

\*\*\*\*\*

**IFB NO. Y18-757-RC**

**ISSUED: April 6, 2018**

**INVITATION FOR BIDS**

**FOR**

**BARBER PARK MULTIPURPOSE FIELD & SPLASH PAD IMPROVEMENT**

\*\*\*\*\*

**PART H  
TECHNICAL SPECIFICATIONS**

\*\*\*\*\*

**PART H  
Volume II**



# **TECHNICAL PROVISIONS**

**FOR**

## **NEW SOCCER FIELDS AT BARBER PARK BARBER PARK SPLASH PAD**

**ORANGE COUNTY, FLORIDA**



**ORANGE COUNTY  
CAPITAL PROJECTS DIVISION  
400 E. SOUTH STREET  
ORLANDO, FL 32801**

*PREPARED BY:*



2215 Wembley Place  
Oviedo, Florida 32765  
p 407-267-8905

**BID DOCUMENTS**  
**February 2018**

# TABLE OF CONTENTS

---

---

## Section No.

## Specification

### DIVISION 1 – GENERAL REQUIREMENTS

01001.....	Project Directory
01005.....	Administrative Provisions
01010.....	Summary of the Work
01027.....	Application of Payment
01035.....	Modification Procedures
01040.....	Project Coordination
01045.....	Cutting & Patching
01070.....	Abbreviations
01095.....	Reference Standards and Definitions
01200.....	Project Meetings
01300.....	Submittals
01380.....	Construction Photographs
01410.....	Testing Laboratory Services
01500.....	Temporary Facilities
01580.....	Project Signs
01600.....	Materials and Equipment
01631.....	Products Substitutions
01700.....	Project Close-out
01740.....	Warranties and Bonds

### DIVISION 2 – SITE WORK

02010.....	Soil Report and Recommendations
02110.....	Site Clearing
02200.....	Earthwork
02220.....	Excavating, Backfilling and Compacting
02221.....	Trenching, Backfilling and Compacting
02222.....	Excavating, Backfilling, and Compacting for Utilities
02400.....	Site Drainage
02500.....	Roadway Base Course
02511.....	Asphalt Concrete Paving
02520.....	Sitework Concrete
02577.....	Pavement Markings
02900.....	Irrigation Water Well

**DIVISION 3 – CONCRETE**

- 03100..... Concrete Formwork
- 31 31 00..... Soil Treatment
- 31 31 18..... Pest Control
- 03200..... Concrete Reinforcement
- 03262..... Concrete Joints and Waterstops
- 03300..... Cast-In-Place Concrete
- 03800..... Leakage Testing of Hydraulic Structures

**DIVISION 6 – WOOD, PLASTIC AND COMPOSITES**

- 06-500 Plastic & Composites

**DIVISION 10 – SPECIALTIES**

- 107300..... Specialties Manufactures of Protective Covers
- 131143..... Aquatic Play Features and Filtration

**DIVISION 26 – ELETRICAL**

- 26 05 00 Common Work Results for 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 09 23 Lighting Control Devices
- 26 24 16 Panelboards
- 26 27 13 Electricity Metering
- 26 27 26 Wiring Devices
- 26 28 13 Fuses
- 26 28 16 Enclosed Switches and Circuit Breakers
- 26 43 13 Transient Voltage Suppression for Low Voltage Electrical Power Circuits
- 26 56 00 Exterior Lighting
- 26 56 68 Exterior Athletic Lighting

**DIVISION 32 – EXTERIOR IMPROVEMENTS**

32 84 00.....	Planting Irrigation
32 92 00.....	Sodding
32 92 01.....	Turf and Grassed (Bermuda)
32 93 00.....	Landscaping
Appendix A.....	Sports Lighting Information

# INDEX OF DRAWINGS

(Prepared by CPWG)

Sheet	Description
	<b>New Soccer Field at Barber Park</b>
1	Cover Sheet
C001	General Notes
C100	Existing Overall Site Plan
C101	Existing Overall Site Plan with Aerial
C102	Erosion Control Plan & Details
C103	Wetland Impacts
C200	Site Plan
C200a	Site Plan (Additive)
C201	Paving, Grading & Drainage Plan
C300	Details
C301	Details
C302	Details
C400	Signing & Pavement Marking Plan
LD-1	Landscape Plan
LD-2	Landscape Planting Schedule & Planting Details
I100	Irrigation Plan
I101	Irrigation Details
I102	Irrigation Details
E100	Field Lighting Plan
E001	Symbol List, General Notes & Lighting Fixture Schedule
E101	Panel Schedule & Power Riser Diagram
E201	Electrical Site Plan

# INDEX OF DRAWINGS

(Prepared by CPWG)

Sheet	Description
	<b>Barber Park Splash Pad Improvements</b>
C1	Cover Sheet
C.2	General Notes
C.3	Erosion Control Plan
C.5	Demolition Plan – Splash Pad
C.6	Demolition Plan – Parking Areas (Additive One)
C.8	Grading & Layout Plan – Parking (Additive One)
C.9	Site Plan – Splash Pad
C.10	Site Plan – Splash Pad Tank
C.11	Layout – Splash Pad Paving
C.12	Layout – Splash Pad Spray Zone
C.13	Layout – Splash Pad Site Layout
C.14	Layout – Splash Pad Piping and Electrical
C.15	Details – Splash Pad Installation Drawing
C.16	Details – Splash Pad Installation Drawing
C.17	Details – Splash Pad Installation Drawing
C.18	Details – Splash Pad Installation Drawing
C.19.1	Details – Construction
C.19.2	Details – Construction
C.20	Details – Enclosure
C.21	Details – Enclosure Foundation
E.1	Electrical Plan – Splash Pad
SV.1	Survey
SV.2	Survey
SV.3	Survey
SV.4	Survey

**SECTION 01001 - PROJECT DIRECTORY**

Civil:

CPWG, Inc.  
2215 Wembley Place  
Oviedo, Florida 32765  
  
(407) 267-8905  
Jeff.earhart@cpwengineering.com

Electrical/Mechanical

Bobes Associates Consulting Engineers, Inc.  
150 Circle Drive  
Maitland, Florida 32751  
(407) 628-0882  
gusjr@bobeseng.com

END SECTION - 01001



## **SECTION 01005-ADMINISTRATIVE PROVISIONS**

### **PART I GENERAL**

#### **1.01 WORK COVERED BY CONTRACT DOCUMENTS**

- A. Work of this Contract comprises site work, splash pad construction pavilion, dewatering operations, road work, utilities, grading, paving, drainage, ditches, ponds, irrigation, sports lighting, demolition and related construction work to produce a complete and functional NEW SOCCER FIELDS AT BARBER PARK and BARBER PARK SPLASH PAD including but not limited to new soccer fields with lighting, new splash pad, irrigation system, new parking lot, site work, underground utilities, paving, concrete, excavation, compacting, and landscaping/irrigation for the construction of the NEW SOCCER FIELDS AT BARBER PARK and BARBER PARK SPLASH PAD.

#### **1.02 CONTRACT METHOD**

- A. Construct the work under a single lump sum contract (or as otherwise defined in bid documents).

#### **1.03 COORDINATION**

- A. Coordinate work of the various Sections of Specifications to assure efficient and orderly sequence of installation of construction elements, with provisions for accommodating items installed later.
- B. Verify characteristics of elements of interrelated operating equipment are compatible; coordinate work of various Sections having interdependent responsibilities for installing, connecting to and placing in service such equipment. Differences shall be brought to the Owner's attention during bid process or remain the responsibility of the Contractor.
- C. Coordinate space requirements and installation of items, such as but not limited to, mechanical, plumbing, systems and electrical work which are indicated diagrammatically or otherwise on drawings. Follow routing shown for pipes, ducts and conduits, as closely as practicable; make runs parallel with lines of building. Utilize spaces efficiently to maximize accessibility for other installations, for facility maintenance and for future repairs.
- D. In finished areas (except as otherwise shown), conceal pipes, ducts, and wiring in the construction. Coordinate locations of fixtures and outlets with finish elements.
- E. Execute cutting and patching to integrate elements of work, uncover ill timed,

defective and nonconforming work, provide openings for penetrations of existing surfaces and provide samples as specified in individual sections for testing. Seal penetrations through floors, walls and ceilings, and fire safe where necessary as part of the lump sum price.

1.04 FIELD ENGINEERING SURVEYING

- A. Provide field engineering surveying services; establish grades, lines and levels, by use of engineering survey practices recognized as standard by the survey industry. Said work shall be required to be provided by a Professional Land Surveyor, registered as such in the State of Florida.

1.05 REFERENCE STANDARDS

- A. For products specified by association or trade standards, comply with requirements of the standard, except when more rigid requirements are specified or are required by applicable codes.
- B. The date of the standard is that in effect when a specified date is specified and if no date is specified, use the latest edition.
- C. Obtain copies of referenced standards listed in individual specification sections. Maintain copy at job site during progress of the specific work.

END OF SECTION 01005

## **SECTION 01010-SUMMARY OF WORK**

### **PART 1 GENERAL**

#### **1.01 RELATED DOCUMENTS**

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

#### **1.02 PROJECT DESCRIPTION**

Performance of all tasks specified in the contract documents shall be the responsibility of the contractor unless specified otherwise. The description of the project is as follows: two 360-ft x 225-ft soccer fields, one 360-ft x 225-ft unlit soccer field, one complete splash pad, stormwater drainage, sports lighting, new parking lot, new entrance driveway, sidewalks, irrigation well, irrigation system, excavation, sodding, road work, utilities, site work, drainage, paving and landscape/irrigation complete.

The project has two additive bids as discussed below.

#### **Additive 1 – South Parking and Walkway**

The additive will include

1. Prepare the area
2. Construct 23 parking spaces and associated work

#### **Additive 2 – North Soccer Parking Area**

The additive will include

1. Prepare the area
2. Construct approximately 77 additional parking spaces and associated work
3. Lighting
4. Sidewalk

#### **Additive 3 – Multi-Purpose Field #3 Bermuda 419 Sod**

The base bid is to include bringing the field to grade and placing bahia sod. The additive will include

1. Placing Bermuda Sod instead of Bahia on Field #3
2. Installing irrigation system on Field #3
3. Finish laser grading

#### **Additive 4 – MUSCO lighting on third field**

The base bid is to include conduit and wiring for the MUSCO lights on the third field. The additive will include

1. Adding the MUSCO lights to the third field. Add fixtures to poles S5 and S6 installed as part of the base bid. Add poles and fixtures S7 and S8.

1.03 WORK UNDER OTHER CONTRACTS

- A. Separate contracts may be issued to perform certain construction operations at the site.

1.04 BUILDING/SITE SECURITY

- A. The site shall be secured by the General Contractor from unwarranted entry at the end of each day.
- B. The construction site shall be secured by means of a construction fence, located around the entire perimeter of the construction site. This construction fence shall be required to be secure from unwarranted entry at the end of each day.

1.05 CONTRACTOR USE OF PREMISES

- A. General: During the construction period the Contractor shall have full use of the premises for construction operations, including use of the site. The Contractors use of the premises is limited only by the Owners right to perform construction operations with the own forces or to employ separate contractors on portions of the project.
- B. General: Limit use of the premises to construction activities in areas indicated within the limit of the premises the Contractor may use any portion of the site for storage or work areas or any legal purpose.
  - 1. Confine operations to areas within Contract limits indicated on the Drawings. Portions of the site beyond areas in which construction operations are indicated are not to be disturbed.
  - 2. Keep driveways and entrances serving the premises clear and available to the Owner and the Owners employees at all times. Do not use these areas for parking or storage of materials.
  - 3. Burial of Waste Materials: Do not dispose of construction debris, vegetation and hazardous material on site, either by burial or by burning.

1.06 DISTRIBUTION OF RELATED DOCUMENTS

- A. The Contractor is solely responsible for the distribution of ALL related documents/drawings/specifications to ALL appropriate vendors/ subcontractors to insure proper coordination of all aspects of the project and its related parts during bidding and construction.

1.07 CONTRACT DOCUMENT FILE

- A. Copies of the Contract Documents, Plans, Specifications, Addenda, Change Orders, Architects Supplemental Instructions, approved Shop Drawings, Substitution Approvals, etc. shall be placed and maintained in the Contractors field office at the project site by the Contractor throughout the entire contract

period. Said these documents shall be filed in a manner that allows for ease of retrieval. Documents shall be made available to the Architect/Engineer and the County's representatives throughout this same period.

PART 2 PRODUCTS

2.01 ASBESTOS FREE MATERIAL

- A. Contractor shall provide a written and notarized statement on company letterhead(s) to certify and warrant that ONLY ASBESTOS FREE MATERIALS AND PRODUCTS were provided as required in this section. Such statement shall be submitted with the final payment request. Final payment shall not be made until such statement is submitted. Contractor agrees that if materials containing asbestos are subsequently discovered at any future time to have been included in the construction, the contractor shall be liable for all costs related to the redesign or modification on the construction of the project so that materials containing asbestos are removed from the facility. If construction has begun or has been completed pursuant to a design that includes asbestos containing materials, the Contractor shall also be liable for all costs related to the abatement of such asbestos.

PART 3 EXECUTION (Not applicable).

END OF SECTION 01010

## **SECTION 01027-APPLICATION FOR PAYMENT**

### **PART I GENERAL**

#### 1.01 RELATED DOCUMENTS

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

#### 1.02 SUMMARY

- A. This Section specifies administrative and procedural requirements governing the Contractor's Applications for Payment.
- B. The Contractor's Construction Schedule and Submittal Schedule are included in Section 01300 – SUBMITTALS □

#### 1.03 SCHEDULE OF VALUES

- A. Coordinate preparation of the Schedule of Values with preparation of Contractor's Construction Schedule.
  - 1. Submit the Schedule of Values to the Owner at the earliest feasible date, but in no case later than Preconstruction Meeting. Refer to Section 01200 – Project Meetings.
  - 2. Sub-Schedules: Where the Work is separated into phases that require separately phased payments, provide sub-schedules showing values correlated with each phase of payment.
- B. Format and Content: Use the Project Manual Table of Contents as a guide to establish the format for the Schedule of Values.
  - 1. Identification: Include the following project identification on the Schedule of Values:
    - a. Project name and location.
    - b. Name of the Architect
    - c. Project Number
    - d. Contractor's name and address
    - e. Date of submittal

2. Arrange the Schedule of Values in a tabular form with separate columns to indicate the following for each item listed:
  - a. Generic name
  - b. Related Specification Section
  - c. Change Orders (numbers) that have affected value
  - d. Dollar Value
  - e. Percentage of Contract Sum to the nearest one-hundredth percent, adjusted to total 100 percent
  
3. Provide a breakdown of the Contract Sum in sufficient detail to facilitate continued evaluation of Applications for Payment and progress reports. Break principal subcontract amounts down into several line items:
  - a. A value will be given for at least every major specification section (subsections can logically be grouped together).
  - b. A single material subcontractor (i.e. sod, window blinds) will not be required to be broken down into labor and material unless it is anticipated the materials will be stored and invoiced prior to installation.
  - c. All multiple item subcontracts or work items (i.e. concrete, roofing, painting, mechanical, electrical items, etc.) will be shown broken down at least in labor and material (all taxes, burden and overhead and profit included).
  - d. Mobilization (move-on, bond, insurance, temporary office and sanitary service installation) shall not exceed 2.5% of contract price.
  - e. For multi-story work all items broken down per floor.
  - f. Concrete broken down at least into foundation slab on grade, columns, beams and suspended slabs.
  - g. Masonry divided into C.M.U. brick, stem walls, exterior walls, interior walls and elevator shaft.
  - h. Plumbing broken down at least into underslab rough-in, vents and stacks supply piping, equipment items (each listed separately), fixtures and trim.
  - I. HVAC: Typically shown per specification section, labor and material, per floor.
  - j. Electrical: same as HVAC.
  - k. Fire protection broken down at least into underground, rough-in and trim. All per building and labor and material.
  - l. Logical grouping of specification subsections is permitted.
  - m. Include line item for closeout documents.
  
4. Round amounts off the nearest whole dollar, the total shall equal the

Contract Sum.

5. For each part of the Work where an Application for Payment may include materials or equipment, purchased or fabricated and stored, but not yet installed, provide separate line items on the Schedule of Values for initial cost of the materials, for each subsequent stage of completion, and for total installed value of that part of the Work.
6. Margins of Cost: Show line items for indirect costs, and margins on actual costs, only to the extent that such items will be listed individually in Applications for Payment. Each item in the Schedule of Values and Applications for Payment shall be complete including its total cost and proportionate share of general overhead and profit margin.
  - a. At the Contractors' option, temporary facilities and other major cost items that are not direct cost of actual work-in-place may be shown as separate line items in the Schedule of Values or distributed as general overhead expense.
7. Schedule Updating:

1.04 APPLICATIONS FOR PAYMENT

- A. Each Application for Payment shall be consistent with previous applications and payments as reviewed by the Owner representative and paid for by the Owner.
  1. The initial Application for Payment, the Application for Payment at time of Substantial Completion, and the Final Application for Payment involve additional requirements. See items G, I, J and K of this section.
- B. Payment Application Times: The period of construction work covered by each Application of Payment is the period indicated in the Agreement.
- C. Payment Application Forms: Use the County's most updated form as the form for Application for Payment. Form is given at the Preconstruction Conference.
- D. Application Preparation: Complete every entry on the form, including notarization and execution by person authorized to sign legal documents on behalf of the Owner. Incomplete applications will be returned without action.
  1. Entries shall match data on the Schedule of Values and Contractors' Construction Schedule. Use updated schedules if revisions have been made.
  2. Include amounts of Change Orders and Construction Change Directives issued prior to the last day of the construction period covered by the application.



- E. Transmittal: Submit five (5) original executed copies of each Application for Payment to the Project Manager by means ensuring receipt within 24 hours; one copy shall be complete, including waivers of lien and similar attachments, when required.
1. Transmit each copy with a transmittal form listing attachments, and recording appropriate information related to the application in a manner acceptable to the Project Manager.
- F. Payment will be processed once a month. Payment for item will be based on percentage completed as determined and approved by the County Project Manager or invoice for stored materials. Retainage (10%) will be held for all applications.
- G. Application for Payment at Substantial Completion: Following issuance of the Certificate of Substantial Completion, submit an Application for Payment; this application shall reflect any Certificates of Partial Substantial Completion issued previously for Owner occupancy of designated portions of the Work. Application shall also include all items listed in Part H. above.
- H. Final Payment Application: Administrative actions and submittals, which must precede or coincide with submittal of the final payment. Application for Payment includes the following:
1. Completion of Project Close-Out requirements
  2. Completion of items specified for completion after Substantial Completion (Punch List)
  3. Contractor's release of lien (on Owner's form)
  4. Subcontractor and material supplier release of lien
  5. Consent of Surety
  6. Power of attorney
  7. Asbestos-free letter
  8. Project requiring badging, provide sworn notarized statement and signed submittal (by owner) that badges have been returned
  9. Current Insurance Certificate
  10. If Davis Bacon, final Certified Payroll

PART 2 PRODUCTS (Not Applicable)

PART 3 EXECUTION (Not Applicable)

END OF SECTION 01027

## **SECTION 01035-MODIFICATION PROCEDURES**

### **PART 1 GENERAL**

#### **1.01 RELATED DOCUMENTS**

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

#### **1.02 SUMMARY**

- A. This section specifies administrative and procedural requirements for handling and processing Contract modifications.

#### **1.03 MINOR CHANGES IN THE WORK**

- A. Supplemental instructions authorizing minor changes in the work, not involving an adjustment to the Contract Sum or Contract Time, will be issued by the Project Manager.

#### **1.04 CHANGE ORDER PROPOSAL REQUESTS**

- A. Owner-Initiated Proposal Requests: Proposed changes in the work that will require adjustment to the Contract Sum or Contract Time will be issued by the Project Manager, with a detailed description of the proposed change and supplemental or revised Drawings and Specifications, if necessary.
  - 1. Proposal requests issued by the Project Manager are for information only. Do not consider them instruction either to stop work in progress, or to execute the proposed change.
  - 2. Unless otherwise indicated in the proposal request, within 7 days of receipt of the proposal request, submit to the Project Manager from the Owner's review, an estimate of cost necessary to execute the proposed change.
    - a. Include a list of quantities of products to be purchased and unit costs, along with the total amount of purchases to be made. Where requested, furnish survey data to substantiate quantities.
    - b. Indicate applicable taxes, delivery charges, equipment rental, and amounts of trade discounts.
    - c. Include a statement indicating the effect the proposed change in the work will have on the Contract Time.

- d. Contractor and subcontractors will provide a complete detailed labor and material breakdown to justify change order request amount.
  - e. Pricing not received within 15 days shall be considered a zero cost item.
- B. Contractor-Initiated Change Order Proposal Requests: When latent or other unforeseen conditions in mutual accord with the Owner Representative's findings require modifications to the Contract, the Contractor may propose changes by submitting a request for a change to the Architect.
1. Include a statement outlining the reasons for the change and the effect of the change on the Work. Provide a complete description of the proposed change. Indicate the effect of the proposed change on the Contract Sum and Contract Time.
  2. Include a list of quantities of products to be purchased and unit costs along with the total amount of purchases to be made. Where requested, furnish survey data to substantiate quantities.
  3. Indicate applicable taxes, delivery charges, equipment rental, and amounts of trade discounts.
  4. Comply with requirements in Section 01631 Product Substitutions- if the proposed change in the work requires that substitution of one product or system for a product or system not specified.
  5. Contractor and subcontractors will provide a complete detailed labor and material breakdown to justify change order request amounts.
  6. Contractor shall submit pricing within 15 calendar days of the condition causing the change. If the change is the result of an RFI this pricing shall be submitted within 15 calendar days of the response date. Failure to do so will result in a zero cost change order.
  7. If the change is a result of an ASI (Architects Supplemental Instruction) pricing shall be submitted by the contractor within 15 calendar days of the issued date of the ASI. Failure to do so will result in a zero cost change order.

#### 1.05 CONSTRUCTION CHANGE DIRECTIVE

- A. Construction Change Directive: When the Owner and Contractor are not in total agreement on the terms of a Change Order Proposal Request, the Project Manager may issue a Construction Change Directive instructing the Contractor to proceed with a change in the Work, for subsequent inclusion in a Change Order.
1. The Construction Change Directive will contain a complete description of

the change in the Work and designate the method to be followed to determine change in the Contract Sum or Contract Time.

- B. Documentation: Maintain detailed records on a time and material basis of work required by the Construction Change Directive.
  - 1. After completion of the change, submit an itemized account and supporting data necessary to substantiate cost and time adjustments to the Contract.

#### 1.07 CHANGE ORDER PROCEDURES

- A. Upon the Owner's approval of a Change Order Proposal Request, the Project Manager will issue a Change Order for signatures of the Owner and Contractor on County's Change Order form, as provided in the Conditions of the Contract.

PART 2 PRODUCTS (Not Applicable)

PART 3 EXECUTION (Not Applicable)

END OF SECTION 01035

## **SECTION 01040-PROJECT COORDINATION**

### **1.01 RELATED DOCUMENTS**

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

### **1.02 SUMMARY**

- A. This Section specifies administrative and supervisory requirements necessary for project coordination including, but not necessarily limited to:
  - 1. Coordination
  - 2. Administrative and supervisory personnel
  - 3. General installation provisions
  - 4. Cleaning and protection
- B. Preconstruction meetings, Progress meetings, Coordination meetings and Pre-installation conferences are included in Section 01200 'Project Meetings'.
- C. Requirements for the Contractor' Construction Schedule are included in Section 01300 'Submittals'.

### **1.03 COORDINATION**

- A. Coordination: Coordinate construction activities included under various Sections of these Specifications to ensure efficient and orderly installation of each part of the Work. Coordinate construction operations included under different Sections of the Specification that are dependent upon each other for proper installation, connection, and operation.
  - 1. Where installation of one part of the Work is dependent on installation of other components, either before or after its own installation, schedule construction activities in the sequence required to obtain the best results.
  - 2. Where availability of space is limited, coordinate installation of different components to assure maximum accessibility for required maintenance, service and repair.

3. Make adequate provisions to accommodate items scheduled for later installation.
- B. Where necessary, prepare memoranda for distribution to each party involved outlining special procedures required for coordination. Include such items as required: notices, reports, and attendance at meetings.
1. Prepare similar memoranda for the Owner and separate Contractors where coordination of their Work is required.
- C. Administrative Procedures: Coordinate scheduling and timing of required administrative procedures with other construction activities to avoid conflicts and ensure orderly progress of the Work. Such administrative activities include, but are not limited to, the following:
1. Preparation of Schedules
  2. Installation and removal of temporary facilities
  3. Delivery and processing of submittals
  4. Progress meetings
  5. Project close-out activities
- D. Conservation: Coordinate construction activities to ensure that operations are carried out with consideration given to conservation of energy, water, and materials.
1. Salvage materials and equipment (if any) involved in performance of, but not actually incorporated in, the Work.
- E. Lack of coordination as specified in this and other sections of the contract documents are in grounds for assessment of back charges and/or termination in order to remediate the situation.

#### 1.04 SUBMITTALS

- A. Coordination Drawings: Prepare and submit coordination Drawings where close and careful coordination is required for installation of products and materials fabricated off-site by separate entities, and where limited space availability necessitates maximum utilization of space for efficient installation of different components.
1. Show the interrelationship of components shown on separate Shop Drawings.
  2. Indicate required installation sequences.
  3. Comply with requirements contained in Section Submittals.

4. Refer to Appropriate Mechanical and Electrical Specifications for specific coordination drawing requirements for mechanical and electrical installations.
- B. Staff Names: At the Preconstruction Conference submit a list of the Contractor's principal staff assignments, including the Superintendent and other personnel in attendance at the site; identify individuals, their duties and responsibilities; list their addresses and telephone numbers.
  1. Post copies of the list in the project meeting room, the temporary field office, and each temporary telephone.

PART 2 PRODUCTS (Not Applicable)

PART 3 EXECUTION

3.01 PROCUREMENT

- A. Contractor shall have all subcontractors under contract within 60 days of execution of contract with owner

3.02 GENERAL INSTALLATION PROVISIONS

- A. Inspection of Conditions: Require the Installer of each major component to inspect both the substrate and conditions under which work is to be performed. Do not proceed until unsatisfactory conditions have been corrected in an acceptable manner.
- B. Manufacturer's Instructions: Comply with manufacturer's installation instructions and recommendations, to the extent that those instructions and recommendations are more explicit or stringent than requirements contained in Contract Documents.
- C. Inspect materials or equipment immediately upon delivery and again prior to installation. Reject damaged and defective items.
- D. Provide attachment and connection devices and methods necessary for securing work. Secure work true to line and level. Allow for expansion and building movement.
- E. Visual Effects: Provide uniform joint widths in exposed work. Arrange joints in exposed work to obtain the best visual effect. Refer questionable choices to Project Manager for final decision.
- F. Recheck measurements and dimensions, before starting each installation.

- G. Install each component during weather conditions and Project status that will ensure the best possible results. Isolate each part of the completed construction from incompatible material as necessary to prevent deterioration.
- H. Coordinate temporary enclosures with required inspections and tests, to minimize the necessity of uncovering completed construction for that purpose.
- I. Mounting Heights: Where mounting heights are not indicated, put request in writing and refer to the Architect/Project Manager for final decision.

### 3.03 CLEANING AND PROTECTION

- A. During handling and installation, clean and protect construction in progress and adjoining materials in place. Apply protective covering where required to ensure protection from damage or deterioration at Substantial Completion.
- B. Clean and maintain completed construction as directed by the Project Manager and as frequently as necessary to ensure its integrity and safety through the remainder of the construction period. Adjust and lubricate operable components to ensure operability without damaging effects.
- C. Limiting Exposures: Supervise construction activities to ensure that no part of the construction, completed or in progress, is subject to harmful, dangerous, damaging, or otherwise deleterious exposure during the construction period. Where the applicable, such exposures include, but are not limited to, the following:
  - 1. Excessive static or dynamic loading
  - 2. Excessively high or low temperatures
  - 3. Excessively high or low humidity
  - 4. Air contamination or pollution
  - 5. Water
  - 6. Solvents
  - 7. Chemicals
  - 8. Soiling, staining and corrosion
  - 9. Rodent and insect infestation
  - 10. Combustion
  - 11. Destructive testing
  - 12. Misalignment
  - 13. Excessive weathering
  - 14. Unprotected storage
  - 15. Improper shipping or handling
  - 16. Theft
  - 17. Vandalism

END OF SECTION 01040



## **SECTION 01045 - CUTTING AND PATCHING**

### **1.01 RELATED DOCUMENTS**

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

### **1.02 SUMMARY**

- A. This Section specifies administrative and procedural requirements for cutting and patching.
- B. Refer to other Sections for specific requirements and limitations applicable to cutting and patching individual parts of the Work.
  - 1. Requirements of this Section apply to mechanical and electrical installations. Refer to the appropriate Mechanical and Electrical -16 Sections for other requirements and limitations applicable to cutting and patching mechanical and electrical installations.

### **1.03 SUBMITTALS**

- A. Cutting and Patching Proposal: Where approval of procedures for cutting and patching is required before proceeding, submit a proposal describing procedures well in advance of the time cutting and patching will be performed and request approval to proceed. Include the following information, as applicable, in the proposal:
  - 1. Describe the extent of cutting and patching required and how it is to be performed; indicate why it cannot be avoided.
  - 2. Describe anticipated results in terms of changes to existing construction; include changes to structural elements and operating components as well as changes in the building's appearance and other significant visual elements.
  - 3. List products to be used and firms or entities that will perform Work.
  - 4. Indicate dates when cutting and patching is to be performed.
  - 5. List utilities that will be disturbed or affected, including those that will be relocated and those that will be temporarily out-of-service. Indicate how long service will be disrupted.
  - 6. Where cutting and patching involves addition of reinforcement to

structural elements, submit details and engineering calculations to show how reinforcement is integrated with the original structure.

7. Approval by the Owner to proceed with cutting and patching does not waive the Owner's right to later require complete removal and replacement of a part of the Work found to be unsatisfactory.

#### 1.04 QUALITY ASSURANCE

- A. Requirements for Structural Work: Do not cut and patch structural elements in a manner that would reduce their load carrying capacity or load-deflection ratio.
  1. Obtain approval of the cutting and patching proposal before cutting and patching the following structural elements.
    - a. Foundation construction
    - b. Bearing and retaining walls
    - c. Structural concrete
    - d. Structural steel
    - e. Lintels
    - f. Timber and primary wood framing
    - g. Structural decking
    - h. Miscellaneous structural metals
    - I. Stair systems
    - j. Exterior curtain wall construction
    - k. Equipment supports
    - l. Piping, ductwork, vessels and equipment
    - m. Structural systems of special construction as noted in Specifications.
- B. Operational and Safety Limitations: Do not cut and patch operating elements or safety related components in a manner that would result in reducing their capacity to perform as intended, or result in increased maintenance, or decreased operational life or safety. Refer to Mechanical and Electrical Divisions regarding Fire Rated Penetrations.
  1. Obtain approval of the cutting and patching proposal before cutting and patching the following operating elements or safety related systems.
    - a. Shoring, bracing and sheeting
    - b. Primary operational systems and equipment
    - c. Air or smoke barriers
    - d. Water, moisture, or vapor barriers
    - e. Membranes and flashings
    - f. Fire protection systems
    - g. Noise and vibration control elements and systems
    - h. Control systems

- I. Communication systems
  - j. Conveying systems
  - k. Electrical wiring systems
  - l. Special construction as noted in specifications
  - m. Elevators and elevator equipment
- C. Visual Requirements: Do not cut and patch construction exposed on the exterior or in occupied spaces, in a manner that would, in the Designer's and or Owner's opinion, reduce the building's aesthetic qualities, or result in visual evidence of cutting and patching. Remove and replace work cut and patched in a visually unsatisfactory manner.
- 1. If possible retain the original installer or fabricator to cut and patch the following categories of exposed work, or if it is not possible to engage the original installer or fabricator, engage another recognized experienced and specialized firm:
    - a. Processed concrete finishes
    - b. Preformed metal panels
    - c. Window wall system
    - d. Stucco and ornamental plaster
    - e. Acoustical ceilings
    - f. Carpeting
    - g. Wall covering
    - h. HVAC enclosures, cabinets or covers
    - I. Roofing systems

## PART 2 PRODUCTS

### 2.01 MATERIALS

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

## PART 3 EXECUTION

### 3.01 INSPECTION

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

potential conflicts before proceeding.

