

**JEA**

21 West Church Street  
Jacksonville, FL 32202-3139

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**NEW MANDARIN WRF  
STORAGE BUILDING AND SITE IMPROVEMENTS  
10828 HAMPTON ROAD  
JACKSONVILLE, FLORIDA 32257**

**FOR CONSTRUCTION DOCUMENTS**

**October 28, 2019**

**PROJECT MANUAL  
Project Summary and  
Specifications**



**BHIDE & HALL ARCHITECTS, P.A.**

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**ARCHITECT**

BHIDE & HALL ARCHITECTS P. A.  
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B&H PROJECT NO.: 17072

**CIVIL ENGINEER**

MICHELE M. AGEE P.E., P.A.  
1329-C KINGSLEY AVE.  
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**STRUCTURAL ENGINEER**

GM HILL ENGINEERING INC..  
9640 SUNBEAM CENTER DR., SUITE 1  
JACKSONVILLE, FLORIDA 32257

**MECHANICAL**

HADDAD ENGINEERING.  
2955 HARTLEY ROAD, SUITE 205  
JACKSONVILLE, FLORIDA 32257

**ELECTRICAL ENGINEER**

HADDAD ENGINEERING INC.  
2955 HARTLEY ROAD, SUITE 205  
JACKSONVILLE, FLORIDA 32257

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## PROJECT OVERVIEW

### IDENTIFICATION

**Project Title:**

JEA - Mandarin WRF  
Engineering Design for the New Mandarin  
WRF Storage Building and Parking

**Project Number:**

**JEA 181316**

**Project Description:**

Bhide & Hall Architects, P.A. has been commissioned to full design documentation on a phased project for the Mandarin Water Reclamation Facility. The project shall address the a new Storage building and additional site hardscape and parking expansions. The project is located at 10828 Hampton Road, in Jacksonville, Florida, 32257.

**Team:**

Architect:	Bhide & Hall Architects, P.A.
Civil:	Michele Agee, P.E., P.A.
Structural:	G.M. Hill Engineering, Inc.
Electrical:	Haddad Engineering, Inc.

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## **Project Summary:**

### **New Storage Building**

A new 50' x 100' (5,000 GSF) single story (<30'-0") concrete block building will be added to the existing JEA Hampton Road Water Reclamation Facility (Industrial Occupancy). The single story structure shall be a cast-in-place concrete frame with precast "double-T" roof members. 12" integrally colored split-face/ribbed concrete masonry unit infill will complete the exterior wall construction. Color and appearance of the new building is to match the existing building #5 which is situated to the south of the new building. The purpose of the building is to house existing metal parts, water pumps, metal piping and fittings, and electrical motors. Outside of the new building will be parking dedicated to trailer mounted power generation equipment. Power receptacles will be provided at the adjacent building face for the equipment to be re-charged.

- Building Codes:
  - Florida Building Code 2017 (6<sup>th</sup> Edition)
  - National Electric Code 2014 - NFPA 70
  - Florida Building Code 2017 (6<sup>th</sup> Edition) - Energy Conservation
  - Florida Fire Prevention Code 2017 (6<sup>th</sup> Edition)
- Occupancy Type: Industrial Facility (I); Building: S-2 (Storage).
- Construction Type is I-B (non-combustible) and non-sprinklered
- Risk Category II
- The building shall be naturally ventilated: FCB Mechanical Code 2017 Version 6: Section 402 - "The minimum openable area to the outdoors shall be 4 percent of the floor area being ventilated." 4 percent of the warehouse area is approximately 215 square feet. The operable overhead doors are classified as an openable area. At 16'x20' (320 square feet) each garage door would provide the openable area required by code.
- Building Envelope Energy Requirements: **LOW ENERGY BUILDING - EXEMPT**
  1. Low-Energy Building: Peak design rate for new building is less than 3.4 Btu/h•ft<sup>2</sup> or 1.0 watt per square foot of floor area for space conditioning purposes.
    - Total Building Energy Usage: 1,980 watts/5,000ft<sup>2</sup> = .396 watts/ft<sup>2</sup>
  2. Does not contain conditioned space
- Roof: Shall Meet FM Global Requirements, Non-insulated.
- Wall insulation: Not Required
- Fire Protection System: Not Required
  - Fire Extinguishers are provided at building exits and within 75' travel distance.
- Fire Alarm System: Not Required

The initial phase of the project will be the removal/demolition of the existing building 6 and its associated infrastructure. The removal of this building will increase the available space for the expansion of the retention pond. This phase of the project should occur around the same time as Phase II since the retention expansion is in response to the increase in impervious surfaces caused from the Phase II parking and hardscape improvements.

### **Site Hardscape/Parking Improvements**

The existing parking next to the Operations Building shall be re-configured to provide a total of 27 parallel 10x18, 8 parallel 9x18, and 5 parallel 12x18 (ADA) parking spaces. Farther north from this parking will be an additional 52 parking spaces provided for trucks and equipment. All spaces will be provided with infrastructure to support future power.

**JEA Mandarin WRF**  
**FOR CONSTRUCTION**

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08 11 16	FLUSH ALUMINUM DOOR FRAMES WITH FRP DOORS
08 33 23	OVERHEAD COILING DOORS

**FINISHES**

09 90 00 PAINTING

**HEATING VENTILATING AND AIR CONDITIONING**

N/A

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**ELECTRICAL**

26 05 19	LOW-VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES
26 05 26	GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS
26 05 29	HANGERS AND SUPPORTS FOR ELECTRICAL SYSTEMS
26 05 33	RACEWAYS AND BOXES FOR ELECTRICAL SYSTEMS
26 05 53	IDENTIFICATION FOR ELECTRICAL SYSTEMS
26 24 16	PANELBOARDS
26 27 26	WIRING DEVICES
26 28 16	ENCLOSED SWITCHES AND CIRCUITS
26 51 19	LED INTERIOR LIGHTING
26 56 19	LED EXTERIOR LIGHTING

**FIRE ALARM**

N/A

**CIVIL**

31 11 00	CLEARING, GRUBBING, AND STRIPPING
31 15 00	DEMOLITION
31 20 00	EARTHWORK
31 23 16	EXCAVATION AND BACKFILL FOR UTILITIES AND STRUCTURES
31 23 19	DEWATERING SYSTEM
31 25 00	EROSION AND SEDIMENTATION CONTROLS
31 31 16	TERMITE CONTROL
32 05 24	CONCRETE REINFORCEMENT
32 05 25	CONSTRUCTION AND EXPANSION JOINTS
32 12 16	PAVEMENT
32 16 00	SITWORK CONCRETE
32 92 23	GRASSING
33 44 00	DRAINAGE

SECTION 01 10 00

SUMMARY

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Project Identification: **JEA  
NEW MANDARIN WRF STORAGE BUILDING  
AND SITE IMPROVEMENTS  
10828 HAMPTON ROAD  
JACKSONVILLE, FL 32257**
- B. Project Summary: **5,000 GSF SINGLE STORY CONCRETE BLOCK  
STORAGE BUILDING. BUILDING IS USED TO  
HOUSE INDUSTRIAL STEEL PARTS: PUMPS,  
PIPES, AND FITTINGS ONLY. BUILDING IS  
CONSTRUCTED OF CAST-IN-PLACE CONCRETE  
STRUCTURE WITH MASONRY INFILL.  
CONCRETE DOUBLE-T ROOF BEAMS  
SUPPORTING A LIGHTWEIGHT INSULATED  
CONCRETE ROOF. PROJECT INCLUDES SITE  
PARKING MODIFICATIONS, ADDITIONS, AND  
MODIFICATIONS TO THE EXISTING STORM  
WATER RETENTION POND. ADDITIONALLY, A  
SMALL EXISTING BUILDING IS TO BE  
DEMOLISHED AT THE CONCLUSION OF THE  
PROJECT.**
- C. Particular Project Requirements:
1. Existing site conditions and restrictions: : **PROJECT SITE IS AN  
OCCUPIED AND OPERATIONAL WATER RECLAMATION  
FACILITY (WASTE WATER TREATMENT PLANT) AND IS  
CLASSIFIED AS AN INDUSTRIAL COMPLEX. CONTRACTOR  
SHALL NOT OBSTRUCT THE OPERATIONS OF THE EXISTING  
FACILITY DURING CONSTRUCTION AND SHALL COORDINATE  
WITH THE OWNERS REPRESENTATIVE FOR DELIVERY AND  
STORAGE OF ALL MATERIALS DURING CONSTRUCTION.**
  2. Requirements for sequencing, scheduling and completion date: Ref:  
Plans for additional information on phasing.
  3. Pre-purchased and pre-ordered items: N/A
  4. Owner-purchased, Owner-installed items: NONE
  5. Owner-purchased, Contractor-installed items: N/A
  6. Owner's early or partial occupancy: N/A
  7. Occupancy of adjacent facilities: **ALL ADJACENT BUILDINGS AND  
FACILITIES WILL BE OCCUPIED AND FULLY OPERATIONAL  
DURING CONSTRUCTION**
  8. Contractor's use of new and existing facilities: **EXISTING FACILITIES  
AND SITE WILL BE IN CONSTANT USE DURING EXTENT OF  
CONSTRUCTION ACTIVITIES. A DETAILED SCHEDULE SHALL BE  
PROVIDED BY THE CONTRACTOR AT OUTSET OF PROJECT.**

9. **THIS IS NOT A LEED PROJECT**

- D. Permits and Fees: Contractor shall apply for, obtain, and pay for permits, fees, and utility company back charges required to perform the work. Submit copies to Architect and owner.
- E. Codes: Comply with applicable codes and regulations of authorities having jurisdiction. Submit copies of inspection reports, notices and similar communications to Architect.
- F. Dimensions: Verify dimensions indicated on drawings with field dimensions before fabrication or ordering of materials. Do not scale drawings.
- G. Existing Conditions: Notify Architect of existing conditions that differ from those indicated on the drawings. Do not remove or alter structural components without prior written approval.
- H. Coordination:
  - 1. Coordinate the work of all trades.
  - 2. Prepare coordination drawings for areas above ceilings where close tolerances are required between building elements and mechanical and electrical work.
  - 3. Verify location of utilities and existing conditions.
- I. Installation Requirements, General:
  - 1. Inspect substrates and report unsatisfactory conditions in writing.
  - 2. Do not proceed until unsatisfactory conditions have been corrected.
  - 3. Take field measurements prior to fabrication where practical. Form to required shapes and sizes with true edges, lines and angles. Provide inserts and templates as needed for work of other trades.
  - 4. Install materials in exact accordance with manufacturer's instructions and approved submittals.
  - 5. Install materials in proper relation with adjacent construction and with proper appearance.
  - 6. Restore units damaged during installation. Replace units which cannot be restored at no additional expense to the Owner.
  - 7. Refer to additional installation requirements and tolerances specified under individual specification sections.
- J. Limit of Use: Limit use of work as indicated. Keep driveways and entrances clear.
- K. Existing Construction: Maintain existing building in a weathertight condition. Repair damage caused by construction operations. Protect building and its occupants.
- L. Definitions:
  - 1. Provide: Furnish and install, complete with all necessary accessories, ready for intended use. Pay for all related costs.
  - 2. Approved: Acceptance of item submitted for approval. Not a limitation or release for compliance with the Contract Documents or regulatory requirements. Refer to limitations of 'Approved' in General and Supplementary Conditions.



3. Match Existing: Match existing as acceptable to the Owner.

- M. Intent: Drawings and specifications are intended to provide the basis for proper completion of the work suitable for the intended use of the Owner. Anything not expressly set forth but which is reasonable implied or necessary for proper performance of the project shall be included.
- N. Writing Style: Specifications are written in the imperative mode. Except where specifically intended otherwise, the subject of all imperative statements is the Contractor. For example, 'Provide tile' means 'Contractor shall provide tile.'

PART 2 PRODUCTS - Not applicable to this Section

PART 3 EXECUTION - Not applicable to this Section

END OF SECTION



## SECTION 01 20 00

### PRICE AND PAYMENT PROCEDURES

#### PART 1 GENERAL

##### 1.1 SECTION INCLUDES

- A. Price and Payment Procedures:
  - 1. Alternates.
  - 2. Allowances.

##### 1.2 ALTERNATES

- A. Total Price: Provide total price for each alternate in Bid Form. Include cost of modifications to other work to accommodate alternate. Include related costs such as overhead and profit..
- B. Acceptance of Alternates: Owner will determine which alternates are selected for inclusion in the Contract.
- C. Coordination of Alternates: Modify or adjust affected adjacent work as necessary to integrate work of the alternate into Project. Coordinate alternates with related work to ensure that work affected by each selected alternate is properly accomplished.
- D. List of Alternates:

##### **Alternate Option 01:**

This design alternate: A BRIDGE CRANE shall be provided inside the new storage building: 5-ton free-standing top running runway braced back to the existing building (4) bays 25'-4", total runway 101'-4". The elevation will provide max hook height using a 21'-0" lowest obstruction height. The runway is sized for (1) fully loaded 5-ton crane(s) per bay. Includes all support steel and runway materials consisting of (8) runway beams, (10) columns, 25# ASCE Rail with hardware, and 4-conductor sliding shoe electrification. All steel painted one coat of gray primer.

##### Bridge Crane: (DESIGN BASIS)

Span: 48'-0"

Speed: Two step inverter control @ 120 fpm

Girder (s): W24

Brakes: DC adjustable torque magnetic disc

Horsepower: 2/3 @ 1200 RPM

Wheels: 6"

Wheel Base: 6'-3"

Wheel Load: 7,444#

##### Hoist Package: (DESIGN BASIS)

Acco Speedway monorail hoist

MODEL: C1W05D019-12M4D1

CAPACITY: **5 TON**

LIFT: 19'- 6"

LIFT SPEED: 12/4 FPM

REEVING: 4-PD

ROPE DIAMETER: 5/16"

TROLLEY SPEED: 50/17 FPM

HOIST MOTOR HP: 4/1.33

TROLLEY HP: .5

VOLTAGE: 460/3/60

ENCLOSURE RATING: NEMA 3R

HOIST WT.: 1,036 LBS

*HOIST DUTY: H4*

*ADDITIONAL: Geared limit switch, VFD trolley, branch circuit fusing, steel sheaves, gravity upper limit, motor thermostats.*

### 1.3 ALLOWANCES

- A. Allowances: Lump sum allowances and unit cost allowances are listed below and as indicated on the Drawings. Amounts shall include all costs including overhead and profit except as specifically noted. Coordinate allowances with requirements for related and adjacent work.
- B. Notification of Owner: Notify Owner of date when final decision on allowance items is required to avoid delays in the work.
- C. Certification of Quantities: Furnish certification that quantities of products purchased are the actual quantities needed with reasonable allowance for cutting or installation losses, tolerances, mixing, waste, and similar margins.
- D. Invoices and Delivery Slips: Submit invoices or delivery slips to indicate actual quantities of materials delivered and costs. Indicate amounts of applicable trade discounts.
- E. Lump Sum Allowances: Include the following amounts in the base bid for materials, installation, overhead, profit and all costs for the following items.

- 1. Temporary on-site storage (enclosed) of existing items housed in building 6. Storage to be provided for duration of project. Contractor to include allowance in base bid and show allowance as a separate line item..**

Rental allowance per month  
(40' container with doors both ends): 180\$/month

END OF SECTION

## SECTION 01 30 00

### ADMINISTRATIVE REQUIREMENTS

#### PART 1 GENERAL

##### 1.1 SECTION INCLUDES

- A. Administration of Contract: Provide administrative requirements for the proper coordination and completion of work including the following:
  - 1. Supervisory personnel.
  - 2. Preconstruction conference.
  - 3. Project meetings, minimum of two per month; prepare and distribute minutes.
- B. Reports: Submit weekly and special reports.
- C. Work Schedule: Submit progress schedule, updated monthly.
- D. Submittal Schedule: Prepare submittal schedule; coordinate with progress schedule.
- E. Schedule of Values: Submit schedule of values to owner's representative.
- F. Schedule of Tests: Submit schedule of required tests including payment and responsibility.
- G. Perform Surveys: Lay out the work and verifying locations during construction. Perform final site survey.
- H. Emergency Contacts: Submit and post a list of emergency telephone numbers and address for individuals to be contacted in case of emergency.
- I. Record Documents: Submit record drawings and specifications; to be maintained and annotated by Contractor as work progresses.

##### 1.2 SUBMITTALS

- A. Types of Submittals: Provide types of submittals listed in individual sections and number of copies required below.
  - 1. Shop drawings, reviewed and annotated by the Contractor - 4 copies.
  - 2. Product data - 4 copies.
  - 3. Samples - 2, plus extra samples as required to indicate range of color, finish, and texture to be expected.
  - 4. Inspection and test reports - 4 copies.
  - 5. Warranties - 4 copies.
  - 6. Survey data - 4 copies.
  - 7. Closeout submittals - 4 copies.
  - 8. Project photographs – 10 digital images **each month** submitted digitally to owner's representative and copied to project architect. Label each image with date.
- B. Submittal Procedures: Comply with project format for submittals. Comply

with submittal procedures established by Architect including Architect's submittal and shop drawing stamp. Provide required resubmittals if original submittals are not approved. Provide distribution of approved copies including modifications after submittals have been approved.

- C. Samples and Shop Drawings: Samples and shop drawings shall be prepared specifically for this project. Shop drawings shall include dimensions and details, including adjacent construction and related work. Note special coordination required. Note any deviations from requirements of the Contract Documents.
- D. Warranties: Provide warranties as specified; warranties shall not limit length of time for remedy of damages Owner may have by legal statute. Contractor, supplier or installer responsible for performance of warranty shall sign warranties.

END OF SECTION

## SECTION 01 33 00

### SUBMITTALS

#### PART 1 GENERAL

##### 1.01 Submittals

- A. The following submittals are required by the Contract Documents and are briefly explained herein:
  - 1. Construction Schedule
  - 2. Schedule of Values
  - 3. Product Data
- B. Information regarding submittal administration is also included herein.

##### 1.02 Construction Schedule

- A. The Contractor shall submit to the Owner and the Architect/Engineer two (2) copies of his Construction Schedule both in PDF format and in Microsoft Project (unless directed otherwise by owner).
- B. Upon acceptance by the Owner and ARCHITECT/ENGINEER, the Contractor shall post a copy of the Schedule within the Field Office where it can be readily referenced. Contractor shall update schedule weekly and issue updates electronically to owner and architect/engineer.

##### 1.03 Schedule of Values

- A. The Contractor shall submit to the Owner and the Architect/Engineer, two (2) copies of his Schedule of Values **within ten (10) days of the Notice to Proceed.**
- B. The Schedule shall be in an outline format divided into major categories of construction as established by the Table of Contents. A value (amount) for each category shall be assigned thereto.
- C. Submit on AIA Form G703, Continuation Sheet for the Application and Certificate for Payment, AIA Form G702.

##### 1.04 Product Data

- A. Product Data includes:
  - 1. Shop drawings
  - 2. Descriptive data
  - 3. Samples
  - 4. Schedules

5. Certificates
6. Guarantees
7. Warranties
8. Maintenance manuals

- B. Submittal requirements for Product Data are listed in the technical sections of the Project Manual. The ARCHITECT/ENGINEER may, at his option, request additional Product Data.

#### 1.05 Submittal Routing

- A. Submittals shall be routed in the following manner:
  1. Subcontractors, suppliers and others shall route to the Contractor.
  2. Following a preliminary review by the contractor for accuracy and conformance to the design documentation, the Contractor shall route to the ARCHITECT/ENGINEER for review.
  3. The ARCHITECT/ENGINEER shall route to the Owner (certain approved Product Data only) following a review for conformance.
- B. Return shall be in the reverse order.
- C. The Contractor shall furnish copies of approved Submittals to the owner as may be required or requested.

#### 1.06 Review Procedures

- A. Contractor's Review: The Contractor shall thoroughly review data submitted for compliance with the Contract Documents.
  1. Data found not to be in accordance with the Contract Document's shall be returned for compliance.
  2. Data found to be acceptable shall be:
    - a. Noted as required.
    - b. Stamped indicating action taken.
    - c. Forwarded to ARCHITECT/ENGINEER.
- B. ARCHITECT/ENGINEER Review: The ARCHITECT/ENGINEER will review submittals and advise of his findings.
  1. ARCHITECT/ENGINEER will not accept material for review that has not been reviewed and approved by the Contractor, and he will return data immediately without review.
  2. The ARCHITECT/ENGINEER will review data which has been properly approved by the Contractor and will either mark it "NO EXCEPTION TAKEN", "MAKE CORRECTIONS NOTED", "REVISE AND RESUBMIT", "SUBMIT SPECIFIED ITEM", or "REJECTED".
  3. Items marked "REJECTED" shall be resubmitted by the Contractor after making any required corrections or additions.



4. Items marked "MAKE CORRECTIONS NOTED" may be resubmitted for further clarification.
  5. ARCHITECT/ENGINEER approval does **NOT** relieve the Contractor of his responsibility for deviations from the Construction Documents.
- C. ARCHITECT/ENGINEER Review Time Limit: Submittals shall be processed by the ARCHITECT/ENGINEER and returned to the Contractor within fourteen (14) days of receipt. The ARCHITECT/ENGINEER will make every effort to expedite review. The Owner shall not be liable to the Contractor for any delay in processing the submittals.
- D. No work for which submittals are required (with the exception of test certificates for completed work, final guarantees and maintenance manuals) shall be performed until submittals are approved by the ARCHITECT/ENGINEER except at the Contractor's risk.

#### 1.07 Definitions

- A. Shop Drawings:
1. Fabrication drawings for custom products.
  2. Modified catalog data annotated for a specific condition of service.
  3. Installation drawings for product assemblies or systems.
- B. Description Data: Manufacturer's catalog data, literature, etc., on product or system.
- C. Samples: Physical examples of products proposed for use.
- D. Schedules: Itemized listing of products and proposed locations.
- E. Certificates: Notarized statements made and signed by authorized company representatives attesting to their product having met the Contingent Document requirements.
- F. Guarantee or Warranty: Specific guarantees required in Project Manual in addition to the completed work guarantee required of Contractor. See Section 01700, Contract Closeout.
- G. Maintenance Manuals:
1. Three-ring (minimum) 8-1/2" x 11" hardback, vinyl-covered binder for Owner's permanent record.
  2. Contents to include reproductions of shop drawings, descriptive data, schedules, etc., corrected through final approval, plus operation, maintenance, parts listing, service availability, cleaning instructions, etc.
  3. Permanently mark edge of binder to indicate contents and project title.

1.08 Required Information to be Included with all Submittals

- A. Date of Submittal
- B. Name of Project
- C. Name of Contractor
- D. Reference to a specific section, drawing or detail
- E. Manufacturer's or fabricator's name
- F. Owner's name
- G. Installer's name

1.09 Required Information to be Included with Shop Drawings and Descriptive Data

- A. Factory or shop applied finish or protective coating.
- B. Installation requirements and recommendations.
- C. Product protection requirements.
- D. Cleaning precautions and/or requirements.
- E. Applicable activation requirements or procedures.

1.10 Quantities (Minimum)

- A. Shop Drawings
  - 1. Custom Fabrications or Assemblies: 1 Hard Copy, 1 Electronic Copy.
  - 2. Modified Catalog Data: 1 Hard Copy, 1 Electronic Copy.
- B. Descriptive Data and Schedules: 1 Hard Copy, 1 Electronic Copy
- C. Physical Samples/Examples: 1 Hard Copy, 1 Electronic Copy
- D. Mockups: N/A
- E. Certificates: 1 Hard Copy, 1 Electronic Copy
- F. Guarantees or Warranties
  - 1. Examples for initial review and approval: 1 Hard Copy, 1 Electronic Copy
  - 2. After approval, actual construction completion documents: 1 Hard Copy, 1 Electronic Copy
- G. Maintenance Manual: 1 Hard Copy, 1 Electronic Copy

END OF SECTION

## SECTION 01 40 00

### QUALITY REQUIREMENTS

#### PART 1 GENERAL

##### 1.1 SECTION INCLUDES

- A. Quality Monitoring: Monitor quality control over suppliers, manufacturers, products, services, site conditions, and workmanship, to produce Work of specified quality. Perform quality control procedures and inspections during installation.
- B. Standards: 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.
- C. Tolerances: Monitor fabrication and installation tolerance control of products to produce acceptable Work. Do not permit tolerances to accumulate. Comply with manufacturers' tolerances.
- D. Reference Standards: For products or workmanship specified by association, trade, or other consensus standards comply with requirements of the standard, except when more rigid requirements are specified or are required by applicable codes.
- E. Manufacturer's Field Services: When specified in individual specification sections, require material or product suppliers or manufacturers to provide qualified staff personnel to perform the following as applicable, and to initiate instructions when necessary.
  - 1. Observe site conditions.
  - 2. Conditions of surfaces and installation.
  - 3. Quality of workmanship.
  - 4. Start-up of equipment.
  - 5. Test, adjust and balance of equipment.
  - 6. FM Global - Visual Inspection observer for roofing (shall be by roofing manufacturer in quantity of inspections as required by roofing manufacturer).

END OF SECTION



## SECTION 01 50 00

### TEMPORARY FACILITIES AND CONTROLS

#### PART 1 GENERAL

##### 1.1 SECTION INCLUDES

- A. Temporary Services: Provide temporary services and utilities, including payment of utility costs including the following.
  - 1. Water (potable and non-potable).
  - 2. Lighting and power.
  - 3. Metering.
  - 4. Telephone.
  - 5. Toilet facilities.
  - 6. Materials storage.
- B. Construction Facilities: Provide construction facilities, including payment of utility costs including the following.
  - 1. Construction equipment.
  - 2. Dewatering and pumping.
  - 3. Enclosures.
  - 4. Heating.
  - 5. Lighting.
  - 6. Access.
- C. Security and Protection: Provide security and protection requirements including the following.
  - 1. Fire extinguishers.
  - 2. Site enclosure fence, barricades, warning signs, and lights.
  - 3. Building enclosure and lock-up.
  - 4. Environmental protection.
  - 5. Pest control during and at the end of construction.
- D. Personnel Support: Provide personnel support facilities including the following.
  - 1. Contractor's field office.
  - 2. Sanitary facilities.
  - 3. Drinking water.
  - 4. Project identification sign.
  - 5. Cleaning.

END OF SECTION



## SECTION 01 60 00

### PRODUCT REQUIREMENTS

#### PART 1 GENERAL

##### 1.1 SECTION INCLUDES

- A. Manufacturers: Provide products from one manufacturer for each type or kind as applicable. Provide secondary materials as acceptable to manufacturers of primary materials.
- B. Product Selection: Provide products selected or equal approved by Architect. Products submitted for substitution shall be submitted with complete documentation, and include construction costs of substitution including related work.
- C. Substitutions: Request for substitution must be in writing. Conditions for substitution include:
  - 1. An '**or equal**' phrase in the specifications.
  - 2. Specified material cannot be coordinated with other work.
  - 3. Specified material is not acceptable to authorities having jurisdiction.
  - 4. Substantial advantage is offered to the Owner in terms of cost, time, or other valuable consideration.
- D. Substitution Requests: Substitutions shall be submitted **prior to award of contract** during the bidding process, unless otherwise accepted. Approval of shop drawings, product data, or samples containing substitutions is not an approval of a substitution unless an item is clearly presented as a substitution at the time of submittal.

END OF SECTION





## SECTION 01 70 00

### CLOSEOUT REQUIREMENTS

#### PART 1 GENERAL

##### 1.1 SECTION INCLUDES

1. Substantial Completion: The following are prerequisites to substantial completion. Provide the following.
  1. Punch list prepared by Contractor and subcontractors as applicable..
  2. Supporting documentation.
  3. Warranties.
  4. Certifications.
  5. Occupancy permit.
  6. Start-up and testing of building systems.
  7. Change-over of locks.
  8. Meter readings.
  9. Commissioning documentation as applicable.
2. Final Acceptance: Provide the following prerequisites to final acceptance.
  1. Final payment request with supporting affidavits.
  2. Completed punch list, verified and accepted by Owners representative.
3. As-Built Drawings: Provide a marked-up set of drawings including all changes, which occurred during construction. Provide 1 hard copy and 1 electronic copy.
  1. Contractor to submit As-built documents to architect for final review prior to approval.
4. Project Closeout: Provide the following during project closeout.
  1. Submission of record documents.
  2. Submission of maintenance manuals.
  3. Training and turnover to Owner's personnel.
  4. Final cleaning and touch-up.
  5. Removal of temporary facilities.

END OF SECTION



## SECTION 01 72 00

### PROJECT RECORD DOCUMENTS

#### PART 1 GENERAL

##### 1.01 Purpose

This section provides Contractor guidance for the creation, preparation and maintenance of:

- A. "Job Set" Record Documents (RD's)
- B. Final Record Documents
- C. Visitor's Log

##### 1.02 Quality Assurance

- A. The Contractor shall delegate the responsibility for the maintenance of Record Documents and the Visitor's Log to one person on his staff as approved by the ARCHITECT/ENGINEER.
- B. The contractor shall insure the accuracy of RD's and shall:
  - 1. Thoroughly coordinate all changes.
  - 2. Make adequate and proper entries.
- C. Timeliness of Entries: The Contractor shall make all entries within a reasonable amount of time (24 hours) after receipt of information or the need for an entry arises.

##### 1.03 Submittals

- A. The ARCHITECT/ENGINEER's approval of current Job Set RD's will be a prerequisite to his approval of the Contractor's monthly Applications for Payment.
- B. The ARCHITECT/ENGINEER's approval of the Final RD's will be a prerequisite to his approval of the Contractor's Application for Final Payment.
- C. The contractor shall submit his Visitor's Log for the inspection of the ARCHITECT/ENGINEER or Owner as may be requested.
- D. The Contractor shall submit a copy of his prior month's Visitor's Log with each Application for Payment. He shall indicate the name of the project and the period covered by the log.

##### 1.04 Protection of RD's

Take precautions to protect RD's from deterioration, loss or damage. Conserve, as necessary, the "Job Set" until the completion of work and the transfer of information from the "Job Set" to the "Final Record Documents."

##### 1.05 "Job Set" Record Documents

- A. Identification  
Upon receipt of the set of documents to be used as the job set, identify each of the documents with the title, "Record Documents - Job Set."

- B. Preservation
  - 1. Devise a suitable method for protecting the "Job Set" from anticipated user wear.
  - 2. Use the "Job Set" only for the entry of new data and the ARCHITECT/ENGINEER's review.
  - 3. Maintain the "Job Set" at the project work site designated by the ARCHITECT/ENGINEER.
- C. Making Entries
  - 1. Use an erasable colored pencil.
  - 2. Clearly describe the change by note or by graphic line.
  - 3. Date all entries.
  - 4. Highlight the change by the use of a "cloud" around the area(s) affected.
  - 5. Use different colors for overlapping changes.
- D. Other Entries
  - 1. Indicate any ARCHITECT/ENGINEER directed changes by note; i.e., "ARCHITECT/ENGINEER directed change."
  - 2. Contractor originated changes and inadvertent errors which are approved by the ARCHITECT/ENGINEER shall be clearly indicated by note.
- E. Schematic Layout Conversion
  - 1. General Background: Most mechanical, electrical, and plumbing drawings are schematic in nature and not intended to portray precise physical layout or location.
    - a. Final physical layout is determined by the Contractor and may be different from that shown on the Drawings.
    - b. Future modifications or maintenance will require accurate, final, physical arrangement information.
  - 2. "Job Set" RD's: The Contractor shall annotate the "Job Set" RD's to show:
    - a. Plan Location: Dimension layout of mechanical/electrical runs to within 1" of the centerline of each run.
    - b. Identification: Identify the item by accurate note showing size, material and function; i.e., "4" cast iron drain," "1/2" copper water," etc.
    - c. Show the vertical (height) location by symbol or note; i.e., "in ceiling plenum," "exposed ceiling mounted," "under slab," etc.
    - d. Make identifications sufficiently descriptive so that they may be easily related to the Specifications.

#### 1.06 Final Record Documents

- A. General: The Contractor shall furnish Final Record Documents that provide factual reference information of a permanent nature, enabling future modifications and maintenance to proceed without expensive site investigation.
- B. Final Record Documents shall be in CD format. Contractor, at his own expense, shall obtain a set of Record Documents in ACAD format from the ARCHITECT/ENGINEER to be used for Final Record Documents.
- C. Prior to the transfer of information from the "Job Set" to the Final RD's, the Contractor shall obtain a review by the ARCHITECT/ENGINEER of all recorded data. Make all required revisions.
- D. Transfer of Data to Drawings
  - 1. Carefully transfer all change data from the "Job Set" to ACAD.
  - 2. Coordinate all changes as required. Clearly indicate changes to all

- drawings affected; i.e., plans, sections, details, etc. Give the full description of changes to provide a comprehensive record. Show actual locations, dimensions, notes, etc.
3. Call attention to each entry by drawing a "cloud" around it.
  4. Make changes neatly and consistently. Drawings shall be modified with either ink or black pencil. Line quality shall be crisp, consistent, and equal to the original.
- E. Transfer of Data to other Documents (Project Manual)
1. Seek ARCHITECT/ENGINEER approval of changes made on the "Job Set" Project Manual. If changes are neat, legible, and clean, the ARCHITECT/ENGINEER is authorized to approve the "Job Set" as the Final.
  2. If ARCHITECT/ENGINEER approval is not forthcoming, obtain a new copy of the Project Manual and make all data changes necessary.
- F. Review and Approval: Submit the complete set of Record Documents to the ARCHITECT/ENGINEER for his approval. Revise as necessary.

#### 1.07 Changes Subsequent to Acceptance

The Contractor's responsibility for recording change ends upon acceptance of the Work by the Owner (Approved Certificate of Final Inspection by State DOE). However, changes resulting from replacements, repairs, and alterations required as a result of the Contractor guarantee work shall be recorded.

#### 1.08 Visitor's Log

- A. The Contractor shall maintain a log in the Field Office to record visits by the ARCHITECT/ENGINEER, his consultants, and all visitors, including Owner's representatives and inspectors.
- B. This log shall become the official record of all job visits and shall show:
1. Date
  2. Time of Arrival
  3. Time of Departure
  4. Person's Name
  5. Entity Represented
- C. The Contractor shall furnish a copy of the log to the Architect/Engineer or Owner.

#### 1.09 Contractors' Project Related Documents

All documents shall be made available to the Owner upon request.

END OF SECTION



## SECTION 02 41 19

### SELECTIVE DEMOLITION

#### PART 1 GENERAL

##### 1.1 SECTION INCLUDES

- A. Selective Site Demolition:
  - 1. Demolition of designated site improvements including paving, curbing, site walls, buildings, and utility structures for areas designated as a part of project scope.  
*Reference Civil drawings for additional information.*
  - 2. Demolition of below-grade foundations and site improvements to a depth to avoid conflict with new construction or site work.
  - 3. Removal of hollow items or items which could collapse.
  - 4. Salvage of designated items: only as indicated on drawings.
  - 5. Protection of site work and adjacent structures, INCLUDING EXISTING SITE UTILITIES AND INFRASTRUCTURE and EXISTING ELECTRICAL INFRASTRUCTURE ASSOCIATED TO RADIO TOWER.
  - 6. Disconnection, capping, and removal of utilities.
  - 7. Pollution control during building demolition, including noise control.
  - 8. Removal and legal disposal of materials.
  - 9. Designated site improvements and adjacent construction.
  - 10. Interruption, capping or removal of utilities as applicable.
  - 11. Coordinate with Civil drawings for any trees that may require protections.
- B. Hazardous Materials:
  - 1. UNKNOWN – CONTRACTOR SHALL INQUIRE WITH OWNER AS TO THE PRESENCE OF ASBESTOS OR HAZARDOUS MATERIALS PRIOR TO COMMENCING DEMOLITION ACTIVITIES ON THE EXISTING BUILDING #6.

##### 1.2 SUBMITTALS

- A. Submit under provisions of Section 01 30 00 - Administrative Requirements.
- B. Schedule: Submit for approval selective site demolition schedule, including schedule and methods for capping utilities to be abandoned and maintaining existing utility service.

##### 1.3 QUALITY ASSURANCE

- A. Codes and Regulations: Comply with governing codes and

regulations. Use experienced workers only.

