PROJECT MANUAL

DEPARTMENT OF SPORTS, PARKS AND RECREATION

Kirwin Terrace Ballpark

PARCEL 76A AND PARTIAL 64, LINDBERG BAY
ST. THOMAS, UNITED STATES VIRGIN ISLANDS

Director Adrienne Octalein-Williams
GOVERNMENT OF THE VIRGIN ISLANDS
OFFICE OF DISASTER RECOVERY
ST. THOMAS, UNITED STATES VIRGIN ISLANDS 00802-5805

FOR

Honorable Calvert White, Commissioner
GOVERNMENT OF THE VIRGIN ISLANDS DEPARTMENT OF SPORTS, PARKS AND RECREATION
ST. THOMAS, UNITED STATES VIRGIN ISLANDS 00802-5805
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DIVISION 0 – PROCUREMENT AND CONTRACTING REQUIREMENTS

Government of the Virgin Islands, Department of Sports Parks and Recreation
KIRWIN TERRACE BALLPARK
Parcels 76A and partial 64, St. Thomas, U.S. Virgin Islands

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GOVERNMENT OF

THE VIRGIN ISLANDS OF THE UNITED STATES

_____o_____

DEPARTMENT OF PROPERTY AND PROCUREMENT

_____o_____

INVITATION FOR BIDS

_____o_____

Invitation No. IFB001SPRT21 (C) Date: October 11, 2020

Pursuant to Laws of the Government of the Virgin Islands sealed bids in Quintuplicate (5) copies ((**1) original and (4) copies)** for the work described herein will be received on **Thursday, November 12, 2020 at 10:00 a.m. at the Department of Property & Procurement** and **publicly open** on **Friday, November 13, 2020, at 10:30 a.m.** Bids can be submitted at the address: **8201 Subbase, 3rd Floor**, **St. Thomas, Virgin Islands 00802** or **via Email submission** at **ebids_proposals@dpp.vi.gov**

Description of Work and Project Number: IFB001SPRT21 (C)– Kirwan Terrace Ballpark Hurricane Repair Project for the Department of Sports, Parks and Recreation ("SPR") on St. Thomas, Virgin Islands

Pre-Bid Conference: **Thursday, October 22, 2020, at 10:30 a.m.** Atlantic Standard Time via Teleconference Call. **A site visit will be scheduled during the meeting**.

Cost Per Set: $75.00 NON-REFUNDABLE

Liquidated Damages: $100.00 per calendar day

Completion time of Work: 150 calendar days

Information regarding bidding documents

Bidding Documents include the Public Notice, this Invitation to Bid, Non- Collusion Affidavit, Instruction to Bidders, Contractor's Qualification and Financial Statement, the Contract, Bid Bond, Performance and Payment Bonds, Bid documents, General Provisions, Special Provision, Supplemental Specifications, Bid Schedule, Plan and Specifications. All documents may be obtained from the Department of Property and Procurement at the cost stated above or download a free copy at http://dpp.vi.gov under project advertisements.

Each bid must be accompanied by a Bid Guarantee as provided for in Form No. P&P-ITB-CC-16-73 (Instruction to Bidders) which is hereby made a part of this Invitation and by this reference incorporated herein as fully and effectively as if set forth in detail.

The Bid Guarantee for bidders will be Five (5%) per cent of the bid price. Bid Guarantee will be in the form of a Bond (Corporate or Individual Surety), Money Order, Certified Check or Irrevocable Letter of Credit.

The bid bond form provided in the bid document must be properly filled out to accompany checks and money orders. **Failure to provide a Five (5%) percent bond will render the bid unresponsive**.

No Bidder will be allowed to withdraw his bond within a period of thirty (30) calendar days following the date set for the opening thereof.

Contractor's Qualification Statement and Condensed Current Financial Statement

Each bidder **must** submit with his/her bid an executed copy of a Contractor's Qualification and Financial Statement which is hereby made a part of this Invitation for Bids and by this reference incorporated herein as fully and effectively as if set forth in detail.

Non -Collusion

Each bidder **must** submit with the bid a notarized copy of the Non-Collusion Affidavit which is hereby made a part of this Invitation and by this reference incorporated herein as fully and effectively as if set forth in detail.

Corporate Documents

a. Current Virgin Islands Business License listing General Construction Co. or Construction Contractor as the Types of License (s). All Bidders bidding as a Joint Venture must be licensed as Joint Venture in the U. S. Virgin Islands.
b. Current Trade Name Registration Certificate, if applicable
c. Certificate of Good Standing dated July 1, 2020 or later
d. Articles of Incorporation (for Corporations) or Articles of Organization (for LLC's) or qualification (Limited Partnerships).

Insurance Requirements

The Cost of which shall be borne by the Contractor and maintained fully during the term of the contract.

a. Certificate of Government Insurance (Workers Compensation):
   i. Respondent will provide a Certificate of Insurance reflecting the required coverage by Virgin Islands law.

b. Comprehensive General Liability Insurance:
   ii. Respondent shall carry comprehensive general liability on an occurrence form with no "x, c, or u" exclusions with the following minimum limits:
      1. Each Occurrence - $1,000,000.00
      2. Damages to Rented Premises- $50.000.00
      3. Medical Expenses - $50,000.00
      4. Persona & Adv Injury - $1,000,000.00
      5. General Aggregate - $2,000,000.00
      6. Products – Complete Ops. Aggregate - $2,000,000.00

   iii. General Aggregate shall apply on a basis.
   iv. Respondent shall provide a Certificate on Insurance reflecting required coverage.

v. In award, the Contractor shall provide proof of adding the Government as an additional insured via a scheduled/individual endorsement.

BONDS:

A Bid Bond, Performance Bond, and Payment Bond each are required as follows:

Bid Bond:	5% of the Contract
Performance Bond:	100% of the Contract
Payment Bond:	100% of the Contract

SECTION 01000 - SUMMARY

DEPARTMENT OF SPORTS PARKS AND RECREATION – KIRWIN TERRACE BALLPARK PARCEL 76A AND PORTION OF 64 ESTATE LINDBERG BAY, ST. THOMAS, UNITED STATES VIRGIN ISLANDS

PART 1 GENERAL

1.1 PROJECT

A. Project Name:

DEPARTMENT OF SPORTS PARKS AND RECREATION – KIRWIN TERRACE BALLPARK, PARCEL 76A AND PORTION OF 64 ESTATE LINDBERG, ST. THOMAS UNITED STATES VIRGIN ISLANDS

B. Owner's Name:
VIRGIN ISLANDS GOVERNMENT, DEPARTMEN OF SPORTS PARKS AND RECREATION

C. Plan Designer's Name:
SPRINGLINE ARCHITECTS, LLC

D. The complete Project consists of the reconstruction of the Public Works Office, 2nd Floor, in Susannaberg, St. John. This construction shall include demolition and construction of doors, windows, floors, walls, ceilings, electrical system, data system, security and painting as shown in the construction drawings prepared by the Department of Public Works.

E. Owner will remove the following items before start of work:

1. N/A

1.2 SALVAGE BY CONTRACTOR

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

1. N. A.

1.3 WORK BY OTHERS

A. N.A.

1.4 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.

B. Owner Responsibilities for products in the following category:
OFCI

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

C. 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:

c. OFCI

5. Protect products from damage after installation.

d. 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:

e. OFCI.

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

f. OFCR

g. 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:

h. OFCI

i. OFCR.

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

j. OFCI

k. OFCR.

1.5 CONTRACTOR FURNISHED PRODUCTS

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

1. CFCI.

B. Contractor's responsibilities:

1. As indicated in the Construction Documents.

1.6 OWNER OCCUPANCY

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

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

C. 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.

D. Schedule the Work to accommodate Owner occupancy.

1.7 CONTRACTOR USE OF SITE AND PREMISES

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

B. Arrange use of site and premises to allow:

1. Owner occupancy and operation.

2. Use of adjacent sites by the public.

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

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

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.

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

F. Relocate stored products which interfere with operations of Owner.

G. Do not load structure with weight that will endanger structure.

H. 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.

I. Utility Outages and Shutdown:
To be scheduled with the Owner's representative prior to implementing.

1.8 WORK SEQUENCE

A. Coordinate construction schedule and operations with Owner.

1.9 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 01020 - ALLOWANCES

DEPARTMENT OF SPORTS PARKS AND RECREATION – KIRWIN TERRACE BALLPARK
PARCEL 76A AND Portions of 64 ESTATE LINDBERG BAY,
ST. THOMAS, UNITED STATES VIRGIN ISLANDS

PART 1 - GENERAL

1.1 - GENERAL CONDITIONS

A. This item covers general project requirements for documentation, meetings, material certifications, certified payrolls, safety tape, marking paint, chalk, barricades, OSHAA compliance, management of crews and subcontractors, insurance, project photos, as-built drawings, temporary power, shop drawings, organizing operations to allow adjacent usage by the public, maintaining drives and walks for access to the site, compliance with laws and ordinances, securing and paying for necessary permits, and supplying miscellaneous materials required for construction.

1.2 MOBILIZATION

A. This item covers preparation of secure areas to accept storage of materials and equipment, mobilization of crews and construction materials, and transportation of equipment and scaffolding.

A. Demobilization and cleanup of the staging areas.

PART 2 - PRODUCTS- NOT USED

PART 3 - PAY ITEMS

A. N/A

END OF SECTION

SECTION 01039-COORDINATION AND MEETINGS

DEPARTMENT OF SPORTS PARKS AND RECREATION - KIRWIN TERRACE BALLPARK
PARCEL 76A AND PORTION OF 64 ESTATE LINDBERG BAY
ST. THOMAS, UNITED STATES VIRGIN ISLANDS

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Coordination and project conditions.

1. Field engineering.

2. Preconstruction meeting.

3. Site mobilization meeting.

1.2 PROGRESS MEETING.

4. Pre-installation meetings.

5. Equipment electrical characteristics and components.

6. Examination.

7. Preparation.

8. Cutting and Patching.

9. Alteration project procedures.

1.3 RELATED SECTIONS (NOT USED)

1.4 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.

1. Verify all existing utility locations.

1.5 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. Coordinate the following requirements with Surveyor.

1. 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.

2. Verify setbacks and easements; confirm drawings dimensions and elevations.

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

4. 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.

5. 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.

1.6 PRECONSTRUCTION MEETING

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

1. Attendance Required:
   Owner, Owner's Construction Representative and Contractor.

2. 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 (reference Field Engineering in this section).

   4. Scheduling.

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

1.7 SITE MOBILIZATION MEETING

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

1. Attendance Required:
   Owner's Representative/Engineer, Contractor's Superintendent, and major Subcontractors.

2. 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.

Security and housekeeping procedures.

Schedules.

Application for payment procedures.

Procedures for testing.

Procedures for maintaining record documents.

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

1.8 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.

1. Contractor shall arrange bi-weekly meetings, prepare agenda with copies for participants, and preside at meetings.

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

3. 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.

Review of submittals schedule and status of submittals.

Review of off-site fabrication and delivery schedules.

Maintenance of progress schedule.

Corrective measures to regain projected schedule.

Planned progress during succeeding work period.

Coordination of projected progress.

Maintenance of quality and work standards.

Effect of proposed changes on progress schedule and coordination.

Other business relating to Work.

4. Contractor 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 01039-COORDINATION AND MEETINGS

DEPARTMENT OF SPORTS PARKS AND RECREATION - KIRWIN TERRACE BALLPARK
PARCEL 76A AND PORTION OF 64 ESTATE LINDBERG BAY
ST. THOMAS, UNITED STATES VIRGIN ISLANDS

SECTION 01045-CUTTING AND PATCHING

DEPARTMENT OF SPORTS PARKS AND RECREATION - KIRWIN TERRACE BALLPARK
PARCEL 76A AND PORTION OF 64 ESTATE LINDBERG BAY
ST. THOMAS, UNITED STATES 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.

1.2 SUMMARY

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

1. 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."

1.3 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.

List products to be used and firms or entities that will perform Work.

Indicate dates when cutting and patching is to be performed.

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.

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.

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.

1.4 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. Structural concrete

b. Lintels

c. Timber and primary wood framing

d. Miscellaneous structural metals

1. 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:

e. Water, moisture, or vapor barriers.

f. Membranes and flashings.

g. Electrical wiring systems.

2. 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.

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 fully match existing adjacent surfaces 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.

3.2 PREPARATION

A. Temporary Support:
Provide temporary support of Work to be cut.

1. 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.

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

3. 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.

3.3 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.

1. 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.

Cut through concrete and masonry using a cutting machine such as a carborundum saw or diamond core drill.

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.

2. 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.

   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.

3.4 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

DEPARTMENT OF SPORTS PARKS AND RECREATION – KIRWIN TERRACE BALL PARK
PARCEL 76A AND PORTION OF 64 ESTATE LINDBERG BAY
ST. THOMAS, UNITED STATES VIRGIN ISLANDS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 DEFINITIONS

A. General:

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

B. 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.

C. 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.

D. 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.

E. 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.

F. Furnish:

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

G. 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.

H. Provide:

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

I. Installer:

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.

J. 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.

K. 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.

L. 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.

M. Owner's Representative:

Agent authorized to act on behalf of the Owner.

1.3 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.

B. 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.

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.

1.4 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.

B. Publication Dates:
   Comply with the standards in effect as of the date of the Contract Documents.

C. 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.

D. 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.

E. 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.

1.5 SUBMITTALS

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

PART 1 - GENERAL

SECTION INCLUDES

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.

RELATED SECTIONS: N/A

SCHEDULE OF VALUES

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.

APPLICATIONS FOR PROGRESS PAYMENT

Payment Period:
Submit at intervals stipulated in the Agreement.

Present required information as typewritten/computer-generated form.

Form:
AIA G702 Application and Certificate for Payment and AIA G703 -Continuation Sheet including continuation sheets when required.

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

Item Number

Description of Work

Scheduled Values

Previous Applications

Work in Place and Stored Materials under this Application

Total Completed and Stored to Date of Application

Percentage of Completion

Balance to Finish

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.

1. Construction progress schedule revised and current as specified in Section 01300.

2. Current construction photographs specified in Section 01300.

3. Partial release of liens from major Subcontractors and Vendors.

4. 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 date with cover letter for each copy of submittal. Show application number and date, and line item by number and description.

MODIFICATION PROCEDURES

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.

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

Promptly execute the change in Work.

Pricing Request:

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:

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.

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.

For pre-determined unit prices and quantities, the amount will be based on the fixed unit prices.

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.

Provide the following data:

Quantities of products, labor, and equipment

Taxes, insurance, and bonds

Overhead and profit

Justification for any change in Contract Time

Credit for deletions from Contract, similarly documented

Support each claim for additional costs with additional information:

Origin and date of claim

Dates and times work was performed, and by whom

Time records and wage rates paid

Invoices and receipts for products, equipment, and subcontracts, similarly documented

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.

APPLICATION FOR FINAL PAYMENT

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:

All closeout procedures specified in Section 01700

- PRODUCTS- NOT USED

- EXECUTION- NOT USED

END OF SECTION

SECTION 01300 – SUBMITTALS

DEPARTMENT OF SPORTS PARKS AND RECREATION – KIRWIN TERRACE BALLPARK
Parcel 76A AND PORTION OF 64 ESTATE LINDBERG BAY
ST. THOMAS, UNITED STATES VIRGIN ISLANDS

PART 1 - GENERAL

SECTION INCLUDES

Project coordination

Preconstruction meeting

Progress meetings

Progress photographs

RELATED SECTIONS

Section 01700- Execution Requirements:
Additional coordination requirements.

Section 01780- Closeout Submittals:
Project record documents.

PROJECT COORDINATION

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:

Requests for Interpretation

Requests for Substitution

Shop Drawings, Product Data, and Samples

Test and Inspection Reports

Manufacturer's Instructions and Field Reports

Applications for Payment and Change Order requests

Progress Schedules

Coordination of Drawings

Closeout Submittals

- PRODUCTS (NOT USED)

– EXECUTION

PRECONSTRUCTION MEETING

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

Attendance Required:

Owner:
Owner's Representative and invited Consultants

Contractor:
Project Manager and Job Superintendent

Major Sub-contractors as requested by the Owner and Contractor.

Minimum Agenda:

Execution of Owner-Contractor Agreement.

Submission of executed bonds and insurance certificates.

Submission of progress schedule.

Procedures and processing of field decisions, submittals and substitutions, applications for payments, pricing requests, Change Orders, and Contract closeout procedures.

Use of premises by Owner and Contractor.

Construction facilities and controls provided by Owner.

Temporary utilities provided by Owner.

Survey and construction layout.

Security and housekeeping procedures.

Schedules.

Application for payment procedures.

Procedures for testing.

Procedures for maintaining record documents.

Scheduling.

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.

1.1 PROGRESS MEETINGS

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:

Contractor, Project Manager and Job Superintendent.

Owner's Representative.

Engineer/Architect.

Major Sub-contractors as appropriate to agenda topics for each meeting.

Minimum Agenda:

Review minutes of previous meetings.

Review of Work progress.

Field observations, problems, and decisions.

Identification of problems which impede planned progress.

Review of submittals schedule and status of submittals.

Maintenance of progress schedule.

Corrective measures to regain projected schedules.

Planned progress during succeeding work period.

Maintenance of quality and work standards.

Effect of proposed changes on progress schedule and coordination.

Other business relating to Work.

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.

1.2 PROGRESS PHOTOGRAPHS

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:

Completed demolition and Site clearing.

Excavations.

Foundations.

Utility Installation – depth, alignment, stub-outs

Final completion.

Views:

Provide non-aerial photographs from three cardinal views at each specified time, until Date of Substantial Completion.

Consult with Owner's Representative for instructions on views required.

Provide factual presentation.

Provide correct exposure and focus, high resolution and sharpness, maximum depth of field, and minimum distortion.

Each Photo: Full color, jpeg format

Provide 3 sets on separate USB sticks
Size: 5 MB file

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

DEPARTMENT OF SPORTS PARKS AND RECREATION – KIRWIN TERRACE BALLPARK
Parcel 76A AND PORTION OF 64 ESTATE LINDBERG BAY
ST. THOMAS, UNITED STATES VIRGIN ISLANDS

PART 1 – GENERAL

SECTION INCLUDES

Preliminary schedule.

Construction progress schedule, bar chart type.

1.3 RELATED SECTIONS (NOT APPLICABLE)

1.4 SUBMITTALS

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.

Submit under transmittal letter form specified in Section 01300.

1.5 QUALITY ASSURANCE

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.

1.6 SCHEDULE FORMAT

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: To allow for notations and revisions.

Software Format: Microsoft Project

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION

3.1 PRELIMINARY SCHEDULE

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

3.2 CONTENT

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.

3.3 BAR CHARTS

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

3.4 REVIEW AND EVALUATION OF SCHEDULE

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.

3.5 UPDATING SCHEDULE

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.

Indicate changes required to maintain Date of Substantial Completion.

3.6 DISTRIBUTION OF SCHEDULE

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

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Quality assurance- control of installation

1. Tolerances
2. References and standards
3. Mock-up
4. Inspecting and testing laboratory services
5. Manufacturers' field services

1.2 RELATED SECTIONS

A. Section 01000 General Specifications:
Contractor's Shop and Working Drawings.

1.3 QUALITY ASSURANCE - CONTROL OF INSTALLATION

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

1. Comply with manufacturers' instructions, including each step in sequence.
2. Should manufacturers' instructions conflict with Contract Documents, request clarification from Owner's Representative/Engineer before proceeding.
3. 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.
4. Perform Work by persons qualified to produce required and specified quality.
5. Verify that field measurements are as indicated on shop drawings or as instructed by the manufacturer.
6. Secure Products in place with positive anchorage devices designed and sized to withstand stresses, vibration physical distortion, or disfigurement.

1.4 TOLERANCES

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

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

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

1.5 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.

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

2. Obtain copies of standards where required by product Specification Sections.

3. 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.

1.6 MOCK UP (NOT USED)

1.7 INSPECTION AND TESTING LABORATORY SERVICES

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

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

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

3. 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.

1.8 INSPECTION SERVICES

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

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

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

3. 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.

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

1.9 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.

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

2. 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)

2.10 - EXECUTION

2.1 EXAMINATION

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

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

2. Examine and verify specific conditions described in individual Specification Sections.

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

2.2 PREPARATION

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

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

2. 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

PART 1 - GENERAL

1.1 REQUIREMENTS INCLUDED

A. Products

B. Transportation and Handling

C. Storage and Protection

D. Product Options

E. Products List

F. Substitutions

1.2 RELATED REQUIREMENTS

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

B. 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.

B. Comply with the Specifications and referenced standards as minimum requirements.

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

2.2 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.

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

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

2.3 STORAGE AND PROTECTION

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

B. 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.

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

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

2.4 PRODUCT OPTIONS

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

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

C. Products specified by Naming Several Manufacturers.

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

2.5 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.

2.6 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.

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

C. 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.

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.

D. 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.

E. 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.

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

2.7 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

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.

B. 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.

C. 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.

D. 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

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.

B. 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.

B. 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.

C. 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.

D. 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.

E. 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.

F. 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.

G. 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

DEPARTMENT OF PUBLIC WORKS, **PUBLIC WORKS OFFICE 2ND FL RECONSTRUCTION**
INTERSECTION OF RT 10 AND RT 104, SUSANNABERG
ST. JOHN, UNITED STATES 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.

1.2 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.

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

1.3 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.

   jj. 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.

B. 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.

6. The Owner will repeat inspection when requested and assured that the Work has been substantially completed.

7. Results of the completed inspection will form the basis of requirements for final acceptance.

1.4 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.

B. 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.

1.5 RECORD DOCUMENT SUBMITTALS

A. General:

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.

B. 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 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.

C. 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.

D. 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 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.

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

E. Record Sample Submitted:

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.

F. 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

3.2 FINAL CLEANING

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

B. 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.

kk. Remove labels that are not permanent labels.

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

mm. 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.

C. Removal of Protection:

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

D. 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

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.

B. 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 contact, 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.

C. 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.

D. 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.

E. 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.

F. 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.

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

END OF SECTION

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.

B. 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.

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

C. 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 (I0) 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.

D. 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.

E. 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

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.

1.2 SECTION INCLUDES:

A. Project Record Document submittal.

1. Operation and Maintenance manuals.

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

1.3 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.

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.

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.

B. 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.

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.

Make submittals within ten days after Date of Substantial Completion.

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.

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.

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

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:

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.

Always make record documents and samples available for review by Owner's Representative and the Owner.

Record actual revisions to the Work concurrent with construction progress.

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 moth 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 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:

   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.

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.

Mark new information that is important to the Owner, but which was not shown on the Contract Documents or Shop Drawings.

Show Addenda items, Change Orders, RFI, or other means of communication used in the construction process.

Show and date revisions to drawings with a "cloud" drawn around the revision.

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.

Shop Drawings:

k. Maintain as record documents; legibly annotate to record changes made after review.

l. 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.

C. 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.

D. 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 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.

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

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.

Each prime contractor (Subcontractor) shall be responsible for marking up and submitting record Product Data for its own Work.

Insofar as possible, insert record product data in individual sub-sections of O&M Manuals. Refer to 3.05 below.

E. 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.

F. 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.

3.2 OPERATION AND MAINTENANCE DATA- GENERAL:

A. For Each Product:
List names, addresses and telephone numbers of Subcontractors and suppliers, including local source of supplies.

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

C. 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.

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

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

3.4 OPERATION AND MAINTENANCE DATA FOR MATERIALS AND FINISHES: (NOT USED)

3.5 OPERATION AND MAINTENANCE MANUALS: (NOT USED)

3.6 WARRANTIES, BONDS, AND PERMIT MANUAL:

A. Project Warranty-General:

1. If, within one (l) 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.

B. Categories of Specific Warranties:

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

4. 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).

C. 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.

D. 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.

E. 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 damages 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.

G. 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.

H. 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.

I. 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.

J. Owner's Recourse:

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.

K. 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.

L. 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.

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

N. Retain warranties and bonds until time specified for submittal.

END OF SECTION

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.

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

1.1 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 all applicable requirements and standards.

1.2 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.

1.3 PROJECT CONDITIONS

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.

B. 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.

C. Promptly repair damages caused to adjacent facilities by demolition Work.

D. 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.

E. 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.

F. 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 ice, flooding, and pollution.

PART 2 - PRODUCTS

A. GENERAL

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.

B. MATERIAL OWNERSHIP

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

2. 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.

B. 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.

C. 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.

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

3.3 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.

B. 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.

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

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

E. 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.

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

G. 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.

H. 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.

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

J. 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.

K. 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.

L. 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.

3.4 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.

B. 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.

3.5 DISPOSAL OF DEMOLISHED MATERIALS

A. 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.

3.6 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.

B. 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

PART 1 -GENERAL

1.1 DESCRIPTION

A. Work Included in This Section:

1. Provide all1abor, materials, equipment, and services, etc., required to furnish and install all cast-in-place plain and reinforced concrete work, as indicated on the Drawings, Specified herein, or otherwise required for a complete and proper job.

B. The Work shall include, but shall not necessarily be limited to:

1. Forms, shoring, reinforcing, reinforcing accessories, and form removal.

2. The furnishing, placing, finishing, curing, and protection of all above and below grade, plain and reinforced, architectural and non-architectural concrete including but not necessarily limited to:

a. Foundations and footings.

b. Walls, pilasters, beams, lintels, columns, pits and piers.

c. Slabs-on-grade

d. Ramps.

e. Cast-in-place stairs.

f. Encasements, miscellaneous fills and enclosures.

g. Equipment bases and housekeeping pads (as required for all trades).

h. Site work concrete: walks, ramps, stairs, islands, curbs, walls, wall caps, headwalls, pads, bases, platforms, cradles, encasements, thrust blocks, etc.

3. Vapor retarders under interior slabs-on-grade.

4. Installation of embedded items (pipe sleeves, duct sleeves, keys, chases, boxes, bolts, anchors, reglets, inserts, expansion joint covers, etc.) furnished by other trades.

5. Cutting and patching existing concrete.

6. Joint filler and sealant in and around concrete slabs.

7. Sealing of concrete slabs to remain exposed.

C. Related Work Specified Elsewhere:

1. SECTION 05300: STEEL DECKING

2. SECTION 05500: MISCELLANEOUS METAL WORK

1.2 SUBMITTALS

A. Product Data:
Submit manufacturers' technical data, application, and installation instructions for each type of manufactured materials and product indicated.

1. Mix Designs: Submit concrete mix designs with two (2) cylinder test results by a qualified independent testing laboratory for each type of concrete to be used, not less than ten (10) days prior to placement. NOTE: If concrete is to be pumped, separate mix design(s) shall be required. If admixtures are to be included in the mix, provide mix design with test results. Indicate quantities of mix water for addition at project site.

B. Shop Drawings:

1. Submit reinforcing steel shop drawings detailing, bending, and placing of reinforcements, and bar lists in accordance with ACI 315 "Manual of Standard Practice for Detailing Concrete Structures".

2. Submit for information only, formwork shop drawings prepared by or under the supervision of a qualified professional engineer detailing fabrication, assembly, and support of formwork. Submit formwork, joint, and tie layout shop drawings for all architectural concrete. The Project Manager will review these drawings for aesthetic considerations only. All form design and engineering shall remain the exclusive responsibility of the Contractor.

3. Submit proposed schedule and sequence of stripping form work, shoring removal, and installing and removing re-shoring.

C. Certificates:
Submit certificates for welding procedures and personnel. Submit material certificates signed by the manufacture certifying materials comply with the project requirements for the following:

1. Cementitious materials and aggregates.

2. Form materials and form release agents.

3. Steel reinforcement and reinforcement accessories.

4. Fiber reinforcement.

5. Admixtures.

6. Curing materials.

7. Floor and slab treatments.

8. Bonding agents.

9. Adhesives.

10. Vapor retarders.

11. Epoxy joint filler.

12. Joint filler strips.

13. Repair materials.

1.3 TESTING AND INSPECTIONS

A. Testing and inspection shall be performed as required by the building code, the Contract Documents, or as otherwise directed by the Project Manager. The Contractor shall employ a testing laboratory for the purpose of testing concrete, inspecting reinforcements and submitting reports. The cost of testing and inspections shall be paid for by the Contractor.

B. The Contractor shall arrange and coordinate all testing and inspections and shall give the Owner's Representative and Project Manager a minimum of forty-eight (48) hours notice before each concrete pour.

C. Sampling and testing for quality control during concrete placement may include the following, as directed by the Project Manager:

1. Slump: ASTM C-143; one test at point of discharge for each day's pour of each type of concrete; additional tests when concrete consistency seems to have changed.

2. Air Content: ASTM C-173; volumetric method for light-weight or normal-weight concrete; ASTM C-231, pressure method for normal-weight concrete; one for each day's pour of each type of concrete mix.

3. Concrete Temperature: ASTM C-1064; one test hourly when air temperature is 80 degrees F and above, and one test for each set of compressive strength specimens.

4. Compression Test Specimen: ASTM C-31; one set of four standard cylinders for each compressive strength test, unless otherwise directed. Mold and store cylinders for laboratory cured test specimens except when field cured test specimens are required.

5. Compressive Strength Tests: ASTM C-39; one set for each day's pour exceeding 5 cu.yd. plus additional sets for each 50 cu.yd. more than the first 25 cu.yd. of each concrete class placed in any one day; one specimen tested at 7 days, two specimens tested at 28 days, and one specimen retained in reserve for later testing if required.

   a. Should tests yield compressive strengths equal to or exceeding 28-day minimum requirements, discontinue testing of remaining cylinders for that sample lot.

b. Specimens in reserve are to be disposed of upon completion of the Project.

6. Unit Weight: ASTM C567, fresh unit weight of structural lightweight concrete; one test for each composite sample, but not less than one test for each day's pour of each concrete mix.

D. When frequency of testing will provide fewer than five strength tests for a given class of concrete, conduct testing from at least five randomly selected batches or from each batch if fewer than five are used.

E. When total quantity of a given class of concrete is less than 50 cu. yd. the Project Manager may waive strength testing if adequate evidence of satisfactory strength is provided.

F. When strength of field cured cylinders are less than 85 percent of companion laboratory cured cylinders, evaluate current operations and provide corrective procedures for protecting and curing the in place concrete.

G. Strength level of concrete will be considered satisfactory if averages of sets of three consecutive strength test results equal or exceed specified compressive strength and no individual strength test result falls below specified compressive strength by more than 500 psi.

H. Test results will be reported in writing to the Owner's Representative, Project Manager, Structural Engineer, Contractor, concrete manufacturer, and Building Inspector within 2 working days. Reports of compressive strength tests shall contain the project identification name and number, date of concrete placement, name of concrete testing service, concrete type and class, location of concrete batch in structure, design compressive strength at 28 days, concrete mix proportions, and materials, compressive breaking strength, and type of break for both 7 day and 28 day tests.

I. Contractor shall pay for testing conducted and any other additional testing as may be required when unacceptable concrete is verified.

J. The Contractor shall remove and replace, or strengthen, as determined by the Project Manager, all concrete work for which test results fall below the specified requirements.

K. Early (4-day) concrete cylinder breaks to facilitate the Contractor's schedule and operations shall be paid for by the Contractor.

1.4 PRECAUTIONS

A. No aluminum of any kind (conduit, wire, reglet, inserts, etc.) shall be placed in concrete work, except where contact surfaces are coated with an epoxy paint, approved by the Project Manager.

B. Use no form release agents containing materials that may affect a satisfactory finish and/or adhesion of materials to be applied to concrete by other sections.

C. Slab curing agents other than water may be used, with prior written approval.

D. No conduits, pipes, ducts, or other non-structural components of any kind shall be placed in concrete slabs, without the Project Manager's prior written authorization.