2. In an occupied Building, any items which may result in a flammable combustible reaction shall have a designated firewatch.

3.

### 3.02 PREPARATION

- A. Temporary Support: Provide temporary support of work to be cut.
- B. Protection: Protect existing construction during cutting and patching to prevent damage. Provide protection from adverse weather conditions for portions of the Project that might be exposed during cutting and patching operations.
- C. Avoid interference with use of adjoining areas and interruption of free passage to adjoining areas.
- D. Take all precautions necessary to avoid cutting existing pipe, conduit or ductwork serving the building, but scheduled to be removed or relocated until provisions have been made to bypass them.

### 3.03 PERFORMANCE

- A. General: Employ skilled workmen to perform cutting and patching. Proceed with cutting and patching at the earliest feasible time and complete without delay.
  1. Cut existing construction to provide for installation of other components or performance of other construction activities and the subsequent fitting and patching required to restore surfaces to their original condition.
- B. Cutting: Cut existing construction using methods least likely to damage elements to be retained or adjoining construction. Where possible review proposed procedures with the original installer; comply with the original installer's recommendations.
  1. In general, where cutting is required use hand or small power tools designed for sawing or grinding, not hammering and chopping. Cut holes and slots neatly to size required with minimum disturbance of adjacent surfaces. Temporarily cover openings when not in use.
  2. To avoid marring existing finished surfaces, cut or drill from the exposed or finished side into concealed surfaces.
  3. Cut through concrete and masonry using a cutting machine such as a Carborundum saw or diamond core drill. Use wet cutting methods unless not possible.
  4. Comply with requirements of applicable Specification Sections where

cutting and patching required excavating and backfilling.

5. By-pass utility services such as pipe or conduit, before cutting, where services are shown or required to be removed. Cap, valve or plug and seal the remaining portion of pipe or conduit to prevent entrance of moisture or other foreign matter after by-passing and cutting.
- C. Patching: Patch with durable seams that are as invisible as possible. Comply with specified tolerances.
1. Where feasible, inspect and test patched areas to demonstrate integrity of the installation.
  2. Restore exposed finishes of patched areas and extend finish restoration into retained adjoining construction in a manner that will eliminate evidence of patching and refinishing.
  3. Where removal of walls or partitions extends one finished area into another, patch and repair floor and wall surfaces in the new space to provide an even surface of uniform color and appearance. Remove existing floor and wall coverings and replace with new materials if necessary to achieve uniform color and appearance.
    - a. Where patching occurs in a smooth painted surfaces, extend final coat over entire unbroken surfaces containing the patch, after the patched area has received primer and second coat.

### 3.04 CLEANING

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

END OF SECTION 01045

**SECTION -01070 ABBREVIATIONS**

PART 1 GENERAL

A. General:

A	Area Square Feet; Ampere
AAMA	Architectural Minimum Manufacturer's Association
ABS	Acrylonitrile Butadiene Styrene
A.C.	Alternating Current; Air conditioning; Plywood Grade A & C
A.B.	Anchor Belt
A.C.I.	American Concrete Institute
Acous.	Acoustical
AD	Plywood, Grade A & D
A.D.	Area Drain
Adh.	Adhesive
Addit	Additional
Adj.	Adjustable
af	Audio-frequency
Aff	Above Finished Floor
Afg	Above Finished Grade
A.G.A.	American Gas Association
Agg.	Aggregate
A.H.	Ampere Hours
A hr.	Ampere-hour
A.H.U.	Air Handling Unit
A.I.A.	American Institute of Architects
A.I.C.	Alternating Interrupting Capacity
AIC	Ampere Interrupting Capacity
AISC	American Institute of Steel Construction
Allow.	Allowance
ALT.	Alternate
Alt.	Altitude
Alum.	Aluminum
a.m.	Ante Meridiem
Amp.	Ampere
Anc.	Anchor
Anod.	Anodized
ANSCI	American National Standards Institute
A.P.	Access Panel
Appd.	Approved
Approx.	Approximately
Apt.	Apartment

Arch.	Architectural
Asb.	Asbestos
A.S.B.C.	American Standard Building Code
A.S.H.R.A.E.	American Society of Heating, Refrig. & AC Engineers
A.S.M.E.	American Society of Mechanical Engineers
A.S.T.M.	American Society for Testing and Materials
Attchmt.	Attachment
Auto.	Automatic
Avg.	Average
A.W.G.	American Wire Gauge
AWI	American Wood Institute
AWS	American Welding Society
Bbl.	Barrel
B.C.	Bare Copper
B.& B.	Grade B. and Better;Balled and Burlapped
B.& S.	Bell and Spigot
B.& W.	Black and White
b.c.c.	Body-centered Cubic
Bd	Board
BE	Bevel End
B.F.	Board Feet
BF.	Bottom Face
Bg. Cem	Bag of Cement
BHP	Boiler Horsepower, Brake Horsepower
B.I.	Black Iron
Bit. ;Bitum	Bituminous
Bk.	Backed
Bkrs.	Breakers
Bldg.	Building
Blk.	Block
Blkg.	Blocking
Bm.	Beam
B.M.	Benchmark
B.O.C.	Bottom of Curb
BOT.	Bottom
Boil.	Boilermaker
B.P.M.	Blows Per Minute
BR	Bedroom
Brg.	Bearing
Brhe.	Bricklayer Helper
Bric.	Bricklayer
Brk.	Brick
Brkt.	Bracket
Brng.	Bearing
Brs.	Brass
Brz.	Bronze

Bsmt.	Basement
Bsn.	Basin
Btr.	Better
BTU	British Thermal Unit
BTUH	BTU per hour
Btwn.	Between
B.U.R.	Built up Roofing
BX	Interlocked Armored Cable
c	Conductivity
C	Hundred; Centigrade
C.	Course
C/C	Center to Center
Cab.	Cabinet
Cair.	Air Tool Laborer
Calc.	Calculated
Cap.	Capacity
Carp.	Carpenter
C.B.	Circuit Breaker
C.BD.	Chalk Board
C.C.A.	Chromate Copper Arsenate
C.C.F.	Hundred Cubic Feet
cd	Candela
cd/sf	Candela per Square Feet
CD	Grade of Plywood Face & Back
CDX	Plywood, grade C & D, exterior glue
Cefi.	Cement Finisher
Cem.	Cement
Cer.	Ceramic
CF	Hundred Feet
C.F.	Cubic Feet
CFM	Cubic Feet per Minute
c.g.	Center of Gravity
CG	Corner Guard
CHW	Chilled Water
C.I.	Cast Iron
C.I.P.	Cast in Place
Circ.	Circuit
C.J.	Control Unit
C.L.	Carload Lot
Clab.	Common Laborer
Clec.	Clock Equipment Cabinet
C.L.F.	Hundred Linear Feet
CLF	Current Limiting Fuse
Clg.	Ceiling
Clkg.	Caulking
Clo.	Closed
CLP	Cross Linked Polyethylene



Clr.	Clear
cm	Centimeter
CMP	Corr. Metal Pipe
C.M.U.	Concrete Masonry Unit
Cntr.	Counter
C.O.	Cleanout
Col.	Column
Conn.	Connection
Cont.	Continuous
Cont.	Contractor
C.Opng.	Cased Opening
CO2	Carbon Dioxide
Comb.	Combination
Compr.	Compressor
Conc.	Continuous; Continued
Cond.	Conductor
Corr.	Corrugated
Cos	Cosine
Cot	Cotangent
Cov.	Cover
CPA	Control Point Adjustment
Cplg.	Coupling
C.P.M.	Critical Path Method
CPVC	Chlorinated Polyvinyl Chloride
C.Pr.	Hundred Pair
CRC	Cold Rolled Channel
Creos.	Creosote
Crpt.	Carpet & Linoleum Layer
CRT	Cathode Ray Tube
CS	Carbon Steel
Csc	Cosecant
C.S.F.	Hundred Square Feet
CSI	Construction Specifications Institute
C.T.	Current Transformer
CTS	Copper Tube Size
Cu	Cubic
Cu. Ft.	Cubic Foot
cw	Continuous Wave
C.W.	Cool White; Cold Water
C. Wall	Curtain Wall
Cwt.	100 Pounds
C.W.X.	Cool White Deluxe
C.Y.	Cubic Yard (27 cubic feet)
C.Y./Hr.	Cubic Yard per Hour
Cyl.	Cylinder
d	Penny (nail size)
D	Deep; Depth; Discharge

Dis; Disch	Discharge
Db.	Decibel
Dbl.	Double
DC	Direct Current
Demob.	Demobilization
d.f.u.	Drainage Fixture Units
D.H.	Double Hang
DHU	Domestic Hot Water
Diag.	Diagonal
Diam.	Diameter
Distrib.	Distribution
Dk.	Deck
D.L.	Deck Load
Do.	Ditto
Dp.	Depth
D.P.S.T.	Double Pole, Single Throw
Dr.	Driver
Drink.	Drinking
D.S.	Double Strength
D.S.A.	Double Strength A Grade
D.S.B.	Double Strength B Grade
Dty.	Duty
DWV	Drain Waste Vent
DX	Deluxe White, Direct Expansion
dyn	Dynbe
e	Eccentricity
E	Equipment only; East
Ea	Each
E.B.	Encased Burial
Econ.	Economy
EDP	Electronic Data Processing
E.D.R.	Equiv. Direct Radiation
Eq.	Equation
Elec.	Electrician; Electrical
Elev.	Elevator; Elevating
EMT	Electrical Metallic Conduit; Thin Wall Conduit
Eng.	Engine
EPDM	Ethylene Propylene Diene Monomer
Eqhv.	Equip. Oper., heavy
Eqlt.	Equip. Oper., light
Eqmd.	Equip. Oper., medium
Eqmm.	Equip. Oper., Master Mechanic
Equol.	Equip. Oper., Oilers
ERW	Electric Resistance Welded
Est.	Estimated
esu	Electrostatic Units
E.W.	Each Way

EWT	Entering Water Temperature
Excav.	Excavation
Exp.	Expansion, Exposure
Ext.	Exterior
Extru.	Extrusion
f.	Fiber Stress
F	Fahrenheit; Female; Fill
Fab.	Fabricated
F.B.C.	Florida Building Code
FBGS	Fiberglass
F.C.	Foot candles
f.c.c.	Face Centered Cubic
fc	Compressive Stress in Concrete; Extreme Compressive Stress
F.E.	Front End
FRP	Fluorinated Ethylene Propylene (Teflon)
F.G.	Flat Grain
F.H.A.	Federal Housing Administration
Fig.	Figure
Fin	Finished
Fixt.	Fixture
Fl. Oz.	Fluid Ounces
Flr.	Floor
F.M.	Frequency Modulation; Factory Mutual
Fmg.	Framing
Fndtn.	Foundation
Fori.	Foreman; Inside
Fount.	Fountain
FPM	Feet Per Minute
Fr.	Frame
F.R.	Fire Rating
FRK	Foil Reinforced Kraft
FRP	Fiberglass Reinforced Plastic
FS	Forged Steel
FSC	Cast Body; Cast Switch Box
Ft.	Foot; Feet
Ftng.	Fitting
Ftg.	Footing
Ft.Lb.	Foot Pound
Furn.	Furniture
FVNR	Full Voltage Non-Reversing
FXM	Female by Male
Fy.	Minimum Yield Stress of Steel
g	Gram
G	Gauss
Ga.	Gauge
Gal.	Gallon

Gal./Min.	Gallon Per Minute
Galv.	Galvanized
Gen.	General
G.F.I.	Ground Fault Interrupter
Glaz.	Glazier
GPD	Gallons per Day
GPH	Gallons per Hour
GPM	Gallons per Minute
GR	Grade
Gran.	Granular
Grnd.	Ground
H	High; High Strength Bar Joist; Henry
H.C.	High Capacity
H.D.	Heavy Duty; High Density
H.D.O.	High Density Overlaid
Hdr.	Header
Hdwe.	Hardware
Help.	Helper Average
HEPA	High Efficiency Particular Air Filter
Hg.	Mercury
HIC	High Interrupting Capacity
H.O.	High Output
Horiz.	Horizontal
H.P.	Horsepower; High Pressure
H.P.F.	High Power Factor
Hr.	Hour
Hrs./Day	Hours per Day
HSC	High Short Circuit
Ht.	Height
Htg.	Heating
Htrs.	Heaters
HVAC	Heating, Ventilating & Air Conditioning
Hvy.	Heavy
HW	Hot Water
Hyd.;Hydr.	Hydraulic
Hz.	Hertz (cycles)
I.	Moment of Inertia
I.C.	Interrupting Capacity
ID	Inside Diameter
I.D.	Inside Dimension; Identification
I.F.	Inside Frosted
I.M.C.	Intermediate Metal Conduit
In.	Inch
Incan.	Incandescent
Incl.	Included; Including
Int.	Interior
Inst.	Installation

Insul.	Insulation
I.P.	Iron Pipe
I.P.S.	Iron Pipe Size
I.P.T.	Iron Pipe Threaded
I.W.	Indirect Waste
J	Joule
J.I.C.	Joint Industrial Council
K	Thousand; Thousand Pounds; Heavy Wall Copper Tubing
K.A.H.	Thousand Amp. Hours
KCMIL	Thousand Circular Mils
KD	Knock Down
K.D.A.T.	Kiln Dried After Treatment
Kg	Kilogram
kG	Kilogauss
kgf	Kilogram force
kHz	Kilohertz
Kip	1000 Pounds
KJ	Kiljoule
K.L.	Effective Length Factor
Km	Kilometer
K.L.F.	Kips per Linear Foot
K.S.F.	Kips per Square Feet
K.S.I.	Kips per Square Inch
K.V.	Kilovolt
K.V.A	Kilovolt Ampere
K.V.A.R.	Kilovolt (Reactance)
KW	Kilowatt
KWh	Kilowatt-hour
L	Labor only; Length; Long; Medium Wall Copper Tubing
La.	Labor
lat	Latitude
Lath.	Lather
Lav.	Lavatory
lb,;#	Pound
L.B.	Load Bearing; L Conduit Body
L. & E.	Labor & Equipment
lb./hr.	Pounds per Hour
lb./L.F.	Pounds Per Linear Foot
L.C.L.	Less than Carload Lot
Ld.	Load
LE	Lead Equivalent
L.F.	Linear Foot
Lg.	Long; Length; Large
L. & H.	Light and Heat
L.H.	Long Span high Strength Bar Joist

L.J.	Long Span Standard Strength Bar Joist
L.L.	Live Load
L.L.D.	Lamp Lumen Depreciation
lm	Lumen
lm/sf	Lumen per Square Feet
lm/W	Lumen per Wall
L.O.A.	Length Over All
log	Logarithm
L.P.	Liquified Petroleum; Low Pressure
L.P.F.	Low Power Factor
L.R.	Long Radius
L.S.	Lump Sum
Lt.	Light
Lt.Ga	Light Gauge
L.T.L.	Less than Truckload Lot
Lt. Wt.	Lightweight
L.V.	Low Voltage
M	Thousand; Material; Male; Light Wall Copper Tubing
m/hr; M.H.	Man Hour
mA	Milliamperere
Mach	Machine
Mag. Str.	Magnetic Starter
Maint.	Maintenance
Marb.	Marble Setter
Mat. Mat'l	Material
Max	Maximum
MBF	Thousand Board Feet
MBH	Thousand BTU's per hr.
MC	Metal Clad Cable
M.C.F.	Thousand Cubic Feet
M.C.F.M.	Thousand Cubic Feet per Minute
M.C.M.	Thousand Circular Mils
M.C.P.	Motor Circuit Protector
MD	Medium Duty
M.D.O.	Medium Density Overlaid
Med.	Medium
MF	Thousand Feet
M.F.B.M.	Thousand Feet Board Measure
Mfg.	Manufacturing
Mfrs.	Manufacturers
mg	Milligram
MGD	Million Gallons per Day
MGPH	Thousand Gallons per Hour
MH:M.H.	Manhole; Metal Halide; Man-Hour
MHz	Megahertz
Mi.	Mile

MI	Malleable Iron; Mineral Insulated
mm	Millimeter
Mill.	Millwright
Min.;min.	Minimum; minute
Misc.	Miscellaneous
mi	Millimeter
M.L.F.	Thousand Linear Feet
Mo.	Month
Mobil.	Mobilization
Mog.	Mogul Base
MPH	Miles Per Hour
MPT	Male Pipe Thread
MRT	Mile Round Trip
ms	Millisecond
M.S.F.	Thousand Square Feet
Mstz.	Mosaic & Terrazzo Worker
M.S.Y.	Thousand Square Yards
Mtd.	Mounted
Mthe.	Mosaic & Terrazzo Helper
Mult.	Multi; Multiply
M.V.A.	Million Volt Amperes
M.V.A.R.	Million Volt Amperes Reactance
MV	Megavolt
MW	Megawatt
MXM	Male by Male
MYD	Thousand Yards
N	Natural; North
nA	Nanoampere
NA	Not Available; Not applicable
N.B.C.	National Building Code
NC	Normally Closed
N.F.M.A.	National Electrical Manufacturers Association
NEHB	Bolted Circuit Breaker to 600V
N.L.B.	Non-Load-Bearing
NM	Non-Metallic Cable
nm	Nanometer
No.	Number
N.O.C.	Not Otherwise Classified
Nose.	Nosing
N.P.T.	National Pipe Thread
NQOB	Bolted Circuit Breaker to 240V
N.R.C.	Noise Reduction Coefficient
N.R.S.	Non Rising Stem
ns	Nanosecond
nW	Nanowatt
OB	Opposing Blade

OC	On Center
OD	Outside Diameter
O.D.	Outside Dimension
ODS	Overhead Distribution System
O & P	Overhead and Profits
Oper.	Operator
Opng.	Opening
Orna.	Ornamental
O.S. & Y.	Outside Screw and Yoke
Ovhd.	Overhead
OWG	Oil, Water or Gas
Oz.	Ounce
P.	Pole; Applied Load; Projection
p.	Page
Pape.	Paperhanger
P.A.P.R.	Powered Air Purifying Respirator
PAR	Weatherproof Reflector
Pc.	Piece
P.C.	Portland Cement; Power Connector
P.C.M.	Phase Contract Microscopy
P.C.F.	Pounds Per Cubic Feet
P.E.	Professional Engineer; Porcelain Enamel; Polyethylene; Plain End
Perf.	Perforated
Ph.	Phase
P.I.	Pressure Injected
Pile.	Pile Driver
pkg.	Package
Pl.	Plate
Plah.	Plaster Helper
Plas.	Plasterer
Pluh.	Plumbers Helper
Plum.	Plumber
Ply.	Plywood
p.m.	Post Meridiem
Pord.	Painter Ordinary
pp	Pages
PP;PPL	Polypropylene
P.P.M.	Parts per Million
Pr.	Pair
Prefab.	Prefabricated
Prefin.	Prefinished
Prop.	Propelled
PSF;psf	Pounds per Square Foot
PSI;psi	Pounds per Square Inch
PSIG	Pounds per Square Inch Gauge
PSP	Plastic Sever Pipe



Pspr.	Painter, Spray	
Psst.	Painter, Structural Steel	
P.T.	Potential Transformer	
P. & T.	Pressure & Temperature	
Ptd.	Painted	
Ptns.	Partitions	
Pu	Ultimate Load	
PVC	Polyvinyl Chloride	
Pvmt.	Pavement	
Pwr.	Power	
Q	Quantity Heat Flow	
Quan.; Qty	Quantity	
Q.C.	Quick Coupling	
r	Radius of Gyration	
R	Resistance	
R.C.P.	Reinforced Concrete Pipe	
Rect.	Rectangle	
Reinf.	Reinforced	
Req'd	Required	
Res.	Resistant	
Resi	Residential	
Rgh.	Rough	
R.H.W.	Rubber, Heat & Water Resistant;	Residential Hot Water
rms	Root Mean Square	
Rnd.	Round	
Rodm.	Rodman	
Rofc.	Roofer, Composition	
Rofp.	Roofer, Precast	
Rohe.	Roofer Helpers (Composition)	
Rots.	Roofer, Tile & Sale	
R.O.W.	Right of Way	
RPM	Revolutions per Minute	
R.R.	Direct Burial Feeder Conduit	
R.S.	Rapid Start	
R.T.	Round Trip	
S.	Suction; Single Entrance; South	
Scaf.	Scaffold	
Sch.;Sched.	Schedule	
S.C.R.	Modular Brick	
S.D.	Sound Deadening	
S.D.R.	Standard Dimension Ratio	
S.E.	Surfaced Edge	
Sel.	Select	
S.E.R.;S.E.U.	Service Entrance Cable	
SF.	Square Foot	
S.F.C.A.	Square Foot Contact Area	

S.F.F.C.M.U.	Split Face Fluted Concrete Masonry Unit.
S.F.G.	Square Foot of Ground
S.F. Hor.	Square Foot Horizontal
S.R.F.	Square Foot of Radiation
S.F.Shlf.	Square Foot of Shelf
S4S	Surface 4 Sides
Shee.	Sheet Metal Worker
Sin.	Sine
Skwk.	Skilled Worker
S.L.	Saran Lined
S.L.	Slimline
Sldr.	Solder
S.N.	Solid Neutral
S.P.	Static Pressure; Single Pole; Self Propelled
Spri.	Sprinkler Installer
Sq.	Square; 100 Square Feet
S.P.D.T.	Single Pole, Double Throw
S.P.S.T.	Single Pole, Single Throw
SPT	Standard Pipe Thread
Sq.Hd.	Square Head
Sq.In.	Square Inch
S.S.	Single Strength; Stainless Steel
S.S.B.	Single Strength B Grade
Sswk.	Structural Steel Worker
Sswl.	Structural Steel Welder
St.;Stl.	Steel
S.T.C.	Sound Transmission Coefficient
Std.	Standard
STP	Standard Temperature & Pressure
Stpi.	Steamfitter, Pipefitter
Str.	Strength; Starter; Straight
Strd.	Stranded
Struct.	Structural
Sty.	Story
Subj.	Subject
Subs.	Subcontractors
Surf.	Surface
Sw.	Switch
Swbd.	Switchboard
S.Y.	Square Yard
Syn.	Synthetic
Sys.	System
t.	Thickness
T	Temperature; Ton
Tan	Tangent
T.C.	Terra Cotta
T & C	Threaded and Coupled

T.D.	Temperature Difference
T.E.M.	Transmission Electron Microscopy
TFE	Tetrafluoroethylene (teflon)
T.& G.	Tongue & Groove; Tar & Gravel
Th.;Thk.	Thick
Thn.	Thin
Thrded.	Threaded
Tilf.	Tile Layer Floor
Tilh.	Tile Layer Helper
THW	Insulated Strand Wire
THWN;THHN	Nylon Jacketed Wire
T.L.	Truckload
Tot.	Total
T.S.	Trigger Start
Tr.	Trade
Transf.	Transformer
Trhv.	Truck Driver, Heavy
Trir.	Trailer
Trit.	Truck Driver, Light
TV	Television
T.W.	Thermoplastic Water Resistant Wire
UCI	Uniform Construction Index
UF	Underground Feeder
U.H.F.	Ultra High Frequency
U.L.	Underwriters Laboratory
Unfin.	Unfinished
URD	Underground Residential Distribution
V	Volt
V.A.	Volt Amperes
V.C.T.	Vinyl Composition Tile
VAV	Variable Air Volume
VC	Veneer Core
Vent.	Ventilating
Vert.	Vertical
V.F.	Vinyl Faced
V.G.	Vertical Grain
V.H.F.	Very High Frequency
VHO	Very High Output
Vib.	Vibrating
V.L.F.	Vertical Linear Foot
Vol.	Volume
W	Wire; Watt; Wide; West
w/	With
W.C.	Water Column; Water Closet
W.F.	Wide Flange
W.G.	Water Gauge
Wldg.	Welding

W. Mile	Wire Mile
W.R.	Water Resistant
Wrck.	Wrecker
W.S.P.	Water Steam, Petroleum
WT, Wt.	Weight
WWF	Welded Wire Fabric
XRMR	Transformer
XHD	Extra Heavy Duty
XHHW;XLPE	Cross Linked Polyethylene Wire Insulation
Y	Wye
yd	Yard
yr	Year
$\Delta$	Delta
%	Percent
$\Phi$	Phase
@	At
<	Less Than
>	Greater Than

PART 2- PRODUCTS:

Not used.

PART 3- EXECUTION:

Not used.

END SECTION 01070

## **SECTION 01095-REFERENCE STANDARDS AND DEFINITIONS**

### **PART 1 GENERAL**

#### **1.01 RELATED DOCUMENTS**

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

#### **1.02 DEFINITIONS**

- A. General: Basic Contract definitions are included in the Conditions of the Contract.
- B. Indicated: The term Indicated refers to graphic representations, notes or schedules on the Drawings, or other Paragraphs or Schedules in the Specifications, and similar requirements in the Contract Documents. Where terms such as shown, noted, scheduled and specified are used, it is to help the reader locate the reference; no limitation on location is intended.
- C. Directed: Terms such as directed, requested, authorized, selected, approved, required, and permitted mean directed by the Project Manager, requested by the Architect/Project Manager and similar phrases.
- D. Accepted: This term; Accepted, where used in conjunction with the Architects action on the Contractors submittals, applications, and requests, is limited to the Architects duties and responsibilities as stated in the Conditions of the Contract.
- E. Regulations: The term Regulations includes laws, ordinances, statutes, and lawful orders issued by authorities having jurisdiction, as well as rules, conventions, and agreements within the construction industry that control performance of the Work.
- F. Furnish: The term furnish is used to mean supply and deliver to the Project site, ready for unloading, unpacking, assembly, installation, and similar operations.
- G. Install: The term install is used to describe operations at project site including the actual unloading, unpacking, assembly, erection, placing, anchoring, applying, working to dimension, finishing, curing, protecting, cleaning, and similar operations.

- H. Provide: The term provide means to furnish and install, complete and ready for the intended use.
- I. Installer: An Installer is the Contractor or an entity engaged by the Contractor, either as an employee, subcontractor, or contractor of lower tier for performance of a particular construction activity, including installation, erection, application, and similar operations. Installers are required to be experienced in the operations they are engaged to perform.
  - 1. The term experienced, when used with the term Installer, means having a minimum of five previous projects similar in size and scope to this Project, being familiar with the special requirements indicated, and having complied with requirements of the authority having jurisdiction.
  - 2. Trades: Use of titles such as carpentry is not intended to imply that certain construction activities must be performed by accredited or unionized individuals of a corresponding generic name, such as carpenter. It also does not imply that requirements specified apply exclusively to trades persons of the corresponding generic name.
- J. Project Site is the space available to the Contractor for performance of construction activities, either exclusively or in conjunction with others performing other work as part of the Project. The extent of the Project Site is shown on the Drawings and may or may not be identical with the description of the land on which the Project is to be built.
- K. Testing Laboratories: testing laboratory is an independent entity engaged to perform specific inspections or tests, either at the Project site or elsewhere, and to report on and, if required, to interpret results of those inspections or tests.

### 1.03 SPECIFICATION FORMAT AND CONTENT EXPLANATION

- A. Specification Format: These Specifications are organized into Divisions and Sections based on the Construction Specifications Institutes 16 Division format and MASTER FORMAT numbering system.
- B. Specification Content: This Specification uses certain conventions in the use of language and the intended meaning of certain terms, words, and phrases when used in particular situations or circumstances. These conventions are explained as follows:
  - 1. Abbreviated Language: Language used in Specifications and other Contract Documents is the abbreviated type. Words and meaning shall be interpreted as appropriate. Words that are

implied, but not stated shall be interpolated as the sense required. Singular words will be interpreted as plural and plural words interpreted as singular where applicable and the context of the Contract Documents so indicates.

2. Imperative and streamlined language is used generally in the Specifications. Requirements expressed in the imperative mood are to be performed by the Contractor. At certain locations in the text, for clarity, subjective language is used to describe responsibilities that must be fulfilled indirectly by the Contractor, or by others when so noted.
  - a. The words, shall be shall be included by inference wherever a colon (:) is used within a sentence or phrase.

PART 2 PRODUCTS (Not Applicable)

PART 3 EXECUTION (Not Applicable)

END OF SECTION 01095

## **SECTION 01200-PROJECT MEETINGS**

### **1.01 RELATED DOCUMENTS**

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

### **1.02 SUMMARY**

- A. This Section specifies administrative and procedural requirements for project meetings including but not limited to:
  - 1. Pre-Construction Conference
  - 2. Pre-Installation Conference
  - 3. Coordination Meetings
  - 4. Progress Meetings
- B. Construction schedules are specified in Section 01300 Submittals.

### **1.03 PRE-CONSTRUCTION CONFERENCE**

- A. Schedule a pre-construction conference and organizational meeting at the project site or other convenient location no later than 20 days after execution of the agreement and prior to commencement of construction activities. Conduct the meeting to review responsibilities and personnel assignments.
- B. Attends: The OWNERS, Representative, the Contractor and its superintendent, major subcontractors, manufacturers, suppliers and other concerned parties shall each be represented at the conference by persons familiar with and authorized to conclude matters relating to the work.
- C. Agenda: Discuss items of significance that could affect progress including such topics as:
  - 1. Tentative construction schedule
  - 2. Critical Work sequencing and/coordinating
  - 3. Designation of responsible personnel
  - 4. Procedures for processing field decisions and Change Orders
  - 5. Procedures for processing Applications for Payment
  - 6. Distribution of Contract Documents
  - 7. Submittal of Shop Drawings, Product Data and Samples
  - 8. Preparation of record documents
  - 9. Use of the Premises
  - 10. Office, Work and storage areas



11. Equipment deliveries and priorities
12. Safety procedures
13. First aid
14. Security
15. Housekeeping
16. Working hours

D. Contractor must submit at the time of the meeting at least the following items:

1. Schedule of Values
2. Listing of key personnel including project superintendent and subcontractors with their addresses, telephone numbers, and emergency telephone numbers.
3. Preliminary Construction Schedule
4. Submittal Schedule

#### 1.04 PRE-INSTALLATION CONFERENCE

A. Conduct a Pre-installation conference at the site before each construction activity that requires coordination with other construction. The Installer and representatives of manufacturers and fabricators involved in or affected by the installation, and its coordination or integration with other materials and installations that have preceded or will follow, shall attend the meeting. Advise at least 48 hours in advance the Project Manager of scheduled meeting dates.

1. Review the progress of other construction activities and preparations for the particular activity under consideration at each pre-installation conference, including requirements for:
  - a. Contract Documents
  - b. Options
  - c. Related Change Orders
  - d. Purchases
  - e. Deliveries
  - f. Shop Drawings, Product Data and Quality Control Samples
  - g. Possible conflicts
  - h. Compatibility problems
  - I. Time schedules
  - j. Weather limitations
  - k. Manufacturer's recommendations
  - l. Comparability of materials
  - m. Acceptability of substrates
  - n. Temporary facilities
  - o. Space and access limitations
  - p. Governing regulations
  - q. Safety

- r. Inspection and testing requirements
  - s. Required performance results
  - t. Recording requirements
  - u. Protection
- 2. Record significant discussions and agreements and disagreements of each conference along with and approved schedule. Distribute the record of the meeting to everyone concerned promptly including the Owner and Architect.
  - 3. Do not proceed if the conference cannot be successfully concluded. Initiate whatever actions are necessary to resolve impediments to performance of Work and reconvene the conference at the earliest feasible date.

#### 1.05 COORDINATION MEETINGS

- A. Conduct project coordination meeting at weekly intervals on day and time as established by the Project Manager or more frequently, if necessary convenient for all parties involved. Project coordination meetings are in addition to specific meetings held for other purposes, such as regular progress meetings and special pre-installation meetings.
- B. Request representation at each meeting by every party currently involved in coordination or planning for the construction activities involved, to include subcontractors and representatives.
- C. Contractor shall record meeting results and distribute copies to everyone in attendance and to others affected by decisions or actions resulting from each meeting.

#### 1.06 PROGRESS MEETINGS

- A. Conduct progress meetings at the Project site at bimonthly intervals or more frequently if necessary as directed by the Project Manager. Notify the Owner at least 48 hours in advance of scheduled meeting time and dates. Coordinate dates of meetings with preparation of the payment request. Contractor shall be responsible for the taking of notes and issuance of meeting minutes, and sign-in sheets.
- B. Attendees: In addition to representatives of the Owner and Architect, each subcontractor, supplier or other entity concerned with current progress of involved in planning, coordination or performance of future activities with the project and authorized to conclude matters relating to progress.
- C. Agenda: Review and correct or approve minutes of the previous progress meeting. Review other items of significance that could affect progress. Include topics for discussion as appropriate to the current status of the Project.

