 Port faceplate, snap-on. Quantity of 3.

PART 10 - EXECUTION

EXAMINATION

Do not begin installation until substrates have been properly constructed and prepared.

Verify structural framing, enclosures, weld plates, blocking, and size and location of pockets.

If substrate preparation is the responsibility of another installer, notify Architect in writing of unsatisfactory preparation before proceeding.

PREPARATION

Clean surfaces thoroughly prior to installation.

Prepare surfaces using the methods recommended by the manufacturer for achieving the best result for the substrate under the project conditions.

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INSTALLATION

Install in accordance with manufacturer's instructions and approved submittals. Test for proper operation and adjust until satisfactory results are obtained.

The Work shall comply with applicable safety rules and regulations including OSHA. The Work shall comply with the requirements of the National Electrical Safety Code (NESC) and the NEC except where local codes or regulations are more stringent, in which case the local codes or regulations shall govern.

The Work shall comply with the requirements and recommendations of the product manufacturers. Where questions arise regarding which requirements and recommendations apply, the more stringent shall prevail.

Replace or repair to original (or better) condition any existing structures, materials, equipment, etc. inadvertently demolished or damaged by the Contractor during the course of construction at no additional cost to the Owner.

FIELD QUALITY CONTROL

Field Inspection: Coordinate field inspection in accordance with appropriate sections in Division 01.

Manufacturer's Services: Coordinate manufacturer's services in accordance with appropriate sections in Division 01.

CLEANING AND PROTECTION

Upon completion of installation, remove surplus materials, rubbish, tools and equipment.

Clean products in accordance with the manufacturers recommendations.

Protect installed products until completion of project.

Touch-up, repair or replace damaged products before Substantial Completion.

END OF SECTION

SECTION 280500 – COMMON WORK RESULTS FOR ELECTRONIC SAFETY AND SECURITY

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DIVISION 27 COMMUNICATION

SECTION 272133

PART 11 - general

11.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General Conditions and Division 01 Specification Sections, apply to this Section.
- B. Specifications throughout all Divisions of the Project Manual are directly applicable to this Section, and this Section is directly applicable to them, including but not limited to the following:
 - 1. Division 07 - Penetration Fire stopping
 - 2. Section 27 00 00 - Communications
 - 3. Section 27 05 26 - Grounding and Bonding for Communications Systems
 - 4. Section 27 05 28 - Pathways for Communications Systems
 - 5. Section 27 05 43 - Underground Ducts and Raceways for Communications Systems
 - 6. Section 27 05 53 - Identification for Low-Voltage Cables
 - 7. Section 27 11 00 - Communications Equipment Room Fittings
 - 8. Section 27 13 00 - Communications Backbone Cabling
 - 9. Section 27 15 00 - Communications Horizontal Cabling

11.2 SUMMARY

- A. This section specifies requirements for the design/layout, and installation of communications data outlets that are to serve IEEE 802.11 wireless access points (WAPs).
- B. Wireless access point design needs to be a perimeter layout first then moving into the core of the building.
- C. Wireless Design cannot be validated until a wireless spectrum survey is completed at Post-Construction.

11.3 DESIGN REQUIREMENTS

- A. Coverage areas
 - 1. All building spaces shall have coverage for currently supported Wi-Fi standards this includes 802.11a/g/n at a minimum SNR of 25dBm.
 - 2. Coordinate with ITS during design for best indoor and outdoor locations.
- B. Density of communication outlets for WAPs
 - 1. Patient care – one per 2000 gross square feet.

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2. Other typical buildings – one per 2300 gross square feet.
3. Unique requirements
 - a. **Auditoriums and large classrooms utilize applications requiring a high density of WAP coverage and also require special accommodations for WAP installations. The WAP density is driven by concurrent users sessions and bandwidth requirements in the space instead of area coverage. Close consultation with ITS is required.**
 - b. **Proper installation and mounting of WAPs in these spaces may result in WAPs with moderate to high visibility. Mounting above a hard deck ceiling or below a hard floor or in proximity to metal building components, HVAC ducts, etc. can diminish the wireless signal beyond the tolerances for a high-density deployment. Current deployments of WAPs in these types of spaces typically have WAPs visibly mounted to both the ceiling and underneath the classroom seating in box enclosures or from the walls.**
 - c. **Cabling pathways to ceiling mount WAP locations as well floor or wall locations must be planned. Pathways may require rigid conduit placed above ceiling, or in the wall.**
 - d. **Some auditorium or large classroom configuration may require the use of external antennas connected to the WAPs. These antennas may mount as patches or poles and may require being mounted in visible locations.**

C. Identification on drawing floor plans

1. Communications data outlets for WAPs shall have a distinct symbol on the drawings.

D. Cabling infrastructure

1. Each communications data outlet for a WAP is to be served by one (1) category 5e Orange cable terminated with a 8P8C connector.
2. Cable locations/mounting will be designed for below ceiling and flush mounted WAPs. Any exceptions, such as high-density locations, shall be approved by ITS.
3. Distance limitation of external antennae coax cable is one meter.

11.4 SUBMITTALS

A. The following submittals are due at the Pre-Construction Phase, in accordance with submittal requirements in Section 27 00 00 Communications:

1. Shop Drawings
 - a. **Provide scaled drawings (not less than 1/8" = 1'-0") indicating location of communications outlets for the WAPs, as well as the routing of conduits and locations of all pull points (to include pull boxes, communications LB, etc.). These locations shall be coordinated with all other trades.**

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B. The following submittals are due Post-Construction, in accordance with the submittal requirements in Section 27 00 00 Communications:

1. Record Drawings

- a. **Provide scaled AutoCad and PDF drawings (not less than 1/8" = 1'-0") indicating actual location of communications outlets for the WAPs, as well as the actual installed routing of conduits and locations of all pull points. Design or shop drawings with field notes will not be accepted.**

PART 12 - PRODUCTS

12.1 GENERAL

A. ITS may provide the WAPs and related equipment (POE switches, patch cables, controllers) in its scope of the project, and can provide the architects specifications for aesthetic concerns. Equipment changes frequently, so the project must get the current part numbers from ITS.

B. Typically used WAP models:

1. Cisco Aironet 3502i Access Point
2. Cisco Aironet 3502e Access Point

PART 13 - EXECUTION

13.1 GENERAL

A. Contractor shall install WAPs after substantial completion (requires all cabling/mounting be installed and tested in secure communication closets).

B. WAP's shall not be mounted any higher than nine feet (Which will allow for maintenance with a five foot ladder).

C. Wireless Spectrum Survey shall be performed after installation to validate the wireless design.

END OF SECTION 27 21 33

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SECTION 27 40 00 AUDIO VIDEO SYSTEMS

Display hidden notes to specifier. (Don't know how? [Click Here](#))

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PART 14 - GENERAL

SECTION INCLUDES

Active electro-acoustic system for performance venues and music rehearsal rooms.

RELATED SECTIONS

Section 01 35 00 - Special Procedures.

Section 06 10 00 - Rough Carpentry.

Section 09 22 16.13 - Non-Structural Metal Stud Framing.

Section 09 51 23 - Acoustical Tile Ceilings.

Section 09 84 36 - Sound-Absorbing Ceiling Units.

Division 16 - Electrical for power wiring.

REFERENCES

ASTM International (ASTM):

ASTM C 423-84a- Standard Test Method for Sound Absorption and Sound Absorption Coefficients by the Reverberation Room Method.

Underwriters Laboratories, Inc. (UL):

UL 1480, UL 2043 - Fire Test for Heat and Visible Smoke Release for Discrete Product and Their Accessories Installed in Air-Heating Spaces

NEC 2011 - National Electric Code.

CEC, Part 1 (2012 Edition) - Canadian Electrical Code.

DEFINITIONS

Transcend Active Acoustics System: A patented, digital signal processing, time-variant synthetic reverberation system designed for performance venues.

VAE Rehearsal System: A patented, digital signal processing, time-variant synthetic reverberation system designed for rehearsal spaces.

SYSTEM DESCRIPTION

Transcend Active Acoustics System Components.

Harman speakers:

Wall mounted.

Ceiling mounted.

Subwoofer.

Microphones:

Schoeps microphones - cardioid.

Neumann microphones - cardioid.

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- Sennheiser microphone - cardioid.
- Harman microphone preamp digital audio interface.
- Harman Amplifiers:
 - Harman amplifiers; network control - 300W/channel.
 - Harman amplifiers; network control - 600W/channel.
 - Harman amplifiers; network control - 1250W/channel.
 - Harman amplifiers; network control - 2500W/channel.
- Wenger Transcend digital signal processor.
- Control Panel System:
 - Harman touch screen control panel.
 - Harman wall control.
 - Crestron touch screen control panel.
- Power sequencer.
- Equipment rack(s).
- Harman Digital Signal Processor (BluLink):
 - Blu 50.
 - Others available as required.
- Design Requirements:
 - Includes multiple preset acoustic enhancement programs developed in conjunction with the end user.
 - Simple, intuitive operation.

VAE Rehearsal System Components:

- Wenger VAE digital signal processor.
- Harman Amplifier:
 - Crown 125W/channel.
- Harman Speakers:
 - Wall mounted.
 - Ceiling mounted.
- Microphones.
- Wenger VAE control panel.
- Power sequencer.
- Equipment rack.

SUBMITTALS

Submit under provisions of Section 01 30 00 - Administrative Requirements.

Product Data: Submit applicable reference standards, current performance data, and application recommendations and product limitations.

Shop Drawings: Submit assembly and installation layout drawings showing product components in assembly with adjacent materials and products (speakers, panels, microphones, electronics rack).

Operation and Maintenance Data.

Warranty: Submit manufacturer's standard warranty statement.

QUALITY ASSURANCE

Manufacturer Qualifications: Minimum 5 years experience in manufacture of similar products in use in similar environments, including project size, and complexity, and with the production capacity to meet the construction and installation schedule.

Installer Qualifications: Installation, disassembly, re-assembly and calibration shall be done by the manufacturer and manufacturer employed approved subcontractors.

Source Limitations: Obtain components and accessories through one source from a single

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approved manufacturer.

Electrical Components: Listed and labeled per NFPA 70, Article 100 by a testing agency acceptable to authorities having jurisdiction.

DELIVERY, STORAGE, AND HANDLING

Pack and ship in accordance with manufacturer's recommendations:
Finish, assemble, and test all components in the factory before shipment.
Rack components will be sub assembled before delivery to jobsite.
Deliver components to room designated for installation.

Do not accept damaged products at the site. Do not install damaged products.

Store products in heated indoor storage near point of installation. Retain protective packaging until installing. Ship to jobsite only after roughing-in, painting work, and other related finish work has been completed and installation areas are ready to accept units and recommended temperature and humidity levels will be maintained during the remainder of construction.

PROJECT CONDITIONS

Environmental Requirements: Do not install system until all mortar, wet and dust producing trades have completed their work and finished floor is in place.

Determine with the customer rack location(s).

Where code permits, wiring may be run outside of conduit. Such wiring shall be coordinated either in a plenum space or by means of secondary enclosure that meets code requirements.

Customer will arrange to assure the noise level in the rehearsal space is at or less than NC 30.

Field Measurements: Obtain required field measurements and indicating performance setups, ceiling construction, wall construction, ventilation features, electrical systems, networks and potential obstacles on shop drawings.

If asbestos is present in existing facility, abatement shall be required by Owner prior to installation.

WARRANTY

Manufacturer's written warranty indicating manufacturer's intent to repair or replace components of system that fail in materials or workmanship from date of Substantial Completion for the number of years indicated below. Repair or replacement shall occur within 30 days following report of such defects by the Owner.
Transcend System: 3 years.
VAE Rehearsal System: 5 years.

PART 15 - PRODUCTS

MANUFACTURERS

Acceptable Manufacturer: Wenger Corporation, JR Clancy and GearBoss, which is located at: 555 Park Dr.; Owatonna, MN 55060; Toll Free Tel: 800-4WENGER (493-6437); Tel: (507) 455-4100; Fax: (507) 455-4258; Email: [request info \(info@wengercorp.com\)](mailto:request info (info@wengercorp.com)); Web: <https://www.wengercorp.com> | <http://www.jrclancy.com>

Substitutions: Not permitted.

Requests for substitutions will be considered in accordance with provisions of Section 01 60 00 - Product Requirements.

Approval of Comparable Products: Submit the following in accordance with project

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substitution requirements, within time period allowed for substitution review:

Product data, including certified independent test data indicating compliance with requirements.

Full-size samples of each component of product specified.

Project references: Minimum of 5 installations not less than 5 years old, with owner contact information.

List of successful installations of similar products available for evaluation by Architect. Sample warranty.

Submit substitution request not less than required days prior to bid date. Substitutions following award of contract are not allowed.

Approved manufacturers shall meet separate requirements of Submittals.

TRANSCEND ACTIVE ACOUSTIC SYSTEM

Control Panels:

AMX/Harman Touch Screen Control Panel: 7 inches (178 mm) diagonal touch screen, wall mounted, with custom programmed presets for Transcend system.

AMX/Harman Control Panel: 7 inches (178 mm) diagonal screen, wall mounted, with custom programmed presets for Transcend system.

BSS Contrio EC-4B: Wall mounted (single or dual gang) Ethernet wall controller for use with HiQnet devices; PoE (power over Ethernet), configured with Audio Architect, 4 programmable buttons, security: remote lock/unlock, local lock/unlock (with PIN entry), Maximum cable length, 100m/300ft, power consumption: 300 mA at 48VDC.

Microphones:

Schoeps Microphone CCM4: Cardioid polar pattern, condenser microphone; frequency response: 40 to 20,000 Hz; Low-cut frequency (-3 dB): 20Hz; sensitivity 13 mV/Pa, equivalent noise level: 15 dB-A, SPL for 0.5% THD: 132 dB, signal to noise ratio (A-weighted): 79 dB; electrical impedance: 90 ohms, minimum recommended load impedance 600 ohm, power requirement: 12Vdc: 8 mA or 48Vdc: 4mA, Cable connection: Limo/XLR-3M; Weight: 43g.

Schoeps Microphone MK4: Cardioid polar pattern, condenser microphone; frequency response: 40 to 20,000 Hz; Low-cut frequency (-3 dB): 20Hz; sensitivity 13 mV/Pa, equivalent noise level: 15 dB-A, SPL for 0.5% THD: 132 dB, signal to noise ratio (A-weighted): 79 dB; Amplifier: CMC 5U: 48Vdc: 4 mA; Impedance: 35 Ohms; Minimum recommended load impedance 600 ohm, Low-cut frequency (-3 dB): 20Hz; Length: 116 mm; Diameter: 20mm; Weight: 68g; Cable connection: XLR-3M.

Neumann Microphone KM100 Condenser Microphone System: AK40 capsule: cardioid polar pattern; condenser microphone; KM140 frequency response: 20 to 20,000 Hz; sensitivity at 1,000 Hz - 15mV/Pa, equivalent noise level: 16 dB-A, SPL for 0.5% THD: 138 dB, signal to noise ratio (A-weighted): 78dB; electrical impedance: 50 ohms, load impedance > 1,000 ohm, power requirement: 48Vdc - 2 mA; Cable connection: XLR-3M; Weight: 80g; Dimensions 92 x 22 mm.

Sennheiser Microphone MKHC 8040 + MZX 8000: Cardioid Polar Pattern; Frequency response: 35 to 20,000 Hz; sensitivity at 1,000 Hz - 20 mV/Pa (-34 dBV), equivalent noise level: 13 dB-A, SPL for 1% THD: 142 dB; power requirement: 48Vdc - 3.3 mA; Length: 41 mm x 19 mm; Weight: 25g; Connector: XLR-3M.

Microphone Preamplifier and A/D Converter:

BSS/Harman London BLU - BIB (microphone to BLU link): Analog Inputs: 8 electronically balanced on Phoenix/Combicon removable screw connectors, Mic/Line Inputs: Nominal gain 0dB, electronically switchable up to +48dB, in 6dB steps, Input Impedance: 3.0kOhm, Maximum Input Level: +20dBu with 0dB input gain, +8dBu with 12dB gain, CMRR: > 40dB at 1kHz, Input Noise (E.I.N): < 123dBu typical with 150 Ohms source, Phantom Power: 48V nominal, selectable per input, A/D Latency: 37/Fs (0.77ms@48k, 0.39ms@96k), Digital Audio Bus: Connectors: 2 x RJ45 Ethernet connectors, Maximum Cable Length: 100m/300ft on Category 5e cable between devices, Maximum Number of Nodes: 60, Latency: 11/Fs (0.23ms@48k,

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0.11ms@96k), Pass Through Latency: 4/Fs (0.08ms@48k, 0.04ms@96k), Power and Dimensions: Mains voltage: 12V DC external power supply included, AC Power Input to Adapter: 19W, BUT Rating: < 65 BUT/hr, Operating Temperature Range: 5(41) to 35(95) degrees C (degrees F), Dimensions (H x W x D): 1.65" x 8.63" x 7.75" (42mm x 219mm x 197 mm), Weight: 2.96lbs / 1.34kg.

Active Acoustics Processor:

Wenger Transcend Processor: System: 48kHz, 32-bit floating point, Digital Inputs/Outputs: Inputs: 16 microphone, 8 auxiliary, Outputs: 32, BLU Link Audio Network: Connectors: @x Ethercon lockable RJ45 Ethernet, Maximum Cable Length: 100m/328ft on Category 5e cable between devices, Maximum number of Nodes: 60, Maximum Number of Channels: 256 at 48kHz, 128 at 96kHz, Latency: 11/Fs (0.23 msec at 48kHz), Pass-Through Latency: 4/Fx (0.08, sec at 48kHz) Front Panel Indicators: LED Meter: Clip (-3dBFS), -10dBFS, -20 dBFS, -50 dBFS, (dBFS = dB Full Scale), Ethernet: Connector: RJ45, Maximum Cable Length: 100m/328ft on Category 5e cable between devices, Communication Protocol: Harman HiQnet™, Communication Applications: Harman Audio Architect, USB Port: Connector: Mini- B, Power and Dimensions: Power Requirements: 100VAC - 240VAC, 50/60Hz, 12 watts, Fuse: 2.5A 250V Timelag Hi Brk, Rack Units: 2U, Temperature: 0 to 40 C (32 to 104 F), Humidity: 95% max, non-condensing, Dimensions: 3.5 inches (H) x 19 inches (W) x 8.25 inches (D); (88.9 mm (H) x 482.6 mm (W) x 209.55 mm (D)), Weight: 8.5 lbs (3.86 kg), Shipping Weight: 11.5 lbs (5.21 kg).

Amplifiers:

Crown/Harman Networked Amplification DCi 8.
Crown/Harman Networked Amplification DCi 8.
Crown/Harman Networked Amplification DCi 2.
Crown/Harman Networked Amplification DCi 2.
Crown/Harman Networked Amplification DCi 4.
Crown/Harman Networked Amplification DCi 4.
Crown/Harman Networked Amplification DCi 2.
Crown/Harman Networked Amplification DCi 4.

Speakers - JBL/Harman Speakers:

Wall Mounted Control 28; Frequency response (-10dB) half space wall: 60 Hz to 16 kHz, continuous program power capacity: 175 Watts, sensitivity: 92 dB SPL, 1W, 1m, directivity factor (Q): 7.5, directivity index (DI) 8.8, nominal impedance: 8 ohms, LF drive 200mm polypropylene cone with WeatherEdge, HF drive: 25mm titanium coated polycarbonate, enclosure material: high impact polystyrene, overload protection: full-range power limiting to protect network and transducers, termination: spring clips, accepts banana plugs, environmental: conforms to Mil Spec 810 for humidity, salt spray, temperature and UV. IEC 529-X4 splash proof rating.

Ceiling mounted Control 26; Frequency response (-10dB) half space flush to ceiling: 75 Hz to 20 kHz, continuous program power capacity: 150 Watts, sensitivity: 89 dB SPL, 1W, 1m, nominal coverage angle: 110 degree conical coverage, directivity factor (Q): 5.9 averaged 500 Hz to 4 kHz, directivity index (DI) 4.6 averaged 500 Hz to 4 kHz, maximum rated SPL 107 dB @ 1m, nominal impedance: 16 ohms, LF driver: 165 mm polypropylene coated, HF drive: 19mm titanium coated polyester, enclosure material: back can; formed steel, baffle/rim: medium impact polystyrene, fire rated UL94V-0 overload protection: full-range power limiting to protect network and transducers, termination: removable locking connector with screw-down terminals, safety agency rating: suitable for use in air handling spaces per UL1480, UL2043, NFPA90 & NFPA70, cut out size 8.75 inches (220 mm), weight: 7.5 lbs (3.4 kg).

Ceiling mounted Control 47C; Frequency response (-10dB) half space flush to ceiling: 75 Hz to 20 kHz, continuous program power capacity: 150 Watts, sensitivity: 91 dB SPL, 1W, 1m, nominal coverage angle: 120 degree conical coverage, directivity factor (Q): 6.5 averaged 1 kHz to 16 kHz, directivity index (DI) 7.9 averaged 1 kHz to 16 kHz, maximum rated SPL 110 dB @ 1m, nominal impedance: 8 ohms, LF driver: 165 mm

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polypropylene coated, HF drive: 25 mm soft dome with damping, ferrofluid cooled, termination: removable locking connector with screw-down terminals, safety agency rating: suitable for use in air handling spaces per UL1480, UL2043, NFPA90 & NFPA70, cut out size: 11.1 inches (282 mm), weight: 11lbs (5 kg).

Ceiling mounted Control 47LP; Frequency response (-10dB) half space flush to ceiling: 68 Hz to 20 kHz, continuous program power capacity: 150 Watts, sensitivity: 91 dB SPL, 1W, 1m, nominal coverage angle: 120 degree conical coverage, half space (ceiling), directivity factor (Q): 6.5 averaged 1 kHz to 16 kHz, directivity index (DI) 7.9 averaged 1 kHz to 16 kHz, maximum rated SPL 110 dB @ 1m, nominal impedance: 8 ohms, LF driver: 165 mm polypropylene coated, HF drive: 25 mm soft dome with damping, ferrofluid cooled, termination: removable locking connector with screw-down terminals, safety agency rating: suitable for use in air handling spaces per UL1480, UL2043, NFPA90 & NFPA70, cut out size: 11.1 inches (282 mm), weight: 9.5 lbs (4.3 kg).

Ceiling mounted Control 47HC; Frequency response (-10dB) half space flush to ceiling: 55 Hz to 20 kHz, continuous program power capacity: 150 Watts, sensitivity: 93 dB SPL, 1W, 1m, nominal coverage angle: 75 degree conical coverage, directivity factor (Q): 10.2 averaged 1 kHz to 16 kHz, directivity index (DI) 12 averaged 1 kHz to 16 kHz, maximum rated SPL 110 dB @ 1m, nominal impedance: 8 ohms, LF driver: 165 mm polypropylene coated, HF drive: 25 mm soft dome with damping, ferrofluid cooled, termination: removable locking connector with screw-down terminals, safety agency rating: suitable for use in air handling spaces per UL1480, UL2043, NFPA90 & NFPA70, cut out size: 12.1 inches (307 mm), weight: 14 lbs (6.4 kg).

In-Wall speakers Control 128: Frequency response (-10dB) half space on wall: 30 Hz to 20 kHz, continuous program power capacity: 120 Watts, sensitivity: 90 dB SPL, 1W, 1m, nominal impedance: 8 ohms, LF drive 200mm polymer-coated aluminum cone, pure butyl rubber surround, HF driver: 25mm pure titanium dome with cloth suspension on low diffraction swivel-mount with -10 degree aimability, termination: screw-down Euroblock-type connector, optimum air cavity behind speaker: 40 to 80 liters.

Ceiling Mounted Sub Woofers Control 19CS: Frequency response (-10dB) half space flush to ceiling: 42 Hz to 200 Hz, continuous program power capacity: 200 Watts, sensitivity: 89 dB SPL, 1W, 1m, nominal coverage angle: 180 degree conical coverage, maximum rated SPL 115 dB @ 1m in ceiling near corner ($\pi/2$), nominal impedance: 8 ohms, LF driver: 200 mm polypropylene coated, HF drive: 38 mm coil on aluminum former, enclosure material: back can; formed steel, baffle/rim: medium impact polystyrene, fire rated UL94V-0 overload protection: full-range power limiting to protect network and transducers, termination: removable locking connector with screw-down terminals, safety agency rating: suitable for use in air handling spaces per UL1480, UL2043, NFPA90 & NFPA70, cut out size 12 inches (305 mm), weight: 12 lbs (5.5 kg).

Ceiling Mounted Sub Woofers Control 312CS: Frequency response (-10dB) half space flush to ceiling: 30 Hz to 3.5 kHz, continuous program power capacity: 250 Watts, sensitivity: 93 dB SPL, 1W, 1m, nominal coverage angle: 180 degree conical coverage, maximum rated SPL 121 dB @ 1m, nominal impedance: 8 ohms, LF driver: 12 inches (300 mm) Kevlar- reinforced with 3 inches (75 mm) voice coil, baffle: metal, 14.4 inches x 14.4 inches (366 mm x 366 mm) driver pre-mounted to baffle, termination: removable locking connector with screw-down terminals, safety agency rating: suitable for use in air handling spaces per UL1480, UL2043, NFPA90 & NFPA70 when used with MTC-300BB12, weight: 17 lbs (7.7 kg).

Ceiling Mounted Backbox MTC-300BB12 for Control 312CS: Enclosure material: formed 16 gauge steel, 1/2 inch (12mm) lined with MDF, dimensions: 12.6 inches x 23.1 inches (324 mm x 587mm; depth 19.9 inches (505mm), safety agency rating: suitable for use in air handling spaces per UL1480, UL2043, NFPA90 & NFPA70, ceiling cut out: 14.9 inches x 14.9 inches (378 mm x 378 mm), weight: 45.5 lbs (20.6 kg).

Surface Mounted Wall Subwoofer SB210: Frequency response (-10dB): 42 Hz to 200 Hz, continuous program power capacity: 800 Watts, sensitivity: 95 dB SPL, 1W, 1m, in half space (2pi 180 degree conical coverage, maximum rated SPL 122 dB @ 1m in half space, nominal impedance: 8 ohms, LF driver: 2 x 250 mm, 50 mm (2 inches)

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edge wound ribbon voice coil, aluminum/ceramic composite cone, enclosure material: high impact polystyrene w/internal 8 mm polyurethane co-mold, overload protection: SonicGuard™, termination: removable locking connector with screw-down terminals, dimensions: 14 inches x 23.3 inches x 22.5 inches (355 mm x 590 mm x 570 mm), weight: 38 lbs (17.1 kg).

Digital Signal Processors:

BSS BLU50: Inputs: 4 analog with 48V phantom power, nominal gain 0dB, electronically switchable up to +48 dB in +6dB steps, input impedance: 3.5k ohms, maximum put level: +20 dBu with 0dB input gain, +8dBu with 12 dB gain, CMRR: > 45dB at 1kHz, input noise: < -128dBu typical with 150 ohm source, A/D latency: 29/Fs (0.60ms@48kHz), outputs: 4 analog with a maximum output level of +20dBu, frequency response 20Hz to 20kHz (+0.5dB/-1dB), THD: 0.005% typically at +4dBu, 1Khz, 0dB input gain, dynamic range: 110dB, A-weighted, > 107dB unweighted, crosstalk: < -100dB, D/A latency 29/Fs (0.60ms@48kHz), control ports: 12 inputs and 6 outputs; control network: connectors: RJ45 Ethernet connectors, maximum cable length: 100m/300ft on Category 5 cable between device and Ethernet switch, BLU link: connectors: 2 x RJ45 Ethernet connectors, Maximum cable length: 100m/300ft, on Category 5e cable between devices, Max. number of nodes: 60, Latency: 11/Fs (0.23ms@48k), Pass Through Latency: 4/Fs (0.08ms@48k), Power requirements: 12 -48 VDC, Power Adapter: 100-240VAC, 50/60Hz, 12VDC output, Power consumption: < 55VA, BTU rating: 188 BTU/hr, Operating temperature range: 5 (41) to 35 (95) degrees C (degrees F), Dimensions (H(U) x W x D): 1.625 inches (41 mm) x 8.63 inches (219 mm) x 7.75 inches (197 mm), Weight: 2.82 lbs (1.28 kg).

Network Switch:

Cisco SG200-26: 26-Gigabit Smart Switch.

Lyntec Locking Switch Set:

SS2LRP: Single rack plate with a locking switch.

Equipment Rack:

Middle Atlantic Rack WRK-44SA-27: Free standing equipment rack, 44 RU, 27" D , 24-1/4" W, LVFD - vented front door, MW-4QFT-FC top fan with thermostatically controller, Middle Atlantic Caster Base CBS-WRK-27R: Caster base for rack

Power Sequencer (required - not provided by Wenger)

LynTec Load Center/Power Sequencer - isolated ground circuits.

Load Center Options:

MSLC326-12 Sequencing load center: Three phase, 4 wire, 208Y/120VAC; main breaker: 100A, 26 branch breaker spaces, capacity 12 controlled breakers.
MSLC326-24 Sequencing load center: Three phase, 4 wire, 208Y/120VAC; main breaker: 100A, 26 branch breaker spaces, capacity 24 controlled breakers.
MSLC326-36 Sequencing load center: Three phase, 4 wire, 208Y/120VAC; main breaker: 100A, 26 branch breaker spaces, capacity 36 controlled breakers.
MSLC341-12 Sequencing load center: Three phase, 4 wire, 208Y/120VAC; main breaker: 225A, 41 branch breaker spaces, capacity 12 controlled breakers.
MSLC341-24 Sequencing load center: Three phase, 4 wire, 208Y/120VAC; main breaker: 225A, 41 branch breaker spaces, capacity 24 controlled breakers.
MSLC341-36 Sequencing load center: Three phase, 4 wire, 208Y/120VAC; main breaker: 225A, 41 branch breaker spaces, capacity 36 controlled breakers.
MSLC341-48 Sequencing load center: Three phase, 4 wire, 208Y/120VAC; main breaker: 225A, 41 branch breaker spaces, capacity 48 controlled breakers.

Motorized Breakers:

MB-20 Motorized breaker: Square D #QO120PL-5393 20 amps (High Magnetic).

VAE REHEARSAL SYSTEM

VAE Rehearsal Control Panel: Wired, 18 button, backlit control panel with digital display. Includes 8

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preset environments and one customizable environment setting. Also includes record/playback function for immediate playback, and uploading /downloading of data to and from a computer.

Microphone/AKG C391B: Cardioid Polar Pattern; Pre-Polarized Condenser Microphone; Frequency response: 20 to 20,000 Hz; sensitivity at 1,000 Hz - 10 mV/Pa (-40 dBV), equivalent noise level: 17 dB-A, SPL for 1% THD: 132 dB, signal to noise ratio (A-weighted): 77dB; electrical impedance: < 200 ohms, load impedance > 1,000 ohm, power requirement: 9 - 52 Vdc from power unit, make XLR connector on power unit.

Digital Processor: Wenger VAE Rehearsal Processor with built-in pre-amplification and equalization. Microphone Inputs: 2 Female XLR, Input Impedance: 3000 Ohms Balanced, Phantom Power: +24 Volt, Frequency Response: 20 to 20 kHz within 1dB THD+N: 0.007%, Sample Rate: 44.1 kHz, Dynamic Range: A/D > 100 dB, 24 Bit resolution, D/A > 100 dB, 24 Bit resolution, Record Output: 1/8' TRS jack, Outputs: Four 1/4' TRS and two 4-pin EURO (5.08mm pitch), Output Impedance: 4/8 ohms, Remote control connector: 10-pin Molex type 42404, USB type B socket: For downloading recorded files, Compact Flash socket: For storing recorded sessions, Internal 15-band 2/3 octave Equalizer, Internal pink noise generator and real-time analyzer, Power Requirements: 115VAC, 10, 60 Hz 20 A. Isolated electrical ground. Optional 230VAC, 10, 50 Hz, 10 A.

Amplification/Crown CT8150: Channels: 8, sensitivity: 1.4V (26dB gain), rated power output: 125W per channel into 8/4 ohms, signal to noise ratio (below rated power 20Hz to 20kHz, A-weighted) 110 dB, total harmonic distortion (THD)(full rated power, 1kHz): < 0.05%, intermodulation distortion (from 0dB down to -30dB): < 0.05%, frequency response (at 1W into 4/8 ohms): +/- 0.5 dB, common mode rejection (20Hz to 1kHz): > 70 dB, load ranges: 4-160 ohms. Voltage: 100V - 240V, 50/60 Hz.

Speakers:

Wall Mounted/JBL Control 28; Frequency response (-10dB) half space wall: 60 Hz to 16 kHz, continuous program power capacity: 175 Watts, sensitivity: 92 dB SPL, 1W, 1m, directivity factor (Q): 7.5, directivity index (DI) 8.8, nominal impedance: 8 ohms, LF drive 200mm polypropylene cone with WeatherEdge, HF drive: 25mm titanium coated polycarbonate, enclosure material: high impact polystyrene, overload protection: full-range power limiting to protect network and transducers, termination: spring clips, shall accept banana plugs, environmental: shall conform to Mil Spec 810 for humidity, salt spray, temperature and UV. IEC 529-X4 splash proof rating.

In-Wall Speakers/JBL Control 128: Frequency response (-10dB) half space on wall: 30 Hz to 20 kHz, continuous program power capacity: 120 Watts, sensitivity: 90 dB SPL, 1W, 1m, nominal impedance: 8 ohms, LF drive 200mm polymer-coated aluminum cone, pure butyl rubber surround, HF driver: 25mm pure titanium dome with cloth suspension on low diffraction swivel-mount with -10 degree amiability, termination: screw-down Euroblock-type connector, optimum air cavity behind speaker: 40 to 80 liters

Ceiling Mounted/JBL Control 26; Frequency response (-10dB) half space flush to ceiling: 75 Hz to 20 kHz, continuous program power capacity: 150 Watts, sensitivity: 89 dB SPL, 1W, 1m, nominal coverage angle: 110 degree conical coverage, directivity factor (Q): 5.9 averaged 500 Hz to 4 kHz, directivity index (DI) 4.6 averaged 500 Hz to 4 kHz, maximum rated SPL 107 dB @ 1m, nominal impedance: 16 ohms, LF driver: 165 mm polypropylene coated, HF drive: 19mm titanium coated polyester, enclosure material: back can; formed steel, baffle/rim: medium impact polystyrene, fire rated UL94V-0 overload protection: full-range power limiting to protect network and transducers, termination: removable locking connector with screw-down terminals, safety agency rating: Shall be suitable for use in air handling spaces per UL1480, UL2043, NFPA90 & NFPA70,

Ceiling Mounted Sub Woofers/JBL Control 40CS/T: Frequency response (-10 dB) half space, flush to ceiling: 32 Hz - 300 Hz, continuous program power capacity: 200W, sensitivity: 95 dB (near corner), 89 dB center of ceiling, maximum rated SPL: 109 dB

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@ 1m (3.3 ft) average, 115 dB peak (center of ceiling), 115 dB @ 1m (3.3 ft) average, 121 dB peak (near corner), rated impedance: 8 ohms, driver: 200 mm (8 in) with polypropylene cone, butyl rubber surround, copper clad coil, vented aluminum former, enclosure: input connectors, six removeable locking 2 pin connectors with screw down terminals, maximum wire: 12 AWG (2.5mm), safety agency, suitable for use in air handling spaces per UL1480, UL2043, NFPA90 & NFPA70, S7232/UL Listed, Signaling Speaker, Transformer UL registered per UL1876. In accordance with IEC60849/EN60849, dimensions: 332mm diameter x 338mm depth from back of baffle (13.1 in. x 13.3 in.), cutout size: 307mm diameter (12.1 in.), ceiling thickness range: accommodate tiles/drywall up to 70mm (2.75 in.), weight: 8.1kg (17.9 lbs).

Sequential Power: Time delayed, switched outlets 120 V @ 60 Hz. 20 A.

Accessories: Control Pedestal Stand.

PART 16 - EXECUTION

EXAMINATION

Transcend Active Acoustic System:

Space shall have the following electrical sources available:

Electrical - 208 Y/120V 3Ø, 60 Hz, 100A (or 225A), Isolated electrical ground.

Transformer Isolation: Required, not provided by Wenger.

Example: Eaton 54kVA, 208 Delta Volts to 208Y/120V, NEMA TP-1Energy Efficient Electrostatically Shielded - Aluminum windings.

VAE Rehearsal System:

Space shall have the following electrical sources available:

Example: 120V, single phase, 20 amp, 60Hz.

INSTALLATION

Manufacturer to install, calibrate and tune system for preset environments determined by customer.

All components are manufactured units, pre-wired where appropriate.

Calibrate system for proper operation.

Acceptance Testing shall be performed during a period designated and agreed upon by all parties.

The minimum time required for Acceptance Testing is five working days of dedicated quiet.

Following the testing period, the owner or owner's representative will work with the manufacturer for final tuning and acceptance.

DEMONSTRATION

Train Owner's personnel to operate, and maintain systems.

Turn over operation and instructions to Owner.

END OF SECTION

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SECTION 27 51 19 SOUND MASKING SYSTEMS

Display hidden notes to specifier. (Don't know how? [Click Here](#))

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PART 17 - GENERAL

SECTION INCLUDES

Sound Masking Systems: Performance based specification for networked based systems including but not limited to the following.

- Digital signal processors.
- Noise generators.
- Paging interfaces.
- Amplifiers.
- Loudspeakers.
- Associated wiring, controls, supervised signals, lines and components.

RELATED SECTIONS

- Section 09 51 23 - Acoustical Tile Ceilings.
- Section 09 84 36 - Sound-Absorbing Ceiling Units.
- Section 26 05 48 - Vibration and Seismic Controls for Electrical Systems.
- Section 26 05 00 - Common Work Results for Electrical.
- Section 26 27 16 - Electrical Cabinets and Enclosures.
- Section 25 15 16 - Integrated Automation Software for Control and Monitoring Networks.
- Section 28 44 00 - Refrigerant Detection and Alarm.

REFERENCES

American Disabilities Act (ADA):

American National Standards Institute (ANSI):

- ANSI S1.4 - American National Standard Specification for Sound Level Meters.
- ANSI S1.6 - American National Standard Specification for Preferred Frequencies and Band Numbers for Acoustical Measurements.
- ANSI S1.11 - American National Standard Specification for Octave-Band and Fractional-Octave-Band Analog and Digital Filters.
- ANSI 709.1 - ISO / IEC Standards for Open Platform.

ASTM International (ASTM):

- ASTM E1374 - Standard Guide for Open Office Acoustics and Applicable ASTM Standards.
- ASTM E1573 - Standard Test Method for Evaluating Masking Sound in Open Office Using A-Weighted and One-Third Octave Band Sound Pressure Levels.
- ASTM E1130 - Standard Test Method for Objective Measurement of Speech Privacy in

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Open Offices Using Articulation Index.

ASTM E1041 - Standard Guide for Measurement of Masking Sound in Open Offices.

European Standard (EN):

EN 55024 - Information technology equipment - Immunity characteristics - Limits and methods of measurement.

EN 60950 - Information Technology Equipment.

EN 61000 - Electromagnetic Compatibility.

ENV50204 - Radiated electromagnetic field from digital radio telephones - Immunity test.

National Fire Protection Association (NFPA):

NFPA 101 - Life Safety Code.

NFPA 72 - Fire Alarm and Signaling Code.

Underwriters Laboratories (UL):

UL 1310 - Standard for Class 2 Power Units.

UL 1480 - Speakers for Fire Alarm and Signaling Systems, Including Accessories.

UL 2043 - Standard for Fire Test for Heat and Visible Smoke Release for Discrete Products and Their Accessories Installed in Air-Handling Spaces.

UL 2572 - Standard for Mass Notification Systems.

UL 6500 - Standard for Audio/Video and Musical Instrument Apparatus for Household, Commercial, and Similar General Use.

UL 60065 - Standard for Audio, Video and Similar Electronic Apparatus - Safety Requirements.

UL 60950 - Information Technology Equipment - Safety.

US Army Corp.'s Unified Facilities Guide Specifications(UFGS):

UFGS 25 10 10 - Utilities Monitoring and Control System.

UFGS 23 09 23 - Direct Digital Control for HVAC and Other Local Building Controls.

SUBMITTALS

Submit under provisions of Section 01 30 00 - Administrative Requirements.

Proposal:

A preliminary listing of proposed major components, in the order and format listed in the products section of these performance specifications, along with the manufacturer's detailed technical data sheets. Advertising literature shall not be accepted.

Product Data:

Manufacturer's data sheets on each product to be used.

Submit in PDF format.

Equipment data sheets will be identified with device IDs that reference drawings and equipment used.

Preparation instructions and recommendations.

Storage and handling requirements and recommendations.

Typical installation methods.

Layouts shall be submitted for approval on the following:

Loudspeaker system locations.

Plenum mounted networked masking noise components.

Equipment rack layouts.

Connection between the rack headend and the Fire Alarm Control Unit.

Test results shall be submitted for approval of the following, as specified herein:

Performance tests on completed component sub-assemblies.

Performance tests on the complete system assemblies.

Shop Drawings: Include details of materials, construction and finish. Include relationship with

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adjacent construction.

Submit in DWG format for approval on all items that require assembly by the Design-Builder, including, but not limited to:

Headend Rack panel layouts.

Loudspeaker enclosures.

Supporting brackets for the suspension and/or support of loudspeaker enclosure and equipment enclosure.

Wiring and installation diagrams showing quantity and location of system components and related cabling and accessories.

Within the scheduled amount of days after receipt of Notice to Proceed, the Design-Builder will submit the following for approval.

Complete components list, in order and format in the contract documents. For proposed substitutions to components listed in this performance specification, manufacturer's independent test data to demonstrate performance specification compliance will be provided.

Complete and final list of components to be furnished, in the same order and format as the specifications, with conforming manufacturers' independent test data for each specified item. Furnish a brochure and photograph (unless included in the brochure) of each item.

SYSTEM DESCRIPTION

Broad band (65 Hz to 20 kHz) background noise in open plan and partitioned work areas.

When Used in Conjunction with Proper Ceiling and Partition Construction:

Limits Speech Intelligibility: Providing privacy between work areas.

Reduces disturbing effects of noise caused by other common office activities i.e. keyboards, printers, etc.

Octave Band Sound Pressure Level Spectrum:

Octave Band (Hz): 200.

Level (dB) Open Areas: 2.5.

Level (dB) Enclosed Office: 2.

Octave Band (Hz): 250.

Level (dB) Open Areas: 3.

Level (dB) Enclosed Office: 2.

Octave Band (Hz): 315.

Level (dB) Open Areas: 2.

Level (dB) Enclosed Office: 1.5.

Octave Band (Hz): 400.

Level (dB) Open Areas: 1.

Level (dB) Enclosed Office: 1.

Octave Band (Hz): 500.

Level (dB) Open Areas: 0.

Level (dB) Enclosed Office: 0.

Octave Band (Hz): 630.

Level (dB) Open Areas: Minus 1.

Level (dB) Enclosed Office: Minus 1.

Octave Band (Hz): 800.

Level (dB) Open Areas: Minus 2.

Level (dB) Enclosed Office: Minus 2.

Octave Band (Hz): 1000.

Level (dB) Open Areas: Minus 3.

Level (dB) Enclosed Office: Minus 3.

Octave Band (Hz): 1250.

Level (dB) Open Areas: Minus 4.

Level (dB) Enclosed Office: Minus 4.5.

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Octave Band (Hz): 1600.

Level (dB) Open Areas: Minus 5.

Level (dB) Enclosed Office: Minus 5.

Octave Band (Hz): 2000.

Level (dB) Open Areas: Minus 6.

Level (dB) Enclosed Office: Minus 6.

Spectrum: Will have relative 1/3 octave band levels which form a smooth spectrum within the constraint of the above octave band values and are within 2 dB in the 400 to 2000 Hz bands and to within a slowly increasing limit for higher and lower bands to a maximum variance of 6 dB in the 63 Hz and 8000 Hz bands.

Nominal Sound Level in dBA for Each Area:

Conference Rooms: 42 dBA.

Enclosed Offices: 44 dBA.

Semi-Enclosed Workstations: 45 dBA.

Open Office Areas: 47 dBA.

Background Noise Level Must Exhibit Temporal Uniformity. The short-term time-average level of each 1/3 octave band over any selected 2 second interval is to vary no more than 3 dB with respect to the long-term average.

In Open Areas and Larger Enclosed Spaces: Overall sound level produced to have spacial uniformity of plus or minus 1 dB between any two sound generating units.

Interface with Fire Alarm Control Unit (FACU): During a fire emergency, sound masking must be muted or turned off per the sound masking shutdown sequence. System must have ability to assist in creating a safer, more intelligible environment in a life safety situation.

SCOPE:

The terms 'Masking Noise System Design-Builder' or 'Design-Builder' refer to the organization providing and installing the masking noise system.

Masking Noise System Design-Builder will be Responsible for the Following:

Make system operational.

Furnish and install system components within space provided by others.

Demonstrate by appropriate test data system meets performance specifications.

Design-Builder Responsibilities:

Obtain and be familiar with drawings and details for the masking noise system.

Furnish and Install the following:

Wiring and cabling.

Masking noise equipment and materials per contract documents.

Support brackets for suspension of loudspeakers.

Seismic bracing per applicable building codes.

Furnish items for mounting, terminating, matching and connecting elements per the contract documents. Additional items required to meet system performance requirements including installation labor, to be supplied by the Design-Builder.

Furnish and install equipment, solid state devices, power supplies, transformers, matching networks, signal indicators, controls, mounting brackets, painting, devices, and other materials even though not specifically mentioned herein, which are necessary for the proper integration of the system, so that the system performs the functions listed herein in compliance with the contract documents.

QUALITY ASSURANCE

Manufacturer Qualifications: Company specializing in manufacturing products specified in this section with a minimum ten years documented experience.

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Design-Builder:

Qualifications:

- Experienced in design, fabrication, installation, checkout, and warranty contract management of systems such as is described in this section.
- Must be factory qualified and certified to install the products listed in this performance specification.

Responsibilities:

- Responsible for system specified and be the single contact point for the Architect, Consultant, Fire Protection Engineer (FPE) and/or the Owner with respect to sound masking Work specified.
- Coordinate with Fire Protection Engineer in order to assemble / connect the sound masking system to the Fire Alarm Control Unit (FACU). Provide connection but NOT make the connection. It is the responsibility of the installation company of the FACU to make the connection with the FACU and then, in conjunction with the Design-Builder, test the system.
- Submit as a part of its bid submittal, a detailed brochure describing its capabilities in terms of facilities, personnel, experience background examples of similar installations (at least two projects within the past two years), distribution arrangements with manufacturers, and financial capability (includes satisfaction of the project bonding requirements). This submittal must justify in the judgment of the Consultant and the Architect, that the Design-Builder is capable of the necessary business and technical arrangements for this installation and the pursuant warranty service.

Manufacturer's Project Engineer:

- Qualifications: Five years' experience with similar electronic specialty systems, or other educational experience background as approved by Architect and Consultant.
- Responsibilities: Obtain and be totally familiar with drawings that have a bearing on the location and installation of electronic equipment, loudspeakers, or any special components.
- Technical liaison between the Design-Builder, the Architect, the General Contractor, Fire Protection Engineer (FPE), and Consultant.
- Participate in meetings and conferences.
- Be present at job site for final inspection.
- Approve operating and maintenance manuals.
- Provide the specified instruction to designated members of Owner's staff.
- Supervise the technical Work which is part of the contract which includes:
 - Preparation of construction drawings from information within performance specifications.
 - Approve and sign shop drawings.
 - Shop fabrication and field installation Work assuring conformance with the performance specifications, and approved shop drawings.
 - Oversee testing of assemblies and sub-assemblies prior to job site delivery.
 - Specified testing of completed installation assuring performance specifications are met.
 - Final testing for approval and acceptance of the system.

Source Limitations: Provide each type of product from a single manufacturing source to ensure uniformity.

Equipment and associated hardware to be fabricated and installed in accordance with the manufacturer's specified recommendations.

Unless otherwise stated, electrical and electronic equipment will be products of established manufacturers with a minimum of 10 years manufacturing sound masking systems. Use the latest models or types which meet the applicable specifications at the time of submittal.

Quality of workmanship and fabrication of equipment and components which are custom fabricated

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to be comparable to professional audio equipment as produced by specialized manufacturers of electronic apparatus. Only skilled craftsmen of the profession required are to be utilized for all aspects of system fabrication and installation.

Materials and Products: New and of the finest quality. No used materials to be installed.

System Design: By an approved manufacturer representative.

Designed so that individual speaker or component failure will have no impact on the balance of the system.

System Adjustment: Completed by an approved manufacturer representative or trained contractor.

Mock-Up: Construct a mock-up with actual materials in sufficient time for Architect's review and to not delay construction progress. Locate mock-up as acceptable to Architect and provide temporary foundations and support.

Intent of mock-up is to demonstrate quality of workmanship and visual appearance.

If mock-up is not acceptable, rebuild mock-up until satisfactory results are achieved.

Retain mock-up during construction as a standard for comparison with completed Work.

Do not alter or remove mock-up until Work is completed or removal is authorized.

PRE-INSTALLATION CONFERENCE

Convene a conference approximately two weeks before scheduled commencement of the Work.

Attendees shall include Architect, Contractor and trades involved. Agenda shall include schedule, responsibilities, critical path items and approvals.

DELIVERY, STORAGE, AND HANDLING

Deliver in manufacturer's original unopened and undamaged packages with manufacturer's labels legible and intact.

Store and handle in strict compliance with manufacturer's written instructions and recommendations. Protect from moisture during shipping, storage and handling.

Protect from damage due to weather, excessive temperature, and construction operations.

Inspect manufacturer's packages upon receipt.

WARRANTIES: ALL EQUIPMENT

Warranted to be free from defects in materials, workmanship, and performance for minimum of 1 year from date of installation.

At Closeout, provide to Owner an executed copy of manufacturer's standard limited warranty against manufacturing defects, outlining terms, conditions, and exclusions from coverage.

System Components for Sound Masking: Must carry a minimum of a 10 year warranty. Warranty statements must be submitted prior to notice to proceed.

PROJECT CONDITIONS

Maintain environmental conditions (temperature, humidity, and ventilation) within limits recommended by manufacturer for optimum results. Do not install products under environmental conditions outside manufacturer's recommended limits.

PART 18 - PRODUCTS

MANUFACTURERS

Acceptable Manufacturer: Lencore Acoustics Corp., which is located at: 1 Crossways Park Dr. W.;

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Woodbury, NY 11797; Tel: 516-682-9292; Fax: 516-682-4785; Email: [request info \(info@lencore.com\)](mailto:requestinfo@lencore.com); Web: <http://www.lencore.com>

Substitutions: Not permitted.

Requests for substitutions will be considered in accordance with provisions of Section 01 60 00 - Product Requirements.

This specification for system components is written as performance specifications intended to promote competition and development of superior new components for high quality sound systems.

SOUND MASKING SYSTEMS

Basis of design: Spectra Classic as manufactured and supplied by Lencore Acoustic Corporation. Masking, music, and paging.

Basis of Design: i.Net non-network as manufactured and supplied by Lencore Acoustic Corporation. Masking, music, and paging.

Basis of Design: i.Net network as manufactured and supplied by Lencore Acoustic Corporation. Masking, music, paging, and network.

Basis of Design: n.Form as manufactured and supplied by Lencore Acoustic Corporation. Masking, music, paging, network, and MNEC.

Design of the sound masking system will be customized and supplied as required to meet the performance and design requirements per this specification.

PROPOSAL REQUIREMENTS

Quote Request:

Company Requesting Quote: _____.

Address: _____.

Contact: _____.

Phone: _____.

Email: _____.

Address of Project Location: _____.

Target Date for Completion: _____.

Address of Project Location: _____.

Scope of Work: _____.

Project is quoted on GSA contract.

Manufacturer to Provide Installation Services.

Permits: Required.

Permits: Not required.

Project site Labor Requirements:

Normal Hours: Non-union.

Normal Hours: Union.

Normal Hours: Prevailing wage.

After Hours: Non-union.

After Hours: Union.

After Hours: Prevailing wage.

Project Specifics; Building Information:

Construction Type: New Construction.

Construction Type: Existing Retrofit.

Description of Building Type: _____.

Ceiling Type: Tiles in place.

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Ceiling Type: Drop tile.
Ceiling Type: Cement.
Ceiling Type: Sheetrock.
Ceiling Type: Steel truss.
Ceiling Type: Open.
Speakers: Painted.
Color: White.
Color: Black.
Color: _____.
Paint Brand: Sherwin Williams.
Paint Brand: Benjamin Moore.
Ceiling Type: Wooden beam.
Ceiling Type: _____.
Insulation Above Ceiling: None.
Insulation Above Ceiling: Sprayed on beams/deck.
Insulation Above Ceiling: Laying on the ceiling tiles.
Insulation Above Ceiling: Unknown.
Approximate Area of Sound Masking (sq ft / sq m): _____.
Approximate Area of Sound Masking: As determined by the Architect.
Approximate Area of Sound Masking: As designated on the Drawings.
Height; Floor to Finished Ceiling (in/mm): _____.
Height; Finished Ceiling to Underside of Deck (in/mm): _____.
Height; Floor to Underside of Deck (in/mm): _____.
Private Office Walls: Constructed floor to slab.
Drawing Data to be supplied to Manufacturer: DWG or PDF files.
Floor plans.
Reflected ceiling plans.

Sound Masking or MNEC Requirements:

Open Office Workstations:
Sound masking.
Notification / paging.
Music.
MNEC.
Private Offices:
Sound masking.
Notification / paging.
Music.
MNEC.
Hallways:
Sound masking.
Notification / paging.
Music.
MNEC.
Conference Rooms:
Sound masking.
Notification / paging.
Music.
MNEC.
Other: _____.
Sound masking.
Notification / paging.
Music.
MNEC.

Control Interface Requirements:

None.
Creston.

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AMX
Other: _____.

PERFORMANCE REQUIREMENTS

Compliance Listings or Approvals from a Nationally Recognized Testing Laboratory (NRTL):

UL - Underwriters Laboratories, Inc.

ULC - Underwriters Laboratories Canada.

ETL - Intertek.

System Architecture: Networked decentralized with addressable masking devices distributed throughout the installation area.

Tied to Fire Alarm Control Unit (FACU) in event of a fire emergency with the purpose of being shut down for safety notification purposes.

Regulatory Testing and Certifications:

Relevant System Components Conforming to Following:

Safety and Electrical: UL 6500 - Standard for Audio/Video and Musical Instrument Apparatus for Household, Commercial and Similar General Use. Products shall be labelled accordingly.

Air-Handling Plenum Installation: UL 2043 - Standard for Fire Test for Heat and Visible Smoke Release for Discrete Products and Their Accessories Installed in Air-Handling Spaces; 1996. Products shall be labeled accordingly.

Plenum Rated Cabling: CSA CMP 75C FT6. Products shall be labelled accordingly.

Electromagnetic Interference (EMI): FCC - Part 15, Subpart B, Class A - Unintentional Radiators.

Heavy Metals: RoHS - Restriction of Hazardous Substances.

Low Voltage Power Supplies: UL1310 - Standard for Class 2 Power Units. Products shall be labeled accordingly.

UL 2572 - Standard for Mass Notification Systems.

Sound Masking Performance: Digital signal processing (DSP) technology for masking sound generation and output adjustment of masking signals.

Masking Sound: Generated via a truly-random, non-deterministic digital process with no repeat cycle within a 24 hour period.

System Requirements:

Single control unit/panel (SMCP): Capable of addressing entire system. Multiple control units not acceptable.

Integrated Sound Masking Digital Signal Processors (DSP's): Utilize an open platform network technology, meeting open control standards with web appliances, browser interfaces, infrared remote controls and internet access capable.

Capable of separately and independently configuring zones for sound masking via the network zoned through its singular central control.

Sound Masking System Shutdown: Through interface with Fire Alarm Control Unit (FACU) as described in Section 28 31 00 (Fire Alarm and Detection Systems, meeting a minimum of UL 2572).

Control System: Capable of using RS232 for intelligent building integration.

Standards for Open Platform: Meet ANSI 709.1 / ISO / IEC.

US Army Corp.'s Unified Facilities Guide Specifications:

UFGS 25 10 10, "Utilities Monitoring and Control System."

UFGS 23 09 23, "Direct Digital Control for HVAC and Other Local Building Controls."

Multi-drop network system, point to point systems are unacceptable; no exceptions.

System Tuning: Through a network or hand-held remote or keypad switches.

Complete diagnostics capability of entire system functions including diagnostics of network, hubs, nodes, routers, DSP, Relays, memory, circuitry, amplifiers and power.

Report entire settings for each zone indicating at a minimum the volume, contour,

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equalization, diagnostics, and zones and channel groupings.
Diagnostics and remote administration via a standard web browser.
Capable of naming network nodes, channels, zones, and external audio sources via its integrated Graphical User Interface.

Equalizer: 30 band parametric or 30 band third-octave compilable via DSP.

Speakers: 4 to 6-1/2 inch (102 to 165 mm) diameter ensuring delivery of a broad frequency spectrum.

Line Interfacing with Fire Alarm Control Unit (FACU) and Sound Masking Control Unit (SMCU): Monitor as defined by UL 2572.

Programmable function to gradually ramp up masking volume at a predetermined schedule.

System Control: Control Panel Component Provide Controls for:

Networked device addressing.

IP setup for controller.

Administration for User Profiles:

Controller must capture and report all changes any user makes to the system.

Password Protection: Admin and user profiles.

System compatible with third party controllers.

Work with BACnet or Modbus systems.

Setup and Configuration:

Initialization.

Harvesting and uploading all settings.

Masking volume and contour adjustment.

Masking equalizer adjustment.

Audio Source equalizer adjustment.

Labeling all nodes, channels, zones, and custom EQ settings.

System independent zoning for masking.

System independent zoning for paging.

System independent zoning for audio input.

Masking timer programming.

Security functions.

System diagnostics and monitoring.

Graphical User Interface address books for multiple buildings on a campus.

Interfacing with the Fire Alarm Control Unit (FACU).

System control for the entire building or buildings by providing operation of multiple system components from a single central location.

Lockouts preventing simultaneous adjustment of system from multiple users.

Defer control to Fire Alarm Control Unit (FACU) in event of a fire emergency for muting the masking through the Sound Masking Shutdown Sequence.

Network Device Discovery:

Identify networked masking devices via an automatic addressing process such that devices that are numbered in sequence based on their location in the network on each floor.

Identified Masking Device: LCD screen display in addition to labels for ID of devices.

Work with network controller ensuring proper display of ID.

Work real time to display any changes.

LCD display for error messages.

System should leverage analytic software, working in real time, to manage and monitor system performance.

Scheduler: Control components providing and integrated masking timer function:

Automatic masking volume adjustments per custom user-programmed schedules.

Ability to digitally assign any group of masking zones to a selected timer zone.

Calendar-based operation.

Automatic and user-defined daylight savings adjustment.

Zoning: Networked masking devices zone capable for masking, paging, and external audio.

Zoning of networked masking devices performed digitally.

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Zone assignments to each type to be independent of each other.
Networked masking devices capable of individual rezoning without rewiring.
Each zone capable of holding, at a minimum 10 programmable zone assignments.

Cabling: Single category-based cable providing, control signals for connections between:

Control panel components and networked masking devices.

Networked masking devices.

Nodes and speakers, and speaker to speaker connections.

Monitored and Supervised Line per UL 2572.

Connection to Fire Alarm Control Unit (FACU) from a single Sound Masking Control Unit (SMCU).

System Power: Run on a separate dedicated cable.

Cabling: Rated for air-handling plenums.

Cabling Connections: Made using connectors with positive locking mechanisms.

Cables: Non-proprietary off the shelf cables. Single source cables are unacceptable.

Diagnostic: Upon initial configuration.

Automatically detect number and type of networked devices connected.

Verify networked devices are communicating with other devices on the network.

Verify networked devices are initialized.

Identify networked devices not communicating.

Verify system design integrity.

General Requirements:

Masking Noise Equipment: UL listed.

Equipment Installed Above Ceiling: UL listed plenum rated.

Electrical Equipment: Products of established manufacturers.

Sustained proper operation at a nominal 120 VAC plus or minus 10 percent, 60 Hz, plus or minus 10 percent power source.

No exposed, unprotected 120 VAC potential inside or outside any enclosure. Exterior metal surfaces to be grounded.

Sustained proper operation within temperature range of 32 to 104 degrees F (0 to 40 degrees C).

Quality of workmanship and fabrication of custom fabricated equipment to be comparable to professional audio equipment as produced by specialized manufacturers of electronic apparatus.

Designed or adaptable for standard front panel rack mounting.

Manufacturers' stock equipment and component labeling and console designations to be in English. Systems nomenclature, signage and custom labeling pertaining to routine system operation shall be on the equipment itself and on descriptive drawings, charts or diagrams.

Equipment to be selected with the criteria of operational simplicity and ease of maintenance.

Masking Noise Processor:

DSP-Based Masking Sound Generator: Provides noise generation, equalization and level control for the system.

Global and Local Level Sound Zoning: Designed per space plan for areas requiring special attention; i.e. patient rooms, exam rooms, reception areas, provider offices, clerical work areas, open areas, patient check in areas, special work areas, executive areas. Zoning must allow both volume and frequency adjustments.

Software Configurable and Controllable: Programming sound pressure level at predetermined times.

Control Unit:

LON or BACNET capable.

Digital input/output relays.

TCP IP and RS-232 port.

Control entire building without any additional controllers.

Browsed using off the shelf software.

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Email reports.
Programming alarms, alarm triggers.
Data logs creation.
Listed UL 2572 by a nationally recognized testing laboratory (NRTL).
Noise Generator: Octave bands from 20 Hz to 20 KHz.
Voltage: 48 Volts DC, 60 Hz.
Contour adjustments.
Spectrum Adjustment: Meet acoustical preferred curve.
Octave Band: 1/3 band EQ for entire spectrum (20 Hz to 20 KHz). Meets ANSI specification for bands.
Parametric EQ for entire spectrum: 20 Hz to 20 KHz.
Central volume control, contour control and EQ control for zones for sound masking.
Central volume control, and EQ control for zones and units for paging and audio.
Power Supply:
Output:
Voltage: 48 VDC.
Rated Current: 3.2 A.
Current Range: 0 to 3.2 A.
Rate Power: 150, 320, 500 W.
Output Voltage Adjustment Range: 45.6 to 52.8 V.
Line Regulation: Plus or minus 0.5 percent.
Load Regulation: Plus or minus 0.5 percent.
Setup, Rise Time: 600 ms, 30 ms at full load.
Hold Up Time: : 20 ms at full load.
Input:
Voltage Range: 85 to 264 VAC. 120 to 370 VDC.
Frequency Range: 47 to 63 Hz.
Power Factor: Greater than 0.93/230 VAC. At Full Load: Greater Than 0.98/115 VAC.
AC Current: 2.5 A at 115 VAC and 1.2 A at 230 VAC.
Inrush Current: Cold Start 40 A at 230 VAC.
Safety and EMC:
Safety Standards: UL60950-1, TUV EN60950-1 and S-Mark J60950 Approved.
Harmonic Current per EN61000-3-2,-3.
EMS Immunity per EN61000-4-2,3,4,5,6,8,11; ENV50204, and EN55024.
Environment:
Working Humidity: 20 to 90 percent RH non-condensing.
Working Temperature: Minus 10 to 60 degrees F (minus 12 to 15.5 degrees C).
Refer to output load derating curve.
Storage Temperature and Humidity: Minus 20 to 85 degrees F (), 10 to 95 percent relative humidity.
Temperature Coefficient: 0.05 percent at (0 to 50 degrees C).
Vibration: 10 to 500 Hz, 2G 10 min per cycle, 60 min each along X, Y, Z axes.
Others:
MTBF: 191.2K hrs. min. per MIL-HDBK-217F 77 degrees F (25 degrees C).
Dimensions: 7-27/32 x 3-29/32 x 1-15/16 inches (199 x 99 x 49 mm).
Protection:
Overload: 105 to 150 percent rated output power.
Protection Type : Constant current limiting, recovers automatically after fault condition is removed.
Over Voltage: 52.8 to 64.8 V.
Over Temperature: 194 to 212 degrees F (90 to 100 degrees C).
TSW1: Detect on heat sink of power transistor.
Protection Type: Shut down o/p voltage, recovers automatically after temperature goes down.

Loudspeaker Systems:

Product Specifications: Meet or exceed.

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Size: 5-1/4 inch (133 mm) wide dispersion.
Power Rating: 10 Watts Root Mean Squared (RMS).
Frequency Response: 65 to 12,000 Hz.
Pressure Sensitivity: SPL at 1 Watt per m: 90 dB.
Impedance: 32 Ohms.
Magnet Weight: 10 oz (283.5 grams) minimum.
Sound Volume from 1 Watt Input at Meter: 86 dB
Impedance: 32 Ohms.
Listed: UL1480.

Remote Central Volume Control:

Generation and integration of multiple random sound masking sources. Channel outputs with three levels of global and independent control.

Contour Control: At source using infra-red technology for each independent channel, quad-pod and global control or via a centralized control.

Parametric Equalization Control: For one to 6,400 speakers.

Third Band Octave Controls: Same as parametric controls for groups.

Volume Control: For entire spaces, to channels, to individual speakers.

Programmable Audio Level Control:

Standard Applications: Scheduling, data logging, alarm detection and dispatch, meter reading, analog functions, and type translation.

Scheduling Application: Permits events and exceptions to be initiated based on time and date schedules configured by the user.

Astronomical Position Calculator: Permits scheduling to be done based on calculated position of sun.

Data Logging Application: Collects network activity for use by trending, reporting, and analysis applications.

New DIME Support: Enables data log upload to a Web services application to occur through a firewall.

Alarming Application: Provides a means to identify, announce, and log alarm conditions.

Meter Reading Application: Supervises impulse meters and provides suitable conversion values for energy, gas, and water metering.

Automatic Sound Power Level Changes: Two system channel changes, four times per day, and capable of different time settings for each day of the week.

Programmable Attenuation Range: Minus 24 to 24 dB (48 dB).

Slide Control Attenuation Range: Minus 24 to 24 dB.

Minutes per dB Change: User programmable.

Acclimation Attenuation Range: Minus 24 to 24 dB.

Acclimate Days per dB Change: 1 to 5 days.

Programmable Events: 24 events per day for each zone.

Sound Masking, Audio and Paging Shutdown Sequence:

Connect Fire Alarm Control Unit (FACU) to the SMCU (Sound Masking Control Unit) utilizing a supervised line and addressable relays, per NFPA 72, to shut down and effectively mute all sound masking, audio and paging systems.

The FACU and associated supervised lines to meet UL 2572 ensuring the shutdown mechanism is properly supervised and is reliable and will in no way damage the FACU or SMCU.

The FACU and associated relays must not introduce any noise into the sound masking, audio or paging system.

Muting ambient sound during an emergency is necessary to meet ADA suggested guidelines and NFPA acoustic requirements.

Non-UL listed SMCU is not acceptable.

Refer to Section 28 31 00.

Program Memory: Nonvolatile for one year, minimum, without power. When re-energized after a power outage, control starts at zero level and automatically advances system sound level at same rate used for programmed level changes.

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Miscellaneous Equipment:

Wiring and Cables:

Use manufacture recommended cable.

Grounding Wire per NEC 800-31 (1984) and NEC 250.

Lacing and Clamping: No intermediate splices are permitted.

Connections: Soldered. No solderless connectors or "wire-nuts" for splicing or connections.

Equipment Racks: By others. Coordinate with IT.

Conduit System: Meet requirements of metallic conduit system described in electrical specifications, Division 26.

Aids-To-Use:

One Durable Single Line Block Diagram: Drawn for the purpose of facilitating the operator's use of the system.

A simplified block diagram mounted inside the front of equipment enclosure panel.

Equipment, controls, etc., to be identified as they are designated or engraved.

No superfluous information such as wire designations, voltages, levels, construction information, etc., is to appear.

PART 19 - EXECUTION

EXAMINATION

Do not begin installation until substrates have been properly constructed and prepared.

If substrate preparation is the responsibility of another installer, notify Architect in writing of unsatisfactory preparation before proceeding.

PREPARATION

Clean surfaces thoroughly prior to installation.

Prepare surfaces using the methods recommended by the manufacturer for achieving the best result for the substrate under the project conditions.

Obtain necessary permits for installation Work.

INSTALLATION

General: Install in accordance with manufacturer's instructions approved submittals and in proper relationship with adjacent construction.

The following installation requirements govern the installation of systems specified. In cases of discrepancy between overall system standards and individual equipment item specifications, the latter will govern.

Workmanship on the installed system shall be of professional quality, best commercial practice and accomplished by persons experienced in the techniques and standards of the particular crafts involved.

Equipment items shall be provided and installed to allow fully normal operation in the anticipated ambient temperature range of 60 degree-90 degree F.

Any Work called for on the Drawings and not mentioned in the specifications, or vice versa, will be performed as though fully set forth in both.

In Case, of Differences Between the Drawings and Specifications: The decision of the Sound Masking Professional responsible for the Sound masking equipment and installation will govern.

Work not Particularly Detailed, Marked, or Specified: Will be construed to be the same as similar parts or areas that are detailed, marked, or specified.

General Contractor: Responsible for supplying any conduit, which may be required to complete the system installation in accordance with the specifications.

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Requirements for the metallic conduit specified in the electrical specifications and Division 16 shall apply to the Work described herein.

Equipment Enclosure Layout and Assembly:

Equipment Enclosure: Installed in the equipment room. Install as shown in the drawings. Constructed to easily accommodate interconnecting cables entering from above or below.

Provide approved terminal blocks. Other suitable means of terminating or connecting incoming and outgoing cables may be used if approved by the Sound Masking Professional responsible for the Sound masking equipment.

Interconnecting Cabling: Will be led laterally from each component to the vertical rack member opposite from the AC power strip and then run vertically, remaining as exposed and accessible as possible. Wherever corners in cabling occur a strain relief spiral covering should be used. All cable clamps shall be non-conducting or have soft insulating covers.

Keep low level signal lines separated from the AC power lines and high level signal lines. This must be observed in rack layout and mechanical support or passage within the equipment room.

Connections of Lines at Terminal Strips: Mechanically secured and soldered. No unsoldered connections permitted. Lines approach enclosure and terminal strips to be mechanically anchored at enclosure with sufficient slack length to avoid strain, abrasion or wear.

Wiring and Cabling:

Wiring: Executed per equipment manufacturer's wiring recommendations. Variations from these requirements, require the prior approval of the Engineer.

Wiring Method: Per local electrical codes. Conceal cable in accessible ceilings, walls and floors. No exposed cable is allowed.

Pulling Cable: Do not exceed manufacturers recommended pulling tensions. Do not install bruised, kinked, scored, deformed, or abraded cable. Do not splice cable between normal termination points. Remove and discard cable where damaged during installation and replace it with new cable.

Cables to be grouped and bundled by type and level and routed from source to termination in a uniform manner throughout equipment housings. Do not break the insulation or deform the cable by harness supports. Cables are not to change relative position in a cable group throughout a cable route.

Power distribution wiring will not be installed adjacent to signal cables. Power distribution cabling will be on the opposite side from signal wiring in equipment enclosures and uniformly located throughout an installation.

Edge protection material ("cat track") installed on the edges of holes, lips of ducts or any other point where cables or harnesses cross metallic edges.

Audio and control cable ends to be neatly formed and shrinkable tubing applied where necessary to secure the insulation against graying or raveling.

Conductors, including spare conductors, which are entering or leaving the above listed components, to be directly terminated on terminal blocks without intermediate splices. Terminals to be properly and completely labeled.

Cable Shields: Terminated in the same manner as other conductors. The shields of cables shall be kept well separated from each other and from ground.

Cable Installation: Responsibility of Design-Builder for the Sound Masking system.

The connection to the Fire Alarm Control Unit (FACU) will be provided by the Design-Builder to the Fire Protection Engineer (FPE).

The FPE will be responsible for the physical connection to the FACU.

Plenum Loud Speakers:

Mount loudspeakers at locations shown on approved shop drawing.

Mountings and Loudspeakers:

Concealed above the acoustical ceiling.

Suspend from slab above by chain. Where possible, the bottom, of speakers to be 6

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to 8 inches (150 to 200 mm) above the acoustical ceiling tile.
Hang at a uniform height insuring sound uniformity when system is on.
Safety cable attached to the deck above at each loudspeaker location.
In the event that the alternate to furnish exposed loudspeaker cables in the ceiling plenum is exercised, locate cables approximately 12 inches below the metal deck and attach cables by approved J-Hook fasteners.
Loudspeaker cables shall not be permitted to lay on ceiling suspension members or the ceiling tile.

Power Distribution Throughout the System: Per applicable codes:

Unless otherwise specified, Design-Builder will supply and install the rack mounted power distribution panel, specified elsewhere, in each equipment console/rack/enclosure.
Power cords from individual equipment to power outlet strips to be shortened to proper length and neatly dressed into the rack or console. Use cradle clamps with removable rubber retainers to secure power cords to the side of the rack supports. Do not secure power cords using non-reusable supports.

Labeling:

Equipment Markings: Present only needed information and be readable from the operator's or service personnel's normal work position. Markings to be designed to avoid ambiguous interpretation.

Networked devices must have an LCD screen that works directly with the network in real time displaying the correct node number.

A descriptive title shall be assigned to each piece of equipment.

Apply an engraved designation title plate to both the front and rear panels of rack-mounted equipment, and to the outside case or enclosure of equipment mounted within a rack.

These same titles will also be indicated on block diagrams, wiring drawings, and installation drawings.

Use plain English (example: Power Amplifier No. 2-1).

Signal and Control Cabling: Individually identified. A unique number located approximately 1.5 inches (38 mm) from cable termination connector at both ends of a cable.

Cable Identification Number: Impressed on a fixed length of white shrinkable tubing with a heat impression stamping machine.

Lettering: Filled with a black filler and covered with a protective coating after shrinking that will not crack, peel or yellow.

After installation, cover labels with clear heat shrinkable tubing.

Letters to be 0.25 inches (6 mm) in height.

These unique numbers to appear on "as built" documentation to be supplied at the completion of the project.

Markers pre-shrunk to approximate size before installing.

Orient for cable markers for ease in viewing before installation.

FIELD QUALITY CONTROL

Field Inspection: Coordinate field inspection in accordance with appropriate sections in Division 01.

Manufacturer's Services: Coordinate manufacturer's services in accordance with appropriate sections in Division 01.

Overall system Performance Requirements and Qualifications:

Validate System as Specified. Fully document Work performed with a neat copy presented for acceptance by sound masking consultant and included in the system manual.
Costs for tests to be borne by the Design-Builder.

Tests Required: To greatest extent possible, pre-assemble and test system component sub-assemblies, including consoles, rack assemblies, interconnections, and system assemblies (excluding, of course, input and output transducers) in Design Builder's own facility.

By Design-Builder at Design-Builder's Facility:

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Frequency Response: Overall frequency response of the complete electronic system (un-equalized) to be 65 to 15,000 Hz plus or minus 2 dB.
Equalizing circuits shall be temporarily set in the indicated "flat" position.
Other equalization devices shall be temporarily removed and replaced with equivalent loss networks.

Distortion: Total harmonic distortion at full power; less than 1.5 percent for frequencies of 50, 1000, 10,000 and 15,000 Hz.

Equalization and Other Testing by Design-Builder at Job Site:

After the following has been installed at the job site, equalize and acoustically test.

Electronic equipment specified.

Ceiling speakers.

Ceiling system with relevant return air sound boots in place.

Tests to be performed with HVAC system and ultrasonic motion detectors, turned off. Carpeting, work stations, desks, chairs, acoustical wall panels, and other materials that may influence acoustical characteristics of the space to be installed prior to testing.

Equalize complete system in all zones to meet octave and third-octave sound spectrum requirements per Design Criteria.

After zones are equalized, set sound level, measured in dBA for each zone to meet Design Criteria. If variation in sound level in a particular zone or area exceeds the nominal value in excess of 2 decibels, adjust individual loudspeakers as required.

Set time clock as follows for all zones (verify with Owner):

Monday - Friday 7 am to 7 pm: 0 dB.

Monday - Friday 7 pm to 7 am: - 3 dB.

Saturday, Sunday: - 3 dB.

All these tests, and any others that the Design-Builder may wish for his own satisfaction, to be performed and successfully achieved before observation is requested for the sound masking consultant. The Consultant may request repetition and demonstration during observation of tests or other critical tests if problems become apparent. If specifications are met, acceptance of the system after this observation may be expected.

If specifications are not met, further observations by the Consultant will be at the Design-Builder's expense.

ACCEPTANCE DOCUMENTATION

Acceptance: Official acceptance of the system covered by this specification will occur when the Design-Builder receives the following written documents:

A letter from the Sound Masking Consultant to the Architect acknowledging Final

Acceptance of the system stating compliance with all articles of the specifications.

A letter from the Architect to the Design-Builder stating that all related Work has been completed to his satisfaction. Until these documents are received, the installation is not formally complete. The official date of acceptance shall be the date of the letter.

Design-Builder will supply complete system documentation with installed system.

Furnish a complete instruction manual as provided by the manufacturer containing an operation description, schematic diagrams, parts layout drawings, as-built drawings, and parts list with each component time supplied by the Design-Builder.

A list of all instruments, including accessories by manufacturer and type number used by the Design-Builder to obtain test data to be submitted to the Owner with maintenance recommendations for equipment furnished under this contract.

System geographical layout and block diagram under a plastic cover on the inside of the equipment enclosure front door.

Record of final field tests and measurements include final adjustment of system.

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Design-Builder will supply complete manufacturers instruction manuals (operation and service) for each purchased system component.

Instruction manuals to contain an operational description of components, schematic diagrams, parts layout, parts list, and maintenance instructions; preventive and corrective.

Organize manuals by system and present in bound volumes, one volume for each system.

Provide three copies of each volume.

DEMONSTRATION AND TRAINING

After required approvals have been issued, and at a time designated by the Owner, the Design-Builder will demonstrate to the Owner's maintenance personnel the operation and maintenance of items installed under the Work in this section.

Instruction:

After the system is totally installed and in proper operating condition as directed, the Design-Builder shall provide instruction sessions as necessary to describe and demonstrate the entire system to the Owner's engineering staff, and those others who will be in charge of or otherwise related to the system operation.

The session shall be scheduled by the Owner and shall be held at a time convenient to the Owner, and shall be at least 4 man-hours.

The operation manuals described above shall be completed at the time of the instruction session and at this time supplied to the Owner to aid in the system description.

CLEANING AND PROTECTION

Clean products in accordance with the manufacturer's recommendations.

Debris resulting from system's installation must be continuously removed during and after installation.

Equipment shall be thoroughly dusted and cleaned after installation.

Touch-up, repair or replace damaged products before Substantial Completion.

END OF SECTION

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DIVISION 28 ELECTRONIC SAFETY AND SECURITY

1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Sleeves for raceways and cables
2. Sleeve seals
3. Grout
4. Common electronic safety and security installation requirements

1.2 SUBMITTALS

- A. Product Data:
For sleeve seals

PART 2 - PRODUCTS

2.1 SLEEVES FOR RACEWAYS AND CABLES

- A. Steel Pipe Sleeves:
ASTM A 53/A 53M, Type E, Grade B, Schedule 40, galvanized steel, plain ends
- B. Cast Iron Pipe Sleeves:
Cast or fabricated "wall pipe," equivalent to ductile-iron pressure pipe, with plain ends and integral water stop, unless otherwise indicated.

2.2 SLEEVE SEALS

- A. Description:
Modular sealing device, designed for field assembly, to fill annular space between sleeve and raceway or cable.
1. Basis of Design Product:
Subject to compliance with requirements, provide or/a comparable product by one of the following:
 - a. Advance Products & Systems, Inc.
 - b. Calpico, Inc.
 - c. Metraflex Co.
 - d. Pipeline Seal and Insulator, Inc.
 2. Sealing Elements:
EPDM interlocking links shaped to fit surface of cable or conduit. Include type and number required for material and size of raceway or cable.

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3. Pressure Plates:

Stainless steel. Include two for each sealing element.

4. Connecting Bolts and Nuts:

Stainless steel of length required to secure pressure plates to sealing elements. Include one for each sealing element.

2.3 GROUT

A. Nonmetallic, Shrinkage Resistant Grout:

ASTM C 1107, factory packaged, nonmetallic aggregate grout, noncorrosive, non-staining, mixed with water to consistency suitable for application and a 30-minute working time.

PART 3- EXECUTION

3.1 COMMON REQUIREMENTS FOR ELECTRONIC SAFETY AND SECURITY INSTALLATION

A. Comply with NECA 1

B. Measure indicated mounting heights to bottom of unit for suspended items and to center of unit for wall mounting items.

C. Headroom Maintenance:

If mounting heights or other location criteria are not indicated, arrange and install components and equipment to provide maximum possible headroom consistent with these requirements.

D. Equipment:

Install to facilitate service, maintenance, and repair or replacement of components of both electronic safety and security equipment and other nearby installations. Connect in such a way as to facilitate future disconnecting with minimum interference with other items in the vicinity.

E. Right of Way:

Give to piping systems installed at a required slope.

3.2 SLEEVE INSTALLATION FOR ELECTRONIC SAFETY AND SECURITY PENETRATIONS

A. Electronic safety and security penetrations occur when raceways, pathways, cables, wireways, or cable trays penetrate concrete slabs, concrete or masonry walls, or fire-rated floor and wall assemblies.

B. Concrete Slabs and Walls:

Install sleeves for penetrations unless core drilled holes or formed openings are used. Install sleeves during erection of slabs and walls.

C. Use pipe sleeves unless penetration arrangement requires rectangular sleeved opening.

D. Fire Rated Assemblies:

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Install sleeves for penetrations of fire-rated floor and wall assemblies unless openings compatible with firestop system used are fabricated during construction of floor or wall.

- E. Cut sleeves to length for mounting flush with both surfaces of walls.
- F. Extend sleeves installed in floors 2 inches (50 mm) above finished floor level.
- G. Size pipe sleeves to provide 1/4-inch (6.4-mm) annular clear space between sleeve and raceway or cable, unless indicated otherwise.
- H. Seal space outside of sleeves with grout for penetrations of concrete and masonry
 - 1. Promptly pack grout solidly between sleeve and wall so no voids remain. Tool exposed surfaces smooth; protect grout while curing.
- I. Interior Penetrations of Non-Fire Rated Walls and Floors:
Seal annular space between sleeve and raceway or cable, using joint sealant appropriate for size, depth, and location of joint. Comply with requirements in Division 07 Section "Joint Sealants."
- J. Fire Rated Assembly Penetrations:
Maintain indicated fire rating of walls, partitions, ceilings, and floors at raceway and cable penetrations. Install sleeves and seal raceway and cable penetration sleeves with fire stop materials. Comply with requirements in Division 07 Section "Penetration Fire Stopping."
- K. Roof Penetration Sleeves:
Seal penetration of individual raceways and cables with flexible boot-type flashing units applied in coordination with roofing work.
- L. Aboveground, Exterior Wall Penetrations:
Seal penetrations using steel pipe sleeves and mechanical sleeve seals. Select sleeve size to allow for 1-inch (25-mm) annular clear space between pipe and sleeve for installing mechanical sleeve seals.

3.3 SLEEVE-SEAL INSTALLATION

- A. Install to seal exterior wall penetrations.
- B. Use type and number of sealing elements recommended by manufacturer for raceway or cable material and size. Position raceway or cable in center of sleeve. Assemble mechanical sleeve seals and install in annular space between raceway or cable and sleeve. Tighten bolts against pressure plates that cause sealing elements to expand and make watertight seal.

3.4 FIRE STOPPING

- A. Apply fire stopping to penetrations of fire rated floor and wall assemblies for electronic safety and security installations to restore original fire-resistance rating of assembly. Fire stopping materials and installation requirements are specified in Division 07 Section "Penetration Fire Stopping."

END OF SECTION

SECTION 280513 – CONDUCTORS AND CABLES FOR ELECTRONIC SAFETY AND SECURITY

GOVERNMENT OF THE U. S. VIRGIN ISLANDS, DEPARTMENT OF PUBLIC WORKS

PROJECT NAME: Elaine I. Sprauve Public Library and Museum Building

Project Location, St. John, U.S. Virgin Islands

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Low-voltage control cabling.
2. Control circuit conductors.
3. Fire alarm wire and cable.
4. Identification products.

1.2 DEFINITIONS

- A. BICSI:
Building Industry Consulting Service International
- B. EMI:
Electromagnetic interference
- C. IDC:
Insulation displacement connector
- D. RCDD:
Registered Communications Distribution Designer
- E. NRTL:
Nationally Recognized Testing Laboratory

1.3 SUBMITTALS

- A. Product Data:
For each type of product indicated
- B. Shop Drawings:
Cable tray layout, showing cable tray route to scale, with relationship between the tray and adjacent structural, electrical, and mechanical elements.
- C. Qualification Data:
For qualified layout technician, installation supervisor, and field inspector
- D. Source quality control reports
- E. Field quality control reports
- F. Operation and maintenance data

1.4 QUALITY ASSURANCE

- A. Testing Agency Qualifications:
An NRTL

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1. Testing Agency's Field Supervisor:
Currently certified by BICSI as an RCDD to supervise on-site testing.
- B. Surface Burning Characteristics:
As determined by testing identical products according to ASTM E 84 by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.
 1. Flame-Spread Index:
25 or less
 2. Smoke-Developed Index:
50 or less

1.5 PROJECT CONDITIONS

- A. Do not install conductors and cables that are wet, moisture damaged, or mold damaged.
 1. Indications that wire and cables are wet or moisture damaged include, but are not limited to, discoloration and sagging of factory packing materials.

PART 2 - PRODUCTS

2.1 PATHWAYS

- A. Cable Trays:
 1. Manufacturers:
Subject to compliance with requirements, provide products by one of the following available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Allied Tube & Conduit; a business unit of Tyco Electrical & Metal Products
 - b. Cablofil
 - c. Cooper B-Line, Inc.
 - d. GS Metals Corp.
 - e. Snaketray; Cable Management Solutions, Inc.
 2. Cable Tray Materials:
Metal, suitable for indoors, and protected against corrosion by hot dip galvanizing, complying with ASTM A 123/A 123M Grade 0.55, not less than 0.002165 inch (0.055 mm) thick.
 - a. Basket Cable Trays:
6 inches (150 mm) wide and 2 inches (50 mm) deep. Wire mesh spacing shall not exceed 2 by 4 inches (50 by 100 mm).
- B. Conduit and Boxes:
Comply with requirements in Division 26 Section "Raceway and Boxes for Electrical Systems."

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-
1. Outlet boxes shall be no smaller than 2 inches (50 mm) wide, 3 inches (75 mm) high, and 2-1/2 inches (64 mm) deep.

2.2 BACKBOARDS

A. Backboards:

Plywood, fire retardant treated, 3/4 by 48 by 96 inches (19 by 1220 by 2440 mm). Comply with requirements for plywood backing panels in Division 06 Section "Rough Carpentry".

2.3 FIRE ALARM WIRE AND CABLE

A. Manufacturers:

Subject to compliance with requirements, provide products by one of the following available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

1. Comtran Corporation
2. Draka Cableteq USA
3. Genesis Cable Products; Honeywell International, Inc.
4. Rockbestos-Suprenant Cable Corp.
5. West Penn Wire; a brand of Belden Inc.

B. General Wire and Cable Requirements:

NRTL listed and labeled as complying with NFPA 70, Article 760.

C. Signaling Line Circuits:

Twisted, shielded pair, not less than No. 18 AWG size as recommended by system manufacturer.

1. Circuit Integrity Cable:

Twisted shielded pair, NFPA 70, Article 760, Classification CI, for power limited fire alarm signal service Type FPL. NRTL listed and labeled as complying with UL 1424 and UL 2196 for a 2-hour rating.

D. Non Power Limited Circuits:

Solid copper conductors with 600-V rated, 75°C, color-coded insulation.

1. Low-Voltage Circuits:

No. 16 AWG, minimum

2. Line-Voltage Circuits:

No. 12 AWG, minimum

3. Multiconductor Armored Cable:

NFPA 70, Type MC, copper conductors, Type TFN/THHN conductor insulation, copper drain wire, copper armor with outer jacket with red identifier stripe, NTRL listed for fire alarm and cable tray installation, plenum rated, and complying with requirements in UL 2196 for a 2- hour rating.

2.4 IDENTIFICATION PRODUCTS

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A. Manufacturers:

Subject to compliance with requirements, provide products by one of the following available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

1. Brady Corporation
2. Hellermann Tyton
3. Kroy LLC
4. PANDUIT CORP.

B. Comply with UL 969 for a system of labeling materials, including label stocks, laminating adhesives, and inks used by label printers.

C. Comply with requirements in Division 26 Section "Identification for Electrical Systems."

2.5 SOURCE QUALITY CONTROL

A. Testing Agency:

Engage a qualified testing agency to evaluate cables.

B. Cable will be considered defective if it does not pass tests and inspections.

C. Prepare test and inspection reports.

PART 3 - EXECUTION

3.1 INSTALLATION OF PATHWAYS

A. Cable Trays:

Comply with NEMA VE 2 and TIA-569-B

B. Comply with requirements in Division 26 Section "Raceway and Boxes for Electrical Systems." for installation of conduits and wireways.

C. Install manufactured conduit sweeps and long-radius elbows whenever possible.

D. Pathway Installation in Equipment Rooms:

1. Position conduit ends next to a corner on backboard where a single piece of plywood is installed or in the corner of room where multiple sheets of plywood are installed around perimeter walls of room.
2. Install cable trays to route cables if conduits cannot be located in these positions.
3. Secure conduits to backboard when entering room from overhead.
4. Extend conduits 3 inches (75 mm) above finished floor.
5. Install metal conduits with grounding bushings and connect with grounding conductor to

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grounding system.

E. Backboards:

Install backboards with 96-inch (2440-mm) dimension vertical. Butt adjacent sheets tightly, and form smooth gap-free corners and joints.

3.2 WIRING METHOD

A. Install wiring in metal raceways and wire ways. Conceal race way except in unfinished spaces and as shown. Smallest conduit size shall be 3/4 inch (21 mm). Control and data transmission wiring shall not share conduit with other building wiring systems.

B. Wiring within Enclosures:

Bundle, lace, and train conductors to terminal points. Use lacing bars and distribution spools. Separate power limited and non-power limited conductors as recommended in writing by manufacturer. Install conductors parallel with or at right angles to sides and back of enclosure. Connect conductors that are terminated, spliced, or interrupted in any enclosure associated with intrusion system to terminal blocks. Mark each terminal according to system's wiring diagrams. Make all connections with approved crimp-on terminal spade lugs, pressure-type terminal blocks, or plug connectors.

3.3 FIRE ALARM WIRING INSTALLATION

A. Comply with NECA 1 and NFPA 72.

B. Wiring Method:

Install wiring in metal raceway according to Division 26 Section "Raceway and Boxes for Electrical Systems."

1. Install plenum cable in environmental air spaces, including plenum ceilings.
2. Fire alarm circuits and equipment control wiring associated with the fire alarm system shall be installed in a dedicated raceway system. This system shall not be used for any other wire or cable.

C. Wiring Method:

1. Cables and raceways used for fire alarm circuits, and equipment control wiring associated with the fire alarm system, may not contain any other wire or cable.
2. Fire Rated Cables:
Use of 2-hour, fire-rated fire alarm cables, NFPA 70, Types MI and CI, is permitted.
3. Signaling Line Circuits:
Power limited fire alarm cables shall not be installed in the same cable or raceway as signaling line circuits.

D. Wiring within Enclosures:

Separate power limited and non-power limited conductors as recommended by manufacturer. Install conductors parallel with or at right angles to sides and back of the enclosure. Bundle, lace, and train conductors to terminal points with no excess. Connect conductors that are terminated, spliced, or interrupted in any enclosure associated with the fire alarm system to terminal blocks. Mark each terminal according to the system's wiring diagrams. Make all connections with

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approved crimp-on terminal spade lugs, pressure-type terminal blocks, or plug connectors.

E. Cable Taps:

Use numbered terminal strips in junction, pull, and outlet boxes, cabinets, or equipment enclosures where circuit connections are made.

F. Color Coding:

Color code fire alarm conductors differently from the normal building power wiring. Use one color code for alarm circuit wiring and another for supervisory circuits. Color code audible alarm indicating circuits differently from alarm initiating circuits. Use different colors for visible alarm indicating devices. Paint fire alarm system junction boxes and covers red.

G. Risers:

Install at least two vertical cable risers to serve the fire alarm system. Separate risers in close proximity to each other with a minimum one hour rated wall, so the loss of one riser does not prevent the receipt or transmission of signals from other floors or zones.

H. Wiring to Remote Alarm Transmitting Device:

1-inch (25-mm) conduit between the fire alarm control panel and the transmitter. Install number of conductors and electrical supervision for connecting wiring as needed to suit monitoring function.

3.4 POWER AND CONTROL CIRCUIT CONDUCTORS

A. 120-V Power Wiring:

Install according to Division 26 Section "Low-Voltage Electrical Power Conductors and Cables" unless otherwise indicated.

B. Minimum Conductor Sizes:

- I. Class I remote-control and signal circuits, No. 14 AWG.
2. Class 2 low-energy, remote-control and signal circuits, No. 16 AWG.
3. Class 3 low-energy, remote-control, alarm and signal circuits, No. 12 AWG.

3.5 CONNECTIONS

- A. Comply with requirements in Division 28 Section "Digital Addressable Fire Alarm System, Zoned (DC Loop) Fire-Alarm System" for connecting, terminating, and identifying wires and cables.

3.6 FIRE STOPPING

- A. Comply with requirements in Division 07 Section "Penetration Fire Stopping."
- B. Comply with TIA-569-B, "Fire Stopping" Annex A
- C. Comply with BICSI TDMM, "Fire Stopping Systems" Article.

3.7 GROUNDING

- A. For communications wiring, comply with ANSI-J-STD-607-A and with BICSI TDMM, "Grounding, Bonding, and Electrical Protection" Chapter.

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- B. For low-voltage wiring and cabling, comply with requirements in Division 26 Section "Grounding and Bonding for Electrical Systems."

3.8 IDENTIFICATION

- A. Identify system components, wiring, and cabling complying with TIA/EIA-606-A. Comply with requirements for identification specified in Division 26 Section "Identification for Electrical Systems."

3.9 FIELD QUALITY CONTROL

- A. Testing Agency:
Engage a qualified testing agency to perform tests and inspections.
- B. Tests and Inspections:
 - 1. Visually inspect cable placement, cable termination, grounding and bonding, equipment and patch cords, and labeling of all components.
- C. End-to-end cabling will be considered defective if it does not pass tests and inspections.

END OF SECTION

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PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Metal conduits, tubing, and fittings.
2. Nonmetallic conduits, tubing, and fittings.
3. Optical-fiber-cable pathways and fittings.
4. Metal wire ways and auxiliary gutters.
5. Nonmetallic wire ways and auxiliary gutters.
6. Surface pathways.
7. Boxes, enclosures, and cabinets.

1.2 SUMMARY

- A. Section includes the security communications system

1.3 SYSTEM DESCRIPTION

- A. Refer to 280500

1.4 DESCRIPTION OF WORK

- A. Refer to 280500

1.5 REFERENCES

- A. Refer to 280500

1.6 DEFINITIONS

- A. Refer to 280500

1.7 GENERAL ARRANGEMENT OF CONTRACT DOCUMENTS

- A. Refer to 280500

1.8 ACTION SUBMITTALS

- A. Refer to 280500

1.9 INFORMATIONAL SUBMITTALS

- A. Refer to 280500

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1.10 CLOSEOUT SUBMITTALS

A. Refer to 280500

1.11 SUBMITTALS

A. Refer to 280500

1.12 QUALITY ASSURANCE

A. Refer to 280500

1.13 DELIVERY, STORAGE, AND HANDLING

A. Refer to 280500

1.14 PROJECT CONDITIONS

A. Refer to 280500

1.15 COORDINATION

A. Refer to 280500

1.16 PROGRAMMING

A. Refer to 280500

1.17 TRAINING

A. Refer to 280500

1.18 TESTING

A. Refer to 280500

1.19 MAINTENANCE & SERVICE

A. Refer to 280500

1.20 WARRANTY

A. Refer to 280500

PART 2 - PRODUCTS

2.1 METAL CONDUITS, TUBING, AND FITTINGS

A. General Requirements for Metal Conduits and Fittings:

1. Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

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2. Comply with TIA-569-B.

B. GRC:

Comply with ANSI C80.1 and UL 6.

C. ARC:

Comply with ANSI C80.5 and UL 6A.

D. IMC:

Comply with ANSI C80.6 and UL 1242.

E. PVC-Coated Steel Conduit:

PVC-coated rigid steel conduit.

1. Comply with NEMA RN 1.

2. Coating Thickness: 0.040 inch, minimum.

F. EMT:

Comply with ANSI C80.3 and UL 797.

G. FMC:

Comply with UL 1; zinc-coated steel or aluminum.

H. LFMC:

Flexible steel conduit with PVC jacket and complying with UL 360.

I. Fittings for Metal Conduit:

Comply with NEMA FB 1 and UL 514B.

1. Conduit Fittings for Hazardous (Classified) Locations:

Comply with UL 886 and NFPA 70.

2. Fittings for EMT:

a. Material:

Steel

b. Type:

Compression

3. Expansion Fittings:

PVC or steel to match conduit type, complying with UL 467, rated for environmental conditions where installed, and including flexible external bonding jumper.

4. Coating for Fittings for PVC-Coated Conduit:

Minimum thickness of 0.040 inch, with overlapping sleeves protecting threaded joints.

J. Joint Compound for IMC, GRC, or ARC:

Approved, as defined in NFPA 70, by authorities having jurisdiction for use in conduit assemblies, and compounded for use to lubricate and protect threaded conduit joints from corrosion and to enhance their conductivity.

2.2 NONMETALLIC CONDUITS, TUBING, AND FITTINGS

A. General Requirements for Nonmetallic Conduits and Fittings:

1. Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
2. Comply with TIA-569-B.

B. ENT:

Comply with NEMA TC 13 and UL 1653.

C. RNC:

Type EPC-40-PVC, complying with NEMA TC 2 and UL651 unless otherwise indicated.

D. LFNC:

Comply with UL 1660.

E. Rigid HDPE:

Comply with UL 651A.

F. Continuous HDPE:

Comply with UL 651B.

G. RTRC:

Comply with UL 1684A and NEMA TC 14.

H. Fittings for ENT and RNC:

Comply with NEMA TC 3; match to conduit or tubing type and material.

I. Fittings for LFNC:

Comply with UL 514B.

- J. Solvent cements and adhesive primers shall have a VOC content of 510 and 550 g/L or less, respectively, when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

- K. Solvent cements and adhesive primers shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small Scale Environmental Chambers."

2.3 OPTICAL-FIBER-CABLE PATHWAYS AND FITTINGS

A. Description:

Comply with UL 2024; flexible-type pathway, approved for plenum installation unless otherwise indicated.

1. Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
2. Comply with TIA-569-B.