1.5 QUALITY ASSURANCE

A. Codes and Standards:
All concrete shall be placed, cured, and tested in accordance with all applicable sections of the American Concrete Institute (ACI) specifications, latest edition, including but not limited to the following, except where more stringent requirements are shown or specified:

1. ACI 117- "Specification for Tolerances for Concrete Construction and Materials".
2. ACI 211.1- "Standard Practice for Selecting Proportions for Normal, Heavyweight, and Mass Concrete".
3. ACI 301- "Structural Concrete for Buildings".
4. ACI 302.1- "Guide for Concrete Floor and Slab Construction".
5. ACI 304- "Recommended Practice for Measuring, Mixing, Transporting and Placing Concrete".
6. ACI 305R- "Hot Weather Concreting".
7. ACI 308- "Standard Practices for Curing Concrete".
8. ACI 311- "Recommended Practice for Concrete Inspection".
9. ACI 315- "Standard Practice for Detailing Reinforced Concrete Structures".
10. ACI 318- "Building Code Requirements for Reinforced Concrete".
11. ACI 347- "Recommended Practice for Concrete Formwork"
12. Concrete Reinforcing Steel Institute (CRSI) "Manual of Standard Practice".

B. Installer Qualifications:
Shall be an experienced installer who has completed concrete work similar in materials, design, and extent to that required for this project, with a record of successful completions.

C. Professional Engineer Qualifications for services related to formwork, shoring and re-shoring installation:
Shall be a professional engineer, licensed in the United States Virgin Islands, experienced in providing engineering services of this type.

D. Ready-mix Plant Qualifications:
Shall be a firm experienced in the manufacture of ready mixed concrete products complying with ASTM C94 requirements for production facilities and equipment. Manufacturer shall be certified according to the National Ready Mixed Concrete Association's Certification of Ready Mixed Concrete Production Facilities.

E. Obtain each type of class of cementitious materials of the same brand from the same manufacturer's plant, each aggregate from one source and each admixture from the same manufacturer.

F. Qualify procedures and personnel according to AWS Dl.4 Structural Welding Code- Reinforcing Steel".

G. Pre-installation Meeting:
A pre-installation meeting to review cast-in-place concrete project requirements shall be attended by the Contractor, General Superintendent, Concrete Sub-contractor, ready-mix producer, testing and inspection agency, Owner's Representative and Project Manager.

1.6 PRODUCT HANDLING

A. Protection:
Protect materials during transit, on-site storage, and handling to prevent deterioration and damage. Reinforcing steel shall be stored off the ground in an orderly manner to facilitate access and usage in designated locations. Repair epoxy coating on steel reinforcement according to ASTM D3963 and ASTM D3963M.

PART 2 - PRODUCTS

2.1 FORM MATERIALS

A. Forms for Exposed Concrete:
Shall be exterior grade plywood, equal to American Plywood Association B-B Plyform, in excellent condition, free of dents, scratches or surface deposits. Forms for architectural concrete shall be HDO (High Density Overlaid) Plyform, in "like-new" condition. Use appropriate thickness of Class I, II or Structural I Plyform as recommended by APA for specific installations.

B. Forms for Concealed Concrete:
May be Plyform, matched dressed lumber or steel.

C. Forms for Cylindrical Columns, Pedestals, and Supports:
Shall be metal, glass fiber reinforced plastic, paper or fiber tubes that shall provide surfaces with gradual or abrupt irregularities not exceeding specified formwork surface class. Provide units with sufficient wall thickness to resist plastic concrete loads without detrimental deformation.

D. Pan-Type Forms:
Glass fiber reinforced plastic or formed steel stiffened to resist plastic concrete loads without detrimental deformation.

E. Void Forms:
Biodegradable paper surface, treated for moisture resistance, structurally sufficient to support weight of plastic concrete and other superimposed loads.

F. Chamfer Strips:
Shall be wood, metal, PVC, or rubber strips, 3/4 by 3/4 inch minimum.

G. Form Ties and Spreaders:
Shall be factory fabricated, adjustable length, removable or snap-off metal or glass fiber reinforced plastic form ties designed to prevent form deflection and to prevent spalling of concrete upon removal. Provide units that will leave no metal closer than one (1) inch to the plane of the exposed concrete surface. Do not use wire ties and wood spreaders. Where concrete is to remain exposed to view or painted, ties shall have removable tapered plastic cones of no greater than one (1") inch outside diameter. Ties for walls below grade and wall indicated to receive damp proofing or waterproofing shall incorporate water seal washers.

H. Form Release Agent:
Shall be a commercial formulation with a maximum of 350 mg/1 volatile organic compounds that will not bond with, stain or adversely affect concrete surfaces and will not impair subsequent treatments of concrete surfaces.

I. Keyed Slab-On-Grade Form:
Shall be 24-ga. Hot dipped galvanized steel with interlocking support stakes, and dowel bar knock-outs, "Model Pro-Key" as manufactured by BoMetals, Inc., or approved equal. Provide appropriate form depth for slab depth as indicated on the Drawings.

2.2 REINFORCING MATERIALS

A. Reinforcing Bars:
Shall be deformed bars complying with ASTM A-615 A and M, Grade 60. Low alloy deformed steel reinforcing bars shall conform to STM A706 A and M. Fabricated deformed epoxy coated reinforcing shall comply with ASTM A934 A and M. Steel bar mats shall conform to ASTM A184 A and M, and shall be assembled with clips.

B. Welded Wire Fabric:
Deformed steel wire shall conform to ASTM A496, and sheets shall conform to ASTM A497, provide in flat sheets. Epoxy coated wire shall conform to ASTM A884 A and M, Class A, plain or deformed as indicated on the Drawings and fabric shall conform to ASTM A884 A and M, Class A.

C. Supports for Reinforcement:
Shall include, but are not limited to: spacers, chairs, ties, bolsters, and other devices for spacing, supporting, and fastening reinforcing bars and welded wire fabric. Supports shall conform to CRSI "Manual of Standard Practice".

1. For concrete surfaces exposed to view where legs of wire bar supports contact forms, use CRSI Class 1 plastic protected or CRSI Class 2 stainless steel bar supports.

2. For epoxy coated reinforcement, use epoxy coated or other dielectric polymer coated wire bar supports.

D. Joint Dowel Bars:
Shall be plain steel bars conforming to ASTM A615 A and M, Grade 60, or epoxy coated bars conforming to ASTM A775A and M Grade 60, as indicated on the Drawings. Cut bars true to length with ends square and free of burrs.

E. Repair Materials:

For epoxy, shall be liquid epoxy repair coating compatible with epoxy coating complying with ASTM A775 A and M.

2.3 CONCRETE MATERIALS

A. Portland Cement:
Shall comply with ASTM C-150, Type II. Only one brand of cement shall be used throughout the project.

B. Concrete Aggregates shall conform to the following requirements:

1. Fine Aggregate:
Shall comply with ASTM C-33 and consist of clean, hard, tough and preferably siliceous material (sand), free from mineral or other coatings, soft particles, clay, loam, or other deleterious matter. Materials for exposed concrete shall come from a single source.

2. Coarse Aggregate (normal weight):
Shall comply with ASTM C-33 and consist of crushed stone or gravel having clean, hard, durable, uncoated particles, free from deleterious matter. Materials for exposed concrete shall come from a single source.

3. Coarse Aggregate (light weight):
Shall comply with ASTM C-33 and consist of cellular materials of mineral origin, such as shale, clay, slate, fly ash, or slag, either naturally occurring or produced by sintering, expansion, palletizing, or rotary kiln processes. Material shall have a dry loose weight of 55 lbs. per cu. ft. and graded from 3/4" to No. 4.

C. Mixing Water shall be potable.

D. Admixtures:
Shall be used in complete accordance with the manufacturer's directions. All admixtures shall be by the same manufacturer, who shall provide at no added cost to the Owner, the services of its representative at the job to ensure proper use of each particular admixture. No admixtures containing calcium chloride (chloride ions) shall be placed in concrete work. Admixtures shall be certified by the manufacturer to contain no more than 0.1 percent water soluble chloride irons by mass of cementitious materials, to be compatible with other admixtures and cementitious materials and to comply with the following:

1. Air-entraining: ASTM C-260.

2. Water-reducing: ASTM C-494, Type A

3. High-range, Water-reducing: ASTM C494, Type F.

4. Water-reducing and accelerating: ASTM C494, Type E.

5. Water-reducing and retarding: ASTM C494, Type D.

6. Corrosion-inhibiting:

Commercially formulated, anodic inhibitor or mixed cathodic and anodic inhibitor, capable of forming a protective barrier and minimizing chloride reactions with steel reinforcement in concrete.

2.4 RELATED MATERIALS

A. Curing Membrane shall be one of the following:

1. White polyethylene sheeting 4 mils thick, ASTM C171; or

2. Waterproof paper, Sisalkraft Type, ASTM C171-69 as manufactured by Fortifiber Corp., Ludlow Papers, Glas-Kraft; or

3. Jute or kenaf, approximately 9 oz. per sq. yd., complying with AASHTO M-182, Class 2.

4. Liquid membrane curing compound of resin or latex base conforming to ASTM C309 Type I, Class A. Confirm compatibility with subsequent surface treatments, sealers, surfacing materials adhesives, etc. prior to use. Product shall be "Kur-N-Seal" or "Kur-N-Seal NB" by Sonneborn, "Safe Cure & Seal" by Dayton Superior Corp., "Spray-Cure & Seal 25" by Conspec Manufacturing, or approved equal.

B. Interior Concrete Sealer:
Exposed interior concrete slabs, shall have two (2) applications of sealer in accordance with manufacturer's directions. Interior cistern surfaces receiving a waterproof epoxy need not be treated with sealers. Office area slabs to receive finish flooring or garage floors to receive 2 coats of epoxy painting shall not be treated with sealers or hardeners.

C. Exterior Concrete Sealer (Sidewalks, plazas, pads):
Shall be "Silocks Plus-WB" as manufactured by Silpro, "Sheild MX" by Conproco, or approved equal.

D. Joint Sealant for joints in slabs and walks:
Shall be self-leveling, multi-component polyurethane. Use primer as recommended by the manufacturer. Sealant shall be "THC-900" or "THC-901" (low sag as required by job conditions) as manufactured by Tremco, or approved equal such as SikaFlex. Color shall be as selected by the Project Manager.

E. Premolded Joint Filler Strips:
Shall be l/2" thick, unless otherwise noted, premolded, resilient, compressible, re- expanding, non-extruding bituminous and fiber material, made with cane fibers, uniformly saturated with not less than 35% and not more than 50% by weight of asphalt, conforming to ASTM D1751.

F. Chemical Bonding Agent:
Shall be film-forming, freeze-thaw resistant compound suitable for brush or spray application, "Daraweld-C" by W.R. Grace Company, 'Eucoweld" by Euclid Chemical Company, or approved equal.

G. Slab Vapor Retarder:

1. Shall be 10 mils thick un-reinforced polyethylene, conforming to ASTM D4397.

H. Plastic Control Joints:
Shall be "Zip Cap" type as manufactured by W.R. Meadows., Sika Corp., or approved equal. Depth shall be as required to penetrate l/4" thickness of slab.

I. Dovetail Anchor Slots:
See SECTION 04200: UNIT MASONRY AND MORTAR.

J. Repair Underlayment:
Shall be cement based, polymer modified, minimum 4,100 psi strength, self-leveling product, for edge feathering to adjacent floor surfaces. Provide a surface primer as recommended by manufacturer.

K. Repair Topping:
Shall be traffic bearing, cement based, polymer modified, minimum 5,700 psi strength, self-leveling product, application thickness from l/4 inch. Provide a surface primer as recommended by manufacturer.

L. Other Materials:
All other materials not specifically described herein, but required for a complete and proper installation, shall be as selected by the Contractor and approved by the Project Manager.

PART 3 - EXECUTION

3.1 PROPORTIONS

A. All concrete shall be ready-mixed controlled concrete and proportioned according to ACI 211 and ACI 301 for normal-weight concrete and light-weight concrete.

B. The nominal maximum size of the aggregate shall not be larger than one-fifth of the narrowest dimension between sides of forms, one-third of the depth of slabs, nor three-fourths of the minimum clear distance between reinforcing bars or between bars and forms, whichever is least. In general, 3/4" size will satisfy these requirements. Aggregate of 1-1/2" size shall be used for slabs on grade, which are 5" or more in thickness.

C. Concrete for every part of the Work shall be a homogeneous structure which, when cured, will have at least the strength required by design. The limiting values of concrete shown in Table A and the requirements hereinafter specified must be met.

D. Proportions of concrete ingredients shall be determined in advance of concreting operations by the testing laboratory, and shall be such as to produce a concrete fulfilling every requirement of the Contract Documents. Advance specimen shall be tested as to compliance with this requirement by standard laboratory tests of concrete made with representative samples of the cement and aggregates, which the Contractor proposes to use for each specific portion of the Work. It shall be the Contractor's responsibility to provide the concrete strengths required and to pay the cost for a laboratory to make necessary trial mixes.

E. The design strength of the concrete in this structure is based upon ultimate strength requirements of ACI 318. The minimum strength requirement stated is the strength of the concrete at 28 days when samples are cured and tested in accordance with the recommended standards of ACI 318.

F. By the water-cement ratio is meant the total quantity of water entering the mixture, including the surface water carried by the aggregates, expressed in terms of the quantity of cement.

G. All concrete exposed to the exterior shall be air-entrained concrete, typically 6% +/- 1% by volume for 3/4" aggregate and 8% +/-1% for 3/8" aggregate. Maximum air-entrainment for exterior slabs shall be 3%. Interior floor slabs shall not be air entrained.

H. The water-cement ratio shall be expressed in U.S. gallons per sack (94 lb net) of cement.

TABLE A

Minimum Allowable Compressive Strength @ 28 Days PSI	Maximum Allowable Net Water Content Gals/Sack*	Cement Sacks Per CU. YD. Minimum Permissible **	Total Water Maximum
3500	3.5	6.0	21.0 gal/CY
4000	4.0	6.5	26.0 gal/CY

* Maximum: Decrease if possible. This represents the total water in the mix at the time of mixing, and includes free water on aggregates. Reduce net allowable water content by one gallon for air-entrained concrete.

** Minimum: Increase as necessary to meet other requirements.

I. The method of measuring water and aggregates shall be such as to secure specified proportion in each batch, and in a manner that proportion of water to cement can be closely controlled and easily checked at any time.

J. The proportions of aggregates to cement for concrete for any of this work shall be such as to produce concrete that will work readily into corners and angles of the forms and around the reinforcement without excessive puddling or spading and without permitting the materials to segregate or free water to collect on the surface.

K. Light-weight concrete mix shall be proportioned as herein specified, and shall produce strength and modulus of elasticity as noted on the Drawings, or Specified herein, with a split-cylinder strength factor (Fsp) of not less than 5.5 and a dry weight of not less than 95 lbs. or more than 100 lbs. after 28 days. Shrinkage shall be limited to 0.03% at 28 days.

L. No change in source of materials or mix shall be made without the Project Manager's authorization. Concrete mix design adjustments may be requested by Contractor when characteristics of materials, job conditions, weather, test results, or other circumstances warrant. Such adjustments shall be at no additional cost to Owner and as accepted by Project Manager. Laboratory test data for revised mix design and strength results shall be submitted to and accepted by Project Manager before using in the Work.

M. Design mix reports shall include the following information:

1. Identification of aggregate source of supply.

2. Tests of aggregate for compliance with specified requirements.

3. Scale weight of each aggregate.

4. Absorbed water in each aggregate.

5. Brand, type and composition of cement.

6. Brand, type and amount of each admixture.

7. Amounts of water used in trial mixes.

8. Proportions of each material per cu. yd.

9. Gross weight and yield per cubic yard of trial mixtures.

10. Measured slump.

11. Compressive strength results of 2 representative samples at 7 and 28 days for each type of concrete to be used.

3.2 STRENGTH COMPLIANCE

A. The following more clearly defines performance:

1. To meet the requirements of this Specification and those of ACI 318, the average of any three consecutive strength tests of laboratory-cured specimens representing each class of concrete shall be equal to or greater than the specified strength (fc), and not more than one out of ten strength tests shall have a value of less than the specified minimum strength. In addition to the above requirement, the allowed 10% of tests below the minimum required strength shall be equal to or greater than 90% of the minimum specified strength (fc).

2. Should the strengths shown by the test specimens fall below the specified design strengths, the Project Manager shall have the right to require additional curing on those portions of the structure represented by those test specimens.

3. When the tests on control specimens of concrete fall below the required strength, the Project Manager will permit, at the Contractor's expense, check tests for strengths to be made by means of Windsor Probes or typical cores drilled from the structure in accordance with ASTM C-42 and C-39. In cases of failure of the latter, the Project Manager, in addition to other resources, may require, at the Contractor's expense, load tests on any members in which such concrete was used. Load tests need not be made until concrete has aged 60 days.

3.3 DESIGN OF FORMWORK

A. The design, engineering, and safety of formwork, as well as its construction shall be the exclusive responsibility of the Contractor.

B. Exercise care in order to ensure that all formwork is properly designed, engineered and erected, and capable of safely supporting all loads and pressures. Forms shall be held to the dimensions indicated on the Drawings, with the tolerances established by ACI 117 concrete surface irregularities shall be limited as designated by ACI 347R.

C. Temporary openings shall be provided at the base of forms and at other points where necessary to facilitate cleaning and observation immediately before concrete is deposited.

D. Forms shall be sufficiently tight to prevent leakage of grout or cement paste.

E. Properly set and secure all embedded items to be furnished by other trades.

F. Properly set and secure all form applications for chamfers, reglets, rustication joints, etc., as indicated on the Drawings. Chamfer exterior corners and edges of permanently exposed concrete.

3.4 PREPARATION OF FORM SURFACES AND EMBEDDING ITEMS

A. Plywood and other wood surfaces not subject to shrinkage shall be sealed against absorption of moisture from the concrete by either: (1) a field applied approved form oil or sealer; or, (2) a factory applied non-absorbent liner. All shall be subject to review for finish appearance.

B. When forms are coated to prevent bond with concrete, it shall be done prior to placing of reinforcing steel. Excess coating material shall not be allowed to stand in puddles in the forms nor allowed to come in contact with concrete against which fresh concrete will be placed.

C. Where architectural (as-cast) finishes are required, only non-staining materials shall be used at form surfaces. Where the finished surface is required to be painted or treated, the material applied to the form surface shall be compatible with the type of paint to be used.

D. All forms shall be thoroughly cleaned before reuse.

E. All necessary chamfer strips and related architectural detail strips shall be provided for as indicated on the Drawings.

F. The Contractor shall thoroughly review all Drawings for special formwork required at openings such as windows, louvers, doors, etc.

G. Set and build into form work anchorage devices and other embedded items required for other work that is attached to or supported by cast-in-place concrete. Set anchor rods by template to ensure proper positioning. Do not cut, core, or sleeve through footings or embed mechanical and electrical utilities in or through footings without consulting with the Project Manager, before any such cutting, coring, sleeving, or embedding is begun.

H. Do not place (embed) mechanical or electrical conduit, ducting, etc., in supported (suspended) concrete slabs.

I. At slabs, set edge forms, bulkheads, and intermediate screed strips to achieve required elevations, and contours in finished surfaces for slabs. Provide and secure units to support screed strips using strike-off templates or compacting-type screeds.

3.5 CONCRETE REINFORCEMENT

A. Reinforcing bars to be embedded in concrete shall be free of oil, dirt, loose mill scale, and loose rust. Reinforcing bars with rust, mill scale, or a combination of both will be acceptable as being satisfactory with cleaning or brushing, provided that upon wire brushing, the dimensions including height of deformations and weights of a cleaned sample shall not be less than the applicable ASTM specification requirements.

B. The placement of bars shall conform to CRSI Manual of Standard Practice, Placing Reinforcing Bars. Maintain adequate space for proper concrete cover.

C. Place no concrete before installation of the reinforcement has been reviewed by the independent inspection agency.

D. In event of displacement of any reinforcement, same shall be corrected and retied as necessary and in a satisfactory manner.

E. All splicing of bars, concrete cover, and bar spacing shall conform to "Building Code Requirements for Reinforced Concrete" (ACI 318) as published by the American Concrete Institute, and to recommended practices in "Splicing Reinforcing Bars" by the Concrete Reinforcing Steel Institute, or as hereinafter specified.

   1. When necessary to splice reinforcement, bars shall be lapped at least 40 bar diameters, unless noted otherwise, placed in contact and wired. Laps shall be avoided at points of maximum stress. All rods shall be securely wired together at all intersections. No permanent device for fastening reinforcement shall be left in contact with the face of forms at exposed surfaces.

F. The welding of reinforcing bars shall be performed in accordance with "Recommended Practices for Welding Reinforcing Steel, Metal Inserts and Connections for Reinforced Concrete Construction" (AWS D12.1), as by the American Welding Society. Welders shall be qualified by tests as prescribed in the "Standard Qualification Procedures" (AWS B3.0), as published by the American Welding Society.

G. Tack welding of reinforcing steel shall not be permitted.

H. Heat bending of reinforcing steel shall not be permitted.

I. All splicing of wire fabric shall be made with fabric lapped at least 2 meshes wide and tied at 3'-0" O.C.

J. Repair all holes in vapor retarders prior to concrete placement.

3.6 MIXING

A. Ready-mixed concrete shall be mixed and delivered in accordance with the requirements set for it in ASTM C94 and ACI 614.

B. Transit-mixed concrete shall be delivered in high-lift trucks to enable it to be easily deposited in the forms.

C. The mixing shall be continuous after the water has been added to the mix in the drum, but no concrete shall be placed in the forms more than 90 minutes after the water has been added.

3.7 CONSISTENCY

A. The consistency of the concrete is mainly dependent upon the thoroughness of the mixing and the quantity of water contained in the mix. In general, the maximum slump and minimum strengths shall be as follows:

Type of Construction	Compressive Strength Required in PSI	Maximum Slump (inches)
All Exterior Concrete	3500 (air entrained)	4
Beams and Columns	3500	4
Footings	3000	4
Foundation Walls	3000	4
Slabs	4000	4

Miscellaneous Concrete	3500	4

3.8 CONCRETE PLACEMENT

A. Inspection:
Prior to placing concrete, all formwork, reinforcements and embedded items shall be complete and inspected by the inspection agency. All embedded items shall be checked for proper location, type, and quantity.

B. Prior to placing concrete:
Clean all equipment used for mixing and transporting the concrete. Remove all debris from the place to be occupied by the concrete, and check forms for dimensions, position, and adequacy.

C. Standing Water:
Water shall be removed from excavations before any concrete is deposited. Any flow of water into an excavation shall be diverted through proper side drains to a sump, or shall be removed by other approved methods that will avoid washing the freshly deposited concrete. No pumping shall be done while the concrete is being placed.

D. Conveyors and Pumps:
Convey concrete from the mixer to the place of final deposit by rapid methods that will prevent the separation or loss of the materials. Equipment for placing concrete shall be of such size and design as to ensure delivery without segregation of the materials. All shall be in accordance with ACI 614.

E. Concrete Placement:

1. Concrete shall not be placed by means of open chutes, the combined length of which exceeds 30', and shall not be allowed to drop freely through distances exceeding 6' or through loosely spaced reinforcing bars, conduits, etc., which will tend to segregate materials.

2. Place concrete as nearly as practicable in its final position to avoid segregation due to handling or flowing. No concrete that has partially hardened or been contaminated by foreign material shall be deposited on the Work.

3. Once concrete placement is started, it shall be carried on as a continuous operation until the placing of the panel, section, or individual foundation is completed, so as not to cause formation of seams and planes of weakness within the section. If a section cannot be placed continuously, construction joints as specified and as detailed on the Drawings shall be provided. The top surface shall be generally level. When construction joints are necessary, they shall be made in as specified herein.

4. Place concrete in layers not over 12" deep, and thoroughly compact by means of vibrators, hand tamping and spading. During the operation of placing, thoroughly work the concrete around reinforcement, embedded fixtures, pipes, and conduits, and into the corners of the forms so as to prevent interior voids, honeycomb, and the patching of concrete surfaces after forms are removed. Internal vibrators should be used to aid in the compaction of the concrete. Extreme care shall be used on thin sections and exposed concrete.

3.9 WEATHER PROTECTION

A. Unless adequate protection is provided and/or approval is obtained, concrete shall not be placed during rain. Rainwater shall not be allowed to increase the mixing water or to damage the surface finish.

B. Hot Weather Concrete Placement:

1. Hot weather concrete placement shall be done in accordance with the recommendations of ACI 305R.

2. Concrete deposited in hot weather shall have a material temperature that will not cause difficulty from loss of slump, flash set, or cold joints (less than 90 degrees F).

3. In hot weather, be adequately prepared to protect the concrete from the adverse influence of heat before the placement of any concrete. Take precautions to avoid cracking of the concrete from rapid drying during placement of concrete, particularly when the work is exposed to direct sunlight.

   a. Cool forms by fogging with water spray or by protecting them from the direct rays of the sun.

   b. If requested by the Contractor, deemed advisable by the Testing Engineer, and approved by the Project Manager, a retardant may be used to delay the initial set of the mix.

3.10 CONCRETE JOINTS

A. Construction joints shall be located so as to least impair the strength and water tightness of the structure. All construction joint locations shall be subject to the notification of and acceptance by the Project Manager, prior to placement.

B. All construction placement joints shall be keyed.

C. Reinforcement shall be continuous through construction joints and additional reinforcing placed as required. Except where otherwise specified, the surfaces of construction joints shall be prepared in a manner that will ensure bonding with concrete or grout placed on them. Wherever practical, construction joint surfaces shall be kept continuously moist until new concrete or grout is placed.

D. Use bonding agent on existing concrete surfaces to be joined with new concrete. Use a epoxy bonding adhesive at locations where fresh concrete is placed against hardened or partially hardened concrete surfaces.

E. Place control joints perpendicular to main reinforcement. Continue reinforcement across control joints except as indicated otherwise.

F. Locate joints for beams, slabs, joists and girders in the middle third of spans. Offset joints in girder a minimum distance of twice the beam width from a beam-girder intersection. Locate horizontal joints in walls and columns at underside of floors, slabs, beams and girders and at the top of footings or floor slabs. Locate joints beside piers integral with walls, near corners, and in concealed locations where possible.

3.11 JOINTS IN SLABS

A. Control (contraction and isolation) joints in slabs-on-grade shall be provided wherever new concrete abuts foundation walls, exterior slabs and to form slab panels as indicated on the Drawings, as otherwise noted, specified or detailed. All joints shall be straight and square to facilitate alignment of finish flooring movement joints where applicable. Where possible, control joints shall be located under a non-bearing partitions. All joints shall be keyed.

B. The area contained between joints shall not exceed 480 square feet. The maximum distance between joints in any direction shall not exceed 24 feet.

C. Construct isolation joints in slabs-on-grade at points of contact between slabs and vertical surfaces, such as column pedestals, foundation walls, grade beams, and other locations as indicated. Extend joint filler strips full width and depth of joint, terminating flush with finished concrete surface, unless otherwise indicated. Terminate full width joint filler strips not less than ½ inch or more than 1 inch below finished concrete surface where joint sealants are indicated. Install joint filler strips in lengths as long as practicable.

D. Joints shall be grooved after initial floating to a radius of 1/8 inch or joints may be sawed as soon as the surface is firm enough so that it will not be torn or damaged by the blade, usually within 4 to 12 hours after the concrete hardens, 1/8 inch wide and 1/4 of slab depth, unless otherwise indicated.

E. All exposed sawed joints shall be filled with control joint filler. Surfaces to receive finish flooring shall utilize control joint filler acceptable to the flooring manufacturer.

F. At the Contractor's option, concrete slabs to be covered by other finish flooring materials may utilize plastic control joints.

G. Expansion joints in slabs shall be constructed with expansion joint covers at locations indicated on the Drawings. Installation shall be as recommended by the manufacturer. Coordinate with the Work of SECTION 05500: MISCELLANEOUS METAL WORK.

H. Install dowel sleeves and dowels or dowel bar and support assemblies at joints where indicated. Use dowel sleeves with lubrication one half of dowel length to prevent concrete bonding to one side of joint.

3.12 REMOVAL OF FORMS

A. Formwork not supporting the weight of concrete, such as sides of beams, walls, and similar parts of the work, may be removed 48 hours after placing the concrete, provided the concrete is sufficiently hard to not be damaged by the form removal operations, and provided that curing and protection operations are maintained.

B. Removal of forms shall be in a manner to ensure safety of structure and prevent damage to concrete surfaces. Particular care shall be taken in the removal of forms for concrete surfaces to remain exposed.

C. Whenever the formwork is removed during the curing period, the exposed concrete shall be cured by one of the methods specified.

D. Formwork for beams, joist, slabs and other structural elements that support weight of concrete in place shall be left in place until the concrete has achieved at least 70 percent of its 28 day design compressive strength, as determined by testing specimens in accordance with ACI 301. Remove forms only if shores have been arranged to permit removal of forms without loosening or disturbing shores.

3.13 PLACING SLABS

A. Slabs-on-grade shall be thicknesses indicated on the Drawings, placed on compacted fill as specified. Concrete shall be full thickness of slab and troweled out as specified herein. Carefully review the Drawings in order to coordinate and provide all slab recesses, depressions, and pitches required for equipment or finishes to be furnished and installed by other trades, or for proper drainage. Install pre-molded joint filler strips at slab perimeters as indicated on the Drawings.

B. Thicken and reinforce slabs-on-grade under non-bearing masonry partitions.

C. Provide a continuous slab vapor retarder under all slabs-on-grade unless specifically noted otherwise. Place, protect and repair vapor retarder sheets according to ASTM EI643 and manufacture's written instructions. Lap seams a minimum of twelve (12") inches and tape. Cover vapor retarder with granular material, moisten and compact. See SECTION 02300: EARTHWORK. Minimize traffic over uncovered vapor retarders to limit damage. Any damage to vapor retarders shall be repaired prior to fill placement above vapor retarders or concrete placement. Where slab vapor retarder is not required at slabs-on-grade, gravel or crushed stone shall be wetted just prior to concrete placement.

D. Concrete slabs shall have wood or metal screeds spaced not over 10' o.c. and set at the elevations shown on the Drawings. NOTE: Contractor may, at his option, use wet screeds provided that wet pads are established at not more than 10' o.c. both ways, with elevations established by use of laser equipment.

E. Deposit and consolidate concrete for slabs in a continuous operation, within limits of construction joints, until completing placement of a panel or section. Concrete shall be thoroughly worked around reinforcements and other embedded items and into corners.

F. Bring slab surfaces to correct level with a straight edge and strike off. Use bull floats or darbies to smooth surface free of humps or hollows. This shall be completed before free moisture rises to the surface so as to avoid bleeding. Do not disturb slab surfaces prior to beginning finishing operations.

G. Adjust concrete volume for L/360 dead load ponding at suspended slabs.

H. Maintain reinforcing in proper position on chairs during concrete placements.

3.14 FINISHING FORMED NON-ARCHITECTURAL CONCRETE SURFACES

A. Rough-Formed Finish:
For concealed non-architectural finish on formed concrete with texture imparted by form material, repair tie holes and defective areas and chip off fins and projections exceeding 114 inch in height.

B. Smooth-Formed Finish:
For exposed non-architectural finish on select formed concrete and for concrete surfaces to receive a direct coating material such as waterproofing, damp proofing, veneer plaster, painting, etc. Immediately upon removal of forms, point all form tie holes and other defects flush with surface and remove all fins and projections exceeding 1/8" for a smooth surface, or as otherwise directed by the Project Manager.