1. Contractor's Construction Schedule: Review progress since the last meeting. Determine where each activity is in relation to the Contractor's Construction Schedule, whether on time, ahead, or behind schedule. Determine how construction behind schedule will be expedited; secure commitments from parties involved to do so. Discuss whether schedule revisions are required to ensure that current and subsequent activities will be completed within the Contract Time.
  2. Review the present and future needs of each entity present, including such items as:
    - a. Interface requirements
    - b. Time
    - c. Sequences
    - d. Deliveries
    - e. Off-site fabrication problems
    - f. Access
    - g. Site utilization
    - h. Temporary facilities and services
    - i. Hours of work
    - j. Hazards and risks
    - k. Housekeeping
    - l. Quality and work standards
    - m. Change Orders
    - n. Documentation of information for payment requests.
- D. Reporting: No later than 3 days after each progress meeting date, distribute copies of minutes of the meeting to each party present and to other parties who should have been present. Include a brief summary, in narrative form, of progress since the previous meeting and report.

PART 2 PRODUCTS

(Not Applicable)

PART 3 EXECUTION

(Not Applicable)

END OF SECTION 01200

## **SECTION 01300-SUBMITTALS**

### **PART 1 GENERAL**

#### **1.01 RELATED DOCUMENTS**

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

#### **1.02 SUMMARY**

- A. This Section specifies administrative and procedural requirements for submittals required for performance of the Work, including:
  - 1. Contractor's Construction Schedule
  - 2. Submittal Schedule
  - 3. Daily Construction Reports
  - 4. Shop Drawings
  - 5. Product Data
  - 6. Samples
- B. Administrative Submittals: Refer to other Division-1 Sections and other Contract Documents for requirements for administrative submittals. Such submittals include, but are not limited to:
  - 1. Permits
  - 2. Applications for Payment
  - 3. Performance and Payment Bonds
  - 4. Insurance Certificates
  - 5. List of Subcontractors with start and finish dates (update as necessary)
  - 6. Schedule of Values
  - 7. Construction Schedule
- C. The Schedule of Values submittal is included in Section 01027 Applications for Payment.
- D. Inspection and test reports are included in Section 01400 Quality Control Services.

#### **1.03 SUBMITTAL PROCEDURES**

- A. Coordination: Coordinate preparation and processing of submittals with performance of construction activities. Transmit each submittal sufficiently in

advance of performance of related construction activities to avoid delay.

1. Coordinate each submittal with fabrication, purchasing, testing, delivery, other submittals and related activities that require sequential activity.
  2. Coordinate transmittal of different types of submittals for related elements of the Work so processing will not be delayed by the need to review submittals concurrently for coordination.
    - a. The Project Manager reserves the right to withhold action on a submittal requiring coordination with other submittals until related submittals are received.
  3. Processing: Allow sufficient review time so that installation will not be delayed as a result of the time required to process submittals, including time for resubmittals.
    - a. Allow two weeks for initial review. Allow additional time if processing must be delayed to permit coordination with subsequent submittals. The Project Manager will promptly advise the Contractor when a submittal being processed must be delayed for coordination.
    - b. If an intermediate submittal is necessary, process the same as the initial submittal.
    - c. Allow two weeks for reprocessing each submittal.
    - d. No extension of Contract Time will be authorized because of failure to transmit submittals to the Architect sufficiently in advance of the Work to permit processing.
- B. Submittal Preparation: Place a permanent label or title block on each submittal for identification. Indicate the name of the entity that prepared each submittal on the label or title block.
1. Provide a space approximately 4" x 5" on the label or beside the title block on Shop Drawings to record the Contractor's review and approval markings and the action taken.
  2. Include the following information on the label for processing and recording action taken.
    - a. Project name
    - b. Date
    - c. Name and address of Architect
    - d. Name and address of Contractor
    - e. Name and address of subcontractor
    - f. Name and address of supplier
    - g. Name of manufacturer

- h. Number and title of appropriate Specification Section
    - I. Drawing number and detail references, as appropriate.
- C. Submittal Transmittal: Package each submittal appropriately for transmittal and handling. Transmit each submittal from Contractor to Project Manager using transmittal form as provided by the Project Manager. Submittals received from sources other than the Contractor will be returned without action.
  - 1. On the transmittal record relevant information and requests for data. On the form, or separate sheet, record deviations from Contract Document requirements, including minor variations and limitation. Include Contractor's certification that information complies with Contract Document requirements.
  - 2. Transmittal Form: As provide by the Project Manager
- D. Contractor shall be responsible for cost of re-review of rejected submittals, shop drawing, etc. Costs for re-review shall be reimbursed to the County by deducting the cost from the Contractors monthly progress payments. Costs to be determined by applying the consultants standard billing rates, plus 10% handling by the County.
- E. Substitution request to specified products will be made within 30 days of Notice to Proceed. After the 30 day period, no requests for substitutions from the Contractor will be considered. Refer to 01631 Product Substitutions.
  - 1. Substitution submitted within the first 30 days will have product data from specified and requested substitute submitted together and demonstrate better quality, cost savings if of equal quality, or show benefit to the County for accepting the substitute.
- F. Once submittals are approved or approved as noted, they will be scanned and converted to PDF documents with OCR (optical character recognition) and given to the owner.

#### 1.04 CONTRACTOR'S CONSTRUCTION SCHEDULE

- A. Critical Path Method (CPM) Schedule: Prepare a fully developed, horizontal bar-chart type Contractor's construction schedule. Submit in accordance with Section 01200 Project Meetings.
  - 1. Provide a separate time bar for each significant construction activity. Provide a continuous vertical line to identify the first working day of each week. Use the same breakdown of units of the work as indicated in the Schedule of Values.

2. Within each time bar, indicate estimated completion percentage in 10 percent increments. As work progresses, place a contrasting mark in each bar to indicate Actual Completion.
  3. Prepare the schedule on a sheet, series of sheets, stable transparency, or other reproducible media, of sufficient width to show data for the entire construction period.
  4. Secure time commitments for performing critical elements of the work from parties involved. Coordinate each element on the schedule with other construction activities; include minor elements involved in the sequence of the work. Show each activity in proper sequence. Indicate graphically sequences necessary for completion of related portions of the work.
  5. Coordinate the Contractor's construction schedule with the schedule of values, list of subcontracts, submittal schedule, progress reports, payment request and other schedules.
  6. Indicate completion in advance of the date established for Substantial Completion. Indicate Substantial Completion on the schedule to allow time for the Architect's procedures necessary for certification of Substantial Completion.
- B. Phasing: Provide notations on the schedule to show how the sequence of the work is affected by requirements for phased completion to permit work by separate Contractors and partial occupancy by the Owner prior to Substantial Completion.
- C. Work Stages: Indicate important stages of construction for each major portion of the work, including testing and installation.
- D. Area Separations: Provide a separate time bar to identify each major construction area for each major portion of the work. Indicate where each element in an area must be sequenced or integrated with other activities.
- E. Cost Correlation: At the head of the schedule, provide a two item cost correlation line, indicating precalculated and actual costs. On the line show dollar-volume of work performed as the dates used for preparation of payment requests.
1. Refer to Section Applications for Payment for cost reporting and payment procedures.
- F. Distribution: Following response to the initial submittal, print and distribute copies to the Architect, Owner, subcontractors, and other parties required to

comply with scheduled dates. Post copies in the project meeting room and temporary field office.

1. When revision are made distribute to the same parties and post in the same locations. Delete parties from distribution when they have completed their assigned portion of the Work and are no longer involved in construction activities.

- G. Schedule Updating: Revise the schedule monthly or activity, where revisions have been recognized or made. Issue the updated schedule concurrently monthly pay request.

#### 1.05 SUBMITTAL LOG

- A. After development and acceptance of the Contractor's construction schedule, prepare a complete log of submittals.
1. Coordinate submittals log with the list of subcontracts, schedule of values and the list of products as well as the Contractor's construction schedule.
  2. Prepare the log in chronological order; include all submittals required. Provide the following information:
    - a. Scheduled date for the first submittal
    - b. Related Section number
    - c. Submittal category
    - d. Name of subcontractor
    - e. Description of the part of the work covered
    - f. Scheduled date for resubmittal
    - g. Scheduled date the Architect's final release or approval.
  3. All submittals must be received within the first 25% of contract time.
- B. Distribution: Following response to initial submittal, print and distribute copies to the Project Manager, subcontractors, and other parties required to comply with submittal dates indicated. Post copies in the project meeting room and field office.
1. When revision are made, distribute to the same parties and post in the same locations. Delete parties from distribution when they have completed their assigned portion of the Work and are no longer involved in construction activities.
- C. Log Updating: Revise the log after each meeting or activity, where revisions



have been recognized or made. Issue the updated schedule concurrently with report of each meeting.

#### 1.06 DAILY CONSTRUCTION REPORTS

- A. Prepare a daily construction report, recording the following information concerning events at the site; and submit duplicate copies to the Project Manager at weekly intervals:
1. List of subcontractors at the site
  2. Approximate count of personnel at the site
  3. High and low temperatures, general weather conditions
  4. Accidents and unusual events
  5. Meetings and significant decisions
  6. Stoppages, delays, shortages, losses
  7. Meter readings and similar recordings
  8. Emergency procedures
  9. Orders and requests of governing authorities
  10. Change Orders received, implemented
  11. Services connected, disconnected
  12. Equipment or system tests and start-ups
  13. Partial completions, occupancies
  14. Substantial Completions authorized

#### 1.07 SHOP DRAWINGS

- A. Submit newly prepared information, drawn to accurate scale. Highlight, encircle, or otherwise indicate deviations from the Contract Documents. Do not reproduce Contract Documents or copy standard information as the basis of Shop Drawings. Standard information prepared without specific reference to the Project is not considered a Shop Drawings and will be rejected.
- B. Shop Drawings include fabrication and installation drawings, setting diagrams, schedules, patterns, templates and similar drawings. Include the following information:
1. All required dimensions
  2. Identification of products and materials included
  3. Compliance with specified standards
  4. Notation of coordination requirements
  5. Notation of dimensions established by field measurement
  6. Sheet Size: Except for templates, patterns and similar full-size Drawings on sheets at least 8 ½" x 11" but no larger than 24" x 36".
  7. Initial Submittal: Submit one correctable translucent reproducible print and one blue-or black-line print for the Project Manager's review; the reproducible print will be returned.

8. Initial Submittal: Submit 2 blue-or black-line prints for the Architect's review; one will be returned.
  9. Final Submittal: Submit 5 blue-or black-line prints; submit 7 prints where required for maintenance manuals. 3 prints will be retained; the remainder will be returned.
  10. Final Submittal: Submit 3 blue-or black-line prints; submit 5 prints where required for maintenance manuals. 2 prints will be retained; the remainder will be returned.
    - a. One of the prints returned shall be marked-up and maintained as a Record Documents.
  11. Do not use Shop Drawings without an appropriate final stamp indicating action taken in connections with construction.
- C. Coordination drawings are a special type of Shop Drawing that show the relationship and integration of different construction elements that require careful coordination during fabrication or installation to fit in the space provided or function as intended.
1. Preparation of coordination Drawings is specified in section Project Coordination and may include components previously shown in detail on Shop Drawings or Product Data.
  2. Submit coordination Drawings for integration of different construction elements. Show sequence and relationships of separate components to avoid any conflict including conflicts in use of space.
  3. Contractor is not entitled to additional payments due to lack of compliance with this Section.

#### 1.08 PRODUCT DATA

- A. Collect Product Data into a single submittal for each element of construction or system. Product Data includes printed information such as manufacturer's installation instructions, catalog cuts, standard color charts, roughing-in diagrams and templates, standard wiring diagrams and performance curves. Where Product Data must be specially prepared because standard printed data is not suitable for use, submit as Shop Drawing.
1. Mark each copy to show applicable choices and options. Where printed Product Data includes information on several products, some of which are not required, mark copies to indicate the applicable information. Include the following information:
    - a. Manufacturer's printed recommendations
    - b. Compliance with recognized trade association standards
    - c. Compliance with recognized testing agency standards

- d. Application of testing agency labels and seals
  - e. Notation of dimensions verified by field measurement
  - f. Notation of coordination requirements
  - g. Manufacturers local representative and phone number.
2. Do not submit Product Data until compliance with requirements of the Contract Documents has been confirmed.
  3. Preliminary Submittal: Submit a preliminary single-copy of Product Data where selection of options is required.
  4. Submittals: Submit six (6) copies of each required submittal. The Project Manager will return two (2) sets to the Contractor marked with action taken and corrections or modifications required.
    - a. Unless noncompliance with Contract Document provisions is observed, the submittal may serve as the final submittal.
  5. Distribution: Furnish copies of final submittal to installers, subcontractors, suppliers, manufacturers, fabricators, and others required for performance of construction activities. Show distribution on transmittal forms.
    - a. Do not proceed with installation until an applicable copy of Product Data applicable is in the Installer's possession.
    - b. Do not permit use of unmarked copies of Product Data in connection with construction.

#### 1.09 SAMPLES

- A. Submit full-size, fully fabricated Samples cured and finished as specified and physically identical with the material or product proposed. Samples include partial sections of materials, color range sets, and swatches showing color, texture and pattern.
  1. Mount, display, or package Samples in the manner specified to facilitate review of qualities indicated. Prepare Samples to match the Architect's/Owner's Sample. Include the following:
    - a. Generic description of the Sample
    - b. Sample source
    - c. Product name or name of manufacturer
    - d. Compliance with recognized standards
    - e. Availability and delivery time
  2. Submit Samples for review of kind, color, pattern, and texture, for a final

check of these characteristics with other elements, and for a comparison of these characteristics between the final submittal and the actual component as delivered and installed.

- a. Where variation in color, pattern, texture or other characteristics are inherent in the material or product represented, submit multiple units (not less than 3), that show approximate limits of the variations.
  - b. Refer to other Specification Sections for requirements for Samples that illustrate workmanship, fabrication techniques, details of assembly, connections, operation and similar construction characteristics.
3. Preliminary submittals: Where Samples are for selection of color, pattern, texture or similar characteristics from a range of standard choices, submit a full set of choices for the material or product.
- a. Preliminary submittals will be reviewed and returned with the Architect's/Owner's mark indicating selection and other action.
4. Submittals: Except for Samples illustrating assembly details, workmanship, fabrication techniques, connections, operation and similar characteristics, submit 3 sets; one will be returned marked with the action taken.
5. Maintain sets of Samples, as returned, at the project site, for quality comparisons throughout the course of construction.
- a. Unless noncompliance with Contract Document provisions is observed, the submittal may serve as the final submittal.
  - b. Sample sets may be used to obtain final acceptance of the construction associated with each set.
- B. Distribution of Samples: Prepare and distribute additional sets to subcontractors, manufacturers, fabricators, suppliers, installers, and others as required for performance of the Work. Show distribution on transmittal forms.
1. Field Samples specified in individual sections are special types of Samples. Field Samples are full-size examples erected on site to illustrate finishes, coatings, or finish materials and to establish the standard by which the work will be judged.
    - a. Comply with submittal requirements. Process transmittal forms to provide a record of activity.

1.10 ARCHITECT'S ACTION

- A. Except for submittals for record, information or similar purposes, where action and return is required or requested, the Architect/Project Manager will review each submittal, mark to indicate action taken, and return promptly.
  - 1. Compliance with specified characteristics is the Contractor's responsibility.
  
- B. Action Stamp: The Architect/Project Manager will stamp each submittal with a uniform, self-explanatory action stamp. The stamp will be appropriately marked, similarly as follows, to indicate the action taken:
  - 1. Final Unrestricted Release: Where submittals are marked "No Exceptions Taken", that part of the work covered by the submittal may proceed provided it complies with requirements of the Contract Documents; final acceptance will depend upon that compliance.
  
  - 2. Final-But-Restricted Release: When submittals are marked Made Corrections Noted that part of the Work covered by the submittal may proceed provided it complies with notations or corrections on the submittal and requirements of the Contract Documents; final acceptance will depend on that compliance.
  
  - 3. Returned for Resubmittal: When submittal is marked Revise and Resubmit, do not proceed with that part of the Work covered by the submittal, including purchasing, fabrication, delivery, or other activity. Revise or prepare a new submittal in accordance with the notations; resubmit without delay. Repeat if necessary to obtain a different action mark.
    - a. Do not permit submittals marked "Revise and Resubmit" to be used at the Project site, or elsewhere where work is in progress.
  
  - 4. Rejected: Submittal does not comply with requirements of the Contract Documents. Submittal must be discarded and entirely new submittal shall be forward to the Project Manager without delay.

PART 2 PRODUCTS  
(Not Applicable)

PART 3 Execution  
(Not Applicable)

END SECTION 01300

**SECTION 01380**  
**CONSTRUCTION PHOTOGRAPHS**

PART 1 GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

- A. General: This Section specifies administrative and procedural requirements for construction photographs.

1.03 SUBMITTALS

- A. General: Refer to Division 1 Section Submittals for general requirements for submitting photographs.
- B. Prints: Submit 3 prints of each view directly to the Project Manager within 5 days of taking photographs. The Project Manager will distribute prints as follows:
  - 1. One print to the Contractor shall be retained in the field office at the project site and available at all times for reference.
  - 2. One print to the Owner as the Owner's permanent record.
  - 3. One print shall be retained in the Architect's files.
- C. Extra Prints: When requested by the Architect, the photographer shall submit extra prints of photographs, with distribution directly to designated parties who will pay the costs for the extra prints directly to the photographer.
- D. Negatives: Retain the photographic negatives 3 years after date of Substantial Completion. During this period, the photographer shall fill orders by the Architect for extra prints. Extra prints shall be priced at prevailing local commercial prices.

1.04 QUALITY ASSURANCE

- A. Engage a qualified commercial photographer to take photographs during construction.

- B. Photographer's Qualifications: Photographer shall be a firm or an individual of established reputation who has been regularly engaged as a professional photographer for not less than 3 years.
- C. Associated Services: Cooperate with the photographer's work. Provide reasonable auxiliary services as requested, including access and use of temporary facilities including temporary lighting.

## PART 2 PRODUCTS

### 2.01 PHOTOGRAPHIC COPIES

- A. Provide 8" x 10" smooth surface gloss color prints on single-weight commercial-grade stock, mounted on muslin. Allow a 1" wide margin punched for standard 3-ring binder. Place margin on the left edge for vertical shots and at the top for horizontal shots.
- B. Identification: Label each photograph on the front in the bottom margin with project name and date the photograph was taken. On the back of each print provide an applied label or rubber stamped impression with the following information:
  - 1. Name of the Project
  - 2. Name and address of the photographer
  - 3. Name of the Architect
  - 4. Name of the Contractor
  - 5. Date the photograph was taken
  - 6. Architect's Project No.
- C. Description of vantage point, in terms of location, direction (by compass point), and evaluation of story on construction.

## PART 3 EXECUTION

### 3.01 PHOTOGRAPHIC REQUIREMENTS

- A. Take three (3) color project photographs at monthly intervals, coinciding with the cutoff date associated with each Application for Payment. The photographer shall select the vantage points for each shot each month to best show the status of construction and progress since the last photographs were taken.
- B. Additional Photographs: From time to time the Architect may issue requests for

additional photographs, in addition to periodic photographs specified. Additional photographs will be paid for by Change Order, and are not included in the Contract Sum or an Allowance.

1. The Architect will give the photographer 3 days notice, where feasible.
  2. In emergency situations, the photographer shall take additional photographs within 24 hours of the Architect's request.
- C. Circumstances that could require additional photographs include, but are not limited to:
1. Substantial Completion of a major phase or component of Work.
  2. Owner's request for special publicity photographs.
  3. Special events planned at project site.
- D. Immediate follow-up when on-site events result in construction damage or losses. Photographs to be taken at fabrication locations away from project site; these are not subject to unit prices or unit-cost allowances. Extra record photographs at time of final acceptance.
- E. Construction projects over \$1,000,000 shall include at least one of the photographs listed in 3.01.A be aerial.
- F. Aerial Photos shall be required from the date of the Notice to Proceed to the date of Final Completion.

END OF SECTION 01380



## **SECTION 01410-TESTING LABORATORY SERVICES**

### **PART 1 GENERAL**

#### **1.01 SECTION INCLUDES**

- A. Selection and payment
- B. Contractor submittals
- C. Laboratory responsibilities
- D. Laboratory reports
- E. Limits on testing laboratory authority
- F. Contractor responsibilities
- G. Schedule of inspections and tests

#### **1.02 RELATED SECTIONS**

- A. Information Available to Bidders: Soil Investigation Data.
- B. General Conditions: Inspections, testing, and approvals required by public authorities.
- C. Individual Specification Sections: Inspections and tests required, and standards for testing.

#### **1.03 REFERENCES**

- A. ANSI/ASTM D3740 or as required in Specifications Divisions 2-16 - Practice for Evaluation of Agencies Engages in testing and/or Inspection of Soil and Rock as Used in Engineering Design and Construction.
- B. ANSI/ASTM E329 or as required in Specifications Divisions 2-16 - Recommended Practice for Inspection and Testing Agencies for Concrete, Steel, and Bituminous Materials as Used in Construction.

#### **1.04 SELECTION AND PAYMENT**

- A. Owner will employ and pay for services of an independent testing laboratory to perform specified inspection and testing.
- B. Employment of testing laboratory shall in no way relieve Contractor of obligation

to perform work in accordance with requirements of Contract Documents.

#### 1.05 QUALITY ASSURANCE

- A. Comply with requirements of ANSI/ASTM E329 and ANSI/ASTM D3740
- B. Laboratory: Authorized to operate in state in which Project is located.
- C. Laboratory Staff: Maintain a full time registered Engineer on staff to review services.
- D. Testing Equipment: Calibrated at reasonable intervals with devices of an accuracy traceable to either National Bureau of Standards (NBS) Standards or accepted values of natural physical constants.

#### 1.06 CONTRACTOR SUBMITTALS

NOT USED

#### 1.07 LABORATORY RESPONSIBILITIES

- A. Test samples of mixes.
- B. Provide qualified personnel at site when required. Cooperate with Orange County and Contractor in performance of services.
- C. Perform specified inspection, sampling, and testing of Products in accordance with specified standards.
- D. Ascertain compliance of materials and mixes with requirements of Contract Documents.
- E. Promptly notify Orange County and Contractor of observed irregularities or non-conformance of Work or Products.
- F. Perform additional inspections and test required by Orange County.
- G. Attend preconstruction conferences and progress meetings.

#### 1.08 LABORATORY REPORTS

- A. After each inspection and test, promptly submit four copies of laboratory report to Orange County, and to Contractor.
- B. Include:

1. Date issued
2. Project title and number
3. Name of inspector
4. Data and time of sampling or inspection
5. Identification of product and specifications section
6. Location in the Project
7. Type of inspection or test
8. Date of test
9. Results of tests
10. Conformance with Contract Documents

C. When requested by Orange County, provide interpretation of test results.

#### 1.09 LIMITS ON TESTING LABORATORY AUTHORITY

- A. Laboratory may not release, revoke, alter, or enlarge on requirements of Contract Documents.
- B. Laboratory may not approve or accept any portion of the Work.
- C. Laboratory may not assume any duties of Contractor
- D. Laboratory has no authority to stop the Work.

#### 1.10 CONTRACTOR RESPONSIBILITIES

- A. Cooperate with laboratory personnel, and provide access to the Work.
- B. Provide incidental labor and facilities to provide access to work to be tested, to obtain and handle samples at the site or at source of products to be tested, to facilitate tests and inspections, storage and curing of test samples.
- C. Notify Orange County and laboratory 48 hours prior to expected time for operations requiring inspection and testing services.
- D. Arrange with laboratory and pay for additional samples and tests required by Contractor beyond specified requirements.

#### 1.11 SCHEDULE OF INSPECTIONS AND TESTS

- A. Backfilling: Requirements for sampling and testing backfilled materials.
- B. Testing required:
  1. Modified proctor maximum density determination tests for each soil type.
  2. Field in-place density tests at intervals not to exceed 300 ft. on sub-base and

base material.

3. Thickness test for asphaltic concrete surfacing and concrete parking. Cores shall be taken at a maximum of 250 ft. The minimum thickness allowed shall be 1/4" less than the required average thickness.
4. Extraction stability and gradation of combine aggregate - one test per 200 tons or part with minimum of one per day. Bitumen content, stability and gradation of aggregate to conform to intent of job mix formula.
5. Provide concrete mix designs as required under Specifications Sections 02520 and 03300.
6. Strength test for each 50 cubic yard of concrete placed per day.
7. Visual inspection of all bar joist bearing ends for compliance with specifications.
8. Visual inspection of all metal roof deck structural welds.

END OF SECTION 01410

## **SECTION 01500-TEMPORARY FACILITIES**

### **PART 1 GENERAL**

#### **1.01 RELATED DOCUMENTS**

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

#### **1.02 SUMMARY**

- A. This Section specifies requirements for temporary services and facilities, including utilities, construction and support facilities, security and protection.
- B. Temporary utilities required include but are not limited to:
  - 1. Water service and distribution
  - 2. Temporary electric power and light
  - 3. Telephone service
  - 4. Sanitary facilities
- C. Temporary construction and support facilities required include but are not limited to:
  - 1. Temporary heat and ventilation as required to facilitate construction process and personnel.
  - 2. Field office and storage sheds.
  - 3. Sanitary facilities, including drinking water.
  - 4. Temporary enclosures.
  - 5. Hoists and temporary elevator use.
  - 6. Temporary project identification signs and bulletin boards
  - 7. Waste disposal services.
  - 8. Rodent and pest control
  - 9. Construction aids and miscellaneous services and facilities.
- D. Security and protection facilities required include but are not limited to:
  - 1. Temporary fire protections
  - 2. Barricades, warning signs, lights
  - 3. Sidewalk bridge or enclosure fence for the site.
  - 4. Environmental protection
  - 5. Fencing
  - 6. Barriers

- a. Contractor shall be responsible for providing a temporary 6' high chain link construction fence around the entire perimeter of the construction site. Fence shall be removed upon completion of the job. Limits of construction fence indicate on the site plan drawings.
  - b. Contractor shall be responsible for providing security measures as required to prevent public entry to construction areas and adjacent properties from damage from construction operations.
  - c. Contractor shall be responsible for providing a protective barrier around trees and plants designated to remain as indicated in plans. Project against vehicular traffic, stored materials, dumping, chemically injurious materials and puddling or continuous running water.
7. Enclosures
- a. Provide temporary weather-tight closures of openings in exterior surfaces to provide acceptable working conditions and protection for materials, in allow for temporary heating, and to prevent entry of unauthorized persons. Provide temporary doors with self-closing hardware and locks.
8. Protection of Installed Work
- a. Provide temporary protection for installed products. Control work and traffic in immediate area to avoid damage.
  - b. Provide protective coverings at walls, projections, jambs, sills and soffits of openings. Provide barriers or coverings to protect roof and finished floors and stairs from work and traffic, movement of heavy objects and storage.
  - c. Prohibit work, traffic and storage on waterproofed and roofed surfaces, and on lawn and landscaped areas that is not a part of the work for those surfaces and areas.
9. Security and Maintenance
- a. Vehicular and pedestrian gates, when indicated or required, shall be securely locked at all times when no work is in progress and when not required for construction activities. During all work hours, gates which must be open shall be continuously monitored by the contractor to prevent unauthorized personnel or vehicles from entering the construction site.
  - b. Fencing shall be as specified in 1.02 D above and shall prevent pedestrian travel through the site for any reason.
  - c. Temporary fencing shall be removed only for construction reasons. If temporary fencing removal is required for non-construction reasons, fencing shall be immediately replaced and secured as soon as the activity for which its removal

was required is completed, or if the activity cannot be completely by the end of the work day, temporary security measures shall be taken by the Contractor to ensure that there is no breach of security even during off-work periods.

- d. 'No Trespassing' and similar signs shall be posted at gates and along fencing adjacent to public areas to inform non-construction personnel of the reason for the fence and potential hazards of entering the construction site. Said signs shall be of a size and spacing to be legible from any point along the entire perimeter of the construction site.

### 1.03 SUBMITTALS

- A. Temporary Utilities: Submit reports of tests, inspections, meter readings and similar procedures performed on temporary utilities.

### 1.04 QUALITY ASSURANCE

- A. Regulations: Comply with industry standards and applicable laws and regulations if authorities having jurisdiction, including but to limited to:
  1. Building Code requirements
  2. Health and safety regulations
  3. Utility company regulations
  4. Police, Fire Department and Rescue Squad rules
  5. Environmental Protection regulations
- B. Standards: Comply with NFPA Code 241, 'Building Construction and Demolition Operations', ANSI-A10 Series standards for 'Safety Requirements for Construction and Demolition', and NECA Electrical Design Library 'Temporary Electrical Facilities'.
  1. Refer to 'Guidelines for Bid Conditions for Temporary Job Utilities and Services', prepared jointly by AGC and ASC, for industry recommendations.
  2. Electrical Services: Comply with NEMA, NECA and UL standards and regulations for temporary electric service. Install service in compliance with National Electric Code (NFPA 70).
- C. Inspections: Arrange for authorities having jurisdiction to inspect and test each temporary utility before use. Obtain required certifications and permits.

### 1.05 PROJECT CONDITIONS

- A. Temporary Utilities: Prepare a schedule indicating dates for implementation and termination of each temporary utility. At the earliest feasible time, when acceptable to the Owner, change over from use of temporary service to use for the permanent service.
- B. Conditions of Use: Keep temporary services and facilities clean and neat in appearance. Operate in a safe and efficient manner. Take necessary fire prevention measures. Do not overload facilities, nor permit them to interfere with progress. Do not allow hazardous dangerous, unsanitary conditions, nor public nuisances to develop or persist on the site.
- C. Water Control: Grade site to drain. Maintain excavations free of water. Provide and operate pumping equipment if necessary. Provide silt barriers required by the Florida Department of Transportation St. Johns and any other authority having jurisdiction over the Project.
- D. Cleaning During Construction: Control accumulation of waste materials and rubbish so as to maintain a neat, clean and orderly and safe project; periodically dispose of off-site as needed.

Clean interior areas prior to start of finish work, maintain areas free of dust and other contaminants during finishing operations.

- E. Project Identification: Provide a sign as outlined in SECTION 01580 PROJECT SIGN. Locate to provide an unobstructed view from adjoining roadway. Remove project sign upon final completion acceptance.
- F. Field Office and Sheds: Office: Weather-tight with lighting, electrical outlets, heating, cooling, and ventilating equipment, and equipped with furniture.

Storage Sheds for Tools, Materials, and Equipment: Weather-tight with adequate space for organized storage and access, and lighting for inspection of stored materials.

Contractor provide 10 x 8 minimum size office with plan table, telephone, heat, a/c for projects exceeding 10,000 sq. ft. building area.

- G. Protection of Adjacent Properties: Locate on site construction operations that will generate noise and/or dust as far as practical from occupied structures on adjacent properties so as to minimize disturbances to the occupants of these structures or properties.

Prevent dust or other contaminants caused by construction operations for this Project from being carried to adjacent properties by installation of



protective barriers and/or suspension of construction operations during high winds.

Dispose of all construction debris which may be carried to adjacent properties by winds. Remove debris daily and/or more often as required to prevent contamination of adjacent properties.

- H. Removal: Remove temporary materials, equipment and construction facilities prior to Substantial Completion inspection.

Remove temporary utility services prior to Final Completion Inspection.

Clean and repair damage caused by installation or use of temporary facilities. Remove underground installations; grade and complete all work on site as indicated.

- I. Conversion to Public Utilities: General Contractor is to coordinate and arrange with the appropriate utility service providing agencies and make arrangements for the installation and connection to final utilities prior to Final Completion inspection.

General Contractor shall provide any and all coordination, scheduling and layouts as may be required by the service utilities.