2.4 METAL WIREWAYS AND AUXILIARY GUTTERS

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A. Description:

Sheet metal, complying with UL 870 and NEMA 250, Type 4 unless otherwise indicated, and sized according to NFPA 70.

1. Metal wire ways installed outdoors shall be listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

2. Comply with TIA-569-B.

B. Fittings and Accessories:

Include couplings, offsets, elbows, expansion joints, adapters, hold-down straps, end caps, and other fittings to match and mate with wire ways as required for complete system.

C. Wire way Covers:

Hinged type unless otherwise indicated.

D. Finish:

Manufacturer's standard enamel finish.

2.5 NONMETALLIC WIREWAYS AND AUXILIARY GUTTERS

A. General Requirements for Nonmetallic Wire ways and Auxiliary Gutters:

1. Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

2. Comply with TIA-569-B.

B. Description:

Fiberglass polyester, extruded and fabricated to required size and shape, without holes or knockouts. Cover shall be gasketed with oil resistant gasket material and fastened with captive screws treated for corrosion resistance. Connections shall be flanged and have stainless steel screws and oil-resistant gaskets.

C. Fittings and Accessories:

Couplings, offsets, elbows, expansion joints, adapters, hold-down straps, end caps, and other fittings shall match and mate with wire ways as required for complete system.

D. Solvent cements and adhesive primers shall have a VOC content of 510 and 550 g/L or less, respectively, when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

E. Solvent cements and adhesive primers shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small Scale Environmental Chambers."

2.6 SURFACE PATHWAYS

A. General Requirements for Surface Pathways:

1. Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

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2. Comply with TIA-569-B.
- B. Surface Metal Pathways: Galvanized steel with snap-on covers complying with UL 5. Prime coated, ready for field painting.
- C. Surface Nonmetallic Pathways:
Two or three piece construction, complying with UL 5A, and manufactured of rigid PVC with texture and color selected by Owner's Representative from manufacturer's standard colors. Product shall comply with UL 94 V-0 requirements for self-extinguishing characteristics.
- D. Tele-Power Poles:
 1. Material:
Galvanized steel with ivory baked-enamel finish.
 2. Fittings and Accessories:
Dividers, end caps, covers, cutouts, wiring harnesses, devices, mounting materials, and other fittings shall match and mate with tele-power pole as required for complete system.

2.7 BOXES, ENCLOSURES, AND CABINETS

- A. General Requirements for Boxes, Enclosures, and Cabinets:
 1. Comply with TIA-569-B.
 2. Boxes, enclosures and cabinets installed in wet locations shall be listed for use in wet locations.
- B. Sheet-Metal Outlet and Device Boxes:
Comply with NEMA OS 1 and UL 514A.
- C. Cast Metal Outlet and Device Boxes:
Comply with NEMA FB 1, aluminum, Type FD, with gasketed cover.
- D. Box extensions used to accommodate new building finishes shall be of same material as recessed box.
- E. Metal Floor Boxes:
 1. Material:
Cast metal or sheet metal.
 2. Type:
Fully adjustable or Semi-adjustable.
 3. Shape:
Rectangular
 4. Listing and Labeling:
Metal floor boxes shall be listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

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F. Nonmetallic Floor Boxes:

Nonadjustable, round.

1. Listing and Labeling:

Nonmetallic floor boxes shall be listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

G. Small Sheet Metal Pull and Junction Boxes:

NEMA OS 1.

H. Cast-Metal Access, Pull, and Junction Boxes:

Comply with NEMA FB 1 and UL 1773, cast aluminum with gasketed cover.

I. Device Box Dimensions:

4-inches square by 2-1/8 inches deep

J. Gangable boxes are allowed

K. Nonmetallic Outlet and Device Boxes:

Comply with NEMA OS 2 and UL 514C.

L. Hinged Cover Enclosures:

Comply with UL 50 and NEMA 250, Type 4 with continuous-hinge cover with flush latch unless otherwise indicated.

1. Metal Enclosures:

Steel, finished inside and out with manufacturer's standard enamel.

2. Nonmetallic Enclosures:

a. Material:

Plastic

3. Interior Panels:

Steel; all sides finished with manufacturer's standard enamel.

M. Cabinets:

1. NEMA 250, Type 3R, galvanized-steel box with removable interior panel and removable front, finished inside and out with manufacturer's standard enamel.

2. Hinged door in front cover with flush latch and concealed hinge.

3. Key latch to match panelboards.

4. Metal barriers to separate wiring of different systems and voltage.

5. Accessory feet where required for freestanding equipment.

6. Nonmetallic cabinets shall be listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

PART 3 - EXECUTION

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3.1 PATHWAY APPLICATION

A. Outdoors:

Apply pathway products as specified below unless otherwise indicated:

1. Exposed Conduit:
GRC, IMC, or RNC, Type EPC-40-PVC
2. Concealed Conduit, Aboveground:
GRC, IMC, EMT, or RNC, Type EPC-40-PVC
3. Underground Conduit:
RNC, Type EPC-40-PVC, Type EPC-80-PVC, direct buried, or concrete encased
4. Connection to Vibrating Equipment (Including Transformers and Hydraulic, Pneumatic, Electric Solenoid, or Motor-Driven Equipment):
LFMC
5. Boxes and Enclosures, Aboveground:
NEMA 250, Type 4

B. Indoors:

Apply pathway products as specified below unless otherwise indicated:

1. Exposed, Not Subject to Physical Damage:
EMT or RNC.
2. Exposed, Not Subject to Severe Physical Damage:
EMT
3. Exposed and Subject to Severe Physical Damage:
GRC
Pathway locations include the following:
 - a. Loading dock.
 - b. Corridors used for traffic of mechanized carts, forklifts, and pallet-handling units.
 - c. Mechanical rooms.
 - d. Gymnasiums
4. Concealed in Ceilings and Interior Walls and Partitions:
EMT
5. Connection to Vibrating Equipment (Including Transformers and Hydraulic, Pneumatic, Electric-Solenoid, or Motor-Driven Equipment):
FMC, except use LFMC in damp or wet locations.
6. Damp or Wet Locations:
IMC.
7. Pathways for Optical-Fiber or Communications Cable in Spaces Used for Environmental Air:

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Plenum-type, optical fiber cable pathway.

8. Pathways for Optical Fiber or Communications-Cable Risers in Vertical Shafts:
Riser type, optical fiber cable pathway.
 9. Pathways for Concealed General Purpose Distribution of Optical Fiber or Communications Cable: General use, optical fiber cable pathway or plenum type, optical fiber cable pathway.
 10. Boxes and Enclosures:
NEMA 250, Type 1, except use NEMA 250, Type 4 stainless steel in institutional and commercial kitchens and damp or wet locations.
- C. Minimum Pathway Size:
1/2-inch trade size. Minimum size for optical-fiber cables is 1 inch.
- D. Pathway Fittings:
Compatible with pathways and suitable for use and location.
1. Rigid and Intermediate Steel Conduit:
Use threaded rigid steel conduit fittings unless otherwise indicated. Comply with NEMA FB 2.10.
 2. PVC Externally Coated, Rigid Steel Conduits:
Use only fittings listed for use with this type of conduit. Patch and seal all joints, nicks, and scrapes in PVC coating after installing conduits and fittings. Use sealant recommended by fitting manufacturer and apply in thickness and number of coats recommended by manufacturer.
 3. EMT:
Use compression, fittings. Comply with NEMA FB 2.10.
 4. Flexible Conduit:
Use only fittings listed for use with flexible conduit. Comply with NEMA FB 2.20.
- E. Do not install aluminum conduits, boxes, or fittings in contact with concrete or earth.
- F. Install surface pathways only where approved by Owner.
- G. Do not install nonmetallic conduit where ambient temperature exceeds 120°F.

3.2 INSTALLATION

- A. Comply with NECA 1, NECA 101, and TIA-569-B for installation requirements except where requirements on Drawings or in this article are stricter. Comply with NECA 102 for aluminum pathways. Comply with NFPA 70 limitations for types of pathways allowed in specific occupancies and number of floors.
- B. Keep pathways at least 6 inches away from parallel runs of flues and steam or hot-water pipes. Install horizontal pathway runs above water and steam piping.
- C. Complete pathway installation before starting conductor installation.
- D. Comply with requirements in Section 260529 "Hangers and Supports for Electrical Systems"

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for hangers and supports.

- E. Arrange stub-ups so curved portions of bends are not visible above finished slab.
- F. Conceal conduit and EMT within finished walls, ceilings, and floors unless otherwise indicated. Install conduits parallel or perpendicular to building lines.
- G. Support conduit within 12 inches of enclosures to which attached.
- H. Pathways Embedded in Slabs:
 - 1. Run conduit larger than 1-inch trade size, parallel or at right angles to main reinforcement. Where at right angles to reinforcement, place conduit close to slab support. Secure pathways to reinforcement at maximum 10-foot intervals.
 - 2. Arrange pathways to cross building expansion joints at right angles with expansion fittings.
 - 3. Arrange pathways to keep a minimum of 1 inch of concrete cover in all directions.
 - 4. Do not embed thread less fittings in concrete unless specifically approved by Owner's Representative for each specific location.
 - 5. Change from ENT to RNC, Type EPC-40-PVC before rising above floor.
- I. Stub-ups to Above Recessed Ceilings:
 - 1. Use EMT, IMC, or RMC for pathways.
 - 2. Use a conduit bushing or insulated fitting to terminate stub-ups not terminated in hubs or in an enclosure.
- J. Threaded Conduit Joints, Exposed to Wet, Damp, Corrosive, or Outdoor Conditions:

Apply listed compound to threads of pathway and fittings before making up joints. Follow compound manufacturer's written instructions.
- K. Coat field cut threads on PVC coated pathway with a corrosion preventing conductive compound prior to assembly.
- L. Terminate threaded conduits into threaded hubs or with locknuts on inside and outside of boxes or cabinets. Install insulated bushings on conduits terminated with locknuts.
- M. Install pathways square to the enclosure and terminate at enclosures with locknuts. Install locknuts hand tight plus 1/4 turn more.
- N. Do not rely on locknuts to penetrate nonconductive coatings on enclosures. Remove coatings in the locknut area prior to conduit assembly to assure a continuous ground path.
- O. Cut conduit perpendicular to the length. For conduits of 2-inch trade size and larger, use roll cutter or a guide to ensure cut is straight and perpendicular to the length.
- P. Install pull wires in empty pathways. Use polypropylene or monofilament plastic line with not less than 200-lb tensile strength. Leave at least 12 inches of slack at each end of pull wire. Cap underground pathways designated as spare above grade alongside pathways in use.

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Q. Surface Pathways:

1. Install surface pathway for surface electrical outlet boxes only where indicated on Drawings.
2. Install surface pathway with a minimum 2-inch radius control at bend points.
3. Secure surface pathway with screws or other anchor type devices at intervals not exceeding 48 inches and with no less than two supports per straight pathway section. Support surface pathway according to manufacturer's written instructions. Tape and glue are not acceptable support methods.

R. Pathways for Optical Fiber and Communications Cable:

Install pathways, metal and nonmetallic, rigid and flexible, as follows:

1. 3/4-Inch Trade Size and Smaller:
Install pathways in maximum lengths of 50 feet.
 2. 1-Inch Trade Size and Larger:
Install pathways in maximum lengths of 75 feet.
 3. Install with a maximum of two 90-degree bends or equivalent for each length of pathway unless Drawings show stricter requirements. Separate lengths with pull or junction boxes or terminations at distribution frames or cabinets where necessary to comply with these requirements.
- S. Install pathway sealing fittings at accessible locations according to NFPA 70 and fill them with listed sealing compound. For concealed pathways, install each fitting in a flush steel box with a blank cover plate having a finish similar to that of adjacent plates or surfaces. Install pathway sealing fittings according to NFPA 70.
- T. Install devices to seal pathway interiors at accessible locations. Locate seals so no fittings or boxes are between the seal and the following changes of environments. Seal the interior of all pathways at the following points:
1. Where conduits pass from warm to cold locations, such as boundaries of refrigerated spaces.
 2. Where an underground service pathway enters a building or structure.
 3. Where otherwise required by NFPA 70.

U. Comply with manufacturer's written instructions for solvent welding PVC conduit and fittings.

V. Expansion-Joint Fittings:

1. Install in each run of aboveground RNC that is located where environmental temperature change may exceed 30°F, and that has straight-run length that exceeds 25 feet. Install in each run of aboveground RMC and EMT conduit that is located where environmental temperature change may exceed 100°F and that has straight-run length that exceeds 100 feet.
2. Install type and quantity of fittings that accommodate temperature change listed for each of the following locations:

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- a. Outdoor Locations Not Exposed to Direct Sunlight:
125°F temperature change.
 - b. Outdoor Locations Exposed to Direct Sunlight:
155°F temperature change.
 - c. Indoor Spaces Connected with Outdoors without Physical Separation:
125°F temperature change.
 - d. Attics:
135°F temperature change.
- 3. Install fitting(s) that provide expansion and contraction for at least 0.00041 inch per foot of length of straight run per degree Fahrenheit of temperature change for PVC conduits. Install fitting(s) that provide expansion and contraction for at least 0.000078 inch per foot of length of straight run per degree Fahrenheit of temperature change for metal conduits.
 - 4. Install expansion fittings at all locations where conduits cross building or structure expansion joints.
 - 5. Install each expansion-joint fitting with position, mounting, and piston setting selected according to manufacturer's written instructions for conditions at specific location at time of installation. Install conduit supports to allow for expansion movement.
- W. Flexible Conduit Connections:
Comply with NEMA RV 3. Use maximum of 72 inches of flexible conduit for recessed and semi-recessed luminaires, equipment subject to vibration, noise transmission, or movement; and for transformers and motors.
- 1. Use LFMC in damp or wet locations subject to severe physical damage.
 - 2. Use LFMC or LFNC in damp or wet locations not subject to severe physical damage.
- X. Mount boxes at heights indicated on Drawings. If mounting heights of boxes are not individually indicated, give priority to ADA requirements. Install boxes with height measured to center of box unless otherwise indicated.
- Y. Recessed Boxes in Masonry Walls:
Saw-cut opening for box in center of cell of masonry block, and install box flush with surface of wall. Prepare block surface to provide a flat surface for a rain tight connection between box and cover plate or supported equipment and box.
- Z. Horizontally separate boxes mounted on opposite sides of walls so they are not in the same vertical channel.
- AA. Support boxes of three gangs or more from more than one side by spanning two framing members or mounting on brackets specifically designed for the purpose.
- BB. Fasten junction and pull boxes to or support from building structure. Do not support boxes by conduits.

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CC. Set metal floor boxes level and flush with finished floor surface.

DD. Set nonmetallic floor boxes level. Trim after installation to fit flush with finished floor surface.

3.3 INSTALLATION OF UNDERGROUND CONDUIT

A. Direct Buried Conduit:

1. Excavate trench bottom to provide firm and uniform support for conduit. Prepare trench bottom for pipe less than 6 inches in nominal diameter.
2. Install backfill.
3. After installing conduit, backfill and compact. Start at tie-in point, and work toward end of conduit run, leaving conduit at end of run free to move with expansion and contraction as temperature changes during this process. Firmly hand tamp backfill around conduit to provide maximum supporting strength. After placing controlled backfill to within 12 inches of finished grade, make final conduit connection at end of run and complete backfilling with normal compaction.
4. Install manufactured duct elbows for stub-ups at poles and equipment and at building entrances through floor unless otherwise indicated. Encase elbows for stub-up ducts throughout the length of elbow.
 - a. Couple steel conduits to ducts with adapters designed for this purpose, and encase coupling with 3 inches of concrete for a minimum of 12 inches on each side of the coupling.
 - b. For stub-ups at equipment mounted on outdoor concrete bases and where conduits penetrate building foundations, extend steel conduit horizontally a minimum of 60 inches from edge of foundation or equipment base. Install insulated grounding bushings on terminations at equipment.
5. Warning Planks:

Bury warning planks approximately 12 inches above direct buried conduits, but a minimum of 6 inches below grade. Align planks along centerline of conduit.
6. Underground Warning Tape:

Comply with requirements in Section 260553 "Identification for Electrical Systems."

3.4 INSTALLATION OF UNDERGROUND HANDHOLES AND BOXES

- A. Install hand holes and boxes level and plumb and with orientation and depth coordinated with connecting conduits to minimize bends and deflections required for proper entrances.
- B. Unless otherwise indicated, support units on a level bed of crushed stone or gravel, graded from 1/2-inch sieve to No. 4 sieve and compacted to same density as adjacent undisturbed earth.
- C. Elevation:

In paved areas, set so cover surface will be flush with finished grade. Set covers of other enclosures 1 inch above finished grade.
- D. Install removable hardware, including pulling eyes, cable stanchions, cable arms, and insulators,

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as required for installation and support of cables and conductors and as indicated. Select arm lengths to be long enough to provide spare space for future cables, but short enough to preserve adequate working clearances in enclosure.

- E. Field cut openings for conduits according to enclosure manufacturer's written instructions. Cut wall of enclosure with a tool designed for material to be cut. Size holes for terminating fittings to be used, and seal around penetrations after fittings are installed.

3.5 SLEEVE AND SLEEVE-SEAL INSTALLATION FOR ELECTRONIC SAFETY AND SECURITY PENETRATIONS

- A. Install sleeves and sleeve seals at penetrations of exterior floor and wall assemblies. Comply with requirements in Section 260544 "Sleeves and Sleeve Seals for Electronic Safety and Security Pathways and Cabling."

3.6 FIRESTOPPING

- A. Install fire stopping at penetrations of fire rated floor and wall assemblies. Comply with requirements in Section 078413 "Penetration Fire Stopping."

3.7 PROTECTION

- A. Protect coatings, finishes, and cabinets from damage and deterioration.
 - 1. Repair damage to galvanized finishes with zinc rich paint recommended by manufacturer.
 - 2. Repair damage to PVC coatings or paint finishes with matching touchup coating recommended by manufacturer.

END OF SECTION

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SECTION 28 10 00
ACCESS CONTROL

Display hidden notes to specifier. (Don't know how? [Click Here](#))

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PART 20 - GENERAL

SECTION INCLUDES

Access and security management system. (Pro-Watch)

Integrated security management system. (Win-Pak)

Web based modular access control system. (NetAXS-4 Access System)

Web based access control system. (NetAXS-123 Access System)

Visitor management system. (Lobbyworks)

Access control readers.

Access control credentials.

Access control cables.

RELATED SECTIONS

Section 26 05 00 - Common Work Results for Electrical.

Section 27 11 23 - Communications Cable Management and Ladder Rack.

REFERENCES

Electronic Industries Alliance (EIA):

RS232C - Interface between Data Terminal Equipment and Data Communications Equipment

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Employing Serial Binary Data Interchange.
RS485 - Electrical Characteristics of Generators and Receivers for use in Balanced Digital Multi-
Point Systems.

Federal Communications Commission (FCC):
FCC Part 15 - Radio Frequency Device.
FCC Part 68 - Connection of Terminal Equipment to the Telephone Network.

Federal Information Processing Standards (FIPS):
Advanced Encryption Standard (AES) (FIPS 197).
FIPS 201: Personal Identity Verification (PIV) of Federal Employees and Contractors.

National Fire Protection Association (NFPA):
NFPA70 - National Electrical Code.

Homeland Security Presidential Directive 12 (HSPD-12).

Underwriters Laboratories (UL):
UL294 - Access Control System Units.
UL1076 - Proprietary Burglar Alarm Units and Systems.

SECURITY MANAGEMENT SYSTEM DESCRIPTION

Pro-Watch: The Security Management System shall function as an electronic access control system and shall integrate alarm monitoring, CCTV, digital video, ID badging and database management into a single platform. A modular and network-enabled architecture shall allow maximum versatility for tailoring secure and dependable access and alarm monitoring solutions.

FIPS Certification: The system shall support FIPS 201 certification.

WIN-PAK: The Integrated Security Management System (ISMS) shall function as an electronic access control system and shall integrate the alarm monitoring, CCTV, digital video, ID badging and database management into a single platform. ISMS shall function as a one-stop gateway for all the access control needs. A modular and network-enabled architecture shall allow maximum versatility for tailoring secure and dependable access and alarm monitoring solutions. The following definitions are applicable for the WIN-PAK system:

Access Card: A coded employee card, usually the size of a credit card, recognizable to the access control system and read by a reader to allow access. It can be used for photo identification of the cardholder and for other data collection purposes. Card technologies include magnetic strips, wiegand-effect, proximity (active/passive), barium ferrite, and smart/intelligent cards.

Abstract Device: An Abstract Device (ADV) is a logical representation of a physical device. The ADVs can be associated with any hardware device, including communication interfaces, panels,

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alarm points, entrances, and CCTV equipment. The ADVs help in monitoring the device status and controlling the actions of a physical device through the Control Map, Floor Plan, or Alarm View.

Access Control System: An interconnected set of controllers, managing the entrance and exit of people through secure areas.

Access Level: The door or combination of doors and/or barriers an individual is authorized to pass through.

Anti-Pass back (Anti-Tailgating): This feature protects against more than one person using the same card or number. It defines each system card reader and card ID number as IN, OUT or other. Once a card is granted access to an IN reader, it must be presented to an OUT reader before another IN reader access is granted. Cards will continue to have access to all authorized OTHER readers.

Alarm: A signal that indicates a problem.

Alarm input: A device that is monitored by the access control panel. An alarm signal will be generated if the device is activated.

Badge: Badge is a template or a design for creating a card. WIN-PAK includes a full-featured badge layout utility for designing, creating, and printing badges. Badge design includes magnetic stripe encoding, bar coding, signatures, and so on.

Bar Code: A method of encoding information using lines and blank spaces of varying size and thickness to represent alphanumeric characters.

Biometrics: A general term for the verification of individuals using unique biological characteristics (i.e. fingerprints, hand geometry, voice analysis, the retinal pattern in the eye).

Card and Card Holder: A card is an identity proof of a person and a card holder is a person who holds the card. Multiple cards can be assigned to a single card holder to provide different access.

Controller: A microprocessor based circuit board that manages access to a secure area. The controller receives information that it uses to determine through which doors and at what times cardholders are granted access to secure areas. Based on that information, the controller can lock/unlock doors, sound alarms, and communicate status to a host computer.

Communication Port: A hardware device that allows a computer to communicate with external devices.

Card Reader: A device that retrieves information stored on an access card and transmits that information to a controller.

Network or Digital Video Recorder (DVR): A security system device that records the video from the surveillance cameras (IP and/or Analog) on a hard disk.

Door: A generic term for a securable entry way. In many access control applications a "door" may actually be a gate, turnstile, elevator door, or similar device.

Duress: Forcing a person to provide access to a secure area against that person's wishes.

Guard Tour: A defined route of a security guard.

Host Computer: The central controlling computer from which access control software applications are run.

Input: An electronic sensor on a controller that detects a change of state in a device outside the controller

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Keypad: An alphanumeric grid which allows a user to enter an identification code. A flat device which has buttons that may be pressed in a sequence to send data to a controller, and which differs from a typewriter-like computer board.

Online Help: A reference program within most software programs that provides basic descriptions and instructions on how to use that software program.

Output Relay: A device that changes its state upon receiving a signal from a controller. Typically the state change prompts an action outside of the controller such as activating or inactivating a device. The auxiliary relays found in access control panels or NODES that control external devices.

Reader: A device that "receives" an identification code from a card, key tag, magnetic stripe card, bar code card, or related item. Refers to the "front end" that a user must interact with to allow access. Readers can be keypads, card readers, proximity readers, and so on.

RS232: A serial communication protocol used for connecting data terminal devices. RS-232 is the most commonly used communication protocol.

Server: The host computer, which has the ISMS functions.

Shunt Time: The length of time a door open alarm is suppressed (shunted) after a valid card access or free egress request. This time should be just enough to allow a card user to open a door or gate, pass through, and then close it.

Time zones: "Schedules" that allow cards to function or not function depending on the time of day. This is used to limit access to the facility. The schedule may include not only time but which days of the week a card is valid.

Wiegand Card: An access control card based on the Wiegand effect. Small bits of specially processed wire are embedded in the card in a pattern that uniquely identifies the card. This identification information can then be decoded by a Wiegand reader.

Wiegand Reader: A reader capable of reading the information encoded on a Wiegand card.

Video Management System (VMS): An enterprise-class video management and storage solution.

SUBMITTALS

Submit under provisions of Section 01 30 00 - Administrative Requirements.

Product Data: Manufacturer's data sheets on each product to be used, including:

Preparation instructions and recommendations.

Storage and handling requirements and recommendations.

Installation methods.

Verification Samples: For each finish product specified, two samples, minimum size 6 inches (150 mm) square representing actual product, color, and patterns.

Manufacturer's Product Data: Submit manufacturer's data sheets indicating systems and components proposed for use.

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Shop Drawings: Submit complete shop drawings indicating system components, wiring diagrams and load calculations.

Record Drawings: During construction maintain record drawings indicating location of equipment and wiring. Submit an electronic version of record drawings for the Security Management System not later than Substantial Completion of the project.

Operation and Maintenance Data: Submit manufacturer's operation and maintenance data, customized to the Security Management System installed. Include system and operator manuals.

Maintenance Service Agreement: Submit a sample copy of the manufacturer's maintenance service agreement, including cost and services for a two year period for Owner's review.

QUALITY ASSURANCE

Manufacturer: Minimum ten years experience in manufacturing and maintaining Security Management Systems. Manufacturer shall be Microsoft Silver Certified.

Installer must be certified by Honeywell Integrated Security Dealer Service Certification Program (DSCP).

DELIVERY, STORAGE, AND HANDLING

Store products in manufacturer's unopened packaging until ready for installation.

PROJECT CONDITIONS

Maintain environmental conditions (temperature, humidity, and ventilation) within limits recommended by manufacturer for optimum results. Do not install products under environmental conditions outside manufacturer's recommended limits.

WARRANTY

Manufacturer's Warranty: Submit manufacturer's standard warranty for the security management system.

PART 21 - PRODUCTS

MANUFACTURERS

Acceptable Manufacturer: Honeywell Security and Fire, which is located at: 2700 Blankenbaker Pkwy. Suite 150; Louisville, KY 40299; Toll Free Tel: 800-323-4576; Email: [request info \(hissales@honeywell.com\)](mailto:request%20info%20(hissales%40honeywell.com)); Web: www.security.honeywell.com

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Substitutions: Not permitted.

Requests for substitutions will be considered in accordance with provisions of Section 01 60 00 - Product Requirements.

ACCESS AND SECURITY MANAGEMENT SYSTEM (PRO-WATCH)

Security Management System Manufacturer: Pro-Watch Security Management Suite as manufactured by the Honeywell Security Group.

The Security Management System shall function as an electronic access control system and shall integrate alarm monitoring, CCTV, digital and network video, ID badging and database management into a single platform. A modular and network-enabled architecture shall allow maximum versatility for tailoring secure and dependable access and alarm monitoring solutions.

Access Control Software Suite: The Security Management System shall offer a security management software suite available in four scalable versions: The Security Management System platform shall offer a complete access control solution: alarm monitoring, video imaging, ID badging and video surveillance control. Provide the following software system:
Pro-Watch Lite Edition: The Security Management System shall utilize the Microsoft SQL Express database for applications with one to four users and up to 32 controlled doors. The Security Management System shall operate in Windows 7 Ultimate/Professional as the host operating system.
Pro-Watch Professional Edition. Professional Edition: The Security Management System shall utilize Microsoft SQL Express (SQL 2008 or later) database for applications from one to five users and up to 64 controlled doors. The Security Management System shall provide a set of tools to easily backup, restore and maintain the Security Management System database. The Security Management System shall allow for expansion to Corporate and/or Enterprise Edition without changing the user interface or database structure. The Security Management System shall operate in Windows 7 Ultimate/Professional as the host operating system.
Pro-Watch Corporate Edition: The Security Management System shall operate in the Windows Server 2012 (64-bit) and Windows Server 2012 R2 (64-bit) environment and utilize SQL Server 2012 SP1 (32-bit and 64-bit) as the database engine.
Pro-Watch Enterprise Edition: The Security Management System shall incorporate regional server architecture. Regional sites shall operate autonomously with all information required to maintain security locally. The enterprise server shall maintain any critical system information via synchronization with each regional site. A single enterprise server shall provide global management of all regional servers and shall act as a central collecting point for all hardware configurations, cardholder and clearance code data and transaction history. The enterprise server and regional server(s) shall support Windows Server 2012 (64-bit) and Windows Server 2012 R2 (64-bit).

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Software Requirements: The Security Management System shall be a modular and network-enabled access control system. The Security Management System shall be capable of controlling multiple remote sites, alarm monitoring, video imaging, ID badging, paging, digital video and CCTV switching and control that allows for easy expansion or modification of inputs and remote control stations. The Security Management System control at a central computer location shall be under the control of a single software program and shall provide full integration of all components. It shall be alterable at any time depending upon facility requirements. Security Management System reconfiguration shall be accomplished online through system programming. The Security Management System shall include the following:

Multi-User/Network Capabilities: The Security Management System shall support multiple operator workstations via local area network/wide area network (LAN/WAN). The communications between the workstations and the server computer shall utilize the TCP/IP standard over industry standard IEEE 802.3 (Ethernet). The communications between the server and workstations shall be supervised, and shall automatically generate alarm messages when the server is unable to communicate with a workstation. The operators on the network server shall have the capability to log on to workstations and remotely configure devices for the workstation. Standard operator permission levels shall be enforced, with full operator audit.

Concurrent Licensing: The Security Management System shall support concurrent client workstation licensing. The Security Management System application shall be installed on any number of client workstations, and shall provide the ability for any of the client workstations to connect to the database server as long as the maximum number of concurrent connections purchased has not been exceeded.

Security Key: The Security Management System shall only require a software security key to be present on the application server for the Security Management System to operate. Security keys shall not be required at the client workstations. The Security Management System shall allow a user to read the information that is programmed on the server security key. The Security Management System shall support the installation, update, and termination of the security key.

Terminal Services: The Security Management System shall support Windows Server 2008 Terminal Services. Terminal Services shall allow the Security Management System server application to reside on the Windows Terminal Server. Operating systems supporting a standard web browser shall be capable of utilizing the thin client architecture. The Security Management System shall support unlimited connections, based on concurrent licensing, to the Security Management System software. Full functionality shall be obtained through the intranet connection allowing full administration and monitoring without the need for a local installation.

Relational Database Management System: The Security Management System shall support industry standard relational database management systems. This shall include relational database management system Microsoft SQL Server 2012 SP1.

Database Partitioning: The Security Management System shall provide the option to restrict access to sensitive information by user ID.

Memory: Proprietary software programs and control logic information used to coordinate and drive system hardware shall be stored in read-only memory.

LDAP/ Microsoft Active Directory Services: The Security Management System shall provide

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support of Lightweight Directory Access Protocol (LDAP) for enabling the user to locate organizations, individuals, and other resources such as files and devices in a network, whether on the public internet or on a private intranet. The Security Management System shall provide a direct link to Microsoft Active Directory Services. The Security Management System shall allow the transfer of Active Directory users into the database via the Data Transfer Utility. Conversely, Security Management System users shall be capable of being exported to the Active Directory. Unicode: The Security Management System shall utilize Unicode worldwide character set standard. The Security Management System shall support double-byte character sets to facilitate adaptation of the Security Management System user interface and documentation to new international markets. Language support shall include at a minimum English, Spanish, Portuguese, French, German and Simple Chinese.

Encryption: The Security Management System shall provide multiple levels of data encryption True 128-bit AES data encryption between the host and intelligent controllers. The encryption shall ensure data integrity that is compliant with the requirements of FIPS-197 and SCIF environments. Master keys shall be downloaded to the intelligent controller, which shall then be authenticated through the Security Management System based on a successful match. Transparent database encryption, including log files and backups
SQL secure connections via SSL

Supervised Alarm Points: Both supervised and non-supervised alarm point monitoring shall be provided. Upon recognition of an alarm, the system shall be capable of switching CCTV cameras that are associated with the alarm point.

Compliance and Validation: The Security Management System shall incorporate signature authentication where modifications to Security Management System resources will require either a single or dual signature authentication. Administrators will have the ability to select specified devices in the Security Management System where data manipulation will be audited and signatures will be required to account for the data modification. Upon resource modification, the user will be required to enter a reason for change or select a predefined reason from a list. All data will be securely stored and maintained in the database and can be viewed using the reporting tool. This functionality will meet the general requirements of Validation and Compliance through Digital Signatures with special attention to the case of Title 21 CFR Part 11 Part B compliance.

Clean Room Solution:

Overview: The Security Management System shall provide a clean room solution which enables users to manage their "Clean Environments" or other areas requiring special restricted access through a process-oriented graphical user interface (GUI).

Configuration: The user shall have the capability of adding, editing, or deleting clean rooms. Each "clean room" shall be capable of having a contamination level set. Entry to a higher level contamination area shall automatically restrict access to cleaner level areas. Individual cards shall be capable of being reset on an immediate one time, automatic, or per-hour basis.

Security Management System Operational Requirements:
System Operations:

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Windows Authentication Login: The Security Management System shall use an integrated login method which accepts the user ID of the person who has logged on to Windows.

Password: The Security Management System shall use an integrated authentication method which utilizes Windows user accounts and policies.

Information Access: The Security Management System shall be capable of limiting operator access to sensitive information. Operators shall have proper authorization to edit the information.

Shadow Login: The Security Management System shall allow users to login over a currently logged-on user without having the current user log off the Security Management System or out of the Windows operating system.

Graphical User Interface: The Security Management System shall be fully compliant with Microsoft graphical user interface standards, with the look and feel of the software being that of a standard Windows application, including hardware tree-based system configuration.

Guard Tour: The Security Management System shall include a guard tour module, which shall allow the users to program guard tours for their facility. The tours shall not require the need for independent or dedicated readers.

Secure Mode Verification (e.g., force guard to do a visual verify): The Security Management System shall provide 'secure mode' control from the verification viewer. This shall allow a user or guard to decide the access of an individual who presents his/her card at a designated secure mode reader.

Database Partitioning: The Security Management System shall support dynamic partitioning. A Security Management System in which partitions are set up at installation and cannot be easily changed shall not be acceptable.

Status Groups: The Security Management System shall support a real-time system status monitor that graphically depicts all logical devices.

Keyboard Accelerators: The Security Management System shall allow the user to use a shortcut key to enable designated system commands.

Automatically Disable Card upon Lack of Use: The Security Management System shall allow system operators to set a predefined time period in which cardholders shall swipe their card through a card reader in the Security Management System.

User Functions and ADA Ability: The Security Management System shall provide user functions and ADA (Americans with Disabilities Act) ability that provides the capability to trigger an event at the Security Management System intelligent controller when a defined card is presented.

Pathways: The Security Management System shall support the capability of programming pathways. A pathway shall be an object that combines input points to be masked (shunted) for a set duration, and an output point to be activated, when a particular card receives a local grant at a reader.

Database Audit Log: The Security Management System shall be capable of creating an audit log in the history file following any change made to the Security Management System database by an operator.

Operator Log: The Security Management System shall be capable of creating an action log in the history file following actions performed by an operator.

Alarm Routing: The Security Management System shall be capable of defining routing groups

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that determine what event information shall be routed to a user or class of users.

Global and Nested Anti-passback: The Security Management System shall support the use of an optional anti-passback mode, in which cardholders are required to follow a proper in/out sequence within the assigned area.

Two Person Rule: The Security Management System shall support a "two person rule" to restrict access to specific access areas unless two cardholders present two different valid cards to the reader one after the other within a period time defined by the door unlock time multiplied by a factor of 2.

Occupancy Restrictions: The Security Management System shall allow the user to define the minimum and maximum occupancy allowed in a designated area.

Multiple Sequential Card Swipes to Initiate Procedure: The Security Management System shall allow the user to define a logical device, quantity of consecutive identical events, a time period and a Security Management System procedure to trigger when the event occurs a maximum quantity of times in the allocated time period.

Hardware Templates: The Security Management System shall include the ability to define hardware templates (door templates) in order to simplify the process of creating an access control system. Hardware templates shall allow a user to define a "typical" door configuration and then use that template over and over in the process of defining doors.

MRDT. Pro-Watch can accommodate Mercury Intrusion hardware like the Mercury MRDT ("Mercury Digital Terminal") with keypad. MRDT works with PW-6000 panel to provide intrusion functionality. Mercury Intrusion requires a special Pro-Watch license.

Access Control Functional Requirements: Functions shall include validation based on time of day, day of week, holiday scheduling, site code verification, automatic or manual retrieval of cardholder photographs, and access validation based on positive verification of card/PIN, card, and video. The following features shall be programmable and shall be capable of being modified by a user with the proper authorization:

Time Zones: Shall define the period during which a reader, card, alarm point, door, or other system feature is active or inactive. In addition to Monday-Sunday, there shall be at least one day of the week called Holiday.

Holidays: The application shall allow holidays to be entered into the Security Management System. Holidays shall have a start date plus duration defining multiple days. Holidays shall have a holiday type of 1, 2, or 3, which may be defined by the user.

Response Codes: The Security Management System shall allow the user to enter a predefined code to represent a response to an alarm occurring in the facility.

Clearance Codes: The Security Management System shall allow the user to establish groups of readers at a facility for the purpose of granting or denying access to badge holders. Clearance codes shall be assigned to companies and individuals employed by the company, and may be modified for individual users in the badge holder maintenance application.

Companies: Each badge holder entered into the Security Management System shall be assigned a company code identifying the individual's employer. The company information dialog box displays and maintains information related to companies having access to the facility.

Group Access: The Security Management System shall allow a user or group of users via

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company selection, a temporary denial of access to specific readers or areas based on a preconfigured event. The group access function shall limit access to a group of cardholders, overriding all other access criteria.

Event: Definitions shall be shipped with system software but shall be capable, upon installation, of being modified, added to, or deleted from the Security Management System.

Alarm Pages: Security Management System shall include the capability to create an unlimited number of customized alarm pages for the alarm monitor and each shall be assignable to users and user classes.

Event Types: Definitions shall be shipped with system software but shall be capable, upon installation, of being modified, added to, or deleted from the Security Management System.

Dynamic Graphical Maps: The Security Management System shall provide the user with the means to add maps and indicator icons to maps that shall represent input/output points, logical devices, or cameras located throughout the Security Management System. Security Management System maps shall display the state and condition of alarm points. The Security Management System shall also provide the ability to monitor the channels or panels.

Brass Keys: Shall maintain information related to assets that are issued in the facility, including brass keys, laptops, RSA keys, cell phones, company cards, etc.

ID Badging Client: The Security Management System Shall maintain information related to a badge holder's card access privileges. Upon entering this application, a window shall appear on the screen and all actions (add, modify, or delete) involving badges and cards shall be initiated from this window. Access privileges shall be linked to the cards used to gain access to doors in the facility. Modifications shall be made by adding or deleting clearance codes, or by door types assigned to the cards or to a badge holder.

ID Badging System: The Security Management System shall include seamlessly integrated ID badging system.

Users: Information related to the users of the Security Management System software shall be stored in the database. Users entered into the Security Management System shall be assigned the access privileges of the class to which they are assigned.

Elevator Control: The elevator control shall be of the Security Management System intelligent controller-based line of devices. The elevator control shall include the following functional features:

Elevator call: Valid card read calls elevator to the floor. No reader in the elevator car.

Floor control: Valid card read in the elevator car enables selectable floor buttons.

Floor select: Valid card read in the elevator car enables selectable floor buttons and logs which floor is selected after the card is presented.

Data Transfer Unit (DTU): The DTU enables data to be imported from an external system directly into the Security Management System database and also exported from Pro-Watch to an external system.

Insert only: If a "data file key column #" shall be provided, the DTU will only insert a new badge record if the key column value is not found. An error shall be displayed in the log file if an existing badge record is found. If no "data file key column #" is provided, every record will be inserted into the Security Management System.

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Updates only: The DTU shall use the "data file key column #" to look for the matching Security Management System record. An error shall be logged in the log file if the badge holder is not found in the Security Management System database.

Inserts, updates: The DTU shall use the "data file key column #" to look for the matching Security Management System record. If a matching record is not found, the DTU shall insert the data. If a matching record is found, the record shall be updated.

DTU shall support SOAP web services.

Generic Channel Interface: The Security Management System shall provide the ability to define generic communications channels over serial port or TCP/IP network socket including IP address and port/socket, to support custom integration of external foreign devices. The Security Management System shall generate events based on data received from the channel matching operator pre-defined instructions.

Application Localization: The Security Management System shall support at least seven languages including English. The languages available shall include German, French, Spanish, Italian, Chinese (simplified), Portuguese (Brazil), Norwegian, Chinese (Traditional), Danish, and Dutch. All database resources will be localized, and will include a standard U.S. English help file.

Event Manager: The Security Management System shall utilize an event manager as a component of system administration and offer the ability to have users control the amount of data stored as well as a quick snapshot of the logged data in the system. Using the various logs in event manager, the user will be able to gather information about events, auditing, and operator actions. The logs are defined as follows: Event log, audit log, unacknowledged alarms.

Intelligent Controllers - Hardware Requirements:

Distributed architecture shall allow controllers to operate independently of the host. The architecture shall place key access decisions, event/action processing and alarm monitoring functions within the controllers, eliminating degraded mode operation.

Flash memory management shall support firmware updates and revisions to be downloaded to the system. Upgrades to the hardware and software shall occur seamlessly without the loss of database, configurations, or historical report data.

Manufacturers: Subject to compliance with requirements, provide Field Controllers or comparable product by one of the following:

Honeywell Security Star II (Legacy support only)
Honeywell Security PW-2000
Honeywell Security PW-3000 (Legacy support only)
Honeywell Security PW-5000
Honeywell Security PW-6000
Honeywell Security PW-6101ICE

Cardkey Controllers: The Security Management System software suite shall provide functionality to Cardkey Controllers using Nodal Protocol B, the Cardkey Controllers D620 (Firmware revision PS-143D or PS143-E), and the Cardkey D600AP (Firmware Revisions PS-155A or PS-155B).

Supported interface is currently, but not limited to, standard STI and STIE devices. Minimum functionality to be supported:

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Controller to host communications.
Downloading of cards.
Downloading of Security Management System parameters.
Downloading of reader parameters.
Downloading of input point parameters.
Downloading of relay output point parameters.

Field Hardware:

The security management system shall be equipped with access control field hardware required to receive alarms and administer all access granted/denied decisions. All field hardware shall meet UL requirements.

Intelligent Controller Board:

Honeywell Security PW3K1IC (Legacy support only)

Honeywell Security PW6K1IC

Honeywell Security PW6K1ICE

Single Reader Module (SRM):

Honeywell Security PW6K1R1

Honeywell Security PW6K1R1E

Dual Reader Module (DRM):

Honeywell Security PW6K1R2

Alarm Input Module (AIM):

Honeywell Security PW6K1IN

Relay Output Module (ROM):

Honeywell Security PW6K1OUT

Mercury Family Hardware:

EP-1501

EP-1502

EP-2500 with Wiegand Reader.

MR-16IN (16 Input Board).

MR-16OUT (16 Output Board).

MR-50 (Single Reader Board).

MR-51E (Single Reader Board ETHERNET).

MR-52 (2-Reader Board).

SCP/SCP2.

Mercury M5 Bridge.

M2K

Lenel Family Hardware:

LNL-1000 with Wiegand Reader.

LNL-1100 (16 Input Board).

LNL-1200 (16 Input Board).

LNL-1300 (Single Reader Board).

LNL-1320 (2-Reader Board).

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LNL-2000 with Wiegand Reader.
LNL-2210.
LNL-3300.
LNL-8000.
SALTO Locksets:
Locksets compatible with SVN - Salto's Virtual Network.
Card Readers:
Honeywell Security:
OmniProx.
OmniAssure
OmniClass.
DigiReaders.
HID:
ProxPro.
MiniProx.
MaxiProx.
ThinLine II.
ProxPro II.
ProxPoint Plus.
Indala:
FlexPass.
FlexPass Linear.
FlexPass Arch.
FlexPass Curve.
FlexPass Long Range.
FlexPass Wave.
Biometric Readers:
BioScript.
Recognition Systems.
WSE Readers (SNET Protocol) - Star I, Star II, PW-6000:
DR4201.
DR4203.
DR4205.
DR4205K.
DR4208.
DR4208K.
DR4220.
MSR42-GW.
Wireless Readers:
IR Wireless Reader.
AD-400 Wireless Locks.
SALTO SALLIS Wireless Reader.

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ASSA ABLOY APERIO Wireless Reader.
SCHLAGE Wireless Reader.

Digital Video Recording Systems:

The Security Management System shall provide fully integrated support for a powerful network and digital video recording and transmission system. The Security Management System shall record, search and transmit video, and shall provide users with live, pre- and post- event assessment capabilities. The NVRs/DVRs shall be seamlessly integrated with existing video equipment and incorporated into any TCP/IP network. The NVRs/DVRs shall provide multiple levels of integration with the Security Management System software, providing control of the network or digital video system from the access control application.

Manufacturer and part numbers:

Honeywell MAXPRO® VMS

Honeywell Fusion III series digital recorders

Honeywell Rapid Eye Multi-Media series digital recorders

Integral Technologies DVXi series digital recorders

Integral Technologies DSXpress Series digital recorders

Video Management Systems (VMS):

With integration to VMS, Security Management System shall control multiple sources of video subsystems in a facility to collect, manage and present video in a clear and concise manner. VMS intelligently determines the capabilities of each subsystem across various sites, allowing video management of any analog or digital video device through a unified configuration and viewer.

Disparate video systems are normalized and funneled through a common video experience. Drag and drop cameras from the Security Management System hardware tree into VMS views.

Leverage Security Management System alarm integration and advanced features such as pursuit that help the operator track a target through a set of sequential cameras with a single click to select a new central camera and surrounding camera views.

Manufacturer and part numbers:

Honeywell Security MAXPRO VMS.

Intercom Interface:

The interface shall provide control of both remote and master intercom stations from within the Security Management System application. The Security Management System shall allow the user to define the site, channel, description, and address as well as provide a checkbox for primary station.

Administrators shall have the capability to program a list of intercom functions that report to the alarm-monitoring module as events. These functions shall coincide with the intercom functions provided with the intercom system. For each intercom function, Security Management System administrators shall be able to define an alphanumeric event description 1 to 40 characters in length and shall also be able to set the parameter value of that function.

The intercom interface shall allow for secondary annunciation of intercom calls, events, and

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alarms in the alarm-monitoring window. Intercom reporting to the alarm monitoring window shall report as any other access control alarm and shall have the same annunciation and display properties as access control alarms.

All intercom calls, events, and alarms that report into the Security Management System shall be stored in the system database for future audit trail and reporting capabilities. Intercom events shall include but not be limited to: Station busy, Station free, Intercom call to busy station, Intercom call to private station, Station disconnected, Function dialed outside connection, Intelligent station ID, Station reset, Station lamp test, Audio program changed, Group hunt occurred, Mail message, Digit dialed during connection, Direct access key pressed, Handset off hook, M-key pressed, C-key pressed

Manufacturer(s) and part numbers:
Stentofon/Zenitel Alphacom series intercoms.
Commend series intercoms.

Intrusion Detection Panels:

Honeywell VISTA-128FBP, VISTA-128BPE, VISTA-128BPT, VISTA-250FBP, VISTA-250BPE, and VISTA-250BPT Controllers:

General Requirements: The Security Management System shall support hardwired and TCP/IP communication for the VISTA 128FBP/VISTA-250 FBP panel. Each panel shall have 8 partitions and 15 zone lists. Zones, partitions, and the top-level panel shall have an events page, with all supported events present. Features:

Disarm and unlock a door on card swipe.

Arm and lock a door on card swipe.

Common area arm/disarm.

Access denied if intrusion system is in alarm or armed.

Monitor and log intrusion system events and alarms in the Security Management System.

Associate intrusion system events and alarms to video surveillance integrations.

Honeywell Galaxy Dimension GD264 and GD520 Controllers:

Security Management System users are able to control and monitor group and zone status using the Security Management System client, and control the individual zones and groups using Security Management System Access control credentials. Depending on the combined user profiles and access permissions defined in Security Management System, a Security Management System cardholder is allowed or denied permission to arm/disarm zones and groups. The access control functionality of the intrusion panel is disabled when the integration is operational. Features:

Disarm a zone on a card swipe.

Arm a zone on consecutive card swipes. Security Management System will support definition of quantity of swipes required and the timeout time in seconds to recognize consecutive swipes.

Security Management System supports linking of intrusion panel users with Security Management System cardholders.

Security Management System operators may be given control permissions for intrusion input and output alarms.

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Security Management System can associate alarm events with video commands to look at current or historic footage.
Security Management System stores and reports on intrusion events.

Software Development Kit (SDK)
Security Management System shall permit custom integration with other third party systems through an SDK. SDK shall support the OBIX communication protocol and interface directly with the Niagara Framework for support of additional communications protocols.
Manufacturer and part numbers:
Honeywell Security HSDK.

Visitor Management System
The Visitor Management System shall allow the user to track visitors, employees, assets and deliveries as they enter and exit the facilities.
The system shall also support printing of custom designed visitor passes with details like expiration date, visit area, host being visited, and visit purpose.
Manufacturer and part numbers:
Honeywell Security LobbyWorks.

Web Client:
Web Alarms
Web Events
Web Badging
Web Reports

Supported Web Browsers:
(Windows) Internet Explorer 11
(Windows) Google Chrome Version 42

INTEGRATED SECURITY MANAGEMENT SYSTEM

Product: WIN-PAK Access System as manufactured by the Honeywell Security Group.

The Integrated Security Management System (ISMS) shall function as an electronic access control system and shall integrate the alarm monitoring, CCTV, digital and network video, ID badging and database management into a single platform. ISMS shall function as a one-stop gateway for all the access control needs. A modular and network-enabled architecture shall allow maximum versatility for tailoring secure and dependable access and alarm monitoring solutions. The ISMS shall offer a security management software suite that includes all the features bundled in the following three editions:
Express Edition (XE): Shall include all the following features: Single concurrent user license, one communication server 256 readers, 10,000 card holders and NetAXS-123, NetAXS-4, NS2 and

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NS2+ panel support.

Standard Edition (SE): Shall include the following features: Single/Five user concurrent license, one communication server, 512 readers, 25,000 card holders and PRO3200, PRO2200, NetAXS-123, NetAXS-4, N1000/PW2000, NS2 and NS2+ panel support.

Professional Edition (PE): Shall include all the features of Standard Edition plus the following additional features: Unrestricted concurrent users, multiple communication servers, 255 IP connections per communication server, 100,000 card holders and PRO3200, PRO2200, NetAXS-123, NetAXS-4, N1000/PW2000, NS2 and NS2+ panel support.

ISMS Components:

The ISMS shall be divided into three components: Database Server, Communication Server, and User Interface. These components shall run on a single computer or on multiple computers, allowing flexibility in configuring a networked system.

Database Server: The database server is used for storing the database tables. This data is accessible to communication server and user interface for retrieving and generating the reports. The database server shall be installed on the client computer or any other computer connected to the network.

Communication Server: The communication server routes user interface requests as well as the access transactions to the panel. The panel in-turn processes the transactions and sends the information to the database server as well as responses to the user interface through the communication server. When the communication server is sending information to the database server, it can also receive a request from the user interface. In this scenario, the communication server considers the user request as a higher priority and stops the panel-database server communication until the user request is processed. The communication server shall be installed on the client computer or any other computer connected to the network.

User Interface (ISMS Client): The user interface helps ISMS operators to communicate with the access control system. The user interface shall be installed on the computer where the database server or the communication server is installed or any other computer connected to the network. Several client computers can be run simultaneously and can access the single database server simultaneously. The number of client computers varies based on the licensing information of ISMS.

The ISMS includes the Command File Server: A command file server provides text files containing device instructions that shall be stored in the command files database. The commands in the command files can be sent to the devices automatically on receiving, acknowledging, or clearing an alarm. Also, the command files can be manually executed.

Guard Tour server: A guard tour is a defined series of check points a guard must activate within a given amount of time. The check points are readers or input points where the guard presents the card or presses the button.

Tracking and Muster Server: A muster server is enabled in the event of an emergency and allows the card holders to swipe the readers. Muster areas are logical areas that contain readers to be used by the card holders, only if there is a call for muster (in the event of a disaster, for example).

Schedule Server: A schedule server schedules the list of events to be performed at a

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predetermined time and intervals such as hourly, daily, or monthly.
Video Management Server: A video management server provides interface to connect to various DVR's/NVR's. In addition, it also provides CCTV control with live monitor display, PTZ control of cameras and video playback operations.

Integrated Security Management System Operational Requirements:

The ISMS shall be a modular and network-enabled access control system capable of controlling multiple remote sites, alarm monitoring, video imaging, ID badging, paging, digital video and CCTV switching and control that allows for easy expansion or modification of inputs and remote control stations. The ISMS control at a central computer location shall be under the control of a single software program and shall provide full integration of all components. It shall be alterable at any time depending upon facility requirements. The ISMS reconfiguration shall be accomplished online through system programming.

The ISMS application shall have the major functional capabilities (considered essential for the system) categorized as follows:

General:

All the databases shall have the ability to add, delete, report, view, and edit information.

All the system transactions shall be saved in a retrievable file.

All the events shall be logged by date and time.

All the system transactions or selected system transactions shall be saved in a disk file.

The end-user shall have the provision to make any system configuration changes such as, but not limited to door open time, door contact shunt time, point and reader names, when and where a cardholder is valid, and the ability to add or modify card databases at any time.

Shall support "Global Anti-pass back", feature allowing cardholder to enter/exit any such defined card reader on the same intelligent control panel or RS-485 drop-line consisting of 2 and 4 door controllers.

Anti-pass back modes shall include: hard (no forgiveness), soft (allows access but generates an alarm event) and timed for all readers on the intelligent controller, on specified reader or card for a definable period of time up to 32,000 seconds.

Shall support the "Duress" feature, where a PIN is used in conjunction with a card read; the numbers of digits are selected using the keypad where the PIN number is a value different from the normal PIN.

Shall support the "Two card holder" rule, where two valid, non-identical "cards" must be used within a 20 second period to grant access.

Shall have the option to display the time when a card holder using a reader has accessed (opened) the door or the card was used, but the door was not opened.

Shall support the "Latch mode" operation where the first card read unlocks the door and the second card read locks it.

Shall provide a mode of system operation that stores system commands not accepted by the hardware.

Shall provide a mode of system operation that requires the operator to enter a response to an event when acknowledging it from the alarm view window.

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Shall provide a mode of system operation that allows acknowledged alarms to be automatically cleared.

Shall provide a mode of system operation where when an acknowledged, but not cleared event will be reissued requiring acknowledgement when the event changes to an alarm or trouble state.

Shall provide a mode of system operation that does not allow the operator to clear an alarm before prior to it being restored to normal.

Shall provide the ability for manual operator control of system output relays. The manual functions shall include the ability to energize, de-energize, return to time zone, or pulse the output relay. The pulse time shall be a programmable setting.

Shall provide the ability for manual operator control of system doors. The manual functions shall include the ability to Lock, Un-Lock, Disable, Card only, Card-Pin only, Pin only, exit only and site code only.

Shall provide the ability to automatically display stored "video image" of cardholder, and switch real-time camera from CCTV or digital video server to card reader location for specific card usage.

The cardholder "video image" pop-up shall be activated based on a priority level set to the cardholder or reader. Information in the pop-up shall include, but not be limited to the card holder's primary image a live video pop-up showing the person who initiated the pop-up, entrance name, time, date, cardholder name, and status. User shall be able to display up to 40 note fields. The size of the pop-ups shall be adjustable by the operator.

Shall support multiple card reader technology including: Proximity, Wiegand effect, Biometrics, Magnetic stripe, Bar Code, Keypad, Card/keypad (PIN), High-speed long range Vehicle ID, and Smart Card.

Shall provide an option for taking scheduled automatic backups of any or all database system files. A means to restore these files from a simple menu shall exist.

Shall provide the ability to address up to 255 serial communication ports per communication server, where each port can be configured for either hardwired, or dial-up. When configured for dial-up, any one port can support multiple dial-up locations.

Communication from the access control communication server to the remote intelligent control panels shall be selectable. Communication options shall be RS-232 directly to the intelligent control, via RS-485 converter, dial-up, leased line from a defined communication port or by LAN/WAN using an IP address for direct connection to the intelligent controller via network interface card. When using IP addressing it shall be un-acceptable to use a communication port converter device on the communication server side of the transmission. A minimum of 255 such IP connections shall be allowed per communication server.

All commands and updates to the panels shall be verified and shall automatically retry if communications fail.

Shall provide a system scheduler that shall automatically: Call remote locations to retrieve history transactions and update panel information, including time and date, Activate or deactivate cards locally or at remote dial-up sites, Initiate a pre-programmed command event/action, Synchronize system to intelligent controller time, Run a pre-defined (template) History report, Run a pre-defined (template) Card Holder report, Card frequency report defined by reader(s), over a defined

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period of time with disposition options to automatically report or report and de-activate card or change the access level of the card, Frequency shall be defined as Never, Now, Once, Hourly, Daily, and Weekly, Once per 2 weeks, and Monthly.

Shall provide drop boxes for all system-required information that the user has previously entered.

Shall provide the ability to initiate an email (via SMTP) or page to a paging system based on a transaction state. A transaction state shall be defined as but not limited to Normal, Alarm, Trouble, Ajar, Trace, Not Found, Anti-Pass back Violation, PIN Violation, Time Zone Violation, Site Code Violation, Door Used, Duress, No Second Card Presented, Trace Card or Expired Card, and System Alarms including, Panel Com, Panel Power Failure, Modem Pool, Guard Tour, and Tamper. Intrusion partition events including but not limited to: Alarm, Alarm Cancel, Alarm Away, Arm Stay, Auto Arm, Auto Disarm, Bypass, Disarm, Early Arm, Early Disarm, Fail to Arm, Fail to Disarm, Normal, Not Ready, Part Arm, Quick Arm, Recent Close, Remote Arm, Remote Disarm, Unbypass, User Code Added, User Code Deleted, user Code Edited. Intrusion zone events including but not limited to: Alarm, Alarm Restore, Bypass, Fault, Fault Restore, Normal, Trouble, Trouble Restore, and Unbypass. Intrusion output events including but not limited to: Alarm, Communication Loss, Normal, Tamper, and Tamper Restore. Intrusion panel events including but not limited to: Access Denied, Automatic Test, Comm Fail, Comm Restore, Faults, Faults Restore, Line Restore, Line Trouble, Manual Test, Pager Restore, Pager Trouble, AC Restore, AC Trouble, Alarm, Battery Low, Battery Low Restore, Disarm, Normal, Recent Close, Reset, Panic Alarm, Power Up, Program begin, Program Changed, Program End, System Shutdown, System Shutdown Restore, Tamper Alarm, Tamper Restore, Test End, Test Start, Time/Date changed.

Shall include a "host grant" mode of operation that requires the host computer to grant accesses to "valid" cards. An alternate host grant mode shall allow the card access information to be downloaded along with unlocking the door for "valid" cards.

Cards: Shall provide a simple card and card holder database import utility. The utility shall be password protected and accessible only to administrators of the access control system.

Information that can be imported shall include but not be limited to: First Name, Last Name, Card Number, Activation Date, De-activation Date, Status, up to 40 note fields and Photo Images. A simple CSV (comma separated value) file shall be used for the importing of data and image file names.

Access Levels: Shall provide an option to define specific access times and specific readers for access. Shall provide a template of a defined access level detail, where changes can be made to the template and saved as a new access level detail.

Video Management Server: Shall support the following Recorders: MAXPRO NVR, MAXPRO NVR HYBRID, RapidEye, HRDP, and Fusion from Honeywell.

Camera Control:

Alarm Monitoring - Alarms Only View:

Alarm Monitoring/System Control - Tree View: Shall provide the ability for dynamic alarm monitoring of alarm points in real time on the system computer's video display terminal.

Operator Database: Shall allow the assignment of operator levels to define the system components that each operator has access to view, operate, change, or delete.

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Access Control Panels: Shall provide ability to program Action Messages and assign an alarm event priority. .

Reports: Shall provide Card holder report capability with filter options to define door(s) that a card holder has access to, reporting card holder name, Card(s), Access Level/schedules, Activation/Expiration.

Tracking/Muster Report: A tracking feature shall allow the system operator to identify an area and the person(s) in that area.

Time Zones: Time zone definitions shall include Starting time, Ending time, Days of the week, and Holiday override.

Floor Plan Graphic: Shall provide the ability to import floor plan graphics stored in a WMF format.

Remote Locations: Shall provide the ability to place remote control panels in an offline mode. In the offline mode, the remote control panels shall retain all panel history events. The amount of historical events shall be limited to the panels' buffer capacity.

Guard Tour: Guard Tour shall allow the operator to program a series of guard check points that must be activated to accomplish the task of a Guard Tour.

ID Badging System/Video Image System: Shall allow any card data fields to be assigned to a badge.

Networking: Shall provide networking capabilities (LAN or WAN) as allowed by the computer's operating system license.

ISMS Hardware and Software Requirements:

The ISMS shall be installed in a computer that supports 1 to 10 readers, 250 cards, and 2 communication ports. The minimum hardware and software requirements to fulfill this installation are:

Processor: Dual Core Intel(R).

CPU: 2.4 GHz.

RAM: 2 Gigabytes (GB).

Hard Disk: 80 GB SATA with minimum 5 GB free space.

Serial Communication Ports: 2.

Secondary Storage: Tape or DVD burner.

Printer port: 1 (2 if badging).

Monitor Display: Size: 15 Inches SVGA, Resolution: 1024 x 768, Colors: 256.

Pointing Device: Mouse (USB preferred).

Operating System: Microsoft Windows 7 SP1.

Database: Microsoft SQL Server 2012 Express Edition.

The ISMS shall be installed in a computer that supports 1 to 100 readers, 5,000 cards, and 8 communication ports. The recommended hardware requirements to fulfill this installation are:

Processor: Quad Core Intel Xeon® .

CPU: 2.4 GHz.

RAM: 4 Gigabytes (GB).

Hard Disk: 250 GB SATA or SCSI.

Serial Communication Ports: 2.

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Secondary Storage: Tape or DVD burner.
Printer port: 1 (2 if badging).
Monitor Display: Size: 17 Inches SVGA, Resolution: 1024 x 768, Colors: True color.
Pointing Device: Mouse (USB preferred).
Operating System: Microsoft Windows 7 SP1.
Database: Microsoft SQL Server2012 Express Edition.
The ISMS shall be installed in a computer that supports that supports more than 100 readers,
100,000 cards and 255 communication ports, The maximum/performance hardware requirements
to fulfill this installation are:
Processor: Intel(R) Quad Core E5504 Xeon.
CPU: 2.4 GHz.
RAM: 8 Gigabytes (GB).
Hard Disk: Minimum 500 GB SATA 7200 RPM, recommended 15kRPM.
Serial Communication Ports: As per the requirement.
Secondary Storage: Tape or DVD burner.
Monitor Display: Size: 19 Inches SVGA, Resolution: 1280 x 1024, Colors: True color.
Pointing Device: Mouse (USB preferred).
Operating System: Microsoft Windows Server 2012 R2.
Database: Microsoft SQL Server2012 with processor/core license.

Hardware Requirements:

Intelligent Controllers:

Distributed architecture shall allow controllers to operate independently of the host. The
architecture shall place key access decisions, event/action processing, and alarm monitoring
functions within the controllers, eliminating degraded mode operation.

Flash memory management shall support firmware updates and revisions to be downloaded to
the system. Upgrades to the hardware and software shall occur seamlessly without the loss of
database, configurations, or historical report data.

Manufacturers: Subject to compliance with requirements, provide Field Controllers or comparable
product by one of the following:

Honeywell NetAXS Controller (NetAXS-123 and NetAXS-4 are the two types of NetAXS
controllers).

Honeywell P-Series Controller (PRO-2200 (Legacy), PRO-3200 are the types of P-Series
controllers).

Intelligent Controller Board: Honeywell Security PRO32IC

Honeywell N-1000 or PW-2000 Controller (Legacy only).

Honeywell Security NS2 or NS2+ (Legacy only).

Field Hardware:

The security management system shall be equipped with access control field hardware required
to receive alarms and administer all access granted/denied decisions. All field hardware shall
meet UL requirements.

Intelligent Controller Board: Honeywell Security PRO32IC

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Single Reader Module (SRM): Honeywell Security PRO22R1
Dual Reader Module (DRM): Honeywell Security PRO32R2
Alarm Input Module (AIM): Honeywell Security PRO32IN. 16 Inputs 2 Outputs.
Relay Output Module (ROM): Honeywell Security PRO32OUT. 16 Outputs 2 Inputs.
NetAXS-4 Access System as manufactured by the Honeywell Security Group
NX4S1: 4 Door Control Panel (Standard Enclosure)
NX4L1: Pre-wired 4 Door Control Panel (Deluxe Enclosure)
NetAXS-123 Access System as manufactured by the Honeywell Security Group
NX1P: One-door compact (plastic) enclosure with tamper switch
NX1MPS: One-door standard (metal) enclosure with tamper switch, power supply, and battery
NXD1: One-door add-on board (to NX1P or NX1MPS) for two-door capacity
NXD2: Two-door add-on board (to NX1P or NX1MPS) for three-door capacity
Card Readers:
Proximity.
Magnetic Stripe.
Wiegand.
Barcode.
MRDT - Mercury Intrusion Display Terminal

System Integrations:

Network and Digital Video Recording Systems:

The Security Management System shall provide fully integrated support for a powerful network and digital video recording and transmission system. The Security Management System shall record, search and transmit video, and shall provide users with live, pre and post- event assessment capabilities. The NVRs/DVRs shall be seamlessly integrated with existing video equipment and incorporated into any TCP/IP network. The NVRs/DVRs shall provide multiple levels of integration with the Security Management System software, providing control of the network or digital video system from the access control application.

WIN-PAK shall support the following Network (NVRs) and Digital Video Recorders (DVRs).

MAXPRO NVR.

MAXPRO NVR HYBRID.

HRDP.

Rapid Eye (Legacy only).

Fusion (Legacy only).

Access Control Panels(Controllers):

Honeywell P-Series Controller (PRO-2200 (Legacy), PRO-3200 are the types of P-Series controllers), Honeywell NetAXS Controller (NetAXS-123 and NetAXS-4 are the two types of NetAXS controllers). Honeywell N-1000, PW-2000, NS2, and NS2+ Controller are legacy controllers and are listed for reference to existing systems only.

P Series Panels shall have the following capabilities:

Supports ABA and WIEGAND card formats.

Types of P-Series panels are: PRO-2200, PRO-3200.

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Eight SIO Boards are included in the PRO-2000 panel. A maximum of 16 SIO boards are supported by the PRO-3200 panel. SIO boards enable extended input and output capabilities to the panel.

Readers, inputs, and outputs that can be connected to the panel are based on the type of SIO Board that is added to the panel. The SIO Board types include 16-Zone Input/Output (16 inputs, 2 outputs, and 0 readers), 16-Relay Output (0 inputs, 16 outputs, and 0 readers), 2-Reader I/O (2 inputs, 8 outputs, and 6 readers), and 1-Reader I/O (1 input, 2 outputs, and 2 readers).

NetAXS Panels shall have the following capabilities:

Types of NetAXS panels available are: NetAXS-4 panel and NetAXS-123 panel.

Panels (NetAXS-123 and NetAXS-4) are called as Gateway panels when added directly to the communication server.

NetAXS-4 Gateway panel supports the downstream devices feature. This feature shall extend the input and output capabilities of the NetAXS-4 panels.

NX4IN and NX4OUT

NX4IN is a 32 input and 0 output downstream add on device

NX4OUT is a 2 input and 16 output downstream add on device

Supports only the WIEGAND card format. The NetAXS panel allows multiple sets of card numbers and site codes embedded in a card format. These multiple embedded sets will be represented as A, B, C, and D sets of card numbers and site codes. The A set shall be used as the default / primary card and site code numbers. The resulting maximum length of the card number will be 64-bits in length (20-digit card number). This is the reason that the system defaults will incorporate the ability to select a 20-digit card number size in addition to the existing 5, 12 and 16 digit

Supports 128 time slots and 256 holidays (per holiday group). Holidays shall be definable in two different holiday types thus allowing for different operational time definitions for each holiday type. The NetAXS panels shall have a provision to add a new time zone while within the panel database. After creating the new time zone, it shall be added to the Time Zones database and applied to the panel's database.

Panel options such as Anti-passback, Groups, Forgiveness, Continuous Card Reads, Reverse Read LEDs, Host Grant, Site Codes, and Command File can be set for providing access to the readers, input points, and output points attached to the NetAXS panels.

NetAXS-4 panel shall allow configuring of 14 inputs with default values. NetAXS-123 panel shall allow configuring 17 inputs with default values.

NetAXS-4 panel shall allow configuring of 16 inputs with default values. NetAXS-123 panel shall allow configuring 14 inputs with default values.

NetAXS-4 panel shall support 4 readers. NetAXS-123 shall support 6 readers controlling 3 doors where the "A" reader is the primary reader for the door and the "B" reader is the Out reader for the door when so used. The B Reader can be programmed separately regarding name, Advanced Options, Anti-Passback configuration, and Intrusion support. The B Reader cannot work alone as a Reader only. When used, the B reader will be tied to the A reader in terms of the interlock relationships pertaining to Door operation. The Advanced Options selection shall provide several advance features not normally used in the typical system and thus the reason they are

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accessed separately to reduce confusion for typical installations. For the NetAXS-123, Reader A and Reader B shall support their own settings.

The Groups option shall be supported only by the NetAXS-4 panels. A maximum of 64 groups shall be defined with a maximum of 76 relays.

N-1000 Series Panels (Legacy) shall have the following capabilities:

Stores 5,000 cards/key codes, expandable to 25,000 with memory upgrade.

Supports ABA and WIEGAND card formats.

Stores eight format (software) commands, allowing use of cards with various bit structures and encoding schemes.

Supports an option to define 63 time zones. Each time zone shall include a start time, end time, day of week specification and holiday specification. Time zones may be assigned to cards via access levels to define when the card is allowed access. Time zones may be assigned to input points, to define when the input points are shunted (de-activated). Time zones may be assigned to output points (relays), to define when the output points are energized, for timed control of doors or devices.

Supports setting of panel options such as anti-passback, groups, and keypads for providing access for the readers, input points, and output points attached to the panel.

Supports the use of card readers in conjunction with keypads, in which users are required to enter a PIN, followed by a card, to gain access.

Supports an option to assign shunt times to input points, from 1-63 seconds, minutes, or hours, and debounce times to input points, from 1-255 seconds.

Supports an option to assign pulse times to output points, from 1-63 seconds, minutes, or hours.

Supports the option to interlock selected input and output points, in any combination. An interlocked input or output point shall take action based upon a change of state from another input or output point.

Stores 32 relay group definitions. Each group may be controlled with the same options available for individual relays.

Supports an option to define 32 holidays, for override of normal system operation.

Supports the followings mechanical and electrical specifications:

Mechanical specifications: Height: 14.6 inches (370mm), Width: 12.6 inches (320mm), Depth: 3.5 inches (89mm), Weight: 5.51 lb. (2.5kg).

Electrical Specifications: 16.5VAC 50 VA or +24 VDC @ 1.25 Amps

NS2+ Series Panels (Legacy) shall have the following capabilities:

Stores 10, 000 cards/key codes. (NS2 = 2,000 cards/key codes)

Supports WIEGAND card format.

Stores eight format (software) commands, allowing use of cards with various bit structures and encoding schemes.

Supports an option to define 63 time zones. Each time zone shall include a start time, end time, day of week specification and holiday specification. Time zones may be assigned to cards via access levels to define when the card is allowed access. Time zones may be assigned to input points, to define when the input points are shunted (de-activated). Time zones may be assigned to output points (relays), to define when the output points are energized, for timed control of doors

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or devices.

Supports setting of panel options such as anti-passback, groups, and key pads for providing access for the readers, input points, and output points attached to the panel.

Supports the use of card readers in conjunction with keypads, in which users are required to enter a PIN, followed by a card, to gain access.

Supports an option to assign shunt times to input points, from 1-63 seconds, minutes, or hours, and debounce times to input points, from 1-255 seconds.

Supports an option to assign pulse times to output points, from 1-63 seconds, minutes, or hours.

Output points shall also have the ability to report in change of state status in the same way an alarm point would. This provides added awareness of door operation in critical installations.

Supports the option to interlock selected input and output points, in any combination. An interlocked input or output point shall take action based upon a change of state from another input or output point.

Supports an option to define 32 holidays, for override of normal system operation. Holidays shall be definable in two different holiday types thus allowing for different operational time definitions for each holiday type.

Supports the followings mechanical and electrical specifications:

Mechanical specifications: Height: 14.6 inches (370mm), Width: 12.6 inches (320mm), Depth: 3.5 inches (89mm), Weight: 5.51 lb. (2.5kg).

Electrical Specifications: 16.5VAC 50 VA or +24 VDC @ 1.25 Amps.

Intrusion Detection Panels:

Honeywell VISTA-128FBP, VISTA-250FBP Controllers, Honeywell VISTA -128BPT, and Honeywell VISTA-250BPT.

General Requirements: The Security Management System shall support hardwired and TCP/IP communication for the VISTA 128FBP/VISTA-250 FBP panel. Each panel shall have 8 partitions and 15 zone lists. Zones, partitions, and the top-level panel shall have an events page, with all supported events present. Features:

Disarm and unlock a door on card swipe.

Arm and lock a door on card swipe.

Common area arm/disarm.

Access denied if intrusion system is in alarm or armed.

Monitor and log intrusion system events and alarms in the Security Management System.

Associate intrusion system events and alarms to video surveillance integrations.

Honeywell Galaxy Dimension Controllers: GALAXY__GD264, GALAXY_GD_48, GALAXY_GD_96 GALAXY_GD_520, Firmware 6.02 and above, Ethernet module firmware 2.08 and above controllers. Honeywell Galaxy Grade 3 Controllers: GALAXY_144, GALAXY_20, Firmware 5.04/5.50 and above, Ethernet module firmware 2.01 and above. Honeywell Classic Panel Controllers: GALAXY_60, GALAXY_128, GALAXY_500, GALAXY_504, GALAXY_512, Firmware 4.50 and above, Ethernet module firmware 2.10 and above.

Security Management System users are able to control and monitor Group and zone status using the Security Management System client, and control the individual zones and groups using Security Management System Access control credentials. Depending on the combined user

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profiles and access permissions defined in Security Management System, Security Management System cardholder is allowed or denied permission to arm/disarm zones and groups. The access control functionality of the intrusion panel is disabled when the integration is operational.

Features:

Disarm a zone on a card swipe.

Arm a zone on consecutive card swipes. Security Management System will support definition of quantity of swipes required and the timeout time in seconds to recognize consecutive swipes.

Security Management System supports linking of intrusion panel users with Security Management System cardholders.

Security Management System operators may be given control permissions for intrusion input and output alarms.

Security Management System can associate alarm events with video commands to look at current or historic footage.

Security Management System stores and reports on intrusion events.

Controller for High Density Installations (PRO3200):

Designed for high density installations. Supporting up to 16 readers per enclosure and 32 readers per intelligent controller along with up to 100,000 card capacity provides a combination of small installation footprint and superior cost per door ratio.

The PRO22R1 provides I/O support for one card access reader, while the PRO32R2 supports two card access readers. Both interface with the intelligent control module (PRO32IC). In the event that communication to the intelligent control module is lost, the card access readers can be individually configured to allow entrance based on security needs. This customization allows for a door to be configured as locked, unlocked, or access only via valid facility code.

The PRO32OUT interfaces with the intelligent control module (PRO32IC) providing up to 12 or 16, Form C, 12 VDC, 2A relay output controls depending if the board is rack or tile-mounted and power fail and panel tamper when tile mounted. Relays may be used for elevator control, status annunciation and for general facility control, such as door monitoring.

The PRO32IN interfaces with the intelligent control module (PRO32IC) providing 16 supervised alarm inputs and a dedicated power fail and panel tamper when tile mounted. An analog to digital converter samples the input values and the digitized result is filtered and processed. Filter parameters are configurable for each input point, resulting in the ability to specify a custom End-Of-Line (EOL) resistance value, sensitivity range and timing parameter.

The PRO3200 Series of access modules are designed to accommodate various mounting options. Units can be mounted in a rack configuration (PRO22ENC1, PRO22ENC2 and PRO22ENC5) when space is limited, or in a tile-mount configuration (PRO22ENC3).

PRO22ENC1 is a wall-mounted enclosure rack unit.

PRO22ENC2 is a 19 inch rack-mounted enclosure rack unit.

PRO22ENC5 is a rack unit which fits inside a customer's enclosure.

WEB BASED MODULAR ACCESS CONTROL SYSTEM

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System: NetAXS-4 Access System as manufactured by the Honeywell Security Group.
NX4S1: 4 Door Control Panel (Standard Enclosure)
NX4L1: Pre-wired 4 Door Control Panel (Deluxe Enclosure)

The Honeywell NetAXS modular access control system shall function as a web-based open architecture facility management system that tracks individuals, defines and controls access levels, monitors alarms, and generates reports. The system shall include the capability to configure alarms and incorporate scheduled events that may be activated by either time or a specific programmed event. Access shall be controlled through a password-protected user interface. Operators can communicate with the system either through a host software system or by connecting to the web server through an Ethernet connection.
The system control panels will be fully upgradeable using flash memory firmware.

System Architecture:

The access control and alarm monitoring system shall be a flexible single-user, open-architecture facility management system. The system shall be designed using reliable state-of-the-art technology allowing for easy and economical expansion. The scaleable design shall allow for operation from an embedded Web based server without a dedicated server or PC workstation. The panel shall also have the capability to operate in a hosted mode with WIN-PAK XE/SE/PE/CS access control software.
The system shall feature embedded Linux software that intelligently controls the reader network to provide automated data collection and configuration updates, facilitating seamless operation from controllers. All control panels shall utilize off-line distributed processing concepts including inter-controller communication if upgraded.
Connecting to the NetAXS web server shall be accomplished via USB, Ethernet through a web server hub connection or Ethernet through web server direct connection.

System Software:

The software suite shall comprise various integrated software modules that allow for the full integration and retrieval of transactions from the hardware, as well as alarm monitoring, reporting, and scheduling capabilities. The software modules shall allow editing of personnel, access levels, system configuration and reporting to be controlled by a password protected user interface. System operation for individual operators shall be possible using assigned passwords only. The user shall have the ability to perform hardware configuration changes during or after the installation which shall include functions such as door open time, door contact time, location and reader names, and access rights configuration.
The system software shall support configuration of alarms triggering the system.
The system shall incorporate scheduled events activated by either time or a specific programmed event, therefore being time or event triggered.
Access control functions shall include validation based on time of day, day of week, holiday scheduling, and access validation based on positive verification of card or card + PIN (Personal Identification Number).

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Zone-related Software Features:

Supervisor card unlock.

Card-related Software Management:

Time-limited access.

PIN codes.

Suspension of cards.

Multiple card access.

Card access groups.

Time patterns (schedules).

Anti-pass back (APB) control.

Reporting.

First Card Rule (Activates the door time zone).

Two Card Rule-Supervisor card and regular card to allow access.

Time zone card toggle for door locks.

Latching mode for door locks.

Hardware:

The quantities of components shall be determined and installed by the Contractor based on the requirement to provide a fully operational integrated access control system as per the intent of the design.

Communication between components i.e. gateway controller shall be RS485.

All terminals and controllers shall allow for direct Firmware upgrade from the RS485 network connection. The units shall be upgradeable during normal system operation. Therefore should one unit be in upgrade mode all other units will continue to operate normally. The firmware shall be stored in FLASH memory on the individual units.

System Controller:

The system controller shall be the Honeywell NetAXS-4 controller. Each controller loop shall be capable of 31 panels or 124 readers.

The standard controller configuration shall support 10,000 card capacity and 25,000 event capacity.

Door Control: The terminals and remote readers supported by the controller shall be any combination of the following: card only, card and pin, card or pin, pin only, lockdown, disabled, supervisor, escort, limited use card, expire on date, first card rule, snow day rule, time zone toggle and anti-passback with local/global capability and hard and soft implementation.

Honeywell OmniProx: The reader shall be fully sealed and potted electronics for use outdoors. It shall include 3 bezels color including black, charcoal and ivory. It shall have an integral optical tamper and security screw. The unit shall be able to communicate with the proximity cards at a read range of 2 to 3 inches (51 to 76 mm).

Inputs: Provides 14 fully configurable four-state supervised input points. System capacity shall have a total of 78 inputs

Outputs: Provides 8 SPDT Form C relay outputs rated at 10A @ 28vdc, 8 open collector's outputs 16ma @12vdc, 4 reader LED aux output and 4 reader buzzer output.

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Cards and Database: The card and event buffer capacity shall be 10,000 card capacity and 25,000 event capacity. The firm ware revision shall have on-board flash memory for field firmware revisions and feature expansion. Offline database backup shall be available. Export capabilities for card database, alarms and events. The panel shall support 128 unique card formats and 8 site codes. Maximum card format size shall be 75bit suitable for handling the card format of PIV, TWIC, and FRAC cards. The time zones support will be a minimum of 127 with 128 access levels and 255 holidays.

Reports and Analysis: The system shall be capable of integrated reports, import/export of card database and alarms and events can be exported and saved in offline storage.

Embedded Web Server: Supported browsers shall include Internet Explorer. The web browser control will allow full control monitor, view live events and manually control doors and readers.

Secure web browsing shall be SSL and SHA-1 secure socket layer encryption.

System Information: The system shall support Global Geographic Time Zone support and Daylight Saving Time support. The processor will be Freescale Coldfire 32-bit. The system shall be CE and FCC compliant with UL-294 listing.

System Testing: The Contractor shall demonstrate the functionality of the system upon completion of installation, and shall document the result of all tests and provide these results to the Customer.

Warranty: All equipment and systems shall be guaranteed by the Contractor for a period of one year commencing with the filing date of the Notice of Completion, provided the system has been inspected and signed off by the Owner. The guarantee shall cover all costs for Warranty Service, including parts, labor, prompt field service, pick-up, transportation, and delivery.

WEB BASED ACCESS CONTROL SYSTEM

System: NetAXS-123 Access System as manufactured by the Honeywell Security Group.

NX1P: One-door compact (plastic) enclosure with tamper switch.

NX1MPS: One-door standard (metal) enclosure with tamper switch, power supply, and battery.

NXD1: One-door add-on board (to NX1P or NX1MPS) for two-door capacity.

NXD2: Two-door add-on board (to NX1P or NX1MPS) for three-door capacity.

The Access Control System shall function as a Web-based open-architecture facility management system that tracks individuals, defines and controls access levels, monitors alarms, and generates reports. The system shall include the capability to configure alarms and incorporate scheduled events that may be activated by either time or a specific programmed event. Access shall be controlled through a password-protected user interface. Operators can communicate with the system either through a host software system or by connecting to the Web server through an Ethernet connection.

The NetAXS-123 Door Access System shall include, as a minimum, the following performance:

The NetAXS-123 Door Access System shall be protected by the most extensive support services in the industry, including Customer Service, Pre-Sales Applications Assistance, After-Sales

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Technical Assistance, access to Technical Online Support, and Online Training using web conferencing.

The NetAXS-123 Door Access System and its components shall be thoroughly tested before shipping from the manufacturer's facility.

The door access system shall support easy remote management anywhere with an Internet connection.

The door access system shall allow you to purchase the exact amount of access control doors immediately required, and to easily add more access controlled doors in the future.

The door access system shall be capable of being web based and controlled using a web browser, and seamless integration with Honeywell's MAXPRO Cloud and/or WIN-PAK XE, WIN-PAK SE, Win-PAK PE, and WIN-PAK CS access control software.

The door access system web user interface shall support Google Chrome™.

The door access system shall support SSL and SHA-1 secure socket layer encryption.

The door access system shall allow each TCP/IP network connected door controller to support connection of up to 31 downstream door controllers by way of a standard RS485 data bus, for control of up to 123 downstream doors in a single web interface.

The door access system shall support up to 10,000 user cards and up to 128 unique card formats up to 75 bits, and eight site codes.

The door access system shall support up to 127 time zones, 128 access levels, and 255 holidays.

The door access system shall maintain up to 25,000 status event log.

The door access system shall provide a number of door control modes including Card only, card and PIN, PIN only, lockdown, disabled, supervisor, escort, limited use card, expire on date, first card rule, snow day rule, time zone toggle, local and global anti-passback, duress and others.

The door access system shall support interlocks for custom actions.

The door access system shall include integrated basic reports, import/export of the card database, and Alarms and event exporting to offline storage in a CSV database.

The door access system shall be designed to be user friendly and shall be easily to train the system user.

The door access system shall feature dynamic screen updating over a web connection, continually collecting and displaying door and system status for immediate display.

The door access system browser shall feature full control of the system to monitor and view live events and to manually control doors and readers.

Door access system status shall include the door state, alarms, events, inputs, outputs, power and other operational status.

The door access system shall feature a Supervisor First capability that allows a supervisor to present his ID card once to the reader and to give individual access. If a supervisor presents a card twice, this shall enable access for their team, allowing members of the team to gain access during a specified time zone.

The door access system shall feature an Escort mode for a Non-supervisor cardholder. The system allows the supervisor to first present his card, and then an escorted person to present his card to maintain accompanied access while in the escort mode.

The door access system shall offer options to be powered by PoE (Power over Ethernet), or to be

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powered by way of an external power supply.

The door access system enclosure shall offer connection to one, two or three doors by simply exchanging optional cards to accommodate the door control requirement.

The door access system processors shall feature a System MTBF (Mean Time between Failure) of 250,000 hours.

The door access system shall provide a multi-lingual user interface, including English, Italian, French, Dutch, Spanish, German, Czech, Simplified Chinese and Arabic.

The NX1P Door access Controller shall have the following mechanical specifications:

Unit Dimensions: 7.75 inches H x 7.75 inches W x 2.75 inches D (20 mm H x 20 mm W x 7 mm D).

Ethernet Connector: RJ45.

Enclosure Type: High Impact Plastic.

Wiring Access Holes: 7.

The NX1MPS Door Access Controller shall have the following mechanical specifications:

Unit Dimensions: 13.9 inches H x 11.9 inches W x 4.7 inches D (35 mm H x 31 mm W x 12 mm D).

Enclosure Type: Metal.

Wiring Access Holes: 19.

The NX1P access door controller shall have the following electrical specifications:

Voltage: 450mA @ 12VDC.

Power over Ethernet 802.3af.

Power Consumption: < 6 Watts.

The NX1MPS access door controller shall have the following electrical specifications:

Voltage: 93VAC to 264 VAC, 50/60 Hz, 12VDC @ 3.5A.

Power Consumption: < 45 Watts.

The NetAXS-123 Door Access System shall be designed to meet the following environmental conditions:

Operating Temperature: 32 to 122 degrees F (0 degrees to 50 degrees C).

Storage Temperature: -67 degrees to 185 degrees F (-55 degrees to 85 degrees C).

Emissions: FCC: Part 15, Class B.

CE: EN55013.

VISITOR MANAGEMENT SYSTEM

Product; Lobbyworks as manufactured by the Honeywell Security Group: The Visitor Management System shall allow the user to track visitors, employees, assets and deliveries as they enter and exit the facilities. The system shall also support printing of custom designed visitor

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passes with details like expiration date, visit area, host being visited, and visit purpose.

The Visitor Management System shall allow the user to:

Keep track of contractors and consultant timesheets.

Track which employees have regular personal visitors.

Secure visitor log.

Clearly identify visitors by category, to restrict access to vulnerable goods and information.

Designate special areas for visitors with custom badges.

Process most visitors in 20 seconds.

Track and print temporary parking passes.

Print vehicle window stickers.

Use self-expiring badges to tighten security.

Generate end-of-day reports to ensure regulatory compliance.

Label information packets with personalized customer information.

Visitor Pre-Registration:

Visitor pre-registration to include security level, length of stay, and maximum entries.

Visitor pre-registration by using FrontDesk, Microsoft Office Outlook Calendar or through Web-based application.

Group/Event pre-registration, pre-loading of visitor picture, badge pre-printing, and arrival instructions.

Complete visitor registration processing within 20 seconds.

Visitor Information Capture:

Quick and complete capture of visitor information as an essential component for proper record keeping and security checks.

Capture of visitor information using various hardware devices. The tasks that can be performed include scanning business cards, scanning driver license, capturing visitor photo, capturing visitor signature, and 2D barcode scanning of driver licenses.

Quick processing of large groups of visitors through queuing of captured data.

Visitor Authentication:

Recalling previous visit information (including pictures) when a visitor revisits.

Detecting each attempted visit and deterring potential security breaches before they affect the user facilities.

Importing guests ranging from disgruntled ex-employees to known felons into the watch list to alert personnel of a potential threat to the organization.

Authenticating a person as having proper identification and determining that he or she is who they claim to be.

Visitor Authorization:

Enforcing visitor authorization prior to printing a badge, entering the premises, authorizing visits at

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reception, security lobby, or remotely by the host employee.
Delegating authorization responsibility to specific individuals.
Providing a denied visitors list.

Visitor Badges Generation:

Provide quick, cost-effective, and individualized badging as an essential component of proper visitor identification.
Allow printing of individualized visitor badges containing name, picture, expiration date, and valid access areas.
Customize badge templates for visitors, VIPs and contractors.
Supports tight integration with Pro-Watch Security systems that allow the assignment of access control privileges via barcode or card to visitors

Host Notification:

Of a visitor's arrival by e-mail messages or real-time network messaging.
When a visitor does not sign out.

Visitor Tracking:

Track events automatically by an accurate log as they relate to the visitor's activities on site.
Track the number of times the visitor signs in and signs out.
Support quick sign in and out using a barcode scanner.
Provide proactive checking for expired visits and network notification to hosts and visitors of expired visits.
Provide web access to the visitor manifest.

Security Policies:

Provide accurate and consistent application of security policies.
Provide a means to view picture and a person's attributes, reason for being on the watch list, and the action to be performed upon visitor's arrival.
Check each visitor against his/her previous visit information.
Ensure that visitors sign out by tracking expired visits and informing their hosts.
Allow host to extend a visit or assign host responsibilities to another employee.

Host Management:

Assign the capabilities available to employees based on their requirement.
Differentiate permanent and temporary employees; limit the number of daily and concurrent visitors per host.
The Front Desk operator shall:
Assign temporary day cards in Pro-Watch for Pro-Watch employees who have forgotten their card.
Have an option to assign either Pro-Watch access privileges to match their permanent card or a visitor privilege. The permanent card is automatically disabled while the temp card is active.

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Be able to do a visual verify of the employee to their photo at the Front Desk.

Traffic Reporting:

Traffic reports - per station, per building, per company, per employee, and per department.

Detailed visit reports.

Time and attendance reports for contractors and other visitors.

Reports on demand, or schedule reports for regular generation and e-mail delivery.

Assets and Deliveries:

Track assets and deliveries as they arrive and depart premises.

Generate asset and delivery tags and scan assets and deliveries in and out with a barcode scanner.

Provide e-mail notification of delivery recipient for unreturned assets.

Self-Registration Kiosk:

Provide a fully featured visitor kiosk to handle visitor registration needs in a busy or unattended lobby. The Kiosk shall be used to perform touchscreen visitor registration using a visitor's business card or driver license.

Allow to sign visitors in and out with voice agent scripted behavior, voice, and text message prompts. The Kiosk shall be used to take picture of visitors for true visitor identification, as well as display visitation rules/non-disclosure agreement.

Print a visitor badge at the self-registration station or at a remote FrontDesk and allow for remote authorization of the visit by the host or security desk. The Kiosk shall notify the hosting employee when their visitor arrives.

Security Audit Compliance:

Secure database.

Audit log.

Tamper proof visitor records.

Audit reports.

Backup and restore capabilities.

ACCESS CONTROL READERS

Contactless Smart Card Readers:

Contactless Smart Card readers shall be "single-package" type, combining electronics and antenna in one package in the following configurations:

Provide surface mounting style 13.56 MHz or 13.56 MHz and 125 kHz prox contactless smart card readers suitable for minimal space mounting configurations as shown on the project plans.

Contactless smart card readers shall comply with ISO 15693, ISO 14443A (CSN), and ISO 14443B and shall read credentials that comply with these standards.

Contactless smart card readers shall output credential data in compliance with the SIA AC-01

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Wiegand standard as follows:

Reads standard proximity format data from OmniClass cards and outputs data as encoded.

Reads card serial number (CSN) of a MIFARE or DESFIRE card with configurable outputs as 26-bit, 32-bit, 34-bit, 40-bit, or 56-bit.

Data security with OmniClass cards shall use up to 128-bit authentication keys to reduce the risk of compromised data or duplicate cards. The contactless smart card reader and OmniClass cards shall require matching keys in order to function together. All RF data transmission between the card and the reader shall be encrypted, using a secure algorithm. Card readers shall be provided with keys that are compatible with the OmniClass cards.

The reader shall be of potted, polycarbonate material, sealed to a NEMA rating of 4X (IP65).

The contactless smart card reader shall provide the ability to change operational features in the field through the use of a factory-programmed command card. Additionally, firmware may be updated by flashing the reader. Command card operational programming options shall include:

Output configurations.

LED & Audio configurations.

Keypad configurations.

Contactless smart card readers shall provide the following programmable audio/visual indication:

An audio transducer shall provide various tone sequences to signify: access granted, access denied, power up, and diagnostics.

A high-intensity light bar shall provide clear visual status (red/green/amber) that is visible even in bright sunlight.

Contactless smart card readers shall meet the following certifications:

UL 294.

Canada/UL 294.

FCC Certification.

Canada Radio Certification.

EU and CB Scheme Electrical Safety.

EU - R&TTE Directive.

CE Mark (Europe).

IP55 Rated.

C-Tick (New Zealand/Australia/Taiwan).

Contactless smart card readers shall meet the following environmental specifications:

Operating temperature: -30 to 150 degrees F (-35 to 65 degrees C).

Operating humidity: 5% to 95% relative humidity non-condensing.

Weatherized design suitable to withstand harsh environments.

Contactless smart card reader cabling requirements shall be:

Manufacturer: Honeywell Cable

Cable distance: (Wiegand): 500 feet (150m).

Cable type: 6-conductor #22 AWG minimum with overall foil shield and drain wire

Standard reader termination: 18 inches (.5m) cable pigtail.

Warranty of contactless smart card readers shall be lifetime against defects in materials and workmanship.

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Product: OM15 Mullion 13.56 MHz Contactless Smart Card Readers as manufactured by the Honeywell Security Group:

Typical contactless smart card read range shall be:

2 inches - 3 inches (5.0 - 7.6 cm) using OmniClass card.

1 inches (2.5 cm) using OmniClass Key Fob.

1 inches(2.5 cm) using OmniClass Sticker (Tag).

1 inches - 1.5 inches (2.5 - 3.8 cm) using OmniClass + HID 125KHz Prox card.

1 inches - 2 inches (2.5 - 5.0 cm) using MIFARE Card (card serial number only).

Contactless smart card readers shall meet the following electrical specifications:
Operating voltage: 5 - 16 VDC, reverse voltage protected. Linear power supply recommended.

Current requirements: (average/peak) 60/90mA @ 12 VDC.

Contactless smart card readers shall meet the following physical specifications:

Dimensions: 1.90 inches x 6 inches x .90 inches (4.8 cm x 15.3 cm x 2.3 cm).

Weight: 3.2.oz (90.7 g).

Material: UL94 Polycarbonate.

Two-part design with separate mounting plate and reader body.

Color: Black.

Product: OM16 Mullion 13.56 MHz Contactless Smart and 125 kHz Prox Card Readers as manufactured by the Honeywell Security Group:

Typical contactless smart card read range shall be:

2 inches - 3 inches (5.0 - 7.6 cm) using OmniClass card.

1 inches (2.5 cm) using OmniClass Key Fob.

1 inches(2.5 cm) using OmniClass Sticker (Tag).

1 inches - 1.5 inches (2.5 - 3.8 cm) using OmniClass + HID 125KHz Prox card.

1 inches - 2 inches (2.5 - 5.0 cm) using MIFARE Card (card serial number only).

1 inches - 3.5 inches (2.5 - 8.9 cm) using 125 kHz Prox card

Contactless smart card readers shall meet the following electrical specifications:

Operating voltage: 5 - 16 VDC, reverse voltage protected. Linear power supply recommended.

Current requirements: (average/peak) 75/100mA @ 12 VDC.

Contactless smart card readers shall meet the following physical specifications:

Dimensions: 1.90 inches x 6 inches x .90 inches (4.8 cm x 15.3 cm x 2.3 cm).

Weight: 3.2.oz (90.7 g).

Material: UL94 Polycarbonate.

Two-part design with separate mounting plate and reader body

Color: Black.

Product: OM30 Mini-Mullion 13.56 MHz Contactless Smart Card Readers as manufactured by the Honeywell Security Group:

Typical contactless smart card read range shall be:

2 inches - 3 inches (5.0 - 7.6 cm) using OmniClass card.

1 inches (2.5 cm) using OmniClass Key Fob.

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1 inches(2.5 cm) using OmniClass Sticker (Tag).
1 inches - 1.5 inches (2.5 - 3.8 cm) using OmniClass + HID 125KHz Prox card.
1 inches - 2 inches (2.5 - 5.0 cm) using MIFARE Card (card serial number only).
Contactless smart card readers shall meet the following electrical specifications:
Operating voltage: 5 - 16 VDC, reverse voltage protected. Linear power supply recommended.
Current requirements: (average/peak) 60/90mA @ 12 VDC.
Contactless smart card readers shall meet the following physical specifications:
Dimensions: 1.90 inches x 4.04 inches x .80 inches (4.83cm x 10.26 cm x 2.03 cm).
Weight: 3.2.oz (90.7 g).
Material: UL94 Polycarbonate.
Two-part design with separate mounting plate and reader body.
Color: Black.

Product: OM31 Mini-Mullion 13.56 MHz Contactless Smart and 125 kHz Prox Card Readers as
manufactured by the Honeywell Security Group:
Typical contactless smart card read range shall be:
2 inches - 3 inches (5.0 - 7.6 cm) using OmniClass card.
1 inches (2.5 cm) using OmniClass Key Fob.
1 inches(2.5 cm) using OmniClass Sticker (Tag).
1 inches - 1.5 inches (2.5 - 3.8 cm) using OmniClass + HID 125KHz Prox card.
1 inches - 2 inches (2.5 - 5.0 cm) using MIFARE Card (card serial number only).
1 inches - 3.5 inches (2.5 - 8.9 cm) using 125 kHz Prox Card
Contactless smart card readers shall meet the following electrical specifications:
Operating voltage: 5 - 16 VDC, reverse voltage protected. Linear power supply recommended.
Current requirements: (average/peak) 75/100mA @ 12 VDC.
Contactless smart card readers shall meet the following physical specifications:
Dimensions: 1.90 inches x 4.04 inches x .80 inches (4.83cm x 10.26 cm x 2.03 cm).
Weight: 3.2.oz (90.7 g).
Material: UL94 Polycarbonate.
Two-part design with separate mounting plate and reader body.
Color: Black.