#### 1.4 PRE-INSTALLATION MEETINGS

- A. Convene minimum two weeks prior to starting work of this section. Coordinate meeting with owner and or owner's representative.

#### 1.5 SEQUENCING

- A. Immediate areas of work will not be occupied during selective demolition. The public may occupy adjacent areas.
- B. No responsibility for site areas to be demolished will be assumed by the Owner.
- C. Ensure that products of this section are supplied to affected trades in time to prevent interruption of construction progress.

### PART 2 EXECUTION

#### 2.1 SCHEDULE

- A. Items for Protection During Demolition and Construction: (The following are samples only)
  - 1. Designated site improvements, trees, and plantings
  - 2. Utilities and existing below ground or above ground services to remain
- B. Utilities Requiring Interruption, Capping, or Removal: Coordinate interruptions with Owner minimum of 72 hrs in advance of interruption.
  - 1. Electric
  - 2. Water
  - 3. Sewerage
  - 4. Gas
  - 5. Cable Television

END OF SECTION



SECTION 06 10 00  
ROUGH CARPENTRY

1. GENERAL:

- 1.1 Related Documents: The requirements of Division 1 are hereby made a part of this section as if fully repeated herein.
- 1.2 Items of work to be performed shall include, but are not limited to, the following:
  - 1.2.1 Framing lumber, furring, backup lumber and blocking as required for the finish installation of materials and equipment by other trades.
  - 1.2.2 Nail strips, grounds.
  - 1.2.3 Hardware for securing rough carpentry materials.
  - 1.2.4 Installation of finish carpentry items and other items and materials installed by carpentry trade.
- 1.3 Related work specified under other sections of these specifications.
  - 1.3.1 Forms for Concrete.

2. MATERIALS:

- 2.1 Lumber shall be well-seasoned, sound stock, free from sap shakes and/or other defects which may impair the appearance, utility or strength of the materials.
- 2.2 Ground Contact Preservative Treatment: All lumber (such as nailers, furring strips or others), which is to be placed in contact with concrete or masonry inside and/or outside of the building envelope shall be pressure treated with Wolman Salts to a retention level of 0.60 pounds per cubic foot and then re-dried after treatment in accordance with AWWPA 22. Provide pressure treated lumber at other locations as shown. All lumber used for edge blocking of the built-up roof shall be pressure treated.
- 2.3 Wood blocking: Provide solid P.T/Fire Treated 2 x wood blocking in the following locations:
  - 1. Roofing curbs and base plates, as required. Reference approved roofing manufacturer typical details and architectural drawings for additional information.

2.4 Fasteners shall be of the type and size best suited for the work. All nails used exterior shall be hot dip galvanized, unless specified otherwise.

3. INSTALLATION:

3.1 Fasten securely all parts of carpentry work in their proper place.

3.2 Sort material to suit its placement so that permitted defects will have the least detrimental effect on the stability and appearance of the work.

3.3 Installation of various carpentry materials and components shall follow standard industry practices of good construction and the instructions of the manufacturer's of the component being installed.

4. STORAGE AND PROTECTION: Stack framing lumber and plywood to insure proper ventilation and drainage. Protect lumber and plywood from elements. All stored material shall be placed on dunnage at nominal 4" above grade. No contact between stored material and ground shall be permitted.

END OF SECTION

SECTION 07 52 00  
MODIFIED BITUMINOUS MEMBRANE ROOFING

PART 1 GENERAL

1.01 SECTION INCLUDES:

- A. Preparation of Substrate to Receive Roofing Materials
- B. Roof Insulation Application to Prepared Substrate
- C. Modified Bitumen Ply Sheet Application to Prepared Substrate
- D. Modified Bitumen Cap Sheet Application to Ply Sheet.
- E. PMMA-based Roof Flashing Application

1.02 RELATED SECTIONS

- A. Section 01 33 00 - Submittals
- B. Section 06 10 00 - Rough Carpentry
- C. Section 07 60 00 - Flashing and Sheet Metal

1.03 REFERENCE STANDARDS

Agencies which may be used as references throughout this specification section include:

ASTM	American Society for Testing and Materials Philadelphia, PA
FM	Factory Mutual Engineering and Research Norwood, MA
NRCA	National Roofing Contractors Association Rosemont, IL
CERTA	Certified Roofing Torch Applicator Program National Roofing Contractors Association Rosemont, IL Midwest Roofing Contractors Association Lawrence, KS
OSHA	Occupational Safety and Health Administration Washington, DC
UL	Underwriters Laboratories

Northbrook, IL

ACI            American Concrete Institute  
                 Hills, MI

ICRI           International Concrete Repair Institute  
                 Des Plaines, IL

#### 1.04 DESCRIPTION OF WORK (Design Basis)

The basic work descriptions required in this specification are referenced below.

Project Type:    New Construction

Deck:            Structural concrete  
Slope:           Less than 1/8 inch

Coverboard:    DensDeck Prime by Georgia-Pacific, having a thickness of 1/4 inch, applied in  
                 Para-Stik Insulation Adhesive.

Roof System:    Paradiene 20 TG, torch applied;  
                 Paradiene 30 FR TG, torch applied.

Flashing:       Veral Aluminum, torch applied.

#### 1.05 SUBMITTALS

##### A. Submittals Prior to Contract Award:

1. Letter from the proposed primary roofing manufacturer confirming that the bidder is an acceptable Contractor authorized to install the proposed system.
2. Letter from the primary roofing manufacturer stating that the proposed application will comply with the Manufacturer's requirements in order to qualify the project for the specified guarantee.
3. Provide Roof NAV Letter for compliance with FM requirements for review and approval.  
FM Roof NAV: #21856-49238-0

#### 1.06 QUALITY ASSURANCE

- A. Acceptable Contractor: Contractor shall be certified in writing by the roofing materials manufacturer to install the primary roofing products.
- B. Product Quality Assurance Program: Primary roofing materials shall be manufactured under a quality management system that is monitored regularly by a third party auditor under the ISO 9001 audit process.
- C. Agency Approvals: The proposed roof system shall conform to the following requirements. No other testing agency approvals will be accepted.

1. Underwriters Laboratories Class A acceptance of the proposed roofing system based upon testing performed in accordance with ASTM E 108 protocol.
  2. The roof configuration shall have been successfully tested by an accredited testing laboratory to meet a minimum design windload pressure of -75 psf and an FM I-150.
- D. Project Acceptance: Submit a completed manufacturer's application for roof guarantee form along with shop drawings of the roofs showing all dimensions, penetrations, and details. The project must receive approval by the membrane manufacturer, through this process, prior to shipment of materials to the project site.
- E. Scope of Work: The work to be performed under this specification shall include but is not limited to the following: Attend necessary job meetings and furnish competent and full time supervision, experienced roof mechanics, all materials, tools, and equipment necessary to complete, in an acceptable manner, the roof membrane/flashing system installation in accordance with this specification. Comply with the latest written application instructions of the manufacturer of the primary roofing products.
- F. Local Regulations: Conform to regulations of public agencies, including any specific requirements of the city and/or state of jurisdiction.
- G. Manufacturer Requirements: The membrane/flashing system manufacturer shall provide direct trained company personnel to attend necessary job meetings, perform periodic inspections as necessary, and conduct a final inspection upon successful completion of the project.

#### 1.07 GUARANTEE/WARRANTY

- A. Roof Membrane Guarantee: Upon successful completion of the project, and after all post installation procedures have been completed, furnish the Owner with the manufacturer's 20 year NDL (No Dollar Limit) labor and materials guarantee covering the coverboard, adhesive, and roof membrane/flashing system. The guarantee shall be a term type, without deductibles or limitations on coverage amount, and shall be issued at no additional cost to the Owner.
- > Manufacturer's 20 year NDL Roof Membrane Guarantee

#### 1.08 PRODUCT DELIVERY STORAGE AND HANDLING

- A. Delivery: Deliver materials in the manufacturer's original sealed and labeled containers and in quantities required to allow continuity of application.
- B. Storage: Store closed containers in a cool, dry area away from heat, direct sunlight, oxidizing agents, strong acids, and strong alkalis. Do not store resins or catalyst at temperatures below 32°F (0°C) or above 85°F (29°C). Keep away from open fire, flame or any ignition source. Store in a well ventilated area.
- C. Handling: Handle all materials in such a manner as to preclude damage and contamination with moisture or foreign matter. Keep away from open fire, flame, or any ignition source. Vapors may form explosive mixtures with air. Avoid skin and eye contact with this material. Avoid breathing fumes when above the Threshold Limit Value (TLV). Do not eat, drink, or smoke in areas where roofing materials are stored or applied.

- D. Damaged Material: Any materials that are found to be damaged or stored in any manner other than stated above shall be automatically rejected, removed and replaced at the Contractor's expense.

## 1.09 PROJECT/SITE CONDITIONS

### A. Requirements Prior to Job Start

1. Notification: Give a minimum of 5 days notice to the Owner and manufacturer prior to commencing any work and notify both parties on a daily basis of any change in work schedule.
2. Permits: Obtain all permits required by local agencies and pay all fees which may be required for the performance of the work.
3. Safety: Familiarize every member of the application crew with all fire and safety regulations recommended by OSHA, NIOSH, NRCA and other industry or local governmental groups. Workers shall wear a long sleeve shirt with long pants and work boots. Workers shall use only butyl rubber or nitrile gloves when mixing or applying PMMA products. Safety glasses with side shields are required for eye protection. Use local exhaust ventilation to maintain worker exposure below the published Threshold Limit Value (TLV). If the airborne concentration poses a health hazard, becomes irritating or exceeds recommended limits, use a NIOSH approved respirator in accordance with OSHA Respirator Protection requirements published under 29 CFR 1910.134. The specific type of respirator will depend on the airborne concentration. A filtering face piece or dust mask is not appropriate for use with this product if TLV filtering levels have been exceeded.

### B. Environmental Requirements

1. Precipitation: Do not apply roofing materials during precipitation or in the event there is a probability of precipitation during application. Take adequate precautions to ensure that materials, applied roofing, and building interiors are protected from possible moisture damage or contamination.
2. Temperature Restrictions – self-adhesive sheets: The minimum required substrate temperature at point of application is 40°F (4°C). Maintain a minimum roof membrane material temperature above 50°F (10°C). In low temperature conditions, materials keep materials warm prior to application. Suspend application in situations where the self-adhered base ply cannot be kept at temperatures allowing for proper adhesion or the substrate temperature will not allow for proper adhesion.
3. Temperature Restrictions – PMMA-based Materials: Do not apply catalyzed resin materials if there is a threat of inclement weather. Follow the resin manufacturer's specifications for minimum and maximum ambient, material and substrate temperatures. Do not apply catalyzed resin materials unless ambient and substrate temperatures fall within the resin manufacturer's published range.

### C. Protection Requirements

1. Membrane Protection: Provide protection against staining and mechanical damage for newly applied roofing and adjacent surfaces.

## PART 2 PRODUCTS

### 2.01 ROOFING SYSTEM ACCESSORIES

- A. Roof Coverboard shall be UL and FM approved. Shall be approved in writing by the manufacturer for intended use and for use with the specified roof assembly. Maintain a maximum panel size of 4 feet by 4 feet where specified to be installed in adhesive.

1. Gypsum Sheathing Panel: A panel composed of a gypsum based, non-structural water resistant core material integrally bonded with fiberglass mats on both sides having a nominal thickness of 1/2 inch. The panel surface shall be factory primed with a non-asphaltic primer. Acceptable types are as follows:

> DensDeck Prime Gypsum Roof Board, by Georgia Pacific Corporation; Atlanta, GA

B. Primers, Sealants and Adhesives for Bitumen Products

1. Insulation Adhesive: A single component, moisture cured, polyurethane foam adhesive, dispensed from a portable, pre-pressurized container used to adhere insulation panels to the substrate as well to other insulation panels.

> Para-Stik Insulation Adhesive by Siplast; Irving, TX

2. Primer: An asphalt, solvent blend conforming to ASTM D 41 requirements.

> Siplast PA-1125 Asphalt Primer by Siplast; Irving, TX

3. Primer for Self-Adhesive Sheets: A quick drying, low-VOC, water-based, high-tack primer specifically designed to promote adhesion of roofing and waterproofing sheets to approved substrates. Primer shall meet South Coast Air Quality District and Ozone Transport Commission requirements.

> TA-119 Primer by Siplast; Irving, TX

4. Elastomeric Sealant: A moisture-curing, elastomeric sealant designed for roofing applications. The sealant shall be approved by the roof membrane manufacturer for use in conjunction with the roof membrane materials. Acceptable types are as follows:

> PS-209 Elastomeric Sealant by Siplast; Irving, TX

C. Fasteners

1. Flashing Reinforcing Sheet Fasteners for Wood/Plywood Substrates to Receive Flashing Coverage: Fasteners shall be approved by the manufacturer of the primary roofing products. Acceptable fasteners for specific substrate types are listed below.

a) Wood/Plywood Substrates

- A 12 gauge, spiral or annular threaded shank, zinc coated steel roofing fastener having a minimum 1 inch head.
- > Square Cap by W.H. Maze Co.; Peru, IL
- > 12 Gauge Simplex Nail by the Simplex Nail and Manufacturing Co., Americus, GA

#### D. Resin Accessories

1. Cleaning Solution/Solvent: A clear solvent used to clean and prepare transition areas of in-place catalyzed resin to receive subsequent coats of resin and to clean substrate materials to receive resin.
  - > Pro Prep by Siplast; Irving, TX
2. Preparation Paste: A PMMA-based paste used for remediation of depressions in substrate surfaces or other irregularities.
  - > Pro Paste Resin by Siplast; Irving, TX

#### E. PMMA Primers

1. Primer for Wood, Plywood and Rigid Insulation, Masonry and Vertical Concrete Substrates: A fast-curing PMMA-based primer for use in over wood, plywood and rigid insulation substrates.
  - > Pro Primer W by Siplast; Irving, TX

#### F. Accessories

1. Ceramic Granule Anti-Skid Surfacing: No. 11 grade specification ceramic granules suitable for broadcast into a PMMA-based resin wearing layer.
  - > No. 11 Granules by Siplast; Irving, TX

## 2.02 DESCRIPTION OF SYSTEMS

- A. Roofing Membrane Assembly: A roof membrane assembly consisting of two plies of a prefabricated, reinforced, homogeneous Styrene-Butadiene-Styrene (SBS) block copolymer modified asphalt membrane, applied over a prepared substrate. Reinforcement mats shall be impregnated/saturated and coated each side with SBS modified bitumen blend and coated one side with a torch grade SBS bitumen blend adhesive layer. The adhesive layer shall be manufactured using a process that embosses the surface with a grooved pattern to provide optimum burn-off of the plastic film and to maximize application rates. The cross sectional area of the sheet material shall contain no oxidized or non-SBS modified bitumen. The roof system shall pass 500 cycles of ASTM D 5849 Resistance to Cyclic Joint Displacement (fatigue) at 14°F (-10°C). Passing results shall show no signs of membrane cracking or interply delamination after 500 cycles. The roof system shall pass 200 cycles of ASTM D 5849 after heat conditioning performed in accordance with ASTM D 5147. The assembly shall possess waterproofing capability, such that a phased roof application, with only the modified bitumen base ply in place, can be achieved for prolonged periods of time without detriment to the watertight integrity of the entire roof system.



- > Siplast Paradiene 20 TG/30 FR TG torchable roof system  
FM ROOF NAV: 21856-49238-0

#### 1. Modified Bitumen Base and Stripping Ply

- a) Thickness (avg): 114 mils (2.9 mm) (ASTM D 5147)
- b) Thickness (min): 110 mils (2.8 mm) (ASTM D 5147)
- c) Weight (min per 100 ft<sup>2</sup> of coverage): 76 lb (3.7 kg/m<sup>2</sup>)
- d) Maximum filler content in elastomeric blend: 35% by weight
- e) Low temperature flexibility @ -15°F (-26°C): PASS (ASTM D 5147)
- f) Peak Load (avg) @ 73°F (23°C): 30 lbf/inch (5.3 kN/m) (ASTM D 5147)
- g) Peak Load (avg) @ 0°F (-18°C): 75 lbf/inch (13.2 kN/m) (ASTM D 5147)
- h) Ultimate Elongation (avg.) @ 73°F (23°C): 50% (ASTM D 5147)
- i) Dimensional Stability (max): 0.1% (ASTM D 5147)
- j) Compound Stability (min): 250°F (121°C) (ASTM D 5147)
- k) Approvals: UL Class listed, FM Approved (products shall bear seals of approval)
- l) Reinforcement: fiberglass mat or other meeting the performance and dimensional stability criteria

- > Siplast Paradiene 20 - torchable grade

#### 2. Modified Bitumen Finish Ply

- a) Thickness (avg): 138 mils (3.5 mm) (ASTM D 5147)
- b) Thickness at selvage (coating thickness) (avg): 118 mils (3.0 mm) (ASTM D 5147)
- c) Thickness at selvage (coating thickness) (min): 114 mils (2.9 mm) (ASTM D 5147)
- d) Weight (min per 100 ft<sup>2</sup> of coverage): 112 lb (5.4 kg/m<sup>2</sup>)
- e) Maximum filler content in elastomeric blend: 35% by weight
- f) Low temperature flexibility @ -15°F (-26°C): PASS (ASTM D 5147)
- g) Peak Load (avg) @ 73°F (23°C): 30 lbf/inch (5.3 kN/m) (ASTM D 5147)
- h) Peak Load (avg) @ 0°F (-18°C): 75 lbf/inch (13.2 kN/m) (ASTM D 5147)
- i) Ultimate Elongation (avg.) @ 73°F (23°C): 55% (ASTM D 5147)
- j) Dimensional Stability (max): 0.1% (ASTM D 5147)
- k) Compound Stability (min): 250°F (121°C) (ASTM D 5147)
- l) Granule Embedment (max loss): 2.0 grams per sample (ASTM D 5147)
- m) Approvals: UL Class listed, FM Approved (products shall bear seals of approval)
- n) Reinforcement: fiberglass mat or other meeting the performance and dimensional stability criteria
- o) Surfacing: ceramic granules

- > Siplast Paradiene 30 FR - torchable grade

B. Flashing Membrane Assembly: A flashing membrane assembly consisting of a prefabricated, reinforced, Styrene-Butadiene-Styrene (SBS) block copolymer modified asphalt membrane with a continuous, channel-embossed metal-foil surfacing. The finish ply shall conform to ASTM D 6298 and the following physical and mechanical property requirements.

- > Siplast Veral flashing system, aluminum finish

#### 1. Cant Backing Sheet and Flashing Reinforcing Ply

- a) Thickness (avg): 102 mils (2.6 mm) (ASTM D 5147)

- b) Thickness (min): 98 mils (2.5 mm) (ASTM D 5147)
- c) Weight (min per 100 ft<sup>2</sup> of coverage): 72 lb (3.5 kg/m<sup>2</sup>)
- d) Maximum filler content in elastomeric blend: 35% by weight
- e) Low temperature flexibility @ -15° F (-26° C) - PASS (ASTM D 5147)
- f) Peak Load (avg) @ 73°F (23°C): 30 lbf/inch (5.3 kN/m) (ASTM D 5147)
- g) Peak Load (avg) @ 0°F (-18°C): 75 lbf/inch (13.2 kN/m) (ASTM D 5147)
- h) Ultimate Elongation (avg.) @ 73°F (23°C): 50% (ASTM D 5147)
- i) Dimensional Stability (max): 0.1% (ASTM D 5147)
- j) Compound Stability (min - sheet): 250°F (121°C) (ASTM D 5147)
- k) Compound Stability (min – adhesive coating): 212°F (100°C) (ASTM D 5147)
- l) Approvals: UL Class listed, FM Approved (products shall bear seals of approval)
- m) Reinforcement: fiberglass mat or other meeting the performance and dimensional stability criteria
- n) Back Surfacing: polyolefin film

> Siplast Paradiene 20 SA

## 2. Metal-Clad Modified Bitumen Flashing Sheet

- a) Thickness (avg): 142 mils (3.6 mm) (ASTM D 5147)
- b) Thickness (min): 138 mils (3.5 mm) (ASTM D 5147)
- c) Weight (min per 100 ft<sup>2</sup> of coverage): 92 lb (4.5 kg/m<sup>2</sup>)
- d) Coating Thickness – back surface (min): 40 mils (1 mm) (ASTM D 5147)
- e) Low temperature flexibility @ 0° F (-18° C): PASS (ASTM D 5147)
- f) Peak Load (avg) @ 73°F (23°C): 85 lbf/inch (15 kN/m) (ASTM D 5147)
- g) Peak Load (avg) @ 0°F (-18°C): 180 lbf/inch (31.7 kN/m) (ASTM D 5147)
- h) Ultimate Elongation (avg) @ 73°F (23°C): 45% (ASTM D 5147)
- i) Tear-Strength (avg): 120 lbf (0.54 kN) (ASTM D 5147)
- j) Dimensional Stability (max): 0.2% (ASTM D 5147)
- k) Compound Stability (min): 225°F (107°C) (ASTM D 5147)
- l) Cyclic Thermal Shock Stability (maximum): 0.2% (ASTM D 7051)
- m) Approvals: UL Approved, FM Approved (products shall bear seals of approval)
- n) Reinforcement: fiberglass scrim mat or other meeting the performance and dimensional stability criteria
- o) Surfacing: aluminum metal foil

> Siplast Veral Aluminum

- C. Catalyzed Acrylic Resin Flashing System: A specialty flashing system consisting of a liquid-applied, fully reinforced, multi-component acrylic membrane installed over a prepared or primed substrate. The flashing system consists of a catalyzed acrylic resin primer, basecoat and topcoat, combined with a non-woven polyester fleece. The resin and catalyst are pre-mixed immediately prior to installation. The use of the specialty flashing system shall be specifically approved in advance by the membrane manufacturer for each application.

> Parapro 123 Flashing System by Siplast; Irving, TX

- D. Substitute Roof Systems: The following substitute roof systems are approved for use in lieu of the specified roof system.

### Manufacturer

Soprema

Base Plies – Sopralene Flam 250

Finish Ply – Sopralene 250 FR GR

Manufacturer

Johns Manville

Base Plies – DynaWeld base 250

Finish Ply – DynaWeld Cap 250 FR

## PART 3 EXECUTION

### 3.01 SUBSTRATE EXAMINATION/PREPARATION

- A. General: Ensure that substrates are free from gross irregularities, loose, unsound or foreign material such as dirt, ice, snow, water, grease, oil, bituminous products, release agents, laitance, paint, loose particles/friable matter, rust or any other material that would be detrimental to adhesion of the catalyzed primer and/or resin to the substrate. Some surfaces may require scarification, shotblasting, or grinding to achieve a suitable substrate.
- B. Preparation of Existing Concrete/Masonry Substrates to Receive Resin Materials: Existing concrete substrates shall have a minimum compressive strength of 3,500 psi (24 N/mm<sup>2</sup>). Following evaluation for moisture content and confirmation that the moisture content is at an acceptable level, shot blast or scarify/shot-blast concrete or masonry surfaces to provide a sound substrate free from laitance and residue from bitumen, coal tar, primer, coatings, adhesives, sealer or any material that may inhibit adhesion of the specified primer. Generate a concrete surface profile of CSP-2 to CSP-4 as defined by the ICRI. Grinding may be used as a preparation method for localized areas that cannot be reached by a shot blasting equipment provided that a surface can be prepared to a CSP-2 to CSP 4. Repair spalls and voids on vertical or horizontal surfaces using the specified primer and preparation paste.
- C. Preparation of Concrete Substrates to Receive a Modified Bitumen Base Ply (Area 5 – Options 3 and 4): Prime the deck surface with asphalt primer at the rate of 1 gallon per 100 to 400 square feet.
- D. Coverboard: Install panels with end joints offset; edges of the panels shall be in moderate contact without forcing applied in strict accordance with the insulation manufacturer's requirements and the following instructions. Maintain a maximum panel size of 4 feet by 4 feet for panels applied in insulation adhesive.
- E. Ply Sheet Application: Bond the modified bitumen ply sheet to the prepared substrate, utilizing minimum 3 inch side and end laps. Apply each sheet directly behind the torch applicator. Cut a dog ear angle at the end laps on overlapping selvage edges. Using a clean trowel, apply pressure to top seal T-laps immediately following sheet application. Stagger end laps a minimum of 3 feet. Follow manufacturer's specifications regarding maximum exposure periods prior to application of the liquid-applied finish membrane.
- F. Preparation of Steel/Aluminum Substrates: Grind to generate a "white-metal" surface and remove loose particles. Extend preparation area a minimum of 1/2-inch (13 mm) beyond the termination of the roofing/flashing system. Notch steel surfaces to provide a rust-stop where detailed.

- G. Rigid Plastic Flashing Substrates: Evaluate the plastic for compatibility with the resin materials. Lightly abrade the surface to receive the flashing system, clean plastic substrates using the specified cleaner/solvent and allow to dry. Extend the preparation area a minimum of 1/2 inch (13 mm) beyond the termination of the flashing system.
- H. Preparation of Wood/Plywood Flashing Substrates to receive Resin: Prime wood/plywood surfaces to receive the specified flashing system with the specified PMMA-based primer at the rate specified by the resin manufacturer and allow primer to cure. Tape the joints between plywood or wood panels using the specified tape and prior to application of the flashing system.

### 3.02 MIXING OF RESIN PRODUCTS

- A. Preparation/Mixing/Catalyzing Resin Products: Pour the desired quantity of resin into a clean container and using a spiral mixer or mixing paddle, stir the liquid for the time period specified by the resin manufacturer. Calculate the amount of catalyst powder needed using the manufacturer's guidelines and add the pre-measured catalyst to the resin component. Mix again for the time period specified by the resin manufacturer, ensuring that the product is free from swirls and bubbles. To avoid aeration, do not use a spiral mixer unless the spiral section of the mixer can be fully contained in the liquid during the mixing process. Mix only enough product to ensure that it can be applied before pot life expires.

### 3.03 PREPARATION PASTE AND PRIMER MIXING/APPLICATION

- A. Primer Application: Apply primer resin using a roller or brush at the rate specified by the primer manufacturer over qualified and prepared substrates. Apply primer resin at the increased rate specified by the primer manufacturer over DensDeck Prime or other porous substrates. Do not let resin pool or pond. Do not under-apply or over-apply primers as this may interfere with proper primer catalyzation. Make allowances for waste, including saturation of roller covers and application equipment.
- B. Paste Application: Apply catalyzed preparation paste using a trowel over prepared and primed substrates. Before application of any resin product over cured paste, wipe the surface of the paste using the specified cleaner/solvent and allow to dry. Treat the surface again if not followed up by resin application within 60 minutes.

### 3.04 FLASHING AND FIELD MEMBRANE APPLICATION

- A. Base Flashing Application
  - 1. Using masking tape, mask the perimeter of the area to receive the flashing system. Apply resin primer to substrates requiring additional preparation and allow primer to cure.
  - 2. Pre-cut fleece to ensure a proper fit at transitions and corners prior to membrane application.
  - 3. Apply an even, generous base coat of flashing resin to prepared surfaces using a roller at the rate specified by the resin manufacturer. Work the fleece into the wet, catalyzed resin using a brush or roller to fully embed the fleece in the resin and remove trapped air. Lap fleece layers a minimum of 2 inch (5 cm) and apply an additional coat of catalyzed resin between layers of overlapping fleece. Again using a roller, apply an even top coat of catalyzed resin immediately following embedment of the fleece at the

rate specified by the resin manufacturer, ensuring that the fleece is fully saturated. Ensure that the flashing resin is applied to extend beyond the fleece (maximum ¼-inch (6 mm)). Remove the tape before the catalyzed resin cures. Make allowances for waste, including saturation of roller covers and application equipment.

4. Should work be interrupted for more than 12 hours or the surface of the cured resin becomes dirty or contaminated by the elements, wipe the surface to be lapped with new flashing resin using the specified cleaner/solvent. Allow the surface to dry for a minimum 20 minutes and a maximum 60 minutes before continuing work.

#### B. Field Membrane Application

1. Using the specified cleaner/solvent, wipe flashing membrane surfaces to be lapped with field membrane. Allow the surface to dry for a minimum 20 minutes before continuing work.
2. Apply an even, generous base coat of field membrane resin to prepared surfaces using a roller at the rate specified by the resin manufacturer. Work the fleece into the wet, catalyzed resin using a brush or roller to fully embed the fleece in the resin and remove trapped air. Lap fleece layers a minimum of 2 inch (5 cm) and apply an additional coat of catalyzed resin between layers of overlapping fleece. Again using a roller, apply an even top coat of catalyzed resin immediately following embedment of the fleece at the rate specified by the resin manufacturer, ensuring that the fleece is fully saturated. Ensure that the flashing resin is applied to extend beyond the fleece (maximum ¼-inch (6 mm)). Make allowances for waste, including saturation of roller covers and application equipment. Allow 2 hours cure time prior to exposing the membrane to foot traffic.

### 3.05 WALKTREAD/SKID RESISTANT SURFACING

- A. Granule Anti-Skid Application: Mask the areas to receive the anti-skid system using masking tape. Apply an additional top coat of catalyzed roof resin at the rate specified by the resin manufacturer, immediately broadcast granules to refusal, and allow to cure. Remove tape before the resin cures. Apply a layer of catalyzed roof resin over granule surfaces. Allow 2 hours cure time prior to exposing the membrane to foot traffic.

### 3.06 FIELD QUALITY CONTROL AND INSPECTIONS

- A. Site Condition: Leave all areas around job site free of debris, roofing materials, equipment and related items after completion of job.
- B. Notification Of Completion: Notify the manufacturer by means of manufacturer's printed Notification of Completion form of job completion in order to schedule a final inspection date.
- C. Final Inspection
  1. Post-Installation Meeting: Hold a meeting at the completion of the project, attended by all parties that were present at the pre-job conference. A punch list of items required for completion shall be compiled by the Contractor and the manufacturer's representative. Complete, sign, and mail the punch list form to the manufacturer's headquarters.
- D. Issuance Of The Guarantee: Complete all post installation procedures and meet the manufacturer's final endorsement for issuance of the specified guarantee.

END OF SECTION



## SECTION 076000

### FLASHING AND SHEET METAL

#### 1. GENERAL:

1.1 Related Documents: The requirements of Division 1 are hereby made a part of this section as if fully repeated herein.

#### 1.2. SCOPE OF WORK:

1.2.1. Aluminum flashings. This section includes work for flashings at the low slope roof. Provide all labor, equipment, and materials fabricate and install the following:

- A. Edge strip and flashing.
- B. Fascia and trim.
- C. Counter and cap-flashings at walls and penetrations.
- D. Base flashing coverings.
- E. Gutters, and downspouts.
- F. Other components.

#### 1.2.2. RELATED SECTIONS

- A. Section 06 10 00 – Rough Carpentry
- B. Section 07 92 00 – Sealants and Caulk

#### 1.3. REFERENCES

ASTM B-209	Specification for aluminum sheet
ASTM B209	Aluminum and Alloy Sheet and Plate
FM	Loss Prevention Data Sheet
NRCA	National Roofing Contractors Association - Roofing Manual
SMACNA	Architectural Sheet Metal Manual

#### 1.4. SUBMITTALS

1.4.1. Submit under provisions of Division 1.

1.4.2. Product Data: Provide manufacturer's specification data sheets for each product.

1.4.3. Submit samples, 8' X 8" inch in size of materials used.

1.4.4. Shop Drawings

- A. For manufactured and shop fabricated gravel stops, fascia, scuppers, and all other sheet metal fabrications.
- B. Shop drawings: Indicate material profile, jointing pattern, jointing

details, fastening methods, flashing, termination's, and installation details.

C. Indicate type gauges and finishes of metal.

#### 1.4.5. Certification

A. Submit roof manufacturer's certification that metal fasteners furnished are acceptable to roof manufacturer.

B. Submit roof manufacturer's certification that metal furnished is acceptable to roofing manufacturer as a component of roofing system and is eligible for roof manufacturer's system warranty.

#### 1.4.6. Manufacturer's Product Data: Metal material characteristics and installation recommendations.

### 1.5. QUALITY CONTROL

#### 1.5.1. Reference Standards

A. Comply with details and recommendations of SMACNA Manual for workmanship, methods of joining, anchorage provision for expansion, etc.

#### 1.5.2. Manufacturer's Warranty

Pre-finished metal material shall require a written 20-year non-prorated warranty covering fading, chalking and film integrity. The material shall not show a color change greater than 5 NBS color units per ASTM D-2244 or chalking excess of 8 units per ASTM D-659. If either occurs material shall be replaced, **at no cost to the Owner.**

1.5.3 The roof membrane shall be inspected by the manufacturer's representative within one year of substantial completion. A report shall be provided to the Architect and Owner.

#### 1.5.4 Contractor's Warranty

The Contractor's warranty for sheet metal shall be included in the roofing warranty.

1.5.5 Wind Loads: All roof assemblies and roof systems shall meet the wind loading criteria listed in the structural drawings.

1.5.6 Class A Classification: All roofing materials shall be labeled as Class A per ASTM E108, and shall be certified by a nationally-recognized independent testing laboratory.



## 1.6. QUALIFICATIONS

Fabricator and Installer: Company specializing in sheet metal flashing work with 5 years experience.

## 1.7. DELIVERY, STORAGE, AND HANDLING

1.7.1. Deliver materials in manufacturer's original, unopened containers or packages with labels intact and legible.

1.7.2. Stack performed and prefinished material to prevent twisting, bending, or abrasion, and to provide ventilation. Slope metal sheets to ensure drainage.

1.7.3. Prevent contact with materials, which may cause discoloration or staining.

## 2. PRODUCTS

### 2.1. MATERIALS

2.1.1. Coping at head of parapet: Similar to Tremlock Coping by Tremco. Preformed aluminum with steel splice and anchor plates. Fastened directly to pressure treated blocking provided at wall cap.

A. Size shall be as required for concrete masonry block at parapet. 8" CMU block.

B. Provide pre-fabricated corners, end caps

C. Finish: Factory Pre-finished top and back with Kynar 500. Color to be selected from manufacturer standard colors

2.1.2. Roofing and gutters: Metal flashings and gutter/downspout system shall be fabricated from .040 aluminum (18 gauge). (ASTM B209, alloy 3003-H14.) Prefinished and mill finish are required.

A. All exposed metal flashings including wall coping, and drip edges shall be prefinished with 70% Kynar 500 coating finish (**color to be selected by architect**) at exposed areas. Provide clear mill finish at concealed areas.

### 2.2. RELATED MATERIALS

2.2.1. Plastic Cement: ASTM D 4586

2.2.2. Sealants for Flashing and Sheet metal:

a. Metal flashings and surfaces of building exterior.  
Refer to Section 07 92 00

b. Mastic Sealant for Metal flashings: Polyisobutylene, non-hardening, non-migrating sealant.

2.2.3. Fasteners:

- a. Corrosion resistant screw fasteners as recommended by metal manufacturer. Finish exposed fasteners same as flashing metal.
- b. Fastening shall conform to the code requirements as stated in the structural drawings
- c. Nails used for fastening gravel-stops and cleats to P.T./Fire Treated wood nailers shall be stainless steel.

#### 2.2.4. Termination Bars:

- a. Shall be aluminum unless otherwise recommended by membrane manufacturers.
- b. Material shall be .125" x 1" (minimum) aluminum conforming to ASTM B-221, mill finish. Bar shall have caulk cup as required.

#### 2.2.5. Gutter and Downspout Anchorage Devices: Minimum 20 Ga, 1" straps at 48" o.c. minimum. Downspouts shall be set 1" minimum away from wall surface.

### 3. EXECUTION

#### 3.1. PROTECTION

Protect contact areas of dissimilar metals with heavy asphalt or other approved coating specifically made to stop electrolytic action.

#### 3.2. GENERAL

- 3.2.1. Install work watertight, without waves, warps, buckles, fastening stress, or distortion, allowing for expansion and contraction.
- 3.2.2. Fastening of metal to walls and wood blocking shall comply with SMACNA Architectural Sheet Metal Manual, wind uplift specifications of the Florida Building Code and/or manufacturer's recommendations whichever is of the highest standard.
- 3.2.3. All accessories or other items essential to the completeness of sheet metal installation, whether specifically indicated or not, shall be provided and of the same material as item to which applied.
- 3.2.4. Metal fascia and soffits shall be secured to wood nailers at the bottom edge with a continuous cleat. Cleats shall be at least one gauge heavier than the metal it secures.