C. Smooth-Rubbed Finish:
For exposed foundation surfaces and other smooth-formed surfaces as indicated on the Drawings, provide a smooth-rubbed finish not later than 1 day after form removal. Moisten concrete surfaces and rub with carborundum brick or other abrasive until producing a uniform color and texture. Remove all fins, burrs, joint marks, and other projections. Do not apply cement grout other than that created by the rubbing process.

D. Grout-Cleaned Finish:
For smooth-formed surfaces as indicated on the Drawings, wet concrete surfaces and apply grout of a consistency of thick paint to coat surfaces and fill small holes. Mix one part Portland cement to one and one-half parts fine sand with a 1:1 mixture of bonding admixture and water. Add white Portland cement in amounts determined by trial patches so color of dry grout will match adjacent surfaces. Scrub grout into voids and remove excess grout. When grout whitens, rub surface with clean burlap and keep surface damp by light water spray for at least 36 hours.

3.15 CONCRETE SLAB FINISHES

A. Scratch Finish:

1. Apply scratch finish to slab surfaces to receive concrete floor topping, mortar setting beds for tile, other bonded cementitious finish flooring materials and where indicated.

2. After placing slabs, plane surface to a levelness/flatness tolerance not exceeding ½ inch in 10 feet when tested with a 10 ft. straight edge. Slope surfaces uniformly to drains where required or as indicated. After leveling, roughen surface before final set with stiff brushes, brooms, or rakes.

B. Float Finish:

1. Apply float finish to slab surfaces to receive trowel finish, other finishes as specified, and slab surfaces to be covered with membrane or elastic waterproofing, membrane, or elastic roofing and where indicated.

2. After screeding, consolidating, and leveling concrete slabs, do not work surface until ready for floating. Begin floating, using float blades or flat shoes only, when surface water has disappeared, or when concrete has stiffened sufficiently to permit operation of power-driven floats, or both. Consolidate surface with power- driven floats or by hand-floating if area is small or inaccessible to power units. Check and level surface plane to a levelness/flatness tolerance not exceeding 1/4 inch in 10 ft. when tested with a 10' straight edge. Cut down high spots and fill low spots. Uniformly slope surfaces to drains. Immediately after leveling, re-float surface to a uniform, smooth, granular texture.

C. Trowel Finish:

3. Apply trowel finish to slab surfaces to be exposed to view and slab surfaces to be covered with resilient flooring, carpet, thin-set ceramic or quarry tile, paint, or other thin-film finish coating system.

4. After floating, begin first trowel finish operation using a power-driven trowel. Begin final troweling when surface produces a ringing sound as trowel is moved over surface. Consolidate concrete surface by final hand-troweling operation, free of trowel marks, uniform in texture and appearance. Level surface plane to a tolerance not exceeding 114 inch in 10 feet when tested with a 10' straight edge. Grind smooth any surface defects that would telegraph through applied floor covering system.

5. Where ceramic or quarry tile is to be installed with thin-set mortar, apply a trowel finish as specified, then immediately follow by slightly scarifying the surface with a fine broom as recommended by the tile manufacturer to ensure proper bonding of tile setting materials. Coordinate with the Work of SECTION 09300: CERAMIC TILE and SECTION 09330: QUARRY TILE, as applicable. Slope surfaces uniformly to drains where required or as indicated.

D. Slip-Resistant Broom Finish:

1. Apply a non-slip broom finish to exterior concrete platforms, sidewalks, pads, steps, ramps, and elsewhere as indicated on the Drawings.

2. Immediately after float finishing, slightly roughen concrete surface by brooming with a fiber-bristle broom perpendicular to main traffic route. Review final finish with Project Manager prior to application.

3. All joints and edges shall be tooled.

4. All surfaces shall be properly damp cured.

5. Slab sealer shall be applied to all exposed exterior concrete slab surfaces.

6. Surfaces shall receive sealer applied at rates and by the methods recommended by the manufacturer.

3.16 MISCELLANEOUS CONCRETE ITEMS

A. Filling In:
Fill in holes and openings left in concrete for passage of work by other trades, unless shown or directed, after work of other trades is in place. Mix, place and cure concrete as specified to blend with in-place construction. Provide other miscellaneous concrete filling shown or required to complete the Work.

B. Equipment Bases and Foundations:
Provide machine and equipment bases and foundations as shown on the Drawings. Set anchor bolts for machines and equipment to templates at correct elevations, complying with information provided by the equipment manufacturer.

C. Interior Curbs:
Provide monolithic finish to interior curbs by stripping forms while concrete is still green and by steel-troweling surfaces to a hard, dense finish with corners, intersections, and terminations slightly rounded.

D. Joint Sealing:
Seal joint as late in the course of the work as possible to allow shrinkage to occur. Clean joints and apply elastomeric sealant in accordance with manufacturer's instructions.

3.17 CURING AND PROTECTION

A. Protect newly placed concrete against low and high temperature effects and against rapid loss of moisture. In hot, dry, and windy weather protect concrete from rapid moisture loss before and during finishing operations with evaporation-control materials. Apply according to manufacturer's instructions, after screeding and bull floating, but before power floating and troweling.

B. Start initial curing as soon as free water has disappeared from concrete surface after placing and finishing. Cure concrete by curing compound, by moist curing, by moisture-retaining cover curing, or by combining these methods. Moist curing shall include keeping concrete surfaces continuously wet by covering with water; using a continuous water-fog spray; or covering the concrete surface with continuously wetted burlap.

1. Curing Slabs, Toppings and Other Flat Surfaces: Within twenty-four (24) hours after final troweling, slab finish surfaces shall be covered to moist cure for at least seven days with burlap or curing paper. Curing paper shall be lapped 4" at edges and sealed with tape at least 3" inches wide. Paper shall be weighted to prevent displacement, and holes or tears shall be immediately repaired.

2. Curing Formed Surfaces: Moist cure with forms in place for the full seven day curing period. If the forms are removed prior to seven days, apply curing compound and cure in accordance with manufacturer's written instructions. Intermittent wetting and drying does not provide acceptable curing. Keep steel forms heated by the sun, and all wood forms in contact with the concrete, wet during the curing period.

C. Form Removal Not Supporting Weight of Concrete (footings, walls): May be removed after curing for 24 hours after placing concrete, provided concrete is sufficiently hard to not be damaged by form removal operations, and provide curing and protection operations are maintained.

D. Form Removal Supporting Weight of Concrete: (beams, suspended slabs, lintels and other structural elements) May not be removed in less than 14 days or until concrete has attained at least 75% of design minimum compressive strength at 28 days. Determine potential compressive strength of in-place concrete by testing field-cured specimens representative of concrete location or members.

E. Where shored, form facing material may be removed 4 days after placement only if shores and other vertical supports have been arranged to permit removal of form facing material without loosening or disturbing shores and supports.

F. Protection From Mechanical Injury: During the curing period, protect concrete from damaging mechanical disturbance, particularly load stresses and excessive vibration. Protect all finished concrete surfaces from damage caused by construction equipment, materials, or methods and running water. Do not overload self-supporting concrete structures. Foundation walls shall not be backfilled or driven over by vehicles during the curing period.

G. Concrete floor sealer shall be applied to all exposed interior concrete slab floors, unless otherwise scheduled. Floors shall be clean and free of marks and stains. Floors shall receive sealer applied at rates and by the methods recommended by the manufacturer.

H. Exterior concrete slab surfaces shall be sealed at rates and by the methods recommended by the manufacturer. Protect fresh concrete from pedestrian and vehicular traffic for at least seven (7) days after placement.

I. Seal all concrete wall-slab perimeters and all penetrations with joint sealant as specified.

3.18 CONCRETE SURFACE REPAIRS

A. Repairing Formed Surfaces:

1. Repair of formed architectural concrete surfaces is not allowed. Only repairing of formed non-architectural concrete surfaces is allowed. Remove and replace concrete that cannot be repaired and patched to Project Manager's approval. Repair and patch defective areas with cement mortar immediately after removing forms. Mix dry-pack mortar, consisting of one-part Portland cement to 2-l/2 parts fine aggregate passing a No. 16 mesh sieve, using only enough water as required for handling and placing.

2. Cut out honeycombs, rock pockets, voids over 1/4 inch in any dimension, and holes left by tie rods and bolts down to solid concrete but in no case to a depth less than 1 inch. Make edges of cuts perpendicular to the concrete surface. Thoroughly clean, dampen with water, and brush-coat the area to be patched with bonding agent. Place patching mortar before bonding agent has dried.

3. For surfaces exposed to view, blend white Portland cement and standard Portland cement so that when dry, patching mortar will match surrounding color. Provide test areas at inconspicuous locations to verify mixture and color match before proceeding with patching. Compact mortar in place and strike-off slightly higher than surrounding surface.

4. Remove and replace concrete having defective surface if defects cannot be repaired to the satisfaction of the Project Manager. Surface defects include color and texture irregularities, cracks, spalls, air bubbles, honeycomb, rock pockets, fins, other surface projections, stain, and other discolorations that cannot be removed by cleaning. Flush out form tie holes and fill with dry-pack mortar or pre-cast cement cone plugs secured in place with bonding agent.

5. Repair concealed formed surfaces containing defects that affect the concrete's durability. If defects cannot be repaired, remove and replace the concrete.

B. Repairing Slab Surfaces:

1. Test slab surfaces for smoothness and verify surface tolerances specified for each surface and finish. Correct low and high areas as specified. Test surface slopes to drain for trueness of slope and smoothness by using a template having the required slope.

2. Repair finished surfaces containing defects that affect the concrete's durability. Surface defects include crazing and cracks in excess of 0.01 inch wide or that penetrate to the reinforcing or completely through non-reinforced sections regardless of width, spalling, pop-outs, honeycombs, rock pockets, and other objectionable conditions. Correct high areas in surfaces by grinding after concrete has cured at least 14 days.

3. Correct low areas in surfaces during or immediately after completing surface finishing operations by cutting out low areas and replacing with patching mortar. Finish repaired areas to blend into adjacent concrete. Proprietary cementitious underlayment compound may be used when acceptable to the Project Manager.

4. Repair defective areas, except random cracks and single holes not exceeding 1 inch in diameter, by cutting out and replacing with fresh concrete. Remove defective areas with clean, square cuts and expose reinforcing steel with at least 3/4 inch clearance all around. Dampen concrete surfaces in contact with patching concrete and apply bonding agent. Mix patching concrete of same material to provide the same type or class as original concrete. Place compact and finish to blend with adjacent finished concrete. Cure in same manner as adjacent concrete.

C. At concealed, non-architectural concrete, repair isolated random cracks and single holes 1 inch or less in diameter by dry-pack method. Groove top of cracks and cut out holes to sound concrete and remove dust, dirt, and loose particles. Dampen cleaned concrete surfaces and apply bonding agent. Place dry-pack before bonding agent has dried. Compact dry-pack mixture in place and finish to match adjacent concrete. Keep patched area continuously moist for at least 72 hours.

D. Perform structural repairs with prior approval of Project Manager for method and procedure, using specified epoxy adhesive and mortar. Repair methods not specified above may be used, subject to acceptance by Project Manager.

END OF SECTION

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 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 1A" 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. Delivery of Materials:
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.

C. 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.

E. 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.

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.

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 spayed-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) 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 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 in 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 Jess 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.

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 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 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 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 ¼", 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.

E. 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

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 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

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. WWPA- 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 AWPA C2 (lumber) and AWPA C9 (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.

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 AWPA 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 AWPA C20 (lumber) and AWPA 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.

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 WWPA; No.2 grade per SPIB; or Standard grade per NLGA, WCLIB or WWPA 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 l/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 Under1ayment for Carpet:
For underlayment under 19/32 inch (15.1 mm) thick, provide plywood panels with fully sanded face and as follows:

1. l. 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.

1. 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 Bl8.6.l.

E. Lag Bolts:
ASME Bl8.2.l. (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.

2.10 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 AWPA 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:

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.

1. Comply with "Code Plus" provisions of above-referenced guide.

B. Fastening Methods:
Fasten panels as indicated below:

2. Combination Subflooring-Underlayment:
Glue and nail to framing throughout.
a. Space panels 1/8 inch (3 mm) at edges and ends.

3. Subflooring:
Glue and nail to framing throughout.
a. Space panels 1/8 inch (3 mm) at edges and ends.

4. Underlayment:
Nail to subflooring.

a. Space panels 1/32 inch (0.8 mm) at edges and ends.

END OF SECTION

PART 1 GENERAL

1.1 SUMMARY

A. Related Documents:

1. Drawings and general provisions of the Subcontract apply to this Section.

2. Review these documents for coordination with additional requirements and information that apply to work under this Section.

B. Section Inacludes:

1. Standing and running trim.

2. Wood paneling.

3. Interior wood door frames.

4. Wood shelves (trim) including related hardware.

5. Perforated hardboard (“Pegboard”).

6. Stripping, blocking, furring and nailers required for millwork and installed from face of walls, floors and ceilings.

7. Complete shop finishing of transparent finished millwork.

C. Related Sections:

1. Division 01 Section "General Requirements."

2. Division 01 Section "Special Procedures."

3. Division 06 Section "Rough Carpentry".

4. Division 06 Section "Architectural Wood Casework".

5. Division 08 Section "Flush Wood Doors".

6. Division 09 Section "Painting".

1.2 REFERENCES

A. General:

1. 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.

2. Unless otherwise noted, the referenced standard edition is the current one at the time of commencement of the Work.

3. Refer to Division 01 Section "General Requirements" for the list of applicable regulatory requirements.

B. Architectural Woodwork Institute

1. Architectural Woodwork Quality Standards. Latest edition.

1.3 SUBMITTALS

A. Submit under provisions of Divisions 01 Section "General Requirements" and "Special Procedures."

B. Shop Drawings: Submit for all millwork items and related accessories. Indicate anchorage methods.

C. Samples:

1. Submit veneer flitches as hereinafter specified.

2. Submit 6 by 8 inches (150 by 200 mm) samples each wood specie which is to receive job applied transparent finish.

3. Submit samples to establish permissible variations for compatibility of color and grain.

4. Submit for shop applied wood finishes. Submit on actual species specified. Samples shall be affixed with label giving full description of finish and number of coats.

D. LEED Submittals:

1. [Product Data for Credit EQ 4.1: For adhesives, including printed statement of VOC content.]

2. [Product Data for Credit EQ 4.4: For composite-wood products, documentation indicating that product contains no urea formaldehyde.]

3. [Certificates for Credit MR 7: Chain-of-custody certificates certifying that products specified to be made from certified wood comply with forest certification requirements. Include evidence that mill is certified for chain of custody by an FSC-accredited certification body.

b. Include statement indicating costs for each certified wood product.]

1.4 QUALITY ASSURANCE

A. Millwork shall be manufactured in accordance with the AWI Standards in the grades hereinafter specified. In event of a dispute as to the quality grades, all parties will call upon an inspection under AWI's inspection procedures and agree to abide by the decision of AWI.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Work of this Section shall be stored flat in a dry, well ventilated space protected from inclement weather. Use care in handling and storing materials to assure proper ventilation and to protect edges and avoid any disfigurement, scratches or corner bruises. Damaged or warped material shall be immediately replaced with new, undamaged material.

B. Make adequate provisions for receiving all materials. Sign for and inspect deliveries. If damage is observed or discovered, note the same on delivery slip and notify the University. If damage is concealed, notify trucker and the University when discovered. After delivery, Subcontractor assumes liability for all subsequent damage to materials and equipment.

C. Make no deliveries of millwork until areas are completely enclosed and wet work completed.

PART 2 PRODUCTS

2.6 MATERIALS

A. General: Items noted or specified as to species (i.e., White Maple", "Birch", etc.) may be presumed to receive a transparent finish. Items which are not designated by species or which are designated or specified as "wood" or "hardwood" may be presumed to receive an opaque finish.

B. Solid Stock: Solid stock trim used with plywood items shall match the plywood unless otherwise noted.

1. Items noted or specified as "White Maple": (Here, specify how sawn).

2. Items noted or specified as "Wood", "Hardwood", or not otherwise designated by species: Natural Birch.

2.7 FABRICATION GRADES

A. Transparent Finished items: Premium Grade.

B. Opaque Finished Items: Custom Grade.

C. Drawings indicate general appearance standards only and are not intended to reduce compliance with specified grade of millwork.

2.8 FABRICATION

A. Surfacing: Wood items shall be smoothly machines and sanded on exposed surfaces as required by grade.

B. Frames: Jambs and heads shall be rabbeted.

C. Shelves: Adjustable shelving shall be banded on all exposed edges; fixed shelving shall be banded on front edge. Edge bands may be solid wood or veneer edge.

2.9 FINISHING

<Here specify transparent finishes.>

PART 3 EXECUTION

3.1 CONDITION OF SURFACES

A. Inspect materials and surfaces prior to installation and report all defects. Proceeding with installation implies acceptance of surfaces as satisfactory.

B. Clean materials as required.

C. Do not attempt to install equipment which is missing parts which will require disassembly or removal at a later time in order to install parts necessary for a functional operation.

3.2 PREPARATION

A. Coordinate work under this Section with other trades whose work adjoins, combines or aligns with same. Take such field measurements as may be required. Report any major discrepancy between Drawings and field dimensions to the Project Manager and secure directions before proceeding.

3.3 INSTALLATION

A. General:

1. Set work in place, scribe plumb, square and level and secure in position indicated with required fastenings, clips, braces, anchors, blocking, shimming and other fittings required to properly secure.

2. Ease exposed edges.

3. Blind nail items where possible; where not possible, use finish nails set for putty. Staples, T-nails and similar fastenings are not permitted for exposed surfaces.

4. Make standing trim single lengths, running trim in longest lengths possible. Miter cut running joints tight and flush on exposed faces and edges. Miter or cope inside corner joints; miter outside corners. Miter and return exposed ends, returns less than 1” longer than thickness, drilled, glued and nailed.

5. Wood millwork not shop finished shall be backprimed (under Division 09 "Painting") prior to setting in place.

6. Hammer marks and other defects caused by installation procures may result in rejection of the particular item damaged.

B. Paneling: Locate joints as indicated, plumb and level, butted tight to adjacent pieces and metal trim, grain direction vertical. Panels shall be a single pied between indicated joints. Install panels using concealed metal clips; face nailing not permitted.

C. Shelves: Shelving which in not noted as adjustable may be presumed to be fixed. Fixed shelving shall be installed on ¾ by 3-1/2 inches (20 mm by 90 mm) hook strips continuous three sides. Provide shelf and rod support to limit spans to 4 feet (1.22 m). Install symmetrically. Adjustable shelving shall be installed with specified hardware, surface mounted.

D. Install hardboard over wood spacers in one piece without joints. Fasten with oval head wood screws at 8 inches (200 mm) o.c. around perimeter and at 16 inches (400 mm) o.c. at intermediate bearings.

3.4 CLEANUP

A. Upon completion of the work, remove all debris, rubbish and surplus materials from the site, resulting from work under this Section.

END OF SECTION

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. Laminate-clad cabinets (plastic-covered casework).

2. Plastic-laminate countertops.

3. Shop finishing of woodwork.

B. Related Sections:
The following Sections contain requirements that relate to this Section:

1. Division 6 Section "Rough Carpentry" for exposed framing and for furring, blocking, shims, and hanging strips for installing interior woodwork.

2. Division 8 Section "Flush Wood Doors" for doors specified by reference to architectural woodwork standards.

1.3 DEFINITIONS

A. Interior architectural woodwork includes wood furring, blocking, shims, and hanging strips for installing woodwork items unless concealed within other construction prior to woodwork installation.

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 each type of product and process specified and incorporated into items of architectural woodwork during fabrication, finishing, and installation.

C. Fire-retardant-treatment data for material treated to reduce combustibility. Include certification by treating plant that treated materials comply with requirements.

D. Shop drawings showing location of each item, dimensioned plans and elevations, large-scale details, attachment devices, and other components.

1. Show details full size.

2. Show locations and sizes of furring, blocking, and hanging strips, including concealed blocking and reinforcing specified in other Sections.

3. Show locations and sizes of cutouts and holes for plumbing fixtures, faucets, soap dispensers, and other items installed in architectural woodwork.

E. Samples for initial selection of the following in the form of manufacturer's color charts consisting of actual units or sections of units showing the full range of colors, textures, and patterns available for each type of material indicated.

1. Shop-applied opaque finishes.

2. Plastic laminates.

F. Samples for verification of the following:

1. Laminate-clad panel products, 8 by 10 inches (200 by 250 mm), for each type, color, pattern, and surface finish, with separate samples of unfaced panel product used for core.

2. Exposed cabinet hardware, one unit for each type and finish.

G. Product certificates signed by woodwork fabricator certifying that products comply with specified requirements.

H. 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 architects and owners, and other information specified.

1.5 QUALITY ASSURANCE

A. Single-Source Responsibility for Fabrication and Installation:
Engage a qualified woodworking firm to assume undivided responsibility for fabricating, finishing, and installing woodwork specified in this Section.

B. Quality Standard:
Except as otherwise indicated, comply with the following standard:

1. AWl Quality Standard:
"Architectural Woodwork Quality Standards" of the Architectural Woodwork Institute for grades of interior architectural woodwork, construction, finishes, and other requirements.

a. Provide AWI Certification Labels or Certificates of Compliance indicating that woodwork meets requirements of grades specified.

A. Fire-Test-Response Characteristics:
Provide materials with the following fire-test-response characteristics as determined by testing identical products per ASTM test method indicated below by UL, Warnock Hersey, or another testing and inspecting agency acceptable to authorities having jurisdiction. Identify fire-retardant-treated material with appropriate markings of applicable testing and inspecting agency in the form of separable paper label or, where required by authorities having jurisdiction, imprint on surfaces of materials that will be concealed from view after installation.

1. Surface-Burning Characteristics:
Not exceeding values indicated below, tested per ASTM E 84 for standard time period (10 minutes).

a. Flame Spread: 75.

b. Smoke Developed: 450.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Protect woodwork during transit, delivery, storage, and handling to prevent damage, soilage, and deterioration.

B. Do not deliver woodwork until painting and similar operations that could damage, soil, or deteriorate woodwork have been completed in installation areas. If woodwork must be stored in other than installation areas, store only in areas whose environmental conditions meet requirements specified in "Project Conditions."

1.7 PROJECT CONDITIONS

A. Environmental Limitations:
Do not deliver or install woodwork until building is enclosed, wet work is completed, and HVAC system is operating and will maintain temperature and relative humidity at occupancy levels during the remainder of the construction period.

B. Environmental Limitations:
Obtain and comply with woodwork fabricator's and Installer's coordinated advice for optimum temperature and humidity conditions for woodwork during its storage and installation. Do not install woodwork until these conditions have been attained and stabilized so that woodwork will be within plus or minus 1.0 percent of optimum moisture content from date of installation through remainder of construction period.

C. Field Measurements:
Where woodwork is indicated to be fitted to other construction, check actual dimensions of other construction by accurate field measurements before fabrication, and show recorded measurements on final shop drawings. Coordinate fabrication schedule with construction progress to avoid delaying the Work.

1. Verify locations of concealed framing, blocking, reinforcements, and furring that support woodwork by accurate field measurements before being enclosed. Record measurements on final shop drawings.

2. Where field measurements cannot be made without delaying the Work, guarantee dimensions and proceed with fabricating woodwork without field measurements. Provide allowance for trimming at site and coordinate construction to ensure that actual dimensions correspond to guaranteed dimensions.

1.8 COORDINATION

A. Coordinate sizes and locations of framing, blocking, furring, reinforcements, and other related units of Work specified in other Sections to ensure that interior architectural woodwork can be supported and installed as indicated.

B. Hardware Coordination:
Distribute copies of approved schedule for cabinet hardware specified in Division 8 Section "Door Hardware" to fabricator of architectural woodwork; coordinate cabinet shop drawings and fabrication with hardware requirements.

PART 2 - PRODUCTS

2.1 MATERIALS

A. General:
Provide materials that comply with requirements of the AWI quality standard for each type of woodwork and quality grade indicated and, where the following products are part of interior woodwork, with requirements of the referenced product standards that apply to product characteristics indicated:

1. Hardboard: AHA A135.4.

2. Medium-Density Fiberboard: ANSI A208.2.

3. Particleboard: ANSI A208.1, Grade M-2.

4. Softwood Plywood: PS 1.

5. Hardwood Plywood and Face Veneers: HPVA HP-1.

B. Formaldehyde Emission Level for Medium-Density Fiberboard:
Comply with requirements of NPA9.

C. Fiberboard:
Medium-density fiberboard made without formaldehyde and complying with ANSI A208.2.

1. Product: Subject to compliance with requirements, provide Medite II by Medite Corp.

D. High-Pressure Decorative Laminate:
NEMA LD 3, grades as indicated, or if not indicated, as required by woodwork quality standard.

2. Available Manufacturers:
Subject to compliance with requirements, manufacturers offering high-pressure decorative laminates that may be incorporated in the Work, but are limited to the following:

a. Nevamar Corp.

2.2 FIRE-RETARDANT-TREATED MATERIALS

A. General:
Where indicated, use materials impregnated with fire-retardant chemical formulations indicated by a pressure process or other means acceptable to authorities having jurisdiction to produce products with fire-test-response characteristics specified.

B. Fire-Retardant Chemicals:
Use chemical formulations that do not bleed through or otherwise adversely affect finishes. Do

not use colorants in solution to distinguish treated material from untreated material.

C. Fire-Retardant-Treated Lumber:
Comply with the following:

1. Low-Hygroscopic Formulation: Interior Type A per AWPA C20.

2. Mill lumber after treatment, within limits set for wood removal that does not affect listed fire-test-response characteristics, using a woodworking plant certified by testing and inspecting agency.

3. Kiln-dry material before and after treatment to levels required for untreated material.

4. Discard treated material that does not comply with requirements of referenced woodworking standard. Do not use twisted, warped, bowed, discolored, or otherwise damaged or defective material.

5. Available Products:
Subject to compliance with requirements, products that may be incorporated in the Work include, but are not limited to, the following:

a. Low-Hygroscopic Formulation (Type A):

1. D-Blaze; J. H. Baxter Co.

2. D-Blaze; Chemical Specialties, Inc.

3. Pyro-guard; Continental Wood Preservers, Inc.

4. Dricon; Hickson Corp.

5. Pyro-guard; Hoover Treated Wood Products, Inc.

D. Fire-Retardant Fiberboard:
Medium-density fiberboard panels complying with ANSI A208.2, made from softwood fibers, synthetic resins, and fire-retardant chemicals mixed together at time of panel manufacture to achieve products identical to those tested for flame spread of 25 or less and for smoke developed of 200 or less per ASTM E 84 by UL, Warnock Hersey, or another testing and inspecting agency acceptable to authorities having jurisdiction. Identify products with appropriate markings of applicable testing and inspecting agency.

1. Product:
Subject to compliance with requirements, provide Medite FR by Medite Corp.

2.3 CABINET HARDWARE AND ACCESSORY MATERIALS

A. General:
Provide cabinet hardware and accessory materials associated with architectural cabinets, except for items specified in Division 8 Section "Door Hardware."

B. Cabinet Hardware Schedule:
Refer to schedule at end of this Section for cabinet hardware required for architectural cabinets.

C. Hardware Standard:
Comply with BHMA A156.9 for items indicated by reference to BHMA numbers or referenced to this standard.

D. Exposed Hardware Finishes:
For exposed hardware, provide finish that complies with BHMA A156.I8 for BHMA code number indicated.

1. Satin Stainless Steel, Stainless-Steel Base: BHMA 630.

E. For concealed hardware provide manufacturer's standard finish that complies with product class requirements for BHMA A156.9.

2.4 INSTALLATION MATERIALS

A. Furring, Blocking, Shims, and Hanging Strips: Fire-retardant-treated softwood lumber, kiln dried to less than 15 percent moisture content.

B. Screws:
Select material, type, size, and finish required for each use. Comply with ASME B 18.6.1 for applicable requirements.

C. Nails:
Select material, type, size, and finish required for each use. Comply with FS FF- N-105 for applicable requirements.

D. Anchors:
Select material, type, size, and finish required for each substrate for secure anchorage. Provide nonferrous metal or hot-dip galvanized anchors and inserts on inside face of exterior walls and elsewhere as required for corrosion resistance. Provide toothed steel or lead expansion bolt devices for drilled-in-place anchors.

2.5 FABRICATION, GENERAL

A. Interior Woodwork Grade:
Provide interior woodwork complying with the referenced quality standard and of the following grade:

1. Grade: Custom.

B. Wood Moisture Content:
Comply with requirements of referenced quality standard for wood moisture content in relation to relative humidity conditions existing during time of fabrication and in installation areas.

C. Sand fire-retardant-treated wood lightly to remove raised grain on exposed surfaces before fabrication.

D. Fabricate woodwork to dimensions, profiles, and details indicated. Ease edges to radius indicated for the following:

1. Corners of cabinets and edges of solid-wood (lumber) members 3/4 inch (19 mm) thick or less: l/16 inch (1.5 mm).

2. Edges of rails and similar members more than 3/4 inch (19 mm) thick: l/8 inch (3 mm).

3. Corners of cabinets and edges of solid-wood (lumber) members and rails: l/16 inch (1.5 mm).

E. Complete fabrication, including assembly, finishing, and hardware application, before shipment to Project site to maximum extent possible. Disassemble components only as necessary for shipment and installation. Where necessary for fitting at site, provide ample allowance for scribing, trimming, and fitting.

1. Trial fit assemblies at the fabrication shop that cannot be shipped completely assembled. Install dowels, screws, bolted connectors, and other fastening devices that can be removed after trial fitting. Verify that various parts fit as intended and check measurements of assemblies against field measurements indicated on approved shop drawings before disassembling for shipment.

F. Shop-cut openings, to maximum extent possible, to receive hardware, appliances, plumbing fixtures, electrical work, and similar items. Locate openings accurately and use templates or roughing-in diagrams to produce accurately sized and shaped openings. Smooth edges of cutouts and, where located in countertops and similar exposures, seal edges with a water-resistant coating.

2.6 LAMINATE-CLAD CABINETS (PLASTIC-COVERED CASEWORK)

A. Quality Standard:
Comply with AWI Section 400 requirements for laminate-clad cabinets - Custom Grade.

B. AWI Type of Cabinet Construction:
Reveal overlay (l/4" Reveal)

C. Laminate Cladding for Exposed Surfaces: High-pressure decorative laminate complying with the following requirements:

1. Horizontal Surfaces Other than Tops: GP-50, 0.050-inch (1.270-mm) nominal thickness.

2. Vertical Surfaces: GP-50, 0.050-inch (1.270-mm) nominal thickness.

3. Edges: GP-50, 0.050-inch (1.270-mm) nominal thickness.

D. Materials for Semi exposed Surfaces:
Provide surface materials indicated below:

1. Surfaces Other than Drawer Bodies: High-pressure decorative laminate, Grade GP-28.

2. Drawer Sides and Backs: Solid hardwood lumber, shop finished.

3. Drawer Bottoms: Thermoset decorative overlay.

E. Colors, Patterns, and Finishes:
Provide materials and products that result in colors and textures of exposed laminate surfaces complying with the following requirements:

1. Provide selections from laminate manufacturer's full range of colors and finishes in the following categories:

a. Solids

b. Allusions

c. Matrix

d. Patterns

e. Hallmark

f. Woodgrains

F. Provide dust panels of l/4-inch (6.4-mm) plywood or tempered hardboard above compartments and drawers except where located directly under tops.