Product: OM40 US Single-Gang 13.56 MHz Contactless Smart Card Readers as manufactured
by the Honeywell Security Group:
Typical contactless smart card read range shall be:
2.5 inches - 4.5 inches (6.3 - 11.4 cm) using OmniClass card.
1 inches (2.5 cm) using OmniClass Key Fob.
1 inches (2.5 cm) using OmniClass Sticker (Tag).
1.5 inches - 2 inches (3.8 - 5.0 cm) using OmniClass + 125KHz HID Prox card.
1 inches - 2 inches (2.5 - 5.0 cm) using MIFARE Card (card serial number only).
Contactless smart card readers shall meet the following physical specifications:
Dimensions: 3.30" x 4.80" x .85" (8.38cm x 12.19 cm x 2.16 cm).

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Weight: 8.8.oz (249.5 g).

Material: UL94 Polycarbonate.

Two-part design with separate mounting plate and reader body.

Color: Black.

Contactless smart card readers shall meet the following electrical specifications:

Operating voltage: 5 - 16 VDC, reverse voltage protected. Linear power supply recommended.

Current requirements: (average/peak) 65/90mA @ 12 VDC.

Product: OM41 US Single-Gang 13.56 MHz Contactless Smart and 125 kHz Prox Card Readers as manufactured by the Honeywell Security Group:

Typical contactless smart card read range shall be:

2.5 inches - 4.5 inches (6.3 - 11.4 cm) using OmniClass card.

1 inches (2.5 cm) using OmniClass Key Fob.

1 inches (2.5 cm) using OmniClass Sticker (Tag).

1.5 inches - 2 inches (3.8 - 5.0 cm) using OmniClass + 125KHz HID Prox card.

1 inches - 2 inches (2.5 - 5.0 cm) using MIFARE Card (card serial number only).

1 inches - 3.5 inches (2.5 - 8.9 cm) using 125 kHz Prox Card

Contactless smart card readers shall meet the following physical specifications:

Dimensions: 3.30 inches x 4.80 inches x .85 inches (8.38 cm x 12.19 cm x 2.16 cm).

Weight: 8.8 oz (249.5 g).

Material: UL94 Polycarbonate.

Two-part design with separate mounting plate and reader body.

Color: Black.

Contactless smart card readers shall meet the following electrical specifications:

Operating voltage: 5 - 16 VDC, reverse voltage protected. Linear power supply recommended.

Current requirements: (average/peak) 85/100mA @ 12 VDC.

Product: OM55 13.56 MHz Contactless Smart Card with Keypad Readers as manufactured by the Honeywell Security Group:

Typical contactless smart card read range shall be:

3 inches - 4 inches (7.6 - 10.1 cm) using OmniClass card.

1 inches - 1.5 inches (2.5 - 3.8 cm) using OmniClass Key Fob.

1 inches - 1.5 inches (2.5 - 3.8 cm) using OmniClass Sticker (Tag).

1.5 inches - 2.0 inches (3.8 - 5.0 cm) using OmniClass + 125KHz HID Prox card.

1 inches - 2 inches (2.5 - 5.0 cm) using MIFARE Card (card serial number only).

Contactless smart card readers shall meet the following physical specifications:

Dimensions: 3.30 inches x 4.80 inches x .90 inches (8.38cm x 12.19 cm x 2.28 cm).

Weight: 10oz (283.4 g).

Material: UL94 Polycarbonate.

Two-part design with separate mounting plate and reader body.

Color: Black.

Contactless smart card readers shall meet the following electrical specifications:

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Operating voltage: 5 - 16 VDC, reverse voltage protected. Linear power supply recommended.
Current requirements: (average/peak) 85/100mA @ 12 VDC.

Product: OM56 13.56 MHz Contactless Smart and 125 kHz Prox Card W/ Keypad Readers as
manufactured by the Honeywell Security Group:

Typical contactless smart card read range shall be:

3 inches - 4 inches (7.6 - 10.1 cm) using OmniClass card.

1 inches - 1.5 inches (2.5 - 3.8 cm) using OmniClass Key Fob.

1 inches - 1.5 inches (2.5 - 3.8 cm) using OmniClass Sticker (Tag).

1.5 inches - 2.0 inches (3.8 - 5.0 cm) using OmniClass + 125KHz HID Prox card.

1 inches - 2 inches (2.5 - 5.0 cm) using MIFARE Card (card serial number only).

1 inches - 3.5 inches (2.5 - 8.9 cm) using 125 kHz Prox Card

Contactless smart card readers shall meet the following physical specifications:

Dimensions: 3.30 inches x 4.80 inches x .90 inches (8.38cm x 12.19 cm x 2.28 cm).

Weight: 10oz (283.4 g).

Material: UL94 Polycarbonate.

Two-part design with separate mounting plate and reader body.

Color: Black.

Contactless smart card readers shall meet the following electrical specifications:

Operating voltage: 5 - 16 VDC, reverse voltage protected. Linear power supply recommended.

Current requirements: (average/peak) 95/105mA @ 12 VDC.

Contactless Proximity Card Readers:

Card readers shall be "single-package" type, combining electronics and antenna in one package
in the following configurations:

Provide surface mounting style 125kHz contactless proximity card readers suitable for minimal
space mounting configurations as shown on the project plans.

Contactless proximity card readers shall output credential data in compliance with the SIA AC-01
Wiegand standard as follows:

Reads standard proximity format data from OmniProx cards and outputs data in Wiegand format.

Reads card number with formats up 84 bits.

The reader shall be of potted, polycarbonate material, sealed to a NEMA rating of 4X (IP65).

The contactless proximity card reader shall provide the ability to change operational features in
the field through the use of a factory-programmed command card. Additionally, firmware may be
updated by flashing the reader. Command card operational programming options shall include:

Output configurations.

LED & Audio configurations.

Keypad configurations.

Contactless proximity card readers shall provide the following programmable audio/visual
indication:

An audio transducer shall provide various tone sequences to signify: access granted, access
denied, power up, and diagnostics.

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A high-intensity light bar shall provide clear visual status (red/green/amber) that is visible even in bright sunlight.

Contactless proximity card readers shall meet the following certifications:

UL 294.

Canada/UL 294.

FCC Certification.

ROHS compliant

Canada Radio Certification.

CE Mark (Europe).

Contactless proximity card readers shall meet the following environmental specifications:

Operating temperature: -25 to 145 degrees F (-31 to 63 degrees C).

Operating humidity: 0% to 95% relative humidity non-condensing.

Weatherized design suitable to withstand harsh environments.

Contactless proximity card reader cabling requirements shall be:

Manufacturer: Honeywell Cable

Cable distance: (Wiegand): 500 feet (150m).

Cable type: 6-conductor #22 AWG minimum with overall foil shield and drain wire.

Standard reader termination: 18 inches (.5m) cable pigtail.

Warranty of contactless proximity card readers shall be lifetime against defects in materials and workmanship.

Product: OP10 Mini-Mullion 125kHz Contactless Proximity Card Readers as manufactured by the Honeywell Security Group:

Typical contactless proximity card read range shall be:

1.5 inches - 4 inches (3.8 - 10.2 cm) using OmniProx card

Contactless proximity card readers shall meet the following electrical specifications:

Operating voltage: 5.0 - 16 VDC, reverse voltage protected. Linear power supply recommended.

Current requirements: 60/120mA @ 12 VDC.

Contactless proximity card readers shall meet the following physical specifications:

Dimensions: 3.15 inches x 1.57 inches x 0.50 inches (80cm x 40 cm x 12.8 cm).

Material: UL94 Polycarbonate.

Two-part design with separate reader body and cover.

Color: Black, charcoal gray & ivory interchangeable bezels.

Contactless card reader shall be Honeywell OP10 compatible with selected card media.

Product: OP30 Mullion 125kHz Contactless Proximity Card Readers as manufactured by the Honeywell Security Group:

Typical contactless proximity card read range shall be:

1.5 inches - 4 inches (3.8 - 10.2 cm) using OmniProx card

Contactless proximity card readers shall meet the following electrical specifications:

Operating voltage: 5.0 - 16 VDC, reverse voltage protected. Linear power supply recommended.

Current requirements: 60/120mA @ 12 VDC.

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Contactless proximity card readers shall meet the following physical specifications:
Dimensions: 5.71 inches x 1.69 inches x 0.79 inches (145cm x 43 cm x 20 cm).
Material: UL94 Polycarbonate.
Two-part design with separate reader body and cover.
Color: Black, charcoal gray & ivory interchangeable bezels.
Contactless proximity card reader shall be Honeywell OP30 compatible with selected card media.

Product: OP40 Single-Gang (US) 125kHz Contactless Proximity Card Readers as manufactured by the Honeywell Security Group:
Typical Contactless proximity Card read range shall be:
1.5 inches - 4 inches (3.8 - 10.2 cm) using OmniProx card
Contactless proximity Card readers shall meet the following electrical specifications:
Operating voltage: 5.0 - 16 VDC, reverse voltage protected. Linear power supply recommended.
Current requirements: 60/120mA @ 12 VDC.
Contactless proximity Card readers shall meet the following physical specifications:
Dimensions: 4.33 inches x 2.95 inches x 0.59 inches (110cm x 75 cm x 15 cm).
Material: UL94 Polycarbonate.
Two-part design with separate reader body and cover.
Color: Black, charcoal gray & ivory interchangeable bezels.
Contactless proximity Card reader shall be Honeywell OP40 compatible with selected card media.

Product: OP45 Single-Gang (EU/APAC) 125kHz Contactless Proximity Card Readers as manufactured by the Honeywell Security Group:
Typical Contactless proximity Card read range shall be:
1.5 inches - 4 inches (3.8 - 10.2 cm) using OmniProx card
Contactless proximity Card readers shall meet the following electrical specifications:
Operating voltage: 5.0 - 16 VDC, reverse voltage protected. Linear power supply recommended.
Current requirements: 60/120mA @ 12 VDC.
Contactless proximity Card readers shall meet the following physical specifications:
Dimensions: 3.5 inches x 3.5 inches x 0.595 inches (88.9 cm x 88.9 cm x 15 cm).
Material: UL94 Polycarbonate.
Two-part design with separate reader body and cover.
Color: Black, charcoal gray & ivory interchangeable bezels
Contactless proximity Card reader shall be Honeywell OP45 compatible with selected card media.

Product: OP90 Single-Gang (US) 125kHz Contactless Proximity Card Vandal Resistant Readers as manufactured by the Honeywell Security Group:
Typical Contactless proximity Card read range shall be:
1.5 inches - 4 inches (3.8 - 10.2 cm) using OmniProx card
Contactless proximity Card readers shall meet the following electrical specifications:

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Operating voltage: 5.0 - 16 VDC, reverse voltage protected. Linear power supply recommended.
Current requirements: 60/120mA @ 12 VDC.
Contactless proximity Card readers shall meet the following physical specifications:
Dimensions: 4.5 inches x 3.15 inches x 0.59 inches (114cm x 80 cm x 15 cm).
Material: UL94 Polycarbonate.
Two-part design with reader body and cover.
Color: Silver.
Contactless proximity Card reader shall be Honeywell OP90 compatible with selected card media.

Product: OP95 Single-Gang (US) 125kHz Contactless Proximity Card Vandal Resistant Readers
+ Keypad as manufactured by the Honeywell Security Group:
Typical Contactless proximity Card read range shall be:
1.5 inches - 4 inches (3.8 - 10.2 cm) using OmniProx card
Contactless proximity Card readers shall meet the following electrical specifications:
Operating voltage: 5.0 - 16 VDC, reverse voltage protected. Linear power supply recommended.
Current requirements: 60/120mA @ 12 VDC.
Contactless proximity Card readers shall meet the following physical specifications:
Dimensions: 4.5 inches x 3.15 inches x 0.59 inches (114cm x 80 cm x 15 cm).
Material: UL94 Polycarbonate.
Two-part design with separate reader body and cover.
Color: Silver
Contactless proximity Card reader shall be Honeywell OP95 compatible with selected card media.

ACCESS CONTROL CREDENTIALS

Access cards shall be used with access readers to gain entry to access controlled portals (e.g.; doors, gates, turnstiles) and to hold information specific to the user and shall be Contactless Smart Card or Contactless Proximity Card technology credentials.

Contactless Smart Cards

Single Technology Access Card:

The card shall meet the following standards for contactless smart cards: ISO 15693 and ISO 14443B2.

The card shall meet ISO 7810 specifications for length, width, thickness, flatness, card construction and durability, and shall be in a form suitable for direct two-sided dye-sublimation or thermal transfer printing on the specified badge printer.

Presentation to the access control reader at any angle within a minimum of one inch (25 mm) shall result in an accurate reading of the card.

Unique 64-bit, fixed card serial number, used for anti-collision and key diversification.

The card shall support capability, with a minimum of 2 Kbits (256 bytes) of EEPROM memory or

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16 Kbits (2048 bytes) of EEPROM memory. The 2 Kbit card shall have a minimum of 2 Application Areas, and the 16Kbit shall have either 2 or 16 Application Areas to support future applications. Data retention shall be 10 years, nominal. Wiegand card data up to 84 bits in length shall be factory programmed in Application Area 1 for use with access control systems.

Each Application Area on the card shall be secured with up to a 128-bit unique, diversified security key, such that data stored in that area cannot be accessed or modified until the card and reader have completed a mutual authentication process.

The card shall be capable of completing any write operation, even if the card is removed from the RF field during that operation.

The card shall be warranted against defects in materials and workmanship for two years, or if multiple technologies are used: with a magnetic stripe the card shall have a fifteen month warranty; or with a contact chip, the card shall have a one year warranty.

Provide "smart" access cards, compatible with the specified card readers. Cards shall be encoded with Wiegand card data, at the factory.

The card shall not carry any identification showing the location of the property unless otherwise specified herein.

The card shall be capable of accepting a slot punch on one end, allowing it to be hung from a strap/clip in a vertical orientation.

Multiple Technology Access Card:

The card shall support 13.56 MHz OmniClass contactless smart chip and antenna plus any or all of the following technologies, simultaneously:

125 kHz HID Proximity chip and antenna.

Magnetic Stripe.

Embedded Contact Smart Chip Module.

The card shall be available with a 13.56 MHz OmniClass contactless smart chip and antenna plus a Wiegand Strip with an optional magnetic stripe, meeting all ISO 7810 standards except for card thickness, which shall be 0.037 inch (0.939 mm). The card will not be available with 125 kHz proximity technology and/or an embedded contact smart chip module.

Access Key Fob:

The Key Fob shall meet the following standards for contactless smart cards: ISO 15693 and ISO 14443B2.

The Key Fob shall be constructed of durable injection molded polycarbonate plastic, with a slot molded into one end, and shall be suitable for placement on a key ring.

Presentation to the access control reader at any angle within one inch (25 mm) shall result in an accurate reading of the key fob.

Provide key fobs compatible with the specified card readers.

The key fob shall not carry any identification showing the location of the property unless otherwise specified herein.

The key fob shall be warranted against defects in materials and workmanship for two years.

Access Sticker:

The Sticker shall meet the following standards for contactless smart cards: ISO 15693 and ISO 14443B2.

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The Sticker shall be a flat disc-shaped unit with a polycarbonate cover and a self-stick adhesive back.

The Sticker shall be capable of affixation to non-metallic personal items such as PDAs, cell phones, business assets, or to existing access control or identification cards for the purpose of transitioning from earlier technologies to contactless smart cards.

The Sticker shall not be used with tractor-feed (full insertion) readers.

Presentation to the access control reader at any angle within one inch (25 mm) shall result in an accurate reading of the Sticker.

The Sticker shall be warranted against defects in materials and workmanship for two years.

Provide Access Stickers compatible with the specified card readers.

The Sticker shall not carry any identification showing the location of the property unless otherwise specified herein.

Contactless Proximity Cards:

The card shall meet the following standards for contactless proximity cards:

125 kHz HID Proximity chip and antenna

The card shall meet ISO 7810 specifications for length, width, thickness, flatness, card construction and durability, and shall be in a form suitable for direct two-sided dye-sublimation or thermal transfer printing on the specified badge printer.

Presentation to the access control reader at any angle within a minimum of one inch (25 mm) shall result in an accurate reading of the card.

The card shall be capable of completing any write operation, even if the card is removed from the RF field during that operation.

The card shall be warranted against defects in materials and workmanship for two years, or if multiple technologies are used: with a magnetic stripe the card shall have a fifteen month warranty.

Provide "smart" access cards, compatible with the specified card readers. Cards shall be encoded with Wiegand card data, at the factory in 26 or 34 bit formats.

The card shall not carry any identification showing the location of the property unless otherwise specified herein.

The card shall be capable of accepting a slot punch on one end, allowing it to be hung from a strap/clip in a vertical orientation

ACCESS CONTROL CABLES

Access Control System components shall be connected using the following Honeywell Genesis Series Cables:

Shielded 6-Conductor Reader Cables: foil shielded with drain wire, stranded copper conductors: 22AWG:

General Purpose Rated: CM, CL2, Sunlight Resistant Listed: Part #: 1206.

Riser Rated: CMR, CL2R, FT4, Sunlight Resistant Listed: Part #: 2206.

Plenum Rated: CMP, CL2P, FT6 Listed: Part #: 3206.

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18AWG:

General Purpose Rated: CM, CL2, Sunlight Resistant Listed: Part #: 1216.

Riser Rated: CMR, CL2R, FT4, Sunlight Resistant Listed: Part #: 2216.

Plenum Rated: CMP, CL2P, FT6 Listed: Part #: 3216.

Unshielded 18AWG 2-Conductor Power/Door Cables: Stranded copper conductors:

General Purpose Rated: CM, CL2, Sunlight Resistant Listed: Part #: 1118.

Riser Rated: CMR, CL2R, FT4, Sunlight Resistant Listed: Part #: 2114.

Plenum Rated: CMP, CL2P, FT6 Listed: Part #: 3114.

Shielded 22AWG 2-Conductor Alarm Cables: foil shielded with drain wire, stranded copper conductors:

General Purpose Rated: CM, CL2, Sunlight Resistant Listed: Part #: 1202.

Riser Rated: CMR, CL2R, FT4, Sunlight Resistant Listed: Part #: 2202.

Plenum Rated: CMP, CL2P, FT6 Listed: Part #: 3202.

Bundled Access Control Cables: 4 components, Profusion unjacketed bundle.

Part #: 2195, Riser Rated, CMR, CL2R, FT4, Sunlight Resistant Listed.

Component 1: 22 AWG, 6 stranded conductors, shielded.

Component 2: 18 AWG, 4 stranded conductors.

Component 3: 22 AWG, 2 stranded conductors.

Component 4: 22 AWG, 4 stranded conductors.

Part #: 2295, Riser Rated, CMR, CL2R, FT4, Sunlight Resistant Listed.

Component 1: 22 AWG, 6 stranded conductors, shielded.

Component 2: 18 AWG, 4 stranded conductors, shielded.

Component 3: 22 AWG, 2 stranded conductors, shielded.

Component 4: 22 AWG, 4 stranded conductors, shielded.

Part #: 3195, Plenum Rated, CMP, CL2P, FT6 Listed.

Component 1: 22 AWG, 6 stranded conductors, shielded.

Component 2: 18 AWG, 4 stranded conductors.

Component 3: 22 AWG, 2 stranded conductors.

Component 4: 22 AWG, 4 stranded conductors.

Part #: 3295, Plenum Rated, CMP, CL2P, FT6 Listed.

Component 1: 22 AWG, 6 stranded conductors, shielded.

Component 2: 18 AWG, 4 stranded conductors, shielded.

Component 3: 22 AWG, 2 stranded conductors, shielded.

Component 4: 22 AWG, 4 stranded conductors, shielded.

Bundled Access Control Cables: 4 components, Overall jacketed bundle.

Part #: 2196, Riser Rated, CMR, CL2R, FT4, Sunlight Resistant Listed.

Component 1: 22 AWG, 6 stranded conductors, shielded.

Component 2: 18 AWG, 4 stranded conductors.

Component 3: 22 AWG, 2 stranded conductors.

Component 4: 22 AWG, 4 stranded conductors.

Part #: 2296, Riser Rated, CMR, CL2R, FT4, Sunlight Resistant Listed.

Component 1: 22 AWG, 6 stranded conductors, shielded.

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Component 2: 18 AWG, 4 stranded conductors, shielded.
Component 3: 22 AWG, 2 stranded conductors, shielded.
Component 4: 22 AWG, 4 stranded conductors, shielded.
Part #: 3196, Plenum Rated, CMP, CL2P, FT6 Listed.
Component 1: 22 AWG, 6 stranded conductors, shielded.
Component 2: 18 AWG, 4 stranded conductors.
Component 3: 22 AWG, 2 stranded conductors.
Component 4: 22 AWG, 4 stranded conductors.
Part #: 3296, Plenum Rated, CMP, CL2P, FT6 Listed.
Component 1: 22 AWG, 6 stranded conductors, shielded.
Component 2: 18 AWG, 4 stranded conductors, shielded.
Component 3: 22 AWG, 2 stranded conductors, shielded.
Component 4: 22 AWG, 4 stranded conductors, shielded.

PART 22 - EXECUTION

EXAMINATION

Examine site conditions to determine site conditions are acceptable without qualifications. Notify Owner in writing if deficiencies are found. Starting work is evidence that site conditions are acceptable.

PREPARATION

Clean surfaces thoroughly prior to installation.

Prepare surfaces using the methods recommended by the manufacturer for achieving the best result for the substrate under the project conditions.

INSTALLATION

System, including but not limited to access control, alarm monitoring and reporting, time management, and user identification cards shall be installed in accordance with the manufacturer's installation instructions.

Supervise installation to appraise ongoing progress of other trades and contracts, make allowances for all ongoing work, and coordinate the requirements of the installation of the System.

FIELD TESTING AND CERTIFICATION

Testing: The control, alarm monitoring and reporting, time management, and user identification cards shall be tested in accordance with the following:

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Conduct a complete inspection and test of all installed access control and security monitoring equipment. This includes testing and verifying connection to equipment of other divisions such as life safety and elevators.

Provide staff to test all devices and all operational features of the System for witness by the Owner's representative and authorities having jurisdiction as applicable.

Correct deficiencies until satisfactory results are obtained.

Submit written copies of test results.

PROTECTION

Protect installed products until completion of project.

Touch-up, repair or replace damaged products before Substantial Completion.

END OF SECTION

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PART 23 - GENERAL

23.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General Conditions and Division 01 Specification Sections, apply to this Section.
- B. Specifications throughout all Divisions of the Project Manual are directly applicable to this Section, and this Section is directly applicable to them.

23.2 SUMMARY

- A. The Work covered by this Section of the Specifications shall include the furnishing of all engineering, labor, materials, transportation, tools and appliances required in the performance of all operations required for the installation of a complete, fully functional and code compliant fire alarm system or system modification in the areas listed.
- B. The fire alarm system contractor must provide a system design which meets all applicable codes and all requirements of these specifications, even when those requirements are specifically in excess of minimum code requirements. Note that engineering drawings are conceptual and provide for infrastructure and basic layout of the system. The fire alarm system contractor must check the provided layout and augment the design as needed to provide a compliant system. Any design inconsistencies or conflicts within this document must be resolved through the Request For Information process. All fire alarm system related RFIs must be reviewed by the Environmental Health and Safety Department.
- C. The contractor must certify the documents they produce meet and comply with all applicable codes and the system is designed in accordance with said codes. Noting non-compliance on drawings or documents is not acceptable. Any design inconsistencies or conflicts within this document must be resolved through the RFI process.

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- D. The term "Owner" shall include a representative from the MD Anderson Cancer Center (MD ACC) Environmental Health and Safety (EH&S) department but is not limited to represent the Owner exclusively. Coordinate all activities to include all of the Owner's representatives.
- E. The Contractor shall perform all Work in accordance with the Drawings and Specifications, and subject to the terms and conditions of the Contract
- F. The approximate locations of related devices are indicated on original Drawings. These Drawings are not intended to give complete and exact details in regard to location of devices, apparatus, etc. Exact device locations and quantity are to be determined by actual measurement at the building and will in all cases be subject to the approval of the Owner. All drawing location changes, additions or deletions shall be made by a licensed fire protection engineer or licensed fire alarm planner representing the fire alarm systems Contractor, and approved by the Owner. The Owner reserves the right to make any reasonable changes in the locations indicated without additional cost. When making changes to existing systems, the record drawing for the area modified shall be updated and the updated record drawing provided to the Owner.
- G. No Work shall be performed until the Shop Drawings, calculations, and product data have been approved by the MD Anderson Cancer Center (MD Anderson) Environmental Health and Safety (EH&S) department. This will require early processing of all submittals. The Contractor is solely liable for any or material purchases made prior to this approval.
- H. All existing fire alarm equipment, wiring, devices and sub-systems that are not shown to be reused shall be removed. All existing fire alarm conduit not shown to be reused shall be removed.
- I. Fire alarm system components removed for construction shall not be reused. Fire alarm system components removed for construction shall not be indicated as existing on shop drawings.
- J. Contractor shall deliver all serviceable equipment removed to the Environmental Health and Safety Department.

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- K. Where these specifications are edited for a specific project the edits shall be reviewed for code compliance and system compatibility by EH&S.
- L. Contractor is responsible for all tools and equipment needed to perform the entire scope of work. Tools and equipment include but are not limited to ladders, scaffolding, lifts, containment cubes, barricades, safety equipment, meters, analyzers, and work carts.

23.3 TEMPORARY PROTECTION

- A. It is the intention of this section to provide for temporary fire alarm detection and notification functions in construction areas. The temporary system when installed and tested will allow for demolition of all existing fire alarm devices raceways and wiring, as required by the project scope, without need for further demolition of fire alarm system components prior to installing new raceways, wiring and devices.
- B. Fire alarm contractor shall submit a hard copy of a drawing of the proposed temporary system for review by EH&S.
- C. Where modifications to existing fire alarm devices or equipment cause Interim Life Safety Measures to remain in place for a period of time exceeding 48 hours, temporary protection shall be provided to the affected area.
- D. Temporary systems shall include detection devices such as heat detectors, notification devices and control devices as required to adequately serve the construction area.
- E. Manual alarm stations shall be installed at construction exits where egress pathways do not have an existing manual station within fifty feet of the construction exit.
- F. Where detection devices are located on the ceiling of the construction area, twenty four inches of yellow caution tape will be affixed to the wiring serving a device within six inches of the device to provide a locator of the temporary detection device. Yellow tape shall not be used for locating or identifying other ceiling mounted devices so as not to detract from detection device locators.

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- G. Existing conduit, raceways and devices not shown to be reused shall not be used to serve the temporary system devices.
- H. Temporary systems shall include wiring to active fire alarm devices beyond the construction area to allow for complete demolition of existing raceways.
- I. Temporary protection devices shall be installed in mounting boxes and secured to building structure.
- J. All wiring connections of the temporary system shall be made in junction boxes. All junction boxes shall be covered and labeled.
- K. Temporary protection installations shall be fully tested and certified by the installing contractor.
- L. Temporary protection installations shall be presented to the Environmental Health and Safety Department for acceptance before demolition or shutdown of the existing fire alarm system or devices.
- M. Temporary protection shall be left in place until the new fire alarm equipment has been tested and certified compliant and operational by the installing contractor and accepted by the owner.
- N. Temporary protection shall resemble the description in Attachment "E".
- O. Where existing fire alarm system devices are used to provide protection in the construction area, they shall not be removed until the new devices have been tested and certified compliant by the installing contractor and accepted by the Environmental Health and Safety Department.
- P. All fire alarm system devices providing protection to construction areas are to be maintained fully functional and compliant at all times. Junction boxes to remain closed at all times.
- Q. Temporary system shall comply with all other sections of these specifications.

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23.4 REFERENCE STANDARDS

- A. The latest published edition of a reference shall be applicable to this Project unless identified by a specific edition date.
- B. All reference amendments adopted prior to the effective date of this Contract shall be applicable to this Project.
- C. All materials, installation and workmanship shall comply with the applicable requirements and standards addressed within the following references:
 - 1. All Work shall comply with the applicable rules of the National Fire Protection Association, National Electrical Safety Codes, and Ordinances as well as any other authorities that have lawful jurisdiction pertaining to the Work specified herein. None of the terms or provisions of this Specification shall be construed as waiving any of the rules, regulations or requirements of said authorities.
 - 2. Contractor shall comply with the Texas Insurance Code Article 5.43-2 Fire Detection and Alarm Devices and Title 28 TAC 34.600 the Fire Alarm Rules
 - 3. The complete installation is to conform to the applicable sections of NFPA 72, NFPA 90A, NFPA 99, Local Code Requirements, NFPA 70 the National Electrical Code with particular attention to Article 760.
 - 4. Additionally, the entire installed system and all integrated system operations shall be within the guidelines of International Building Code, and the American with Disabilities Act, Public Law 101-336.
 - 5. All control equipment shall have transient protection devices to comply with UL864 requirements.
 - 6. The system controls shall be UL listed for Power Limited Applications per NEC 760. All circuits shall be marked in accordance with NEC 760-23.
- D. In any instance where these Specifications call for materials or construction of a better quality than required by the codes, the provisions of these Specifications shall take precedence.

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23.5 QUALITY ASSURANCE

- A. Each and all items of the fire alarm system shall be listed as a product of a single fire alarm system manufacturer under the appropriate category by Underwriters' Laboratories, Inc. (UL), and shall bear the "U.L." label. All control equipment shall be listed under both UL category UOJZ Control Units System as a single unit and under UL category APOU Proprietary Alarm Units. Service under APOU shall be Grade A. Partial listings, or multiple listings for various major sections of the control, shall not be acceptable.
- B. The installation shall be performed by a company specializing in installing the products specified in this Section with a minimum of five years of experience, and certified by the State of Texas as fire alarm installers.

23.6 SUBMITTALS

A. General:

- 1. Submittals must conform to requirements of Section 26 01 00 and Division 01.
- 2. The contractor shall furnish a full sized hard copy of the entire fire alarm submittal, with drawings, to the Environment Health and safety Department for review. This hard copy shall be in addition to any on line, database or electronic version requirements. No revised shop drawings are to be delivered to the field without prior review of the revisions by EH&S.
- 3. If the original submittal or any subsequent submittal is not accepted by the Environmental Health and Safety Department, a resubmission of a hard copy of the entire fire alarm submittal must be provided to the Environment Health and safety Department for further review.
- 4. The fire alarm system shall comply with these specifications and all applicable codes. Acceptance of the fire alarm system submittal does not exempt the contractor from full compliance with the contract documents.
- 5. An electronic version of the submittal shall be provided.
- 6. Submittals shall include the MD Anderson project number on the cover page.
- 7. All products submitted shall conform to all aspects of these Specifications. Non conforming products may cause the submittal to be rejected.

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8. Submittals shall include device installation instructions as well as the product data sheets to allow for verification of compliance with NFPA 70.760.130 B & 70.110 .3 B.
9. Submittal shall include description of warranty service indicating compliance with all warranty requirements specified in this document.
10. Contractor shall not submit disclaimers or exclusions which may result in a fire alarm system which is not complete, or a fire alarm system which is not fully operational, or a fire alarm system which is not code compliant, or a fire alarm system which does not comply with these specifications. Disclaimers which conflict with these specifications shall not be considered valid.
11. Submittals shall include any requests for information (RFIs) and the responses to the requests. Unsigned or unidentified responses are not valid.
12. Submittals shall include a list of manufacturer representatives responsible for the design, installation and service of the installation.
13. Contractor shall not submit equipment for which the contractor does not maintain a local stock which is immediately available for service requirements.

B. Furnish information on the complete scope of work including:

1. Design and engineering responsibilities.
2. Equipment and products provided.
3. Installation and start-up details.
4. Testing and commissioning responsibilities.
5. System certification.
6. Warranty details.

C. Owner's Pricing Detail:

1. Submittal shall include a complete bill of materials listing all material quantities and unit prices identifying components by manufacturer's part number.
2. Submittal shall include the unit costs and extended costs of each item listed in the bill of materials.

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3. Pricing detail shall resemble Attachment "A".
4. Contractor shall submit separately and directly to Owner a pricing breakdown of all cost associated to Project for review. This is to include but not be limited to material quantity, description, unit list price, multiplier, cost, extended cost, material costs adjustment less Owner's discount price, outside material price totaled and itemized, itemized subcontract price associated to Project, and total Project support price.
5. Contractor labor hour quantities shall be itemized by mechanical labor, electrical labor, field programming labor and design and management labor. Hour quantities shall be itemized by journeyman rate, technician rate and design/management rate with quantity of hours listed separately. Programming hours shall be listed separately from other hours using the same rate such as panel terminations etc.
6. All estimated overtime shall be disclosed. Profit for Project shall be disclosed. Total Project price shall not exceed the sum of the listed itemized costs.
7. This pricing summary, including any attachments, is intended only for the Owner and contains confidential and/or privileged information. Any unauthorized review; use, disclosure or distribution is prohibited.
8. Where temporary protection devices are included, they shall be labeled as such in the pricing detail.

D. Sequence of Operations:

1. Submittal shall include a complete written sequence of operations of all functions of the system.
2. In addition to the written sequence of operations, all sequence functions shall be depicted using a sequence of operations dot matrix chart of all functions showing how the system will react to the activation of each type of device, as recommended by NFPA 72.
3. The MD Anderson campus consists of multiple buildings using various system matrixes. The submittal must include a matrix which is applicable to the building and scope of work.
4. Submittal shall include details of all interfaced functions. Details shall include all fire alarm system functions and interconnections applicable to each interface. Each individual function shall be referenced in the sequence of operation.

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E. Drawings:

1. Prepare drawings using AutoCAD software and include all Contractors' information. The Contractor shall be responsible for verifying all critical dimensions shown on the drawings provided by the Architect.
2. Drawings shall include title blocks with contractors name, address, telephone number and license number.
3. Drawings shall include a title page with an accurate legend of symbols for all fire alarm devices installed. The legend must include the model and quantity for each device.
4. Floor plans: Provide locations for all devices (with device number at each addressable device corresponding to control unit programming), appliances, panels, power boosters, equipment, junction / terminal cabinets, risers, electrical power connections individual circuit and raceway routing, number size and type of raceways, and conductors in each raceway. Conduit fill calculations with cross section area percent fill for each type of conductor and raceway. Show all interfaces for all fire safety functions.
5. Drawings shall include a reference list of all equipment panels, NAC panels, terminal panels, control panels with areas served and locations indicated by room number.
6. Any devices removed from the fire alarm system during construction shall not be referred to as existing devices on drawings. All devices installed shall be new.
7. Device placement on drawings shall be in accordance with section 3.02 of these specifications.
8. Drawings shall include elevations of all wall mounted equipment.
9. Drawings shall include a list of all remote power supplies including location by room numbers.
10. Raceways and raceway junction boxes shall be indicated on fire alarm shop drawings. Coordination between trades may be necessary.
11. Where junction boxes contain wiring splices the boxes shall be identified on the fire alarm shop drawing.

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12. Floor plans shall show the entire project area and connections to existing system. All fire alarm devices (new and existing) shall be shown. A demo page may be used to show existing devices.
13. Floor plans shall show room numbers and use for each room.
14. Floor plans shall clearly show and identify all fire or smoke rated walls within the construction area. Coordinate with construction documents.
15. Floor plans shall show details and UL listing numbers of fire stop systems used at all penetrations. Coordinate with construction documents and other trades as necessary.
16. Riser diagrams: Provide, for the entire system, the number, size and type of riser raceways and conductors in each riser raceway and number of each type of device per floor and zone. Show door holder interface, elevator control interface, HVAC shutdown interface, fire extinguishing system interface, and all other fire safety interfaces. Show wire styles on the riser diagram for all circuits. The riser schematic shall show locations of all control panels, transponder cabinets, terminal cabinets, NAC power supplies. Locations shown shall be identified by room number.
17. Detail: Show campus network interface detail including all modems and interconnections necessary for a fully functional network interface.
18. Detail: Show connection to campus voice system and remote speaker circuit selection switches. Include detailed schematic of all components necessary to for a fully functional voice control and delivery system. Show all interconnection details for the integration with the existing voice panel in monitoring services and the voice panel in room R2.2743 indicating which switches will be used for speaker selection, wiring paths connection boxes, modems, equipment etc.
19. Detailed wiring diagrams: Provide for control panels, modules, power supplies, electrical power connections, auxiliary relays, and annunciators showing termination identifications, size and type conductors, circuit boards, LED lamps, indicators, adjustable controls, jumpers, switches, connectors, harnesses terminal strips and connectors. Diagrams shall be drawn to a scale sufficient to show the spatial relationships between components, enclosures and equipment configuration.

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20. Prior to performing the final acceptance test the Contractor shall deliver to the Environmental Health and Safety representative: one (1) set of reproducible, Record Drawings two (2) blue line copies and one (1) set of the Record Drawing computer files using AutoCAD. Record Drawings shall show all new and existing conduit and wiring used for the fire alarm system.
21. Contractor shall provide complete system point-to-point wiring diagrams with appropriate terminal designations and schematics for all components provided and for interfaces to equipment and cabling supplied under other Divisions or by the Owner.
22. Drawings shall indicate source of power at each device for any device requiring fire alarm system power for operation.
23. The name of the Fire Alarm System Planner providing the manufacturer's Drawings.
24. A listing of the manufacturer's representative responsible for installation, coordination and service.
25. Contractor's wire marking schedule.
26. When visual notification devices are added to existing systems the submittal shall include a power availability analysis showing the intended source of power, the notification circuit capacity and standby power availability.
27. Submittal shall include battery calculation sheets for all fire alarm control panels and auxiliary power supplies. Battery calculation shall include all electrical requirements of the entire fire alarm system, including the power consumption of the individual devices, both in alarm and supervisory modes.
28. Equipment and design submitted shall comply with all referenced codes and standards. Any deviation from codes and standards must be approved by Owner and documentation of that approval must be included in the submittal.
29. When audible notification devices are added to existing systems the submittal shall include a power availability analysis showing the intended source of audio, the amplifier used, the notification circuit capacity and standby power availability. All manufacturers' data pertaining to audible circuits such as noise suppression and wiring limitations shall be included in the submittal.
30. Changes to contract drawings shall be submitted to EH&S for review and acceptance. Installation shall be as per the approved drawings only.

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31. No revised shop drawings are to be delivered to the field without prior review of the revisions by EH&S.

F. System Design Details:

1. The submitted design shall meet all applicable codes and standards. Contractor shall submit all necessary requests for information to meet this requirement.
2. Submittal shall include voltage-drop calculations for all notification appliance circuits. Maximum voltage drop shall not exceed 10 percent of the system supply voltage.
3. Where voice communication systems are required by code, the voice communications system shall be designed to meet the intelligibility standard.
4. Design shall include identification of all acoustically distinguishable spaces (ADS) and these spaces shall be indicated on the fire alarm system shop drawings. Each ADS shall be identified as requiring or not requiring voice intelligibility.
5. Where stairwell pressurization fan operation requires a Fire Fighters Smoke Control Station called for in NFPA 92A the operation of the Fire Fighters Smoke Control Station may be independent from the Building Fire Alarm System or it may be integrated with the Building Fire Alarm System. The Building Fire Alarm System shall perform all required smoke detection, duct smoke detection and stairwell fan activation in either case. When integrated with the building fire alarm system the Fire Fighters Smoke Control Station shall be detailed in the fire alarm system submittal. Where the Fire Fighters Smoke Control Station is an integral part of the building fire alarm system it shall comply with all additional requirements of NFPA 92A. The Fire Fighters Smoke Control Station shall include separate switches for required manual fan activation and deactivation and separate switches for optional manual override after shutdown from the duct smoke detector. Fire Fighters Smoke Control Station off normal and trouble status shall be indicated on the building fire alarm system. Where the Fire Fighters Smoke Control Station is submitted separately from the building fire alarm system it shall not be directly connected to the building fire alarm system. Interface with a Fire Fighters Smoke Control Station not included in the building fire alarm system submittal shall be interfaced with the Building Fire Alarm System via dry contacts. Fire Fighters Smoke Control Station shall include all field wiring and devices necessary to perform all functions independent from the building fire alarm system.

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6. Where power operated doors are required to be interfaced with the fire alarm system, dedicated smoke detectors, installed according to NFPA 72 and section 3.02 of these specifications, detectors for door release shall be used to initiate the signal for deactivation of the manual power open function. This signal is in addition to a general by floor alarm signal which will signal the powered door operator to close the doors. Two separately programmable fire alarm system relays shall be required to provide this feature.
7. Magnetic door holders and automatic door interface relays shall be powered from and controlled by dedicated door control NACs as per section 2.07 H.
8. Where relays are used the relays shall be normally in the non-operated mode and shall activate upon alarm.
9. The submittal shall include detailed description of methods used to ensure compliance with voice intelligibility standard.
10. Where structured cabling method is used, submittal shall include detailed description of the specific method used and a complete list of fittings.
11. All device labels displayed at system control panels and annunciators shall conform to the standard MDACC format listing the building acronym, floor level and room number with corridor or special designator. Example: HMB7.2421 Corr. See attachment "C". All control points, initiation points panel names etc. shall include location by room number designator.
12. Include room location in all displayed transponder, node, NAC or equipment labels.
13. Contractor shall furnish and install a drawing print hanger and brackets on the wall in the fire command room. The hanger shall have the capacity to accommodate a complete set of fire alarm system drawings thirty inches by forty inches. The top of the hanger brackets shall be at 52 inches above the finished floor. The brackets shall hold the drawings flat against the wall. This requirement applies to new fire command rooms or existing fire command rooms where no brackets or hangers are present.

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14. When sprinklers are installed in elevator equipment rooms, the electrical power to the elevator controller must shut down prior to sprinkler activation. A heat detector shall activate an independently controlled shunt trip circuit breaker (provided and installed by the Electrical Contractor) when the temperature in the machine room exceeds the setting of the heat detector. The detector shall have both a lower temperature rating and a higher sensitivity (lower Response Time Index) as compared to the sprinkler. Heat detectors used to shut down elevator power prior to sprinkler operation shall be placed within two (2) feet of each sprinkler head and connected to the fire alarm control panel. Electric power for initiating shunt trip shall be monitored by the fire alarm system at the point where the power is switched by the fire alarm relay. Where multiple shunt trip relays are used, the power at each relay shall be monitored..
15. Where audible notification devices are added to an existing system, the design shall include a power availability analysis showing the intended source of the audio, the amplifier used, the amplifier's current and proposed power usage, the notification circuit capacity and standby power availability.
16. Where a specialized tone is required in a specific building area, the voice system may be designed with a dedicated amplifier and tone source to provide the specialized tone as an alternative to designing an entire multi-channel system. Such alternative shall have the capability to provide all voice messaging functions.
17. Where fiber optic modems are installed, the modem power supply and battery backup shall be independent of the fire alarm system power supplies to allow for fire alarm panel servicing without network interruption.
18. The fire alarm system control panel shall not contain amplifiers or NAC circuits or SLC circuits or door controls. The building fire alarm control panel shall contain system control equipment only.
19. Fire alarm system programming shall not include timing functions for interfaced equipment. The fire alarm system shall not be used to sequence events such as time of day security, shunt trip delays, etc.

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20. AHU shutdown relays shall be provided where air handler shutdown is required. The shutdown relay shall be controlled by either a supervised NAC circuit, independently controlled programmable supervised duct detector output circuit, or I/O point circuit. The shutdown relay shall not be controlled by an electronic control module. Each shutdown relay shall have two sets of form C contacts, the first set to be used for the shutdown signal and the second set used for notification to the building automation system. The shutdown relay shall be located adjacent to the controller for the AHU.
21. Where the building automation system requires signals in addition to the AHU shutdown signal, the additional signals shall be provided through a backnet interface.
22. Where the system design does not require a controlled output from a specific duct detector, a duct detector without the optional output circuit shall be installed.
23. System power supplies shall not be used for door holders. Provide stand-alone addressable NACs for door holder power and switching.
24. Stand-alone power supplies shall not be used to provide power for control panel equipment or cards including I/O cards and I/O output power.
25. Remote test stations shall not be installed on any system detector.
26. Smoke detectors shall be installed in all exit access corridors, electrical rooms, storage rooms, telecommunications rooms, shops, laboratories, and at all fire alarm equipment and control panel locations including NAC panel locations.
27. Corridor smoke detectors shall be installed within five feet of any cross corridor door on each side of the door.
28. Smoke detectors shall be installed within ten feet of any stairwell door where the stairwell has a stairwell pressurization fan.
29. Smoke detectors shall be installed within five feet on each side of any door requiring an interface with the fire alarm system.
30. Smoke detectors shall be installed and located as required for all auxiliary functions requiring smoke detection including but not limited to stairwell pressurization, elevator recall, door release, fire shutters, smoke damper control, plenum smoke return etc.

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31. Building fire alarm system notification device shall be installed in MRI rooms in addition to any pre action notification device.
32. Where power operated doors are required to be interfaced with the building fire alarm system, dedicated smoke detectors, installed in accordance with "NFPA 72 detectors for door release" shall be used to initiate the signal for deactivation of the manual power open function. This signal is in addition to a general by floor alarm signal which signals the powered door operator to close the doors. Two separately programmable fire alarm system relays shall be required to provide this feature.
33. The fire alarm system shall automatically unlock all egress doors upon alarm detection as required by code allowing for immediate egress and stairwell reentry. Manual signaling for door release or stairwell reentry from a switch in the fire command center shall not be a function of the fire alarm system.

G. Record Documents

1. In addition to the manuals required elsewhere in the documents, prior to Substantial Completion, fire alarm systems Shop Drawings shall be upgraded to Record documents including labeling, program, and wiring details. One (1) set of reproducible masters and Drawings on a CD in a DXF format shall be provided to the Owner for their use.
2. Contractor shall provide a site specific list of service repair part numbers for all system components. Standard manufacturer's service repair parts list is not acceptable. The part numbers provided shall be the only numbers needed to order correct replacement parts. All system components shall be identifiable by a permanent part number. The exact parts used on site shall be listed with the correct service part number. The site specific list shall include a cross reference from the component identification number to the correct replacement part order number.
3. All documents required by code and these specifications shall be included in the record documents. The record documents shall be available at the final acceptance test.

H. Disclaimers or Exclusions:

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1. Contractor shall not submit disclaimers or exclusions which may result in a fire alarm system which is not complete, or a fire alarm system which is not fully operational, or a fire alarm system which is not compliant or a fire alarm system which does not comply with these specifications. Disclaimers which conflict with these specifications shall not be considered valid.

23.7 MATERIAL STORAGE

A. MD Anderson does not provide storage facilities except for onsite storage as directed by the project manager.

1. All contractor-provided equipment and components shall be new and packaged in unopened manufacturer's packaging. Components in open packages or delivered loose to the jobsite shall be considered used and not acceptable for installation unless specifically approved by the Environmental Health and Safety department on a case by case basis.
2. Equipment, components, tools and materials shall be stored on the jobsite as directed by the project manager.
3. Equipment, tools, components and materials shall not be stored in mechanical rooms, or electrical rooms, or air chases, vacant rooms or any other location except the project site as directed by the project manager.
4. The contractor shall protect from damage all equipment stored on the project site.
5. All equipment and components stored on MD Anderson property by the contractor shall be for designated MD Anderson projects only. All equipment, materials, and component cartons shall be marked with the MD Anderson project number for which they are designated.

23.8 EXTRA MATERIALS

A. Refer to Section 01 78 46 for Maintenance Material Requirements.

- 1.

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23.9 WARRANTY

- A. Contractor shall warrant the completed fire alarm system wiring and equipment to be free from inherent defects for a period of one (1) year after system acceptance. The Owner shall determine the date of acceptance. The acceptance date shall not come before substantial completion of the system. The acceptance date shall not come before the system has been completely tested and certified. The acceptance date shall not come before written acceptance by the MD Anderson Cancer Center (MDACC) Environmental Health and Safety (EH&S) department.
- B. The Owner reserves the right to make changes to the fire alarm system during the Warranty Period. Such changes do not constitute a waiver of warranty. Contractor shall warrant parts and installation work regardless of any such changes made by Owner, unless the Contractor provides clear and convincing evidence that a specific problem is the result of such changes to the fire alarm system. Any disagreement between Owner and Contractor on such matters shall be subject to resolution through the Contract 'Disputes' clause.
- C. Contractor shall maintain an immediately available local stock of all replacement components necessary for emergency warranty repairs.
- D. Contractor shall provide a site specific list of service repair part numbers for system components. Standard manufacturer's service repair parts list is not acceptable. The exact parts used on site shall be listed with the correct service repair part numbers.
- E. Contractor shall provide written documentation of all warranty service to the Environmental Health and Safety office. Documentation shall include a description of repairs, any component replaced and the cause of any component failure.

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- F. Contractor shall maintain a record of warranty repairs on site. The specific location shall be the R2 2743 fire command room. Contractor shall provide a record for each warranty service call. The record maintained at this location shall include the time and date the warranty service was requested by MDACC, the time and date the onsite service was initiated, times and dates of any suspension of active corrections prior to the service problem being corrected and the reason for the suspension of service, the time and date of the final completion of the service, the name(s) of the responding technician(s), the exact reason of system or component failure. The building for which the service was provided shall have the appropriate service sticker attached to the control panel.
- G. The equipment manufacturer shall make available to the Owner a maintenance Contract proposal to provide a minimum of two (2) inspections and tests per year in compliance with NFPA-72 guidelines.
- H. Repair service shall be provided 24 (twenty-four) hours per day. Request for routine service and /or repairs shall be responded to within six (6) hours. Emergency request for service and/or repairs shall be responded to within six (6) hours. The contractor shall arrive on site within six hours of a request for warranty service.
- I. The responding technician shall be qualified to work on the warranted equipment and have all the tools and equipment necessary to repair the system, programming or components.
- J. In the last month of the Warranty Period, all System software and firmware, software, drivers, etc. will be upgraded to the latest release (version) in effect at the end of the Warranty Period.

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- K. At any time during the Warranty Period that Contractor is on Site for maintenance, emergency, or normal service, Contractor shall notify Owner via MD Anderson Monitoring Services or directly to the fire safety supervisor. Contractor shall notify said personnel of all work anticipated being involved for the service work. In addition, no work affecting system operation shall commence until express permission is granted. After the work is completed a work order ticket describing in detail all work performed (i.e. hardware replaced or serviced, software or firmware modifications made, etc.), hours worked, follow-up work required, etc., must be signed by an authorized building manager. Service tickets shall include an explanation of the cause of any component failure. The warranty service record at R2.2743 must be updated with all required details of the service call.

PART 24 - PRODUCTS

24.1 GENERAL

A. System

1. All materials shall meet or exceed all applicable referenced standards, federal, state and local requirements, and conform to codes and ordinances of authorities having jurisdiction.
2. Each system shall include all components necessary to meet interface requirements with other systems identified in these specifications.
3. All panels and peripheral devices shall be the standard product of a single manufacturer.
4. Each system shall include all control center panels, transponders, manual pull stations, smoke detectors, heat detectors, speakers, strobe lights, horns, fire phones, wiring, outlet boxes, and all the necessary material for a complete operating system. The panels and peripheral devices shall be compatible with and interface via one of the existing fire alarm system networks.
5. The system shall have sufficient capacity to incorporate all equipment and perform all functions as stipulated within these Specifications and the Drawings for this Project.

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6. The fire alarm system shall allow for loading or editing special instructions and operating sequences as required. The system shall be capable of onsite programming to accommodate and facilitate building parameter changes or changes as required by local codes.

B. Fire Alarm Control Panel

1. The Central Processing Unit (CPU) shall be compatible with the existing MDACC networked systems.
2. The alphanumeric display, keyboard and printer shall be operational on battery standby power.
3. Building control panels shall have the large expanded display.
4. Control panels shall be installed so that the readable portion of the panel display is not more than sixty six inches above the finished floor and not less than 60 inches above the finished floor.
5. The fire alarm control panel shall be equipped with all software, firmware, and hardware necessary to communicate to associated network nodes and receive audio voice messages from remote network locations over fiber optic connections. Listed fiber optic modems may be used to meet this requirement. The fire alarm contractor shall demonstrate this functionality at the time of the acceptance test.
6. The fire alarm system controls shall contain all custom message firmware, hardware and software necessary for the delivery of the MD Anderson custom voice messages including DR. Red announcements, drill announcements, all clear announcements and testing announcements. Actual messaging delivered upon alarm conditions shall be building specific and selectable on Site. Voice messaging shall initiated by password protected switch inputs on the face of the voice control panel. Text for voice messages shall match that of Attachment "B".
7. The fire alarm system controls shall contain the custom MD Anderson multilevel test functions. The test functions include floor test, notification device test, AHU/damper test, door test, elevator test and sprinkler test. Selection of test features shall be by password protected switches on the main fire alarm control panel. Test features shall perform as outlined in Attachment "D".
8. Each fire alarm control panel, equipment cabinet, transponder cabinet, terminal cabinet, battery cabinet or fire phone cabinet, shall be identified with a plastic tag permanently affixed to the cabinet and engraved with 1 inch letters identifying the cabinet.

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9. To accommodate and facilitate Project Site changes, notification appliance circuits shall be individually configurable on Site to provide selective alarm, general alarm; evacuation, alert, test or no alarm, supervised door release, fan, or damper control. All audio appliances installed shall have the capability to transmit voice messaging, i.e. speakers, but may be installed to transmit tones only where appropriate and when the MD Anderson EH&S department has authorized to do so in writing prior to bid approval.
10. All panels and peripheral devices shall be the standard product of a single manufacturer and shall display the manufacturer's name on each component.

C. Equipment Enclosures

1. The fire alarm control panel electronics shall be housed in a cabinet(s) of sufficient size to accommodate the specified equipment. The cabinets shall be equipped with locks and transparent door panel(s) which will prevent tampering and allow full view of the system controls.
2. Fire alarm equipment cabinets other than the main control panel shall be equipped with locks and a solid door to prevent tampering. All system cabinets shall be keyed alike.

D. Wiring

1. The system wiring shall consist of a communications network to interlink all transponders to the main system controls; and a multi-addressable peripherals network to interlink fire alarm devices to the transponders. The system shall use addressable peripheral devices communicating over digital communications circuits to minimize wiring and to maximize system expansion without the need to make an additional home run to the control panel. Each digital circuit shall not have more than 50 percent of its capacity used during initial installation so that space is available for future expansion.
2. All exposed fire alarm wiring installed above ceiling, on the surface of ceiling, in open raceways, on sidewalls or fished in concealed spaces shall be red in color. This applies to all fire alarm system circuits including but not limited to S.L.C. circuits, initiation circuits, notification circuits, control circuits, door holder circuits, fireman's telephone circuits, auxiliary power circuits, hardwired network communication circuits and annunciator circuits. It is the intent of this specification that all exposed fire alarm system wiring is readily identifiable by color.
3. All data wiring serving peripheral devices shall be shielded style wire.

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4. All speaker circuits shall be shielded style wire.
5. All telephone circuits shall be shielded style wire.
6. All wiring shields shall be free of grounds and the shield shall be continuous throughout the circuit.
7. Installation of wiring and peripherals shall be in accordance with recommendations of the manufacturer of the material being installed.
8. Where wiring is required to be run underground or in the slab, direct burial type cable shall be run in conduit. All wiring run underground or in slab shall be tested for insulation integrity and the results of the integrity test shall be recorded in the record documents.
9. Where wiring is required to be run underground or in the slab, the conduit shall be marked at each entry with the next remote exit location. System drawings shall clearly show each entrance to the slab or underground and note the corresponding exit.
10. Contractor shall furnish and install a drawing print hanger and brackets on the wall in the fire command room. The hanger shall have the capacity to accommodate a complete set of fire alarm system drawings thirty inches by forty inches. The top of the hanger brackets shall be installed at a height of fifty-two inches above the finished floor. This requirement applies to new fire command rooms or existing fire command rooms where no brackets or hangers are present.
11. The fire alarm control panels, the remote transponder cabinets, terminal cabinets and equipment cabinets shall be accessible for maintenance without special tools or ladders. Clearance around panel locations shall allow for the panel doors to be opened fully as designed by the equipment manufacturer. All fire alarm cabinets shall be keyed alike. All keys shall be delivered to the environmental health and safety representative at the time of the acceptance test. Back boxes shall be installed so that the readable portion of the panel display is not more than sixty six inches above the finished floor and not less than 60 inches above the finished floor.

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12. A terminal cabinet shall be installed adjacent to each equipment cabinet. The terminal cabinet shall be keyed alike with the control panel. All field wiring serving the equipment cabinet including data circuits, notification circuits, and other data and power wires, shall be terminated in this panel and shall be permanently labeled. Writing on the wiring insulation with a marking pen as a method of labeling shall not be acceptable. Labels shall indicate the circuit number and the area served. This cabinet shall be accessible without special tools or ladders. Terminals in this cabinet will allow wiring to be disconnected for the servicing of individual circuits. Panel doors shall be a hinged door. Terminal cabinets and other fire alarm equipment shall be installed adjacent to, not above or below the equipment panels. Existing cabinets shall be expanded to provide sufficient terminals for any additional wiring added to the equipment cabinet. The terminal cabinet shall be used for wiring terminations only and shall not be used to house system components, relays, modules etc. The minimum size of any terminal cabinet shall be 24 inches by 24 inches and the cabinet shall be of sufficient size to allow for the expedient disconnection of an individual circuit without interruption of any other circuit. All terminals used shall be securely mounted to the backplane of the terminal cabinet. A minimum of 30 percent unused terminal capacity shall be provided in the terminal can. A 24 inch by 24 inch terminal cabinet shall have a minimum of six inches of clearance between the conduit entrance at the top of the cabinet and the top of the terminal strip to allow for wire routing. Where conduits enter at the sides or bottom of the cabinets additional six inches of clearance shall be provided at these locations. Where terminal cabinet size increases the clearances required shall also increase at a ratio of three inches additional clearance for each additional twelve inches of cabinet size.

E. Remote Dialers

1. Wherever a fire alarm control panel is installed in a building which cannot be served by the fire alarm network communications loop the following equipment shall be provided for alternate reporting to both the Monitoring Services Control Room, Main Campus and Knight Road locations:

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- a. **An automatic telephone communicator shall be provided to facilitate remote reporting. The communicator shall be a Silent Knight Model 5104 fire control communicator. The dialer shall be installed in the fire command room or in the telephone communications room if no fire command room is present. The dialer shall be programmed to report primarily to the receiver in Monitoring Services and to the receiver at the Knight Road location.**
- b. **Three (3) relays shall be provided at the dialer location, one (1) to activate upon alarm, one (1) to activate upon a system trouble condition and one (1) to activate upon a supervisory condition. The relays shall be permanently labeled as to their function. The relays shall be controlled from the fire alarm control panel and connected to the panel via supervised signaling circuits. Wherever relays are used the relay shall include an LED indicator which indicates the activated state of the relay. The LED indicator shall allow for visual verification of relay activation without disassembly of the relay or the relay enclosure.**
- c. **The dialer shall be connected to the public switched telephone network upstream of any private telephone system at the protected premises. Two (2) telephone lines, a primary line and a secondary line, shall be provided for the dialer. The telephone lines shall be terminated at the dialer location using RJ31X style jacks.**

24.2 MANUFACTURERS

- A. Simplex.
- B. Edwards Systems Technology (EST).
- C. Silent Knight Model 5104 fire control communicator (dialer).
- D. Acceptable Substitutions:

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1. Wherever a specific vendor's name, type and model number is given and the option of an acceptable solution is specifically stated, all substitutions submitted by the Contractor shall be approved in writing by the MD Anderson EH&S department. Any fire alarm CPU installed must be either EST or Simplex brand in order to maintain complete functionality of each network. Any auto dialer installed must be the Silent Knight model designated in these specifications.
2. The fire alarm system installed shall interface and transmit comprehensive data and control signals beyond alarm, trouble and supervisory signals with the existing Simplex or EST network. There shall only be no more than (2) different brands of fire alarm networks in total at MD Anderson.
3. Where renovations occur in a building, the entire alarm system for that building shall be of one manufacturer and must fully integrate with either the existing Simplex network (i.e. be a Simplex brand system) or EST network.

24.3 OPERATION

A. Fire Alarm Control System Network:

1. Each Fire Alarm Control Panel shall operate as a proprietary local system.
2. Each fire control panel, voice control panel or network node shall be equipped with a display panel. CPUs shall not be installed without a display panel.
3. The building Fire Alarm Control Panel shall have an expanded display.
4. Under normal condition the front panel shall display the current time and date.
5. Note requirements for remote annunciation at both central monitoring stations (Main Campus monitoring services and Knight Road UTPD locations) and at the R2.2743 and B1.4351 locations.
6. The panel shall display the following information relative to the abnormal condition of a point in the system:
 - a. **Custom location label (40 Character minimum).**
 - b. **Mnemonic identifier or associated nametag.**
 - c. **Point status (i.e., alarm, trouble).**

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d. Priority banner (Fire, Security).

- B. The Fire Alarm Control Panel shall have a printer and shall print the following information relative to the abnormal condition of a point in the system:
 - 1. Custom location label (40 Character minimum).
 - 2. Mnemonic identifier or associated nametag.
 - 3. Point status (i.e., alarm, trouble).
 - 4. Priority banner (Fire, Security).
- C. Systems not capable of such a printer on the fire alarm control panel faceplate shall include a printer meeting the above requirements and battery backup for printer. The printer shall be located at the fire alarm control panel location.
- D. Fire alarm control panels shall include a fire drill, test and inspection program. The manufacturer shall provide a two-step test program that shall be incorporated into each system to allow for fire drills, annual tests, and inspections. The program shall function uniformly with the existing programs now in use by the Owner (further detail will be supplied to the Contractor upon request). Should the test feature be on for an inappropriate amount of time (manually adjustable), the program shall automatically print out a trouble alarm, which will require operator acknowledgment every thirty (30) minutes until the system is restored to normal operation. The test program shall include a by floor test function as the first stage and switch selected notification, AHU, door, elevator and sprinkler test functions as the second stage. Test features shall perform as outlined in Attachment "D".

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- E. Fire alarm control panels shall include a network disconnect function to allow for testing and maintenance without disruption to the overall network. The fire alarm control panel shall include a network bypass function which isolates that system and that system's associated nodes from its network and closes the network loop as a single function. The network disconnect function shall be initiated by a password protected switch at the control panel location. The disconnected system shall continue to function as a complete building system without interruption between that building system's nodes. The network shall continue to function normally except that a node missing trouble shall be displayed for each disconnected node.

24.4 ALARM SEQUENCE

- A. Fire Alarm Detection and Control: System alarm operation for any manual or automatic fire alarm initiating device activation shall be as follows:
 - 1. The "PRIORITY 1 ALARM" LED shall flash on the fire alarm control panel in the building Fire Command Room and at the Monitoring Services Control Room, the UTPD monitoring station and at the R2.2743 and B1.4351 locations until the alarm has been manually acknowledged. When the alarm has been acknowledged, this same LED shall latch on. A subsequent alarm received after any acknowledgment shall again flash the same LED.
 - 2. The source of alarm shall be annunciated via an English language description on the alphanumeric display at the fire alarm control panel in the following locations:
 - a. **Fire Command Room**
 - b. **Monitoring Services Control Room**
 - c. **UTPD Monitoring Station**
 - d. **Room R2.2743**
 - e. **Room B1.4351**

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3. All alphanumeric device labels shall follow the standard MD Anderson label format and are subject to the approval of the Environmental Health and Safety representative. Any labels not approved by Environmental Health and Safety prior to installation are subject to reprogramming at the contractors expense. Label format shall be as shown in Attachment "C".
4. All fire speakers and all fire strobe lamps on the floor of alarm, the floor below and the floor above shall be activated.
5. All door holders, fire shutters and automatic smoke dampers shall be released on the floor of the alarm.
6. Where communicating spaces connect multiple floors, all connected floors shall be considered the floor of alarm for sequencing purposes
7. Where door release on multiple floors is required due to communicating spaces, the doors shall be programmed to release from the affected floors and not from a general alarm condition.
8. Doors in exit passageways or stairwell doors shall close upon general alarm initiated from any initiating device.
9. All alarm conditions shall be visually indicated at the system control panel and at the Monitoring Services Control Room, the UTPD monitoring station, and at the R2.2743 and B1.4351 locations.
10. In addition to network annunciation requirements, all Fire Alarm Control Panel alarm trouble and supervisory signals shall be annunciated at the backup annunciator at the Monitoring Services Control Room. This backup annunciator will sound the general campus alarm and trouble chime and flash the general campus alarm and trouble strobe unit. All fire alarm control panels must interface with this unit to facilitate the general campus alarm signal and local acknowledge. Contractor shall provide all modems, hardware, control equipment and interface equipment to make this interface fully functional.
11. All alarms shall be recorded with the time and date on the fire alarm control panel printer at the building Fire Command Room.
12. The alarm activation of any two elevator lobby smoke sensors in an elevator lobby shall, in addition to the operations listed above, initiate a signal to the elevator controls to cause the elevators to be recalled to their primary or alternate level dependent on the origin of alarm.

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13. Alarm verification feature shall not be active at the time of installation. Alarm verification operation shall be only for smoke sensor alarms designated by the Environmental Health and Safety Department. All other sources of alarm shall be processed immediately. The alarm confirmation or verification feature shall not be used on any detector which has a dedicated control function such as duct detectors, door release detectors or detectors used for elevator recall.
14. The system operation shall be such that the alarm operation of any alarm-initiating device shall not prevent the subsequent alarm operation of any other initiating device due to wiring or power limitations.
15. The act of turning any sprinkler valve wheel shall initiate a distinctive pulsing signal and cause the supervisory LED to flash at the system controls so that there shall be no confusion between valve activation and opens and/or grounds on fire alarm initiation wiring.
16. All operation subsequent to automatic or manual activation's of all system functions shall occur within a maximum time of ten (10) seconds regardless of system size.

B. Manual Voice Paging Sequence:

1. The System shall be configured to allow selective voice paging.
2. If any speaker manual control switches are activated, the control panel operator shall be able to make announcements via the push-to-talk paging microphone over the pre-selected speakers. When manually selecting speakers for voice paging, evacuation or supervisory tones shall not be delivered to the selected speakers.
3. Facility for total building evacuation and paging shall be provided to allow for activation of speakers. This shall be accomplished by means of an "All Circuit" switch.
4. Each voice control panel will be equipped with the MD Anderson custom firmware containing custom voice messages for all clear, drill and testing announcements. Voice messages shall be activated via switch controls. Custom message text is found in Attachment "B".

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5. Each voice control panel shall be designed to receive audio voice and system control signals from the audio system at the Main Campus location R2.2743 and retransmit the signals to selected floors in the building served by the voice control panel. Controls of this operation shall be initiated from the R2.2743 and Monitoring Services locations. All equipment and software needed to make this function operational shall be installed prior to the final acceptance test. No additional hardware, software, firmware, interface equipment, modems or fiber connections shall be needed to make this function fully operational.
6. Emergency voice/alarm communications shall reproduce prerecorded, synthesized or live messages WITH VOICE INTELLIGIBILITY in the occupied area, this being achieved when the quantity lav-s exceeds a Common Intelligibility Scale (CIS) score of 0.70 or better, as specified in B3 of IEC 60849, Sound Systems for Emergency Purposes, second edition. Preliminary test reports shall include documentation of voice intelligibility.

C. Two-way Voice Communication Sequence:

1. The system shall incorporate a Two-Way Firefighter Communication operation. Voice communications shall be clear with no interference. All fire phone locations shall be connected (via the transponders and multiplexed communication circuits) to the master phone at the fire alarm control panel. The operation shall be as follows:
2. The act of plugging a handset into an emergency phone jack or removal of any phone from its normal hook position shall cause the appropriate phone location LED to flash and a distinctive audible device to sound at the control panel. The subsequent picking up of the master phone and acknowledgment of the proper phone circuit shall silence the pulsing tone and cause the phone location LED to stop flashing and remain on. This action shall couple the remote phone to the master phone to provide direct and private communications. Normal operation of the firefighter phone controls shall not cause system trouble conditions.
3. Attempting to use a subsequent phone on the same circuit shall not cause the pulsing tone to activate if any two-way communications are already established. Any new circuits activated shall cause their discrete phone circuit LEDs to flash until acknowledged.
4. The Two-Way Communications System shall provide the capacity to handle simultaneous use of five (5) remote phones.

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5. The act of unplugging all handsets in use and replacement of all remote phones to their normal hook position and returning all the related circuit acknowledgment switches to the normal position shall cause the restoration of all normal supervisory functions. If any remote phone is not hung up, or unplugged then the appropriate phone zone indicator LED shall flash and the pulsing tone shall resume at the control panel.
6. Phone operations (with the exceptions of phone system trouble) shall not be recorded on the system printer. However, it shall be possible to print this operation if required.
7. The system shall be configured to allow for remote paging from any firefighter remote phone location via the system speakers as manually selected at the main controls.
8. The phone system shall be free of background or induced noise.

D. Elevator Recall:

1. When appropriate alarms are reported, control points tied to the elevator control circuitry will energize and the elevators will be recalled to the primary floor for fire fighter's use. If the initiating device is on the primary floor, the elevators will be sent to the predestinated alternate floor.
2. The Contractor shall provide all necessary cables and wire for elevator recall, including wiring to elevator car.
3. The Contractor shall install the elevator recall, alternate recall and elevator signal relays adjacent to the elevator wire gutter in the respective elevator machine room.
4. A minimum of two (2) smoke detectors in the same elevator lobby shall be required to initiate elevator recall.
5. Two lobby smoke detectors shall be located on the ceiling within 21 feet of the centerline of all doors within the elevator bank under control of the detectors.

E. The system alarm operation subsequent to the alarm activation of any manual station, automatic detection device, or sprinkler flow switch is to be as follows:

1. Selected speaker circuits shall sound a selected tone and silenced by the alarm silence switch at the control panel or at the building Fire Command Room.

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2. Selected visual alarm indicating appliances shall flash continuously until the fire alarm system is reset.

24.5 SYSTEM CONTROLS

A. Fire Alarm Control Panel

1. The Central Processing Unit, CPU, shall be compatible with the existing MD Anderson networked systems.
2. The alphanumeric display, keyboard and printer shall be operational on battery standby, as well as all power supplies, transformers, circuit boards, input-output connections, and batteries to meet all system requirements.
3. Each control panel shall have a liquid crystal display that shall be backlit for enhanced readability. It shall not be lit during an AC power failure unless an alarm condition occurs or there is keypad activity. The building fire alarm control panel shall have the expanded large display. Control panels shall be installed so that the readable portion of the panel display is not more than sixty six inches above the finished floor and not less than 60 inches above the finished floor.
4. Should a trouble condition be present within the system and the audible trouble signal silenced, the trouble signal shall resound at preprogrammed time intervals to act as a reminder that the fire alarm system is not 100 percent operational.
5. Both the time interval and the trouble reminder signal shall be programmable to suit the Owner's application.
6. The fire alarm control panel shall be equipped with all software, firmware and hardware necessary to communicate to associated network nodes, and receive audio voice messages from remote network locations over fiber optic cable connections. Multiple signal fiber optic modems may be used to meet this requirement. The fire alarm Contractor shall demonstrate this functionality at the time of the acceptance test. Wherever fiber optic modems are used the modem power supply and battery backup shall be independent from the fire alarm panel power supply to allow for uninterrupted communication between modems during panel servicing.

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7. The fire alarm control panel shall not be used as a system equipment panel. The fire alarm control panel shall be a separate cabinet containing building controls only. Field detection, notification and control circuits shall not be routed to the fire alarm control panel, except when the fire alarm control panel is the only panel containing the buildings fire alarm systems electronic controls and the wiring method has been authorized in writing by the Environmental Health and Safety Department.

B. Equipment Panels

1. Where shown on the Drawings and where appropriate, provide and install a remote equipment panels compatible with existing building control system. Construction shall be modular with solid state, microprocessor based electronics.
2. Fire alarm equipment panels shall not be located in the fire command room.
3. Primary Keys and Panel Display: Each equipment panel or node containing its own CPU shall have a liquid crystal display that shall be backlit for enhanced readability. It shall not be lit during an AC power failure unless an alarm condition occurs or there is keypad activity.
4. With LCD display, an operator at the equipment panel having a proper access level, shall have the capability to manually control the following for each analog sensor:
 - a. Examine equipment and point status.**
 - b. Examine history log.**
5. Equipment panels shall be installed so that the readable portion of the panel display is not more than sixty six inches above the finished floor and not less than 60 inches above the finished floor.
6. NAC panels shall be installed so that the top of any NAC cabinet is less than seventy inches above the finished floor and the bottom of any NAC cabinet is at least thirty six inches above the finished floor.

C. Equipment Enclosures

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1. The fire alarm control panel shall be housed in a cabinet(s) of sufficient size to accommodate the aforementioned equipment. The cabinet(s) shall be equipped with locks and transparent door panel(s) providing freedom from tampering yet allowing full view of the various lights and controls.
2. Fire alarm equipment cabinets shall be housed in a cabinet(s) of sufficient size to accommodate the aforementioned equipment. The cabinet(s) shall be equipped with locks and solid door panel(s) to prevent tampering. Transponder cabinets shall be keyed alike with the fire alarm control panel. Cabinet doors shall open fully and not obstruct access to other control panels or equipment cabinets or terminal cabinets.

D. Batteries

1. Wherever a control panel, transponder, NAC panel or other panel requires batteries as a secondary source of power, the batteries shall be permanently marked with the date of manufacture. The date of manufacture shall be written in the Standard English date format.
2. Only manufacture date codes which are decipherable without a separate table or legend may be used for this purpose. The contractor may decipher the manufacture date from a code and permanently mark the date in the English format. The manufacture date shall be clearly identifiable as the date of manufacture.
3. The batteries installed shall not be older than one year from the date of manufacture.
4. The date of installation shall also be permanently marked on the batteries. The installation date shall be clearly identifiable as the installation date.

24.6 REMOTE ANNUNCIATOR(S)

A. System Annunciators.

1. Provide annunciators capable of two methods of acknowledgement for each abnormal condition. Method choice shall be field programmable.
2. For NFPA 72 Chapter 9 requirements: pressing the appropriate acknowledge button shall display and acknowledge the first unacknowledged condition in the list. Each unacknowledged condition in the list must be acknowledged individually.

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3. For NFPA 72 Chapter 6, 7 or 8 requirements: pressing the appropriate acknowledge button shall globally acknowledge all unacknowledged conditions in the list.

B. Nurse Station Annunciators.

1. Wherever patient room smoke detectors are required to be annunciated at the nurse's station the annunciator shall be a peripheral of the fire alarm system. Annunciation of patient room smoke detectors through other systems such as nurse call systems is not acceptable.
2. Nurse station annunciators shall be programmable to annunciate only the alarms from rooms required to be monitored from that nurse's station.

24.7 PERIPHERAL DEVICES

A. General:

1. Where peripheral devices are installed outside, in wet locations or in cold rooms the devices and mounting boxes shall be the waterproof type.

B. Speakers:

1. The moisture-repellent, fire-retardant speakers shall be selectable for 25-volt circuits or 70-volt circuits.
2. The speaker shall be equipped with a matching transformer with multiple taps (0.25W, 0.5W, 1W and 2W).
3. The speaker shall have a minimum sound level of 75 db at 10 feet and a maximum of 88 db at 10 feet.
4. Speakers shall be red in color except where white is used to match existing devices.
5. The speaker shall allow surface/or-flush mounting capabilities. Where surface mounted speakers are installed a skirt enclosure shall be installed to conceal the electrical box to which the speaker is mounted. The correct surface box shall be used to ensure the skirt fits properly and is flush with the wall.
6. Speakers shall be wall mounted at a height of 83 inches to the center of device.
7. Contractor to ensure speakers have the correct sound pressure as per NFPA 72.

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8. Ceiling mounted speakers shall not be acceptable except where a hard ceiling exists and upon approval from the Environmental and Health and Safety representative. Speakers mounted in ceiling tiles shall not be acceptable. Speaker shall be UL listed for its intended purpose.

C. Strobe Light:

1. ADA Visual notification appliances shall be comprised of a Xenon flashtube with a clear lens and be entirely solid state.
2. Visual notification devices shall be red with white lettering except where white is used to match existing devices.
3. Visual notification devices shall be selectable for either free run or synchronized operation.
4. Visual notification devices shall have selectable candela levels.
5. These devices shall be UL 1971 Listed and shall be wall mounted.
6. Provide a unit approved for ADA compliance,
7. The lexan lens shall be pyramidal in shape to allow better visibility.
8. Where surface mounted strobe lights are installed a skirt enclosure shall be installed to conceal the electrical box to which the strobe lights are mounted. The correct surface box shall be used to ensure the skirt fits properly and is flush with the wall.
9. Ceiling mounted strobe lights shall not be acceptable except where a hard ceiling exists and upon approval from the Environmental and Health and Safety representative. Strobe lights mounted in ceiling tiles shall not be acceptable.
10. Strobe light candela shall comply with NFPA Standards based on room size and device location.
11. Install units at 83 inches height from finished floor to bottom of lens.
12. Where existing visual units are installed at a code compliant height above floor, the new strobe unit may be installed at the same compliant height to avoid an uneven appearance.

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13. The installing contractor shall coordinate between trades to ensure that placement of cabinets, shelving, or other material does not interfere with occupant's view of the strobe device.
14. Strobe lights shall not be added to existing signal circuits without first performing the necessary calculations to ensure adequate power is available to both the circuit to which the device is to be added and the fire alarm control panel power supply which supplies the power to the circuit. These readings and written calculations shall be documented in the equipment submittal and forwarded to the MD Anderson EH&S department via the Owner's Project Manager. Existing power supply loads must be determined when adding additional equipment.

D. Speaker/Visible Alarm Notification Appliances:

1. Audible/Visible devices shall conform to MD Anderson Standards and shall provide a common enclosure for the fire alarm audible and visual alarm devices.
2. The unit shall be complete with a tamper resistant, pyramidal shaped Lexan lens with Fire lettering visible from a 180-degree field of view.
3. Provide a unit approved for ADA compliance. The moisture-repellent, fire-retardant speakers shall be selectable for 25-volt circuits or 70-volt circuits.
4. The speaker shall be equipped with a matching transformer with multiple taps (0.25W, 0.5W, 1W and 2W).
5. Visual portion shall have selectable candela levels.
6. Visual portion shall be selectable for free run or synchronized operation.
7. Unit shall be complete with all mounting hardware.
8. Where surface mounted Audible/Visible devices are installed a skirt enclosure shall be installed to conceal the electrical box to which the Audible/Visible device is mounted. The correct surface box shall be used to ensure the skirt fits properly and is flush with the wall.
9. Audio/visual unit shall be UL Listed for its intended purpose.
10. Audio visual devices shall be red in color except where white is used to match existing devices.
11. Install units at 83 inches height from finished floor to bottom of lens.

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12. Where existing visual units are installed at a code compliant height above floor, the new strobe unit may be installed at the same compliant height to avoid an uneven appearance.

E. Relays, electronic control relays, and electronic control modules programmed as relays:

1. Wherever relays or electronic control modules are used to interface with control functions, the relay or electronic control module shall include a red LED indicator which indicates the activated state of the relay or electronic control module. The red LED indicator shall remain steadily lit while the relay or module is activated. If necessary to provide this visual indication of relay activation, a second relay and 24 volts supervised control power may be required in addition to the module relay. The red LED indicator shall allow for visual verification of relay or electronic control module activation without disassembly of the relay or electronic control module enclosure.
2. The red LED indicator shall light steady as long as the relay or electronic control module is activated.
3. Relays shall be normally in the non-operated mode and shall activate upon alarm.
4. All relays shall be mounted adjacent to the interfaced equipment except where the relay is used to switch power to multiple devices it shall be mounted adjacent to the power source.
5. Relays and relay indicators shall be labeled with the relay's function, controlled unit number and circuit number. Labels shall be uniform, printed, and clearly legible from floor.
6. Where the relay is mounted above five feet or the relay's LED cannot be observed from floor level or without lifting ceiling tiles a remote indicator shall be installed.
7. Relay cover and base shall be marked to ensure the correctly labeled cover remains with the correct base.
8. The fire alarm Contractor shall coordinate with other trades to ensure the relay used is the correct contact ampere rating for the switched current.

F. Water Flow Switches:

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1. To prevent false alarms, the flow switch shall incorporate an adjustable time delay mechanism between the paddle-operated stem and the alarm initiating contacts. The time delay shall be adjusted to provide a delay time between 30 to 45 seconds from the initiation of water flow.
2. A tapped ½ inch conduit connection shall be provided.
3. Flow switch shall be UL Listed for its intended purpose; furnished mounted and adjusted under Division 23 and connected under Division 26.

G. Sprinkler Valve Tamper Switches:

1. Sprinkler valve tamper switches shall be provided with either two sets of single pole, double throw (SPDT) switches as required.
2. A tapped ½ inch conduit connection shall be provided.
3. Tamper switch shall be UL Listed for its intended-purpose; furnished mounted and adjusted under Division 23 and connected by Division 26.

H. Door Holders:

1. Combination door closers / door holders shall not be specified as a component of the fire alarm system. Where such combination devices are provided the devices shall be independent from the fire alarm system and shall not be powered from any fire alarm system source. The fire alarm system shall provide a relay for door release signaling purposes only.
2. Magnetic door holder back boxes shall be mounted to building structure.
3. Retrofit boxes or other boxes mounted to sheetrock only shall not be acceptable.
4. Magnetic door holders shall be UL-Listed for their intended purpose.
5. Coordinate mounting with door hardware
6. Magnetic door holders shall have an approximate holding force of 35 lbs.
7. The door portion shall have a stainless steel pivotal mounted armature with shock absorbing nylon bearing.
8. Unit shall be surface, flush, semi-flush or floor mounted as required.

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9. Magnetic door holders shall be 24 volts D.C.
10. System power supplies shall not be used as a source for door holder power.
11. Magnetic door holders shall be powered from a NAC power supply at a designated remote location(s). The NAC power supply shall be dedicated to door holder operation. The dedicated power supplies shall not share power with notification devices. The dedicated NAC aux power output shall not be used for door holders or for powering fire alarm peripherals or devices.
12. Magnetic door holder operation shall be independent from another operation such as damper or fire shutter control.
13. The door holder circuits shall be individually wired to and switched from the designated NAC panel. Auxiliary relays at the NAC panel may be used to provide the switching function.
14. When magnetic door holders are added to an existing system the submittal shall include a power availability analysis showing the intended source of power, the door holder circuit capacity and standby power capacity.
15. Coordinate mounting with door hardware.
16. Automatic Door / fire alarm system interface relays shall be switched from a dedicated door holder NAC.
17. A conceptual drawing of a door control NAC is provided as attachment "F".

24.8 ADDRESSABLE PERIPHERAL DEVICES

A. General:

1. The system control panel, over its peripheral data circuits, must be capable of communicating with the types of addressable devices specified below.

B. Addressable Pull Stations:

1. Addressable pull stations shall contain electronics that communicate the station status (alarm, normal) to the control panel over two (2) wires, which also provide power to the pull station. The address shall be set on each station. The stations shall be manufactured from high impact red lexan. Lettering shall be raised and painted white. The station shall mechanically latch upon operation and remain so until manually reset by opening with a key.

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2. Pull stations shall be dual action.
3. The addressable manual station shall be capable of field programming of its address location on an addressable signaling line circuit.
4. There shall be no limit to the number of stations, detectors, or addressable monitor modules which may be activated or in alarm simultaneously.
5. The operable part of the manual station shall be installed 48 inches above finished floor.
6. At any outside location and any location subject to moisture, weatherproof manual stations shall be installed.
7. Pull station break rods shall be installed at the time of the acceptance test.
8. The keys for each pull station shall be delivered to the environmental health and safety representative at the time of the acceptance test.
9. For any project requiring more than 20 pull stations, two (2) stopper II type pull station covers shall be provided to the Owner as spare parts.

C. Photoelectric Smoke Detectors:

1. Smoke sensors and bases shall be listed to UL Standard 268 and documented compatible with the control equipment to which they are connected. The sensors shall be listed for both ceiling and wall mount applications.
2. The sensor shall be of the solid-state photoelectric type and shall contain no radioactive material. Sensor will use a pulsed infrared LED light source and be sealed against rear airflow entry.
3. The photoelectric type sensor shall be a plug-in unit that mounts to a twist-lock base.
4. The sensor shall fit into a base that is common with both the heat sensor and smoke sensor and shall be compatible with other addressable detectors, addressable manual stations, and addressable monitor modules on the same circuit.
5. There shall be no limit to the number of sensors, stations or addressable monitor modules that may be activated or in alarm simultaneously.

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6. The photoelectric sensor shall have a fine 30 mesh or finer insect screen.
7. The sensor electronics shall be completely shielded to protect against false alarms from EMI and RFI (Electromagnetic and Radio Frequency Interference).
8. The detector shall be able to be disassembled in order to readily clean the smoke detection chamber. Manufacturer's cleaning instructions shall be provided for each type of detector used.
9. Smoke detector relay outputs shall not be used to control life safety functions.
10. Smoke detector alarm verification feature shall not be initially enabled.

D. Thermal Heat Detectors:

1. The thermal type sensor shall be a plug-in unit that mounts to a twist-lock base.
2. The sensor shall be a combination rate of rise/fixed temperature sensor U.L. Listed as a rate compensated heat detector.
3. The sensor shall fit into a base that is common with both smoke and heat sensors and shall be compatible with other addressable detectors, addressable manual stations and addressable monitor modules on the same circuit.
4. There shall be no limit to the amount of sensors, stations or addressable monitor modules, which may be activated or in alarm simultaneously.
5. Each sensor is capable of operating at a selectable rate of rise operation of 15 or 20 degrees F per minute and is self-restorable.
6. Each sensor is capable of fixed temperature operation selectable for either 117 or 135 degrees F, independent of the rate of rise setting.
7. Each sensor can be configured for utility monitoring and capable of sensing temperature between 32 and 158 degrees F.

E. Photoelectric Duct Detectors:

1. The sensor shall be photoelectric type that obtains its operating power from the current in the fire alarm detection loop.

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2. Sensors shall be of the solid-state photoelectric type and shall operate on the light scattering, photodiode principle. To minimize nuisance alarms, detectors shall have a minimum 30 mesh insect screen and be designed to ignore invisible particles or smoke densities that are below the factory set point. No radioactive material shall be used.
3. For maintenance purposes, it shall be possible to clean the duct housing sampling tubes by accessing them through the duct housing front cover.
4. The duct detector may include a relay or relay driver output where a specific control function is called for. Wherever relays or electronic control modules are used to interface with control functions the relay or electronic control module shall include a red LED indicator which indicates the activated state of the relay. The red LED indicator shall light steady while the relay or electronic control module is activated. The red LED indicator shall allow for visual verification of relay activation without disassembly of the relay or the relay enclosure.
5. Where no specific control function is required, a duct detector without the output circuit shall be installed.
6. Activation of relays shall be performed through the system program. Tracking the alarm only condition of the duct sensor is not acceptable.
7. Each sensor shall be scanned by the control panel for its type identification to prevent inadvertent substitution of another sensor type. The control panel shall operate with the installed device but shall initiate a "Wrong Device" trouble condition until the proper type is installed or the programmed sensor type is changed.
8. The sensor electronics shall be immune from false alarms caused by EMI and RFI.
9. Where a duct sensor is located above the ceiling or wherever the alarm indicating red LED cannot be seen from the floor a remote alarm indicating red LED shall be provided. The red LED shall glow steady while the detector is in alarm. Remote LED alarm indicators shall be wall mounted except where a hard ceiling exists. Remote alarm indicators mounted in ceiling tiles shall not be acceptable. Where a relay output for specific control function is called for the remote alarm indicator is in addition to a relay activation indicator.

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10. Where duct detectors are mounted in weatherproof enclosures, a remote alarm indicator shall be installed adjacent to the housing to allow for alarm verification without opening the housing. The weatherproof enclosure shall not be modified except for connecting conduit to the factory provided knock-outs. Enclosure "ears" shall be used for mounting. In no case are holes to be drilled in weatherproof enclosures for equipment mounting. Where a relay output for specific control function is called for the remote alarm indicator is in addition to a relay activation indicator.

F. Addressable Sensor Bases (where applicable):

1. Sensor bases shall be compatible with all models of the manufacturer's sensors currently installed within the MD Anderson Campus.
2. If a wrong device type is installed the panel will continue to monitor for alarms and troubles using the default setting for the wrong device until the proper type is installed or the program is changed.
3. Each sensor base shall contain a LED that will flash each time it is scanned by the control panel.
4. Each sensor base shall contain a LED that will glow steady while the detector is in alarm.
5. Each sensor base shall contain a LED that will glow steady while the detector is in trouble. The trouble indicator(s) will extinguish during system fire alarm conditions.
6. The remote LED output of the sensor base shall not be used for control activation or relay functions.
7. Sensor Base Relay. Where sensor bases control dedicated relays, the relays shall be controlled by system programming. The operation of the relay shall not be directly dependent upon the alarm state of the detector. Relays may be used for signaling only. Other systems shall provide any secondary power necessary for the desired action. Other systems shall provide additional relays or contactors necessary for adequate switching capacity. Relay operation shall comply with other sections of these specifications. Sensor base relays shall not be used to initiate life safety functions.

G. Addressable Monitor Module:

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1. Modules shall be used for monitoring of water flow, valve tamper, non-addressable detectors and AHU status.
2. An addressable interface module shall be provided for interfacing normally open direct contact devices to an addressable signaling line circuit.
3. Addressable monitor modules shall be capable of mounting in a standard electric outlet box. Module enclosures shall have cover plates to allow surface or flush mounting. Modules shall include all mounting hardware to allow for the removal of the modules cover while the module remains secure in the electrical box.
4. The module's system address, function and device monitored shall be marked on the outside of the cover plate.
5. For conventional contact device monitoring with Style B or Style A (NFPA 72 initiating device circuit) wiring supervision. This type of addressable device module will provide power to monitor the status of a zone consisting of conventional 2-wire smoke detectors and/or N/O contact devices. The supervision of the initiating device circuit wiring will be Style B. These monitor modules will communicate the zone status (normal, alarm, trouble) to the control panel.
6. Addressable monitor modules shall include all mounting hardware to allow for the removal of the modules cover while the module remains secure in the electrical box.
7. Where addressable monitor modules are used to monitor sprinkler tamper and flow switches, separate modules shall be used for each function. Combination circuits such as WSO style shall not be acceptable.

H. Electronic Control Module

1. Electronic control modules will communicate the supervised wiring status (normal, trouble) to the fire alarm control panel and will receive a command to transfer the relay from the fire alarm control panel.
2. Electronic control modules shall not be used to control automatic doors, magnetic door release, smoke damper control, fire/smoke damper control, fire shutter control, smoke control signaling.

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3. Wherever relays or electronic control modules are used to interface with control functions the relay or electronic control module shall include a red LED indicator which indicates the activated state of the relay. The red LED indicator shall glow steady to allow for visual verification of activation without disassembly of the relay, electronic control module or their enclosures. Where the relay or electronic control module's LED cannot be observed without lifting ceiling tiles a remote indicator shall be installed. The remote indicator shall be wall mounted except where a hard ceiling is available. Remote indicators mounted in ceiling tiles shall not be acceptable. The red LED shall remain steadily lit while the relay or electronic control module is activated. In order to provide the steadily lit red LED visual indication of relay activation of the electronic control module, a second relay and 24 volts supervised control power may be required in addition to the electronic control module relay. The control module's red led indicator shall not illuminate when the module is not activated.
4. The electronic control module shall be supervised and uniquely identified by the control panel. Device identification shall be transmitted to the control panel for processing according to the program instructions. Should the module become non-operational, tampered with, or removed, a discrete trouble signal, unique to the device, shall be transmitted to, and annunciated at, the control panel.
5. All electronic control modules shall be labeled on the outside of the cover as to data circuit and device number, function and unit served.
6. Addressable electronic control modules shall be capable of mounting in a standard electric outlet box. Addressable monitor module shall include cover plates to allow surface or flush mounting.
7. Addressable electronic control modules shall include all mounting hardware to allow for the removal of the modules cover while the module remains secure in the electrical box.
8. High voltage circuits shall not be present in the electronic control module's enclosure.

24.9 FIREFIGHTERS TELEPHONE SYSTEM

A. General:

1. Provide a two way telephone system in compliance with NFPA 72.

B. Emergency Phone Jacks:

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1. Provide Emergency Phone Jacks as shown on the Drawings. Each jack shall be mounted on a stainless steel single gang plate with the words "Fire Emergency Phone" screened on each.
2. Provide Emergency Phone Jacks for installation in each elevator car by the elevator Contractor. It shall be the responsibility of the fire alarm Subcontractor to ensure that the required wiring from elevator controls to each elevator car be installed by the elevator Subcontractor. Wiring to be provided by fire alarm Subcontractor.
3. Provide an emergency phone jack adjacent to the fire pump controller cabinet.

C. Emergency Phone Stations:

1. Provide Remote Phones in cabinets for installation in the building emergency control stations. The phone stations shall be keyed alike with the fire alarm system control panel.
2. Emergency phones shall be red and shall be equipped with an armored cable.
3. Provide Emergency Phone jacks for installation in each elevator car by the elevator Subcontractor. Wiring to the elevator cars will provide for the proper supervision of the phone station circuit. T-tapped wiring between cars shall not be acceptable.
4. Provide a minimum of five (5) Pluggable Emergency Phones within a storage cabinet to be mounted at the building Fire Command Room. The emergency phone cabinet shall be keyed alike with the fire alarm system control panel.

24.10 FACP REMOTE REPORT

A. Remote Devices:

1. The fire alarm control panel shall report to all existing remote annunciators on the fire alarm system's network. Where no network exists or a new network is installed or a network is expanded, or a network is modified, the network shall include new annunciators at all the existing campus annunciator locations.
2. At a minimum the fire alarm control panel shall report to remote locations at room R2.2743, the Monitoring Services Control room, room B1.4351, and the UTPD monitoring station. The fire alarm control panels shall report to existing annunciators at these locations or new annunciators shall be provided to receive the reports from the fire alarm control panel.

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3. Remote reports shall include individual point information including location by building and room number, point status and circuit address.

PART 25 - EXECUTION

25.1 INSTALLATION

- A. Installation shall meet or exceed all applicable federal, state and local requirements, referenced standards and conform to codes and ordinances of authorities having jurisdiction.
- B. Installation shall be in accordance with manufacturer's published recommendations.
- C. Installation of wiring and peripherals shall be in accordance with the recommendations of manufacturer of the material being installed.
- D. Installation of the fire alarm system shall be as shown on the approved drawings. Changes to the approved drawings shall be submitted to EH&S for review and approval.
- E. Installation personnel shall have available on the jobsite the approved shop drawings and submittal showing the complete scope of work throughout the installation.
- F. Fasteners requiring explosive powder (shooting) or pneumatic-driven actuation will not be acceptable under any circumstances.

25.2 DEVICE PLACEMENT

A. General

1. Fire alarm system devices shall be installed in a manner that provides accessibility for periodic maintenance or replacement of entire device.
2. Fire alarm system devices shall not be installed in inaccessible locations.
3. Access to fire alarm system devices shall not be obstructed by conduit, plumbing, ductwork etc.

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B. Smoke Detectors

1. Smoke detectors used for door release, automatic door control, or corridor detectors near any cross corridor door shall be located within five feet of the door. Detector shall be placed according to NFPA 72 Smoke Detectors for Door Release Service.
2. Where smoke detection is required for stairwell pressurization fan initiation, a smoke detector shall be located within ten feet of each stairwell entrance door as per NFPA 101.
3. Where smoke detectors are required for elevator recall service two smoke detectors shall be located on the ceiling within 21 feet of the centerline of each elevator door within the elevator bank under control of the detectors.
4. Smoke detectors shall be installed in locations that allow ready access for maintenance or replacement of the entire device. Where detectors cannot be accessed without the use of lifts or scaffolds, other means of smoke detection shall be applied. The floor area immediately under detectors must allow for the proper placement of a ladder. Special application detectors mounted above a suspended ceiling must be accessible from a ladder which is no higher than the ceiling height.
5. Where a smoke detector is installed in a room or closet, the detector shall be mounted as close as possible to the center of the room. Where a room has a door opening to a shower or lavatory mount the detector as far away from the door as code permits to reduce potential false alarm. In patient rooms mount the detector as far away from the head of the bed as is practical to reduce the potential for false alarm from breathing treatment mists. Maintain a consistent location for all like rooms.

C. Heat Detectors

1. Where heat detectors are used in lieu of smoke detectors due to environmental conditions, the heat detectors shall be spaced as required by NFPA 72.
2. Where heat detectors are used to initiate elevator shutdown functions the heat detectors shall be installed according to NFPA 72 Elevator Shutdown.

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3. Heat detectors shall be installed in locations that allow ready access for maintenance or replacement of the entire device. Where detectors cannot be accessed without the use of lifts or scaffolds, other means of heat detection must be applied. The floor area immediately under detectors must allow for the proper placement of a ladder. Special application detectors mounted above a suspended ceiling must be accessible from a ladder which is no higher than the ceiling height.
4. Where a heat detector is installed in a room or closet, the detector shall be mounted as close as possible to the center of the room. Maintain a consistent location for all like rooms.

D. Duct Detectors

1. Exact duct detector placement shall be determined by the fire alarm system contractor. The fire alarm system contractor shall certify the correct placement and operation of the duct detector.
2. Duct detectors shall be installed in locations that allow ready access for maintenance. Where detectors cannot be accessed without the use of lifts or scaffolds, other means of duct smoke detection must be applied. The floor area immediately under detectors must allow for the proper placement of a ladder. Special application duct detectors mounted above a suspended ceiling must be accessible from a ladder which is no higher than the ceiling height.

E. Manual Stations

1. Manual stations shall be installed so that the operable part of the station is at a height of 48" above the finished floor.
2. Where manual stations are installed in a service corridor or other location where the potential for damage to the station from expected activities exists, a guard shall be installed to protect the station. Fire alarm contractor to coordinate identification of these locations with the general contractor.

F. Monitor Modules

1. Monitor modules shall be placed where they are readily accessible for troubleshooting or maintenance.
2. Monitor modules are to be located as close to the monitored device as is practical. Accessibility shall take precedence over proximity.

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G. Visual Notification Devices

1. Visual notification devices shall be wall mounted at a height of 83 inches above finished floor to the bottom of the lens.
2. Ceiling mounted visual devices shall not be acceptable except where a hard ceiling exists and upon approval from EH&S.
3. Where existing visual units are wall mounted at a code compliant height above floor, the new strobe unit may be installed at the same compliant height to avoid an uneven appearance.

H. Audible Notification Devices

1. Audible notification devices shall be wall mounted at a height of 85 inches to the center of the device.
2. Ceiling mounted Audible devices shall not be acceptable except where a hard ceiling exists and upon approval from EH&S.
3. Where existing audible units are wall mounted at a code compliant height above floor, the new audible unit may be installed at the same compliant height to avoid an uneven appearance.

I. Combination Audible / Visual Notification Devices

1. Audible / Visual notification devices shall be wall mounted at a height of 83 inches above finished floor to the bottom of the lens.
2. Ceiling mounted Audible/Visual devices shall not be acceptable except where a hard ceiling exists and upon approval from EH&S.
3. Where existing audible / visual units are wall mounted at a code compliant height above floor, the new strobe unit may be installed at the same compliant height to avoid an uneven appearance.