#### 3.3. INSPECTION

- 3.3.1. Verify roof openings, curbs, pipes, sleeves, ducts, or vents through roof are solidly set, cant strips and reglets are in place, and nailing strips

located.

3.3.2. Verify membrane termination and base flashings are in place, sealed, and secure.

3.3.3. Beginning of installation means acceptance of existing conditions.

3.3.4. Field measure site conditions prior to fabricating work.

#### 3.4. MANUFACTURED SHEET METAL SYSTEMS

3.4.1. Installing Contractor shall be responsible for determining if the sheet metal systems are in general conformance with roof manufacturer's recommendations.

3.4.2. Furnish and install manufactured sheet metal systems in strict accordance with manufacturer's printed instructions.

3.4.3. Provide all factory-fabricated accessories including, but not limited to, fascia extenders, miters, scuppers, joint covers, etc.

#### 3.5. SHOP FABRICATED SHEET METAL

3.5.1. Installing Contractor shall be responsible for determining if the sheet metal systems are in general conformance with roof manufacturer's recommendations. Refer to the Roofing Manufacturer's Technical Specification Manual for installation guidelines of specific items.

3.5.2. Metal work shall be shop fabricated to configurations and forms in accordance with recognized sheet metal practices.

3.5.3. Hem exposed edges.

3.5.4. Angle bottom edges of exposed vertical surfaces to form drip.

3.5.5. All corners for sheet metal shall be lapped with adjoining pieces fastened and set in sealant.

3.5.6. Joints for fascia system shall be formed with a 1/4" opening between sections. The opening shall be covered by a cover plate or backed by an internal drainage plate formed to the profile of fascia piece. The cover plate shall be embedded in mastic, fastened through the opening between the sections and loose locked to the drip edges.

3.5.7. Install sheet metal to comply with Architectural Sheet Metal manual, Sheet Metal and Air Conditioning Contractor's National Associations, Inc.

END OF SECTION



## SECTION 079200

### SEALANTS AND CAULKING

#### 1. GENERAL:

- 1.1 Related Documents: The requirements of Division 1 are hereby made a part of this section as if fully repeated herein.
- 1.2 Summary: It is the intent of this section to provide for the furnishing and installing of sealants and caulking as described herein as is necessary to provide a complete, water-tight building for a complete, finished appearance.
- 1.3 Related Work Specified Elsewhere:
  - 1.3.1 Section 076000, Flashing and Sheet Metal
- 1.4 Submittals:
  - 1.4.1 Samples:
    - 1.4.1.1 Submit one cartridge of each type and color sealant to be used.
    - 1.4.1.2 Submit three (3) pieces of backing material, minimum 6" long, of each size required.
  - 1.4.2 Product Data:
    - 1.4.2.1 Submit three (3) copies of product manufacturer's specifications, recommendations, and installation instructions for sealant, backing, and associated materials.
    - 1.4.2.2 Submit two (2) copies of manufacturer's color chart for sealant selection.
  - 1.4.3 Provide minimum three (3) copies of manufacturer's specification data sheets for each product specified.
- 1.5 Product Handling:
  - 1.5.1 Deliver materials in original, tightly sealed containers or unopened packages with manufacturer's name, label, product identification and lot numbers, where appropriate, intact.
  - 1.5.2 Store materials out of weather as recommended by manufacturer.
  - 1.5.3 Protect materials from damage before, during, and after installation.
- 1.6 Job Conditions:
  - 1.6.1 Environmental requirements:
    - 1.6.1.1 Apply only when temperatures shall be a minimum of 50° F. and when rain is not forecast for 24 hours.
    - 1.6.1.2 Observe manufacturer's recommendations for safe handling and ventilation.
  - 1.6.2 Protection:
    - 1.6.2.1 Adjacent Surfaces: Protect work of other trades from damage by sealant with masking tape or other means necessary.
    - 1.6.2.2 Damaged Work: Clean, repair, or replace damaged work, to include, but not limited to, work of other trades, at no additional cost.

- 1.7 Warranty:
  - 1.7.1 Provide manufacturer's written warranty of five- (5) year period against material failure.
  - 1.7.2 Provide a warranty for workmanship against leakage for two- (2) year period.

## 2. PRODUCTS:

- 2.1 Sealants:
  - 2.1.1 Exterior Joints: (metal flashings to exterior building surface, masonry joints, windows, trim, etc.) :**Sikaflex -2cNS** 2-component, premium grade, polyurethane-based elastomeric sealant.
  - 2.1.2 Expansion Joints on the exterior and interior side of CMU walls: **Sikaflex - 2cNS** 2-component, premium grade, polyurethane-based elastomeric sealant
  - 2.1.3 Floor Slab/CMU wall joint: Preformed expansion joint filler with **Sikaflex - 2cNS** 2-component, premium grade, polyurethane-based elastomeric sealant
- 2.2 Backer Rod:
  - 2.2.1 Material: Open cell compressible, resilient, non-waxing, polyurethane foam compatible with sealant.
  - 2.2.2 Size and Shape: Variable to control depth of sealant and provide 20% to 50% compression upon insertion.
- 2.2 Primer: Non-staining type approved by sealant manufacturer.
- 2.3 Bond Breaker: Pressure sensitive adhesive polyethylene tape approved by sealant manufacturer.
- 2.4 Masking Tape: Pressure sensitive adhesive paper tape.
- 2.6 Joint Cleaner: Xylol or product recommended by sealant manufacturer.

## 3. EXECUTION:

- 3.1 Inspection:
  - 3.1.1 Examine surfaces to be caulked to assure that they are sound, smooth, clean, dry, and free of visible contamination, suitable and ready for sealant application.
  - 3.1.2 Assure that surfaces requiring curing have been properly cured and ready for sealant application.
  - 3.1.3 Do not start work until surface conditions to be caulked are satisfactory and defects have been corrected.
- 3.2 Preparation:
  - 3.2.1 Cleaning: Clean joint surfaces, using joint cleaner as necessary, to be free of dust, dirt, oil, grease, rust, lacquers, moisture, or other contaminants and matter which may adversely affect proper adhesion of sealant.
  - 3.2.2 Masking: Mask area adjacent to joints.
  - 3.2.3 Primer: After cleaning joints, apply primer, only as recommended by

- sealant manufacturer, to dry surfaces.
- 3.2.4 Joint Backer: Where joint depth exceeds required depth of sealant, install joint backing to provide backing and uniform depth of sealant.
- 3.2.5 Bond Breaker: Where joint backing is not required or cannot be installed, install bond breaker tape smoothly at back of joint.
- 3.3 Installation / Application:
  - 3.3.1 Sealant Application:
    - 3.3.1.1 Apply sealant in accordance with manufacture's application instructions.
    - 3.3.1.2 Use hand guns or air-pressure equipment, with proper nozzle size, with sufficient pressure to drive and force sealant into and completely fill joints.
  - 3.3.2 Tooling:
    - 3.3.2.1 Tool joints to form smooth, uniform beads with slightly concave surfaces.
    - 3.3.2.2 Finish joints to be straight, uniform, smooth, and neatly finished.
- 3.4 Cleaning:
  - 3.4.1 Clean off excess compound or smears with cleaning agent recommended by sealant manufacturer.
  - 3.4.2 Take care not to damage adjacent work with cleaning agent, to include but not limited to, defacing or marring finished surfaces.
  - 3.4.3 Protect finished sealant work as required to prevent damage until acceptance of work.

**END OF SECTION**





SECTION 08 11 16  
FLUSH ALUMINUM DOOR FRAMES  
WITH FRP DOORS

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Aluminum Door Frames.
- B. FRP Doors
- C. Finish Hardware

1.2 RELATED SECTIONS

- A. Section - Unit Masonry
- B. Section 06 10 00 - Rough Carpentry.
- C. Section 07 90 20 – Sealants and Caulk.
- D. Section 09 90 00 - Painting and Coating.

1.3 REFERENCES

- A. AAMA 605.2 - Guide Specification for High Performance Finishes
- B. AAMA 609 - Anodized Architectural Finishes Cleaning and Maintenance.
- C. AAMA 611 - Anodized Architectural Standards.
- D. AAMA 701 - Pile Weather Strip.
- E. ASTM B209 - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate.
- F. ASRM B 221 - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes.
- G. ASTM C 365 - Standard Test Method for Flatwise Compressive Properties of Sandwich Cores
- H. ASTM E 330 - Structural Performance of Exterior Doors.
- I. ASTM E 1996 - Standard Specification for Performance of Exterior Windows, Curtain Walls, Doors, and Impact Protective Systems Impacted by Windborne Debris in Hurricanes.

1.4 TESTING AND PERFORMANCE REQUIREMENTS

- A. Structural Test Unit: Minimum size of 3-feet (91.44 cm) by 7-feet (213.36 cm) with 24-inch (60.96 cm) by 34-inch (86.36 cm) vision light shall be evaluated compliant with ASTM E 330 testing method.
- B. Test Procedures and Performances:

1. With door closed and locked, test unit in accordance with ASTM E 330 at static air pressure difference of 90.0 pounds per square foot (3.35 kPa) positive pressure and 90.0 pounds per square foot negative pressure.
2. At conclusion of test there shall be no glass breakage, permanent damage to fasteners, hardware parts, support arms or actuating mechanism, nor any other damage that would cause the door to be inoperable.
3. Provide Florida Product Approval Declaration per manufacturer:
  - a. CORRIM Company (Design Basis): FL14311.R2
  - b. CLINE Aluminum Doors: 200BE FL6336
  - c. Or Approved Equal

## 1.5 SUBMITTALS

- A. Submit under provisions of Section 01 30 00 - Administrative Requirements.
- B. Product Data: Manufacturer's data sheets on each product to be used, including:
  1. Preparation instructions and recommendations.
  2. Storage and handling requirements and recommendations.
  3. Installation methods.
  4. Operation and maintenance data.
- C. Shop Drawings: Indicate the following:
  1. Elevations and details of each door and frame type.
  2. Schedule of doors and frames.
  3. Conditions at openings with various wall thicknesses and materials.
  4. Location and installation requirements for hardware.
  5. Thicknesses of materials, joints.
  6. Connections and trim.
- D. Selection Samples: For each finish product specified, two complete sets of color chips representing manufacturer's full range of available colors and patterns.
- E. Verification Samples: For each finish product specified, two samples, minimum size 6 inches (150 mm) by 6 inches (150 mm), representing actual product, color, and finish. Where color or texture variations are anticipated for anodized finishes, include two or more units in each set of samples indicating extreme limits of variations.
- F. Manufacturer's Certificates: Certify products meet or exceed specified requirements.
- G. Closeout Submittals: Provide manufacturer's maintenance instructions that include recommendations for periodic checking and adjustment and periodic cleaning and maintenance of all components.

## 1.6 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Company specializing in manufacturing aluminum door and frame systems of the type required for this project, with minimum ten continuous years documented experience.
- B. Product Qualifications: Wind-Load test certification conforming to ASTM E 330 on samples of previous products shall be provided for the type of door to be used.
- C. Installer Qualifications: Company specializing in installation aluminum door and frame systems of the type required for this project, with minimum five continuous years documented experience.

## 1.7 DELIVERY, STORAGE, AND HANDLING

- A. Deliver doors and frames palletted, wrapped, or individually crated. Doors shall be side protected with surrounding grooved 2-inch (50.8 mm) by 4-inch (101.6 mm) wood frame and covered with 275-pound (124.74 kg) test corrugated cardboard.
- B. Inspect delivered doors and frames for damage; unload and store with minimum handling. Repair minor damage if refinished items are equal in all respects to new work; otherwise, remove damaged items and replace with new.
- C. Store products under cover in manufacturer's unopened packaging with labels intact until installation.
  - 1. Place units on minimum 4 inch (101.6 mm) wood blocking.
  - 2. Do not use non-vented plastic or canvas covers.
  - 3. Remove packaging immediately if packaging becomes wet.
  - 4. Provide 0.25 inch (6.35 mm) air spaces between stacked doors.
- D. Protect materials and finish from damage during handling and installation.

## 1.8 SEQUENCING

- A. Ensure that templates and other information required for installation of products of this section are furnished to affected trades in time to prevent interruption of construction progress.

## 1.9 PROJECT CONDITIONS

- A. Maintain environmental conditions (temperature, humidity, and ventilation) within limits recommended by manufacturer for optimum results. Do not install products under environmental conditions outside manufacturer's absolute limits.
- B. Verify actual openings by field measurements before fabrication; show recorded measurements on shop drawings.
- C. Coordinate field measurements and fabrication schedule with construction progress to avoid construction delays.

## 1.10 WARRANTY

- A. Provide manufacturer's ten year warranty against defects in workmanship and materials, including warping, rotting, decaying or bowing.
- B. Installer: Warrant installation procedures and performance for five years against defect due to workmanship and materials handling.

## PART 2 PRODUCTS

### 2.1 MANUFACTURERS

- A. Acceptable Manufacturer(s):

CORRIM Company; 1870 Stillman Drive, Oshkosh, WI 54901-1010 (Design Basis)

CLINE Aluminum Doors, Inc.

112 – 32nd Avenue West, Bradenton, Florida 34205-8907  
Telephone: (800) 648-6736, (941) 746-4104; Fax: (941) 746-5153  
Website: [www.clinedoors.com](http://www.clinedoors.com), Email: [inquire@clinedoors.com](mailto:inquire@clinedoors.com)  
Model: Series 200BE

- B. Substitutions: As accepted by Owner.

## 2.2 Fiberglass Reinforced Polyester System (FRP) Door

- A. Aluminum Members: Alloy and temper recommended by manufacturer for strength, corrosion resistance, and application of required finish.
- B. FRP Door Composite Components: Minimum 3-ply composite laminated construction to include:
- C. FRP Doors: CORRIM Company
1. FRP Skin Minimum Thickness: 0.12" thick
  2. Rating: NONE
  3. Door Series: Florida Product Approval FL14311.R2
    - a. Approved by independent third party 12/17/2017, expires 12/31/2025
  4. Class 'C' Exterior skin
  5. Frame: 6063-T6 Hardened Aluminum Alloy, Fire Rated
  6. Core: Mineral
  7. Assembly Type: 3 (rim/panic device)
  8. Design Pressure: +/- 70psf
    - a. Hardware: Provide Electro-lynx Cable system to Junction Box
    - b. Electric Trim Exit Device: ED5600 PR9M9905-M92-630
    - c. Pull-Trim: L910ET (Corbin Russwin)
    - d. Closer: DC8210 A3 689 Finish (Corbin Russwin)
    - e. Hinges: Electric Transfer Hinge: T4A3386 4.5x4.5 QC12 630
    - f. Threshold: 2005 AT 36"
    - g. Rain Drip: 345 ANB 36"
    - h. Power Supply: Provide Altronix E-FLOW-4N and Altronix LINQ2 Altronix ACM4CB and Altronix BT-12-6 (Qty 2)
    - i. Door Position Switch: DPS-M-GY (Magnetic switch recessed in door and door frame.)
    - j. Door Perimeter Wiring Harness: QC-C006
    - k. Cylinder: Medeco Cylinder core by owner  
Contractor to provide construction core
    - l. *Reference JEA Typical Security Wiring Diagram ST-1E for additional requirements (attached at end of this specification section).*
  9. Max Opening Width: 36"
  10. Max Opening Height: 84"
  11. Finish: Factory Primed and painted. Color as selected by architect.
  12. Lites: (UL-20-90 RATED) 100 square inch maximum visibility.
    - a. #110 Stainless Steel frame
    - b. 1/4" Wirelite NT Glass w/ 3/8" Exterior Lexan overlay - Glass and Glazing by CORRIM Company or approved substitution.
  13. Allowable Design Pressures: +/- 70PSF
  14. Follow manufacturers anchorage details for approved substrate
- D. Aluminum Frames:
1. Frame Components: Extruded channel 6063-T5 aluminum alloy, minimum wall thickness 0.125-inch; cut corners square and joinery shall be mechanical with no exposed fasteners.
  2. Profile: Open back with applied stop (OBS), 1.75" x 6" or 1.75" x 5"
  3. Hinge and Strike Mounting Plates: Aluminum alloy bar stock, 0.1875 inch thick mounted in a concealed integral channel with no exposed fasteners.
  4. Replaceable weather-stripping" MA1538 EPDM weather-seal gasket, polypropylene pile at head and jambs.
  5. Door Stop: No screw-on stops acceptable.

6. Frame Finish: Shall be anodized with Class II mechanical finish to match door.
  - E. Aluminum Members: Provide alloy and temper recommended by manufacturer for strength, corrosion resistance, and application of required finish.
- 2.3 FINISH
- A. Finish: Factory primed with high performance Organic Coating: Kynar/Polyvinylidene Fluoride (PVDF) (AAMA 605.2).
    1. Color: Custom color matching Architect's sample.
- 2.4 ACCESSORIES
- A. Fasteners: Aluminum, nonmagnetic stainless steel, or other material warranted by manufacturer as non-corrosive and compatible with aluminum components. Do not use exposed fasteners.
  - B. Brackets and Reinforcements: Manufacturer's high-strength aluminum units where feasible, otherwise, nonferrous stainless steel.
  - C. Bituminous Coating: Cold-applied asphaltic mastic, compounded for 30-mil (0.76 mm) thickness per coat.
- 2.5 FABRICATION
- A. FRP Flush Door: Fabricate Doors of the type, size and design indicated on the Drawings.
    1. Door Size: Sizes are nominal; provide standard clearances as follows:
      - a. Hinge and Lock Stiles: 0.125-inch (3.18 mm).
      - b. Between Meeting Stiles: 0.25-inch (6.35 mm).
      - c. At Top Rails: 0.125-inch (3.18 mm).
      - d. Between Door Bottom and Threshold: 0.125-inch (3.18 mm).
  - B. Aluminum Frames: Fabricate doors frames of the type, size and design indicated
    1. Corners shall be cut square.
    2. Reinforce and secure mechanically.
    3. No exposed fasteners.

## PART 3 EXECUTION

### 3.1 EXAMINATION

- A. Do not begin installation until substrates have been properly prepared.
- B. Verify that wall surfaces and openings are ready to receive frames and are within tolerances specified in manufacturer's instructions.
- C. If preparation is the responsibility of another installer, notify Architect of unsatisfactory preparation before proceeding.

### 3.2 PREPARATION

- A. Clean surfaces thoroughly prior to installation.
- B. Prepare surfaces using the methods recommended by the manufacturer for achieving the best result for the substrate under the project conditions.

### 3.3 INSTALLATION

- A. Install frames in accordance with manufacturer's instructions and approved shop drawings; set frames plumb, square, level, and aligned to receive doors.
- B. Anchor frames to adjacent construction within tolerances specified in manufacturer's instructions.
- C. Seal metal-to-metal joints between framing members using good quality elastomeric sealant.
- D. Where aluminum surfaces contact with metals other than stainless steel, zinc or small areas of white bronze, protect from direct contact by one or more of the following methods.
  - 1. Paint dissimilar metal with one coat of heavy-bodied bituminous paint.
  - 2. Apply good quality elastomeric sealant between aluminum and dissimilar metal.
  - 3. Paint dissimilar metal with one coat of primer and one coat of paint recommended for aluminum surface applications.
  - 4. Use non-absorptive tape or gasket in permanently dry locations.
- E. Install doors in accordance with manufacturer's instructions and approved shop drawings.
- F. Hang doors with required clearances as follows:
  - 1. Hinge and Lock Stiles: 0.125 inch (3.18 mm).
  - 2. Between Meeting Stiles: 0.250 inch (6.35 mm).
  - 3. At Top Rails: 0.125 inch (3.18 mm).
  - 4. Between Door Bottom and Threshold: 0.125 inch (3.18 mm).
- G. Adjust doors and hardware to operate properly.
- H. Install glazing in glazing frames.
- I. Installation of door hardware is specified in Section 08 71 00 - Door Hardware.

### 3.4 CLEANING

- A. Upon completion of installation, thoroughly clean door and frame surfaces in accordance with AAMA 609.
- B. Do not use abrasive, caustic or acid cleaning agents.

### 3.5 PROTECTION

- A. Protect installed products until completion of project.
- B. Touch-up, repair or replace damaged products before Substantial Completion.

END OF SECTION







SECTION 083323  
OVERHEAD COILING DOORS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes: **[Manually]** operated overhead coiling doors, operators, controls and accessories.

B. Related Sections:

1. Division 5 Sections: Miscellaneous Metals for steel supports.
2. Division 8 Sections: Hardware, Locks, Access Panels.
3. Division 9 Sections: Finish Painting, Field Painting.

1.2 REFERENCES

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

B. American Society for Testing and Materials (ASTM):

1. ASTM A 653/A 653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.

1.3 PERFORMANCE REQUIREMENTS

A. Structural Performance:

1. Wind Loads: Uniform pressure of: **+/- 40 p.s.f. Design Load**

1.4 SUBMITTALS

A. General: Submit listed submittals in accordance with Conditions of the Contract and Division 1 Submittal Procedures Section.

B. Product Data: Submit manufacturer's product data and installation instructions.

C. Shop Drawings: Provide drawings indicating guide details, head and jamb conditions, clearances, anchorage, accessories, finish colors, patterns and textures, operator mounts and other related information.

D. Quality Assurance Submittals: Submit the following:

1. Certificates: Submit manufacturer's certificate that products meet or exceed specified requirements.
2. Certificates: Submit installer qualifications.

E. Closeout Submittals: Submit the following:

1. Warranty documents available at [www.raynor.com](http://www.raynor.com) or your authorized Raynor dealer.

## 1.5 QUALITY ASSURANCE

A. Installer Qualifications: Utilize an installer having demonstrated experience on projects of similar size and complexity, and trained and authorized by the door dealer to perform the work of this section.

C. Preinstallation Meetings: Verify project requirements, substrate conditions, manufacturer's installation instructions and manufacturer's warranty requirements. Comply with Division 1 Project Management and Coordination (Project Meetings) Section.

## 1.6 DELIVERY, STORAGE & HANDLING

A. General: Comply with Division 1 Product Requirements.

B. Comply with manufacturer's ordering instructions and lead time requirements to avoid construction delays.

C. Delivery: Deliver materials in manufacturer's original, unopened, undamaged containers with identification labels intact.

D. Storage and Protection: Store materials protected from exposure to harmful environmental conditions and at temperature and humidity conditions recommended by the manufacturer.

## 1.7 WARRANTY

A. Project Warranty: Refer to Conditions of the Contract for project warranty provisions.

B. Manufacturer's Warranty: Submit, for Owner's acceptance, manufacturer's standard warranty document executed by authorized company official. Manufacturer's warranty is in addition to, and not a limitation of, other rights Owner may have under contract documents.

## 1.8 MAINTENANCE

A. Maintenance Service: Submit for Owner's consideration and acceptance maintenance service agreement for products installed.

## PART 2 - PRODUCTS

### 2.1 MANUFACTURER

A. Manufacturer: Raynor Door.

1. Contact: P.O. Box 448, 1101 East River Road, Dixon, IL 61021-0448;  
Telephone: (800) 472-9667, (815) 288-1431; Fax: (815) 288-7142; E-mail:  
thegarage@raynor.com; website: www.raynor.com.

B. Manufacturer Product Designation: **DuraCOIL - Model FF**  
**Standard Flat Slat 20 Ga**

### 2.2 DOOR OPERATORS

A. Provide doors designed for **hand chain** operation.  
of the door (side with counterbalance or hood exposed).

### 2.3 CURTAIN

A. Material: Interlocking steel slats, 20 gauge Steel

1. Slat Type: [Standard Flat Slat]
  - a. Insulation: Polyurethane with R-value 8.0.
  - b. Back Covers: Steel, 20 gauge, #4 finish

B. Mounting: [**Face Mounting: fasten to face of wall on each side of door opening**]

C. Color and Finish: (Standard White, Gray, or Tan)

- a. Rail to be standard Gray.

D. Endlocks: Lateral movement of the slats to be contained by means of zinc-plated malleable endlocks fastened with two zinc-plated steel rivets.

E. Bottom Bar and Seal: Two roll-formed galvanized steel angles, minimum 1-1/2 inches by 1-1/2 inches by 1/8 inch (38.1 mm x 38.1 mm x 3.2 mm) with single-contact type bottom astragal. Structural angle bottom bar to receive one coat of rust-inhibitive primer.

### 2.4 GUIDES

A. Guide Assemblies: To consist of three structural steel angles, minimum 3 inches by 2 inches by 3/16 inch (76 mm by 51 mm by 4.8 mm) and fitted with removable curtain stops. Steel guides to be provided with one coat of rust-inhibitive primer.

B. Jamb Construction: **Masonry Jambs with anchor bolt fasteners.**

C. Weather Seal: **Snap-on vinyl seal.**

## 2.5 COUNTERBALANCE SYSTEM

A. Headplates: **18-30** 3/16 inch (4.8 mm) steel plate, attached to wall angle of guide assembly with 1/2 inch (12.7 mm) diameter class 5 case hardened bolts. Inside of drive bracket fitted with sealed ball bearing. Provide head plates with one coat of rust-inhibitive primer

B. Barrel: Minimum 4-1/2 inches (114.3 mm) O.D. and 0.120 inch (3.1 mm) wall thickness structural steel pipe. Deflection of pipe under full load shall not exceed 0.03 inch (0.8 mm) per foot of span.

C. Counterbalance: Provide torsion counterbalance mechanism as follows: [**Torsion Spring: Oil-tempered, helical torsion springs, grease packed and mounted on a continuous steel torsion shaft**

## 2.6 ENCLOSURES

A. Hood: **Round Hood: 22 gauge stainless steel, #4 finish to match curtain.**

B. Hood Baffle: **With EPDM rubber seal to inhibit air infiltration through hood cavity.**

## 2.7 HARDWARE

A. Locks: Furnish door system with: **Locking Bar, to receive padlock provided by owner, for use with hand chain, and hand crank operated doors.**

## PART 3 - EXECUTION

### 3.1 MANUFACTURER'S INSTRUCTIONS

A. Comply with instructions and recommendations of door manufacturer.

### 3.2 ACCEPTABLE INSTALLERS

A. Installer shall have a minimum of 5 years experience and approved to install Raynor Doors and systems.

### 3.3 EXAMINATION

A. Site Verification of Conditions: Verify through direct observation and field measurement that site conditions are acceptable for installation of doors, operators, controls and accessories. Ensure that openings square, flush and plumb.

B. Do not proceed with installation of doors, and accessories until unacceptable conditions are corrected.

### 3.4 INSTALLATION

A. General: Install door, guide and operating equipment complete with all necessary accessories and hardware according to shop drawings, manufacturer's instructions.

B. Site Tolerances: **1/8" out of plumb maximum**

C. Related Products Installation: Refer to Related Sections paragraph for related products installation.

### 3.6 ADJUSTING

A. General: Lubricate bearings and sliding parts, and adjust doors for proper operation, balance, clearance and similar requirements.

### 3.7 CLEANING

A. Remove temporary coverings and protection of adjacent work areas. Repair or replace installed products damaged prior to or during installation.

B. Clean installed products in accordance with manufacturer's instructions prior to Owner's acceptance. Remove and legally dispose of construction debris from project site.

END OF SECTION



## **SECTION 09 90 00**

### **PAINTING**

#### **PART 1 - GENERAL**

##### **1.1 - SUMMARY**

- A. Section Includes: Preparation of surfaces, shop painting of items furnished, field painting of new and existing structures, piping, and equipment and masonry waterproofing.

##### **1.2 - REFERENCES**

- A. Codes and standards referred to in this Section are:

1. SSPC SP 1 - Solvent Cleaning
2. SSPC SP 3 - Power Tool Cleaning
3. ICRI - International Concrete Repair Institute

##### **1.3 - SUBMITTALS**

- A. Provide all submittals, including the following, as specified in the General Conditions.

1. Submit shop drawings per the General Conditions.
2. Submit manufacturer's standard color chart for color selection.
3. Where equipment is customarily shipped with a standard finish, submit samples of the proposed color and finish for approval prior to shipping.
4. Furnish affidavits from the manufacturer certifying that materials furnished conform to the requirements specified and that paint products have been checked for compatibility.
5. Submit a supplementary schedule of paint products with mil thickness and solids by volume, including all paint applied in the shop and in the field. Provide a schedule that is in accordance with the recommendations of the paint manufacturer.

##### **1.4 - PAINTING REQUIREMENTS**

- A. Shop Primed and Field Painted Items: Furnish the following items shop primed and field painted: structural steel and wrought metals, steel joists and joist girders, hangers and supports, steel lintels, doors and frames.
- B. Field Primed and Finished Items: Field prime and finish, where exposed to view, all items not shop primed or shop finished. This Work generally includes, but is not limited to, the following: interior concrete block, interior concrete walls, columns, beams and ceilings, covering over insulation on piping, electrical conduit systems, small piping and copper tubing, and any other additional items indicated on the drawings.
- C. Unpainted Items: Do not paint the following items, unless otherwise specified: Exterior exposed concrete block and cast in place concrete, interior structural steel not exposed to view, registers, grilles, name and identification plates and tags, stainless steel, wood, spray-on fireproofing, steel to receive spray-on fireproofing, surfaces to receive field welding, steel to be embedded or in contact with cast-in-place concrete, and anodized aluminum work.

##### **1.5 - DELIVERY, STORAGE AND HANDLING**

- A. General: Deliver, store, and handle all products and materials as specified in the General Conditions and as specified herein.

- B. Delivery and Storage: Only those coatings that are intended for use on this project shall be stored at the project site.
- C. Packaging and Labeling: Prepare, pack and label paints, stains, varnish or ingredients of paints to be used on the job. Deliver all material to the site in original, unbroken containers.
- D. Storage: Store the painting materials at the site in accordance with applicable codes and regulations and in accordance with manufacturer's instructions. Keep the storage space clean at all times. Take every precaution to eliminate fire hazards.
- E. Colors: Prime coats shall be tinted to easily differentiate between coats. Final coats shall be colors as selected by OWNER.

## **PART 2 - PRODUCT**

### **2.1 - MANUFACTURERS**

- A. Acceptable manufacturer – Tnemec Company, Inc.

### **2.2 - MATERIALS**

- A. General: Furnish paint and other materials of the type and quality of the manufacturer on which the painting schedule specified herein is based.
  - 1. Provide compatible shop and field coats.
  - 2. Provide all coats of paint for any particular surface from the same manufacturer.
  - 3. Provide paint of approved color as selected from the manufacturer's standard range of colors.

### **2.3 - PAINT SCHEDULE (NOTE: NOT ALL SCHEDULE LISTINGS MAY BE APPLICABLE)**

#### **A. Ferrous Metals**

- 1. Abrasive blast to a minimum SSPC SP 6 Commercial Grade Finish. Apply coatings before any rust bloom forms.
- 2. Primer: Apply one (1) coat of Tnemec Series 1 Omnithane modified aromatic polyurethane primer at 2.5 – 4.0 mils DFT.
- 3. Intermediate Coat: Apply one (1) coat of Tnemec Series 27WB Typoxy inorganic Hybrid water-based epoxy coating at 4.0 – 6.0 mils DFT.
- 4. Finish Coat: Apply one (1) coat of Tnemec Series 740 Endura-Shield hybrid

#### **B. Concrete Block and Structural Concrete - Interior**

- 1. Surface preparation:
  - a. Remove all chalk, dirt, dust, loose cementitious coatings, mold, mildew, and other soluble contaminants by high pressure water blast cleaning (minimum 1500 p.s.i. using potable water). A cleaning detergent such as Trisodium Phosphate may be utilized to facilitate cleaning.
  - b. The areas of efflorescence may require a soft brush to help remove.
  - c. All surfaces must be clean and dry prior to the application of any coatings.
  - d. Abrade existing coatings before proceeding.
- 2. Masonry Filler - Tnemec Series 54 apply (60-80sf per gallon). Apply with ¾" - 2" nap roller.
- 3. Finish Coat: Apply two (2) coats of Tnemec Series 114 H.B.Tneme-Tufcoat waterborne acrylic epoxy at 4.0-6.0 mils DFT. NOTE: Owner may require a "satin"



finish. If a "satin" finish is required use Tnemec Series 113 at the same film thickness and number of coats.

**C. Building Interior - Concrete Floor**

**1. Surface preparation:**

- a. Allow new concrete to cure a minimum 28 days at 75°F. Power wash to remove laitance and any loose materials, dirt and containments.
- b. Acid-etch or mechanically abrade concrete to remove laitance and create a profile. If acid etching, no contaminants such as form release agents, curing compounds, sealers, hardeners, old coatings or other contaminants shall be present as they impede the acid's ability to properly etch and profile the floor.
- c. If any of these conditions exist then a mechanical means, such as sweep abrasive blasting or mechanical abrading, will be required to remove the above.
- d. Large voids or other cavities should be filled with a recommended filler or surfacer. Reference SSPC-SP13/NACE 6 with an ICRI CSP1-3.
- e. Verify dryness by testing for moisture with a "plastic film tape-down test" (ASTM D4263).
- f. All surfaces must be clean and dry prior to the application of any coatings.

**2. First Coat:** Apply Tnemec Series 287 Enviro-Pox @ 1.0-4.0 mils DFT

**3. Finish Coat:** Apply Tnemec Series 290 CRU @ 2.0-3.0 mils DFT..

**D. Aluminum in contact with incompatible materials**

**1. Surface preparation:**

- a. Roughen the surface to be coated.

**2. Coating system**

- a. Apply two (2) coats of Tnemec Series 46-465 Tneme-Tar at a minimum 10.0 mils DFT/coat.

**PART 3 - EXECUTION**

**3.1 - PREPARATION**

**A. Inspection:** Prior to surface preparation perform the following:

1. Verify that surface substrate conditions are ready to receive Work as instructed by the product manufacturer.
2. Examine specifications for all Work and become thoroughly familiar with all provisions regarding painting.

**B. Surface Preparation:** After inspection and prior to painting, perform the following:

1. Inspect all Work prior to application of any paint or finishing material.
2. Prepare the surface to be painted in accordance with the instructions of the manufacturer and as approved.
3. Brush and wash concrete surfaces and concrete masonry. Remove all loose dirt, free lime, form oil, curing compounds and other foreign matter by approved methods. Patch concrete surfaces requiring repair and spackle and repair surfaces to receive paint. Acid etch concrete surfaces to be painted as recommended by

the manufacturer of the coating to be applied, to produce a slightly granular surface required for adherence of the paint to the concrete unless otherwise indicated. Note ICRI guidelines. Determine that concrete and concrete masonry is thoroughly dry prior to painting.

4. Thoroughly clean surfaces to be given protective coatings.
5. Refinish shop-coated equipment that has scratches and abrasions.
6. Do not begin field painting prior to approval of the surface preparation.
7. Thoroughly clean wood surfaces to remove all foreign matter. Properly fill and smooth cracks and nail holes. Finish exposed wood with sandpaper to a fine finish and wipe clean of dust.
8. Prepare and clean all surfaces prior to painting, as specified and required. Verify that surfaces are dry before any paint is applied. Perform special surface preparation work as directed by the manufacturer of the paint specified to be applied to the surface. Follow dew point limitations
9. Clean the surface of structural steel and steel encased in concrete, masonry or spray-on fireproofing by removing all rust, mill scale, oil, grease or dirt in accordance with Steel Structures Painting Council SSPC-SP6.
10. Prior to coating interior surfaces and steel components, grind smooth all welds, beads, blisters or protuberances, other than identification markings and remove other imperfections. Remove all rust, mill scale, oil, grease and dirt by sandblasting in accordance with Steel Structures Painting Council Near White SSPC-SP-10 unless otherwise indicated. Follow manufactures requirements for required blast profile.
11. Prior to painting metals other than steel, grind smooth all welds, beads, blisters of protuberances, other than identification markings, and remove other imperfections. Solvent clean all nonferrous metals, galvanized steel and stainless steel whether shop primed or field primed, in accordance with SSPC-SP-1 prior to the application of the primer.
12. Prime cleaned metal the same day immediately after sandblasting to prevent rusting.

### 3.2 - INSTALLATION

A. General: Install all painting and coatings in accordance with the manufacturer's recommendations and approved shop drawings and as specified in Division 1.