2.7 COUNTERTOPS

A. Quality Standard:
Comply with AWI Section 400 requirements for countertops - Custom Grade.

B. Type of Top:
High-pressure decorative laminate complying with the following:

1. Grade: GP-50, 0.050-inch (1.270-mm) nominal thickness.

2. Colors, Patterns, and Finishes:
Provide materials and products that result in colors and textures of exposed laminate surfaces complying with the following requirements:

a. Provide selections from manufacturer's full range of colors and finishes in the following categories:

i. Solid

ii. Allusions

iii. Matrix

iv. Patterns

v. Hallmark

vi. Woodgrains

3. Edge Treatment: Same as laminate cladding on horizontal surfaces.

4. Core Material: Fire-retardant particleboard.

2.8 SHOP FINISIDNG OF INTERIOR ARCIDTECTURAL WOODWORK

A. Quality Standard:
Comply with AWI Section 1500, unless otherwise indicated- Custom Grade.

B. General:
The entire finish of interior architectural woodwork is specified in this Section, regardless of whether shop applied or applied after installation.

1. Shop Finishing:
To the greatest extent possible, finish architectural woodwork at the fabrication shop. Defer only final touch up, cleaning, and polishing until after installation.

C. General:
The priming and shop finishing (if any) of interior architectural woodwork required to be performed at the fabrication shop are specified in this Section. Refer to Division 9 Section "Painting" for final finishing of installed architectural woodwork and for material and application requirements of prime coats for woodwork not specified to receive final finish in this Section.

D. Preparations for Finishing:
Comply with referenced quality standard for sanding, filling countersunk fasteners, sealing concealed surfaces, and similar preparations for finishing architectural woodwork, as applicable to each unit of work.

1. Back priming:
Apply one coat of sealer or primer compatible with finish coats to concealed surfaces of woodwork, including backs of trim, cabinets, paneling, and ornamental work and the underside of countertops. Apply 2 coats to back of paneling. Concealed surfaces of plastic laminate-clad woodwork do not require back priming when surfaced with plastic laminate or thermoset decorative overlay.

PART 3 - EXECUTION

3.1 PREPARATION

A. Condition woodwork to average prevailing humidity conditions in installation areas before installing.

B. Before installing architectural woodwork, examine shop-fabricated work for completion and complete work as required, including back priming and removal of packing.

3.2 INSTALLATION

A. Quality Standard:
Install woodwork to comply with AWI Section I700 for the same grade specified in Part 2 of this Section for type of woodwork involved.

B. Install woodwork plumb, level, true, and straight with no distortions. Shim as required with concealed shims. Install to a tolerance of 118 inch in 96 inches (3 mm in 2,400 mm)

C. For plumb and level (including tops).

D. Scribe and cut woodwork to fit adjoining work and refinish cut surfaces or repair damaged finish at cuts.

E. Fire-Retardant-Treated Wood:
Handle, store, and install fire-retardant-treated wood to comply with recommendations of chemical treatment manufacturer, including those for adhesives used to install woodwork.

F. Anchor woodwork to anchors or blocking built in or directly attached to substrates. Secure to grounds, stripping and blocking with countersunk, concealed fasteners and blind nailing as required for complete installation. Use fine finishing nails for exposed nailing, countersunk and filled flush with woodwork and matching final finish where transparent finish is indicated.

G. Cabinets:
Install without distortion so that doors and drawers fit openings properly and are accurately aligned. Adjust hardware to center doors and drawers in openings and to provide unencumbered operation. Complete the installation of hardware and accessory items as indicated.

1. Install cabinets with no more than 1/8 inch in 96-inch (3 mm in 2400-mm) sag, bow, or other variation from a straight line.

2. Maintain veneer sequence matching of cabinets with transparent finish.

H. Tops:
Anchor securely to base units and other support systems as indicated. Calk space between backsplash and wall with specified sealant.

1. Install countertops with no more than 1/8 inch in 96-inch (3 mm in 2,400-mm) sag, bow, or other variation from a straight line.

2. Secure backsplashes to tops with concealed metal brackets at 16 inches (400 mm) O.C.

I. Complete the finishing work specified in this Section to the extent not completed at shop or before installation of woodwork. Fill nail holes with matching filler where exposed. Apply specified finish coats, including stains and paste fillers if any, to exposed surfaces where only sealer/prime coats were applied in the shop.

J. Refer to Division 9 Sections for final finishing of installed architectural woodwork.

3.3 ADJUSTING AND CLEANING

A. Repair damaged and defective woodwork where possible to eliminate functional and visual defects; where not possible to repair, replace woodwork. Adjust joinery for uniform appearance.

B. Clean, lubricate, and adjust hardware.

C. Clean woodwork on exposed and semi exposed surfaces. Touch up shop-applied finishes to restore damaged or soiled areas.

3.4 PROTECTION

A. Provide final protection and maintain conditions in a manner acceptable to fabricator and Installer that ensures that woodwork is without damage or deterioration at the time of Substantial Completion.

3.5 CABINET HARDWARE AND ACCESSORY SCHEDULE

BHMA numbers are used below to designate hardware requirements, except as otherwise indicated.

A. Butt Hinges:
2-3/4-inch (70-mm), 5-knuckle steel hinges made from 0.095-inch- (2.4-mm-) thick metal, and as follows:

B. Semi concealed Hinges for Overlay Doors:
B0152l.

C. Pulls:
Wire pulls, 4 inches (100 mm) long, 5/16 inches (8 mm) in diameter.

D. Adjustable Shelf Standards:
B04071

1. Shelf Rests for Standards: B04081

E. Shelf Rests: B04013

F. Drawer Slides:
Side-mounted, full-extension, zinc-plated steel drawer slides with steel ball bearings, complying with BHMA Al56.9, Grade I and rated for the following loads:

1. Box Drawer Slides: 75 lbf (330 N)

2. File Drawer Slides: 150 lbf (670 N)

3. Pencil Drawer Slides: 45 lbf (200 N).

G. Door Locks: E07121- Provide for all doors.

H. Drawer Locks: E07041 -Provide for all drawers.

I. Grommets for cable passage through countertops:
1-inch (25 mm) OD brown, molded-plastic grommets with 3/4-inch (19-mm) whole and brown plastic cap with slot for wire passage.

END OF SECTION

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.

B. Related Sections

1. Section 02 4115 "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.

1.2 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.

B. 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.

C. 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.

1.3 REFERENCES

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.

1.4 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.

   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.

1.5 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].

B. Test and Evaluation Reports.

1. Fastener pull-out test report.

2. Adhesive pull test report.

C. 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.

D. 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.

E. Qualification Statements:

1. For installer is approved by warrantor of existing roofing system.

1.6 QUALITY ASSURANCE

A. Installer Qualifications:

1. Installer of new membrane roofing system, approved by warrantor of existing roofing system to work on existing roofing.

B. Regulatory Requirements:

1. Comply with governing EPA notification regulations before beginning membrane roofing removal. Comply with hauling and disposal regulations of authorities having jurisdiction.

1.7 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.

B. Limit construction loads on roof to 20 psi rooftop equipment wheel loads and 100 psf for uniformly distributed loads.

C. 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.

D. 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.

1.8 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.

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.

2.2 TEMPORARY ROOFING MATERIALS

A. Design and selection of materials for temporary roofing and responsibilities of Construction Subcontractor.

B. Sheathing paper:

1. Red-rosin type, minimum 3 lb/100 sq. ft.

C. Base Sheet:

1. ASTM 4601, Type II, non-perforated, asphalt-impregnated and –coated, glass-fiber sheet.

2.3 RECOVER BOARDS

A. Recover Board:

1. ASTM C 1177/C 1177M, glass-mat, water resistant gypsum substrate; Type X, 5/8 inch thick.

B. 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.

2.4 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.

B. Base Sheet Fasteners:

1. Capped head, factory-coated steel fasteners, listed in FM Approval's "Approval Guide."

C. Sheet Metal Flashing and Retrofit Flashing:

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.

B. 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.

C. During removal operations, have sufficient and suitable materials on-site to facilitate rapid installation of temporary protection in the event of unexpected rain.

D. 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.

E. Verify that rooftop utilities and service piping have been shut off before beginning the work.

3.2 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.

B. Remove pavers and accessories from roofing membrane. Store and protect pavers and accessories for reuse. Discard cracked pavers.

C. Remove protection mat and extruded-polystyrene insulation from protected roofing membrane.

1. Discard extruded-polystyrene insulation that is wet and exceeds 8 lb/cu.ft.

2. Store extruded-polystyrene insulation for reuse and protect from physical damage.

D. 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.

E. 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.

3.3 DECK PREPARATION

A. Inspect deck after [partial] tear-off of membrane roofing system.

B. 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.

C. 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.

D. 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.

E. Provide additional deck attachment as indicated on Drawings.

3.4 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.

3.5 TEMPORARY ROOFING MEMBRANE

A. Install approved temporary roofing membrane over area to be reroofed.

B. Remove temporary roofing membrane before installing new roofing membrane.

C. 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.

3.6 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.

B. Remove blisters and areas of membrane not fully adhered.

3.7 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.

B. 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.

C. Inspect parapet sheathing for deterioration and damage. If parapet sheathing has deteriorated, immediately notify Owner's Representative.

D. 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"

3.8 FASTENER PULL-OUT TESTING

A. 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.

3.9 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.

3.10 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.

B. Transport and legally dispose of demolished materials off owner's property.

3.11 PROTECTION OF INSTALLED CONSTRUCTION

A. Install temporary protection board over uncovered deck surfaces where materials or walkways are to be determined.

B. Install temporary sheeting up and over parapets and curbing. Retain sheeting in position with temporary fasteners.

C. Provide for surface drainage from sheeting to existing drainage facilities.

D. Do not permit traffic over unprotected or repaired deck surface.

END OF SECTION

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 this Section.

1.2 SUMMARY

A. This section includes manufactured roof panels and wall panels of the following type:

a. Exposed-fastener, lap-seam, metal roof panels.

B. Related Sections: The following sections contain requirements that relate to this Section:

1. Division 7 Section "Flashing and Sheet Metal" for and/or wall flashing and other sheet metal work

2. Division 7 Section "Joint Sealants" for field-applied panel sealants

1.3 SYSTEM PERFORMANCE REQUIREMENTS

A. Provide certified test results by a recognized testing laboratory or agency in accordance with specified test methods for each system.

B. Air Infiltration: Provide roof system with no air leakage when tested in accordance with ASTM E 283 at pressure differentials up to 1.57 psf.

C. Air Infiltration: Provide wall systems with an air infiltration rate of not more than 0.06 cfm per sq. ft. of fixed wall area when tested in accordance with ASTM E 283 at a static air pressure differential of 1.57 psf.

D. Water Penetration: Provide systems with no water penetration as defined in the test method when tested in accordance with ASTM E 33 I at an inward static air pressure differential of not less than 6.24 psf and not more than 12.0 psf.

1.4 SUBMITTALS

A. General: Submit the following in accordance with Conditions of Contract and Division 1 Specification Sections.

B. Product data including manufacturer’s product specifications, standard details, certified product test results, installation instructions, and general recommendations, as applicable to materials and finishes for each component and for total system.

C. Samples for initial selection purposes in form of manufacturer's color charts or chips showing full range of colors, textures, and patterns available for roof system with factory applied finishes.

D. Shop Drawings showing layouts of roofs, details of edge conditions, joints, corners, profiles, supports, anchorages, trim, flashings, closures, and special details. Distinguish between factory and field assembly work.

1.5 QUALITY ASSURANCE

A. Fire Resistance Rating: Provide systems that have been tested and listed by design no. in UL "Fire Resistance Directory" for 2-hr. assembly rating.

B. Wind Uplift: Provide roof system including supports meeting requirements of Underwriters Laboratories, Inc. for Class 90 wind uplift resistance. Design wind speed to be 175 miles per hour, Exposure D, and Seismic Zone 4.

C. Field Measurements: Where possible, prior to fabrication, take field measurements of structure or substrates to receive panel system. Allow for trimming where final dimensions cannot be established prior to fabrication.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Deliver panels and other components so they will not be damaged or deformed. Package wall and roof panels for protection against transportation damage.

B. Handling: Exercise care in unloading, storing, and erecting wall and roof covering panels to prevent bending, warping, twisting, and surface damage.

C. Stack materials on platforms or pallets, covered with tarpaulins or other suitable weathertight ventilated covering. Store metal wall and roof panels so that they will not accumulate water. Do not store panels in contact with other materials that might cause staining, denting, or other surface damage.

1.7 WARRANTY

A. Finish Warranty: Furnish panel manufacturer's written warranty covering failure of the factory-applied exterior finish on metal wall and roof panels within the warranty period. This warranty shall be in addition to and not a limitation of other rights the Owner may have against the Contractor under the Contract Documents.

1. Warranty period for factory-applied exterior finishes on wall and roof panels is 20 years after the date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering metal roof or wall panel systems that may be incorporated in the work include but are not limited to the following:

1. Aluminum Roof and Wall Panels:

a. AEP-Span

b. Allied Roof System

c. Architectural Panels, Inc.

d. Atas Aluminum Corp.

e. Cheney Flashing Company

f. ECI Building Components, Inc.

g. Fashion, Inc.

h. Flexospan

i. MBCI

j. Merchant & Evans, Inc.

k. MM Systems Corp.

l. Petersen Aluminum Corp.

m. E. G. Smith Construction Products, Inc.

n. Vin-Cor Steel Corp.

2.2 SHEET MATERIALS

A. Stainless Steel Sheet: Comply with ASTM A 240, Type 304 with No. 4 Finish in accordance with ASTM A480.

B. Aluminum Sheets: Comply with ASTM B 209 for Alclad alloy 3003 or 3004 with temper as required to suit forming operations.

1. Cladding: Except as otherwise indicated, where aluminum sheets are exterior exposed without supplied coatings, provide special aluminum alloy-clad sheet known as "Alclad."

2.3 METAL FINISHES

A. General:
Apply coatings either before or after forming and fabricating panels, as required by coating process and as required for maximum coating performance capability. Protect coating either by application of strippable film or by packing plastic film or other suitable material between panels in a manner to properly protect the finish. Furnish air-drying spray finish in matching color for touch-up.

1. Color: As selected by the Owner's Representative from the manufacturer's standard colors.

B. Fluoropolymer Coating:

Manufacturer's standard two-coat, thermo-cured, full-strength 70 percent "Kynar 500" coating consisting of a primer and a minimum 0.75-mil dry film thickness with a total minimum dry film thickness of 0.9 mil and 30 percent reflective gloss when tested in accordance with ASTM D 523.

1. Durability:
Provide coating that has been field tested under normal range of weathering conditions for minimum of 20 years without significant peel, blister, flake, chip, crack, or check in finish; without chalking in excess of No. 8 in accordance with ASTM D 659; and without fading in excess of 5 NBS units.

2.4 THERMAL INSULATION

A. Polyisocyanurate Board Insulation:
Unfaced, preformed, rigid, cellular, polyurethane thermal insulation complying with ASTM C 59I, Type 2 with aged R-values of 6.2 at 75 deg F (23.9 deg C).

2.5 MISCELLANEOUS MATERIALS

A. Gypsum Board: Type X fire rated, UL-labeled board of thicknesses indicated, complying with ASTM C 442 or ASTM C 36.

B. Fasteners: Self-tapping screws, bolts, nuts, self-locking rivets, self-locking bolts, end-welded studs, and other suitable fasteners designed to withstand design loads.

1. Use aluminum, corrosion-resistant steel, or stainless steel fasteners for exterior application and galvanized or cadmium-plated fasteners for interior applications.

2. Provide exposed fasteners with heads matching color of roof or wall panel by means of plastic caps or factory-applied coating.

3. Provide metal-backed neoprene washers under heads of exposed fasteners bearing on weather side of panels.

4. Locate and space exposed fasteners in true vertical and horizontal alignment. Use proper tools to obtain controlled uniform compression for positive seal without rupture of neoprene washer.

C. Felts: Provide asphalt-saturated organic felts conforming to the requirements of ASTM D 226, Type II (No. 30).

D. Accessories: Except as indicated as work of another specification section, provide components required for a complete roof or wall panel system, including trim, copings, fasciae, gravel stops, mullions, sills, corner units, ridge closures, clips, seam covers, battens, flashings, gutters, louvers, sealants, gaskets, fillers, closure strips, and similar items. Match materials and finishes of panels.

1. Closure Strips: Closed-cell, self-extinguishing, expanded cellular rubber or cross linked polyolefin foam flexible closure strips. Cut or pre-mold to match configuration of roof and wall panels. Provide closure strips where indicated or necessary to ensure weathertight construction.

2. Sealing Tape: Pressure-sensitive 100 percent solids polyisobutylene compound sealing tape with release paper backing. Provide permanently elastic, no sag, nontoxic, no staining tape.

3. Joint Sealant: One-part elastomeric polyurethane, polysulfide, or silicone rubber sealant as recommended by the building manufacturer.

E. Bituminous Coating: Cold-applied asphalt mastic, SSPC paint 12, compounded for 15 mil dry film thickness per coat.

2.6 PANEL FABRICATION

A. General: Fabricate and finish panels and accessories at the factory to greatest extent possible, by manufacturer's standard procedures and processes, as required to fulfill indicated performance requirements demonstrated by laboratory testing. Comply with indicated profiles and dimensional requirements and with structural requirements.

B. Sound Control: Where absorption requirement sound is indicated, fabricate interior liner panels with approximately 1,000 uniformly spaced 1/8-inch-diameter holes per sq. ft. Cover insulation with polyethylene film and provide inserts of wire mesh to form acoustical spacer grid.

C. Apply bituminous coating or other permanent separation materials on concealed panel surfaces where panels would otherwise be in direct contact with substrate materials that are not compatible or could result in corrosion or deterioration of either material or finishes.

D. Fabricate panel joints with captive gaskets or separator strips, which provide a tight seal and prevent metal-to-metal contact in a manner that will minimize noise from movements within panel system.

2.7 ROOF AND WALL PANELS

A. Face Sheets: Fabricate wall and roof panel face sheets to the profile or configuration indicated from 0.040-inch-thick 3003 or 3004 Alclad alloy embossed finish aluminum sheets.

B. Standing Seam Roof Panels: Manufacturer's standard factory-formed standing-seam roof panel system designed for mechanical attachment of panels to roof purlin using a concealed clip. Form panels of 0.040-inch-thick 3003 or 3004 Alclad alloy embossed finish aluminum sheets.

1. Clips: Provide 16-gage (0.0598-inch) 304 stainless steel panel clips designed to meet negative load requirements.

2. Cleats: Factory-caulked, mechanically seamed cleats formed from 24-gage (0.0239-inch), 304 stainless steel sheets.

2.8 PANEL SUPPORTS AND ANCHORAGE

A. Secondary Framing: Provide the following secondary framing members:

1. Roof Purlin and Wall Girts: "C"- or "Z"-shaped sections fabricated from 16-gage (0.0598-inch) shop-painted, roll-formed steel. Purlin spacers shall be fabricated from 14-gage (0.0747-inch) cold-formed galvanized steel sections.

2. Eave Struts: Unequal flange "C"-shaped sections formed to provide adequate backup for both wall and roof panels. Fabricate from 16-gage (0.0598-inch) shop-painted, roll-formed steel.

3. Flange and Sag Bracing: 1-5/8- by 1-5/8-inch angles fabricated from 16-gage (0.0598-inch) shop-painted, roll-formed steel.

4. Base or Sill Angles: Fabricate from 14-gage (0.0747-inch) cold-formed galvanized steel sections.

5. Secondary structural members, except columns and beams, shall be the manufacturer's standard sections fabricated from 14-gage (0.0747-inch) cold-formed galvanized steel.

PART 3 - EXECUTION

3.1 PANEL SUPPORTS AND ANCHORAGE

A. Girts, purlin, and other secondary structural panel support members and anchorage shall be installed in accordance with AISC Manual of Steel Construction "Code of Standard Practice."

3.2 PANEL INSTALLATION

A. General: Comply with manufacturers' instructions and recommendations for installation, as applicable to project conditions and supporting substrates. Anchor panels and other components of the work securely in place, with provisions for thermal and structural movement.

1. Field cutting of exterior panels by torch is not permitted.

2. Install panels with concealed fasteners.

3. Install panels with exposed exterior and interior fasteners, prefinished to match panel finishes.

4. Install roof panels over minimum 3:12 pitch solid substrate with one ply of felt installed from lower edge up with at least 3-inch side laps and 4-inch end laps.

B. Accessories: Install components required for a complete roof or wall panel system, including trim, copings, fasciae, gravel stops, mullions, sills, corner units, ridge closures, clips, seam covers, battens, flashings, gutters, louvers, sealants, gaskets, fillers, closure strips, and similar items.

C. Joint Sealers: Install gaskets, joint fillers, and sealants where indicated and where required for weatherproof performance of panel systems. Provide types of gaskets, sealants, and fillers indicated or, if not otherwise indicated, types recommended by panel manufacturer.

1. Provide weather seal under ridge cap. Flash and seal roof panels at eave and rake with rubber, neoprene, or other closures to exclude weather.

2. Refer to other sections of these specifications for product and installation requirements applicable to indicated joint sealers.

D. Joint Sealers: Refer to other sections of these specifications for post-installation requirements on joint sealers; not work of this section.

E. Lap-Seam Roof Panels: Provide sealant tape at lapped joints of ribbed or fluted roof sheets and between roof sheets and protruding equipment, vents, and accessories.

1. Apply a continuous ribbon of sealant tape to clean, dry surface of the weather side of fastenings on end laps, and on side laps of corrugated nesting-type, ribbed, or fluted panels and elsewhere as needed to make roof sheets weatherproof to driving rains.

F. Standing Seam Roof Panel System: Fasten roof panels to supports with concealed clip in accordance with the manufacturer's instructions.

1. Install clips at each support with self-drilling/self-tapping fasteners.

2. At end laps of panels, install tape caulk between panels.

3. Install factory caulked cleats at standing-seam joints. Apply snap on batten to the panels to provide a weathertight joint.

4. Seaming: Complete seaming of panel joints by operation of portable power-driven equipment of type recommended by panel manufacturer to provide a weathertight joint.

G. Wall Panels: Apply elastomeric sealant continuously between metal base channel (sill angle) and concrete and elsewhere as necessary for waterproofing. Handle and apply sealant and backup in accordance with the sealant manufacturer's recommendations.

1. Align bottom of wall panels and fasten panels with blind rivets, bolts, or self-tapping screws. Fasten flashings and trim around openings and similar elements with self-tapping screws.

2. Install screw fasteners with power tools having controlled torque adjusted to compress neoprene washer tightly without damage to washer, screw threads, or panels. Install screws in predrilled holes.

3. Provide weatherproof escutcheons for pipe and conduit penetrating exterior walls.

H. Installation Tolerances: Shim and align panel units within installed tolerance of 1/4 inch in 20'-0" on level/plumb/slope and location/line as indicated, and within l/8-inch offset of adjoining faces and of alignment of matching profiles.

3.3 CLEANING AND PROTECTION

A. Damaged Units: Replace panels and other components of the work that have been damaged or have deteriorated beyond successful repair by means of finish touch-up or similar minor repair procedures.

B. Cleaning: Remove temporary protective coverings and strippable films (if any) as soon as each panel is installed. Upon completion of panel installation, clean finished surfaces as recommended by panel manufacturer, and maintain in a clean condition during construction.

END OF SECTION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 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

B. Integral masonry flashings are specified as masonry work in sections of Division 4.

C. Roofing accessories installed integral with roofing membrane are specified in roofing system sections as roofing work.

D. Roof accessory units of premanufactured, set-on type are specified in Division 7 Section "Roof Accessories."

1.3 SUBMITTALS

A. General:
Submit the following in accordance with Conditions of Contract and Division 1 Specification Sections.

B. 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.

C. 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.

1.4 PROJECT CONDITIONS

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.

B. 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.

2.2 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.

B. 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.

C. Expansion Provisions:

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 I inch deep, filled with mastic sealant (concealed within joints).

D. 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.

E. 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.

F. 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.

2.3 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.

B. 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

C. 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. 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.

B. 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.

C. Bed flanges of work in a thick coat of bituminous roofing cement where required for waterproof performance.

D. 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.

E. 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.

F. 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.

G. 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.

H. 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.

3.2 CLEANING AND PROTECTION

A. Clean exposed metal surfaces, removing substances that might cause corrosion of metal or deterioration of finishes.

B. 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

PART 1 - GENERAL

A. The work shall consist of furnishing and installation of roof gutters and downspouts on existing buildings as shown on the drawings.

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.

B. 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.

C. No used materials shall be installed in this project.

D. 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.

B. Gutters shall have the minimum cross section dimensions as shown on the drawings.

C. The opening in the gutter into the downspout shall equal the minimum downspout size shown on the drawings.

D. Where applicable, the connection between the downspouts and underground outlets will prevent contaminated surface water from entering outlet.

E. PROTECTION

1. Gutters and downspouts shall be installed so that they are protected from damage by livestock and equipment.

END OF SECTION

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. 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

B. 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.

1.3 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.

B. Coordinate dimensions with rough-in information or Shop Drawings of equipment to be supported.

1.4 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.

B. 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.

C. Samples:
For each exposed product and for each color and texture specified, prepared on Samples of size to adequately show color.

D. 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.

1. Detail mounting, securing, and flashing of roof-mounted items to roof structure. Indicate coordinating requirements with roof membrane system.

2. Wind-Restraint Details:

a. Detail fabrication and attachment of wind restraints. Show anchorage details and indicate quantity, diameter, and depth of penetration of anchors.

1.5 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.

B. Sample Warranties: For manufacturer's special warranties.

1.6 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data:
For roof accessories to include in operation and maintenance manuals.

1.7 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

A. 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.

B. 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.

C. Wind-Restraint Performance:
175 mph

2.2 EQUIPMENT SUPPORTS

A. 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.

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.

B. Size:
Coordinate dimensions with roughing-in information or Shop Drawings of equipment to be supported.

C. Supported Load Capacity:
Coordinate load requirements with items being supported by equipment supports

D. Material:
Aluminum-zinc alloy-coated steel sheet, 0.079 inch (2.01 mm) thick.

1. Finish:
Two-coat fluoropolymer

2. Color:
As indicated by manufacturer's designations.

E. Material:
Aluminum sheet, 0.125 inch (3.17 mm) thick.

1. Finish:
Two-coat fluoropolymer or powder coat.

2. Color:

Light bronze.

F. Material:
Stainless-steel sheet, 0.078 inch (1.98 mm) thick.

1. Finish:
Manufacturer's standard.

G. Construction:
Curb Profile:
Compatible with roofing system.

2. Insulation:
Factory insulated with 1-1/2 inch (38 mm) thick glass-fiber board insulation.

3. Liner:
Same material as equipment support, of manufacturer's standard thickness and finish.

4. Nailer:
Factory-installed continuous wood nailers 3-1/2 inches (90 mm) wide on top flange of equipment supports, continuous around support perimeter.

5. 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.

6. 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.

7. Metal Counterflashing:
Manufacturer's standard, removable, fabricated of same metal and finish as equipment support.

8. On ribbed or fluted metal roofs, form deck-mounting flange at perimeter bottom to conform to roof profile.

9. Fabricate equipment supports to minimum height of 12 inches (305 mm) above roofing surface unless otherwise indicated.

10. 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.

2.3 ROOF HATCH

A. 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 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)

B. Type and Size:
Double leaf lid, 72 by 96 inches (1830 by 2440 mm).

C. Loads:
Minimum 60 lbf/sq. ft. (2.9-kPa) external live load and internal hurricane uplift load.

D. Hatch Material:
Aluminum-zinc alloy coated steel sheet.

1. Thickness:
0.079 inch (2.01 mm)

2. Color:
As indicated by manufacturer's designations.

E. Hatch Material:
Aluminum sheet.

1. Thickness:
0.079 inch (2.01 mm)

2. Finish:
Two-coat fluoropolymer

3. Color:
Light bronze

F. Hatch Material:
Stainless-steel sheet.

1. Thickness: 0.078 inch (1.98 mm)

2. Finish:
Manufacturer's standard.

G. Construction:

1. Insulation:
Cellulosic-fiber board.

a. R-Value: 12.0 according to ASTM C1363.

2. Nailer:
Factory-installed wood nailer continuous around hatch perimeter.

3. Hatch Lid:
Opaque, insulated, and double walled, with manufacturer's standard metal liner of same material and finish as outer metal lid.

4. Curb Liner:
Manufacturer's standard, of same material and finish as metal curb.

5. Fabricate curbs to minimum height of 12 inches (305 mm) above roofing surface unless otherwise indicated.

6. 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.

H. Hatch-Lid Finish:

1. Outer Double-Dome Color:
Bronze tinted

2. Inner Double-Dome Color:
Bronze tinted

I. 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.

1. Provide two-point latch on lids larger than 84 inches (2130 mm).

J. 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.

1. Height:
42 inches (1060 mm) above finished roof deck.

2. 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.

3. Flat Bar:
Galvanized steel, 2 inches (50 mm) high by 3/8 inch (9 mm) thick.

4. Maximum Opening Size in rail:
System constructed to prevent passage of a sphere 21 inches (533 mm) in diameter, and no horizontal footholds.

5. Chain Pass way Barrier:
Galvanized proof coil chain with quick link on fixed end.

6. Post and Rail Tops and Ends:
Weather resistant, closed or plugged with prefabricated end fittings.

7. Provide weep holes or another means to drain entrapped water in hollow sections of handrail and railing members.

8. Fabricate joints exposed to weather to be watertight.

9. Fasteners:
Manufacturer’s standard finished to match railing system.

10. Finish:
Manufacturer's standard

a. Color:
As indicated by manufacturer's designations.

K. Ladder Assist Post:
Roof-hatch manufacturer's standard device for attachment to roof-access ladder.

1. Operation:
Post locks in place on full extension; release mechanism returns post to closed position.

2. Height:
42 inches (1060 mm) above finished roof deck.

3. Material:
Stainless steel or Aluminum.

4. Post:
1-5/8 inch (41 mm) diameter pipe.

5. Finish:
Polished stainless steel, or powder coat for aluminum

a. Color:
As indicated by manufacturer's designations

2.4 HEAT AND SMOKE VENTS

A. 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.

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.

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.

B. 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.

1. 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.

2. Size:
48 by 48 inches (1219 by 1219 mm).

3. 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.

4. Heat and Smoke Vent Standard: Provide units that have been tested and listed to comply with UL793.

5. Curb and Framing Material:
Aluminum sheet.

a. Thickness:
Manufacturer's standard thickness for vent size indicated.

b. Finish:
Two-coat fluoropolymer.

c. Color:
Light bronze

6. 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.

7. Dome Glazing:
Single glazing of thickness capable of resisting indicated loads.

a. Single-Dome Color:
Bronze tinted, transparent.

8. 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.

9. Hardware:
Manufacturer's standard, stainless-steel; with hinges, hold-open devices, and independent manual-release devices for **inside** operation of lids.

2.5 GRAVITY VENTILATORS

A. 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 Gibralter Industries company.

c. Dur-Red Products.

d. Greenheck Fan Corporation.

e. Loren Cook Company.

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 rewireable 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.

B. Louvered Penthouse-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. 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.

2. Insect Screens:

Manufacturer's standard mesh with rewireable frame.

3. Frame, Base Flange, Cap, and Louver Material: Stainless-steel sheet, of manufacturer's standard thickness.

4. Finish:
As indicated by manufacturer's designations

C. Turbine-Style Gravity Ventilators:
Manufacturer's standard, fabricated as indicated, with manufacturer's standard welded or sealed mechanical joints:

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. Air Vent, Inc.; a Gibraltar company.

b. Moffitt Corporation Inc.

c. PennBarry.

d. Romlair Ventilator Co.

2. Provide integral weathertight base cap, outlet duct, and rotating louvered turbine.

3. Insect Screens:
Manufacturer's standard mesh with rewireable frame.

4. Weathertight Base Cap, Outlet Duct, and Turbine Material:
Aluminum sheet, of manufacturer's standard thickness.

5. Finish:
As indicated by manufacturer's designations

2.6 PIPE AND DUCT SUPPORTS

A. 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.

B. 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.

C. 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.

D. 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-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.

E. 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.

2.7 PIPE PORTALS

A. 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.

B. Flashing Pipe Portal:
Formed aluminum membrane-mounting flashing flange and sleeve with collared opening and pressure-sealed conically shaped EPDM protective rubber cap 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.