J. Door Holders

1. Magnetic door holders shall be installed at a height of 86 inches or less from the finished floor to the center of the back box.

K. Relays

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1. Fire alarm system relays shall be installed within three feet of the controlled device or circuit.
2. Relays mounted at motor controllers or other controlled equipment shall be mounted adjacent to, not above or below controlled equipment.
3. Relays mounted in open mechanical spaces above five feet shall have remote indicators mounted no higher than eight feet.

L. Remote Indicators

1. The remote indicator shall be wall mounted except where a hard ceiling is available. Remote indicators mounted in ceiling tiles shall not be acceptable. The remote indicator shall be mounted on the wall within six inches of the ceiling. Where the ceiling is above 8 feet or where location may be aesthetically challenging, the remote indicators shall be located at a designated location approved in writing by the Environmental Health and Safety Department.
2. Remote indicators in open spaces without ceilings shall be mounted no higher than eight feet. Remote indicators shall be clearly visible from the floor.

M. Isolation Modules

1. Isolation modules shall be installed adjacent to the terminal cabinet serving the equipment panel to which the isolated circuit(s) is connected. Separate wiring from each floor served shall be run to the terminal cabinet

25.3 NOTIFICATION

A. Disregards.

1. Prior to working on existing fire alarm system equipment or components the contractor must notify the Fire Life Safety Supervisor or the Safety Program Manager.
2. Contractor shall not perform any work or programming on the fire alarm system without the required outage and ILSM in place.
3. Contractor must verify the MDACC Monitoring Services has received the proper disregard for alarm, trouble and supervisory signals which may be generated by the contractor's activity.

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4. Where the contractor's activities may prevent the MDACC Monitoring Services from receiving signals from an online system, the contractor must monitor the online systems and manually notify monitoring services of any alarm(s).
5. The contractor shall directly notify the Fire and Life Safety Supervisor or Safety Program Manager upon completion of the work.

B. System Shutdowns

1. Prior to performing any work which may impair any portion of an on line fire alarm system equipment or components the contractor must submit a request for system shutdown to the project manager. The contractor must inform the project manager of the specific location(s) affected and list the circuits which may be inoperable during the outage and the length of time the system will be impaired.
2. Requests for system shutdown must be made ten business days prior to performing the work.
3. Where a shutdown of four hours or greater is requested, all manual pull stations in all locations listed in the request must have an out of service tag affixed. The tag shall be affixed to each manual station regardless of the stations ability to signal an alarm. The tag must give direction to call 911 in the event of a fire and the tag must list the anticipated time the station will be returned to service. The tag shall be affixed to each manual station at the beginning of the outage and remain affixed throughout the outage duration.
4. Where a shutdown of four hours or greater is requested, Interim Life Safety Measures may be mandated by the Environmental Health and Safety Department. The contractor shall review the measures prior to the scheduled shutdown and comply with all applicable measures.
5. The contractor shall directly notify the Fire and Life Safety Supervisor or Safety Program Manager upon completion of the work.

25.4 SYSTEM CIRCUITS

A. Field circuit wiring shall be installed as follows:

1. All wires serving each level shall be home run to the terminal box adjacent to the equipment panel serving that level. An exception to this requirement exists where a specific levels notification device wiring is routed to a remote NAC power supply on that level.

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2. Where data circuits are required to be isolated between floors the isolation device shall be a separate device mounted at a readily accessible location adjacent to the fire alarm equipment cabinet or terminal cabinet. Combination devices such as a smoke detector / isolation device are not acceptable.
3. Individual data circuits shall serve each floor. The wiring shall be terminated in the terminal cabinet adjacent to the equipment cabinet serving that floor. Individual data wires terminated in the terminal cabinet shall not serve more than one floor.
4. System shall be designed so that any visual signal circuit, audible signal circuit and door holder circuit will serve not more than one floor.
5. Power and data wiring for annunciators shall be dedicated to the annunciators on each floor. Each floor's wiring shall be terminated in the terminal cabinet adjacent to the equipment cabinet.
6. Power and data wiring for relay driver and status monitor boards shall be dedicated to the boards on each floor. Wiring on each floor shall be terminated in the terminal cabinet adjacent to the equipment cabinet serving that floor. AHU status, override, and shutdown functions shall be wired in accordance with the recommendations of the manufacturer of the material being installed. Appropriate interfaces shall be used where required to ensure compliance with these recommendations.
7. All control wiring serving field devices shall have individual common wires to each device. All common wires shall be terminated individually at the terminal cabinet adjacent to the control panel.

25.5 CONDUIT SYSTEM AND WIRING

A. General

1. The fire alarm control panels, terminal cabinets, and the remote equipment cabinets shall not be used for junction boxes.
2. Any interconnections of system alarm wiring within the control panels or equipment cabinets shall be made using the manufacturer's terminal blocks intended for that application. Wire nuts are not allowed in control panel or equipment enclosures.
3. No more than two wires shall be connected at any single device or control panel terminal. No two wires of different gauge conductors shall be terminated at any single terminal.

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4. Where end of line resistors are used to provide circuit supervision such as at a notification device, tamper or water flow switch contacts, the resistor shall not be placed under a terminal which has a circuit conductor of a larger gauge present. The end of line device must be remotely mounted if a separate termination point is not present.
5. Field wiring from each floor shall be routed directly to the terminal cabinet located next to the equipment cabinet which serves that floor. Circuit wiring shall not be shared between floors.
6. A terminal cabinet shall be installed adjacent to each equipment cabinet and control panel. Field wiring shall terminate in this cabinet. Field wiring shall not be run directly into equipment cabinets.
7. Communication lines between equipment cabinets within an individual building shall not be routed through equipment cabinets outside of that building. All building equipment cabinet communication lines shall be routed through that buildings fire alarm control panel and shall allow for network disconnect without communication loss between equipment cabinets within that building.
8. The fire alarm system control panel shall not be used as a system equipment cabinet. The fire alarm control panel shall be a separate cabinet containing building control equipment only. Field detection, notification and control circuits shall not be routed to the fire alarm control panel. Fire alarm system equipment cabinet shall not be located in the fire command room.
9. Fire alarm system network communications and audio routing between building fire alarm systems shall be via dedicated fiber connections. Network fiber shall be routed from the buildings fire alarm control panel directly to the campus voice control panel location. Fiber connections shall be made using a single strand of single mode fiber.

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10. Location of all controls, alarm actuating devices and audible alarm signaling devices shall generally be as shown on the Drawings. The Contractor shall not change locations indicated on Drawings. All location changes require the revisions to be made by an approved engineer or licensed fire alarm planner. In areas where there are no ceilings, install detectors against the building structure in accordance with manufacturer recommendations. In finished areas, devices shall be located in a symmetrical pattern relating to ceiling and/or wall features and, where applicable, ceiling mounted devices shall be located symmetrically with the ceiling grid centered in two directions. Vertically align pull stations and audible/visual alarm signaling devices. Where audio/visual, audio only or visual only devices are surface mounted to surface mounted junction boxes, install the manufacturer's skirt, or manufacturer's color-matched surface mount box or EH&S approved equivalent, which is designed to enhance aesthetics.
11. The correct electrical box shall be used for wall mounted notification devices. The notification device must fit flush against the wall. Surface mounted devices shall be used where flush mounting is not possible due to wall thickness. Surface mounting of wall mounted devices is not allowed where flush mounting is possible even if the flush mounting requires installing the correct back box.
12. Where fiber optic cable is used a fiber terminal box shall be installed adjacent to the fire alarm control panels or equipment cabinets served. Fiber optic cable shall not be run directly into the fire alarm panel(s). Cable terminal boxes placed within fire alarm panel enclosures shall not be acceptable. Fiber optic jumpers shall be used to complete the connection into the fire alarm panel. The fiber terminal box shall not have more than 50 percent of its capacity used during initial installation and shall be equipped with all terminals to allow for the addition of future connections. Each fiber strand terminated at the cable box shall be clearly labeled with the building and room number of its remote terminus. Each strand shall be labeled as to its function. Each jumper connected between the fire alarm panel and the fiber terminal shall be clearly identified. Writing on the cable with marking pens shall not be acceptable labeling.
13. The fire alarm system Contractor shall provide the correct style and length fiber jumpers between the fire alarm panel and the LUI terminals above the fire alarm panel. The LUI may use ST or SC style terminals.

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14. The fire alarm system Contractor shall be responsible for the certification of the fire alarm system wiring. The fire alarm system Contractor must perform all necessary oversight and inspections to ensure code compliance of system wiring installed by others. The fire alarm Contractor shall check the wiring periodically during the installation process to ensure the wiring is not damaged or made susceptible to damage by other trades.

B. Wiring method shall be either conduit or structured cabling.

1. Conduit shall be installed wherever required by applicable codes.
2. Conduit shall be the preferred wiring method.
3. Where a building's fire alarm system is being added to or modified, the wiring method shall match the building's predominant existing wiring method

C. Installations using conduit raceways.

1. Total wiring size including insulation shall be considered when sizing conduit runs and calculating the 40 percent fill.
2. Adequate J-boxes shall be installed to allow for wire removal or replacement.
3. Wherever splices are made in J-boxes, wires shall be labeled with the system circuit number and area served. Wire tags shall be affixed to identify the wires. Writing on wires with a marking pen shall not be an acceptable means of wire identification.
4. J-box covers shall be painted half red and clearly marked "Fire Alarm".
5. Any system junction box containing wiring splices shall readily accessible for troubleshooting or maintenance without use of lifts or scaffolds. The floor area immediately under junction boxes containing spliced wires must allow for the proper placement of a ladder.

D. Installations using structured cabling.

1. Structured cabling method shall include the use of cable trays for the main wiring runs.

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2. Where cable tray is provided above the ceiling, fire alarm cabling is to be routed in the cable tray, otherwise route fire alarm cabling in conduit from the fire alarm panel, between floors, and in equipment rooms. Plenum-rated fire alarm cable and bridge rings are acceptable for branch wiring. Between individual devices and the cable tray or bridge rings, utilize EMT conduit in partitions and stub-out above an accessible ceiling. Any junction boxes and covers required shall be painted red. All covers of junction boxes shall be labeled in bold, permanent marker "Fire Alarm".
3. Where plenum-rated fire cable enters a device mounting box it shall be secured with a device to provide strain relief. A locking fitting designed for this purpose shall be attached to the mounting box and adjusted to secure the wiring and provide adequate strain relief to prevent plenum-rated wiring from pulling loose from device terminals. Wire ties used to provide strain relief shall not be acceptable.
4. Fire alarm system wiring shall not be attached to the underside of raceways or cable trays.
5. Fire alarm system wiring shall not exit through the bottom of a cable tray.
6. Where fire alarm system wiring is installed exposed, the wiring shall be installed in such a way that maximum protection from physical damage is provided.
7. Provide bushings, connectors, strain relief devices, boxes and covers specifically designed for structured cabling use.
8. Support all conduits and J-boxes above ceilings from the building structure.
9. All openings through walls, roof, etc., shall be sleeved.
10. Bushings and throats shall be installed for fittings, raceways, boxes or other enclosures prior to installing cables and wiring systems.
11. Coordinate cable tray installation with piping ductwork and light fixture installation. Maintain clearance inside cable tray for installation of cables. Install according to manufacturer's instructions. Provide "Caution - Do Not Use As Walkway" signs suitably displayed as designated by the Owner.
12. All unused raceway openings shall be closed.

E. Control Panel Installation

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1. Any interconnections of system alarm wiring within the control panels or equipment cabinets shall be made using the manufacturer's terminal blocks intended for that application.
2. Each fire alarm control panel, equipment cabinet, terminal cabinet, battery cabinet or fire phone cabinet, shall be identified with a plastic tag permanently affixed to the cabinet and engraved with 1 inch letters identifying the cabinet.
3. Labeling must be attached to the inside of the fire control panel and equipment cabinet identifying the location of that panels 120 volt electrical source. This label is in addition to any labeling required under the electrical specifications.
4. The fire alarm control panels, the remote terminal cabinets and equipment cabinets shall be accessible for maintenance without special tools or ladders. Clearance around panel locations shall allow for the panel doors to be opened fully as designed by the equipment manufacturer. All fire alarm cabinets shall be keyed alike. A like key shall be used to key all fire alarm panels, cabinets and fire phone boxes. All keys shall be delivered to the environmental health and safety representative at the time of the acceptance test.

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5. A terminal cabinet shall be installed adjacent to each control panel or equipment cabinet. The terminal cabinet shall be keyed with the same key as the fire alarm control panel. All field wiring serving this control panel including data circuits, notification circuits, and other data and power wires, shall be terminated in this panel and shall be permanently labeled. Writing on the wiring insulation with a marking pen as a method of labeling shall not be acceptable. Labels shall indicate the circuit number and the area served. This cabinet shall be accessible without special tools or ladders. Terminals in this cabinet will allow wiring to be disconnected for the servicing of individual circuits. Panel doors shall be a hinged door. Terminal cabinets and other fire alarm equipment shall be installed adjacent to, not above or below the equipment cabinets. Existing cabinets shall be expanded to provide sufficient terminals for any additional wiring added to the control panel or equipment cabinet. The terminal cabinet shall be used for wiring terminations only and shall not be used to house system components, relays, modules etc. The minimum size of any terminal cabinet shall be 24 inches by 24 inches and the cabinet shall be of sufficient size to allow for the expedient disconnection of an individual circuit without interruption of any other circuit. All terminals used shall be securely mounted to the backplane of the terminal cabinet. A minimum of 30 percent unused terminal capacity shall be provided in the terminal can. A 24 inch by 24 inch terminal cabinet shall have a minimum of six inches of clearance between the conduit entrance at the top of the cabinet and the top of the terminal strip to allow for wire routing. Where conduits enter at the sides or bottom of the cabinets additional six inches of clearance shall be provided at these locations. Where terminal cabinet size increases the clearances required shall also increase at a ratio of three inches additional clearance for each additional twelve inches of cabinet size.
6. Where a print hanger is installed in the fire command room, the top of the hanger brackets shall be installed at a height of fifty-two inches above the finished floor.

25.6 TESTING

A. General

1. All installation and acceptance inspections shall be performed by a licensed fire alarm technician or planner and be documented on the inspection form.
2. The Contractor shall direct, coordinate, and oversee the commissioning process and witness functional performance testing.
3. It is the Contractor's responsibility to coordinate all testing between trades to ensure all necessary personnel are present and prepared at scheduled tests.

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4. The Contractor shall perform all tests required by NFPA, State, and Local codes.
5. Acceptance test methods shall comply with NFPA 72.
6. All test equipment, instruments, tools and labor required to conduct the system tests shall be made available by the Contractor. The following equipment shall be a minimum for conducting the tests:
 - a. **Ladders to access all installed equipment.**
 - b. **Multimeter for reading voltage, current and resistance.**
 - c. **Intelligent device programmer/tester.**
 - d. **Laptop computer with programming software for any required program revisions.**
 - e. **Two-way radios, flashlights, smoke generation-devices and supplies.**
 - f. **Spare printer paper.**
 - g. **Decibel meter.**
 - h. **Voice intelligibility meter.**
7. The Owner and MD Anderson EH&S Department shall be notified 10 days before the start of the required tests. The notice to the EH&S Department shall be in writing and sent directly to the fire and life safety supervisor. This written notice to EH&S shall be in addition to all other notices or posting of the inspection. All items found at variance with the applicable Codes, Drawings, or Specifications during testing or inspection by a representative of the Authority Having Jurisdiction shall be corrected by Contractor at no charge or expense to the Owner.
8. In addition to testing specified to be performed by the Contractor, the installation shall be subject to test by Owner.

B. Construction Inspections

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1. The installing fire alarm system contractor shall perform the construction inspections required by the Texas Administrative Code (28 TAC Chapter 4. 34.618).
2. The Owner and MD Anderson EH&S Department shall be notified 10 days before the start of the required tests. The notice to the EH&S Department shall be in writing and sent directly to the fire and life safety supervisor. This written notice to EH&S shall be in addition to all other notices or posting of the inspection.

C. Preliminary Testing

1. Preliminary testing shall include all testing necessary to certify the correct operation of the entire fire alarm system. The certification of the fire alarm system is required prior to presenting the system for acceptance testing. Preliminary testing shall include as a minimum a pre-functional test, functional performance test and an integrated system test. It is the contractor's responsibility to schedule, perform and document these tests. A representative from the Environmental Health and Safety Department may monitor the preliminary tests but the presence of a representative of the Environmental Health and Safety Department is not required. No part of the fire alarm system is considered to be accepted at any point prior to the final acceptance test.
2. The Owner and MD Anderson EH&S Department shall be notified 10 days before the start of the required tests. The notice to the EH&S Department shall be in writing and sent directly to the fire and life safety supervisor. This written notice to EH&S shall be in addition to all other notices or posting of the inspection.
3. Preliminary testing shall include and document the systematic inspection of all system equipment and components to ensure compliance with these specifications.
4. Contractor shall provide skilled technicians to execute starting of equipment and to assist in execution of Functional Performance Tests. Contractor shall ensure that they are available and present during the agreed-upon schedules and for a sufficient duration to complete the necessary tests, adjustments, and problem solving.
5. Preliminary testing as required by code and state laws shall be performed and properly documented at the appropriate times during the installation process.

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6. During construction, maintain Record marked-up Drawings and Specifications of all Contract Documents and Contractor-generated coordination Drawings. The Record Drawings and Specifications shall be delivered to the Owner both in electronic format and hard copies as required by the Owner.
7. On larger projects, multiple preliminary tests shall be performed as each portion of work completed dictates. All preliminary tests shall be completed prior to presenting the fire alarm system for acceptance testing.
8. Documentation of the preliminary testing shall be retained by the certifying company and presented at the acceptance test as part of the project documentation package.

D. Device testing.

1. All intelligent devices shall be tested and logged for correct address and sensitivity using test equipment specifically designed for that purpose.
2. Each notification device shall be individually tested and shall be logged by location. The test report shall include the device type, model number, circuit number, candela or wattage setting, individual device location and test results. For each device a passing note shall indicate the device meets all codes, specifications and manufacturer's recommendations regarding placement, performance and workmanship.
3. Wiring runs shall be tested for continuity, short circuits and grounds before system is energized. Resistance, current and voltage readings shall be made as work progresses.
4. Wiring shields shall be tested for continuity and the results of testing shall be documented in the test report.
5. Correct deficiencies (differences between specified and observed performance) as interpreted by the Owner's Project Manager and retest the system and equipment.
6. Prepare required documentation prior to requesting the final acceptance test. Documents needed for final acceptance include:
 - a. **A copy of the preliminary test report. This copy to be retained by EH&S.**
 - b. **System certification form. (009)**

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- c. Record Drawings from approved drawings.**
- d. Site Specific software.**
- e. Intelligibility report.**
- f. SFM installation inspection form.**
- g. Request for inspection form from the project manager.**

E. Acceptance Testing

1. The Commissioning Plan required under Section 26.08 00 shall be provided to the Environmental Health and Safety Department for approval.
2. The commissioning plan shall comply with all requirements of these specifications.
3. A written request for the final acceptance test shall be sent to the fire and life safety supervisor 10 days prior to the requested test date. The requesting contractor shall be responsible for confirming the receipt of the acceptance test request. The request shall be sent directly to the Fire Life Safety Supervisor in addition to any other notices, requests, or postings of the acceptance test.
4. Every device and every function of the system is to be tested, verified and documented that it works properly and meets all contract and code requirements prior to requesting an acceptance test. Each and every interfaced function is to be tested, verified and documented that it works properly and meets all contract and code requirements prior to requesting an acceptance test.
5. Prior to conducting any acceptance testing the contractor shall present to the Owner documentation of the required testing reports and system certification. All pages of any report shall be identified and numbered to assure it is complete. All report documentation shall be dated and signed.

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- a. A copy of the report of the inspection performed at the completion of the back-box installation but prior to the start of the cable installation. This report shall include the date of the inspection, the Texas Fire Alarm license number of the individual performing the inspection, the printed name of the individual performing the inspection, and the signature of the individual performing the inspection.**
- b. A copy of the report of the inspection performed at the completion of cable installation but prior to the start of the device installation. This report shall include the date of the inspection, the Texas Fire Alarm license number of the individual performing the inspection, the printed name of the individual performing the inspection, and the signature of the individual performing the inspection.**
- c. A copy of the inspection performed at the completion of the device inspection but prior to activating the fire alarm system. This report shall include the date of the inspection, the Texas Fire Alarm license number of the individual performing the inspection, the printed name of the individual performing the inspection, and the signature of the individual performing the inspection.**
 - 1) A copy of the comprehensive preliminary inspection report performed prior to the start of acceptance testing. The preliminary report shall document the correct operation of the entire fire alarm system and complete detailed report of each and all interfaced functions. The preliminary inspection report shall note all system functions individually and all devices tested shall be identified by device type, custom label, system circuit and address numbers. The preliminary test report shall comply with the requirements of NFPA 72 chapter 10. This report shall include the date of the inspection, the Texas Fire Alarm license number of the individual performing the inspection, the printed name of the individual performing the inspection, and the signature of the individual performing the inspection.

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- 2) The completed and signed Certificate of Compliance in accordance with NFPA 72 paragraph 2.2.2 and Texas administrative Code Title 28 Part 1 Chapter 34 Subchapter F Rule 34.617. This certificate shall include the date of the certification, the Texas Fire Alarm license number of the individual performing the certification, the printed name of the individual providing the certification and the signature of the individual providing the certification. All applicable information shall be correctly detailed on this certification. This certification shall include the MD Anderson project number to correctly identify the scope of work referenced in the certification.
- 3) Approved Record Drawing shall be provided to EH&S at the time of the acceptance test. This Record Drawing may be a markup drawing provided a date for delivery of permanent drawing has been documented.
- 4) Audio intelligibility report shall be provided to EH&S at the time of the acceptance test.
- 5) Site specific software shall be provided to EH&S at the time of the acceptance test.
6. The fire alarm Contractor shall document each device failure and installation discrepancy at the time of the acceptance test. A written explanation of each discrepancy and failure shall be included as part of the installation documentation.
7. In the event of the systems failure to perform as specified and programmed during the ATP procedure, at the discretion of the Owner or at the discretion of the Authority Having Jurisdiction, the test shall be terminated. The contractor shall repeat the preliminary test prior to requesting further acceptance testing.
8. The Contractor shall retest the system, correcting all deficiencies and providing test documentation to the Owner.
9. The certifying contractor shall provide written explanation of any system failures or non-compliance discovered at the acceptance test. This documentation shall be included in the record documents.
10. The correcting contractor shall document the correction of each discrepancy noted during the ATP. Conducting multiple tests to determine the status of the discrepancy list is not acceptable procedure. Retesting shall be scheduled for and limited to those documented corrections except where a percentage of devices are required to be retested due to system software changes.

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11. In the event that software changes are required during the ATP, a utility program shall be furnished by the system manufacturer to compare the edited program with the original. The utility shall yield a printed list of the changes and all system functions, inputs and outputs affected by the changes. The items listed by the program shall be the minimum acceptable to be retested before calling for resumption of the ATP. The printed list and the printer log of the retesting shall be submitted before scheduling of the ATP.
12. The Owner or the Authority Having Jurisdiction may elect to require the complete ATP to be performed again if, in their opinion, modifications to the system hardware or software warrant complete retesting.
13. All acceptance testing for this project will be accomplished by the Contractor in accordance with the procedural specification listed herein.
14. Every device and every function of the system is to be tested and verified that it works properly.
15. If the system does not function properly and repairs or reprogramming are required, then a retest will be necessary. If multiple discrepancies are found the contractor shall be required to repeat the pretests prior to repeating the final acceptance test.
16. All acceptance testing and documentation shall conform to NFPA 72 Chapter 10, Section 10.4 and this specification. The Contractor shall be responsible for the performance of the Acceptance Test Procedure (ATP), demonstrating the function of the system components, circuits and programming. The acceptance test shall be performed for Owner approval.
17. Prior to testing, the Owner shall be provided Drawings showing the correct address for all addressable alarm initiation devices. The addresses shall be shown in their respective locations for the device on the Drawings. Signals shall be sequentially numbered as the address of the controlling module. Each notification device shall be individually tested and shall be logged by location.
18. The Acceptance Test Procedure shall include but not be limited to the following:
 - a. **A systematic inspection of all system equipment and components to ensure compliance with these specifications.**
 - b. **System mapping feature shall not be disabled at the time of acceptance.**

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- c. A reboot of all the system components shall be performed to ensure restart of all fire alarm system equipment without system troubles or mapping errors.**
- d. A comprehensive test of all peripheral devices.**
- e. Testing of all network annunciators to ensure correct display of added points.**
- f. Manual pull stations shall be tested by pulling the handle and reset with key. The break rod shall be installed at the time the manual pull station has passed the acceptance test. The keys for each manual pull station shall be delivered to the Environmental Health and Safety representative at the time of the acceptance test.**
- g. Smoke detectors shall be tested using smoke detector test smoke approved for that purpose.**
- h. Smoke detectors shall be tested with the alarm verification feature turned off.**
- i. Each visual notification device shall be checked for correct candela settings. Correct operation and jumper settings of each notification devices shall be verified and listed individually in the inspection report.**
- j. Peripheral devices shall be observed to be free of dust, dirt and paint. Strobe lenses shall be clear.**
- k. Acceptance tester shall demonstrate and document the accessibility of all installed devices. Use ladders and test equipment as required by specification. Scaffolds and lifts are not acceptable for access to devices.**
- l. Contractor shall perform Audio Intelligibility testing and sound level testing, providing test results in an acceptance testing report.**

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- m. The system shall be tested in full general alarm mode for a minimum of 10 minutes.**
 - n. A complete test of all system functions and controls.**
19. In addition to the basic system functions, acceptance testing shall include but not be limited to the following systems as appropriate.
- a. Elevator recall.**
 - b. Elevator shunt trip.**
 - c. AHU shutdown.**
 - d. Sprinkler system monitoring modules.**
 - e. Smoke damper operation.**
 - f. Fire/smoke shutter operation.**
20. Secondary power capabilities shall be demonstrated as follows:
- a. System primary power shall be disconnected for a period of seven (7) hours. At the end of that period, an alarm condition shall be created and the system shall perform as specified for a period of five (5) minutes.**
 - b. System primary power shall be restored for 48 hours and system-charging current shall be normal trickle charge for a fully charged battery pack.**
 - c. System battery voltages and charging currents shall be checked at the fire alarm control panel using the test codes and displayed on the LCD display.**
21. Fireman's HVAC override system functions shall be demonstrated as follows:

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- a. **On/off control of each controlled element and test for interaction of other automatic and manual control functions while in the override mode.**
 - b. **Correct status display of monitored elements.**
 - c. **Correct logging of activity to printer and historical memory as programmed.**
 - d. **Contractor shall provide skilled technicians to execute testing. Ensure that they are available and present during the agreed-upon schedules and for sufficient duration to complete the necessary tests, adjustments and problem solving.**
- 22. Correct message display, building, room number, and icon location for each alarm input at the control panel, each remote annunciator display and at the remote voice control panel.
- 23. Correct printer logging at the building control panel.
- F. Documentation
 - 1. Record Drawings:
 - a. **The Contractor shall provide a complete and correct set of printed record drawings to be installed in the fire command room. The printed record drawings provided shall be thirty inches by forty inches. This set of record drawings shall be in addition to all other drawings required. The printed record drawings shall be available at the time of the acceptance test. These drawings shall not be marked or modified during the acceptance test.**

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- b. The Contractor shall provide a complete and correct set of printed record drawings to be installed in the fire command room and a separate complete set of as built drawings shall be delivered to the EH&S Fire Safety Project Manager. An electronic copy of the record drawings shall be provided to the EH&S representative on a CD in a DXF format. This set of electronic record drawings shall be in addition to all other drawings required. The electronic drawings shall be available at the time of the acceptance test.**
2. Contractor shall prepare Pre-functional Checklists and Functional Performance Test (FPT) procedures and execute and document results. All Pre-functional Checklists and tests must be documented using specific, procedural forms in Microsoft Word or Excel software developed for that purpose. Prior to testing, Contractor shall submit those forms to the Owner for review and approval.
 3. No documentation shall be marked as "passed" by the Environmental Health and Safety representative until the entire installation, including all peripheral devices, has met all code and specification requirements. An exception to this requirement would be a project designed and installed in phases with appropriate phased drawings previously submitted for review by EH&S.
 4. Contractor shall provide Owner with documentation required for Commissioning work. At minimum, documentation shall include: Detailed Start-up procedures, Full sequences of operation, Operating and Maintenance data, Performance data, Functional Performance Test Procedures, Control Drawings, and details of Owner-Contracted tests.
 5. Contractor shall submit to Owner installation and checkout materials actually shipped inside equipment and actual field checkout sheet forms used by factory or field technicians.
 6. Contractor shall confirm all equipment listed on the bill of materials has been installed or delivered to EH&S.
 7. Attic stock shall be transferred to the Environmental health and safety department prior to acceptance of any system or modification.

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8. Contractor shall have readily available all replacement components necessary for emergency warranty repairs. Contractor shall provide a site specific list of service repair part numbers for system components. Standard manufacturer's service repair parts list is not acceptable. The exact parts used on site shall be listed with the correct service repair part numbers.
9. Contractor shall review and approve other relative documentation for impact on FPT's of the systems:
 - a. **Shop Drawings and product submittal data related to systems or equipment to be commissioned. The Subcontractor responsible for the FPT shall review and incorporate comments from the Owner and A/E via the Contractor.**
 - b. **Incorporate manufacturer's Start-up procedures with Pre-functional checklists.**
 - c. **Draft Electrical Testing Agency (ETA) Reports: Review and provide comments to Owner.**
 - d. **Factory Performance Test Reports: Review and compile all factory performance data to assure that the data is complete prior to executing the FPT's.**
 - e. **Completed equipment Start-up certification forms along with the manufacturer's field or factory performance and Start-up test documentation: Subcontractor performing the test will review the documentation prior to commencing with the scheduled FPT's.**
10. Final ETA Reports: Subcontractor performing the test will review the documentation prior to commencing with the scheduled FPT's.
11. Operating and Maintenance (O&M) information per requirements of the Technical Specifications and Division 01 requirements: To validate adequacy and completeness of the FPT, the Contractor shall ensure that the O&M manual content, marked-up record Drawings and Specifications, component submittal drawings, and other pertinent documents are available at the Project Site for review.

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25.7 TRAINING

- A. Formal training for the operation and maintenance of all fire alarm equipment and the systems specified herein shall be given by factory trained and certified personnel.
- B. The training shall consist of a minimum of three (3) complete 4-hour training sessions and an eight hour follow up training. The follow up training shall take place approximately six (6) months after the date of acceptance.
 - 1. The first and third sessions shall be for operational and general maintenance subjects.
 - 2. The second and forth sessions shall be for technical training.
 - 3. The follow up session shall be for warranty issues and retraining.
- C. The training shall not take place until all system devices, annunciators and controls have been installed and certified operational by the licensed fire alarm technician. The certifying technician shall be present throughout the training sessions.
- D. The specified training shall be given at a location designated and provided by the Owner for a minimum of ten (10) personnel selected by the Owner, in addition to any necessary on-Site orientation and training.
- E. A training program shall be submitted with material, instructors' qualifications, and proposed schedule, a minimum of sixty (60) days prior to the proposed training for each building system.
- F. The Owner reserves the right of approval of any training course, material, instructor and schedule.
- G. Contractor shall provide a site specific list of service repair part numbers for system components. Standard manufacturer's service repair parts list is not acceptable. The exact parts used on site shall be listed with the appropriate service repair part number. The service part number shall be the only part number needed for correct replacement of the service part.

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- H. A minimum of twelve (12) bound copies of training material shall be provided at the time of training, with four (4) additional copies submitted at the time of Substantial Completion included in the Owner's Operating and Maintenance Manuals.

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Attachment “A”

FIRE ALARM SYSTEM PRICING DETAIL

The University of Texas

FIRE ALARM AND SMOKE DETECTOR SYSTEMS

MD Anderson Cancer Center

28 30 00 “A”

MS092216

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Project Location, St. John, U.S. Virgin
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DATE:
March
06, 2008

Project Name: New Research Building

PROJECT NUMBER: # 08-0001

The University of Texas

FIRE ALARM AND SMOKE DETECTOR SYSTEMS

MD Anderson Cancer Center

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| Control Equipment | | | | | |
|--------------------------------|-------|--------|----------|--|------------|
| Description | Part# | Unit | Quantity | | Extended |
| Back box with | 222- | \$ | 1 | | \$ |
| FACP Voice | 222- | \$ | 1 | | \$ |
| Audio Module | 222- | \$ | 1 | | \$ |
| Switch | 222- | \$ | 6 | | \$ |
| Network | 222- | \$ | 2 | | \$ |
| Battery | 222- | \$ | 2 | | \$ |
| Peripheral Equipment | | | | | |
| Description | Part# | Unit | Quantity | | Extended |
| Smoke | 232- | \$ | 32 | | \$ 2080.00 |
| Heat Detector | 232- | \$ | 8 | | \$ 480.00 |
| Smoke | 232- | \$ | 40 | | \$ 3200.00 |
| Speaker / | 232- | \$ | 12 | | \$ 1080.00 |
| Visual Only | 32- | \$ | 4 | | \$ 212.00 |
| Installation Equipment | | | | | |
| Description | Part# | Unit | Quantity | | Extended |
| Wire #18 | 676 | \$.70 | 1600 | | \$ 1120.00 |
| Caddy Bar | 655 | \$ | 40 | | \$ 140.00 |
| Boxes | 674 | \$ | 40 | | \$ 40.00 |
| | | | | | |
| labor | | | | | |
| Description | Part# | Unit | Quantity | | Extended |
| Design Labor | N.A. | \$ | 10 | | \$ 600.00 |
| Installation | N.A. | \$ | 60 | | \$ 3000.00 |
| Technical | N.A. | \$ | 10 | | \$ 900.00 |
| Programming | N.A. | \$ | 10 | | \$ 900.00 |
| Test / | N.A. | \$ | 12 | | \$ 600.00 |
| Outside Purchase / Subcontract | | | | | |
| Description | Part# | Unit | Quantity | | Extended |
| Conduit Riser | | \$ | 1 | | \$ 1900.00 |

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| | | | | |
|----------------|---|----|---|-----------|
| Riser Terminal | | \$ | 3 | \$ 480.00 |
| TOTAL | = | | | \$ |

END OF ATTACHMENT “A” - SECTION 28 30 00

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Attachment “B”

PRERECORDED DIGITAL VOICE MESSAGES TEXT

ALL CLEAR

Attention, may I have your attention please.

The fire alarm condition has been cleared.

I repeat.

The fire alarm condition has been cleared.

All systems have been returned to normal.

Thank you for your co-operation.

ALL CLEAR IN SPANISH

Su atencion, por favor

El estado de alerta de fuego ha sido resuelto.

Repito

El estado de alerta de fuego ha sido resuelto.

Todos los sistemas se han normalizado.

Gracias por su cooperacion

28 30 00 “B”

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TESTING

Attention, may I have your attention please.

We are conducting a test of the life safety system.

Please disregard the audio signals and flashing lights, as they are only a test.

Thank you.

TESTING IN SPANISH

Su atencion, por favor.

Estamos conduciendo una prueba del sistema de seguridad.

Por favor, ignore las senales de audio y las luces intermitentes, porque son solo una prueba.

Gracias

TESTING COMPLETED

Attention, may I have your attention please.

We have completed our test of the life safety system.

All systems have been returned to normal.

Thank you for your co-operation.

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TESTING COMPLETED IN SPANISH

Su atencion por favor

Hemos completado nuestra prueba del sistema de seguridad.

Todos los sistemas se han normalizado.

Repito

Hemos completado nuestra prueba del sistema de seguridad.

Todos los sistemas se han normalizado.

Gracias por su cooperacion.

DRILL MESSAGE

Attention, may I have your attention please.

This is a practice fire drill.

Please follow RACE procedures.

Thank you.

DRILL MESSAGE IN SPANISH

Su atencion por favor.

Este es un simulacro de incendio.

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Por favor, siga los procedimientos de R-A-C-E
Gracias

DRILL COMPLETED

Attention, may I have your attention please.

This has been a fire drill.

I repeat

This has been a fire drill.

This is an all-clear notification.

Thank you for your co-operation

DRILL COMPLETED IN SPANISH

Su atencion por favor.

Esto ha sido un simulacro de incendio.

Repito.

Esto ha sido un simulacro de incendio.

Esta es la senal de finalizacion del simulacro.

Gracias por su cooperacion.

END OF ATTACHMENT "B" - SECTION 28 30 00

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Attachment “C”

DEVICE LABELING CONVENTION FOR FIRE ALARM SYSTEMS

BUILDING



ACB8.1608 CORR M5-35-0

FLOOR OR
FVFI



ACB8.1608 CORR M5-35-0

ROOM

The University of Texas

MD Anderson Cancer Center

MS092216

FIRE ALARM AND SMOKE DETECTOR SYSTEMS

28 30 00 “C”

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ACB8.1608 CORR M5-35-0

In Corridor Outside Room



ACB8.1608 CORR M5-35-0

Fire Alarm System

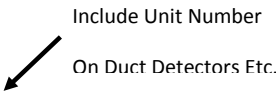


ACB8.1608 CORR M5-35-0

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ACB8.1608 AHU7 M5-35-0

Typical Labels:

- G11.3615 CORRM5-95
- G11.3711 CORR M5-96
- G11.3674 CORRM5-97
- G11.3678 CORRM5-98
- G11.3681 CORRM5-99
- G11.3631 CORRM5-100
- G11.3659 CORRM5-102

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G11.3362 CORRM5-103

G11.3631 M5-107

G11.3613 M5-108

G11.3662 CORRM5-109

G11.STAIR AA M5-114

G11.3536 M5-115

G11.3532 M5-116

G11.3461 M5-117

Y5.5811 CORR M6-4

S5.8228A M7-23

TB.ELEV TB SDM1-9

G11.3461 Mech M1-10

G10.3300 Elec M1-9

G8.1010 Mach M5-15

ADDITIONAL NOTES:

1. Device types report separately and are not needed in the label.
2. If a system is used which cannot report device types separately the device type shall follow the location and precede the device identifier:

a. G11.3659 CORR Pull M5-102

The University of Texas

FIRE ALARM AND SMOKE DETECTOR SYSTEMS

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b. Y5.5811 CORR Smk Det M6-4

- 3. If in doubt contact MD Anderson EH&S Department for direction.

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Attachment "D"

UNIFORM FIRE ALARM CONTROL PANEL TEST FEATURES

25.8 OPERATIONAL INSTRUCTIONS AND EXPLANATION OF FUNCTIONS

- A. The test functions of our fire alarm panels have been revised and made uniform for all buildings. The new format includes changes meant to provide an increased level of safety, simplified operator control and minimizes disruption of building operations during testing, maintenance and fire drills.
- B. The most significant change is the elimination of a test program. The test functions are built into each system's custom control equations and works in conjunction with, not in lieu of, the system's operating program.
- C. The new functionality consists of three elements:
 - 1. FLOOR TEST
 - a. **The first element is the selection of the floor to be placed in test mode. One or more floors may be placed in the test mode by activating specific pseudo point(s) at the control panel. Placing a floor in test mode prevents all normal functions from occurring due to an alarm initiated from that floor except that any device activated will report to that system's control panel and annunciators. This allows for discreetly testing the performance of all initiating devices without the need for bypassing or disconnecting control or signaling devices. All floors other than the one(s) in test mode will continue to operate normally without any limited functionality upon alarm initiation.**

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- b. The pseudo points used for the floor selection are the same in all panels. Pseudo point 700 is used for the basement, 701 for 1st floor 702 for the 2nd floor etc. For buildings with levels lower than basement level, pseudo points 699, 698 etc. are used.**

2. ENHANCED TEST FUNCTIONS

- a. The second element allows for the activation of selected functions for further testing or drills. These features are added to the floor(s) in test by activating one of three buttons on the face of the control panel.**
 - 1) The first button labeled Notification Test, when activated, will enable the audio and visual notification devices on the floor(s) in test mode.
 - 2) The second button labeled AHU / Damper test, when activated, will enable AHU shutdown (either by duct detector or by floor as programmed) on any floor(s) in test mode.
 - 3) The third button labeled Door Test, when activated will enable the door release feature on any floor(s) in test mode.

3. INDEPENDENT TEST FUNCTIONS

- a. The third element allows for the testing and maintenance of elevator or sprinkler systems without the need to disable individual points or to place any floors in test mode. These features are used independently, without the need for floor test activation.**

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- 1) The fourth button labeled Elevator Test, when activated, allows for the testing of elevator recall functions without the need to disable any fire alarm signaling or control functions. Alarms initiated from elevator lobby or elevator machine room smoke detectors will report to the fire alarm system control panel and annunciators and activate elevator recall functions as programmed without activating fire alarm signaling or control functions. All other system initiation devices including elevator shunt trip will activate control and signaling devices as programmed. This feature allows the inspector to expeditiously test lobby detectors and the associated recall functions moving from floor to floor without activating alarm signal or control devices.
- 2) The fifth button labeled Sprinkler Test, when activated, allows for the testing of sprinkler flow switches without the need to disable any fire alarm signaling or control functions. Sprinkler flow switches will still report to the fire alarm panel and annunciators when activated without activating fire alarm signaling or control functions. This feature allows for the refilling of sprinkler risers without the need to put any floors in test and will allow the sprinkler techs to identify those flow switches which may be in need of adjustment because they activated too soon.

D. Note: Activation of any test feature will cause a system trouble. System trouble reminder will repeat if system is left in the test mode.

END OF ATTACHMENT "D" - SECTION 28 30 00

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The University of Texas

MD Anderson Cancer Center

MS092216

FIRE ALARM AND SMOKE DETECTOR SYSTEMS

28 30 00 "D"

4 OF 4

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Attachment "E"

TEMPORARY FIRE ALARM PROTECTION

- 25.9 FIRE ALARM DEVICES ARE FOUND IN ALL AREAS OF ALL BUILDINGS AND IMPACT ALMOST ALL CONSTRUCTION PROJECTS LARGE AND SMALL. THIS DESCRIPTION WILL HELP THE CONSTRUCTION PROCESS BY GETTING THE FIRE ALARM DEVICES "OUT OF THE WAY" WHILE MAINTAINING AN ACCEPTABLE LEVEL OF LIFE SAFETY PROTECTION.
- A. Fire alarm system issues should be considered during the design and review process. Any project which requires removal or replacement of detection or notification devices should include a survey by a professional fire alarm engineer or designer. Since these projects will eventually require the services of a fire alarm company to do the replacement or relocation work and the fire alarm company representative has to make an initial walkthrough inspection to determine the price of the work needed, the survey could take place at that time. The fire alarm company representative can determine the amount of temporary coverage needed, the best way to demolish existing devices, and identify any control functions which may be affected by the construction work.
- B. Prior to the removal or demolition of any fire alarm equipment provide separate temporary coverage to the construction area.
1. Temporary wiring should be run separately from existing wiring or conduit.
 2. Temporary wiring should be placed where it will be out of the way throughout the construction process.
 3. Consideration should be given to the eventual removal of the wire upon completion of the project.
 4. Temporary wiring may be identified by placing small amounts of construction tape along its path to prevent accidental demolition of the temporary wiring.

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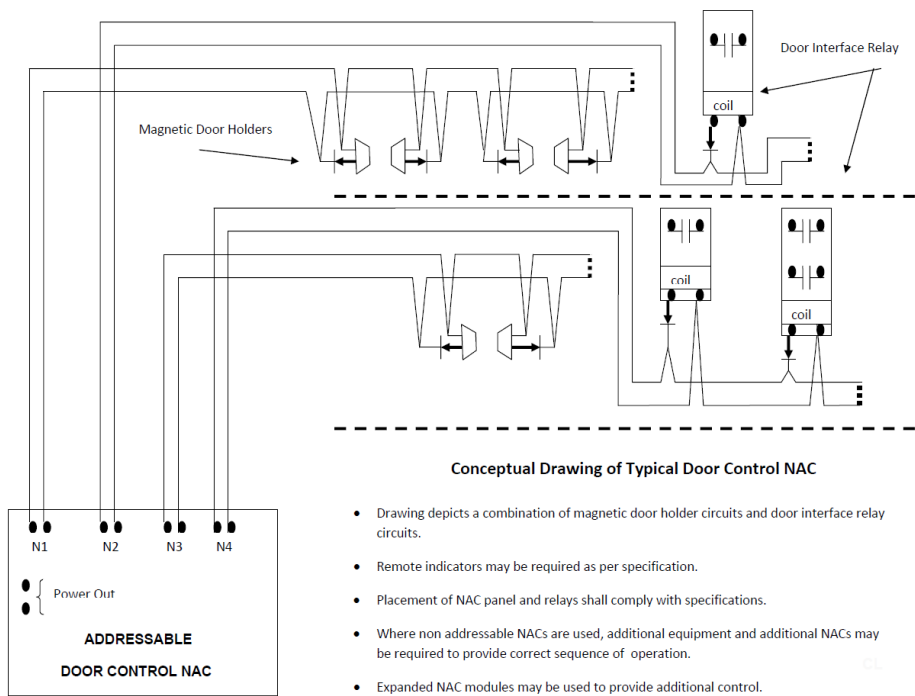
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5. Temporary protection devices should include heat detectors, manual pull stations at exits, smoke detectors where control functionality is required such as active elevator lobbies, audible and visual notification devices appropriate for the area, and any devices which need to be functional during the construction process.
 6. Additional temporary wiring may be needed to replace circuits which are routed beyond the construction area to active fire alarm equipment.
 7. The temporary fire alarm coverage should be properly tested and documented before proceeding with the demolition of existing devices. Devices beyond the construction zone which may have been affected by system changes should also be tested.
- C. Demolition of existing equipment should begin by the fire alarm contractor disconnecting the existing circuits at the control panels, terminal cans or junction boxes as appropriate and rerouting any active circuits around the construction area utilizing the previously installed temporary wiring.
1. A general functional test of the affected areas should be done at this time.
 2. Existing fire alarm devices and equipment should be removed and given to the MD Anderson Environmental Health and Safety Representative. The Contractor is now free to remove conduit and wiring without risk to life safety or control equipment.

END OF ATTACHMENT "E" - SECTION 28 30 00

Attachment “F”

DOOR HOLDER POWER AND CONTROL NAC
CONCEPTUAL DRAWING



SECTION 270500 – COMMON WORK RESULTS FOR COMMUNICATIONS

GOVERNMENT OF THE U. S. VIRGIN ISLANDS, DEPARTMENT OF PUBLIC WORKS

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END OF ATTACHMENT "F" - SECTION 28 30 00

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DIVISION 28 ELECTRONIC SAFETY AND SECURITY

SE

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Fire-alarm control unit
2. Manual fire-alarm boxes
3. System smoke detectors
4. Heat detectors
5. Notification appliances
6. Magnetic door holders
7. Remote annunciator
8. Addressable interface device
9. Digital alarm communicator transmitter
10. System printer

1.3 DEFINITIONS

- A. LED:
Light emitting diode
- B. NICET:
National Institute for Certification in Engineering Technologies
- C. NRTL:
Nationally Recognized Testing Laboratory

1.4 SYSTEM DESCRIPTION

- A. Noncoded addressable emergency voice alarm communication system, with automatic sensitivity control of certain smoke detectors and multiplexed signal transmission, dedicated to fire alarm service only. Digitally stored message sequences shall notify the building occupants that a fire or life safety condition has been reported.

1.5 ACTION SUBMITTALS

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A. General Submittal Requirements:

1. Submittals shall be submitted to and approved by authorities having jurisdiction prior to submitting them to the Owner's Representative for review.

B. Product Data:

For each type of product indicated

C. Shop Drawings:

For fire alarm system, include plans, elevations, sections, details, and attachments to other work.

1. Comply with recommendations in the "Documentation" Section of the "Fundamentals of Fire Alarm Systems" Chapter in NFPA 72.
2. Include voltage drop calculations for notification appliance circuits.
3. Include battery size calculations.
4. Include performance parameters and installation details for each detector, verifying that each detector is listed for complete range of air velocity, temperature, and humidity possible when air-handling system is operating.
5. Include plans, sections, and elevations of heating, ventilating, and air-conditioning ducts, drawn to scale and coordinating installation of duct smoke detectors and access to them. Show critical dimensions that relate to placement and support of sampling tubes, detector housing, and remote status and alarm indicators. Locate detectors according to manufacturer's written recommendations.
6. Include voice/alarm signaling service equipment rack or console layout, grounding schematic, amplifier power calculation, and single line connection diagram.
7. Include floor plans to indicate final outlet locations showing address of each addressable device. Show size and route of cable and conduits.

D. General Submittal Requirements:

1. Submittals shall be approved by authorities having jurisdiction prior to submitting them to Owner's Representative.
2. Shop Drawings shall be prepared by persons with the following qualifications:
 - a. Trained and certified by manufacturer in fire-alarm system design.
 - b. NICET-certified fire-alarm technician, Level IV minimum.
 - c. Licensed or certified by authorities having jurisdiction.

E. Delegated-Design Submittal:

For smoke and heat detectors indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

1. Drawings showing the location of each smoke and heat detector, ratings of each, and installation details as needed to comply with listing conditions of the detector.

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2. Design Calculations:
Calculate requirements for selecting the spacing and sensitivity of detection, complying with NFPA 72.

1.6 INFORMATIONAL SUBMITTALS

- A. Qualification Data:
For qualified Installer and Designer
- B. Field quality control reports

1.7 PRODUCT DELIVERY, STORAGE AND HANDLING

- A. The contractors and suppliers involved in the installation and checkout of the fire alarm system shall, as a minimum, observe the following material handling precautions:
 1. Receive equipment at job site; verify applicable components and quantity delivered.
 2. Handle equipment to prevent internal components' damage and breakage, as well as denting and scoring of enclosure finish.
 3. Do not install damaged equipment.
 4. Store equipment in a clean, dry space and protect from dirt, fumes, water, construction debris and physical damage.
 5. After installation, protect equipment from damage by work of other trades.

1.8 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data:
For fire alarm systems and components to include in emergency, operation, and maintenance manuals. In addition to items specified in Section 017823 "Operation and Maintenance Data," include the following:
 1. Comply with the "Records" Section of the "Inspection, Testing and Maintenance" Chapter in NFPA 72.
 2. Provide "Record of Completion Documents" according to NFPA 72 article "Permanent Records" in the "Records" Section of the "Inspection, Testing and Maintenance" Chapter.
 3. Record copy of site-specific software
 4. Provide "Maintenance, Inspection and Testing Records" according to NFPA 72 article of the same name and include the following:
 - a. Frequency of testing of installed components.
 - b. Frequency of inspection of installed components.
 - c. Requirements and recommendations related to results of maintenance.
 - d. Manufacturer's user training manuals.

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5. Manufacturer's required maintenance related to system warranty requirements.
6. Abbreviated operating instructions for mounting at fire alarm control unit.

B. Software and Firmware Operational Documentation:

1. Software operating and upgrade manuals
2. Program Software Backup:
On magnetic media or compact disk, complete with data files
3. Device address list
4. Printout of software application and graphic screens

1.9 AS BUILT DRAWING SUBMITTAL

- A. As-Built Drawings shall be provided to the owner within 30 days of final acceptance. Drawings shall consist of:
 1. Full, final floor plan layout showing all devices, addresses, wire types, circuiting and conduit runs.
 2. Panel module drawings showing all wiring terminations inside the fire alarm panels.
 3. Final version of the Addressable Device List, as programmed.
- B. As-Built drawings shall be furnished on CD-R or DVD-R media and be in electronic format consisting of AutoCAD ".dwg" and Adobe ".pdf" formats.

1.10 SOFTWARE PROGRAMMING

- A. Provide the services of a factory trained and authorized technician to perform all system software programming.
- B. Provide all hardware, software, programming tools and documentation necessary to modify the fire alarm system on site.
 1. Modification includes addition and deletion of devices, circuits, zones and changes to system operation and custom label changes for devices or zones.
 2. The system structure and software shall place no limit on the type or extent of software modifications on-site. Modification of software shall not require power down of the system or loss of system fire protection while modifications are being made.

1.11 SOFTWARE SERVICE AGREEMENT

- A. Comply with UL 864.
- B. Technical Support:
Beginning with Substantial Completion, provide software support for five years.
- C. Upgrade Service:

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Update software to latest version at Project completion. Install and program software upgrades that become available within two years from date of Substantial Completion. Upgrading software shall include operating system. Upgrade shall include new or revised licenses for use of software.

1. Provide 30 days' notice to Owner to allow scheduling and access to system and to allow Owner to upgrade computer equipment if necessary.

1.12 EXTRA MATERIALS

A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Lamps for Remote Indicating Lamp Units:
Quantity equal to 10 percent of amount installed, but no fewer than 1 unit.
2. Lamps for Strobe Units:
Quantity equal to 10 percent of amount installed, but no fewer than 10 units.
3. Initiating Devices:
Quantity equal to 10 percent of amount of each type installed, but no fewer than 5 unit of each type.
4. Detector Bases:
Quantity equal to 2 percent of amount of each type installed, but no fewer than 5 unit of each type.
5. Keys and Tools:
One extra set for access to locked and tamper proofed components.
6. Audible and Visual Notification Appliances:
Ten of each type installed.
7. Fuses:
Two of each type installed in the system.

1.13 QUALITY ASSURANCE

- A. Installer Qualifications:
Personnel shall be trained and certified by manufacturer for installation of units required for this Project.
- B. Electrical Components, Devices, and Accessories:
Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Manufacturers:
Subject to compliance with requirements, provide products by one of the following:

1. NOTIFIER; a Honeywell company

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2. Gamewell FCI by Honeywell
3. Siemens Building Technologies, Inc.; Fire Safety Division
4. Simplex Grinnell LP; a Tyco International company
5. GE Infrastructure; a unit of General Electric Company

2.2 SYSTEMS OPERATIONAL DESCRIPTION

A. Fire-alarm signal initiation shall be by one or more of the following devices and systems:

1. Manual stations
2. Heat detectors
3. Flame detectors
4. Smoke detectors
5. Duct smoke detectors
6. Verified automatic alarm operation of smoke detectors
7. Automatic sprinkler system water flow
8. Heat detectors in elevator shaft and pit
9. Fire extinguishing system operation
10. Fire standpipe system

B. Fire-alarm signal shall initiate the following actions:

1. Continuously operate alarm notification appliances.
2. Identify alarm at fire-alarm control unit and remote annunciators.
3. Transmit an alarm signal to the remote alarm receiving station.
4. Unlock electric door locks in designated egress paths.
5. Release fire and smoke doors held open by magnetic door holders.
6. Activate voice/alarm communication system.
7. Switch heating, ventilating, and air-conditioning equipment controls to fire alarm mode.
8. Activate smoke control system (smoke management) at firefighter smoke control system panel.
9. Activate stairwell and elevator shaft pressurization systems.

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10. Close smoke dampers in air ducts of designated air-conditioning duct systems.
 11. Recall elevators to primary or alternate recall floors.
 12. Activate emergency lighting control.
 13. Activate emergency shutoffs for gas and fuel supplies.
 14. Record events in the system memory.
 15. Record events by the system printer.
- C. Supervisory signal initiation shall be by one or more of the following devices and actions:
1. Valve supervisory switch
 2. Low-air-pressure switch of a dry-pipe sprinkler system
 3. Elevator shunt-trip supervision
- D. System trouble signal initiation shall be by one or more of the following devices and actions:
1. Open circuits, shorts, and grounds in designated circuits.
 2. Opening, tampering with, or removing alarm-initiating and supervisory signal-initiating devices.
 3. Loss of primary power at fire-alarm control unit.
 4. Ground or a single break in fire-alarm control unit internal circuits.
 5. Abnormal AC voltage at fire-alarm control unit.
 6. Break in standby battery circuitry.
 7. Failure of battery charging.
 8. Abnormal position of any switch at fire-alarm control unit or annunciator.
 9. Fire-pump power failure, including a dead-phase or phase-reversal condition.
 10. Low-air-pressure switch operation on a dry-pipe or preaction sprinkler system.
- E. System Trouble and Supervisory Signal Actions:
Initiate notification appliance and annunciate at fire alarm control unit and remote annunciators.
Record the event on system printer.

2.3 FIRE ALARM CONTROL UNIT

- A. General Requirements for Fire Alarm Control Unit:
1. Field programmable, microprocessor based, modular, power limited design with electronic modules, complying with UL 864 and listed and labeled by an NRTL.

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- a. System software and programs shall be held in flash electrically erasable programmable read-only memory (EEPROM), retaining the information through failure of primary and secondary power supplies.
 - b. Include a real-time clock for time annotation of events on the event recorder and printer.
 2. Addressable initiation devices that communicate device identity and status.
 - a. Smoke sensors shall additionally communicate sensitivity setting and allow for adjustment of sensitivity at fire-alarm control unit.
 - b. Temperature sensors shall additionally test for and communicate the sensitivity range of the device.
 3. Addressable control circuits for operation of mechanical equipment.
- B. Alphanumeric Display and System Controls:
Arranged for interface between human operator at fire alarm control unit and addressable system components including annunciation and supervision. Display alarm, supervisory, and component status messages and the programming and control menu.
1. Annunciator and Display:
Liquid-crystal type, 3 line(s) of 80 characters, minimum
 2. Keypad:
Arranged to permit entry and execution of programming, display, and control commands
- C. Circuits:
1. Initiating Device, Notification Appliance, and Signaling Line Circuits:
NFPA 72, Class A
 - a. Initiating Device Circuits:
Style D
 - b. Notification Appliance Circuits:
Style Z.
 - c. Signaling Line Circuits:
Style 6
 - d. Install no more than 50 addressable devices on each signaling line circuit
 2. Serial Interfaces:
Two RS-232 ports for printers.
- D. Smoke Alarm Verification:
1. Initiate audible and visible indication of an "alarm-verification" signal at fire-alarm control unit.
 2. Activate an NRTL listed and approved "alarm-verification" sequence at fire alarm control unit and detector.

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3. Record events by the system printer.
4. Sound general alarm if the alarm is verified.
5. Cancel fire alarm control unit indication and system reset if the alarm is not verified.

E. Elevator Recall:

1. Smoke detectors at the following locations shall initiate automatic elevator recall.
 - a. Elevator lobby detectors except the lobby detector on the designated floor.
 - b. Smoke detector in elevator machine room.
 - c. Smoke detectors in elevator hoist way.
2. Elevator lobby detectors located on the designated recall floors shall be programmed to move the cars to the alternate recall floor.
3. Water flow alarm connected to sprinkler in an elevator shaft and elevator machine room shall shut down elevators associated with the location without time delay.
 - a. Water flow switch associated with the sprinkler in the elevator pit may have a delay to allow elevators to move to the designated floor.

F. Door Controls:

Door hold-open devices that are controlled by smoke detectors at doors in smoke barrier walls shall be connected to fire-alarm system.

G. Remote Smoke-Detector Sensitivity Adjustment:

Controls shall select specific addressable smoke detectors for adjustment, display their current status and sensitivity settings, and change those settings. Allow controls to be used to program repetitive, time-scheduled, and automated changes in sensitivity of specific detector groups. Record sensitivity adjustments and sensitivity adjustment schedule changes in system memory, and print out the final adjusted values on system printer.

H. Transmission to Remote Alarm Receiving Station:

Automatically transmit alarm, supervisory, and trouble signals to a remote alarm station.

I. Voice/Alarm Signaling Service:

Central emergency communication system with redundant microphones, preamplifiers, amplifiers, and tone generators provided as a special module that is part of fire-alarm control unit.

1. Indicated number of alarm channels for automatic, simultaneous transmission of different announcements to different zones or for manual transmission of announcements by use of the central control microphone. Amplifiers shall comply with UL 1711 and be listed by an NRTL.
 - a. Allow the application of and evacuation signal to indicated number of zones and, at same time, allow voice paging to the other zones selectively or in any combination.
 - b. Programmable tone and message sequence selection
 - c. Standard digitally recorded messages for "Evacuation" and "All Clear"

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- d. Generate tones to be sequenced with audio messages of type recommended by NFPA 72 and that are compatible with tone patterns of notification appliance circuits of fire-alarm control unit.

2. Status Annunciator:

Indicate the status of various voice/alarm speaker zones and the status of firefighters' two-way telephone communication zones.

3. Preamplifiers, amplifiers, and tone generators shall automatically transfer to backup units, on primary equipment failure.

J. Printout of Events:

On receipt of signal, print alarm, supervisory, and trouble events. Identify zone, device, and function. Include type of signal (alarm, supervisory, or trouble) and date and time of occurrence. Differentiate alarm signals from all other printed indications. Also print system reset event, including same information for device, location, date, and time. Commands initiate the printing of a list of existing alarm, supervisory, and trouble conditions in the system and a historical log of events.

K. Primary Power:

24-V DC obtained from 120-V AC service and a power supply module. Initiating devices, notification appliances, signaling lines, trouble signals, supervisory signals supervisory and digital alarm communicator transmitters shall be powered by 24-V DC source.

1. Alarm current draw of entire fire-alarm system shall not exceed 80 percent of the power supply module rating.

L. Secondary Power:

24-V DC supply system with batteries, automatic battery charger, and automatic transfer switch.

1. Batteries:

Sealed lead calcium

M. Instructions:

Computer printout or typewritten instruction card mounted behind a plastic or glass cover in a stainless steel or aluminum frame. Include interpretation and describe appropriate response for displays and signals. Briefly describe the functional operation of the system under normal, alarm, and trouble conditions.

2.4 MANUAL FIRE-ALARM BOXES

A. General Requirements for Manual Fire Alarm Boxes:

Comply with UL 38. Boxes shall be finished in red with molded, raised letter operating instructions in contrasting color; shall show visible indication of operation; and shall be mounted on recessed outlet box. If indicated as surface mounted, provide manufacturer's surface back box.

1. Double-action mechanism requiring two actions to initiate an alarm, pull-lever type; with integral addressable module arranged to communicate manual-station status (normal, alarm, or trouble) to fire- alarm control unit.
2. Station Reset:
Key or wrench operated switch.

2.5 SYSTEM SMOKE DETECTORS

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A. General Requirements for System Smoke Detectors:

1. Comply with UL 268; operating at 24-V DC, nominal.
2. Detectors shall be four-wire type.
3. Integral Addressable Module:
Arranged to communicate detector status (normal, alarm, or trouble) to fire-alarm control unit.
4. Base Mounting:
Detector and associated electronic components shall be mounted in a twist-lock module that connects to a fixed base. Provide terminals in the fixed base for connection to building wiring.
5. Self-Restoring:
Detectors do not require resetting or readjustment after actuation to restore them to normal operation.
6. Integral Visual-Indicating Light:
LED type indicating detector has operated and power-on status
7. Remote Control:
Unless otherwise indicated, detectors shall be analog-addressable type, individually monitored at fire-alarm control unit for calibration, sensitivity, and alarm condition and individually adjustable for sensitivity by fire-alarm control unit.
 - a. Rate-of-rise temperature characteristic shall be selectable at fire-alarm control unit for 15 or 20°F (8 or 11°C) per minute.
 - b. Fixed-temperature sensing shall be independent of rate-of-rise sensing and shall be settable at fire alarm control unit to operate at 135 or 155°F (57 or 68°C).
 - c. Provide multiple levels of detection sensitivity for each sensor.

B. Photoelectric Smoke Detectors:

1. Detector address shall be accessible from fire alarm control unit and shall be able to identify the detector's location within the system and its sensitivity setting.
2. An operator at fire-alarm control unit, having the designated access level, shall be able to manually access the following for each detector:
 - a. Primary status
 - b. Device type
 - c. Present average value
 - d. Present sensitivity selected
 - e. Sensor range (normal, dirty, etc.)

C. Duct Smoke Detectors:

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Photoelectric type complying with UL 268A.

1. Detector address shall be accessible from fire alarm control unit and shall be able to identify the detector's location within the system and its sensitivity setting.
2. An operator at fire alarm control unit, having the designated access level, shall be able to manually access the following for each detector:
 - a. Primary status
 - b. Device type
 - c. Present average value
 - d. Present sensitivity selected
 - e. Sensor range (normal, dirty, etc.)
3. Weatherproof Duct Housing Enclosure:
NEMA 250, Type 4X; NRTL listed for use with the supplied detector.
4. Each sensor shall have multiple levels of detection sensitivity.
5. Sampling Tubes:
Design and dimensions as recommended by manufacturer for specific duct size, air velocity, and installation conditions where applied.
6. Relay Fan Shutdown:
Rated to interrupt fan motor-control circuit

2.6 HEAT DETECTORS

- A. General Requirements for Heat Detectors:
Comply with UL 521.
- B. Heat Detector, Combination Type:
Actuated by either a fixed temperature of 135°F (57°C) or a rate of rise that exceeds 15°F (8°C) per minute unless otherwise indicated.
 1. Mounting:
Twist-lock base interchangeable with smoke detector bases.
 2. Integral Addressable Module:
Arranged to communicate detector status (normal, alarm, or trouble) to fire alarm control unit.
- C. Heat Detector, Fixed-Temperature Type:
Actuated by temperature that exceeds a fixed temperature of 190°F (88°C).
 1. Mounting:
Adapter plate for outlet box mounting
 2. Integral Addressable Module:

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Arranged to communicate detector status (normal, alarm, or trouble) to fire-alarm control unit.

2.7 NOTIFICATION APPLIANCES

A. General Requirements for Notification Appliances:

Individually addressed, connected to a signaling line circuit, equipped for mounting as indicated and with screw terminals for system connections.

1. Combination Devices:

Factory integrated audible and visible devices in a single mounting assembly, equipped for mounting as indicated and with screw terminals for system connections.

B. Visible Notification Appliances:

Xenon strobe lights comply with UL 1971, with clear or nominal white polycarbonate lens mounted on an aluminum faceplate. The word "FIRE" is engraved in minimum 1-inch (25- mm) high letters on the lens.

1. Rated Light Output:

a. 15/30/75/110 cd, selectable in the field. The selector switch for selecting the candela shall be tamper resistant.

b. 115/177 cd for ceiling mounted devices.

2. Mounting:

Wall mounted unless otherwise indicated.

3. For units with guards to prevent physical damage, light output ratings shall be determined with guards in place.

4. Flashing shall be in a temporal pattern, synchronized with other units.

5. Strobe Leads:

Factory connected to screw terminals.

6. The strobe shall be of low current design.

7. Device Color and Mounting Faceplate:

Factory finished, color by Owner's Representative

C. Voice/Tone Notification Appliances:

1. Appliances shall comply with UL 1480 and shall be listed and labeled by an NRTL.

2. High-Range Units:

Rated 2 to 15 W

3. Low-Range Units:

Rated 1 to 2 W

4. Mounting:

Flush

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5. Matching Transformers:

Top range matched to acoustical environment of speaker location.

2.8 MAGNETIC DOOR HOLDERS

A. Description:

Units are equipped for wall or floor mounting as indicated and are complete with matching doorplate.

1. Electromagnet:

Requires no more than 3 W to develop 25-lbf (111-N) holding force.

2. Wall Mounted Units:

Flush mounted unless otherwise indicated

3. Rating:

24-V AC or DC

4. Rating:

120-V AC

B. Material and Finish:

Match door hardware

2.9 REMOTE ANNUNCIATOR

A. Description:

Annunciator functions shall match those of fire alarm control unit for alarm, supervisory, and trouble indications. Manual switching functions shall match those of fire alarm control unit, including acknowledging, silencing, resetting, and testing.

1. Mounting:

Flush cabinet, NEMA 250, Type 1

B. Display Type and Functional Performance:

Alphanumeric display and LED indicating lights shall match those of fire alarm control unit. Provide controls to acknowledge, silence, reset, and test functions for alarm, supervisory, and trouble signals.

2.10 ADDRESSABLE INTERFACE DEVICE

A. Description:

Microelectronic monitor module, NRTL listed for use in providing a system address for alarm initiating devices for wired applications with normally open contacts.

B. Integral Relay:

Capable of providing a direct signal to elevator controller to initiate elevator recall or to circuit breaker shunt trip for power shutdown.

2.11 DIGITAL ALARM COMMUNICATOR TRANSMITTER

A. Digital alarm communicator transmitter shall be acceptable to the remote central station and shall comply with UL 632 and be listed and labeled by an NRTL.

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B. Functional Performance:

Unit shall receive an alarm, supervisory, or trouble signal from fire alarm control unit and automatically capture two telephone line(s) and dial a preset number for a remote central station. When contact is made with central station(s), signals shall be transmitted. If service on either line is interrupted for longer than 45 seconds, transmitter shall initiate a local trouble signal and transmit the signal indicating loss of telephone line to the remote alarm receiving station over the remaining line. Transmitter shall automatically report telephone service restoration to the central station. If service is lost on both telephone lines, transmitter shall initiate the local trouble signal.

C. Local functions and display at the digital alarm communicator transmitter shall include the following:

1. Verification that both telephone lines are available.
2. Programming device
3. LED display
4. Manual test report function and manual transmission clear indication
5. Communications failure with the central station or fire alarm control unit

D. Digital data transmission shall include the following:

1. Address of the alarm-initiating device
2. Address of the supervisory signal
3. Address of the trouble-initiating device
4. Loss of AC supply or loss of power
5. Low battery
6. Abnormal test signal
7. Communication bus failure

E. Secondary Power:

Integral rechargeable battery and automatic charger

F. Self-Test:

Conducted automatically every 24 hours with report transmitted to central station.

2.12 SYSTEM PRINTER

- A. Printer shall be listed and labeled by an NRTL as an integral part of fire alarm system.

2.13 DEVICE GUARDS

A. Description:

Clear UV-stabilized polycarbonate enclosure sized for device requiring protection.

1. Manual Stations:

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- a. Weatherproof Protective Shield:
Factory fabricated clear UV-stabilized polycarbonate enclosure with gasket hinged at the top to permit lifting for access to initiate an alarm. Lifting the cover actuates an integral battery-powered audible horn intended to discourage false alarm operation.

2. Notification Appliances:

- a. Weatherproof Protective Shield:
Factory fabricated clear UV-stabilized polycarbonate enclosure with gasket.

PART 3 --EXECUTION

3.1 EQUIPMENT INSTALLATION

- A. Comply with NFPA 72 for installation of fire alarm equipment.
- B. Equipment Mounting:
Install fire alarm control unit on finished floor with tops of cabinets not more than 72 inches (1830 mm) above the finished floor.
- C. Install wall mounted equipment, with tops of cabinets not more than 72 inches (1830 mm) above the finished floor.
- D. The Contractor shall provide and install the system in accordance with the plans and specifications, all national and state applicable codes, NEC wiring criteria, and the manufacturer's recommendations. All communications wiring shall be twisted and shielded cables.
- E. All wiring shall be in a conduit system separate from other building wiring. All junction boxes shall be sprayed red and labeled "Fire Alarm". Wiring color code shall be maintained throughout the project.
- F. Conduit and boxes containing fire alarm wiring shall be furnished with a red outer finish. Conduit shall be labeled every 10 feet.
- G. Wiring shall be identified at terminal and junction locations, in a manner that will prevent unintentional interference with the signaling circuit during testing and servicing.
- H. Installation of equipment and devices that pertain to other work in the Contract shall be closely coordinated with the appropriate subcontractors.
- I. Installation of equipment and devices shall be closely coordinated with the Owner's Representative
- J. The manufacturer's authorized representative shall provide all on-site software modifications and supervision of installation of the complete Fire Alarm System installation, perform a complete functional test of the system, and submit a written report to the Contractor attesting to the proper operation of the completed system.
- K. Manual Stations:
All manual stations shall be mounted per ADA requirements (48 inches AFF to the operable part of the station).
- L. Smoke or Heat Detector Spacing:

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1. Comply with NFPA 72, "Smoke Sensing Fire Detectors" Section in the "Initiating Devices" Chapter, for smoke detector spacing.
2. Comply with NFPA 72, "Heat Sensing Fire Detectors" Section in the "Initiating Devices" Chapter, for heat detector spacing.
3. Smooth ceiling spacing shall not exceed 30 feet (9 m).
4. Spacing of detectors for irregular areas, for irregular ceiling construction, and for high ceiling areas shall be determined according to Appendix A or Appendix B in NFPA 72.
5. HVAC:
Locate detectors not closer than 3 feet (1 m) from air-supply diffuser or return-air opening.
6. Lighting Fixtures:
Locate detectors not closer than 12 inches (300 mm) from any part of a lighting fixture.
- M. Do not install smoke detectors until after the construction cleanup of all trades is complete and final per NFPA 72.
- N. Do not remove shipping covers on smoke detector heads until after completion of the final contractor cleaning of the building. The contractor shall be required to provide new smoke detectors wherever and whenever a shipping cover has been removed prior to final clean-up.
- O. Duct Smoke Detectors:
Comply with NFPA 72 and NFPA 90A. Install sampling tubes so they extend the full width of duct.
- P. Heat Detectors in Elevator Shafts:
Coordinate temperature rating and location with sprinkler rating and location.
- Q. Single Station Smoke Detectors:
Where more than one smoke alarm is installed within a dwelling or suite, they shall be connected so that the operation of any smoke alarm causes the alarm in all smoke alarms to sound.
- R. Remote Status and Alarm Indicators:
Install near each smoke detector and each sprinkler water-flow switch and valve-tamper switch that is not readily visible from normal viewing position.
- S. Audible Visual Alarm Indicating Devices:
Install not less than 6 inches (150 mm) below the ceiling.
- T. Device Location Indicating Lights:
Locate in public space near the device they monitor.
- U. Fire Alarm Control Unit:
Surface mounted, with tops of cabinets not more than 72 inches (1830 mm) above the finished floor.
- V. Annunciator:
Install with top of panel not more than 72 inches (1830 mm) above the finished floor.
- W. Addressable Control Modules and Relays:

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All control modules and relays shall be mounted within three (3) feet of the device being controlled, unless wired for fail safe operation

3.2 CONNECTIONS

- A. For fire protection systems related to doors in fire rated walls and partitions and to doors in smoke partitions, comply with requirements in Section 087100 "Door Hardware." Connect hardware and devices to fire alarm system.
 - 1. Verify that hardware and devices are NRTL listed for use with fire alarm system in this Section before making connections.
- B. Make addressable connections with a supervised interface device to the following devices and systems. Install the interface device less than 3 feet (1 m) from the device controlled. Make an addressable confirmation connection when such feedback is available at the device or system being controlled.
 - 1. Alarm initiating connection to smoke control system (smoke management) at firefighter smoke control system panel.
 - 2. Alarm initiating connection to stairwell and elevator shaft pressurization systems.
 - 3. Smoke dampers in air ducts of designated air-conditioning duct systems
 - 4. Alarm initiating connection to elevator recall system and components.
 - 5. Alarm initiating connection to activate emergency lighting control.
 - 6. Alarm initiating connection to activate emergency shutoffs for gas and fuel supplies.
 - 7. Supervisory connections at valve supervisory switches
 - 8. Supervisory connections at low-air pressure switch of each dry pipe sprinkler system.
 - 9. Supervisory connections at elevator shunt trip breaker
 - 10. Supervisory connections at fire-pump power failure including a dead-phase or phase-reversal condition.
 - 11. Supervisory connections at fire-pump engine control panel.

3.3 IDENTIFICATION

- A. Identify system components, wiring, cabling, and terminals. Comply with requirements for identification specified in Section 260553 "Identification for Electrical Systems."
- B. Install framed instructions in a location visible from fire-alarm control unit.

3.4 GROUNDING

- A. Ground fire alarm control unit and associated circuits; comply with IEEE 1100. Install a ground wire from main service ground to fire alarm control unit.

3.5 FIELD QUALITY CONTROL

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- A. Field tests shall be witnessed by Project Consultant, Owner's designated representative and authorities having jurisdiction.
- B. Manufacturer's Field Service:
Engage a factory authorized service representative to inspect, test, and adjust components, assemblies, and equipment installations, including connections.
- C. Perform tests and inspections.
 - 1. Manufacturer's Field Service:
Engage a factory authorized service representative to inspect components, assemblies, and equipment installations, including connections, and to assist in testing.
- D. Tests and Inspections:
 - 1. Visual Inspection:
Conduct visual inspection prior to testing.
 - a. Inspection shall be based on completed Record Drawings and system documentation that is required by NFPA 72 in its "Completion Documents, Preparation" Table in the "Documentation" Section of the "Fundamentals of Fire Alarm Systems" Chapter.
 - b. Comply with "Visual Inspection Frequencies" Table in the "Inspection" Section of the "Inspection, Testing and Maintenance" Chapter in NFPA 72; retain the "Initial/Reacceptance" column and list only the installed components.
 - 2. System Testing:
Comply with "Test Methods" Table in the "Testing" Section of the "Inspection, Testing and Maintenance" Chapter in NFPA 72.
 - 3. Test audible appliances for the public operating mode according to manufacturer's written instructions. Perform the test using a portable sound level meter complying with Type 2 requirements in ANSI S1.4.
 - 4. Test audible appliances for the private operating mode according to manufacturer's written instructions.
 - 5. Test visible appliances for the public operating mode according to manufacturer's written instructions.
 - 6. Factory authorized service representative shall prepare the "Fire Alarm System Record of Completion" in the "Documentation" Section of the "Fundamentals of Fire Alarm Systems" Chapter in NFPA 72 and the "Inspection and Testing Form" in the "Records" Section of the "Inspection, Testing and Maintenance" Chapter in NFPA 72.
- E. Re-acceptance Testing:
Perform re-acceptance testing to verify the proper operation of added or replaced devices and appliances.
- F. Fire alarm system will be considered defective if it does not pass tests and inspections.
- G. Prepare test and inspection reports.
- H. Maintenance Test and Inspection:

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Perform tests and inspections listed for weekly, monthly, quarterly, and semi-annual periods. Use forms developed for initial tests and inspections.

1. Annual Test and Inspection:

One year after date of Substantial Completion, test fire alarm system complying with visual and testing inspection requirements in NFPA 72. Use forms developed for initial tests and inspections.

3.6 DEMONSTRATION

A. Engage a factory authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain fire alarm system.

B. The equipment manufacturer's representative shall provide, as part of this Contract, a minimum of eight (8) hours system operating training the Owner's designated representative, and fire department personnel. Training sessions shall be in two parts: System Operation and System Maintenance. These sessions shall be scheduled at the owner's convenience.

END OF SECTION

CTON 29311 DIGITAL ADDRESSABLE FIRE ALARM SUSTEM

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PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:

1. Communications equipment coordination and installation.
2. Sleeves for pathways and cables.
3. Sleeve seals.
4. Grout.
5. Common communications installation requirements.

DEFINITIONS

- A. EPDM: Ethylene-propylene-diene terpolymer rubber.
- B. NBR: Acrylonitrile-butadiene rubber.

SUBMITTALS

- A. Product Data: For sleeve seals.

1.2 COORDINATION

A. Coordinate arrangement, mounting, and support of communications equipment:

1. To allow maximum possible headroom unless specific mounting heights that reduce headroom are indicated.
2. To provide for ease of disconnecting the equipment with minimum interference to other installations.
3. To allow right of way for pathways installed at required slope.
4. Ensure connecting pathways, cables, wireways, cable trays, and busways will be clear of obstructions and of the working and access space of other equipment.

Coordinate installation of required supporting devices in cast-in-place concrete, masonry walls, and other structural components as they are constructed.

Coordinate location of access panels and doors for communications items that are behind finished surfaces or otherwise concealed.

Coordinate selection and application of Firestopping specified in Division 07 Section "Through-Penetration Firestop Systems."

- PRODUCTS

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1.1 SLEEVES FOR PATHWAYS AND CABLES

A. Steel Pipe Sleeves: ASTM A 53/A 53M, Type E, Grade B, Schedule 40, galvanized steel, plain ends.

Cast-Iron Pipe Sleeves:

Cast or fabricated "wall pipe," equivalent to ductile-iron pressure pipe, with plain ends and integral waterstop, unless otherwise indicated.

Sleeves for Rectangular Openings: Galvanized sheet steel.

1. Minimum Metal Thickness:

- a. For sleeve cross-section rectangle perimeter less than 50 inches (1270 mm) and no side more than 16 inches (400 mm), thickness shall be 0.052 inch (1.3 mm).
- b. For sleeve cross-section rectangle perimeter equal to, or more than, 50 inches (1270 mm) and 1 or more sides equal to, or more than, 16 inches (400 mm), thickness shall be 0.138 inch (3.5 mm).

SLEEVE SEALS

A. Description:

Modular sealing device, designed for field assembly, to fill annular space between sleeve and pathway or cable.

1. Basis of Design Product:

Subject to compliance with requirements, provide or/a comparable product by one of the following:

- a. Advance Products & Systems, Inc.
- b. Calpico, Inc.
- c. Metraflex Co.
- d. Pipeline Seal and Insulator, Inc.

Sealing Elements:

EPDM interlocking links shaped to fit surface of cable or conduit. Include type and number required for material and size of pathway or cable.

Pressure Plates: Stainless steel. Include two for each sealing element.

Connecting Bolts and Nuts:

Stainless steel of length required to secure pressure plates to sealing elements. Include one for each sealing element.

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GROUT

- A. Nonmetallic, Shrinkage Resistant Grout:
ASTM C 1107, factory packaged, nonmetallic aggregate grout, noncorrosive, non-staining, mixed with water to consistency suitable for application and a 30-minute working time.

- EXECUTION

1.1 COMMON REQUIREMENTS FOR COMMUNICATIONS INSTALLATION

- A. Comply with NECA 1.
 - B. Measure indicated mounting heights to bottom of unit for suspended items and to center of unit for wall mounting items.
 - C. Headroom Maintenance: If mounting heights or other location criteria are not indicated, arrange and install components and equipment to provide maximum possible headroom consistent with these requirements.
 - D. Equipment:
Install to facilitate service, maintenance, and repair or replacement of components of both communications equipment and other nearby installations. Connect in such a way as to facilitate future disconnecting with minimum interference with other items in the vicinity.
- Right of Way: Give to piping systems installed at a required slope.

SLEEVE INSTALLATION FOR COMMUNICATIONS PENETRATIONS

- A. Communications penetrations occur when pathways, cables, wireways, or cable trays penetrate concrete slabs, concrete or masonry walls, or fire-rated floor and wall assemblies.
 - B. Concrete Slabs and Walls:
Install sleeves for penetrations unless core drilled holes or formed openings are used.
Install sleeves during erection of slabs and walls.
Use pipe sleeves unless penetration arrangement requires rectangular sleeved opening.
- Fire Rated Assemblies:
Install sleeves for penetrations of fire rated floor and wall assemblies unless openings compatible with fire stop system used are fabricated during construction of floor or wall.
- Cut sleeves to length for mounting flush with both surfaces of walls.
- Extend sleeves installed in floors 2 inches (50 mm) above finished floor level.
- Size pipe sleeves to provide 1/4-inch (6.4-mm) annular clear space between sleeve and pathway or cable, unless indicated otherwise.
- Seal space outside of sleeves with grout for penetrations of concrete and masonry

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1. Promptly pack grout solidly between sleeve and wall so no voids remain. Tool exposed surfaces smooth; protect grout while curing.

Interior Penetrations of Non-Fire Rated Walls and Floors:

Seal annular space between sleeve and pathway or cable, using joint sealant appropriate for size, depth, and location of joint. Comply with requirements in Division 07 Section "Joint Sealants."

Fire Rated Assembly Penetrations:

Maintain indicated fire rating of walls, partitions, ceilings, and floors at pathway and cable penetrations. Install sleeves and seal pathway and cable penetration sleeves with fire stop materials. Comply with requirements in Division 07 Section "Penetration Firestopping."

Roof-Penetration Sleeves:

Seal penetration of individual pathways and cables with flexible boot-type flashing units applied in coordination with roofing work.

Above ground, Exterior Wall Penetrations:

Seal penetrations using steel pipe sleeves and mechanical sleeve seals. Select sleeve size to allow for 1-inch (25-mm) annular clear space between pipe and sleeve for installing mechanical sleeve seals.

Underground, Exterior Wall Penetrations:

Install cast iron pipe sleeves. Size sleeves to allow for 1-inch (25-mm) annular clear space between pathway or cable and sleeve for installing mechanical sleeve seals.

SLEEVE-SEAL INSTALLATION

- A. Install to seal exterior wall penetrations.
- B. Use type and number of sealing elements recommended by manufacturer for pathway or cable material and size. Position pathway or cable in center of sleeve. Assemble mechanical sleeve seals and install in annular space between pathway or cable and sleeve. Tighten bolts against pressure plates that cause sealing elements to expand and make watertight seal.

FIRE STOPPING

- A. Apply fire stopping to penetrations of fire rated floor and wall assemblies for communications installations to restore original fire resistance rating of assembly. Firestopping materials and installation requirements are specified in Division 07 Section "Penetration Fire Stopping."

END OF SECTION

SECTION 270256 – GROUNDING & BONDING FOR COMMUNICATION SYSTEMS

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PART 2 GENERAL

2.2 TELECOMMUNICATIONS SERVICE ENTRANCE FACILITIES

- B. Access to the telecommunications grounding system specified by ANSI/TIA/EIA-607-A is mandatory.

Main Telecommunications Equipment Rooms

- A. Access shall be made available to the telecommunications grounding system specified by ANSI/TIA/EIA – 607 - Commercial Building Grounding and Bonding Requirements for Telecommunications.

Telecommunications Rooms

- A. Access shall be made available to the telecommunications grounding system specified by ANSI/TIA/EIA – 607 - Commercial Building Grounding and Bonding Requirements for Telecommunications.

GROUNDING AND BONDING

- C. The National Electrical Code (NEC) provides grounding, bonding, and electrical protection requirements to ensure life safety. Modern telecommunications systems require an effective grounding infrastructure to ensure optimum performance of the wide variety of electronic information transport systems that may be used throughout the life of a building. The grounding and bonding requirements of ANSI/TIA/EIA-607 are intended to work in concert with the cabling topology specified in ANSI/TIA/EIA-568 and installed in pathways and spaces as specified in ANSI/TIA/EIA-569. The requirements of these standards, and of this manual, are in addition to the requirements of the NEC.

Conduits for Backbone and Horizontal Cabling Pathways shall be bonded to the grounding electrode system per the NEC.

All conduits shall be bonded to the grounding system as per NEC.

Telecommunications grounding, bonding, and electrical protection at Territory facilities shall comply with the requirement of the NEC, ANSI/TIA/EIA-607, and the additional requirements stated herein.

Telecommunications Main Grounding Busbar (TMGB)

2. The TMGB shall be installed at an accessible and convenient location in each Entrance Facility.
3. The TMGB shall be a pre-drilled copper busbar with standard NEMA bolt hole sizing and spacing. The busbar shall be ¼-inch thick x 4-inch wide, with length sized to accommodate ground connection of telecommunications racks, equipment, and shielded cables in the room, plus provision for 30% growth.

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4. The TMGB shall be bonded to the building main electrical service-grounding electrode. No other grounding point for the TMGB shall be allowed. The TMGB shall not be bonded independently to water pipe, structural steel or electrical conduit.

Telecommunications Ground Busbar (TGB)

5. The Telecommunications Grounding Busbar (TGB) shall be a pre-drilled copper busbar with standard NEMA bolt hole sizing and spacing. The busbar shall be ¼-inch thick x 2-inch wide, with length sized to accommodate ground connection of all telecommunications racks, equipment, and shielded cables in the room, plus provision for 30% growth. The TGB shall be installed in each of the Telecommunications Rooms.

The TGB's shall be bonded together. Refer to the Telecommunications Riser Diagram.

Equipment Racks, Equipment Cabinets and Cable Ladder Racks

6. Equipment racks, equipment cabinets, cable ladder racks and exposed non-current carrying metal parts of the telecommunications Structured Cabling System shall be bonded to the TMGB or TGB.
7. Each section of a cable ladder rack or tray, shall be bonded together by one of three ways:
 - e. Remove paint down to bare metal at the point where the rack section interconnection hardware is mounted. Bond the rack assembly to the TMGB or TGB with a #6 AWG ground wire unless noted otherwise.
 - f. Bond individual rack sections together using braided metal bonding straps or #6 AWG ground wires. The straps or ground wire shall be attached with bolts through holes drilled in the cable rack sections. The bolts must contact bare metal on the rack sections. Bond the rack assembly to the TMGB or TGB with a #6 AWG ground wire unless noted otherwise.
 - g. Bond individual rack sections to a #6 AWG ground cable unless noted otherwise run throughout the entire length of rack. The ground cable shall be bonded to the TMGB or TGB.

Grounding and Bonding of Backbone Cables

- h. OSP copper backbone cables shall have the metallic cable shields bonded to the ground lug of the primary protector block at the entrance to each building.
- i. Optical fiber cables that contain metallic shielding or metallic strength members must have those metallic components bonded to the TMGB at each end of the cable.
- j. Inside plant copper or optical fiber backbone cables that contain metallic shielding shall have their shields bonded to the TMGB at each end.

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- k. The metallic shield of splices made to backbone cables shall be bonded together to maintain shield continuity.

PART 3 PRODUCTS

3.3 TELECOMMUNICATIONS SERVICE ENTRANCE FACILITIES

D. GROUNDING AND BONDING

1. Service Entrance TMGB

- l. Provide a bond with a minimum of a # 6 AWG unless noted otherwise, green insulated ground wire from the TMGB to the main electrical service building ground.
- m. Label grounding and bonding hardware and connections per ANSI/TIA/EIA 606-A.
- n. The ground busbar assembly shall be copper, 1/4" x 4" x 23" with insulators and support bracket. Provide lugs for each Bonding Conductor (BC) and the Telecommunications Bonding Backbone (TBB). Hardware (bolts) shall be silicone bronze and lugs shall be copper alloy sized for connecting the BC and TBB to the TMGB and TGB.
- o. Rack mounted equipment ground busbar shall be 3/16" x 3/4" x 18 5/16" for attachment to 19" mounting rails of equipment racks and cabinets. Provide splice plates for attachment to multiple equipment racks and cabinets, #6-32 silicon bronze screws, ground lugs and mounting hardware.

MAIN TELECOMMUNICATIONS EQUIPMENT ROOMS

E. GROUNDING AND BONDING

- 8. The TGB shall be bonded to the Main Electrical service building ground by means of a # 6 AWG unless noted otherwise, green insulated ground wire.
 - 9. Label grounding and bonding hardware and connections per ANSI/TIA/EIA 606A.
 - 10. The ground busbar assembly shall be copper, 1/4" x 4" x 13.5" with insulators and support bracket. Provide lugs for each BC and the TBB. Hardware (bolts) shall be silicone bronze and lugs shall be copper alloy sized for connecting the BC and TBB to the TMGB and TGB.
- Rack mounted equipment ground busbar shall be 3/16" x 3/4" x 18 5/16" for attachment to 19" mounting rails of equipment racks and cabinets. Provide splice plates for attachment to multiple equipment racks and cabinets, #6-32 silicon bronze screws, ground lugs and mounting hardware.

ADMINISTRATION AND LABELING

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- F. The BC shall be provided with a self-adhesive, self-laminating, mechanically printed label with a clear protective laminating over wrap or mechanically printed heat shrink tubing. The label shall be approved by the BIT/RCDD prior to application.

The TGB and TMGB shall be provided with a copper, brass or 1/16" mechanically stamped tag, 3" square surface area minimum, legible and permanently affixed. The tag shall be approved by the BIT/RCDD prior to application.

3.4 GROUNDING

- G. Comply with requirements in Division 16 Section 16450 for grounding conductors and connectors.

Telecommunications Main Bus Bar:

11. Connectors: Mechanical type, cast silicon bronze, solderless compression-type wire terminals, and long-barrel, two-bolt copper alloy lugs for connection to ground bus bar.
12. Ground Bus Bar: Copper, minimum 1/4 inch thick by 4 inches wide with 9/32-inch holes spaced 1-1/8 inches apart.
13. Stand-Off Insulators: Comply with UL 891 for use in switchboards, 600 V. Lexan or PVC, impulse tested at 5000 V.

Comply with ANSI-J-STD-607-A.

Label grounding and bonding hardware and connections per ANSI/TIA/EIA-606-A.

PART 4 EXECUTION

4.5 TELECOMMUNICATIONS SERVICE ENTRANCE FACILITIES

H. GROUNDING AND BONDING

14. The LVLTC shall install the grounding busbar as required by ANSI/TIA/EIA 607-A and the NEC.
15. Equipment racks, conduits, cable trays, ladder racks, etc. shall be bonded to the grounding busbar.
16. Bonding connectors and clamps shall be mechanical type made of silicon bronze.
17. Terminals shall be solderless compression type, copper long-barrel NEMA two bolts.
18. The LVLTC shall bond the shield of shielded cables to the grounding busbar per applicable code and manufacturers recommended practices.

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19. Grounding and bonding shall be in accordance with ANSI/TIA/EIA-607-A and the NEC.

20. Labeling shall be in accordance with ANSI/TIA/EIA 606-A.

4.6 GROUNDING

- I. Install grounding according to the BICSI TDMM, "Grounding, Bonding, and Electrical Protection" Chapter.

Comply with ANSI-J-STD-607-A.

Locate grounding bus bar to minimize the length of bonding conductors. Fasten to wall allowing at least 2-inch clearance behind the grounding bus bar. Connect grounding bus bar with a minimum No. 3/0 AWG grounding electrode conductor from grounding bus bar to suitable electrical building ground.

Bond metallic equipment to the grounding bus bar, using not smaller than No. 6 AWG equipment grounding conductor.

1. Bond the shield of shielded cable to the grounding bus bar in communications rooms and spaces.

ADMINISTRATION AND LABELING

- J. The LVLTC shall permanently secure the label within six (6) inches from both ends of the BC.

The LVLTC shall permanently secure the tag within six (6) inches from the TMGB and TGB.

END OF SECTION

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PART 5 - GENERAL

5.7 RELATED DOCUMENTS

- K. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

SUMMARY

L. Section Includes:

- 21. Metal conduits and fittings.
- 22. Nonmetallic conduits and fittings.
- 23. Optical-fiber-cable pathways and fittings.
- 24. Metal wire ways and auxiliary gutters.
- 25. Nonmetallic wire ways and auxiliary gutters.
- 26. Surface pathways.
- 27. Boxes, enclosures, and cabinets.
- 28. Hand holes and boxes for exterior underground cabling.

Related Requirements:

- 29. Section 260543 "Underground Ducts and Raceways for Electrical Systems" for exterior duct banks, manholes, and underground utility construction.
- 30. Section 260533 "Raceways and Boxes for Electrical Systems" for conduits, wire ways, surface raceways, boxes, enclosures, cabinets, hand holes, and faceplate adapters serving electrical systems.
- 31. Section 280528 "Pathways for Electronic Safety and Security" for conduits, surface pathways, inner duct, boxes, and faceplate adapters serving electronic safety and security.
- 32. Rooms used for telecommunications, including Service Entrance Facilities (SEF), the Main Equipment Rooms (MER), and Telecommunication Rooms (TR) shall be dedicated to the sole use of Telecommunications. No other building facility equipment shall be housed in rooms used for telecommunications including, but not limited to, fire alarm systems, monitoring systems, security systems, janitorial services, supply storage, departmental storage, etc.

DEFINITIONS

- M. ARC: Aluminum rigid conduit

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N. GRC: Galvanized rigid steel conduit

O. IMC: Intermediate metal conduit

ACTION SUBMITTALS

P. Product Data: For surface pathways, wireways and fittings, floor boxes, hinged-cover enclosures, and cabinets

Q. LEED Submittals

INFORMATIONAL SUBMITTALS

R. Coordination Drawings:

Pathway routing plans, drawn to scale, on which the following items are shown and coordinated with each other, using input from installers of items involved:

33. Structural members in paths of pathway groups with common supports

34. HVAC and plumbing items and architectural features in paths of conduit groups with common supports

Qualification Data: For professional engineer.

Source quality-control reports.

5.8 MAIN TELECOMMUNICATIONS EQUIPMENT ROOMS

S. The Equipment Room shall be connected to the backbone pathway for cabling to the Telecommunications Entrance Facility and the Telecommunications Rooms.

5.9 BACKBONE PATHWAYS

T. The TRs shall have vertical 4" ID minimum conduit sleeved holes to the TR above provided by Division 26. Each TR shall have 4" sleeves provided by Division 26 between them. If the TRs are offset, multiple 4" conduits between them shall be provided by Division 26. An extra minimum 1-inch metallic sleeve shall be provided by Division 26 for the vertical riser ground system.

U. Sleeves provided by Division 26 will extend below the ceiling and above the floor 4" with a 2" clearance from the finished wall.

V. Firestop material shall be installed in sleeves.

- PRODUCTS

5.10 METAL CONDUITS AND FITTINGS

W. Manufacturers:

Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

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- 35. AFC Cable Systems, Inc.
- 36. Allied Tube & Conduit; a Tyco International Ltd. Co.
- 37. Alpha Wire Company
- 38. Anamet Electrical, Inc.
- 39. Electri-Flex Company
- 40. 0-ZIGedney; a brand of EGS Electrical Group
- 41. Republic Conduit
- 42. Southwire Company
- 43. Thomas & Betts Corporation
- 44. Western Tube and Conduit Corporation
- 45. Wheatland Tube Company; a division of John Maneely Company

General Requirements for Metal Conduits and Fittings:

- 46. Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- 47. Comply with TIA-569-B.

GRC: Comply with ANSI C80.1 and UL 6.

ARC: Comply with ANSI C80.5 and UL 6A.

IMC: Comply with ANSI C80.6 and UL 1242.

PVC-Coated Steel Conduit: PVC-coated rigid steel conduit

- 48. Comply with NEMA RN 1.
- 49. Coating Thickness: 0.040 inch (1 mm), minimum

EMT: Comply with ANSI C80.3 and UL 797.

Fittings for Metal Conduit: Comply with NEMA FB I and UL 514B.

- 50. Conduit Fittings for Hazardous (Classified) Locations: Comply with UL 886 and NFPA 70.
- 51. Fittings for EMT:
 - p. Material: Steel

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q. Type: Setscrew or compression

Expansion Fittings:

PVC or steel to match conduit type, complying with UL-467, rated for environmental conditions where installed, and including flexible external bonding jumper.

Coating for Fittings for PVC-Coated Conduit: Minimum thickness of 0.040 inch (1 mm), width

Joint Compound for IMC, GRC, or ARC:

Approved, as defined in NFPA 70, by authorities having jurisdiction for use in conduit assemblies, and compounded for use to lubricate and protect threaded conduit joints from corrosion and to enhance their conductivity.

NONMETALLIC CONDUITS AND FITTINGS

X. Manufacturers:

Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

52. AFC Cable Systems, Inc.
53. Allied Tube & Conduit; a Tyco International Ltd. Co.
54. Anamet Electrical, Inc.
55. Arnco Corporation
56. CANTEX Inc.
57. CertainTeed Corp.
58. Condux International, Inc.
59. Electri-Flex Company
60. Kraloy
61. Lamson & Sessions; Carlon Electrical Products
62. Niedax-Kleinhuis USA, Inc.
63. RACO; a Hubbell company
64. Thomas & Betts Corporation

General Requirements for Nonmetallic Conduits and Fittings:

65. Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
66. Comply with TIA-569-B.

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RNC: Type EPC-40-PVC, complying with NEMA TC 2 and UL 651 unless otherwise indicated.