1. Apply products in accordance with the latest edition of AWWA D102 and the manufacturer's instructions.
2. Refer to manufacturers literature for minimum application temperatures.
3. Paint or finish all surfaces that are left unfinished by the requirements of other specifications and specified herein to be painted or finished.
4. Paint surfaces in accordance with the material painting schedule included in this Section.
5. Completely cover all surfaces to be painted. Cover by additional coats when color on undercoats shows through the final coat of paint, until paint is of uniform color and appearance and coverage is complete.
6. Do not apply exterior coatings during rain or snow, or when relative humidity is outside the humidity ranges required by the paint product manufacturer.

7. Provide sufficient temporary ventilation during painting operations in enclosed areas to remove moisture and solvents, and to keep the atmosphere safe from harmful or dangerous fumes and dust levels for personnel.
- B. Touch-Up Shop-Primed and Finished Items: Touch-up all damaged portions and imperfections in shop-primed and finished items. Use the same paint as used for the shop prime and finish. Prepare the surface prior to touch-up by wire brushing and sanding to remove rust, scale and loose paint.
- C. Aluminum and Incompatible Surfaces: Where aluminum surfaces come in contact with incompatible metals, lime, mortar, concrete or other masonry materials, apply one field coat of Tnemec Series 66HS Hi-Build Epoxoline.
- D. Field Painting: Perform field painting at the job site as follows:
1. Mix all paints and similar materials in galvanized iron pans or pails or other approved containers of adequate capacity.
  2. Mix all paint thoroughly before being taken from the containers. Keep mixed while painting. Apply all ready-mixed paint exactly as received from the manufacturer without addition of any kind of drier or thinner, except as specified, to mix colors to conform to approved color schedule. Tint successive coats of paint to make various coats easily distinguishable. Tint undercoats of paint to the approximate shade of the final coat of paint.
  3. Use only skilled painters on the Work, and employ specialists where required. Apply paint by brush, roller or sprayer in accordance with the manufacturer's recommendation.
  4. Paint top and bottom edges of doors. Thoroughly and uniformly sand undercoats on hollow metal Work with No. 00 sandpaper or equal abrasive to remove all surface defects and provide a smooth, even surface. Do not allow brush marks or other irregularities on finished surfaces.
  5. Perform painting as a continuous and orderly operation to facilitate adequate inspection. Prime coat and paint materials subject to weathering or corrosion before erection. Perform all paint application methods in accordance with the instructions of the paint manufacturer and as approved. Do not field paint equipment, such as electrical control cabinets, motors, unit heaters and similar items which are shipped with a final baked enamel finish and having received prior approval unless the finish is damaged in transit or installation. Paint access panels, pipe, pipe covering, ducts and other building appurtenances built into adjoining walls the same color as adjacent walls, unless color coding applies. Remove or protect hardware and accessories, fixtures and similar items placed prior to painting during painting and replace them upon completion of painting.
  6. Paint all wall surfaces which will be concealed by equipment before equipment installation.
  7. Fully protect areas under and adjacent to painted Work at all times and promptly remove dripped or spattered paint.
  8. Repair, refinish and repaint any adjacent surfaces that have been damaged or discolored by overspray.
  9. Do not paint when the air or surface temperature is below that recommended by the manufacturer, or in dust-laden air, or until moisture on the surface has completely disappeared. If necessary, provide sufficient heating and ventilation to keep the atmosphere and all surfaces to be painted dry and warm until each coat of paint has hardened.

10. Remove any painting found defective. Touch-up and provide remedial painting as directed and as required until completion and acceptance of final Work.

### 3.3 - CLEANING AND PAINTING

- A. Touch up and restore any finish damaged. Remove paint or other finishes spilled, splashed or splattered from all surfaces taking care not to mar any surface or item being cleaned.

END OF SECTION

## SECTION 26 05 19

### LOW-VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES

#### PART 1 - GENERAL

##### 1.1 SUMMARY

###### A. Section Includes:

1. Copper building wire rated 600 V or less.
2. Connectors, splices, and terminations rated 600 V and less.

##### 1.2 ACTION SUBMITTALS

- A. Product Data: For each type of product.
- B. Product Schedule: Indicate type, use, location, and termination locations.

##### 1.3 INFORMATIONAL SUBMITTALS

- A. Field quality-control reports.

#### PART 2 - PRODUCTS

##### 2.1 COPPER BUILDING WIRE

- A. Description: Flexible, insulated and uninsulated, drawn copper current-carrying conductor with an overall insulation layer or jacket, or both, rated 600 V or less.
- B. Standards:
  1. Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and use.
  2. RoHS compliant.
  3. Conductor and Cable Marking: Comply with wire and cable marking according to UL's "Wire and Cable Marking and Application Guide."
- C. Conductors: Copper, complying with ASTM B 3 for bare annealed copper and with ASTM B 496 for stranded conductors.

## 2.2 CONNECTORS AND SPLICES

- A. Description: Factory-fabricated connectors, splices, and lugs of size, ampacity rating, material, type, and class for application and service indicated; listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and use.
- B. Lugs: One piece, seamless, designed to terminate conductors specified in this Section.
  - 1. Material: Copper.
  - 2. Type: One or Two hole with standard barrels.
  - 3. Termination: Compression or Crimp.

## PART 3 - EXECUTION

### 3.1 CONDUCTOR MATERIAL APPLICATIONS

- A. Feeders: Copper; solid for No. 10 AWG and smaller; stranded for No. 8 AWG and larger.
- B. Feeders: Copper for feeders smaller than No. 4 AWG; copper or aluminum for feeders No. 4 AWG and larger. Conductors shall be solid for No. 10 AWG and smaller; stranded for No. 8 AWG and larger.
- C. Branch Circuits: Copper. Solid for No. 10 AWG and smaller; stranded for No. 8 AWG and larger.
- D. Branch Circuits: Copper. Solid for No. 12 AWG and smaller; stranded for No. 10 AWG and larger.

### 3.2 CONDUCTOR INSULATION AND MULTICONDUCTOR CABLE APPLICATIONS AND WIRING METHODS

- A. Service Entrance: Type THHN/THWN-2, single conductors in raceway.
- B. Exposed Feeders: Type THHN/THWN-2, single conductors in raceway.
- C. Feeders Concealed in Ceilings, Walls, Partitions, and Crawlspace: Type THHN/THWN-2, single conductors in raceway.
- D. Feeders Concealed in Concrete, below Slabs-on-Grade, and Underground: Type THHN/THWN-2, single conductors in raceway.
- E. Exposed Branch Circuits, Type THHN/THWN-2, single conductors in raceway.
- F. Branch Circuits Concealed in Ceilings, Walls, and Partitions: Type THHN/THWN-2, single conductors in raceway.

- G. Branch Circuits Concealed in Concrete, below Slabs-on-Grade, and Underground: Type THHN/THWN-2, single conductors in raceway.

### 3.3 INSTALLATION OF CONDUCTORS AND CABLES

- A. Conceal cables in finished walls, ceilings, and floors unless otherwise indicated.
- B. Complete raceway installation between conductor and cable termination points according to Section 260533 "Raceways and Boxes for Electrical Systems" prior to pulling conductors and cables.
- C. Use manufacturer-approved pulling compound or lubricant where necessary; compound used must not deteriorate conductor or insulation. Do not exceed manufacturer's recommended maximum pulling tensions and sidewall pressure values.
- D. Use pulling means, including fish tape, cable, rope, and basket-weave wire/cable grips, that will not damage cables or raceway.
- E. Install exposed cables parallel and perpendicular to surfaces of exposed structural members, and follow surface contours where possible.
- F. Support cables according to Section 260529 "Hangers and Supports for Electrical Systems."

### 3.4 CONNECTIONS

- A. Tighten electrical connectors and terminals according to manufacturer's published torque-tightening values. If manufacturer's torque values are not indicated, use those specified in UL 486A-486B.
- B. Make splices, terminations, and taps that are compatible with conductor material and that possess equivalent or better mechanical strength and insulation ratings than unspliced conductors.
  - 1. Use oxide inhibitor in each splice, termination, and tap for aluminum conductors.
- C. Wiring at Outlets: Install conductor at each outlet, with at least **6 inches (150 mm)** of slack.

### 3.5 IDENTIFICATION

- A. Identify and color-code conductors and cables according to Section 260553 "Identification for Electrical Systems."
- B. Identify each spare conductor at each end with identity number and location of other end of conductor, and identify as spare conductor.

3.6 SLEEVE AND SLEEVE-SEAL INSTALLATION FOR ELECTRICAL PENETRATIONS

- A. Install sleeves and sleeve seals at penetrations of exterior floor and wall assemblies. Comply with requirements in Section 260544 "Sleeves and Sleeve Seals for Electrical Raceways and Cabling."

3.7 FIRESTOPPING

- A. Apply firestopping to electrical penetrations of fire-rated floor and wall assemblies to restore original fire-resistance rating of assembly.

END OF SECTION



## SECTION 26 05 26

### GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS

#### PART 1 - GENERAL

##### 1.1 SUMMARY

- A. Section includes grounding and bonding systems and equipment.
- B. Section includes grounding and bonding systems and equipment, plus the following special applications:
  - 1. Underground distribution grounding.
  - 2. Ground bonding common with lightning protection system.
  - 3. Foundation steel electrodes.

##### 1.2 ACTION SUBMITTALS

- A. Product Data: For each type of product.

##### 1.3 INFORMATIONAL SUBMITTALS

- A. Coordination Drawings: Plans showing dimensioned as-built locations of grounding features specified in "Field Quality Control" Article.
- B. Qualification Data: For testing agency and testing agency's field supervisor.
- C. Field quality-control reports.

##### 1.4 CLOSEOUT SUBMITTALS

- A. Operation and maintenance data.
  - 1. Plans showing as-built, dimensioned locations of grounding features specified in "Field Quality Control" Article, including the following:
    - a. Test wells.
    - b. Ground rods.
    - c. Ground rings.
    - d. Grounding arrangements and connections for separately derived systems.
  - 2. Instructions for periodic testing and inspection of grounding features at test wells grounding connections for separately derived systems based on NFPA 70B.

- a. Tests shall determine if ground-resistance or impedance values remain within specified maximums, and instructions shall recommend corrective action if values do not.
- b. Include recommended testing intervals.

## 1.5 QUALITY ASSURANCE

- A. Testing Agency Qualifications: Certified by NETA.

## PART 2 - PRODUCTS

### 2.1 SYSTEM DESCRIPTION

- 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 UL 467 for grounding and bonding materials and equipment.

### 2.2 CONDUCTORS

- A. Insulated Conductors: Copper or tinned-copper wire or cable insulated for 600 V unless otherwise required by applicable Code or authorities having jurisdiction.
- B. Bare Copper Conductors:
  - 1. Solid Conductors: ASTM B 3.
  - 2. Stranded Conductors: ASTM B 8.
  - 3. Tinned Conductors: ASTM B 33.
  - 4. Bonding Cable: 28 kcmil, 14 strands of No. 17 AWG conductor, 1/4 inch (6 mm) in diameter.
  - 5. Bonding Conductor: No. 4 or No. 6 AWG, stranded conductor.
  - 6. Bonding Jumper: Copper tape, braided conductors terminated with copper ferrules; 1-5/8 inches (41 mm) wide and 1/16 inch (1.6 mm) thick.
  - 7. Tinned Bonding Jumper: Tinned-copper tape, braided conductors terminated with copper ferrules; 1-5/8 inches (41 mm) wide and 1/16 inch (1.6 mm) thick.
- C. Grounding Bus: Predrilled rectangular bars of annealed copper, 1/4 by 4 inches (6.3 by 100 mm) in cross section, with 9/32-inch (7.14-mm) holes spaced 1-1/8 inches (28 mm) apart. Stand-off insulators for mounting shall comply with UL 891 for use in switchboards, 600 V and shall be Lexan or PVC, impulse tested at 5000 V.

## 2.3 CONNECTORS

- A. Listed and labeled by an NRTL acceptable to authorities having jurisdiction for applications in which used and for specific types, sizes, and combinations of conductors and other items connected.
- B. Welded Connectors: Exothermic-welding kits of types recommended by kit manufacturer for materials being joined and installation conditions.
- C. Bus-Bar Connectors: Mechanical type, cast silicon bronze, solderless compression-type wire terminals, and long-barrel, two-bolt connection to ground bus bar.
- D. Bus-Bar Connectors: Compression type, copper or copper alloy, with two wire terminals.
- E. Beam Clamps: Mechanical type, terminal, ground wire access from four directions, with dual, tin-plated or silicon bronze bolts.
- F. Cable-to-Cable Connectors: Compression type, copper or copper alloy.
- G. Cable Tray Ground Clamp: Mechanical type, zinc-plated malleable iron.
- H. Conduit Hubs: Mechanical type, terminal with threaded hub.
- I. Ground Rod Clamps: Mechanical type, copper or copper alloy, terminal with hex head bolt.
- J. Ground Rod Clamps: Mechanical type, copper or copper alloy, terminal with hex head bolt.
- K. Lay-in Lug Connector: Mechanical type, copper rated for direct burial terminal with set screw.
- L. Service Post Connectors: Mechanical type, bronze alloy terminal, in short- and long-stud lengths, capable of single and double conductor connections.
- M. Signal Reference Grid Clamp: Mechanical type, stamped-steel terminal with hex head screw.
- N. Straps: Solid copper, copper lugs. Rated for 600 A.
- O. Tower Ground Clamps: Mechanical type, copper or copper alloy, terminal one or two piece clamp.
- P. U-Bolt Clamps: Mechanical type, copper or copper alloy, terminal listed for direct burial.
- Q. Water Pipe Clamps:
  - 1. Mechanical type, two pieces with stainless-steel bolts.
    - a. Material: Die-cast zinc alloy.
    - b. Listed for direct burial.

2. U-bolt type with malleable-iron clamp and copper ground connector.

## 2.4 GROUNDING ELECTRODES

- A. Ground Rods: Copper-clad steel, sectional type; 3/4 inch by 10 feet (19 mm by 3 m).
- B. Ground Plates: 1/4 inch (6 mm) thick, hot-dip galvanized.

## PART 3 - EXECUTION

### 3.1 APPLICATIONS

- A. Conductors: Install solid conductor for No. 8 AWG and smaller, and stranded conductors for No. 6 AWG and larger unless otherwise indicated.
- B. Underground Grounding Conductors: Install bare copper conductor, No. 2/0 AWG minimum.
  1. Bury at least 24 inches (600 mm) below grade.
- C. Grounding Bus: Install in electrical equipment rooms, in rooms housing service equipment, and elsewhere as indicated.
  1. Install bus horizontally, on insulated spacers 2 inches (50 mm) minimum from wall, 6 inches (150 mm) above finished floor unless otherwise indicated.
  2. Where indicated on both sides of doorways, route bus up to top of door frame, across top of doorway, and down; connect to horizontal bus.
- D. Conductor Terminations and Connections:
  1. Pipe and Equipment Grounding Conductor Terminations: Bolted connectors.
  2. Underground Connections: Welded connectors except at test wells and as otherwise indicated.
  3. Connections to Ground Rods at Test Wells: Bolted connectors.
  4. Connections to Structural Steel: Welded connectors.

### 3.2 GROUNDING UNDERGROUND DISTRIBUTION SYSTEM COMPONENTS

- A. Comply with IEEE C2 grounding requirements.
- B. Pad-Mounted Transformers and Switches: Install two ground rods and ground ring around the pad. Ground pad-mounted equipment and noncurrent-carrying metal items associated with substations by connecting them to underground cable and grounding electrodes. Install tinned-copper conductor not less than No. 2 AWG for ground ring and for taps to equipment grounding terminals. Bury ground ring not less than 6 inches (150 mm) from the foundation.

### 3.3 EQUIPMENT GROUNDING

- A. Install insulated equipment grounding conductors with all feeders and branch circuits.
- B. Install insulated equipment grounding conductors with the following items, in addition to those required by NFPA 70:
  - 1. Feeders and branch circuits.
  - 2. Lighting circuits.
  - 3. Receptacle circuits.
  - 4. Single-phase motor and appliance branch circuits.
  - 5. Three-phase motor and appliance branch circuits.
  - 6. Flexible raceway runs.
  - 7. Armored and metal-clad cable runs.
  - 8. Busway Supply Circuits: Install insulated equipment grounding conductor from grounding bus in the switchgear, switchboard, or distribution panel to equipment grounding bar terminal on busway.
- C. Water Heater, Heat-Tracing, and Antifrost Heating Cables: Install a separate insulated equipment grounding conductor to each electric water heater and heat-tracing cable. Bond conductor to heater units, piping, connected equipment, and components.
- D. Poles Supporting Outdoor Lighting Fixtures: Install grounding electrode and a separate insulated equipment grounding conductor in addition to grounding conductor installed with branch-circuit conductors.

### 3.4 INSTALLATION

- A. Grounding Conductors: Route along shortest and straightest paths possible unless otherwise indicated or required by Code. Avoid obstructing access or placing conductors where they may be subjected to strain, impact, or damage.
- B. Ground Bonding Common with Lightning Protection System: Comply with NFPA 780 and UL 96 when interconnecting with lightning protection system. Bond electrical power system ground directly to lightning protection system grounding conductor at closest point to electrical service grounding electrode. Use bonding conductor sized same as system grounding electrode conductor, and install in conduit.
- C. Ground Rods: Drive rods until tops are 2 inches (50 mm) below finished floor or final grade unless otherwise indicated.
  - 1. Interconnect ground rods with grounding electrode conductor below grade and as otherwise indicated. Make connections without exposing steel or damaging coating if any.
- D. Bonding Straps and Jumpers: Install in locations accessible for inspection and maintenance except where routed through short lengths of conduit.
  - 1. Bonding to Structure: Bond straps directly to basic structure, taking care not to penetrate any adjacent parts.

2. Bonding to Equipment Mounted on Vibration Isolation Hangers and Supports: Install bonding so vibration is not transmitted to rigidly mounted equipment.
3. Use exothermic-welded connectors for outdoor locations; if a disconnect-type connection is required, use a bolted clamp.

E. Grounding and Bonding for Piping:

1. Metal Water Service Pipe: Install insulated copper grounding conductors, in conduit, from building's main service equipment, or grounding bus, to main metal water service entrances to building. Connect grounding conductors to main metal water service pipes; use a bolted clamp connector or bolt a lug-type connector to a pipe flange by using one of the lug bolts of the flange. Where a dielectric main water fitting is installed, connect grounding conductor on street side of fitting. Bond metal grounding conductor conduit or sleeve to conductor at each end.
2. Water Meter Piping: Use braided-type bonding jumpers to electrically bypass water meters. Connect to pipe with a bolted connector.
3. Bond each aboveground portion of gas piping system downstream from equipment shutoff valve.

### 3.5 FIELD QUALITY CONTROL

A. Perform tests and inspections.

B. Tests and Inspections:

1. After installing grounding system but before permanent electrical circuits have been energized, test for compliance with requirements.
2. Inspect physical and mechanical condition. Verify tightness of accessible, bolted, electrical connections with a calibrated torque wrench according to manufacturer's written instructions.
3. Test completed grounding system at each location where a maximum ground-resistance level is specified, at service disconnect enclosure grounding terminal, at ground test wells, and at individual ground rods. Make tests at ground rods before any conductors are connected.
  - a. Measure ground resistance no fewer than two full days after last trace of precipitation and without soil being moistened by any means other than natural drainage or seepage and without chemical treatment or other artificial means of reducing natural ground resistance.
  - b. Perform tests by fall-of-potential method according to IEEE 81.
4. Prepare dimensioned Drawings locating each test well, ground rod and ground-rod assembly, and other grounding electrodes. Identify each by letter in alphabetical order, and key to the record of tests and observations. Include the number of rods driven and their depth at each location, and include observations of weather and other phenomena that may affect test results. Describe measures taken to improve test results.

C. Grounding system will be considered defective if it does not pass tests and inspections.

- D. Prepare test and inspection reports.
- E. Report measured ground resistances that exceed the following values:
  - 1. Power and Lighting Equipment or System with Capacity of up to 1000 kVA: 5 ohms.
  - 2. Power and Lighting Equipment or System with Capacity More Than 1000 kVA: 3 ohms.
  - 3. Power Distribution Units or Panelboards Serving Electronic Equipment: 3 ohm(s).
  - 4. Pad-Mounted Equipment: 5 ohms.
- F. Excessive Ground Resistance: If resistance to ground exceeds specified values, notify Architect promptly and include recommendations to reduce ground resistance.

END OF SECTION





## SECTION 26 05 29

### HANGERS AND SUPPORTS FOR ELECTRICAL SYSTEMS

#### PART 1 - GENERAL

##### 1.1 SUMMARY

###### A. Section Includes:

1. Steel slotted support systems.
2. Conduit and cable support devices.
3. Support for conductors in vertical conduit.
4. Structural steel for fabricated supports and restraints.
5. Mounting, anchoring, and attachment components, including powder-actuated fasteners, mechanical expansion anchors, concrete inserts, clamps, through bolts, toggle bolts, and hanger rods.
6. Fabricated metal equipment support assemblies.

##### 1.2 ACTION SUBMITTALS

###### A. Product Data: For each type of product.

###### B. Shop Drawings: For fabrication and installation details for electrical hangers and support systems.

1. Hangers. Include product data for components.
2. Slotted support systems.
3. Equipment supports.
4. Vibration Isolation Base Details: Detail fabrication including anchorages and attachments to structure and to supported equipment. Include adjustable motor bases, rails, and frames for equipment mounting.

###### C. Delegated-Design Submittal: For hangers and supports for electrical systems.

1. Include design calculations and details of hangers.
2. Include design calculations for seismic restraints.

##### 1.3 INFORMATIONAL SUBMITTALS

###### A. Coordination Drawings: Reflected ceiling plan(s) and other details, drawn to scale, and coordinated with each other, using input from installers of the items involved.

###### B. Welding certificates.

#### 1.4 QUALITY ASSURANCE

- A. Welding Qualifications: Qualify procedures and personnel according to AWS D1.1/D1.1M or AWS D1.2/D1.2M.
- B. Welding Qualifications: Qualify procedures and personnel according to the following:
  - 1. AWS D1.1/D1.1M.
  - 2. AWS D1.2/D1.2M.

### PART 2 - PRODUCTS

#### 2.1 SUPPORT, ANCHORAGE, AND ATTACHMENT COMPONENTS

- A. Steel Slotted Support Systems: Preformed steel channels and angles with minimum ~~13/32-inch-~~ (10-mm-) diameter holes at a maximum of 8 inches (200 mm) o.c. in at least one surface.
  - 1. Standard: Comply with MFMA-4 factory-fabricated components for field assembly.
  - 2. Material for Channel, Fittings, and Accessories: Galvanized steel.
  - 3. Channel Width: Selected for applicable load criteria.
  - 4. Metallic Coatings: Hot-dip galvanized after fabrication and applied according to MFMA-4.
- B. Conduit and Cable Support Devices: Steel hangers, clamps, and associated fittings, designed for types and sizes of raceway or cable to be supported.
- C. Support for Conductors in Vertical Conduit: Factory-fabricated assembly consisting of threaded body and insulating wedging plug or plugs for nonarmored electrical conductors or cables in riser conduits. Plugs shall have number, size, and shape of conductor gripping pieces as required to suit individual conductors or cables supported. Body shall be made of malleable iron.
- D. Structural Steel for Fabricated Supports and Restraints: ASTM A 36/A 36M steel plates, shapes, and bars; black and galvanized.
- E. Mounting, Anchoring, and Attachment Components: Items for fastening electrical items or their supports to building surfaces include the following:
  - 1. Powder-Actuated Fasteners: Threaded-steel stud, for use in hardened portland cement concrete, steel, or wood, with tension, shear, and pullout capacities appropriate for supported loads and building materials where used.
  - 2. Mechanical-Expansion Anchors: Insert-wedge-type, zinc-coated or stainless steel, for use in hardened portland cement concrete, with tension, shear, and pullout capacities appropriate for supported loads and building materials where used.

3. Concrete Inserts: Steel or malleable-iron, slotted support system units are similar to MSS Type 18 units and comply with MFMA-4 or MSS SP-58.
4. Clamps for Attachment to Steel Structural Elements: MSS SP-58 units are suitable for attached structural element.
5. Through Bolts: Structural type, hex head, and high strength. Comply with ASTM A 325.
6. Hanger Rods: Threaded steel.

## 2.2 FABRICATED METAL EQUIPMENT SUPPORT ASSEMBLIES

- A. Description: Welded or bolted structural-steel shapes, shop or field fabricated to fit dimensions of supported equipment.
- B. Materials: Comply with requirements in Section 055000 "Metal Fabrications" for steel shapes and plates.

## PART 3 - EXECUTION

### 3.1 APPLICATION

- A. Comply with the following standards for application and installation requirements of hangers and supports, except where requirements on Drawings or in this Section are stricter:
  1. NECA 1.
  2. NECA 101
  3. NECA 102.
  4. NECA 105.
  5. NECA 111.
- B. Comply with requirements in Section "Penetration Firestopping" for firestopping materials and installation for penetrations through fire-rated walls, ceilings, and assemblies.
- C. Comply with requirements for raceways and boxes specified in Section 260533 "Raceways and Boxes for Electrical Systems."
- D. Maximum Support Spacing and Minimum Hanger Rod Size for Raceways: Space supports for EMT, IMC, and RMC as scheduled in NECA 1, where its Table 1 lists maximum spacings that are less than those stated in NFPA 70. Minimum rod size shall be 1/4 inch (6 mm) in diameter.
- E. Multiple Raceways or Cables: Install trapeze-type supports fabricated with steel slotted [or other] support system, sized so capacity can be increased by at least 25 percent in future without exceeding specified design load limits.
  1. Secure raceways and cables to these supports with two-bolt conduit clamps or single-bolt conduit clamps.

- F. Spring-steel clamps designed for supporting single conduits without bolts may be used for 1-1/2-inch (38-mm) and smaller raceways serving branch circuits and communication systems above suspended ceilings, and for fastening raceways to trapeze supports.

### 3.2 SUPPORT INSTALLATION

- A. Comply with NECA 1 and NECA 101 for installation requirements except as specified in this article.
- B. Raceway Support Methods: In addition to methods described in NECA 1, EMT may be supported by openings through structure members, according to NFPA 70.
- C. Strength of Support Assemblies: Where not indicated, select sizes of components so strength will be adequate to carry present and future static loads within specified loading limits. Minimum static design load used for strength determination shall be weight of supported components plus 200 lb (90 kg).
- D. Mounting and Anchorage of Surface-Mounted Equipment and Components: Anchor and fasten electrical items and their supports to building structural elements by the following methods unless otherwise indicated by code:
  - 1. To Wood: Fasten with lag screws or through bolts.
  - 2. To New Concrete: Bolt to concrete inserts.
  - 3. To Masonry: Approved toggle-type bolts on hollow masonry units and expansion anchor fasteners on solid masonry units.
  - 4. To Existing Concrete: Expansion anchor fasteners.
  - 5. Instead of expansion anchors, powder-actuated driven threaded studs provided with lock washers and nuts may be used in existing standard-weight concrete 4 inches (100 mm) thick or greater. Do not use for anchorage to lightweight-aggregate concrete or for slabs less than 4 inches (100 mm) thick.
  - 6. To Steel: Beam clamps (MSS SP-58, Type 19, 21, 23, 25, or 27), complying with MSS SP-69.
  - 7. To Light Steel: Sheet metal screws.
  - 8. Items Mounted on Hollow Walls and Nonstructural Building Surfaces: Mount cabinets, panelboards, disconnect switches, control enclosures, pull and junction boxes, transformers, and other devices on slotted-channel racks attached to substrate.
- E. Drill holes for expansion anchors in concrete at locations and to depths that avoid the need for reinforcing bars.

### 3.3 INSTALLATION OF FABRICATED METAL SUPPORTS

- A. Comply with installation requirements in Section 055000 "Metal Fabrications" for site-fabricated metal supports.
- B. Cut, fit, and place miscellaneous metal supports accurately in location, alignment, and elevation to support and anchor electrical materials and equipment.

C. Field Welding: Comply with AWS D1.1/D1.1M.

END OF SECTION



## SECTION 26 05 33

### RACEWAYS AND BOXES FOR ELECTRICAL SYSTEMS

#### PART 1 - GENERAL

##### 1.1 SUMMARY

###### A. Section Includes:

1. Metal conduits and fittings.
2. Nonmetallic conduits and fittings.
3. Metal wireways and auxiliary gutters.
4. Nonmetal wireways and auxiliary gutters.
5. Boxes, enclosures, and cabinets.
6. Handholes and boxes for exterior underground cabling.

##### 1.2 ACTION SUBMITTALS

- A. Product Data: For each type of product.
- B. Shop Drawings: For custom enclosures and cabinets. Include plans, elevations, sections, and attachment details.

##### 1.3 INFORMATIONAL SUBMITTALS

- A. Coordination Drawings: Conduit routing plans, drawn to scale, on which the following items are shown and coordinated with each other, using input from installers of items involved:
  1. Structural members in paths of conduit groups with common supports.
  2. HVAC and plumbing items and architectural features in paths of conduit groups with common supports.

#### PART 2 - PRODUCTS

##### 2.1 METAL CONDUITS AND FITTINGS

###### A. Metal Conduit:

1. Listing and Labeling: Metal conduits, tubing, and fittings shall be listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
2. GRC: Comply with ANSI C80.1 and UL 6.
3. ARC: Comply with ANSI C80.5 and UL 6A.

4. IMC: Comply with ANSI C80.6 and UL 1242.
  5. PVC-Coated Steel Conduit: PVC-coated rigid steel conduit.
    - a. Comply with NEMA RN 1.
    - b. Coating Thickness: 0.040 inch (1 mm), minimum.
  6. FMC: Comply with UL 1; aluminum.
  7. LFMC: Flexible steel conduit with PVC jacket and complying with UL 360.
- B. Metal Fittings: Comply with NEMA FB 1 and UL 514B.
1. Listing and Labeling: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
  2. Fittings, General: Listed and labeled for type of conduit, location, and use.
  3. Expansion Fittings: PVC or steel to match conduit type, complying with UL 651, rated for environmental conditions where installed, and including flexible external bonding jumper.
  4. Coating for Fittings for PVC-Coated Conduit: Minimum thickness of 0.040 inch (1 mm), with overlapping sleeves protecting threaded joints.
- C. Joint Compound for IMC, GRC, or ARC: Approved, as defined in NFPA 70, by authorities having jurisdiction for use in conduit assemblies, and compounded for use to lubricate and protect threaded conduit joints from corrosion and to enhance their conductivity.

## 2.2 NONMETALLIC CONDUITS AND FITTINGS

- A. Listing and Labeling: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
1. RNC: Type EPC-40-PVC, complying with NEMA TC 2 and UL 651 unless otherwise indicated.
  2. LFNC: Comply with UL 1660.
- B. Nonmetallic Fittings:
1. Fittings, General: Listed and labeled for type of conduit, location, and use.
  2. Fittings for RNC: Comply with NEMA TC 3; match to conduit or tubing type and material.
  3. Solvents and Adhesives: As recommended by conduit manufacturer.

## 2.3 NONMETALLIC WIREWAYS AND AUXILIARY GUTTERS

- A. Listing and Labeling: Nonmetallic wireways and auxiliary gutters shall be listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- B. Description: PVC, extruded and fabricated to required size and shape, and having snap-on cover, mechanically coupled connections, and plastic fasteners.



- C. Fittings and Accessories: Couplings, offsets, elbows, expansion joints, adapters, hold-down straps, end caps, and other fittings shall match and mate with wireways as required for complete system.

## 2.4 BOXES, ENCLOSURES, AND CABINETS

- A. General Requirements for Boxes, Enclosures, and Cabinets: Boxes, enclosures, and cabinets installed in wet locations shall be listed for use in wet locations.
- B. Sheet Metal Outlet and Device Boxes: Comply with NEMA OS 1 and UL 514A.
- C. Cast-Metal Outlet and Device Boxes: Comply with NEMA FB 1, aluminum, Type FD, with gasketed cover.
- D. Luminaire Outlet Boxes: Nonadjustable, designed for attachment of luminaire weighing **50 lb (23 kg)**. Outlet boxes designed for attachment of luminaires weighing more than **50 lb (23 kg)** shall be listed and marked for the maximum allowable weight.
- E. Paddle Fan Outlet Boxes: Nonadjustable, designed for attachment of paddle fan weighing **70 lb (32 kg)**.
  - 1. Listing and labeling: Paddle fan outlet boxes shall be listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- F. Cast-Metal Access, Pull, and Junction Boxes: Comply with NEMA FB 1 and UL 1773, cast aluminum with gasketed cover.
- G. Box extensions used to accommodate new building finishes shall be of same material as recessed box.
- H. Device Box Dimensions: **4 inches square by 2-1/8 inches deep (100 mm square by 60 mm deep)**.
- I. Gangable boxes are allowed.

## 2.5 HANDHOLES AND BOXES FOR EXTERIOR UNDERGROUND WIRING

- A. General Requirements for Handholes and Boxes:
  - 1. Boxes and handholes for use in underground systems shall be designed and identified as defined in NFPA 70, for intended location and application.
  - 2. Boxes installed in wet areas shall be listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- B. Polymer-Concrete Handholes and Boxes with Polymer-Concrete Cover: Molded of sand and aggregate, bound together with polymer resin, and reinforced with steel, fiberglass, or a combination of the two.

1. Standard: Comply with SCTE 77.
2. Configuration: Designed for flush burial with open bottom unless otherwise indicated.
3. Cover: Weatherproof, secured by tamper-resistant locking devices and having structural load rating consistent with enclosure and handhole location.
4. Cover Finish: Nonskid finish shall have a minimum coefficient of friction of 0.50.
5. Cover Legend: Molded lettering, "ELECTRIC."
6. Conduit Entrance Provisions: Conduit-terminating fittings shall mate with entering ducts for secure, fixed installation in enclosure wall.

## PART 3 - EXECUTION

### 3.1 RACEWAY APPLICATION

#### A. Outdoors: Apply raceway products as specified below unless otherwise indicated:

1. Exposed Conduit: PVC coated rigid steel conduit or RNC, Type EPC-80-PVC.
2. Concealed Conduit, Aboveground: Aluminum.
3. Underground Conduit: RNC, Type EPC-40-PVC.
4. Connection to Vibrating Equipment (Including Transformers and Hydraulic, Pneumatic, Electric Solenoid, or Motor-Driven Equipment): LFMC.
5. Boxes and Enclosures, Aboveground: NEMA 250, Type 3R.

#### B. Indoors: Apply raceway products as specified below unless otherwise indicated.

1. Exposed, Not Subject to Physical Damage: Aluminum.
2. Exposed, Not Subject to Severe Physical Damage: Aluminum.
3. Exposed and Subject to Severe Physical Damage: PVC coated rigid steel conduit.
4. Concealed in Ceilings and Interior Walls and Partitions: Aluminum.
5. Connection to Vibrating Equipment (Including Transformers and Hydraulic, Pneumatic, Electric Solenoid, or Motor-Driven Equipment): FMC, except use LFMC in damp or wet locations.
6. Boxes and Enclosures: NEMA 250, Type 1, except use NEMA 250, Type 4 stainless steel in institutional and commercial kitchens and damp or wet locations.

#### C. Minimum Raceway Size: 1/2-inch (16-mm) trade size.

#### D. Raceway Fittings: Compatible with raceways and suitable for use and location.

1. Rigid and Intermediate Steel Conduit: Use threaded rigid steel conduit fittings unless otherwise indicated. Comply with NEMA FB 2.10.
2. PVC Externally Coated, Rigid Steel Conduits: Use only fittings listed for use with this type of conduit. Patch and seal all joints, nicks, and scrapes in PVC coating after installing conduits and fittings. Use sealant recommended by fitting

manufacturer and apply in thickness and number of coats recommended by manufacturer.

3. Flexible Conduit: Use only fittings listed for use with flexible conduit. Comply with NEMA FB 2.20.

- E. Do not install aluminum conduits, boxes, or fittings in contact with concrete or earth.
- F. Install surface raceways only where indicated on Drawings.
- G. Do not install nonmetallic conduit where ambient temperature exceeds 120 deg F (49 deg C).