2.8 PREFORMED FLASHING SLEEVES

A. 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

B. Vent Stack Flashing:
Metal flashing sleeve, uninsulated, with integral deck flange.

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. Lifetime Tool & Building Products, LLC.

c. Milcor; Commercial Products Group of Hart & Cooley, Inc.

d. Thaler Metal Industries, Ltd.

2. Metal:
Aluminum sheet, 0.063 inch (1.60 mm) thick

3. Height:
7 inches (175 mm)

4. Diameter:
As indicated on Drawings

5. Finish:
Manufacturer's standard

C. Zinc-Coated (Galvanized) Steel Sheet:
ASTM A 653/A 653M, G90 (Z275) coating designation

1. 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.

2. 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).

D. Aluminum-Zinc Alloy-Coated Steel Sheet:
ASTM A 792/A 792M, AZ50 (AZM150) coated.

1. 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.

2. 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).

E. Aluminum Sheet:
ASTM B 209 (ASTM B 209M), manufacturer's standard alloy for finish required, with temper to suit forming operations and performance required.

1. 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.

2. 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).

F. 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.

G. Stainless-Steel Sheet and Shapes:
ASTM A 666, Type 304.

H. Steel Shapes:
ASTM A 36/A 36M, hot dip galvanized according to ASTM A 123/A 123M unless otherwise indicated.

I. Steel Tube:
ASTM A 500/A 500M, round tube.

J. Galvanized-Steel Tube:
ASTM A 500/A 500M, round tube, hot dip galvanized according to ASTM A 123/A 123M.

K. Steel Pipe:
ASTM A 53/A 53M, galvanized.

2.9 MISCELLANEOUS MATERIALS

A. General:
Provide materials and types of fasteners, protective coatings, sealants, and other miscellaneous items required by manufacturer for a complete installation.

B. 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).

C. Cellulosic-Fiber Board Insulation:
ASTM C 208, Type II, Grade 1, thickness as indicated.

D. 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 AWPA C2; not less than 1-1/2 inches (38 mm) thick.

E. Bituminous Coating:
Cold-applied asphalt emulsion complying with ASTM D 1187/D 1187M.

F. 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 nonremovable 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.

G. 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.

H. 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.

2.10 GENERAL FINISH REQUIREMENTS

A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.

B. 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

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, to verify actual locations, dimensions, and other conditions affecting performance of the Work.

B. Verify that substrate is sound, dry, smooth, clean, sloped for drainage, and securely anchored.

C. Verify dimensions of roof openings for roof accessories.

D. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. 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.

B. 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.

1. Coat concealed side of stainless-steel roof accessories with bituminous coating where in contact with wood, ferrous metal, or cementitious construction.

2. Underlayment: Where installing roof accessories directly on cementitious or wood substrates, install a course of underlayment and cover with manufacturer's recommended slip sheet.

3. Bed flanges in thick coat of asphalt roofing cement where required by manufacturers of roof accessories for waterproof performance.

C. Roof Curb Installation:
Install each roof curb so top surface is level

D. Equipment Support Installation:
Install equipment supports so top surfaces are level with each other

E. Roof-Hatch Installation:

1. Verify that roof hatch operates properly. Clean, lubricate, and adjust operating mechanism and hardware.

2. Attach safety railing system to roof-hatch curb.

3. Attach ladder-assist post according to manufacturer's written instructions.

F. Heat and Smoke Vent Installation:

1. Install heat and smoke vent so top perimeter surfaces are level.

2. Install and test heat and smoke vents and their components for proper operation according to NFPA 204.

G. Gravity Ventilator Installation:
Verify that gravity ventilators operate properly and have unrestricted airflow. Clean, lubricate, and adjust operating mechanisms.

H. 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.

1. Pipes of Various Sizes:
Space supports for smallest pipe size or install intermediate supports for smaller diameter pipes as specified for individual pipe hangers.

I. 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.

3.3 REPAIR AND CLEANING

A. Galvanized Surfaces:
Clean field welds, bolted connections, and abraded areas and repair galvanizing according to ASTM A 780/A 780M.

B. Touch up factory-primed surfaces with compatible primer ready for field painting.

C. Clean exposed surfaces according to manufacturer's written instructions.

D. Clean off excess sealants.

E. Replace roof accessories that have been damaged or that cannot be successfully repaired by finish touchup or similar minor repair procedures.

END OF SECTION

PART 1 - GENERAL

1.1 SUMMARY

A. 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.

B. 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.

1. 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

1.2 REFERENCES

A. ASTM C 719-93 - Standard Test Method for Adhesion and Cohesion of Elastomeric Joint Sealants Under Cyclic Movement (Hockman Cycle); 1993.

B. ASTM C 834-95- Standard Specification for Latex Sealants; 1995.

C. ASTM C 920-95- Standard Specifications for Elastomeric Joints Sealants 1995.

D. ASTM C 1193-91- Standard Guide for Use of Joint Sealants; 1991.

E. ASTM D 3405-78 - Standard Specification for Joint Sealants, Hot-poured for Concrete and Asphalt Pavements; 1978.

F. ASTM D 3406-85(91) - Standard Specification for Joint Sealant, Hot-Applied, Elastomeric -Type, for Portland cement Concrete Pavements 1985 (Reapproved 1991).

G. FS A-A-272- Caulking Compounds; 1980.

H. FS SS-S-200E- Sealants, Joint, Two-Component, Jet-Blast-Resistant, Cold-Applied, for Portland cement Concrete Pavement; 1984 (Amended 1988).

1.3 DEFINITIONS

A. 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. 0-type substrates:
Woods, unglazed tile; substrates not included under other categories

1.4 SUBMITTALS

A. Product Data:

1. Manufacturer's data on each joint sealer, with instruction for substrate preparation and installation.

B. Samples for Color Selection:

1. Cured samples of actual products showing manufacturer's full range of colors. (Products exposed to view only).

C. Certified Product Test Reports:

1. Independent testing agency reports showing compliance with all specified requirements.

2. 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.

D. Field Installation Test Reports.

E. 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.

F. Installer's Preconstruction Inspection Report:
List all conditions detrimental to performance of joint sealer work.

1.5 QUALITY ASSURANCE

A. 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.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Deliver materials in original containers or bundles with labels showing manufacturer, product name or designation, color, shelf life, and installation instructions.

1.7 PROJECT CONDITIONS

A. Environmental Limitations:
Do not install sealers if any of the following conditions exist.

1. Air or substrate temperature exceeds the range recommended by sealer manufacturers.

2. Substrate is wet or damp.

B. Dimensional Limitations:
Do not install sealers if joint dimensions are less than or greater than that recommended by sealer manufacturer; notify alternative procedures.

1.8 WARRANTY

A. 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 2 - PRODUCTS

2.1 MATERIALS - GENERAL

A. 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

2.2 ELASTOMERIC SEALANTS

A. 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

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.

B. Two-Part Pourable Polysulfide Sealant:
Type M, Grade P, Class 12-l/2 T

C. 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.

D. 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.

E. Multipart Pourable Urethane Sealant:
Type M, Grade P, Class 25, Use T

F. No sag Urethane Sealant for Use T:
Type S or M, Grade NS, Class 25, Use T

G. One-part No sag Urethane Sealant:
Type S, Grade P, Class 25, Use T

2.3 PAVING JOINT SEALANTS

A. 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-l/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.

B. One-Part Urethane Paving Sealant:
Pourable, chemically curing (cold-applied), bitumen modified urethane; complying with FS SS-S-200.

C. PVC/Coal-Tar Paving Sealant (ASTM D 3406):
Hot-poured, one-part, polyvinyl chloride/coal tar blend; complying with ASTM D 3406.

D. Rubber/Asphalt Paving Sealant (ASTM D 3405):
Hot-poured, one-part, rubber/asphalt blend; complying with ASTMD3405.

2.4 SOLVENT-RELEASE-CURING SEALANTS

A. Butyl Sealant:
No sag, one part, solvent-release-curing; complying with FS A-A-272, Type III, no staining; paintable.

2.5 LATEX SEALANTS

A. Acrylic-Latex Emulsion Sealant:
One-part, No sag, mildew-resistant, paintable; complying with ASTM C 834.

2.6 SEALANT BACKERS

A. Backers- General:
No staining; recommended or approved by sealant manufacturer for specific use.

B. 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.

2.7 MISCELLANEOUS MATERIALS

A. Primers:
As recommended by sealer manufacturer.

B. Cleaners:
As recommended by sealer manufacturer and not damaging to substrates.

C. Masking Tape:
Nonabsorbent, no staining.

D. Tooling Agents:
Approved by sealant manufacturer; no staining to sealant and substrate.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine joints for characteristics that may affect sealer performance including configuration and dimensions.

B. Do not begin joint sealer work until unsatisfactory conditions have corrected.

3.2 PREPARATION

A. 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.

3. Clean M-type and 0-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.

B. Priming:
Prime substrates as recommended by sealer manufacturer.

C. 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.

D. Install fillers where needed to provide proper joint depth or support for sealant backers.

3.3 INSTALLATION

A. Comply with sealer manufacturers' installation instructions and recommendations, except where more restrictive requirements are specified.

B. Gun Applied and Pourable Sealants:
Comply with recommendations of ASTM C 1193.

C. 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.

D. 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.

1. Use concave joint shape shown in Figure 5A in ASTM C 1193, where not otherwise indicated.

3.4 PROTECTION AND CLEANING

A. 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.

B. Protect joint sealers from contamination and damage.

C. Remove and replace damage sealers.

A. 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.

B. 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

C. Interior Joints for Which No Other Sealer Is Indicated:

1. Use one of the following sealants:

a. Acrylic-emulsion latex sealant

2. Backer:
Backer rod

3. Joint shape:
Concave joint Configuration

D. Exterior Joints Well Protected from Weather and Not Subject to Movement.

1. Use one of the following sealants:

a. Any sealer

2. Backer:
Backer rod.

E. Vehicular Paving Joints, Not Over l-l/2 Percent Slope.

1. 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).

e. Rubber-asphalt paving sealant (ASTM D 3405).

2. Use bond-breaker tape.

3. Backer: Joint filler specified elsewhere.

F. Interior Floor Joints And Pedestrian Paving Joints, Less than 1-1/2 Percent Slope:

1. 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.

2. Backer:
Backer rod.

3. Joint shape:
Concave joint configuration.

END OF SECTION

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. Solid-core doors with wood-veneer faces
2. Factory finishing flush wood doors
3. Louvers for flush wood doors

B. Related Sections include the following:

1. Division 8 Section "Steel Frames" for hollow metal frames
2. Division 8 Section "Door Hardware"

1.3 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.

B. 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.

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.

C. Samples for Verification: As follows:

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.

2. Louver blade and frame sections, 6 inches (150 mm) long, for each material and finish specified.

3. Frames for light openings, 6 inches (150 mm) long, for each material, type, and finish required.

1.4 QUALITY ASSURANCE

A. Source Limitations: Obtain flush wood doors through one source from a single manufacturer.

B. Quality Standard: Comply with the following standard:

1. NWWDA Quality Standard:
NWWDA I.S.l-A, "Architectural Wood Flush Doors."

2. AWl Quality Standard:
AWl's "Architectural Woodwork Quality Standards" for grade of door, core, construction, finish, and other requirements.

C. 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.

1.5 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.

B. Mark each door with individual opening numbers used on Shop Drawings. Use removable tags or concealed markings.

1.6 PROJECT CONDITIONS

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.

1.7 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.

B. 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 114 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.

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. Flush Wood Doors:

a. Eggers Industries; Architectural Door Division.

b. Mohawk Flush Doors, Inc.

c. Weyerhaeuser Co.

2. Metal Louvers for Doors:

a. Air Louvers, Inc.

b. Anemostat Door Products.

c. Construction Specialties, Inc.

d. Leslie-Locke, Inc.

2.2 DOOR CONSTRUCTION, GENERAL

A. Doors for Transparent Finish:
Comply with the following requirements:

1. Grade: Premium, with Grade AA faces.

2. Faces: Red Oak.

3. Match between Veneer Leaves: Red Oak.

4. Stiles: Same as species face.

2.3 SOLID-CORE DOORS

A. Particleboard Cores: Comply with the following requirements:

1. Particleboard: ANSI A208.1, Grade LD-2.

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

B. Exterior Doors: Comply with the following requirements:

1. Core: Glued-block core

2. Construction: Five or seven plies with stiles and rails bonded to core, then entire unit abrasive planed before veneering

C. Interior Veneer-Faced Doors: Comply with the following requirements:

1. Core: Particleboard core

2. Construction:
Five or seven plies with stiles and rails bonded to core, then entire unit abrasive planed before veneering.

D. 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.

2. 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.

3. 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.

2.4 LOUVERS AND LIGHT FRAMES

A. Metal Louvers: As follows:

1. Blade Type: Adjustable type with spring closer and 135 deg F (57 deg C) fusible link.

2. Metal and Finish:
Galvanized steel, 0.0396 inch (1.0 mm) thick, hot-dip zinc coated and factory primed for paint finish.

B. Metal Frames for Light Openings in Fire Doors:
Manufacturer's standard frame formed of 0.0478-inch- (1.2-mm-) thick, cold-rolled steel sheet, factory primed and approved for use in doors of fire rating indicated.

2.5 FABRICATION

A. Fabricate flush wood doors in sizes indicated for Project site fitting.

B. Fabricate and trim doors to size at factory to coordinate with frame shop drawings and floor finishes as indicated in the finish schedule.

C. Factory machine doors for hardware that is not surface applied. Locate hardware to comply with DHI- WDHS-3. Comply with final hardware schedules, door frame Shop Drawings, DHI All5-W series standards, and hardware templates.

1. Coordinate measurements of hardware mortises in metal frames to verify dimensions and alignment before factory machining.

D. Openings:
Cut and trim openings through doors to comply with applicable requirements of referenced standards for kind(s) of door(s) required.

1. Light Openings: Trim openings with moldings of material and profile indicated.

2. Louvers: Factory install louvers in prepared openings.

E. Exterior Doors: Factory treat exterior doors with water repellent after manufacturing has been completed.

1. Flash top of out-swinging doors (with manufacturer's standard metal flashing)

2.6 SHOP PRIMING

A. Transparent Finish:
Shop seal faces and edges of doors for transparent finish with stain (if required), other required pretreatments, and first coat of finish as specified in the following:

1. Division 9 Section "Painting"

2. Division 9 Section "Exterior Wood Stains"

2.7 FACTORY FINISHING

A. General: Comply with referenced quality standard's requirements for factory finishing.

B. Finish wood doors at factory

C. Transparent Finish:
Comply with requirements indicated for grade, finish system, staining effect, and sheen.

1. Grade: Custom

2. Finish: AWI System TR-4 conversion varnish

3. Staining: Match building standard

4. Effect: Match building standard

5. Sheen: Match building standard

PART 3 - EXECUTION

3.1 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.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Hardware:
For installation, see Division 8 Section "Door Hardware."

B. Manufacturer's Written Instructions:
Install wood doors to comply with manufacturer's written instructions, referenced quality standard, and as indicated.

1. Install fire-rated doors in corresponding fire rated frames according to NFPA 80.

C. 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 l/8 inch (3.2 mm) at heads, jambs, and between pairs of doors. Provide l/8 inch (3.2 mm) from bottom of door to top of decorative floor finish or covering. Where threshold is shown or scheduled, provide l/4 inch (6.4 mm) from bottom of door to top of threshold.

a. Comply with NFPA 80 for fire-rated doors.

2. Bevel non-fire-rated doors 1/8 inch in 2 inches (3-1/2 degrees) at Jock and hinge edges.

3. 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.

D. Factory-Finished Doors: Restore finish before installation, if fitting or machining is required at Project site.

3.3 ADJUSTING AND PROTECTING

A. Operation: Rehang or replace doors that do not swing or operate freely.

B. Finished Doors: Refinish or replace doors damaged during installation.

C. 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

SECTION 085113 – ALUMINUM WINDOWS

Government of the Virgin Islands, Department of Public Works
KIRWIN TERRACE BALLPARK
Parcels 76A and partial 64, St. Thomas, 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.

B. Section 088100 Glass and Glazing

1.2 SUMMARY

A. Section includes aluminum windows for exterior locations.

1.3 SUBMITTALS

A. Product Data: For each type of product.

B. Shop Drawings: Include plans, elevations, sections, hardware, accessories, insect screens, operational clearances, and details of installation, including anchor, flashing, and sealant installation.

C. Samples: For each exposed product and for each color specified.

D. Product test reports.

1.4 DELIVERY, STORAGE, AND HANDLING

A. Protect windows 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 windows in plastic bags or cardboard cartons.

2. Individually package windows in cardboard cartons and wrap bundles of doors in plastic sheeting.

B. Mark each window with individual opening numbers used on Shop Drawings. Use removable tags or concealed markings.

1.5 WARRANTY

A. Sample warranties.

B. Manufacturer's Warranty: Manufacturer agrees to repair or replace aluminum windows that fail in materials or workmanship within specified warranty period.

1. Warranty Period:

a. Window: 10 years from date of Substantial Completion.
b. Glazing Units: 10 years from date of Substantial Completion.
c. Aluminum Finish: 10 years from date of Substantial Completion.

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. PGT Industries

2.2 WINDOW PERFORMANCE REQUIREMENTS

A. Product Standard: Comply with AAMA/WDMA/CSA 101/I.S.2/A440 for definitions and minimum standards of performance, materials, components, accessories, and fabrication unless more stringent requirements are indicated.

1. Window Certification: AAMA certified with label attached to each window.

B. Solar Heat-Gain Coefficient (SHGC): NFRC 200 maximum whole-window SHGC of 0.30.

C. Thermal Movements: Provide aluminum windows, including anchorage, that allow for thermal movements resulting from the following maximum change (range) in ambient and surface temperatures by preventing buckling, opening of joints, overstressing of components, failure of joint sealants, failure of connections, and other detrimental effects. Base engineering calculation on surface temperatures of materials due to both solar heat gain and nighttime-sky heat loss.

1. Temperature Change: 120 deg F ambient; 180 deg F material surfaces.

D. Windborne-Debris Impact Resistance: Passes ASTM E1886 missile-impact and cyclic-pressure tests in accordance with ASTM E1996 for Wind Zone 5.

1. Large-Missile Test: For glazing located within [30 feet (9.1 m)] <Insert dimension> of grade.
2. Small-Missile Test: For glazing located between 30 feet (9.1 m) and [60 feet (18.3 m)] <Insert dimension> above grade.

2.3 ALUMINUM WINDOWS

A. Types: As indicated on Drawings.

B. Frames and Sashes: Aluminum extrusions complying with AAMA/WDMA/CSA 101/I.S.2/A440.

1. Thermally Improved Construction: Fabricate frames, sashes, and muntins with an integral, concealed, low-conductance thermal barrier located between exterior materials and window members exposed on interior side in a manner that eliminates direct metal-to-metal contact.

C. Glazing System: Manufacturer's standard factory-glazing system that produces weathertight seal.

D. Hardware, General: Provide manufacturer's standard corrosion-resistant hardware sized to accommodate sash weight and dimensions.

1. Exposed Hardware Color and Finish: As selected by Architect from manufacturer's full range.

E. Horizontal-Sliding Window Hardware:

1. Sill Cap/Track: Designed to comply with performance requirements indicated and to drain to the exterior.
2. Locks and Latches: Operated from the inside only.
3. Roller Assemblies: Low-friction design.

F. Weather Stripping: Provide full-perimeter weather stripping for each operable sash unless otherwise indicated.

G. Fasteners: Noncorrosive and compatible with window members, trim, hardware, anchors, and other components.

1. Exposed Fasteners: Do not use exposed fasteners to greatest extent possible. For application of hardware, use fasteners that match finish hardware being fastened.

2.4 INSECT SCREENS

A. General: Fabricate insect screens to integrate with window frame. Provide screen for each operable exterior sash. Screen wickets are not permitted.

1. Type and Location: Half, outside for sliding sashes.

B. Aluminum Frames: Complying with SMA 1004 or SMA 1201.

C. Glass-Fiber Mesh Fabric: 20-by-20 mesh of PVC-coated, glass-fiber threads; woven and fused to form a fabric mesh resistant to corrosion, shrinkage, stretch, impact damage, and weather deterioration. Comply with ASTM D3656/D3656M.

1. Mesh Color: Manufacturer's standard.

2.5 FABRICATION

A. Fabricate aluminum windows in sizes indicated. Include a complete system for assembling components and anchoring windows.

B. Glaze aluminum windows in the factory.

C. Weather strip each operable sash to provide weathertight installation.

D. Weep Holes: Provide weep holes and internal passages to conduct infiltrating water to exterior.

E. Provide water-shed members above side-hinged sashes and similar lines of natural water penetration.

F. Mullions: Provide mullions and cover plates, matching window units, complete with anchors for support to structure and installation of window units. Allow for erection tolerances and provide for movement of window units due to thermal expansion and building deflections. Provide mullions and cover plates capable of withstanding design wind loads of window units.

G. Complete fabrication, assembly, finishing, hardware application, and other work in the factory to greatest extent possible. Disassemble components only as necessary for shipment and installation.

2.6 ALUMINUM FINISHES

A. Finish designations prefixed by AA comply with the system established by the Aluminum Association for designating aluminum finishes.

B. Class I, Color Anodic Finish: AA-M12C22A42/A44 (Mechanical Finish: nonspecular as fabricated; Chemical Finish: etched, medium matte; Anodic Coating: Architectural Class I, integrally colored or electrolytically deposited color coating 0.018 mm or thicker) complying with AAMA 611.

1. Color: As selected by Architect from full range of industry colors and color densities.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Comply with manufacturer's written instructions for installing windows, hardware, accessories, and other components. For installation procedures and requirements not addressed in manufacturer's written instructions, comply with installation requirements in ASTM E2112.

B. Install windows level, plumb, square, true to line, without distortion or impeding thermal movement, anchored securely in place to structural support, and in proper relation to wall flashing and other adjacent construction to produce weathertight construction.

C. Install windows and components to drain condensation, water penetrating joints, and moisture migrating within windows to the exterior.

D. Separate aluminum and other corrodible surfaces from sources of corrosion or electrolytic action at points of contact with other materials.

E. Adjust operating sashes and hardware for a tight fit at contact points and weather stripping for smooth operation and weathertight closure.

F. Clean exposed surfaces immediately after installing windows. Avoid damaging protective coatings and finishes. Remove excess sealants, glazing materials, dirt, and other substances.

G. Remove and replace glass that has been broken, chipped, cracked, abraded, or damaged during construction period.

END OF SECTION 085113

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 this Section.

1.2 SUMMARY

A. 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.

B. This Section includes the following:

1. Hinges
2. Continuous hinges
3. Pivots
4. Spring hinges
5. Key control system
6. Lock cylinders and keys
7. Lock and latch sets
8. Bolts
9. Exit devices
10. Push/Pull units
11. Closers
12. Overhead holders
13. Miscellaneous door control devices
14. Door trim units
15. Protection plates
16. Weather stripping for exterior doors
17. Sound stripping for interior doors

18. Automatic drop seals (door bottoms)

19. Astragals or meeting seals on pairs of doors

20. Thresholds

C. Related Sections:
The following Sections contain requirements that relate to this Section:

1. Section 08110: Steel Doors and Frames

2. Section 08211: Flush Wood Doors

3. Section 08410: Metal-framed Storefronts

4. Section 08450: All-glass Entrances and Storefronts

5. Division 16: Electrical

D. Products furnished but not installed under this Section to include:

1. Cylinders for locks on hi-parting aluminum doors.

2. Cylinders for locks on frameless glass doors.

3. Final replacement cores and keys to be installed as directed by Owner.

1.3 REFERENCES

A. Standards of the following as referenced:

1. American National Standards Institute (ANSI)

2. Door and Hardware Institute (DHI)

3. Factory Mutual (FM)

4. National Fire Protection Association (NFPA)

5. Underwriters' Laboratories, Inc. (UL)

   a. UL 1OC - Fire Tests Door Assemblies

6. Warnock Hersey

B. Regulatory standards of the following as referenced:

1. Department of Justice, Office of the Attorney General, *Americans with Disabilities Act*, Public Law 110-325 (ADA)

2. CABO/ANSI A117.1: Providing Accessibility and Usability for Physically Handicap People, 2017 edition

1.4 SUBMITTALS

A. General:
Submit the following in accordance with Conditions of Contract and Division 1 Specification sections.

B. 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.

C. Final hardware schedule coordinated with doors, frames, and related work to ensure proper size, thickness, hand, function, and finish of door hardware.

1. 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:

a. Type, style, function, size, and finish of each hardware item.

b. Name and manufacturer of each item.

c. Fastenings and other pertinent information.

d. Location of each hardware set cross-referenced to indications on Drawings both on floor plans and in door and frame schedule.

e. Explanation of all abbreviations, symbols, and codes contained in schedule.

f. Mounting locations for hardware.

g. Door and frame sizes and materials.

h. Keying information.

i. Wiring diagrams, riser diagrams and system descriptions fully detailing the function(s) of each electrically controlled opening.

j. Cross-reference numbers used within schedule deviating from those specified.

i. Column 1: State specified item and manufacturer.

ii. Column 2: State prior approved substituted item and its manufacturer.

1. 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.

2. Keying Schedule:
Submit separate detailed schedule indicating clearly how the Owner's final instructions on lock functions and keying of locks has been fulfilled.

D. 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.

1. 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.

E. 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.

F. Contract closeout submittals:

1. Operation and maintenance data: Complete information for installed door hardware

2. Warranty: Completed and executed warranty forms

1.5 QUALITY ASSURANCE

A. Single Source Responsibility:
Obtain each type of hardware (latch and locksets, hinges, closers, etc.) from a single manufacturer.

B. 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.

C. Coordination Meetings:
Supplier shall set up and attend the following:

1. Supplier to meet with the Owner to finalize lock functions and keying requirements and to obtain final instructions in writing.

2. Supplier to meet with the installer prior to beginning of installation of door hardware.

3. 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.

D. 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 1O C.

1. 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".

1.6 PRODUCT HANDLING

A. Tag each item or package separately with identification related to final hardware schedule and include basic installation instructions with each item or package.

B. 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.

C. Inventory door hardware jointly with representatives of hardware supplier and hardware installer until each is satisfied that count is correct.

D. Deliver individually packaged door hardware items promptly to place of installation (shop or Project site).

E. 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.

1.7 WARRANTY

A. Special warranties:

1. Door Closers: Ten-year period

2. Exit Devices: Three-year period

3. Automatic Door Operators: Two-year period

4. Locks and Cylinders: Three-year period

1.8 MAINTENANCE

A. 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.

B. Parts kits: Furnish manufacturers' standard parts kits for locksets, exit devices, and door closers.

PART 2 - PRODUCTS

2.1 MANUFACTURED UNITS

(*Denotes manufacturer referenced in the Hardware Headings)

A. Hinges:

1. Acceptable manufacturers:

a. Ives*

b. Hager Companies

c. Bommer

2. Characteristics:

a. Templates: Provide only template-produced units

b. Screws: Provide Phillips flat-head screws complying with the following requirements:

i. For metal doors and frames, install machine screws into drilled and tapped holes.

ii. For wood doors and frames, install threaded-to-the-head wood screws.

iii. For fire-rated wood doors, install #12 x 1-1/4 inch, threaded-to-the-head steel wood screws.

iv. Finish screw heads to match surface of hinges or pivots.

c. Hinge pins: Except as otherwise indicated, provide hinge pins as follows:

i. Out-Swing Exterior Doors: Non-removable pins.

ii. Out-Swing Corridor Doors with Locks: Non-removable pins.

iii. Interior Doors: Non-rising pins.

iv. Tips: Flat button and matching plug. Finished to match leafs.

d. Size: Except as otherwise indicated, size hinges as follows:

i. Exterior Doors: Heavy weight, ball bearing, nonferrous, 5 x 4-1/2

ii. Interior Doors:

1) Doors up to 3'-0" in width: Standard weight, ball bearing, 4-1/2 x 4-1/2

2) Doors over 3'-1" in width and labeled doors over 8'-0" in height: Heavy weight, ball bearing, 5 x 4-1/2.

e. 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.

B. Continuous Hinges:

1. Acceptable manufacturers:

a. Select Products Ltd.*

b. Hager Companies

c. Markar Products

2. Characteristics:

a. Continuous geared hinges to be manufactured of extruded 6063 T6 aluminum alloy with anodized finish and concealed, self-lubricating thrust bearings.

b. Continuous barrel-type hinges to be manufactured of stainless steel with knuckles formed around a pin extending the entire length of the hinge.

c. Uncut hinges shall be non-handed, manufactured to template.

d. Hinges to be assembled in matching pairs. Fasteners supplied shall be 305 stainless steel.

e. 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.

C. Cylinders:

1. Acceptable manufacturers:

a. Schlage* Everest-D/Primus

b. Medeco

c. Sargent ASSA V-I 0

2. Characteristics:

a. 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.

b. 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 AI56.5, 1992, Grade I Operational.

c. 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.

d. 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.

e. 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.

i. Permanently inscribe each key with manufacturer's key symbol, and notation, "DO NOT DUPLICATE."

ii. Permanently inscribe each cylinder, in a concealed location, with manufacturer's key symbol.

f. Key Material: Provide keys of nickel silver only.

g. Key and Core Quantity:

i. Furnish 3 change keys for each lock, not to exceed l0 change keys for each keyed alike group

ii. Furnish 4 control keys

iii. Furnish 5 master keys for each master system

iv. Furnish 5 grandmaster keys for each grandmaster system

v. Furnish 5 great grandmaster keys for each great grandmaster system

vi. Furnish 10 construction master keys

vii. Furnish 2 construction control keys

viii. Furnish 200 extra blanks for each keyway

ix. Furnish 10 extra un-combinated cores for each keyway

h. Furnish 1 Framon KX-1 Code Machine with space cams, depth cams, vices and cutters as required to accommodate key system

i. Key Control software:
Schlage Sitemaster 200 for Windows or equivalent, preloaded with factory bitting, door numbers and keysets per instructions.

j. Deliver keys, extra cores, key control software and code machine to Owner.

D. Locksets, Latchsets, Deadbolts:

1. Acceptable manufacturers:

a. Schlage* L9000 Series, 07A Lever Design

2. Mortise Locksets and Latchsets: as scheduled.

a. Chassis: Cold-rolled steel, handing field-changeable without disassembly.

b. Latch bolts: 3/4-inch throw stainless steel anti-friction type

c. Lever Trim: Through-bolted, accessible design and independent break-away spindles.

d. Thumb turns: Accessible design not requiring pinching or twisting motions to operate.

e. Deadbolts: Stainless steel l-inch throw.

f. Electric operation: Manufacturer-installed continuous duty solenoid.

g. Strikes: 16 gage curved stainless steel with 1" deep box construction, lips of sufficient length to clear trim and protect clothing.

h. Certifications:

i. ANSI A156.13, 1994, Grade 1 Operational, Grade 2 Security.

i. Attic Stock: (Deliver to owner)

i. Furnish 2 passage lock bodies

ii. 2 privacy lock bodies

iii. 5 office/classroom lock bodies

iv. 2 storeroom lock bodies

v. 5 complete sets trim

vi. 10-cylinder housings

E. Manually Programmable Access Control Locks:

1. Acceptable manufacturers:

a. Schlage* PR05500 Series, 17 Lever design

2. Characteristics:

a. Access control locks shall be battery-powered, stand alone, keypad programmable with cylinder override.

b. Allow for a minimum of 120 three to eight digit user codes.

c. Certifications: ANSI/BHMA Grade 1

F. Exit Devices:

1. Acceptable manufacturers:

a. Von Duprin* 35A/98 Series

2. Characteristics:

a. Exit devices shall be "UL" listed for life safety. All exit devices for fire rated openings shall have "UL" labels for "Fire Exit Hardware."

b. Exit devices mounted on labeled wood doors shall be mounted on the door per the door manufacturer's requirements.

c. Trim shall be thru bolted to the lock stile case. Lever design to match locksets.

d. Exit devices shall be equipped with cylinder dogging feature in lieu of hex dogging.

e. 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.

f. Provide glass bead conversion kits to shim exit devices on doors with raised glass heads.

g. 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.

h. Lever trim shall be solid case material with a break-away feature to limit damage to the unit from vandalism.

i. 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.

j. 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.