Rigid HDPE: Comply with UL 651A.

RTRC: Comply with UL 1684A and NEMA TC 14.

Fittings for RNC: Comply with NEMA TC 3; match to conduit or tubing type and material.

Solvent cements and adhesive primers shall have a VOC content of 510 and 550 g/L or less, respectively, when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

Solvent cements and adhesive primers shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small Scale Environmental Chambers."

OPTICAL-FIBER-CABLE PATHWAYS AND FITTINGS

Y. Manufacturers:

Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

67. Alpha Wire Company.

68. Arnco Corporation.

69. Endot Industries Inc.

70. IPEX.

Description:

Comply with UL 2024; flexible type pathway, approved for plenum installation unless otherwise indicated.

71. Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

72. Comply with TIA-569-B.

METAL WIREWAYS AND AUXILIARY GUTTERS

Z. Manufacturers:

Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

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73. Cooper B-Line, Inc.

74. Hoffman; a Pentair company

75. Mono-Systems, Inc.

76. Square D; a brand of Schneider Electric

Description:

Sheet metal, complying with UL 870 and NEMA 250, Type 1 unless otherwise indicated, and sized according to NFPA 70.

77. Metal wire ways installed outdoors shall be listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

78. Comply with TIA-569-B.

Fittings and Accessories:

Include covers, couplings, offsets, elbows, expansion joints, adapters, hold down straps, end caps, and other fittings to match and mate with wire ways as required for complete system.

Wire way Covers: Hinged type unless otherwise indicated

Finish: Manufacturer's standard enamel finish.

NONMETALLIC WIREWAYS AND AUXILIARY GUTTERS

AA. Manufacturers:

Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

79. Allied Moulded Products, Inc.

80. Hoffman; a Pentair company

81. Lamson & Sessions; Carlon Electrical Products

82. Niedax-Kieinhuis USA, Inc.

General Requirements for Nonmetallic Wireways and Auxiliary Gutters:

83. Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

84. Comply with TIA-569-B.

Description:

Fiberglass polyester extruded and fabricated to required size and shape, without holes or knockouts. Cover shall be gasketed with oil resistant gasket material and fastened with captive screws treated for corrosion resistance. Connections shall be flanged and have stainless steel screws and oil-resistant gaskets.

Description:

PVC, extruded and fabricated to required size and shape, and having snap-on cover,

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mechanically coupled connections, and plastic fasteners.

Fittings and Accessories:

Couplings, offsets, elbows, expansion joints, adapters, hold-down straps, end caps, and other fittings shall match and mate with wireways as required for complete system.

Solvent cements and adhesive primers shall have a VOC content of 510 and 550 g/L or less, respectively, when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

Solvent cements and adhesive primers shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small Scale Environmental Chambers."

SURFACE PATHWAYS

BB. General Requirements for Surface Pathways:

85. Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

86. Comply with TIA-569-B.

Surface Metal Pathways:

Galvanized steel with snap-on covers complying with UL 5. Prime coated, ready for field painting.

87. Manufacturers:

Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

r. Mono-Systems, Inc.

s. Niedax-Kleinhuis USA, Inc.

t. Panduit Corp

u. Wiremold / Legrand

Surface Nonmetallic Pathways:

Two- or three-piece construction, complying with UL 5A, and manufactured of rigid PVC with texture and color selected by Owner's Representative from manufacturer's standard colors.

Product shall comply with UL-94 V-0 requirements for self-extinguishing characteristics.

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88. Manufacturers:

Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

v. Hubbell Incorporated; Wiring Device-Kellems Division

w. Lamson & Sessions; Carlon Electrical Products

x. Mono-Systems, Inc.

y. Panduit Corp.

z. Wiremold / Legrand

BOXES, ENCLOSURES, AND CABINETS

CC.Manufacturers:

Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

89. Adalet

90. Cooper Technologies Company; Cooper Crouse-Hinds

91. EGSI Appleton Electric

92. Erickson Electrical Equipment Company

93. Hoffman; a Pentair company

94. Hubbell Incorporated; Killark Division

95. Lamson & Sessions; Carlon Electrical Products

96. Milbank Manufacturing Co.

97. Molex; Woodhead Brand

98. Mono-Systems, Inc.

99. 0-ZIGedney; a brand of EGS Electrical Group

100. RACO; a Hubbell company

101. Robroy Industries

102. Spring City Electrical Manufacturing Company

103. Stahlin Non-Metallic Enclosures; a division of Robroy Industries

104. Thomas & Betts Corporation

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105. Wiremold / Legrand

General Requirements for Boxes, Enclosures, and Cabinets:

106. Comply with TIA-569-B.

107. Boxes, enclosures and cabinets installed in wet locations shall be listed for use in wet locations.

Sheet Metal Outlet and Device Boxes: Comply with NEMA OS 1 and UL 514A.

Cast Metal Outlet and Device Boxes: Comply with NEMA FB 1, aluminum, Type FD, with gasketed cover.

Box extensions used to accommodate new building finishes shall be of same material as recessed box.

Metal Floor Boxes:

108. Material: Cast metal

Type: Fully adjustable

Shape: Rectangular

Listing and Labeling:

Metal floor boxes shall be listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

Nonmetallic Floor Boxes: Nonadjustable, rectangular

109. Listing and Labeling:

Nonmetallic floor boxes shall be listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

Small Sheet Metal Pull and Junction Boxes: NEMA OS 1

Cast-Metal Access, Pull, and Junction Boxes:

Comply with NEMA FB 1 and UL 1773, cast aluminum with gasketed cover.

Device Box Dimensions: 4 inches square by 2-1/8 inches deep (100 mm square by 60 mm deep)

Gangable boxes are prohibited.

Nonmetallic Outlet and Device Boxes: Comply with NEMA OS 2 and UL 514C.

Hinged Cover Enclosures:

Comply with UL 50 and NEMA 250, Type 1 with continuous hinge cover with flush latch unless otherwise indicated.

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110. Metal Enclosures: Steel, finished inside and out with manufacturer's standard enamel

111. Nonmetallic Enclosures:

aa. Material: Fiberglass

bb. Finished inside with radio-frequency-resistant paint.

Interior Panels: Steel; all sides finished with manufacturer's standard enamel.

Cabinets:

112. NEMA 250, Type 1, galvanized-steel box with removable interior panel and removable front, finished inside and out with manufacturer's standard enamel.

113. Hinged door in front cover with flush latch and concealed hinge

114. Key latch to match panelboards.

115. Metal barriers to separate wiring of different systems and voltage.

116. Accessory feet where required for freestanding equipment

117. Nonmetallic cabinets shall be listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

HANDHOLES AND BOXES FOR EXTERIOR UNDERGROUND CABLING

DD. General Requirements for Handholes and Boxes:

118. Boxes and handholes for use in underground systems shall be designed and identified as defined in NFPA 70, for intended location and application.

119. Boxes installed in wet areas shall be listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

120. Comply with TIA-569-B.

Polymer Concrete Handholes and Boxes with Polymer Concrete Cover:

Molded of sand and aggregate, bound together with polymer resin, and reinforced with steel, fiberglass, or a combination of the two.

121. Manufacturers:

Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

cc. Armorcast Products Company

dd. Carson Industries, LLC.

ee. CDR Systems Corporation; Hubbell Power Systems

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ff. New Basis

gg. Oldcastle Precast, Inc.; Christy Concrete Products

hh. Synertech Moulded Products; a division of Oldcastle Precast, Inc.

Standard: Comply with SCTE 77.

Configuration: Designed for flush burial with open bottom unless otherwise indicated.

Cover:

Weatherproof, secured by tamper resistant locking devices and having structural load rating consistent with enclosure and handhole location.

Cover Finish: Nonskid finish shall have a minimum coefficient of friction of 0.50.

Cover Legend: Molded lettering, "COMMUNICATIONS"

Conduit Entrance Provisions:

Conduit terminating fittings shall mate with entering ducts for secure, fixed installation in enclosure wall.

Handholes 12 Inches Wide by 24 Inches Long (300 mm Wide by 600 mm Long) and Larger:

Have inserts for cable racks and pulling-in irons installed before concrete is poured.

Fiberglass Handholes and Boxes:

Molded of fiberglass reinforced polyester resin, with frame and covers of polymer concrete.

122. Manufacturers:

Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

ii. Armorcast Products Company

jj. Carson Industries LLC.

kk. CDR Systems Corporation; Hubbell Power Systems

ll. New Basis

mm. Nordic Fiberglass, Inc.

nn. Oldcastle Precast, Inc.; Christy Concrete Products

oo. Synertech Moulded Products; a division of Oldcastle Precast, Inc.

Standard: Comply with SCTE 77.

Color of Frame and Cover: Gray

Configuration: Designed for flush burial with open bottom unless otherwise indicated.

Cover:

Weatherproof, secured by tamper-resistant locking devices and having structural load rating consistent with enclosure and handhole location.

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Cover Finish: Nonskid finish shall have a minimum coefficient of friction of 0.50.

Cover Legend: Molded lettering, "COMMUNICATIONS"

Conduit Entrance Provisions:

Conduit-terminating fittings shall mate with entering ducts for secure, fixed installation in enclosure wall.

Handholes 12 Inches Wide by 24 Inches Long (300 mm Wide by 600 mm Long) and Larger:

Have inserts for cable racks and pulling-in irons installed before concrete is poured.

SOURCE QUALITY CONTROL FOR UNDERGROUND ENCLOSURES

EE. Handhole and Pull Box Prototype Test:

Test prototypes of handholes and boxes for compliance with SCTE 77. Strength tests shall be for specified tier ratings of products supplied.

123. Tests of materials shall be performed by an independent testing agency.

124. Strength tests of complete boxes and covers shall be by either an independent testing agency or manufacturer. A qualified registered professional engineer shall certify tests by manufacturer.

125. Testing machine pressure gages shall have current calibration certification following ISO 9000 and ISO 10012, and traceable to NIST standards.

5.11 LADDER RACK

FF. Provide ladder rack and stand-offs for support of backbone cables passing vertically through TRs.

GG. Include connecting hardware and support hardware for a complete installation including, but not limited to, equipment rack to runway mounting plates, wall angle support brackets, butt splice swivels, junction splice connections and grounding kits.

Ladder Rack:

126. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

pp. Cooper B-Line, Inc.

qq. Ortronics, Inc.

rr. Siemon Co.

ss. Panduit Corp.

tt. Hubbell

uu. CommScope, Inc

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vv. Leviton

Ladder Rack Materials: Types 304 and 316 stainless steel. Ladder rack shall be a tubular side bar type nominally 3/8" thick by 1-1/2" high (Minimum) with 1/2" x 1" welded rings spaced 9" on center.

ww. Ladder Racks: Nominally 18 inches wide, and a rung spacing of 9 inches.

5.12 STRUCTURED CABLING (HORIZONTAL) SUPPORTS

HH. Metallic J-hooks may be used for this project.

II. Cable Support: NRTL labeled. Cable support brackets shall be designed to prevent degradation of cable performance and pinch points that could damage cable. Cable ties are not allowed.

1. Comply with NFPA 70 and UL 2043 for fire-resistant and low-smoke-producing characteristics.
2. Adjustable cable supports, plenum rated.

- EXECUTION

5.13 PATHWAY APPLICATION

JJ. Outdoors: Apply pathway products as specified below unless otherwise indicated:

127. Exposed Conduit: RNC, Type EPC-40-PVC
128. Concealed Conduit, Aboveground: IMC, EMT
129. Underground Conduit: RNC, Type EPC-40-PVC, direct buried
130. Boxes and Enclosures, Aboveground: NEMA 250, Type 4

Indoors: Apply pathway products as specified below unless otherwise indicated:

131. Exposed, Not Subject to Physical Damage: EMT
132. Exposed, Not Subject to Severe Physical Damage: EMT
133. Exposed and Subject to Severe Physical Damage: GRC. Pathway locations include the following:
 - xx. Loading dock
 - yy. Corridors used for traffic of mechanized carts, forklifts, and pallet-handling units
 - zz. Mechanical rooms
 - aaa. Gymnasiums

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Concealed in Ceilings and Interior Walls and Partitions: EMT

Damp or Wet Locations: GRC

Pathways for Optical Fiber or Communications Cable in Spaces Used for Environmental Air:
EMT

Pathways for Optical-Fiber or Communications-Cable Risers in Vertical Shafts: EMT

Pathways for Concealed General-Purpose Distribution of Optical-Fiber or Communications
Cable: EMT

Boxes and Enclosures:

NEMA 250 Type I, except use NEMA 250 Type 4 nonmetallic in institutional and commercial
kitchens and damp or wet locations.

Minimum Pathway Size: 1-inch (27-mm) trade size. Minimum size for optical fiber cables is 1 inch
(27 mm).

Pathway Fittings: Compatible with pathways and suitable for use and location

134. Rigid and Intermediate Steel Conduit:

Use threaded rigid steel conduit fittings unless otherwise indicated. Comply with NEMA FB
2.10.

PVC Externally Coated, Rigid Steel Conduits:

Use only fittings listed for use with this type of conduit. Patch and seal all joints, nicks, and
scraps in PVC coating after installing conduits and fittings. Use sealant recommended by
fitting manufacturer and apply in thickness and number of coats recommended by manufacturer.

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EMT: Use setscrew or compression, steel fittings. Comply with NEMA FB 2.10.

Do not install aluminum conduits, boxes, or fittings in contact with concrete or earth.

Install surface pathways only where indicated on Drawings.

Do not install nonmetallic-conduit where ambient temperature exceeds 120°F (49°C).

INSTALLATION

KK. Comply with NECA 1, NECA 101, and TIA-569-B for installation requirements except where requirements on Drawings or in this article are stricter. Comply with NECA 102 for aluminum pathways. Comply with NFPA 70 limitations for types of pathways allowed in specific occupancies and number of floors.

LL. Keep pathways at least 6 inches (150 mm) away from parallel runs of flues and steam or hot-water pipes. Install horizontal pathway runs above water and steam piping.

MM. Complete pathway installation before starting conductor installation.

NN. Comply with requirements in Section 260529 "Hangers and Supports for Electrical Systems" for hangers and supports.

OO. Arrange stub-ups so curved portions of bends are not visible above finished slab.

PP. Install no more than the equivalent of two 90-degree bends in any pathway run. Support within 12 inches (300 mm) of changes in direction. Utilize long radius ells for all optical fiber cables.

QQ. Conceal conduit and EMT within finished walls, ceilings, and floors unless otherwise indicated. Install conduits parallel or perpendicular to building lines.

RR. Support conduit within 12 inches (300 mm) of enclosures to which attached.

SS. Pathways Embedded in Slabs:

135. Run conduit larger than 1-inch (27-mm) trade size, parallel or at right angles to main reinforcement. Where at right angles to reinforcement, place conduit close to slab support. Secure pathways to reinforcement at maximum 10-foot (3-m) intervals.

136. Arrange pathways to cross building expansion joints at right angles with expansion fittings.

137. Arrange pathways to keep a minimum of 1 inch (25 mm) of concrete cover in all directions.

138. Do not embed threadless fittings in concrete unless specifically approved by Owner's Representative for each specific location.

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139. Change from ENT to IMC before rising above floor.

Stub-ups to Above Recessed Ceilings:

140. Use EMT, IMC, or RMC for pathways.

141. Use a conduit bushing or insulated fitting to terminate stub-ups not terminated in hubs or in an enclosure.

Threaded Conduit Joints, Exposed to Wet, Damp, Corrosive, or Outdoor Conditions:

Apply listed compound to threads of pathway and fittings before making up joints. Follow compound manufacturer's written instructions.

Coat field cut threads on PVC coated pathway with a corrosion preventing conductive compound prior to assembly.

Terminate threaded conduits into threaded hubs or with locknuts on inside and outside of boxes or cabinets. Install insulated bushings on conduits terminated with locknuts.

Install pathways square to the enclosure and terminate at enclosures with locknuts. Install locknuts hand tight plus 1/4 turn more.

Do not rely on locknuts to penetrate nonconductive coatings on enclosures. Remove coatings in the locknut area prior to assembling conduit to enclosure to assure a continuous ground path.

Cut conduit perpendicular to the length. For conduits of 2-inch (53-mm) trade size and larger, use roll cutter or a guide to ensure cut is straight and perpendicular to the length.

Install pull wires in empty pathways. Use polypropylene or monofilament plastic line with not less than 200-lb (90-kg) tensile strength. Leave at least 12 inches (300 mm) of slack at each end of pull wire. Cap underground pathways designated as spare above grade alongside pathways in use.

Surface Pathways:

142. Install surface pathway for surface telecommunications outlet boxes only where shown on Drawings.

143. Install surface pathway with a minimum 2-inch (50-mm) radius control at bend points.

144. Secure surface pathway with screws or other anchor-type devices at intervals not exceeding 48 inches (1200 mm) and with no less than two supports per straight pathway section. Support surface pathway according to manufacturer's written instructions. Tape and glue are not acceptable support methods.

Pathways for Optical Fiber and Communications Cable: Install pathways, metal and nonmetallic, rigid and flexible, as follows:

145. 3/4-Inch (21-mm) Trade Size and Smaller: Install pathways in maximum lengths of 50 feet (15m).

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1-Inch (27-mm) Trade Size and Larger: Install pathways in maximum lengths of 75 feet (23m).

Install with a maximum of two 90-degree bends or equivalent for each length of pathway unless Drawings show stricter requirements. Separate lengths with pull or junction boxes or terminations at distribution frames or cabinets where necessary to comply with these requirements.

Install pathway sealing fittings at accessible locations according to NFPA 70 and fill them with listed sealing compound. For concealed pathways, install each fitting in a flush steel box with a blank cover plate having a finish like that of adjacent plates or surfaces. Install pathway sealing fittings according to NFPA 70.

Install devices to seal pathway interiors at accessible locations. Locate seals so no fittings or boxes are between the seal and the following changes of environments. Seal the interior of all pathways at the following points:

- 146. Where conduits pass from warm to cold locations, such as boundaries of refrigerated spaces.
- 147. Where an underground service pathway enters a building or structure.
- 148. Where otherwise required by NFPA 70.

Comply with manufacturer's written instructions for solvent welding PVC conduit and fittings.

Mount boxes at heights shown on Drawings. If mounting heights of boxes are not individually indicated, give priority to ADA requirements. Install boxes with height measured to top of box unless otherwise indicated.

Recessed Boxes in Masonry Walls:

Saw-cut opening for box in center of cell of masonry block and install box flush with surface of wall. Prepare block surface to provide a flat surface for a raintight connection between box and cover plate or supported equipment and box.

Horizontally separate boxes mounted on opposite sides of walls, so they are not in the same vertical channel.

Support boxes of three gangs or more from more than one side by spanning two framing members or mounting on brackets specifically designed for the purpose.

Fasten junction and pull boxes to or support from building structure. Do not support boxes by conduits.

Set metal floor boxes level and flush with finished floor surface.

Set nonmetallic floor boxes level. Trim after installation to fit flush with finished floor surface.

INSTALLATION OF UNDERGROUND CONDUIT

TT.Direct-Buried Conduit:

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149. Excavate trench bottom to provide firm and uniform support for conduit. Prepare trench bottom as specified in Section 312000 "Earth Moving" for pipe less than 6 inches (150 mm) in nominal diameter.
150. Install backfill as specified in Section 312000 "Earth Moving."
151. After installing conduit, backfill and compact. Start at tie-in point, and work toward end of conduit run, leaving conduit at end of run free to move with expansion and contraction as temperature changes during this process. Firmly hand tamp backfill around conduit to provide maximum supporting strength. After placing controlled backfill to within 12 inches (300 mm) of finished grade, make final conduit connection at end of run and complete backfilling with normal compaction as specified in Section 312000 "Earth Moving."
152. Install manufactured duct elbows for stub-ups at poles and equipment and at building entrances through floor unless otherwise indicated. Encase elbows for stub-up ducts throughout length of elbow.
153. Install manufactured rigid steel conduit elbows for stub-ups at poles and equipment and at building entrances through floor.
 - bbb. Couple steel conduits to ducts with adapters designed for this purpose and encase coupling with 3 inches (75 mm) of concrete for a minimum of 12 inches (300 mm) on each side of the coupling.
 - ccc. For stub-ups at equipment mounted on outdoor concrete bases and where conduits penetrate building foundations, extend steel conduit horizontally a minimum of 60 inches (1500 mm) from edge of foundation or equipment base. Install insulated grounding bushings on terminations at equipment.

Warning Planks:

Bury warning planks approximately 12 inches (300 mm) above direct-buried conduits, but a minimum of 6 inches (150 mm) below grade. Align planks along centerline of conduit.

Underground Warning Tape: Comply with requirements in Section 260553 "Identification for Electrical Systems."

INSTALLATION OF UNDERGROUND HANDHOLES AND BOXES

UU. Install handholes and boxes level and plumb and with orientation and depth coordinated with connecting conduits to minimize bends and deflections required for proper entrances.

VV. Unless otherwise indicated, support units on a level bed of crushed stone or gravel, graded from 1/2-inch (12.5-mm) sieve to No. 4 (4.75-mm) sieve and compacted to same density as adjacent undisturbed earth.

WW. Elevation:

In paved areas, set so cover surface will be flush with finished grade. Set covers of other enclosures 1 inch (25 mm) above finished grade.

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SLEEVE AND SLEEVE-SEAL INSTALLATION FOR COMMUNICATIONS PENETRATIONS

- XX. Install sleeves and sleeve seals at penetrations of exterior floor and wall assemblies. Comply with requirements in Section 270544 "Sleeves and Sleeve Seals for Communications Pathways and Cabling."

FIRE STOPPING

- YY. Install fire stopping at penetrations of fire-rated floor and wall assemblies. Comply with requirements in Section 078413 "Penetration Fire Stopping."

PROTECTION

- ZZ. Protect coatings, finishes, and cabinets from damage or deterioration.

154. Repair damage to galvanized finishes with zinc-rich paint recommended by manufacturer.

155. Repair damage to PVC coatings or paint finishes with matching touchup coating recommended by manufacturer.

5.14 LADDER RACK

- AAA. Install at 84" AFF per manufacturer's recommendations and secured to the top of equipment racks.

- BBB. The ladder rack shall be supported at three-foot intervals with triangular support brackets from the walls and securely attached to the equipment.

Cable radius waterfalls shall be attached to the ladder rack to maintain cable bending radius where cables enter and exit the ladder rack.

Cable shall be secured to the ladder rack using reusable Velcro type cable ties to arrange cables in logical bundles.

Telecommunications grounding and bonding shall be in accordance with applicable codes and regulations. Comply with ANSI/TIA/EIA-607-A and the NEC.

Comply with requirements for demarcation point, pathways, cabinets, and racks specified in Division 27 Section "Communications Equipment Room Fittings." Drawings indicate general arrangement of pathways and fittings.

Ladder racks shall comply with NEMA VE2 and ANSI/TIA/EIA 569-B.

5.15 VERTICAL LADDER RACKS

- CCC. Vertical ladder rack shall be installed by the LVLTC.

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The vertical ladder rack shall be installed on the wall above/below sleeves from the floor to the ceiling above. Stand offs shall be installed as necessary to support the required ladder rack. The anchoring system provided shall be suitable for the type of wall and the weight to be supported by the ladder rack.

5.16 STRUCTURED CABLING (HORIZONTAL) SUPPORTS

DDD. Metallic J-hooks may be used for this project.

EEE. Provide adjustable cable supports for the structured cabling on 30-inch centers maximum.

Provide Velcro type tie wraps for the structured cabling.

The adjustable cable supports shall be rated to carry Category 6 cabling and sized not to exceed the manufacturer's recommended quantity of cables.

END OF SECTION

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The University of Texas

FIRE ALARM AND SMOKE DETECTOR SYSTEMS

MD Anderson Cancer Center

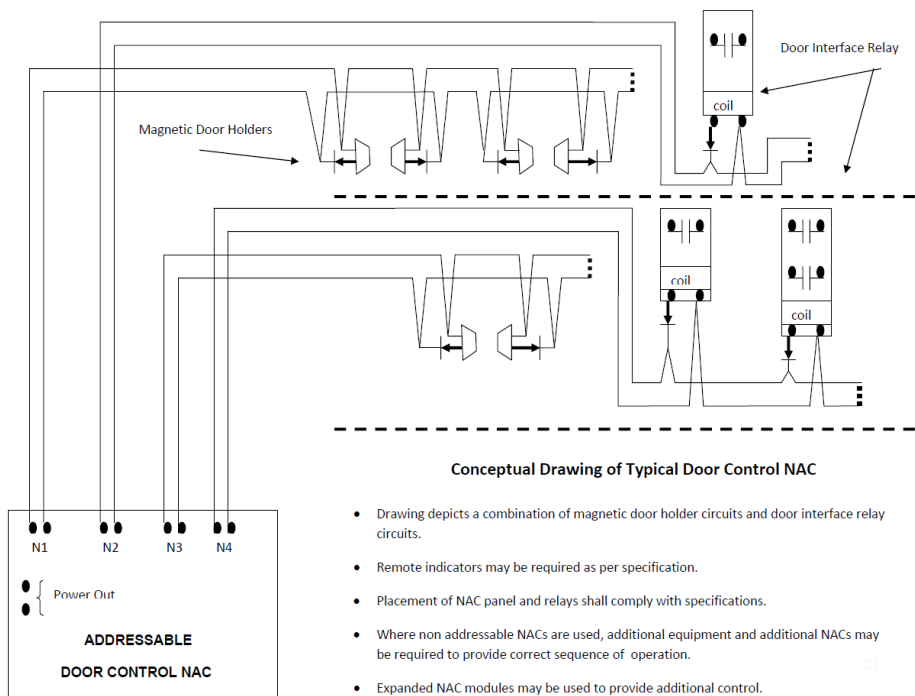
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1 OF 1

Attachment “F”

DOOR HOLDER POWER AND CONTROL NAC
CONCEPTUAL DRAWING



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END OF ATTACHMENT "F" - SECTION 28 30 00

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PART 11 GENERAL

11.25 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

11.26 SUMMARY

- A. Section Includes:

1. Fire-alarm control unit
2. Manual fire-alarm boxes
3. System smoke detectors
4. Heat detectors
5. Notification appliances
6. Magnetic door holders
7. Remote annunciator
8. Addressable interface device
9. Digital alarm communicator transmitter
10. System printer

11.27 DEFINITIONS

- A. LED: Light emitting diode
- B. NICET: National Institute for Certification in Engineering Technologies
- C. NRTL: Nationally Recognized Testing Laboratory

11.28 SYSTEM DESCRIPTION

- A. Noncoded addressable emergency voice alarm communication system, with automatic sensitivity control of certain smoke detectors and multiplexed signal transmission, dedicated to fire alarm service only. Digitally stored message sequences shall notify the building occupants that a fire or life safety condition has been reported.

11.29 ACTION SUBMITTALS

- A. General Submittal Requirements:

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1. Submittals shall be submitted to and approved by authorities having jurisdiction prior to submitting them to the Owner's Representative for review.

Product Data: For each type of product indicated

Shop Drawings: For fire alarm system, include plans, elevations, sections, details, and attachments to other work.

1. Comply with recommendations in the "Documentation" Section of the "Fundamentals of Fire Alarm Systems" Chapter in NFPA 72.
2. Include voltage drop calculations for notification appliance circuits.
3. Include battery size calculations.
4. Include performance parameters and installation details for each detector, verifying that each detector is listed for complete range of air velocity, temperature, and humidity possible when air-handling system is operating.
5. Include plans, sections, and elevations of heating, ventilating, and air-conditioning ducts, drawn to scale and coordinating installation of duct smoke detectors and access to them. Show critical dimensions that relate to placement and support of sampling tubes, detector housing, and remote status and alarm indicators. Locate detectors according to manufacturer's written recommendations.
6. Include voice/alarm signaling service equipment rack or console layout, grounding schematic, amplifier power calculation, and single line connection diagram.
7. Include floor plans to indicate final outlet locations showing address of each addressable device. Show size and route of cable and conduits.

General Submittal Requirements:

1. Submittals shall be approved by authorities having jurisdiction prior to submitting them to Owner's Representative.
2. Shop Drawings shall be prepared by persons with the following qualifications:
 - a. Trained and certified by manufacturer in fire-alarm system design.
 - b. NICET-certified fire-alarm technician, Level IV minimum.
 - c. Licensed or certified by authorities having jurisdiction.

Delegated-Design Submittal:

For smoke and heat detectors indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

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1. Drawings showing the location of each smoke and heat detector, ratings of each, and installation details as needed to comply with listing conditions of the detector.
2. Design Calculations: Calculate requirements for selecting the spacing and sensitivity of detection, complying with NFPA 72.

INFORMATIONAL SUBMITTALS

- A. Qualification Data: For qualified Installer and Designer
- B. Field quality control reports

PRODUCT DELIVERY, STORAGE AND HANDLING

- A. The contractors and suppliers involved in the installation and checkout of the fire alarm system shall, as a minimum, observe the following material handling precautions:
 1. Receive equipment at job site; verify applicable components and quantity delivered.
 2. Handle equipment to prevent internal components' damage and breakage, as well as denting and scoring of enclosure finish.
 3. Do not install damaged equipment.
 4. Store equipment in a clean, dry space and protect from dirt, fumes, water, construction debris and physical damage.
 5. After installation, protect equipment from damage by work of other trades.

CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data:

For fire alarm systems and components to include in emergency, operation, and maintenance manuals. In addition to items specified in Section 017823 "Operation and Maintenance Data," include the following:

 1. Comply with the "Records" Section of the "Inspection, Testing and Maintenance" Chapter in NFPA 72.
 2. Provide "Record of Completion Documents" according to NFPA 72 article "Permanent Records" in the "Records" Section of the "Inspection, Testing and Maintenance" Chapter.
 3. Record copy of site-specific software
 4. Provide "Maintenance, Inspection and Testing Records" according to NFPA 72 article of the same name and include the following:
 - a. Frequency of testing of installed components.
 - b. Frequency of inspection of installed components.

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c. Requirements and recommendations related to results of maintenance.

d. Manufacturer's user training manuals.

Manufacturer's required maintenance related to system warranty requirements.

Abbreviated operating instructions for mounting at fire alarm control unit.

Software and Firmware Operational Documentation:

1. Software operating and upgrade manuals
2. Program Software Backup: On magnetic media or compact disk, complete with data files
3. Device address list
4. Printout of software application and graphic screens

AS BUILT DRAWING SUBMITTAL

A. As-Built Drawings shall be provided to the owner within 30 days of final acceptance. Drawings shall consist of:

1. Full, final floor plan layout showing all devices, addresses, wire types, circuiting and conduit runs.
2. Panel module drawings showing all wiring terminations inside the fire alarm panels.
3. Final version of the Addressable Device List, as programmed.

As-Built drawings shall be furnished on CD-R or DVD-R media and be in electronic format consisting of AutoCAD ".dwg" and Adobe ".pdf" formats.

SOFTWARE PROGRAMMING

- A. Provide the services of a factory trained and authorized technician to perform all system software programming.
- B. Provide all hardware, software, programming tools and documentation necessary to modify the fire alarm system on site.
 1. Modification includes addition and deletion of devices, circuits, zones and changes to system operation and custom label changes for devices or zones.

The system structure and software shall place no limit on the type or extent of software modifications on- site. Modification of software shall not require power down of the system or loss of system fire protection while modifications are being made.

SOFTWARE SERVICE AGREEMENT

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A. Comply with UL 864.

B. Technical Support: Beginning with Substantial Completion, provide software support for five years.

C. Upgrade Service:

Update software to latest version at Project completion. Install and program software upgrades that become available within two years from date of Substantial Completion. Upgrading software shall include operating system. Upgrade shall include new or revised licenses for use of software.

1. Provide 30 days' notice to Owner to allow scheduling and access to system and to allow Owner to upgrade computer equipment if necessary.

EXTRA MATERIALS

A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Lamps for Remote Indicating Lamp Units: Quantity equal to 10 percent of amount installed, but no fewer than 1 unit.
2. Lamps for Strobe Units: Quantity equal to 10 percent of amount installed, but no fewer than 10 units.
3. Initiating Devices: Quantity equal to 10 percent of amount of each type installed, but no fewer than 5 unit of each type.
4. Detector Bases: Quantity equal to 2 percent of amount of each type installed, but no fewer than 5 unit of each type.
5. Keys and Tools: One extra set for access to locked and tamper proofed components.
6. Audible and Visual Notification Appliances: Ten of each type installed.
7. Fuses: Two of each type installed in the system.

QUALITY ASSURANCE

A. Installer Qualifications:

Personnel shall be trained and certified by manufacturer for installation of units required for this Project.

Electrical Components, Devices, and Accessories:

Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

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- PRODUCTS

11.30 MANUFACTURERS

A. Manufacturers:

Subject to compliance with requirements, provide products by one of the following:

1. NOTIFIER; a Honeywell company
2. Gamewell FCI by Honeywell
3. Siemens Building Technologies, Inc.; Fire Safety Division
4. Simplex Grinnell LP; a Tyco International company
5. GE Infrastructure; a unit of General Electric Company

SYSTEMS OPERATIONAL DESCRIPTION

A. Fire-alarm signal initiation shall be by one or more of the following devices and systems:

1. Manual stations
2. Heat detectors
3. Flame detectors
4. Smoke detectors
5. Duct smoke detectors
6. Verified automatic alarm operation of smoke detectors
7. Automatic sprinkler system water flow
8. Heat detectors in elevator shaft and pit
9. Fire extinguishing system operation
10. Fire standpipe system

Fire-alarm signal shall initiate the following actions:

1. Continuously operate alarm notification appliances.
2. Identify alarm at fire-alarm control unit and remote annunciators.
3. Transmit an alarm signal to the remote alarm receiving station.
4. Unlock electric door locks in designated egress paths.
5. Release fire and smoke doors held open by magnetic door holders.

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6. Activate voice/alarm communication system.
7. Switch heating, ventilating, and air-conditioning equipment controls to fire alarm mode.
8. Activate smoke control system (smoke management) at firefighter smoke control system panel.
9. Activate stairwell and elevator shaft pressurization systems.
10. Close smoke dampers in air ducts of designated air-conditioning duct systems.
11. Recall elevators to primary or alternate recall floors.
12. Activate emergency lighting control.
13. Activate emergency shutoffs for gas and fuel supplies.
14. Record events in the system memory.
15. Record events by the system printer.

Supervisory signal initiation shall be by one or more of the following devices and actions:

1. Valve supervisory switch
2. Low-air-pressure switch of a dry-pipe sprinkler system
3. Elevator shunt-trip supervision

System trouble signal initiation shall be by one or more of the following devices and actions:

1. Open circuits, shorts, and grounds in designated circuits.
2. Opening, tampering with, or removing alarm-initiating and supervisory signal-initiating devices.
3. Loss of primary power at fire-alarm control unit.
4. Ground or a single break in fire-alarm control unit internal circuits.
5. Abnormal AC voltage at fire-alarm control unit.
6. Break in standby battery circuitry.
7. Failure of battery charging.
8. Abnormal position of any switch at fire-alarm control unit or annunciator.
9. Fire-pump power failure, including a dead-phase or phase-reversal condition.

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10. Low-air-pressure switch operation on a dry-pipe or preaction sprinkler system.

System Trouble and Supervisory Signal Actions:

Initiate notification appliance and annunciate at fire alarm control unit and remote annunciators.

Record the event on system printer.

FIRE ALARM CONTROL UNIT

A. General Requirements for Fire Alarm Control Unit:

1. Field programmable, microprocessor based, modular, power limited design with electronic modules, complying with UL 864 and listed and labeled by an NRTL.
 - a. System software and programs shall be held in flash electrically erasable programmable read-only memory (EEPROM), retaining the information through failure of primary and secondary power supplies.
 - b. Include a real-time clock for time annotation of events on the event recorder and printer.

Addressable initiation devices that communicate device identity and status.

- a. Smoke sensors shall additionally communicate sensitivity setting and allow for adjustment of sensitivity at fire-alarm control unit.
- b. Temperature sensors shall additionally test for and communicate the sensitivity range of the device.

Addressable control circuits for operation of mechanical equipment.

Alphanumeric Display and System Controls:

Arranged for interface between human operator at fire alarm control unit and addressable system components including annunciation and supervision. Display alarm, supervisory, and component status messages and the programming and control menu.

1. Annunciator and Display: Liquid-crystal type, 3 line(s) of 80 characters, minimum
2. Keypad: Arranged to permit entry and execution of programming, display, and control commands

Circuits:

1. Initiating Device, Notification Appliance, and Signaling Line Circuits: NFPA 72, Class A
 - a. Initiating Device Circuits: Style D
 - b. Notification Appliance Circuits: Style Z.
 - c. Signaling Line Circuits: Style 6
 - d. Install no more than 50 addressable devices on each signaling line circuit

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Serial Interfaces: Two RS-232 ports for printers.

Smoke Alarm Verification:

1. Initiate audible and visible indication of an "alarm-verification" signal at fire-alarm control unit.
2. Activate an NRTL listed and approved "alarm-verification" sequence at fire alarm control unit and detector.
3. Record events by the system printer.
4. Sound general alarm if the alarm is verified.
5. Cancel fire alarm control unit indication and system reset if the alarm is not verified.

Elevator Recall:

1. Smoke detectors at the following locations shall initiate automatic elevator recall.
 - a. Elevator lobby detectors except the lobby detector on the designated floor.
 - b. Smoke detector in elevator machine room.
 - c. Smoke detectors in elevator hoist way.

Elevator lobby detectors located on the designated recall floors shall be programmed to move the cars to the alternate recall floor.

Water flow alarm connected to sprinkler in an elevator shaft and elevator machine room shall shut down elevators associated with the location without time delay.

- a. Water flow switch associated with the sprinkler in the elevator pit may have a delay to allow elevators to move to the designated floor.

Door Controls:

Door hold-open devices that are controlled by smoke detectors at doors in smoke barrier walls shall be connected to fire-alarm system.

Remote Smoke-Detector Sensitivity Adjustment:

Controls shall select specific addressable smoke detectors for adjustment, display their current status and sensitivity settings, and change those settings. Allow controls to be used to program repetitive, time-scheduled, and automated changes in sensitivity of specific detector groups. Record sensitivity adjustments and sensitivity adjustment schedule changes in system memory and print out the final adjusted values on system printer.

Transmission to Remote Alarm Receiving Station: Automatically transmit alarm, supervisory, and trouble signals to a remote alarm station.

Voice/Alarm Signaling Service:

Central emergency communication system with redundant microphones, preamplifiers, amplifiers, and tone generators provided as a special module that is part of fire-alarm control

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unit.

1. Indicated number of alarm channels for automatic, simultaneous transmission of different announcements to different zones or for manual transmission of announcements by use of the central control microphone. Amplifiers shall comply with UL 1711 and be listed by an NRTL.
 - a. Allow the application of and evacuation signal to indicated number of zones and, at same time, allow voice paging to the other zones selectively or in any combination.
 - b. Programmable tone and message sequence selection
 - c. Standard digitally recorded messages for "Evacuation" and "All Clear"
 - d. Generate tones to be sequenced with audio messages of type recommended by NFPA 72 and that are compatible with tone patterns of notification appliance circuits of fire-alarm control unit.

Status Annunciator:

Indicate the status of various voice/alarm speaker zones and the status of firefighters' two-way telephone communication zones.

Preamplifiers, amplifiers, and tone generators shall automatically transfer to backup units, on primary equipment failure.

Printout of Events:

On receipt of signal, print alarm, supervisory, and trouble events. Identify zone, device, and function. Include type of signal (alarm, supervisory, or trouble) and date and time of occurrence. Differentiate alarm signals from all other printed indications. Also print system reset event, including same information for device, location, date, and time. Commands initiate the printing of a list of existing alarm, supervisory, and trouble conditions in the system and a historical log of events.

Primary Power:

24-V DC obtained from 120-V AC service and a power supply module. Initiating devices, notification appliances, signaling lines, trouble signals, supervisory signals supervisory and digital alarm communicator transmitters shall be powered by 24-V DC source.

1. Alarm current draw of entire fire-alarm system shall not exceed 80 percent of the power supply module rating.

Secondary Power: 24-V DC supply system with batteries, automatic battery charger, and automatic transfer switch.

1. Batteries: Sealed lead calcium

Instructions:

Computer printout or typewritten instruction card mounted behind a plastic or glass cover in a stainless steel or aluminum frame. Include interpretation and describe appropriate response for displays and signals. Briefly describe the functional operation of the system under normal, alarm, and trouble conditions.

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MANUAL FIRE-ALARM BOXES

A. General Requirements for Manual Fire Alarm Boxes:

Comply with UL 38. Boxes shall be finished in red with molded, raised letter operating instructions in contrasting color; shall show visible indication of operation; and shall be mounted on recessed outlet box. If indicated as surface mounted, provide manufacturer's surface back box.

1. Double-action mechanism requiring two actions to initiate an alarm, pull-lever type; with integral addressable module arranged to communicate manual-station status (normal, alarm, or trouble) to fire- alarm control unit.
2. Station Reset: Key or wrench operated switch.

SYSTEM SMOKE DETECTORS

A. General Requirements for System Smoke Detectors:

1. Comply with UL 268; operating at 24-V DC, nominal.
2. Detectors shall be four-wire type.
3. Integral Addressable Module: Arranged to communicate detector status (normal, alarm, or trouble) to fire-alarm control unit.
4. Base Mounting:

Detector and associated electronic components shall be mounted in a twist-lock module that connects to a fixed base. Provide terminals in the fixed base for connection to building wiring. Self-Restoring:

Detectors do not require resetting or readjustment after actuation to restore them to normal operation.

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Integral Visual-Indicating Light:

LED type indicating detector has operated and power-on status

Remote Control:

Unless otherwise indicated, detectors shall be analog-addressable type, individually monitored at fire-alarm control unit for calibration, sensitivity, and alarm condition and individually adjustable for sensitivity by fire-alarm control unit.

- a. Rate-of-rise temperature characteristic shall be selectable at fire-alarm control unit for 15 or 20°F (8 or 11°C) per minute.
- b. Fixed-temperature sensing shall be independent of rate-of-rise sensing and shall be settable at fire alarm control unit to operate at 135 or 155°F (57 or 68°C).
- c. Provide multiple levels of detection sensitivity for each sensor.

Photoelectric Smoke Detectors:

1. Detector address shall be accessible from fire alarm control unit and shall be able to identify the detector's location within the system and its sensitivity setting.
2. An operator at fire-alarm control unit, having the designated access level, shall be able to manually access the following for each detector:
 - a. Primary status
 - b. Device type
 - c. Present average value
 - d. Present sensitivity selected
 - e. Sensor range (normal, dirty, etc.)

Duct Smoke Detectors:

Photoelectric type complying with UL 268A.

1. Detector address shall be accessible from fire alarm control unit and shall be able to identify the detector's location within the system and its sensitivity setting.

An operator at fire alarm control unit, having the designated access level, shall be able to manually access the following for each detector:

- a. Primary status
- b. Device type
- c. Present average value
- d. Present sensitivity selected
- e. Sensor range (normal, dirty, etc.)

SECTION 283111 –DIGITAL ADDRESSABLE FIRE ALARM SYSTEM

GOVERNMENT OF THE U. S. VIRGIN ISLANDS, DEPARTMENT OF PUBLIC WORKS

PROJECT NAME: Elaine I. Sprauve Public Library and Museum Building

Project Location, St. John, U.S. Virgin Islands

Weatherproof Duct Housing Enclosure: NEMA 250, Type 4X; NRTL listed for use with the supplied detector.

Each sensor shall have multiple levels of detection sensitivity.

Sampling Tubes:

Design and dimensions as recommended by manufacturer for specific duct size, air velocity, and installation conditions where applied.

Relay Fan Shutdown: Rated to interrupt fan motor-control circuit

HEAT DETECTORS

A. General Requirements for Heat Detectors: Comply with UL 521.

B. Heat Detector, Combination Type:

Actuated by either a fixed temperature of 135°F (57°C) or a rate of rise that exceeds 15°F (8°C) per minute unless otherwise indicated.

1. Mounting: Twist-lock base interchangeable with smoke detector bases.

2. Integral Addressable Module: Arranged to communicate detector status (normal, alarm, or trouble) to fire alarm control unit.

Heat Detector, Fixed-Temperature Type: Actuated by temperature that exceeds a fixed temperature of 190°F (88°C).

1. Mounting: Adapter plate for outlet box mounting

Integral Addressable Module: Arranged to communicate detector status (normal, alarm, or trouble) to fire-alarm control unit.

NOTIFICATION APPLIANCES

A. General Requirements for Notification Appliances:

Individually addressed, connected to a signaling line circuit, equipped for mounting as indicated and with screw terminals for system connections.

1. Combination Devices:

Factory integrated audible and visible devices in a single mounting assembly, equipped for mounting as indicated and with screw terminals for system connections.

Visible Notification Appliances:

Xenon strobe lights comply with UL 1971, with clear or nominal white polycarbonate lens mounted on an aluminum faceplate. The word "FIRE" is engraved in minimum 1-inch (25- mm) high letters on the lens.

1. Rated Light Output:

a. 15/30/75/110 cd, selectable in the field. The selector switch for selecting the candela shall be tamper resistant.

b. 115/177 cd for ceiling mounted devices.

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Mounting: Wall mounted unless otherwise indicated.

For units with guards to prevent physical damage, light output ratings shall be determined with guards in place.

Flashing shall be in a temporal pattern, synchronized with other units.

Strobe Leads: Factory connected to screw terminals.

The strobe shall be of low current design.

Device Color and Mounting Faceplate: Factory finished, color by Owner's Representative

Voice/Tone Notification Appliances:

1. Appliances shall comply with UL 1480 and shall be listed and labeled by an NRTL.
2. High-Range Units: Rated 2 to 15 W
3. Low-Range Units: Rated 1 to 2 W
4. Mounting: Flush
5. Matching Transformers: Top range matched to acoustical environment of speaker location.

MAGNETIC DOOR HOLDERS

A. Description: Units are equipped for wall or floor mounting as indicated and are complete with matching doorplate.

1. Electromagnet: Requires no more than 3 W to develop 25-lbf (111-N) holding force.
2. Wall Mounted Units: Flush mounted unless otherwise indicated
3. Rating: 24-V AC or DC
4. Rating: 120-V AC

Material and Finish: Match door hardware

REMOTE ANNUNCIATOR

A. Description:

Annunciator functions shall match those of fire alarm control unit for alarm, supervisory, and trouble indications. Manual switching functions shall match those of fire alarm control unit, including acknowledging, silencing, resetting, and testing.

1. Mounting: Flush cabinet, NEMA 250, Type 1

Display Type and Functional Performance:

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Alphanumeric display and LED indicating lights shall match those of fire alarm control unit. Provide controls to acknowledge, silence, reset, and test functions for alarm, supervisory, and trouble signals.

ADDRESSABLE INTERFACE DEVICE

- A. Description: Microelectronic monitor module, NRTL listed for use in providing a system address for alarm initiating devices for wired applications with normally open contacts.
- B. Integral Relay: Capable of providing a direct signal to elevator controller to initiate elevator recall or to circuit breaker shunt trip for power shutdown.

DIGITAL ALARM COMMUNICATOR TRANSMITTER

- A. Digital alarm communicator transmitter shall be acceptable to the remote central station and shall comply with UL 632 and be listed and labeled by an NRTL.
- B. Functional Performance:
Unit shall receive an alarm, supervisory, or trouble signal from fire alarm control unit and automatically capture two telephone line(s) and dial a preset number for a remote central station. When contact is made with central station(s), signals shall be transmitted. If service on either line is interrupted for longer than 45 seconds, transmitter shall initiate a local trouble signal and transmit the signal indicating loss of telephone line to the remote alarm receiving station over the remaining line. Transmitter shall automatically report telephone service restoration to the central station. If service is lost on both telephone lines, transmitter shall initiate the local trouble signal. Local functions and display at the digital alarm communicator transmitter shall include the following:

1. Verification that both telephone lines are available.
2. Programming device
3. LED display
4. Manual test report function and manual transmission clear indication
5. Communications failure with the central station or fire alarm control unit

Digital data transmission shall include the following:

1. Address of the alarm-initiating device
2. Address of the supervisory signal
3. Address of the trouble-initiating device
4. Loss of AC supply or loss of power
5. Low battery
6. Abnormal test signal

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7. Communication bus failure

Secondary Power: Integral rechargeable battery and automatic charger

Self-Test: Conducted automatically every 24 hours with report transmitted to central station.

SYSTEM PRINTER

- A. Printer shall be listed and labeled by an NRTL as an integral part of fire alarm system.

DEVICE GUARDS

- A. Description: Clear UV-stabilized polycarbonate enclosure sized for device requiring protection.

1. Manual Stations:

a. Weatherproof Protective Shield:

Factory fabricated clear UV-stabilized polycarbonate enclosure with gasket hinged at the top to permit lifting for access to initiate an alarm. Lifting the cover actuates an integral battery-powered audible horn intended to discourage false alarm operation.

Notification Appliances:

- a. Weatherproof Protective Shield: Factory fabricated clear UV-stabilized polycarbonate enclosure with gasket.

--EXECUTION

11.31 EQUIPMENT INSTALLATION

- A. Comply with NFPA 72 for installation of fire alarm equipment.
- B. Equipment Mounting: Install fire alarm control unit on finished floor with tops of cabinets not more than 72 inches (1830 mm) above the finished floor.
- C. Install wall mounted equipment, with tops of cabinets not more than 72 inches (1830 mm) above the finished floor.
- D. The Contractor shall provide and install the system in accordance with the plans and specifications, all national and state applicable codes, NEC wiring criteria, and the manufacturer's recommendations. All communications wiring shall be twisted and shielded cables.
- E. All wiring shall be in a conduit system separate from other building wiring. All junction boxes shall be sprayed red and labeled "Fire Alarm". Wiring color code shall be maintained throughout the project.
- F. Conduit and boxes containing fire alarm wiring shall be furnished with a red outer finish. Conduit shall be labeled every 10 feet.

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- G. Wiring shall be identified at terminal and junction locations, in a manner that will prevent unintentional interference with the signaling circuit during testing and servicing.
- H. Installation of equipment and devices that pertain to other work in the Contract shall be closely coordinated with the appropriate subcontractors.
- I. Installation of equipment and devices shall be closely coordinated with the Owner's Representative
- J. The manufacturer's authorized representative shall provide all on-site software modifications and supervision of installation of the complete Fire Alarm System installation, perform a complete functional test of the system, and submit a written report to the Contractor attesting to the proper operation of the completed system.
- K. Manual Stations: All manual stations shall be mounted per ADA requirements (48 inches AFF to the operable part of the station).
- L. Smoke or Heat Detector Spacing:
 - 1. Comply with NFPA 72, "Smoke Sensing Fire Detectors" Section in the "Initiating Devices" Chapter, for smoke detector spacing.
 - 2. Comply with NFPA 72, "Heat Sensing Fire Detectors" Section in the "Initiating Devices" Chapter, for heat detector spacing.
 - 3. Smooth ceiling spacing shall not exceed 30 feet (9 m).
 - 4. Spacing of detectors for irregular areas, for irregular ceiling construction, and for high ceiling areas shall be determined according to Appendix A or Appendix B in NFPA 72.
 - 5. HVAC: Locate detectors not closer than 3 feet (1 m) from air-supply diffuser or return-air opening.
 - 6. Lighting Fixtures: Locate detectors not closer than 12 inches (300 mm) from any part of a lighting fixture.

Do not install smoke detectors until after the construction cleanup of all trades is complete and final per NFPA 72.

Do not remove shipping covers on smoke detector heads until after completion of the final contractor cleaning of the building. The contractor shall be required to provide new smoke detectors wherever and whenever a shipping cover has been removed prior to final clean-up.

Duct Smoke Detectors: Comply with NFPA 72 and NFPA 90A. Install sampling tubes so they extend the full width of duct.

Heat Detectors in Elevator Shafts: Coordinate temperature rating and location with sprinkler rating and location.

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Single Station Smoke Detectors:

Where more than one smoke alarm is installed within a dwelling or suite, they shall be connected so that the operation of any smoke alarm causes the alarm in all smoke alarms to sound.

Remote Status and Alarm Indicators:

Install near each smoke detector and each sprinkler water-flow switch and valve-tamper switch that is not readily visible from normal viewing position.

Audible Visual Alarm Indicating Devices: Install not less than 6 inches (150 mm) below the ceiling.

Device Location Indicating Lights: Locate in public space near the device they monitor.

Fire Alarm Control Unit: Surface mounted, with tops of cabinets not more than 72 inches (1830 mm) above the finished floor.

Annunciator: Install with top of panel not more than 72 inches (1830 mm) above the finished floor.

Addressable Control Modules and Relays:

All control modules and relays shall be mounted within three (3) feet of the device being controlled, unless wired for fail safe operation

CONNECTIONS

- A. For fire protection systems related to doors in fire rated walls and partitions and to doors in smoke partitions, comply with requirements in Section 087100 "Door Hardware." Connect hardware and devices to fire alarm system.

1. Verify that hardware and devices are NRTL listed for use with fire alarm system in this Section before making connections.

Make addressable connections with a supervised interface device to the following devices and systems. Install the interface device less than 3 feet (1 m) from the device controlled. Make an addressable confirmation connection when such feedback is available at the device or system being controlled.

1. Alarm initiating connection to smoke control system (smoke management) at firefighter smoke control system panel.
2. Alarm initiating connection to stairwell and elevator shaft pressurization systems.
3. Smoke dampers in air ducts of designated air-conditioning duct systems
4. Alarm initiating connection to elevator recall system and components.
5. Alarm initiating connection to activate emergency lighting control.
6. Alarm initiating connection to activate emergency shutoffs for gas and fuel supplies.
7. Supervisory connections at valve supervisory switches
8. Supervisory connections at low-air pressure switch of each dry pipe sprinkler system.
9. Supervisory connections at elevator shunt trip breaker

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10. Supervisory connections at fire-pump power failure including a dead-phase or phase-reversal condition.

11. Supervisory connections at fire-pump engine control panel.

IDENTIFICATION

- A. Identify system components, wiring, cabling, and terminals. Comply with requirements for identification specified in Section 260553 "Identification for Electrical Systems."
- B. Install framed instructions in a location visible from fire-alarm control unit.

GROUNDING

- A. Ground fire alarm control unit and associated circuits; comply with IEEE 1100. Install a ground wire from main service ground to fire alarm control unit.

FIELD QUALITY CONTROL

- A. Field tests shall be witnessed by Project Consultant, Owner's designated representative and authorities having jurisdiction.

B. Manufacturer's Field Service:

Engage a factory authorized service representative to inspect, test, and adjust components, assemblies, and equipment installations, including connections.
Perform tests and inspections.

1. Manufacturer's Field Service:

Engage a factory authorized service representative to inspect components, assemblies, and equipment installations, including connections, and to assist in testing.

Tests and Inspections:

1. Visual Inspection: Conduct visual inspection prior to testing.

- a. Inspection shall be based on completed Record Drawings and system documentation that is required by NFPA 72 in its "Completion Documents, Preparation" Table in the "Documentation" Section of the "Fundamentals of Fire Alarm Systems" Chapter.
- b. Comply with "Visual Inspection Frequencies" Table in the "Inspection" Section of the "Inspection, Testing and Maintenance" Chapter in NFPA 72; retain the "Initial/Reacceptance" column and list only the installed components.

System Testing:

Comply with "Test Methods" Table in the "Testing" Section of the "Inspection, Testing and Maintenance" Chapter in NFPA 72.

Test audible appliances for the public operating mode according to manufacturer's written instructions. Perform the test using a portable sound level meter complying with Type 2 requirements in ANSI S1.4.

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Test audible appliances for the private operating mode according to manufacturer's written instructions.

Test visible appliances for the public operating mode according to manufacturer's written instructions.

Factory authorized service representative shall prepare the "Fire Alarm System Record of Completion" in the "Documentation" Section of the "Fundamentals of Fire Alarm Systems" Chapter in NFPA 72 and the "Inspection and Testing Form" in the "Records" Section of the "Inspection, Testing and Maintenance" Chapter in NFPA 72.

Re-acceptance Testing: Perform re-acceptance testing to verify the proper operation of added or replaced devices and appliances.

Fire alarm system will be considered defective if it does not pass tests and inspections.

Prepare test and inspection reports.

Maintenance Test and Inspection:

Perform tests and inspections listed for weekly, monthly, quarterly, and semi-annual periods.

Use forms developed for initial tests and inspections.

1. Annual Test and Inspection:

One year after date of Substantial Completion, test fire alarm system complying with visual and testing inspection requirements in NFPA 72. Use forms developed for initial tests and inspections.

DEMONSTRATION

- A. Engage a factory authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain fire alarm system.
- B. The equipment manufacturer's representative shall provide, as part of this Contract, a minimum of eight (8) hours system operating training the Owner's designated representative, and fire department personnel. Training sessions shall be in two parts: System Operation and System Maintenance. These sessions shall be scheduled at the owner's convenience.

END OF SECTION

SECTION 265600- EXTERIOR LIGHTING

GOVERNMENT OF THE U. S. VIRGIN ISLANDS, DEPARTMENT OF PUBLIC WORKS

PROJECT NAME

Project Location, U.S. Virgin Islands

DIVISION 31 – SITE CONSTRUCTION

Government of the Virgin Islands, Department of Public Works

PROJECT NAME: Elaine I. Sprauve Pubic Library and Museum Building

Project Location: **St. John, U.S. Virgin Islands**

SECTION 312110 - CLEARING AND GRUBBING

Government of the Virgin Islands, Department of Public Works

PROJECT NAME: Elaine I. Sprauve Pubic Library and Museum Building

Project Location: St. John, U.S. Virgin Islands

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Clearing trees, brush, and other vegetation
- B. Removing stumps and root systems
- C. Removing surface debris and rubbish

1.2 REFERENCED SECTIONS

- A. FHWA FP-14 Standard Specifications for Construction of Roads and Bridges on Federal Highway Projects, 2014 edition

1.3 SUBMITTALS

- A. Submit Staging Plan if stumps are to be ground for mulch showing proposed staging areas and duration of activities.

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION

3.4 PREPARATION

- A. Identify all existing utilities, structures, vegetation, and other features designated to remain.

3.5 PROTECTION

- A. Protect existing utilities, structures, vegetation and other features designated to remain.
- B. Protect benchmarks, survey stakes and the like from damage and displacement.
- C. Paint all cut or damaged surfaces larger than 1-1/2 inches on trees or shrubs selected to remain with an approved wound dressing.

3.6 TEMPORARY EROSION CONTROL

- A. Conform to the requirements of USVI, DPNR, FP-14 and the project's "Earth Change" permit for temporary erosion control measures.

3.7 CLEARING

- A. Clear all trees, vegetation (except grass), down timber, snags, and brush within areas required for access to and execution of the work except for areas or features designated to remain.
- B. Trees, brush, and other vegetation in areas to be cleared shall be cut off flush with or below the ground surface.

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- C. Trim dead branches 1-1/2 inches or more in diameter and such other branches as may be shown on the Plans from trees designated to remain
- D. Limbs and branches to be trimmed shall be neatly cut close to the trunk or main branch. Paint all cuts 1-1/2 inches or more in diameter with an approved wound dressing.

3.8 GRUBBING

- A. Remove all stumps, root systems, matted roots, debris, and rubbish to 18 inches below the bottom of excavation (or original ground surface, if no excavation is required).
- B. Fill and compact all depressions resulting from grubbing operations to conform to adjacent soil conditions.
- C. Perform all operations so as to minimize loss of topsoil.

3.9 DISPOSAL

- A. No burning of cleared or grubbed material will be allowed on site.
- B. All cleared and grubbed materials shall become the sole property of the CONTRACTOR and shall be removed from the site.
- C. If grinding stumps for mulch, conform to the approved Staging Plan for grubbing operations.
- D. Contractor shall secure a waste disposal permit from the Waste Management Authority.

END OF SECTION

SECTION 312200-EARTHWORK

Government of the Virgin Islands, Department of Public Works

PROJECT NAME: Elaine I. Sprauve Pubic Library and Museum Building

Project Location: **St. John, U.S. Virgin Islands**

PART 1 - GENERAL

1.1 REQUIREMENTS INCLUDED

- A. Without limiting the generality thereof, the work under this Section includes the furnishing of all labor, equipment, supplies and materials and the performing of all operations in connection with but not necessarily limited to the following items:
1. Rock blasting and removal as required, for excavation to the lines and grades indicated on the Drawings. Note: Rock blasting will not be allowed for this project.
 2. Excavation and disposal of unsuitable or excess materials. Excavation of all traces of loam within the excavation and fill limits. Removal of all excess materials.
 3. Excavation, fill, and compaction as indicated or required for the grading of the new paved drives, walks and parking areas.
 4. Base and sub-base course material under pavements, slabs and footings, including compaction.
 5. Dewatering and control of water for all construction operations.
 6. Protection of existing buildings, pavements and utilities to remain.
 7. Dust and environmental controls.
 8. Trench and pit excavation, bedding, and backfill for all utilities, including compaction.
 9. Sheet piling, shoring and bracing of structural and trench excavations.
- B. Subsurface investigations have been executed and the results are included on the Drawings. These results are furnished for the Contractor's general information only. The Engineer assumes no responsibility for their completeness, accuracy or correctness.

1.2 JOB CONDITIONS

A. Utilities:

1. The locations of known buried water lines, sewer lines, telephone cables, storm drains, culverts, gas mains, electric conduits, and other and other utilities are shown on the Drawings. No guarantee is made as to the correctness of the locations shown and to the completeness of the information given. The information shown is based upon a boundary survey done by BGM Engineers and Surveyors dated May 1, 2014. It is also based upon field observation and interviews with the Owner.
2. Discontinue excavation by machinery when the excavation approaches pipes, conduits, or other underground structures of which the approximate locations are known. Use manual excavation methods to locate the obstructions.

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B. Existing Structures:

1. Perform excavation in such a manner that will prevent any possibility of undermining and disturbing the foundations of any existing structures and any work previously completed under this Contract.
2. Where existing buildings and other structures are in close proximity to the proposed construction, exercise extreme caution and utilize sheeting, bracing, and whatever other precautionary measures that may be required.

C. Repairing Damage:

Repair, or have repaired, all damage to existing utilities, structures, lawns, other public and private property which results from construction operations, at no additional expense to the Owner, to the complete satisfaction of the Engineer, the utility company and the property owner.

D. Do not leave any trenches open overnight.

E. Trench Bracing:

Properly support all trenches in strict accordance with all pertinent rules and regulations. Brace, sheet, and support trench walls in such a manner that they will be safe and that the ground alongside the excavation will not slide or settle, and that all existing improvements of every kind, whether on public or private property, will be fully protected from damage. In the event of damage to such improvements, immediately make all repairs and replacements necessary to the approval of the Engineer and at no additional cost to the Owner.

PART 2 - PRODUCTS

2.1 FILL MATERIAL

A. Approval Required:

All fill material shall be subject to the approval of the Engineer.

B. Notification:

For approval of fill material, notify the Engineer at least four working days in advance of intention to import material, designate the proposed borrow area, and permit the Engineer to sample as necessary from the borrow area for the purpose of making acceptance tests to prove the quality of the material.

2.2 ONSITE FILL MATERIAL

- A. In general, all on-site fill material shall be soil or soil-rock mixture that is free from organic matter and other deleterious substance. It shall contain no rocks or lumps over six inches in greatest dimension, and not more than 15% of the rocks or lumps shall be larger than 2 1/2 inches in greatest dimension. No on-site fill shall be placed without the approval of the Engineer.

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- B. The Contractor shall not have any right of property in any suitable materials taken from any excavation. Do not remove any such materials form the construction site without the approval of the Engineer. This provision shall in no way relieve the Contractor of his obligations to remove and dispose of any material determined by the Engineer to be unsuitable for backfilling.

2.3 BORROW AND BEDDING MATERIAL

A. Work Included:

Provide, place and compact borrow and bedding material in authorized excavation(s) below normal depth and in other location(s) as shown on the Drawings and/or as requested by the Engineer and/or as specified herein.

B. Gravel Borrow:

1. Well graded granular material suitable for placement in authorized excavations below the bottom of the bedding layer to replace deficient excavated material, for service road construction, and other designated uses.
2. Conform to requirements of ASTM D-1241-68, Type I, Gradation B or C.

C. Screened Gravel or Crushed Stone (Bedding Material):

1. Screened gravel or crushed stone shall be well graded in size from 1/4 inch to 3/4 inch.
2. Clean, hard, and durable particles or fragments.
3. Sieve Analysis:

| Sieve Designation | %Passing by Weight Square Opening |
|----------------------|---|
| 1" | 100 |
| 3/4" | 90-100 |
| 3/8" | 20-55 |
| No.4 | 0-10 |
| No.8 | 0-5 |

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D. Sand:

1. Clean, hard and durable particles or fragments.

2. Sieve Analysis:

| Sieve Designation | %Passing by Weight Square Opening |
|----------------------|---|
| 3/8" | 100 |
| No.4 | 95-100 |
| No.16 | 50-85 |
| No.50 | 10-30 |
| No.100 | 2-10 |

E. Common Borrow:

1. Common borrow shall consist of earth suitable for embankment construction. It shall be free from perishable rubbish, peat and other unsuitable material.

2. The moisture content shall be enough to provide the required compaction and stable embankment.

In no case shall the moisture content exceed 4 percent above optimum.

3. The optimum moisture content shall be determined in accordance with AASHTO T 180, Method C or D.

2.4 OTHER MATERIALS

A. All other materials, not specifically described but required for a complete and proper installation, shall be provided as selected by the Contractor subject to the approval of the Engineer.

B. Embankment Material:

Obtain prior approval and instructions from the Engineer prior to undertaking the excavation for pipe placement of any fill material that has been in an embankment less than one year.

2.5 UNSUITABLE MATERIAL

A. If, in the opinion of the Engineer, the material encountered above the indicated grade shown on the Drawings for excavation is unsuitable material, remove the material to the widths and depths as directed by the Engineer. Replace this material as specified in the "Backfilling, Compaction, Control and Testing" Section of this Division.

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- B. If, in the opinion of the Engineer, the material encountered at or below the indicated grade shown on the Drawings for excavation is unsuitable material, remove the material to the full width of the trench and to a minimum depth of 12-inches below the pipe. Replace this material with thoroughly compacted, suitably screened gravel or crushed stone bedding material.
- C. All excavated materials designated by the Engineer as unsuitable shall become the property of the Contractor and disposed of at locations acceptable to or designated by the Owner, at no additional cost to the Owner.

PART 3 - EXECUTION

3.1 EXCAVATION- EARTH

A. General:

- 1. Unless otherwise specifically directed or permitted by the Engineer, begin excavation at the low end of sewer lines and proceed upgrade.
- 2. Perform excavation for sewers in a logical sequence.

B. Amount of Excavation:

1. Trench Width:

As shown on the Drawings or as specified for pipe installation.

2. Trench Depth:

As shown on the Drawings.

3. Open Excavation:

- a. The extent of open excavation shall be controlled by prevailing conditions.
- b. Open excavation shall, at all times, be confined to the limits prescribed by the Engineer.

4. Unauthorized Excavation:

- a. Backfill to the specified grade any excavation beyond the limits stated above and as shown on the Drawings (unless specifically ordered by the Engineer) with thoroughly compacted crushed stone or screened gravel.
- b. Backfilling unauthorized excavation shall be at no additional cost to the Owner.

C. Shoring and Bracing:

As the excavation progresses, install such shoring and bracing necessary to prevent caving and sliding and to meet the requirements of the State and OSHA safety standards.

3.2 EXCAVATION- LEDGE

A. Work Included:

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1. Excavation work in ledge includes the removal of ledge and rock required for the installation of pipes and/or structures.
2. "Ledge" and "rock" includes any natural compound, natural mixture, and chemical element in excess of two yards in volume and required to be excavated that, in the opinion of the Engineer, can be removed from its existing position and state only by blasting, drilling and blasting, wedging, drilling and wedging, wedging and breaking with power hand tools, or by extending the use of an approved excavating machine beyond normal and design wear and tear. No boulder, ledge, slab, or other single piece of excavated material less than one cubic yard in total volume shall be considered to be rock unless, in the opinion of the Engineer, it must be removed from its existing position by one of the methods mentioned above.
3. All trench excavation shall be classed as earth or ledge.

B. Related Work Specified Elsewhere (When Applicable):

1. The use of explosives is not allowed.
2. Traffic regulation, when applicable, is specified in Division 1.
3. When applicable, clearing, removal and replacement of paving, trench excavation, earth, backfilling, dewatering, borrow and bedding material, manholes and catch basins are specified in the appropriate Sections in this Division.
4. Pipe and pipe fittings, valves, gates and hydrants, when applicable, are specified in Divisions 2 and 15.

C. Existing Structures:

1. Perform excavation in such a manner that will prevent any possibility of undermining and disturbing the foundations of any existing structures and any work previously completed under this Contract.
2. Where existing buildings and other structures are in close proximity to the proposed construction, exercise extreme caution and utilize whatever precautionary measure that may be required.

D. Repairing Damage:

Repair, or have repaired, all damage to existing utilities, structures, lawns, and other public and private property which results from construction operation, at no additional expense to the Owner, to the complete satisfaction of the Engineer, the utility company, property owner, and the Owner.

E. Use of Explosives:

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The use of explosives on this project is prohibited. However, when the use of explosives is necessary for the prosecution of the Work, exercise the utmost care not to endanger life or property. The Contractor shall be responsible for any and all damage resulting from the use of explosives. Approval must be obtained from the Owner and other regulatory agencies prior to considering the use of explosives.

1. Store all explosives in a secure manner, in compliance with all State and local laws and ordinances, and legally mark all such storage places. Storage shall be limited to such quantity as may be needed for the work underway.
2. Designate as a BLASTING AREA all sites where electric blasting caps are located and where explosive charges are being placed. Mark all blasting areas with signs as required by law.
3. Place signs as required by law at each end of the blasting area and leave in place while the above conditions prevail. Immediately remove signs after blasting operations or the storage of caps is over.
4. Notify each property owner and public utility company having structures in proximity to the site of the work sufficiently in advance to enable the companies to take such steps as they may deem necessary to protect their property. Such notice shall not relieve the Contractor of any of his responsibility for damage resulting from his blasting operation.
5. Warn all persons within the danger zone of blasting operations and do not perform blasting work until the area is cleared. Provide sufficient flaggers outside the danger zone to stop all approaching traffic and pedestrians. Provide watch people during the loading period and until charges have been exploded. Place adequate protective covering over all charges before exploding.

3.3 BACKFILLING, COMPACTION, CONTROL AND TESTING

A. Work Included:

Backfilling work includes backfilling trenches and/or excavation around structures with suitable material removed in the course of excavating and other suitable material.

B. Related Work Specified Elsewhere (When applicable):

1. Traffic regulations are specified in Division 1.
2. Clearing, removal and replacement of paving, when applicable, are specified in the appropriate Sections in this Division.

C. Quality Assurance:

1. Where backfill is required and/or where shown on the Drawings, compact fill to an in-place density not less than 95 percent of the maximum density of the material in accordance with ASTM D1556 Method "B", unless otherwise indicated on the Drawings or herein.
2. Determine in-place density in accordance with ASTM DI556 or by other methods as approved by the Engineer.

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3. Have density testing performed by an independent soils laboratory as approved by the Engineer, at no additional cost to the Owner.
4. Locations of tests (when applicable):
 - a. Average of one test between each manhole for interceptor sewers.
 - b. Average of two tests between each manhole for sewer laterals.
 - c. Average of one test on each side of each manhole in addition to b. above.

D. Performance:

1. General:

- a. Provide and place all necessary backfill material.
- b. Do not allow large masses of backfill material to be dropped into the excavation, as from a grab bucket, in such a manner that may endanger pipes and structures.
- c. Place material in a manner that will prevent stones and lumps from becoming nested.
- d. Completely fill all voids between stones with fine material.
- e. Do not place backfill on or against new concrete until it has attained sufficient strength to support loads without distortion, cracking, and other damage.
- f. Deposit backfill material evenly on all sides of structures to avoid unequal soil pressures.
- g. Place screened gravel, crushed rock, crushed stone, gravel borrow or sand in layers of uniform thickness not greater than 6 inches or as shown on the Drawings.
- h. Thoroughly compact each layer by means of a suitable vibrator or mechanical tamper.
- i. In excavations below normal depth or where unsuitable materials are excavated, gravel borrow may be used unless groundwater makes such usage impossible. If such is the case, then screened gravel or crushed stone shall be used.
- j. Do not backfill with, or on, frozen materials. Remove, or otherwise treat as necessary, previously placed material that has frozen prior to placing backfill.
- k. Do not mechanically or hand compact material that is, in the opinion of the Engineer, too wet. Do not continue backfilling **until** the previously placed and new materials have dried sufficiently to permit proper compaction.
- l. When original excavated material is unsuitable use only approved gravel borrow for backfilling.

2. Sheeting:

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- a. Leave sheeting in place when damage is likely to result from its withdrawal.
 - b. Completely fill with suitable material and thoroughly compact all voids left by the removal of sheeting.
3. Backfilling in Paved Areas:
- a. Backfill trenches in streets and other paved areas by moistening and compacting each layer to a minimum of 95% of the modified Proctor for the material.
 - b. Backfill in such a manner as to permit the rolling and compaction of the filled trench with the adjoining material to provide the required bearing value for paving immediately after backfilling is completed.
 - c. Where required, place excavated material that is acceptable to the Engineer for surfacing or pavement sub-base, at the top of the backfill to the depths as directed by the Engineer. Bring the surface to the required grade and rake out and remove stones.
4. Backfilling Trenches in Non-paved Areas:
- a. Grade the ground to a reasonable uniformity.
 - b. Leave the mounding of 1" per 1' of trench depth over the trenches in a uniform and neat condition, satisfactory to the Engineer.
5. Bedding & Backfilling Pipelines:
- a. Install pipe bedding and cushion and primary backfill in accordance with 1 (g) above.
 - b. Deposit and thoroughly compact the remainder of the backfill in 12 inch layers.
6. Placing and Compacting Backfill:
- c. Water Jetting:
 - i. Backfill by water jetting shall not be used.
 - d. Puddling:
 - i. Backfill puddling shall not be used.
 - e. Tamping:
 - i. Deposit and spread the backfill material in uniform parallel layers not exceeding 6 inches thick.
 - ii. Tamp each layer as required to obtain a thoroughly compacted mass.
 - iii. If necessary, furnish and use in adequate number of power driven tampers, each weighing at least 20 lbs.

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f. Rolling:

i. Compact material by rolling only when the width and depth of the excavation are sufficient to accommodate the rollers, dozers, mechanical tampers, or other similar powered equipment, as may prove to be acceptable, and when it can be performed without causing damage to pipes installed in the excavation.

ii. Deposit and spread the backfill material in uniform parallel layers not exceeding 8 inches thick.

iii. Roll each layer as required to obtain a thoroughly compacted mass.

g. Other placing and compacting methods may be employed only when approved by the Engineer.

7. Improper Backfill:

h. When excavation and trenches have been improperly backfilled, and when settlement occurs, reopen the excavation to the depth required, as directed by the Engineer.

i. Refill and compact the excavation or trench with suitable material and restore the surface to the required grade and condition.

j. Excavation, backfilling, compacting work and testing performed to correct improper backfilling shall be performed at no additional cost to the Owner.

END OF SECTION

SECTION 312270 – EROSION CONTROL

Government of the Virgin Islands, Department of Public Works

PROJECT NAME: Elaine I. Sprauve Pubic Library and Museum Building

Project Location: **St. John, U.S. Virgin Islands**

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Temporary erosion control measures
- B. Coordination of temporary and permanent erosion control measures

1.2 REFERENCES

- A. FHWA FP-14 Standard Specifications for Construction of Roads and Bridges, on Federal Highway Projects, 2014 edition.

1.3 SUBMITTALS

- A. Erosion Control Plan:
Submit prior to commencing affected work a schedule based on Project conditions showing proposed methods, sequencing, and coordination of temporary and permanent erosion control measures.

PART 2 PRODUCTS

2.1 MATERIALS

- A. Stone Check Dams:
Composed of stone 3/4 - 1 inch in diameter free of organic material, debris, waste and conform to ASTM C33; stone size No. 67.
- B. Sandbags:
Heavy cloth bags of approximately one cubic foot capacity filled with sand or gravel.
- C. Matting:
Composed of straw, twisted craft paper, jute yam, wood excelsior, glass fiber, or plastic film.
- D. Mulch:
Mats, netting, straw or hay, bark chips, wood fiber, or other acceptable material. Do not use musty, moldy, caked, or otherwise low quality material.
- E. Temporary Grass:
Suitable quick-growing species providing a temporary cover which will not compete with permanent grass sown later.
- F. Silt Fence:
 - 1. Propex Silt-Stop, Mirafi 100X, or approved equal.
 - 2. Supports shall be in accordance with the manufacturer's recommendations, or as required for adequate performance.

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G. Erosion Control Blankets:

1. Erosion Control Blankets used in swales shall be made of 100% straw with associated netting and/or thread.
2. Erosion Control Blankets used on level spreaders shall be jute or excelsior matting.

H. Temporary Drains:

1. Flexible drains shall consist of collapsible neoprene pipe, minimum 3 inches in diameter or approved equal.
2. Drains under traffic areas shall consist of corrugated metal of a gauge consistent with the loading conditions.

PART 3 EXECUTION

3.1 GENERAL

- A. Do not start work until Erosion Control Plan has been approved.
- B. Conduct all operations in a manner and sequence that minimizes disturbance of existing protective vegetation.
- C. Install permanent erosion control features at the earliest practical time. Use temporary erosion controls:
 1. To control erosion when it is not practical to install permanent erosion control features.
 2. To control temporary erosion not associated with permanent erosion control.
 3. To correct unsatisfactory conditions that develop during construction.
- D. Maintain and supplement as necessary all erosion control features and devices required to effectively prevent migration of sediment from the work area throughout the life of the Contract.

3.2 INSTALLATION OF TEMPORARY EROSION CONTROLS

- A. Temporary Grass:

Install in accordance with Section 02930 where shown on the Plans or as required to stabilize disturbed slopes. Seed all slopes before they reach 30 feet in slope length.
- B. Sediment Check Dams:

Install check dams in ditches, swales, along the toe of embankments, and at other locations required to effectively control erosion.
- C. Slope Drains:

Construct temporary slope drains where shown on the Plans or where necessary to control erosion. Protect outlets with riprap.

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D. Silt Fence:

Install where shown on the Plans and at other locations as necessary to control erosion. Support in accordance with manufacturer's recommendations.

E. Mulch:

Install immediately after each area has been properly prepared. When seed for erosion control is sown prior to placing the mulch, the mulch shall be placed 48 hours after seeding.

F. Erosion Control Blankets:

Install along the bed of swales or level spreaders when called for on the Plans.

1. Swales shall be prepared and seeded in accordance with Section 02930 prior to installation of erosion control blankets. Install blankets starting at the upstream end unrolling downstream.
2. Level Spreaders: Place two strips of jute or excelsior matting along the lip of each level spreader.
3. Blankets should not be stretched but allowed to lay loosely on the soil surface to achieve maximum soil contact. Overlap and secure the blankets to the ground in accordance with the manufacturer's recommendations.

END OF SECTION

SECTION 312300 – TRENCHING, BACKFILLING AND COMPACTING

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PART 1 GENERAL

1.1 DESCRIPTION

- A. This section describes excavating, backfilling, and installing utility warning tape and locate wire for underground utilities and structures.
- B. If the Contractor encounters suspected contaminated soil in the work area beyond that mentioned in the contract documents, the Contractor shall immediately stop all work in the area of the suspected contamination and notify the Port. Contaminated soil is soil that produces fuel or chemical odors, produces an oil sheen on the surface of water, has staining, contains debris or other visible indicators, or soil designated as contaminated.

1.2 REFERENCES

- A. AASHTO: American Association of State Highway and Transportation Officials
 - 1. AASHTO T027: Standard Method of Test for Sieve Analysis of Fine and Coarse Aggregates
 - 2. AASHTO T099: Standard Method of Test for Moisture-Density Relations of Soils Using a 2.5-kg (5.5-lb) Rammer and a 305-mm (12-in.) Drop
 - 3. AASHTO T180: Standard Method of Test for Moisture-Density Relations of Soils Using a 4.54-kg (10-lb) Rammer and a 457-mm (18-in.) Drop
- B. ASTM: American Society for Testing and Materials
 - 1. ASTM D698: Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Standard Effort (12 400 ft-lbf/ft³ (600 kN-m/m³))
 - 2. ASTM D1556: Standard Test Method for Density and Unit Weight of Soil in Place by the Sand-Cone Method
 - 3. ASTM D1557: Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft-lbf/ft³ (2,700 kN-m/m³))
 - 4. ASTM D2922: Standard Test Methods for Density of Soil and Soil-Aggregate in Place by Nuclear Methods (Shallow Depth)

- C. OSHA: Occupational Safety and Health Administration

1.3 SUBMITTALS

- A. Submit manufacturer's product data for utility warning tape, utility locate wire, and electrical splices.

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PART 2 PRODUCTS

2.1 TRENCH EXCAVATION MATERIAL

- A. Soil material, regardless of condition, excavated from subgrade to the bottom of the trench; or, where there is no subgrade, from original ground to the bottom of the trench.

2.2 UNSUITABLE MATERIAL

- A. Trench excavation material designated as not usable for backfill.
- B. Material excavated below the bottom of the trench designated as not usable for foundation or backfill.

2.3 TRENCH STABILIZATION

- A. 6"-3/4" pit run or crushed rock. Not more than 10 percent passing a #200 sieve.

2.4 BEDDING

- A. Crushed aggregate: 3/4"-0" for sewer pipe; 3/4"-0" for water lines.

2.5 BACKFILL

- A. Native
 - 1. Approved trench excavation material. Material shall not contain particles larger than 3/4".
- B. Imported
 - 1. Crushed aggregate: 3/4"-0" for sewer pipe; 3/4"-0" for water lines. Water lines shall be covered 6 inches, minimum, with 3/4"-0" before changing to another material.
 - 2. Sand conforming to the following gradation limits AASHTO T 27:

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| SIEVE SIZE | PERCENT PASSING |
|------------|-----------------|
| No. 10 | 95-100 |
| No. 40 | 50-100 |
| No. 60 | 20-40 |
| No. 200 | 0-5 |

2.6 UTILITY WARNING TAPE

- A. Use 3-inch wide, 3.5 mil thick non-metallic plastic tape for all utilities 4 feet deep or less. For utilities more than 4 feet deep, use 6-inch wide, 3.5 mil thick non-metallic plastic tape. Tape should be imprinted continuously along its length with: “CAUTION - STOP DIGGING - BURIED [(GAS), (WATER), (SEWER), (ELECTRIC), (TELEPHONE)] LINE BELOW,” or similar.

1. Acceptable Products/Manufacturers:

- a. Brady “Identoline”
- b. Services and Materials “Buried Underground Tape”
- c. Somerset (Thomas & Betts) “Protect-A-Line”
- d. Or equal.

2.7 UTILITY LOCATE WIRE

- A. Use stranded copper type XHHW AWG size No. 10. Locate wire does not require direct burial listing. Locate wire shall be in colors specified below.
- B. Electrical Splicing: Use mechanical compression splice with waterproof heat-shrink jacket designed for underground burial. Splice by Burndy, jacket by 3M, or equal.
- C. Utility locate wire tag shall be non-corrosive metal or plastic tag with a permanent stamped label reading “Locate.”

2.8 TAPE AND WIRE COLOR CODES

- A. Use the following APWA color codes for utility warning tape and utility locate wire:
1. GAS = Yellow
 2. WATER = Blue

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3. SEWER AND SUBDRAINS = Green

4. ELECTRIC = Red

5. TELEPHONE/SIGNAL = Orange

PART 3 EXECUTION

3.1 TRENCH EXCAVATION

- A. Dig trench to lines and grades established on the drawings or as directed.
- B. Trench width shall be as shown on the drawings. If not shown on the drawings, trench width shall be as follows:
 - 1. Not less than the outside diameter of the pipe plus 12 inches.
 - 2. Not more than the inside diameter of the pipe plus 30 inches, to a point 12 inches (minimum) above the top of the pipe, unless otherwise approved.
- C. Trench length shall be sufficient to allow for satisfactory construction and inspection of the project, without endangering other construction work or adjacent facilities.
- D. Slope trench walls to OSHA standards or shore trench walls.
- E. Restore unauthorized excavation made below grade to the required design grade at no additional cost to the Port.
- F. Separate and stockpile approved trench excavation material for reuse as backfill.
- G. Haul excess trench excavation material suitable for backfill to the disposal site as directed by the Owner's Representative.
- H. Haul other excess trench excavation material and unsuitable excavation material off Port property and dispose of in accordance with Section 015000, Temporary Facilities and Controls.
- I. Use hand methods for excavation that cannot be accomplished without endangering existing or new structures or other facilities.

3.2 REMOVAL AND REPLACEMENT OF UNSUITABLE MATERIAL

- A. Unsuitable Trench Excavation
 - 1. Remove, haul off property and dispose of properly offsite.
 - 2. Replace with excess approved common excavation material from other portions of the project or imported backfill as directed.

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3. Compact as specified below.

B. Unsuitable Trench Bottom

1. Excavate to established and approved lines and limits. Dispose of properly offsite.
2. Backfill with trench stabilization material and compact as specified.

3.3 TRENCH PROTECTION

A. Provide materials, labor, and equipment necessary to protect trenches at all times.

B. Sheet piling and Bracing

1. Furnish and install sheet piling and bracing as required to prevent caving or sloughing of trench walls.
2. Solid-sheet trench, if necessary, to preserve a suitable grade for the pipe. Drive far enough below grade to prevent inflow of material from outside of trench lines.
3. Remove sheet piling and bracing from trench before or during backfilling operations unless otherwise directed.

3.4 PIPE BEDDING

- A.** Bed pipe according to specifications.
- B.** Place bedding material to a uniform grade. Compact to 92 percent of maximum density as measured by AASHTO T-180 (ASTM D1557).
- C.** Shape bottom of trench or bedding so that the lower quarter of the pipe circumference is in continuous contact with the bottom of the trench.

3.5 BACKFILLING

- A.** Notify the Owner's Representative and DPNR at least 24 hours in advance of backfilling.
- B.** Conduct utility check tests before backfilling. Backfill and compact trench before acceptance testing.
- C.** Place pipe zone backfill uniformly on both sides of the pipe in 6-inch uncompacted lifts until 12 inches over the pipe.
- D.** Solidly ram and tamp backfill into spaces around pipe and related structures.
- E.** Backfill trench with lifts up to 12 inches, loose measure.

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- F. Protect pipe from lateral movement, damage from impact, or unbalanced loading to avoid displacement of pipe and structures.
- G. Do not place backfill against concrete structures until the concrete has cured for at least 14 days or has reached 90 percent of its designed strength.
- H. Maintain backfilled trench surface between any two successive manholes until the following operations have been completed and approved.
 - 1. Service connections installed, backfilled, and compacted, including water settling when required.
 - 2. Construction of manholes and appurtenances.
 - 3. Hydrostatic or air testing.
 - 4. Cleanup and restoration of all physical features.
 - 5. Utilities restored to their original condition or better.
 - 6. All work required between the two manholes accomplished.
- I. Maintain backfilled trench surface between any two successive valves until the following operations have been completed and approved.
 - 1. Service connections installed and backfilled.
 - 2. Valves, valve boxes, and hydrants installed.
 - 3. Hydrostatic testing.
 - 4. Flushing and sterilization.
 - 5. Cleanup and restoration of all physical features.
 - 6. Utilities restored to their original condition or better.
 - 7. All work required between the two valves accomplished, including restoration of surface to specified condition.

3.6 COMPACTION

- A. The Owner may conduct in-place density tests in accordance with ASTM D2922 or D1556 requirements.
- B. Compact backfill deeper than 4 feet below subgrade to 92 percent of maximum density, unless otherwise directed.

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- C. Compact the backfill from subgrade to a depth of 4 feet below subgrade to 95 percent of maximum density as measured by AASHTO T-180 (ASTM D1557), unless otherwise directed.
- D. Compacting trench backfill under flooding water is an acceptable means of compaction.
- E. For compaction testing, excavate test pits in the backfill as directed to demonstrate that the specified compaction has been obtained for the entire depth of the backfill. Density tests may be taken in a lift of compacted backfill immediately before placing the next lift. In general, one successful test for the entire backfill depth and three successful tests at lesser depths per 400 linear feet of pipe installed will be required. Additional successful tests at lateral crossings at various depths may also be required. All costs in connection with excavating test pits, shoring, backfilling, and from standby time during field density test shall be considered as incidental to backfill.
- F. If required compaction density has not been obtained, remove the backfill from trench or structure, replace with approved backfill, and compact to the specified density. Then, should routine field densities taken during the course of construction show the specified compaction is not being obtained because of changes in soil types or for any other reason, the compacting procedure will be modified. In no case will excavation, pipe-laying, or other operation be allowed to proceed until the specified compaction is attained. Changes in methods may be required to accommodate changes in soil conditions.
- G. Any subsequent settlement of trench or structure backfill during the maintenance period shall be considered to be the result of improper compaction and shall be promptly corrected.

3.7 UTILITY WARNING TAPE AND UTILITY LOCATE WIRE INSTALLATION AND TESTING

A. Utility Warning Tape:

- 1. Install utility warning tape as shown on the drawings.
- 2. Utility warning tape is not required on irrigation branch lines.

B. Utility Locate Wire:

- 1. Install the utility locate wire along the full length of all utilities being installed.
- 2. Install utility locate wire along the top of the utility in a manner that will avoid damaging the wire during compaction of the trench.
- 3. Splice new utility locate wires into existing utility locate wires at tees or other locations where the utilities connect.

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4. Bring the locate wire up inside each manhole, vault, valve box, handhole, pull box, or similar structure along the route of the utility. Terminate the wire for each utility entering the structure as shown on the drawings.
5. Permanently attach utility locate wire tags between 2 and 6 inches from the end of the wire.
6. Where utilities enter a building, bring locate wire to grade level 5 feet from the building and install in a water valve type box or equal.

C. Utility Locate Wire for Non-Metallic Conductors:

1. Install utility locate wire where metallic conductors in existing conduits are replaced with non-metallic conductors.
2. Procedure for pulling new utility locate wire through existing infrastructure:
 - a. Attach utility locate wire externally to non-metallic conductor or inner-duct and pull through system.
 - b. If an existing multi-cell conduit does not have locate wire and is being loaded with non-metallic conductors, pull a utility locate wire through one of the existing cells.
 - c. Bring the locate wire up inside each manhole, vault, valve box, handhole, pull box, or similar structure along the route of the utility. Terminate the wire for each utility entering the structure as shown on the drawings.

D. Utility Locate Wire Testing:

1. Test utility locate wire network using standard utility locating equipment.
2. Verify that all connections for test equipment are accessible and installed in accordance with the drawings and specifications.
3. Verify continuity in the wire network by tracing all installed wire.
4. Repair or replace deficiencies.
5. Submit documentation showing that all test equipment connection points have been installed properly and all wires have been successfully traced.

3.8 REMOVAL AND PLUGGING OF ABANDONED PIPES, CONDUITS, CULVERTS, AND MISCELLANEOUS STRUCTURES

A. Removal of Abandoned Pipes, Conduits, and Other Items:

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1. Trenching: Abandoned pipes and conduits encountered during trench excavation shall be removed the full width of the trench. If a pipe is encountered by multiple trenches, remove pipe the full width of affected area.
 2. Excavation: Abandoned pipes or portions of other items exposed during excavation shall be removed a minimum of 2 feet back of face of slope or 2 feet below subgrade.
- B. Cap or plug the ends of partially removed pipes, culverts, conduits, and miscellaneous structures with concrete to produce a watertight seal.
- C. Contact the Owner's Representative for direction if unidentified utilities are uncovered during the work.
- D. Dispose of removed pipes, conduits, culverts, and miscellaneous structures off site, at no additional cost to the Owner.

END OF SECTION

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PART 1 - GENERAL

1.1 SECTION INCLUDES

- A. Flowable fill (cement stabilized backfill).

1.2 RELATED SECTIONS

- A. 312000 - Earth Moving
- B. 033001 - Reinforced Concrete

1.3 ACTION SUBMITTALS

- A. Submit the following:
 - 1. Material certifications. A complete list of materials including type; brand; source and amount of cement, fly ash, pozzolans, and admixtures; and applicable reference specifications shall be included in the mix design submittal. Provide design mixes and test reports.
 - 2. Batch tickets.
 - 3. Field test reports (if required per 3.5)

1.4 DESCRIPTION

- A. Flowable fill is a self-leveling slurry of cement, fly ash, aggregates, admixtures, and water with low final strength that can be hand dug later.
- B. Flowable fill may be used for trenches, pipe structures, fill for abandoned water and sewer lines, and other works where cavities exist and firm support is required.
- C. The use of flowable fill around or adjacent to utility lines or structures shall be reviewed and approved by the appropriate LANL Utilities and Infrastructure system representative. Flowable fill shall not be around or adjacent to utility lines that have requirements for movement.

1.5 QUALITY ASSURANCE

- A. When work or portions of work of this section are completed and require testing, notify the Owner's Representative.
- B. Ensure all required cast-in-place concrete, embedment items, and utility work has been completed prior to placing flowable fill.

1.6 JOB CONDITIONS

SECTION 312300 – TRENCHING, BACKFILLING AND COMPACTING

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- A. Perform concrete washout, trucks and mixers, in a designated and controlled area to prevent the runoff of washout material and the co-mingling of unset concrete with storm water. Properly dispose of all hardened excess concrete.

PART 2 PRODUCTS

2.1 MATERIALS

- A. Cement: ASTM C 150, Type I or Type II.
- B. Fine and Coarse Aggregates: Conform to ASTM C 33. Provide a uniform mixture of fine aggregate or fine and coarse aggregate, as determined by ASTM D 422.

Aggregate Mixture Gradation Requirements

| Sieve Size | Percent Passing |
|-------------------|------------------------|
| 1 inch | 100 |
| 3/8 inch | 95 – 100 |
| No. 4 | 80 – 100 |
| No. 8 | 60 – 95 |
| No. 16 | 45 – 80 |
| No. 30 | 25 – 60 |
| No.50 | 5 – 45 |
| No. 100 | 5 – 35 |
| No. 200 | 0 - 30 |

- C. Water: Potable water that is clean and not detrimental to concrete.
- D. Fly Ash: Conform to ASTM C 618, Class C or Class F.
- E. Air Entrainment: Conform to ASTM C260. Air entrainment may be between 6 and 25 percent. Air entraining is not required for below grade installation in areas not subject to freeze/thaw cycles.

2.2 PROPORTIONING AND PHYSICAL PROPERTY REQUIREMENTS

- A. Provide a flowable fill mix design in accordance with the following limits:
1. Cement, maximum 50 lbs/yd³

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2. Fly ash, from 150 lbs/yd³ to 300 lbs/yd³
3. Air content, optional
4. Slump, from 6 to 11 inches
5. Water/Cement ratio, proportioned by weight to produce a slump within limits.
6. Consistent aggregate throughout the concrete mixture
7. Compressive strength will not exceed 150 psi at 28 days.

2.3 FLOWABLE FILL

- A. Mix and deliver flowable fill in accordance with ASTM C94.
- B. Use set retarding admixtures during hot weather only when approved by the Owner's Representative.
- C. Do not use calcium chloride as an admixture.
- D. Add air-entraining agent if required to produce a flowable mix.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Verify that all items of cast-in-place concrete, grading, trenching, and all utilities and other embedded items are in place prior to placing flowable fill.
- B. Utilities that are subject to required movement (e.g., steam and condensate lines), shall not be embedded in flowable fill or otherwise have restricted movement.
- C. Flowable fill shall not be used as a substitute for sand bedding or earth backfill for primary utilities unless approved by the Owner's representative.

3.2 PREPARATION

- A. Remove all loose material from the uneven tuff and the concrete structures.
- B. Set elevation marks or otherwise determine the proper top elevation for the flowable fill.

3.3 PLACEMENT OF FLOWABLE FILL

- A. Notify Owner's Representative a minimum of 48 hours prior to placement of flowable fill.

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- B. Flowable fill may be placed by direct discharge from the truck, by pumping, or by other approved methods.
- C. The flowable fill shall be placed in a uniform manner that will prevent voids or segregation of the bedding and filling material. If required, the flowable fill shall be consolidated with internal vibrators.
- D. Pipes, reinforcement, inserts, or other embedded parts shall be placed, supported, and secured in a manner that shall prevent the flowable fill from displacing, sagging, or from floating embedded items.
- E. Flowable fill shall be brought up uniformly to the fill line shown on the plans. Formed walls or other bulkheads shall be constructed to withstand the exerted hydrostatic pressure and confine the material within a dedicated space.
- F. Placement of flowable fill shall start only when weather conditions are favorable. The temperature shall be at least 35 degrees F and rising. Flowable fill shall not be placed on frozen ground or when it is raining.

3.4 CURING AND PROTECTION

- A. Immediately after placement, protect flowable fill from premature drying, excessively hot or cold temperatures and mechanical injury.
- B. The flowable fill shall not be subjected to load and shall remain undisturbed by construction activities for at least 24 hours after placement.

3.5 FIELD QUALITY CONTROL

- A. Testing of flowable fill is not necessarily required. If testing is required, the Subcontractor shall employ an independent testing agency to perform compressive strength test cylinders.
- B. For field testing use a standard (15 lb) T-post driver to drive a #6 reinforcing bar with a flat end into the flowable fill material 24 hours after placement. Lift the driver until the bottom of the driver is even with a mark located 6 inches below the top of the rebar and then allow it to fall under its own weight. Remove and replace the flowable fill if fewer than 6 blows or more than 25 blows are required to drive the rebar 12 inches into the fill.
- C. Provide unobstructed access to work and cooperate with appointed firm.

3.6 DEFECTIVE FLOWABLE FILL

- A. Do not accept or place defective flowable fill that is not in conformance with acceptance criteria. Return the fresh flowable fill to the supplier.

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- B. Defective flowable fill is material having excessive honeycomb, embedded debris, higher than maximum compressive strength, or not conforming to required lines, details, dimensions, tolerances or specified requirements. Repair or replace defective flowable fill as directed by the LANL STR.
- C. Replace flowable fill not in conformance with details, tolerances, and other construction requirements at Contractor's expense.

END OF SECTION

SECTION 312500 – EROSION AND SEDIMENTATION CONTROL

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PART 1 - GENERAL

1.1 SECTION INCLUDES

- A. This WORK shall consist of temporary measures needed to control erosion and water pollution. These temporary measures shall include, but not be limited to, berms, dikes, dams, sediment basins, fiber mats, netting, gravel, mulches, grasses, slope drains, and other erosion control devices or methods. These temporary measures shall be installed at the locations where needed to control erosion and water pollution during the construction of the PROJECT, and as directed by ENGINEER, and as shown on the DRAWINGS.
- B. The Erosion Control Plan presented in the DRAWINGS serves as a minimum for the requirements of erosion control during construction. CONTRACTOR has the ultimate responsibility for providing adequate erosion control and water quality throughout the duration of the PROJECT. Therefore, if the provided plan is not working sufficiently to protect the PROJECT areas, then CONTRACTOR shall provide additional measures as required to obtain the required protection. CONTRACTOR shall include in the BID price for erosion control a minimum of all items shown on the Erosion Control Plan and any additional items that may be needed to control erosion and water pollution.