## PART 2 PRODUCTS

### 2.01 MATERIALS

- A. General: Provide new materials; of acceptable to the Project Manager, undamaged previously used materials in serviceable condition maybe used. Provide materials suitable for the use intended.
- B. Lumber and Plywood: Comply with requirements in Division 6 Section 'Rough Carpentry'.
1. For job-built temporary offices, shops and sheds within the construction area, provide UL labeled, fire treated lumber and plywood for framing, sheathing and siding.
  2. For signs and directory boards, provide exterior type, Grade B-B High Density Concrete Form Overlay Plywood conforming to PS-1 of sizes and thickness indicated.
  3. For fences and vision barriers, provide exterior type, minimum 3/8" thick plywood.

4. For safety barriers, sidewalk bridges and similar uses, provide minimum 5/8" thick exterior plywood.
- C. Paint: Comply with requirements of Division 9 Section 'Finish Painting'.
1. For job-built temporary offices, shops, sheds, fences and other exposed lumber and plywood, provide exterior grade acrylic-latex emulsion over exterior primer.
  2. For sign panels and applying graphics, provide exterior grade alkyd gloss enamel over exterior primer.
  3. For interior walls of temporary offices, provide two coats interior latex flat wall paint.
- D. Tarpaulins: Provide waterproof, fire-resistant, UL labeled tarpaulins with flame-spread rating of 15 or less. For temporary enclosure provide translucent nylon reinforced laminated polyethylene or polyvinyl chloride fire retardant tarpaulins.
- E. Water: Provide portable water approved by local health authorities.
- F. Open-Mesh Fencing: Provide 11-gage, galvanized 2-inch, chain link fabric fencing 6-feet high with galvanized barbed wire top strand and galvanized steel pipe post, one (1) " I.D. for line posts and two (2) I.D. for corner posts.

## 2.02 EQUIPMENT

- A. General: Provide new equipment: if acceptable to the Project Manager, undamaged, previously used equipment in serviceable condition may be used. Provide equipment suitable for use intended.
- B. Water Hoses: Provide 3/4" heavy-duty, abrasion-resistant, flexible rubber hoses 100 ft. Long, with pressure rating greater than the maximum pressure of the water distribution system. Provide adjustable shut-off nozzles at hose discharge.
- C. Electrical Outlets: Provide properly configured NEMA polarized outlets to prevent insertion of 110-120 volt plugs into higher voltage outlets. Provide receptacle outlets equipped with ground-fault circuit interrupters, reset bottom and pilot light, for connection of power tools and equipment.
- D. Electrical Power Cords: Provide grounded extension cords; use hard-service cords where exposed to abrasion and traffic. Provide water proof

connectors to connect separate lengths of electric cords, if single lengths will not reach areas where construction activities are in progress.

- E. Lamps and Light Fixtures: Provide general service incandescent lamps of wattage required for adequate illumination. Provide guard cages or tempered glass enclosures, where exposed to breakage. Provide exterior fixtures where exposed to moisture.
- F. Heating Units: Provide temporary heating units that have been tested and labeled by UL, FM or another recognized trade association related to the type of fuel being consumed.
- G. Temporary Offices: Provide prefabricated or mobile units or similar job-built construction with lockage entrances, operable windows and serviceable finished. Provide heated and air-conditioned units on foundations adequate for normal loading.
- H. Temporary Toilet Units: Provide self-contained single-occupant toilet units of the chemical, aerated recirculation, or combustion type, properly vented and fully enclosed with a glass fiber reinforced polyester shell or similar nonabsorbent material.
- I. First Aid Supplies: Comply with governing OSHA and any other regulations.
- J. Fire Extinguishers: Provide hand-carried, portable UL-rated, class "A" fire extinguishers for temporary offices and similar spaces. In other locations provide hand-carried, portable UL-rated, class 'ABC' dry chemical extinguishers, or a combination of extinguishers of NEPA recommended classes for the exposures.
  - 1. Comply with NFPA 10 and 241 for classification, extinguishing agent and size required by location and class of fire exposure.

## PART 3 EXECUTION

### 3.01 INSTALLATION

- A. Use qualified personnel for installation of temporary facilities. Locate facilities where they will serve the project adequately and result in minimum interference with performance of the work. Relocate and modify facilities as required.
- B. Provide each facility ready for use when needed to avoid delay. Maintain and modify as required. Do not remove until facilities are no longer

needed, or are replaced by authorized use of completed permanent facilities.

### 3.02 TEMPORARY UTILITY INSTALLATION

- A. General: Engage the appropriate local utility company to install temporary service or connect to existing service. Where the company provides only part of the service, provide the remainder with matching, compatible materials and equipment; comply with the company's recommendations.
  - 1. Arrange with the company and existing users for a time when service can be interrupted, where necessary, to make connections for temporary services.
  - 2. Provide adequate capacity at each stage of construction. Prior to temporary utility availability, provide trucked-in services.
  - 3. Obtain easements to bring temporary utilities to the site, where the Owner's easements cannot be used for that purpose.
  - 4. Use Charges: Cost of use charges for temporary facilities are not chargeable to the Owner or Architect, and will not be acceptable as a basis of claims for a Change Order.
- B. Water Service: Install water service and distribution piping of sized and pressures adequate for construction until permanent water service is in use.
- C. Temporary Electric Power Service: Provide weatherproof, grounded electric power service and distribution system of sufficient size, capacity, and power characteristics during construction period. Include meters, transformers, overload protected disconnects, automatic ground-fault interrupters and main distribution switch gear.
- D. Temporary Lighting: Whenever overhead floor or roof deck has been installed, provide temporary lighting with local switching.
  - 1. Install and operate temporary lighting that will fulfill security and protection requirements, without operating the entire system, and will provide adequate illumination for construction operations and traffic conditions.
- E. Temporary Telephones: Provide temporary telephone service for all personnel engaged in construction activities, throughout the construction period. Install telephone on a separate line for each temporary office and

first aid station. Where an office has more than two occupants, install a telephone for each additional occupant or pair of occupants.

1. At each telephone, post a list of important telephone numbers.
- F. Sewers and Drainage: If sewers are available, provide temporary connections to remove effluent that can be discharged lawfully. If sewers are not available or cannot be used, provide drainage ditches, dry wells, stabilization ponds and similar facilities. If neither sewers nor drainage facilities can be lawfully used for discharge or effluent, provide containers to remove and dispose of effluent off the site in a lawful manner.
1. Filter out excessive amounts of soil, construction debris, chemicals, oils and similar contaminants that might clog sewers or pollute waterways before discharge.
- G. Provide earthen embankments and similar barriers in and around excavations and subgrade construction, sufficient to prevent flooding by run-off of storm water from heavy rains.

### 3.03 TEMPORARY CONSTRUCTION AND SUPPORT FACILITIES INSTALLATION

- A. Locate field offices, storage sheds, sanitary facilities and other temporary construction and support facilities for easy access.
1. Maintain temporary construction and support facilities until Substantial Completion. Personnel remaining after Substantial Completion will be permitted to use permanent facilities, under conditions acceptable to the Owner.
- B. Provide incombustible construction for offices, shops and sheds located within the construction area or within 30 feet of building lines. Comply with requirements of NFPA 241.
- C. Temporary Heat: Provide temporary heat required by construction activities, for curing or drying of completed installations or protection of installed construction from adverse effects of low temperatures or high humidity. Select safe equipment that will not have a harmful effect on completed installations or elements being installed. Coordinate ventilation requirements to produce the ambient condition required and minimize consumption of energy.

- D. Heating Facilities: Except where use of the permanent system is authorized, provide electric vented self-contained LP gas or fuel oil heaters with individual thermostatic control.
1. Use of gasoline-burning space heaters, open flame, or salamander type heating units is prohibited.
- E. Storage and Fabrication Sheds: Install storage and fabrication sheds, sized, furnished and equipped to accommodate materials and equipment involved, including temporary utility service. Sheds maybe open shelters or fully enclosed spaces with the building or elsewhere on the site.
- F. Temporary Paving: Construct and maintain temporary roads and paving to support the indicated loading and to withstand exposure to traffic during the construction period. Locate temporary paving the roads, storage areas and parking where the same permanent facilities will be located. Review proposed modifications to permanent paving with the Architect.
1. Paving: Comply with Division 2 Section 'Asphalt Concrete Paving' or construction and maintenance of temporary paving.
  2. Coordinate temporary paving development with subgrade grading, compaction, installation, and stabilization of sub-base, and installation of base and finish courses of permanent pavings.
  3. Install temporary paving to minimize the need to rework the installations and to result in permanent reads and paved areas that are without damage or deterioration when occupied by the Owner.
  4. Delay installation of the final course of permanent asphalt concrete paving until immediately before Substantial Completion. Coordinate with either conditions to avoid unsatisfactory results.
  5. Extend temporary paving in and around the construction area as necessary to accommodate delivery and storage of materials, equipment usage, administration and supervision.
- G. Sanitary facilities include temporary toilets, wash facilities and drinking water fixtures. Comply with regulations and health codes for the type, number, location, operation and maintenance of fixtures and facilities. Install where facilities will best serve the Project's needs.
1. Provide toilet tissue, paper towels, paper cups and similar disposable materials for each facility. Provide covered waste containers for used material.

- H. Toilets: Install self-contained toilet units. Shield toilets to ensure privacy. Use of pit-type privies will not be permitted. Provide one toilet for each 15 workers on site and have serviced weekly as a minimum.
- I. Wash Facilities: Install wash facilities supplied with portable water at convenient locations for personnel involved in handling materials that require wash-up for a healthy and sanitary condition. Dispose of drainage properly. Supply cleaning compounds appropriate for each condition.
  - 1. Provide safety showers, eye-wash fountains and similar facilities for convenience, safety and sanitation of personnel.
- J. Drinking Water Fixtures: Provide drinking water fountains including paper cups supply.
  - 1. Where power is accessible, provide electric water coolers to maintain dispensed water temperature at 45 to 55 degree F (7 to 13 degree C).
- K. Dewatering Facilities and Drains: For temporary drainage and dewatering facilities and operations not directly associated with construction activities included under individual Sections, comply with dewatering requirements of applicable Division 2 Sections. Where feasible, utilize the same facilities. Maintain the site, excavations and construction free of water.
- L. Temporary Enclosures: Provide temporary enclosure for protection of construction in progress and completed, from exposure, foul weather, other construction operations and similar activities.
  - 1. Where heat is needed and the permanent building enclosure is not complete, provide temporary enclosures where there is no other provision for containment of heat. Coordinate enclosure with ventilating and material drying or curing requirements to avoid dangerous conditions and effects.
  - 2. Install tarpaulins securely, with incombustible wood framing and other materials. Close openings of 25 square feet or less with plywood or similar materials.
  - 3. Close openings through floor or roof decks and horizontal surfaces with load-bearing wood-framed construction.

4. Where temporary wood or plywood enclosure exceeds 100 square feet in area, use UL-labeled fire-retardant treated material for framing and main sheathing.
- M. Temporary Lifts and Hoist: Provide facilities for hoisting materials and employees. Truck cranes and similar devices used for hoisting material are considered 'tools and equipment' and not temporary facilities.
- N. Temporary Elevator Use: Refer to Division 14 'Elevator' Sections.
- I. Project Identification and Temporary Signs: Prepare project identification and other signs of the size indicated. Install signs where indicated to inform the public and persons seeking entrance to the Project. Support on posts or framing of preservative treated wood or steel. Do not permit installation of unauthorized signs.
1. Project Identification Signs: Engage an experienced sign painter to apply graphics. Comply with details indicated.
  2. Temporary Signs: Prepare signs to provide directional information to construction personnel and visitors.
- P. Temporary Exterior Lighting: Maintain exterior yard and sign lights so that signs are visible when work is being performed.
- Q. Collection and Disposal of Waste: Collect waste from construction areas and elsewhere daily. Comply with requirements of NFPA 241 for removal of combustible waste material and debris. Enforce requirements strictly. Do not hold materials more than 7 days during normal weather or 3 days when the temperature is expected to raise above 80 degree F (27 degree). Handle hazardous, dangerous, or unsanitary waste materials separately from other waste by containerizing properly. Dispose of materials in a lawful manner.
- R. Rodent and Pest Control: Before foundation work has been completed, retain a local exterminator or pest control company to recommend practices to minimize attraction and harboring of rodents, roaches and other pests. Employ this service to perform extermination and control procedures at regular intervals so the project will be relatively free of pests and their residues at Substantial Completion. Perform control operations in a lawful manner using environmentally safe materials.

### 3.04 SECURITY AND PROTECTIONS FACILITIES INSTALLATION

- A. Except for use of permanent fire protection as soon as available do not change over from use of temporary security and protection facilities to



permanent facilities until Substantial Completion, or longer as requested by the Project Manager.

- B. Temporary Fire Protection: Until fire protection needs are supplied by permanent facilities of the types needed to protect against reasonably predictable and controllable fire losses. Comply with NFPA 10 Standard for Portable Fire Extinguishers, and NFPA 141 Standard for Safeguarding Construction, Alterations and Demolition Operations.
1. Locate fire extinguishers where convenient and effective for their intended purpose, but not less than one extinguisher on each floor at or near each usable stairwell.
  2. Store combustible materials in containers in fire-safe locations.
  3. Maintain unobstructed access in fire extinguishers, fire hydrants, temporary fire protection facilities, stairways and other access routes for fighting fires. Prohibit smoking in hazardous fire exposure areas.
  4. Provide supervision of welding operations, combustion type temporary heating units, and similar sources of fire ignition.
- C. Permanent Fire Protection: At the earliest feasible date in each area of the Project, complete installation of the permanent fire protection facility, including connected services, and place into operation and use. Instruct key personnel on use of facilities.
- D. Barricades, Warning Signs and Lights: Comply with standards and code requirements for erection of structurally adequate barricades. Paint with appropriate colors, graphics and warning signs to inform personnel and the public of the hazard being protected against. Where appropriate and needed, provide lighting including flashing red or amber lights.
- E. Enclosure Fence: When excavation begins, install an enclosure fence with lockable entrance gates. Locate where indicated, or enclose the entire site or the portion determined sufficient to accommodate construction operations. Install in a manner that will prevent people, dogs and other animals from easily entering the site, except by the entrance gates.
1. Provide open-mesh, chain-link fencing with posts set in a compacted mixture of gravel and earth.
- F. Security Enclosure and Lockup: Install substantial temporary enclosure of partially completed areas of construction. Provide locking entrances to

prevent unauthorized entrance, vandalism, theft and similar violations of security.

1. Storage: Where materials and equipment must be stored, and are of value or attractive for theft, provide a secure lockup. Enforce discipline in connection with the installation and release of materials to minimize the opportunity for theft and vandalism.

- G. Environmental Protection: Provide protection, operate temporary facilities and conduct construction in ways and by methods that comply with environmental regulations, and minimize the possible that air, waterways and sub-soil might be contaminated or polluted, or that other undesirable effects might result. Avoid use of tools and equipment which product harmful poise. Restrict use of noise making tools and equipment to hours that will minimize complaints from persons or firms near the site.

### 3.05 OPERATION, TERMINATION AND REMOVAL

- A. Supervision: Enforce strict discipline in use of temporary facilities. Limit availability of temporary facilities to essential and intended uses to minimize waste and abuse.
- B. Maintenance: Maintain facilities in good operating condition until removal. Protect from damage by freezing temperatures and similar elements.
1. Maintain operation of temporary enclosures, heating, cooling, humidity control, ventilation and similar facilities on a 24 hour day basis where required to achieve indicated results and to avoid possibility of damage.
  2. Protection: Prevent water filled piping from freezing. Maintain makers for underground lines. Protect from damage during excavation operations.
- C. Termination and Removal: Unless the Architect requests that it be maintained longer, remove each temporary facility when the need has ended, or when replaced by authorized use of a permanent facility, or no later than substantial completion. Complete or, if necessary, restore permanent construction that may have been delayed because of interference with the temporary facility. Repair damaged work, clean exposed surfaces and replace construction that cannot be satisfactorily repaired.

1. Materials and facilities that constitute temporary facilities are property of the Contractor. The Owner reserves the right to take possession of Project identification signs.
2. Remove temporary paving that is not intended for or acceptable for integration into permanent paving. Where the area is intended for landscape development, remove soil and aggregate fill that does not comply with requirements for fill or subsoil in the area. Remove materials contaminated with road oil, asphalt and other petrochemical compounds, and other substances which might impair growth of plant materials or lawns. Repair or replace street pavings, curbs and sidewalks at the temporary entrances, as required by the governing authority.
3. At Substantial Completion, clean and renovate permanent facilities that have been used during the construction period, including but not limited to:
  - a. Replace air filters and clean inside of ductwork and housings.
  - b. Replace significantly worn parts and parts that have been subject to unusual operating conditions.
  - c. Replace lamps that are burned out or noticeably dimmed by substantial hours of use as noted by the Owner's representative.

END OF SECTION 01500

**SECTION 01580**  
**PROJECT SIGN**

PART 1 GENERAL

1.01 DESCRIPTION

- A. Furnish, install and maintain one project identification sign, 48 inches x 96 inches in size. Contractor shall verify maximum allowable job site sign size specifications prior to fabrication of sign. Contractor shall be required to obtain and pay for any and/or all permits and approvals for the erection of said project identification sign. Unless local authorities have different maximum size requirements that would not allow for such size.
- B. Content required on sign:
  - 1. Title of project/address of project
  - 2. Name of Owner/name of Orange County chairman and commissioner(s). All names shall be those in office on the date the construction contract is awarded.
  - 3. Title and names of:
    - a. Engineer of Record
    - b. General Contractor
- C. No other signs or advertising will be permitted on the project site, without approval of County, except signs for safety purposes.

1.02 CODES

- A. Where required by Local Code, comply with minimum structural and foundation requirements.

1.03 SUBMITTALS

- A. Shop Drawings, showing:
  - 1. Layout, showing sizes and styles of letters
  - 2. Type of paint.

PART 2 PRODUCTS

2.01 SIGN MATERIALS

- A. Southern Pine No. 2 pressure treated, AWPB LP-2. Surfaced four sides.
- B. Plywood: A-C EXT MDO APA PSI, with medium density overlay, 3/4" thick.
- C. Nails: Hot-dip galvanized
- D. Paint: Manufactured by Sherwin-Williams or equal
  - 1. Primer: A-100 Ext. Wood Primer Y24W20
  - 2. Second, and third coats: Industrial Enamel B54(S-W)
- E. Sign Colors: Refer to project sign drawing attached herein.

2.02 LETTERING

- A. All Lettering shall be Times Roman Bold Style

PART 3 EXECUTION

3.01 INSTALLATION

- A. Install members plumb, in true alignment, and in concrete foundations by Local Code.
- B. Securely attach framing members to each other and to foundations.

3.02 PAINT

- A. Paint all exposed surfaces of sign and support construction.

3.03 REMOVAL

- A. Remove sign, framing and foundations no later than date of Final Completion.

3.04 SIGN DETAILS

- A. Construct sign in accordance with the attached drawing.

END OF SECTION 01580

## **SECTION 01600-MATERIALS AND EQUIPMENT**

### **PART 1 GENERAL**

#### **1.01 RELATED DOCUMENTS**

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

#### **1.02 SUMMARY**

- A. This Section specifies administrative and procedural requirements governing the Contractors selection of products for use in the Project.
  - 1. Multiple Prime Contracts: Provisions of this Section apply to the construction activities of each prime Contractor.
- B. The Contractors Construction Schedule and the Schedule of Submittals are included under Section 01300 Submittals.
- C. Standards: Refer to Section Definitions and Standards for applicability of industry standards to products specified.
- D. Administrative procedures for handling requests for substitutions made after award of the Contract are included under Section 01631 Product Substitution.

#### **1.03 DEFINITIONS**

- A. Definitions used in this Article are not intended to change the meaning of other terms used in the Contract Documents such as specialties, systems, structure, finishes, accessories, and similar terms. Such terms are self-explanatory and have well recognized meanings in the construction industry.
  - 1. Products are items purchased for incorporation in the Work, whether purchased for the Project or taken from previously purchased stock. The term product includes the term material, equipment, system and terms of similar intent.
    - a. Named Products are items identified by manufacturers' product name, including make or model designation, indicated in the manufacturers published product literature that is current as of the date of the Contract Documents.

- b. Foreign Products, as distinguished from domestic products, are items substantially manufactured (50 percent or more of value) outside of the United States and its possessions; or produced or supplied by entities substantially owned (more than 50 percent) by persons who are not citizens or nor living within the United States and its possessions.
2. Materials are products that are substantially shaped; cut, worked, mixed, finished, refined or otherwise fabricated, processed, or installed to form a part of the Work.
3. Equipment is a product with operational parts, whether motorized or manually operated, that requires service connections such as wiring or piping.

#### 1.04 SUBMITTALS

- A. Product List Schedule: Prepare a schedule showing products specified in a tabular form acceptable to the Project Manager. Include generic names of products required. Include the manufacturers name and proprietary product names for each item listed.
  1. Coordinate the product list schedule with the Contractors Construction Schedule and the Schedule of Submittals.
    - a. Related Specification Section Number
    - b. Generic name used in Contract Documents
    - c. Proprietary name, model number and similar designations.
    - d. Manufacturers name and address
    - e. Suppliers name and address
    - f. Installers name and address
    - g. Projected delivery date, or time span of delivery period.
  2. Initial Submittal: Within 30 days after date of commencement of the Work, submit 3 copies of an initial product list schedule. Provide a written explanation for omissions of data, and for known variations from Contract requirements.
    - a. At the Contractors option, the initial submittal may be limited to product selections and designations that must be established early in the Contract period.
  3. Complete Scheduled: Within 45 days after date of commencement of the Work, submit 3 copies of the completed product list schedule. Provide a written explanation for omissions of data, and for known variations from Contract requirements.



4. Architects Action: The Architect will respond in writing to the Contractor within 2 weeks of receipt of the completed product list schedule. No response within this time period constitutes no objection to listed manufacturers or products, but does not constitute a waiver of the requirement that products comply with Contract Documents. The Architects response will include the following:
  - a. A list of unacceptable product selections, containing a brief explanation of reasons for this action.

#### 1.05 QUALITY ASSURANCE

- A. Source Limitations: To the fullest extent possible, provide products of the same kind, from a single source.
- B. Compatibility of Options: When the Contractor is given the option of selecting between two or more products for use on the Project; the product selected shall be compatible with products previously selected, even if previously selected products were also options.
- C. Nameplates: Except for required labels and operating data, do not attach or imprint manufacturers or producers nameplates or trademarks on exposed surfaces of products which will be exposed to view in occupied spaces or on the exterior.
  1. Labels: Locate required product labels and stamps on a concealed surface or, where required for observation after installation, on an accessible surface that is not conspicuous.
  2. Equipment Nameplates: Provide a permanent nameplate on each item of service-connected or power-operated equipment. Locate on an easily accessible surface which is inconspicuous in occupied spaces. The nameplate shall contain the following information and other essential operating data.
    - a. Name of product and manufacturer
    - b. Model and serial number
    - c. Capacity
    - d. Speed
    - e. Ratings
    - f. Additional pertinent information

#### 1.06 PRODUCT DELIVERY, STORAGE AND HANDLING

- A. Deliver, store and handle products in accordance with the manufacturers' recommendations, using means and methods that will prevent damage, deteriorating and loss, including theft.
1. Schedule delivery to minimize long-term storage at the site and to prevent overcrowding of construction spaces.
  2. Coordinate delivery with installation time to ensure minimum holding time for items that are flammable, hazardous, easily damaged, or sensitive to deterioration, theft and other losses.
  3. Deliver products to the site in the manufacturers original sealed container or other packaging system, complete with labels and instructions for handling, storing, unpacking, protecting and installing.
  4. Inspect products upon delivery to ensure compliance with the Contract Documents and to ensure that products are undamaged and properly protected.
  5. Store products at the site in a manner that will facilitate inspection and measurement of quantity or counting of units.
  6. Store heavy materials away from the Project structure in a manner that will not endanger the supporting construction.
  7. Store products subject to damage by the elements above ground, under cover in a weather tight enclosure, with ventilation adequate in prevent condensation. Maintain temperature and humidity within range required by manufacturers instructions.

## PART 2 PRODUCTS

### 2.01 PRODUCT SELECTION

- A. General Product Requirements: Provide products that comply with the Contract Documents, that are undamaged and, unless otherwise indicated, unused at the time of installation.
1. Provide products complete with all accessories, trim, finish, safety guards and other devices and details needed for a complete installation and for the intended use and effect.
  2. Standard Products: Where available, provide standard products of types that have been produced and used successfully in similar situation on other projects.

- B. Product Selection Procedures: Product selection is governed by the Contract Documents and governing regulations, not by previous Project experience. Procedures governing product selection include the following:
1. Proprietary Specification Requirements: Where only a single product or manufacturer is named, provide the product indicated. No substitutions will be permitted.
    - a. Where products or manufacturers are specified by name, accompanied by the term or equal or approved equal comply with the Contractor Document provisions concerning substitutions to obtain approval for use of an unnamed product.
  2. Non-Proprietary Specifications: When the Specifications list products or manufacturers that are available and may be incorporated in the Work, but do not restrict the Contractor to use of those products only, the Contractor may propose any available product that complies with Contract requirements. Comply with Contract Document provisions concerning substitutions to obtain approval for use of an unnamed product.
  3. Descriptive Specification Requirements: Where Specifications describe a product or assembly, listing exact characteristics required, with or without use of a brand or trade name, provide a product or assembly that provides the characteristics and otherwise complies with Contract requirements.
  4. Performance Specification Requirements: Where Specifications require compliance with performance requirements, provide products that comply with these requirements, and are recommended by the manufacturer for the application indicated.
    - a. Manufacturers recommendations may be contained in published product literature, or by the manufacturers' certification of performance.
  5. Compliance with Standards, Codes and Regulations: Where the Specifications only requires compliance with an imposed code, standard or regulation, select a product that complies with the standards, codes or regulations specified.
  6. Visual Matching: Where Specifications require matching an established Sample, the Architects decision will be final on whether a proposed product matches satisfactorily.
    - a. Where no product available within the specified category matches

satisfactorily and also complies with other specified requirements, comply with provisions of the Contract Documents concerning substitutions for selection of a matching product in another product category, or for noncompliance with specified requirements.

7. Visual Selection: Where specified product requirements include the phrase ... as selected from manufacturers standard colors, pattern, textures... or a similar phrase, select a product and manufacturer that complies with other specified requirements. The Architect will select the color, pattern and texture from the product line selected.
8. Asbestos free materials: No products containing asbestos shall be used for any part of the work for this product. Provide verification.

END OF SECTION 01600

## **SECTION 01631-PRODUCTS SUBSTITUTIONS**

### **PART 1 GENERAL**

#### **1.01 RELATED DOCUMENTS**

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

#### **1.02 SUMMARY**

- A. This Section specifies administrative and procedural requirements for handling request for substitutions made after award of the Contract.
- B. The Contractor's Installation Schedule and the Schedule of Submittals are included under Section Submittals.
- C. Standards: Refer to Section Definitions and Standards for applicability of industry standards to products specified.
- D. Procedural requirements governing the Contractor's selection of products and product options are included under Section Materials and Equipment.
- E. Contractor shall use the attached Request for Substitution form.

#### **1.03 DEFINITIONS**

- A. Definitions used in this Article are not intended to change or modify the meaning of other terms used in the Contract Documents.
- B. Substitutions: Requests for changes in products, materials, equipment, and methods of installation required by Contract Documents proposed by the Contractor after award of the Contract are considered requests for substitutions. The following are not considered substitutions:
  - 1. Revisions to Contract Documents requested by the Owner or Architect.
  - 2. Specified options of products and installation methods included in Contract Documents.
  - 3. The Contractor's determination of and compliance with governing regulations and orders issued by governing authorities.

#### **1.04 SUBMITTALS**

- A. Substitution Request Submittal: Request for substitution will be considered if received within thirty five (30) days after commencement of the Work. As long as this time allowance will not impact the construction schedule.
1. Submit three (3) copies of each request for substitution for consideration. Submit requests in the form and in accordance with procedures required for Change Order proposals.
  2. Identify the product, or the fabrication or installation method to be replaced in each request. Include related Specification Section and Drawing numbers. Provide complete documentation showing compliance with the requirements for substitution, and the following information, as appropriate:
    - a. Product Data, including Drawings, and descriptions of products, fabrication and installation procedures.
    - b. Samples, where applicable or requested.
    - c. A detailed comparison of significant qualities of the proposed substitution with those of the Work specified. Significant qualities may include elements such as size, weight, durability, performance and visual effect.
    - d. Coordination information, including a list of changes or modifications needed to other parts of the Work and to construction performed by the Owner and separate Contractors that will become necessary to accommodate the proposed substitution.
    - e. A statement indicating the substitution's effect on the Contractor's construction schedule compared to the schedule without approval of the substitution. Indicate the effect of the proposed substitution on overall Contract Time.
    - f. Cost information, including a proposal of the net change, if any in the Contract Sum.
    - g. Certification by the Contractor that the Substitution proposed is equal-to or better in every significant respect to that required by the Contract Documents, and that it will perform adequately in the application indicated. Include the contractor's waiver of rights to additional payment or time, that may subsequently become necessary because of the failure of the substitution to perform adequately.
  3. Architect's Action: Within two weeks of receipt of the request for substitution, the Architect will request additional information or documentation necessary for

evaluation of the request if needed. Within two (2) weeks of receipt of the request, or one week of receipt of the additional information or documentation, whichever is later, the Architect will notify the Contractor of acceptance or rejection of the proposed substitution. If a decision on use of a proposed substitute cannot be made or obtained within the time allocated, use the project specified by name. Decision on the use of a product substitution or its rejection by the Architect is considered final. Acceptance will be in the form of a Change Order.

## PART 2 PRODUCTS

### 2.01 SUBSTITUTIONS

- A. Conditions: The Contractor's substitution request will be received and considered by the Architect when one or more of the following conditions are satisfied, as determined by the Architect; otherwise request will be returned without action except to record noncompliance with these requirements.
1. Extensive revisions to Contract Documents are not required.
  2. Proposed changes are in keeping with the general intent of Contract Documents.
  3. The request is timely, fully documented and properly submitted.
  4. The specified product or method of construction cannot be provided within the Contract Time. The request will not be considered if the product or method cannot be provided as a result of failure to pursue the work promptly or coordinate activities properly.
  5. The specified product or method of construction cannot receive necessary approval by a governing authority, and the requested substitution can be approved.
  6. A substantial advantage is offered to the Owner, in terms of cost, time, energy conservation or other considerations of merit, after deducting offsetting responsibilities the Owner may be required to bear. Additional responsibilities for the Owner may include additional compensation to the Architect for redesign and evaluation services, increased cost of other construction by the Owner or separate Contractors, and similar consideration.

7. The specified product or method of construction cannot be provided in a manner that is compatible with other materials, and where the Contractor certifies that the substitution will overcome the incompatibility.
  8. The specified product or method of construction cannot be coordinated with other materials, and where the Contractor certifies that the proposed substitution can be coordinated.
  9. The specified product or method of construction cannot provide a warranty required by the Contract Documents and where the Contractor certifies that the proposed substitution provide the required warranty.
- B. The Contractor's submittal and Project Manager's acceptance of Shop Drawings, Product Data or Samples that relate to construction activities not complying with the Contract Documents does not constitute an acceptable or valid request for substitution, nor does it constitute approval.
- C. Substitution request constitutes a representation that the Contractor:
1. Has investigated proposed product and determined that it meets or exceeds, in all respects, specified product.
  2. Will provide the same warranty for substitution as for specified product.
  3. Will coordinate installation and make other changes which may be required for work to be complete in all respects.
  4. Waives claims for additional costs which may subsequently become apparent. All costs associated with the substitution will be paid by the Contractor regardless of approvals given, and regardless of subsequent difficulties experienced as a result of substitutions.

END OF SECTION 01631



## **SECTION 01700-PROJECT CLOSE-OUT**

### **PART 1 GENERAL**

#### **1.01 RELATED DOCUMENTS**

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

#### **1.02 SUMMARY**

- A. This Section specifies administrative and procedural requirements for project close-out, including but not limited to:
  - 1. Inspection procedures
  - 2. Project record document submittal. (Substantial Completion)
  - 3. Operating and maintenance manual submittal (Substantial Completion Requirements).
  - 4. Submittal of warranties (Substantial Completion Requirement).
  - 5. Final cleaning
- B. Close-out requirements for specific construction activities are included in the appropriate Sections in Divisions 2 through 16.
- C. Final payment to be made when the County has received all required close-out documents.