G. Closers and Door Control Devices:

1. Acceptable manufacturers:

a. LCN Closers*

2. Characteristics:

a. Door closers shall have fully hydraulic, full rack and pinion action with a high strength cast iron cylinder.

b. All closers shall utilize a stable fluid withstanding temperature range of l20°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 l0C.

c. 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.

d. 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 cush type closers are used.

e. Furnish all closers with full metal covers (MC).

f. 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.l provisions for door opening force.

g. 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.

h. Powder coating finish to be certified to exceed l00 hours salt spray testing by ETL, an independent testing laboratory used by BHMA for ANSI certification.

i. Magnetic Door Holders to be heavy duty wall mounted with metal housing and complete mounting hardware. Provide 24V holding coils unless otherwise scheduled.

j. Attic Stock: Furnish 8 extra closer bodies as scheduled. Deliver attic stock to Owner.

H. Overhead Door Holders:

1. Acceptable manufacturers:

a. Glynn Johnson*

b. Rixson Firemark

2. Characteristics:

a. Provide heavy duty and medium duty, concealed door holders of stainless steel where scheduled.

b. 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.

I. Floor Stops and Wall Bumpers:

1. Acceptable manufacturers:

a. Ives*

b. Rockwood Manufacturing

c. Hager Companies

2. Characteristics: Refer to Hardware Headings.

J. Door Bolts/Coordinators:

1. Acceptable manufacturers:

a. Ives*

b. Rockwood Manufacturing

c. Hager Companies

2. Characteristics:

   a. Flush bolts to be forged brass 6-3/4" x 1", with 112" diameter bolts. Plunger to be supplied with milled surface one side that fits into a matching guide.

   b. Provide dustproof type bottom strikes.

K. Plush Plates:

1. Acceptable manufacturers:

   a. Ives*

   b. Rockwood Manufacturing

   c. Hager Companies

2. Characteristics:

   a. Exposed Fasteners: Provide manufacturers standard exposed fasteners.

   b. Provide plates sized as shown in Hardware Headings.

L. Door Pulls & Pull Plates:

1. Acceptable manufacturers:

   a. Ives*

   b. Rockwood Manufacturing

   c. Hager Companies

2. Characteristics:

   a. Provide concealed thru-bolted trim on back to back mounted pulls, but not for single units.

   b. Provide unit type and size as shown in Hardware Headings.

M. Push Pull Sets:

1. Acceptable manufacturers:

   a. Ives*

   b. Rockwood Manufacturing

   c. Hager Companies

2. Characteristics:

a. Provide mounting systems as shown in Hardware Headings.

b. Provide Push/Pull sets of type and size as shown in Hardware Headings.

N. Protective Plates:

1. Acceptable manufacturers:

a. Ives*

b. Rockwood Manufacturing

c. Hager Companies

2. Characteristics:

a. Provide manufacturers standard exposed fasteners for door trim units consisting of either machine screws or self-tapping screws.

b. Materials: Stainless Steel, .050-inch US 18 gage

c. Fabricate protection plates not more than 2 inches less than door width on hinge side and not more than I inch less than door width on pull side.

d. Heights:

i. Kick plates to be 10 inches in height.

ii. Mop plates to be 10 inches in height.

iii. Armor plates to be 36 inches in height. Armor plates on fire doors to comply with NFPA 80.

O. Thresholds:

1. Acceptable manufacturers:

a. National Guard Products, Inc.*

b. Hager Companies

c. Pemko Manufacturing

2. Types: Indicated in Hardware Headings.

P. Door Seals/Gasketing:

1. Acceptable manufacturers:

a. National Guard Products, Inc.*

b. Hager Companies

c. Pemko Manufacturing

2. Types: Indicated in Hardware Headings.

Q. Silencers:

1. Acceptable manufacturers:

a. Hager Companies

b. Ives

c. Rockwood Manufacturing

2. Three each for single doors; two each for pairs of doors and four each for double egress doors.

R. Key Cabinet and System:

1. Acceptable manufacturers:

a. Telkee, Inc.* AWC-450-S

2. 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.

a. 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.

b. Provide hinged-panel type cabinet for wall mounting.

2.2 MATERIALS AND FABRICATION

A. 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.

B. Fasteners:
Provide hardware manufactured to conform to published templates, generally prepared for machine screw installation.

1. Do not provide hardware that has been prepared for self-tapping sheet metal screws, except as specifically indicated.

2. 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.

3. 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.

4. 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.

2.3 HARDWARE FINISHES

A. Match items to the manufacturer's standard color and texture finish for the latch and lock sets.

B. Provide finishes that match those established by ANSI or, if none established, match the Owner's Representative's sample.

C. 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.

D. 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."

E. The designations used to indicate hardware finishes are those listed in ANSIIBHMA Al56.18, "Materials and Finishes," including coordination with the traditional U.S. finishes shown by certain manufacturers for their products.

1. Hinges: 630 (US32D) Satin Stainless Steel

2. Continuous Geared Hinges: 628 (US28) Clear Anodized Aluminum

3. Continuous Pinned Barrel Hinges: 630 (US32D) Satin Stainless Steel

4. Flush Bolts: 626 (US26D) Satin Chrome Plated Brass/Bronze

5. Locks: 630 (US32D) Satin Stainless Steel

6. Manually Programmable Access Control Locks: 626 (US26D) Satin Chrome Plated Brass/Bronze

7. Exit Devices: 628 (US28) chassis, 689 (powder coated) covers, and 630 (US32D) touchpads

8. Door Closers: 689 Powder Coat Aluminum

9. Push Plates: 630 (US32D) Satin Stainless Steel

10. Pull Plates: 630 (US32D) Satin Stainless Steel

11. Push Pull Sets: 630 (US32D) Satin Stainless Steel

12. Protective Plates: 630 (US32D) Satin Stainless Steel

13. Wall Stops: 630 (US32D) Satin Stainless Steel

14. Floor Stops: 626 (US26D) Satin Chrome Plated Brass/Bronze

15. Overhead Holders: 630 Satin Stainless Steel

16. Thresholds/Weather stripping: 627/628 (US27/US28) Aluminum

PART 3 - EXECUTION

3.1 INSTALLATION

A. 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.

1. "Recommended Locations for Builders Hardware for Standard Steel Doors and Frames" by the Door and Hardware Institute.

2. "Recommended Locations for Builders Hardware for Custom Steel Doors and Frames" by the Door and Hardware Institute.

3. NWWDA Industry Standard I.S.l.7, "Hardware Locations for Wood Flush Doors."

B. 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.

C. Set units level, plumb, and true to line and location. Adjust and reinforce the attachment substrate as necessary for proper installation and operation.

D. Drill and countersink units that are not factory prepared for anchorage fasteners. Space fasteners and anchors in accordance with industry standards.

E. 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".

F. Weather Stripping and Seals:
Comply with manufacturer's instructions and recommendations to the extent installation requirements are not otherwise indicated.

3.2 ADJUSTING, CLEANING, AND DEMONSTRATING

A. 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.

1. 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.

B. Clean adjacent surfaces soiled by hardware installation.

C. Door Hardware Supplier's Field Service

1. Inspect door hardware items for correct installation and adjustment after complete installation of door hardware.

2. Instruct Owner's personnel in the proper adjustment and maintenance of door hardware and hardware finishes.

3. File written report of this inspection to the Owner’s Representative.

D. Door Hardware Manufacturers' Field Service

1. 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.

2. A written report of the inspection results shall be provided to the Owner’s Representative and shall include the appropriate certificates.

END OF SECTION

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.

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 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 all applicable federal, state, and local requirements, and conform to codes and ordinances of the authorities having jurisdiction.

1.3 DEFINITIONS

A. Manufacturer is used in this Section to refer to a firm that produces primary glass or fabricated glass as defined in the referenced glazing standard.

B. Deterioration of Coated Glass: Defects developed from normal use that are attributed to the manufacturing process and not to causes other than glass breakage and practices for maintaining and cleaning coated glass contrary to manufacturer's directions. Defects include peeling, cracking, and other indications of deterioration in metallic coating.

C. Deterioration of Laminated Glass: Defects developed from normal use that are attributed to the manufacturing process and not to glass breakage and practices for maintaining and cleaning laminated glass contrary to manufacturer's directions. Defects include edge separation, delamination materially obstructing vision through glass, and blemishes exceeding those allowed by referenced laminated glass standard.

D. Deterioration of Insulating Glass: Failure of the hermetic seal under normal use due to causes other than glass breakage and improper practices for maintaining, and cleaning insulating glass. Evidence of failure is the obstruction of vision by dust, moisture, or film on the interior surfaces of glass. Improper practices for maintaining and cleaning glass do not comply with the manufacturer's directions.

1.4 QUALITY ASSURANCE

A. Glazing Publications: Comply with published recommendations of glass product manufacturers and organizations below, except where more stringent requirements are indicated. Refer to these publications for glazing terms not otherwise defined in this Section or in referenced standards.

1. FGMA Publications: "FGMA Glazing Manual."

2. Subject to compliance with requirements, provide safety glass permanently marked with certification label of Safety Glazing Certification Council (SGCC) or other certification agency acceptable to authorities having jurisdiction.

B. Fire Resistive Glazing Products for Door and Window Assemblies: Products labeled and listed by UL or another testing and inspecting agency acceptable to authorities having jurisdiction.

C. Insulating Glass Certification Program: Provide insulating glass units permanently marked either on spacers or at least one component lite of units with appropriate certification label of inspecting and testing agency indicated below:

1. Insulating Glass Certification Council (IGCC).

2. Associated Laboratories, Inc. (ALI).

3. National Certified Testing Laboratories (NCTL).

D. Glazier Qualifications: Engage an experienced glazier who has completed glazing similar in material, design, and extent to that indicated for Project with a record of successful in service performance.

E. Single Source Responsibility for Glass: Obtain glass from one source for each product indicated below:

1. Primary flat glass of each (ASTM C 1036) type and class indicated.

2. Heat treated flat glass of each (ASTM C 1048) condition indicated.

3. Laminated flat glass of each (ASTM C 1172) kind indicated.

4. Insulating glass of each construction indicated.

F. Single Source Responsibility for Glazing Accessories: Obtain glazing accessories from one source for each product and installation method indicated.

G. Field Constructed Mockups: Prior to glazing, erect mockups for each glass product indicated below to verify selections made under sample submittals and to demonstrate aesthetic effects and quality of materials and execution. Build mockups to comply with the following requirements, using materials indicated for final unit of Work:

1. Glass Products: Erect mockups with the following kinds of glass to match glazing systems required for Project, including typical lite size, framing systems, and glazing methods:

a. Heat strengthened coated glass.

b. Fully tempered glass.

c. Spandrel glass.

d. Laminated glass.

e. Coated insulating glass.

2. Place mockups at the Project Site in location and of size indicated or, if not indicated, as directed by Architect.

3. Notify Architect one week in advance of the dates and times when mockups will be erected.

4. Obtain Architect's acceptance of mockups before start of final unit of Work.

5. Demonstrate the proposed range of aesthetic effects and workmanship.

6. Retain and maintain mockups during construction in undisturbed condition as a standard for judging completed unit of Work.

7. When directed, demolish and remove mockups from Project Site.

8. Accepted mockups in undisturbed condition at time of Substantial Completion may become part of completed unit of Work.

H. Preconstruction Compatibility and Adhesion Testing: Submit to sealant manufacturers, samples of each glass, gasket, glazing accessory, and glass framing member that will contact or affect glazing sealants for compatibility and adhesion testing as indicated below:

1. Use test methods standard with sealant manufacturer to determine if priming and other specific preparation techniques are required for rapid, optimum glazing sealants adhesion to glass and glazing channel substrates.

a. Perform tests under normal environmental conditions during installation.

2. Submit not less than nine pieces of each type and finish of glass framing members and each type, class, kind, condition, and form of glass (monolithic, laminated, insulating units) for adhesion testing, as well as one sample of each glazing accessory (gaskets, setting blocks and spacers) for compatibility testing.

3. Schedule sufficient time to test and analyze results to prevent delay in the Work.

4. Investigate materials failing compatibility or adhesion tests and get sealant manufacturer's written recommendations for corrective measures, including using special primers.

5. Testing is not required when glazing sealant manufacturer can submit required preparation data that is acceptable to Architect and is based on previous testing of current sealant products for adhesion to and compatibility with submitted glazing materials.

I. Pre-Installation Conference: Conduct conference at the Project Site to comply with requirements of Division 01.

1.5 SUBMITTALS

A. Product Data:

1. Submit manufacturer's technical data for each glazing material and fabricated glass product required, including installation and maintenance instructions.

B. Samples:

1. Submit, for verification purposes, 12-inch square samples of each type of glass indicated except for clear single pane units, and 12-inch-long samples of each color required (except black) for each type of sealant or gasket exposed to view. Install sealant or gasket sample between two strips of material representative of adjoining framing system in color.

C. Certificate: Submit certificates from respective manufacturers attesting that glass and glazing materials furnished for Project comply with requirements.

1. Separate certification will not be required for glazing materials bearing manufacturer's permanent labels designating type and thickness of glass, provided labels represent a quality control program involving a recognized certification agency or independent testing laboratory acceptable to authorities having jurisdiction.

D. Compatibility and Adhesion Test Report: Submit statement from sealant manufacturer indicating that glass and glazing materials have been tested for compatibility and adhesion with glazing sealants and interpreting test results relative to material performance, including recommendations for primers and substrate preparation needed to obtain adhesion.

E. Record Documents:

1. Provide record approved product data, samples, reports, and certificates.

1.1 DELIVERY, STORAGE AND HANDLING

A. Protect glazing materials to comply with manufacturer's directions and as needed to prevent damage to glass and glazing materials from condensation, temperature changes, direct exposure to sun, or other causes.

1. Where insulating glass units will be exposed to substantial altitude changes, comply with insulating glass fabricator's recommendations for venting and sealing to avoid hermetic seal ruptures.

1.2 SYSTEM PERFORMANCE REQUIREMENTS

A. Provide glazing systems that are produced, fabricated, and installed to withstand normal thermal movement, wind loading, and impact loading (where applicable), without failure including loss or glass breakage attributable to the following: defective manufacture, fabrication, and installation; failure of sealants or gaskets to remain watertight and airtight; deterioration of glazing materials; and other defects in construction.

B. Glass Design: Glass thicknesses indicated on Drawings are for detailing only. Confirm glass thicknesses by analyzing Project loads and in-service conditions. Provide glass lites for the various size openings in the thicknesses and strengths (annealed or heat treated) to meet or exceed the following criteria:

1. Minimum glass thickness, nominally, of lites in exterior walls is 6.0 mm (0.23 inch).

2. Tinted and heat absorbing glass thicknesses for each tint indicated are the same throughout Project.

3. Minimum glass thicknesses of lites, whether composed of annealed or heat treated glass, are selected so the worst case probability of failure does not exceed the following:

   a. 8 lites per 1000 for lites set vertically or not over 15 degrees off vertical and under wind action. Determine minimum thickness of monolithic annealed glass according to ASTM E 1300. For other than monolithic annealed glass, determine thickness per glass manufacturer's standard method of analysis including applying adjustment factors to ASTM E 1300 based on type of glass.

   b. 1 lite per 1000 for lites set over 15 degrees off vertical and under action of wind or snow.

C. Normal thermal movement results from the following maximum change (range) in ambient and surface temperatures acting on glass framing members and glazing components. Base engineering calculation on materials' actual surface temperatures due to both solar heat gain and nighttime sky heat loss.

   1. Temperature Change (Range): 120 degrees F (67 degrees C), ambient; 180 degrees F (100 degrees C), material surfaces.

1.3 PROJECT CONDITIONS

A. Environmental Conditions: Do not proceed with glazing when ambient and substrate temperature conditions are outside the limits permitted by glazing materials manufacturer or when glazing channel substrates are wet from rain, frost, condensation, or other causes.

   1. Install liquid sealants at ambient and substrate temperatures above 40 degrees F (4.4 degrees C).

1.4 WARRANTY

A. Warranties specified in this Section shall not deprive the Owner of other rights the Owner may have under other provisions of the Contract Documents and will be in addition to and run concurrent with other warranties made by the Contractor under requirements of the Contract Documents.

B. Manufacturer's Warranty on Coated Glass Products: Submit written warranty signed by coated glass manufacturer agreeing to furnish replacements for those coated glass units that deteriorate as defined in "Definitions" article, f.o.b. point of manufacture, freight allowed Project Site, within specified warranty period indicated below. Warranty covers only deterioration due to normal conditions of use and not to handling, installing, and cleaning practices contrary to glass manufacturer's published instructions.

   1. Warranty Period: Manufacturer's standard but not less than five (5) years after date of Substantial Completion.

C. Manufacturer's Warranty on Laminated Glass: Submit written warranty signed by insulating glass manufacturer agreeing to furnish replacements for those laminated glass units that deteriorate as defined in the "Definitions" article, f.o.b. point of manufacture, freight allowed Project Site, within specified warranty period indicated below. Warranty covers only deterioration due to normal conditions of use and not to handling, installing, and cleaning practices contrary to glass manufacturer's published instructions.

   1. Warranty Period: Manufacturer's standard but not less than five (5) years after date of Substantial Completion.

D. Manufacturer's Warranty on Insulating Glass: Submit written warranty signed by manufacturer of insulating glass agreeing to furnish replacements for insulating glass units that deteriorate as defined in "Definitions" article, f.o.b. point of manufacture, freight allowed Project Site, within specified warranty period indicated below. Warranty covers only deterioration due to normal conditions of use and not to handling, installing, protecting, and maintaining practices contrary to glass manufacturer's published instructions.

   1. Warranty Period: Manufacturer's standard but not less than ten (10) years after date of Substantial Completion.

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.

2.2 PRIMARY GLASS PRODUCTS

A. Glass Type "1": Clear float glass conforming to ASTM C 1036, Type I, Class 1, Quality q3; ¼ inch thick.

B. Glass Type "2": Clear float glass conforming to ASTM C 1036, Type I, Class 1, Quality q3, which has been fully tempered by manufacturer's standard process (after cutting to final size), to achieve a flexural strength of 4 times normal glass strength, in accordance with ASTM C 1048, Condition A; ¼ inch thick.

C. Glass Type "3": Clear float glass conforming to ASTM C 1036 Type I, Class 1, Quality q3, 3/8 inch thick, with polished edges.

D. Glass Type "4": Bronze tinted float glass conforming to ASTM C 1036, Type I, Class 2, Quality q3; ¼ inch thick unless otherwise indicated with a visible light transmittance of 55 percent, Reflectance of 6 percent, and a shading coefficient of 0.73.

E. Glass Type "5": Bronze tinted float glass conforming to ASTM C 1036, Type I, Class 2, Quality q3, which has been fully tempered by manufacturer's standard process (after cutting to final size), to achieve a flexural strength of 4 times normal glass strength, in accordance with ASTM C 1048, Condition A; 1/4 inch thick with a visible light transmittance of 55 percent, Reflectance of 6 percent, and a shading coefficient of 0.73.

F. Glass Type "6": Laminated glass conforming to ASTM C1172, 9/16-inch nominal overall thickness, consisting of an outboard light of 1/4 inch thick clear float glass laminated with a 0.060 inch thick polyvinyl butyral interlayer to an inboard light of 1/4 inch thick clear float glass.

G. Glass Type "7": Laminated glass conforming to ASTM C1172, consisting of 2 sheets of clear float glass, 1/8 inch thick, complying with ASTM C 1036, Type I, Class 2, laminated with a 0.030 inch thick polyvinyl butyral interlayer by manufacturer's standard heat-plus-pressure process with dirt, air pockets, and foreign substances excluded.

H. Glass Type "8": Insulating glass, 1 inch overall thickness, double glass with 1/2 inch air space; exterior light 1/4 inch thick coated bronze tinted tempered float glass; interior light 1/4 inch thick clear float glass, LOF "Eclipse Clear (2)" glazed with the coating on the Number 2 surface as viewed from the exterior with a visible light transmittance of 36 percent, Reflectance of 42 percent, and a shading coefficient of 0.55.

I. Glass Type "9": Insulating glass, 1 inch overall thickness, double glass with 1/2 inch air space; exterior light 1/4 inch thick coated bronze tinted tempered float glass; interior light 1/4 inch thick clear tempered float glass, LOF "Eclipse Clear (2)" glazed with the coating on the Number 2 surface as viewed from the exterior with a visible light transmittance of 36 percent, Reflectance of 42 percent, and a shading coefficient of 0.55.

J. Glass Type "10": Insulating glass, 1 inch overall thickness, double glass with 1/2 inch air space; exterior light 1/4 inch thick coated bronze tinted tempered float glass; interior light 5/16 inch thick clear laminated glass, similar to LOF "Eclipse Bronze (2)" glazed with the coating on the Number 2 surface as viewed from the exterior with a visible light transmittance of 21 percent, Reflectance of 19 percent, and a shading coefficient of 0.41.

K. Glass Type "11": Spandrel Glass: 1/4 inch thick coated bronze tinted float glass, fully tempered by manufacturer's standard process (after cutting to final size), to achieve a flexural strength of 4 times normal glass strength, glazed with the coating on the Number 2 surface as viewed from the exterior, and with 1 inch bonded "Black" fiberglass insulation.

L. Bullet Resistant Glass: Laminated, clear float glass, Type I, Class 1, Quality q3, minimum of 1 3/16 inch (30 mm) thickness, conforming to UL Test No. 752, Fifth Edition, "Standard for Bullet Resisting Equipment" for resistance to medium power small arms. Appearance and performance data equivalent to Globe Amerada Glass Company "BR 136" bullet resisting glass.

2.3 CERAMIC COATED SPANDREL GLASS PRODUCTS

A. Ceramic Coated Spandrel Glass: ASTM C 1048, Condition B (spandrel glass, one surface ceramic coated), Type I (transparent glass, flat), Class 1 (clear), Quality q3 (glazing select), and complying with requirements specified.

B. Fallout Resistance: Provide spandrel units identical to those passing fallout resistant test for spandrel glass specified in ASTM C 1048.

2.4 WIRED GLASS

A. Wired Glass: ASTM C 1036, Type II (patterned and wired glass, flat), Class 1 (clear), Quality q8 (glazing); 6 mm (0.23 inch) thick; of form and mesh pattern indicated below:

1. Polished Wired Glass: Form 1 (wired, polished both sides), Mesh m1 (diamond).

2. Patterned Wired Glass: Form 2 (patterned and wired), Mesh m1 (diamond).

B. Manufacturers: Subject to compliance with requirements, provide wired glass by one of the following companies.

1. Polished Wired Glass:

a. Ashai Glass Co.

b. Central Glass Co., Ltd.

c. Nippon Sheet Glass Ltd.

d. Pilkington Sales (North America) Ltd.

2. Patterned Wired Glass:

a. AFG Industries, Inc.

2.5 PATTERNED GLASS PRODUCTS

A. Patterned Glass: ASTM C 1036, Type II (patterned and wired glass, flat), Class 1 (clear), Form 3 (patterned), Quality q8 (glazing), Finish f1 (patterned one side), of pattern indicated.

B. Tempered Patterned Glass: ASTM C 1048, Kind FT (fully tempered), Type II (patterned glass, flat), Class 1 (clear), Form 3 (patterned), Quality q8 (glazing), Finish f1 (patterned one side), of pattern indicated.

2.6 FIRE RESISTIVE GLAZING PRODUCTS

A. Fire Resistive, Ceramic Glazing Material: Proprietary product in the form of clear flat sheets permanently labeled with appropriate marks of testing and inspecting agency, acceptable to authorities having jurisdiction, showing product complies with fire resistive installation indicated, and as follows:

1. Polished on both surfaces, transparent with visible light transmission of 76.9 percent.

2. Unpolished on both surfaces, transparent.

3. Patterned (textured) on one surface, translucent.

4. Product: Subject to compliance with requirements, provide the following product manufactured by Nippon Electric Glass Co., Ltd. and distributed by Technical Glass Products:

a. Premium FireLite.

b. Standard FireLite.

c. Patterned FireLite.

B. Fire Resistive, Gel Filled, Dual Glazed Units: Proprietary product consisting of two lites of Condition A (uncoated surfaces), Type I (transparent glass, flat), Class 1 (clear), Kind FT (fully tempered) float glass, each lite 6.0 mm (0.23 inch) thick, with a perimeter metal spacer separating lites and dual edge seal, enclosing cavity filled completely with clear, fully transparent, heat absorbing gel.

1. Fire Resistance: As follows, determined by testing identical products in metal framed assemblies per ASTM E 119 by a testing and inspecting agency acceptable to authorities having jurisdiction:

a. 30 minutes for units 31.0 mm in overall thickness, plus or minus 1.5 mm.

b. 60 minutes for units 41.0 mm in overall thickness plus or minus 1.5 mm.

2. Product: Subject to compliance with requirements, provide the following product:

a. Contraflam 30, Saint Gobain.

b. Contraflam 60, Saint Gobain.

C. Fire Resistive, Gel Filled, Triple Glazed Units: Proprietary product consisting of two outer lites of Condition A (uncoated surfaces), Type I (transparent glass, flat), Class 1 (clear), Kind FT (fully tempered) float glass, each lite 6.0 mm (0.23 inch) thick, one inner lite of Type I, Class 1, annealed float glass 3.0 mm thick; with a perimeter metal spacer separating lites and dual edge seals, enclosing two cavities each filled completely with clear, fully transparent, heat absorbing gel, and with an overall thickness of 72.0 mm plus or minus 1.5 mm.

1. Fire Resistance: 90 minutes as determined by testing identical products in metal framed assemblies per ASTM E 119 by a testing and inspecting agency acceptable to authorities having jurisdiction.

2. Product: Subject to compliance with requirements, provide Contraflam 90, Saint Gobain.

D. Fire Resistive, Gel Filled, Triple Glazed Units: Proprietary product consisting of two outer lites and one inner lite of Condition A (uncoated surfaces), Type I (transparent glass, flat), Class 1 (clear), Kind FT (fully tempered) float glass, each outer lite 6.0 mm (0.23 inch) thick, with a perimeter metal spacer separating lites and dual edge seals, enclosing two cavities each completely filled with clear, fully transparent, water base, heat absorbing gel; a 50.9 mm overall thickness, and a fire protection rating of 45 minutes.

1. Fire Resistance: 45 minutes as determined by testing identical products in door and window assemblies by a testing and inspecting agency acceptable to authorities having jurisdiction.

2. Product: Subject to compliance with requirements, provide Pyrovue Commercial by Advanced Glass Systems Corp.

2.7 MIRROR GLASS

A. Primary Glass: Float glass complying with ASTM C 1036 requirements for Type I (transparent, flat) and for class and quality indicated below:

1. Clear Float Glass: Quality q2 (mirror), Class 1 (clear).

B. Tempered Glass: Tempered float glass manufactured by horizontal (roller hearth) process with roll wave distortion parallel with bottom edge of glass as installed, unless otherwise indicated, complying with ASTM C 1048 for Kind FT (fully tempered), Condition A (uncoated surfaces), Type I (transparent, flat), Quality q3 (glazing select), and for class indicated below:

1. Clear Tempered Float Glass: Class 1 (clear).

C. Transparent (One Way) Mirror Glass: Clear float glass, ASTM C 1036, Type I, Class 1, Quality q3; 1/4 inch thick, with chrome alloy or similar reflective metallic coating permanently deposited on one face of glass, with sufficient abrasion resistance to permit repeated cleaning with nonabrasive compound and soft cotton cloth without significant removal of coating.

2.8 MIRRORED GLASS PRODUCTION AND FABRICATION

A. Glass Coating: Coat second surface of glass with successive layers of chemically deposited silver, electrically or chemically deposited copper, and manufacturer's standard protective organic coating to produce coating system that complies with FS DD M 0041, except with salt spray test period extended to 300 hours and undercutting, discolorations, blackening, and silver impairment at mirror edges not greater than 1/8 inch.

B. Mirror Edge Treatment: Provide forms of edge treatment indicated below, with edges sealed after treatment to prevent chemical or atmospheric penetration of glass coating:

1. Flat polished edge.

2. Rounded polished edge.

3. Beveled polished edge of width shown.

4. Perform edge treatment and sealing in factory immediately after cutting to final sizes.

2.9 ELASTOMERIC GLAZING SEALANTS

A. Provide products of type indicated, complying with the following requirements:

1. Compatibility: Select glazing sealants and tapes of proven compatibility with other materials they will contact, including glass products, seals of insulating glass units, and glazing channel substrates, under conditions of installation and service, as demonstrated by testing and field experience.

2. Suitability: Comply with sealant and glass manufacturer's recommendations for selecting glazing sealants and tapes that are suitable for applications indicated and conditions existing at time of installation.

3. Colors: Provide color of exposed joint sealants to comply with the following:

   a. Match colors indicated by reference to manufacturer's standard designations.

   b. Provide selections made by Architect from manufacturer's full range of standard colors for products of type indicated.

B. Elastomeric Glazing Sealant Standard: Provide manufacturer's standard chemically curing, elastomeric sealants of base polymer indicated that comply with ASTM C 920 requirements for Type, Grade, Class and Uses.

C. Glazing Sealant for Fire Resistant Glazing Products: Identical to product used in test assembly to obtain fire resistive rating.

2.10 GLAZING TAPES

A. Back Bedding Mastic Glazing Tape: Preformed, butyl based elastomeric tape with a solids content of 100 percent, nonstaining and nonmigrating in contact with nonporous surfaces, with or without spacer rod as recommended by tape and glass manufacturers for application indicated, packaged on rolls with a release paper backing, and complying with AAMA 800.

B. Expanded Cellular Glazing Tape: Closed cell, polyvinyl chloride foam tape, factory coated with adhesive on both surfaces, packaged on rolls with release liner protecting adhesive, and complying with AAMA 800 for product 810.5.

C. Products: Subject to compliance with requirements, provide one of the following:

   1. Back Bedding Mastic Glazing Tape Without Spacer Rod:

      a. PTI 303 Glazing Tape (shimless), Protective Treatments, Inc.

      b. S M 5700 Poly Glaze Tape Sealant, Schnee Morehead, Inc.

      c. Tremco 440 Tape, Tremco Inc.

      d. Extru Seal, Pecora Corp.

      e. PTI 606 Architectural Sealant Tape, Protective Treatments, Inc.

      f. Dyna Seal, Pecora Corp.

      g. PTI 626 Architectural Sealant Tape, Protective Treatments, Inc.

      h. S M 5710 H.P Poly Glaze Tape Sealant, Schnee Morehead, Inc.

      i. SST 800 Tape, Tremco, Inc.

   2. Back Bedding Mastic Glazing Tape With Spacer Rod:

a. PTI 303 Glazing Tape (with shim), Protective Treatments, Inc.

b. Pre shimmed Tremco 440 Tape, Tremco, Inc.

c. PTI 606 Architectural Sealant Tape, Protective Treatments, Inc.

3. Expanded Cellular Glazing Tape:

a. Norseal V 980 Closed Cell Glazing Tape, Norton Company.