1.2 RELATED SECTIONS

- A. The following is a list of SPECIFICATIONS which may be related to this section:
 - 1. Section 31 11 00, Clearing and Grubbing.

1.3 REFERENCES

- A. The following is a list of standards which may be referenced in this section:
 - 1. Virgin Islands Department of Parks and Natural Resources (DPNR).

1.4 SUBMITTALS

- A. Submit the following information:
 - 1. Erosion Control Plan.
 - 2. Construction schedule for Erosion Control per Article Scheduling.
 - 3. Sequencing Plan per Article Scheduling.
 - 4. Plan for disposal of waste material per Article Scheduling.
 - 5. Product data for materials proposed for use.

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6. All applicable permits for Erosion Control.

1.5 REGULATORY REQUIREMENTS

A. Construction Dewatering Industrial Wastewater Permit:

1. CONTRACTOR shall apply for and obtain a Construction Dewatering Permit from the Virgin Islands Waste Management Authority (WMA).
2. All costs for this permit shall be the responsibility of CONTRACTOR.
3. CONTRACTOR is legally obligated to comply with all terms and conditions of the permit including testing for effluent limitations.
4. CONTRACTOR shall allow the WMA and DPNR or other representatives to enter the site to test for compliance with the permit.
5. Non-compliance with the permit can result in stoppage of all WORK.

B. In the event of conflict between these requirements and erosion and pollution control laws, rules, or regulations of other Federal, State, or local agencies, the more restrictive laws, rules, or regulations shall apply.

1.6 SCHEDULING

A. Sequencing Plan:

1. CONTRACTOR shall submit a sequencing plan for approval for erosion control in conformance with CONTRACTOR's overall Construction Plan for approval by OWNER.
2. Changes to the Erosion Control Sequencing Plan may be considered by OWNER only if presented in writing by the CONTRACTOR.

B. Temporary Erosion Control:

1. When so indicated in the CONTRACT DOCUMENTS, or when directed by ENGINEER, CONTRACTOR shall prepare construction schedules for accomplishing temporary erosion control WORK including all maintenance procedures.
2. These schedules shall be applicable to clearing and grubbing, grading, structural WORK, construction, etc.

C. CONTRACTOR shall submit for acceptance the proposed method of erosion control on haul roads and borrow pits and a plan for disposal of waste material.

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- D. CONTRACTOR shall be required to incorporate all permanent erosion control features into the PROJECT at the earliest practicable time as outlined in the accepted schedule. Temporary erosion control measures shall then be used to correct conditions that develop during construction.
- E. WORK shall not be started until the erosion control schedules and methods of operations have been accepted.

PART 2 PRODUCTS

2.1 MATERIALS

- A. All materials shall be submitted for approval prior to installation.
- B. Materials may include hay bales, straw, fiber mats, fiber netting, wood cellulose, fiber fabric, gravel, and other suitable materials, and shall be reasonably clean, free of deleterious materials, and certified weed free.
- C. Grass Seed:
 - 1. Temporary grass cover (if required) shall be a quick growing species, suitable to the area, in accordance with local criteria and permit requirements, which will provide temporary cover, and not compete with the grasses sown for permanent cover.
 - 2. All grass seed shall be approved by ENGINEER and in accordance with local regulations prior to installation.
- E. Fertilizer and soil conditioners shall be approved by ENGINEER and in accordance with local regulations prior to installation.

PART 3 EXECUTION

3.1 GENERAL

- A. All temporary and permanent erosion and sediment control practices shall be maintained and repaired as needed to ensure continued performance of their intended function.
- B. OWNER will monitor CONTRACTOR's erosion control and WORK methods.
 - 1. If the overall function and intent of erosion control is not being met, OWNER will require CONTRACTOR to provide additional measures as required to obtain the desired results.
 - 2. Costs for any additional erosion control measures shall be paid for at contract unit prices.

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- C. The erosion control features installed by CONTRACTOR shall be adequately maintained by CONTRACTOR until the PROJECT is accepted.
- D. Working In or Crossing Watercourses and Wetlands:
 - 1. Construction vehicles shall be kept out of watercourses to the extent possible.
 - 2. Where in-channel WORK is necessary, precautions shall be taken to stabilize the WORK area during construction to minimize erosion.
 - 3. The channel (including bed and banks) shall always be stabilized immediately after in-channel WORK is completed.
 - 4. Where a live (wet) watercourse must be crossed by construction vehicles during construction, a Temporary Stream Crossing shall be provided for this purpose.

3.2 PROTECTION OF ADJACENT PROPERTIES

- A. Properties adjacent to the site of a land disturbance shall be protected from sediment deposition.
- B. In addition to the erosion control measures required on the DRAWINGS, perimeter controls may be required if damage to adjacent properties is likely, and may include, but is not limited to:
 - 1. Vegetated buffer strip around the lower perimeter of the land disturbance.
 - a. Vegetated buffer strips may be used only where runoff in sheet flow is expected and should be at least twenty (20) feet in width.
 - 2. Sediment barriers such as straw bales, erosion logs, and silt fences.
 - 3. Sediment basins and porous landscape detention ponds.
 - 4. Combination of above measures.

3.3 CONSTRUCTION

- A. Stabilization of Disturbed Areas:
 - 1. Temporary sediment control measures shall be established within five (5) days from time of exposure/disturbance.
 - 2. Permanent erosion protection measures shall be established within five (5) days after final grading of areas.
- B. Stabilization of Sediment and Erosion Control Measures:

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1. Sediment barriers, perimeter dikes, and other measures intended to either trap sediment or prevent runoff from flowing over disturbed areas shall be constructed as a first step in grading and be made functional before land disturbance takes place.
2. Earthen structures such as dams, dikes, and diversions shall be stabilized within five (5) days of installation.
3. Stormwater outlets shall also be stabilized prior to any upstream land disturbing activities.

C. Stabilization of Waterways and Outlets:

1. All onsite stormwater conveyance channels used by CONTRACTOR for temporary erosion control purposes shall be designed and constructed with adequate capacity and protection to prevent erosion during storm and runoff events.
2. Stabilization adequate to prevent erosion shall also be provided at the outlets of all pipes and channels.

D. Storm Sewer Inlet Protection: All storm sewer inlets which are made operable during construction or which drain stormwater runoff from a construction site shall be protected from sediment deposition by the use of filters.

E. Construction Access Routes:

1. Wherever construction vehicles enter or leave a construction site, a Stabilized Construction Entrance is required.
2. Where sediment is transported onto a public road surface, the roads shall be cleaned thoroughly at the end of each day.
3. Sediment shall be removed from roads by shoveling or sweeping and be transported to a sediment controlled disposal area.
4. Street washing shall be allowed only after sediment is removed in this manner.

3.4 DISPOSITION OF TEMPORARY MEASURES

- A. All temporary erosion and sediment control measures shall be disposed of within thirty (30) days after final site stabilization is achieved or after the temporary measures are no longer needed as determined by OWNER.
- B. Trapped sediment and other disturbed soil areas resulting from the disposition of temporary measures shall be permanently stabilized to prevent further erosion.
- C. Substantial Completion of Erosion Control Measures:

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1. At the time specified in the CONTRACT DOCUMENTS, and subject to compliance with specified materials and installation requirements, CONTRACTOR shall receive a Substantial Completion Certificate for temporary erosion control measures.
2. Maintenance of Erosion Control Measures after Substantial Completion: CONTRACTOR shall be responsible for maintaining temporary erosion control measures as specified in the DRAWINGS and CONTRACT DOCUMENTS until such time as WORK has been accepted by OWNER as specified in Section 01 77 00, Closeout Procedures.

D. Final Completion and Acceptance of Erosion Control Measures:

1. After ENGINEER and OWNER have determined that the drainage area has stabilized, CONTRACTOR shall remove all remaining temporary erosion control measures.
2. Any damage to the site shall be repaired to the satisfaction of ENGINEER and at no cost to OWNER.

END OF SECTION

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PART 1 GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section Includes:

1. Polymer-based sheet barrier system.
2. Soil treatment.
3. Wood treatment.
4. Bait-station system.
5. Metal mesh barrier system.

- B. Related Requirements:

1. Section 061000 "Rough Carpentry" for wood preservative treatment by pressure process.
2. Section 076200 "Sheet Metal Flashing and Trim" for custom-fabricated, metal termite shields.

1.3 PREINSTALLATION MEETINGS

- A. Pre-installation Conference: Conduct conference at Project site.

1.4 ACTION SUBMITTALS

- A. Product Data: For each type of product.

1. Include construction details, material descriptions, dimensions of individual components, and profiles for termite control products.
2. Include the EPA-Registered Label for termiticide products.

1.5 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For qualified Installer.

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- B. Product Certificates: For each type of termite control product.
- C. Soil Treatment Application Report: After application of termiticide is completed, submit report for Owner's records and include the following:
 - 1. Date and time of application.
 - 2. Moisture content of soil before application.
 - 3. Termiticide brand name and manufacturer.
 - 4. Quantity of undiluted termiticide used.
 - 5. Dilutions, methods, volumes used, and rates of application.
 - 6. Areas of application.
 - 7. Water source for application.
- D. Wood Treatment Application Report: After application of termiticide is completed, submit report for Owner's records and include the following:
 - 1. Date and time of application.
 - 2. Termiticide brand name and manufacturer.
 - 3. Quantity of undiluted termiticide used.
 - 4. Dilutions, methods, volumes used, and rates of application.
 - 5. Areas of application.
- E. Bait-Station System Installation Report: After installation of bait-station system is completed, submit report for Owner's records and include the following:
 - 1. Location of areas and sites conducive to termite feeding and activity.
 - 2. Plan drawing showing number and locations of bait stations.
 - 3. Dated report for each monitoring and inspection occurrence, indicating level of termite activity, procedure, and treatment applied before time of Substantial Completion.
 - 4. Termiticide brand name and manufacturer.
 - 5. Quantities of termiticide and nontoxic termite bait used.
 - 6. Schedule of inspections for one year from date of Substantial Completion.

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F. Research/Evaluation Reports: For metal mesh barrier system.

G. Sample Warranties: For special warranties.

1.6 QUALITY ASSURANCE

A. Installer Qualifications: A specialist who is licensed according to regulations of authorities having jurisdiction to apply termite control treatment and products in jurisdiction where Project is located and who employs workers trained and approved by manufacturer to install manufacturer's products.

1.7 FIELD CONDITIONS

A. Soil Treatment:

1. Environmental Limitations: To ensure penetration, do not treat soil that is water saturated or frozen. Do not treat soil while precipitation is occurring. Comply with requirements of the EPA-Registered Label and requirements of authorities having jurisdiction.
2. Related Work: Coordinate soil treatment application with excavating, filling, grading, and concreting operations. Treat soil under footings, grade beams, and ground-supported slabs before construction.

1.8 WARRANTY

A. Termite Infestation Warranty: Manufacturer warrants that their ASTM E 1745 classified polymer-based sheet barrier system, constructed without chemical termiticides, will prevent under-slab termite infestation caused by termite penetration of the barrier material. If subterranean termite damage is discovered and certified during warranty period, manufacturer's warranty shall at least provide for a refund of the purchase price or replacement of the barrier material.

1. Warranty Period: 60 days from installation, whichever occurs first.

B. Soil Treatment Special Warranty: Manufacturer's standard form, signed by Applicator and Contractor, certifying that termite control work consisting of applied soil termiticide treatment will prevent infestation of subterranean termites, including Formosan termites (*Coptotermes formosanus*). If subterranean termite activity or damage is discovered during warranty period, re-treat soil and repair or replace damage caused by termite infestation.

1. Warranty Period: Five years from date of Substantial Completion.

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- C. Wood Treatment Special Warranty: Manufacturer's standard form, signed by Applicator and Contractor, certifying that termite control work consisting of applied wood termiticide treatment will prevent infestation of subterranean termites, including Formosan termites (*Coptotermes formosanus*). If subterranean termite damage is discovered during warranty period, repair or replace damage caused by termite infestation and treat replacement wood.

- 1. Warranty Period: 12 years from date of Substantial Completion.

PART 2 PRODUCTS

2.1 MANUFACTURERS

- A. Source Limitations: Obtain termite control products from single source.

2.2 POLYMER-BASED SHEET BARRIER SYSTEM

- A. Polymer-Based Sheet: Multi-layered, 15 mil (0.381 mm) thick, polyolefin plastic extrusion termite barrier system; ASTM E 1745, Class C, under-slab vapor retarder.

- 1. Basis-of-Design Product: Subject to compliance with requirements, provide Stego Industries, LLC; Pango Wrap or comparable product.

- a. Properties:

- b. Water Vapor Permeance: 0.010 perms (0.576 ng/Pa*s*sq. m) in accordance with ASTM E 1249.

- c. Puncture Resistance: 3.39 lb (1538 grams) in accordance with ASTM D 1709.

- d. Push-Through Puncture: 30.93 lbf (137.6 N) in accordance with ASTM D 4833.

- e. Tensile Strength: 48.6 lbf/in (8.51 kN/m) in accordance with ASTM D 882.

- f. Permeance After Conditioning: 0.010 perms (0.576 ng/Pa*s*sq. m) in accordance with ASTM E 154, Sections 8, 11, 12 and 13.

- g. Methane Transmission Rate: 227.8 GTR in accordance with ASTM D 1434.

- h. Radon Diffusion Coefficient: 0.000000000215 sq. ft/s (0.00000000002 sq. m/s) in accordance with test K124/02/95.

2.3 SOIL TREATMENT

- A. Termiticide: EPA-Registered termiticide acceptable to authorities having jurisdiction, in an aqueous solution formulated to prevent termite infestation.

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1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. BASF Corporation.
 - b. Bayer Environmental Science.
 - c. Ensystem, Inc.
 - d. Syngenta.
2. Service Life of Treatment: Soil treatment termiticide that is effective for not less than five years against infestation of subterranean termites.

2.4 WOOD TREATMENT

- A. Borate: EPA-Registered borate termiticide acceptable to authorities having jurisdiction, in an aqueous solution for spray application and a gel solution for pressure injection, formulated to prevent termite infestation in wood.
 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Ensystem, Inc.
 - b. Nisus Corporation.
 - c. NovaGuard Technologies, Inc.

2.5 BAIT-STATION SYSTEM

- A. Description: EPA-Registered system acceptable to authorities having jurisdiction. Provide bait stations based on the dimensions of building perimeter indicated on Drawings, according to product's EPA-Registered Label and manufacturer's written instructions.
 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. BASF Corporation.
 - b. Dow Chemical Company (The).
 - c. Ensystem, Inc.

2.6 METAL MESH BARRIER SYSTEM

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A. Stainless-Steel Mesh: 0.025-by-0.018 inch (0.64-by-0.45 mm) mesh of 0.08-inch (2.0-mm) diameter, stainless-steel wire, Type 316.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following or approved equal:

a. Termimesh USA Inc.

PART 3 EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Applicator present, for compliance with requirements for moisture content of soil per termiticide label, interfaces with earthwork, slab and foundation work, landscaping, utility installation, and other conditions affecting performance of termite control.

B. Proceed with application only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. General: Prepare work areas according to the requirements of authorities having jurisdiction and according to manufacturer's written instructions before beginning application and installation of termite control treatment(s). Remove extraneous sources of wood cellulose and other edible materials, such as wood debris, tree stumps and roots, stakes, formwork, and construction waste wood from soil within and around foundations.

B. Soil Treatment Preparation: Remove foreign matter and impermeable soil materials that could decrease treatment effectiveness on areas to be treated. Loosen, rake, and level soil to be treated, except previously compacted areas under slabs and footings. Termiticides may be applied before placing compacted fill under slabs if recommended in writing by termiticide manufacturer.

1. Fit filling hose connected to water source at the site with a backflow preventer, according to requirements of authorities having jurisdiction.

3.3 INSTALLING POLYMER-BASED SHEET BARRIER SYSTEM

A. Install polymer-based sheet barrier system to provide a continuous barrier to entry of subterranean termites, according to ASTM E 1643 and manufacturer's written instructions.

3.4 APPLYING SOIL TREATMENT

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- A. Application: Mix soil treatment termiticide solution to a uniform consistency. Distribute treatment uniformly. Apply treatment at the product's EPA-Registered Label volume and rate for maximum specified concentration of termiticide to the following so that a continuous horizontal and vertical termiticidal barrier or treated zone is established around and under building construction.
1. Slabs-on-Grade and Basement Slabs: Underground-supported slab construction, including footings, building slabs, and attached slabs as an overall treatment. Treat soil materials before concrete footings and slabs are placed.
 2. Foundations: Soil adjacent to and along the entire inside perimeter of foundation walls; along both sides of interior partition walls; around plumbing pipes and electric conduit penetrating the slab; around interior column footers, piers, and chimney bases; and along the entire outside perimeter, from grade to bottom of footing.
 3. Crawlspace: Soil under and adjacent to foundations. Treat adjacent areas, including around entrance platform, porches, and equipment bases. Apply overall treatment only where attached concrete platform and porches are on fill or ground.
 4. Masonry: Treat voids.
 5. Penetrations: At expansion joints, control joints, and areas where slabs and below-grade walls will be penetrated.
- B. Post warning signs in areas of application.
- C. Reapply soil treatment solution to areas disturbed by subsequent excavation, grading, landscaping, or other construction activities following application.

3.5 APPLYING WOOD TREATMENT

- A. Wood Treatment: Apply wood treatment after framing, sheathing, and exterior weather protection is completed but before electrical and mechanical systems are installed.
- B. Application: Mix borate wood treatment solution to a uniform consistency. Apply treatment at the product's EPA-Registered Label volume and rate for the maximum borate concentration allowed for each specific use so that wood framing, sheathing, siding, and structural members subject to infestation receive treatment. Apply treatment to the height of 8 feet (244 mm) above grade.
1. Framing and Sheathing: Apply termiticide solution by spray to bare wood and with complete coverage.
 2. Heavy Wood Members: For wood greater than 4 inches (100 mm) thick, inject termiticide gel solution under pressure into holes of size and spacing required by manufacturer for treatment.

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3. Exterior Uncoated Wood Trim and Siding: Apply termiticide solution to bare wood only when forecasted weather conditions indicate no precipitation or fog before application of seal coat. After 48 hours, verify that surface is sufficiently dry for seal coat and apply seal coat of paint as specified in Section 099113 "Exterior Painting."

3.6 INSTALLING BAIT-STATION SYSTEM

- A. Bait-Station System: Install during construction to determine areas of termite activity.
- B. Place bait stations according to product's EPA-Registered Label and manufacturer's written instructions, in the following locations:
 1. Conducive sites and locations indicated on Drawings.
 2. In and around infested trees and stumps.
 3. In mulch beds.
 4. Where wood directly contacts soil.
 5. Areas of high soil moisture.
 6. Near irrigation sprinkler heads.
 7. Each area where roof drainage system, including downspouts and scuppers, drains to soil.
 8. Along driplines of roof overhangs without gutters.
 9. Where condensate lines from mechanical equipment drip or drain to soil.
 10. At plumbing penetrations through ground-supported slabs.
 11. Other sites and locations as determined by licensed Installer.
- C. Spacing: Place bait stations according to manufacturer's written instructions and at a frequency no less than the following:
 1. One bait station per 8 linear feet (2.4 linear meters).
 2. One cluster of bait stations per 20 linear feet (6.1 linear meters), with no fewer than three bait stations per cluster.

3.7 INSTALLING METAL MESH BARRIER SYSTEM

- A. Install metal mesh barrier system to provide a continuous barrier to entry of subterranean termites, according to manufacturer's written instructions.

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1. Fit mesh tightly around pipes and other penetrations and terminate at slab and foundation perimeters.
2. Install mesh under the perimeter of concrete slab edges and joints after vapor retarder and reinforcing steel are in place.

3.8 PROTECTION

- A. Avoid disturbance of treated soil after application. Keep off treated areas until completely dry.
- B. Protect termiticide solution dispersed in treated soils and fills from being diluted by exposure to water spillage or weather until ground-supported slabs are installed. Use waterproof barrier according to EPA-Registered Label instructions.

3.9 MAINTENANCE SERVICE

- A. Maintenance Service: Beginning at Substantial Completion, maintenance service shall include 12 months' full maintenance by skilled employees of termite-control-treatment Installer. Include annual maintenance as required for proper performance according to the product's EPA-Registered Label and manufacturer's written instructions. Parts and supplies shall be manufacturer's authorized replacement parts and supplies.
- B. Continuing Maintenance Proposal: Provide from termite-control-treatment Installer to Owner, in the form of a standard yearly (or other period) maintenance agreement, starting on date initial maintenance service is concluded. State services, obligations, conditions, and terms for agreement period and for future renewal options.
 1. Include annual inspection for termite activity and effectiveness of termite treatment according to manufacturer's written instructions.

END OF SECTION

DIVISION 32 – EXTERIOR IMPROVEMENTS

Government of the Virgin Islands, Department of Public Works

PROJECT NAME: Elaine I. Sprauve Library and Museum Building

Project Location: **St. John, U.S. Virgin Islands**

SECTION 321400 – BRICK PAVERS

Government of the Virgin Islands, Department of Public Works

PROJECT NAME: Elaine I. Sprauve Library and Museum Building

Project Location: **St. John, U.S. Virgin Islands**

PART 1 - GENERAL

1.1 SECTION INCLUDES

- A. Pedestrian/light vehicular pavers.
 - 1. Heavy vehicular pavers.
 - 2. Relieved edge pavers.
 - 3. Relieved edge and lugged pavers.
 - 4. Danish hand mould pavers.
 - 5. Paver step treads.
 - 6. Permeable pavers.

1.2 RELATED SECTIONS

- A. Section 321316.23 - Stamped Concrete Paving.
- B. Section 321000 - Bases, Ballasts, and Paving.
- C. Section 096340 - Stone Flooring.

1.3 REFERENCES

- A. ASTM International, Inc. (ASTM):
 - 1. ASTM C 902 - Standard Specification for Pedestrian and Light Traffic Paving Brick.
 - 2. ASTM C 1272 - Standard Specification for Heavy Vehicular Paving Brick.

1.4 SUBMITTALS

- A. Submit under provisions of Section 01 30 00 - Administrative Requirements.
- B. Product Data: Manufacturer's data sheets on each product to be used, including:
 - 1. Preparation instructions and recommendations.
 - 2. Storage and handling requirements and recommendations.
 - 3. Cleaning methods.
- C. Verification Samples: For each product and finish specified, two full-size samples representing actual products, colors and textures.

1.5 QUALITY ASSURANCE

SECTION 321400 – BRICK PAVERS

Government of the Virgin Islands, Department of Public Works

PROJECT NAME: Elaine I. Sprauve Library and Museum Building

Project Location: **St. John, U.S. Virgin Islands**

- A. Manufacturer Qualifications: All primary products specified in this section will be supplied by a single manufacturer with a minimum of ten years experience.
- B. Installer Qualifications: All products listed in this section are to be installed by a single installer with a minimum of five years demonstrated experience in installing products of the same type and scope as specified.
- C. Mock-Up: Provide a completely assembled, typical wall areas installed with related accessories, in composite configurations designed to fulfill the performance criteria, and representative of the design as shown on the Drawings.
 - 1. Locate mock-up in location as directed by the Architect.
 - 2. Do not proceed with remaining work until workmanship is approved by Architect.
 - 3. Mock-up area may become part of finished work, if approved by the Architect.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Deliver, store and handle materials and products in strict compliance with manufacturer's instructions and recommendations and industry standards.
- B. Store materials in manufacturer's original sealed, labeled packaging until ready for installation and in accordance with manufacturer's instructions. Protect from damage.

1.7 PROJECT CONDITIONS

- A. Maintain environmental conditions (temperature, humidity and ventilation) within limits recommended by manufacturer for optimum results. Do not install products under environmental conditions outside manufacturer's recommended limits.

1.8 WARRANTY

- A. Manufacturer's Standard Material Warranty: At project closeout, provide to Owner or Owners Representative an executed copy of the manufacturer's standard limited warranty against manufacturing defect, outlining its terms, conditions, and exclusions from coverage.

PART 2 PRODUCTS

2.1 MANUFACTURERS

- A. Acceptable Manufacturers:
 - 1. Endicott Clay Products Co., which is located at: 57120 707th Rd.; Endicott, NE 68350; Tel: 402-729-3315; Fax: 402-729-5804; Email: [request info \(endicott@endicott.com\)](mailto:request info (endicott@endicott.com)); Web: www.endicott.com
 - 2. Requests for substitutions will be considered in accordance with provisions of Section 016000 - Product Requirements.

SECTION 321400 – BRICK PAVERS

Government of the Virgin Islands, Department of Public Works

PROJECT NAME: Elaine I. Sprauve Library and Museum Building

Project Location: **St. John, U.S. Virgin Islands**

2.2 PEDESTRIAN/LIGHT VEHICULAR PAVERS

- A. Pedestrian/Light Vehicular Pavers: Nominal 4 inch x 8 inch brick pavers with wirecut surface texture (Choose size, compliance, color and pattern):

1. Actual Product Size: 4 x 8 x 1-1/4 inches (102 x 203 x 32 mm).
2. Actual Product Size: 4 x 8 x 2-1/4 inches (102 x 203 x 57 mm).
3. Actual Product Size: 3-5/8 x 7-5/8 x 1-1/4 inches (102 x 203 x 32 mm).
4. Actual Product Size: 3-5/8 x 7-5/8 x 2-1/4 inches (102 x 203 x 57 mm).
5. Compliance: ASTM C 902, Class SX, Type 1.
6. Compliance: ASTM C 1272, Type R, application PS.
7. Compliance: ASTM C 1272, Type R, application PX.
8. Compliance: ASTM C 1272, Type F, application PS.
9. Compliance: ASTM C 1272, Type F, application PX.
10. Color: Rose Blend.
11. Color: Red Blend.
12. Color: Burgundy Blend.
13. Color: Bordeaux Blend.
14. Color: Copper Canyon.
15. Color: Coppertone.
16. Color: Medium Ironspot No. 77.
17. Color: Medium Ironspot No. 46.
18. Color: Dark Ironspot.
19. Color: Manganese Ironspot.
20. Pattern: Herringbone 90 degree Pattern 10 ' T' spacers/sf; including perimeter spacers.
21. Pattern: Herringbone 45 degree Pattern 10 ' T' spacers/sf; including perimeter spacers.
22. Pattern: Running Bond Pattern 10 ' T' spacers/sf; including perimeter spacers.

SECTION 321400 – BRICK PAVERS

Government of the Virgin Islands, Department of Public Works

PROJECT NAME: Elaine I. Sprauve Library and Museum Building

Project Location: **St. John, U.S. Virgin Islands**

23. Pattern: Basket Weave Pattern 7.5 ' T' spacers/sf and 1.5 ' +' spacers/sf; including perimeter spacers.

B. Pedestrian/Light Vehicular Pavers: Nominal 8 inch x 8 inch brick pavers with wirecut surface texture. (Choose size, compliance, color and pattern):

1. Actual Product Size: 8 x 8 x 2-1/4 inches (203 x 203 x 57 mm).

2. Actual Product Size: 7-5/8 x 7-5/8 x 2-1/4 inches (194 x 194 x 57 mm).

3. Actual Product Size: 7-5/8 x 7-5/8 x 1-1/4 inches (194 x 194 x 32 mm).

a. Surface Texture: Finished on five sides, one 8 x 8 inch face unfinished.

4. Compliance: ASTM C 902, Class SX, Type 1.

5. Compliance: ASTM C 1272, Type R, application PS.

6. Compliance: ASTM C 1272, Type R, application PX.

7. Compliance: ASTM C 1272, Type F, application PS.

8. Compliance: ASTM C 1272, Type F, application PX.

9. Color: Rose Blend.

10. Color: Red Blend.

11. Color: Burgundy Blend.

12. Color: Bordeaux Blend.

13. Color: Copper Canyon.

14. Color: Coppertone.

15. Color: Medium Ironspot No. 77.

16. Color: Medium Ironspot No. 46.

17. Color: Dark Ironspot.

18. Color: Manganese Ironspot.

19. Pattern: Herringbone 90 degree Pattern 10 ' T' spacers/sf; including perimeter spacers.

20. Pattern: Herringbone 45 degree Pattern 10 ' T' spacers/sf; including perimeter spacers.

21. Pattern: Running Bond Pattern 10 ' T' spacers/sf; including perimeter spacers.

SECTION 321400 – BRICK PAVERS

Government of the Virgin Islands, Department of Public Works

PROJECT NAME: Elaine I. Sprauve Library and Museum Building

Project Location: **St. John, U.S. Virgin Islands**

22. Pattern: Basket Weave Pattern 7.5 ' T' spacers/sf and 1.5 ' +' spacers/sf; including perimeter spacers.
- C. Pedestrian/Light Vehicular Pavers: Nominal 4 inch x 12 inch brick pavers with wirecut surface texture. (Choose size, compliance, color and pattern):
1. Actual Product Size: 4 x 12 x 2-1/4 inches (102 x 305 x 57 mm).
 2. Actual Product Size: 3-5/8 x 11-5/8 x 2-1/4 inches (92 x 295 x 57 mm).
 3. Compliance: ASTM C 902, Class SX, Type 1.
 4. Compliance: ASTM C 1272, Type R, application PS.
 5. Compliance: ASTM C 1272, Type R, application PX.
 6. Compliance: ASTM C 1272, Type F, application PS.
 7. Compliance: ASTM C 1272, Type F, application PX.
 8. Color: Rose Blend.
 9. Color: Red Blend.
 10. Color: Burgundy Blend.
 11. Color: Bordeaux Blend.
 12. Color: Copper Canyon.
 13. Color: Coppertone.
 14. Color: Medium Ironspot No. 77.
 15. Color: Medium Ironspot No. 46.
 16. Color: Dark Ironspot.
 17. Color: Manganese Ironspot.
 18. Pattern: Herringbone 90 degree Pattern 10 ' T' spacers/sf; including perimeter spacers.
 19. Pattern: Herringbone 45 degree Pattern 10 ' T' spacers/sf; including perimeter spacers.
 20. Pattern: Running Bond Pattern 10 ' T' spacers/sf; including perimeter spacers.
 21. Pattern: Basket Weave Pattern 7.5 ' T' spacers/sf and 1.5 ' +' spacers/sf; including perimeter spacers.

2.3 HEAVY VEHICULAR PAVERS

SECTION 321400 – BRICK PAVERS

Government of the Virgin Islands, Department of Public Works

PROJECT NAME: Elaine I. Sprauve Library and Museum Building

Project Location: **St. John, U.S. Virgin Islands**

- A. Heavy Vehicular Pavers: Nominal 4 inch x 8 inch brick pavers with wirecut surface texture (Choose size, compliance, color and pattern):

1. Actual Product Size: 4 x 8 x 2-5/8 inches (102 x 203 x 67 mm).
2. Compliance: ASTM C 902, Class SX, Type 1.
3. Compliance: ASTM C 1272, Type R, application PS.
4. Compliance: ASTM C 1272, Type R, application PX.
5. Compliance: ASTM C 1272, Type F, application PS.
6. Compliance: ASTM C 1272, Type F, application PX.
7. Color: Rose Blend.
8. Color: Red Blend.
9. Color: Burgundy Blend.
10. Color: Bordeaux Blend.
11. Color: Copper Canyon.
12. Color: Coppertone.
13. Color: Medium Ironspot No. 77.
14. Color: Medium Ironspot No. 46.
15. Color: Dark Ironspot.
16. Color: Manganese Ironspot.
17. Pattern: Herringbone 90 degree Pattern 10 ' T' spacers/sf.
18. Pattern: Herringbone 45 degree Pattern 10 ' T' spacers/sf.
19. Pattern: Running Bond Pattern 10 ' T' spacers/sf.
20. Pattern: Basket Weave Pattern 7.5 ' T' spacers/sf and 1.5 ' +' spacers/sf.

2.4 RELIEVED EDGE PAVERS

- A. Relieved Edge Pavers: Nominal 4 inch x 8 inch brick pavers with wirecut surface texture (Choose size, compliance, color and pattern):

1. Actual Product Size: 4 x 8 x 2-1/4 inches (102 x 203 x 57 mm).

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2. Actual Product Size: 4 x 8 x 2-5/8 inches (102 x 203 x 67 mm).
3. Compliance: ASTM C 902, Class SX, Type 1.
4. Compliance: ASTM C 1272, Type R, application PS.
5. Compliance: ASTM C 1272, Type R, application PX.
6. Compliance: ASTM C 1272, Type F, application PS.
7. Compliance: ASTM C 1272, Type F, application PX.
8. Relieved Edges: 1/8 inch x 1/8 inch.
9. Color: Rose Blend.
10. Color: Red Blend.
11. Color: Burgundy Blend.
12. Color: Bordeaux Blend.
13. Color: Copper Canyon.
14. Color: Coppertone.
15. Color: Medium Ironspot No. 77.
16. Color: Medium Ironspot No. 46.
17. Color: Dark Ironspot.
18. Color: Manganese Ironspot.
19. Pattern: Herringbone 90 degree Pattern 10 ' T' spacers/sf; including perimeter spacers.
20. Pattern: Herringbone 45 degree Pattern 10 ' T' spacers/sf; including perimeter spacers.
21. Pattern: Running Bond Pattern 10 ' T' spacers/sf; including perimeter spacers.
22. Pattern: Basket Weave Pattern 7.5 ' T' spacers/sf and 1.5 ' +' spacers/sf; including perimeter spacers.

2.5 RELIEVED EDGE AND LUGGED PAVERS

- A. Relieved Edge/Lugged Pavers: Nominal 4 inch x 8 inch brick pavers with wirecut surface texture (Choose size, compliance, color and pattern):

1. Actual Product Size: 4 x 8 x 2-1/4 inches (102 x 203 x 57 mm).

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Project Location: **St. John, U.S. Virgin Islands**

- a. Lugs: 1/8 inch (3 mm).
2. Actual Product Size: 4 x 8 x 2-1/4 inches (102 x 203 x 57 mm).
 - a. Lugs: 1/4 inch (6 mm).
3. Actual Product Size: 4 x 8 x 2-5/8 inches (102 x 203 x 67 mm).
 - a. Lugs: 1/8 inch (3 mm).
4. Actual Product Size: 4 x 8 x 2-5/8 inches (102 x 203 x 67 mm).
 - a. Lugs: 1/4 inch (6 mm).
5. Compliance: ASTM C 902, Class SX, Type 1.
6. Compliance: ASTM C 1272, Type R, application PS.
7. Compliance: ASTM C 1272, Type R, application PX.
8. Compliance: ASTM C 1272, Type F, application PS.
9. Compliance: ASTM C 1272, Type F, application PX.
10. Color: Rose Blend.
11. Color: Red Blend.
12. Color: Burgundy Blend.
13. Color: Bordeaux Blend.
14. Color: Copper Canyon.
15. Color: Coppertone.
16. Color: Medium Ironspot No. 77.
17. Color: Medium Ironspot No. 46.
18. Color: Dark Ironspot.
19. Color: Manganese Ironspot.

2.6 HANDICAP DETECTABLE WARNING PAVERS

- A. Handicap Detectable Warning Pavers: Nominal 4 inch x 8 inch brick pavers with wirecut surface texture (Choose size, compliance, color and pattern):
 1. Actual Product Size: 4 x 8 x 1-1/4 inches (102 x 203 x 32 mm).

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2. Actual Product Size: 4 x 8 x 2-1/4 inches (102 x 203 x 57 mm).
3. Actual Product Size: 3-5/8 x 7-5/8 x 1-1/4 inches (92 x 194 x 32 mm).
4. Actual Product Size: 3-5/8 x 7-5/8 x 2-1/4 inches (92 x 194 x 57 mm).
5. Surface Protrusions: 8 raised protrusions per paver unit; 0.2 inches (5 mm) in height, tapering from 0.9 inches (23 mm) at the base to 0.75 inches (19 mm).
6. Compliance: ASTM C 902, Class SX, Type 1.
7. Compliance: ASTM C 1272, Type R, application PS.
8. Compliance: ASTM C 1272, Type R, application PX.
9. Compliance: ASTM C 1272, Type F, application PS.
10. Compliance: ASTM C 1272, Type F, application PX.
11. Color: Rose Blend.
12. Color: Red Blend.
13. Color: Burgundy Blend.
14. Color: Bordeaux Blend.
15. Color: Copper Canyon.
16. Color: Coppertone.
17. Color: Medium Ironspot No. 77.
18. Color: Medium Ironspot No. 46.
19. Color: Dark Ironspot.
20. Color: Manganese Ironspot.
21. Pattern: Herringbone 90 degree Pattern 10 ' T' spacers/sf; including perimeter spacers.
22. Pattern: Herringbone 45 degree Pattern 10 ' T' spacers/sf; including perimeter spacers.
23. Pattern: Running Bond Pattern 10 ' T' spacers/sf; including perimeter spacers.
24. Pattern: Basket Weave Pattern 7.5 ' T' spacers/sf and 1.5 ' +' spacers/sf; including perimeter spacers.

1.9 DANISH HAND MOULD PAVERS

SECTION 321400 – BRICK PAVERS

Government of the Virgin Islands, Department of Public Works

PROJECT NAME: Elaine I. Sprauve Library and Museum Building

Project Location: **St. John, U.S. Virgin Islands**

- A. Danish Hand Mould Pavers: Nominal 4 inch x 8 inch brick pavers with wirecut surface texture (Choose size, compliance, color and pattern):

1. Actual Product Size: 3-5/8 x 7-5/8 x 2-5/8 inches (92 x 194 x 67 mm).
2. Color: Coppertone.
3. Color: Medium Ironspot No. 77.
4. Color: Medium Ironspot No. 46.
5. Color: Dark Ironspot.
6. Color: Manganese Ironspot.
7. Compliance: ASTM C 902, Class SX, Type 1.
8. Pattern: Herringbone 90 degrees.
9. Pattern: Herringbone 45 degrees.
10. Pattern: Running Bond Pattern.
11. Pattern: Basket Weave Pattern.

2.7 PAVER STEP TREADS

- A. Paver Step Treads: Brick paver step treads with wirecut surface texture (Choose size, compliance, color and pattern):

1. Actual Product Size: 11-5/8 x 3-5/8 x 2-1/4 inches (295 x 92 x 57 mm).
2. Actual Product Size: 7-5/8 x 7-5/8 x 2-1/4 inches (194 x 194 x 57 mm).
3. Radiused Edges: 1/2 inch (12 mm) radius on two adjacent 3-5/8 inch (92 mm) edges.
4. Compliance: ASTM C 902, Class SX, Type 1.
5. Compliance: ASTM C 1272, Type R, application PS.
6. Compliance: ASTM C 1272, Type R, application PX.
7. Compliance: ASTM C 1272, Type F, application PS.
8. Compliance: ASTM C 1272, Type F, application PX.
9. Color: Rose Blend.
10. Color: Red Blend.

SECTION 321400 – BRICK PAVERS

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11. Color: Burgundy Blend.
12. Color: Bordeaux Blend.
13. Color: Copper Canyon.
14. Color: Coppertone.
15. Color: Medium Ironspot No. 77.
16. Color: Medium Ironspot No. 46.
17. Color: Dark Ironspot.
18. Color: Manganese Ironspot.

2.8 PERMEABLE PAVERS

A. .

1.

PART 3 EXECUTION

3.1 EXAMINATION AND PREPARATION

- A. Prepare substrates using the methods recommended by the manufacturer for achieving best result for the substrates under project conditions.
- B. Do not proceed with installation until substrates have been prepared using the methods recommended by the manufacturer and deviations from manufacturer's recommended tolerances are corrected. Commencement of installation constitutes acceptance of conditions.
- C. If preparation is the responsibility of another installer, notify Architect in writing of deviations from manufacturer's recommended installation tolerances and conditions.

3.2 INSTALLATION

- A. Install pavers accordance with manufacturer's instructions and in proper relationship with adjacent construction.

3.3 PROTECTION

- A. Protect installed products until completion of project.
- B. Touch-up, repair or replace damaged products before Substantial Completion.

END OF SECTION

SECTION 321413 – PRECAST CONCRETE UNIT PAVING

Government of the Virgin Islands, Department of Public Works

PROJECT NAME: Elaine I. Sprauve Library and Museum Building

Project Location: **St. John, U.S. Virgin Islands**

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Precast concrete unit paving including the following:

1. Non-permeable concrete pavers.
2. Permeable concrete pavers.
3. Joint sand.
4. Permeable joint opening aggregate.
5. Setting bed sand.
6. Permeable setting bed aggregate.
7. Base aggregate.
8. Permeable base aggregate.
9. Subbase aggregate.
10. Permeable subbase aggregate.
11. Geotextile.
12. Edge restraints.
13. Accessories.

1.2 RELATED SECTIONS

- A. Section 312000 - Earth Moving.
- B. Section 323213 - Cast-in-Place Concrete Retaining Walls.
- C. Section 033000 - Cast-in-Place Concrete.

1.3 REFERENCES

A. ASTM International (ASTM):

1. ASTM C29 - Bulk Density and Voids in Aggregate Materials.
2. ASTM C33 - Standard Specification for Concrete Aggregates.
3. ASTM C67 - Standard Test Methods for Sampling and Testing Brick and Structural Clay Tile, Section 8, Freezing and Thawing.

SECTION 321413 – PRECAST CONCRETE UNIT PAVING

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4. ASTM C136 - Standard Test Method for Sieve Analysis of Fine and Coarse Aggregates.
5. ASTM C140 - Standard Test Methods for Sampling and Testing Concrete Masonry Units and Related Units.
6. ASTM C144 - Standard Specifications for Aggregate for Masonry Mortar.
7. ASTM D448 - Standard Classification for Sizes of Aggregate for Road and Bridge Construction.
8. ASTM C936 - Standard Specification for Solid Concrete Interlocking Paving Units.
9. ASTM C979 - Standard Specification for Pigments for Integrally Colored Concrete.
10. ASTM C1645 - Standard Test Method for Freeze-thaw and De-icing Salt Durability of Solid Concrete Interlocking Paving Units.
11. ASTM D698 - Test Methods for Moisture Density Relations of Soil and Soil Aggregate Mixtures Using a 5.5 lb (24.4 N) Rammer and 12 in. (305 mm) drop.
12. ASTM D1557 - Test Methods for Moisture Density Relations of Soil and Soil Aggregate Mixtures Using a 10-lb (44.5 N) Rammer and 18 in. (457 mm) drop.
13. ASTM D1883 - Test Method for California Bearing Ratio of Laboratory-Compacted Soils.
14. ASTM D2940 - Graded Aggregate Material for Bases or Subbases for Highways or Airports.
15. ASTM D4254 - Standard Test Methods for Minimum Index Density and Unit Weight of Soils and Calculation of Relative Density.
16. ASTM D4354 - Standard Practice for Sampling of Geosynthetics for Testing.
17. ASTM D4491 - Standard Test Method for Water Permeability of Geotextiles by Permittivity.
18. ASTM D4533 - Standard Test Method for Index Trapezoidal Tearing Strength of Geotextiles.
19. ASTM D4632 - Standard Test Method for Grab Breaking Load and Elongation of Geotextiles.
20. ASTM D4751 - Standard Test Method for Determining Apparent Opening Size of a Geotextile.
21. ASTM D4759 - Standard Practice for Determining the Specifications Conformance of Geosynthetics.

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PROJECT NAME: Elaine I. Sprauve Library and Museum Building

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22. ASTM D4833 - Standard Test Method for Index Puncture Resistance of Geotextiles, Geomembranes and Related Products.

23. ASTM D5261 - Standard Test Method for Measuring Mass per Unit Area of Geotextiles.

B. U.S. Green Building Council, Leadership in Energy and Environmental Design (LEED):

1. LEED Building Design and Construction.

1.4 SUBMITTALS

A. Submit under provisions of Section 013000 - Administrative Requirements.

B. Product Data:

1. Manufacturer's data sheets on each product to be used.

2. Preparation instructions and recommendations.

3. Storage and handling requirements and recommendations.

4. Typical installation methods.

C. Selection Samples: For each finish product specified, two complete sets of color chips representing manufacturer's full range of available colors and patterns.

D. Verification Samples: For each finish product specified, two samples, minimum size 6 inches (150 mm) square representing actual product, color, and patterns.

E. Shop Drawings: Include details of materials, construction and finish. Include relationship with adjacent construction.

1.5 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing products specified in this section with a minimum ten years documented experience.

B. Installer Qualifications: Company specializing in performing Work of this section with minimum two years documented experience with projects of similar scope and complexity.

C. Source Limitations: Provide each type of product from a single manufacturing source to ensure uniformity.

D. Mock-Up: Construct a mock-up with actual materials in sufficient time for Architect's review and to not delay construction progress. Locate mock-up as acceptable to Architect and provide temporary foundations and support.

1. Intent of mock-up is to demonstrate quality of workmanship and visual appearance.

SECTION 321413 – PRECAST CONCRETE UNIT PAVING

Government of the Virgin Islands, Department of Public Works

PROJECT NAME: Elaine I. Sprauve Library and Museum Building

Project Location: **St. John, U.S. Virgin Islands**

2. If mock-up is not acceptable, rebuild mock-up until satisfactory results are achieved.
3. Retain mock-up during construction as a standard for comparison with completed work.
4. Do not alter or remove mock-up until work is completed or removal is authorized.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Store and handle in strict compliance with manufacturer's written instructions and recommendations.
- B. Protect from damage due to weather, excessive temperature, and construction operations.

1.7 PROJECT CONDITIONS

- A. Maintain environmental conditions (temperature, humidity, and ventilation) within limits recommended by manufacturer for optimum results. Do not install products under environmental conditions outside manufacturer's recommended limits.

1.8 EXTRA MATERIALS

- B. Provide 100 square feet of each product and size used to owner for maintenance and repair. Furnish Pavers from the same production run as installed materials.

PART 2 PRODUCTS

2.1 MANUFACTURER

- A. Acceptable Manufacturer: UNILOCK®, which is located at: 287 Armstrong Ave.; Georgetown, ON, Canada L7G 4X6; Toll Free Tel: 800-864-5625; Fax: 888-477-1707; Email:[request info \(Elaine.Willis@unilock.com\)](mailto:request info (Elaine.Willis@unilock.com)); Web:<https://unilock.com>

1. Unilock Ltd, 287 Armstrong Avenue, Georgetown, ON L7G 4X6. 416-646-9000
2. Unilock New England, 35 Commerce Dr., Uxbridge, MA 01569. 508-278-4536
3. Unilock New York, 51 International Blvd., Brewster NY 10509. 845-278-6700
4. Unilock Inc., 510 Smith Street, Buffalo, NY 14210. 716-826074
5. Unilock Ohio, 12560 Sheets Rd, Rittman, OH 44270. 330-927-4000
6. Unilock Michigan, 12591 Emerson Dr., Brighton, MI 48116 248-437-7037
7. Unilock Chicago, 301 E Sullivan Rd, Aurora, IL 60505. 630-892-9191
8. Unilock W4814 County Rd A, Elkhorn, WI 53121. 262-742-3890
9. email: customerservice@unilock.com

SECTION 321413 – PRECAST CONCRETE UNIT PAVING

Government of the Virgin Islands, Department of Public Works

PROJECT NAME: Elaine I. Sprauve Library and Museum Building

Project Location: **St. John, U.S. Virgin Islands**

10. Web: www.unilock.com.

- B. Requests for substitutions will be considered in accordance with provisions of Section 016000 - Product Requirements.

2.2 PERFORMANCE REQUIREMENTS

A. Standards Compliance:

1. Provide pavers meeting the minimum material and physical properties set forth in ASTM C936. Efflorescence is not a cause for rejection.

2. Pigments conforming to ASTM C979.

B. Compressive Strength: 8,000 psi (55 MPa) average, with no individual unit under 7,200 psi (50 MPa).

C. Absorption (ASTM C140): 5 percent average with no unit greater than 7 percent.

D. Resistance to Freeze-Thaw (ASTM C1645): No breakage greater than 1.0 percent loss in dry weight of individual unit after 50 cycles.

E. Maximum allowable breakage of product is 5 percent.

F. TX Active Cement: Portland Cement complying with ASTM C150 with addition of proprietary particles of titanium dioxide specifically engineered for use in concrete products.

1. Concrete will resist most organic and inorganic pollutants that gather on the surface causing discoloration.

2. Concrete will remove significant amounts of environmental pollutants deemed harmful to human health.

2.3 NON-PERMEABLE PAVERS

A. Basis of Design: Courtstone; as manufactured by Unilock (Choose color and size).

1. Color: Basalt.

2. Color: Belgian Blue.

3. Color: Dawn Mist.

4. Color: Pebble Taupe.

5. Color: Blend of Dawn Mist and Pebble Taupe.

6. Color: Blend of Belgian Blue and Basalt.

7. Color: To be selected by Architect.

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8. Finish: Realta Cobblestone, timeworn finish.

9. Thickness: 6 cm (2.375 inches).

10. Sizes:

a. Random Bundle: (the following sizes sold together in one bundle)

b. XL Rectangle: 21.5 x 13 cm (8.5 x 5.125 inches).

c. Large Rectangle: 18.5 x 13 cm (7.25 x 5.125 inches).

d. Rectangle: 16.5 x 13 cm (6.5 x 5.125 inches).

e. Small Rectangle: 14.5 x 13 cm (5.75 x 5.125 inches).

f. Square: 13 x 13 cm (5.125 x 5.125 inches).

B. Basis of Design: Copthorne; as manufactured by Unilock (Choose color and size).

1. Color: Basalt.

2. Color: Burgundy Red.

3. Color: Burnt Clay.

4. Color: Old Oak.

5. Color: Steel Blue (grey).

6. Color: To be selected by Architect.

7. Finish: Realta Cobblestone, timeworn finish.

8. Size: 20 x 6.5 x 6 cm (7.875 x 2.5 x 2.375 inches).

C. Basis of Design: Richcliff; as manufactured by Unilock. (Choose color and size).

1. Color: Smoke Shale.

2. Color: Dawn Mist.

3. Color: Pebble Taupe.

4. Color: To be selected by Architect.

5. Finish: Realta Flagstone.

6. Thickness: 6 cm (2.375 inches).

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7. Sizes:

- a. Large Rectangle: 52.8 x 30.2 cm (20.75 x 11.875 inches).
- b. Random Bundle: (the following sizes sold together in one bundle)
- c. Rectangle: 30 x 22.6 cm (11.75 x 8.875 inches).
- d. Small Rectangle: 22.6 x 15 cm (8.875 x 5.875 inches).
- e. Square: 22.6 x 22.6 cm (8.875 x 8.875 inches).

D. Basis of Design: Town Hall; as manufactured by Unilock. (Choose color and size).

1. Color: Burgundy Red.
2. Color: Burnt Clay.
3. Color: Old Oak.
4. Color: Basalt.
5. Color: Heritage Red.
6. Color: Heritage Clay.
7. Color: To be selected by Architect.
8. Finish: Realta Cobblestone, timeworn finish.
9. Size: 25 x 10 x 7 cm (9.875 x 3.875 x 2.75 inches).

E. Basis of Design: Umbriano; as manufactured by Unilock. (Choose color and size).

1. Color: Midnight Sky.
2. Color: Winter Marvel.
3. Color: Summer Wheat.
4. Color: French Grey.
5. Color: To be selected by Architect.
6. Edge Detail: Smooth - Zero Bevel.
7. Finish: Umbriano.
8. Sizes:

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- a. 60 x 60 x 7 cm (23.625 x 23.625 x 2.75 inches).
- b. 30 x 60 x 7 cm (11.75 x 23.625 x 2.75 inches).
- c. 40 x 40 x 7 cm (15.75 x 15.75 x 2.75 inches).
- d. 40 x 20 x 7 cm (15.75 x 7.875 x 2.75 inches).
- e. 20 x 20 x 7 cm (7.875 x 7.875 x 2.75 inches).
- f. 20 x 40 x 7 cm (7.875 x 15.75 x 2.75 inches).
- g. Beacon Hill Platform Random Bundle (the following units are sold together)
 - i. Large Rectangle: 5 x 35 x 6 cm (20.625 x 13.75 x 2.375 inches).
 - ii. Small Rectangle: 17.5 x 35 x cm (6.875 x 13.75 x 2.375 inches).
 - iii. Square: 35 x 35 x 6 cm (13.75 x 13.75 x 2.375 inches).
- h. Beacon Hill Platform Random Bundle (the following units are sold together)
 - i. Large Rectangle: 52.5 x 35 x 8 cm (20.625 x 13.75 x 3.125 inches).
 - ii. Small Rectangle: 17.5 x 35 x 8 cm (6.875 x 13.75 x 3.125 inches).
 - iii. Square: 35 x 35 x 8 cm (13.75 x 13.75 x 3.125 inches).

F. Basis of Design: Series; as manufactured by Unilock. (Choose color and size).

- 1. Color: Black Granite.
- 2. Color: To be selected by Architect.
- 3. Finish: Series.
- 4. Sizes:
 - a. 20 x 10 x 7 cm (7.875 x 3.875 x 2.75 inches).

G. Basis of Design: Il Campo; as manufactured by Unilock. (Choose color and size).

- 1. Color: Dark Charcoal
- 2. Color: To be selected by Architect.
- 3. Finish: Il Campo.
- 4. Sizes:

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a. 20 x 10 x 7 cm (7.875 x 3.875 x 2.75 inches).

H. Basis of Design: Hollandstone; as manufactured by Unilock. (Choose color and size).

1. Color: Granite.
2. Color: Terra Cotta.
3. Color: Rustic Red.
4. Color: Sierra.
5. Color: To be selected by Architect.
6. Finish: Standard.
7. Sizes:

a. 20 x 10 x 6 cm (7.875 x 3.875 x 2.375 inches).

I. Basis of Design: Beacon Hill Flagstone; as manufactured by Unilock. (Choose color and size).

1. Color: Tuscany.
2. Color: To be selected by Architect.
3. Finish: Flagstone Premier.
4. Sizes:

- a. XL Unit: 53 x 72 x 6 cm (20.875 x 28.3 x 2.375 inches). (CDA only)
- b. XL Unit: 53 x 88 x 6 cm (20.875 x 34.625 x 2.375 inches). (USA only)
- c. Beacon Hill Platform Random Bundle (the following units are sold together)
- d. Large Rectangle: 54 x 36 x 6 cm (21.25 x 14.125 x 2.375 inches).
- e. Small Rectangle: 18 x 36 x 6 cm (7.125 x 14.125 x 2.375 inches).
- f. Square: 36 x 36 x 6 cm (14.125 x 14.125 x 2.375 inches).

J. Basis of Design: Beacon Hill Smooth; as manufactured by Unilock. (Choose color and size).

1. Color: Opal
2. Color: To be selected by Architect.

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3. Finish: Smooth Premier.

4. Sizes:

a. Beacon Hill Platform Random Bundle (the following units are sold together)

b. Large Rectangle: 54 x 36 x 6 cm (21.25 x 14.125 x 2.375 inches).

c. Small Rectangle: 18 x 36 x 6 cm (7.125 x 14.125 x 2.375 inches).

d. Square: 36 x 36 x 6 cm (14.125 x 14.125 x 2.375 inches).

K. Basis of Design: Tribeca Cobble; as manufactured by Unilock. (Choose color and size).

1. Color: Crystalline Basalt.

2. Color: Peppered Granite.

3. Color: To be selected by Architect.

4. Finish: Series.

5. Sizes:

a. Tribeca Cobble Platform Random Bundle (the following units are sold together)

b. Large Rectangle: 30.5 x 13 x 7 cm (12 x 5.125 x 2.75 inches).

c. Rectangle: 23 x 13 x 7 cm (14.125 x 5.125 x 2.75 inches).

d. Small Rectangle: 17.5 x 13 x 7 cm (6.875 x 5.125 x 2.75 inches).

2.4 PERMEABLE PAVERS

A. Basis of Design: Eco-Optiloc; (Choose color and size).

1. Color: Natural.

2. Color: To be selected by Architect.

3. Finish: Standard.

4. Finish: Series.

5. Finish: Il Campo.

6. Finish: Smooth Premier.

7. Edge: Chamfer, 3 mm bevel.

8. Size and Shape: L-shape, 26 x 26 x 8 cm (10.25 x 10.25 x 3.125 inches).

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B. Basis of Design: Eco-Priora; as manufactured by Unilock. (Choose color and size).

1. Color: To be selected by Architect.
2. Finish: Standard.
3. Finish: Smooth Premier.
4. Finish: Il Campo.
5. Finish: Series.
6. Finish: Umbriano.
7. Edge: Chamfer, 3 mm bevel.
8. Sizes:
 - a. 10 X 10: 24 x 24 x 8 cm (9.5 x 9.5 x 3.125 inches).
 - b. 5 X 10: 24 x 12 x 8 cm (9.5 x 4.75 x 3.125 inches).
 - c. 5 X 5: 12 x 12 x 8 cm (4.75 x 4.75 x 3.125 inches).

C. Basis of Design: Ecoloc as manufactured by Unilock. (Choose color and size).

1. Color: _____.
2. Finish: Standard.
3. Finish: Smooth Premier.
4. Finish: Il Campo.
5. Finish: Series.
6. Finish: Umbriano.
7. Edge: Chamfer, 3 mm bevel.
8. Size: 22.86 x 22.86 x 7.94 cm (9 x 9 x 3.125 inches).

D. Basis of Design: Eco-Line; as manufactured by Unilock. (Choose color and size).

1. Color: _____
2. Finish: Standard.
3. Finish: Smooth Premier.

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4. Finish: Il Campo.
 5. Finish: Series.
 6. Finish: Umbriano.
 7. Edge: Chamfer, 3 mm bevel.
 8. Sizes: Eco-Line Platform Random Bundle (the following units are sold together)
 - a. Unit A: 35.7 x 8.40 x 10 cm (14 x 3.25 x 3.875 inches).
 - b. Unit B: 31.7 x 8.40 x 10 cm (12.5 x 3.25 x 3.875 inches).
 - c. Unit C: 27.7 x 8.40 x 10 cm (10.875 x 3.25 x 3.875 inches).
 - d. Unit D: 23.7 x 8.40 x 10 cm (9.375 x 3.25 x 3.875 inches).
 - e. Unit E: 35.7 x 11.4 x 10 cm (14 x 4.5 x 3.875 inches).
 - f. Unit F: 31.7 x 11.4 x 10 cm (12.5 x 4.5 x 3.875 inches).
 - g. Unit G: 27.7 x 11.4 x 10 cm (10.875 x 4.5 x 3.875 inches).
 - h. Unit H: 23.7 x 11.4 x 10 cm (9.375 x 4.5 x 3.875 inches).
- E. Basis of Design: Eco-Promenade; as manufactured by Unilock. (Choose color and size).
1. Color: _____.
 2. Finish: Standard.
 3. Finish: Smooth Premier.
 4. Finish: Il Campo.
 5. Finish: Series.
 6. Finish: Umbriano.
 7. Edge: Chamfer, 3 mm bevel.
 8. Size: 30 x 7.5 x 10 cm (11.75 x 3 x 3.875 inches).
- F. Basis of Design: Town Hall; as manufactured by Unilock. (Choose color and size).
1. Color: Burgundy Red.
 2. Color: Burnt Clay.

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3. Color: Old Oak.
4. Color: Basalt.
5. Color: Heritage Red.
6. Color: Heritage Clay.
7. Color: To be selected by Architect.
8. Finish: Realta Cobblestone, timeworn finish.
9. Edge: Chamfer, 3 mm bevel.
10. Size: 25 x 10 x 7 cm (9.875 x 3.875 x 2.75 inches).

G. Basis of Design: Tribeca Cobble; as manufactured by Unilock. (Choose color and size).

1. Color: Crystalline Basalt.
2. Color: Peppered Granite.
3. Color: To be selected by Architect.
4. Finish: Washed.
5. Edge: Chamfer, 3 mm bevel.
6. Sizes:
 - a. Tribeca Cobble Platform Random Bundle (the following units are sold together)
 - b. Large Rectangle: 30.5 x 13 x 7 cm (12 x 5.125 x 2.75 inches).
 - c. Rectangle: 23 x 13 x 7 cm (14.125 x 5.125 x 2.75 inches).
 - d. Small Rectangle: 17.5 x 13 x 7 cm (6.875 x 5.125 x 2.75 inches).
 - e. Curb: 29 x 23 x 10 cm (11.375 x 9 x 3.875 inches).

2.5 JOINT SAND

A. Natural Joint Sand.

1. Washed, clean, non-plastic, free from deleterious or foreign matter, symmetrically shaped, natural or manufactured from crushed rock.
2. Do not use limestone screenings, stone dust, or sand for the Joint Sand material that does not conform to the grading requirements of ASTM C33.

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3. Utilize sands that are as hard as practically available where concrete pavers are subject to vehicular traffic.

4. Gradation Requirements per ASTM C144. Percent Passing Sieve Size:

- a. No. 4 (4.75 mm): 100 percent.
- b. No. 8 (2.36 mm): 95 to 100 percent.
- c. No. 16 (1.18 mm): 70 to 100 percent.
- d. No. 30 (0.600 mm): 40 to 75 percent.
- e. No. 50 (0.300 mm): 10 to 30 percent.
- f. No. 100 (0.150 mm): 2 to 15 percent.
- g. No. 200 (0.075 mm): 0 to 1 percent.

B. Polymeric Joint Sand: Dry mix, contains polymeric binding agent, activated with water.

1. Products:

- a. Techniseal RG+.
- b. Unicare HP Polymeric Max Sand.
- c. Do not use polymeric joint sand with Belpasso, Umbriano, Series, Il Campo, Unigranite, or Tribeca Cobble.

2. Color: Grey.

3. Color: Tan.

4. Color: To be selected by Architect.

5. Compression Strength: proven resistance to compression of 550 PSI after drying for 7 days under controlled conditions of 73 degrees F (23 degrees C) at 50 percent humidity).

6. Test sand sample shape: cylinder (2 inch (5 cm) dia. X 4 inch (10 cm) high).

7. Gradation Requirements per ASTM C144. Percent Passing Sieve Size:

- a. No. 4 (4.75 mm): 100 percent.
- b. No. 8 (2.36 mm): 95 to 100 percent.
- c. No. 16 (1.18 mm): 70 to 100 percent.

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- d. No. 30 (0.600 mm): 40 to 75 percent.
- e. No. 50 (0.300 mm): 20 to 40 percent.
- f. No. 100 (0.150 mm): 10 to 25 percent.
- g. No. 200 (0.075 mm): 0 to 10 percent.

2.6 PERMEABLE JOINT OPENING AGGREGATE

A. Permeable Joint Opening Aggregate: Conforming to ASTM C33.

1. Provide washed, clean aggregates having zero plasticity, free from deleterious or foreign matter, crushed, angular rock and contain no No. 200 sieve size aggregate materials.
2. Gradation Requirements per ASTM D448 No. 8. Percent Passing Sieve Size:
 - a. 1/2 inch (12.5 mm): 100 percent.
 - b. 3/8 inch (9.5 mm): 85 to 100 percent.
 - c. No. 4 (4.75 mm): 10 to 30 percent.
 - d. No. 8 (2.36 mm): 0 to 10 percent.
 - e. No. 16 (1.18 mm): 0 to 5 percent.

B. Permeable Joint Opening Aggregate: Granite chips conforming to ASTM C33.

1. Provide washed, clean aggregates having zero plasticity, free from deleterious or foreign matter, crushed, angular rock and contain no No. 200 sieve size aggregate materials.
2. Supplier:
 - a. Kafka Granite LLC; 101 S. Weber Ave; Stratford, WI 54484; 800-852-7415.
 - b. Alliance Aqua-Roc.
 - c. SEK Perm Chip.
 - d. Approved equal.
 - e. Color: _____.
3. Gradation Requirements: Percent Passing Sieve Size:
 - a. 1/4 inch (6 mm): 97 to 100 percent.

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- b. No. 4 (4.75 mm): 70 to 83 percent.
- c. No. 8 (2.36 mm): 37 to 50 percent.
- d. No. 16 (1.18 mm): 0 to 12 percent.

2.7 SETTING BED SAND

A. Setting Bed Sand.

1. Washed, clean, non-plastic, free from deleterious or foreign matter, symmetrically shaped, natural or manufactured from crushed rock.
2. Do not use limestone screenings, stone dust, or sand for the Joint Sand material that does not conform to the grading requirements of ASTM C33.
3. Do not use mason sand or sand conforming to ASTM C 144.
4. Utilize sands that are as hard as practically available where concrete pavers are subject to vehicular traffic.
5. Gradation Requirements per ASTM C33. Percent Passing Sieve Size:
 - a. 3/8 inch (9.5 mm): 100 percent.
 - b. No. 4 (4.75 mm): 95 to 100 percent.
 - c. No. 8 (2.36 mm): 85 to 100 percent.
 - d. No. 16 (1.18 mm): 50 to 85 percent.
 - e. No. 30 (0.600 mm): 25 to 60 percent.
 - f. No. 50 (0.300 mm): 10 to 30 percent.
 - g. No. 100 (0.150 mm): 2 to 10 percent.
 - h. No. 200 (0.075 mm): 0 to 1 percent.

2.8 PERMEABLE SETTING BED AGGREGATE

A. Permeable Setting Bed Aggregate: Conforming to ASTM C33.

1. Provide washed, clean aggregates having zero plasticity, free from deleterious or foreign matter, crushed, angular rock and contain no No. 200 sieve size aggregate materials.
2. Gradation Requirements per ASTM D448 No. 8. Percent Passing Sieve Size:
 - a. 1/2 inch (12.5 mm): 100 percent.

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- b. 3/8 inch (9.5 mm): 85 to 100 percent.
- c. No. 4 (4.75 mm): 10 to 30 percent.
- d. No. 8 (2.36 mm): 0 to 10 percent.
- e. No. 16 (1.18 mm): 0 to 5 percent.

2.9 BASE AGGREGATE FOR NON-PERMEABLE PAVERS ONLY

- A. As specified in Section 312000 - Earth Moving.
- B. As specified in Section 033000 - Cast-in-Place Concrete.
- C. Provide Base Aggregate conforming to ASTM D2940. Passing Sieve Size:
 - a. 2 inch (50 mm): 100 percent.
 - b. 1-1/2 inch (37.5 mm): 95 to 100 percent.
 - c. 3/4 inch (19 mm): 70 to 92 percent.
 - d. 3/8 inch (9.5 mm): 50 to 70 percent.
 - e. No. 4 (4.75 mm): 35 to 55 percent.
 - f. No. 30 (0.600 mm): 12 to 25 percent.
 - g. No. 200 (0.075 mm): 0 to 8 percent.

2.10 PERMEABLE BASE AGGREGATE

- A. Permeable Base Aggregate: Conforming to ASTM C33.
 - 1. Provide washed, clean aggregates having zero plasticity, free from deleterious or foreign matter, crushed, angular rock and contain no No. 200 sieve size aggregate materials.
 - 2. Gradation Requirements per ASTM D448 No. 57. Percent Passing Sieve Size:
 - a. 1-1/2 inch (37.5 mm): 100 percent.
 - b. 1 inch (25 mm): 95 to 100 percent.
 - c. 1/2 inch (12.5 mm): 25 to 60 percent.
 - d. No. 4 (4.75 mm): 0 to 10 percent.
 - e. No. 8 (2.36 mm): 0 to 5 percent.

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2.11 SUBBASE AGGREGATE FOR PERMEABLE PAVERS

- A. Permeable Base Aggregate: Conforming to ASTM C33.
 - 1. Provide washed, clean aggregates having zero plasticity, free from deleterious or foreign matter, crushed, angular rock and contain no No. 200 sieve size aggregate materials.
 - 2. Gradation Requirements per ASTM D448 No. 2. Percent Passing Sieve Size:
 - a. 3 inch (75 mm): 100 percent.
 - b. 2-1/2 inch (63 mm): 90 to 100 percent.
 - c. 2 inch (50 mm): 35 to 70 percent.
 - d. 1-1/2 inch (37.5 mm): 0 to 15 percent.
 - e. 3/4 inch (19 mm): 0 to 5 percent.

2.12 GEOTEXTILE

- A. Performance Requirements:
 - 1. Grab Tensile Strength (ASTM D4632): 115 pounds.
 - 2. Grab Tensile Elongation (ASTM D4632): 50 percent.
 - 3. Trapezoidal Tear (ASTM D4533): 50 pounds.
 - 4. Puncture (ASTM D4833): 65 pounds.
 - 5. Apparent Opening Size (ASTM D4751): 0.212 mm, 70 U.S. Sieve.
 - 6. Permittivity (ASTM D4491): 2.0 sec -1.
 - 7. Flow Rate (ASTM D4491): 140 gal/min/s.f.
- B. Geotextile Material: 4 ounce, non-woven, needle punched geotextile composed of 100 percent polypropylene staple fibers that are inert to biological degradation and resists naturally encountered chemicals, alkalis, and acids.
- C. Products:
 - 1. Carthage Mills FX-40HS.
 - 2. U.S. Fabrics US 115NW.
 - 3. Mirafi 140N.
 - 4. Approved equal.

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2.13 EDGE RESTRAINTS

A. Concrete Edge Restraint: As indicated on Drawings.

B. Plastic Edge Restraints:

1. Pave Tech Pave Edge Rigid.
2. Pave Tech Pave Edge Flexible.
3. Pave Tech Pave Edge Industrial.
4. Snap Edge One Piece Edging, 96 inches.
5. Approved equal.

C. Metal Edge Restraints:

1. Permaloc Aluminum, Model No. _____.
2. Approved equal.

2.14 ACCESSORIES

A. Cleaners: _____.

B. Sealers: _____.

C. Joint Sand Stabilizers: _____.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Do not begin installation until substrates have been properly constructed and prepared.
- B. If substrate preparation is the responsibility of another installer, notify Architect in writing of unsatisfactory preparation before proceeding.

3.2 PREPARATION

- A. Prepare surfaces using the methods recommended by the manufacturer for achieving the best result for the substrate under the project conditions.
- B. Prevent damage to underdrain pipes, overflow pipes, observation wells, or inlets and other drainage appurtenances during installation.

3.3 INSTALLATION

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- A. Install in accordance with manufacturer's instructions, approved submittals and in proper relationship with adjacent construction.
 - 1. Provide edge restraints as indicated.
 - 2. Provide separation geotextile on bottom and sides of prepared subgrade. Secure in place to prevent wrinkles and folds. Overlap edges minimum of 18 inches (450 mm) in direction of drainage.
 - 3. Provide base and subbase indicated. Compact and provide to tolerances as recommended by paver manufacturer.
 - 4. Provide and spread setting bed as recommended by paver manufacturer.
 - 5. Mix concrete pavers from a minimum of three bundles to produce uniform blend of colors and textures.
 - 6. Lay concrete pavers to pattern indicated.
 - 7. Provide spacing recommended by paver manufacturer.
 - 8. Cut pavers as recommended by manufacturer.
 - 9. Vibrate pavers to leveling course as recommended by manufacturer.
 - 10. Spread joint material and vibrate until joints are completely filled.
 - 11. Apply sealer in accordance with sealer and paver manufacturer recommendations after cleaning products.

3.4 FIELD QUALITY CONTROL

- A. Verify final elevations for conformance to the Drawings.
 - 1. Prevent finished grade elevations from deviating more than 3/8 inch (10 mm) under a 10 foot (3 m) straightedge or indicated slope.
 - 2. No greater than 1/32 inch (0.8 mm) difference in height between pavers and adjacent paved surfaces.

3.5 CLEANING AND PROTECTION

- A. Prevent traffic on pavers until joint material is vibrated into joints.
- B. Clean products in accordance with the manufacturers recommendations.
- C. Touch-up, repair or replace damaged products before Substantial Completion.

3.6 MAINTENANCE FOR PERMEABLE PAVERS

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- A. Remove all debris from joint and provide additional Permeable Joint Aggregate material after 120 days and before 150 days after date of Substantial Completion.
- B. Fill Permeable Joint Aggregate material full to the lip of the paver.
- C. Annual Maintenance:
 - 1. Annually inspect Permeable Joint Aggregate material for areas clogged with debris.
 - 2. Vacuum or sweep as necessary to restore surface infiltration.
 - 3. Replenish removed Permeable Joint Aggregate material with clean aggregate material flush to paver lip.
 - 4. Sweep excess material from paver surface.

END OF SECTION

SECTION 322500-PAVING AND SURFACING

Government of the Virgin Islands, Department of Public Works

PROJECT NAME: Elaine I. Sprauve Library and Museum Building

Project Location: **St. John, U.S. Virgin Islands**

PART 1 GENERAL

1.1 RELATED SECTIONS

- A. Refer to Division 32 for requirements related to paving and surfacing. Refer to Division 3 for requirements relating to concrete.

1.2 SCOPE OF SECTION

- A. This section contains the requirements relating to various paved or surfaced areas, such as sidewalks, streets, service drives, bicycle lanes and paths, and parking lots and garages. Included are the requirements for marking pavement and the repair of pavement disturbed by construction.

1.3 PAVING AND SURFACING

A. GENERAL DESIGN REQUIREMENTS

1. Requirement For Design By Professional: Roadway design, including bicycle lanes (on-road) and paths (off-road), shall be by a Virgin Islands licensed professional engineer or Virgin Islands registered landscape Project Manager.
2. Applicable Design Standard: Roadway construction shall be designed in accordance with the latest edition of the American Association of State Highway and Transportation Officials (AASHTO) Guidelines and the Federal Highway Administration (FHWA) Standards.
3. Design Guide For Bicycle Facilities: Bicycle lanes and paths shall be designed in accordance with the latest version of FHWA "Small Town and Rural Multimodal Networks".
4. All new paved areas shall have positive drainage to eliminate ponding. Where new paved areas join existing, measures shall be taken to incorporate positive drainage to eliminate ponding. All new and existing paved areas shall incorporate storm drainage infrastructure to prevent run-off into public right-of-ways.

B. ROADWAY CONSTRUCTION

1. Applicable Technical Specifications for Construction:
 - a. Construction procedures shall follow the usual practices of the FHWA FP-14 for work of similar character and extent.
2. Minimum Requirements:
 - a. New pavement sections shall have a minimum 8" base of D gradation stone or equivalent, compacted to 95% of maximum density. Paving shall be 2" (minimum) binder asphaltic concrete and 2" (minimum) surface asphaltic concrete. Assume an ESAL (Equivalent Axel Loadings over its lifetime) of 5 million.

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3. Site Conditions:

4. Weather Limitations: Apply prime and tack coats. Do not apply when base is wet or contains an excess of moisture.
5. Construct hot-mixed asphalt base course and surface course when base is dry.
6. Establish and maintain required lines and grade elevations.

7. Materials:

- a. Use locally available materials that exhibit a satisfactory record of previous installations. Shall meet or exceed the requirements of FHWA FP-14 standard specifications for roadways and structures.
- b. Aggregate Base - Crushed stone or gravel conforming to FHWA FP-14 standard specifications for roadways and structures.
- c. Coarse Aggregate - Sound, angular crushed stone or crushed gravel complying with ASTM D 692-88.
- d. Fine Aggregate-Sharp edge natural sand or sand prepared from stone, gravel complying with ASTM D 1073.
- e. Mineral Filler- Rock or other inert material complying with ASTM D 242.
- f. Asphalt Cement-ASTM D 3381 for viscosity graded materials. ASTM D 946 for penetration graded material.
- g. Tack Coat-Emulsified asphalt ASTM D 977.
- h. Lane Marking Type H-Thermoplastic markings with Type 1 glass beads. Engineer to verify lane marking color requirements.

8. Testing:

- a. Testing of in place hot mixed asphalt courses for compliance with the requirements for thickness and surface smoothness shall be done by the Contractor's testing consultant, with results transmitted to the project engineer. Repair or remove and replace unacceptable paving at the Contractor's expense as directed by the engineer.

C. PARKING LOTS

1. Minimum Requirements:

- a. New pavement sections shall have a minimum 4" subbase of D gradation stone or equivalent, compacted to 95% of maximum density. Paving shall be 2" (minimum) binder asphaltic concrete, and 2" surface asphaltic concrete.

D. ROAD CLOSURES AND TRAFFIC MAINTENANCE

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1. In no case shall a road be closed in its entirety. At least one lane of traffic shall always be maintained. Special permission for an off-road detour may be granted in some cases; permission shall be obtained through the Project Manager.
2. Temporary barricades and flagmen shall be provided in accordance with Manual of Uniform Traffic Control Devices (MUTCD) standards.

E. BICYCLE LANES AND PATHS

1. Provision Requirement:
 - a. All new road construction, or major reconstruction of existing roads, shall accommodate bicycle traffic through the provision of on-road bicycle lanes or off-road bicycle paths. On-road bicycle lanes are preferred.
2. Connection Requirement:
3. New bicycle lanes and paths shall connect to existing bicycle lanes and paths.
4. Bicycle Lane Construction:
5. On-road bicycle lane construction shall not differ in construction (i.e. type of materials used, level of compaction, or cross-sectional thickness of materials) from adjacent vehicle traffic lanes.
6. Bicycle Path Construction:
7. A typical section for off-road bicycle paths would be a 10' wide path consisting of a minimum 4" thick B graded stone or equivalent base with a minimum 2" thick asphaltic concrete surface course.
8. Bicycle Parking and Storage Facilities:
 - a. Refer to Section 322840 for the requirements relating to bicycle facilities for parking and on-site storage

F. SIDEWALKS

1. General:
 - a. Separate sidewalks shall be provided with all new road construction or major reconstruction.
2. Construction Requirements:
 - a. Concrete sidewalks are to be a minimum of 5" thick, with welded wire mesh reinforcement or concrete reinforced with fiber.
 - b. Rebar reinforcements shall be installed at sidewalk intersections.

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- c. Sidewalk width shall be a minimum of 5.2' and shall match surrounding sidewalk patterns and widths if greater than 5.2'.
- d. Expansion joints shall be a maximum of 18' apart with kerfs at 5' intervals.
- e. Zip strips shall be used during pour at expansion joints. After strip is removed a self-leveling urethane caulk shall be used to fill the void.
- f. Any curb radii poured at entrances shall have ADA compliant handicapped ramp installed.

1.4 PROTECTION OF THE WORK

A. PROTECTION FROM DAMAGE

The Contractor shall adequately and fully protect all parts of the work against damage until completed and accepted by the Engineer for maintenance. Damages shall be properly repaired by the Contractor at no additional expense to the Government.

B. TEMPORARY BARRICADES

Throughout the duration of the Contract, the Contractor shall provide temporary barricades, conforming to the latest edition of U.S. Department of Transportation's MUTCD, properly lighted, to keep traffic off the current portion of the work.

C. PROTECTION OF ADJACENT SURFACES

The Contractor shall protect exposed surfaces adjacent to the work from physical damage resulting from construction activities, and from becoming stained during application of paving materials. The Contractor shall clean, repair, or replace, as required, surfaces damaged during the course of the work at no additional expense to the Owner.

D. PROTECTION FROM GRAFFITI

Newly poured concrete roads, streets, curbs, or sidewalks shall be protected AND guarded from graffiti from passersby until the concrete has sufficiently cured to resist such molestation. Failure to prevent graffiti, or other such vandalism, shall result in the new concrete having to be removed and replaced. This requirement shall mandate the Contractor to take the necessary steps in preventing such incidents including, but not limited, to guarding the project after normal working hours.

1.5 REPAIR OF PAVEMENT

A. GENERAL

1. All roads, streets, service drives, or sidewalks, whether concrete or asphalt construction, shall be restored (repaved) within 3 days from the time of backfilling and compaction.

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2. Backfilling of all cuts through pavement shall be properly compacted to 95% of maximum density in 6" lifts or less.
3. Cuts made through any paved surface shall be repaired in a non-discernible fashion.
4. The cross-sectional thickness of materials used in repairing a section of roadway shall match or exceed the adjacent roadway.
5. Extensive pavement repairs shall be made in accordance with the minimum specifications outlined above.

B. CONCRETE PAVEMENT

Cuts through concrete shall be repaired by replacing the section between the nearest two joints - either construction or expansion. Protect adjacent areas from damage by new work.

C. ASPHALT PAVEMENT

1. Cuts through asphalt shall be repaired so that depressions or humps do not develop. If they do, they shall be corrected, at the Contractor's expense. Repairs shall match the adjacent roadway surfaces.
2. Asphalt and base compaction by "normal traffic" is not permitted. Proper compaction for the depth of the cut is required.
3. All cuts to existing bituminous concrete paving shall be saw cut where new work adjoins pavement to remain.

D. REPAIR OF PAVEMENT MARKINGS

When cuts are made through any paved surface and the cuts extend through the pavement markings, the replaced pavement shall be marked to match the existing.

1.6 PAVEMENT MARKING:

A. GENERAL

1. Applicable Design Standards:

All pavement marking shall be in accordance with the latest edition of the U.S. Department of Transportation MUTCD.

2. Thermoplastic Striping:

All thermoplastic striping shall be placed on an FHWA FP-14 approved mix that minimizes the slipperiness of the marking surface.

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- a. Thermoplastic traffic line paint shall be a reflectorized thermoplastic pavement striping material applied to the road surface in a molten state by mechanical means. It shall have surface application of glass beads which, upon cooling to normal pavement temperature, will produce an adherent reflectorized stripe of the specified thickness and width.
 - b. The markings must be capable of conforming to pavement contours, breaks and faults through the action of traffic at normal pavement temperatures. The markings shall have resealing characteristics, such that it is capable of fusing with itself and previously applied thermoplastic when heated with a torch.
 - c. The material shall contain at least 30 percent of graded glass beads by weight. It must contain enough titanium dioxide pigment to ensure a color like Federal Highway White, Color No. 17886, as per Federal Standard 595.
 - d. The surface must have a minimum skid resistance value of 55 BPN when tested according to ASTM E303.
 - e. The material, when applied at a temperature range of 400 °F to 425 °F and a thickness of 125 to 188 mils, shall set to bear traffic in not more than 3 minutes when the air temperature is 60 °F. Minimum thickness shall be 125 mils.
 - f. The material must be resistant to deterioration due to exposure to sunlight, water, oil, gasoline, salt or adverse weather conditions.
 - g. When applied to Portland concrete surfaces, the application notes above still apply, except that a compatible surface primer/sealer shall be applied prior to the application of the Thermoplastic material to assure proper adhesion.
3. Pavement Marking Exceptions:
- a. Consult with Plans and Project Manager for pavement marking exceptions such as directional arrows, traffic control markings, etc.
4. Existing Pavement Markings:
- a. Prior to the installation of paint or thermoplastic pavement marking lines and symbols, existing pavement markings shall be removed by a method which does not materially damage the existing pavement surfaces.
 - b. Materials deposited on the pavement and adjacent surfaces as a result of the removal of pavement markings shall be removed as the work progresses.
 - c. When a blast removal method is used, care must be taken to protect adjacent surfaces and structures from flying debris.
 - d. Painting over, or black out painting, of existing pavement markings with black paint or bituminous solutions shall not be allowed.

B. ROADS

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1. Thermoplastic striping shall be used for traffic markings on all roads, drives, and service drives. Material and application shall be in accordance with the latest versions of the FHWA FP-14 "Standard Specifications for Roads and Bridges Construction Projects".
2. To accommodate the concrete surfaces of the parking layout, pavement markings for curbs and tire stops shall be made with latex paint.

C. PARKING GARAGES

Thermoplastic striping shall be used for traffic markings and for designating parking spaces in all parking garages. Material and application shall be in accordance with the latest versions of the FHWA "Standard Specifications for Roads and Bridges Construction Projects".

D. SURFACE PARKING LOTS

Pavement markings in surface parking lots shall be made with thermoplastic.

E. BIKE PATHS AND LANES

1. Design Guide:

Pavement marking for bicycle lanes and paths shall be designed in accordance with latest version of the FHWA "Small Town and Rural Multimodal Networks", with additional input from the Project Manager.

2. Curb Inlets, Storm Drains, and Other Potential Hazards:

Where hazards to bicyclists cannot be eliminated, pavement marking is required to make the hazard more visible.

END OF SECTION

SECTION 322510-BITUMINOUS PAVEMENT

Government of the Virgin Islands, Department of Public Works

PROJECT NAME: Elaine I. Sprauve Library and Museum Building

Project Location: **St. John, U.S. Virgin Islands**

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Placing and compacting base courses
- B. Temporary pavement patching
- C. Permanent roadway paving and patching

1.2 REFERENCED SECTIONS

- A. Section 312110 - Clearing and Grubbing
- B. Section 312200 - Earthwork

1.3 REFERENCES

- A. FHWA FP-14 Standard Specifications for Construction of Roads and Bridges Projects, 2014 Edition.

1.4 SUBMITTALS

- A. Submit test reports of proposed aggregate sources prior to incorporating such materials into the Project.
- B. Submit Certificates of Compliance for all pavement mixtures furnished under this Section.

1.5 QUALITY ASSURANCE

- A. The CONTRACTOR shall perform tests to qualify each source of materials and at sufficient intervals to assure conformance of all materials furnished for use under this Section.
- B. The "Materials and Research Engineer" or the "Engineer" shall refer to the CONTRACTOR's person responsible for Quality Control of hot mix pavements.
- C. Verification testing of material may be performed by an independent testing laboratory paid for by the OWNER.

PART 2 PRODUCTS

2.1 MATERIALS

- A. Base Courses:
 - 1. 4" asphaltic concrete Type II Binder Section 322505
- B. Bituminous Pavement:
 - 1. 2" asphaltic concrete Type I Surface, with anti-strip additive designed for 5,000,000 ESAL.

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2.2 SOURCE QUALITY CONTROL

- A. Test each proposed source of aggregates for gradation and moisture-density relationship.
- B. Verification testing of materials at the asphalt plant may be performed by the OWNER to ensure conformance with the requirements for materials furnished under this Section.

PART 3 EXECUTION

3.1 PREPARATION

- A. Prepare site in accordance with Section 312110.
- B. Backfill excavations in accordance with Section 332200.
- C. The subgrade shall be prepared in accordance with Section 312200.

D. RECLAMATION OF PAVEMENT:

Where bituminous pavement is to be reclaimed, process the material and stock-pile for reuse.

- E. Exercise care in the removal of pavement so that no pavement is unnecessarily disturbed or destroyed.
- F. Mechanically cut pavement shall be removed to a straight line unless otherwise directed by the ENGINEER.
- G. Diamond saws shall be used for sawing bituminous concrete pavement. Cutting-type grader blades will not be allowed.

3.2 PROTECTION

- A. Curbs, walks, and walls are to be adequately protected and left in a clean condition.

3.3 BASE COURSES

- A. Install subbase and base courses in accordance with Construction drawings.
- B. The finished base course surface shall not vary more than 1/4 inch from a 10-foot straightedge applied parallel or perpendicular to the centerline.

3.4 TEMPORARY PATCHING

- A. Temporary pavement repairs shall be made before subjecting excavations to traffic and shall be maintained until permanent pavement repairs are made.
- B. Subbase and base courses and materials shall conform to the requirements for permanent pavement repairs.

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- C. Temporary pavement shall consist of a single 2-inch binder course unless otherwise shown on the Plans.

3.5 PERMANENT PATCHING

- A. Cut back existing pavement from the edge of excavations to form a sharp, clean, straight edge on undisturbed material.
- B. Apply tack coat to saw cut edges and other surfaces where bond to new pavement is required.
- C. Install permanent pavement as specified below.
- D. Any additional paving required by trenches wider than the limits specified in the Plan will be performed at no additional cost to the OWNER.

3.6 PERMANENT PAVEMENT

- A. Install permanent pavement in accordance with construction drawings.
- B. Adjust manhole covers, catch basin grates, valve and meter boxes and the like to not less than 1/8 inch and not more than 1/2 inch below final pavement grade.
- C. Apply tack coat to saw cut edges and other surfaces where bond to new pavement is required.
- D. Full width permanent pavement shall consist of the lift thicknesses and types shown on the Plans.
- E. Shim low, uneven, or settled areas with leveling mix before application of wearing course.

3.7 REPAIR OF SETTLED SURFACES

- A. Should an area settle that the CONTRACTOR has permanently paved:
 - 1. Saw cut and remove the affected pavement.
 - 2. Remove base materials if necessary to ensure proper compaction of subgrade, subbase, and base.
 - 3. Repair as specified for permanent patching.

3.8 FIELD QUALITY CONTROL

- A. Verification testing of installed materials may be performed to ensure conformance with the requirements for materials, compaction, and surface tolerance of this Section.

END OF SECTION

SECTION 323100 – DECORATIVE METAL FENCES AND GATES

Government of the Virgin Islands, Department of Public Works

PROJECT NAME: Elaine I. Sprauve Library and Museum Building

Project Location: **St. John, U.S. Virgin Islands**

PART 1 - GENERAL

1.1 SECTION INCLUDES

- A. Ornamental welded steel fence system. (Classic Commercial)
- B. Ornamental rackable welded steel fence system. (Versai Commercial)
- C. Ornamental rackable welded steel fence system. (Versai Assurance Commercial)
- D. Ornamental rackable mechanically locked fence system. (Titan Industrial)

1.2 RELATED SECTIONS

- A. Section 033000 - Cast-in-Place Concrete.
- B. Section 311000 - Site Clearing.

1.3 REFERENCES

- A. American Society for Testing and Materials International (ASTM).
 - 1. ASTM D523 - Standard Test Method for Specular Gloss.
 - 2. ASTM D1654 - Standard Test Method for Evaluation of Painted or Coated Specimens Subjected to Corrosive Environments.
 - 3. ASTM D2244 - Standard Practice for Calculation of Color Tolerances and Color Differences from Instrumentally Measured Color Coordinates.
 - 4. ASTM D2794 - Standard Test Method for Resistance of Organic Coatings to the Effects of Rapid Deformation (Impact).
 - 5. ASTM D3359 - Standard Test Methods for Measuring Adhesion by Tape Test.
 - 6. ASTM F593 - Standard Specification for Stainless Steel Bolts, Hex Cap Screws, and Studs.
- B. American Welding Society (AWS): AWS D1.1 - Structural Welding Code - Steel

1.4 SUBMITTALS

- A. Submit under provisions of Section 01 30 00 - Administrative Requirements.
- B. Manufacturer's printed product information indicating material compliance and specified options are to be submitted prior to installation. Submit manufacturer's product data sheets on each product to be used.
- C. Shop drawings shall include plans, elevations, sections, details, and attachments to other work. Drawings must be submitted for approval and be approved prior to installation.

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- D. Design data which verifies compliance with design loads specified in Performance Requirements Article. Design data shall be signed and sealed by the qualified professional engineer responsible for their preparation.
- E. Submit samples for initial color selection. Submit samples of each specified finish.

1.5 QUALITY ASSURANCE

- A. Manufacturing company with engineering and fabrication of custom fencing and gate systems for a minimum of 15 years.
- B. Installation company with experienced in manufacturer's products for a minimum of 5 years. The Contractor shall provide trained laborers with prior experience in the type of construction involved as well as experience installing the materials and techniques specified.
- C. Obtain each fence system and gates through one source from a single manufacturer.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Upon delivery to the jobsite, inspect all materials for damage that might have occurred during shipment.
- B. Handle and store materials in manufacturer's packaging until materials are ready to be installed. Store materials in such a way as to prevent damage and theft.

1.7 PROJECT CONDITIONS

- A. Verify actual locations of walls and other construction contiguous with fencing and gates by field measurements before fabrication and indicate measurements on shop drawings. Provide allowance for trimming and fitting onsite.

1.8 COORDINATION AND SCHEDULING

- A. Coordinate installation of anchorages for fencing and gates. Furnish setting drawings, templates, and directions for installing anchorages, including sleeves, concrete inserts, anchor bolts, and items with integral anchors that are to be embedded in concrete or masonry. Deliver such items to the Project Site in time for installation.
- B. Schedule installation so wall attachments are made only to completed walls. Do not support systems temporarily by any means that do not satisfy structural performance requirements.

1.9 WARRANTY

- A. Manufacturer's Warranty: Provide manufacturer's standard 20 year limited warranty, from the date of purchase, against defects in materials and workmanship including protection against cracking, peeling, blistering, and corrosion (rusting).

PART 2 PRODUCTS

SECTION 323100 – DECORATIVE METAL FENCES AND GATES

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PROJECT NAME: Elaine I. Sprauve Library and Museum Building

Project Location: **St. John, U.S. Virgin Islands**

2.1 MANUFACTURERS

- A. Acceptable Manufacturer: Fortress Fence Products, which is located at: 1720 North First Street; Garland, TX 75040; Toll Free Tel: 844-909-1999; Fax: 972-372-0078; Email:request_info@FortressFence.com; Web:<http://www.fortressfence.com>
- B. Substitutions: Requests for substitutions will be considered in accordance with provisions of Section 01 60 00 - Product Requirements.

2.2 SITE FENCING AND GATES

A. Ornamental Welded Steel Fence Systems:

- 1. Basis of Design: Classic Commercial Fence Systems as manufactured by Fortress Fence Products, a division of The Fortress Company.
- 2. Style: As indicated on the Drawings.
- 3. Style: Extended Picket (EXT).
- 4. Style: Spear Point Picket (SP).
- 5. Fence Panels: Fabricated in standard length of 90-1/2 inches (2299 mm).
 - a. Height: 46 inch (1168 mm).
- 6. Materials:
 - a. Rails and pickets shall be cold-rolled steel formed and welded tubing with a Grade A minimum tensile strength of 45,000 psi (310 MPa) conforming to ASTM A653 and have a G60 zinc coating, 0.60 oz./ft² (0.18 kg/m²) in accordance with ASTM A653.
 - b. Posts shall be cold-rolled steel formed and welded tubing with a Grade A minimum tensile strength of 45,000 psi (310 MPa) conforming to ASTM A653, have a G60 zinc coating, 0.60 oz./ft² (0.18 kg/m²) in accordance With ASTM A653, and have a powder-coated factory finish.
- 7. Components:
 - a. Rails: 1-1/2 inch (38 mm) square, 16 gauge.
 - b. Pickets: 3/4 inch (19 mm) square, 19 gauge.
 - c. Posts: 2-1/2 inch (63.5 mm) square, 16 gauge.
- 8. Gates: Provide manufacturer's standard gates and hardware.
- 9. Fabrication:

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- a. Fence Panels: Fabricated in standard length of 90-1/2 inches (2299 mm). Comply with requirements indicated for materials, thickness, design and details of construction.
- b. Welded connections shall comply with AWS standards for recommended practice in shop welding.
- c. Components shall be accurately cut and drilled to receive hardware, fasteners, and accessories.
- d. Fence panel shall be capable of meeting structural test load capabilities for a commercial fence system referenced in table 2 of ASTM 2409.
- e. Fence panel shall be capable of meeting coating performance requirements in table 3 of ASTM 2409.

7. Finish:

- a. Materials are coated with the Fortress Guard process including galvanization, zinc phosphate, and architectural grade powder coat.
- b. Metal parts shall be assembled and finished individually prior to shipment.
- c. Galvanized steel fence components shall be cleaned with a non-petroleum solvent followed by the application of a sealing zinc phosphate coating.
- d. Immediately after sealing, a powder finish coating is applied by the electrostatic spray process. This consists of a thermosetting carboxyl polyester resin top

Minimum Post Sizes for V2 Versai Commercial

| Line of Fence Posts | Panel Heights |
|---------------------|-----------------------------|
| 2.5" x 16ga | Up to & Including 6' height |
| 2.5" x 14ga | 7' & 8' |

Versai Commercial Post Spacing by Bracket Type

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| | |
|---------------|---|
| Style | Flat Top, Spear Top, Extended Picket and Curved Top 8' Nominal (90.5" Rail) |
| Bracket Types | One Direction Flat Mount (EX-106), for 2-1/2" post size One Direction Flat Mount (EX-106), for 3" post size, 95.5" post setting Two Direction Line (EX-206), for 2-1/2" post size, 95" post setting Three Direction Universal (EX-306), for 2-1/2" post size, 95" post setting Swivel Flat Mount (EXS-106), for 2-1/2" post size, 95" post setting Swivel Flat Mount (EXS-106), for 3" post size, 95.5" post setting |

Versai Commercial Gate Posts Sizes

| Gate Leaf | | Gate Height | |
|------------|----------------------|------------------------------|-----------|
| | Up to & Including 4' | Over 4' Up to & Including 6' | 7' & 8' |
| Up to 4' | 2.5" x 14ga | 3" x 12ga | 3" x 12ga |
| 4'1" to 6' | 3" x 12ga | 3" x 12ga | 4" x 11ga |
| 6'1" to 8' | 3" x 12ga | 4" x 11ga | 4" x 11ga |

B. Ornamental Rackable Welded Steel Fence Systems:

1. Basis of Design: Versai Commercial Fence Systems as manufactured by Fortress Fence Products, a division of The Fortress Company.
 - a. Style: As indicated on the Drawings.
 - b. Style: Flat Top, Extended Bottom (FT).
 - c. Style: Flat Top, Flat Bottom (FT/FB).
 - d. Style: Flat Top, Flat Bottom (PL) for Swimming Pool installations
 - e. Style: Extended Top, Extended Bottom (EXT).
 - f. Style: Extended Top, Flat Bottom (EXT/FB).
 - g. Style: Spear Point Top, Extended Bottom (SP).
 - h. Style: Spear Point Top, Flat Bottom (SP/FB).
 - i. Style: Curve Top, Extended Bottom (CT).
 - j. Style: Curve Top, Flat Bottom (CT/FB).

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k. Rails: 2.

l. Rails: 3.

m. Fence Panels: Fabricated in standard length of 90-1/2 inches (2299 mm).

i. Height: As indicated on the Drawings.

ii. Height: 34 inch (864 mm).

iii. Height: 40 inch (1016 mm).

iv. Height: 46 inch (1168 mm).

v. Height: 54 inch (1372 mm).

vi. Height: 58 inch (1473 mm).

vii. Height: 70 inch (1778 mm).

viii. Height: 82 inch (2083 mm).

ix. Height: 94 inch (2388 mm).

n. Airspace Between Pickets, V2 Commercial: 3-15/16 inch.

o. Materials:

i. Rails shall be cold-rolled steel formed U-channel and pickets shall be cold-rolled steel formed and welded tubing, both having a Grade A minimum tensile strength of 45,000 psi (310 MPa) conforming to ASTM A653 and have a G60 zinc coating, 0.60 oz./ft² (0.18 kg/m²) in accordance with ASTM A653.

ii. Posts shall be cold-rolled steel formed and welded tubing with a Grade A minimum tensile strength of 45,000 psi (310 MPa) conforming to ASTM A653, have a G60 zinc coating, 0.60 oz./ft² (0.18 kg/m²) in accordance with ASTM A653, and have a powder-coated factory finish.

p. Components:

i. Rails: 1-9/16 inch (40 mm) by 1-3/16 inch (30 mm) (Leg x Web), 14 gauge.

ii. Pickets:

1) 3/4 inch (19 mm) square, 16 gauge.

2) 3/4 inch (19 mm) square, 14 gauge.

a. Posts: 2-1/2 inch (64 mm) square, 16 gauge.