#### **1.03 SUBSTANTIAL COMPLETION**

- A. Preliminary Procedures: Before requesting inspection for certification of Substantial Completion, complete the following: List exceptions in the request.
  - 1. In the Application for Payment that coincides with, or first follows, the date Substantial Completion is claimed, show 100 percent completion for the portion of the Work claimed as substantially complete. Include supporting documentation for completion as indicated in these Contract Documents and a statement showing an accounting of changes to the Contract Sum.
    - a. If 100 percent completion cannot be shown, include a list of incomplete items, the value of incomplete construction, and reasons the Work is not complete.
  - 2. Advise Owner of pending insurance change-over requirements.

3. Submit specific warranties, workmanship bonds, maintenance agreements, final certifications and similar documents.
  4. Obtain and submit releases enabling the Owner unrestricted use of the Work and access to services and utilities; include occupancy permits, operating certificates and similar releases.
  5. Complete final clean up requirements, including touch-up painting. Touch-up and otherwise repair and restore marred exposed finishes.
- B. Inspection Procedures: On receipt of a request for inspection, the Project Manager will either proceed with inspection or advise the Contractor of unfilled requirements. The Project Manager will prepare the Certificate of Substantial Completion following inspection, or advise the Contractor of construction that must be completed or corrected before the certificate will be issued.
1. Results of the completed inspection will form the basis of requirements for final acceptance.
  2. Should the project fail to meet the standards required for Substantial Completion as defined in the documents the Contractor will pay the expense of a second inspection by the Project Manager/Consultants and the Owner. Cost will be deducted from the Contractors retainage.

#### 1.04 FINAL ACCEPTANCE

- A. Preliminary Procedures: Before requesting final inspection for certification of final acceptance and final payment, complete the following List exceptions in the request:
1. Submit the final payment request with releases and supporting documentation not previously submitted and accepted. Include certificates of insurance for products and completed operations where required.
  2. Submit and updated final statement, accounting for final additional changes to the Contract Sum.
  3. Submit a certified copy of the Project Managers final inspection list of item to be completed or corrected, stating that each item has been completed or otherwise resolved for acceptance, and the list has been endorsed and dated by the Project Manager.

4. Submit final meter readings for utilities, a measured record of stored fuel and similar data as of the date of Substantial Completion, or when the Owner took possession of the responsibility for corresponding elements of the Work.
  5. Submit consent of surety to final payment.
  6. Submit a final liquidated damages settlement statement
  7. Submit evidence of final, continuing insurance coverage complying with insurance requirements.
- B. Reinspection Procedure: The Project Manager will reinspect the Work upon receipt of notice that the Work, including inspection list items from earlier inspections, has been completed, except items whose completion has been delayed because of circumstances acceptable to the Project Manager.
1. Upon completion of reinspection, the Project Manager will prepare a certification of final acceptance, or advise the Contractor of Work that is incomplete or of obligations that have not been fulfilled but are required for final acceptance.

#### 1.05 RECORD DOCUMENT SUBMITTALS

- A. General: Do not use record documents for construction purposes; protect from deterioration and loss in a secure, fire-resistive location; provide access to record documents for the Project Managers reference during normal working hours.
- B. Record Drawings: Maintain a clean, undamaged set of blue or black line white-prints of Contractor Drawings and Shop Drawings. Mark the set to show the actual installation where the installation varies substantially from the Work as originally shown. Mark whichever drawing is most capable of showing conditions fully and accurately; where Shop Drawings are used, record a cross-reference at the corresponding location on the Contract Drawings. Give particular attention to concealed elements that would be difficult to measure and record at a later date. Provide for project photographs if deemed necessary by Owners representative.
1. Mark record sets with red erasable pencil; use other colors to distinguish between variations in separate categories of the Work.
  2. Mark new information that is important to the Owner, but was not

shown on Contract Drawings or Shop Drawings.

3. Note related Change Order numbers where applicable.
  4. Organize record drawing sheets, an print. suitable titles, dates and other identification on the cover of each set.
  5. Provide three (3) additional sets of black line drawing sets of As-Builts Drawings.
- C. Record Specifications: Maintain one complete copy of the Project Manual, including addenda, and one copy of other written construction documents such as Change Orders and modifications issued in printed form during construction. Mark these documents to show substantial variations in actual Work performed in comparison with the text of the Specifications and modifications. Give particular attention to substitutions, selection of options and similar information on elements that are concealed or cannot otherwise be readily discerned later by direct observation. Note related record drawing information and Project Data.
1. Upon completion of the Work, submit record Specifications to the Project Manager for the Owners records.
- D. Record Project Data: Maintain one copy of each Product Data submittal. Mark these documents to show significant variation in actual Work performed in comparison with information submitted. Include variations in products delivered to the site, and from the manufacturers installation instructions and recommendations. Give particular attention to concealed products and portions of the Work which cannot otherwise be readily discerned later by direct observation. Note related Change Orders and mark-up of record drawings and Specifications.
1. Upon completion of mark-up, submit complete set of record Product Data in the three ring binder (indexed) to the Project Manager for the Owners records.
- E. Record Sample Submitted: Immediately prior to the date or dates of Substantial Completion, the Contractor will meet at the site with the Project Manager and the Owners personnel to determine which of the submitted Samples that have been maintained during progress of the Work are to be transmitted to the Owner for record purposes. Comply with delivery to the Owners Sample storage area.
- F. Miscellaneous Record Submittals: Refer to other Specification Sections for requirements of miscellaneous record-keeping and submittals in connection with actual performance of the Work. Immediately prior to the

date or dates of Substantial Completion, complete miscellaneous record and place in good order, properly identified and bound or filed, ready for continued use and reference. Submit to the Project Manager for the Owners records.

- G. Maintenance Manuals: Organize operating and maintenance data into five (5) suitable sets of manageable size. Bind properly indexed data in individual heavy-duty 2-inc, 3-ring vinyl covered binders, with pocket folders for folded sheet information. Mark appropriate identification on front and spine of each binder. Include the following types of information:

1. Emergency instructions
2. Spare parts list
3. Copies of warranties
4. Wiring diagrams
5. Recommended turn around cycles
6. Inspection procedures
7. Shop Drawings and Product Data
8. Fixture lamping schedule

PART 2 PRODUCTS (Not Applicable)

PART 3 EXECUTION

3.01 CLOSE-OUT PROCEDURES

- A. Operating and Maintenance Instructions: Arrange for each installer of equipment that requires regular maintenance. If installers are not experienced in procedures, provide instruction by manufacturers representatives. All items to be provided or completed prior to certificate of Substantial Completion being issued by the Owner. Include a detailed review of the following items:

1. Maintenance manuals
2. Record documents
3. Spare parts and materials
4. Tools
5. Lubricants
6. Fuels
7. Identification systems
8. Control sequences
9. Hazards
10. Cleaning
11. Warranties and bonds
12. Maintenance agreements and similar continuing commitments

13. On site instructions to County maintenance personnel on major systems operations such as HVAC as per technical specifications.
- B. As part of instruction for operating equipment, demonstrate the following procedures, prior to the Owner issuing Certificate of Substantial Completion:
  1. Start-up
  2. Shutdown
  3. Emergency operations
  4. Noise and vibration adjustments
  5. Safety procedures
  6. Economy and efficiency adjustments

### 3.02 PROJECT CLOSE-OUT MANUALS AT SUBSTANTIAL COMPLETION

- A. Submit Project Close-out Manuals prior to issuance of final application for payment. Provide three (3) copies.
- B. Bind in commercial quality 8 ½" x 11" three ring binder, indexed with hardback, cleanable, plastic covers.
- C. Label cover of each binder with typed title PROJECT CLOSE-OUT MANUAL, with title of project; name, address, and telephone number of Contractor and name of responsible Principal.
- D. Provide table of contents: Neatly typed, in the following sequence:
  1. Final Certificate of Occupancy
  2. Warranty Service Subcontractors Identification List
  3. Final Lien Waivers and Releases
  4. Warranties and Guarantees
  5. Systems Operations and Maintenance Instruction
  6. Manufacturers Certificates and Certifications
  7. Maintenance Service Contracts
  8. Spare Parts Inventory List
  9. Special Systems Operating Permits or Approvals
  10. Asbestos free materials notarized statement
- E. Provide all documents for each section listed. List individual documents in each section in the table of contents, in the sequence of the Table of Contents of the Project Manual.
- F. Identify each document listed in the Table of Contents with the number and title of the specification section in which specified, and the name of the Product or Work item.

- G. Separate each section with index to sheets that are keyed to the Table of Contents listing.
- H. Warranty Service Subcontractors List shall identify subcontractor supplier, and manufacturer for each warranty with name, address and emergency telephone number.

### 3.03 FINAL CLEANING

- A. General: General cleaning during construction is required by the General Conditions and included in Section Temporary Facilities.
- B. Cleaning: Employ experienced workers or professional cleaners for final cleaning. Clean each surface or unit to the condition expected in a normal, commercial building cleaning and maintenance program. Comply with manufacturers instructions.
  - 1. Complete the following cleaning operations before requesting inspection for Certification of Substantial Completion.
    - a. Remove labels that are not permanent labels.
    - b. Clean transparent materials, including mirrors and glass in doors and windows. Remove glazing compound and other substances that are noticeable vision-obscuring materials. Replace chipped or broken glass and other damaged transparent materials.
    - c. Clean exposed exterior and interior hard-surfaced finished to a dust-free condition, free of stains, films and similar foreign substances. Restore reflective surfaces to their original reflective condition. Leave concrete floors broom clean. Vacuum carpeted surfaces. Apply floor wax to vinyl floors.
    - d. Wipe surfaces of mechanical and electrical equipment. Remove excess lubrication and other substances. Clean plumbing fixtures to a sanitary condition. Clean light fixtures and lamps.
    - e. Clean the site, including landscape development areas, of rubbish, litter and other foreign substances. Sweep paved areas broom clean; remove stains, spills and other foreign deposits. Rake grounds that are neither paved nor planted, to a smooth even-textured surface. Remove waste and surplus materials from the site in an appropriate manner.
- C. Pest Control: Engage an experienced exterminator to make a final inspection, and rid the Project of rodents, insects and other pests.

- D. Removal of Protection: Remove temporary protection and facilities installed for protection of the Work during construction.
- E. Compliance: Comply with regulations of authorities having jurisdiction and safety standards for cleaning. Do not burn waste materials. Do not bury debris or excess materials on the Owners property. Do not discharge volatile, harmful or dangerous materials into drainage systems. Remove waste materials from the site and dispose of in a lawful manner.
  - 1. Where extra materials of value remaining after completion of associated Work have become the Owners property, arrange for disposition of these materials as direct.

END OF SECTION 01700



## **SECTION 01740-WARRANTIES AND BONDS**

### **PART 1 GENERAL**

#### **1.01 RELATED DOCUMENTS**

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

#### **1.02 SUMMARY**

- A. This Section specifies general administrative and procedural requirements for warranties and bonds required by the Contract Documents, including manufacturers standard warranties on products and special warranties.
  - 1. Refer to the General Conditions for terms of the Contractors special warranty of workmanship and materials.
  - 2. General close-out requirements are included in Section Project Close-Out.
  - 3. Specific requirements for warranties for the Work and products and installations that are specified to be warranted, are included in the individual Sections of Division 2 through 16.
  - 4. Certifications and other commitments and agreements for continuing services to Owner are specified elsewhere in the Contract Documents.
- B. Disclaimers and Limitations: Manufacturers disclaimers and limitations on product warranties to not relieve the Contractor of the warranty on the Work that incorporates the products, nor does it relieve suppliers, manufacturers, and subcontractors required do countersign special warranties with the Contractor.

#### **1.03 WARRANTY REQUIREMENTS**

- A. Related Damages and Losses: When correcting warranted Work that has failed, remove and replace other Work that has been damaged as a result of such failure or that must be removed and replaced to provide access for correction of warranted Work.
- B. Reinstatement of Warranty. When Work covered by a warranty has failed and been corrected by replacement or rebuilding, reinstate the warranty by written endorsement. The reinstated warranty shall be equal to the original warranty with an equitable adjustment for depreciation.
- C. Replacement Cost: Upon determination that Work covered by a warranty has

failed, replace or rebuild the Work to an acceptable condition complying with requirements of Contract Documents.

- D. Owners Recourse: Written warranties made to the Owner are in addition to implied warranties, and shall not limit the duties, obligation, rights and remedies otherwise available under the law, nor shall warranty periods be interpreted as limitations on time in which the Owner can enforce such other duties, obligations, rights, or remedies.
  - 1. Rejection of Warranties: The Owner reserves the right to reject warranties and to limit selections to products with warranties not in conflict with requirements of the Contract Documents.
- E. The Owner reserves the right to refuse to accept Work for the Project where a special warranty, certification, or similar commitment is required on such Work or part of the Work, until evidence is presented that entities required to countersign such commitments are willing to do so.

#### 1.04 WARRANTY PERIOD

- A. The Contractor shall participate with the County and the Architects representative, at the beginning of the tenth month of the warranty period, in conducting an on site review and evaluation of all items of equipment, materials and workmanship covered by the warranties and guarantees. Contractor shall act promptly and without cost to the County to correct all defects, problems, or deficiencies determined as such by the Architect/Owner during on the site review.
- B. All warranties and guarantees shall commence on the date of Substantial Completion except for items which are determined by the County to be incomplete or a non-comply status at the time of Substantial Completion. The coverage commencement date for warranties and guarantees of such work shall be the date of the County's acceptance of that work.
- C. Warranty period shall be manufacturers standard for product specified except where specific warranty periods are specified in individual sections. But in no case less than one year.

#### 1.05 SUBMITTALS

- A. Submit written warranties to the Owner prior to the date certified for Substantial Completion. If the Architects Certificate of Substantial Completion designates a commencement date for warranties other than the date of Substantial Completion for the Work, or a designated portion of the Work, submit written warranties upon request of the Project Manager.
  - 1. When a designated portion of the Work is completed and occupied or used

by the Owner, by separate agreement with the Contractor during the construction period, submit properly executed warranties to the Project Manager within fifteen (15) days of completion of that designated portion of the Work.

- B. When a special warranty is required to be executed by the Contractor, or the Contractor and a subcontractor, supplier or manufacturer, prepared a written document that contains appropriate terms and identification, ready for execution by the required parties. Submit a draft to the Owner through the Architect for approval prior to final execution.
  - 1. Refer to individual Sections of Division 2 through 16 for specific content requirements, and particular requirements for submittal of special warranties.
- C. Form of Submittal: At Final Completion compile two (2) copies of each required warranty and bond properly executed by the Contractor, or by the subcontractor, supplier or manufacturer. Organize the warranty documents into an orderly sequence based on the table of contents of the Project Manual.
- D. Bind (3) three sets of warranties and bonds in heavy-duty, commercial quality, durable 3-ring vinyl covered loose-leaf binders, thickness as necessary to accommodate contents, and sized to receive 8" by 11" paper.
  - 1. Provide heavy paper dividers with Celluloid covered tabs for each separate warranty. Mark the tab to identify the product or installation. Provide a typed description of the product or installation, including the name of the product, and the name, address and telephone number of the installer.
  - 2. Identify each binder on the front and the spine with the typed or printed title WARRANTIES AND BONDS, the Project title or name, and the name of the Contractor.
  - 3. When operating and maintenance manuals are required for warranted construction, provide additional copies of each required warranty, as necessary, for inclusion in each required manual.

PART 2 PRODUCTS (Not Applicable)

PART 3 EXECUTION (Not Applicable)

END OF SECTION 01740

**SECTION 02010 – SOIL REPORT AND RECOMMENDATIONS**

PART 1 - GENERAL

See Attached Report

# Geotechnical Engineering Report

**Barber Park Expansion  
Gatlin Avenue and Dixie Belle Drive  
Orlando, Florida**

September 24, 2015  
Terracon Project No. H1155140

**Prepared for:**  
Orange County Capital Projects Division  
Orlando, Florida

**Prepared by:**  
Terracon Consultants, Inc.  
Winter Park, Florida

[terracon.com](http://terracon.com)

**Terracon**

Environmental



Facilities



Geotechnical



Materials

September 24, 2015

Orange County Capital Projects Division  
400 E. South Street  
Orlando, Florida 32801



Attn: Mr. Roan Waterbury, LEED AP  
P: [407] 836-0034  
E: Roan.Waterbury@ocfl.net

Re: Geotechnical Engineering Report  
Barber Park Expansion  
Gatlin Avenue and Dixie Belle Drive  
Orlando, Orange County, Florida  
Terracon Project Number: H1155140

Dear Mr. Waterbury:

Terracon Consultants, Inc. (Terracon) has completed the geotechnical engineering services for the above referenced project. This study was performed in general accordance with our proposal number PH1150541 dated July 23, 2015.

This report presents the findings of the subsurface exploration and provides geotechnical recommendations concerning earthwork, the design and construction of playfields, pavements, and stormwater management design parameters for the proposed project.

We appreciate the opportunity to be of service to you on this project. If you have any questions concerning this report, or if we may be of further service, please contact us.

Sincerely,  
**Terracon Consultants, Inc.**  
Certificate of Authorization Number 8830

Shenna McMaster, P.E.  
Senior Geotechnical Engineer  
Florida PE #57537

Jay W. Casper, P.E.  
Senior Associate

Enclosures

Terracon Consultants, Inc. 1675 Lee Road Winter Park, Florida 32789  
P [407] 740 6110 F [407] 740 6112 terracon.com

# TABLE OF CONTENTS

<b>EXECUTIVE SUMMARY .....</b>	<b>i</b>
<b>1.0 INTRODUCTION .....</b>	<b>1</b>
<b>2.0 PROJECT INFORMATION .....</b>	<b>1</b>
2.1 Project Description .....	1
2.2 Site Location and Description .....	2
<b>3.0 SUBSURFACE CONDITIONS .....</b>	<b>2</b>
3.1 Soil Survey .....	2
3.2 Typical Profile .....	3
3.3 Groundwater .....	3
<b>4.0 RECOMMENDATIONS FOR DESIGN AND CONSTRUCTION .....</b>	<b>4</b>
4.1 Geotechnical Considerations .....	4
4.2 Earthwork .....	4
4.2.1 Site Preparation .....	4
4.2.2 Material Requirements .....	5
4.2.3 Compaction Requirements .....	6
4.2.4 Grading and Drainage .....	6
4.2.5 Earthwork Construction Considerations .....	6
4.3 Pavements .....	7
4.3.1 Subgrade Preparation .....	7
4.3.2 Design Considerations .....	7
4.3.3 Estimates of Minimum Pavement Thickness .....	8
4.3.4 Asphalt Concrete Design Recommendations .....	8
4.3.5 Portland Cement Concrete Design Recommendations .....	10
4.3.6 Pavement Drainage .....	10
4.3.7 Pavement Maintenance .....	10
4.4 Stormwater Management .....	11
<b>5.0 GENERAL COMMENTS .....</b>	<b>12</b>

## APPENDIX A – FIELD EXPLORATION

Exhibit A-1	Topographic Vicinity Map
Exhibit A-2	U.S.D.A. Soils Map
Exhibit A-3	Soil Survey Descriptions
Exhibit A-4	Boring Location Plan
Exhibit A-5	Field Exploration Description
Exhibit A-6 to A-13	Boring Logs

## APPENDIX B – SUPPORTING INFORMATION

Exhibit B-1	Laboratory Testing
-------------	--------------------

## APPENDIX C – SUPPORTING DOCUMENT

Exhibit C-1	Unified Soil Classification System
-------------	------------------------------------

## **EXECUTIVE SUMMARY**

Geotechnical exploration has been performed for the proposed expansion to the existing Barber Park located on Gatlin Avenue, west of Dixie Belle Drive in Orlando, Orange County, Florida. Eight (8) manual auger borings, designated as B-1 through B-8, have been performed to depths of 7 and 7.5 feet below the existing ground surface across the proposed expansion area.

Based on the information obtained from our geotechnical exploration, it appears that the site can be developed for the proposed project. The following geotechnical considerations were identified:

- Soil conditions observed consisted of fine sand (SP) and fine sand with silt (SP-SM). Soils with trace organics, indicative of topsoil, were observed at the surface of many borings. The soil conditions are generally suitable for the proposed improvements.
- Groundwater was observed in the borings at depths of 0.8 to 1.5 feet below existing grade. Seasonal high groundwater levels are expected to be near observed levels.
- Careful attention to relatively high groundwater levels is recommended in pavement and site grading.
- Shallow swales, possibly constructed in fill and/or constructed with bottom underdrains, will be required to make dry stormwater systems feasible at this site.

This summary should be used in conjunction with the entire report for design purposes. It should be recognized that details were not included or fully developed in this section, and the report must be read in its entirety for a comprehensive understanding of the items contained herein. The section titled **GENERAL COMMENTS** should be read for an understanding of the report limitations.



**GEOTECHNICAL ENGINEERING REPORT  
BARBER PARK EXPANSION  
GATLIN AVENUE AND DIXIE BELLE DRIVE  
ORLANDO, FLORIDA**

Terracon Project No. H1155140

September 24, 2015

## **1.0 INTRODUCTION**

This geotechnical engineering report has been prepared for the proposed expansion to the existing Barber Park located on Gatlin Avenue, west of Dixie Belle Drive in Orlando, Orange County, Florida as shown on the Topographic Vicinity Map included as Exhibit A-1 in Appendix A. Eight (8) manual auger soil borings, designated B-1 through B-8, were performed to depths of 7 to 7.5 feet below the existing ground surface across the proposed expansion area. Logs of the borings along with a Boring Location Plan (Exhibit A-4) are included in Appendix A of this report. Laboratory testing procedures are included in Exhibit B-1 in Appendix B.

The purpose of these services is to provide information and geotechnical engineering recommendations relative to:

- subsurface soil conditions
- groundwater conditions
- earthwork
- pavement design
- stormwater pond design

## **2.0 PROJECT INFORMATION**

### **2.1 Project Description**

<b>Item</b>	<b>Description</b>
<b>Site layout</b>	Based on the conceptual site plan provided, three (3) soccer fields, a paved parking area, and stormwater pond areas are planned.
<b>Design traffic</b>	Standard duty: 30,000 E <sub>18</sub> SALs (assumed <sup>1</sup> ) Heavy duty: 50,000 E <sub>18</sub> SALs (assumed <sup>1</sup> )
<b>Stormwater Management</b>	A stormwater pond is anticipated in the southern portion of the project site.

1. Pavement design to be based on the indicated total number of 18-kip equivalent single axle load repetitions (E<sub>18</sub>SALs) over a 20-year design life.

## 2.2 Site Location and Description

Item	Description
<b>Location</b>	The project site is located at the existing Barber Park on Gatlin Avenue, west of Dixie Belle Drive in Orlando, Florida
<b>Existing Site Conditions</b>	The expansion is planned to the northeast of the existing park facility. The current ground cover is grass lawn.
<b>Existing topography</b>	The site currently appears nearly level. The USGS topographic quadrangle maps “Orlando East, Florida” and “Pine Castle, Florida” depict the ground surface elevations near elevation +100 feet referencing the National Geodetic Vertical Datum of 1929 (NGVD29).
<b>Surface Water</b>	The USGS topographic quadrangle maps “Orlando East, Florida” and “Pine Castle, Florida” depict Lake George (formerly Lake Barber) to the north of the site with a recorded water level near +94 feet.

## 3.0 SUBSURFACE CONDITIONS

### 3.1 Soil Survey

The Soil Survey of Orange County, Florida as prepared by the United States Department of Agriculture (USDA), Soil Conservation Service (SCS; later renamed the Natural Resource Conservation Service - NRCS), identifies the soil types at the subject site as *Basinger fine sand, depressional (3)*, *Ona fine sand (26)*, *Seffner fine sand (43)*, and *Zolfo fine sand (54)*. It should be noted that the Soil Survey is not intended as a substitute for site-specific geotechnical exploration; rather it is a useful tool in planning a project scope in that it provides information on soil types likely to be encountered. Boundaries between adjacent soil types on the Soil Survey maps are approximate (included in Appendix as Exhibit A-2). Descriptions of the mapped soil units are included in Appendix A as Exhibit A-3.

### 3.2 Typical Profile

Based on the results of the borings, subsurface conditions on the project site can be generalized as follows:

Approximate Depth to Bottom of Stratum (feet)	Material Description
1 to 3	Fine sand with silt (SP-SM) with occasional trace organics, indicative of topsoil, observed at the surface
At least 7 to 7.5 feet	Fine sand (SP)

Conditions encountered at each boring location and results of laboratory testing are indicated on the individual boring logs. Stratification boundaries on the boring logs represent the approximate location of changes in soil types. The in-situ transition between materials may be gradual. Details for each of the borings can be found on the boring logs in Appendix A of this report. Descriptions of our field exploration are included as Exhibit A-5 in Appendix A. Descriptions of our laboratory testing procedures are included as Exhibit B-1 in Appendix B. A more detailed description of the Unified Soil Classification System (USCS) is included as Exhibit C-1 in Appendix C.

### 3.3 Groundwater

The boreholes were observed during drilling for the presence and level of groundwater. Groundwater was observed in all of the borings, between depths of 0.8 and 1.5 feet below existing grade. It should be recognized that fluctuations of the groundwater table will occur due to seasonal variations in the amount of rainfall, runoff and other factors not evident at the time the boring was performed. In addition, perched water can develop within higher permeability soils overlying less permeable soils. Therefore, groundwater levels during construction or at other times in the future may be higher or lower than the levels indicated on the boring logs.

We estimate that during the normal wet season with rainfall and recharge at a maximum, groundwater levels will be near those observed during the field exploration. Our estimates of the seasonal groundwater conditions are based on the USDA Soil Survey, the encountered soil types, recent weather conditions, and the encountered water levels.

These seasonal water table estimates do not represent the temporary rise in water table that occurs immediately following a storm event, including adjacent to other stormwater management facilities. This is different from static groundwater levels in wet ponds and/or drainage canals which can affect the design water levels of new, nearby ponds. The high water

table may vary from normal when affected by extreme weather changes, localized or regional flooding, karst activity, future grading, drainage improvements, or other construction that may occur on our around the site following the date of this report.

## **4.0 RECOMMENDATIONS FOR DESIGN AND CONSTRUCTION**

### **4.1 Geotechnical Considerations**

Borings encountered sand to sand with silt. These materials are generally suitable for construction of the proposed playfields, pavements, and stormwater systems following the recommended Earthwork portions of this report.

Potential limitations to be considered during stormwater management design are the relatively shallow groundwater levels. Use of a wet bottom stormwater pond or shallow dry bottom swale, possibly constructed in fill, appears most appropriate. Underdrains may be required to provide adequate recovery for a dry system.

To improve surface infiltration and reduce the potential for prolonged periods of soggy, wet conditions following heavy rainfall, we recommend that the upper 12 inches of fill placed in playfield areas consist of well-draining, inorganic, non-cohesive sand with less than 5 percent fines content. Field surfaces should be sloped appropriately for drainage.

Design and construction recommendations for earth connected phases of the project are outlined below.

### **4.2 Earthwork**

#### **4.2.1 Site Preparation**

We anticipate construction will be initiated by clearing any surface vegetation and other deleterious material and stripping the topsoil. Once stripping is complete, the exposed subgrade should be observed and proofrolled with a medium or heavy weight roller (minimum 10,000 pounds static weight). Proofrolling should be avoided in dry stormwater system areas, where stormwater infiltration is required to provide recovery. When the prevailing groundwater table is high, proofrolling should be performed in static mode. Proofrolling aids in providing a firm base for compaction of new fill and delineating soft or disturbed areas that may exist at or near the exposed subgrade level as well as overall densification of the upper loose sands. Proofrolling should be performed in the presence of a Terracon representative in order to aid in evaluating unstable subgrade areas. Unstable areas observed at this time should be improved as recommended by the engineer based on field conditions and typically includes scarification and recompaction or by undercutting and replacement with suitable compacted fill.

Where fill is placed on existing slopes steeper than 5H:1V, benches should be cut into the existing slopes prior to fill placement. The benches should have a minimum vertical face height of 1 foot and a maximum vertical face height of 3 feet and should be cut wide enough to accommodate the compaction equipment. This benching will help provide a positive bond between the fill and natural soils and reduce the possibility of failure along the fill/natural soil interface. Furthermore, we recommend that fill slopes be over filled and then cut back to develop an adequately compacted slope face.

#### 4.2.2 Material Requirements

Compacted structural fill should meet the following material property requirements:

Fill Type <sup>1</sup>	USCS Classification	Acceptable Location for Placement	Maximum Lift Thickness (in.)
General <sup>1</sup>	SP (fines content < 5%)	All locations and elevations. This is the best fill for pavement subgrade and upper lifts of playfield areas.	12 <sup>2</sup>
	SP-SM (fines content between 5 and 12%)	Most locations and elevations, except strict moisture control will be required during placement, particularly during the rainy season. This material is not recommended for upper foot of fill placed in playfield areas.	8 to 12 <sup>2</sup>

1. Controlled, compacted fill should consist of approved materials that are free of organic matter and debris.
2. Loose thickness when heavy compaction equipment is used in vibratory mode. Lift thickness should be decreased if static compaction is being used, typically to no more than 8 inches, and the required compaction must still be achieved. Use 4 to 6 inches in loose thickness when hand-guided equipment (i.e. jumping jack or plate compactor) is required.

### 4.2.3 Compaction Requirements

Item	Description
<b>Minimum Compaction Requirements</b> <sup>1</sup>	95 percent of the material's maximum modified Proctor dry density (ASTM D 1557).
<b>Moisture Content</b> <sup>2</sup>	Within ±2 percent of optimum moisture content as determined by the Modified Proctor test, at the time of placement and compaction.
<b>Minimum Testing Frequency</b>	One field density test per 20,000 square feet or fraction thereof per 1-foot lift.

1. We recommend that engineered fill be tested for moisture content and compaction during placement. Should the results of the in-place density tests indicate the specified moisture or compaction limits have not been met, the area represented by the test should be reworked and retested as required until the specified moisture and compaction requirements are achieved.
2. Specifically, moisture levels should be maintained low enough to allow for satisfactory compaction to be achieved without the cohesionless fill material pumping when proofrolled.

### 4.2.4 Grading and Drainage

Final surrounding grades should be sloped away from the playfields on all sides to prevent ponding of water. Site grades should be set considering the estimated seasonal high groundwater presented in Section 3.3.

It is recommended that all exposed earth slopes be seeded to provide protection against erosion. Seeded slopes should be protected with erosion mats until the vegetation is established.

### 4.2.5 Earthwork Construction Considerations

After initial proofrolling and compaction, unstable subgrade conditions could develop during general construction operations, particularly if the soils are wetted and/or subjected to repetitive construction traffic. The use of static compaction and/or light construction equipment would aid in reducing subgrade disturbance.

As a minimum, all temporary excavations should be sloped or braced as required by Occupational Health and Safety Administration (OSHA) regulations to provide stability and safe working conditions. Temporary excavations will probably be required during grading operations. The grading contractor, by his contract, is usually responsible for designing and constructing stable, temporary excavations and should shore, slope or bench the sides of the excavations as required, to maintain stability of both the excavation sides and bottom. All excavations should

comply with applicable local, state and federal safety regulations, including the current OSHA Excavation and Trench Safety Standards.

Depending on groundwater levels at the time of construction, temporary lowering of the groundwater level (dewatering) at the site may be necessary. The purposes of dewatering are to facilitate compaction of the subgrade soils during proofrolling and to provide dry, stable footing excavations. Dewatering can probably be accomplished at this site by a system of temporary drainage ditches graded to drain to sumps which can be pumped sufficiently to maintain water levels at the ditch bottoms. However, dewatering methods should be determined by the contractor.

### **4.3 Pavements**

The near surface soil throughout most of the site consisted of fine sand and fine sand with silt. Stabilizing material will likely be necessary for the construction of pavement subgrades.

#### **4.3.1 Subgrade Preparation**

Site grading is typically accomplished relatively early in the construction phase. Fills are placed and compacted in a uniform manner. However, as construction proceeds, excavations are made into these areas, rainfall and surface water saturates some areas, heavy traffic from concrete trucks and other delivery vehicles disturbs the subgrade and many surface irregularities are filled in with loose soils to temporarily improve ride comfort. As a result, the pavement subgrades, initially prepared early in the project, should be carefully evaluated as the time for pavement construction approaches.