### 3.2 INSTALLATION

- A. Comply with requirements in Section 260529 "Hangers and Supports for Electrical Systems" for hangers and supports.
- B. Comply with NECA 1 and NECA 101 for installation requirements except where requirements on Drawings or in this article are stricter. Comply with NECA 102 for aluminum conduits. Comply with NFPA 70 limitations for types of raceways allowed in specific occupancies and number of floors.
- C. Do not install raceways or electrical items on any "explosion-relief" walls or rotating equipment.
- D. Do not fasten conduits onto the bottom side of a metal deck roof.
- E. Keep raceways at least 6 inches (150 mm) away from parallel runs of flues and steam or hot-water pipes. Install horizontal raceway runs above water and steam piping.
- F. Comply with requirements in Section 260529 "Hangers and Supports for Electrical Systems" for hangers and supports.
- G. Arrange stub-ups so curved portions of bends are not visible above finished slab.
- H. Install no more than the equivalent of three 90-degree bends in any conduit run except for control wiring conduits, for which fewer bends are allowed. Support within 12 inches (300 mm) of changes in direction.
- I. Make bends in raceway using large-radius preformed ells. Field bending shall be according to NFPA 70 minimum radii requirements. Use only equipment specifically designed for material and size involved.
- J. Support conduit within 12 inches (300 mm) of enclosures to which attached.
- K. Raceways Embedded in Slabs:
  1. Run conduit larger than 1-inch (27-mm) trade size, parallel or at right angles to main reinforcement. Where at right angles to reinforcement, place conduit close

- to slab support. Secure raceways to reinforcement at maximum 10-foot (3-m) intervals.
2. Arrange raceways to cross building expansion joints at right angles with expansion fittings.
  3. Arrange raceways to keep a minimum of 2 inches (50 mm) of concrete cover in all directions.
  4. Do not embed threadless fittings in concrete unless specifically approved by Architect for each specific location.
- L. Stub-ups to Above Recessed Ceilings:
1. Use Schedule 80 PVC for raceways.
  2. Use a conduit bushing or insulated fitting to terminate stub-ups not terminated in hubs or in an enclosure.
- M. Threaded Conduit Joints, Exposed to Wet, Damp, Corrosive, or Outdoor Conditions: Apply listed compound to threads of raceway and fittings before making up joints. Follow compound manufacturer's written instructions.
- N. Coat field-cut threads on PVC-coated raceway with a corrosion-preventing conductive compound prior to assembly.
- O. Raceway Terminations at Locations Subject to Moisture or Vibration: Use insulating bushings to protect conductors including conductors smaller than No. 4 AWG.
- P. Terminate threaded conduits into threaded hubs or with locknuts on inside and outside of boxes or cabinets. Install bushings on conduits up to 1-1/4-inch (35-mm) trade size and insulated throat metal bushings on 1-1/2-inch (41-mm) trade size and larger conduits terminated with locknuts. Install insulated throat metal grounding bushings on service conduits.
- Q. Install pull wires in empty raceways. Use polypropylene or monofilament plastic line with not less than 200-lb (90-kg) tensile strength. Leave at least 12 inches (300 mm) of slack at each end of pull wire. Cap underground raceways designated as spare above grade alongside raceways in use.
- R. Install raceway sealing fittings at accessible locations according to NFPA 70 and fill them with listed sealing compound. For concealed raceways, install each fitting in a flush steel box with a blank cover plate having a finish similar to that of adjacent plates or surfaces.
- S. Install devices to seal raceway interiors at accessible locations. Locate seals so no fittings or boxes are between the seal and the following changes of environments. Seal the interior of all raceways at the following points:
1. Where conduits pass from warm to cold locations, such as boundaries of refrigerated spaces.
  2. Where an underground service raceway enters a building or structure.
  3. Conduit extending from interior to exterior of building.
  4. Conduit extending into pressurized duct and equipment.

5. Conduit extending into pressurized zones that are automatically controlled to maintain different pressure set points.
6. Where otherwise required by NFPA 70.

T. Expansion-Joint Fittings:

1. Install fitting(s) that provide expansion and contraction for at least **0.00041 inch per foot of length of straight run per degree F** (**0.06 mm per meter of length of straight run per degree C**) of temperature change for PVC conduits.
2. Install expansion fittings at all locations where conduits cross building or structure expansion joints.
3. Install each expansion-joint fitting with position, mounting, and piston setting selected according to manufacturer's written instructions for conditions at specific location at time of installation. Install conduit supports to allow for expansion movement.

U. Flexible Conduit Connections: Comply with NEMA RV 3. Use a maximum of **72 inches (1830 mm)** of flexible conduit for recessed and semirecessed luminaires, equipment subject to vibration, noise transmission, or movement; and for transformers and motors.

1. Use LFMC in damp or wet locations subject to severe physical damage.
2. Use LFMC in damp or wet locations not subject to severe physical damage.

V. Mount boxes at heights indicated on Drawings. If mounting heights of boxes are not individually indicated, give priority to ADA requirements. Install boxes with height measured to center of box unless otherwise indicated.

W. Recessed Boxes in Masonry Walls: Saw-cut opening for box in center of cell of masonry block, and install box flush with surface of wall. Prepare block surfaces to provide a flat surface for a raintight connection between the box and cover plate or the supported equipment and box.

X. Horizontally separate boxes mounted on opposite sides of walls so they are not in the same vertical channel.

Y. Locate boxes so that cover or plate will not span different building finishes.

Z. Support boxes of three gangs or more from more than one side by spanning two framing members or mounting on brackets specifically designed for the purpose.

AA. Fasten junction and pull boxes to or support from building structure. Do not support boxes by conduits.

### 3.3 INSTALLATION OF UNDERGROUND CONDUIT

A. Direct-Buried Conduit:

1. Excavate trench bottom to provide firm and uniform support for conduit.

2. Install backfill.
3. After installing conduit, backfill and compact. Start at tie-in point, and work toward end of conduit run, leaving conduit at end of run free to move with expansion and contraction as temperature changes during this process. Firmly hand tamp backfill around conduit to provide maximum supporting strength. After placing controlled backfill to within **12 inches (300 mm)** of finished grade, make final conduit connection at end of run and complete backfilling with normal compaction.
4. Install manufactured duct elbows for stub-up at poles and equipment and at building entrances through floor unless otherwise indicated. Encase elbows for stub-up ducts throughout length of elbow.
5. Install manufactured rigid steel conduit elbows for stub-ups at poles and equipment and at building entrances through floor.
  - a. Couple steel conduits to ducts with adapters designed for this purpose, and encase coupling with **3 inches (75 mm)** of concrete for a minimum of **12 inches (300 mm)** on each side of the coupling.
  - b. For stub-ups at equipment mounted on outdoor concrete bases and where conduits penetrate building foundations, extend steel conduit horizontally a minimum of **60 inches (1500 mm)** from edge of foundation or equipment base. Install insulated grounding bushings on terminations at equipment.
6. Underground Warning Tape: Comply with requirements in Section 260553 "Identification for Electrical Systems."

### 3.4 INSTALLATION OF UNDERGROUND HANDHOLES AND BOXES

- A. Install handholes and boxes level and plumb and with orientation and depth coordinated with connecting conduits to minimize bends and deflections required for proper entrances.
- B. Unless otherwise indicated, support units on a level bed of crushed stone or gravel, graded from **1/2-inch (12.5-mm)** sieve to **No. 4 (4.75-mm)** sieve and compacted to same density as adjacent undisturbed earth.
- C. Field-cut openings for conduits according to enclosure manufacturer's written instructions. Cut wall of enclosure with a tool designed for material to be cut. Size holes for terminating fittings to be used, and seal around penetrations after fittings are installed.

### 3.5 SLEEVE AND SLEEVE-SEAL INSTALLATION FOR ELECTRICAL PENETRATIONS

- A. Install sleeves and sleeve seals at penetrations of exterior floor and wall assemblies.

### 3.6 FIRESTOPPING

- A. Install firestopping at penetrations of fire-rated floor and wall assemblies.

### 3.7 PROTECTION

- A. Protect coatings, finishes, and cabinets from damage and deterioration.
  - 1. Repair damage to galvanized finishes with zinc-rich paint recommended by manufacturer.
  - 2. Repair damage to PVC coatings or paint finishes with matching touchup coating recommended by manufacturer.

END OF SECTION





## SECTION 260553

### IDENTIFICATION FOR ELECTRICAL SYSTEMS

#### 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. Color and legend requirements for raceways, conductors, and warning labels and signs.
  - 2. Labels.
  - 3. Bands and tubes.
  - 4. Tapes and stencils.
  - 5. Tags.
  - 6. Signs.
  - 7. Cable ties.
  - 8. Paint for identification.
  - 9. Fasteners for labels and signs.

##### 1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product.
- B. Samples: For each type of label and sign to illustrate composition, size, colors, lettering style, mounting provisions, and graphic features of identification products.
- C. Delegated-Design Submittal: For arc-flash hazard study.

#### PART 2 - PRODUCTS

##### 2.1 PERFORMANCE REQUIREMENTS

- A. Comply with ASME A13.1.
- B. Comply with NFPA 70.
- C. Comply with 29 CFR 1910.144 and 29 CFR 1910.145.

- D. Comply with ANSI Z535.4 for safety signs and labels.
- E. Comply with NFPA 70E requirements for arc-flash warning labels.
- F. Adhesive-attached labeling materials, including label stocks, laminating adhesives, and inks used by label printers, shall comply with UL 969.
- G. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes.
  - 1. Temperature Change: 120 deg F (67 deg C), ambient; 180 deg F (100 deg C), material surfaces.

## 2.2 COLOR AND LEGEND REQUIREMENTS

- A. Raceways and Cables Carrying Circuits at 600 V or Less:
  - 1. Black letters on an orange field.
  - 2. Legend: Indicate voltage.
- B. Color-Coding for Phase Identification, 600 V or Less: Use colors listed below for ungrounded service feeder and branch-circuit conductors.
  - 1. Color shall be factory applied or field applied for sizes larger than No. 6 AWG if authorities having jurisdiction permit.
  - 2. Colors for 208/120-V Circuits:
    - a. Phase A: Black.
    - b. Phase B: Red.
    - c. Phase C: Blue.
  - 3. Colors for 480/277-V Circuits:
    - a. Phase A: Brown.
    - b. Phase B: Orange.
    - c. Phase C: Yellow.
  - 4. Color for Neutral: White.
  - 5. Color for Equipment Grounds: Green.
  - 6. Colors for Isolated Grounds: Green two or more yellow stripes.
- C. Warning Label Colors:
  - 1. Identify system voltage with black letters on an orange background.
- D. Warning labels and signs shall include, but are not limited to, the following legends:
  - 1. Multiple Power Source Warning: "DANGER - ELECTRICAL SHOCK HAZARD - EQUIPMENT HAS MULTIPLE POWER SOURCES."

2. Workspace Clearance Warning: "WARNING - OSHA REGULATION - AREA IN FRONT OF ELECTRICAL EQUIPMENT MUST BE KEPT CLEAR FOR 36 INCHES (915 MM)."

E. Equipment Identification Labels:

1. Black letters on a white field.

## 2.3 LABELS

- A. Vinyl Wraparound Labels: Preprinted, flexible labels laminated with a clear, weather- and chemical-resistant coating and matching wraparound clear adhesive tape for securing label ends.
- B. Snap-around Labels: Slit, pretensioned, flexible, preprinted, color-coded acrylic sleeves, with diameters sized to suit diameter and that stay in place by gripping action.
- C. Self-Adhesive Wraparound Labels: Preprinted, 3-mil- (0.08-mm-) thick, vinyl flexible label with acrylic pressure-sensitive adhesive.
  1. Self-Lamination: Clear; UV-, weather- and chemical-resistant; self-laminating, protective shield over the legend. Labels sized such that the clear shield overlaps the entire printed legend.
  2. Marker for Labels: Permanent, waterproof, black ink marker recommended by tag manufacturer.
  3. Marker for Labels: Machine-printed, permanent, waterproof, black ink recommended by printer manufacturer.
- D. Self-Adhesive Labels: Vinyl, thermal, transfer-printed, 3-mil- (0.08-mm-) thick, multicolor, weather- and UV-resistant, pressure-sensitive adhesive labels, configured for intended use and location.
  1. Minimum Nominal Size:
    - a. 1-1/2 by 6 inches (37 by 150 mm) for raceway and conductors.
    - b. 3-1/2 by 5 inches (76 by 127 mm) for equipment.
    - c. As required by authorities having jurisdiction.

## 2.4 BANDS AND TUBES

- A. Snap-around, Color-Coding Bands: Slit, pretensioned, flexible, solid-colored acrylic sleeves, 2 inches (50 mm) long, with diameters sized to suit diameter and that stay in place by gripping action.

## 2.5 TAPES AND STENCILS

- A. Marker Tapes: Vinyl or vinyl-cloth, self-adhesive wraparound type, with circuit identification legend machine printed by thermal transfer or equivalent process.

- B. Self-Adhesive Vinyl Tape: Colored, heavy duty, waterproof, fade resistant; not less than 3 mils (0.08 mm) thick by 1 to 2 inches (25 to 50 mm) wide; compounded for outdoor use.
- C. Underground-Line Warning Tape:
  - 1. Tape:
    - a. Recommended by manufacturer for the method of installation and suitable to identify and locate underground electrical and communications utility lines.
    - b. Printing on tape shall be permanent and shall not be damaged by burial operations.
    - c. Tape material and ink shall be chemically inert and not subject to degradation when exposed to acids, alkalis, and other destructive substances commonly found in soils.
  - 2. Color and Printing:
    - a. Comply with ANSI Z535.1, ANSI Z535.2, ANSI Z535.3, ANSI Z535.4.
    - b. Inscriptions for Orange-Colored Tapes: "TELEPHONE CABLE, CATV CABLE, COMMUNICATIONS CABLE, OPTICAL FIBER CABLE" .
  - 3. Tag: Type ID:
    - a. Detectable three-layer laminate, consisting of a printed pigmented polyolefin film, a solid aluminum-foil core, and a clear protective film that allows inspection of the continuity of the conductive core; bright colored, compounded for direct-burial service.
    - b. Width: 3 inches (75 mm).
    - c. Overall Thickness: 5 mils (0.125 mm).
    - d. Foil Core Thickness: 0.35 mil (0.00889 mm).
    - e. Weight: 28 lb/1000 sq. ft. (13.7 kg/100 sq. m).
    - f. Tensile according to ASTM D882: 70 lbf (311.3 N) and 4600 psi (31.7 MPa).

## 2.6 TAGS

## 2.7 SIGNS

- A. Baked-Enamel Signs:
  - 1. Preprinted aluminum signs, punched or drilled for fasteners, with colors, legend, and size required for application.
  - 2. 1/4-inch (6.4-mm) grommets in corners for mounting.
  - 3. Nominal Size: 7 by 10 inches (180 by 250 mm).
- B. Metal-Backed Butyrate Signs:
  - 1. Weather-resistant, nonfading, preprinted, cellulose-acetate butyrate signs, with 0.0396-inch (1-mm) galvanized-steel backing, punched and drilled for fasteners, and with colors, legend, and size required for application.

2. 1/4-inch (6.4-mm) grommets in corners for mounting.
3. Nominal Size: 10 by 14 inches (250 by 360 mm).

C. Laminated Acrylic or Melamine Plastic Signs:

1. Engraved legend.
2. Thickness:
  - a. For signs up to 20 sq. in. (129 sq. cm), minimum 1/16 inch (1.6 mm) thick.
  - b. For signs larger than 20 sq. in. (129 sq. cm), 1/8 inch (3.2 mm) thick.
  - c. Engraved legend with black letters on white face.
  - d. Framed with mitered acrylic molding and arranged for attachment at applicable equipment.

## 2.8 CABLE TIES

A. General-Purpose Cable Ties: Fungus inert, self-extinguishing, one piece, self-locking, and Type 6/6 nylon.

1. Minimum Width: 3/16 inch (5 mm).
2. Tensile Strength at 73 Deg F (23 Deg C) according to ASTM D638: 12,000 psi (82.7 MPa).
3. Temperature Range: Minus 40 to plus 185 deg F (Minus 40 to plus 85 deg C).
4. Color: Black, except where used for color-coding.

B. UV-Stabilized Cable Ties: Fungus inert, designed for continuous exposure to exterior sunlight, self-extinguishing, one piece, self-locking, and Type 6/6 nylon.

1. Minimum Width: 3/16 inch (5 mm).
2. Tensile Strength at 73 Deg F (23 Deg C) according to ASTM D638: 12,000 psi (82.7 MPa).
3. Temperature Range: Minus 40 to plus 185 deg F (Minus 40 to plus 85 deg C).
4. Color: Black.

C. Plenum-Rated Cable Ties: Self-extinguishing, UV stabilized, one piece, and self-locking.

1. Minimum Width: 3/16 inch (5 mm).
2. Tensile Strength at 73 Deg F (23 Deg C) according to ASTM D638: 7000 psi (48.2 MPa).
3. UL 94 Flame Rating: 94V-0.
4. Temperature Range: Minus 50 to plus 284 deg F (Minus 46 to plus 140 deg C).
5. Color: Black.

## 2.9 MISCELLANEOUS IDENTIFICATION PRODUCTS

A. Paint: Comply with requirements in painting Sections for paint materials and application requirements. Retain paint system applicable for surface material and location (exterior or interior).

- B. Fasteners for Labels and Signs: Self-tapping, stainless-steel screws or stainless-steel machine screws with nuts and flat and lock washers.

## PART 3 - EXECUTION

### 3.1 INSTALLATION

- A. Verify and coordinate identification names, abbreviations, colors, and other features with requirements in other Sections requiring identification applications, Drawings, Shop Drawings, manufacturer's wiring diagrams, and operation and maintenance manual. Use consistent designations throughout Project.
- B. Install identifying devices before installing acoustical ceilings and similar concealment.
- C. Verify identity of each item before installing identification products.
- D. Coordinate identification with Project Drawings, manufacturer's wiring diagrams, and operation and maintenance manual.
- E. Apply identification devices to surfaces that require finish after completing finish work.
- F. Install signs with approved legend to facilitate proper identification, operation, and maintenance of electrical systems and connected items.
- G. Self-Adhesive Identification Products: Before applying electrical identification products, clean substrates of substances that could impair bond, using materials and methods recommended by manufacturer of identification product.
- H. System Identification for Raceways and Cables over 600 V: Identification shall completely encircle cable or conduit. Place adjacent identification of two-color markings in contact, side by side.
  - 1. Secure tight to surface of conductor, cable, or raceway.
- I. Auxiliary Electrical Systems Conductor Identification: Identify field-installed alarm, control, and signal connections.
- J. Elevated Components: Increase sizes of labels, signs, and letters to those appropriate for viewing from the floor.
- K. Vinyl Wraparound Labels:
  - 1. Secure tight to surface at a location with high visibility and accessibility.
  - 2. Attach labels that are not self-adhesive type with clear vinyl tape, with adhesive appropriate to the location and substrate.
- L. Snap-around Labels: Secure tight to surface at a location with high visibility and accessibility.

- M. Self-Adhesive Wraparound Labels: Secure tight to surface of raceway or cable at a location with high visibility and accessibility.
- N. Self-Adhesive Labels:
1. On each unit of equipment, install unique designation label that is consistent with wiring diagrams, schedules, and operation and maintenance manual.
  2. Unless otherwise indicated, provide a single line of text with ~~1/2-inch-~~ (13-mm-) high letters on ~~1-1/2-inch-~~ (38-mm-) high label; where two lines of text are required, use labels ~~2 inches~~ (50 mm) high.
- O. Snap-around Color-Coding Bands: Secure tight to surface at a location with high visibility and accessibility.
- P. Marker Tapes: Secure tight to surface at a location with high visibility and accessibility.
- Q. Self-Adhesive Vinyl Tape: Secure tight to surface at a location with high visibility and accessibility.
1. Field-Applied, Color-Coding Conductor Tape: Apply in half-lapped turns for a minimum distance of ~~6 inches~~ (150 mm) where splices or taps are made. Apply last two turns of tape with no tension to prevent possible unwinding.
- R. Tape and Stencil: Comply with requirements in painting Sections for surface preparation and paint application.
- S. Underground Line Warning Tape:
1. During backfilling of trenches, install continuous underground-line warning tape directly above cable or raceway at ~~6 to 8 inches~~ (150 to 200 mm) below finished grade. Use multiple tapes where width of multiple lines installed in a common trench [or concrete envelope ]exceeds ~~16 inches~~ (400 mm) overall.
  2. Limit use of underground-line warning tape to direct-buried cables.
  3. Install underground-line warning tape for direct-buried cables and cables in raceways.
- T. Baked-Enamel Signs:
1. Attach signs that are not self-adhesive type with mechanical fasteners appropriate to the location and substrate.
  2. Unless otherwise indicated, provide a single line of text with ~~1/2-inch-~~ (13-mm-) high letters on minimum ~~1-1/2-inch-~~ (38-mm-) high sign; where two lines of text are required, use signs minimum ~~2 inches~~ (50 mm) high.
- U. Metal-Backed Butyrate Signs:
1. Attach signs that are not self-adhesive type with mechanical fasteners appropriate to the location and substrate.
  2. Unless otherwise indicated, provide a single line of text with ~~1/2-inch-~~ (13-mm-) high letters on minimum ~~1-1/2-inch-~~ (38-mm-) high sign; where two lines of text are required, use signs minimum ~~2 inches~~ (50 mm) high.

V. Laminated Acrylic or Melamine Plastic Signs:

1. Attach signs and plastic labels that are not self-adhesive type with mechanical fasteners appropriate to the location and substrate.
2. Unless otherwise indicated, provide a single line of text with **1/2-inch- (13-mm-)** high letters on minimum **1-1/2-inch- (38-mm-)** high sign; where two lines of text are required, use signs minimum **2 inches (50 mm)** high.

W. Cable Ties: General purpose, for attaching tags, except as listed below:

1. Outdoors: UV-stabilized nylon.
2. In Spaces Handling Environmental Air: Plenum rated.

### 3.2 IDENTIFICATION SCHEDULE

- A. Install identification materials and devices at locations for most convenient viewing without interference with operation and maintenance of equipment. Install access doors or panels to provide view of identifying devices.
- B. Identify conductors, cables, and terminals in enclosures and at junctions, terminals, pull points, and locations of high visibility. Identify by system and circuit designation.
- C. Accessible Raceways and Metal-Clad Cables, 600 V or Less, for Service, Feeder, and Branch Circuits, More Than 30 A and 120 V to Ground: Identify with self-adhesive vinyl tape applied in bands.
1. Locate identification at changes in direction, at penetrations of walls and floors, at **50-foot (15-m)** maximum intervals in straight runs, and at **25-foot (7.6-m)** maximum intervals in congested areas.
- D. Power-Circuit Conductor Identification, 600 V or Less: For conductors in vaults, pull and junction boxes, manholes, and handholes, use vinyl wraparound labels or self-adhesive wraparound labels to identify the phase.
1. Locate identification at changes in direction, at penetrations of walls and floors, at **50-foot (15-m)** maximum intervals in straight runs, and at **25-foot (7.6-m)** maximum intervals in congested areas.
- E. Control-Circuit Conductor Identification: For conductors and cables in pull and junction boxes, manholes, and handholes, use write-on tags or self-adhesive wraparound labels with the conductor or cable designation, origin, and destination.
- F. Control-Circuit Conductor Termination Identification: For identification at terminations, provide self-adhesive wraparound labels with the conductor designation.
- G. Conductors to Be Extended in the Future: Attach marker tape to conductors and list source.



- H. Auxiliary Electrical Systems Conductor Identification: Self-adhesive vinyl tape that is uniform and consistent with system used by manufacturer for factory-installed connections.
  - 1. Identify conductors, cables, and terminals in enclosures and at junctions, terminals, and pull points. Identify by system and circuit designation.
- I. Locations of Underground Lines: Underground-line warning tape for power, lighting, communication, and control wiring and optical-fiber cable.
- J. Instructional Signs: Self-adhesive labels, including the color code for grounded and ungrounded conductors.
- K. Warning Labels for Indoor Cabinets, Boxes, and Enclosures for Power and Lighting: Self-adhesive equipment labels or Baked-enamel warning signs.
  - 1. Apply to exterior of door, cover, or other access.
  - 2. For equipment with multiple power or control sources, apply to door or cover of equipment, including, but not limited to, the following:
    - a. Power-transfer switches.
    - b. Controls with external control power connections.
- L. Arc Flash Warning Labeling: Self-adhesive labels.
- M. Operating Instruction Signs: Baked-enamel warning signs.
- N. Equipment Identification Labels:
  - 1. Indoor Equipment: Baked-enamel signs.
  - 2. Outdoor Equipment: Laminated acrylic or melamine sign.

END OF SECTION



## SECTION 262416

### PANELBOARDS

#### GENERAL

#### SUMMARY

Section Includes:

Distribution panelboards.  
Lighting and appliance branch-circuit panelboards.

#### DEFINITIONS

MCCB: Molded-case circuit breaker.

SPD: Surge protective device.

#### ACTION SUBMITTALS

Product Data: For each type of panelboard.

Shop Drawings: For each panelboard and related equipment.

Include dimensioned plans, elevations, sections, and details.  
Detail enclosure types including mounting and anchorage, environmental protection, knockouts, corner treatments, covers and doors, gaskets, hinges, and locks.  
Detail bus configuration, current, and voltage ratings.  
Short-circuit current rating of panelboards and overcurrent protective devices.  
Include evidence of NRTL listing for series rating of installed devices.  
Include evidence of NRTL listing for SPD as installed in panelboard.  
Detail features, characteristics, ratings, and factory settings of individual overcurrent protective devices and auxiliary components.  
Include wiring diagrams for power, signal, and control wiring.  
Key interlock scheme drawing and sequence of operations.  
Include time-current coordination curves for each type and rating of overcurrent protective device included in panelboards.

#### INFORMATIONAL SUBMITTALS

Panelboard schedules for installation in panelboards.

## CLOSEOUT SUBMITTALS

Operation and maintenance data.

## FIELD CONDITIONS

Service Conditions: NEMA PB 1, usual service conditions, as follows:

Ambient temperatures within limits specified.

Altitude not exceeding 6600 feet (2000 m).

## WARRANTY

Manufacturer's Warranty: Manufacturer agrees to repair or replace panelboards that fail in materials or workmanship within specified warranty period.

Panelboard Warranty Period: 12 months from date of Substantial Completion.

## PRODUCTS

### PANELBOARDS COMMON REQUIREMENTS

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.

Comply with NEMA PB 1.

Comply with NFPA 70.

Enclosures: Flush and Surface-mounted, dead-front cabinets.

Rated for environmental conditions at installed location.

Indoor Dry and Clean Locations: NEMA 250, Type 1.

Outdoor Locations: NEMA 250, Type 3R.

Wash-Down Areas and were indicated on drawings: NEMA 250, Type 4X stainless steel.

Height: 84 inches (2.13 m) maximum.

Front: Secured to box with concealed trim clamps. For surface-mounted fronts, match box dimensions; for flush-mounted fronts, overlap box. Trims shall cover all live parts and shall have no exposed hardware.

Hinged Front Cover: Entire front trim hinged to box and with standard door within hinged trim cover. Trims shall cover all live parts and shall have no exposed hardware.

Incoming Mains Location: Convertible between top and bottom.

Phase, Neutral, and Ground Buses: Tin-plated aluminum.

Conductor Connectors: Suitable for use with conductor material and sizes.

Material: Tin-plated aluminum Hard-drawn copper, 98 percent conductivity.

Main and Neutral Lugs: Mechanical type, with a lug on the neutral bar for each pole in the panelboard.

Ground Lugs and Bus-Configured Terminators: Mechanical type, with a lug on the bar for each pole in the panelboard.

Feed-Through Lugs: Mechanical type, suitable for use with conductor material. Locate at opposite end of bus from incoming lugs or main device.

Subfeed (Double) Lugs: Mechanical type suitable for use with conductor material. Locate at same end of bus as incoming lugs or main device.

Future Devices: Panelboards shall have mounting brackets, bus connections, filler plates, and necessary appurtenances required for future installation of devices.

Panelboard Short-Circuit Current Rating: Rated for series-connected system with integral or remote upstream overcurrent protective devices and labeled by an NRTL. Include label or manual with size and type of allowable upstream and branch devices listed and labeled by an NRTL for series-connected short-circuit rating.

Panelboard Short-Circuit Current Rating: Fully rated to interrupt symmetrical short-circuit current available at terminals. Assembly listed by an NRTL for 100 percent interrupting capacity.

## PERFORMANCE REQUIREMENTS

Surge Suppression: Factory installed as an integral part of indicated panelboards, complying with UL 1449 SPD Type 1.

## POWER PANELBOARDS

Manufacturer: Eaton, GE, Square D, Siemens

Panelboards: NEMA PB 1, distribution type.

Doors: Secured with vault-type latch with tumbler lock; keyed alike.

For doors more than 36 inches (914 mm) high, provide two latches, keyed alike.

Mains: Circuit breaker and Lugs only.

Branch Overcurrent Protective Devices for Circuit-Breaker Frame Sizes 125 A and Smaller: Bolt-on circuit breakers.

Branch Overcurrent Protective Devices for Circuit-Breaker Frame Sizes Larger Than 125 A: Bolt-on circuit breakers.

Branch Overcurrent Protective Devices: Fused switches.

## LIGHTING AND APPLIANCE BRANCH-CIRCUIT PANELBOARDS

Manufacturer: Eaton, GE, Square D, Siemens

Panelboards: NEMA PB 1, lighting and appliance branch-circuit type.

Mains: Circuit breaker or lugs only.

Branch Overcurrent Protective Devices: Bolt-on circuit breakers, replaceable without disturbing adjacent units.

Doors: Concealed hinges; secured with flush latch with tumbler lock; keyed alike.

## DISCONNECTING AND OVERCURRENT PROTECTIVE DEVICES

Manufacturer: Eaton, GE, Square D, Siemens

MCCB: Comply with UL 489, with series-connected rating to meet available fault currents.

Thermal-Magnetic Circuit Breakers:

- Inverse time-current element for low-level overloads.

- Instantaneous magnetic trip element for short circuits.

- Adjustable magnetic trip setting for circuit-breaker frame sizes 250 A and larger.

Adjustable Instantaneous-Trip Circuit Breakers: Magnetic trip element with front-mounted, field-adjustable trip setting.

Electronic Trip Circuit Breakers:

- RMS sensing.

- Field-replaceable rating plug or electronic trip.

- Digital display of settings, trip targets, and indicated metering displays.

- Multi-button keypad to access programmable functions and monitored data.

- Ten-event, trip-history log. Each trip event shall be recorded with type, phase, and magnitude of fault that caused the trip.

- Integral test jack for connection to portable test set or laptop computer.

Field-Adjustable Settings:

- Instantaneous trip.

- Long- and short-time pickup levels.

- Long and short time adjustments.

- Ground-fault pickup level, time delay, and  $I^2t$  response.

GFCI Circuit Breakers: Single- and double-pole configurations with Class A ground-fault protection (6-mA trip).

GFEP Circuit Breakers: Class B ground-fault protection (30-mA trip). Kitchen equipment only.

Arc-Fault Circuit Interrupter Circuit Breakers: Comply with UL 1699; 120/240-V, single-pole configuration.

Subfeed Circuit Breakers: Vertically mounted.

MCCB Features and Accessories:

Standard frame sizes, trip ratings, and number of poles.  
Breaker handle indicates tripped status.  
UL listed for reverse connection without restrictive line or load ratings.  
Lugs: Mechanical style, suitable for number, size, trip ratings, and conductor materials.  
Ground-Fault Protection: Integrally mounted relay and trip unit with adjustable pickup and time-delay settings, push-to-test feature, and ground-fault indicator.

## IDENTIFICATION

Panelboard Label: Manufacturer's name and trademark, voltage, amperage, number of phases, and number of poles shall be located on the interior of the panelboard door.

Breaker Labels: Faceplate shall list current rating, UL and IEC certification standards, and AIC rating.

Circuit Directory: Directory card inside panelboard door, mounted in transparent card holder.

## EXECUTION

### INSTALLATION

Comply with NECA 1.

Install panelboards and accessories according to NECA 407.

Mount top of trim **90 inches (2286 mm)** above finished floor unless otherwise indicated.

Mount panelboard cabinet plumb and rigid without distortion of box.

Mount recessed panelboards with fronts uniformly flush with wall finish and mating with back box.

Install overcurrent protective devices and controllers not already factory installed.

Set field-adjustable, circuit-breaker trip ranges.

Make grounding connections and bond neutral for services and separately derived systems to ground. Make connections to grounding electrodes, separate grounds for isolated ground bars, and connections to separate ground bars.

Install filler plates in unused spaces.

Stub four **1-inch (27-EMT)** empty conduits from panelboard into accessible ceiling space or space designated to be ceiling space in the future. Stub four **1-inch (27-EMT)** empty conduits into raised floor space or below slab not on grade.

Arrange conductors in gutters into groups and bundle and wrap with wire ties.

## IDENTIFICATION

Identify field-installed conductors, interconnecting wiring, and components; install warning signs complying with requirements in Section 260553 "Identification for Electrical Systems."

Create a directory to indicate installed circuit loads; incorporate Owner's final room designations. Obtain approval before installing. Handwritten directories are not acceptable. Install directory inside panelboard door.

Panelboard Nameplates: Label each panelboard with a nameplate complying with requirements for identification specified in Section 260553 "Identification for Electrical Systems."

Device Nameplates: Label each branch circuit device in power panelboards with a nameplate complying with requirements for identification specified in Section 260553 "Identification for Electrical Systems."

Install warning signs complying with requirements in Section 260553 "Identification for Electrical Systems" identifying source of remote circuit.

## FIELD QUALITY CONTROL

Perform tests and inspections.

Acceptance Testing Preparation:

Test insulation resistance for each panelboard bus, component, connecting supply, feeder, and control circuit.

Test continuity of each circuit.

Tests and Inspections:

Perform each visual and mechanical inspection and electrical test for low-voltage air circuit breakers stated in NETA Acceptance Testing Specification. Certify compliance with test parameters.

Correct malfunctioning units on-site, where possible, and retest to demonstrate compliance; otherwise, replace with new units and retest.

Panelboards will be considered defective if they do not pass tests and inspections.

Prepare test and inspection reports, including a certified report that identifies panelboards included and that describes scanning results, with comparisons of the two scans. Include notation of deficiencies detected, remedial action taken, and observations after remedial action.

END OF SECTION



## SECTION 262726

### WIRING DEVICES

#### PART 1 - GENERAL

##### 1.1 SUMMARY

###### A. Section Includes:

1. Standard-grade receptacles, 125 V, 15 and 20 A.
2. USB receptacles.
3. GFCI receptacles, 125 V, 20 A.
4. Toggle switches, 120/277 V, 15 and 20 A.
5. Decorator-style devices, 15 and 20 A.
6. Occupancy sensors.
7. Digital timer light switches.
8. Residential devices.
9. Wall-box dimmers.
10. Wall plates.

##### 1.2 ACTION SUBMITTALS

- A. Product Data: For each type of product.
- B. Shop Drawings: List of legends and description of materials and process used for premarking wall plates.
- C. Samples: One for each type of device and wall plate specified, in each color specified.

##### 1.3 INFORMATIONAL SUBMITTALS

- A. Field quality-control reports.

#### PART 2 - PRODUCTS

##### 2.1 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 use.
- B. Comply with NFPA 70.
- C. RoHS compliant.

- D. Comply with NEMA WD 1.
- E. Device Color: Ivory
  - 1. Wiring Devices Connected to Normal Power System: White unless otherwise indicated or required by NFPA 70 or device listing.
  - 2. Wiring Devices Connected to Essential Electrical System: Red.
  - 3. SPD Devices: Blue.
  - 4. Isolated-Ground Receptacles: Orange.
- F. Wall Plate Color: For plastic covers, match device color.
- G. Source Limitations: Obtain each type of wiring device and associated wall plate from single source from single manufacturer.