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- b. Posts: 2-1/2 inch (64 mm) square, 14 gauge.
 - c. Posts: 2-1/2 inch (64 mm) square, 12 gauge.
 - d. Posts: 3 inch (76 mm) square, 14 gauge.
 - e. Posts: 3 inch (76 mm) square, 12 gauge.
 - f. Gates: Provide manufacturer's standard gates and hardware.
 - g. Fabrication:
 - i. Fence panels shall be fabricated in standard length of 90-1/2 inches (2299 mm). Comply with requirements indicated for materials, thickness, design, and details of construction.
 - ii. Pickets are welded to the rails with a patented pin hinge system which allows the panel to rake without metal fatigue or damage to the finish.
 - iii. Welded connections shall comply with AWS standards for recommended practice in shop welding.
 - iv. Components shall be accurately cut and drilled to receive hardware, fasteners, and accessories.
 - h. Panels shall be rackable to an 18 degree change in grade (30 inch vertical travel per panel).
 - i. Fence panel shall be capable of meeting structural test load capabilities for a commercial fence system referenced in table 2 of ASTM 2409.
 - j. Fence panel shall be capable of meeting coating performance requirements in table 3 of ASTM 2409.
2. Basis of Design: Versai Assurance Commercial Fence Systems as manufactured by Fortress Fence Products, a division of The Fortress Company.
- a. Style: As indicated on the Drawings.
 - b. Style: Flat Top, Extended Bottom (FT).
 - c. Style: Flat Top, Flat Bottom (FT/FB).
 - d. Style: Flat Top, Flat Bottom (PL) for Swimming Pool installations
 - q. Style: Extended Top, Extended Bottom (EXT).
 - r. Style: Extended Top, Flat Bottom (EXT/FB).
 - s. Style: Spear Point Top, Extended Bottom (SP).

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- t. Style: Spear Point Top, Flat Bottom (SP/FB).
- u. Style: Curve Top, Extended Bottom (CT).
- v. Style: Curve Top, Flat Bottom (CT/FB).
- w. Rails: 2.
- x. Rails: 3.
- y. Fence Panels: Fabricated in standard length of 90-1/2 inches (2299 mm).
 - i. Height: As indicated on the Drawings.
 - ii. Height: 34 inch (864 mm).
 - iii. Height: 40 inch (1016 mm).
 - iv. Height: 46 inch (1168 mm).
 - v. Height: 54 inch (1372 mm).
 - vi. Height: 58 inch (1473 mm).
 - vii. Height: 70 inch (1778 mm).
 - viii. Height: 82 inch (2083 mm).
 - ix. Height: 94 inch (2388 mm).
- z. Airspace Between Pickets, V2 Assurance Commercial: 3 inch.
- aa. Materials:
 - i. Rails shall be cold-rolled steel formed U-channel and pickets shall be cold-rolled steel formed and welded tubing, both having a Grade A minimum tensile strength of 45,000 psi (310 MPa) conforming to ASTM A653 and have a G90 zinc coating, 0.90 oz./ft² (0.18 kg/m²) in accordance with ASTM A653.
 - ii. Posts shall be cold-rolled steel formed and welded tubing with a Grade A minimum tensile strength of 45,000 psi (310 MPa) conforming to ASTM A653, have a G90 zinc coating, 0.90 oz./ft² (0.18 kg/m²) in accordance with ASTM A653, and have a powder-coated factory finish.
- bb. Components:
 - i. Rails: 1-9/16 inch (40 mm) by 1-3/16 inch (30 mm) (Leg x Web), 14 gauge.
 - ii. Pickets:

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1) 3/4 inch (19 mm) square, 16 gauge.

2) 3/4 inch (19 mm) square, 14 gauge.

cc. Posts: 2-1/2 inch (64 mm) square, 16 gauge.

dd. Posts: 2-1/2 inch (64 mm) square, 14 gauge.

ee. Posts: 2-1/2 inch (64 mm) square, 12 gauge.

ff. Posts: 3 inch (76 mm) square, 14 gauge.

gg. Posts: 3 inch (76 mm) square, 12 gauge.

hh. Gates: Provide manufacturer's standard gates and hardware.

ii. Fabrication:

i. Fence panels shall be fabricated in standard length of 90-1/2 inches (2299 mm). Comply with requirements indicated for materials, thickness, design, and details of construction.

ii. Pickets are welded to the rails with a patented pin hinge system which allows the panel to rake without metal fatigue or damage to the finish.

iii. Welded connections shall comply with AWS standards for recommended practice in shop welding.

iv. Components shall be accurately cut and drilled to receive hardware, fasteners, and accessories.

v. Panels shall be rackable to an 18 degree change in grade (30 inch vertical travel per panel).

vi. Fence panel shall be capable of meeting structural test load capabilities for a commercial fence system referenced in table 2 of ASTM 2409.

vii. Fence panel shall be capable of meeting coating performance requirements in table 3 of ASTM 2409.

8. Finish:

a. Materials are coated with the Fortress Shield process including galvanization, zinc phosphate, electrodeposition (E-coat), and architectural grade powder coat.

b. Metal parts shall be assembled and finished individually prior to shipment.

c. Galvanized steel fence components shall be cleaned with a non-petroleum solvent followed by the application of a sealing zinc phosphate coating.

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- d. Immediately after sealing, provide a two-step finishing process consisting first of an electrostatic dipping process in a lead-free high corrosion resistant epoxy resin leaving a coating of approximately 20 microns followed by a thermosetting carboxyl polyester resin top coat with a minimum dry film thickness of 60 microns. The second coating shall be applied by the electrostatic spray process.

Minimum Post Sizes for Titan Industrial

| Line of Fence Posts | Panel Heights |
|---------------------|-----------------------------|
| 2.5" x 12ga | Up to & Including 6' height |
| 3" x 12ga | 7' up to 10' |

Titan Industrial Post Spacing by Bracket Type

| | |
|---------------|---|
| Style | Flat Top, Spear Top, Extended Picket and Curved Top 8' Nominal (90.5" Rail) |
| Bracket Types | One Direction Flat Mount (EX-107), for 2-1/2" post size, 125"+/- 1/4" OC post settings |
| | One Direction Flat Mount (EX-107), for 3" post size, 125.5"+/- 1/4" OC post settings |
| | Two Direction Line (EX-207), for 2-1/2" post size, 125"+/- 1/4" OC post settings |
| | Two Direction Line (EX-207), for 3" post size, 125.5"+/- 1/4" OC post settings |
| | Three Direction Universal (EX-307), for 2-1/2" post size, 125"+/- 1/4" OC post settings |
| | Three Direction Universal (EX-307), for 3" post size, 125.5" +/- 1/4" OC post settings |
| | Swivel Flat Mount (EXS-107), for 2-1/2" post size, 125"+/- 1/4" OC post settings |
| | Swivel Flat Mount (EXS-107), for 3" post size, 125.5"+/- 1/4" OC post settings |

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Titan Industrial Gate Posts Sizes

| Gate Leaf | | Gate Height | |
|------------|----------------------|------------------------------|---------------------------------|
| | Up to & Including 6' | Over 6' Up to & Including 8' | Over 8' up to and Including 10' |
| Up to 4' | 3" x 12ga | 3" x 12ga | 4" x 11ga |
| 4'1" to 6' | 3" x 12ga | 3" x 12ga | 4" x 11ga |
| 6'1" to 8' | 4" x 11ga | 6" x 3/16" wall | 6" x 3/16" wall |

A. Ornamental Rackable Mechanically Locked Steel Fence Systems:

1. Basis of Design: Titan Industrial Fence Systems as manufactured by Fortress Fence Products, a division of The Fortress Company.

- a. Style: As indicated on the Drawings.
- b. Style: Flat Top, Extended Bottom (FT).
- c. Style: Extended Top, Extended Bottom (EXT).
- d. Style: Spear Point Top, Extended Bottom (SP).
- e. Style: Curve Top, Extended Bottom (CT).
- f. Rails: 2.
- g. Rails: 3.
- h. Fence Panels: Fabricated in standard length of 92 inches (2337 mm).
 - i. Height: As indicated on the Drawings.
 - ii. Height: 34 inch (864 mm).
 - iii. Height: 46 inch (1168 mm).
 - iv. Height: 58 inch (1473 mm).
 - v. Height: 70 inch (1778 mm).
 - vi. Height: 82 inch (2083 mm).
 - vii. Height: 94 inch (2388 mm).
 - viii. Height: 106 inch (2692 mm).

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- ix. Height: 118 inch (2997 mm).
- i. Fence Panels: Fabricated in standard length of 90-1/2 inches (2299 mm).
 - i. Height: As indicated on the Drawings.
 - ii. Height: 34 inch (864 mm).
 - iii. Height: 46 inch (1168 mm).
 - iv. Height: 58 inch (1473 mm).
 - v. Height: 70 inch (1778 mm).
 - vi. Height: 82 inch (2083 mm).
 - vii. Height: 94 inch (2388 mm).
 - viii. Height: 106 inch (2692 mm).
 - ix. Height: 118 inch (2997 mm).
- j. Airspace Between Pickets: 3-15/16 inch.
- k. Materials:
 - i. Rails shall be cold-rolled steel formed U-channel and pickets shall be cold-rolled steel formed and welded tubing, both having a Grade A minimum tensile strength of 45,000 psi (310 MPa) conforming to ASTM A653 and have a G60 zinc coating, 0.60 oz./ft² (0.18 kg/m²) in accordance with ASTM A653.
 - ii. Posts shall be cold-rolled steel formed and welded tubing with a Grade A minimum tensile strength of 45,000 psi (310 MPa) conforming to ASTM A653, have a G60 zinc coating, 0.60 oz./ft² (0.18 kg/m²) in accordance with ASTM A653, and have a powder-coated factory finish.
- l. Components:
 - i. Rails: 1-3/4 inch (44.5 mm) x 1-3/4 inch (44.5 mm), 14 gauge.
 - ii. Pickets: 1 inch (25 mm) square, 14 gauge.
 - iii. Pickets: 1 inch (25 mm) square, 16 gauge.
 - iv. Pickets: 1 inch (25 mm) square, 18 gauge.
 - v. Slide Lock: 18 gauge patented slide lock system, attaches pickets to each rail.
 - vi. Post Size: 2-1/2 inches (63.5 mm) tube, 16 gauge.

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- vii. Post Size: 2-1/2 inches (63.5 mm) tube, 14 gauge.
- viii. Post Size: 2-1/2 inches (63.5 mm) tube, 12 gauge.
- ix. Post Size: 3 inches (76 mm) tube, 12 gauge.
- x. Post Size: 4 inches (102 mm) tube, 11 gauge.
- m. Gates: Provide manufacturer's standard gates and hardware.
- n. Fabrication:
 - i. Fence panels shall be fabricated in standard length of 92 inches (2337 mm). Comply with requirements indicated for materials, thickness, design, and details of construction.
 - ii. Fence panels shall be fabricated in standard length of 90-1/2 inches (2299 mm). Comply with requirements indicated for materials, thickness, design, and details of construction.
 - iii. Pickets are inserted into the rails through grommets which are put into the rails pre-punched holes, and held in place with the patented slide lock system. This allows the panel to rake without metal fatigue or damage to the finish.
 - iv. Panels shall be rackable to a 14.5 degree change in grade (24 inch vertical travel per panel).
 - v. Components shall be accurately cut and drilled to receive hardware, fasteners, and accessories.
 - vi. Fence panel shall be capable of meeting structural test load capabilities for an industrial fence system referenced in table 2 of ASTM 2409.
 - vii. Fence panel shall be capable of meeting coating performance requirements in table 3 of ASTM 2409.
- 2. Basis of Design: Titan Commercial Fence Systems as manufactured by Fortress Fence Products, a division of The Fortress Company.
 - a. Style: As indicated on the Drawings.
 - b. Style: Flat Top, Extended Bottom (FT).
 - c. Style: Extended Top, Extended Bottom (EXT).
 - d. Style: Spear Point Top, Extended Bottom (SP).
 - e. Rails: 2.
 - f. Rails: 3.
 - g. Fence Panels: Fabricated in standard length of 92 inches (2337 mm).

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- i. Height: As indicated on the Drawings.
 - ii. Height: 34 inch (864 mm).
 - iii. Height: 46 inch (1168 mm).
 - iv. Height: 58 inch (1473 mm).
 - v. Height: 70 inch (1778 mm).
- k. Fence Panels: Fabricated in standard length of 90-1/2 inches (2299 mm).
- i. Height: As indicated on the Drawings.
 - ii. Height: 34 inch (864 mm).
 - iii. Height: 46 inch (1168 mm).
 - iv. Height: 58 inch (1473 mm).
 - v. Height: 70 inch (1778 mm).
- o. Airspace Between Pickets: 3-15/16 inch.
- p. Materials:
- i. Rails shall be cold-rolled steel formed U-channel and pickets shall be cold-rolled steel formed and welded tubing, both having Grade A minimum tensile strength of 45,000 psi (310 MPa) conforming to ASTM A653 and have a G90 zinc coating, 0.90 oz./ft² (0.18 kg/m²) in accordance with ASTM A653.
 - ii. Posts shall be cold-rolled steel formed and welded tubing with a Grade A minimum tensile strength of 45,000 psi (310 MPa) conforming to ASTM A653, have a G60 zinc coating, 0.60 oz./ft² (0.18 kg/m²) in accordance with ASTM A653, and have a powder-coated factory finish.
- q. Components:
- i. Rails: 1-3/4 inch (44 mm) by 1-1/2 inch (38 mm) (Leg x Web), 16 gauge.
 - ii. Pickets: 3/4 inch (19 mm) square, 16 gauge.
 - iii. Slide Lock: 18 gauge patented slide lock system, attaches pickets to each rail.
- r. Post Size: 2-1/2 inch (64 mm) square, 16 gauge.
- s. Post Size: 2-1/2 inch (64 mm) square, 14 gauge.
- t. Post Size: 2-1/2 inch (64 mm) square, 12 gauge.

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- u. Post Size: 3 inch (76 mm) square, 12 gauge.
- v. Post Size: 4 inch (102 mm) square, 11 gauge.
- w. Gates: Provide manufacturer's standard gates and hardware.
- x. Fabrication:
 - i. Fence panels shall be fabricated in standard length of 92 inches (2337 mm). Comply with requirements indicated for materials, thickness, design, and details of construction.
 - ii. Fence panels shall be fabricated in standard length of 90-1/2 inches (2299 mm). Comply with requirements indicated for materials, thickness, design, and details of construction.
 - iii. Pickets are inserted into the rails through grommets which are put into the rails pre-punched holes, and held in place with the patented slide lock system. This allows the panel to rake without metal fatigue or damage to the finish.
 - iv. Panels shall be rackable to a 14.5 degree change in grade (24 inch vertical travel per panel).
 - v. Components shall be accurately cut and drilled to receive hardware, fasteners, and accessories.
 - vi. Fence panel shall be capable of meeting structural test load capabilities for a commercial fence system referenced in table 2 of ASTM 2409.
 - vii. Fence panel shall be capable of meeting coating performance requirements in table 3 of ASTM 2409.

3. Finish:

- a. Materials are coated with the Fortress Shield process including galvanization, zinc phosphate, electrodeposition (E-coat), and architectural grade powder coat.
- b. Metal parts are assembled and finished individually prior to shipment.
- c. Galvanized steel fence components are cleaned with a non-petroleum solvent followed by the application of a sealing zinc phosphate coating.
- d. Immediately after sealing, a two-step finishing process consisting first of an electrostatic dipping process in a lead free high corrosion resistant epoxy resin leaving a coating of approximately 20 microns followed by a thermosetting carboxyl polyester resin top coat with a minimum dry film thickness of 50 microns. The second coating will be applied by the electrostatic spray process.
- e. Materials are coated with the Fortress Armour process including galvanization, zinc phosphate, epoxy powder coat, and architectural grade powder coat.
- f. Metal parts are finished and assembled individually prior to shipment.

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- g. Galvanized steel fence components are cleaned with a non-petroleum solvent followed by the application of a sealing zinc phosphate coating.
- h. Immediately after sealing, a two-step finishing process consisting first of an epoxy powder coat leaving a coating of approximately 20 microns followed by a thermosetting carboxyl polyester resin top coat with a minimum dry film thickness of 60 microns. The second coating will be applied by the electrostatic spray process.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Examine areas and conditions under which the work is to be installed, and notify the Contractor in writing, with a copy to the Owner and the Architect, of any conditions detrimental to the proper and timely completion of the work. Do not proceed with the work until unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Stake layout showing locations of gates and posts per submitted shop drawings.
- B. Contact applicable authorities and take necessary precautions prior to beginning any excavation work.

3.3 INSTALLATION

- A. Install fences in accordance with manufacturer's written instructions and in accordance with authorities having jurisdiction. Installation shall conform to the specifications referenced elsewhere in this Section and as indicated on the Drawings.
- B. Refer to Division 3 for concrete specification. Recommend minimum 28 day compressive strength of 3,000 psi (20 MPa). Crown concrete at top to shed water.
- C. On-center post spacing per manufacturer's drawings.
- D. For non-level installations the on-center post spacing must be measured along the grade. Ensure that fence sections are parallel to grade within 1/4 inch (6mm) in 12 feet (3658 mm).
- E. Install brackets onto fence section and posts as indicated in manufacturer's printed instructions for specific fence style. Attach fence sections to brackets with approved fasteners and techniques.
- F. Install gate in accordance with manufacturer's printed instructions and approved signoff drawings. Do not mount gate from wall of a structure. Provide gate post on both sides of a gate. For double drive gate installation, provide concrete center drop to foundation depth and drop rod retainers at center. Lubricate to ensure smooth operation and verify proper latch operation.

3.4 CLEANING

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- A. Remove cutting and drilling chips that are attached to the fencing, post, brackets, or additions to prevent corrosion.
- B. Repair scratches and other installation-incurred damage using manufacturers recommended paint. Use paint of the appropriate color with a zinc additive to prevent rust from forming.
- C. Clean up debris and unused material, and remove from site.

3.5 PROTECTION

- A. Protect finishes from damage during construction period with temporary protective coverings approved by manufacturer. Remove protective coverings at time of Substantial Completion.
- B. Restore finishes damaged during installation and construction period so no evidence remains of correction work. Return items that cannot be refinished in field to shop; make required alterations and refinish entire unit, or provide new units.

END OF SECTION

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PART 1 GENERAL

- A. This section is based on the products of Omega II Fence Systems, which is located at:

1735 St-Elzear West

Laval, QC, Canada H7L 3N6

Toll Free Tel: 800-836-6342

Tel: 450-686-9600

Fax: 450-681-7905

Email: [requestinfo \(information@omegatwo.com\)](mailto:requestinfo@omegatwo.com)

Web: www.omegatwo.com

- B. Ornamental Steel Security Fencing and Gates Including the Following:

1. Omega II Architectural Fences.
2. Omega II Elite Fences.
3. Omega II Evolution Fences.
4. Omega II Secur Fences.
5. Omega II Harmony Fences.
6. Omega II Eco Fences.
7. Omega II Vertical Grating 10-20 Fences.
8. Omega II Vertical Grating 80-100 Fences.
9. Omega II Omega Max Fences
10. Swinging Gates.
11. Cantilever Gates.
12. Gate Operators.
13. Remote Controls.

1.1 RELATED SECTIONS

- A. Section 31 10 00 - Site Clearing.
- B. Section 31 20 00 - Earth Moving.
- C. Section 32 90 00 - Planting.

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D. Section 03 30 00 - Cast-in-Place Concrete.

E. Division 16 - Electrical, electrical service and connections for motor operators, controls, limit switches, other powered devices and for system disconnect switches.

1.2 REFERENCES

A. ASTM International (ASTM):

1. ASTM A82: Cold Drawn Steel Wire, Plain, for Concrete Reinforcement.
2. ASTM A121: Standard Specification for Metallic-Coated Carbon Steel Barbed Wire.
3. ASTM A185: Steel Welded Wire Fabric, Plain, for Concrete Reinforcement.
4. ASTM A446: Standard Specification for Steel Sheet, Zinc Coated (Galvanized) by the Hot-Dip Process, Structural (physical) Quality.
5. ASTM A500: Standard Specification for Cold formed welded and seamless carbon steel structural tubing in round shapes.
6. ASTM A513: Standard Specification for Electric-Resistance-Welded Carbon and Alloy Steel Mechanical Tubing.
7. ASTM A641: Standard Specification for Zinc-Coated (Galvanized) Carbon Steel Wire.
8. ASTM A653: Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.
9. ASTM A787: Standard Specification for Electric-Resistance-Welded Metallic-Coated Carbon Steel Mechanical Tubing.
10. ASTM A1008: Steel, Sheet, Cold-Rolled, Carbon, Structural, High-Strength Low-Alloy (HSLA) and HSLA with Improved Formability.
11. ASTM B6: Standard Specification for Zinc.
12. ASTM B117: Standard Test Method of Salt Spray (Fog) Testing.
13. ASTM B221: Standard Specification for Aluminum and Aluminum-alloy extruded bars, rods, wire, shapes and tubes.
14. ASTM D2247: Standard Practice for Testing Water Resistance of Coatings in 100% Relative Humidity.

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15. ASTM D2794: Standard Test Method for Resistance of Organic Coatings to the Effects of Rapid Deformation (Impact).
16. ASTM D3359: Standard Test Methods for Measuring Adhesion by Tape.
17. ASTM F626: Standard Specification for Fence Fittings.
18. ASTM F900: Standard Specification for industrial and commercial swing gates.
19. ASTM F934: Standard Specification for Standard Colors for Polymer-Coated Chain Link Fence Materials.
20. ASTM F1043: Standard Specification for Strength and Protective Coatings on Steel Industrial Chain Link Fence Framework
21. ASTM F1184: Standard Specification for industrial and commercial horizontal slide gates.
22. ASTM F1234: Standard Specification for protection coatings on steel framework for fences.
23. ASTM F2919: Standard Specification for Welded Wire Mesh Fence Fabric (Metallic-Coated or Polymer Coated) with Variable Mesh Patterns or Meshes Greater than 6 square inches (3871 mm²) in Panels.

B. Canadian Standards Association (CSA):

1. CAN/CSA-A23.1, Concrete - Constituents et Execution des Travaux.
2. CAN/CSA-G164, Hot Galvanization of Irregular Objects.
3. Canadian General Standards Board (CGSB):
4. CAN/CGSB-138.1, Steel Meshes for fence.
5. CAN/CGSB-138.2, Steel mounting galvanized for fence.
6. CAN/CGSB-138.3, Installation of the latticed fences.
7. CAN/CGSB-138.4, Gates for fences.
8. CAN/CGSB-1.181, Rich zinc coating, organic, prepared.

1.3 SUBMITTALS

- A. Submit under provisions of Section 01 30 00 - Administrative Requirements.

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B. Product Data: Material descriptions, construction details, dimensions of individual components and profiles, and finishes for the following:

1. Fence and gate posts, rails, and fittings.
2. Gates and hardware.
3. Gate operators, including operating instructions.
4. Motors: Show nameplate data, ratings, characteristics, and mounting arrangements.

C. Shop Drawings:

1. Show locations of fence, each gate, posts, rails, and details of gate swing, or other operation, hardware, and accessories.
2. Indicate materials, dimensions, sizes, weights, and finishes of components.
3. Include plans, elevations, sections, gate swing and other required installation and operational clearances, and details of post anchorage, attachment and bracing.
4. Installation procedures and instructions describing details for a typical fence and gates.
5. Gate Operator: Show locations and details for installing operator components, switches, and controls. Indicate motor size, electrical characteristics, drive arrangement, mounting, and grounding provisions.
6. Wiring Diagrams: Power and control wiring, communication features, and access control features. Differentiate between factory-installed and field-installed wiring and between components provided by fence manufacturer and those provided by sections.

D. Verification Samples: For each finish product specified, two samples, minimum size 6 inches (150 mm) square or long, representing actual color.

E. Qualification Data: For firms and persons specified in "Quality Assurance" article to demonstrate their capabilities and experience. Include lists of completed projects with project names and addresses, names and addresses of architects and owners, and other information specified.

F. Maintenance Data: Provide a maintenance guide and parts list.

1.4 QUALITY ASSURANCE

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- A. Installer Qualifications: Minimum 2 years' experience installing fences and gates similar in material, design, and extent to those indicated for this Project and whose work has resulted in construction with a record of successful in-service performance.
- B. Source Limitations for Fences and Gates: Obtain each component for fences and gates from one source with resources to provide fences and gates of consistent quality in appearance and physical properties.
 - 1. Electrical Components, Devices, and Accessories: listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.
 - 2. Provide gate operators that comply with UL 325.
- C. Electrical Components, Devices, and Accessories: listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.
- D. UL Standard: Provide gate operators that comply with UL 325.
- E. System Requirements: Emergency Access Requirements shall comply with requirements of authorities having jurisdiction for automatic gate operators serving as a required means of access.
 - 1. Coordinate with door hardware and site security requirements.
 - 2. Coordinate direction of entering and exiting traffic with life safety plans.
- F. Mock-Up: Provide a mock-up for evaluation of overall appearance and application workmanship.
 - 1. Construct areas designated by Architect.
 - 2. Do not proceed with remaining work until workmanship and material are approved by Architect.
 - 3. Correct mock-up installation as required to produce acceptable work.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Deliver and store products in manufacturer's tagged and unopened packaging until ready for installation.
- B. Handle products in accordance with manufacturer's instructions.

1.6 PROJECT CONDITIONS

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- A. Existing Utilities: Do not interrupt utilities serving facilities occupied by Owner or others unless permitted under the following conditions:
 - 1. Notify local utility marking services before beginning work.
 - 2. Unless otherwise indicated in the general provisions of the contract, notify Architect no less than two days in advance of proposed utility interruptions.
 - 3. Do not proceed with utility interruptions without Architect's written permission.
- B. Field Measurements: Verify layout information for fences and gates shown on drawings in relation to property survey and existing structures. Verify dimensions by field measurements.

1.7 WARRANTY

- A. Manufacturer's Warranty: Provide manufacturer's standard ten-year limited warranty for finish.

PART 2 PRODUCTS

2.1 MANUFACTURERS

- A. Acceptable Manufacturer: Omega II Fence Systems, which is located at: 1735 St-Elzear West; Laval, QC, Canada H7L 3N6; Toll Free Tel: 800-836-6342; Tel: 450-686-9600; Fax: 450-681-7905; Email:[request info \(information@omegatwo.com\)](mailto:request_info@omegatwo.com); Web:www.omegatwo.com
- B. Requests for substitutions will be considered in accordance with provisions of Section 016000 - Product Requirements.
 - 4. All substitution approval requests shall be accompanied by manufacturing drawings and specifications, and they shall meet all specifications for design, size, gauge of metal parts, and fabrication.

2.2 OMEGA II ARCHITECTURAL FENCES

- A. Height:
 - 1. 4 feet (1245 mm).
 - 2. 5 feet (1549 mm).
 - 3. 6 feet (1778 mm).
 - 4. 8 feet (2464 mm).

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5. Multiple stacked panels as shown on the Drawings.

B. Architectural Self-Supporting Steel Mesh Fence Panels:

1. 92-3/4 inch (2356 mm) wide, welded by resistance using 6 gauge - 0.192 inch (4.88 mm) pre-galvanized steel wire, welded at each crossing to form rectangles 2 x 6 inch (50 x 150 mm).
2. Cold rolled wire with tensile strength of at least 75,000 psi (515 Mpa) and a 2,172 lbs (985 Kg) breaking strength in accordance with ASTM A185 and A853.
3. One end of the vertical wires of the panel shall extend 1 inch (25 mm) from the last or the first horizontal wire to create a spiked top or bottom depending on installed position. The other end is cut flush.
4. Panels shall have the following number of folds at 92.75 inches (2356 mm) wide based on the panel height:
 - a. 4 feet (1245 mm): 2 folds.
 - b. 5 feet (1549 mm): 2 folds.
 - c. 6 feet (1778 mm): 3 folds.
 - d. 8 feet (2464 mm): 4 folds.
5. Panel camber may not exceed 0.094 inch (2.5 mm).

C. Square Posts: Cold rolled 1008 grade steel to meet ASTM 500 and ASTM A787 and the following maximum horizontal loads, length as required for installation type:

1. Installation: In ground, post length as required for local frost line requirements.
2. Installation: Surface mounted, flanged.
3. Post Size: 2 x 2 inch (50 x 50 mm) for 4' fence:
 - a. 16 gauge (1.6 mm), 329 pound (149 kg) maximum horizontal load.
 - b. 11 gauge (3.0 mm), 578 pound (262 kg) maximum horizontal load.
4. Post Size: 3 x 3 inch (75 x 75 mm) for 4' fence:
 - a. 11 gauge (3.0 mm), 1383 pound (627 kg) maximum horizontal load.
5. Post Size: 2 x 2 inch (50 x 50 mm) for 5' fence:

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- b. 16 gauge (1.6 mm), 263 pound (119 kg) maximum horizontal load.
- c. 11 gauge (3.0 mm), 463 pound (210 kg) maximum horizontal load.
- 6. Post Size: 3 x 3 inch (75 x 75 mm) for 5' fence:
 - a. 11 gauge (3.0 mm), 1106 pound (501 kg) maximum horizontal load.
- 7. Post Size: 2 x 2 inch (50 x 50 mm) for 6' fence:
 - a. 11 gauge (3.0 mm), 385 pound (175 kg) maximum horizontal load.
- 8. Post Size: 3 x 3 inch (75 x 75 mm) for 6' fence:
 - a. 11 gauge (3.0 mm), 922 pound (418 kg) maximum horizontal load.
- 9. Post Size: 2 x 2 inch (50 x 50 mm) for 8':
 - a. 11 gauge (3.0 mm), 289 pound (131 kg) maximum horizontal load.
- 10. Post Size: 3 x 3 inch (75 x 75 mm):
 - a. 11 gauge (3.0 mm), 691 pound (313 kg) maximum horizontal load.

D. Post Brackets:

- 1. Universal Post Bracket Kit Includes the following: 13-gauge (2.4mm) steel collar, nut, washer and carriage bolt 1/4 x 1-1/4 inch (6.4 x 32 mm), all galvanized steel.
 - a. For 90 degrees turns, use the same bracket.
 - b. For different angles, use universal angle brackets.
 - c. For 4 foot (1245 mm) high panels: Provide 4 brackets per panel.
 - d. For 5 foot (1549 mm) high panels: Provide 6 brackets per panel.
 - e. For 6 foot (1778 mm) high panels: Provide 6 brackets per panel.
 - f. For 8 foot (2464 mm) high panels: Provide 8 brackets per panel.
- 2. U-Shaped Bracket Kit, Includes the following: Stainless steel U rod 5/16 inch (8 mm) diameter, rear flange in PVC 1-1/2" x 1-1/8 inches (37.8 x 28.4 mm), forehead support in PVC 5/8" x 1-1/16 (15.2 x 27.5 mm) cosmetic plastic caps and nuts (M8).

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- a. For 4 foot (1245 mm) high panels: Provide 4 brackets per panel.
 - b. For 4 foot (1230 mm) high panels: Provide 6 brackets per panel.
 - c. For 5 foot (1549 mm) high panels: Provide 6 brackets per panel.
 - d. For 6 foot (1778 mm) high panels: Provide 6 brackets per panel.
 - e. For 8 foot (2464 mm) high panels: Provide 8 brackets per panel.
- E. Special Panel Fittings (SPF): Hot dipped galvanized steel enables panels to be fastened to any vertical or horizontal surface, such as steel or concrete beams or wood posts. Provide the following model:
1. SPF-W Kit: For mounting on a vertical surface, consisting of an L-shaped slotted plate, which accommodates a 1-3/4" (45 mm) vertical adjustment and a retaining plate that hold two vertical wires when bolted together.
 2. SPF-C Kit: for horizontal surfaces, uses the same "L" shaped slotted plate and 2 wire retaining plates.
 3. SPF-P Kit: connects two panels together.
- F. Post Caps:
1. Aluminum alloy.
 2. Galvanized steel.
- G. Overhang Extension:
1. Same dimensions as the post, minimum 18 in. (460 mm) long, welded to the end square posts to form a 45 degrees angle to receive a panel of 16 in. (420 mm).
 2. Provide with two fastener kits.
- H. Architectural mesh panels and posts shall be zinc-coated steel wire conforming to specification ASTM A641 (1989) Class 1, and with 4 mils polyester powder coating as specified below.

2.3 OMEGA II ELITE FENCES

- A. Height:
1. 4 feet (1230 mm).

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2. 6 feet (1830 mm).
3. 8 feet (2430 mm).
4. Multiple stacked panels as shown on the Drawings.

B. Elite Steel Mesh Fence Panels:

1. Fabricated welded wire mesh panels zinc-coated steel wire conforming to specification ASTM A641, 98-7/8inches (2511mm) wide, formed by one vertical wire of 0.192 inch (4.88 mm) placed between two horizontal wires of 0.225 inch (5.72 mm), as per ASTM A185 and A853.
2. The wires are welded by resistance weld at each crossing to form rectangles 1-15/16 x 7-7/8 inches (50 x 200mm).
3. The cold rolled wire shall have a tensile strength of at least 75,000 psi (515 Mpa) and a 3150 lbs (1430 Kg) break strength for an individual wire.
4. One end of the vertical wires of the panel shall exceed 1 inch (25 mm) from the last or first horizontal wire creating a spiked top or bottom depending on the position when installed. The other end is cut flush.
5. Panel camber may not exceed 0.094inch (2.5 mm).

C. Square Posts: Cold rolled 1008 grade steel to meet ASTM 500 and ASTM A787 and the following maximum horizontal loads, length as required for installation type:

1. Installation: In ground, post length as required for local frost line requirements.
2. Installation: Surface mounted, flanged.
3. Post Size: 2 x 2 inch (50 x 50 mm) for 4' high fences:
 - a. 16 gauge (1.6 mm), 329 pound (149 kg) maximum horizontal load.
 - b. 11 gauge (3.0 mm), 578 pound (262 kg) maximum horizontal load.
4. Post Size: 3 x 3 inch (75 x 75 mm):
 - a. 11 gauge (3.0 mm), 1383 pound (627 kg) maximum horizontal load.
5. Post Size: 2 x 2 inch (50 x 50 mm) for 5' high fences:
 - a. 16 gauge (1.6 mm), 263 pound (119 kg) maximum horizontal load.
 - b. 11 gauge (3.0 mm), 463 pound (210 kg) maximum horizontal load.

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6. Post Size: 3 x 3 inch (75 x 75 mm):

a. 11 gauge (3.0 mm), 1106 pound (501 kg) maximum horizontal load.

7. Post Size: 2 x 2 inch (50 x 50 mm) for 6' high fences:

a. 11 gauge (3.0 mm), 385 pound (175 kg) maximum horizontal load.

8. Post Size: 3 x 3 inch (75 x 75 mm):

a. 11 gauge (3.0 mm), 922 pound (418 kg) maximum horizontal load.

9. Post Size: 2 x 2 inch (50 x 50 mm) for 8' high fences:

a. 11 gauge (3.0 mm), 289 pound (131 kg) maximum horizontal load.

10. Post Size: 3 x 3 inch (75 x 75 mm):

a. 11 gauge (3.0 mm), 691 pound (313 kg) maximum horizontal load.

D. Post Brackets:

1. Universal Post Bracket Kit Includes the following: 13-gauge (2.4mm) steel collar, nut, washer and carriage bolt 1/4 x 1-1/4 inch (6.4 x 32 mm), all galvanized steel.

a. For 90 degrees turns, use the same bracket.

b. For different angles, use universal angle brackets.

c. For 4 foot (1230 mm) high panels: Provide 4 brackets per panel.

d. For 5 foot (1449 mm) high panels: Provide 6 brackets per panel.

e. For 6 foot (1830 mm) high panels: Provide 6 brackets per panel.

f. For 8 foot (2430 mm) high panels: Provide 8 brackets per panel.

2. U-Shaped Bracket Kit, Includes the following: Stainless steel U rod 5/16 inch (8 mm) diameter, rear flange in PVC 1-1/2" x 1-1/8 inches (37.8 x 28.4 mm), forehead support in PVC 5/8" x 1-1/16 (15.2 x 27.5 mm) cosmetic plastic caps and nuts (M8).

a. For 4 foot (1230 mm) high panels: Provide 4 brackets per panel.

b. For 4 foot (1230 mm) high panels: Provide 6 brackets per panel.

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- c. For 5 foot (1449 mm) high panels: Provide 6 brackets per panel.
- d. For 6 foot (1830 mm) high panels: Provide 6 brackets per panel.
- e. For 8 foot (2430 mm) high panels: Provide 8 brackets per panel.
- E. Special Panel Fittings (SPF): Hot dipped galvanized steel enable panels to be fastened to any vertical or horizontal surface, such as steel or concrete beams or wood posts. Provide the following model:
 - 1. SPF-W Kit: For mounting on a vertical surface, consisting of an L-shaped slotted plate, which accommodates a 1-3/4" (45 mm) vertical adjustment and a retaining plate that hold two vertical wires when bolted together.
 - 2. SPF-C Kit: for horizontal surfaces, uses the same "L" shaped slotted plate and 2 wire retaining plates.
 - 3. SPF-P Kit: connects two panels together.
- F. Post Caps:
 - 1. Aluminum alloy.
 - 2. Galvanized steel.
- G. Overhang Extension:
 - 1. Same dimensions as the post, minimum 18 in. (460 mm) long, welded to the end square posts to form a 45 degrees angle to receive a panel of 16 in. (420 mm).
 - 2. Provide with two fastener kits.
- H. Elite mesh panels and posts shall be zinc-coated steel wire conforming to specification ASTM A641 (1989) Class 1, and with 4 mils polyester powder coating as specified below.

2.4 OMEGA II EVOLUTION FENCES

- A. Height:
 - 1. 4 feet (1230 mm).
 - 2. 6 feet (1830 mm).
 - 3. 8 feet (2430 mm).

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4. Multiple stacked panels as shown on the Drawings.

B. Evolution Steel Mesh Fence Panels:

1. Fabricated welded wire mesh panels zinc-coated steel wire conforming to specification ASTM A641, 98-7/8 inches (2511mm) wide, formed by one vertical wire of 0.192 inch (4.88 mm) placed between two horizontal wires of 0.225 inch (5.72 mm), as per ASTM A185 and A853.
2. The wires are welded by resistance weld at each crossing to form rectangles 1-15/16 x 7-7/8 inches (50 x 200mm).
3. The cold rolled wire shall have a tensile strength of at least 75,000 psi (515 Mpa) and a 3150 lbs (1430 Kg) break strength for an individual wire.
4. One end of the vertical wires of the panel shall exceed 1 inch (25 mm) from the last or first horizontal wire creating a spiked top or bottom depending on the position when installed. The other end is cut flush.

C. Evolution steel mesh panels are welded at each intersection into a solid one-piece mesh sheet. Mesh panels are hot dipped galvanized in conformity with ASTM A123/A123M (GAW).

D. End-to-End Connectors: Allow panels to be connected without requiring a post in accordance with the following:

1. Quantity per 4' Panels: 3 Eye-U-Brackets and 4 End-to-End Connectors.
2. Quantity per 6' Panels: 3 Eye-U-Brackets and 5 End-to-End Connectors.
3. Quantity per 8' Panels: 4 Eye-U-Brackets and 7 End-to-End Connectors.

E. Special Panel Fittings (SPF): Hot dipped galvanized steel enables panels to be fastened to any vertical or horizontal surface, such as steel or concrete beams or wood posts. Provide the following model:

1. SPF-W Kit: For mounting on a vertical surface, consisting of an L-shaped slotted plate, which accommodates a 1-3/4" (45 mm) vertical adjustment and a retaining plate that hold two vertical wires when bolted together.
2. SPF-C Kit: for horizontal surfaces, uses the same "L" shaped slotted plate and 2 wire retaining plates.
3. SPF-P Kit: connects two panels together.

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F. Chain Link Fence Fittings: to ASTM F 626. All ferrous metal fittings shall be galvanized.

G. Tie Wire or twist ties may be used or added if required. Minimum 9-gauge, 0.148 inch (3.76 mm) galvanized steel or aluminum for attachment of panels to posts.

H. Stretcher bands: fabric bands and brace bands shall be galvanized pressed steel.

I. Fasteners: All nuts and bolts to be galvanized.

J. Evolution Round Fence Posts:

1. New line (intermediate), End and Corner Posts: 2-3/8-inch (60.0mm) diameter, minimum 24 to 36 inches (610 mm to 914mm) longer than the height of the panel for installation in the ground depending on local frost line requirements.

2. Steel Pipe Posts: Cold formed with minimum yield strength of 50,000 psi (344 MPa) and produced in accordance with ASTM F1043.

3. To upgrade an existing facility, keep the same posts or slide a new oversized post over the existing posts using the same foundation if acceptable to the Owner. Affix new posts with tap screws located at the base. No pull post, rail or braces are required.

a. Evolution Round Fence Posts Brackets:

4. Manufacturer's standard eye-U-bracket kit designed to wrap around 2-3/8" (60 mm) or 3-1/2 inch (88,9 mm) round posts, including one pre-galvanized 1/4 inch (32mm) wire eye-U-bracket, one 1/8 inch (3mm) thick retaining plate hot dip galvanized, two nuts, washers and carriage bolts 5/16 x 1 1/4 inch (8 x 32 mm), all galvanized steel.

5. Hardware allows for straight line and turns, each turn requires a post. For 90 degree turns, use the manufacturer's stretcher band.

K. Evolution Post Caps:

1. Aluminum alloy.

2. Galvanized steel.

L. Evolution Swing Gates:

1. Gate Posts: Cold rolled from 1008 grade steel. Dimension corresponding to posts including cap and SPF-W kit for adjacent panel mounting

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2. Gate Frames: Fabricated in accordance with ASTM F900 using galvanized steel members 1.90 inch (48.3 mm) outside diameter, weighing 2.28 lb/ft (3.30 kg/m), welded at all corners to create a rigid frame. Welded joints shall be coated in accordance with ASTM A780, employing a zinc-rich paint.
 - a. Gates over 8 feet (2440 mm) high or 8 feet (2440 mm) wide shall have horizontal or vertical members.
3. Gate Mesh: Filler shall match that shown in the fence section. Mesh panel to be attached to frame with fabric bands at the external vertical members, and with J-bolts or hook bolts to horizontal and internal vertical members. Bands and J-bolts, hook bolts maximum of 18 inch (460 mm) centers.
4. Gate Hardware: ASTM F900 for hinges, latch, drop rods, hot-dip galvanized steel, and sized to assure proper gate operation.
5. Hinge: Structurally designed by manufacturer to support gates without deformation during opening and closing and capable of swinging 180 degrees (3.14 rad) in or out.
6. Latch: Clamp-on gravity system, self-latching.
7. Double Gates Hardware: One drop bar to secure in closed position one of the gate leaves, complete with stop pipe to engage the center drop rod, and gate keeper mechanical device with gravity-lock system that fasten each gate leaf when in full open position.

M. Dimensions and Nominal Weights for Gate Leafs in Single Openings:

1. Panel heights less than 6 feet (1830), with gates 4 ft. (1220 mm) or less.
 - a. Outside Diameter: 2-3/8 inches (60.3 mm). Nominal Weight: 3.12 lb/ft (4.6 kg/m).
2. Panel heights less than 6 feet (1830), with gates 4 ft. (1220 mm) to 10 ft. (3050 mm).
 - a. Outside Diameter: 2-7/8 inches (73.0 mm). Nominal Weight: 4.64 lb/ft (6.9 kg/m).
3. Panel heights less than 6 feet (1830), with gates 10 ft. (3050 mm) to 18 ft (5490 mm).
 - a. Outside Diameter: 4 inches (101.6 mm). Nominal Weight: 6.56 lb/ft (9.8 kg/m).

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4. Panel heights less than 6 feet (1830), with gates 18 ft. (5490 mm) to 24 ft (7320 mm).

a. Outside Diameter: 6-1/4 inches (168.3 mm). Nominal Weight: Per manufacturer.

5. Panel heights over 6 feet (1830), with gates up to 6 ft. (1830 mm) or less.

a. Outside Diameter: 4 inches (101.6 mm). Nominal Weight: 9.11 lb/ft (13.5 kg/m).

6. Panel heights over 6 feet (1830 mm), with gates 6 ft. (1830 mm) to 12 feet (3660 mm).

a. Outside Diameter: 6-5/8 inches (168.3 mm). Nominal Weight: 18.97 lb/ft (28.2 kg/m).

7. Panel heights over 6 feet (1830 mm), with gates 12 ft. (3660 mm) to 18 feet (5490 mm).

a. Outside Diameter: 8-1/4 inches (219.1 mm). Nominal Weight: 28.58 lb/ft (42.5 kg/m).

8. Panel heights over 6 feet (1830 mm), with gates 18 ft. (5490 mm) to 24 feet (7320 mm).

a. Outside Diameter: 2-7/8 inches (73.0 mm). Nominal Weight: 5.79 lb/ft (8.6 kg/m).

N. Gate Framing Members for Round Pipe Swing Gates:

1. For gates 6 ft. (1830 mm) or less in height or width.

a. Outside Diameter: 1.660 inches (42.2 mm). Nominal Weight: 1.83 lb/ft (2.7 kg/m).

2. For gates from 6 ft. (1830 mm) to 8 ft. (2440 mm) in height or width.

a. Outside Diameter: 1.9 inches (48.3 mm). Nominal Weight: 2.28 lb/ft (3.3 kg/m).

b. Provide the following for interior bracing, swing or roll gates, when required or recommended by the manufacturer:

i. Outside Diameter: 1.660 inches (42.2 mm). Nominal Weight: 1.83 lb/ft (2.7 kg/m).

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2.5 OMEGA II SECUR FENCES

A. Height:

1. 4 feet (1230 mm).
2. 6 feet (1830 mm).
3. 8 feet (2430 mm).
4. Multiple stacked panels as shown on the Drawings.

B. Secur Steel Mesh Fence Panels:

1. Fabricated welded wire mesh panels zinc-coated steel wire conforming to specification ASTM A641, 98-7/8inches (2511mm) wide, formed by one vertical wire of 0.225 inch (5.72 mm) placed between two horizontal wires of 0.303 inch (7.70 mm), as per ASTM A185 and A853.
2. The wires are welded by resistance weld at each crossing to form rectangles 1-15/16 x 7-7/8 inches (50 x 200mm).
3. The cold rolled wire shall have a tensile strength of at least 75,000 psi (515 Mpa) and a 3150 lbs (1430 Kg) break strength for the 0.225-inch (5.72 mm) wires and of 5600 lbs (2545 Kg) for the 0.303-inch (7.70 mm) wires.
4. One end of the vertical wires of the panel shall exceed 1 inch (25 mm) from the last or first horizontal wire creating a spiked top or bottom depending on the position when installed. The other end is cut flush.
5. Panel camber may not exceed 0.094inch (2.5 mm).

C. Square Posts: Cold rolled 1008 grade steel to meet ASTM 500 and ASTM A787 and the following maximum horizontal loads, length as required for installation type:

1. Installation: In ground, post length as required for local frost line requirements.
2. Installation: Surface mounted, flanged.
3. Post Size: 2 x 2 inch (50 x 50 mm) for 4-foot-high fences:
 - a. 16 gauge (1.6 mm), 329 pound (149 kg) maximum horizontal load.
 - b. 11 gauge (3.0 mm), 578 pound (262 kg) maximum horizontal load.
4. Post Size: 3 x 3 inch (75 x 75 mm):

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- a. 11 gauge (3.0 mm), 1383 pound (627 kg) maximum horizontal load.
- 5. Post Size: 2 x 2 inch (50 x 50 mm) for 5-foot-high fences:
 - a. 16 gauge (1.6 mm), 263 pound (119 kg) maximum horizontal load.
 - b. 11 gauge (3.0 mm), 463 pound (210 kg) maximum horizontal load.
- 6. Post Size: 3 x 3 inch (75 x 75 mm):
 - a. 11 gauge (3.0 mm), 1106 pound (501 kg) maximum horizontal load.
- 7. Post Size: 2 x 2 inch (50 x 50 mm) for 6-foot-high fences:
 - a. 11 gauge (3.0 mm), 385 pound (175 kg) maximum horizontal load.
- 8. Post Size: 3 x 3 inch (75 x 75 mm):
 - a. 11 gauge (3.0 mm), 922 pound (418 kg) maximum horizontal load.
- 9. Post Size: 2 x 2 inch (50 x 50 mm) for 8-foot-high fences:
 - a. 11 gauge (3.0 mm), 289 pound (131 kg) maximum horizontal load.
- 10. Post Size: 3 x 3 inch (75 x 75 mm):
 - a. 11 gauge (3.0 mm), 691 pound (313 kg) maximum horizontal load.

D. Post Brackets:

- 1. Universal Post Bracket Kit Includes the following: 13-gauge (2.4mm) steel collar, nut, washer and carriage bolt 1/4 x 1-1/4 inch (6.4 x 32 mm), all galvanized steel.
 - a. For 90 degrees turns, use the same bracket.
 - b. For different angles, used universal angle brackets.
 - c. For 4 foot (1230 mm) high panels: Provide 4 brackets per panel.
 - d. For 5 foot (1449 mm) high panels: Provide 6 brackets per panel.
 - e. For 6 foot (1830 mm) high panels: Provide 6 brackets per panel.
 - f. For 8 foot (2430 mm) high panels: Provide 8 brackets per panel.

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2. U-Shaped Bracket Kit, Includes the following: Stainless steel U rod 5/16 inch (8 mm) diameter, rear flange in PVC 3-1/2' x 1-1/2' x 1-1/8 inches (88.7 x 37.8 x 28.4 mm), forehead support in PVC 2-3/8' x 5/8' x 1-1/16 (60.4 x 15.2 x 27.5 mm) cosmetic plastic caps and nuts (M8).
 - a. For 4 foot (1230 mm) high panels: Provide 4 brackets per panel.
 - b. For 4 foot (1230 mm) high panels: Provide 6 brackets per panel.
 - c. For 5 foot (1449 mm) high panels: Provide 6 brackets per panel.
 - d. For 6 foot (1830 mm) high panels: Provide 6 brackets per panel.
 - e. For 8 foot (2430 mm) high panels: Provide 8 brackets per panel.
- E. Special Panel Fittings (SPF): Hot dipped galvanized steel enables panels to be fastened to any vertical or horizontal surface, such as steel or concrete beams or wood posts. Provide the following model:
 1. SPF-W Kit: For mounting on a vertical surface, consisting of an L-shaped slotted plate, which accommodates a 1-3/4" (45 mm) vertical adjustment and a retaining plate that hold two vertical wires when bolted together.
 2. SPF-C Kit: for horizontal surfaces, uses the same "L" shaped slotted plate and 2 wire retaining plates.
 3. SPF-P Kit: connects two panels together.
- F. Post Caps:
 1. Aluminum alloy for posts 2 x 2 inches (50 x 50 mm) to 4 x 4 inches (100 mm x 100 mm).
 2. Galvanized steel for larger dimensions.
- G. Overhang Extension:
 1. Same dimensions as the post, minimum 18 in. (460 mm) long, welded to the end square posts to form a 45 degrees angle to receive a panel of 16 in. (420 mm).
 2. Provide with two fastener kits.
- H. Secur mesh panels and posts shall be zinc-coated steel wire conforming to specification ASTM A641 (1989) Class 1, and with 4 mils polyester powder coating as specified below.

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2.6 OMEGA II HARMONY FENCES

A. Height:

1. 4 feet (1289 mm).
2. 6 feet (1889 mm).

B. Harmony Self-Supporting Steel Mesh Fence Panels:

1. Wire mesh fence panels measuring 92-3/4-inch (2356 mm) wide are welded by resistance as per ASTM-A185 using 6 gauge 0.192 inch (4.88 mm) pre-galvanized steel wire for the vertical wire.
2. Wires are welded at each crossing on 0.225 inch (5.72 mm) pre-galvanized horizontal steel wire to form a rectangle of 2 x 7.875 inches (50 x 200 mm).
3. Cold rolled wires have a minimum tensile strength of 75,000 psi (515 Mpa) and a 2,172 lb (985 Kg) breaking strength.
4. The two last horizontal wires at the top edge of the panel are welded with a curved shape and spaced at 2 inches (50 mm) between wires.
5. The lower curved wire starts at 3.5 inches (90 mm) from the last horizontal wire each end of the panel.
6. All the vertical wires on the top of the panel are bended thereby creating an arrow shape and shall exceed 3.5 inches (90 mm) from the last curved horizontal wire.
7. The vertical wires on the bottom of panel are cut flush.
8. Panels shall have the following number of folds at 92.75 inches (2356 mm) wide based on the panel height:
 - a. 4 feet (1289 mm): 2 folds.
 - b. 6 feet (1889 mm): 3 folds.
9. Panel camber may not exceed 0.094 inch (2.5 mm).

C. Harmony Post Performance Requirements:

1. Post Size: 2 x 2 inch (50 x 50 mm) for 4-foot-high fences:
 - a. 16 gauge (1.6 mm), 329 pounds (149 kg) maximum horizontal load.

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- b. 11 gauge (3.0 mm), 578 pound (262 kg) maximum horizontal load.
- 2. Post Size: 3 x 3 inch (75 x 75 mm) for 6-foot-high fences:
 - a. 11 gauge (3.0 mm), 1106 pound (502 kg) maximum horizontal load
- D. Harmony mesh panels and posts shall be zinc-coated steel wire conforming to specification ASTM A641 (1989) Class 1, and with 4 mils polyester powder coating as specified below.

2.7 OMEGA II ECO FENCES

A. Height:

- 3. 4 feet (1245 mm).
- 4. 5 feet (1549 mm).
- 5. 6 feet (1778 mm).
- 6. 8 feet (2464 mm).
- 7. Multiple stacked panels.

B. Eco Self-Supporting Steel Mesh Fence Panels:

- 1. The OMEGA ECO system is in a combination of two panels separated by a 5" or 6" (125 mm or 150 mm) gap.
- 2. Provide with Elite Wire mesh as specified above.
- 3. Provide with Secur wire mesh as specified above.
- 4. Wire mesh fence panels are 98-5/8 inches (2505 mm) wide, welded by resistance using 6-gauge 0.192 inch (4.88 mm) pre-galvanized steel wire, welded at each crossing to form rectangles of 2 x 6 inches (50 x 150 mm).
- 5. The cold rolled wire shall have a tensile strength of at least 75,000 psi (515 Mpa) and 2,172 lbs (985 Kg) break strength.
- 6. One end of the vertical wires of the panel shall exceed 1 inch (25 mm) from the last or the first horizontal wire creating a spiked top or bottom depending on position when installed. The other end is cut flush.
- 7. Panels shall have the following number of folds at 92.75 inches (2356 mm) wide based on the panel height:

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- a. 4 feet (1245 mm): 2 folds.
 - b. 5 feet (1549 mm): 2 folds.
 - c. 6 feet (1778 mm): 3 folds.
 - d. 8 feet (2464 mm): 4 folds.
8. Panel camber may not exceed 0.094inch (2.5 mm).
- C. Square Posts: Cold rolled 1008 grade steel to meet ASTM 500 and ASTM A787 and the following maximum horizontal loads, length as required for installation type:
- 1. Installation: In ground, post length as required for local frost line requirements.
 - 2. Installation: Surface mounted, flanged.
 - 3. Post Size: 2 x 2 inch (50 x 50 mm) for 4-foot-high fences:
 - a. 16 gauge (1.6 mm), 329 pound (149 kg) maximum horizontal load.
 - b. 11 gauge (3.0 mm), 578 pound (262 kg) maximum horizontal load.
 - 4. Post Size: 3 x 3 inch (75 x 75 mm):
 - a. 11 gauge (3.0 mm), 1383 pound (627 kg) maximum horizontal load.
 - 5. Post Size: 2 x 2 inch (50 x 50 mm) for 5-foot-high fences:
 - a. 16 gauge (1.6 mm), 263 pound (119 kg) maximum horizontal load.
 - b. 11 gauge (3.0 mm), 463 pound (210 kg) maximum horizontal load.
 - 6. Post Size: 3 x 3 inch (75 x 75 mm):
 - a. 11 gauge (3.0 mm), 1106 pound (501 kg) maximum horizontal load.
 - 7. Post Size: 2 x 2 inch (50 x 50 mm) for 6-foot-high fences:
 - a. 11 gauge (3.0 mm), 385 pound (175 kg) maximum horizontal load.
 - 8. Post Size: 3 x 3 inch (75 x 75 mm):
 - a. 11 gauge (3.0 mm), 922 pound (418 kg) maximum horizontal load.
 - 9. Post Size: 2 x 2 inch (50 x 50 mm) for 8-foot-high fences:
 - a. 11 gauge (3.0 mm), 289 pound (131 kg) maximum horizontal load.

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10. Post Size: 3 x 3 inch (75 x 75 mm):

- a. 11 gauge (3.0 mm), 691 pound (313 kg) maximum horizontal load.

D. Post Brackets:

1. ECO Post Bracket Kit Includes the following: 14-gauge (2.6mm) steel collar and wire retaining plate 1/4 x 1 inch (6.3 x 25 mm), nut, washer and carriage bolt 5/16 x 1-1/4 inch (8.0 x 32 mm), all galvanized steel.

- a. For 4 foot (1245 mm) high panels: Provide 2 brackets per post.
- b. For 5 foot (1549 mm) high panels: Provide 3 brackets per post.
- c. For 6 foot (1778 mm) high panels: Provide 3 brackets per post.
- d. For 8 foot (2464 mm) high panels: Provide 4 brackets per post.

2. U-Shaped Bracket Kit, Includes the following: Stainless steel U rod 5/16 inch (8 mm) diameter, rear flange in PVC 3-1/2' x 1-1/2' x 1-1/8 inches (88.7 x 37.8 x 28.4 mm), forehead support in PVC 2-3/8' x 5/8' x 1-1/16 (60.4 x 15.2 x 27.5 mm) cosmetic plastic caps and nuts (M8).

E. Special Panel Fittings (SPF): Hot dipped galvanized steel enables panels to be fastened to any vertical or horizontal surface, such as steel or concrete beams or wood posts. Provide the following model:

- 1. SPF-W Kit: For mounting on a vertical surface, consisting of an L-shaped slotted plate, which accommodates a 1-3/4" (45 mm) vertical adjustment and a retaining plate that hold two vertical wires when bolted together.
- 2. SPF-C Kit: for horizontal surfaces, uses the same "L" shaped slotted plate and 2 wire retaining plates.
- 3. SPF-P Kit: connects two panels together.

F. Post Caps:

- 1. Aluminum alloy for posts 2 x 2 inches (50 x 50 mm) to 4 x 4 inches (100 mm x 100 mm).
- 2. Galvanized steel for larger dimensions.

G. Overhang Extension:

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1. Same dimensions as the post, minimum 18 in. (460 mm) long, welded to the end square posts to form a 45 degrees angle to receive a panel of 16 in. (420 mm).
 2. Provide with two fastener kits.
- H. Eco mesh panels and posts shall be zinc-coated steel wire conforming to specification ASTM A641 (1989) Class 1, and with 4 mils polyester powder coating as specified below.

2.8 OMEGA II VERTICAL GRATING 10-20 FENCES

- A. Height:
1. 47.01 inches (1194 mm).
 2. 78.19 inches (1986 mm).
 3. 98.98 inches (2514 mm).
 4. Multiple stacked panels.
- B. Louver Panel Width: 64.65 inches (1642 mm).
- C. Bar Spacing:
1. OMEGA 10: 5.197 inches (132 mm) horizontal bar spacing
 2. OMEGA 20: 2.60 inches (66 mm) horizontal bar spacing.
- D. Vertical Grating Self-Supporting Steel Mesh Fence Panels:
1. Fabricated of 6-gauge, 0.192-inch (4.88 mm) diameter steel horizontal bars welded to steel vertical plates.
 2. Steel Wires: 6 gauge, cold-rolled, annealed to AISI 1018 and ASTM A853-04.
 3. Plates: Heat-formed 1 inch (25 mm) wide plates to ASTM A505.
 4. Plate Thickness: 0.08 inch (2.0 mm).
 5. OMEGA 10: Bars and wires are resistance welded to create 2.44 x 5.20-inch (62 x 132 mm) rectangles.
 6. OMEGA 20: Bars and wires are resistance welded to create 2.44 x 2.60-inch (62 x 66 mm) rectangles.

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7. Steel Bars Tensile Strength: 75000 psi (515 MPa)
 8. Steel Bars Breaking Load: 2,166 lb (982.4 kg) per bar.
 9. Frame: 2 heat-formed horizontal plates 1 inch (25 mm) wide and 0.16 inch (4.0 mm) thick to AISI 1008 and ASTM A505.
 10. Frame ends are folded at 90 degrees for securing to posts.
 11. Folds are 2.56 inch (65 mm) longer than the vertical plates of the fence panel.
 12. Panel longitudinal curvature shall not exceed 1/200 of frame length.
 13. Transverse curvature shall be less than or equal to 0.394 inch per 39.37 inches (10 mm per 1 m) of panel.
 13. The difference between the panel width at the top and the width at the bottom shall be less than 0.25 inch (6.4 mm).
 14. Panel diagonals shall not present a difference of more than 0.25 inch per 59.05 inches (6.4 mm per 1.5 m) panel length.
- E. Square Posts: For installation in the ground or on base plates to meet the following horizontal loading requirements. Secured to posts with 3/8 x 3-1/2 inch (9.5 x 89 mm) galvanized carriage bolts and 3/8 inch (9.5 mm) galvanized nuts.
1. 2 x 2 inches (50 x 50 mm) 11-gauge (3.0mm) posts:
 - a. 50 inches (1290 mm) Posts: 502.8 pounds (2442 N).
 - b. 82 inches (2082 mm) Posts: 339.3 pounds (1513 N).
 - c. 102 inches (2610 mm) Posts: 270.7 pounds (1207 N).
 2. 3 x 3 inches (75 x 75 mm) 11-gauge (3.0mm) posts:
 - a. 50 inches (1290 mm) Posts: 1309.7 pounds (5840 N).
 - b. 82 inches (2082 mm) Posts: 811.3 pounds (3618 N).
 - c. 102 inches (2610 mm) Posts: 647.2 pounds (2886 N).
- F. Flat Posts: For installation in the ground or on base plates to meet the following horizontal loading requirements. Secured to the posts at top of frame and bottom of frame using 3/8 x 1-1/2 inch (9.5 x 38 mm) galvanized carriage bolts and 3/8 inch (9.5 mm) galvanized nuts.
1. 2.36 x 1/4-inch (60 x 6.35 mm) Posts:

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- a. 50 inches (1274 mm): 241.5 pounds (1077 N).
 - b. 81 inches (2066 mm): 148.9 pounds (664 N).
 - c. 102 inches (2594 mm): 118.6 pounds (529 N).
2. 3.15 x 1/4-inch (80 x 6.35 mm) Posts:
- a. 50 inches (1274 mm): 429.2 pounds (1077 N).
 - b. 81 inches (2066 mm): 264.6 pounds (1180 N).
 - c. 102 inches (2594 mm): 210.8 pounds (940 N).
- G. Number of parts required to secure panels on posts:
1. For 47.01 inch (1194 mm) high panel height, provide 4 bolts, 4 nuts, support brackets
 2. For 78.19 inch (1986 mm) high panel height, provide 6 bolts, 6 nuts, and 2 support brackets.
 3. For 98.98 inch (2514 mm) high panel height, provide 6 bolts, 6 nuts, and 2 support brackets.

2.9 OMEGA II VERTICAL GRATING 80-100 FENCES

- A. Height:
1. 77.28 inches (1963 mm).
 2. Multiple stacked panels.
- B. Width: 78.43 inches (1992 mm).
- C. Horizontal Louver Profile:
1. OMEGA 80.
 2. OMEGA 100.
- D. Vertical Grating Self-Supporting Steel Mesh Fence Panels:
1. Fabricated of 0.08 inch (2 mm) thick horizontal louvers welded to two vertical plates at the ends. Heat-formed complying with AISI 1008 and ASTM A 505.

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2. Vertical Plates: 0.12 inch (3 mm) thick and 2 inches (50 mm) wide. Heat-formed complying with AISI 1008 and ASTM A 505.
 3. Vertical Wires: 0.16-inch (4.06 mm) AISI 1018 steel in accordance with ASTM A 653 resistance-welded to louvers.
 4. Rectangle Size: 5.20 inch by 1.80 inch (132 mm by 45.77 mm).
 5. Cold Rolled Steel Bars: Tensile strength 75,000 psi (515 MPa) and breaking load 1499 lb (680.0 kg) per bar.
 6. Panel longitudinal curvature shall not exceed 1/200 of the frame length.
 7. Transverse curvature shall be less than or equal to 0.394 in. per 39.37 in. (10 mm per 1 m) of panel length.
 8. The difference between the panel width at the top and the width at the bottom shall be less than 0.25 in. (6.4 mm).
 9. Panel diagonals shall not present a difference of more than 0.25 in. (6.4 mm) in length. Difference between c/c distances of horizontal bars shall not be more than 0.25 in. per 59.05 in. (6.4 mm per 1.5 m) of panel length.
- E. Square Posts: For installation in the ground or on base plates to meet the following horizontal loading requirements. Fabricated of 16 gauge or 11-gauge pre-galvanized steel; cold-formed AISI 1008 steel in compliance with ASTM A500 Grade C and ASTM A787.
1. 2 x 2 inches (50 x 50 mm) 11-gauge (3.0mm) posts:
 - a. Model 80 - 79.05 (2008 mm), 351.8 pounds (1569 N).
 - b. Model 100 - 79.53 (2020 mm), 349.8 pounds (1560 N).
 2. 3 x 3 inches (75 x 75 mm) 11-gauge (3.0mm) posts:
 - a. Model 80 - 79.05 (2008 mm), 841.4 pounds (3752 N).
 - b. Model 100 - 79.53 (2020 mm), 836.3 pounds (3729 N).
- F. Flat Posts: For installation in the ground or on base plates to meet the following horizontal loading requirements. Standard Flat Post thickness is 0.25 in. (6.35 mm). Hot dip galvanized in accordance with ASTM A123 G100.
1. 2.36 x 1/4-inch (60 x 6.35 mm) Posts:
 - a. Model 80 - 78.42 inch (1992 mm), 154.5 pounds (689 N).

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- b. Model 100 - 78.90 inch (2004 mm), 153.4 pounds (684 N).
- 2. 3.15 x 1/4-inch (80 x 6.35 mm) Posts:
 - a. Model 80 - 78.42 inch (1992 mm), 275.5 pounds (1224 N).
 - b. Model 100 - 78.90 inch (2004 mm), 272.9 pounds (1217 N).
- G. Panels: Secured to the posts with vertical plates. Galvanized 3/8-inch diameter X 1-1/2-inch (9.5 mm x 38 mm) carriage bolts and galvanized 3/8-inch diameter (9.5 mm) nuts are required to secure panels to flat posts. For 2-inch square posts, install posts using galvanized 3/8-inch diameter x 3-1/2-inch (9.5 mm x 89 mm) carriage bolts and galvanized 3/8-inch diameter (9.5 mm) nuts. Four attachment points are required.
- H. Square Post Caps: Aluminum, 2 inches. x 2 inch (50 mm x 50 mm) or 3-inch x 3 inch (76 mm x 76 mm) depending on chosen post model. Galvanized steel, 4-inch x 4 inch (102 mm x 102 mm) or larger posts.
- I. Extensions: If applicable, 45-degree extensions on 2 inch (50 mm) and on 3 inch (76 mm) square posts, as well as on 2.36 in. x 1/4 inch (60 mm x 6.35 mm) and on 3.15 in. x 1/4 inch. (80 mm x 6.35 mm) flat posts. The extension length shall be a minimum of 18 inches (460 mm) and shall be welded at the end of the square post at a 45-degree angle. A minimum fence height of 6 feet (1829 mm) is required to be able to use these extensions.
- J. Straight or V-shaped Caps: 14.5 inch (368 mm) long at a 45 degree angle, with provisions to attach 3 rows of barbed wire at 4 inch (100 mm) intervals, shall be solidly secured to the posts with self-tapping screws which can withstand a 250 lb (113 kg) load.

2.10 SWING GATES

- A. Configuration:
 - 1. Single swing.
 - 2. Double swing.
 - 3. Swing as shown on the Drawings.
- B. Gate Frames under 7 feet (2134 MM): Two horizontal ASTM F900 galvanized square steel tubes, 16 gauge, 1-1/2 x 1-1/2 inch (38 mm X 38 mm), and two vertical tubes 2 x 2 inch (50 x 50 mm) welded at intersections to create a rigid frame.

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- C. Gate Frames (over 7 feet (2134 mm): Two horizontal ASTM F900 galvanized square steel tubes, 11 gauge, 1-1/2 x 1-1/2 inch (38 mm X 38 mm), two vertical tubes 2 x 2 inch (50 x 50 mm), and 1-1/2 x 1-1/2 inch (38 x 38 mm) supplementary vertical support, welded at intersections to create a rigid frame.
- D. Gate Posts: Cold rolled 1008 grade steel to meet ASTM 500 and ASTM A787, length as required for installation type:
 - 1. Installation: In ground, post length as required for local frost line requirements.
 - 2. Installation: Surface mounted, flanged.
 - 3. Post Size for fences under 6' (1830 mm) high: 3 x 3 inch (75 x 75 mm).
 - 4. Post Size for fences between 6'-1" (1830 mm) and 13'6" (4115mm) high: 4 x 4 inch (100 x 100 mm).
 - 5. Post Size for fences between 13'6" (4115mm) and 16' (4875mm) high: 6 x 6 inch (150 x 150 mm).
 - 6. Post Size for fences over 16' (4875mm) high: Custom engineering by the manufacturer.
- E. Gate Hardware: Hinges, Latches, Drop Rods: Hot-dipped galvanized steel to ASTM F900, sized to assure proper gate operation. Non-moving parts shall be powder coated.
 - 1. Hinge: Structurally designed by manufacturer to support gates without deformation during opening and closing.
 - 2. Latch: Clamp-on, self-latching, gravity system.
 - 3. Optional Keyed Lockbox: LOCINOX with single lever, one side of each gate as shown.
 - 4. Optional Keyed Lockbox: LOCINOX with double levers, both sides of gates.
 - 5. Additional Hardware for Double Gates:
 - a. Keeper: Mechanical device with gravity-lock system to fasten each gate leaf in fully open position.
 - b. Drop Bar: Secures one gate in closed position using stop pipe to engage the center drop rod.
 - c. Self-Locking Device: Integral to latch, and with padlock eyes.

2.11 CANTILEVER GATES

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A. Construction: 6063-T6 aluminum to ASTM B221, weighing 0.94 lb/ft (1.39 kg/m), fabricated in accordance with ASTM F1184, Class 2.

1. Members are welded together to form rigid one-piece frames with integral top track.
2. Provide 2 track and wheel assemblies for each gate leaf, comply with manufacturer instructions for gates larger than 30 feet (9144 mm).
3. Vertical Uprights: 2 x 2-inch (50 x 50 mm) aluminum, welded to gate frames approximately 8 foot (2440 mm) apart, dividing the frame into equal sections.
4. Gates over 27 feet (8230 mm): Shipped in 2 parts and field spliced with special attachments provided by manufacturer.

B. Gate Leaf in Single Openings:

1. Cantilever Support (Overhang) for gates 6 ft. (1830 mm) to 10 ft. (3040 mm): 6.5 feet (1980 mm).
2. Cantilever Support (Overhang) for gates 11 ft. (3350 mm) to 14 ft. (4270 mm): 7.5 feet (2290 mm).
3. Cantilever Support (Overhang) for gates 15 ft. (4570 mm) to 22 ft (6710 mm): 10 feet (3040 mm).
4. Cantilever Support (Overhang for gates 23 ft. (7010 mm) to 30 ft. (9140 mm): 12 feet (3660 mm) with additional 2 inch (50 mm) square lateral support of aluminum weighing 1.71 lb/ft. (2.54 kg/m) welded to top horizontal rail, and with bottom rail 2 x 4 inches (50 x 100 mm).
5. Cantilever Support (Overhang for gates 31 ft. (9450 mm) to 35 ft (10670 mm): 13.5 feet (4120 mm) aluminum member weighing 1.71 lb/ft. (2.54 kg/m), with 2 top tracks welded together to form a dual enclosed track, with 2 truck assemblies for each track in each gate leaf, for a total of 4 truck assemblies. Bottom rail 2 x 4 inches (50 x 100 mm).
6. Cantilever Support (Overhang for gates 36 ft. (10970 mm) to 40 ft. (12190 mm): 16 feet (4880 mm) aluminum member weighing 1.71 lb/ft. (2.54 kg/m), with 2 top tracks welded together to form a dual enclosed track, with 2 truck assemblies for each track in each gate leaf, for a total of 4 truck assemblies. Bottom rail 2 x 4 inches (50 x 100 mm).

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7. Cantilever Support (Overhang for gates 41 ft. (12500 mm) to 50 ft. (15240 mm): Custom by manufacturer. Typically fabricated of 24 inch (610 mm) wide rigid box frame truss of dual side frames, separated by square cross members and diagonal truss rod bridging. Dual side frames each contain top track to provide support for truss from both sides. Provide 4 trucks for each track, total 8 for each gate leaf. Weld steel plate between top of support posts to maintain truck assemblies in alignment with tracks.

8. As Shown on the Drawings.

C. Sliding Components:

1. Bracing: Diagonal adjustable length truss rods of 3/8 inch (9.5mm) galvanized steel, in each panel of gate frames.

2. Top Track: Enclosed, combination one-piece track and rail of aluminum extrusion weighing 3.72 lb/ft (5.54 kg/m), able to withstand reaction load of 2000 lb (907 kg). Track does not receive polymer coating.

3. Truck Assembly: Swivel type, zinc die cast, with 4 sealed lubricant ball bearing rollers, 2 inches (50 mm) in diameter by 9/16 inch (14 mm) in width, and 2 side rolling wheels to ensure truck alignment in track. Mounted on post brackets using 7/8-inch (22 mm) diameter ball bolts with 1/2-inch (13 mm) shank. Design truck assembly to withstand same reaction load as track assembly.

4. Gate Hangers, Latches, Brackets, Guide Assemblies, and Stops: Malleable iron or steel, galvanized after fabrication. Provide positive latch for padlocking. Fittings do not receive Polymer coating.

5. Bottom Guide Wheel Assemblies: Two 4-inch (100 mm) diameter rubber wheels, straddling bottom horizontal gate rail, to allow adjustments to maintain gate frame plumb and in proper alignment. One assembly attached to each guidepost. Bottom guide wheel assemblies do not receive polymer coating.

D. Gate Posts: Square sections of 4 inch (100mm) hot-dipped galvanized steel to ASTM A500, Grade B with a minimum yield strength of 40,000 psi (275 MPa), weighing 7.04 lb/ft (10.8 kg/m), and with minimum 1.8 oz/sq.ft. (549 g/m²) zinc coating to ASTM F1234. Length of gate posts minimum 36 inches (914mm) more than the actual height of the fence for installation in the ground to meet local frost line requirements.

1. Single Slide Gate: 1 latch post and 2 support posts.

2. Double Slide Gates: 1 latch post and 4 support posts for double slide gates.

2.12 GATE OPERATORS

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- A. System Description: Factory-assembled automatic gate operation system comprised of UL approved components, designed for gate size, type, weight, construction, use, traffic-flow patterns, and operation frequency. Provide with minimum two keys per lock and the following:
1. Operator System: of size, capacity, and with features, characteristics, and accessories suitable for Project conditions, as recommended and provided by gate manufacturer. Complete with electric motor and factory-prewired motor controls, remote-control stations, control devices, power disconnect switch, obstruction detection device, and wiring from motor controls to motor.
 2. Coordinate operator wiring requirements and electrical characteristics with building electrical system.
 3. Control Equipment: Comply with NEMA ICS 1, NEMA ICS 2, NEMA ICS 6, and NFPA 70, Class 2 control circuit, maximum 24-V ac or dc.
 4. Electrohydraulic Operation: Provide unit designed for mounting as shown on the drawings; consisting of electric motor, pump, hydraulic actuator to suit gate type, valves.
 5. Enclosure: Lockable weatherproof enclosures to protect controls, operating parts, and accessories. Include corrosion-resistant factory finish to match gates.
 6. Operator shall allow motor to be removed without disturbing limit-switch adjustment and without affecting auxiliary emergency operator.
 7. Units are designed and wired for both right-hand and left-hand opening, permitting universal installation.
- B. Electrohydraulic Operation: Provide unit designed for mounting as shown on the drawings; consisting of electric motor, pump, hydraulic actuator to suit gate type, valves.
- C. Electromechanical Operation: Provide unit designed for mounting as shown on the drawings; consisting of electric motor and factory-prewired motor controls, starter, speed control device, chain-drive assembly, brake, clutch or torque limiter, and as follows:
1. Enclosed worm gear reducer, roller chain drive.
 2. Enclosed worm gear and chain and sprocket reducers, roller chain drive.
 3. V-belt and worm gear reducers, roller chain drive.
 4. V-belt and chain and sprocket reducers, roller chain drive.

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5. Enclosed worm gear reducer, wheel and rail drive.

D. Operation Cycle Requirements: Design gate operator to operate for not less than the following duty and cycles per hour. One cycle equals one gate opening plus one gate closing.

1. Medium Duty: 10 cycles per hour.

2. Heavy Duty: 25 cycles per hour.

3. Peak Duty: 20 cycles per hour at peak periods.

4. Custom: ____ cycles per hour.

5. Custom: ____ cycles per day.

E. Gate Operation Speed:

1. Minimum 45 fpm (0.229 m/s).

2. Minimum 60 fpm (0.305 m/s).

3. Minimum ____ fpm (____ m/s).

F. Electric Motors: High-starting torque, continuous-duty, insulated electric motors, complying with NEMA MG 1, sized to start and operate size and weight of gate considering Project's service conditions without exceeding nameplate ratings or considering service factor.

1. Direction: Reversible.

2. Direction: Single direction.

3. Service Factor: According to NEMA MG 1, unless otherwise indicated.

4. Enclosure: Totally enclosed, non-ventilated or fan-cooled motors, fitted with plugged drain, unless otherwise indicated.

5. Thermal Protection: Internal manual reset.

6. Thermal Protection: Internal automatic reset.

7. Motors Smaller Than 1/2 hp: Single phase, 60 Hz.

8. Motors Smaller Than 1/2 hp: Polyphase, 60 Hz.

9. Motors 1/2 hp and Larger: Polyphase, ____ voltage rating, 60 Hz.

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10. Motor horsepower as recommended by operator manufacturer.

11. Motor horsepower as indicated on Drawings.

12. Motor horsepower: _____.

G. Limit Switches: Adjustable switches, interlocked with motor controls and set to automatically stop gate at fully retracted and fully extended positions.

H. Emergency Release Mechanism: Quick disconnect release of operator drive system of the following type of mechanism, permitting manual operation if operator fails. Design system so control circuit power is disconnected during manual operation.

1. Integral fail-safe release, allowing gate to be pushed open without mechanical devices, keys, cranks, or special knowledge.

2. Mechanical device, key, or crank-activated release.

I. Operating Features: Include the following:

1. Digital Microprocessor Control: Electronic programmable means for setting, changing, and adjusting control features.

a. Provide unit that is isolated from voltage spikes and surges.

b. Provide unit capable of monitoring and auditing gate activity.

2. Fully Systems Compatible: With controlling circuit board capable of accepting any type of input from external devices.

3. Master/Slave Capability: Control stations designed and wired for gate pair operation.

4. Automatic Closing Timer: With adjustable time delay before closing.

a. Provide unit with timer cut-off switch.

5. Open Override Circuit: Designed to override closing commands.

6. Reversal Time Delay: Designed to protect gate system from shock load on reversal in both directions.

7. Maximum Run Timer: Designed to prevent damage to gate system by shutting down system if normal time to open gate is exceeded.

8. Clock Timer: 24-hour, programmable for regular events.

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9. Clock Timer: Seven-day, programmable for regular events.

2.13 REMOTE CONTROLS

- A. Electric controls separated from gate and motor and drive mechanism, with NEMA ICS 6, Type 1, NEMA ICS 6, Type 4, or other type of enclosure approved by the local jurisdiction, for mounting as shown on the drawings, and with space for additional optional equipment.:
- B. Keyed Control Station:
 - 1. Two-position, switch-operated control station located remotely from gate, with on and off functions. Minimum two-keys per station.
 - 2. Three-position, switch-operated control station with open and close functions and spring return to off position. Minimum two-keys per station.
 - 3. Three-position, switch-operated control station with open and close functions and spring return to off position with stop button. Minimum two-keys per station.
- C. Momentary-Contact Control Station:
 - 1. Single-button-operated control station with open and close functions.
 - 2. Three-button-operated control station with open, close, and stop positions.
 - 3. Three-button-operated control station with open, close, and stop positions, and with key switch to lock out open and close buttons. Minimum two-keys per station.
- D. Card Readers: Functions only when authorized card is presented. Provide insertion-reader-type, face-lighted unit fully visible at night and the following:
 - 1. Magnetically coded, single-code system activated by coded card.
 - 2. Magnetically coded, single-code system activated by coded card and permitting four different access time periods.
 - 3. Programmable, multiple-code capability permitting validating or voiding of individual cards.
 - 4. Programmable, multiple-code capability permitting validating or voiding of individual cards and permitting four different access time periods.
- 5. Reader Type:

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- a. Touch plate.
- b. Swipe.
- c. Insertion.
- d. Proximity.
- 6. Timed anti-passback.
- 7. Limited time usage.
- 8. Capable of monitoring and auditing gate activity.
- E. Digital Keypad Entry Unit: Functions only when authorized code is entered.
 - 1. Multiple-code capability of not less than 5 possible individual codes.
 - 2. Multiple-code capability of not less than 100 possible individual codes.
 - 3. Multiple-code capability of not less than 500 possible individual codes.
 - 4. Multiple-code capability of not less than 2,500 possible individual codes.
 - 5. Multiple-code capability of not less than 10,000 possible individual codes.
 - 6. Multiple-code capability as indicated.
 - 7. Programmable using 1 to 6 digits.
 - 8. Programmable using 1 to 6 digits and permitting up to four different access time periods.
 - 9. Face-lighted unit with metal-keyed keypad fully visible at night
 - 10. Face-lighted unit with keyless-membrane keypad fully visible at night.
 - 11. Timed anti-passback.
 - 12. Limited time usage.
 - 13. Capable of monitoring and auditing gate activity.
- F. Radio Control: Digital system consisting of code-compatible universal coaxial receiver, remote antenna with coaxial cable and mounting brackets, including:
 - 1. Provide one radio control per gate.

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2. Provide radio controls where indicated on Drawings.
3. Provide one permanently mounted transmitter per receiver.
4. Provide four portable transmitters per receiver.
5. Provide number of transmitters as recommended by the manufacturer for each condition.
6. Provide programmable transmitter with multiple-code capability permitting validating or voiding of not less than the following codes per channel:
 - a. 1000 codes per channel.
 - b. 10,000 codes per channel.
7. Button Transmitters:
 - a. Single-button-operated control station with open and close functions.
 - b. Three-button-operated control station with open, close, and stop positions.
 - c. Three-button-operated control station with open, close, and stop positions, and with key switch to lock out open and close buttons. Minimum two-keys per station.
 - d. Provide independent channels and settings to control various receiver and gate combinations as indicated.
- G. Telephone Entry System: Hands-free voice-communication system for connection to building telephone system with digital-entry code activation of gate operator, including:
 1. Auxiliary keypad entry.
 2. Residential System: Designed to be wired to same line with telephone.
 3. Multiunit System: Designed to be wired to a dedicated telephone line, and the following:
 - a. Capacity to access 20 telephones
 - b. Capacity to access 100 telephones
 - c. Include electronic directory.

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H. Vehicle Loop Detector System: Automatic closing timer with adjustable time delay before closing, electronic loop detector with detection patterns adjustable sensitivity and frequency settings, and panel indicator light designed to detect presence or transit of a vehicle over an embedded loop of wire and to emit a signal activating the gate operator. Provide number of loops consisting of multiple strands of wire, number of turns, loop size, and method of placement at location shown on Drawings, as recommended in writing by detection system manufacturer for function indicated. Provide with the following:

1. Timer cut-off switch.
2. Operation:
 - a. Designed to open and close gate.
 - b. Designed hold gate open until traffic clears.
 - c. Designed to reverse gate.
3. Loop:
 - a. Wire in size indicated for field assembly, and sealant.
 - b. Factory preformed in size indicated.
 - c. Installation Style:
 - d. Pave-over.
 - e. Saw-cut.

I. Vehicle Presence Detector: System with automatic closing timer and adjustable time delay before closing and presence detector, adjustable detection pattern and sensitivity zones, designed to detect the presence or transit of a vehicle in gate pathway by interrupting an infrared beam in zone pattern to emit a signal activating the gate operator, and the following:

1. Timer cut-off switch.
2. Operation:
 - a. Designed to open and close gate.
 - b. Designed hold gate open until traffic clears.
 - c. Designed to reverse gate.

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3. Detector Type:

- a. Retroreflective
- b. Emitter/receiver.

J. Obstruction Detection Devices: Provide each motorized gate with automatic safety sensors that cause operator to immediately function as follows:

1. Action: Reverse gate in both opening and closing cycles and hold until clear of obstruction.
2. Action: Stop gate in opening cycle and reverse gate in closing cycle and hold until clear of obstruction.
3. Internal Sensor: Built-in torque or current monitor senses gate is obstructed.
4. Sensor Edge: Contact-pressure-sensitive safety edge, profile, and sensitivity designed for type of gate and component indicated, in locations as follows. Connected to control circuit using the following:
 - a. Take-up cable reel.
 - b. Self-coiling cable.
 - c. Gate edge transmitter and operator receiver system.
 - d. Sensor edge location:
 - i. Along entire gate leaf leading edge.
 - ii. Along entire gate leaf trailing edge.
 - iii. Across entire gate leaf bottom edge.
 - iv. Along entire length of gate posts.
 - v. Along entire length of gate guideposts.
 - vi. Where indicated on Drawings.
5. Photoelectric/Infrared Sensor System: Designed to detect an obstruction in partition's path by interruption of an infrared beam in the zone pattern without obstruction contacting gate.

2.14 ACCESSORIES

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- A. Concrete Footing Mixture for In-Ground Installations: Unless otherwise specified in Division 03 Concrete, provide the following:
 - 1. Normal-weight concrete with not less than 3000 psi (20.7- Mpa) compressive strength (28 days);
 - 2. 3-inch (75-mm) slump and containing coarse aggregate of minimum diameter of 0.2 inches (5 mm) to maximum of 3/4 inch (20 mm);
 - 3. 5% to 7% air entrainment.
- B. Nonshrink, Nonmetallic Grout: Premixed, factory-packaged, nonstaining, noncorrosive, nongaseous grout complying with ASTM C1107. Provide grout, recommended in writing by manufacturer, for exterior applications.
- C. Erosion-Resistant Anchoring Cement: Factory-packaged, non-shrink, non-staining, hydraulic-controlled expansion cement formulation for mixing with potable water at Project site to create pourable anchoring, patching, and grouting compound. Provide formulation resistant to erosion from water exposure without needing protection by a sealer or waterproof coating and recommended in writing by manufacturer for exterior applications.
- D. Barbed Wire:
 - 1. Supporting Arms: Pressed steel arms attached to post support 3 rows of barbed wire. Arms withstand 250 lb. (113 kg) downward pull at outermost end of arm without failure.
 - 2. Barbed Wire: Zinc or aluminum coated steel wire to ASTM A121, double strand, 12 gauge, twisted line wire with 4 point barbs, spaced approximately 3 inches (75 mm) on center.
 - 3. Barbed Wire: Zinc or aluminum coated steel wire to ASTM A121, double strand, 12 gauge, twisted line wire with 4 point barbs, spaced approximately 5 inches (125 mm) on center.
- E. Mounting kit including pedestal.
- F. Audio Warning Module: ADA-compliant audible alarm sounding three to five seconds in advance of gate operation and continuing until gate stops moving.
- G. Visual Warning Module: ADA-compliant visible alarm sounding three to five seconds in advance of gate operation and continuing until gate stops moving.
 - 1. Alarm Light Type: Constant.

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2. Alarm Light Type: Strobe.

H. Battery Backup System: Battery-powered drive and access control system, independent of primary drive system, opening gate if power fails.

1. External electric-powered lock with delay timer allowing time for lock to release before gate operates. Provide with:

2. Solenoid for swing gate.

3. Magnetic for swing gate.

4. Solenoid for slide gate.

5. Magnetic for slide gate.

I. Fire box in accordance with local jurisdiction's requirements.

J. Postal box in accordance with local jurisdiction's requirements.

K. Fire strobe sensor.

L. Fire siren sensor.

M. Intercom system.

N. Instructional, Safety, and Warning Labels and Signs:

1. According to UL 325.

2. Manufacturer's standard for components and features specified.

3. As indicated on Drawings.

2.15 FINISHES

A. Zinc Coating:

1. Wire Mesh Coating: 0.5 oz./sq.ft. (150 g/m²) zinc in conformity with ASTM A 641 (1989) Class 1.

2. Fence Posts and Gate Frames Coating: Zinc coated (galvalume process) with a minimum of 0.9 oz/sq.ft. (275 g/m²) as per ASTM A653 G90.

B. Polyester Coating: Polyester coating to be minimum 4 mils applied by an electrostatic method to cover all surfaces of the wire mesh and post sections. Coating shall be capable of withstanding requirements of the following tests:

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1. Mechanical Adhesion: ASTM D 3359 - Method B.
2. Shock Resistance: ASTM D 2794.
3. Salt Spray Testing: Minimum of 1,000 hours without red rust appearance, per ASTM B 117 (1990).
4. Humidity Resistance: ASTM D 2247, weather meter chamber.
5. Exposure to Ultraviolet Light: ASTM D1499, exposure of 1000 hours using apparatus Type E and 63 degreesC.

C. Polyester Surface Coating Colors:

1. Standard Coating: Black, RAL 9004.
2. Gloss Coating: Signal white, RAL 9003.
3. Gloss Coating: Silver grey, RAL 7001.
4. Gloss Coating: Basalt grey, RAL 7012.
5. Gloss Coating: Fir green, RAL 6009.
6. Gloss Coating: Chocolate brown, RAL 8017.
7. Gloss Coating: Signal red, RAL 3001.
8. Textured Coating: Signal yellow, RAL 1003.
9. Textured Coating: Taupe brown.
10. Textured Coating: Sapphire blue, RAL 5003.
11. Metallic Coating: Silver.
12. Metallic Coating: Silver vein.
13. Metallic Coating: Copper vein.
14. Custom Coating: [_____] [Match RAL ____].

PART 3 EXECUTION

3.1 EXAMINATION

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A. Examine areas and conditions, with Installer present, for compliance with requirements for site clearing, earthwork, pavement work, and other conditions affecting performance.

1. Do not begin installation before final grading is completed, unless otherwise permitted by Architect.

2. Provide a verified survey of property lines and legal boundaries.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Stake locations of fence lines, gates, and terminal posts. Do not exceed intervals of 500 feet (152.5 m) or line of sight between stakes.

B. Indicate locations of utilities, lawn sprinkler system, underground structures, benchmarks, and property monuments marked by registered surveyor and utility companies.

3.3 FENCE POST LAYOUT

A. Layout fencing on established boundaries inside property line.

B. Terminal Posts Layout: Locate terminal end, corner, and gate posts at changes in horizontal or vertical alignment of:

1. 15 degrees or more.

2. 30 degrees or more.

3. As indicated on Drawings.

4. _____

C. Post spacing for 2-inch (50 mm) posts:

1. Architectural panel 97-3/4-inch (2483 mm) center to center with an adjustment of plus or minus 1-1/2 in. (38 mm).

2. Elite & Secur panel 103-7/8-inch (2638 mm) center to center with an adjustment of plus or minus 1-1/2 in. (38 mm).

3. ECO Architectural panel 95-9/16-inch (2427 mm) center to center with an adjustment of plus or minus 1-1/2 in. (38 mm).

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4. OMEGA 10-20 panels fence 80-3/4-inch (2051 mm) center to center with a adjustment of plus or minus 5/16 in. (8 mm).

5. OMEGA 80-100 panels 67-inch (1701 mm) center to center with an adjustment of plus or minus 5/16 in. (8 mm).

D. Post spacing for 3-inch (75 mm) posts:

1. Architectural panel 98-3/4-inch (2508 mm) center to center with an adjustment of plus or minus 1-1/2 in. (38 mm).

2. Elite & Secur panel 104-7/8-inch (2664 mm) center to center with an adjustment of plus or minus 1-1/2 in. (38 mm).

3. ECO Architectural panel 95-9/16-inch (2427 mm) center to center with an adjustment of plus or minus 1-1/2 in. (38 mm).

4. OMEGA 10-20 panels fence 81-3/4-inch (2076 mm) center to center with a adjustment of plus or minus 5/16 in. (8 mm).

5. OMEGA 80-100 panels 68-inch (1726 mm) center to center with an adjustment of plus or minus 5/16 in. (8 mm).

E. For Evolution 4 and 6-foot-high panel installation; Space line posts equal distant 10 feet (3050 mm) maximum center to center.

F. For Evolution 8-foot-high panel installation; Space line posts equal distance 8 feet (2430 mm) maximum center to center.

G. Sloped Fences:

1. Step fence sections in accordance with the manufacturer's instructions.

2. Unless otherwise shown on the drawings, align a new post at each step for a clean line.

3. Slide universal brackets on posts to desired height, always installing flush with horizontal wire (no gap).

4. For steep slopes, provide longer posts and panels cut in half or panels in special shapes to keep gaps under panels to a minimum.

3.4 IN-GROUND CONCRETE INSTALLATION

A. Drill or hand-excavate holes for posts to spacing indicated, in firm, undisturbed or compacted soil.

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- B. Dig holes with a diameter 4 times the diameter of the post and 6 inches (150 mm) deeper than the bottom of the post.
 - 1. Minimum 8 inch (200 mm) in diameter and 42 inch (1070 mm) in depth.
- C. Concrete forms are not necessary or recommended. Crown concrete at top to shed water.
- D. Measure, batch, and mix project-site-mixed concrete according to ASTM C 94. Pour concrete and let cure in accordance with ACI 301 and Division 03 Section "Cast-in-Place Concrete".
- E. Exposed Concrete Footings: Extend concrete 2 inches (50 mm) above grade, or as indicated on Drawings, smooth, and shape to shed water.
- F. Concealed Concrete Footings: Stop footings 2 inches (50 mm) below grade or as indicated on Drawings to allow covering with surface material.
- G. Post Setting: Set posts in concrete footing. Protect portion of posts above ground from concrete splatter. Place concrete around posts and consolidation. Using mechanical devices to set posts is not permitted. Verify that posts are set plumb, aligned, and at correct height and spacing, and hold in position during placement and finishing operations until concrete is sufficiently cured.
- H. Posts Set into Concrete in Sleeves: Use steel pipe sleeves preset and anchored into concrete for installing posts. After posts have been inserted into sleeves, fill annular space between post and sleeve with non-shrink, non-metallic grout, or anchoring cement, mixed and placed to comply with anchoring material manufacturer's written instructions, and finished sloped to drain water away from post.
- I. Posts Set into Concrete in Voids: Form or core drill holes not less than 5 inches (125 mm) deep and 3/4 inch (20 mm) larger than outside diameter of post. Clean holes of loose material, insert posts, and fill granular space between post and concrete with non-shrink, non-metallic grout or anchoring cement, mixed and placed to comply with anchoring material manufacturer's written instructions, and finished sloped to drain water away from post.

3.5 SURFACE MOUNTED FLANGE INSTALLATION

- A. Flange Post Installation: Bolt mounting plates attached to each post to slab or structure as indicated, using expansion bolts in accordance with the manufacturer's instructions.

3.6 PANEL INSTALLATION

- A. Once the post installation is complete, install the mesh sections with the Universal Bracket kits, flush with horizontal wire of the panel (no gap).

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- B. Attach the panels to the posts with eye-U-bracket and tie wire or twist tie. Where two panels meet and no post is set, join them with end-to-end connectors used for panel to panel linkage. Do not exceed manufacturers recommended spacing. Attach panel to corner posts with bands spaced maximum of 24 inches (2610 mm) on center.
- C. Panel Installation: Installed a minimum of 1-1/4 inch (30 mm) and maximum of 2 inches (50 mm) above the ground surface.
 - 1. Install vertical wire extensions pointing up for security.
 - 2. Install vertical wire extensions pointing down for safety.
- D. Upon cutting or trimming, a post or a wire mesh section, apply a zinc rich primer to the exposed ends and finish with matching touch-up paint supplied by the manufacturer.
- E. Barbed wire: Uniformly space parallel rows of barbed wire on security side of fence. Pull wire taut and attach to each extension arm. The extension arm is fastened to the post.

3.7 GATE OPERATOR INSTALLATION

- A. General: Install gate operators according to manufacturer's written instructions, aligned and true to fence line and grade.
- B. Excavation for Supports: Hand-excavate holes for bases, in firm, undisturbed or compacted soil to dimensions and depths and at locations as required by gate operator component manufacturer's written instructions and as indicated on Drawings.
- C. Concrete Bases: Cast-in-place or precast concrete, made of not less than 3000 psi (20.7-Mpa) compressive strength (28 days), depth not less than 12 inches (300 mm) below frost line or detail on Drawings, dimensioned and reinforced according to gate operator component manufacturer's written instructions and as indicated on Drawings.
- D. Vehicle Loop Detector System Installation:
 - 1. Cut grooves in pavement to bury and seal wire loop according to manufacturer's written instructions.
 - 2. Connect to equipment operated by detector.
 - 3. Comply with NFPA 70 and manufacturer's written instructions for grounding of electric-powered motors, controls, and other devices.

3.8 GATE INSTALLATION AND ADJUSTMENT

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- A. Install gate posts in accordance with manufacturer's instructions.
- B. Concrete Set Gate Posts:
 - 1. Drill holes in firm, undisturbed or compacted soil.
 - 2. Holes shall have a diameter 4 times greater than outside dimension of post, and depths at least 6 inches (150 mm) deeper than frost level.
 - 3. Set post bottom 36 inches (914 mm) below surface when in firm, undisturbed soil.
 - 4. Excavate and set posts deeper where required for adequate support in soft and loose soils, and for posts with heavy lateral loads.
 - 5. Place concrete around posts in a continuous pour, tamp for consolidation.
 - 6. Trowel finish around gate posts and slope to direct water away.
 - 7. Check each post for vertical and top alignment and maintain in position during placement and finishing operations.
- C. Install gates perfectly horizontal and levelled (at junction), plumb, and secure for full opening without interference.
- D. Attach hardware with nuts inside the property making the assembly tamper-proof to prevent unauthorized removal. Install ground-set items in concrete for anchorage.
- E. Adjust hardware for smooth operation and lubricate where necessary to operate smoothly, easily, and quietly, free from binding, warp, excessive deflection, distortion, nonalignment, misplacement, disruption, or malfunction, throughout entire operational range. Confirm that latches and locks engage accurately and securely without forcing or binding.

3.9 GROUNDING AND BONDING

- A. Unless otherwise indicated in Division 26 Electrical, or grounding resistance is unusually high, provide the following.
- B. Fence Grounding: Maximum intervals of 1500 feet (450 m).
- C. Fences within 100 feet (30 m) of Buildings, Structures, Walkways, and Roadways: Ground at maximum intervals of 750 feet (225 m).
- D. Gates and Other Fence Openings: Ground fence on each side of opening.
 - 1. Bond metal gates to gate posts.