We recommend the moisture content and density of the top 12 inches of the subgrade be evaluated and the pavement subgrades be proofrolled and tested within two days prior to commencement of actual paving operations. Compaction tests should be performed at a frequency of 1 test per 10,000 square feet or fraction thereof. Areas not in compliance with the required ranges of moisture or density should be moisture conditioned and recompacted. Particular attention should be paid to high traffic areas that were rutted and disturbed earlier and to areas where backfilled trenches are located. Areas where unsuitable conditions are found should be repaired by removing and replacing the materials with properly compacted fills.

If a significant precipitation event occurs after the evaluation or if the surface becomes disturbed, the subgrade should be reviewed by qualified personnel immediately prior to paving. The subgrade should be in its finished form at the time of the final review.

#### **4.3.2 Design Considerations**

Traffic patterns and anticipated loading conditions were not available at the time that this report was prepared. However, we anticipate that traffic loads will be produced primarily by automobile traffic and occasional delivery and trash removal trucks. The thickness of pavements subjected to

heavy truck traffic should be determined using expected traffic volumes, vehicle types, and vehicle loads and should be in accordance with local, city or county ordinances.

Pavement thickness can be determined using AASHTO, Asphalt Institute, PCA, and/or other methods if specific wheel loads, axle configurations, frequencies, and desired pavement life are provided. Terracon can provide thickness recommendations for pavements subjected to loads other than personal vehicle and occasional delivery and trash removal truck traffic if this information is provided. However, absent that data, we recommend the following minimum typical sections.

### 4.3.3 Estimates of Minimum Pavement Thickness

Typical Pavement Section (inches)						
Traffic Area	Alternative	Asphalt Concrete Surface Course	Limerock, Soil-Cement or Crushed Concrete Base Course	Stabilized Subbase Course <sup>2,3,4</sup>	Portland Cement Concrete	Free Draining Subgrade
Car Parking	PCC	--	--		5.0	18.0
	AC	1.5	6.0	12.0	--	--
Truck and Drive Areas	PCC	--	--		6.0	18.0
	AC	2.5	8.0	12.0	--	--
Trash Container Pad <sup>1</sup>	PCC	--	--		6.0	18.0

1. The trash container pad should be large enough to support the container and the tipping axle of the collection truck.
2. Often referred to as Stabilized Subgrade.
3. Use coarse granular materials such as recycled crushed concrete, shell, or gravel when seasonal high groundwater is within 4 feet of the profile grade. Clay stabilization is acceptable with deeper seasonal high groundwater.
4. Some municipalities do not require stabilized subbase beneath soil-cement base.

### 4.3.4 Asphalt Concrete Design Recommendations

The following items are applicable to asphalt concrete pavement sections.

- Terracon recommends a minimum separation of 12 inches between the bottom of the base course and the seasonal high water table, if a soil cement or crushed concrete base is used. If a limerock base is used, a minimum separation of 18 inches between the bottom of the base course and the estimated seasonal high groundwater table is recommended.



- Natural or fill subgrade soils to a depth of 18 inches below the base should be clean, free draining sands with a fines content passing a No. 200 sieve of 7 percent or less.
- Stabilized subgrade soils (also identified as stabilized subbase) should be stabilized to a minimum Limerock Bearing Ratio (LBR; Florida Method of Test Designation FM 5-515) value of 40 if they do not already meet this criterion, or modified/replaced with new compacted fill that meets the minimum LBR value. Although LBR testing has not been performed, our experience with similar soils indicates that the near surficial sands encountered in the soil borings are unlikely to meet this requirement.
- The stabilized subgrade course should be compacted to at least 98 percent of the Modified Proctor maximum dry density (AASHTO T-180 or ASTM D-1557). Any underlying, newly-placed subgrade fill need only be compacted to a minimum of 95 percent of the Modified Proctor maximum dry density. Compaction tests should be performed at a frequency of 1 test per 10,000 square feet or fraction thereof.
- Limerock base courses from an approved FDOT source should have a minimum LBR value of 100, and be compacted to a minimum of 98 percent of the maximum dry density as determined by the Modified Proctor test. Limerock should be placed in uniform lifts not to exceed 6 inches loose thickness. Recycled limerock is not a suitable substitute for virgin limerock for base courses but may be used as a granular stabilizing admixture.
- Soil cement base courses typically experience shrinkage cracking due to hydration curing of the cement. This shrinkage cracking typically propagates through the overlying asphalt course and reflects in the pavement surface. This reflective cracking is not necessarily indicative of a pavement structural failure, though it is sometimes considered to be aesthetically undesirable.
- Soil cement bases should have 7-day design strength of 300 psi. Soil cement base should be compacted to a minimum of 98 percent of the material's maximum dry density as determined by the Standard Proctor Test for Soil Cement (AASHTO T-134). Higher design strengths may result in increased cracking.
- Crushed (recycled) concrete base should meet the current FDOT specification 204 for recycled materials.
- Asphalt should be compacted to a minimum of 95 percent of the design mix density. Asphalt surface courses should be Type SP, Type S, or other suitable mix design according to FDOT and local requirements.
- To verify thicknesses, after placement and compaction of the pavement courses, core the wearing surface to evaluate material thickness and composition at a minimum frequency of 5,000 square feet or two locations per day's production.
- Underdrains or strip drains should be considered along all landscaped areas in, or adjacent to pavements to reduce moisture migration to subgrade soils. Underdrains will also be required below pavement if the separation between the bottom of the base course and the seasonal high groundwater table is less than 1 foot.
- All curbing should be full depth. Use of extruded curb sections which lie on top of asphalt surface courses can allow migration of water between the surface and base courses, leading to rippling and pavement deterioration.

#### **4.3.5 Portland Cement Concrete Design Recommendations**

The following items are applicable to rigid concrete pavement sections.

- At least 18 inches of free-draining material should be included directly beneath rigid concrete pavement. Fill meeting the requirements of “General Fill” presented in Section 4.2 (Earthwork) of this report may be considered free-draining for this purpose. Limerock should not be considered free draining for this purpose.
- The PCC should be a minimum of 4,000 psi at 28 days. PCC pavements are recommended for trash container pads and in any other areas subjected to heavy wheel loads and/or turning traffic.
- The upper 1 foot of rigid pavement subgrade soils should be compacted to at least 98 percent of the Modified Proctor maximum dry density (AASHTO T-180 or ASTM D-1557). Compaction tests should be performed at a frequency of 1 test per 10,000 square feet or fraction thereof.
- Rigid PCC pavements will perform better than ACC in areas where short-radii turning and braking are expected (i.e. entrance/exit aprons) due to better resistance to rutting and shoving. In addition, PCC pavement will perform better in areas subject to large or sustained loads. An adequate number of longitudinal and transverse control joints should be placed in the rigid pavement in accordance with ACI and/or AASHTO requirements. Expansion (isolation) joints must be full depth and should only be used to isolate fixed objects abutting or within the paved area.
- Adequate separation should be provided between the bottom of the concrete and the seasonal high water table. Terracon recommends that in no case should less than 1 foot of separation be provided.
- Sawcut joint patterns should generally be square or rectangular but nearly square, and extend to a depth equal to a quarter of the slab thickness. If the bottom of the concrete pavement is separated from the seasonal high water table by at least 1 foot, filter fabric will not be necessary beneath the expansion joints.

#### **4.3.6 Pavement Drainage**

Pavements should be sloped to provide rapid drainage of surface water. Water allowed to pond on or adjacent to the pavements could saturate the subgrade and contribute to premature pavement deterioration. In addition, the pavement subgrade should be graded to provide positive drainage within the granular base section. The subgrade and the pavement surface should have a minimum  $\frac{1}{4}$  inch per foot slope to promote drainage. Appropriate sub-drainage or connection to a suitable daylight outlet should be provided to remove water from the base layer.

#### **4.3.7 Pavement Maintenance**

The pavement sections provided in this report represent minimum recommended thicknesses and, as such, periodic maintenance should be anticipated. Therefore preventive maintenance should be planned and provided for through an on-going pavement management program.

Maintenance activities are intended to slow the rate of pavement deterioration, and to preserve the pavement investment. Maintenance consists of both localized maintenance (e.g., crack and joint sealing and patching) and global maintenance (e.g., surface sealing). Preventive maintenance is usually the first priority when implementing a pavement maintenance program. Additional engineering observation is recommended to determine the type and extent of a cost effective program. Even with periodic maintenance, some movements and related cracking may still occur and repairs may be required.

#### **4.4 Stormwater Management**

Design of the stormwater management system has not been completed yet. Dry retention ponds generally need to be at least 1 foot and sometimes as much as 3 feet (or more for large ponds) above the seasonal high water table to recover adequately.

Use of shallow dry-bottom swales may be feasible. Construction of swales in suitable permeable fill or use of underdrains may be required to allow a dry pond/swale system to adequately recover. If swales are constructed in fill, use of naturally occurring clean sand is recommended to promote recovery.

Bulk samples of anticipated swale subgrade soils (Boring Locations B-6 and B-8, 1 to 2 feet below existing grade) had measured permeability rates of 3 and 23 feet/day. We consider this permeability rate to be indicative of a saturated vertical permeability. Past experience and published references have indicated that unsaturated vertical permeability as used in some locally available groundwater models is typically 2/3 the saturated value. Experience with the observed soil types has shown that horizontal permeability may be on the order of 1.5 times the saturated vertical permeability in undisturbed materials. Fill soils placed in the proposed swale areas should consist of similar relatively clean sands. Permeability rates used in recovery analyses should consider any fill placed in the swale areas during construction.

A confining layer was not observed within the explored depths of 7 feet. Therefore we conservatively recommend that you consider the maximum explored depth of 7 feet as the confining layer for the purpose stormwater system design. A fillable porosity of 25 percent is recommended for near surface sands. The table below summarizes our recommended stormwater design parameters:

<b>Parameter</b>	<b>Boring Location B-6</b>	<b>Boring Location B-8</b>
Estimated Confining Layer Depth,	7 feet	7 feet
Estimated Seasonal High Water Table Elevation	1 foot	1 foot
Unsaturated Vertical Infiltration Rate, $k_v$	20 feet/day	3 feet/day
Horizontal Saturated Hydraulic Conductivity, $k_H$	30 feet/day	5 feet/day
Fillable Porosity, $\eta$	25 percent	25 percent

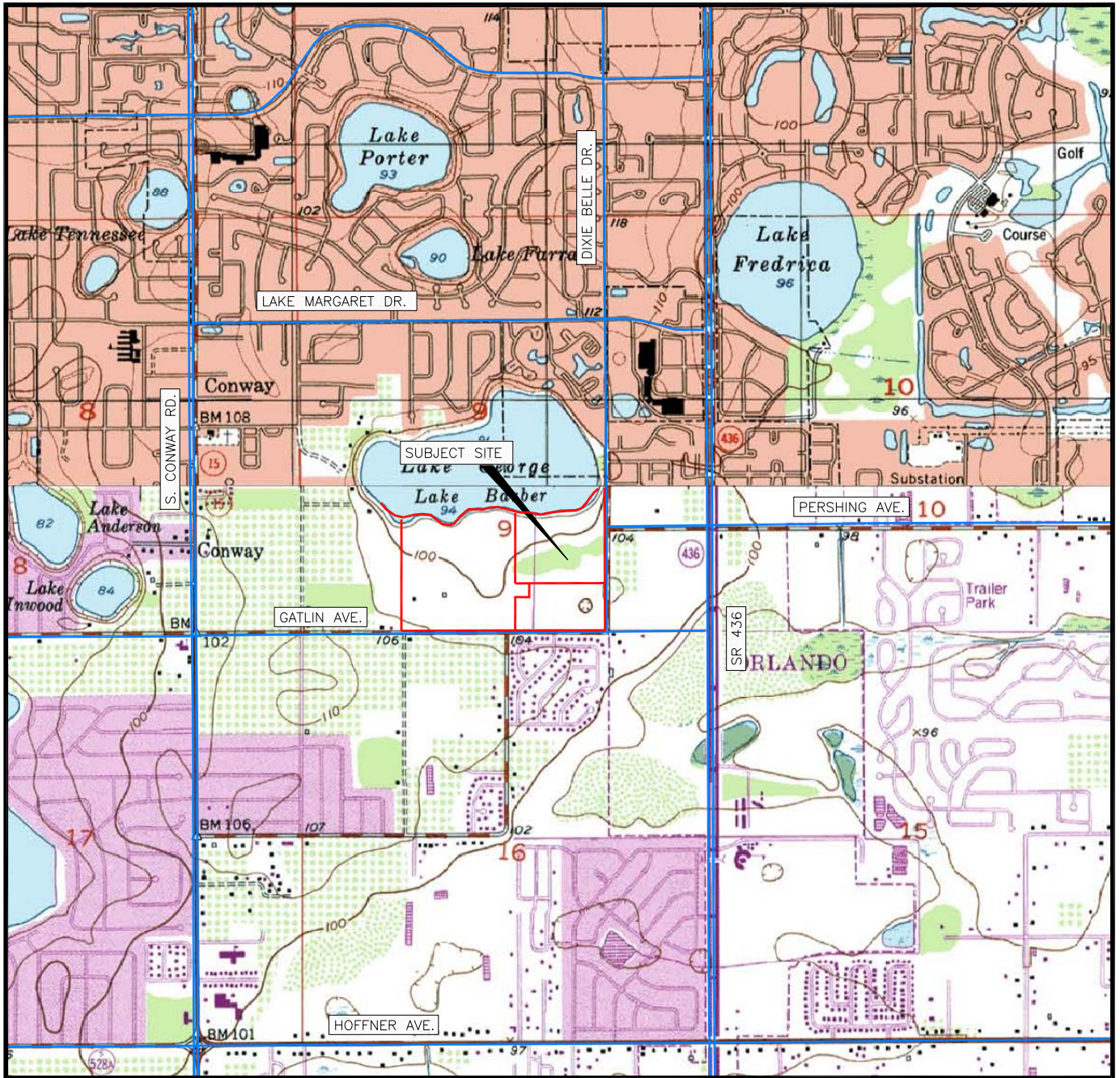
## **5.0 GENERAL COMMENTS**

The analysis and recommendations presented in this report are based upon the data obtained from the borings performed at the indicated locations and from other information discussed in this report. This report does not reflect variations that may occur between borings, across the site, or due to the modifying effects of construction or weather. The nature and extent of such variations may not become evident until during or after construction. If variations appear, we should be immediately notified so that further evaluation and supplemental recommendations can be provided.

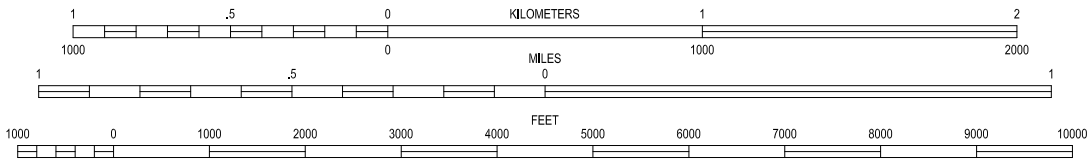
The scope of services for this project does not include either specifically or by implication any environmental or biological (e.g., mold, fungi, bacteria) assessment of the site or identification or prevention of pollutants, hazardous materials or conditions. If the owner is concerned about the potential for such contamination or pollution, other studies should be undertaken.

This report has been prepared for the exclusive use of our client for specific application to the project discussed and has been prepared in accordance with generally accepted geotechnical engineering practices. No warranties, either expressed or implied, are intended or made. Site safety, excavation support, and dewatering requirements are the responsibility of others. In the event that changes in the nature, design, or location of the project as outlined in this report are planned, the conclusions and recommendations contained in this report shall not be considered valid unless Terracon reviews the changes and either verifies or modifies the conclusions of this report in writing.

**APPENDIX A**  
**FIELD EXPLORATION**



SCALE 1:24 000



CONTOUR INTERVAL 5 FEET  
NATIONAL GEODETIC VERTICAL DATUM OF 1929

SECTION: 9  
TOWNSHIP: 23 SOUTH  
RANGE: 30 EAST

ORLANDO EAST, FLORIDA ISSUED: 1994  
PINE CASTLE, FLORIDA ISSUED: 1953 REVISED: 1980  
7.5 MINUTE SERIES (QUADRANGLE)



Sep21, 2015 - 11:28am N:\Projects\2015\H1155140\PROJECT DOCUMENTS (Reports-Letters-Drafts to Clients)\Cod\5140-usgs.dwg

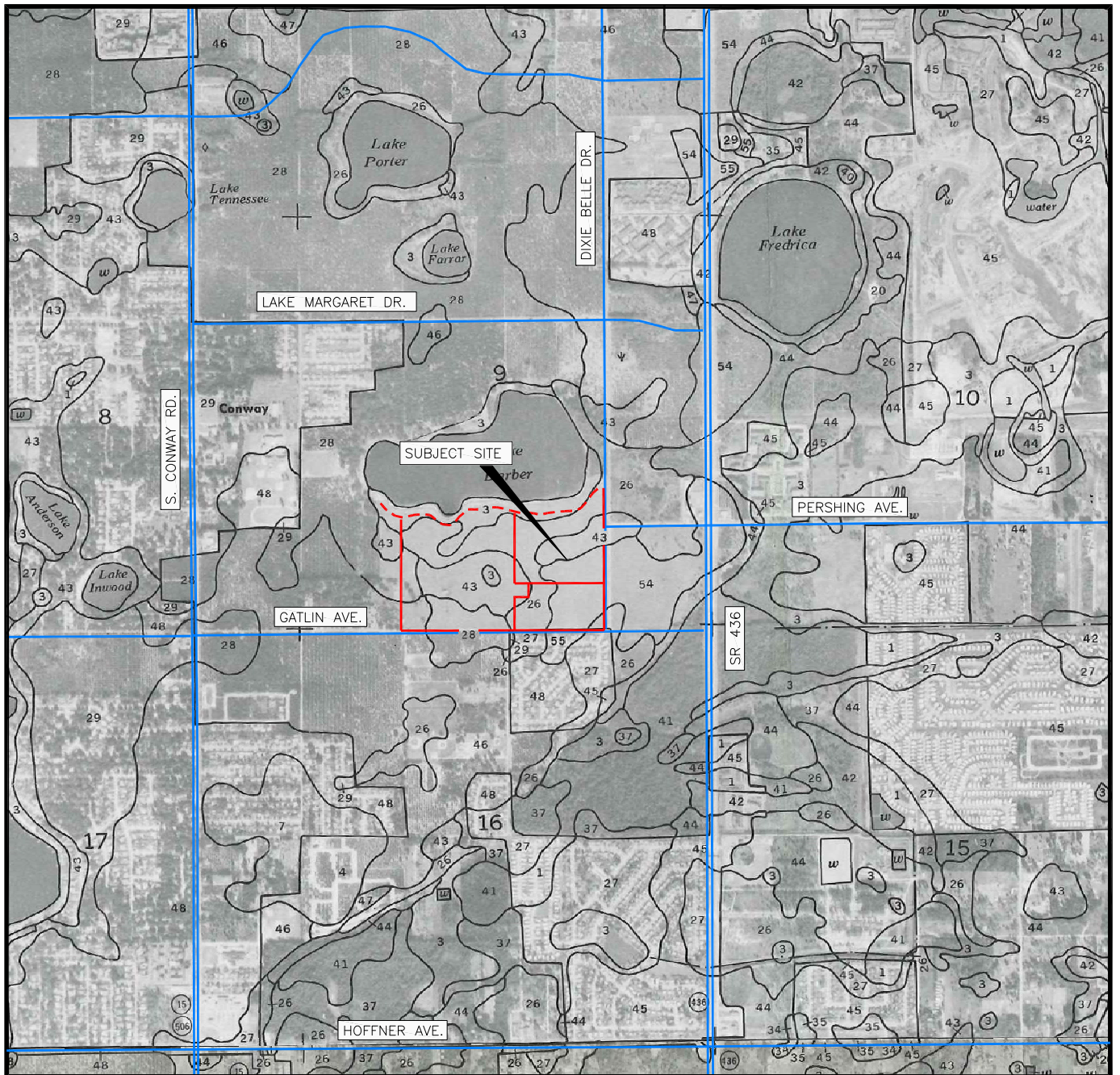
Project Mngr:	SM	Project No.	H1155140
Drawn By:	SW	Scale:	AS SHOWN
Checked By:	SM	File No.	H1155140-1
Approved By:	JWC	Date:	9-21-15

**Terracon**  
Consulting Engineers and Scientists  
1675 LEE ROAD WINTER PARK, FLORIDA 32789  
PH. (407) 740-6110 FAX. (407) 740-6112

TOPOGRAPHIC VICINITY MAP  
GEOTECHNICAL ENGINEERING EVALUATION  
BARBER PARK EXPANSION  
GATLIN AVENUE AND DIXIE BELLE DRIVE  
ORANGE COUNTY, FLORIDA

EXHIBIT  
**A-1**

Sep21, 2015-11:28am N:\Projects\2015\H1155140\PROJECT DOCUMENTS (Reports-Letters-Drafts to Clients)\Cod\5140-usda.dwg



SCALE 1" = 2000'



**U.S.D.A. SOIL SURVEY FOR ORANGE COUNTY, FLORIDA  
ISSUED: 1989**



SECTION: 9  
TOWNSHIP: 23 SOUTH  
RANGE: 30 EAST

ORANGE COUNTY SOILS MAP INDEX	
3	BASINGER FINE SAND, DEPRESSIONAL
26	ONA FINE SAND
43	SEFFNER FINE SAND
54	ZOLFO FINE SAND

Project Mngr:	SM	Project No.	H1135105
Drawn By:	SW	Scale:	AS SHOWN
Checked By:	SM	File No.	H1135105-2
Approved By:	JWC	Date:	9-6-13

  
**Terracon**  
 Consulting Engineers and Scientists  
 1675 LEE ROAD WINTER PARK, FLORIDA 32789  
 PH. (407) 740-6110 FAX. (407) 740-6112

**U.S.D.A. SOILS MAP**  
 GEOTECHNICAL ENGINEERING EVALUATION  
 BARBER PARK EXPANSION  
 GATLIN AVENUE AND DIXIE BELLE DRIVE  
 ORANGE COUNTY, FLORIDA

**EXHIBIT**  
**A-2**

## Soil Survey Descriptions

3 – Basinger fine sand, depressional. This soil type is nearly level and poorly drained. It is typically found in shallow depressions and sloughs along edges of freshwater marshes and swamps. In its natural state, water stands on the surface of this soil type for 6 to 9 months during most years and is within 12 inches of the surface for the rest of the year. This soil type is sometimes associated with a surficial organic layer, typical thickness of 7 inches, typical organic contents of between 1 and 8 percent.

Typical permeability rates for this soil type generally range from 6 to 20 inches per hour (12 to 40 feet per day) throughout the defined profile of 80 inches (6.7 feet).

26 – Ona fine sand. This soil type is nearly level and poorly drained. It is typically found in broad areas on the flatwoods. In most years, a seasonal high water table is within 10 inches (0.8 feet) of the surface for 1 month to 2 months. It recedes to a depth of 10 to 40 inches (0.8 to 3.3 feet) for periods of 6 months or more.

Typical permeability rates for this soil type generally range from 6 to 20 inches per hour (12 to 40 feet per day) except between typical depths of 6 and 15 inches (0.5 and 1.3 feet) where typical permeability rates range from 0.6 to 2 inches per hour (1.2 to 4 feet per day).

43 – Seffner fine sand. This soil type is nearly level and somewhat poorly drained. It is encountered on the rims of depressions and on broad, low ridges on the flatwoods. Under natural conditions, and during years of normal rainfall, this soil type has a seasonal high water table at a depth of between 18 and 40 inches (1.5 and 3.3 feet) for 2 to 4 months, receding to a depth of less than 60 inches (5.0 feet) during prolonged dry periods. The water table also may rise to within 10 to 20 inches (0.8 to 1.7 feet) of the surface for periods of up to 2 weeks during wet periods.

54 – Zolfo fine sand. This soil type is nearly level and somewhat poorly drained. It is typically found on broad, slightly higher positions adjacent to the flatwoods. In its natural state, during years of normal rainfall, this soil type has a seasonal high water table at a depth of between 24 and 40 inches (2.0 and 3.3 feet) for 2 to 6 months, receding to a depth of 60 inches (5.0 feet) during prolonged dry periods.

Typical permeability rates for this soil type generally range from 6 to 20 inches per hour (12 to 40 feet per day) between the surface and a typical depth of 55 inches (4.6 feet) and from 0.6 to 2 inches per hour (1.2 to 4 feet per day) between typical depths of 55 inches and the maximum defined depth of 80 inches (4.6 and 6.7 feet).



Sep21, 2015-12:37pm N:\Projects\2015\H1155140\PROJECT DOCUMENTS (Reports-Letters-Drafts to Clients)\Cad\51140-plan 4.dwg



 APPROXIMATE LOCATION OF AUGER BORING

Project Mngr:	SM
Drawn By:	SW
Checked By:	SM
Approved By:	JWC

Project No.	H1155140
Scale:	AS SHOWN
File No.	H1155140-4
Date:	9-21-15

**Terracon**  
 Consulting Engineers and Scientists  
 1675 LEE ROAD WINTER PARK, FLORIDA 32789  
 PH. (407) 740-6110 FAX. (407) 740-6112

**BORING LOCATION PLAN**  
 GEOTECHNICAL ENGINEERING EVALUATION  
 BARBER PARK EXPANSION  
 GATLIN AVENUE AND DIXIE BELLE DRIVE  
 ORANGE COUNTY, FLORIDA

EXHIBIT  
**A-4**

## **Field Exploration Description**

The boring locations were laid out at the project site by Terracon personnel. The borings were located in the field using GPS coordinates obtained from Google Earth imagery. The GPS unit used to locate the borings has an accuracy of about 20 feet. The locations of the borings should be considered accurate only to the degree implied by the means and methods used to define them.

The hand auger boring procedure consisted of manually turning a 3 inch diameter, 6 inch long sampler into the soil until it is full. The sampler was then retrieved and the soils in the sampler were visually examined and classified. The procedure was repeated until the desired termination depth was achieved or shallow groundwater levels cause collapse of the borehole.

Portions of the samples from the borings were sealed in glass jars to reduce moisture loss, and then the jars were taken to our laboratory for further observation and classification. Upon completion, the boreholes were backfilled with the site soil.

Field logs of each boring were prepared by the drill crew. These logs included visual classifications of the materials encountered during drilling as well as the driller's interpretation of the subsurface conditions between samples. The boring logs included with this report represent an interpretation of the field logs and include modifications based on laboratory observation of the samples.

# BORING LOG NO. B-1

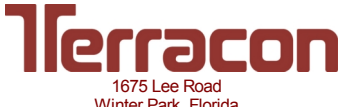
**PROJECT: BARBER PARK EXPANSION**

**CLIENT: Orange County Capital Projects Division**

**SITE: Gatlin Avenue and Dixie Belle Drive  
Orange County, Fla.**

GRAPHIC LOG	LOCATION See Exhibit A-4 Latitude: 28.498655° Longitude: -81.317284°	DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	FIELD TEST RESULTS	PERMEABILITY (feet/day)	WATER CONTENT (%)	PERCENT FINES
DEPTH								
1.5	<b>SAND WITH SILT (SP-SM)</b> , fine grained, dark brown		▽					
7.0	<b>SAND (SP)</b> , fine grained, gray-brown to light gray	5					25	4
	<b>Boring Terminated at 7 Feet</b>							

Stratification lines are approximate. In-situ, the transition may be gradual.

Advancement Method: Auger Boring	See Exhibit A-5 for description of field procedures  See Appendix B for description of laboratory procedures and additional data (if any).  See Appendix C for explanation of symbols and abbreviations.	Notes:
Abandonment Method:		
<b>WATER LEVEL OBSERVATIONS</b>		Boring Started: 9/2/2015 Boring Completed: 9/2/2015
▽ Observed Groundwater Level at 1' Depth		Drill Rig: Terracon Project No.: H1 15 5140 Exhibit: A-6

THIS BORING LOG IS NOT VALID IF SEPARATED FROM ORIGINAL REPORT. GEO SMART LOG-NO WELL H1155140-BORINGS GINT.GPJ TERRACON2015.GDT 9/25/15

# BORING LOG NO. B-2

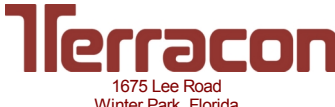
**PROJECT: BARBER PARK EXPANSION**

**CLIENT: Orange County Capital Projects Division**

**SITE: Gatlin Avenue and Dixie Belle Drive  
Orange County, Fla.**

GRAPHIC LOG	LOCATION See Exhibit A-4 Latitude: 28.498717° Longitude: -81.314988°	DEPTH (Ft)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	FIELD TEST RESULTS	PERMEABILITY (feet/day)	WATER CONTENT (%)	PERCENT FINES
DEPTH								
1.0	<b>SAND WITH SILT (SP-SM)</b> , trace organics (topsoil), fine grained, dark gray		▽					
3.0	<b>SAND WITH SILT (SP-SM)</b> , fine grained, gray-brown							
7.0	<b>SAND (SP)</b> , fine grained, brown to light brown	5						
	<b>Boring Terminated at 7 Feet</b>							

Stratification lines are approximate. In-situ, the transition may be gradual.

Advancement Method: Auger Boring	See Exhibit A-5 for description of field procedures  See Appendix B for description of laboratory procedures and additional data (if any).  See Appendix C for explanation of symbols and abbreviations.	Notes:
Abandonment Method:		
<b>WATER LEVEL OBSERVATIONS</b>		Boring Started: 9/2/2015      Boring Completed: 9/2/2015 Drill Rig:      Driller: Terracon Project No.: H1 15 5140      Exhibit: A-7
▽ Observed Groundwater Level at 0.8' Depth		

THIS BORING LOG IS NOT VALID IF SEPARATED FROM ORIGINAL REPORT. GEO SMART LOG-NO WELL H1155140-BORINGS GINT.GPJ TERRACON2015.GDT 9/25/15

# BORING LOG NO. B-3

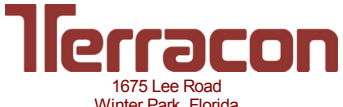
**PROJECT: BARBER PARK EXPANSION**

**CLIENT: Orange County Capital Projects Division**

**SITE: Gatlin Avenue and Dixie Belle Drive  
Orange County, Fla.**

GRAPHIC LOG	LOCATION See Exhibit A-4 Latitude: 28.49791° Longitude: -81.316235°	DEPTH (Ft)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	FIELD TEST RESULTS	PERMEABILITY (feet/day)	WATER CONTENT (%)	PERCENT FINES
DEPTH								
1.0	<b>SAND WITH SILT (SP-SM)</b> , trace organics (topsoil), fine grained, dark brown		▽					
3.0	<b>SAND WITH SILT (SP-SM)</b> , fine grained, dark gray-brown							
7.0	<b>SAND (SP)</b> , fine grained, light gray-brown	5					27	3
	<b>Boring Terminated at 7 Feet</b>							

Stratification lines are approximate. In-situ, the transition may be gradual.

Advancement Method: Auger Boring	See Exhibit A-5 for description of field procedures  See Appendix B for description of laboratory procedures and additional data (if any).  See Appendix C for explanation of symbols and abbreviations.	Notes:
Abandonment Method:		
<b>WATER LEVEL OBSERVATIONS</b>		Boring Started: 9/2/2015 Boring Completed: 9/2/2015
▽ Observed Groundwater Level at 1' Depth		Drill Rig: Driller: Terracon
		Project No.: H1 15 5140 Exhibit: A-8

THIS BORING LOG IS NOT VALID IF SEPARATED FROM ORIGINAL REPORT. GEO SMART LOG-NO WELL H1155140-BORINGS GINT.GPJ TERRACON2015.GDT 9/25/15

# BORING LOG NO. B-4

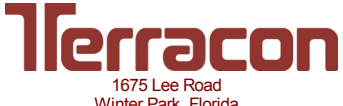
**PROJECT: BARBER PARK EXPANSION**

**CLIENT: Orange County Capital Projects Division**

**SITE: Gatlin Avenue and Dixie Belle Drive  
Orange County, Fla.**

GRAPHIC LOG	LOCATION See Exhibit A-4 Latitude: 28.497968° Longitude: -81.314839°	DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	FIELD TEST RESULTS	PERMEABILITY (feet/day)	WATER CONTENT (%)	PERCENT FINES
DEPTH								
1.5	<b>SAND WITH SILT (SP-SM)</b> , fine grained, dark brown		▽					
7.5	<b>SAND (SP)</b> , fine grained, gray-brown to light brown to gray	5						
	<b>Boring Terminated at 7.5 Feet</b>							

Stratification lines are approximate. In-situ, the transition may be gradual.