## 2.2 STANDARD-GRADE RECEPTACLES, 125 V, 20 A

- A. Duplex Receptacles, 125 V, 20A:
  - 1. Manufacturer: Hubbell, Leviton, Legrand
  - 2. Description: Two pole, three wire, and self-grounding.
  - 3. Configuration: NEMA WD 6, Configuration 5-20R.
  - 4. Standards: Comply with UL 498 and FS W-C-596.
- B. Tamper-Resistant Duplex Receptacles, 125 V, 20 A:
  - 1. Manufacturer: Hubbell, Leviton, Legrand
  - 2. Description: Two pole, three wire, and self-grounding. Integral shutters that operate only when a plug is inserted in the receptacle.
  - 3. Configuration: NEMA WD 6, Configuration 5-20R.
  - 4. Standards: Comply with UL 498 and FS W-C-596.
  - 5. Marking: Listed and labeled as complying with NFPA 70, "Tamper-Resistant Receptacles" Article.
- C. Weather-Resistant Duplex Receptacle, 125 V, 20 A:
  - Manufacturer: Hubbell, Leviton, Legrand
  - 1. Description: Two pole, three wire, and self-grounding. Integral shutters that operate only when a plug is inserted in the receptacle. Square face.
  - 2. Configuration: NEMA WD 6, Configuration 5-20R.
  - 3. Standards: Comply with UL 498.
  - 4. Marking: Listed and labeled as complying with NFPA 70, "Receptacles in Damp or Wet Locations" Article.
- D. Tamper- and Weather-Resistant Duplex Receptacles, 125 V, 20 A:
  - Manufacturer: Hubbell, Leviton, Legrand
  - 1. Description: Two pole, three wire, and self-grounding. Integral shutters that operate only when a plug is inserted in the receptacle. Square face.
  - 2. Configuration: NEMA WD 6, Configuration 5-20R.

3. Standards: Comply with UL 498.
4. Marking: Listed and labeled as complying with NFPA 70, "Tamper-Resistant Receptacles" and "Receptacles in Damp or Wet Locations" articles.

## 2.3 USB RECEPTACLES

### A. USB Charging Receptacles:

1. Manufacturer: Hubbell, Leviton, Legrand
2. Description: Single-piece, rivetless, nickel-plated, all-brass grounding system. Nickel-plated, brass mounting strap.
3. USB Receptacles: Dual, USB Type A, 5 V dc, and 2.1 A per receptacle (minimum).
4. Standards: Comply with UL 1310 and USB 3.0 devices.

### B. Tamper-Resistant Duplex and USB Charging Receptacles:

1. Manufacturer: Hubbell, Leviton, Legrand
2. Description: Single-piece, rivetless, nickel-plated, all-brass grounding system. Nickel-plated, brass mounting strap. Integral shutters that operate only when a plug is inserted in the line voltage receptacle.
3. Line Voltage Receptacles: Two pole, three wire, and self-grounding; NEMA WD 6, Configuration 5-20R.
4. USB Receptacles: Dual USB Type A, 5 V dc, and 2.1 A per receptacle (minimum).
5. Standards: Comply with UL 498, UL 1310, USB 3.0 devices, and FS W-C-596.
6. Marking: Listed and labeled as complying with NFPA 70, "Tamper-Resistant Receptacles" Article.

## 2.4 GFCI RECEPTACLES, 125 V, 20 A

### A. Duplex GFCI Receptacles, 125 V, 20 A:

1. Manufacturer: Hubbell, Leviton, Legrand
2. Description: Integral GFCI with "Test" and "Reset" buttons and LED indicator light. Two pole, three wire, and self-grounding.
3. Configuration: NEMA WD 6, Configuration 5-20R.
4. Type: Non-feed through.
5. Standards: Comply with UL 498, UL 943 Class A, and FS W-C-596.

### B. Tamper-Resistant Duplex GFCI Receptacles, 125 V, 20 A:

1. Manufacturer: Hubbell, Leviton, Legrand
2. Description: Integral GFCI with "Test" and "Reset" buttons and LED indicator light. Two pole, three wire, and self-grounding. Integral shutters that operate only when a plug is inserted in the receptacle.
3. Configuration: NEMA WD 6, Configuration 5-20R.
4. Type: Non-feed through.
5. Standards: Comply with UL 498, UL 943 Class A, and FS W-C-596.

6. Marking: Listed and labeled as complying with NFPA 70, "Tamper-Resistant Receptacles" Article.

C. Tamper- and Weather-Resistant, GFCI Duplex Receptacles, 125 V, 20 A:

1. Manufacturer: Hubbell, Leviton, Legrand
2. Description: Integral GFCI with "Test" and "Reset" buttons and LED indicator light. Two pole, three wire, and self-grounding. Integral shutters that operate only when a plug is inserted in the receptacle. Square face.
3. Configuration: NEMA WD 6, Configuration 5-15R.
4. Type: Non-feed through.
5. Standards: Comply with UL 498 and UL 943 Class A.
6. Marking: Listed and labeled as complying with NFPA 70, "Tamper-Resistant Receptacles" and "Receptacles in Damp or Wet Locations" articles.

2.5 TOGGLE SWITCHES, 120/277 V, 20 A

A. Single-Pole Switches, 120/277 V, 20 A:

1. Manufacturer: Hubbell, Leviton, Legrand
2. Standards: Comply with UL 20 and FS W-S-896.

B. Two-Pole Switches, 120/277 V, 20 A:

1. Manufacturer: Hubbell, Leviton, Legrand
2. Comply with UL 20 and FS W-S-896.

C. Three-Way Switches, 120/277 V, 20 A:

1. Manufacturer: Hubbell, Leviton, Legrand
2. Comply with UL 20 and FS W-S-896.

D. Lighted Single-Pole Switches, 120/277 V, 20 A:

1. Manufacturer: Hubbell, Leviton, Legrand
2. Description: Handle illuminated when switch is off.
3. Standards: Comply with NEMA WD 1, UL 20, and FS W-S-896.

2.6 OCCUPANCY SENSORS

A. Wall Switch Sensor Light Switch, Dual Technology:

1. Manufacturer: Hubbell, Leviton, Legrand, Wattstopper
2. Description: Switchbox-mounted, combination lighting-control sensor and conventional switch lighting-control unit using dual (ultrasonic and passive infrared) technology.
3. Standards: Comply with UL 20.
4. Rated 960 W at 120 V ac for tungsten lighting, 10 A at 120 V ac or 10 A at 277 V ac for fluorescent or LED lighting, and 1/4 hp at 120 V ac.

5. Adjustable time delay of 15 minutes.
6. Able to be locked to Manual-On mode.
7. Automatic Light-Level Sensor: Adjustable from 2 to 200 fc (21.5 to 2152 lux).
8. Connections: Provisions for connection to BAS.
9. Connections: RJ-45 communications outlet.
10. Connections: Integral wireless networking.

B. Wall Sensor Light Switch, Passive Infrared:

1. Manufacturer: Hubbell, Leviton, Legrand, Wattstopper
2. Description: Switchbox-mounted, combination, lighting-control sensor and conventional switch lighting-control unit using passive infrared technology.
3. Standards: Comply with UL 20.
4. Connections: Provisions for connection to BAS.
5. Connections: Hard wired.
6. Connections: Wireless.
7. Rated 960 W at 120 V ac for tungsten lighting, 10 A at 120 V ac or 10 A at 277 V ac for fluorescent or LED lighting, and 1/4 hp at 120 V ac.
8. Integral relay for connection to BAS.
9. Adjustable time delay of 15 minutes.
10. Able to be locked to Manual-On mode.
11. Automatic Light-Level Sensor: Adjustable from 2 to 200 fc (21.5 to 2152 lux).

## 2.7 TIMER LIGHT SWITCH

A. Digital Timer Light Switch:

1. Manufacturer: Hubbell, Intermatic
2. Description: Switchbox-mounted, combination digital timer and conventional switch lighting-control unit, with backlit digital display, with selectable time interval in 10 minute increments.
3. Standards: Comply with UL 20.
4. Rated 960 W at 120 V ac for tungsten lighting, 10 A at 120 V ac or 10 A at 277 V ac for fluorescent or LED lighting, and 1/4 hp at 120 V ac.
5. Integral relay for connection to BAS.

## 2.8 WALL PLATES

A. Single Source: Obtain wall plates from same manufacturer of wiring devices.

B. Single and combination types shall 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 and damp locations.

- C. Wet-Location, Weatherproof Cover Plates: NEMA 250, complying with Type 3R, weather-resistant thermoplastic (while in use cover).

## PART 3 - EXECUTION

### 3.1 INSTALLATION

- A. Comply with NECA 1, including mounting heights listed in that standard, unless otherwise indicated.
- B. Coordination with Other Trades:
  - 1. 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.
  - 2. 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.
  - 3. Install wiring devices after all wall preparation, including painting, is complete.
- C. Device Installation:
  - 1. Connect devices to branch circuits using pigtails that are not less than **6 inches (152 mm)** in length.
  - 2. When mounting into metal boxes, remove the fiber or plastic washers used to hold device-mounting screws in yokes, allowing metal-to-metal contact.
- D. Receptacle Orientation:
  - 1. Install ground pin of vertically mounted receptacles down, and on horizontally mounted receptacles to the left.
  - 2. Install hospital-grade receptacles in patient-care areas with the ground pin or neutral blade at the top.
- E. 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.
- F. Dimmers:
  - 1. Install dimmers within terms of their listing.
  - 2. Verify that dimmers used for fan-speed control are listed for that application.
  - 3. Install unshared neutral conductors on line and load side of dimmers according to manufacturers' device, listing conditions in the written instructions.
- G. Arrangement of Devices: Unless otherwise indicated, mount flush, with long dimension vertical and with grounding terminal of receptacles on top. Group adjacent switches under single, multigang wall plates.

- H. Adjust locations of floor service outlets and service poles to suit arrangement of partitions and furnishings.

### 3.2 FIELD QUALITY CONTROL

- A. Perform the following tests and inspections:
  - 1. Test Instruments: Use instruments that comply with UL 1436.
  - 2. Test Instrument for Receptacles: Digital wiring analyzer with digital readout or illuminated digital-display indicators of measurement.
- B. Tests for Receptacles:
  - 1. Line Voltage: Acceptable range is 105 to 132 V.
  - 2. Percent Voltage Drop under 15-A Load: A value of 6 percent or higher is unacceptable.
  - 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.
- C. Wiring device will be considered defective if it does not pass tests and inspections.
- D. Prepare test and inspection reports.

END OF SECTION





## SECTION 26 28 16

### ENCLOSED SWITCHES AND CIRCUIT BREAKERS

#### PART 1 - GENERAL

##### 1.1 SUMMARY

###### A. Section Includes:

1. Fusible switches.
2. Nonfusible switches.
3. Receptacle switches.
4. Shunt trip switches.
5. Molded-case circuit breakers (MCCBs).
6. Molded-case switches.
7. Enclosures.

##### 1.2 ACTION SUBMITTALS

###### A. Product Data: For each type of enclosed switch, circuit breaker, accessory, and component indicated. Include nameplate ratings, dimensioned elevations, sections, weights, and manufacturers' technical data on features, performance, electrical characteristics, ratings, accessories, and finishes.

1. Include time-current coordination curves (average melt) for each type and rating of overcurrent protective device; include selectable ranges for each type of overcurrent protective device. Provide in PDF electronic format.

###### B. Shop Drawings: For enclosed switches and circuit breakers.

1. Include plans, elevations, sections, details, and attachments to other work.
2. Include wiring diagrams for power, signal, and control wiring.

##### 1.3 INFORMATIONAL SUBMITTALS

###### A. Qualification Data: For qualified testing agency.

###### B. Field quality-control reports.

##### 1.4 CLOSEOUT SUBMITTALS

###### A. Operation and maintenance data.

## 1.5 QUALITY ASSURANCE

- A. Testing Agency Qualifications: Accredited by NETA.
  - 1. Testing Agency's Field Supervisor: Currently certified by NETA to supervise on-site testing.

## 1.6 WARRANTY

- A. Manufacturer's Warranty: Manufacturer and Installer agree to repair or replace components that fail in materials or workmanship within specified warranty period.
  - 1. Warranty Period: One year from date of Substantial Completion.

## PART 2 - PRODUCTS

### 2.1 GENERAL REQUIREMENTS

- A. Source Limitations: Obtain enclosed switches and circuit breakers, overcurrent protective devices, components, and accessories, within same product category, from single manufacturer.
- B. Product Selection for Restricted Space: Drawings indicate maximum dimensions for enclosed switches and circuit breakers, including clearances between enclosures, and adjacent surfaces and other items. Comply with indicated maximum dimensions.
- C. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by an NRTL, and marked for intended location and application.
- D. Comply with NFPA 70.

### 2.2 FUSIBLE SWITCHES

- A. Manufacturer: Eaton, GE, Square D, Siemens
- B. Type HD, Heavy Duty:
  - 1. Single throw.
  - 2. Three pole.
  - 3. 240-V ac.
  - 4. 1200 A and smaller.
  - 5. UL 98 and NEMA KS 1, horsepower rated, with clips or bolt pads to accommodate indicated fuses.
  - 6. Lockable handle with capability to accept three padlocks, and interlocked with cover in closed position.
- C. 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. Isolated Ground Kit: Internally mounted; insulated, labeled for copper and aluminum neutral conductors.
4. Class R Fuse Kit: Provides rejection of other fuse types when Class R fuses are specified.
5. Service-Rated Switches: Labeled for use as service equipment.

## 2.3 NONFUSIBLE SWITCHES

- A. Manufacturer: Eaton, GE, Square D, Siemens
- B. Type HD, Heavy Duty, Three Pole, Single Throw, 240-V ac, 1200 A and Smaller: UL 98 and NEMA KS 1, horsepower rated, lockable handle with capability to accept three padlocks, and interlocked with cover in closed position.
- C. 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. Isolated Ground Kit: Internally mounted; insulated, labeled for copper and aluminum neutral conductors.
  4. Class R Fuse Kit: Provides rejection of other fuse types when Class R fuses are specified.

## 2.4 MOLDED-CASE CIRCUIT BREAKERS

- A. Manufacturer: Eaton, GE, Square D, Siemens
- B. Circuit breakers shall be constructed using glass-reinforced insulating material. Current carrying components shall be completely isolated from the handle and the accessory mounting area.
- C. Circuit breakers shall have a toggle operating mechanism with common tripping of all poles, which provides quick-make, quick-break contact action. The circuit-breaker handle shall be over center, be trip free, and reside in a tripped position between on and off to provide local trip indication. Circuit-breaker escutcheon shall be clearly marked on and off in addition to providing international I/O markings. Equip circuit breaker with a push-to-trip button, located on the face of the circuit breaker to mechanically operate the circuit-breaker tripping mechanism for maintenance and testing purposes.
- D. The maximum ampere rating and UL, IEC, or other certification standards with applicable voltage systems and corresponding interrupting ratings shall be clearly marked on face of circuit breaker. Circuit breakers shall be 100 percent rated.

- E. MCCBs shall be equipped with a device for locking in the isolated position.
- F. Standards: Comply with UL 489 with interrupting capacity to comply with available fault currents.
- G. Thermal-Magnetic Circuit Breakers: Inverse time-current thermal 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.
- H. Features and Accessories:
  - 1. Standard frame sizes, trip ratings, and number of poles.

## 2.5 ENCLOSURES

- A. Enclosed Switches and Circuit Breakers: UL 489, NEMA KS 1, NEMA 250, and UL 50, to comply with environmental conditions at installed location.
- B. Enclosure Finish: The enclosure shall be finished with gray baked enamel paint, electrodeposited on cleaned, phosphatized steel (NEMA 250 Type 1) gray baked enamel paint, electrodeposited on cleaned, phosphatized galvanized steel (NEMA 250 Types 3R, 12).
- C. Operating Mechanism: The circuit-breaker operating handle shall be directly operable through the front cover of the enclosure (NEMA 250 Type 1), directly operable through the dead front trim of the enclosure (NEMA 250 Type 3R). The cover interlock mechanism shall have an externally operated override. The override shall not permanently disable the interlock mechanism, which shall return to the locked position once the override is released. The tool used to override the cover interlock mechanism shall not be required to enter the enclosure in order to override the interlock.

## PART 3 - EXECUTION

### 3.1 ENCLOSURE ENVIRONMENTAL RATING APPLICATIONS

- A. Enclosed Switches and Circuit Breakers: Provide enclosures at installed locations with the following environmental ratings.
  - 1. Indoor, Dry and Clean Locations: NEMA 250, Type 1.
  - 2. Outdoor Locations: NEMA 250, Type 3R.
  - 3. Kitchen and Wash-Down Areas: NEMA 250, Type 4X, stainless steel.
  - 4. Other Wet or Damp, Indoor Locations: NEMA 250, Type 4.

### 3.2 INSTALLATION

- A. Coordinate layout and installation of switches, circuit breakers, and components with equipment served and adjacent surfaces. Maintain required workspace clearances and required clearances for equipment access doors and panels.
- B. Install individual wall-mounted switches and circuit breakers with tops at uniform height unless otherwise indicated.
- C. Temporary Lifting Provisions: Remove temporary lifting of eyes, channels, and brackets and temporary blocking of moving parts from enclosures and components.
- D. Install fuses in fusible devices.
- E. Comply with NFPA 70 and NECA 1.

### 3.3 IDENTIFICATION

- A. Comply with requirements in Section 260553 "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.

### 3.4 FIELD QUALITY CONTROL

- A. Perform tests and inspections with the assistance of a factory-authorized service representative.
- B. Tests and Inspections for Switches:
  - 1. Visual and Mechanical Inspection:
    - a. Inspect physical and mechanical condition.
    - b. Inspect anchorage, alignment, grounding, and clearances.
    - c. Verify that the unit is clean.
    - d. Verify blade alignment, blade penetration, travel stops, and mechanical operation.
    - e. Verify that fuse sizes and types match the Specifications and Drawings.
    - f. Verify that each fuse has adequate mechanical support and contact integrity.
    - g. Inspect bolted electrical connections for high resistance using one of the two following methods:
      - 1) Use a low-resistance ohmmeter.
        - a) Compare bolted connection resistance values to values of similar connections. Investigate values that deviate from those

of similar bolted connections by more than 50 percent of the lowest value.

- 2) Verify tightness of accessible bolted electrical connections by calibrated torque-wrench method in accordance with manufacturer's published data or NETA ATS Table 100.12.

- a) Bolt-torque levels shall be in accordance with manufacturer's published data. In the absence of manufacturer's published data, use NETA ATS Table 100.12.

- h. Verify that operation and sequencing of interlocking systems is as described in the Specifications and shown on the Drawings.
- i. Verify correct phase barrier installation.
- j. Verify lubrication of moving current-carrying parts and moving and sliding surfaces.

## 2. Electrical Tests:

- a. Perform resistance measurements through bolted connections with a low-resistance ohmmeter. Compare bolted connection resistance values to values of similar connections. Investigate values that deviate from adjacent poles or similar switches by more than 50 percent of the lowest value.
- b. Measure contact resistance across each switchblade fuseholder. Drop values shall not exceed the high level of the manufacturer's published data. If manufacturer's published data are not available, investigate values that deviate from adjacent poles or similar switches by more than 50 percent of the lowest value.
- c. Perform insulation-resistance tests for one minute on each pole, phase-to-phase and phase-to-ground with switch closed, and across each open pole. Apply voltage in accordance with manufacturer's published data. In the absence of manufacturer's published data, use Table 100.1 from the NETA ATS. Investigate values of insulation resistance less than those published in Table 100.1 or as recommended in manufacturer's published data.
- d. Measure fuse resistance. Investigate fuse-resistance values that deviate from each other by more than 15 percent.
- e. Perform ground fault test according to NETA ATS 7.14 "Ground Fault Protection Systems, Low-Voltage."

## C. Tests and Inspections for Molded Case Circuit Breakers:

### 1. Visual and Mechanical Inspection:

- a. Verify that equipment nameplate data are as described in the Specifications and shown on the Drawings.
- b. Inspect physical and mechanical condition.
- c. Inspect anchorage, alignment, grounding, and clearances.
- d. Verify that the unit is clean.
- e. Operate the circuit breaker to ensure smooth operation.

- f. Inspect bolted electrical connections for high resistance using one of the two following methods:
  - 1) Use a low-resistance ohmmeter.
    - a) Compare bolted connection resistance values to values of similar connections. Investigate values that deviate from those of similar bolted connections by more than 50 percent of the lowest value.
  - 2) Verify tightness of accessible bolted electrical connections by calibrated torque-wrench method in accordance with manufacturer's published data or NETA ATS Table 100.12.
    - a) Bolt-torque levels shall be in accordance with manufacturer's published data. In the absence of manufacturer's published data, use NETA ATS Table 100.12.
- g. Inspect operating mechanism, contacts, and chutes in unsealed units.
- h. Perform adjustments for final protective device settings in accordance with the coordination study.

2. Electrical Tests:

- a. Perform resistance measurements through bolted connections with a low-resistance ohmmeter. Compare bolted connection resistance values to values of similar connections. Investigate values that deviate from adjacent poles or similar switches by more than 50 percent of the lowest value.
- b. Perform insulation-resistance tests for one minute on each pole, phase-to-phase and phase-to-ground with circuit breaker closed, and across each open pole. Apply voltage in accordance with manufacturer's published data. In the absence of manufacturer's published data, use Table 100.1 from the NETA ATS. Investigate values of insulation resistance less than those published in Table 100.1 or as recommended in manufacturer's published data.
- c. Perform a contact/pole resistance test. Drop values shall not exceed the high level of the manufacturer's published data. If manufacturer's published data are not available, investigate values that deviate from adjacent poles or similar switches by more than 50 percent of the lowest value.
- d. Perform insulation resistance tests on all control wiring with respect to ground. Applied potential shall be 500-V dc for 300-V rated cable and 1000-V dc for 600-V rated cable. Test duration shall be one minute. For units with solid state components, follow manufacturer's recommendation. Insulation resistance values shall be no less than two megohms.
- e. Test functionality of the trip unit by means of primary current injection. Pickup values and trip characteristics shall be as specified and within manufacturer's published tolerances.
- f. Perform minimum pickup voltage tests on shunt trip and close coils in accordance with manufacturer's published data. Minimum pickup voltage of the shunt trip and close coils shall be as indicated by manufacturer.

- g. Verify correct operation of auxiliary features such as trip and pickup indicators; zone interlocking; electrical close and trip operation; trip-free, anti-pump function; and trip unit battery condition. Reset all trip logs and indicators. Investigate units that do not function as designed.
    - h. Verify operation of charging mechanism. Investigate units that do not function as designed.
  - 3. Correct malfunctioning units on-site, where possible, and retest to demonstrate compliance; otherwise, replace with new units and retest.
  - 4. Test and adjust controls, remote monitoring, and safeties. Replace damaged and malfunctioning controls and equipment.
- D. Enclosed switches and circuit breakers will be considered defective if they do not pass tests and inspections.
- E. Prepare test and inspection reports.
  - 1. Test procedures used.
  - 2. Include identification of each enclosed switch and circuit breaker tested and describe test results.
  - 3. List deficiencies detected, remedial action taken, and observations after remedial action.

END OF SECTION



SECTION 26 51 19  
LED INTERIOR LIGHTING

PART 1 - GENERAL

1.1 ACTION SUBMITTALS

- A. Product Data: For each type of product.
  - 1. Manufacturers' Certified Data: Photometric data certified by manufacturer's laboratory with a current accreditation under the National Voluntary Laboratory Accreditation Program for Energy Efficient Lighting Products.
- B. Shop Drawings: For nonstandard or custom luminaires.
  - 1. Include plans, elevations, sections, and mounting and attachment details.
  - 2. Include details of luminaire assemblies. Indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
  - 3. Include diagrams for power, signal, and control wiring.

1.2 INFORMATIONAL SUBMITTALS

- A. Coordination Drawings: Reflected ceiling plan(s) and other details, drawn to scale and coordinated with each other, using input from installers of the items involved.
- B. Product Certificates: For each type of luminaire.
- C. Product test reports.
- D. Sample warranty.

1.3 CLOSEOUT SUBMITTALS

- A. Operation and maintenance data.

1.4 QUALITY ASSURANCE

- A. Luminaire Photometric Data Testing Laboratory Qualifications: Luminaire manufacturer's laboratory that is accredited under the NVLAP for Energy Efficient Lighting Products.
- B. Provide luminaires from a single manufacturer for each luminaire type.

- C. Each luminaire type shall be binned within a three-step MacAdam Ellipse to ensure color consistency among luminaires.

## 1.5 WARRANTY

- A. Warranty: Manufacturer and Installer agree to repair or replace components of luminaires that fail in materials or workmanship within specified warranty period.
- B. Warranty Period: Five year(s) from date of Substantial Completion.

## PART 2 - PRODUCTS

### 2.1 LUMINAIRE REQUIREMENTS

- 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. Factory-Applied Labels: Comply with UL 1598. Include recommended lamps. Locate labels where they will be readily visible to service personnel, but not seen from normal viewing angles when lamps are in place.
  - 1. Label shall include the following lamp characteristics:
    - a. "USE ONLY" and include specific lamp type.
    - b. Lamp diameter, shape, size, wattage, and coating.
    - c. CCT and CRI.
- C. Recessed luminaires shall comply with NEMA LE 4.

### 2.2 LIGHTING FIXTURES TYPE.

- A. See drawings for lighting fixtures schedule.

### 2.3 MATERIALS

- A. Metal Parts:
  - 1. Free of burrs and sharp corners and edges.
  - 2. Sheet metal components shall be steel unless otherwise indicated.
  - 3. Form and support to prevent warping and sagging.
- B. Steel:
  - 1. ASTM A 36/A 36M for carbon structural steel.
  - 2. ASTM A 568/A 568M for sheet steel.

- C. Stainless Steel:
  - 1. 1. Manufacturer's standard grade.
  - 2. 2. Manufacturer's standard type, ASTM A 240/240 M.
- D. Galvanized Steel: ASTM A 653/A 653M.
- E. Aluminum: ASTM B 209.

## 2.4 METAL FINISHES

- A. Variations in finishes are unacceptable in the same piece. Variations in finishes of adjoining components are acceptable if they are within the range of approved Samples and if they can be and are assembled or installed to minimize contrast.

## 2.5 LUMINAIRE SUPPORT

- A. Comply with requirements in Section 260529 "Hangers and Supports for Electrical Systems" for channel and angle iron supports and nonmetallic channel and angle supports.
- B. Single-Stem Hangers: 1/2-inch (13-mm) steel tubing with swivel ball fittings and ceiling canopy. Finish same as luminaire.
- C. Wires: ASTM A 641/A 641 M, Class 3, soft temper, zinc-coated steel, 12 gage (2.68 mm).
- D. Rod Hangers: 3/16-inch (5-mm) minimum diameter, cadmium-plated, threaded steel rod.
- E. Hook Hangers: Integrated assembly matched to luminaire, line voltage, and equipment with threaded attachment, cord, and locking-type plug.

## PART 3 - EXECUTION

### 3.1 INSTALLATION

- A. Comply with NECA 1.
- B. Install luminaires level, plumb, and square with ceilings and walls unless otherwise indicated.
- C. Install lamps in each luminaire.
- D. Supports:
  - 1. Sized and rated for luminaire weight.
  - 2. Able to maintain luminaire position after cleaning and relamping.

3. Provide support for luminaire without causing deflection of ceiling or wall.
  4. Luminaire-mounting devices shall be capable of supporting a horizontal force of 100 percent of luminaire weight and a vertical force of 400 percent of luminaire weight.
- E. Comply with requirements in Section 260519 "Low-Voltage Electrical Power Conductors and Cables" for wiring connections.

### 3.2 IDENTIFICATION

- A. Identify system components, wiring, cabling, and terminals. Comply with requirements for identification specified in Section 260553 "Identification for Electrical Systems."

### 3.3 FIELD QUALITY CONTROL

- A. Perform the following tests and inspections:
1. Operational Test: After installing luminaires, switches, and accessories, and after electrical circuitry has been energized, test units to confirm proper operation.
  2. Test for Emergency Lighting: Interrupt power supply to demonstrate proper operation. Verify transfer from normal power to battery power and retransfer to normal.
- B. Luminaire will be considered defective if it does not pass operation tests and inspections.
- C. Prepare test and inspection reports.

END OF SECTION

SECTION 26 56 19  
LED EXTERIOR LIGHTING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Exterior solid-state luminaires that are designed for and exclusively use LED lamp technology.
2. Luminaire supports.
3. Luminaire-mounted photoelectric relays.

1.2 DEFINITIONS

- A. CCT: Correlated color temperature.
- B. CRI: Color rendering index.
- C. Fixture: See "Luminaire."
- D. IP: International Protection or Ingress Protection Rating
- E. Lumen: Measured output of lamp and luminaire, or both.
- F. Luminaire: Complete lighting unit, including lamp, reflector, and housing.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of luminaire.

1.4 INFORMATIONAL SUBMITTALS

- A. Coordination Drawings: Plans, drawn to scale and coordinated.
- B. Product Certificates: For each type of the following:
  1. Luminaire.
  2. Photoelectric relay.
- C. Sample warranty.

## 1.5 CLOSEOUT SUBMITTALS

### A. Operation and maintenance data.

1. Provide a list of all lamp types used on Project. Use ANSI and manufacturers' codes.
2. Provide a list of all photoelectric relay types used on Project; use manufacturers' codes.

## 1.6 FIELD CONDITIONS

### A. Mark locations of exterior luminaires for approval by Architect prior to the start of luminaire installation.

## 1.7 WARRANTY

### A. Warranty: Manufacturer and Installer agree to repair or replace components of luminaires that fail in materials or workmanship within specified warranty period.

1. Warranty Period: 5 years from date of Substantial Completion.

# PART 2 - PRODUCTS

## 2.1 LUMINAIRE REQUIREMENTS

- 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. NRTL Compliance: Luminaires shall be listed and labeled for indicated class and division of hazard by an NRTL.
- C. Source Limitations: Obtain luminaires from single source from a single manufacturer.
- D. Source Limitations: For luminaires, obtain each color, grade, finish, type, and variety of luminaire from single source with resources to provide products of consistent quality in appearance and physical properties.

## 2.2 LUMINAIRE TYPES

### A. See drawings for lighting fixtures schedule.

## 2.3 MATERIALS

### A. Metal Parts: Free of burrs and sharp corners and edges.

- B. Doors, Frames, and Other Internal Access: Smooth operating, free of light leakage under operating conditions, and designed to permit relamping without use of tools. Designed to prevent doors, frames, lenses, diffusers, and other components from falling accidentally during relamping and when secured in operating position. Doors shall be removable for cleaning or replacing lenses.
- C. Diffusers and Globes:
  - 1. Acrylic Diffusers: 100 percent virgin acrylic plastic, with high resistance to yellowing and other changes due to aging, exposure to heat, and UV radiation.
  - 2. Glass: Annealed crystal glass unless otherwise indicated.
  - 3. Lens Thickness: At least 0.125 inch (3.175 mm) minimum unless otherwise indicated.
- D. Lens and Refractor Gaskets: Use heat- and aging-resistant resilient gaskets to seal and cushion lenses and refractors in luminaire doors.
- E. Reflecting surfaces shall have minimum reflectance as follows unless otherwise indicated:
  - 1. White Surfaces: 85 percent.
  - 2. Specular Surfaces: 83 percent.
  - 3. Diffusing Specular Surfaces: 75 percent.
- F. Housings:
  - 1. Rigidly formed, weather- and light-tight enclosure that will not warp, sag, or deform in use.
  - 2. Provide filter/breather for enclosed luminaires.

## PART 3 - EXECUTION

### 3.1 GENERAL INSTALLATION REQUIREMENTS

- A. Comply with NECA 1.
- B. Use fastening methods and materials selected to resist seismic forces defined for the application and approved by manufacturer.
- C. Install lamps in each luminaire.
- D. Fasten luminaire to structural support.
- E. Supports:
  - 1. Sized and rated for luminaire weight.
  - 2. Able to maintain luminaire position after cleaning and relamping.
  - 3. Support luminaires without causing deflection of finished surface.

4. Luminaire-mounting devices shall be capable of supporting a horizontal force of 100 percent of luminaire weight and a vertical force of 400 percent of luminaire weight.

F. Wall-Mounted Luminaire Support:

1. Attached to structural members in walls.

G. Wiring Method: Install cables in raceways. Conceal raceways and cables.

H. Install luminaires level, plumb, and square with finished grade unless otherwise indicated.

I. Coordinate layout and installation of luminaires with other construction.

J. Adjust luminaires that require field adjustment or aiming.

K. Comply with requirements in Section 260519 "Low-Voltage Electrical Power Conductors and Cables" and Section 260533 "Raceways and Boxes for Electrical Systems" for wiring connections and wiring methods.

### 3.2 INSTALLATION OF INDIVIDUAL GROUND-MOUNTED LUMINAIRES

A. Aim as indicated on Drawings.

B. Install on concrete base with top 4 inches (100 mm) above finished grade or surface at luminaire location. Cast conduit into base, and finish by troweling and rubbing smooth. Concrete materials, installation, and finishing are specified in Section 033000 "Cast-in-Place Concrete."

### 3.3 CORROSION PREVENTION

A. Aluminum: Do not use in contact with earth or concrete. When in direct contact with a dissimilar metal, protect aluminum by insulating fittings or treatment.

B. Steel Conduits: Comply with Section 260533 "Raceways and Boxes for Electrical Systems." In concrete foundations, wrap conduit with 0.010-inch- (0.254-mm-) thick, pipe-wrapping plastic tape applied with a 50 percent overlap.

### 3.4 IDENTIFICATION

A. Identify system components, wiring, cabling, and terminals. Comply with requirements for identification specified in Section 260553 "Identification for Electrical Systems."

### 3.5 FIELD QUALITY CONTROL

A. Inspect each installed luminaire for damage. Replace damaged luminaires and components.



- B. Perform the following tests and inspections:
  - 1. Operational Test: After installing luminaires, switches, and accessories, and after electrical circuitry has been energized, test units to confirm proper operation.
  - 2. Verify operation of photoelectric controls.
- C. Illumination Tests:
  - 1. Measure light intensities at night. Use photometers with calibration referenced to NIST standards. Comply with the following IES testing guide(s):
    - a. IES LM-5.
    - b. IES LM-50.
    - c. IES LM-52.
    - d. IES LM-64.
    - e. IES LM-72.
  - 2. Operational Test: After installing luminaires, switches, and accessories, and after electrical circuitry has been energized, test units to confirm proper operation.
- D. Luminaire will be considered defective if it does not pass tests and inspections.
- E. Prepare a written report of tests, inspections, observations, and verifications indicating and interpreting results. If adjustments are made to lighting system, retest to demonstrate compliance with standards.

### 3.6 DEMONSTRATION

- A. Train Owner's maintenance personnel to adjust, operate, and maintain luminaires.

END OF SECTION



**SECTION 31 11 00  
CLEARING, GRUBBING, AND STRIPPING**

**PART 1 - GENERAL**

**1.1 DESCRIPTION**

- A. This section describes the work included in clearing, grubbing, stripping, and otherwise preparing the project site for construction operations.

**1.2 EXISTING TREES AND SHRUBBERY**

- A. Existing trees, shrubbery, and other vegetative material may not be shown on the drawings. Inspect the site as to the nature, location, size, and extent of vegetative material to be removed or preserved, as specified herein. Preserve in place trees that are specifically shown on the drawings and designated to be preserved.

**1.3 CLEARING AND GRUBBING LIMITS**

- A. All excavation and embankment areas associated with new structures, slabs, and roadways shall be cleared and grubbed.

**PART 2 - MATERIALS**

None Required

**PART 3 - EXECUTION**

**3.1 PRESERVATION OF EXISTING TREES, SHRUBS, AND OTHER PLANT MATERIAL**

- A. All plant materials (trees, shrubbery, and plants) beyond the limits of clearing and grubbing shall be saved and protected from damage resulting from the work. No filling, excavating, trenching, or stockpiling of materials will be permitted within the drip line of these plant materials. The drip line is defined as a circle drawn by extending a line vertically to the ground from the outermost branches of a plant or group of plants. To prevent soil compaction within the drip line area, no equipment will be permitted within this area.
- B. When trees are close together, restrict entry to area within drip line by fencing. In areas where no fence is erected, the trunks of all trees 2 inches or greater in diameter shall be protected by encircling the trunk entirely with boards held securely by 12-gauge wire and staples. This protection shall extend from ground level to a height of 6 feet. Cut and remove tree branches where such cutting is necessary to effect construction operation. Remove branches other than those required to effect the work to provide a balanced appearance of any tree. Seals resulting from the removal of branches shall be treated with tree sealant.