2.11 GLAZING GASKETS

A. Lock Strip Gaskets: Neoprene extrusions in size and shape indicated, fabricated into frames with molded corner units and zipper lock strips, complying with ASTM C 542, black.

B. Dense Compression Gaskets: Molded or extruded gaskets of material indicated below, complying with standards referenced with name of elastomer indicated below, and of profile and hardness required to maintain watertight seal:

1. Neoprene, ASTM C 864.

2. EPDM, ASTM C 864.

3. Silicone, ASTM C 1115.

4. Thermoplastic polyolefin rubber, ASTM C 1115.

5. Any material indicated above.

C. Soft Compression Gaskets: Extruded or molded closed cell, integral skinned gaskets of material indicated below, complying with ASTM C 509, Type II, black, and of profile and hardness required to maintain watertight seal:

1. Neoprene.

2. EPDM.

3. Silicone.

4. Thermoplastic polyolefin rubber.

5. Any material indicated above.

D. Manufacturers: Subject to compliance with requirements, provide products by one of the following companies.

1. Lock Strip Gaskets: Stanlock Div., Griffith Rubber Mills.

2. Preformed Gaskets:

b. Advanced Elastomer Systems, L.P.

c. Schnee Morehead, Inc.

d. Tremco, Inc.

2.12 MISCELLANEOUS GLAZING MATERIALS

A. Provide products of material, size, and shape complying with referenced glazing standard, requirements of manufacturers of glass and other glazing materials involved for glazing application indicated, and with a proven record of compatibility with surfaces contacted in installation.

B. Cleaners, Primers and Sealers: Type recommended by sealant or gasket manufacturer.

C. Setting Blocks: Elastomeric material with a Shore A durometer hardness of 85 plus or minus 5.

D. Spacers: Elastomeric blocks or continuous extrusions with a Shore A durometer hardness required by glass manufacturer to maintain glass lites in place for installation indicated.

E. Edge Blocks: Elastomeric material of hardness needed to limit glass lateral movement (side walking).

F. Plastic Foam Joint Fillers: Preformed, compressible, resilient, nonstaining, nonextruding, nonoutgassing, strips of closed cell plastic foam of density, size, and shape to control sealant depth and otherwise contribute to produce optimum sealant performance.

G. Perimeter Insulation for Fire Resistive Glazing: Identical to product used in test assembly to obtain fire resistive rating.

H. Mirror Mastic: An adhesive setting compound, produced specifically for setting mirrors by spot application, certified as compatible with glass coating by organic protective coating manufacturer and approved by mirror manufacturer.

I. Mirror Hardware: Extruded aluminum mirror hardware, of size and profile indicated, in manufacturer's standard finish, complying with description below:

1. Match Architect's sample.

2. Clear anodized finish.

3. Bronze color anodized finish.

4. Clear polished finish.

2.13 FABRICATION OF GLASS AND OTHER GLAZING PRODUCTS

A. Fabricate glass and other glazing products in sizes required to glaze openings indicated for Project, with edge and face clearances, edge and surface conditions, and bite complying with recommendations of product manufacturer and referenced glazing standard as required to comply with system performance requirements.

B. Clean cut or flat grind vertical edges of butt glazed monolithic lites in a manner that produces square edges with slight kerfs at junctions with indoor and outdoor faces.

PART 3 EXECUTION

3.1 PREPARATION

A. Examine glass framing, with glazier present, for compliance with the following:

1. Manufacturing and installation tolerances, including those for size, squareness, offsets at corners.

2. Presence and functioning of weep system.

3. Minimum required face or edge clearances.

4. Effective sealing between joints of glass framing members.

B. Do not proceed with glazing until unsatisfactory conditions have been corrected.

C. Clean glazing channels and other framing members receiving glass immediately before glazing. Remove coatings that are not firmly bonded to substrates.

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

C. Glazing – General:

1. Comply with combined recommendations of manufacturers of glass, sealants, gaskets, and other glazing materials, except where more stringent requirements are indicated, including those in referenced glazing publications.

2. Glazing channel dimensions as indicated on Drawings provide necessary bite on glass, minimum edge and face clearances, and adequate sealant thicknesses, with reasonable tolerances. Adjust as required by Project conditions during installation.

3. Protect glass from edge damage during handling and installation as follows:

a. Use a rolling block in rotating glass units to prevent damage to glass corners. Do not impact glass with metal framing. Use suction cups to shift glass units within openings; do not raise or drift glass with a pry bar. Rotate glass lites with flares or bevels on bottom horizontal edges so edges are located at top of opening, unless otherwise indicated by manufacturer's label.

b. Remove damaged glass from Project Site and legally dispose of off Site. Damaged glass is glass with edge damage or other imperfections that, when installed, weaken glass and impair performance and appearance.

4. Apply primers to joint surfaces where required for adhesion of sealants, as determined by preconstruction sealant substrate testing.

5. Install elastomeric setting blocks in sill rabbets, sized and located to comply with referenced glazing standard, unless otherwise required by glass manufacturer. Set blocks in thin course of compatible sealant suitable for heel bead.

6. Do not exceed edge pressures stipulated by glass manufacturers for installing glass lites.

7. Provide spacers for glass sizes larger than 50 united inches (length plus height) as follows:

   a. Locate spacers inside, outside, and directly opposite each other. Install correct size and spacing to preserve required face clearances, except where gaskets and glazing tapes are used that have demonstrated ability to maintain required face clearances and comply with system performance requirements.

   b. Provide 1/8 inch minimum bite of spacers on glass and use thickness equal to sealant width. With glazing tape, use thickness slightly less than final compressed thickness of tape.

8. Provide edge blocking to comply with requirements of referenced glazing publications, unless otherwise required by glass manufacturer.

9. Set glass lites in each series with uniform pattern, draw, bow, and similar characteristics.

10. Where wedge shaped gaskets are driven into one side of channel to pressurize sealant or gasket on opposite side, provide adequate anchorage so gasket cannot walk out when installation is subjected to movement.

11. Square cut wedge shaped gaskets at corners and install gaskets in manner recommended by gasket manufacturer to prevent corners from pulling away; seal corner joints and butt joints with sealant recommended by gasket manufacturer.

D. Tape Glazing:

1. Position tapes on fixed stops so that when compressed by glass their exposed edges are flush with or protrude slightly above sightline of stops.

2. Install tapes continuously but not in one continuous length. Do not stretch tapes to make them fit opening.

3. Where framing joints are vertical, cover these joints by applying tapes to heads and sills first and then to jambs. Where framing joints are horizontal, cover these joints by applying tapes to jambs and then to heads and sills.

4. Place joints in tapes at corners of opening with adjoining lengths butted together, not lapped. Seal joints in tapes with compatible sealant approved by tape manufacturer.

5. Do not remove release paper from tape until just before each lite is installed.

6. Apply heel bead of elastomeric sealant.

7. Center glass lites in openings on setting blocks and press firmly against tape by inserting dense compression gaskets formed and installed to lock in place against faces of removable stops. Start gasket applications at corners and work toward centers of openings.

8. Apply cap bead of elastomeric sealant over exposed edge of tape.

E. Gasket Glazing (Dry):

1. Fabricate compression gaskets in lengths recommended by gasket manufacturer to fit openings exactly, with stretch allowance during installation.

2. Secure compression gaskets in place with joints located at corners to compress gaskets producing a weathertight seal without developing bending stresses in glass. Seal gasket joints with sealant recommended by gasket manufacturer.

3. Install gaskets so they protrude past face of glazing stops.

F. Sealant Glazing (Wet):

1. Install continuous spacers between glass lites and glazing stops to maintain glass face clearances and to prevent sealant from extruding into glass channel weep systems until sealants cure. Secure spacers in place and in position to control depth of installed sealant relative to edge clearance for optimum sealant performance.

2. Force sealants into glazing channels to eliminate voids and to ensure complete wetting or bond of sealant to glass and channel surfaces.

3. Tool exposed surfaces of sealants to provide a substantial wash away from glass. Install pressurized gaskets to protrude slightly out of channel to eliminate dirt and moisture pockets.

G. Lock Strip Gasket Glazing:

1. Comply with ASTM C 716 and gasket manufacturer's printed recommendations. Provide supplementary wet seal and weep system unless otherwise indicated.

H. Mirror Glazing:

1. Install mirrors to comply with printed directions of mirror manufacturer, and with referenced FGMA standard and NAMM document. Mount mirrors in place to avoid distorting reflected images and provide space for air circulation between back of mirror and face of mounting surface.

2. Mastic Spot Installation System: Install mirrors with mastic as follows:

a. Identify and examine surfaces over which mirror is to be mounted. Comply with manufacturer's printed installation directions for preparation of mounting surfaces including coating surfaces with mastic manufacturer's special bond coating where applicable.

b. Apply barrier coat to mirror backing where approved by manufacturers of mirror and backing material.

c. Apply mastic in spots to comply with mastic manufacturer's printed directions for coverage and to allow air circulation between back of mirror and face of mounting surface.

d. After mastic is applied, align mirror and press into place while maintaining a minimum air space of 3/16 inch between back of mirror and mounting surface.

e. For wall mounted mirrors install permanent means of support at bottom and top edges with bottom support designed to withstand mirror weight and top support to prevent mirror from coming away from wall along top edges.

i. Attach mirror hardware securely to mounting surfaces with mechanical fasteners installed with anchors or inserts as applicable.

ii. For continuous bottom supports, provide 1/8 inch by 4-inch setting blocks at quarter points. For channels or other continuous supports in which water could be trapped, provide two (2) 1/4-inch diameter weeps drilled between setting blocks.

3.3 PROTECTION AND CLEANING

A. Protect exterior glass from breakage immediately after installation by attaching crossed streamers to framing held away from glass. Do not apply markers to glass surface. Remove nonpermanent labels, and clean surfaces.

B. Protect glass from contact with contaminating substances resulting from construction operations including weld splatter. If, despite such protection, contaminating substances do come into contact with glass, remove them immediately as recommended by glass manufacturer.

C. Examine glass surfaces adjacent to or below exterior concrete and other masonry surfaces at frequent intervals during construction, but not less than once a month, for build up of dirt, scum, alkali deposits, or stains, and remove as recommended by glass manufacturer.

D. Remove and replace glass that is broken, chipped, cracked, abraded, or damaged in any way, including natural causes, accidents and vandalism, during construction period.

E. Wash glass on both faces in each area of Project not more than four (4) days prior to date scheduled for inspections that establish date of Substantial Completion. Wash glass as recommended by glass manufacturer.

END OF SECTION

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 this Section.

1.2 SUMMARY

A. This Section includes the following:

1. Steel stud systems.

2. Metal lath and furring.

3. Portland cement plastering.

B. Related Sections:
The following sections contain requirements that relate to this Section:

1. None.

C. Wood framing and furring are specified in Division 6.

1.3 SUBMITTALS

A. General:
Submit the following in accordance with Conditions of Contract and Division 1 Specification Sections.

B. Product data consisting of manufacturer's product specifications and installation instructions for each product, including data showing compliance with the requirements.

C. Samples for initial selection purposes in form of manufacturer's color charts consisting of actual units or sections of units at least 12 inches square showing full range of colors, textures, and patterns available for each type of finish indicated.

1. Where finish involves normal color and texture variations, include sample sets composed of two or more units showing full range of variations expected.

2. Include similar samples of material for joints and accessories involving color selection.

D. Samples for verification purposes in units at least 12 inches square of each type of finish indicated, in sets for each color, texture, and pattern specified, showing full range of variations expected in these characteristics.

1.4 QUALITY ASSURANCE

A. Fire-Resistance Ratings:

1. Where plaster systems with fire-resistance ratings are indicated, provide materials and installations identical to those of applicable assemblies tested per ASTM E 119 by fire testing laboratories acceptable to authorities having jurisdiction.

2. Provide plaster for fire-resistance rated systems that has same aggregate as specified for similar nonrated work, unless specified aggregate has not been tested by accepted fire testing laboratories.

B. Coordination of Work:
Coordinate layout and installation of suspension system components for suspended ceilings with other work supported by or penetrating through ceiling.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Deliver materials in original packages, containers, or bundles bearing brand name and identification of manufacturer.

B. Store materials inside, under cover, and in manner to keep them dry, protected from weather, direct sunlight, surface contamination, aging, corrosion, and damage from construction traffic and other causes.

1.6 PROJECT CONDITIONS

A. Environmental Requirements, General:
Comply with requirements of referenced plaster application standards and recommendations of plaster manufacturer for environmental conditions before, during, and after application of plaster.

B. Ventilation:
Ventilate building spaces as required to remove water in excess of that required for hydration of plaster. Begin ventilation immediately after plaster is applied and continue until it sets.

C. Protect contiguous work from soiling, spattering, moisture deterioration and other harmful effects that might result from plastering.

PART 2 - PRODUCTS

2.1 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. Metal Supports:

a. Allied Structural Industries, Inc.

b. American Studco, Inc.

c. Chapman Industries, Inc.

d. Chicago Metallic Corp.

e. Dale Industries, Inc.

f. Dietrich Industries, Inc.

g. Gold Bond Building Products Div., National Gypsum Co.

h. Marino Industries.

i. United States Gypsum Co.

j. Expanded Metal Lath:

k. Alabama Metal Industries Corp. (AMICO)

l. Gold Bond Building Products Div., National Gypsum Co.

m. United States Gypsum Co.

n. Western Metal Lath Co.

2. Accessories:

a. Fry Reglet Corp.

b. Gold Bond Building Products Div., National Gypsum Co.

c. Keene Corp.

d. MM Systems Corp.

e. Plastic Components, Inc.

f. United States Gypsum Co.

g. Western Metal Lath Co.

2.2 METAL SUPPORTS FOR SUSPENDED AND FURRED CEILINGS (09200.A)

A. General:
Size metal ceiling supports to comply with the following, unless otherwise indicated.

B. Portland Cement Plaster Installation:
ASTM C 1063.

C. Wire for Hangers and Ties:
ASTM A 641, Class I zinc coating, soft temper.

D. Rod Hangers:
Mild steel, zinc or cadmium coated.

E. Flat Hangers:
Mild steel, zinc or cadmium coated or protected with rust-inhibitive paint.

F. Channels:
Cold-rolled steel, 0.05980-inch minimum thickness of base metal (uncoated), allowable bending stress of 18,000 psi, protected with rust-inhibitive paint or galvanizing complying with ASTM A 525 for G60 coating designation, and as follows:

G. Carrying Channels:
1-1/2-inch-deep by 7/16-inch-wide flanges, 475 lbs. per 1000 feet painted, 508 lbs. per 1000 feet galvanized.

H. Furring Channels:
3/4-inch-deep by 7/16-inch-wide flanges, 300 lbs. per 1000 feet painted, 316 lbs. per 1000 feet galvanized.

I. Provide galvanized channels for exterior installations.

J. Hanger Anchorage Devices:
Screws, cast-in-place concrete inserts, or other devices appropriate for anchorage to the form of structural framing indicated and whose suitability for use intended has been proven through standard construction practices or certified test data.

K. Size devices to develop full strength of hanger but not less than 3 times calculated hanger loading, except size direct pullout concrete inserts for 5 times calculated hanger loading.

2.3 STEEL STUDS AND RUNNERS (TRACKS) (09200.B)

A. Non-Load (Axial) - Bearing Studs and Runners (09200.Bl):
ASTM C 645 and complying with following requirements for minimum thickness of base metal (uncoated) and other characteristics:

B. Stud Thickness:
0.034I inch, unless otherwise indicated.

C. Stud Depth:
6 inches, unless otherwise indicated.

D. Load-Bearing (Transverse and Axial) Studs and Runners (09200.B2):
ASTM C 955 and complying with the following requirements for quality, grade, and finish of steel sheet, design thickness of base metal (uncoated), and other dimensional characteristics:

E. Metal Quality:
Zinc-coated (galvanized) steel sheet complying with ASTM A 446, Coating Designation G 90, for grades indicated below:

1. Grade D (50,000 psi yield point) for design thicknesses of 0.0598 inch or more.

F. Stud Thickness: 0.0598 inch, unless otherwise indicated.

G. Stud Lip Depth: 1/4 inch.

H. Stud Depth: 6 inches, unless otherwise indicated.

2.4 VERTICAL METAL FURRING (09200.C)

A. Channel Furring and Braces:
Cold-rolled steel, 0.0598-inch min. thickness of base (uncoated) metal, allowable bending stress of 18,000 psi, protected with rust-inhibitive paint finish or galvanizing, 3/4-inch-deep by 7/16-inch-wide flanges, 300 lbs. per 1000 feet with painted finish, 316 lbs. per 1000 feet with galvanized finish.

B. Hat-Channels:
Hat shaped screwable furring channels, 7/8-inch deep formed from zinc-coated (galvanized) steel sheet minimum 0.0 I79-inch thick complying with ASTM A 446, Coating Designation G 60, grade A (33,000 psi yield point).

C. Z-Furring Members:
Manufacturer's standard screw-type zee-shaped furring members formed from zinc-coated (galvanized) steel sheet, 0.0179-inch min. base (uncoated) metal thickness, complying with ASTM A 525, Coating Designation G 60, designed for mechanical attachment of insulation boards or blankets to monolithic concrete and masonry walls.

D. Furring Brackets:
Serrated-arm type, 0.0329-inch min. thickness of base (uncoated) metal, adjustable from l/4-inch to 2-1/4-inch wall clearance for channel furring.

2.5 LATH (09200.D)

A. Expanded Metal Lath:
Fabricate expanded metal lath from uncoated or zinc-coated (galvanized) steel sheet to produce lath complying with ASTM C 847 for type, configuration, and other characteristics indicated below, with uncoated steel sheet painted after fabrication into lath.

B. Diamond Mesh Lath: Comply with the following requirements:

1. Configuration: Self-furring.

2. Weight: 3.4 lbs. per sq. yd.

3. Paper Backing:
Where paper-backed diamond mesh lath is indicated, provide asphalt-impregnated paper factory-bonded to back and complying with FS UU-B-790, for Type I, Grade D (vapor permeable), Style

C. Rib Lath:
Comply with the following requirements:

1. Configuration: Rib depth of 3/8 inch.

2. Weight: 4.0 lbs. per sq. yd.

D. Lath Attachment Devices:
Devices of material and type required by referenced standards and recommended by lath manufacturer for secure attachment of lath to framing members and of lath to lath.

2.6 PLASTER ACCESSORIES FOR PORTLAND CEMENT PLASTER (09200.E)

A. General:
Comply with material provisions of ASTM C I 063; coordinate depth of accessories with thicknesses and number of coats required.

B. Metal Corner Reinforcement:
Expanded large-mesh diamond mesh lath fabricated from zinc-alloy or welded wire mesh fabricated from 0.0475-inch-diameter zinc-coated (galvanized) wire and specially formed to reinforce external corners of Portland cement plaster on exterior exposures while allowing full plaster encasement.

C. Metal Corner Beads:
Small nose corner beads fabricated from zinc alloy, with expanded flanges of large-mesh diamond lath to allow full encasement by plaster.

D. Casing Beads:
Square-edged style, with expanded flanges and removable protective tape.

E. Control Joints:
Prefabricated, of material and type indicated below:

F. Material: Zinc coated (galvanized) steel.

G. One Piece Type: Folded pair of unperforated screeds in M-shaped configuration, with expanded flanges.

2.7 PORTLAND CEMENT PLASTER MATERIALS (09200.F)

A. Base Coat Cements:
Type as indicated below:

1. Portland cement, ASTM C 150, Type I or II.

2. Masonry cement, ASTM C 91, Type N.

B. Finish Coat Cement:
Type as indicated below:

1. Portland cement, ASTM C 150, Type I, white.

2. Masonry cement, ASTM C 91, Type N, white.

C. Lime:

Special hydrated lime for finishing purposes, ASTM C 206, Type S, or special hydrated lime for masonry purposes, ASTM C 207, Type S.

D. Sand Aggregate for Base Coats:
ASTM C 897.

E. Fiber for Base Coat:
Alkaline-resistant (AR) glass or polypropylene fibers, 1/2 inch long, free of contaminates, manufactured for use in Portland cement plaster.

2.8 MISCELLANEOUS MATERIALS

A. Water for Mixing and Finishing Plaster:
Drinkable and free of substances capable of affecting plaster set or of damaging plaster, lath, or accessories

B. Bonding Agent for Portland cement Plaster:
ASTM C 932

C. Acoustical Sealant:
ASTM C 919, non-oxidizing, skinning paintable types for exposed applications; nondrying, non-hardening, non-staining, non-bleeding, gun applied sealant complying with requirement specified in Division 7 Section "Joint Sealers" for concealed applications.

2.9 PORTLAND CEMENT PLASTER MIXES AND COMPOSITIONS

A. General:
Comply with ASTM C 926 for Portland cement plaster base and finish coat mixes as applicable to plaster bases, materials, and other requirements indicated.

B. Portland Cement Plaster Base Coat Mixes and Compositions:
Proportion materials for respective base coats in parts by volume for cementitious materials and in parts by volume per sum of cementitious materials for aggregates to comply with the following requirements for each method of application and plaster base indicated. Adjust mix proportions below within limits specified to attain workability.

C. Fiber Content:
Add fiber to following mixes after ingredients have mixed at least 2 minutes. Comply with fiber manufacturer's directions but do not to exceed 2 lbs. per cu. ft. of cementitious materials. Reduce aggregate quantities accordingly to maintain workability.

D. Three-Coat Work Over Metal Lath:
Base coats as indicated below:

1. Scratch Coat: l part Portland cement, 0 to 3/4 parts lime, 2-1/2 to 4 parts sand

2. Brown Coat: 1 part Portland cement, 0 to 3/4 parts lime, 3 to 5 parts sand

E. Job-Mixed Portland Cement Plaster Finish Coats:

Proportion materials for finish coats in parts by volume for cementitious materials and parts by volume per sum of cementitious materials for aggregates to comply with the following requirements:

1. 1 part Portland cement, 3/4 to 1-1/2 parts lime, 3 parts sand.

2. 1 part Portland cement, 1 part masonry cement, 3 part sand.

3. 1 part Portland cement, 1-1/2 to 2 parts lime, 3 parts sand.

4. 1 part masonry cement, 1-1/2 parts sand.

2.10 MIXING

A. Mechanically mix cementitious and aggregate materials for plasters to comply with applicable referenced application standard and with recommendations of plaster manufacturer.

PART 3 - EXECUTION

3.1 INSTALLATION OF LATHING AND FURRING, GENERAL

A. Portland Cement Plaster Lathing and Furring Installation Standard:
Install lathing and furring materials indicated for Portland cement plaster to comply with ASTM C 1063.

B. Install supplementary framing, blocking, and bracing at terminations in the work and for support of equipment services, heavy trim, and similar work to comply with details indicated or, if not otherwise indicated, to comply with applicable published recommendations of gypsum plaster manufacturer or, if not available, of "Gypsum Construction Handbook" published by United States Gypsum Co.

C. Isolation:
Where lathing and metal support system abuts building structure horizontally and where partition/wall work abuts overhead structure, isolate the work from structural movement sufficiently to prevent transfer of loading into the work from the building structure. Install slip or cushion type joints to absorb deflections but maintain lateral support.

D. Frame both sides of control and expansion joints independently, and do not bridge joints with furring and lathing or accessories.

3.2 INSTALLATION OF STEEL STUD WALL/PARTITION SUPPORT SYSTEMS

A. General:
Install components for steel stud wall/partition support systems to comply with directions of steel stud manufacturer for applications indicated and with the following:

1. For non-load (axial)-bearing stud systems, comply with ASTM C 754.

2. For load-bearing (axial and transverse) stud systems, comply with ASTM C 1007 and as indicated.

B. Steel Stud Systems to Receive Metal Lath:
Comply with requirements of ML/SFA "Specifications for Metal Lathing and Furring" applicable to each installation condition and type of metal stud system indicated.

C. Extend and attach partition support systems to structure above suspended ceilings, unless otherwise indicated.

D. Extend partition support systems to finish ceilings and attach to ceiling suspension members, unless otherwise indicated.

3.3 INSTALLATION OF VERTICAL METAL FURRING

A. Metal Furring to Receive Metal Lath:
Comply with requirements of ML/SFA "Specification for Metal Lathing and Furring" applicable to each installation condition indicated.

3.4 METAL LATHING

A. Install expanded metal lath for the following applications where plaster base coats are required. Provide appropriate type, configuration, and weight of metal lath selected from materials indicated that comply with referenced lathing installation standards.

B. Vertical metal framing and furring.

3.5 INSTALLATION OF PLASTERING ACCESSORIES

A. General:
Comply with referenced lathing and furring installation standards for provision and location of plaster accessories of type indicated. Miter or cope accessories at corners; install with tight joints and in alignment. Attach accessories securely to plaster bases to hold accessories in place and alignment during plastering.

B. Accessories for Portland Cement Plaster:
Provide the following types to comply with requirements indicated for location:

1. Corner Reinforcement: Install at external corners.

2. Corner Bead: Install at external corners.

3. Casing Beads: Install at terminations of plaster work unless otherwise indicated.

4. Control Joints: Install control joints at locations indicated or, if not indicated, at locations complying with the following criteria and approved by Owner's Representative.

a. Where an expansion or control joint occurs in surface of construction directly behind plaster membrane.

b. Where plaster panel sizes or dimensions change, extend joints full width or height of plaster membrane.

c. For Portland cement Plaster: Where, in surfaces of ceilings and walls, distances between and areas within control joints exceed, respectively, the following measurements:

1) 18 feet in either direction and 144 sq. ft.

3.6 INSTALLATION OF SOUND-RATED PLASTER WORK

A. Where sound-rated plaster work is indicated by STC ratings or other notation, seal work at perimeters, control joints, openings, and penetrations with a continuous bead of acoustical sealant. Comply with ASTM C 919 and plastering manufacturer's recommendations for location of sealant beads.

3.7 PLASTER APPLICATION, GENERAL

A. Prepare monolithic surfaces for bonded base coats and use bonding compound or agent to comply with requirements of referenced plaster application standards for conditioning of monolithic surfaces.

B. Tolerances:
Do not deviate more than 1/8 inch in 10'-0" from a true plane in finished plaster surfaces, as measured by a 10'-0" straightedge placed at any location on surface.

C. Grout hollow metal frames, bases, and similar work occurring in gypsum plastered areas, with base coat plaster material, and prior to lathing where necessary. Except where full grouting is indicated or required for fire-resistance rating, grout at least 6 inches at each jamb anchor clip.

D. Sequence plaster application with the installation and protection of other work so that neither will be damaged by the installation of the other.

E. Plaster flush with metal frames and other built-in metal items or accessories that act as a plaster ground, unless otherwise indicated. Where plaster is not terminated at metal by casing beads, cut base coat free from metal before plaster sets and groove finish coat at the junctures with metal.

F. Apply thicknesses and number of coats of plaster as indicated or as required by referenced standards.

G. Concealed Plaster:
Where plaster application will be concealed by wood paneling, above suspended ceilings and similar locations, finish coat may be omitted; where concealed behind cabinets and similar furnishings and equipment, apply finish coat; where used as a base for adhesive application of tile and similar finishes, omit finish coat and coordinate thickness with overall dimension as shown and comply with tolerances specified.

3.8 PORTLAND CEMENT PLASTER APPLICATION

A. Portland Cement Plaster Application Standard:
Apply Portland cement plaster materials, compositions, and mixes to comply with ASTM C 926.

B. Number of Coats:

Apply Portland cement plaster, of composition indicated, to comply with the following requirements:

1. Use three-coat work over the following plaster bases:

a. Metal lath.

b. Concrete unit masonry.

c. Concrete, cast-in-place or precast when surface complies with ASTM C 926 for plaster bonded direct to solid base.

d. Finish Coat: Floated finish unless otherwise indicated; match Owner's Representative's sample for texture and color.

C. Moist-cure Portland cement plaster base and finish coats to comply with ASTM C 926, including recommendations for time between coats and curing in "Annex A2 Design Considerations."

3.9 CUTTING AND PATCHING

A. Cut, patch, point up, and repair plaster as necessary to accommodate other work and to restore cracks, dents, and imperfections. Repair or replace work to eliminate blisters, buckles, excessive crazing and check cracking, dry outs, efflorescence, sweat outs, and similar defects and where bond to the substrate has failed.

B. Sand smooth-troweled finishes lightly to remove trowel marks and arises.

3.10 CLEANING AND PROTECTION

A. Remove temporary protection and enclosure of other work. Promptly remove plaster from door frames, windows, and other surfaces that are not to be plastered. Repair floors, walls, and other surfaces that have been stained, marred, or otherwise damaged during the plastering work. When plastering work is completed, remove unused materials, containers, and equipment and clean floors of plaster debris.

B. Provide final protection and maintain conditions, in a manner suitable to Installer that ensure plaster work's being without damage or deterioration at time of Substantial Completion.

END OF SECTION

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 surface preparation and field painting of the following:

B. Exposed interior items and surfaces.

C. Surface preparation, priming, and finish coats specified in this Section are in addition to shop priming and surface treatment specified in other Sections.

D. 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.

E. 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.

F. Do not paint prefinished items, concealed surfaces, finished metal surfaces, operating parts, and labels.

G. Prefinished items include the following factory-finished components:

1. Architectural woodwork and casework.

2. Elevator equipment.

3. Finished mechanical and electrical equipment.

4. Light fixtures.

5. Distribution cabinets.

H. Concealed surfaces include walls or ceilings in the following generally inaccessible spaces:

1. Ceiling plenums.

I. Finished metal surfaces include the following:

1. Anodized aluminum

2. Stainless steel

3. Chromium plate

4. Copper

5. Bronze and brass

J. Operating parts include moving parts of operating equipment and the following:

1. Valve and damper operators

2. Linkages

3. Sensing devices

4. Motor and fan shafts

K. 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.

L. Related Sections include the following:

M. Division 5 Section "Structural Steel" for shop priming structural steel

N. Division 5 Section "Metal Fabrications" for shop priming ferrous metal

O. Division 6 Section "Interior Architectural Woodwork" for shop priming interior architectural woodwork

P. Division 8 Section "Steel Frames" for shop priming steel doors and frames

Q. Division 9 Section "Gypsum Board Assemblies" for surface preparation for gypsum board

1.3 DEFINITIONS

A. General:
Standard coating terms defined in ASTM D 16 apply to this Section.

B. Flat refers to a lusterless or matte finish with a gloss range below 15 when measured at an 85-degree meter.

C. Eggshell refers to low-sheen finish with a gloss range between 5 and 20 when measured at a 60-degree meter.

D. Satin refers to low-sheen finish with a gloss range between 15 and 35 when measured at a 60-degree meter.

E. Semi-gloss refers to medium-sheen finish with a gloss range between 30 and 65 when measured at a 60-degree meter.

F. Full gloss refers to high-sheen finish with a gloss range more than 65 when measured at a 60-degree meter.

1.4 SUBMITTALS

A. Product Data:
For each paint system specified. Include block fillers and primers.

B. 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.

C. Manufacturer's Information:
Provide manufacturer's technical information, including label analysis and instructions for handling, storing, and applying each coating material proposed for use.

D. Certification by the manufacturer that products supplied comply with local regulations controlling use of volatile organic compounds (VOCs).

E. Samples for Verification:
Of each color and material to be applied, with texture to simulate actual conditions.

F. 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.

1.5 QUALITY ASSURANCE

A. 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.

B. Source Limitations:
Obtain block fillers, primers, and undercoat materials for each coating system from the same manufacturer as the finish coats.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Deliver materials to the Project Site in manufacturer's original, unopened packages and containers bearing manufacturer's name and label, and the following information:

B. Product name or title of material

C. Product description (generic classification or binder type)

D. Manufacturer's stock number and date of manufacture

E. Contents by volume, for pigment and vehicle constituents

F. Thinning instructions

G. Application instructions

H. Color name and number

I. VOC content

J. 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.

K. 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.

1.7 PROJECT CONDITIONS

A. Apply water-based paints only when the temperature of surfaces to be painted and surrounding air temperatures are below 90°F (32°C).