Advancement Method: Auger Boring	See Exhibit A-5 for description of field procedures  See Appendix B for description of laboratory procedures and additional data (if any).  See Appendix C for explanation of symbols and abbreviations.	Notes:
Abandonment Method:		
<b>WATER LEVEL OBSERVATIONS</b>		Boring Started: 9/2/2015 Boring Completed: 9/2/2015
▽ Observed Groundwater Level at 1.5' Depth	1675 Lee Road Winter Park, Florida	Drill Rig: Driller: Terracon
		Project No.: H1 15 5140 Exhibit: A-9

THIS BORING LOG IS NOT VALID IF SEPARATED FROM ORIGINAL REPORT. GEO SMART LOG-NO WELL H1155140-BORINGS GINT.GPJ TERRACON2015.GDT 9/25/15

# BORING LOG NO. B-5

**PROJECT: BARBER PARK EXPANSION**

**CLIENT: Orange County Capital Projects Division**

**SITE: Gatlin Avenue and Dixie Belle Drive  
Orange County, Fla.**

GRAPHIC LOG	LOCATION See Exhibit A-4 Latitude: 28.497172° Longitude: -81.317651°	DEPTH (Ft)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	FIELD TEST RESULTS	PERMEABILITY (feet/day)	WATER CONTENT (%)	PERCENT FINES
DEPTH								
0.0	<b>SAND WITH SILT (SP-SM)</b> , fine grained, gray-brown		▽					
3.0	<b>SAND (SP)</b> , fine grained, light brown	5					29	3
7.0	<b>Boring Terminated at 7 Feet</b>							

Stratification lines are approximate. In-situ, the transition may be gradual.

Advancement Method: Auger Boring	See Exhibit A-5 for description of field procedures  See Appendix B for description of laboratory procedures and additional data (if any).  See Appendix C for explanation of symbols and abbreviations.	Notes:
Abandonment Method:		
<b>WATER LEVEL OBSERVATIONS</b>		Boring Started: 9/2/2015
▽ Observed Groundwater Level at 1' Depth		Boring Completed: 9/2/2015
	1675 Lee Road Winter Park, Florida	Drill Rig: Terracon
		Project No.: H1 15 5140
		Exhibit: A-10

THIS BORING LOG IS NOT VALID IF SEPARATED FROM ORIGINAL REPORT. GEO SMART LOG-NO WELL H1155140-BORINGS GINT.GPJ TERRACON2015.GDT 9/25/15

# BORING LOG NO. B-6

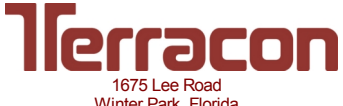
**PROJECT: BARBER PARK EXPANSION**

**CLIENT: Orange County Capital Projects Division**

**SITE: Gatlin Avenue and Dixie Belle Drive  
Orange County, Fla.**

GRAPHIC LOG	LOCATION See Exhibit A-4 Latitude: 28.4971° Longitude: -81.316257°	DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	FIELD TEST RESULTS	PERMEABILITY (feet/day)	WATER CONTENT (%)	PERCENT FINES
DEPTH								
1.5	<b>SAND WITH SILT (SP-SM)</b> , fine grained, dark brown		▽					
7.0	<b>SAND (SP)</b> , fine grained, gray-brown	5				23	34	3
	<b>Boring Terminated at 7 Feet</b>							

Stratification lines are approximate. In-situ, the transition may be gradual.

Advancement Method: Auger Boring	See Exhibit A-5 for description of field procedures  See Appendix B for description of laboratory procedures and additional data (if any).  See Appendix C for explanation of symbols and abbreviations.	Notes:
Abandonment Method:		
<b>WATER LEVEL OBSERVATIONS</b>		Boring Started: 9/2/2015
▽ Observed Groundwater Level at 1' Depth		Boring Completed: 9/2/2015
	1675 Lee Road Winter Park, Florida	Drill Rig: Terracon
		Project No.: H1 15 5140
		Exhibit: A-11

THIS BORING LOG IS NOT VALID IF SEPARATED FROM ORIGINAL REPORT. GEO SMART LOG-NO WELL H1155140-BORINGS GINT.GPJ TERRACON2015.GDT 9/25/15



# BORING LOG NO. B-7

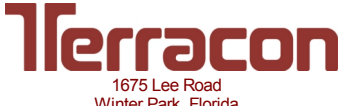
**PROJECT: BARBER PARK EXPANSION**

**CLIENT: Orange County Capital Projects Division**

**SITE: Gatlin Avenue and Dixie Belle Drive  
Orange County, Fla.**

GRAPHIC LOG	LOCATION See Exhibit A-4 Latitude: 28.497263° Longitude: -81.315051°	DEPTH (Ft)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	FIELD TEST RESULTS	PERMEABILITY (feet/day)	WATER CONTENT (%)	PERCENT FINES
DEPTH								
1.0	<b>SAND WITH SILT (SP-SM)</b> , fine grained, dark brown		▽					
7.0	<b>SAND (SP)</b> , fine grained, light brown to gray	5					34	4
	<b>Boring Terminated at 7 Feet</b>							

Stratification lines are approximate. In-situ, the transition may be gradual.

Advancement Method: Auger Boring	See Exhibit A-5 for description of field procedures  See Appendix B for description of laboratory procedures and additional data (if any).  See Appendix C for explanation of symbols and abbreviations.	Notes:
Abandonment Method:		
<b>WATER LEVEL OBSERVATIONS</b>		Boring Started: 9/2/2015
▽ Observed Groundwater Level at 1' Depth		Boring Completed: 9/2/2015
		Drill Rig: Terracon
		Project No.: H1 15 5140
		Exhibit: A-12

THIS BORING LOG IS NOT VALID IF SEPARATED FROM ORIGINAL REPORT. GEO SMART LOG-NO WELL H1155140-BORINGS GINT.GPJ TERRACON2015.GDT 9/25/15

# BORING LOG NO. B-8

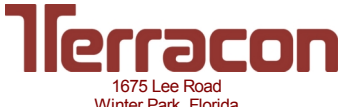
**PROJECT: BARBER PARK EXPANSION**

**CLIENT: Orange County Capital Projects Division**

**SITE: Gatlin Avenue and Dixie Belle Drive  
Orange County, Fla.**

GRAPHIC LOG	LOCATION See Exhibit A-4 Latitude: 28.497907° Longitude: -81.317399°	DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	FIELD TEST RESULTS	PERMEABILITY (feet/day)	WATER CONTENT (%)	PERCENT FINES
DEPTH								
1.5	<b>SAND WITH SILT (SP-SM)</b> , fine grained, gray to dark brown		▽					
7.0	<b>SAND (SP)</b> , fine grained, light gray	5				3	17	4
	<b>Boring Terminated at 7 Feet</b>							

Stratification lines are approximate. In-situ, the transition may be gradual.

Advancement Method: Auger Boring	See Exhibit A-5 for description of field procedures  See Appendix B for description of laboratory procedures and additional data (if any).  See Appendix C for explanation of symbols and abbreviations.	Notes:
Abandonment Method:		
<b>WATER LEVEL OBSERVATIONS</b>		Boring Started: 9/2/2015 Boring Completed: 9/2/2015
▽ Observed Groundwater Level at 1' Depth	1675 Lee Road Winter Park, Florida	Drill Rig: Driller: Terracon
		Project No.: H1 15 5140 Exhibit: A-13

THIS BORING LOG IS NOT VALID IF SEPARATED FROM ORIGINAL REPORT. GEO SMART LOG-NO WELL H1155140-BORINGS GINT.GPJ TERRACON2015.GDT 9/25/15

## **APPENDIX B – LABORATORY TESTING**

## Geotechnical Engineering Report

Barber Park Expansion ■ Orlando, Florida

September 24, 2015 ■ Terracon Project No. H1155140



### Laboratory Testing

During the field exploration, a portion of each recovered sample was sealed in a glass jar and transported to our laboratory for further visual observation and laboratory testing. Selected samples retrieved from the borings were tested for moisture (water) content, fines content (soil passing a US standard #200 sieve), and laboratory permeability. Those results are included in this report and on the respective boring logs. The visual-manual classifications were modified as appropriate based upon the laboratory testing results.

The soil samples were classified in general accordance with the appended General Notes and the Unified Soil Classification System based on the material's texture and plasticity. The estimated group symbol for the Unified Soil Classification System is shown on the boring logs and a brief description of the Unified Soil Classification System is included in Appendix C. The results of our laboratory testing are presented in the Laboratory Test Results section of this report and on the corresponding borings logs.

Permeability testing was performed on bulk samples obtained from adjacent to Borings B-6 and Boring B-8, from between depths of 1 and 2 feet below existing grade, the presumed subgrade soils for the proposed stormwater management areas. The bulk samples were remolded in a permeameter to subjectively approximate in-place relative density of the sampled soil. Water was allowed to flow into the soil sample until the sample was apparently saturated. Once saturated, the amount of water which flows through the sample while maintaining a constant hydraulic head was measured over a certain time period.

**APPENDIX C**  
**SUPPORTING DOCUMENT**

# UNIFIED SOIL CLASSIFICATION SYSTEM

Criteria for Assigning Group Symbols and Group Names Using Laboratory Tests <sup>A</sup>				Soil Classification		
				Group Symbol	Group Name <sup>B</sup>	
<b>Coarse Grained Soils:</b> More than 50% retained on No. 200 sieve	<b>Gravels:</b> More than 50% of coarse fraction retained on No. 4 sieve	<b>Clean Gravels:</b> Less than 5% fines <sup>C</sup>	$Cu \geq 4$ and $1 \leq Cc \leq 3$ <sup>E</sup>	GW	Well-graded gravel <sup>F</sup>	
			$Cu < 4$ and/or $1 > Cc > 3$ <sup>E</sup>	GP	Poorly graded gravel <sup>F</sup>	
		<b>Gravels with Fines:</b> More than 12% fines <sup>C</sup>	Fines classify as ML or MH	GM	Silty gravel <sup>F,G,H</sup>	
			Fines classify as CL or CH	GC	Clayey gravel <sup>F,G,H</sup>	
	<b>Sands:</b> 50% or more of coarse fraction passes No. 4 sieve	<b>Clean Sands:</b> Less than 5% fines <sup>D</sup>	$Cu \geq 6$ and $1 \leq Cc \leq 3$ <sup>E</sup>	SW	Well-graded sand <sup>I</sup>	
			$Cu < 6$ and/or $1 > Cc > 3$ <sup>E</sup>	SP	Poorly graded sand <sup>I</sup>	
		<b>Sands with Fines:</b> More than 12% fines <sup>D</sup>	Fines classify as ML or MH	SM	Silty sand <sup>G,H,I</sup>	
			Fines classify as CL or CH	SC	Clayey sand <sup>G,H,I</sup>	
<b>Fine-Grained Soils:</b> 50% or more passes the No. 200 sieve	<b>Silts and Clays:</b> Liquid limit less than 50	<b>Inorganic:</b>	$PI > 7$ and plots on or above "A" line <sup>J</sup>	CL	Lean clay <sup>K,L,M</sup>	
			$PI < 4$ or plots below "A" line <sup>J</sup>	ML	Silt <sup>K,L,M</sup>	
		<b>Organic:</b>	Liquid limit - oven dried	< 0.75	OL	Organic clay <sup>K,L,M,N</sup>
			Liquid limit - not dried			Organic silt <sup>K,L,M,O</sup>
	<b>Silts and Clays:</b> Liquid limit 50 or more	<b>Inorganic:</b>	$PI$ plots on or above "A" line	CH	Fat clay <sup>K,L,M</sup>	
			$PI$ plots below "A" line	MH	Elastic Silt <sup>K,L,M</sup>	
		<b>Organic:</b>	Liquid limit - oven dried	< 0.75	OH	Organic clay <sup>K,L,M,P</sup>
			Liquid limit - not dried			Organic silt <sup>K,L,M,Q</sup>
<b>Highly organic soils:</b>	Primarily organic matter, dark in color, and organic odor			PT	Peat	

<sup>A</sup> Based on the material passing the 3-inch (75-mm) sieve

<sup>B</sup> If field sample contained cobbles or boulders, or both, add "with cobbles or boulders, or both" to group name.

<sup>C</sup> Gravels with 5 to 12% fines require dual symbols: GW-GM well-graded gravel with silt, GW-GC well-graded gravel with clay, GP-GM poorly graded gravel with silt, GP-GC poorly graded gravel with clay.

<sup>D</sup> Sands with 5 to 12% fines require dual symbols: SW-SM well-graded sand with silt, SW-SC well-graded sand with clay, SP-SM poorly graded sand with silt, SP-SC poorly graded sand with clay

$$E \quad Cu = D_{60}/D_{10} \quad Cc = \frac{(D_{30})^2}{D_{10} \times D_{60}}$$

<sup>F</sup> If soil contains  $\geq 15\%$  sand, add "with sand" to group name.

<sup>G</sup> If fines classify as CL-ML, use dual symbol GC-GM, or SC-SM.

<sup>H</sup> If fines are organic, add "with organic fines" to group name.

<sup>I</sup> If soil contains  $\geq 15\%$  gravel, add "with gravel" to group name.

<sup>J</sup> If Atterberg limits plot in shaded area, soil is a CL-ML, silty clay.

<sup>K</sup> If soil contains 15 to 29% plus No. 200, add "with sand" or "with gravel," whichever is predominant.

<sup>L</sup> If soil contains  $\geq 30\%$  plus No. 200 predominantly sand, add "sandy" to group name.

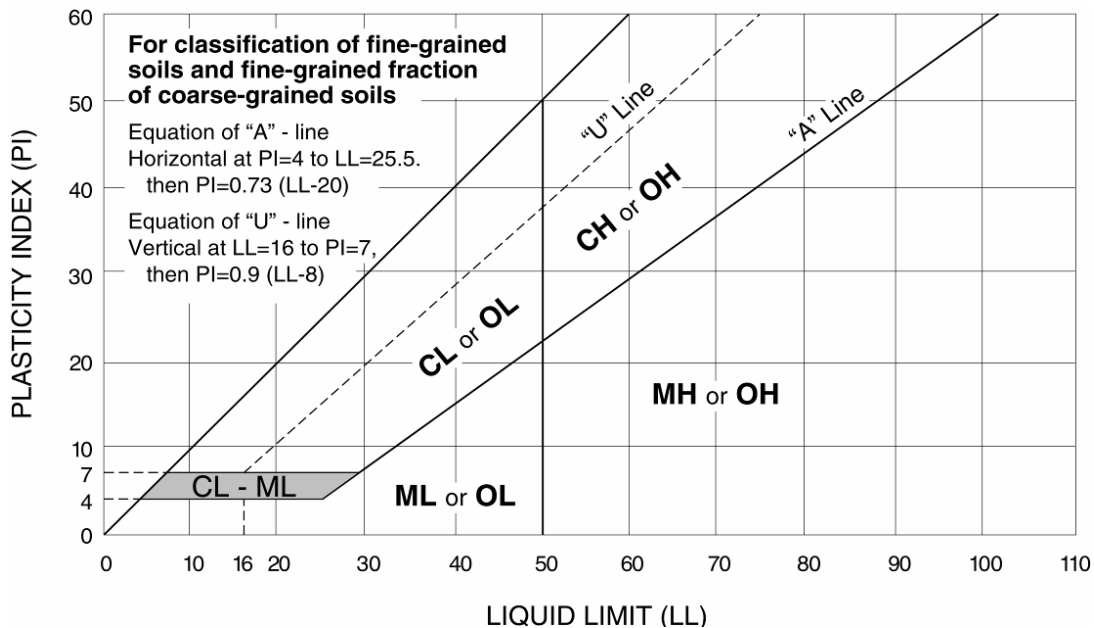
<sup>M</sup> If soil contains  $\geq 30\%$  plus No. 200, predominantly gravel, add "gravelly" to group name.

<sup>N</sup>  $PI \geq 4$  and plots on or above "A" line.

<sup>O</sup>  $PI < 4$  or plots below "A" line.

<sup>P</sup>  $PI$  plots on or above "A" line.

<sup>Q</sup>  $PI$  plots below "A" line.



**SECTION 02110 - SITE CLEARING**

PART 1 - GENERAL

1.01 SCOPE OF WORK:

Site clearing work includes, but is not limited to:

Removal of trees and other vegetation.  
Topsoil stripping.  
Clearing and grubbing.  
Removing above grade improvements.  
Removing below grade improvements.

1.02 RELATED SECTIONS:

Section 02200 - Earthwork

1.03 JOB CONDITIONS:

A. Traffic:

Conduct site clearing operations to ensure minimum interference with roads, streets, walks, and other adjacent occupied or used facilities. Do not close or obstruct streets, walks, or other occupied or used facilities without permission from authorities having jurisdiction.

B. Protection of Existing Improvements:

Provide protection necessary to prevent damage to existing improvements indicated to remain in place.

Protect bench marks and existing work from damage or displacement.

Protect improvements on adjoining properties and on Owner's property.

Restore damaged improvements to original condition as acceptable to parties having jurisdiction.

C. Regulatory Requirements:

Conform to applicable local code for disposal of debris.

1.04 EROSION CONTROL:

Whether otherwise shown on the plans or not, provide adequate protection to eliminate contamination of streams, canals, lakes, reservoirs and other impoundments by oil, fuels, bitumen, calcium chloride or other harmful materials. Take positive steps to minimize erosion and resultant siltation.

Where air pollution is a factor water the haul roads and construction areas to help reduce the dust.

Where soil or other materials from the work area have been allowed, for whatever reason, to enter public lands, roads or streams, the Contractor shall remove the materials and repair any damage to the public facility.

Permanent erosion control features shall be installed as early as possible. Do not expose large areas of erodible earth at any one time and make every effort to protect against such erosion.

## PART 2 - PRODUCTS

### 2.01 MATERIALS:

#### A. Topsoil:

Sandy clay surface soil found in depth of not less than 6". Satisfactory topsoil is reasonably free of subsoil, clay lumps, stones, and other objects over 2" in diameter, and without weeds, roots, and other objectionable material.

## PART 3 - EXECUTION

### 3.01 SITE CLEARING:

Remove trees, shrubs, grass, other vegetation, improvements, or obstructions interfering with installation of new construction.

Remove items elsewhere on site or premises as specifically indicated. Removal includes digging out stumps and roots.

Strip topsoil to whatever depths encountered to prevent intermingling with underlying subsoil or other objectionable material. Remove heavy growths of grass from areas before stripping.

Stockpile topsoil in storage piles in areas shown or where directed. Construct storage piles to freely drain surface water. Cover storage piles if required to prevent windblown dust.

Dispose of unsuitable or excess topsoil same as specified for waste material.



3.02 Clearing and Grubbing:

The trees selected by the Project Engineer for saving shall be protected from construction equipment by the Contractor in a manner approved by the Project Engineer and meeting the criteria for such protection as required by the applicable governmental agency.

Clear site of trees, shrubs, and other vegetation.

Completely remove stumps, roots, and other debris protruding through ground surface.

Fill depressions caused by clearing and grubbing operations with satisfactory soil material, unless further excavation or earthwork is indicated.

Place fill material in horizontal layers not exceeding 6" loose depth, and thoroughly compact to density equal to adjacent original ground, unless otherwise shown on the plans.

3.03 Removal of Improvements: Remove existing above grade and below grade improvements necessary to permit construction and other work.

Remove abandoned underground piping or conduit interfering with construction.

3.04 DISPOSAL OF WASTE MATERIALS:

Removal from Owner's Property: Remove waste materials and unsuitable and excess topsoil from Owner's property and dispose of off-site in legal manner.

END OF SECTION

**SECTION 02200 - EARTHWORK**

PART 1 - GENERAL

1.01 SCOPE OF WORK:

Provide all labor, tools, materials, equipment and supervision necessary for excavation and site grading as specified herein.

1.02 RELATED WORK:

Section 02110 – Site Clearing

1.03 STANDARDS:

Comply with state and local environmental standards and as specified herein.

1.04 EARTHWORK:

Borrow material to be used for fill shall be tested for radon level. The contractor shall collect three samples of material at the borrow pit and submit them to a certified laboratory for testing. Radon levels shall not exceed 2pCi/g. The contractor shall submit certifications to the architect showing that the borrow material meets this criteria before bringing any material to the project site.

PART 2 - PRODUCTS

NOT USED

PART 3 - EXECUTION

3.01 EXCAVATION:

Excavation shall conform to the limits indicated on the plans or specified herein. This work shall include shaping and sloping and other work necessary in bringing the excavation to the required grade, alignment and cross section.

All suitable materials removed by the excavation shall be used as far as practicable in the formation of the embankments, subgrades, shoulders, and other places as directed. No excavated material shall be wasted without permission, and where necessary to waste such material, it shall be disposed of as directed by the Owner. Waste excavated material shall be considered property of the Owner and disposed of as directed by the Owner.

3.02 AREA EXCAVATION:

The area of excavation shall be as indicated on the construction plans.

3.03 FILLING AND COMPACTING:

Replace excavated material as necessary. Place fill in layers and compact to a minimum density at optimum moisture as required.

3.04 EMBANKMENT:

Embankments shall be constructed of material containing no muck, stumps, roots, brush, vegetable matter, rubbish or other material that will not compact into a stable finished grade surface.

Embankments shall be formed of suitable material placed in layers of not more than 8 inches in depth measured loose and rolled and/or vibrated with suitable equipment until compacted. Each layer shall be uniformly compacted, using equipment that will achieve the required density. As compaction operations progress, each layer shall be shaped and manipulated as necessary to assure density throughout the embankment or backfill. Moisture content shall be such that the specified density can be reached and, if necessary, water shall be added or the material manipulated to assist drying. Thickness of layers may be increased provided the equipment and methods used are proven by field density testing to be capable of compacting thicker layers to specified densities. Layer thickness shall be decreased if equipment and methods used are proven to be incapable of compacting layers to specified densities.

Embankment on building sites, shall be compacted to a density of not less than 100 percent of its maximum density as determined by AASHTO T 99, Method C.

The bottoms of the drainage retention areas shall not be compacted so as to not reduce the soil infiltration capacity.

Final earthwork elevations shall be within 0.2 feet of the proposed elevations.

3.05 MAINTENANCE AND PROTECTION OF WORK:

The Contractor shall maintain all earthwork construction throughout the life of the contract, unless otherwise provided, and shall take all reasonable precautions to prevent loss of material from the site due to the action of wind or water. He shall repair at his expense, except as otherwise provided herein, any slides, washouts, settlement, subsidence, or other mishap which may occur prior to final acceptance of work.

3.06 FINAL DRESSING:

Before final acceptance, the Contractor shall dress all earthwork to the planned line, grade and cross section. Ditches shall be shaped so that no water is impounded, unless otherwise shown on the plans. Earthwork shall be shaped to match adjacent grades, structures, etc.

### 3.07 SUBGRADE STABILIZATION

Methods of Subgrade Stabilization: Subgrade shall be stabilized by either: (i) addition of approved materials to the existing subgrade, or (ii) manipulating materials already in existence in the subgrade to achieve the desired results. It is the intent of this Specification that the subgrade be uniform, compact, capable of carrying reasonable loads, meet the required density and the required bearing value specified in the plans and/or these Specifications.

Mixing and Compacting: Additive materials shall be spread uniformly over the entire surface to be stabilized using a mechanical spreader, for a length that will provide sufficient distance to promote uniform mixing. A spreading tolerance of three inches (3) in excess of plan width will be tolerated on each side.

Mixing shall be done, with rotary tillers, or other equipment meeting the Engineer's approval, for the full depth shown in the plans, and for the full width of the stabilizing limits.

The Contractor may, if he so elects, mix the materials in a plant of an approved type in lieu of the spreading and mixing operation described above.

Where the subgrade is of rock, the Engineer shall determine whether or not it is necessary to undercut and stabilize the subgrade and, if he determines the rock subgrade is extensive enough in nature to waive the requirement for subgrade stabilization, he shall so notify the Contractor in writing.

At the completion of the mixing any particles within the limits of the stabilizing area not passing a three and one half inch (3 1/2") sieve shall be removed or broken down.

After mixing has been completed and requirements for bearing value, uniformity and particle size have been satisfied, the stabilized area shall be compacted to at least 96 percent of its maximum density as determined by AASHTO T180. If the moisture content of the material is improper for attaining the specified density, either water shall be added or the material permitted to dry to the proper moisture.

Spreading, mixing and compacting shall be done as one lift unless otherwise specified in the plans.

After stabilizing and compacting operations have been completed the subgrade shall be firm and substantially unyielding, to the extent it will support construction equipment, and will have the bearing value required by the plans. All soft and unyielding material and any other portions of the

subgrade which will not compact readily shall be removed and replaced with suitable material and the whole subgrade brought to line and grade, with proper allowance for subsequent compaction.

Maintenance of Completed Subgrade: The Contractor shall be wholly responsible for maintaining the completed subgrade free from ruts, depressions, damage from hauling or handling of materials, tools and equipment. Such responsibility shall include any repairs, replacements, etc. of curbs, curb and gutter, sidewalks or other structures which might become necessary in order to recompact the subgrade in the event of underwash or other damage occurring to the previously compacted subgrade. The subgrade shall be restored to an acceptable condition prior to placement of base.

Tolerances in Bearing Value Requirements: The following under-tolerances from the specified bearing value will be allowed as based on tests performed on samples obtained after mixing operations have been complete:

SPECIFIED LIMEROCK BEARING RATION	MAXIMUM PERMITTED UNDER TOLERANCE
LBR 40	5.0
LBR 35	4.0
LBR 30 or Under	2.5

Local Materials:

Local materials used for stabilizing may be high bearing value soils or sand-clay materials. The portion of the material passing the 40 mesh sieve shall have a liquid limit not greater than 30 and a plasticity index not greater than ten (10). Local materials, may, if so approved by the Engineer, be blended to achieve the above requirements but, if so blended shall be tested and approved before spreading on the roadway.

Commercial Materials:

Commercial materials used for stabilization may consist of commercial limerock, lime-rock overburden or crushed shell. For limerock and limerock overburden the percentage of carbonates of calcium and magnesium shall be at least 70, and the plasticity index shall not exceed ten (10). The gradation of limerock and limerock overburden shall be such that 97 percent of the material will pass a one inch (1") sieve.

Crushed shell for this use shall be mollusk shell (oyster, mussels, clams, cemented coquina, etc.). Steamed shell shall not be permitted. At least 97 percent by weight of the crushed shell shall pass the three and one-half inch (3 1/2") sieve and at least 50 percent by weight of the total material shall be retained in the No. 4 sieve. In addition, no more than 15 percent by weight of the total material shall pass the No. 200 sieve when washed over the sieve. In the event the shell meets the above criteria without crushing, the crushing will not be required.

NEW SOCCER FIELDS AT BARBER PARK  
ORANGE COUNTY, FLORIDA

SECTION 02200  
EARTHWORK

END OF SECTION

## **SECTION 02220 - EXCAVATING, BACKFILLING, AND COMPACTING**

### PART 1 - GENERAL

#### 1.01 DESCRIPTION

A. Scope of Work: The work included under this Section consists of excavating, backfilling and compacting as required for the construction of the utility system consisting of piping and appurtenances as shown on the Drawings and specified herein.

B. Definitions:

1. Maximum Density: Maximum weight in pounds per cubic foot of a specific material.
2. Optimum Moisture: Percentage of water in a specific material at maximum density.
3. Rock Excavation: Excavation of any hard natural substance which requires the use of explosives and/or special impact tools such as jack hammers, sledges, chisels or similar devices specifically designed for use in cutting or breaking rock, but exclusive of trench excavating machinery.
4. Suitable: Suitable materials for fills shall be a noncohesive, nonplastic granular local sand and shall be free from vegetation, organic material, marl, silt or muck. The Contractor shall furnish all additional fill material required.
5. Unsuitable: Unsuitable materials are highly organic soil (Peat or muck) classified as A-8 in accordance with AASHTO Designation M 145.

C. Plan For Earthwork: The Contractor shall be responsible for having determined to his satisfaction, prior to the submission of his bid, the conformation of the ground, the character and quality of the substrata, the types and quantities of materials to be encountered, the nature of the groundwater conditions, the prosecution of the work, the general and local conditions and all other matters which can in any way affect the work under this Contract. Prior to commencing the excavation, the Contractor shall submit a plan of his proposed operations to the Engineer for review. The Contractor shall consider, and his plan for excavation shall reflect, the equipment and methods to be employed in the excavation. The prices established in the Proposal for the work to be done will reflect all costs pertaining to the work.

#### 1.02 QUALITY ASSURANCE

A. A testing laboratory employed by the Owner will make such tests as are deemed advisable. The Contractor shall schedule his work so as to permit a reasonable time for

testing before placing succeeding lifts and shall keep the laboratory informed of his progress. Costs for all testing shall be paid by the Owner. However, any and all tests which have to be repeated because of the failure of the tested material to meet specification shall be paid for by the Contractor and the cost of any tests shall be deducted from payments due the Contractor.

B. Standards:

1. OSHA 29 CFR Subpart P - Excavations and Trenches a) 1926.650, 1926.651, 1926.652.
2. OSHA 29 CFR Subpart J - a) 1910.146 for Confined Space Entry.

1.03 JOB CONDITIONS

A. Test borings made on the site and the surface exploration data are available upon request and are for the Contractor's information only.

B. If, in the opinion of the Engineer, conditions encountered during construction warrant a change in the footing elevation, or in the depth of removal of unsuitable material from that indicated on the Drawings, an adjustment will be made in the contract price, as provided in the Schedule of cost for Changes in Quantities.

1.04 PROTECTION

A. Sheeting and Bracing:

1. Furnish, put in place, and maintain such sheeting and bracing as may be required to support the sides of excavations, to prevent any movement which could in any way diminish the width of the excavation below that necessary for proper construction, and to protect adjacent structures, power poles, etc. from undermining, and to protect workers from hazardous conditions or other damage. Such support shall consist of braced steel sheet piling, braced wood lagging and soldier beams or other approved methods. If the Engineer/RPR is of the opinion that at any points sufficient or proper supports have not been provided, he may order additional supports put in at the expense of the Contractor, and compliance with such order shall not relieve or release the Contractor from his responsibility for the sufficiency of such supports. Care shall be taken to prevent voids outside of the sheeting, but if voids are formed, they shall be immediately filled and compacted. Where soil cannot be properly compacted to fill a void, lean concrete shall be used as backfill at no additional expense to the Owner.

2. The Contractor shall construct the sheeting outside the neat lines of the foundation unless indicated otherwise to the extent he deems it desirable for his method of operation. Sheeting shall be plumb and securely braced and tied in position. Sheeting and bracing shall be adequate to withstand all pressure to which the structure or trench



will be subjected. Any movement or bulging which may occur shall be corrected by the Contractor at his own expense so as to provide the necessary clearances and dimensions.

3. Where sheeting and bracing is required to support the sides of excavations for structures, the Contractor shall engage a Professional Geotechnical Engineer, registered in the State of Florida, to design the sheeting and bracing. The sheeting and bracing installed shall be in conformity with the design, and certification of this shall be provided by the Professional Engineer.

4. The installation of sheeting, particularly by driving or vibrating, may cause distress to existing structures. The Contractor shall evaluate the potential for such distress and, if necessary, take all precautions to prevent distress of existing structures because of sheeting installation.

5. The Contractor shall leave in place to be embedded in the backfill all sheeting and bracing not shown on the Drawings but which the Owner may direct him in writing to leave in place at any time during the progress of the work for the purpose of preventing injury to structures, utilities, or property, whether public or private. The Engineer/R.P.R. may direct that timber used for sheeting and bracing be cut off at any specified elevation.

6. All sheeting and bracing not left in place shall be carefully removed in such manner as not to endanger the construction or other structures, utilities, or property. All voids left or caused by withdrawal of sheeting shall be immediately refilled with sand by ramming with tools especially adapted to that purpose, or otherwise as may be directed by the Engineer/R.P.R.

7. The right of the Engineer/R.P.R. to order sheeting and bracing left in place shall not be construed as creating any obligation on his part to issue such orders, and his failure to exercise his right to do so shall not relieve the Contractor from liability for damages to persons or property occurring from or upon the work occasioned by negligence or otherwise, growing out of a failure on the part of the Contractor to leave in place sufficient sheeting and bracing to prevent any caving or moving of the ground.