**3.2 CLEARING AND GRUBBING**

- A. Clearing and grubbing shall be performed in the areas indicated and where required to provide adequate work space, including ditches, areas where fill will be placed and where structures will be erected, and including spaces for control stakes and hubs for pipeline work. Should such items be

damaged, they shall be replaced in kind or restored to at least as good condition as that in which they were found immediately before the work was begun, at the expense of the Contractor and to the satisfaction of the Engineer.

- B. All weeds, rubbish and all other obstructions resting on or protruding through the surface of the existing ground, shall be collected and satisfactorily disposed of as specified herein and in compliance with the applicable laws and regulations. All such material shall be removed to a depth of one foot below finished grade.
- C. Where excavation is performed within areas cleared and grubbed, all stumps, roots over two inches in diameter, and deleterious material thereby exposed shall be removed to a depth of one foot below the excavated surface.
- D. Where debris is removed from areas other than those where subsequent excavation, filling, and grading will be done, no depressions shall be left, but the resulting holes shall be filled and neatly graded to conform to the grades indicated on the drawings.

### **3.3 STRIPPING**

- A. Areas to be stripped: All excavation and embankment areas associated with new structures, slabs, walks, and roadway shall be stripped. Stockpile areas shall be stripped.
- B. Stripping: Remove and dispose of all organic sod, topsoil, grass and grass roots, and other objectionable material remaining after clearing and grubbing from the areas designated to be stripped.

### **3.4 DISPOSAL OF CLEARING AND GRUBBING DEBRIS**

- A. All material removed in clearing and grubbing shall be disposed of as promptly as practical and shall not be left until the completion of the Contract.
- B. Burning combustible clearing and grubbing materials from the site will not be allowed. The Contractor shall be responsible for disposing, clearing and grubbing material at a suitable city dump or private dump in accordance with all applicable laws and regulations. All dumping charges are to be paid by the Contractor.
- C. The use of herbicides or blasting in clearing and grubbing is specifically prohibited.

### **3.5 MEASUREMENT AND PAYMENT**

- A. No additional payment shall be made for the work hereinbefore specified. The Contractor's unit price or lump sum bid as set forth in the PROPOSAL shall constitute full compensation for the work provided in this section.

END OF SECTION

**SECTION 31 15 00  
DEMOLITION**

**PART 1 - GENERAL**

**1.1 WORK INCLUDED**

- A. The work covered by this section of the specifications consists of furnishing all material, labor, tools, equipment, appliances and services necessary to complete the demolition of control structures shown in the drawings and specified herein. The contractor shall examine the various drawings, visit the site and determine for himself the extent of the work, the extent of work affected therein and all conditions under which he is required to perform the various operations.
- B. Existing site structures and appurtenances affected herein are indicated generally in the drawings.

**1.2 RELATED WORK**

- A. Permits and Licenses: Contractor shall obtain all necessary permits and licenses for performing the work and shall furnish a copy of same to the engineer prior to commencing the work. The contractor shall comply with the requirements of the permits.

**1.3 JOB CONDITIONS**

- A. Sequence of Construction: Demolition and removal work shall be coordinated with the Owner and agreed upon sequence of construction to minimize down time at the site.

**1.4 DISPOSITION OF DEMOLISHED MATERIALS**

- A. Salvaged materials designated as property of the Owner shall be stored in areas designated by the owner. The contractor shall promptly remove all other materials from the site.

**PART 2 - MATERIALS (Not applicable)**

**PART 3 - EXECUTION**

**3.1 PREPARATION**

- A. Salvage: Material to be salvaged shall be removed with the minimum amount of damage and stored on the site as directed by the owner. Material stored on the ground shall be placed on blocks, and all stored material shall be staked and placed in an orderly manner.

### **3.2 PERFORMANCE**

- A. General: Demolition shall result in the complete removal and disposal of existing structures and appurtenances from the site as indicated on drawings, the salvaging of indicated items and the cleanup after completion of the demolition work.
- B. Concrete Slabs and Vaults: Concrete slabs and foundation walls shall be removed to a depth of not less than 24 inches below grade.
- C. Piping: All abandoned piping not in conflict with the proposed work may either be removed from the site by the Contractor at no extra cost to the owner or ends shall be capped with suitable material and backfilled.
- D. Modifications:
  - 1. The cutting and removal of existing work necessary for modifications and installation of new work shall be made with a minimum of damage to the work that is to remain. Any damage done to existing facilities which are to remain shall be repaired at the Contractor's expense to the satisfaction of the owner.
  - 2. The contractor shall follow other specific instructions for the modification work given in other sections of these specifications and as shown on the drawings.

### **3.3 CLEANUP**

- A. Site shall be left in a clean condition satisfactory to the engineer, free from demolished materials, rubbish or debris.
- B. The contractor shall restore items intended to remain that have been damaged by demolition work.
- C. All interrupted utility services shall be returned to their pre-existing state. Disconnect temporary services, unless otherwise specified.

### **3.4 MEASUREMENT AND PAYMENT**

- A. No additional payment shall be made for the work hereinbefore specified. The Contractor's lump sum bid as set forth in the PROPOSAL shall constitute full compensation for the work provided in this section.

END OF SECTION

**SECTION 31 20 00  
EARTHWORK**

**PART 1 - GENERAL**

**1.1 SCOPE**

- A. The work under this section includes the furnishing of all labor, materials, tools and equipment necessary to complete the earthwork shown on the drawings and specified herein, including rough grading.

**1.2 GENERAL REQUIREMENTS**

- A. Bidders shall examine the site of the work and make their own determination of the character of materials and the conditions to be encountered on the work, and their proposal shall be based upon their own investigations. Neither the Owner nor the Engineer shall be held responsible for variations found to exist between any soils data which may be included for information only, and actual field conditions that develop through the period of construction.
- B. Underground structures and utilities shown on the drawings are located according to the best available records. However, it shall be the Contractor's responsibility to become acquainted with all information and to locate all underground structures and utilities along the line of work in order to avoid conflict with existing facilities. Neither the Owner nor the Engineer shall be held responsible for the inaccuracies or omissions in the location or grade of facilities of this type.
- C. Where actual conflicts are unavoidable, work shall be performed so as to cause as little interference as possible with the service rendered by the facility disturbed. Facilities or structures damaged in the prosecution of the work shall be repaired immediately at the Contractor's expense, in conformance with the best standard practice, to the satisfaction of the facility owner and to the extent required, including replacement.
- D. Benchmarks and other reference points shall be carefully maintained and, if disturbed or destroyed by the Contractor, shall be replaced by a Professional Surveyor registered to practice in the State of Florida, to the satisfaction of the Engineer and at no additional cost to the Owner. Location of benchmarks and other reference points not shown on the drawings but used during construction shall be recorded on the Contractor's "as-builts" of the Contract Drawings.
- E. On paved surfaces the Contractor shall not use or operate tractors, bulldozers, or other power operated equipment which would damage such surfaces. All surfaces which have been damaged by the Contractor's operations shall be restored to a condition at least equal to that in which they were found immediately before work was begun. Suitable materials and methods as determined by the Engineer shall be used for such restoration.
- F. Core boring data, including groundwater elevations or conditions, existing piping, and structure locations as appended to these specifications and indicated on the drawings, are presented only as information that is available which indicates certain conditions found and limited to the exact locations and on the dates indicated. The inclusion of such data shall not be interpreted as an indication of conditions that may actually be encountered through the period of construction.

**PART 2 - MATERIALS**

None required.

### **PART 3 - EXECUTION**

#### **3.1 STRIPPING AND STOCKPILING TOPSOIL**

- A. When directed by the Owner, topsoil suitable for final grading operations shall be stripped and stockpiled in designated areas for reuse. Unsuitable material shall be removed from the site and disposed of in a manner satisfactory to the Engineer at no additional cost to the Owner.
- B. The Owner reserves the right to claim and use for his own benefit all excess spoil material.

#### **3.2 GRADING**

- A. Grade all areas as indicated. Fill shall be brought to finish grades shown and shall be graded to drain water away from structures.
- B. Overall Area Grading for Which No Grades are Indicated: Within the limits of construction and outer limits of clearing and grubbing, all holes and other depressions shall be filled, all mounds and ridges cut down, and the area brought to sufficiently uniform control so that the Owner's subsequent mowing operation will not be hindered by irregular terrain. This work shall be done regardless of whether the irregularities were the result of the Contractor's operations or originally existed.

#### **3.3 EXCESS MATERIAL**

- A. Excess excavated material suitable for reuse as backfill, shall be immediately disposed of by the Contractor at a site selected by the Engineer or Owner, and at no additional cost to the Owner. Material shall be spread and graded in such a manner as to drain properly and not disturb existing drainage conditions.
- B. Excess excavated material not suitable as reuse for backfill shall be immediately disposed of by the Contractor at no expense to the Owner.

#### **3.4 DUST CONTROL**

- A. If, in the opinion of the Owner or the Engineer, it is necessary to control dust from time to time during the progress of the work, the Contractor shall use water trucks and/or furnish and spread calcium chloride at the site of the work as directed by the Engineer at no additional cost to the Owner.



### **3.5 SILTATION AND EROSION**

- A. The Contractor shall take steps and make suitable provisions to minimize siltation and erosion which may result from, or as a result of, his operations during the course of construction of this project. All siltation and erosion control shall be in strict accordance with applicable local, state, and federal requirements. All siltation and erosion control shall be in strict accordance with Section 31 25 00 of these specifications.

### **3.6 COMPACTION**

- A. Unless otherwise specified or shown on the drawings, areas outside the limits of pipe trenches and structures must meet the following compaction requirements:
  - 1. Subgrade Under Fill or Backfill: 90% relative density to a depth of 12 inches.
  - 2. Backfill or Fill Under Pavement: 98% relative density in 6-inch maximum layers.
  - 3. All Other Areas: 95% relative density in 6-inch maximum layers.
- B. Compact by using methods acceptable to the owner or his representative (powered tampers, vibrators, etc.). Compact the first two feet of backfill over pipe either by hand-operated tamping devices or with powered equipment which will not damage the pipe. Flooding or puddling with water to consolidate backfill is not acceptable, except where sand is encountered and the specified density can be obtained using this method. This method shall be approved by the Engineer.
- C. During the compacting operations, maintain material within  $\pm 2\%$  of optimum moisture. Aerate material containing excessive moisture by blading, discing, or harrowing to hasten the drying process.

### **3.7 TESTING**

- A. Shall be contracted by the Owner with an independent testing laboratory to perform material and soil testing in accordance with County Requirements.

### **3.8 MEASUREMENT AND PAYMENT:**

- A. No additional payment shall be made for the work hereinbefore specified. The Contractor's unit price or lump sum bid as set forth in the PROPOSAL shall constitute full compensation for the work involved for each item.

END OF SECTION



**SECTION 31 23 16**  
**EXCAVATION AND BACKFILL FOR UTILITIES AND STRUCTURES**

**PART 1 - GENERAL**

**1.1 DESCRIPTION**

- A. This section includes materials, testing, and installation of earthwork for excavations, fills, and embankments for structures, pavements, rights-of-way, and sites and trench excavating, backfilling, and compacting for underground pipelines and appurtenant structures.

**1.2 STANDARDS**

- A. Determine the density of soil in place by the sand cone method, ASTM D1556, by nuclear methods, ASTM D2922; or by the rubber balloon method, ASTM D2167.
- B. Determine laboratory optimum moisture-density relations of cohesive soils by ASTM D1557 (modified Proctor).
- C. Sample backfill materials by ASTM D75.
- D. For cohesive soils, "relative density" is the ratio, expressed as a percentage, of the in place dry density to the laboratory maximum dry density as determined by ASTM D1557 (modified Proctor).
- E. Determine the relative density of cohesionless soils by ASTM D2049.

**1.3 DEFINITIONS**

- A. Subgrade: The undisturbed material immediately below the bottom of an excavation, below an area of fill, or below a structure.
- B. Excavation: Removal of earth or buried material, either temporarily or permanently, as specified or as necessary for construction of the project.
- C. Over-excavation: Excavation exceeding that specified or shown on the plans.
- D. Backfill: Earth material placed permanently in an excavated area.
- E. Fill: Earth material placed permanently above the existing grade.
- F. Borrow: Earth material brought from off the site to be used as fill or backfill.
- G. Structural Backfill: Backfill placed beneath structures and in over-excavated areas.
- H. Structures: Buildings, foundations, and other man-made, stationary features above or below ground.

**PART 2 - PRODUCTS**

## 2.1 BACKFILL AND FILL

A. For structures: Backfill and fill shall be excavated material or borrow that is free from clayballs larger than 2 inches in their largest dimension and contains no more than 15% by weight passing the No. 200 sieve, no more organic matter (peat, humus, leaves, and carbon compounds) than 1% by weight, and no cobbles larger than 2 inches in their largest dimension unless otherwise specified. The gradation of this granular material shall be such as to achieve the specified compaction.

B. For pipe and appurtenance structures conform:

1. First Lift: From the excavation grade to a level 12 inches above the top of the pipeline. Exclude material with fragments larger than the following:

<u>Pipe Type</u>	<u>Fragment Size</u> <u>(Greatest Dimension-Inches)</u>
PVC	½ "
Concrete, steel, cast or ductile iron and corrugated metal	2"

2. Second Lift: From the top of the First Lift to the ground surface. Exclude material with fragments larger than three inches.

C. In the event there is insufficient satisfactory material from the excavation to meet the requirements for backfill or fill material, obtain borrow which meets the requirements for backfill material from sources secured by the Contractor.

## 2.2 STRUCTURAL BACKFILL

A. Structural backfill shall be free from clay balls and shall conform to ASTM D1241, Type I, Gradation

## 2.3 WATER FOR COMPACTION

A. Water shall be free of acid, alkali, or organic materials and shall have a pH of 7.0 to 9.0. Provide all water needed for earthwork. Provide temporary piping, valves, and trucks to convey water from the source to the point of use. Provide any meters required if the water is taken from a public water system.

## **PART 3 – EXECUTION**

### **3.1 DEWATERING**

- A. Provide and operate equipment adequate to keep excavations free of water. Dewater subgrade to a minimum of 2 feet below the bottom of the excavation. Remove water during periods when concrete is being deposited, when pipe is being laid, during the placing of backfill, and for proper inspection and/or testing of the exposed subgrade. These provisions shall apply during the noon hour as well as overnight. Do not drain trench water through the pipeline under construction. Avoid settlement or damage to adjacent property. Dispose of water in a manner that will not damage adjacent property or interfere with normal drainage. When dewatering open excavations, dewater from outside the structural limits and from a point below the bottom of the excavation. Obtain and comply with all required discharge permits from appropriate regulatory authorities.

### **3.2 EXCAVATION**

- A. Excavate to the elevations shown on the drawings, to the bottom elevations of the slabs, structures, and foundations or the bottom of the roadway subbase (top of subbase if only to be compacted), whichever is the lowest elevation.
- B. Perform all excavation regardless of the type, nature, or condition of the material encountered to accomplish the construction. Excavate for foundations to a point 5' horizontally behind the outside face of footings and base mats.
- C. After the excavation has been completed, the Owner or his representative will observe the exposed subgrade to determine the need for any additional excavation. It is intended that additional excavation be conducted in all areas within the influence of the structure where unacceptable subgrade materials exist at the exposed subgrade. Over-excavation shall include the removal of all such unacceptable material that exists directly beneath the hole or structure for the full width of the hole or structure and to a depth required to reach suitable foundation material. Refill the over-excavated areas with structural backfill. All such over-excavation and backfilling shall be executed in accordance with a change order. Payment for over-excavation and backfill shall be made in accordance with the Standard General Conditions.
- D. Do not carry excavation for footings, slabs, or conduits deeper than the elevations shown on the plans. Backfill over-excavations below the elevations shown to the proper elevation with compacted structural backfill material. Correct cuts below grade by similarly cutting adjoining areas and creating a smooth transition.
- E. The Contractor will not receive any additional payment for over-excavation or backfill material used for his convenience or which is not authorized by the Owner or his representative.
- F. The Contractor shall become acquainted with existing conditions and locate all structures and utilities within the project area in order to avoid conflicts.
- G. Protect any pipes, conduits, wires, mains, footings or other underground structures encountered in trenching/excavating/backfilling from damage or displacement. Replace any pipes, conduits, wires, mains, footings or other structures disturbed during construction.
- H. Contact all utility companies with underground utilities in the project area and obtain their assistance in locating facilities prior to excavation.
- I. Excavate sufficiently in advance of pipe laying to discover obstructions in time to modify alignment, if necessary, to avoid the obstruction. The Owner or his representative must review such

alignment modifications.

### **3.3 PREPARATION OF SUBGRADE PRIOR TO PLACING FOUNDATIONS**

- A. Excavate and shape subgrade to line, grade, and cross section. Remove soft material encountered and replace with structural backfill. Fill holes and depressions to the required line, grade, and cross sections with structural backfill. The finished subgrade shall be within a tolerance of  $\pm 0.08$  feet of the grade and cross section shown, smooth and free from irregularities, and at the specified relative density.

### **3.4 PREPARATION FOR PLACING FILL OR BACKFILL**

- A. Remove loosened and disturbed materials at the subgrade.
- B. Remove form materials and trash before placing any fill or backfill. Obtain the specified compressive strength and finish of concrete work before backfilling.
- C. Do not operate earthmoving or excavation equipment within five feet of existing structures or newly completed structures. Place and compact fill or backfill adjacent to concrete walls with hand-operated tampers or other equipment that will not damage the structure.
- D. Fill or backfill around water-holding basins and channels only after specified leakage tests have been conducted.

### **3.5 COMPACTION**

- A. Unless otherwise specified or shown on the drawings, areas outside pipe trenches must meet the following compaction requirements:
  - 1. Structural Backfill: 95% relative density in 6-inch maximum layers.
  - 2. Subgrade Under Fill or Backfill: 90% relative density to a depth of 12 inches.
  - 3. Subgrade Under Structural Backfill or Structures: 95% relative density to a depth of 24 inches.
  - 4. Backfill or Fill Under Pavement: 98% relative density in 6-inch maximum layers.
  - 5. All Other Areas: 95% relative density in 6-inch maximum layers.
- B. Compact by using methods acceptable to the owner or his representative (powered tampers, vibrators, etc.). Compact the first 2 feet of backfill over pipe either by hand-operated tamping devices or with powered equipment which will not damage the pipe. Flooding or puddling with water to consolidate backfill is not acceptable, except where sand is encountered and the specified density can be obtained using this method.
- C. During the compacting operations, maintain material within  $\pm 2\%$  of optimum moisture. Aerate material containing excessive moisture by blading, discing, or harrowing to hasten the drying process.

- D. Non-Plastic Pipe and Appurtenant Structures: Unless otherwise shown on the drawings or otherwise described in the specifications for the particular type of pipe installed, compact soil in pipe trenches to the following minima:
1. First Lift - 95% relative density.
  2. Second Lift not beneath paving - 90% relative density.
  3. Second Lift in paved areas and under structures - 98% relative density.
  4. Backfill for over-excavation - 95% relative density.

### **3.6 SHEETING, SHORING, AND BRACING OF TRENCHES**

- A. Install adequate sheeting and bracing to prevent damage to property and injury to persons. Comply with all applicable safety regulations and laws.
- B. Remove sheeting when the trench has been backfilled to at least one-half its depth or when remove will not endanger proper pipe alignment or support.
- C. When conditions or plans and specifications require that sheeting be left in place, cut off the top at an elevation 2.5 feet below finished grade, unless otherwise specified.
- D. All sheeting, shoring, and bracing shall be designed by a Professional Engineer registered in the State of Florida.

### **3.7 SIDEWALK, PAVEMENT, AND CURB REMOVAL**

- A. Cut and remove bituminous and concrete pavements, curbs and sidewalks prior to excavation of the trenches. Width of the pavement or brick pavement cut shall be at least one foot wider than the required width of the trench at ground surface. Haul pavement and concrete materials from the site to disposal site secured by Contractor. Do not use for trench backfill.

### **3.8 TRENCHING**

- A. Cut trenches to a minimum width equal to the outside diameter of the pipe at the joint plus eight inches for unsheeted trenches, or 12 inches for sheeted trenches. The maximum width of trench, measured at the top of the pipe, shall not exceed the outside pipe barrel diameter plus two feet, unless otherwise shown on the plans or details.
- B. Maintain vertical trench walls from the bottom of the trench to a line measured 12 inches above the top of the pipe.
- C. Utility Bedding: The minimum utility bedding allowable shall consist of a shaped trench bottom which provides firm bedding for the utility pipe. Bed the pipe in undisturbed firm soil of hand-shaped unyielding material, so that the pipe will be in continuous contact therewith for its full length and provide a minimum bottom segment support for the pipe equal to 0.6 of the outside diameter of the barrel.
- D. Construct special bedding as called for on the plans or in the contract documents.
- E. Excavate the trench to the lines and grades shown on the drawings with allowance for pipe thickness and for pipe base or special bedding. If the trench is excavated below the required

grade, backfill any part of the trench excavated below the required grade, backfill any part of the trench excavated below the grade at no additional cost to the owner. Place the backfilling material over the full width of trench in compacted layers not exceeding six inches deep to the established grade with allowance for the pipe base or special bedding.

- F. During trench excavation, place the excavated material only within the project area. Do not obstruct any roadways or streets. Conform to federal, state, and local codes governing the safe loading of trenches with excavated material.
- G. Limit the length of open trench to 800 feet in advance of pipelaying or amount of pipe that may be installed in one working day. Complete backfilling and temporary or first layer paving not more than 1200 feet in the rear of pipelaying.

### **3.9. TRENCH EXCAVATION IN BACKFILL AND FILL AREAS**

- A. Construct trench excavation for pipe, pipes, or conduit in backfill or fill areas in accordance with the following procedures:
  - 1. Construct and compact the backfill or fill to an elevation of one foot minimum over the top of the pipe or conduit to be installed.
  - 2. Excavate trench in the compacted backfill or fill. Place pipe base material, install pipe or conduit, and backfill to 12 inches above the pipe as specified for the type of pipe used. Compact backfill above this point to the same relative density as the adjacent embankment.

### **3.10 STRUCTURAL BACKFILL**

- A. Place structural backfill where specified and in over-excavation areas, to the lines and grades shown or specified. Compact each layer. Stop structural backfill at least 6 inches below finished grade in all areas where topsoil is to be replaced. Moisten material as necessary to aid compaction.

### **3.11 TRENCH BACKFILLING**

- A. Excavate bell holes at each joint to permit proper assembly and inspection of the entire joint.
- B. Backfill for non-plastic pipe and appurtenant structures in accordance with the following procedures:
  - 1. After pipe has been bedded, place "First Lift" material simultaneously on both sides of the pipe, keeping the level of backfill the same on each side. Carefully place the material around the pipe so that the pipe barrel is completely supported and that no voids or uncompacted areas are left beneath the pipe. Place material on the underside of the pipe in such a manner as to prevent lateral movement during subsequent backfilling.
  - 2. Compact material placed within 12 inches of the outer surface of the pipe by hand tamping only.
  - 3. Push the backfill material carefully onto the backfill previously placed in the "First Lift". Do not permit free fall of the material until at least two feet of cover is provided over the top of the pipe. Do not drop sharp, heavy pieces of material directly onto the pipe or the tamped material around the pipe.



- C. Place backfill material in maximum 12 inch layers and compact each lift to the specified relative density.

### **3.12 SITE WORK**

- A. Shape the surface of earthwork to conform to lines, grades and cross sections that existed prior to beginning work or as shown on the drawings, within 1/10 of a foot. Round tops of banks to circular curves to not less than a 6-foot radius. Neatly and smoothly trim rounded surfaces. Do not over-excavate and backfill to achieve the proper grade.
- B. Remove excess, unsuitable, or cleared material resulting from the facility installation from the work site and dispose of at locations secured by the Contractor.

### **3.13 DRAINAGE, EROSION AND SEDIMENTATION**

- A. Maintain all existing drainage patterns and control run-off from the construction area to prevent erosion, sedimentation, or flooding due to the construction.

### **3.14 PROTECTION OF PROPERTY**

- A. Protect the trunks of trees adjacent to this work by enclosure with padding or wood. Operate excavating machinery and cranes with care to prevent damage to trees, particularly to overhanging branches and limbs.
- B. Do not cut branches, limbs and roots unless they are within six inches of the facility under construction. Make all necessary cuts smoothly and neatly without splitting or crushing. Neatly trim and cover the tree with healing paint at all cut or damaged portions.
- C. Do not cut or operate on paved surfaces any equipment with treads or wheels which will cut or otherwise damage paved surfaces. Provide adequate protective measures to avoid damages to the paved surfaces.
- D. As promptly as practicable, restore existing property or structures. Do not leave restoration until the end of the construction period.

### **3.15 TESTING**

- A. Field density tests will be made in locations reviewed by the Owner, normally in each vertical layer, and using the following approximate spacing.
  - 1. Under structures, pavements, and slabs, one per 2500 square feet with at least two per structure or area.
  - 2. In trenches, one every 300 feet in continuous trenches under pavements or future pavements plus one at each intersection or one every 500 feet in continuous trenches not under pavements, plus one at each pavement of driveway crossing.
- B. If any field density tests are below the specified relative density, re-compact or re-excavate, re-backfill and re-compact the area until the specific density is obtained. Make a minimum of two field density tests per re-compacted and/or re-excavated area, but do not exceed the spacing specified above.

### **3.16 ACCEPTANCE**

- A. After the specified density tests have been successfully completed, the Owner or his representative will cross section the excavation and/or fill area to verify that the excavation or fill area conforms to the lines and grades shown on the plans and to determine quantities of material. The Contractor will correct deviations from line and grade in excess of the tolerances specified at the Contractor's expense.

### **2.17 MEASUREMENT AND PAYMENT**

- A. No additional payment shall be made for the work hereinbefore specified. The Contractor's unit price or lump sum bid as set forth in the PROPOSAL shall constitute full compensation for the work provided in this section.

END OF SECTION

## **SECTION 31 23 19 DEWATERING SYSTEM**

### **PART 1 - GENERAL**

#### **1.1 SCOPE**

- A. In general, the work specified in this section of the specifications shall consist of supplying all labor and materials and performing all work necessary to lower and control the groundwater levels and hydrostatic pressures to permit all excavation and construction specified under this Contract to be performed in the dry. The control of all surface water shall be considered as a part of the work.

#### **1.2 EXAMINATION OF THE SITE**

- A. The Contractor shall take all steps that he considers necessary to familiarize himself with the site conditions, the ground conditions and the groundwater conditions. The data described is furnished for information only and it is expressly understood that the Owner and the Engineer will not be held responsible for any interpretation or conclusions drawn there from by the Contractor.

#### **1.3 DEWATERING REQUIREMENTS**

- A. It is the intent of these specifications that an adequate dewatering system be installed to lower and control the groundwater in order to permit excavation, construction of the structures, and the placement of the fill materials, all to be performed under dry conditions. The dewatering system shall be adequate to pre-drain the water-bearing strata above and below the bottom of the structure foundations, the drains, the sewers and all other excavations. In addition, the system to be used shall reduce the hydrostatic head in the water-bearing strata below the structure foundations, the drains, sewers, and all other excavations, to the extent that the water level and piezometric water levels in the construction area remain below the prevailing excavation surface at all times.

#### **1.4 SUBMITTAL**

- A. The Contractor shall submit complete plans and description of the overall dewatering system, including observation wells proposed to be used for the work under this section, showing the details of the dewatering system prior to initiation of any excavation within three feet of the prevailing groundwater levels. These plans shall carry the seal of a professional engineer with Florida registration and specializing in the work or having extensive experience in underground dewatering.

### **PART 2 - MATERIALS**

#### **2.1 DEWATERING SYSTEM**

Materials used in the dewatering system for the new structures are not to remain in place and may be of steel construction. The dewatering system shall be as manufactured by Griffin Wellpoint Corporation, Moretrench Corporation, or equal.

### **PART 3 - EXECUTION**

### 3.1 **INSTALLATION AND OPERATION**

- A. Prior to any excavation below the groundwater level, the dewatering system shall be placed into operation to lower the water levels as required and then shall be operated continuously 24 hours per day, seven days per week until all drains, sewers, and structures have been satisfactorily constructed, including placement of fill materials, and no longer require dewatering. An adequate weight of fill material shall be in place to prevent buoyancy prior to discontinuing operation of the dewatering system.
- B. The Contractor shall be solely responsible for the arrangement, location, and depths of the dewatering system necessary to accomplish the work described under this section of the specifications. The dewatering shall be accomplished in a manner that will reduce the hydrostatic head below any excavation to the extent that the water level and piezometric water levels in the construction area are below the prevailing excavation surface; will prevent the loss of fines, seepage, boils, quick conditions or softening of the foundation strata; will maintain stability of the sides and bottom of the excavation; and will result in all construction operations being performed in the dry.
- C. The control of all surface and subsurface water is considered as part of the dewatering requirements. The control should be adequate so that the stability of excavated and constructed slopes are not adversely affected by water, that erosion is controlled and that flooding of excavations or damage to the structures does not occur. Surface water drainage shall not be directed toward the excavations.
- D. The Contractor shall dispose of all water removed from the excavations in such a manner as will not endanger public health, property, any portion of the work under construction or completed either by him/her or any other Contractor, and shall be performed in such a manner as will cause no inconvenience whatsoever to the Owner, the Engineer, or to others engaged in work about the site.
- E. The Contractor will provide complete standby equipment, installed and available, for immediate operation as may be required, to adequately maintain the dewatering on a continuous basis in the event that all or any part of the dewatering system may become inadequate or fail.
- F. If the dewatering requirements are not satisfied due to inadequacy or failure of the dewatering system, then loosening of the foundation strata or instability of the slopes, or damage to the foundations or structures may occur. The supply of all labor, materials, and plant, and the performance of all work necessary to carry out additional work for reinstatement of the structures or foundation soil resulting from such inadequacy or failure shall be undertaken by the Contractor to the approval of the Owner and at no additional expense to the Owner.

### 3.2 **MEASUREMENT AND PAYMENT**

- A. No additional payment shall be made for the work hereinbefore specified. The Contractor's lump sum bid as set forth in the Proposal shall constitute full compensation for the work involved for each item.

END OF SECTION

**SECTION 31 25 00**  
**EROSION AND SEDIMENTATION CONTROLS**

**PART 1 - GENERAL**

**1.1 RELATED DOCUMENTS**

- A. The General Provisions of the Contract, including the General Conditions, Supplementary Conditions, and Special Conditions, along with the General Requirements, apply to the work specified in this section.

**1.2 SUMMARY**

- A. The work specified in this section consists of measures required to control erosion on the project so as to prevent pollution of water, detrimental effects of public or private property adjacent to the project right-of-way and damage to work on the project. These measures will consist of construction and maintenance of permanent erosion control features or, where practical, the construction and maintenance of permanent erosion control features as shown in the plans or as may be directed by the Engineer. Contractor will be required to obtain the NPDES permit. Contractor will also be required to prepare the Stormwater Pollution Prevention Plan (SWPPP), to maintain the plan on site, and to comply with inspection and reporting requirements.

**1.3 REFERENCED STANDARDS**

- A. The Florida Department of Transportation Standard Specifications for Road and Bridge Construction, latest edition, are referred to hereinafter as the Standard Specifications. References to the Standard Specifications are used to specify materials, application, and installation. Administrative, contractual, and measurement and payment requirements are not applicable.
- B. Standard Drawings: Except as otherwise shown on drawings or specified herein, the applicable details of the Florida Department of Transportation (F.D.O.T.) Roadway and Traffic Design Standards, Index Nos. 100 through 106, latest edition, shall apply. References to the F.D.O.T. Roadway and Traffic Design Standards are used to specify materials, application, and installation. Administrative, contractual, and measurement and payment requirements are not applicable.

**PART 2 - PRODUCTS**

**2.1 MATERIALS:**

- A. All materials in accordance with Section 104 of the Standard Specifications.

**PART 3 - EXECUTION**

**3.1 EROSION CONTROL**

- A. All installation and construction methods in accordance with Section 104 of the Standard Specifications.

END OF SECTION



## SECTION 31 31 16

### TERMITE CONTROL

#### 1. GENERAL:

1.1. Summary: Provide soil treatment for termite control as herein specified. Chemically treat the compacted soil under all concrete floor slabs prior to the installation of the vapor barrier. Initial termite treatment (Termador) is required for building and for concrete slab on grade.

#### 1.2. Submittals

1.2.1. Product Data: Submit manufacturer's technical data and application instructions.

1.2.2. Termite protection shall be provided by registered termiticides, including soil applied pesticides, baiting systems, and pesticides applied to wood, or other approved methods of termite protection labeled for use as a preventative treatment to new construction. Upon completion of the application of the termite protective treatment, a certificate of compliance shall be issued to the building department by the licensed pest control company that contains the following statement: "The building has received a complete treatment for the prevention of subterranean termites. Treatment is in accordance with rules and laws established by the Florida Department of Agriculture and Consumer Services."

#### 1.3. Quality Assurance

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

1.3.2. Engage a professional pest control operator, licensed in accordance with regulations of governing authorities for application of soil treatment solution.

1.3.3. Use only termiticides, which bear a Federal registration number of the U.S. Environmental Protection Agency.

#### 1.4. Job Conditions

- 1.4.1. Restrictions: Do not apply soil treatment solution until excavating, filling and grading operations are completed, except as otherwise required in construction operations.
- 1.4.2. To insure penetration, do not apply soil treatment to frozen or excessively wet soils or during inclement weather. Comply with handling and application instructions of the soil toxicant manufacturer.

#### 1.5. Specific Product Warranty

- 1.5.1. The Subcontractor for the initial soil poisoning must furnish a service agreement stating the Work performed will be guaranteed for a period of 10 years from the date of Substantial Completion and that the structure will be inspected yearly for infestation and treatment provided as necessary. The Service Agreement shall state that in the event of damage during the Guarantee Period, the Subcontractor shall make repairs to structurally damaged surfaces to a dollar value based on the size of the building. An Independent Testing Laboratory shall certify that the treatment meets the requirements of the Specifications.

### 2. PRODUCTS

#### 2.1. Soil treatment solution

- 2.1.1. Use an emulsible concentrate termiticide for dilution with water, specially formulated to prevent infestation by termites. Fuel oil will not be permitted as a diluent. Provide a solution consisting of one of following chemical elements and concentrations:
  - a. Chloropyrifos ("Dursban TC"); 1.0 percent in water emulsion.
  - b. Permethrin (Dragnet", "Torpedo"); 0.5 percent in water emulsion.
- 2.1.2. Other solutions may be used as recommended by Applicator if also acceptable to Architect and approved for intended application by jurisdictional authorities.

### 3. EXECUTION

#### 3.1. Application

- 3.1.1. Surface Preparation: Remove foreign matter on areas to receive treatment, which could decrease effectiveness of treatment.



- a. Loosen rake and level soil to be treated, except previously compacted areas under slabs and foundations.
- b. Toxicants may be applied before placement of compacted fill under slabs if recommended by toxicant manufacturer.

3.1.2. Application Rates: Apply soil treatment solution as follows:

a. Under slab-on-grade structures, treat soil before concrete slabs are placed, using the following rates of application

- Apply 4 gallons of chemical solution per 10 lin. ft. to soil in critical areas under slab, including entire inside perimeter inside of foundation walls, along both sides of interior partition walls, around plumbing pipes and electric conduit penetrating slab, and around interior column footers.
- Apply one gallon of chemical solution per 10 sq. ft. as an overall treatment under slab and attached slab areas where fill is soil or unwashed gravel. Apply 1-1.2 gallons of chemical solution to areas where fill is washed gravel or other coarse absorbent material.

b. Apply 4 gallons of chemical solution per 10 lin. ft. of trench, for each foot of depth from grade to footing, along outside edge of building.

- Dig a trench 6" to 8" wide along outside of foundation to a depth of not less than 12".
- Punch holes to top of footing at not more than 12" o.c. and apply chemical solution.
- Mix chemical solution with the soil as it is being replaced in trench.

c. At hollow masonry foundations or grade beams, treat voids at rate of 2 gal. Per 10 lin. ft. poured directly into the hollow spaces.