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2. Bond across openings, with and without gates, except openings indicated as intentional fence discontinuities.
 3. Use No. 2 AWG wire and bury it at least 18 inches (460 mm) below finished grade.
- E. Conductors: Bare, solid wire for No. 6 AWG and smaller; stranded wire for No. 4 AWG and larger.
- F. Material Above Finished Grade: Copper.
- G. Material Above Finished Grade: Aluminum.
- H. Material On or Below Finished Grade: Copper.
- I. 3 Bonding Jumpers: Braided copper tape, 1 inch (25 mm) wide, woven of No. 30 AWG bare copper wire, terminated with copper ferrules.
- J. Connectors and Ground Rods: Listed in UL 467.
- K. Connectors for Below-Grade Use: Exothermic welded type.
- L. Ground Rods: Copper-clad steel, sized 5/8 x 96 inches (16 by 2400 mm).
- M. Protection at Crossings of Overhead Electrical Power Lines: Ground fence at location of crossing and at a maximum distance of 150 feet (45 m) on each side of crossing.
- N. Fences Enclosing Electrical Power Distribution Equipment: Ground as required by IEEE C2, unless otherwise indicated.
- O. Grounding Method: At each grounding location, drive a ground rod vertically until the top is 6 in. (150 mm) below finished grade. Connect rod to fence with No. 6 AWG conductor. Connect conductor to each fence component at the grounding location.
- P. Bonding Method for Gates: Connect bonding jumper between gate post and gate frame.
- Q. Connections: Make connections so possibility of galvanic action or electrolysis is minimized. Select connectors, connection hardware, conductors, and connection methods so metals in direct contact will be galvanically compatible.
1. Use electroplated or hot-tin-coated materials to ensure high conductivity to make contact points closer in order of galvanic series.
 2. Make connections with clean, bare metal at points of contact.
 3. Make aluminum-to-steel connections with stainless-steel separators and mechanical clamps.

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- 4. Make aluminum-to-galvanized-steel connections with tin-plated copper jumpers and mechanical clamps.
- 5. Coat and seal connections having dissimilar metals with inert material to prevent future penetration of moisture to contact surfaces.
- R. Bonding to Lightning Protection System: If fence terminates at lightning-protected building or structure, ground the fence and bond the fence grounding conductor to lightning protection down conductor or lightning protection grounding conductor complying with NFPA 780

3.10 FIELD QUALITY CONTROL- GROUNDING

- A. Ground-Resistance Testing Agency: Contractor shall engage a qualified independent testing agency to perform field quality-control testing.
- B. Ground-Resistance Testing Agency: Owner will engage a qualified independent testing agency to perform field quality-control testing.
- C. Ground-Resistance Tests: Subject completed grounding system to a megger test at each grounding location. Measure ground resistance not less than two full days after last trace of precipitation, without soil having been moistened by any means other than natural drainage or seepage and without chemical treatment or other artificial means of reducing natural ground resistance. Perform tests by two-point method according to IEEE 81.
- D. Desired Maximum Grounding Resistance Value: 25 ohms.
- E. Excessive Ground Resistance: If resistance to ground exceeds desired value, notify Architect promptly. Include recommendations to reduce ground resistance and proposal to accomplish recommended work.
- F. Report: Prepare test reports, certified by testing agency, of ground resistance at each test location. Include observations of weather and other phenomena that may affect test results.

3.11 GATE OPERATOR ADJUSTING

- A. Gate: Adjust gate to operate smoothly, easily, and quietly, free from binding, warp, excessive deflection, distortion, nonalignment, misplacement, disruption, or malfunction, throughout entire operational range. Confirm that latches and locks engage accurately and securely without forcing or binding.
- B. Automatic Gate Operator: Energize circuits to electrical equipment and devices. Adjust operators, controls, safety devices, alarms, and limit switches.

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1. Electrohydraulic Operator: Purge operating system, adjust pressure and fluid levels, and check for leaks.
2. Operational Test: After electrical circuitry has been energized, start units to confirm proper motor rotation and unit operation. Perform tests to confirm that operation meets desired function. Remove damaged and malfunctioning units, replace with new units, and retest.
 - a. Lubricate moving parts.

3.12 GATE OPERATOR DEMONSTRATION

- A. Engage a factory-authorized service representative to train Owner's personnel to adjust, operate, and maintain gates.
 1. Test and adjust operators, controls, devices and operating hardware. Replace damaged or malfunctioning operable components.
 2. Train Owner's personnel on procedures and schedules for starting and stopping, troubleshooting, servicing, and maintaining equipment and schedules.
 3. Review data in maintenance manuals. Refer to Division 1. For demonstration and documentation requirements.
- B. Schedule training with Owner with at least 7 days' notice.

3.13 PROTECTION

- A. Protect installed products until completion of project.
- B. Touch-up, repair or replace damaged products before Substantial Completion.

END OF SECTION

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Fence framework, fabric, and accessories
 - 1. Pedestrian and vehicle gates
 - 2. Concrete
 - 3. Electrical grounding

1.2 CONTRACTOR PERFORMED WORK

- A. Layout fence lines, gates, and terminal posts with suitable stakes (at intervals not exceeding 500 feet or line of sight).
- B. Layout USC&G benchmarks, property monuments, and other underground structures with suitable stakes.
- C. Obtain excavation/soil disturbance permit for Subcontractor.
- D. Furnish signs for Subcontractor to install on fence. See Part 3.

1.3 ACTION SUBMITTALS

- A. Submit the following:
 - 1. Catalog data on fabric, posts, accessories, fittings, and hardware.
 - 2. Two legible copies of batch tickets for each load of concrete to the Owner's Representative.

1.4 DELIVERY, STORAGE, AND HANDLING

- A. Deliver, store, and handle structural steel without damaging finish.
- B. Deliver manufactured materials in original unopened packages, containers, or bundles with manufacturer's label intact and legible.
- C. Store materials off ground, under cover, and away from damp surfaces.
- D. Remove damaged unlabeled or unsatisfactory materials that do not meet this specification from the job site.

1.5 QUALITY ASSURANCE

SECTION 323132 – WOOD COMPOSIT FENCES AND GATES**Government of the Virgin Islands, Department of Public Works****PROJECT NAME****Project Location, U.S. Virgin Islands**

A. Comply with the following unless otherwise noted.

| Federal Specification RR-F (http://www.dtic.mil/dtic/search/tr/) | |
|--|-------------------------|
| 191K | General Specification |
| 191/1D | Fabric |
| 191/2D | Gates |
| 191/3D | Posts, Rails and Braces |
| 191/4D | Accessories |

| ASTM International | |
|---------------------------|-----------------------|
| ASTM F-552 | Definition of Terms |
| ASTM F-567 | Installation |
| ASTM F-626 | Fence Fittings |
| ASTM F-669 | Strength Requirements |
| ASTM F-900 | Gate Construction |
| ASTM F-1083 | Steel Pipe for Fence |
| ASTM F-1910 | Long Barbed Tape |

PART 2 PRODUCTS

2.1 MATERIALS

- A. Fabric: ASTM A392, Class 1, zinc coated (1.2 ounces), steel wire/fabric, 2-inch mesh size on a side, 9 American Wire Gauge (AWG) (0.148 inches) coated wire size, galvanized before weaving, with twisted barbed selvages top and bottom.
- B. Posts, Rails & Braces: ASTM F1083 galvanized steel pipe.
- C. Galvanizing: ASTM A123, unless otherwise indicated, provide hot-dipped, zinc-coated accessories of ferrous material with weight of zinc coating not less than 1.2 ounces per square foot.
- D. Barbed Wire: ASTM A121 metallic coated steel, Type Z zinc coating strand wire, 12-1/2 AWG (0.099 inches) steel wire, 4 barb points, 14 AWG (0.080 inches) spaced on 5-inch centers.
- E. Barbed tape: 430 stainless steel, 0.025 inches thick by minimum 1-inch wide prior to forming, 18-inch diameter single helical coil, die stamped to produce a cluster of 4 barbed points at maximum 4 inches on center, cold rolled around a galvanized steel core wire. Aluminum ties not acceptable.
- F. Fence Fittings: ASTM F626, Standard Specification for Fence Fittings, type and components as noted.

2.2 BASIC FENCE SYSTEM COMPONENTS

- A. Terminal Posts (angles, corners, ends, and pull posts): 2-1/2-inch Schedule 40 for fence height up to 8 feet and 3 inch Schedule 40 for fence height over 8 feet and equal to or under 16 feet.
- B. Line Posts: 2-inch Schedule 40 for fabric height up to 8 feet, 2-1/2-inch Schedule 40 for fabric height over 8 feet and equal to or under 16 feet.
- C. Braces at Terminal or Gateposts: 1-1/4-inch Schedule 40.
- D. Tension Rods: 3/8-inch diameter galvanized steel with turnbuckle end-fitting-type tighteners.
- E. Tension Wire: 7- AWG coil spring, hard tempered carbon steel wire.
- F. Tension Bars: 3/4 x 3/16-inch-thick galvanized steel. Minimum length shall be 2 inches less than the full fabric height.
- G. Tension Bands: Minimum 3/4 x 0.074 inch () galvanized steel offset bands.

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- H. Brace Bands: Minimum 3/4 x 0.105 inch () thick galvanized steel.
- I. Brace Ends: Cupped fittings of formed steel or cast iron with ears for attaching horizontal braces to brace bands and for connecting diagonal tension rods.
- J. Wire Ties: Galvanized, steel 9 AWG with a diameter of 0.148 inches.
- K. Post Caps: Formed steel, malleable cast iron, or aluminum, sized to post diameter, with set screw retainer.
- L. Hog Rings: Minimum 12 AWG galvanized steel
- M. Barbed Wire Extension Arms: Galvanized pressed steel, type as specified.
- N. Gate Posts:
 - 1. Gate leaf-widths up to 6 feet: 2-1/2-inch Schedule 40.
 - 2. Gate leaf-widths up to 12 feet: 3-1/2-inch Schedule 40.
 - 3. Gate leaf-widths up to 18 feet: 6-inch Schedule 40.
 - 4. Gate leaf-widths up to 23 feet: 8-inch Schedule 40.
- O. Gate Frames:
 - 1. Gate leaf-widths less than 10 feet: 1-1/2-inch Schedule 40.
 - 2. Gate leaf-widths 10 feet to 16 feet: 2-inch Schedule 40.
 - 3. Gate leaf-widths greater than 16 feet: 2-inch Schedule 80.
 - 4. Diagonal tension rods for leaf-widths over 6 feet.
 - 5. For gate leaves greater than 8 feet in any direction, provide intermediate braces placed symmetrically so that frame members, including bracing, are spaced not further than 8 feet. Provide braces same size as those called out for fence.
- P. Provide non-lift-off type gate hinges sized for gate of adequate strength with large rearing surface for clamping in position so that hinges do not easily twist or turn with gate action.

2.3 FENCE GROUNDING

- A. Grounding Cable: No. 4/0 AWG bare, stranded, soft temper copper cable conforming to ASTM B8, Standard Specification for Concentric-Lay stranded Copper Conductors.

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- B. Flexible Braid: Tinned copper braid with tinned copper ferrules; minimum 250 ampere rating; 12-inch-minimum length. O-Z/Gedney Type FB.
- C. Cable to Pipe Clamps: NRTL (National Recognized Testing Laboratory) listed copper alloy connectors with silicon bronze hardware for making cable to pipe connections. O-Z/Gedney Type ABG 1-1/2 inch and smaller, Type CG 2 inch and larger pipe diameter.
- D. Flexible Braid to Pipe Clamps: NRTL listed copper alloy connectors with silicon bronze hardware for making braid or copper bar to pipe connections. O-Z/Gedney Type RG.

2.4 CONCRETE

- A. Concrete: Furnish concrete for posts and braces in accordance with Section 033046, *Cast-In-Place Concrete*.

PART 3 - EXECUTION

3.1 PREPARATION

- A. Notify Owner's Representative 15 working days prior to start of construction to identify known utilities and stake and flag locations.
- B. Before installing chain-line fence, perform site clearing and grading as noted on Drawings.
- C. Allow footing to cure minimum 7 days before installing fabric and other materials.

3.2 GENERAL REQUIREMENTS

- A. Coat damaged galvanized finish with zinc-enriched paint.
- B. Leave area of installation neat and free of debris caused by erection of fence.
- C. Posts, bracing, and other structural members shall be located on the inside of the security fence.
- D. Gate hardware installed in PA or higher security area that if removed would facilitate unauthorized entry must be installed in a manner to mitigate tampering and/or removal (e.g., by brazing, peening, or welding). Consult with LANL Physical Security.

3.3 LATCHES

- A. Single gates less than 10 feet wide may use forked type latches.

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- B. Provide single gates, 10 feet, or more, wide, and inactive leaves of double gates with positive latching devices at top, bottom and center of closing edges such as fork type latches with full gate height plunger bar or rod.
- C. At double gates, provide locking devices that retain both gate leaves in same plane when closed.
- D. Arrange plunger bars and rods so that they engage gate stops and cannot be raised when locked.
- E. Rigidly weld brackets for plunger bars holders to inactivate leaves.
- F. Arrange latching mechanisms at double gates so one padlock can lock both gate leaves at center latch integral to gate.
- G. Install keepers consisting of a mechanical device for securing free end of gate when in full open position.

3.4 POSTS

- A. Space line posts equidistant at intervals not exceeding 10 feet. Measure interval parallel to grade of proposed fence and in line of fence from center to center of post.
- B. Set terminal posts (end, corner, and gate) at beginning and end of each continuous length of fence and at abrupt changes in vertical and horizontal alignments.
- C. Set fence and gate posts in concrete in holes of diameter and depth as follows:
 - 1. Minimum Diameter: Four times outside diameter of post up to four inches and three times for larger outside diameters.
 - 2. Minimum Depth: 36 inches plus an additional 3 inches for each 1-foot increase in fence height over 4 feet.
- D. Post shall be centered in the concrete base within a +/- one-inch tolerance.
- E. Set fence posts in a vertical position, plumb within a one-half inch tolerance over height of fence in two planes, and in line. Backfill concrete into excavation and extend 2 inches above grade. An alternative method is to stop footing 4 inches below grade to allow for cover with sod, black top, or concrete slab. In either case, crown concrete at top to shed water and slope 2 inches away from post to ground with tolerance of +0 to -1 inch. Crown shall have a troweled finish and be free from surface contours that trap water.

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- F. When solid rock or concrete is encountered, without an overburden of soil, set posts in solid rock or concrete. Depth of hole shall be twelve times the largest cross section of posts. Diameter of hole shall be 6 inch greater than largest cross section of post.
- G. The use of sleeves in order to leave voids in new concrete construction is recommended.
- H. Half-fill the void with non-shrinkable hydraulic cement and force post to bottom of hole and plumb. Thoroughly work additional grout into hole so as to leave no voids. Crown grout to shed water.
- I. Provide tension offset bands fitted around terminal posts at maximum 15-inch intervals to attach tension bars to posts.
- J. Provide brace center band to secure brace ends and tension rods to post.
- K. Install post caps on all pipe post terminals: end, corner, and gate and all line posts that do not have barbed-wire extension arms.

3.5 FABRIC

- A. Place chain-link fabric on outside of the area enclosed. Posts, bracing, and other structural members shall be located on the inside of the fence.
- B. Place fabric by securing one end, applying sufficient tension to remove slack before making attachment elsewhere. Tighten fabric to provide smooth uniform appearance free from sag.
- C. Cut fabric by untwisting a picket and attach each span independently at terminal posts. Use stretcher bars with tension bands at maximum 15-inch intervals.
- D. Join rolls of wire fabric by weaving a single picket into ends of rolls to form continuous mesh.
- E. Provide continuous length tension bars equal to fence height and located wherever chain link fabric end attaches to terminal post. Thread bars through fabric ends for full height and attach to posts by tension bands.
- F. Install fence fabric 2 inches maximum above ground level. Ground level shall be defined as compacted ground or earth material or base course below the fence fabric. Compacted material shall extend three feet on each side of fence and along same contour as fence within +/-6 inches.

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- G. Fasten fence fabric with wire ties to top and bottom of line posts and at intervals not exceeding 15 inches. The final process of tightening the tie wire shall draw the fabric tightly to the post and top rail. Wire ties shall wrap a full 360 degrees around the post and engage a full diamond of the fence fabric. The two ends of the tie shall be twisted securely with three full twists, power twisting is subcontractor option. Ends shall be cut off to prevent untwisting by hand. Care shall be taken to assure ends of ties do not protrude beyond the vertical plane of the fabric.

3.6 BARBED WIRE

- A. Fencing: Top fencing with [3] strands of barbed wire on each extension arm. Provide [vertical extension arm outriggers] [single 45-degree extension arm] [double 45-degree extension arm]. Angle single extension arm away from security area or as directed by LANL Physical Security.
- B. Pull taut to remove sag, firmly install barbed wire in slots of extension arms, and secure to post or terminal arm.
- C. Gate: Install barbed wire strands at 6 inches on center between extended gate frame members above gate fabric.

3.7 BARBED TAPE

- A. Top fencing with barbed tape at loop spacing of 9 inches.
- B. Fencing: Provide 45-degree double extension arm with 2 strands of barbed wire in each extension arm. Pull wire taut to remove sag, and firmly install barbed wire in most inner and outer slot of extension arm. Attach barbed tape to barbed wire with hog rings.
- C. Gate: Provide one strand of barbed wire to top of extended gate frame and pull taut to remove sag. Secure barbed tape to barbed wire and top selvage of gate fabric with hog rings at each loop. Barbed tape loop spacing same as fence.

3.8 GATES

- A. Install gates true to opening and plumb in closed position within a vertical tolerance of one-half inch.
- B. Hang gates so that bottom of gate is as close to ground as practical (2 inches max.) while allowing sufficient clearance for free operation through at least 90 degree in one direction from closed position.

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- C. Fasten gate fabric to vertical (end) gate frame members using tension bars and bands as for fence fabric. Fasten fabric to top and bottom gate frame members and to intermediate braces with 11 AWG wire ties or clips at minimum spacing of 14 inches on center.
- D. Extend end frame members 18 inches vertically above top member of gate frame to support barbed wire.
- E. Provide tension rods as diagonal braces on gates and secure rods at gate corner only.
- F. Gates installed in PA or higher security area, gate hardware shall be installed in a manner to mitigate tampering and/or removal, e.g., by brazing, peening or welding to prevent removal with hand tools. Hinges shall be tamper proof and installed to prevent the gate from being lifted off.

3.9 TENSION WIRE AND RAIL

- A. Provide [top] and] bottom tension wire and stretch wire from end to end of each stretch of fence at height that will enable it to be fastened to the fabric.
- B. Stretch tension wire taut (not to exceed 6 inches sideway deflection) between terminal posts, securely fasten the tension wire to the terminal posts. Tension wire shall be within 2 inches of [top and] bottom of the fence fabric and secured to fabric with hog rings at 24 inches on center, secure with wire ties to every third line post minimum.
- C. Provide top rail and support at each post so that a continuous brace from end to end of each stretch of fence is formed. Fasten fabric to the top rail at intervals not exceeding 24 inches. Securely fasten top rail to terminal posts and join with sleeves or coupling to allow for expansion and contraction. The rail sleeve must be fabricated to prevent movement along the rail.

3.10 ELECTRICAL GROUNDING

- A. Bond gateposts on both sides of gate openings using direct buried grounding cable and cable to pipe clamps. Bond gateposts to gates using flexible braid and flexible braid to pipe clamps. Ground posts on both ends of gates; steel posts set in concrete will be considered as adequately grounded.
- B. Ground permanent metallic fences crossed by overhead power at every third post for a distance of 50 feet from the crossing; chain link fences with steel post set in concrete will be considered as adequately grounded.
- C. Ground metal fences surrounding substations and switching stations to station ground system in accordance with the National Electrical Safety Codes and IEEE Std. 80.

3.11 EXCAVATION, BACKFILL, AND COMPACTION

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- A. Refer to Section 31 2000, *Earth Moving*.

3.12 SIGN INSTALLATION (GFE)

- A. Install government furnished property signs or no trespassing signs in areas as indicated by the Owners Representative.
- B. Signs will generally be 24" x 24" or smaller and shall be attached to the wire fabric by the use of, as specified, hog rings.
- C. General sign locations will be located on all gates, 25 feet each side of gates, and at visible distances along the fence line, not to exceed 300 feet.

END OF SECTION

SECTION 328000 – IRRIGATION SYSTEMS

Government of the Virgin Islands, Department of Public Works

PROJECT NAME: Elaine I. Sprauve Library and Museum Building

Project Location: **St. John, U.S. Virgin Islands**

PART 1 GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General Conditions and Division 01 Specification Sections, apply to this Section.
- B. Specifications throughout all Divisions of the Project Manual are directly applicable to this Section, and this Section is directly applicable to them.

1.2 SUMMARY

- A. This Section specifies the requirements for providing the Irrigation System as indicated on the Drawings and/or electronic files such as .dwg, pdf, etc.
- B. Contractor shall provide Irrigation System as a complete system including but not limited to: heads, valves, valve boxes, control wire splice boxes, control wiring, electric controller, piping circuits, and all accessories, including electric power source coordination and installation.

1.3 QUALITY ASSURANCE

- A. Available Manufacturers - Subject to compliance with specified requirements, manufacturers offering products which may be incorporated in the work are included in the specifications or denoted on the Drawings, and/or electronic files such as .dwg, pdf, etc.
- B. Installation of Irrigation System shall be performed under the direction and supervision of a currently licensed State of Texas Irrigator with not less than 5 years of direct design and installation experience in this type of work.
- C. Reference Standards Applicable to this Section:
 - 1. ANSI: American National Standards Institute
 - a. Z55.1: Gray Finishes for Industrial Apparatus and Equipment
 - 2. ASTM: American Society for Testing and Materials
 - a. B88: Specifications for Seamless Copper water tube.
 - b. D 1785: Specifications for Poly Vinyl Chloride (PVC) Plastic Pipe, Schedules 40, 80, and 120.
 - c. D 2241: Specification for Poly Vinyl Chloride (PVC) Pressure-Rated Pipe (SDR Series)

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- d. D 2466: Specification for Poly Vinyl Chloride (PVC) Plastic Pipe Fittings, Schedule 80
 - e. D 2564: Specification for Solvent Cements for Poly Vinyl Chloride (PVC) Plastic Pipe and Fittings
 - f. F 690: Practice for Underground Installation of Thermoplastic Pressure Piping Irrigation Systems
3. AWWA: American Water Works Association
- a. C 500: Gate Valves, 3 inches through 48 inches NPS, for Water and Sewage Systems
 - b. C 506: Backflow Prevention Devices, Reduced Pressure Principle and Double Check Valve Types
4. ICC: International Code Council
- a. IBC: International Building Code
 - b. IPC: International Plumbing Code
5. NEMA: National Electrical Manufacturer's Assoc.
- a. 250: Enclosures for Electrical Equipment (1000 Volts Maximum)
6. NFPA: National Fire Protection Association
- a. NFPA 70 (NEC): National Electric Code
7. NSF: National Sanitation Foundation
- a. No. 14 - Plastic Piping System Components and Related Materials
8. Chapter 344 – Texas Water Code-Regulations governing irrigation
9. Chapter 290 – Texas Water Code-Regulations governing backflow installation and inspections
10. Chapter 37 Texas Water Code- Regulations governing irrigation licensing
11. Chapter 1903 Texas Water Code – Regulations governing irrigation licensing.

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- D. The contractor shall maintain a Record Drawing as prescribed by Section 01 78 39. This record or log shall include all changes and modifications to the original plan on a daily basis. Upon completion of the project, these changes contained in the Record Drawing shall be incorporated into the design, notes, etc on all of the designs, documents, etc, and will be provided to the Owner in the form of a completed Record Drawing.
- E. This record or log must be maintained on the job site during normal business hours.
- F. The Contractor shall provide a completed “As Built” Drawing to the Owner at the completion of the project. This Record Drawing shall be in the form of paper copy as well as a .DWG formatted CD.

1.4 SUBMITTALS

A. SYSTEM DESIGN

- 1. The Irrigation System design shall be a complete Irrigation System including but not limited to: heads, valves, valve boxes, control wire splice boxes, control wiring, electric controller, piping circuits, and all accessories, including electric power source coordination and installation. This design shall be scaled to a 1:20 scale. This design shall be provided to the Owner. This design shall be provided on paper following generally accepted industry standards utilizing a title block, page numbers, page descriptions, and all other pertinent data relating to the Irrigation System. The design shall include the following:
- 2. A hydraulic calculation for the *worst-case scenario* irrigation head in the *worst case* irrigation zone shall be provided. This calculation shall provide the “actual head pressure” for this identified sprinkler head and shall be representative for the system.
- 3. A hydraulic calculation showing the “design pressure” for the *worst-case scenario* irrigation head in the *worst case* irrigation zone shall be provided.
- 4. The licensed irrigator or Landscape Architect shall affix their seal over these hydraulic calculations.
- 5. The manufacturer’s recommended pressure for each product used shall be noted on the design and hydraulic section.
- 6. Location of Heads - Represent design location as accurately as possible. Make minor adjustments on site with approval of the irrigation designer or Landscape Architect as necessary to ensure consistent and even spacing where applicable. The goal for the design is 100% coverage, head to head spacing, and matched precipitation rate (MPR) application. Set all heads minimum 4” from back of curb and 4" from edge of concrete walls.

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7. The design shall utilize a “center fed” valve configuration and progressive pipe sizing of all irrigation lines. If appropriate, the use of a looped main is preferred. When a looped main is used, there shall be independent isolation valves at each leg of the looped main.
8. The Irrigation System design shall comply with a maximum velocity of 5 linear feet per second through the discharge piping of the Irrigation System.
9. The system shall have the landscape beds and turf on separate zones. Rotors and spray shall also be on different zones. If drip is used, it shall utilize pressure compensation, pressure regulation, and pressure filtration.
10. The design shall include a sheet(s) titled “Typical Exploded Views”. This sheet shall show detail of specific installation applications. All major component utilized on the project shall have a “Typical Exploded View”
11. A statement on the irrigation designer or Landscape Architect’s letterhead shall be included that indicates the irrigation design provided to the Owner is in 100% compliance with all prevailing city codes, ordinances, and the TCEQ standards, rules, and regulations. In addition, the document will contain the seal of either the licensed irrigator or the Landscape Architect.
12. Submit an ET (Evapotranspiration) based schedule indicating length of time each valve is to be open to produce a given amount of precipitation for the ET value of July. In addition, submit the recommended monthly adjustment rates in percentages for the ET of the other eleven months. Include any schedules deemed appropriate for any “watering windows” that may be imposed by the Authority Having Jurisdiction (AHJ) and/or requested by the Owner.

B. Product Data

1. Submit manufacturer's technical data, specifications, installation instructions and all shop drawings of the sprinkler heads, automatic valves, controllers, backflow preventers, connections, details, and related items to the Grounds and Landscape Department.
2. Submit the manufacturer’s operation instructions for all applicable irrigation components.
3. Submit maintenance instructions on all items requiring manufacturer's standard detail submittal.

C. Water Tap Connections

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4. All fees, permits, and costs associated with the installation of the landscape irrigation water meter(s) shall be the responsibility of the Contractor unless otherwise directed by the Owner. The Owner will be responsible for any deposits dictated by the AHJ.

D. Water

1. Potable water to be supplied by Owner. Contractor shall make provisions for all connections required.

E. Permits and Inspections

1. Copies of all required permits and inspections and their associated fees shall be part of this contract and are the responsibility of the Contractor. A copy of all inspections shall be forwarded to the University of Texas, MD Anderson Grounds and Landscape Department.

1.5 PRODUCT DELIVERY AND HANDLING

- A. Materials, where appropriate, shall be delivered in manufacturer's unopened packaging labeled to indicate manufacturer's name and product identification. Ensure that packaging and labeling remain intact until installation. Materials shall be stored protected from the elements, including direct sunlight.
- B. Pipes shall be handled to prevent being damaged and to maintain their straightness. Pipe ends shall be wrapped. Pipes shall be stored on beds the full length of the pipes. Damaged or dented pipes or fittings shall not be used.
- C. At no time will pipe joints other than swing joints; be accepted at lengths that are less than 20 feet in length.

1.6 EXTRA MATERIALS

- A. Refer to Section 01 78 46 for Maintenance Material Requirements.

1.7 DEFINITIONS

- A. Irrigation Main - Irrigation main is the piping from the water source(s) to control valves. Irrigation main is that pipe which is on the pressure side of irrigation control valves. This definition shall include looped mains and sub-looped mains.
- B. Irrigation Lateral Lines - Irrigation lateral line is the piping from the control valves to the irrigation heads. Lateral line is that pipe which is on the non-pressure side of irrigation control valves.

PART 2 PRODUCTS

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2.1 PIPES

- A. Markings - Thermoplastic pipes shall be marked in accordance with ASTM D 1785 and ASTM D 2241 as applicable and shall bear the NSF mark in accordance with NSF 14.
- B. Irrigation Main Pipe - ASTM D 2231, PVC, 1120 or 1220, Schedule 40. or Class 200.
- C. Irrigation Lateral Line Pipe
 - 1. Pipes 3/4-inch diameter and larger: ASTM D 2231, PVC, 1120 or 1220, SDR 21.0, 200 PSI
 - 2. Pipes 1/2-inch diameter: ASTM D 2241, PVC, 1120 or 1220, SDR 13.5, 315 PSI
- D. Copper Tubing - ASTM B 88, Type K

2.2 FITTINGS FOR SOLVENT WELDED JOINTS

- A. Schedule 40: ASTM D 2466
- B. Schedule 80: ASTM D 2467

2.3 SOLVENT CEMENT FOR SOLVENT WELDED JOINTS

- A. IPS Weld-On PVC Cement: IPS Corporation, 455 West Victoria Street, Compton, Ca 90220; 1-800-421-2677.
 - 1. Weld-On 700 for PVC pipe up to 4” and /or Weld-On 710 for PVC pipe up to 2”.
 - 2. In the event PVC pipe is greater than 4” then a Weld-On 704 series “medium” body shall be used.
- B. IPS Weld-On Primer: IPS Corporation, 455 West Victoria Street, Compton, Ca 90220; 1-800-421-2677.
 - 1. Weld-On P-68 or P-70 primer shall be used for surface preparation for all PVC pipe and fittings prior to cement applications.

2.4 FITTINGS FOR THREADED JOINTS

- A. ASTM D 2466, PVC, Schedule 80.

2.5 SEALANT FOR THREADED JOINTS UNDER CONSTANT PRESSURE

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- A. No liquid Teflon or “pipe dope” shall be used on any threaded electric irrigation control valve.
- B. A high-quality MIL-SPEC (MIL-T-27730) Teflon tape shall be used for threaded electric irrigation control valves.
- C. All other types of threaded joints under constant pressure may use RECTOR SEAL LIQUID TEFLON by Rector Seal Corp., 2830 Produce Row, Houston, Texas 77023, (713) 928-6423, or approved equal.

2.6 SLEEVES UNDER PAVING FOR CONTROL WIRE AND IRRIGATION LINES

- A. ASTM D 2466, PVC, Schedule 40, sized as shown on Drawings.
- B. In the event the sleeve is not shown on plan or an additional sleeve is to be installed, the sleeve shall be at a minimum two (2) pipe sizes larger than the pipe that is to be routed through the sleeve.
- C. For sleeves that are to be used specifically for control wires only, the sleeve shall be a 1-1/2” sleeve
- D. All sleeves shall extend a minimum of 12” beyond the obstacle that was sleeved.
- E. All sleeves shall be marked and located on the Record Drawings by one of the methods listed below:
 - 1. A minimum of two measurements from two known and fixed positions that terminate at the end of the sleeve.
 - 2. A GPS (Global Positioning System) fix in degrees, minutes, and seconds for the longitude and latitude location of the end of the sleeve.
- F. All sleeves shall have an identification marker installed in the concrete at the point where the sleeve is located. These markers shall be Berntsen Survey markers as provided by Berntsen International Inc., P.O. Box Madison, WI 53708-8670. Telephone number: 800-356-7388
 - 1. The markers shall be a 3 1/2” Aluminum domed concrete marker, part number C-35-D as per Berntsen International Inc.
 - 2. The markers shall have at the minimum, the following information stamped on them: MD Anderson. Irrigation Sleeve Sleeve Size in inches
 - 3. Marker layout shall be approved by MD Anderson, and Grounds and Landscape Department prior to placing final order for the markers.

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4. The markers shall be installed as per the manufacturer's specifications.

2.7 IRRIGATION SPRINKLER HEADS

A. All rotor and spray sprinkler heads and all landscape irrigation drip line shall be provided by Rain Bird, 6991 E. South point Road, Tucson, As, 85706. Telephone 520-741-6100 unless specifically authorized by MD Anderson, Grounds and Landscape Department.

B. Spray Heads

1. Spray heads shall be Rain Bird 1800 series sprinkler heads with the height as indicated on the design or design legend. Under no conditions will an 1802 series sprinkler head be installed.
2. The nozzles shall be from the "MPR" series unless otherwise indicated on the design.
3. All 1800 series sprinkler heads shall have filters installed.
4. SAM-PRS (Seal-A-Matic check valve and in-stem pressure regulation) sprinkler heads shall be installed on all projects where the turf area is adjoined by a pedestrian walk path. They are not required in areas other than low drainage or areas that are specifically called for in the design. All other areas will use the standard 1800's as specified.
5. If adjustments of radius are required on a specific design that reduces the radius of a given nozzle by more than 25%, then a Rain Bird PCS (Pressure Compensating Screen) with the appropriate color shall be installed.
6. All sprinklers shall be connected to irrigation lateral lines by "swing joints". These swing joints shall be constructed via flexible PVC with a street elbow on one end and a coupler on the other end. These constructed swing joints shall be solvent welded with "hot glue" and shall be constructed at least 24 hours prior to installation.
7. The nozzles on pop-up spray head body shall be as shown on Drawings and shall be capable of covering the radius as designated on Drawings.

C. Rotor Heads

1. Rotor heads shall be from the Rain Bird product line. When the site conditions permit, Rain Bird 5000 series rotor heads with MPR nozzles shall be used. When site conditions dictate larger diameter rotors, the designer shall utilize Matched Precipitation Rate design concepts in the nozzle selection.

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D. Drip Irrigation

1. Drip irrigation products shall be from the Rain Bird product line.
2. All use of drip irrigation that is incorporated into the design shall utilize the following items:
 - a. All drip applications shall utilize “Pressure Compensation” type products and a uniform regulated pressure.
 - b. All drip applications shall utilize a pressure regulator incorporated into the valve configuration.
 - c. All drip applications shall have air/vacuum relief valves and flush flow valves installed as per manufactures specifications.
 - d. All drip applications shall incorporate a Rain Bird Automatic Filter kit with each section of drip. The drain line from this filter shall be routed to either a drain approved by the Owner, or to an area where it can be discharged via an impact type head with a large nozzle. Under no circumstances shall the drain line be “day lighted”. The stainless-steel mesh screen shall be a 150-micron mesh. The valve configuration shall be sized according to the manufacturer’s specifications.
3. When site conditions permit, utilize the Rain Bird Landscape Drip line. The spacing standards shall be:
 - a. 12” spacing – sandy soil conditions
 - b. 18” spacing – loam soil conditions
 - c. 24” spacing – clay soil conditions
 - d. Design preference is for use of uniform rows, centers fed zones, and maximum spacing not exceeding the manufacturer’s specifications.
4. The drip shall be designed and installed as per the manufacturer’s recommendations.

2.8 ELECTRIC REMOTE-CONTROL VALVES

- A. Remote control irrigation zone valves shall be manufactured by Rain Bird, 6991 E. Southpoint Road, Tucson, Az, 85706. Telephone 520-741-6100. These valves will be Rain Bird PEB Normally Closed (N.C.) series valves with the size shown on the design.

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- B. A Normally Open (N.O.) *master* valve shall be used with the RainMaster DX2 controller. This master valve shall be as per RainMaster specification.

2.9 REMOTE CONTROL VALVE TAGS

- A. Remote control valve tags shall be plastic tags with plastic wire to attach numbered tag to valve.

2.10 VALVE BOX

- A. Valve boxes shall be heavy duty plastic 17 inch by 11-3/4 inch by 12-inch depth, black with black cover. Valve box shall be non-hinged, bolt type by Carson Industries, Inc., 1925 Street, LaVerne, CA 91750, (213) 732-6265, or approved equal.

2.11 CONTROL WIRE SPLICE BOXES

- A. Control wire splice boxes shall be heavy duty plastic 10-inch diameter by 10-1/4-inch-deep, black with black cover, No. 910-12B, by Carson Industries, Inc. or approved equal.

2.12 GRAVEL BACKFILL

- A. Gravel backfill for valve boxes and control wire splice boxes shall be 3/8-inch diameter pea gravel.

2.13 ELECTRIC CONTROLLER(S)

- A. Controllers shall be RainMaster DX2 Evolution by RainMaster Irrigation Systems, 3910-B Royal Avenue, Simi Valley, California 93063 (805)527-4498
 - 1. The DX2 Evolution controller shall be used on all projects unless otherwise specified by MD Anderson, Grounds and Landscape Department.
 - 2. The DX2 Controllers shall be housed in wall mounted Stainless Steel cabinets provided by RainMaster unless otherwise specified.
 - 3. In areas where a wall mount controller is not feasible a Stainless-Steel Pedestal mount controller will be used.
 - 4. All DX2 controllers shall have the lighting protection kit installed and shall be grounded and installed as per manufacturer's specifications.
 - 5. Coordinate with the Owner as to the communication source for the connectivity to the Central Control system.

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- a. Once the communications source is determined, the appropriate communications equipment shall be provided as specified under the “communications” specifications.
 6. The number of zones per each controller shall be determined by the irrigation designer or Landscape Architect based on site conditions, water sources, watering windows, and input from the Owner. All controllers specified shall have a capacity to add an additional two zones of irrigation to the number of zones needed without exceeding the controller’s capacity.
 7. Install the appropriately sized flow sensor as per Rainmaster installation specifications.
 8. A master valve shall be used in conjunction with the DX2 controller. The master valve shall be a normally open (N.O.) valve as specified by RainMaster.
- B. Equipment Associated with RainMaster Central Control
1. Master Valve
 - a. A master valve shall be installed on all Irrigation Systems that utilize a DX2 Controller unless otherwise specified by the Owner. The master valve shall be as specified by RainMaster.
 2. Flow Sensor
 - a. The flow sensor shall be a Rainmaster flow sensor sized as per the RainMaster specifications for the main line pipe size and flow.
 - b. A **DX-Flow** sensing circuit board will be required for flow sensors
 - c. Each flow sensor will require **EV-CAB-SEN** flow sensing cable. The maximum allowable distance is 2000’ linear feet.
 3. Communications
 - a. The appropriate type of communications equipment, including cards, wire, and devices shall be specified to correspond with each controller that is used. The Contractor shall coordinate with the Owner as to the connectivity of each device and the existing Central Control software.
 4. Rain Switch

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- a. A wireless rain switch by Hunter shall be installed as per manufacturer's specifications utilizing the normally open (N.O.) lead. A conventional hard wire switch will be used when wireless is not compatible. Coordinate with the RainMaster distributor to obtain the required interface kit- "DXCID-KIT".

2.14 IRRIGATION CONTROL WIRE

- A. Wire: Solid copper wire, NEC type UF, UL listed for direct burial in ground. Minimum size: No. 14 AWG. No. 12 UF for runs over 1000 LF.
- B. The wires for all irrigation control valves shall be red in color.
- C. The common wires for all irrigation control valves shall be white in color.
- D. Splicing Material shall be King Wire Connectors, Tan in color, by King Innovation, 3801 Lloyd King Drive, St. Charles, Mo 63304. A new King wire connector shall be used for every electrical connection
- E. An extra "transient" or spare wire shall be installed. This "transient" wire shall be yellow in color and will be labeled as spare in the controller.

2.15 BACKFLOW PREVENTER

- A. Backflow Preventers shall be bronze and copper, pressure vacuum breaker (PVB) assembly Febco model 765 or reduced pressure device (RPZ) model 825 YA by Febco Sales, Inc. (CMB Industries), P.O. Box 8070, Fresno, CA 93747, (209) 252-0791, or approved equal. Size as per Drawings.
- B. The backflow devices shall be installed in accordance with the manufacturer, TCEQ, and local codes and standards.
- C. The backflow device(s) shall be installed in an enclosure by StrongBox, V.I.T. Products, Inc., 800.729-1314.
 - 1. The enclosure shall be the "Smooth Touch Vandal Resistant Backflow Enclosure" model sized as per the backflow device. It shall be powder coated the standard dark green color.
 - 2. Each enclosure shall include a "PolarBearier" insulated blanket sized to fit the backflow device.

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3. Each enclosure shall be installed on Contractor built enclosure pad. The holes for the irrigation lines shall be large enough in diameter so as to accommodate foam insulation wrap around the irrigation pipe so as to protect against freeze and chafing. There shall be a drainage area so as to alleviate any standing water inside the enclosure.
 - a. The pad shall be adequately anchored and shall have the concrete sleeved where the irrigation lines protrude through the concrete.
 - b. The pad shall have pea gravel no larger than 3/8" diameter installed in the Contractor installed drainage hole in the bottom of the pad.
 - c. The pad shall have a mechanism installed that will allow the enclosure pad to lock the enclosure to the pad.
 - d. The Owner will provide padlocks to the Contractor. The Contractor shall ensure all enclosures are locked.
 - e. The pad shall be installed in locations as per the manufacturer's specifications in a location approved by M D Anderson, Grounds and Landscape Department.

2.16 GATE VALVES

- A. Gate Valves shall comply with AWWA C-500. Valves up to 3-inch size shall be 125-pound, bronze body, bronze-mounted, non-rising stem with solid wedge gates. The size shall correspond to the main line they are attached to.

2.17 QUICK COUPLING VALVES

- A. Quick coupling valves shall have heavy duty brass construction, durable thermoplastic rubber cover, stainless steel internal valve spring, two-piece body design. These valves shall be sized as 1".
- B. Provide four valve keys with 3/4-inch swivel hose ends.
- C. The Quick Coupling valves shall be installed as per the "typical exploded view" found on the detail sheets. The 1" size shall supersede any sizing that may be shown on an "exploded view".
- D. Coordinate location of the Quick Coupling valves with M D Anderson, Grounds and Landscape Department.

PART 3 EXECUTION

3.1 TRENCHING AND BACKFILLING

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- A. General - Contractor shall comply with Division 31 of these Specifications. Excavate straight and true with bottom uniformly sloped to low points. Protect existing lawns and plantings. Remove and replant as necessary to complete installation. Replace damaged lawn areas and plants with new products to restore to existing installation's original condition.
- B. Minimum Cover - Provide 18-inch minimum cover over top of installed irrigation main piping. Provide 12-inch minimum cover over top of installed irrigation lateral line piping. Provide 2 inches of earth between parallels and wire. Parallels shall be laid side-by-side, not stacked.
- C. Backfill - Backfill with clean material from excavation after obtaining Landscape Architect's approval. Remove organic material, as well as rocks and debris larger than 1 inch in diameter. Place acceptable backfill in 6-inch lifts and water jet all trenches.
- D. Existing Lawns - Where trenching is required across existing lawns, (or in event of changes or repairs after new lawn has been established), uniformly cut strips of sod 6 inches wider than trench. Remove sod in rolls of suitable size for handling and keep moistened until replanted.
 - 1. Backfill trench to within 6 inches of finished grade and compact. Continue fill with acceptable topsoil and compact to bring sod even with existing lawn.
 - 2. Replant sod within 2 days after removal, roll and water generously.
 - 3. Resod and restore to original condition all sod areas not in healthy condition equal to adjoining lawns 30 days after replanting.

3.2 INSTALLATION

- A. General - Unless otherwise indicated, Contractor shall comply with requirements of the governing International Plumbing Code and Chapter 344 of the Texas Water Code. Verify all applicable irrigation codes.
- B. Pipes
 - 1. Piping Mains and Laterals - Lay out sprinkler mainlines and perform line adjustments and site modifications to laterals prior to excavation. Lay pipe on solid subbase, uniformly sloped without humps or depressions.
 - 2. PVC Pipe Assembly
 - a. Cut PVC pipe, square and de-burr. Use PVC pipe cutter when possible. Clean pipe and fittings using primer as recommended by the PVC pipe manufacturer. Use purple tinted primer to aid in visual inspection.

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- b. Apply a thin even flow coat of PVC solvent cement to the pipe first, then the inside of the fitting. Utilize the appropriate size applicator and the correct temperature range of solvent weld material for the size of the pipe. Cure joints as recommended by the manufacturer and keep pipe and fitting out of service during curing period. Construct watertight joints equal or greater in strength than the pipe. Do not tap pipe at fittings.
3. Install plastic pipe in dry weather, when temperature is above 40 degrees F. and in accordance with manufacturer's written instructions. Allow joints to cure at least 24 hours at temperature above 40 degrees F. before testing.
4. Plastic pipe shall be snaked in the trenches in a manner to provide for expansion and contraction as recommended by pipe manufacturer.
- C. Sleeves Under Paving - The majority of sleeves under paving are existing as shown on Drawings. Where boring is required for new sleeves (refer to Drawings), it shall be a "wet bore." Install sleeves 12" beyond edge of pavement. Perform trench and backfill in accordance with these specifications.
- D. Irrigation Heads
 1. Flush irrigation lines with full head of water and install heads after hydrostatic test is completed.
 2. Install heads at manufacturer's recommended heights. Activate the zone valve and flush out the heads.
 3. Locate part-circle heads to maintain a minimum distance of 4 inches from walls and 4 inches from other boundaries, unless otherwise indicated.
 4. Check for uniformity of coverage and pattern correctness. Adjust for 100% coverage where required.
 5. Install nozzles as indicated on the design.
 6. Adjust arcs and radius at the stated manufacturer's pressure. Adjust the flow control valve until this pressure is obtained at the last head on each zone.
- E. Electric Remote-Control Valves
 1. Adjust automatic control valves to provide flow rate at rated operating pressure required for each irrigation section.
 2. Install valves in valve boxes, arranged for easy adjustment and removal. Locate valves to ensure ease of access for maintenance such that no physical interference with other elements of the project exists.

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3. Install a 3' expansion coil at each valve.

F. Remote Control Valve Tags - One Remote Control Valve Tag shall be attached to stem of each electric remote-control valve. Tags shall be numbered sequentially. Numbers shall correspond to station numbers and controller numbers. Provide tags and corresponding numbers for wires pulled for future valves.

G. Valve Boxes - Install valve boxes to cover electric remote-control valves. Top of valve box shall be flush with finished grade. Bury minimum 4 bricks under base of each box as support.

H. Control Wire Splice Boxes - Install control wire splice box to cover any splice in control wire. Top of valve box shall be flush with finished grade. Bury minimum 4 bricks under base of each box as support. Install control wire splice box to cover wires pulled for future valves.

I. Gravel Backfill - Backfill valve boxes and control wire splice boxes with gravel, minimum 6-inch depth.

J. Electric Controller

1. Controllers shall be fully grounded as per the manufacturer's specifications.

2. Connect remote control valves to controller in clockwise sequence to correspond with stations 1, 2, 3, successively.

3. Provide M D Anderson, Grounds and Landscape Department with a size reduced copy of the irrigation plan.

4. Provide two keys to Owner. Keys to be matched with existing controller key locking mechanisms.

5. Power to Controller & Locations: Locations shown on plan for controllers is approximate. Final location shall be determined on site by Owner. Contractor shall supply 120 VAC to controller from adjacent existing power sources. Follow local governing codes in electrical work.

6. Take an ohm reading on all irrigation electric control valves and spare wiring prior to connection to the controller. Note the ohms readings on the Record Drawing.

K. Irrigation Control Wires

1. Provide 24-volt system for control of automatic circuit-section valves of underground Irrigation System. Provide unit capacity to suit number of circuits indicated.

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2. Install control wires with irrigation mains and laterals in common trench where possible. Lay control wires neatly together to side of pipe. Provide 3' expansion coils at valves, corners, bores and snake wire in trench to allow for contraction. Tape wires in bundles at 10-foot intervals. Line splices will be allowed on runs of 500 Ft. or more. Splices shall be made and placed in control wire splice boxes.
3. Common ground wire shall be white. No other wires shall be white.
4. Supply one extra wire, for each direction of run, to valve which is located the greatest distance from the controller. Extra wire shall be yellow and labeled as spare in the controller.
5. Color of wire from controller to control valve shall be consistent to each valve. Red shall be used for the zone valves.
6. Provide 12-inch-long expansion loop within 3 feet of each wire connection and splice on runs of wire 100 feet or longer.

L. Backflow Preventers

1. Make required connection to water supply according to local codes and manufacturer's written instructions.
2. Install pressure type backflow devices at required grade in accordance with the local Plumbing Code. Exposed mainline and mainline risers above PVC pipe main elevation shall be copper. Install a brass union in the riser on the upstream and downstream of the device.
3. Install the "StrongBox" and insulation blanket as per manufacturer's recommendations.
4. Provide an isolation valve (gate valve) prior to the PVB. Install a valve box as per specifications over the valve. Locate the valve on the as built drawings utilizing one of the following methods.
 - a. A minimum of two measurements from two known and fixed positions that terminate at the end of the sleeve.
 - b. A GPS (Global Positioning System) fix in degrees, minutes, and seconds for the longitude and latitude location of device.
5. Have the PVB tested. Provide the Owner a copy of this inspection.

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- M. The Contractor shall maintain a Record Drawing. This Record Drawing shall include all changes and modifications to the original plan on a daily basis. Upon completion of the project, these changes contained in the Record Drawing shall be noted on all of the designs, documents, etc, and will be provided to the Owner in the form of a completed Record Drawing.

3.3 TESTING

- A. General - Notify Landscape Architect 48 hours in advance when testing will be conducted. Conduct tests in presence of Landscape Architect and a representative of M D Anderson, Grounds and Landscape Department.
- B. Hydrostatic Test - Test irrigation main line, before backfilling trenches, to a hydrostatic pressure of not less than 100 psi for 1 hour. Piping may be tested in sections to expedite work. Remove and repair or replace piping and connections which do not pass hydrostatic testing. System shall not lose more than 1-1/2 gallons of water in 1 hour.
- C. Shut off mainline at backflow preventer during non-working hours until Contractor has demonstrated the mainline is stable.
- D. Operational Testing - Perform operational testing after hydrostatic testing is completed, backfill is in place, and irrigation heads are adjusted to final position.
 - 1. Demonstrate to Landscape Architect that system meets coverage requirements, is as specified and indicated, and that automatic controls function properly.
 - 2. Coverage requirements are based on operation of one circuit at a time.
 - 3. After completion of grading, sodding, and rolling of grass areas, carefully adjust lawn sprinkler heads so they will be flush with or not more than 1/2 inch above finished grade. Set shrub sprinkler heads not more than 1/2 inch above top of mulch.

3.4 MAINTENANCE

- A. Contractor shall coordinate with the Owner on the implementation of the initial ET based irrigation schedule.
- B. Contractor shall correctly maintain the Irrigation System during the installation process and throughout the landscaping maintenance service period as specified in Section 32 91 20 - Exterior Landscape Maintenance.
- C. Contractor shall provide Record Drawings for new work, showing dimensioned location of valves, meters, vacuum breakers, controllers, and mainline. Contractor shall request reproducible mylars from the Landscape Architect in preparation of Record Drawings.

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END OF SECTION

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PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section includes planting soils specified by composition of the mixes.
- B. Related Requirements:
 - 1. Section 32930 PLANTS for placing planting soil for plantings.

1.3 DEFINITIONS

- A. AAPFCO: Association of American Plant Food Control Officials.
- B. Backfill: The earth used to replace or the act of replacing earth in an excavation. This can be amended or unamended soil as indicated.
- C. CEC: Cation exchange capacity.
- D. Compost: The product resulting from the controlled biological decomposition of organic material that has been sanitized through the generation of heat and stabilized to the point that it is beneficial to plant growth.
- E. Duff Layer: A surface layer of soil, typical of forested areas, that is composed of mostly decayed leaves, twigs, and detritus.
- F. Imported Soil: Soil that is transported to Project site for use.
- G. Layered Soil Assembly: A designed series of planting soils, layered on each other, that together produce an environment for plant growth.
- H. Manufactured Soil: Soil produced by blending soils, sand, stabilized organic soil amendments, and other materials to produce planting soil.
- I. NAPT: North American Proficiency Testing Program. An SSSA program to assist soil-, plant-, and water-testing laboratories through interlaboratory sample exchanges and statistical evaluation of analytical data.
- J. Organic Matter: The total of organic materials in soil exclusive of undecayed plant and animal tissues, their partial decomposition products, and the soil biomass; also called "humus" or "soil organic matter."

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- K. Planting Soil: Existing, on-site soil; imported soil; or manufactured soil that has been modified as specified with soil amendments and perhaps fertilizers to produce a soil mixture best for plant growth.
- L. RCRA Metals: Hazardous metals identified by the EPA under the Resource Conservation and Recovery Act.
- M. SSSA: Soil Science Society of America.
- N. Subgrade: Surface or elevation of subsoil remaining after excavation is complete, or the top surface of a fill or backfill before planting soil is placed.
- O. Subsoil: Soil beneath the level of subgrade; soil beneath the topsoil layers of a naturally occurring soil profile, typified by less than 1 percent organic matter and few soil organisms.
- P. Surface Soil: Soil that is present at the top layer of the existing soil profile. In undisturbed areas, surface soil is typically called "topsoil"; but in disturbed areas such as urban environments, the surface soil can be subsoil.
- Q. USCC: U.S. Composting Council.

1.4 ACTION SUBMITTALS

- A. Product Data: For each type of product.
 - 2. Include recommendations for application and use.
 - 3. Include test data substantiating that products comply with requirements.
 - 4. Include sieve analyses for aggregate materials.
- 5. Material Certificates: For each type of **imported soil and soil mix** before delivery to the site, according to the following:
 - a. Manufacturer's qualified testing agency's certified analysis of standard products.
 - b. Analysis of fertilizers, by a qualified testing agency, made according to AAPFCO methods for testing and labeling and according to AAPFCO's SUIP #25.
 - c. Analysis of nonstandard materials, by a qualified testing agency, made according to SSSA methods, where applicable.

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- B. Samples: For each bulk-supplied material, **1-quart** volume of each in sealed containers labeled with content, source, and date obtained. Each Sample shall be typical of the lot of material to be furnished; provide an accurate representation of composition, color, and texture.

1.5 QUALITY ASSURANCE

- A. Testing Agency Qualifications: An independent, state-operated, or university-operated laboratory; experienced in soil science, soil testing, and plant nutrition; with the experience and capability to conduct the testing indicated; and that specializes in types of tests to be performed.

1.6 PRECONSTRUCTION TESTING

- A. Preconstruction Soil Analyses: For each unamended soil type, perform testing on soil samples and furnish soil analysis and a written report containing soil-amendment and fertilizer recommendations by a qualified testing agency performing the testing according to "Soil- Sampling Requirements" and "Testing Requirements" articles.
 - 1. Have testing agency identify and label samples and test reports according to sample collection and labeling requirements.

1.7 SOIL-SAMPLING REQUIREMENTS

- A. Sample Collection and Labeling: Have samples taken and labeled by **Contractor in presence of Owner's Representative**.
 - 1. Number and Location of Samples: Minimum of **three** representative soil samples for each soil to be used or amended for landscaping purposes.
 - 2. Procedures and Depth of Samples: As directed by Owner's Representative.
 - 3. Labeling: Label each sample with the date, location keyed to a site plan or other location system, visible soil condition, and sampling depth.

1.8 TESTING REQUIREMENTS

- A. General: Perform tests on soil samples according to requirements in this article.
- B. Physical Testing:
 - 1. Soil Texture: Soil-particle, size-distribution analysis by **one of** the following methods according to SSSA's "Methods of Soil Analysis - Part 1-Physical and Mineralogical Methods":

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- a. Sieving Method: Report sand-gradation percentages for very coarse, coarse, medium, fine, and very fine sand; and fragment-gradation (gravel) percentages for fine, medium, and coarse fragments; according to USDA sand and fragment sizes.
 - b. Hydrometer Method: Report percentages of sand, silt, and clay.
2. Total Porosity: Calculate using particle density and bulk density according to SSSA's "Methods of Soil Analysis - Part 1-Physical and Mineralogical Methods."
3. Water Retention: According to SSSA's "Methods of Soil Analysis - Part 1-Physical and Mineralogical Methods."
4. Saturated Hydraulic Conductivity: According to SSSA's "Methods of Soil Analysis - Part 1-Physical and Mineralogical Methods"; at 85% compaction, according to ASTM D 698 (Standard Proctor).
- C. Chemical Testing:
 1. CEC: Analysis by sodium saturation at pH 7 according to SSSA's "Methods of Soil Analysis - Part 3- Chemical Methods."
- D. Fertility Testing: Soil-fertility analysis, including the following:
 1. Percentage of organic matter.
 2. CEC, calcium percent of CEC, and magnesium percent of CEC.
 3. Soil reaction (acidity/alkalinity pH value).
 4. Buffered acidity or alkalinity.
 5. Nitrogen ppm.
 6. Phosphorous ppm.
 7. Potassium ppm.
 8. Manganese ppm.
 9. Manganese-availability ppm.
 10. Zinc ppm.
 11. Zinc availability ppm.

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12. Copper ppm.
 13. Sodium ppm and sodium absorption ratio.
 14. Soluble-salts ppm.
 15. Presence and quantities of problem materials including salts and metals cited in the Standard protocol. If such problem materials are present, provide additional recommendations for corrective action.
 16. Other deleterious materials, including their characteristics and content of each.
- E. Organic-Matter Content: Analysis using loss-by-ignition method according to SSSA's "Methods of Soil Analysis - Part 3- Chemical Methods."
- F. Recommendations: Based on the test results, state recommendations for soil treatments and soil amendments to be incorporated to produce satisfactory planting soil suitable for healthy, viable plants indicated. Include, at a minimum, recommendations for nitrogen, phosphorous, and potassium fertilization, and for micronutrients.
1. Fertilizers and Soil Amendment Rates: State recommendations in weight per 1000 sq. ft. for 6-inch depth of soil.
 2. Soil Reaction: State the recommended liming rates for raising pH or sulfur for lowering pH according to the buffered acidity or buffered alkalinity in weight per 1000 sq. ft. for 6-inch depth of soil.

1.9 DELIVERY, STORAGE, AND HANDLING

- A. Packaged Materials: Deliver packaged materials in original, unopened containers showing weight, certified analysis, name and address of manufacturer, and compliance with state and Federal laws if applicable.
- B. Bulk Materials:
1. Do not dump or store bulk materials near structures, utilities, walkways and pavements, or on existing turf areas or plants.
 2. Provide erosion-control measures to prevent erosion or displacement of bulk materials, discharge of soil-bearing water runoff, and airborne dust reaching adjacent properties, water conveyance systems, or walkways.
 3. Do not move or handle materials when they are wet or frozen.

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4. Accompany each delivery of bulk fertilizers and soil amendments with appropriate certificates.

PART 2 - MATERIALS

2.1 PLANTING SOILS SPECIFIED BY COMPOSITION

- A. General: Soil amendments, fertilizers, and rates of application specified in this article are guidelines that may need revision based on testing laboratory's recommendations after preconstruction soil analyses are performed.
- B. Planting-Soil Type for turf and planting beds: Existing, on-site surface soil, with the duff layer, if any, retained **and stockpiled on-site**; modified to produce viable planting soil. Blend existing, on-site surface soil with soil amendments, per Owner's standards.

2.2 INORGANIC SOIL AMENDMENTS

- A. Lime: ASTM C 602, agricultural liming material containing a minimum of 80 percent calcium carbonate equivalent and as follows:
 1. Class: T, with a minimum of 99 percent passing through a No. 8 sieve and a minimum of 75 percent passing through a No. 60 sieve.
 2. Class: O, with a minimum of 95 percent passing through a No. 8 sieve and a minimum of 55 percent passing through a No. 60 sieve.
 3. Form: Provide lime in form of ground **dolomitic limestone**.
- B. Sulfur: Granular, biodegradable, and containing a minimum of 90 percent elemental sulfur, with a minimum of 99 percent passing through a No. 6 sieve and a maximum of 10 percent passing through a No. 40 sieve.
- C. Iron Sulfate: Granulated ferrous sulfate containing a minimum of 20 percent iron and 10 percent sulfur.
- D. Perlite: Horticultural perlite, soil amendment grade.
- E. Agricultural Gypsum: Minimum 90 percent calcium sulfate, finely ground with 90 percent passing through a No. 50 sieve.
- F. Sand: Clean, washed, natural or manufactured, free of toxic materials, and according to ASTM C 33/C 33M.

2.3 ORGANIC SOIL AMENDMENTS

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- A. Compost: Well-composted, stable, and weed-free organic matter produced by composting feedstock and bearing USCC's "Seal of Testing Assurance."
- B. Manure: Well-rotted, unleached, stable or cattle manure containing not more than 25 percent by volume of straw, sawdust, or other bedding materials; free of toxic substances, stones, sticks, soil, weed seed, debris, and material harmful to plant growth.

PART 3 - EXECUTION

3.1 GENERAL

- A. Place planting soil and fertilizers according to requirements in other Specification Sections and as indicated in the drawings.
- B. Verify that no foreign or deleterious material or liquid such as paint, paint washout, concrete slurry, concrete layers or chunks, cement, plaster, oils, gasoline, diesel fuel, paint thinner, turpentine, tar, roofing compound, or acid has been deposited in planting soil.
- C. Proceed with placement only after unsatisfactory conditions have been corrected.

3.2 PLACING AND MIXING PLANTING SOIL OVER EXPOSED SUBGRADE

- A. General: Apply and mix unamended soil with amendments on-site to produce required planting soil. Do not apply materials or till if existing soil or subgrade is frozen, muddy, or excessively wet.
- B. Subgrade Preparation: Till subgrade to a minimum depth of **4 inches**. Remove stones larger than **1-1/2 inches** in any dimension and sticks, roots, rubbish, and other extraneous matter and legally dispose of them off Owner's property.
 - 1. Apply, add soil amendments, and mix approximately half the thickness of unamended soil over prepared, loosened subgrade according to "Mixing" Paragraph below. Mix thoroughly into top **2 inches** of subgrade. Spread remainder of planting soil.
- C. Mixing: Spread unamended soil to total depth of **6 inches** or as **indicated on Drawings**, but not less than required to meet finish grades after mixing with amendments and natural settlement. Do not spread if soil or subgrade is frozen, muddy, or excessively wet.
 - 1. Amendments: Apply soil amendments evenly on surface, and thoroughly blend them with unamended soil to produce planting soil.

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- D. Compaction: Compact each blended lift of planting soil to **75 to 82** percent of maximum Standard Proctor density according to ASTM D 698 and tested in-place.
- E. Finish Grading: Grade planting soil to a smooth, uniform surface plane with loose, uniformly fine texture. Roll and rake, remove ridges, and fill depressions to meet finish grades.

3.3 BLENDING PLANTING SOIL IN PLACE

- A. General: Mix amendments with in-place, unamended soil to produce required planting soil. Do not apply materials or till if existing soil or subgrade is frozen, muddy, or excessively wet.
- B. Preparation: Till unamended, existing soil only in planting areas free of existing tree roots and outside of critical root zones, to a minimum depth of **6 inches**. Remove stones larger than **1-1/2 inches** in any dimension and sticks, roots, rubbish, and other extraneous matter and legally dispose of them off Owner's property.
- C. Mixing: Apply soil amendments evenly on surface, and thoroughly blend them into full depth of unamended, in-place soil to produce planting soil.
- D. Finish Grading: Grade planting soil to a smooth, uniform surface plane with loose, uniformly fine texture. Roll and rake, remove ridges, and fill depressions to meet finish grades.

3.4 PROTECTION

- A. Protection Zone: Identify protection zones according to local standards.
- B. Protect areas of in-place soil from additional compaction, disturbance, and contamination. Prohibit the following practices within these areas except as required to perform planting operations:
 - 1. Storage of construction materials, debris, or excavated material.
 - 2. Parking vehicles or equipment.
 - 3. Vehicle traffic.
 - 4. Foot traffic.
 - 5. Erection of sheds or structures.
 - 6. Impoundment of water.
 - 7. Excavation or other digging unless otherwise indicated.

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- C. If planting soil or subgrade is over compacted, disturbed, or contaminated by foreign or deleterious materials or liquids, remove the planting soil and contamination; restore the subgrade as directed by Owner and replace contaminated planting soil with new planting soil.

3.5 CLEANING

- A. Protect areas adjacent to planting-soil preparation and placement areas from contamination. Keep adjacent paving and construction clean and work area in an orderly condition.
- B. Remove surplus soil and waste material including excess subsoil, unsuitable materials, trash, and debris and legally dispose of them off Owner's property unless otherwise indicated.
 - 1. Dispose of excess subsoil and unsuitable materials on-site where directed by Owner.

END OF SECTION

SECTION 329113- SOIL PREPARATION

Government of the Virgin Islands, Department of Public Works

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Project Location: **St. John, U.S. Virgin Islands**

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section includes planting soils specified by composition of the mixes.
- B. Related Requirements:
 - 1. Section 32930 PLANTS for placing planting soil for plantings.

1.1 DEFINITIONS

- A. AAPFCO: Association of American Plant Food Control Officials.
- B. Backfill: The earth used to replace or the act of replacing earth in an excavation. This can be amended or unamended soil as indicated.
- C. CEC: Cation exchange capacity.
- D. Compost: The product resulting from the controlled biological decomposition of organic material that has been sanitized through the generation of heat and stabilized to the point that it is beneficial to plant growth.
- E. Duff Layer: A surface layer of soil, typical of forested areas, that is composed of mostly decayed leaves, twigs, and detritus.
- F. Imported Soil: Soil that is transported to Project site for use.
- G. Layered Soil Assembly: A designed series of planting soils, layered on each other, that together produce an environment for plant growth.
- H. Manufactured Soil: Soil produced by blending soils, sand, stabilized organic soil amendments, and other materials to produce planting soil.
- I. NAPT: North American Proficiency Testing Program. An SSSA program to assist soil-, plant-, and water-testing laboratories through interlaboratory sample exchanges and statistical evaluation of analytical data.
- J. Organic Matter: The total of organic materials in soil exclusive of undecayed plant and animal tissues, their partial decomposition products, and the soil biomass; also called "humus" or "soil organic matter."

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- K. Planting Soil: Existing, on-site soil; imported soil; or manufactured soil that has been modified as specified with soil amendments and perhaps fertilizers to produce a soil mixture best for plant growth.
- L. RCRA Metals: Hazardous metals identified by the EPA under the Resource Conservation and Recovery Act.
- M. SSSA: Soil Science Society of America.
- N. Subgrade: Surface or elevation of subsoil remaining after excavation is complete, or the top surface of a fill or backfill before planting soil is placed.
- O. Subsoil: Soil beneath the level of subgrade; soil beneath the topsoil layers of a naturally occurring soil profile, typified by less than 1 percent organic matter and few soil organisms.
- P. Surface Soil: Soil that is present at the top layer of the existing soil profile. In undisturbed areas, surface soil is typically called "topsoil"; but in disturbed areas such as urban environments, the surface soil can be subsoil.
- Q. USCC: U.S. Composting Council.

1.2 ACTION SUBMITTALS

- A. Product Data: For each type of product.
 - 1. Include recommendations for application and use.
 - 2. Include test data substantiating that products comply with requirements.
 - 3. Include sieve analyses for aggregate materials.
- 4. Material Certificates: For each type of **imported soil and soil mix** before delivery to the site, according to the following:
 - a. Manufacturer's qualified testing agency's certified analysis of standard products.
 - b. Analysis of fertilizers, by a qualified testing agency, made according to AAPFCO methods for testing and labeling and according to AAPFCO's SUIP #25.
 - c. Analysis of nonstandard materials, by a qualified testing agency, made according to SSSA methods, where applicable.

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- B. Samples: For each bulk-supplied material, **1-quart** volume of each in sealed containers labeled with content, source, and date obtained. Each Sample shall be typical of the lot of material to be furnished; provide an accurate representation of composition, color, and texture.

1.3 QUALITY ASSURANCE

- A. Testing Agency Qualifications: An independent, state-operated, or university-operated laboratory; experienced in soil science, soil testing, and plant nutrition; with the experience and capability to conduct the testing indicated; and that specializes in types of tests to be performed.

1.4 PRECONSTRUCTION TESTING

- A. Preconstruction Soil Analyses: For each unamended soil type, perform testing on soil samples and furnish soil analysis and a written report containing soil-amendment and fertilizer recommendations by a qualified testing agency performing the testing according to "Soil- Sampling Requirements" and "Testing Requirements" articles.
 - 1. Have testing agency identify and label samples and test reports according to sample collection and labeling requirements.

1.5 SOIL-SAMPLING REQUIREMENTS

- B. Sample Collection and Labeling: Have samples taken and labeled by **Contractor in presence of Owner's Representative**.
 - 1. Number and Location of Samples: Minimum of **three** representative soil samples for each soil to be used or amended for landscaping purposes.
 - 2. Procedures and Depth of Samples: As directed by Owner's Representative.
 - 3. Labeling: Label each sample with the date, location keyed to a site plan or other location system, visible soil condition, and sampling depth.

1.6 TESTING REQUIREMENTS

- A. General: Perform tests on soil samples according to requirements in this article.
- B. Physical Testing:
 - 1. Soil Texture: Soil-particle, size-distribution analysis by **one of** the following methods according to SSSA's "Methods of Soil Analysis - Part 1-Physical and Mineralogical Methods":

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- a. Sieving Method: Report sand-gradation percentages for very coarse, coarse, medium, fine, and very fine sand; and fragment-gradation (gravel) percentages for fine, medium, and coarse fragments; according to USDA sand and fragment sizes.
 - b. Hydrometer Method: Report percentages of sand, silt, and clay.
 2. Total Porosity: Calculate using particle density and bulk density according to SSSA's "Methods of Soil Analysis - Part 1-Physical and Mineralogical Methods."
 3. Water Retention: According to SSSA's "Methods of Soil Analysis - Part 1-Physical and Mineralogical Methods."
 4. Saturated Hydraulic Conductivity: According to SSSA's "Methods of Soil Analysis - Part 1-Physical and Mineralogical Methods"; at 85% compaction, according to ASTM D 698 (Standard Proctor).
- C. Chemical Testing:
1. CEC: Analysis by sodium saturation at pH 7 according to SSSA's "Methods of Soil Analysis - Part 3- Chemical Methods."
- D. Fertility Testing: Soil-fertility analysis, including the following:
1. Percentage of organic matter.
 2. CEC, calcium percent of CEC, and magnesium percent of CEC.
 3. Soil reaction (acidity/alkalinity pH value).
 4. Buffered acidity or alkalinity.
 5. Nitrogen ppm.
 6. Phosphorous ppm.
 7. Potassium ppm.
 8. Manganese ppm.
 9. Manganese-availability ppm.
 10. Zinc ppm.
 11. Zinc availability ppm.

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12. Copper ppm.
 13. Sodium ppm and sodium absorption ratio.
 14. Soluble-salts ppm.
 15. Presence and quantities of problem materials including salts and metals cited in the Standard protocol. If such problem materials are present, provide additional recommendations for corrective action.
 16. Other deleterious materials, including their characteristics and content of each.
- E. Organic-Matter Content: Analysis using loss-by-ignition method according to SSSA's "Methods of Soil Analysis - Part 3- Chemical Methods."
- F. Recommendations: Based on the test results, state recommendations for soil treatments and soil amendments to be incorporated to produce satisfactory planting soil suitable for healthy, viable plants indicated. Include, at a minimum, recommendations for nitrogen, phosphorous, and potassium fertilization, and for micronutrients.
1. Fertilizers and Soil Amendment Rates: State recommendations in weight per 1000 sq. ft. for 6-inch depth of soil.
 2. Soil Reaction: State the recommended liming rates for raising pH or sulfur for lowering pH according to the buffered acidity or buffered alkalinity in weight per 1000 sq. ft. for 6-inch depth of soil.

1.7 DELIVERY, STORAGE, AND HANDLING

- A. Packaged Materials: Deliver packaged materials in original, unopened containers showing weight, certified analysis, name and address of manufacturer, and compliance with state and Federal laws if applicable.
- B. Bulk Materials:
1. Do not dump or store bulk materials near structures, utilities, walkways and pavements, or on existing turf areas or plants.
 2. Provide erosion-control measures to prevent erosion or displacement of bulk materials, discharge of soil-bearing water runoff, and airborne dust reaching adjacent properties, water conveyance systems, or walkways.
 3. Do not move or handle materials when they are wet or frozen.
 4. Accompany each delivery of bulk fertilizers and soil amendments with appropriate certificates.

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PART 2 - MATERIALS

2.1 PLANTING SOILS SPECIFIED BY COMPOSITION

- A. General: Soil amendments, fertilizers, and rates of application specified in this article are guidelines that may need revision based on testing laboratory's recommendations after preconstruction soil analyses are performed.
- B. Planting-Soil Type for turf and planting beds: Existing, on-site surface soil, with the duff layer, if any, retained **and stockpiled on-site**; modified to produce viable planting soil. Blend existing, on-site surface soil with soil amendments, per Owner's standards.

2.2 INORGANIC SOIL AMENDMENTS

- A. Lime: ASTM C 602, agricultural liming material containing a minimum of 80 percent calcium carbonate equivalent and as follows:
 - 1. Class: T, with a minimum of 99 percent passing through a No. 8 sieve and a minimum of 75 percent passing through a No. 60 sieve.
 - 2. Class: O, with a minimum of 95 percent passing through a No. 8 sieve and a minimum of 55 percent passing through a No. 60 sieve.
 - 3. Form: Provide lime in form of ground **dolomitic limestone**.
- B. Sulfur: Granular, biodegradable, and containing a minimum of 90 percent elemental sulfur, with a minimum of 99 percent passing through a No. 6 sieve and a maximum of 10 percent passing through a No. 40 sieve.
- C. Iron Sulfate: Granulated ferrous sulfate containing a minimum of 20 percent iron and 10 percent sulfur.
- D. Perlite: Horticultural perlite, soil amendment grade.
- E. Agricultural Gypsum: Minimum 90 percent calcium sulfate, finely ground with 90 percent passing through a No. 50 sieve.
- F. Sand: Clean, washed, natural or manufactured, free of toxic materials, and according to ASTM C 33/C 33M.

2.3 ORGANIC SOIL AMENDMENTS

- A. Compost: Well-composted, stable, and weed-free organic matter produced by composting feedstock and bearing USCC's "Seal of Testing Assurance."

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- B. Manure: Well-rotted, unleached, stable or cattle manure containing not more than 25 percent by volume of straw, sawdust, or other bedding materials; free of toxic substances, stones, sticks, soil, weed seed, debris, and material harmful to plant growth.

PART 3 - EXECUTION

3.1 GENERAL

- A. Place planting soil and fertilizers according to requirements in other Specification Sections and as indicated in the drawings.
- B. Verify that no foreign or deleterious material or liquid such as paint, paint washout, concrete slurry, concrete layers or chunks, cement, plaster, oils, gasoline, diesel fuel, paint thinner, turpentine, tar, roofing compound, or acid has been deposited in planting soil.
- C. Proceed with placement only after unsatisfactory conditions have been corrected.

3.2 PLACING AND MIXING PLANTING SOIL OVER EXPOSED SUBGRADE

- A. General: Apply and mix unamended soil with amendments on-site to produce required planting soil. Do not apply materials or till if existing soil or subgrade is frozen, muddy, or excessively wet.
- B. Subgrade Preparation: Till subgrade to a minimum depth of **4 inches**. Remove stones larger than **1-1/2 inches** in any dimension and sticks, roots, rubbish, and other extraneous matter and legally dispose of them off Owner's property.
 - 1. Apply, add soil amendments, and mix approximately half the thickness of unamended soil over prepared, loosened subgrade according to "Mixing" Paragraph below. Mix thoroughly into top **2 inches** of subgrade. Spread remainder of planting soil.
- G. Mixing: Spread unamended soil to total depth of **6 inches** or as **indicated on Drawings**, but not less than required to meet finish grades after mixing with amendments and natural settlement. Do not spread if soil or subgrade is frozen, muddy, or excessively wet.
 - 1. Amendments: Apply soil amendments evenly on surface, and thoroughly blend them with unamended soil to produce planting soil.
- H. Compaction: Compact each blended lift of planting soil to **75 to 82** percent of maximum Standard Proctor density according to ASTM D 698 and tested in-place.

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- I. Finish Grading: Grade planting soil to a smooth, uniform surface plane with loose, uniformly fine texture. Roll and rake, remove ridges, and fill depressions to meet finish grades.

3.3 BLENDING PLANTING SOIL IN PLACE

- A. General: Mix amendments with in-place, unamended soil to produce required planting soil. Do not apply materials or till if existing soil or subgrade is frozen, muddy, or excessively wet.
- B. Preparation: Till unamended, existing soil only in planting areas free of existing tree roots and outside of critical root zones, to a minimum depth of **6 inches**. Remove stones larger than **1-1/2 inches** in any dimension and sticks, roots, rubbish, and other extraneous matter and legally dispose of them off Owner's property.
- C. Mixing: Apply soil amendments evenly on surface, and thoroughly blend them into full depth of unamended, in-place soil to produce planting soil.
- D. Finish Grading: Grade planting soil to a smooth, uniform surface plane with loose, uniformly fine texture. Roll and rake, remove ridges, and fill depressions to meet finish grades.

3.4 PROTECTION

- A. Protection Zone: Identify protection zones according to local standards.
- B. Protect areas of in-place soil from additional compaction, disturbance, and contamination. Prohibit the following practices within these areas except as required to perform planting operations:
 1. Storage of construction materials, debris, or excavated material.
 2. Parking vehicles or equipment.
 3. Vehicle traffic.
 4. Foot traffic.
 5. Erection of sheds or structures.
 6. Impoundment of water.
 7. Excavation or other digging unless otherwise indicated.

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- C. If planting soil or subgrade is over compacted, disturbed, or contaminated by foreign or deleterious materials or liquids, remove the planting soil and contamination; restore the subgrade as directed by Owner and replace contaminated planting soil with new planting soil.

3.5 CLEANING

- A. Protect areas adjacent to planting-soil preparation and placement areas from contamination. Keep adjacent paving and construction clean and work area in an orderly condition.
- B. Remove surplus soil and waste material including excess subsoil, unsuitable materials, trash, and debris and legally dispose of them off Owner's property unless otherwise indicated.
 - 1. Dispose of excess subsoil and unsuitable materials on-site where directed by Owner.

END OF SECTION

SECTION 329300-PLANTS

Government of the Virgin Islands, Department of Public Works

PROJECT NAME: Elaine I. Sprauve Library and Museum Building

Project Location: **St. John, U.S. Virgin Islands**

PART 1 GENERAL

1.1 RELATED DOCUMENTS AND STANDARDS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.
- B. Specifications throughout all Divisions of the Project Manual are directly applicable to this Section, and this Section is directly applicable to them.
 - 1. Section 312000 - Earth Moving.
 - 2. ANSI: American National Standards Institute
 - a. Z60.1: Nursery Stock
 - 3. Association of Official Agriculture Chemists
 - 4. FS: Federal Specifications and Standards
 - a. Q-P-166E: Peat, Moss; Peat, Humus; and Peat, Reed-Sedge
 - 5. NBS: National Bureau of Standards
 - a. PS23: Perlite Product Standard

1.2 SUMMARY

- A. This Section specifies the requirements for providing planting materials and their installation as indicated and scheduled. For grass installation refer to Section 32 92 23 – Sodding, and Section 32 92 13 – Hydromulching. For maintenance, refer to Section 32 91 20 – Exterior Landscape Maintenance.

1.3 SECTION INCLUDES

- A. Trees, shrubs, plants and groundcover.
- B. Topsoil and soil amendments.
- C. Initial maintenance of planting materials.
- D. Pruning and relocation of existing plant materials.

1.4 SUBMITTALS

- A. Submit under provisions of Section 01 30 00 - Administrative Requirements.

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- B. Product Data: Manufacturer's data sheets on each product to be used, including:
 - 1. Preparation instructions and recommendations.
 - 2. Storage and handling requirements and recommendations.
 - 3. Installation methods.
 - 4. Manufacturer's or vendor's certified analysis of soil amendments.
 - 5. Fertilizer certification as to the chemical analysis of the fertilizer, a listing of the elements contained therein and their percentages
- C. Maintenance Data: Submit maintenance data, including maintenance schedule. Submit typewritten instructions, including manufacturer's recommendations and instructions recommending procedures to be established by Owner for maintenance of planting work. Submit instructions prior to expiration of Contractor's required maintenance period.
- D. Notices: Submit 48-hour written notice prior to turnover to Owner for watering and maintenance.
- E. Warranty: Warrant trees and shrubs for a period of one year after date of Substantial Completion, against defects including death and unsatisfactory growth and except for defects resulting from neglect by Owner, abuse by others, or natural phenomena. Replace unsatisfactory plant material at end of warranty period at no additional expense to the Owner. One replacement is required.
- F. Work Schedule: Contractor shall submit a work schedule for all planting work prior to purchase and installation of plant material.
- G. Submittals: Submit samples of topsoil, mulch and prepared backfill mix.
- H. Prepare an ET based irrigation schedule for all trees. This irrigation schedule shall include the amount of water to be applied to the trees and when the application is to be applied. This data can be provided in ET, precipitation rates, inches per hour, or inches per month.
- I. Prepare an ET based irrigation schedule for all shrubs. This irrigation schedule shall include the amount of water to be applied to the shrubs and when the application is to be applied. This data can be provided in ET, precipitation rates, inches per hour, or inches per month.

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- J. Prepare an ET based irrigation schedule for all turf grass. This irrigation schedule shall include the amount of water to be applied to the turf grass and when the application is to be applied. This data can be provided in ET, precipitation rates, inches per hour, or inches per month.

1.5 QUALITY ASSURANCE

- A. Installer Qualifications: Installation of planting work shall be performed by a single firm specializing in landscape and planting work. Contractor shall be licensed by the Texas Association of Nurserymen, shall possess an agricultural certificate, shall be a licensed pest applicator, and shall have not less than 5 years of experience in this type of work.
 - 1. Trees, Shrubs, and Groundcovers:
 - a. Provide plants of quantity, size, genus, species and variety shown and scheduled for planting work and complying with recommendations and requirements of ANSI Z60.1 "American Standard for Nursery Stock." Provide healthy, vigorous stock, grown in recognized nursery in accordance with good horticultural practice and free of disease, insects, eggs, larvae and defects such as knots, sunscald, injuries, abrasions, or disfigurement.
 - b. Label each plant with securely attached waterproof tag bearing legible designation of botanical and common name.
- B. Compliance: Ship planting materials with Certificates of Inspection as required by governing authorities. Comply with all applicable local and federal requirements regarding materials, methods of work, and disposal of excess and waste materials.
- C. Substitutions: Do not make substitutions unless approved in writing by Owner. If specified planting material is not obtainable, submit proof of non-availability to Owner together with proposal for use of equivalent material. Contractor shall submit proposal in a timely manner as to not impact project completion or installation of other work.
- D. Analysis and Standards: All packaged products shall be delivered in original manufacturer's sealed containers. For unpackaged materials, submit analysis by recognized laboratory made in accordance with methods established by the Association of Official Agriculture Chemists, wherever applicable. Testing: Laboratory testing for suitable soil amendments and fertilizer.

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- E. Inspection: Notify Owner at least 2 weeks prior to installation, of location where materials that have been selected for planting may be inspected, either at place of growth or the site prior to planting. Plant material will be inspected for compliance with requirements for genus, species, variety, size and quality. Owner retains right to further inspect trees for size and conditions of balls and root systems, insects, injuries and latent defects, and to reject unsatisfactory or defective material at any time during progress of work. Contractor shall remove rejected trees immediately from site and replace with specified materials. Plant material not installed in accordance with Contract Documents will be rejected.

1.6 PRE-INSTALLATION MEETINGS

- A. Convene minimum two weeks prior to starting work of this section.

1.7 DELIVERY, STORAGE, AND HANDLING

- A. Packaged Materials: Deliver packaged materials in fully labeled original containers showing weight, analysis and name of manufacturer. Protect materials from deterioration during delivery, and while stored at site.
- B. Plants
 - 1. Do not drop stock during delivery.
 - 2. Materials shall not be pruned prior to installation unless otherwise approved by Owner in writing. Do not bend or bind-tie trees and shrubs in such a manner as to damage bark, break branches or destroy natural shape. Provide protective covering during delivery.
 - 3. Deliver plants after preparation for planting has been completed and plant immediately. If planting is delayed more than 7 hours after delivery, set plants in shade, protect from weather and mechanical damage. Keep roots moist by covering with mulch, burlap or other acceptable means of retaining moisture, and water as needed.
 - 4. Do not remove container grown stock from containers before time of planting and water immediately after delivery and prior to planting.

1.8 PROJECT CONDITIONS

- A. Maintain environmental conditions (temperature, humidity, and ventilation) within limits recommended by manufacturer for optimum results. Do not install products under environmental conditions outside supplier's recommended limits.
- B. Proceed with and complete planting work in a timely manner, working within seasonal limitations for each kind of planting work required.

SECTION 329300-PLANTS

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1.9 SEQUENCING

- A. Work Scheduling: Proceed with and complete planting work in a timely manner, working within seasonal limitations for each kind of planting work required.
- B. Planting Time:
 - 1. Correlate planting with specified maintenance periods to provide maintenance from date of Substantial Completion. Ensure that products of this section are supplied to affected trades in time to prevent interruption of construction progress.
 - 2. Plant trees, shrubs and groundcover after final grades are established and prior to planting of lawns, unless otherwise directed by Owner in writing. If planting occurs after lawn work, protect lawn areas and promptly repair damage to lawns resulting from planting operations.
- C. Utilities: Refer to engineering drawings and coordinate with Utility Contractor for location of utilities. Contractor shall be responsible for damage to existing utilities and structures. Contractor shall contact the Texas One call system and shall provide a copy of the transmittal number to the Owner.
- D. Security: The Owner will not assume any responsibility for security of any materials, equipment, etc. during construction of the project until project acceptance.
- E. Excavation: When conditions detrimental to plant growth are encountered, such as rubble fill, adverse drainage conditions beyond the scope of this contract, or obstructions, notify Owner of such conditions, immediately and before planting.
- F. Pollution Control: Control dust caused by planting operations. Dampen surfaces as necessary. Comply with pollution control regulations of governing authorities.

PART 2 PRODUCTS

2.1 MATERIALS

- A. Fertilizer

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1. For Planting areas shall be a commercial all organic, all-natural biological fertilizer, which includes humates, rock minerals, bio-inoculants and bio-stimulants. Fertilizer shall be granular, uniform in composition, free flowing, and suitable for application with approved equipment. Fertilizer which has been exposed to high humidity and moisture, has become caked or otherwise damaged making it unsuitable for use, will not be acceptable. Fertilizer shall be Microlife Ultimate (8-4-6) as manufactured by San Jacinto Environmental Supply, 2221 A West 34th Street, Houston, TX 77018, or approved equal. Broadcast fertilizer at the rate of 40 lbs. fertilizer per 1000 square feet and mix to 4"-6" depth into prepared planting soil. Contractor shall top-dress with an additional application of the same fertilizer at the end of the maintenance period, approximately 60 days after planting at 1/2 the manufacturer's recommend rate (20 lbs. fertilizer per 1000 square feet).
2. Additional Microlife Ultimate fertilizer shall be evenly dispersed through soil in planting pits at the following rate:

| Material | No. of OZ. Per Planting Pit |
|------------|-----------------------------|
| 15 gallon | 3 |
| 30 gallon | 6 |
| 65 gallon | 12 |
| 100 gallon | 18 |
| 200 gallon | 36 |

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3. Fertilizer for turf areas shall be Majestic Gro (18-5-9) as manufactured by San Jacinto Environmental Supply or approved equal commercial blend of high quality, low salt synthetic fertilizer, 50% slow-release, with Houactinite (as carrier), 3% Fe, 8% Sulfur, 1% Mg and Micronutrients including Zinc, Boron, Copper, Molybdenum and Potassium Sulfate. Fertilizer shall be free flowing and suitable for application with approved equipment. Fertilizer which has been exposed to high humidity and moisture, has become caked or otherwise damaged making it unsuitable for use will not be acceptable. Fertilizer shall be applied at the rate of one 50 lb. bag per 7500 square feet to all turf areas and raked into the topsoil prior to application of sod. For hydromulched areas, Majestic Gro fertilizer shall be mixed in the tank at the rate specified in Section 02921 – Hydromulch. Contractor shall top-dress all sod and hydromulch areas with an additional application of Majestic Gro fertilizer approximately 60 days after planting, at half the manufacturer's recommended rate (one 50 lb. bag per 15,000 square feet). Apply preventative fire-ant treatment over all sod and hydromulch areas during the 60-day maintenance period.
- B. Sharp Sand: Sand shall be thoroughly washed, coarse grade sharp, construction or brick sand, free of clay balls, weeds, and grass. So-called cushion sand, blow sand, or creek silt is not acceptable for substitution where sharp sand is specified.
- C. Herbicide
 1. Apply pre-emergent herbicide over all planting areas prior to spreading mulch at the rate of 7 lbs. per 1000 square feet.
 2. If necessary, contact herbicide shall be Roundup by Monsanto, 800 N. Lindbergh, St. Louis, MO 63167, 314-694-1000, or approved equal. Apply Roundup only if necessary and if approved by Owner or Owner's representative. Do not exceed manufacturer's recommended rate of application.
- D. Mulch for top dressing: Organic mulch free from deleterious materials and suitable for top dressing of trees, shrubs or plants. Mulch shall be composted, well-rotted, blended double-shredded hardwood mulch (70%) and composted pine bark mulch (30%), black or dark brown in color. Mulch pieces shall not exceed 2" in any dimension. No dyes, mushroom compost or other additives shall be used to artificially enhance the appearance of the level of composting.
- E. Biological Inoculant: MicroGro Granular as manufactured by San Jacinto Environmental Supply, or approved equal multi-purpose biological inoculant with humates, select sugars and bio-stimulants. Apply to all seasonal, perennial and groundcover areas at the rate of 10 lbs. per 1000 square feet.

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F. Compost for bed prep/soil backfill mix: Compost must be made from organic materials. Compost must contain less than 1% by dry weight of inert contaminants such as glass, plastic, rocks, etc. Industrial or hazardous waste cannot be used in the production of the compost (i.e. boiler ash, rice hull ash, etc.). Compost shall be free of fillers such as rice hulls or pine bark. Compost shall not exceed the heavy metal limits as specified in the US EPA Part 503 Regulations.

1. Contractor shall furnish copies of manufacturer's literature, certifications, sources, samples, or laboratory analytical data for the following items: Certificates of inspection required for transportation shall accompany each shipment of materials. Provide certificates to Owner.

G. Testing:

1. If herbicide contamination is suspected, then a radish/rye-grass growth trial must be performed. For delivered material, test one grab sample for each fifty (50) cubic yards of bulk material delivered to the site. Testing will be at the expense of Contractor. Deviations greater than plus or minus twenty (20%) percent from control data may be grounds for rejection of mixes tested. Non-conforming materials shall not be used and shall be removed from the site.

H. Biological, physical and chemical specifications:

I. Biological Specifications: Stability/Maturity (Carbon Dioxide Evolution Rate) Shall be less than 8 mg CO₂-C per g OM (organic matter) per day and greater than 6.0 on the SolvitaTM Compost Maturity Test.

1. Biological components: Bacteria (active) - Minimum of 15-25 micrograms per gram of compost; Bacteria (total) - minimum of 150 micrograms per gram of compost; Fungus (active) - minimum of 15-25 micrograms per gram of compost; Fungus (total) - minimum of 150 micrograms per gram of compost; Fungus (hyphal diameter) – should be greater than 1 mm; Protozoa: flagellates - 8,000 or higher per gram of compost; amoebae - 8,000 or higher per gram of compost; ciliates - 50-100 or higher per gram of compost; Root Feeding Nematodes should not be present (beneficial nematodes are a benefit).

J. PHYSICAL Specifications: Moisture Content - 30-60%, wet weight basis; Moisture Holding Capacity - 75-200% of dry weight; Organic Matter Content - 30-70% (40-50% preferred), dry weight basis; Particle Size: Standard Grade Compost - 100% passing through a 1" rectangular mesh screen or smaller; Fine Grade Compost - 100% passing through a 3/8" rectangular mesh screen or smaller; Bulk Density - 700-1,200 (800-1,000 preferred), pounds per cubic yard; Electrical Conductivity (Soluble Salt Concentration) - 10 dS/m (mmhos/cm.) maximum, (2.0-3.6 or less preferred).

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- K. **CHEMICAL Specifications:** pH 6.0-8.5; Total Salinity-2,000 ppm or lower; Chemical components (H₂O extraction): Nitrogen-10 ppm or higher, Phosphorus-100 ppm or higher, Potassium- 400 ppm or higher, Calcium-2000 ppm or higher, Magnesium-200 ppm or higher, Zinc-6 ppm or higher, Iron-25 ppm or higher, Manganese - 8 ppm or higher, Copper-1 ppm or higher, Sodium-1000 ppm or less, Sulfur-10 ppm or higher, Boron-1 ppm or higher.
- L. **Root Stimulator:** Root stimulator shall be Super Seaweed as manufactured by San Jacinto Environmental Supply or approved equal.
- M. **Soil Acidifier:** 90% Sulfur.
- N. **Fire Ant Prevention:** Award as manufactured by Syngenta, 1800 Concord Pike, Wilmington, DE 19850 or Amdro as manufactured by Ambrands, 2255 Cumberland Parkway Building 600-B, Atlanta, GA, 30339, or approved equal. Preventative fire ant control shall be broadcast over all landscaped area at manufacturer's recommended rate of 1 ½ lbs. per acre.
- O. **Insecticide:** No insecticide shall be applied on this site without the permission of the Owner.
- P. **Prepared Planting Backfill Mix:** Shall be 33% topsoil, 33% sharp sand, and 33% organic compost or approved commercially available soil mix.
- Q. **Topsoil**
 - 1. Provide topsoil which is a fertile, friable, natural loam or sandy loam, surface soil, free of subsoil, clay lumps, brush, weeds and other litter, and free of roots, stumps, stones larger than 2 inches in any dimension and other extraneous or toxic matter harmful to plant growth.
 - 2. Obtain topsoil only from naturally, well-drained sites where topsoil occurs in a depth of not less than 4 inches. Topsoil shall not be collected from sites that are infected with growth of, or the reproductive parts of noxious weeds, especially nut grass. Topsoil shall not be stripped, collected or deposited while wet. Topsoil shall not be excessively acid or alkaline or contain toxic substances which may be harmful to plant growth. Topsoil shall be without admixture of subsoil.
- R. **Steel Edging:** Edging shall be Ryerson steel or approved equal, 4" x 3/16" thick green in color.
- S. **Filter Fabric –** Filter fabric shall be non-woven filter bond. Soil separator as manufactured by DeWitt Co. with a minimum permeability rate of 219 gals./SF/minute or approved equal.

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T. Plant Materials: Provide specimen quality plant material as described in Construction Documents. Each individual species of plant material shall be obtained and provided from a single source.

U. Wood Headers and Edging: All heart redwood or pressure treated southern yellow pine.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Do not begin installation until substrates have been properly prepared.
- B. If substrate preparation is the responsibility of another installer, notify Owner's Representative of unsatisfactory preparation before proceeding.

3.2 PLANTING BEDS

- A. Prepare surfaces using the methods recommended by the manufacturer for achieving the best result for the substrate under the project conditions.
 - 1. Strip existing vegetation and 1" soil to remove root layer. Excavate entire planting beds 4" below finished grade.
 - 2. Dispose of soil removed from planting beds excavations. Do not mix with planting soil or use as backfill.
- B. Till bottom of planter 2"-4" leaving bottom of planter un-compacted. Backfill with minimum 8" (after settling) of prepared soil backfill mix. Prepare topsoil by mixing fertilizer with loam. Install soil mix to a depth of 18 inches in plant beds.
- C. Apply fertilizer and evenly distribute through top 6" of soil. For seasonal, groundcover and perennial areas, apply biological inoculants and evenly distribute through soil.

3.3 TREES AND SHRUBS

- A. Install materials in accordance with approved submittals. Install landscape work in proper relation with adjacent construction and with uniform appearance. Coordinate with work of other sections.
- B. Excavate as required for trees and shrubs.
- C. Apply fertilizer at a rate of 2 pounds of actual nitrogen per 1000 sq. ft. for plant beds and 2 pounds per inch of trunk for tree pits.

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- D. Set stock on layer of planting soil mixture, plumb and slightly above adjacent finished planting grades. Place additional backfill mix around base and sides of ball and work each layer to settle backfill and eliminate voids and air pockets. Layer and distribute additional fertilizer in planting hole at specified rate. Water entire bed thoroughly, adjusting plant if settling occurs.
- E. Treat entire areas of planting and tree root balls with:
 - 1. Broadcast application of pre-emergent herbicide at manufacturer's recommended rate in all planting areas (except seasonal beds) prior to applying mulch.
 - 2. Broadcast application of fire ant insecticide at manufacturer's recommended rate in all planting areas, after mulching.
 - 3. Mulching: Immediately after planting has been completed, mulch tree wells and plant beds. Provide not less than 2" thickness of composted hardwood & pine bark mulch in planting beds and 3" thickness at all trees.
- F. Provide maintenance and watering until turnover to Owner for maintenance and watering. Replace damaged materials and dead or unhealthy plants prior to turnover to Owner.

3.4 PROTECTION

- A. During planting work, keep pavements clean and work area in an orderly condition. Sweep site and remove trash at end of each workday as necessary.
- B. Protect planting work and materials from damage due to planting operations, operations by other contractors and trades and trespassers. Maintain protection during installation periods. Treat, repair or replace damaged planting work as directed by Owner.
- C. Stockpile, haul from site, and legally dispose of waste materials and debris. Accumulation will not be permitted. Maintain haul and disposal routes clear, clean, and free of debris. On-site burning of combustible cleared materials will not be permitted.
- D. Upon completion of work, clean areas within Contract limits, remove tools, supplies and equipment. Wash down curbs and pavement areas. Scrub curbs and walks as necessary to insure a clean surface. Provide site clean and free of materials and suitable for use as intended.

3.5 INSPECTION AND ACCEPTANCE

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- A. When planting work is completed and at the completion of maintenance period, Owner will inspect to determine acceptability.
- B. When inspected planting work does not comply with the Contract Document requirements, replace rejected work and continue specified maintenance until re-inspected by Owner and found to be acceptable. Contractor shall remove rejected plants and materials promptly from site.
- C. Contractor shall correctly maintain all planting during the installation process and throughout the landscaping maintenance service period as specified in Section 32 91 20 - Exterior Landscape Maintenance.
- D. Touch-up, repair or replace damaged products before Substantial Completion.

END OF SECTION