B. Apply solvent-thinned paints only when the temperature of surfaces to be painted and surrounding air temperatures are below 95°F (35°C).

C. 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.

D. 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.

1.8 EXTRA MATERIALS

A. 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.

B. 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.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Available Products:

B. 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.

C. 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:

1. Devoe & Raynolds Co. (Devoe).

2. Fuller-O'Brien Paints (Fuller).

3. Glidden Co. (The) (Glidden).

4. Benjamin Moore & Co. (Moore).

5. PPG Industries, Inc. (PPG).

6. Pratt & Lambert, Inc. (P & L).

7. Sherwin-Williams Co. (S-W).

8. Martin Seymour Co. (MS).

2.2 PAINT MATERIALS, GENERAL

A. 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.

B. 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.

C. 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.

D. Colors:
Match colors indicated by reference to manufacturer's color designations.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with the Applicator present, under which painting will be performed for compliance with paint application requirements.

B. Do not begin to apply paint until unsatisfactory conditions have been corrected and surfaces receiving paint are thoroughly dry.

C. Start of painting will be construed as the Applicator's acceptance of surfaces and conditions within a particular area.

D. 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.

E. Notify the Owner's Representative about anticipated problems using the materials specified over substrates primed by others.

3.2 PREPARATION

A. 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.

B. After completing painting operations in each space or area, reinstall items removed using workers skilled in the trades involved.

C. 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.

D. Schedule cleaning and painting so dust and other contaminants from the cleaning process will not fall on wet, newly painted surfaces.

E. Surface Preparation:
Clean and prepare surfaces to be painted according to manufacturer's written instructions for each particular substrate condition and as specified.

F. Provide barrier coats over incompatible primers or remove and re-prime.

G. 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.

1. Blast steel surfaces clean as recommended by paint system manufacturer and according to requirements of SSPC-SP 10.

2. Treat bare and sandblasted or pickled clean metal with a metal treatment wash coat before priming.

3. 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.

H. 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.

I. Materials Preparation:
Mix and prepare paint materials according to manufacturer's written instructions.

J. Maintain containers used in mixing and applying paint in a clean condition, free of foreign materials and residue.

K. 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.

L. Use only thinners approved by paint manufacturer and only within recommended limits.

M. 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.

3.3 APPLICATION

A. General:
Apply paint according to manufacturer's written instructions. Use applicators and techniques best suited for substrate and type of material being applied.

B. Paint colors, surface treatments, and finishes are indicated in the schedules.

C. Do not paint over dirt, rust, scale, grease, moisture, scuffed surfaces, or conditions detrimental to formation of a durable paint film.

D. Provide finish coats that are compatible with primers used.

E. The term "exposed surfaces" includes areas visible when permanent or built-in fixtures, convector 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.

F. 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.

G. Paint back sides of access panels and removable or hinged covers to match exposed surfaces.

H. Finish exterior doors on tops, bottoms, and side edges the same as exterior faces.

I. Sand lightly between each succeeding enamel or varnish coat.

J. 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.

K. 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.

L. Omit primer on metal surfaces that have been shop primed and touch up painted.

M. 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.

N. 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.

O. Application Procedures:
Apply paints and coatings by brush, roller, spray, or other applicators according to manufacturer’s written instructions.

P. Brushes:
Use brushes best suited for the type of material applied. Use brush of appropriate size for the surface or item being painted.

Q. Rollers:
Use rollers of carpet, velvet back, or high-pile sheep's wool as recommended by the manufacturer for the material and texture required.

R. Spray Equipment:
Use airless spray equipment with orifice size as recommended by the manufacturer for the material and texture required.

S. 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.

T. Mechanical and Electrical Work:
Painting of mechanical and electrical work is limited to items exposed in equipment rooms and in occupied spaces.

U. Mechanical items to be painted include, but are not limited to, the following:

V. Piping, pipe hangers, and supports

W. Equipment supports

X. Accessory items

Y. Electrical items to be painted include, but are not limited to, the following:

Z. Conduit and fittings

AA. 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.

BB. 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.

CC. 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.

DD. Provide satin finish for final coats.

EE. Completed Work:
Match approved samples for color, texture, and coverage. Remove, refinish, or repaint work not complying with requirements.

3.4 CLEANING

A. Cleanup:
At the end of each workday, remove empty cans, rags, rubbish, and other discarded paint materials from the site.

B. 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.

3.5 PROTECTION

A. 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.

B. Provide "Wet Paint" signs to protect newly painted finishes. Remove temporary protective wrappings provided by others to protect their work after completing painting operations.

C. At completion of construction activities of other trades, touch up and restore damaged or defaced painted surfaces. Comply with procedures specified in PDCA Pl.

3.6 EXTERIOR PAINT SCHEDULE

A. Ferrous Metal:
Provide the following finish systems over exterior ferrous metal. Primer is not required on shop-primed items.

B. Semi-gloss, Acrylic-Enamel Finish: 2 finish coats over a rust-inhibitive primer.

1. 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).

2. 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).

3.7 INTERIOR PAINT SCHEDULE

A. Gypsum Board:
Provide the following finish systems over interior gypsum board surfaces:

B. Flat Acrylic Finish: 2 finish coats over a primer

C. 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).

D. Use only thinners approved by paint manufacturer and only within the recommended limits.

E. 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).

F. Ferrous Metal:
Provide the following finish systems over ferrous metal:

G. Semi-gloss, Acrylic-Enamel Finish: One finish coat over an enamel undercoat and a primer

1. 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).

2. 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).

3. 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).

H. Zinc-Coated Metal:
Provide the following finish systems over zinc-coated metal:

I. Semi-gloss, Acrylic-Enamel Finish: 2 finish coats over a primer

1. 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).

2. 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).

J. 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.

END OF SECTION

PART 1 - GENERAL

1.1 SECTION INCLUDES

1. Single-sided LED baseball scoreboard

1.2 REFERENCES

A. Standard for Electric Signs, UL 48

B. Standard for CSA C22.2 #207

C. Federal Communications Commission Regulation Part 15

D. National Electric Code

1.3 SUBMITTALS

A. Product data: Submit manufacturer's product illustrations, data and literature that fully describe the scoreboards and accessories proposed for installation.

B. Shop drawings: Submit mechanical and electrical drawings.

C. Maintenance data: Submit manufacturer's installation, operation, and maintenance manuals.

1.4 DELIVERY, STORAGE, AND HANDLING

A. Product delivered on site

B. Scoreboard and equipment to be housed in a clean, dry environment

1.5 PROJECT CONDITIONS

A. Environmental limitations: Do not install scoreboard equipment until mounting structure is secure and concrete has ample time to cure.

B. Field measurements: Verify position and elevation of structure and its layout for scoreboard equipment. Verify dimensions by field measurements.

C. Verify mounting structure is capable of supporting the scoreboard's weight and windload in addition to the auxiliary equipment.

D. Installation may proceed within acceptable weather conditions.

1.6 QUALITY ASSURANCE

A. For outdoor use

B. Source Limitations: Obtain each type of scoring or related equipment through one source from a single manufacturer.

C. ETL listed to UL 48

D. NEC compliant

E. FCC compliant

F. ETLC listed to CSA 22.2 #207

1.7 WARRANTY

A. Provide 5 years of no cost parts exchange including standard shipping on electronics parts and radios due to manufacturing defects

B. Provide toll-free service coordination

C. Provide technical phone support during Daktronics business hours

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Daktronics, Inc., 201 Daktronics Drive, P.O. Box 5128, Brookings, SD 57006-5128

B. Electro-Mech Scoreboard Co., 120 Industrial Parkway, Wrightsville, GA 31096.

C. Or approved equal

2.2 PRODUCT

A. Model to include single-sided baseball scoreboard displays HOME and GUEST team scores for up to nine innings, total RUNS to 99 for each team, BALL to three, STRIKE to two and OUT to two.

2.3 SCOREBOARD

A. General information -

2. PEJ Scoreboard Dimension – 7’ high x 26’ wide x 8” deep minimum

3. Terrance martin Field Dimensions: 6'-6" (1.98 m) high, 20'-0" (6.10 m) wide, 0'-8" (203 mm) deep minimum

4. Base weight: 600 lb (272 kg) with vinyl captions – options may increase weight

5. Base power requirement: 230 W (red/amber digits), 495 W (white digits) with vinyl captions – options may increase wattage

6. Color: provide over 150 colors to choose from

B. Construction

1. Alcoa aluminum alloy 5052 for excellent corrosion resistance

2. Scoreboard back, face, and perimeter: 0.063" (1.60 mm) thick

3. Scoreboard top and bottom: 0.125" (3.18 mm) thick

C. Digits

1. LED color BALL, STRIKE, OUT and RUNS digits Red, all others

2. BALL, STRIKE, and OUT digits: 18" (457 mm) high

3. Inning scores and RUNS digits: 15" (381 mm) high
4. Seven bar segments per digit
5. PanaView® LED digit technology
6. All digits are sealed front and back with weather-tight silicone gel

D. Captions

1. Vinyl applied directly to scoreboard face
2. HOME and GUEST captions: 12" (305 mm) high
3. BALL, STRIKE, and OUT captions: 10" (254 mm) high
4. Inning numbers and RUNS captions: 8" (203 mm) high
5. Color: standard white or others available upon request

2.4 SCORING CONSOLE

A. Console is an All Sport® 5000 controller or approved equal

B. Scores multiple sports using changeable keyboard inserts

C. Controls multiple scoreboards and displays, including other All Sport 5000 controlled displays currently owned by customer

D. Recalls clock, score, and period information if power is lost

E. Runs Time of Day and Segment Timer modes

F. Console includes:

1. Rugged aluminum enclosure to house electronics
2. Sealed membrane water-resistant keyboard
3. 32-character LCD to verify entries and recall information currently displayed
4. Power cord that plugs into a standard grounded outlet; 6 watts max
5. Control cable to connect to the control receptacle junction box (wired system only)
6. Hand-held switch for main clock start/stop and horn
7. Soft-sided carrying case

G. Accessory Equipment

1. Hard carrying case
2. Battery pack

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify that mounting structure is ready to receive scoreboard. Verify that placement of conduit and junction boxes are as specified and indicated in plans and shop drawings. Verify concrete has cured adequately according to specifications.

3.2 INSTALLATION

A. All power and control cables to scoreboards and displays will be routed in conduit. Power to the scoreboards/displays as well as raceways shown on electrical plans by the Electrical Contractor. Scoreboard control wiring including conduit will be the responsibility of the contractor assigned the scoreboard equipment.

B. Install scoreboards and exterior displays to beams in location detailed and in accordance with manufacturer's instructions. Verify unit is plumb and level.

3.3 INSTALLATION—CONTROL CENTER

A. Provide boxes, cover plates and jacks in locations per plans.

B. Test connect control unit to all jacks and check for proper operation of control unit, scoreboard and all features. Leave control unit in carrying case and other loose accessories with owner's designated representative.

C. Verify earth ground does not exceed 15 ohms.

END OF SECTION

PART 1 - - GENERAL

1.1 SUMMARY

A. Stadium game equipment is indicated on the Drawings and includes the following items:

1. Netting and cable support system for stadium backstop and dugouts.
2. Netting and cable support system for batting tunnels.
3. Foul Ball Poles.
4. Field Equipment.
5. Tarps.
6. Pitching Rubbers, Bases, and Home Plates.

B. Related Sections: Cabling for stadium backstop as indicated on the structural drawings.

C. Related Sections: Poles for stadium backstop as indicated on the structural drawings.

1.2 SUBMITTALS

A. Product data: Submit manufacturers' specifications and installation instructions.

B. Shop Drawings: Submit shop drawings for the fabrications and installation of stadium game equipment.

PART 2 - PRODUCTS

2.3 ACCEPTABLE MANUFACTURERS

A. Manufacturer: Subject to compliance with requirements. Provide products from the following:

1. Stadium Backstop, Dugout Netting, and BattingTunnels:

   a. C&H Baseball, Inc. 10615 Technology Terrace, Lakewood Ranch, FL 34211 (800) 248-5192; (941) 727-0588 fax; info@chbaseball.com

   b. Model Number: BSN100 – Backstop Netting

   c. Or approved equal

2. Foul Ball Poles:

   a. C&H Baseball, Inc. 10615 Technology Terrace, Lakewood Ranch, FL 34211 (800) 248-5192; (941) 727-0588 fax; info@chbaseball.com

   b. Model Number: FBP100 – Foul Ball Poles

   c. Or approved equal

2.4 MATERIALS

A. Backstop and Dugout Netting: Possible choices, select one:

1. **#18 Dyneema,** 100% Raw Allied Signal Dyneema SK75 fibers, 1 ¾" x 1 ¾" mesh size, breaking strength is 352 LBF, Yield 1,330 ft./lb., 9,600 total denier, 5/16" black twisted polyethylene roped edge, Treated to provide additional UV and weather protection.
2. Or approved equal

B. Backstop cable support system:

1. **Cables**: All cables to be galvanized IWRC 7 x 19 class or 6 x 19 class. All cables to comply with ASTM A 603. End termination allowed:
   a. Swaged wire rope socket
   b. Mechanical splice sleeve
   c. Forged wire clips and thimbles
2. Terminations must handle design loads.
3. Cable sizes:
   a. See structural drawings for required cable sizes.
   b. Fittings: Other cable fittings shall be sized to match the load carrying capacity of the cable or design load where the fitting is used. (Turnbuckles, shackles, coupling links, wall brackets, net hold down clips, etc.)
   a. Turnbuckles, clips and thimbles should be galvanized.
4. **#36 Knotted Nylon.** Solutia type 66 nylon seine twine strands, 1 ¾" x 1 ¾" mesh size, breaking strength is 350 LBF, Yield 461 ft./lb., 20,160 total denier, 5/16" black twisted polyethylene roped edge, Treated to provide additional UV and weather protection

D. Foul Ball Poles

1. Foul Ball Pole Manufacturing Specifications:
   a. Schedule 40 Steel Pipe
   b. 1 ½" x #9 Expanded Metal Mesh
   c. 1 ½" x 1 ½" x 1/8" Square Steel Tubing Primed and Powder Coated Safety Yellow
   d. Installation
      i. Set in concrete footer with rebar
      ii. Bolted to concrete with a steel bolt plate

E. Baseball Field Equipment: Provide the following:

1. Portable Batting Cages: C & H Baseball CAG100 Pitcher's Screen: C & H Baseball SCR100
2. First Base Screen: C & H Baseball SCR200 Second Base Screen: C & H Baseball SCR300 Ball Caddy: C & H Baseball BCD100
3. Batting Tunnel Screen: C & H Baseball SCR430

2.5 MANUFACTURED UNITS

A. Field Wall Pads: Vinyl covering over filler foam. Mount to wall/fence using appropriate attachment.

B. Sewn Wall Pads: Typically mounted to wall/fence and secured through brass grommets from grommet strip to grommet strip.

C. Fence Post Pads: Typically covers the face of the fence post and the pad is secured through the brass grommets through the chain link mesh and fastened behind the fence.

D. "L" Shaped Top Rail Pads: Typically covers the top of a chain link fence and the pad is secured underneath the top fence post and behind the top fence post.

E. Guard Rail Pads: Typically wraps around pole or post and secured through brass grommets from grommet strip to grommet strip.

PART 3 - EXECUTION

A. Installed per manufacturer's recommendations and approved shop drawings.

END OF SECTION

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.

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.

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.

END OF SECTION

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.

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.

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 lace 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.

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
8	20	2	2
10	20	3	2
12	20	4	3
14	20	5	4
16	20	7	5

Pipe Diameter, in.	Pipe Len2th, 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

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

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:

$$\mathbf{L= [SD((P)^{0.5})] / [147,809]\ (Equation\ l)}$$

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.

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 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

2.6 SUPPORTING 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 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.

2.7 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 Al3.1, 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. em), 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.

2.8 TOUCHUP PAINT

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.

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 I-I/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 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:

i. Fire-Alarm System: Red.

ii. Security System: Blue and yellow.

iii. 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

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 another 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.

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:

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.

B. Frames and Covers:

1. Campbell Foundry Co.
2. East Jordan Iron Works, Inc.
3. McKinley Iron Works, Inc.
4. Neenah Foundry Co.

C. Nonmetallic Ducts:

1. Arnco Corp.
2. Breeze-Illinois, Inc.
3. CANTEX, Inc.
4. Carlon; Lamson & Sessions Company.
5. Pipe and Plastic Group; Certainteed 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.

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 “ELECTRIC.” 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 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: 4000 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.

3.3 - EARTHWORK:

A. Excavation and Backfill: Conform to Division 31 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 32 Section "Exterior Improvements,"

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 32 Section "Exterior Improvements".

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.

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 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.

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

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-l991 -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-l Switches for household and similar fixed electrical installations-electronic switches.

D. International Organization for Standardization (ISO):

1. 900l: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

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.

1.7 QUALITY ASSURANCE

A. Manufacturer: Minimum 10 years' experience in manufacture of architectural lighting controls.

B. Manufacturer's Quality System:
Registered to ISO 9001:2000 Quality Standard, including in-house engineering for product design activities.

1.8 PROJECT CONDITIONS

A. Do not install equipment until following conditions can be maintained in spaces to receive equipment:

1. Ambient temperature: Under 40 degrees C (104 degrees F).

2. Relative humidity: Maximum 90 percent, non-condensing.

3. Lighting control system must be protected from dust during installation.

1.9 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:

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-IOOOR-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.

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 lifetime 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

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:

i. Minimum experience of 2 years training in the electrical/electronic field.

ii. Certified by the equipment manufacturer on the system installed.

b. Make a visit upon completion of installation of lighting control system:

i. Verify connection and location of controls.

ii. Verify system operation control by control, zone by zone.

iii. Verify proper integration of manufacturers interfacing equipment.

iv. 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

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.

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:
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:

F. Bolt-on circuit breakers.

G. 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.

H. Branch Overcurrent Protective Devices: Fused switches

2.3 LIGHTING AND APPLIANCE BRANCH-CIRCUIT 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, 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 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 l, 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.

h. Handle Clamp: Loose attachment, for holding circuit-breaker handle in on position.

C. Fused Switch: NEMA KS l, Type HD; clips to accommodate specified fuses; lockable handle

1. 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 l-inch (27-GRC) empty conduits from panelboard into accessible ceiling space or space designated to be ceiling space in the future. Stub four l-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:
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

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.

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 I, 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: 2221 (single pole), 2222 (two pole), 2223 (three way), 2224 (four way)

b. Hubbell: CS122l (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: 20ACl (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, l22l-7 PLR for 277 V

d. Pass & Seymour; PS20ACl-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: 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, I20/277 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: 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 ensure 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.

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: 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 online 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: 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

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

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

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 *1* fuses.

C. Switches:
Three poles, 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.

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

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.

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

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:

B. Disposal of lamps.

C. Section 024100, DEMOLITION:

D. Removal and disposal of lamps and ballasts.

E. Section 130541, SEISMIC RESTRAINT REQUIREMENTS FOR NON-STRUCTURAL COMPONENTS:

F. Requirement for seismic restraint for nonstructural components.

G. Section 260511, REQUIREMENTS FOR ELECTRICAL INSTALLATIONS:

H. Requirements that apply to all sections of Division 26.

I. Section 260519, LOW-VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES:

J. Low-voltage conductors.

K. Section 260526, GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS:

L. Requirements for personnel safety and to provide a low impedance path to ground for possible ground fault currents.

M. Section 262726, WIRING DEVICES:

N. 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.

   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:

4. 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

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.

D. Recessed fixtures mounted in an insulated ceiling shall be listed for use in insulated ceilings.

E. 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.

F. 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.

G. Lighting fixtures shall have a specific means for grounding metallic wire ways and housings to an equipment grounding conductor.

H. 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.

I. Lighting fixtures in hazardous areas shall be suitable for installation in Class and Division areas as defined in NFPA 70.

J. 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.

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: 0.87 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

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

9. 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

9. Power Factor: 0.98 or higher

10. 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: 0.90 or higher

9. Interference:
Comply with CFR Title 47 Part 18 for limitations on electromagnetic and radio-frequency interference for non-consumer equipment.

10. 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 un-switched circuit to battery inverter unit and switched circuit to fixture ballast.

2. Test Push Button and Indicator Light:

a. Visible and accessible without opening fixture or entering ceiling space

b. Push Button:

i. Push to test type, in unit housing, simulates loss of normal power and demonstrates unit operability.

c. Indicator Light:

i. 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:

a. 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.

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

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.

2.7 WALL MOUNTED FLUORESCENT BEDLIGHT FIXTURES

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 bedrooms where the switch shall energize and de-energize the downward light only. In the single bedrooms, 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

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:

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.

G. 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: ≤ 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:

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.

i. 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 two 12-gauge safety hangers hung slack between diagonal corners of the fixture and the building structure.

ii. 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.

5. 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.

i. Screws attaching the fixture to the outlet box pass through round holes (not key-hole slots) in the fixture body.

ii. The outlet box is attached to a main ceiling runner (or cross runner) with approved hardware.

iii. 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.

6. 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.

7. 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.

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

J. 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 SECTION

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 interior lighting fixtures, lamps, ballasts, emergency lighting units, and accessories.

1.3 DEFINITIONS

A. Emergency Lighting Unit:
A fixture with integral emergency battery powered supply and the means for controlling and charging the battery. It is also known as an emergency light set.

B. Fixture:
A complete lighting unit, exit sign, or emergency lighting unit. Fixtures include lamps and parts required to distribute light, position and protect lamps, and connect lamps to power supply. Internal battery powered exit signs and emergency lighting units also include a battery and the means for controlling and recharging the battery. Emergency lighting units include ones with and without integral lamp heads.

C. Average Life: The time after which 50 percent fails and 50 percent survives under normal conditions.

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 describing fixtures, lamps, ballasts, and emergency lighting units. Arrange Product Data for fixtures in order of fixture designation. Include data on features and accessories and the following:

1. Outline drawings indicating dimensions and principal features of fixtures.

2. Electrical Ratings and Photometric Data: Certified results of independent laboratory tests for fixtures and lamps.

3. Battery and charger data for emergency lighting units.

C. Maintenance data for fixtures to include in the operation and maintenance manual specified in Division.

1.5 QUALITY ASSURANCE

A. Electrical Component Standard:

Provide components that comply with NFPA 70 and that are listed and labeled by UL where available.

B. Listing and Labeling:
Provide fixtures, emergency lighting units, and accessory components specified in this Section that are listed and labeled for their indicated use and installation conditions on Project. The Terms "Listed" and "Labeled" as defined in the National Electrical Code, Article 100.

1. Listing and Labeling Agency Qualifications: A "Nationally Recognized Testing Laboratory" (NRTL) as defined in OSHA Regulation 1910.7.

C. Coordinate fixtures, mounting hardware, and trim with ceiling system and other items, including work of other trades, required to be mounted on ceiling or in ceiling space.

1.6 WARRANTY

A. General Warranty:
The special 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.

1.7 EXTRA MATERIALS

A. Furnish extra materials described below that match products installed, are packaged with protective covering for storage, and are identified with labels describing contents.

1. Lamps: 10 lamps for every 100 of each type and rating installed. Furnish at least one of each type.

2. Ballasts: 1 for every 100 of each type and rating installed. Furnish at least one of each type.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Products:
Subject to compliance with requirements, provide one of the products specified in each Interior Lighting Fixture Schedule as indicated on the drawings.

2.2 FIXTURES AND FIXTURE COMPONENTS, GENERAL

A. Metal Parts: Free from burrs, sharp comers, and edges.

B. Sheet Metal Components: Steel, except as indicated. Form and support to prevent warping and sagging.

C. Doors, Frames, and Other Internal Access:

Smooth operating, free from light leakage under operating conditions, and arranged to permit re-lamping without use of tools. Arrange doors, frames, lenses, diffusers, and other pieces to prevent accidental falling during re-lamping and when secured in operating position.

D. Reflecting Surfaces: Minimum reflectance as follows, except as otherwise indicated:

1. White Surfaces: 85 percent

2. Specular Surfaces: 83 percent

3. Diffusing Specular Surfaces: 75 percent

4. Laminated Silver Metallized Film: 90 percent

E. Lens glasses, Diffusers, Covers, and Globes: 100 percent virgin acrylic plastic or water white, annealed crystal s, except as otherwise indicated.

1. Lens Thickness: 0.125-inch (3 mm) minimum; except where greater thickness is indicated.

2. Plastic: High resistance to yellowing and other changes due to aging, exposure to heat, and UV radiation.

F. Fixture Support Components: Comply with Division 26 Section "Basic Electrical Materials and Methods."

1. Single-Stem Hangers:
1/2-inch (12-mm) steel tubing with swivel ball fitting and ceiling canopy. Finish same as fixture.

2. Twin-Stem Hangers:
Two, 1/2-inch (12-mm) steel tubes with single canopy arranged to mount a single fixture. Finish same as fixture.

3. Rod Hangers: 3/16-inch (5-mm) minimum diameter, cadmium-plated, threaded steel rod

4. Hook Hanger:
Integrated assembly matched to fixture and line voltage and equipped with threaded attachment, cord, and locking-type plug.

G. Fluorescent Fixtures: Conform to UL 1570.

H. Fluorescent Ballasts:
Electronic integrated circuit, solid-state, full-light-output, energy-efficient type compatible with lamps and lamp combinations to which connected.

1. Certification by Electrical Testing Laboratory (ETL).

2. Labeling by Certified Ballast Manufacturers Association (CBM).

3. Type: Class P, high power factor, except as otherwise indicated

4. Sound Rating: "A" rating, except as otherwise indicated

5. Voltage: Match connected circuits

6. Lamp Flicker: Less than 5 percent.

7. Minimum Power Factor: 90 percent

8. Total Harmonic Distortion (THD) of Ballast Current: Less than 20 percent

9. Conform to FCC Regulations Part 15, Subpart J for electromagnetic interference.

10. Conform to IEEE C62.41, Category A, for resistance to voltage surges for normal and common modes.

11. Multi-lamp Ballasts: Use 2, 3, or 4 lamp ballasts for multi-lamp fixtures where possible.

12. Lamp-ballast connection method does not reduce normal rated life of lamps.

I. Exit Signs: Conform to UL 924 and the following:

1. Sign Colors: Conform to local code.

2. Minimum Height of Letters: Conform to local code

3. Arrows: Include as indicated

4. Lamps for AC Operation: Light-emitting diodes (LED), 70,000 hours minimum rated life

J. Emergency Lighting Units: Conform to UL 924. Provide self-contained units with the following features:

1. Battery:
Sealed, maintenance-free, lead-calcium type with minimum 10-year nominal life and special warranty.

2. Charger: Minimum 2-rate, fully automatic, solid-state type, with sealed transfer relay.

3. Operation:
Relay automatically turns lamp on when supply circuit voltage drops to 80 percent of nominal voltage or below. Lamp automatically disconnects from battery when voltage approaches deep-discharge level. Relay disconnects lamps and battery and automatically recharges and floats on trickle charger when normal voltage is restored.

2.3 LAMPS

A. Comply with ANSI C78 series that is applicable to each type of lamp.

B. Fluorescent Color Temperature and Minimum Color-Rendering Index (CRI): 4800 K and 85 CRI, except as otherwise indicated.

C. Not Compact Fluorescent Lamp Life: Rated average is 20,000 hours at 3 hours per start when used on rapid start circuits.

2.4 FINISHES

A. Manufacturer's standard, except as otherwise indicated, applied over corrosion resistant treatment or primer, free of streaks, runs, holidays, stains, blisters, and similar defects.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Set units plumb, square, and level with ceiling and walls, and secure according to manufacturer's written instructions and approved Shop Drawings. Support fixtures according to requirements of Division 26 Section "Basic Electrical Materials and Methods."

B. Support for Recessed and Semi-recessed Grid Type Fluorescent Fixtures:
Units may be supported from suspended ceiling support system. Install ceiling support system rods or wires at a minimum of 4 rods or wires for each fixture, located not more than 6 inches (150 mm) from fixture comers.

1. Install support clips for recessed fixtures, securely fastened to ceiling grid members, at or near each fixture comer.

2. Fixtures Smaller than Ceiling Grid:

3. Install a minimum of 4 rods or wires for each fixture and locate at comer of ceiling grid where fixture is located. Do not support fixtures by ceiling acoustical panels.

4. Fixtures of Sizes Less than Ceiling Grid:
Center in acoustical panel. Support fixtures independently with at least two 3/4-inch (20-mm) metal channels spanning and secured to ceiling tees.

C. Support for Suspended Fixtures:
Brace pendants and rods over 48 inches (1200 mm) long to limit swinging. Support stem mounted, single unit, suspended fluorescent fixtures with twin-stem hangers. For continuous rows, use tubing or stem for wiring at one point and tubing or rod for suspension for each unit length of chassis, including one at each end.

D. Lamping: Where specific lamp designations are not indicated, lamp units according to manufacturer's instructions.

3.2 CONNECTIONS

A. Ground lighting unit:
Tighten electrical connectors and terminals, including grounding connections, according to manufacturer's published torque-tightening values. Where manufacturer's torque values are not indicated, use those specified in UL 486A and UL 486B.

3.3 FIELD QUALITY CONTROL

A. Inspect each installed fixture for damage. Replaced damaged fixtures and components.

B. Give advance notice of dates and times for field tests.

C. Provide instruments to make and record test results.

D. Tests:
Verify normal operation of each fixture after fixtures have been installed and circuits have been energized with normal power source. Interrupt electrical energy to demonstrate proper operation of emergency lighting installation. Include the following information in tests of emergency lighting equipment:

1. Duration of supply.

2. Low battery voltage shutdown.

3. Normal transfer to battery source and retransfer to normal.

4. Low supply voltage transfer.

E. Replace or repair malfunctioning fixtures and components, then retest. Repeat procedure until all units operate properly.

F. Report results of tests.

G. Replace fixtures that show evidence of corrosion during Project warranty period.

3.4 ADJUSTING AND CLEANING

A. Clean fixtures after installation. Use methods and materials recommended by manufacturer.

B. Adjust aimed fixtures to provide required light intensities.

END OF SECTION

PART 1 - GENERAL

1.1 DESCRIPTION

A. 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.

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:

4. 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

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 Lamp holders
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

A. 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

A. 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.

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:

7. All necessary hardware and specified accessories shall be the product of the pole manufacturer.

8. 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.

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.

I. 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): $\geq$ 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.

D. Mercury vapor lamps shall not be used.

2.6 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.

5. Power Factor (PF): $\geq$ 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.

2.7 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

A. 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.

3.3 ACCEPTANCE CHECKS AND TESTS

A. Verify operation after installing luminaires and energizing circuits.

END OF SECTION

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.

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

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. Sheeting, 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, telephones 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.

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.

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

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.

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:

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 l.

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:

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.

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:

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.

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

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 1OOX, or approved equal.

2. Supports shall be in accordance with the manufacturer's recommendations, or as required for adequate performance.

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.

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

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 by the Port as contaminated. The Port will characterize contaminated soil, obtain profile for disposal, and determine the location of disposal.

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

4. ASTM D698: Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Standard Effort (12 400 ft-lbf/ft3 (600 kN-m/m3))

5. ASTM D1556: Standard Test Method for Density and Unit Weight of Soil in Place by the Sand-Cone Method

6. ASTM D1557: Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft-lbf/ft3 (2,700 kN-m/m3))

7. 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.

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:

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

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.

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. Sheeting and Bracing

1. Furnish and install sheeting 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 sheeting 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.

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.

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.

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:

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

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

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.

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.

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.

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.

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.

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.

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

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