3.1.3. Post signs in areas of application to warn workers that soil termiticide treatment has been applied. Remove signs when areas are covered by other construction.

3.1.4. Reapply soil treatment solution to areas disturbed by subsequent excavation, or other construction activities following application.

END OF SECTION



**SECTION 32 16 00  
SITWORK CONCRETE**

**PART 1 - GENERAL**

**1.1 RELATED DOCUMENTS**

- A. The General Provisions of the Contract, including the General Conditions, Supplementary Conditions, and Special Conditions, if any, along with the General Requirements, apply to the work specified in this section.

**1.2 CODES AND REGULATIONS:**

- A. All work shall comply with applicable Local codes and regulations.

**1.3 REFERENCED STANDARDS**

- A. The Florida Department of Transportation Standard Specifications for Road and Bridge Construction, latest edition, are referred to hereinafter as the Standard Specifications. References to the Standard Specifications are used to specify materials, application, and installation. Administrative, contractual, and measurement and payment requirements are not applicable.
- B. Standard Drawings: Except as otherwise shown on drawings or specified herein, the applicable details of the Florida Department of Transportation (F.D.O.T.) Standard Plans for Road Construction, latest edition, shall apply. References to the F.D.O.T. Standard Plans for Road Construction are used to specify materials, application, and installation. Administrative, contractual, and measurement and payment requirements are not applicable.

**PART 2 - MATERIALS**

**2.1 CONCRETE**

- A. Comply with applicable requirements of the Standard Specifications for concrete materials, admixtures, bonding materials, curing materials, and others as required. Mix design to produce standard-weight concrete with minimum compressive strength of 3000 psi at 28 days, 2-inch to 4-inch slump range for sidewalks and curb. All work shall have a minimum strength of 3000 psi and meet the conditions of Class I concrete, Section 347 of the Standard Specifications. Mix design to produce standard-weight concrete with minimum compressive strength of 4000 psi at 28 days, 2-inch to 4-inch slump range for pavement. All work shall have a minimum strength of 4000 psi and meet the conditions of Class I concrete, Section 347 of the Standard Specifications.

**2.2 FORMS**

- A. Either steel or wood of sufficient strength to resist movement during concrete placement, straight and free of distortion and defects. Use flexible spring steel forms on radius bends. Coat forms with a non-staining form release agent that will not discolor or deface the surface of the concrete.

**2.3 EXPANSION JOINT FILLER**

- A. Asphalt impregnated fiber strips ½-inch thick, full depth in accordance with specification section CONSTRUCTION AND EXPANSION JOINTS.

## **2.4 WELDED WIRE REINFORCEMENT:**

- A. Welded plain cold-drawn welded wire reinforcement, ASTM A 185.

## **PART 3 - EXECUTION**

### **3.1 DETAILS**

- A. Concrete sidewalk shall conform to F.D.O.T. Standard Plans for Road Construction, Index No. 522.
- B. Pavement: 6" thick concrete slab installed over compacted bed, reinforced with welded wire reinforcement meeting ASTM A185 standards. Edges neatly tooled. Where slabs have an exposed perimeter edge (i.e., does not abut a wall) or as shown on plans, turn down slab at edge 12" deep total and 6" wide at narrowest point.

### **3.2 INSPECTION**

- A. Examine the prepared subgrade for unstable areas in need of additional compaction. Do not proceed with work until unsatisfactory conditions have been corrected. Remove all trash, debris, and other loose material prior to placement.

### **3.3 LINES AND GRADES**

- A. Set form to required lines and grades, rigidly braced and secured with a tolerance of 1/4-inch in 10 feet. Install sufficient quantity of forms to allow continuous progress of the work and so that forms can remain in place at least 24 hours after concrete placement. It is intended that the lip of the gutter shall match the original existing street elevation.
- B. Clean forms after each use and coat with form release agent as often as required to ensure separation from concrete without damage.

### **3.4 UTILITIES**

- A. Take care not to damage existing utilities. All adjustments to the existing utilities that must be made for the work of this section shall be the responsibility of the Contractor.

### **3.5 JOINTS**

- A. Construct expansion, contraction, and construction joints true-to-line with face perpendicular to surface of the concrete, unless otherwise indicated. Construct transverse joints at right angles to the centerline, unless otherwise indicated. All joints will be constructed per specification section CONSTRUCTION AND EXPANSION JOINTS.
- B. Unless shown otherwise on the drawings, provide contraction joints at intervals of 10 feet except where a lesser interval is required for closure. No section shall be less than 4 feet in length. Construct joints for a depth equal to at least 1/4 concrete thickness, as follows:
  - 1. Tooled Joints: Form joints in fresh concrete by grooving top portion with a recommended cutting tool and finishing edges with a jointer.

2. Sawn Joints: Form joints using powered saws equipped with shatterproof abrasive or diamond-rimmed blades. Cut joints into hardened concrete as soon as surface will not be torn, abraded, or otherwise damaged by cutting action.
- C. Place construction joints at the end of all pours and at locations where placement operations are stopped for a period of more than ½ hour, except where such pours terminate at expansion joints. Construct joints as shown, or, if not shown, use standard metal keyway-section forms.
- D. Expansion joints shall be constructed at all radius points and at other locations indicated on the drawings. They shall be located at intervals of 500 feet between other expansion joints, ends of a run and between truck loads that exceed the time limits previously specified. Provide premolded joint filler for expansion joints abutting concrete curbs, walks, and other fixed objects, unless otherwise indicated.
  1. Extend joint fillers full width and depth of joint and below finished surface where joint sealer is indicated. If no joint sealer, place top of joint filler flush with finished concrete surface.
  2. Furnish joint fillers in one piece lengths for the full width being placed, wherever possible. Where more than one length is required, lace or clip joint filler sections together.
  3. Protect the top edge of the joint filler during concrete placement with a metal cap or other temporary material. Remove protection after concrete has been placed on both sides of joint.

### **3.6 REINFORCEMENT**

- A. Welded Wire: Shall be placed in accordance with Section 415 of the Standard Specifications.
- B. Fiber Reinforcement: Shall be sized and mixed in accordance with the manufacturer's recommendations.

### **3.7 PLACING**

- A. Comply with the requirements of the Standard Specifications for mixing and placing concrete and as herein specified.
- B. Do not place concrete until subgrade and forms have been checked for line and grade. Moisten subgrade if required to provide a uniform dampened condition at the time concrete is placed. Do not place concrete around manholes or other structures until they are at required finish elevation and alignment.
- C. Place concrete using methods which prevent segregation of the mix. Consolidate concrete along the face of forms and adjacent to transverse joints with an internal vibrator. Keep vibrator away from joint assemblies or side forms. Use only square-faced shovels for hand-spreading and consolidation.
- D. Deposit and spread concrete in a continuous operation between transverse joints, as far as possible. If interrupted for more than ½ hour, place a construction joint.
- E. Curbs and Gutters: Automatic machine may be used for curb and gutter placement at Contractor's option. If machine placement is to be used, submit revised mix design and laboratory test results which meet or exceed the minimums herein specified. Machine placement must produce curbs and gutters to the required cross section, lines, grades, finish, and jointing as specified for formed concrete. If results are not acceptable, remove and replace with formed concrete as specified.

### **3.8 FINISHING**

- A. After striking-off and consolidating concrete, smooth the surface by screeding and floating. Use hand methods only where mechanical floating is not possible. Adjust the floating to compact the surface and produce a uniform texture.

- B. After floating, test surface for trueness with a 10-foot straightedge. Distribute concrete as required to remove surface irregularities and refloat repaired areas to provide a continuous smooth finish.
- C. Work edge of formed joints with an edging tool, and round to ½-inch radius, unless otherwise indicated. Eliminate any tool marks on concrete surface.
- D. After completion of floating and when excess moisture or surface sheen has disappeared, complete surface with a broom finish. Draw a fine-hair broom across concrete surface, perpendicular to line of traffic. Repeat operation if required to provide a fine line texture.
- E. Do not remove forms for 24 hours after concrete has been placed. After form removal, clean ends of joints and point-up any minor honeycombed areas. Remove and replace areas or sections with major defects.

### **3.9 CURING AND PROTECTION**

- A. Comply with applicable requirements in the Standard Specifications. Protect and cure finished concrete. Use moist-curing method for initial curing whenever possible.

### **3.10 REPAIRS AND PROTECTIONS**

- A. Minor defects shall be filled with mortar composed of one part Portland Cement and two parts fine aggregate.
- B. Protect concrete from damage until acceptance of work. Exclude traffic from pavement for at least 14 days after placement. When construction traffic is permitted, maintain pavement as clean as possible by removing surface stains and spillage of materials as they occur. Sweep concrete pavement and wash free of stains, discolorations, dirt and other foreign material just prior to final inspection.

### **3.11 BACKFILLING AND COMPACTION**

- A. After the concrete has set sufficiently, but not later than three (3) days after pouring, the backfill the area adjacent to the new concrete to the required elevation with suitable material which shall be placed and thoroughly compacted in layers not thicker than 6 inches.

END OF SECTION

## **SECTION 32 92 23 GRASSING**

### **PART 1 - GENERAL**

#### **1.1 DESCRIPTION**

- A. Furnish all material, equipment, transportation, water, tools and labor, unless otherwise specified, to establish grass plus all items called for or that can be reasonably inferred from the drawings, including sodding, grading, fertilizing, watering, and maintaining the area for a complete job. If any items for a complete job are omitted or not shown, furnish and install the same without cost to the Owner.

#### **1.2 QUANTITIES**

- A. Provide all sod required to complete the work as shown on the plans and specified herein.

#### **1.3 APPLICABLE PUBLICATIONS**

- A. The portion publications listed below form a part of this specification only to the extent referenced.
  - 1. Florida Department of Transportation, "Standard Specifications for Road and Bridge Construction" (Standard Specifications), latest editions
  - 2. Florida Department of Transportation, "Utility Accommodation Guide" Section 5, paragraphs K, L, and M, except delete "as directed by the Maintenance or Resident Engineer." and delete "or otherwise, to the satisfaction of the Maintenance or Resident Engineer.", July 1979.

#### **1.4 RECORDS**

- A. Submit weekly records to the Owner of all grassed areas for use in determining the beginning and end of the maintenance period. Records shall indicate the date of grassing, the type (sod) and quantity (sq. ft., sq. yds, or acres) of grassing as well as the location of the grassed areas.

### **PART 2 - PRODUCTS**

#### **2.1 SOD**

- A. DOT Spec, Section 981-3, "Argentine Bahia", as indicated and specified herein. Except delete "approved by the Engineer" and the last two (2) sentences of Section 981.3.3

#### **2.2 FERTILIZER**

- A. DOT Spec, Section 982, "Fertilizer"

#### **2.3 WATER**

- A. DOT Spec, Section 983, "Water for Grassing".

## **PART 3 - EXECUTION**

### **3.1 CONSTRUCTION METHODS - GENERAL**

- A. Provide and establish grassing in accordance with FDOT Utility Accommodation Guide; unless specified otherwise herein.
- B. Do not fertilize when wind velocities exceed 15 miles per hour.
- C. When a length of roadway slopes or other areas have been graded and made ready, commence sodding in accordance with these specifications. Incorporate grass covering into the project at the earliest practical time in the life of the contract to reduce potential erosion.
- D. Store fertilizer in dry locations away from contaminants. Lightly sprinkle sod with water, cover with moist burlap, straw or other reviewed covering, and protect from exposure to wind and direct sunlight until planted. Provide covering that will allow air to circulate so that heating will not develop.

### **3.2 CONSTRUCTION METHODS FOR GRASSING**

- A. Grassing will be required in all areas disturbed during construction.
- B. The type and location of grassing will be as called for in the plans, and/or specified herein.
- C. Sequence of Operations: The several operations involved in the work shall proceed in the following sequence: Preparation of the ground, sodding, fertilizing, watering and maintaining.
- D. Preparation of Area to be Grassed: Bring all planting areas to finished grades, filling as needed or removing weeds, surplus dirt and rock debris over 1 inch in diameter, and floating to a smooth uniform grade. Slope all areas to drain. Establish flow lines to match existing or as shown on the plans. Finish grass areas 1 inch below top of adjoining pathway.
- E. Restore existing lawns adjacent to residential or commercial property using grass sod species to match the existing lawns. Use Argentine Bahia Sod for a minimum of 15 feet around structures and in other areas where sod is specified or indicated.

### **3.3 SODDING**

- A. Incorporate sodding into the project at the earliest practical time in the life of the contract. Do not use sod which has been cut for more than 5 days. Stack any sod which is not planted within 24 hours after cutting and maintain properly moistened.
- B. Place the sod on a prepared surface with closely abutting joints. Fill any gaps or cracks between sod blocks with sod. Roll with a minimum one-ton roller to obtain an even surface. Bring the sod edge in a neat, clean manner to the edge of all paving and shrub areas.



- C. Replace any pieces of sod which, after placing, show on appearance of extreme dryness.
- D. Mow the sod to establish a uniform grass surface to 2-1/2 inches.

### **3.4 WATERING**

- A. Maintain a balanced watering program until the acceptance of work.
- B. Apply water in sufficient quantities and as often as seasonal conditions require to keep the grassed areas moist at all times to a depth of 6 inches below the root system.

### **3.5 FERTILIZATION**

- A. Thirty days after the application of seed and sod broadcast fertilizer at a rate of 450 pounds per acre. Notify the Owner and Owner's representative, in writing, within 7 days prior to the date of application.

### **3.6 SATISFACTORY GROWTH**

- A. The term "Satisfactory Growth" as used in this section is defined as even plant growth in healthy conditions without bare spots larger than one square foot. Bare spots larger than one square foot shall be resodded and maintained until satisfactory growth has been demonstrated.

### **3.7 MAINTENANCE**

- A. Maintain all grassed areas for a period of 90 days from the date of application of sod, and guarantee against all defects and faults of material and workmanship.
- B. Maintain grassed areas by watering, fertilizing, and mowing to establish an even and uniform grass surface of 2-1/2 inches.
- C. In the event that the grass exhibits iron chlorosis symptoms during the establishment period, apply Fe 138 Geigy or equivalent at manufacturer's recommended rates.

### **3.8 GUARANTEE**

- A. Guarantee all grassed areas to be alive and in satisfactory growth at the end of the maintenance period (90 days from planting date).
- B. Replace any grass that is dead or not in satisfactory growth, as determined by the Owner or Owner's representative. Guarantee and maintain new grass for an additional period of 90 days.
- C. Replace grass with the same variety as initially specified.

### **3.9 INSPECTION**

- A. Request a review from the Owner or his representative at least 72 hours in advance of the time inspection is required.

**3.10 MEASUREMENT AND PAYMENT**

- A. No additional payment shall be made for the work hereinbefore specified. The Contractor's unit price or lump sum bid as set forth in the PROPOSAL shall constitute full compensation for the work provided in this section.

END OF SECTION

**SECTION 33 11 00  
POTABLE WATER MAINS**

**PART 1 - GENERAL**

**1.1 SCOPE**

- A. The Contractor shall furnish and install the potable water piping system, complete, tested, disinfected, and ready for operation. This section contains standard specifications for use in general procedures as specified herein or as otherwise shown on the drawings.

**1.2 GENERAL REQUIREMENTS**

- A. All work shall be proved to be in first class condition and constructed properly in accordance with the drawings and specifications. All defects and leaks disclosed by the tests shall be remedied. All tests shall be performed by the Contractor and observed by the Owner. Water for testing will be furnished by the Contractor.
- B. The Contractor shall submit to the Engineer for approval before work begins certificates of inspection from the pipe manufacturer that the pipe and fittings supplied have been inspected at the plant and meet the requirements of these specifications.
- C. All work shall be performed in accordance with the requirements of the location authority having jurisdiction.

**PART 2 - MATERIALS**

**2.1 GENERAL**

- A. Unless indicated otherwise on the drawings, pipe materials for water mains shall be PVC DR 18.
- B. All material shall be free from defects impairing strength and durability and be of the best commercial quality for the purpose specified. It shall have structural properties sufficient to safely sustain or withstand strains and stresses to which it is normally subjected and be true to detail.

**2.2 POLYVINYL CHLORIDE**

- A. Pipe shall be polyvinyl chloride (PVC) pipe for potable water and shall have a bell type coupling with a thickened wall section integral with the pipe barrel. The pipe material shall be clean, virgin, NSF approved Class 12454-A or 12454-B PVC compound conforming to ASTM resin specification D-1784. The pipe shall be tested at levels meeting the requirements of the U.S. Department of Commerce Public Standard 22-70, and shall conform to the physical standards specifications of the Plastic Pipe Institute. Pipe shall be approved for potable water by the National Sanitation Foundation. All herein referenced standards shall be of the latest edition or revision.
- B. PVC 1120 Pipe, Class 150, DR18 - Pipe shall conform to AWWA Standard C-900-latest for use in sizes 4 inches and larger in diameter. Pipe is to be manufactured to cast iron pipe equivalent outside diameters and may be used in lieu of cast iron and ductile iron pipe. The pipe shall be designed to pass without failure a sustained pressure test of 500 psi in conformance with ASTM D1598 and for a quick burst test of 755 psi in conformance with ASTM D1599. In any case of conflict with standards specified herein, the requirements of AWWA Standard C900 shall prevail.

- C. PVC 1120, Schedule 40 – Pipe shall conform to ASTM D-1785 – latest and be NSF-PW rated, for use in sizes 3 inches and smaller. The sustained pressure test shall be conducted in accordance with ASTM D-1598 at test pressures given in ASTM 1785 when tested in accordance with ASTM D-2672 (Section 6.5). The burst pressure test shall be conducted in accordance with ASTM D-1599 at test pressures given in ASTM 1785. When determined in accordance with ASTM D-2672 (Section 6.6). The pipe shall be PVC 1120, Schedule 40, as manufactured by Ethyl Corporation or approved equal. All pipe joints shall meet AWWA Standards.

## 2.3 DUCTILE IRON PIPE

- A. Unless noted or specified otherwise herein, all pipe 3" and larger shall be ductile iron designed in accordance with ANSI A21.50 (AWWA C150) latest using 60,000 psi tensile strength, 42,000 psi yield strength and manufactured in accordance with ANSI (AWWA C151) latest. The pipe shall be designed for internal operating pressure of 250 psi, at 8 foot depth of cover and type 2 laying condition.
- B. The pressure rating, metal thickness class, net weight of pipe without lining, length of pipe, and name of manufacturer shall be clearly marked on each length of pipe.
- C. Except as modified herein, the class of ductile iron pipe shall be as follows: mechanical and push-on joint pipe shall be Class 51; flanged pipe shall be Class 53.

## 2.4 LABORATORY OR PLANT TESTS

- A. Pipe and materials shall be tested in and for conformity with the latest editions of the following:

Item	Specifications	Number of Tests
Ductile Iron Pipe And Fittings	ANSI A21.50 (AWWA C150) Sworn Statement ANSI A21.51 (AWWA C151) ANSI A21.53 (AWWA C153)	
Polyvinyl Chloride Pipe	ASTM D-1598 ASTM D-1599 ASTM D-1784 ASTM D-2122 ASTM D-2241 ASTM D-2837 PS-22-70	Sworn Statement

## 2.5 JOINTS

- A. PVC pipe joints shall be the manufacturer's standard push-on bell type with rubber sealing ring for pipe sizes 3-inches and larger installed in strict accordance with the pipe manufacturer's recommendations. Ductile iron fitting shall be used for PVC pipe 4-inches and larger.

## 2.6 FITTINGS

- A. Ductile Iron Fittings and special castings, shall conform to the type of pipe being installed and have

a minimum working pressure of 200 psi. Fittings shall conform to ANSI Specification A21.53 (AWWA C153) latest. Short radius pattern fittings shall normally be installed. Long radius fittings shall be used where the drawings specifically call for on radius fittings or at the option of the Contractor when the laying length is not controlled by short radius patterns. Fittings shall be mechanical joint fittings unless otherwise specified or indicated on the drawings.

## **2.7 LININGS AND COATINGS**

- A. All ductile iron fittings and specials shall be cement mortar lined. The exterior of buried ductile iron pipe shall receive a coat of hot coal-tar. The exterior of all above ground pipe shall receive a coat of rust inhibitor prime compatible with the finish paint schedule. All bolts, nuts, studs and other uncoated parts of joints for underground installation shall be coated with asphalt or coal-tar prior to backfilling. Pipes crossing ditches, culverts, rivers, creeks, etc., shall be considered as buried pipe.

## **2.8 INSPECTION**

- A. The Contractor shall obtain from the manufacturer and submit to the Engineer a Certificate of Inspection stating the materials furnished have been inspected at the plant, meet the requirements of these specifications and have been tested as called for above.
- B. The entire product of any manufacturer or of any one plant may be rejected when, in the opinion of the Engineer, the methods of manufacture fail to secure uniform results acceptable to the requirements of these specifications.
- C. All pipe and fittings shall be subject to inspection at time of delivery and also in the field just prior to installation. All pipe and fittings which in the opinion of the Owner do not conform to these specifications will be rejected and shall be removed by the Contractor at no additional cost to the Owner.

## **PART 3 - EXECUTION**

### **3.1 PIPE LAYING GENERAL REQUIREMENTS**

- A. Water mains shall be constructed of the materials specified and as shown on the drawings. Each section of the pipe shall rest upon the pipe bed for the full length of its barrel. Any pipe which has its grade or joint disturbed after laying shall be taken up and relaid. No pipe shall be laid when the trench conditions or the weather is unsuitable for such work, except by permission of the Owner. Pipe fittings shall be carefully handled to avoid damage; they shall be inspected for defects and to detect cracks. Defective, damaged or unsound pipe or fittings shall be rejected. Any section of pipe already laid which is found to be defective or damaged shall be replaced with new pipe without additional cost to the Owner.
- B. Pipe Cover: The minimum cover over all piping shall be 30 inches for pipe diameters of 10" or less and 36" for pipe diameters of 12" or greater except where specifically shown otherwise. Bedding details are specified on drawings, backfill, and compaction in earthwork specification.
- C. Thrust Blocking: Suitable concrete reaction thrust backing shall be applied on all pressure pipe lines (except for those having screwed or flanged joints) at all tees, plugs, caps, and at bends deflecting 22-1/2 degrees or more. Concrete used for this purpose shall be 2,500 psi minimum. Schedule and details for required thrust blocks are included on the drawings.

### 3.2 CLEANING AND FLUSHING

- A. Prior to the pressure and leakage tests, all piping shall be thoroughly cleaned of all dirt, dust, oil, grease, and other foreign matter.
- B. All lines shall be thoroughly flushed with clean water to clear all lines of foreign matter.

### 3.2 FIELD TESTING

- A. All field tests shall be made in the presence of the Engineer and a representative from the local authority having jurisdiction. Except as directed otherwise, all pipelines shall be tested. Pipelines laid in excavation (other than trench excavation) or embedded in concrete, shall be tested prior to backfilling of the excavation or placing of the concrete.
- B. All piping to operate under liquid pressure shall be tested in sections of approved length. For these tests the Contractor shall furnish clean water, suitable temporary testing plugs or caps, and other necessary equipment and all labor required without additional compensation. The Contractor will furnish suitable pressure gauges, calibrated by an approved testing laboratory, with increments no greater than 2 psi. Gauges used shall be of such size that pressures tested will not register less than 10% nor more than 90% of the gauge capacity.
  - 1. Unless it has already been done, the section of pipe to be tested shall be filled with water of approved quality and all air shall be expelled from the pipe. If hydrants, blowoffs, or other outlets are not available at high points for releasing air, the Contractor shall make the temporary taps at such points and shall plug said holes after completion of the test.
  - 2. Hydrostatic testing shall consist of both pressure tests and leakage tests. Pressure tests shall be of 1-hour duration and leakage tests shall be of 2-hour duration, unless specified otherwise or notified in writing by the Owner. Test pressures shall be as set forth hereinafter. Specified test pressures, based on the elevation of the highest point of the line or section under test and corrected to the elevation of the test gauge, shall be applied by means of a pump connected to the pipe in a manner satisfactory to the Owner. Pressure shall be of the minimum pressure applied to the line or section under test. The pump, pipe connection, and all necessary apparatus, including the proper gauges, shall be furnished by the Contractor and shall be subject to the approval of the Engineer.
  - 3. Pressure tests shall be conducted with a pressure loss of not more than 2# per square inch regardless of length being tested. All exposed pipe, fittings, valves, hydrants, and joints shall be examined carefully during the test. Any damaged or defective pipe, fittings, valves, or hydrants 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 and at no additional cost to the Owner.
  - 4. Leakage tests shall be conducted subsequent to the pressure tests. Leakage is defined as the quantity of water that must be supplied to the line or section under test to maintain constant pressure throughout the duration of the test. No pipe installation will be accepted if the leakage is greater than determined by the following formula from ANSI/AWWA C600-latest:

$$L = S \cdot D \cdot (P)^{1/2}$$

in which L is the allowable leakage in gallons per hour; S is the length of pipeline tested in feet; D is the nominal diameter of the pipe in inches; and P is the average test

pressure during the leakage test in pounds per square inch gauge. If any test discloses leakage greater than that specified above, the Contractor shall, at his own expense, locate and repair the defective material until the leakage is within the specified allowance.

5. In the event a section fails to pass the tests, the Contractor shall do everything necessary to locate, uncover (even to the extent of uncovering the entire section), and repair or replace the defective pipe, fitting, or joint. Visible leaks shall be corrected regardless of total leakage. Lines which fail to meet these tests shall be repaired and retested as necessary until test requirements are complied with. All testing shall be performed at no additional cost to the Owner.
6. If, in the judgment of the Engineer, it is impracticable to follow the foregoing procedures exactly for any reason, modifications in the procedure shall be made as required or approved; but, in any event, the Contractor shall be responsible for the ultimate tightness of the piping within the above requirements.
7. Test Pressures - All Polyvinyl-chloride piping shall be pressure and leak tested as follows:

Pressure Test - 2 hour duration at 150 psig

Leakage Test - 2 hour duration at 150 psig

### **3.3 DISINFECTION**

- A. All water pipes and fittings at whatever size and wherever installed on potable water lines shall be thoroughly disinfected prior to being placed in service. Disinfection shall conform to the applicable provisions of procedures established for the disinfection of water mains in AWWA C-651-latest and shall be in accordance with both state and local requirements.
- B. After disinfection has been completed, samples of water for bacteriological analysis shall be collected and submitted to the appropriate state agency for testing. Should these samples or subsequent samples prove to be unsatisfactory, then the piping shall be disinfected until satisfactory samples are obtained.

### **3.4 MEASUREMENT AND PAYMENT**

- A. No additional payment shall be made for the work hereinbefore specified. The Contractor's unit price or lump sum bid as set forth in the Proposal shall constitute full compensation for the work involved in this section.

END OF SECTION





**SECTION 33 40 00  
DRAINAGE**

**PART 1 - GENERAL**

**1.1 RELATED DOCUMENTS**

- A. The General Provisions of the Contract, including the General Conditions, Supplementary Conditions, and Special Conditions, if any, along with the General Requirements, apply to the work specified in this section.

**1.2 DESCRIPTION**

- A. Perform all the work in connection with all pipe, culverts, inlets, manholes, and auxiliary drainage structures indicated on the drawings or otherwise necessary to collect all surface and subsurface water and discharge such water into existing drainage facilities.

**1.3 REFERENCED STANDARDS**

- A. The Florida Department of Transportation Standard Specifications for Road and Bridge Construction, latest edition, are referred to hereinafter as the Standard Specifications. References to the Standard Specifications are used to specify materials, application, and installation. Administrative, contractual, and measurement and payment requirements are not applicable.
- B. Standard Drawings: Except as otherwise shown on drawings or specified herein, the applicable details of the Florida Department of Transportation (F.D.O.T.) Roadway and Traffic Design Standards, latest edition, shall apply. References to the F.D.O.T. Roadway and Traffic Design Standards are used to specify materials, application, and installation. Administrative, contractual, and measurement and payment requirements are not applicable.

**1.4 APPROVALS AND PERMITS**

- A. The Contractor shall apply for and obtain any permits or approvals as may be required by the governing authorities except those obtained by the Owner. Where the construction requirements of agencies are more stringent than this specification, the Contractor shall abide by such requirements and this specification shall be considered as supplemental to those requirements.

**1.5 PIPE**

- A. Unless specified otherwise, pipe sizes shown on the drawings are based on a coefficient of roughness of 0.013 for concrete and 0.012 for PVC.

**1.6 WORKMANSHIP**

- A. All workmanship, materials, equipment, and plant shall be in accordance with the applicable portions of the Standard Specifications. The specific sections of the above-mentioned Standard Specifications which are applicable are listed below.

**PART 2 - PRODUCTS**

**2.1 MATERIAL**

- A. Concrete Pipe: Concrete pipe for culverts shall conform to Section 430 of the Standard Specifications. All pipe shall be Class III unless otherwise noted on the drawings. The joints of new pipe shall be sealed with use of round gaskets as described in Section 942 of the Standard Specifications.
- B. Polyvinyl Chloride Pipe (PVC): PVC pipe for drainage shall be Schedule 80 and conform to the requirements of ASTM D 1785 for Type II, Grade I for pipes up to 4" diameter. Pipe 4 inches in diameter and larger shall conform to the requirements of AWWA C900-75, DR18, and ASTM D-1785, Type I, Grade I or other types as may be specifically called for in the plans or special provisions.
- C. Underdrain Pipe: Pipe shall be polyvinyl chloride (PVC) double walled corrugated sewer pipe with a smooth interior, meeting ASTM F949 requirement. Joints shall be integral wall bell and spigot, rubber gasket, push-on type.
- D. Underdrain Filter Material: Aggregate shall be gravel or stone meeting Section 901 of the Standard Specifications, No. 57 standard size.

## **2.2 INLETS, MANHOLE AND CONTROL STRUCTURES**

- A. Drainage structures shall be constructed of reinforced concrete, complete with frames and covers.
  - 1. Concrete and reinforced concrete shall be 4,000 psi and shall meet the requirements in Section 346 of the Standard Specifications.
  - 2. Reinforcing steel in accordance with Section 415 of the Standard Specifications.
  - 3. Manhole frames and covers shall be of cast iron and shall meet the requirements of Paragraph 425-3.2 of the Standard Specifications. Weight, shape, size, and waterway openings for grates and curb inlets shall be as shown on the drawings.
  - 4. Structural steel frames and grates in accordance with Paragraph 425-3.2 of the Standard Specifications.
  - 5. Inlet grates shall be of the type indicated on the drawings and in accordance with the Standard Specifications.
  - 6. Precast inlets and manholes shall be manufactured in accordance with Section 425-5 of the Standard Specifications and Index No. 201 of the Florida Department of Transportation (F.D.O.T.) Roadway and Traffic Design Standards.
  - 7. Brick and concrete masonry units in accordance with Section 949 of the Standard Specifications.
  - 8. Mortar for brick masonry in accordance with Paragraph 425-2.2 of the Standard Specifications.

## **2.3 MITERED END SECTION**

- A. In accordance with Index Nos. 272 and 273 of the F.D.O.T. Roadway and Traffic Design Standards, or approved F.D.O.T. precast alternate.

## **PART 3 - EXECUTION**

### **3.1 INSTALLATION**

- A. All excavation, trenching, backfilling, and compaction operations shall be in accordance with Division 31 Section 31 23 16 - EXCAVATION AND BACKFILL FOR UTILITIES AND STRUCTURES.
  - 1. Pipe: The storm drain shall be installed in accordance with Section 430 of the Standard Specifications.
  - 2. Drainage Structures: Headwalls, manholes, inlets, mitered end sections, and control

- structures shall be installed in accordance with the details shown. All work and materials shall be in accordance with applicable portions of the Standard Specifications.
3. Adjusting Existing Structures: Existing structures shall be adjusted in accordance with Paragraph 425-6.7 of the Standard Specifications.

#### **PART 4 – TELEVISION INSPECTION OF STORM SEWER**

##### **4.1 INSPECTION**

- A. The Contractor shall be required to perform a television inspection on all new and/or replacement sewers constructed under this project. This service shall be provided by the Contractor as part of this contract. The Engineer shall instruct the Contractor when this requirement shall be performed. The purpose of the inspection is to locate structural damage or other defects which may be present in the sewer. All internal inspection shall be performed in the presence of the Engineer or his/her appointed representative.

##### **4.2 DEFECTS**

- A. Any defects found in the sewer(s) shall be documented in writing and a video record made, and the Engineer shall be notified immediately. Defects shall include damaged pipe, leaking joints, presence of mud or other debris, misaligned or sagging pipe, bowed pipe sections, deflected pipe, pipe joints not fully seated, improperly installed gaskets, standing water or other abnormalities not in conformance with the specifications.

##### **4.3 EQUIPMENT**

- A. The color television camera used for the inspection shall be one specifically designed and constructed for such inspection. The camera shall be a Pan & Tilt or radial view camera with the ability to look up any connection. Lighting for the camera shall be suitable to allow a clear picture for the entire periphery of the pipe. The camera shall be operable in 100 percent humidity conditions. The camera, television monitor, and other components of the video system shall be capable of producing a minimum 500 line resolution video picture. Picture quality and definition shall be to the satisfaction of the Engineer and if unsatisfactory, equipment shall be removed. Video records shall be DVD format. The cable length shall be sufficient to go completely from manhole to manhole without a reverse setup.

#### **4.4 PROCEDURE**

- A. The camera color monitor shall be located within a mobile vehicle unit that will accommodate three people to watch the sewer line inspection. The Engineer and Owner shall have access to view the television monitor at all times.
- B. A skilled technician shall control the operation of the equipment from a control panel located in the mobile unit and shall have control of the movement of the television camera at all times. This may be accomplished by means of remote-control winches or a self-propelled tractor or other suitable means.
- C. The camera shall be moved through the line in the downstream direction at a uniform rate not to exceed 30 ft./min., stopping when necessary to insure proper documentation of the sewer's condition. The camera shall be stopped and aimed up each connection with the connection properly documented. Power winches, TV cable, power rewinds, tractors, floats or other devices that do not obstruct the camera view or interfere with proper documentation of the sewer conditions will be used to move the camera through the sewer line. If, during the inspection operation the television camera will not pass through the entire manhole section, then the line is considered failed and must be repaired or cleaned before re-TVing.

#### **4.5 DOCUMENTATION**

- A. A log approved by the Engineer shall be provided for all line inspections listing the date, project or subdivision name (section or block number), township, project number, inspection number, manhole numbers and street location where applicable. Printed location records shall be kept by the Contractor and will clearly show the location of each defect observed during inspection. In addition, other points of interest such as locations of connections, unusual conditions, storm sewer connections, presence of scale and corrosion, and other discernible features shall be recorded. A log sheet and video record of the entire inspection shall be supplied to the Engineer. A key to all abbreviations used shall be included on each log sheet.
- B. The locations of all defects, connections and other points of interest shall be identified by logging the distance to each defect or point of interest measured from the center of the starting manhole. The importance of accurate distance measurements is emphasized. The measuring device for location of defects shall be above ground by means of a meter device. Marking on the cable or the like, which would require interpolation for depth of manhole, will not be allowed. Accuracy of the distance meter shall be checked by use of a walking meter, roll-a-tape, cloth tape or other suitable device from manhole to manhole and the accuracy shall be satisfactory to the Engineer. The starting and ending manhole numbers, the running distance from the starting manhole and stationing corresponding to sewer stationing shown on plans for each manholes and service location shall be continuously displayed on the video recording.

#### **4.6 FORMAT**

- A. The video shall be in DVD format and be submitted to the Engineer with two (2) of the computer printouts showing manhole numbers and stationing, service stationing and distance between manholes prior to occupancy release for the dwelling units being served by the sewer. The tape and printout shall be labeled with the project name, tract number, street names, and contractor's name and shall list the station of any defects, dirt, low spots, etc. in the pipe.

#### **4.7 REPAIR OF DEFECTS**

- A. All defects discovered by the television inspection shall be repaired or replaced by the Contractor in a manner acceptable to the Engineer at no cost to the Owner prior to occupancy release for the commercial site being served by the sewer. Even though the sewer line may have successfully passed the leakage and infiltration tests, any defects or low spots in the line shall be repaired to the satisfaction of the Owner.

END OF SECTION