8. No wood sheeting is to be withdrawn if driven below mid-diameter of any pipe, and under no circumstances shall any wood sheeting be cut off at a level lower than 1 foot above the top of any pipe.

B. Groundwater Observation Wells:

1. Prior to excavation, the Contractor shall install groundwater observation wells at locations to be approved by the Engineer adjacent to structures under construction for the purpose of measuring water levels during excavation. The observation well shall consist of a screen, casing and cap of approved size and material of construction. The observation well shall be placed in a 2-1/2-inch bore hole which shall be carried to an

elevation at least 2 feet below final bottom grade of structure. The annular space surrounding the intake point and the riser pipe shall be sealed in such a way as to prevent infiltration from surface water. The observation well shall be developed in such a manner as to insure proper indication of subsurface water levels adjacent to the well.

2. The Contractor shall be responsible for maintaining the observation wells and for observing and recording the elevation of groundwater in them until adjacent structure is completed and backfilled. Each observation well shall be observed and recorded daily. Measurements shall be supplied daily to the R.P.R. and Engineer. The Engineer may require that the observation wells reflect true groundwater levels by adding water to the well recording the drop in level from the time the water was added. A plugged observation well shall be redeveloped as necessary to indicate true groundwater levels.
3. Observation well shall be abandoned when directed by the Engineer/R.P.R. and in a manner acceptable to the Engineer.

C. Pumping and Drainage:

1. The Contractor shall at all times during construction provide and maintain proper equipment and facilities to remove all water entering excavations, and shall keep such excavations dry so as to obtain a satisfactory undisturbed subgrade foundation condition until the fills, structures or pipes to be built thereon have been completed to such extent that they will not be floated or otherwise damaged by allowing water levels to return to natural levels as stipulated in Section 02140. The Contractor shall engage a Professional Geotechnical Engineer registered in the State of Florida, to design the dewatering systems for all structures. The Contractor shall submit to the Engineer for review a plan for dewatering systems prior to commencing work. The dewatering system installed shall be in conformity with the overall construction plan, and certification of this shall be provided by the Professional Engineer. The Professional Engineer shall be required to monitor the performance of the dewatering systems during the progress of the work and require such modifications as may be required to assure that the systems are performing satisfactorily.
2. Dewatering shall at all times be conducted in such a manner as to preserve the undisturbed bearing capacity of the subgrade soils at proposed bottom of excavation and to preserve the integrity of adjacent structures. Well or sump installations shall be constructed with proper sand filters to prevent drawing of finer grained soil from the surrounding ground.
3. Water entering the excavation from surface runoff shall be collected in shallow ditches around the perimeter of the excavation, drained to sumps, and pumped from the excavation to maintain a bottom free from standing water.
4. The Contractor shall take all additional precautions to prevent uplift of any structure during construction.

5. The conveying of water in open ditches or trenches will not be allowed. Permission to use any storm sewers, or drains, for water disposal purposes shall be obtained from the authority having jurisdiction. Any requirements and costs for such use shall be the responsibility of the Contractor. However, the Contractor shall not cause flooding by overloading or blocking up the flow in the drainage facilities, and he shall leave the facilities unrestricted and as clean as originally found. Any damage to facilities shall be repaired or restored as directed by the Engineer or the authority having jurisdiction, at no cost to the Owner.

6. Flootation shall be prevented by the Contractor by maintaining a positive and continuous operation of the dewatering system. The Contractor shall be fully responsible and liable for all damages which may result from failure of this system.

7. Removal of dewatering equipment shall be accomplished after the system is no longer required; the material and equipment constituting the system, shall be removed by the Contractor.

8. The Contractor shall take all necessary precautions to preclude the accidental discharge of fuel, oil, etc. in order to prevent adverse effects on groundwater quality.

## PART 2 - PRODUCTS

### 2.01 MATERIALS

#### A. General:

1. All fill material shall be subject to the approval of the Engineer.
2. All fill material shall be free of organic material, trash, or other objectionable material. Excess or unsuitable material shall be removed from the job site by the Contractor.

B. Common Fill Material: Common fill shall be sand and shall not contain stones, rock, concrete or other rubble larger than two (2) inches in diameter. It shall have physical properties which allow it to be easily spread and compacted.

C. Structural Fill: Structural fill shall be reasonably well graded sand to gravelly sand having the following gradation:

<u>U.S. Sieve Size</u>	<u>Percent Passing By Weight</u>
1 - in.	100
No. 4	75-100
No. 40	15-80
No. 100	0-30

No. 200

0-12

D. Class 1 Soils\*: Manufactured angular, granular material, 1/4 to 1 1/2 inches (6 to 4 mm) size, including materials having significance such as crushed stone or rock, broken coral, crushed slag, cinders, or crushed shells. Sieve analysis for crushed stone is given below separately.

Crushed Stone: Crushed stone shall consist of clean mineral aggregate free from clay, loam or organic matter, conforming with ASTM C33 stone size No. 89 and with particle size limits as follows:

<u>U.S. Sieve Size</u>	<u>Percent Passing By Weight</u>
1/2	100
3/8	90-100
No. 4	20-55
No. 8	5-30
No. 16	0-10
No. 50	0- 5

E. Class II Soils\*\*:

1. GW: Well-graded gravels and gravel-sand mixtures, little or no fines. Fifty (50) percent or more retained on No. 4 sieve. More than 95 percent retained on No. 200 sieve. Clean.
2. GP: Poorly graded gravels and gravel-sand mixtures, little or no fines. Fifty (50) percent or more retained on No. 4 sieve. More than 95 percent retained on No. 200 sieve. Clean.
3. SW: Well-graded sands and gravelly sands, little or no fines. More than fifty (50) percent passes No. 4 sieve. More than 95 percent retained on No. 200 sieve. Clean.
4. SP: Poorly graded sands and gravelly sands, little or no fines. More than fifty (50) percent passes No. 4 sieve. More than 95 percent retained on No. 200 sieve. Clean.

\* Soils defined as Class I materials are not defined in ASTM D2487.

\*\* In accordance with ASTM D2487, less than 5 percent pass No. 200 sieve.

F. Coarse Sand: Sand shall consist of clean mineral aggregate with particle size limits as follows:

<u>U.S. Sieve Size</u>	<u>Percent Passing By Weight</u>
3/8 inch	100
No. 10	85-100
No. 40	20-40
No. 200	0-12

G. Other Material: All other material, not specifically described, but required for proper completion of the work shall be selected by the Contractor and approved by the Engineer.

### PART 3 - EXECUTION

#### 3.01 PREPARATION

A. Clearing:

1. The construction areas shall be cleared of all obstructions and vegetation including large roots and undergrowth, within 10 feet of the lines of the excavation.
2. Strip and stockpile topsoil on the site at the location to be determined by the Owner.

#### 3.02 EXCAVATION

A. General: Excavations for roadways, structures and utilities must be carefully executed in order to avoid interruption of utility service.

B. Excavating for Roadways/Structures/Utilities:

1. Excavation shall be made to such dimensions as will give suitable room for building the foundations and the structures, for bracing and supporting, for pumping and draining, and for all other work required.
  - a. Excavation for precast or prefabricated structures shall be carried to an elevation 2 feet lower than the proposed outside bottom of the structure to provide space for the select backfill material. Prior to placing the select backfill, the excavation shall be measured by the Engineer to indicate to the satisfaction of the Owner that the excavation has been carried to the proper depth and is reasonably uniform over the area to be occupied by the structure.

- b. Excavation for structures constructed or cast in place in dewatered excavations shall be carried down to the bottom of the structure where dewatering methods are such that a dry excavation bottom is exposed and the naturally occurring material at this elevation leveled and left ready to receive construction. Material disturbed below the founding elevation in dewatered excavations shall be replaced with Class B concrete.
- c. Footings: Cast-in-place concrete footing sides shall be formed immediately after excavation. Forming for footing sides is specified elsewhere.
2. Immediately document the location, elevation, size, material type and function of all new subsurface installations, and utilities encountered during the course of construction.
3. Excavation equipment operators and other concerned parties shall be familiar with subsurface obstructions as shown on the Drawings and should anticipate the encounter of unknown obstructions during the course of the work.
4. Encounters with subsurface obstructions shall be hand excavated.
5. Excavation and dewatering shall be accomplished by methods which preserve the undisturbed state of subgrade soils. Subgrade soils which become soft, loose, "quick" or otherwise unsatisfactory for support of structures as a result of inadequate dewatering or other construction methods, shall be removed and replaced by crushed stone as required by the Engineer/R.P.R. at the Contractor's expense.
6. The bottom of excavations shall be rendered firm and dry before placing any structure. Excavated material not suitable for backfill shall be removed from the site and disposed of by the Contractor.
7. All pavements shall be cut prior to removal, with saws or approved power tools.
8. Excavated material shall be stockpiled in such a manner as to prevent nuisance conditions. Surface drainage shall not be hindered.
9. All locations and elevations as required herein must be permanently documented by the Contractor, on the Record Drawings prior to the Engineer's approval of the Application for Payment for that work.
10. When force main pipe is less than 10 feet from a water main, the depth of cover shall be increased to 5 feet or 18 inches below the water main, whichever is greater.

### 3.03 DRAINAGE

- A. The Contractor shall at all times during construction provide and maintain proper equipment and facilities to remove promptly and dispose of properly all water entering

excavations, and keep such excavations dry so as to obtain a satisfactory undisturbed subgrade foundation condition. The dewatering method used shall prevent disturbance of earth below grade.

B. All water pumped or drained from the work shall be disposed of in a suitable manner without undue interference with other work, without damage to surrounding property, and in accordance with pertinent rules and regulations.

C. No construction, including pipe laying, shall be allowed in water. No water shall be allowed to contact masonry or concrete within 24 hours after being placed. The Contractor shall constantly guard against damage due to water and take full responsibility for all damage resulting from his failure to do so.

D. The Contractor will be required at his expense to excavate below grade and refill with crushed stone (gradation 57 or 89) or other approved fill material if the Engineer determines that adequate dewatering has not been provided.

### 3.04 UNDERCUT

A. If the bottom of any excavation is below that shown on the Drawings or specified because of Contractor error, convenience, or unsuitable subgrade due the Contractor's excavation methods, he shall refill to normal grade with fill at his own cost. Fill material and compaction method shall be as directed by the Engineer.

### 3.05 FILL AND COMPACTION

A. Compact and backfill excavations and construct embankment according to the following schedule. (Proctor standard shall be ASTM D-698):

#### STRUCTURES AND ROADWORK

<u>Area</u>	<u>Material</u>	<u>Compaction</u>
Beneath Structures	Structural Fill	12" lifts, compacted to 95% maximum density as determined by AASHTO T-180. Fill should not be placed over any in-place soils until those deposits have been compacted to 95% Modified Proctor.
Around structures	Structural Fill	8" lifts, 95% of maximum density as determined by AASHTO T-180. Use light rubber-tired or vibratory plate compactors.
Beneath Paved Surfaces	Common Fill	12" lifts, 98% by maximum density as determined by AASHTO T-180 or as required by the FDOT Standards.
Open Areas	Common Fill	12" lifts, 95% by maximum density as determined by AASHTO T-180.

B. Pipe shall be laid in open trenches unless otherwise indicated on the Drawings or elsewhere in the Contract Documents.

C. Excavations shall be backfilled to the original grade or as indicated on the Drawings. Deviation from this grade because of settling shall be corrected. Backfill operation shall be performed to comply with all rules and regulation and in such a manner that it does not create a nuisance or safety hazard.

D. Embankments shall be constructed true to lines, grades and cross sections shown on the plans or ordered by the Owner. Embankments shall be placed in successive layers of not more than 8 inches in thickness, loose measure, for the full width of the embankment. As far as practicable, traffic over the work during the construction phase shall be distributed so as to cover the maximum surface area of each layer.

E. If the Contractor requests approval to backfill material utilizing lifts and/or methods other than those specified herein, such request shall be in writing to the Owner. Approval will be considered only after the Contractor has performed tests, at the Contractor's expense, to identify the material used and density achieved throughout the backfill area utilizing the method of backfill requested. The Owner's approval will be in writing.

END OF SECTION



**SECTION 02221 - TRENCHING, BACKFILLING AND COMPACTING**

PART I - GENERAL

1.01 SCOPE OF WORK

A. Furnish all labor, materials, equipment and incidentals necessary to perform all trenching, removal of unsuitable or unsatisfactory material, backfilling and compaction for utilities required to complete the work shown on the Drawings and specified herein. The work shall include, but not necessarily be limited to, all trenching; all backfilling; compaction, disposal of waste and surplus materials; and all related work such as sheeting, bracing and dewatering.

B. The Contractor shall examine the site and review the available data prior to submitting his proposal, taking into consideration all conditions that may affect his work. The Owner and Engineer will not assume responsibility for variations of subsurface conditions.

C. The Contractor shall be solely responsible for the means, methods, techniques, sequences and procedures of construction, for safety precautions and programs incident to the work and regulations, ordinances, codes and orders applicable to the furnishing and performance of the work.

RELATED DOCUMENTS

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

1.03 APPLICABLE PUBLICATIONS:

A. The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by the basic designation only.

B. American Association of State Highway and Transportation Officials (AASHTO) Standards:

M145-82 The Classification of Soils and Soil Aggregate Mixtures for Highway Construction Purposes.

T180-74 Moisture-Density Relations of Soils Using a 10-lb. (4.54 kg) Rammer and an 18-inch (457 mm) Drop. (Modified Proctor Test).

T 191-61 Density of Soil In-Place by the Sand-Cone Method.  
(R 1982)

C. Florida Department of Transportation; "Standard Specifications for Road and Bridge Construction", (FDOT) 1996 edition.

ASTM D2487: "Unified Classification System."

1.04 DEFINITIONS:

A. Common Fill: Common fill shall consist of any material classified as SW, SW-SM, SW-SC, SP, SP-SM, or SP-SC under Unified Classification System (ASTM D2487) which does not contain stones larger than 2 inches in any dimension and which has no more than 12 percent of its material by weight passing the No. 200 sieve.

B. Unsatisfactory Materials: Unsatisfactory materials shall be materials that do not comply with the requirements for common fill. Unsatisfactory materials include, but are not limited to, those materials containing roots and other organic matter, trash, debris, and stones larger than 2 inches, and materials classified in AASHTO M145 as groups A-2-4, A-2-5, A-2-6, A-2-7, A-4, A-5, A-6, A-7, A-7-5 and A-7-6. Unsatisfactory materials also include man-made fills, refuse, or backfills from previous construction.

C. Unyielding Material: Unyielding material shall consist of rock and gravelly soils with stones greater than 2 inches in any dimension, or maximum size stones as defined by the pipe manufacturer, whichever is smaller.

D. Unstable material shall consist of material without the sufficient bearing capacity to support the utility pipe conduit or appurtenance structure.

E. Select Common Fill: Select common fill shall meet the requirements for common fill specified above with the exception that select common fill shall not have more than 5 percent of its material by weight passing the No. 200 sieve. Also, the maximum allowable aggregate size for select common fill shall be 1 inch, or the maximum size recommended by the pipe manufacturer, whichever is smaller.

F. Degree of compaction: Degree of compaction shall be expressed as a percentage of the maximum density obtained by the test procedure presented in AASHTO T180. Field verification will be obtained by the test procedure presented in AASHTO T191. The term "maximum density" shall mean the maximum density determined under AASHTO T180.

G. Bedding Rock: Coarse aggregate structural bedding and support for utilities appurtenances and structures equal to FDOT Number 57, or as required by pipe manufacturer's recommendations for water mains.

1.05 PROTECTION

A. Prior to commencing trenching or dewatering, the Contractor shall take precautions to ensure that existing structures, which may be subject to settlement or distress resulting from trenching or dewatering are protected. Such precautions shall include establishing reference elevation markings on structures which are adjacent to new work and monitoring them to

ascertain evidence of settlement or distress throughout construction. If settlement or distress becomes evident, modifications to the trenching, dewatering or protection procedures shall be made to prevent additional settlement or distress and any damage caused to the structure shall be repaired at the Contractor's expense.

B. The Contractor shall furnish, put in place, and maintain such sheeting and bracing as may be required to support the sides of trenches, to prevent any movement which could in any way diminish the width of the trench below that necessary for proper construction, and to protect adjacent structures and other facilities from undermining or other damage. The stability of all excavated faces shall be maintained in compliance with the Occupational Safety and Health Administration's excavation safety standards, 29 C.F.R. S. 1926.650 Subpart P until final acceptance of the work. The Contractor shall also comply with all applicable requirements of the Florida "Trench Safety Act" (90-96, Laws of Florida), and all other applicable rules and regulations.

C. The Contractor shall, at all times during construction, provide and maintain proper equipment and facilities to remove all water entering trenches, and shall keep such trenches dry so as to obtain a satisfactory undisturbed subgrade foundation condition until the utilities to be built thereon have been completed to such extent that they will not be floated or otherwise damaged by allowing water levels to return to natural levels. Dewatering shall be conducted in such a manner as to preserve the undisturbed bearing capacity and composition of the subgrade soils at the proposed bottom of the trench. Grading shall be done as may be necessary to prevent surface water from flowing into the trench, and any water accumulating therein shall be removed so that the stability of the bottom and sides of the excavations is maintained.

#### 1.06 SUBMITTALS

A. Submit to the Owner for review, the proposed methods of construction, including dewatering, excavation, bedding, filling, compaction, and backfilling for the various portions of the work. Review shall be for informational purposes only. The Contractor shall remain responsible for the adequacy and safety of the methods.

#### 1.07 SOIL TESTING

The Owner will employ the services of a testing laboratory to perform all soils testing.

B. The Owner shall have sole authority over the frequency of testing and shall direct the testing laboratory in its work. The Owner may order the excavation down to any depth of backfilled material which has not been tested and have a test performed. The Contractor shall excavate for the test and backfill after the test at no additional cost to the Owner. The Contractor shall re-excavate to the depth required and re-compact any areas found to be improperly backfilled.

### PART 2 - PRODUCTS

2.01 MATERIALS

A. Only common fill or select common fill, as defined above, may be used as backfill unless otherwise directed by the Owner.

PART 3 - EXECUTION

3.01 TRENCHING

A. The trench shall be excavated as recommended by the manufacturer of the pipe to be installed and as shown on Drawings. Trench walls below the top of the pipe shall be vertical to the extent possible to 1 foot above the proposed top of pipe. From 1 foot above the top of the pipe, trench walls shall be sloped 1:1 vertical to horizontal ratio. The maximum width of trench in the vertical pipe zone shall not exceed the pipe outside diameter plus a 9 inch allowance on each side of the pipe.

B. The bottoms of trenches shall be accurately graded to provide uniform bearing and support for the bottom half of each section of the pipe. Bell holes shall be excavated to the necessary size at each joint or coupling to eliminate point bearing. The trench bottom shall be free from unyielding material. Where unyielding material is encountered in the bottom of the trench, such material shall be removed 4 inches below the required grade and replaced with select common fill compacted to minimum 95% AASHTO T-180.

C. Where unstable material is encountered in the bottom of the trench, such material shall be removed to the depth directed and replaced to the proper grade with select common fill or bedding rock as directed by the Owner.

D. Unless otherwise specified or indicated on the Contract drawings, pipe trenches shall be of a depth to provide a minimum cover of three (3) feet from the existing ground surface, or from the indicated finished grade, whichever is lower, to the top of the pipe. The pipe shall be buried a minimum of three (3) feet from the top of the pipe to the existing grade or three (3) feet below the proposed adjoining road surface grade, whichever results in the greatest depth.

3.02 DEMUCKING

A. The Contractor shall remove all muck in all areas where it is encountered. The muck shall be excavated to the depth required for complete removal, and disposed of at an approved dump site in accordance with all applicable rules and regulations. The Contractor shall notify the Owner if muck is encountered on the site.

3.03 MISCELLANEOUS EXCAVATION

A. The Contractor shall perform all the remaining miscellaneous excavation. The Contractor shall make all excavations necessary to permit the completion of the work as shown on the Drawings and specified herein.

### 3.04 BACKFILLING

A. Backfill material shall consist of common fill or select common fill as defined herein and as shown on the drawings. Backfill shall be placed in layers not exceeding 6 inches loose thickness for compaction by hand operated machine compactors, and 12 inches loose thickness for other than hand-operated machines, unless otherwise specified. Each layer shall be compacted to at least 95 percent of the maximum dry density as determined by AASHTO T180 for cohesionless soils unless otherwise specified. The bottoms of all excavations shall be compacted to at least 95 percent of the maximum density prior to backfill.

B. Trench Backfilling: For trenches, unyielding material removed from the bottom of the trench and unsuitable or unstable material removed from the trench shall be replaced with select common fill as specified. Replacement materials and backfill materials shall be select common fill and shall be placed in layers not exceeding 6 inches loose thickness from the bottom of the trench to 12 inches above the top of pipe. Backfill materials from 12 inches above the pipe to finished grade in unpaved areas and finished subgrade in paved areas shall be common fill placed in layers not exceeding 12 inches loose thickness. In unpaved areas, each layer of replacement material, or backfill material, shall be compacted to at least 95 percent of maximum density. In paved areas, each layer of replacement material, or backfill material, shall be compacted to at least 98 percent of maximum density. The bottoms of all trenches shall be in an undisturbed condition or, if disturbed, shall be compacted to at least 95 percent of maximum density to a depth of at least 1-foot below the trench bottom. Specified densities shall be as determined by AASHTO T180.

C. Moisture Control: Where subgrade or layer of soil material must be moisture conditioned before compaction, uniformly apply water to surface or subgrade, or layer of soil material. Prevent free water from appearing on surface during or subsequent to compaction operations.

Remove and replace, or scarify and air-dry, soil material that is too wet to permit compaction to specified density.

2. Soil material that has been removed because it is too wet to permit compaction, but is otherwise satisfactory, may be stockpiled or spread and allowed to dry until moisture is reduced to a satisfactory value.

### 3.05 SURPLUS MATERIAL

A. Excavated material or borrow fill to be used in construction shall be neatly piled so as to inconvenience, as little as possible, the public and adjoining property owners until used or otherwise disposed of. Suitable excavated material may be used for fill, trench backfill or backfill on the different parts of the work as required. Surplus fill shall become the property of the Contractor, and shall be removed and disposed of by him off the site.

B. The Contractor shall remove and dispose of all pieces of rock (ledge) and boulders which are not suitable for use in other parts of the work. Rock disposed of by hauling away to spoil areas is to be replaced by approved surplus excavation obtained elsewhere in the work insofar as it is available. Any deficiency in the backfill material shall be made up with satisfactory material provided by the Contractor at no additional cost to the Owner. Rock may be used in embankment fill only with approval of the Owner.

C. The right is reserved to make minor adjustments or revisions in lines or grade, if found necessary, as the work progresses, due to discrepancies on the Drawings or in order to obtain satisfactory construction of utilities.

END OF SECTION

## **SECTION 02222 - EXCAVATING, BACKFILLING AND COMPACTING FOR UTILITIES**

### **PART 1 - GENERAL**

#### **1.01 SCOPE OF WORK:**

This section includes excavation, bedding, and backfilling for utilities necessary to perform all work necessary to prepare for laying the piping or main, including clearing, digging the trench, preparing the pipe bed, compacting, and preparing the surface restoration, and disposal of surplus material.

Maintain in operating condition existing utilities, active utilities, and drainage systems encountered in utility installation. Repair any surface or subsurface improvements shown on Drawings.

Verify location, size, elevation, and other pertinent data required to make connections to existing utilities and drainage systems as indicated on Drawings. Comply with permits and regulations according to General Conditions.

#### **1.02 SUBMITTALS:**

Shop Drawings or details pertaining to excavation and backfill are not required unless use of materials, methods, equipment, or procedures contrary to Drawings or these specifications are proposed. Do not perform work until required shop drawings have been accepted by Owner and Engineer.

#### **1.03 JOB CONDITIONS:**

Set all lines, elevations, and grades for utility system work and control system for duration of work, including careful maintenance of bench marks, property corners, monuments, or other reference points.

#### **1.04 TRENCH SAFETY:**

Care shall be taken to strictly observe all applicable, State, local and Federal standards with respect to the safety of persons during excavation and backfill. The contractor shall recognize OSHA excavation safety standards, agree to abide by them, and identify the costs to comply. The bidder, therefore, acknowledges that the total bid price includes costs for complying the Florida Trench Safety Act (90-96, Laws of Florida), effective October 1, 1990.

#### **1.05 JACK AND BORE, DIRECT BORE CONSTRUCTION (IF APPLICABLE):**

Jack and bore, direct bore construction shall be conducted in accordance with the Florida Department of Transportation Utilities Accommodation Guide.

1.06 TESTING:

Testing shall be conducted in accordance with AASHTO T-180, modified proctor density test. Tests shall be conducted on all trench backfill within 10 feet of pavement or proposed pavement areas and under all existing paved areas.

Frequency tests shall be conducted at each public roadway crossing and at no less than 300-foot intervals along the pipeline or on each pipeline run between manholes, inlets or junction boxes in accordance with these specifications. There shall be at least one test per layer placed.

Test report results shall be furnished to the Owner and Engineer.

PART 2 - PRODUCTS

2.01 MATERIALS:

A. Bedding Material

Processed sand and gravel free from clay lumps, organic, or other deleterious material, and complying with following gradation requirements:

U.S. Sieve Size	Passing by Weight, Percent
1 Inch	100
3/4 Inch	90-100
3/8 Inch	20- 55
No. 4	0- 10
No. 8	0- 5

PART 3 - EXECUTION

3.01 EXCAVATION, TRENCHING, AND BACKFILLING:

Performing excavation as indicated or specified depths. During excavation, pile materials suitable for backfilling in orderly manner far enough from bank of trench to avoid overloading, slides, or cave-ins.

Remove excavated materials not required or not suitable for backfill or embankments and waste as specified.



Prevent surface water from flowing into trenches or other excavations by temporary grading or other methods, as required. Remove accumulated water in trenches or other excavations by pumping or other acceptable methods.

Open cut excavation with trenching machine or backhoe. Where machines other than ladder or wheel-type trenching machines are used, do not use clods for backfill. Dispose of unsuitable material and provide other suitable material at no additional cost to Owner.

### 3.02 TRENCH EXCAVATION:

Dig trench at proper width and depth for laying pipe, conduit, or cable. Cut trench banks as nearly vertical as practical and remove stones as necessary to avoid point-bearing. Over excavate wet or unstable soil, if encountered, from trench bottom as necessary to provide suitable base for continuous and uniform bedding. The amount of trench to be open at any one time shall be limited at the discretion of the Engineer to minimize public inconvenience and/or damage to life or property. Not more than 1,000' feet of trench shall be opened ahead of pipe laying operations, unless greater length of trench is approved by the Engineer.

All existing utilities such as pipes, poles and structures shall be carefully supported and protected from injury, and in case of damage, they shall be restored at no cost to the Owner.

Any pipes, conduits, wires, mains footings, or other underground structures encountered in trenching operations shall be carefully protected from injury or displacement. Any damage thereto shall be fully, promptly and properly repaired by the Contractor to the satisfaction of the Engineer and the Owner thereof.

Failure of the plans to show the exact location, nature or extent of any sub-surface obstruction shall not be the basis of a claim for extra work.

All trench excavation side walls greater than 5 feet in depth shall be sloped, shored, sheated, braced or otherwise supported by means of the sufficient strength to protect the workmen within them in accordance with the applicable rules and regulations established for construction by the Department of Labor, Occupational Safety and Health Administration (OSHA), and by local ordinances. Lateral travel distance to and exit ladder or steps shall not be greater than 25 feet in trenches 4 feet or deeper.

Accurately grade trench bottom to provide uniform bearing and support for each section of pipe on undisturbed soil or bedding material at every point along entire length, except where necessary to excavate for bell holes, proper sealing of pipe joints, or other required connections. Dig bell holes and depressions for joints after trench bottom has been graded. Dig no deeper, longer, or wider than needed to make joint connection properly.

The minimum width of the trench shall be equal to the outside diameter of the pipe at the bell plus six (6) inches on each side of the pipe. All other trench width requirements for pipe,

conduit, or cable shall be least practical width that will allow for proper compaction of trench backfill.

### 3.03 SHEETING AND BRACING:

Provide sheeting and bracing, when necessary, in trenches and other excavations where protection of workmen required. Sheeting may be removed after excavation has been backfilled sufficiently to protect against damaging or injurious caving.

### 3.04 PIPE BEDDING:

Accurately cut trenches for pipe or conduit that is installed to designated elevations and grades to line and grade 4" below bottom of pipe and to width as specified. Place 4" of bedding material, compact in bottom of trench, and accurately shape to conform to lower portion of pipe barrel. After pipe installation, place select backfill and compact in maximum 6" layers, measured loose, to at least 1'0" above top of pipe.

### 3.05 TRENCH BACKFILLING:

#### A. Criteria

Do not backfill trenches until required tests are performed, utility systems, as installed, comply with specified requirements, and are accepted by applicable governing authority. Backfill trenches as specified. If improperly backfilled, reopen to depth required to obtain proper compaction. Backfill and compact, as specified, to properly correct condition in an acceptable manner.

#### B. Backfilling

After pipe or conduit has been installed, bedded, and tested as specified, backfill trench or structure excavation with specified material placed in lifts or layers not exceeding 8" of loose material. Compact to minimum density of 95% of optimum density in accordance with ASTM D 698 or AASHTO T-99.

#### C. Compaction

Exercise proper caution when compacting immediately over top of pipes or conduits. Water jetting or flooding is not permitted as method of compaction.

#### D. Compaction Testing

Independent testing laboratory shall perform test at intervals not exceeding 300 feet of trench for each 12" of compacted trench backfill and furnish copies of test results as specified.

### 3.06 RESTORATION OF SURFACE:

The top surface of the trench fill shall be restored to the original or planned condition. Paved sections shall conform in grade to the adjacent area. Restoration shall be completed as promptly as practicable and shall not be prolonged until the end of the construction period.

### 3.07 DEWATERING:

If dewatering activity is required, unless specifically authorized by the Engineer, all pipe shall be laid "in the dry". The Contractor shall minimize the length of excavation in advance of pipe laying so as to minimize the amount of trench dewatering required. The Contractor shall dewater before trench excavation, utilizing one or more of the following approved methods: well point system, trench gravity underdrain system, or sumps with pumps.

Well point systems must be efficient enough to lower the water level in advance of the excavation and maintain it continuously in order that the trench bottom and sides shall remain firm and reasonably dry. The well points shall be designed especially for this type of service, and the pumping unit used shall be capable of maintaining of high vacuum, and at the same time, of handling large volumes of air as well as water.

If the material encountered at trench grade is suitable for the passage of water without destroying the sides or bottom of the main trench, sumps may be provided at intervals to the side of the main excavation, and pumps may be used to lower the water level by taking their suction from these sumps. In the event such pumps are employed, care shall be exercised to prevent the movement of pipe foundation material and to this end a bed of crushed stone may be required.

The Contractor shall be responsible for disposing of all water resulting from trench dewatering operations, and shall dispose of the water without damage or undue inconvenience to the work, the surrounding area, or the general public. He shall not dam, divert, or cause water to flow in excess in existing gutters, pavements, or other structures.

END OF SECTION

## **SECTION 02400 - SITE DRAINAGE**

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

#### **1.01 SCOPE OF WORK:**

Installation and furnishing of all materials, equipment, and accessories to be used in the construction of the storm sewer and site drainage system.

#### **1.02 STORM DRAINAGE STRUCTURES:**

Pipe  
Inlets, Manholes and Junction Boxes  
Concrete Curb  
Sidewalk

#### **1.03 RELATED WORK:**

Section 02222: Excavation, Backfilling, And Compacting For Utilities.

#### **1.04 JOB CONDITIONS:**

Set lines, elevations, and grades for drainage system work and control system for duration of work, including careful maintenance of bench marks, property corners, monuments, or other reference points.

### **PART-2 - PRODUCTS**

#### **2.01 PIPE USED SHALL MEET THE FOLLOWING SPECIFICATIONS::**

Round Concrete Pipe or HDPE Pipe (over 12" in dia.) ASTM C76-70

PVC pipe (12" in diameter or less) ASTM D 3034

#### **2.02 INLETS, MANHOLES AND JUNCTION BOXES:**

Inlets, manholes and junction boxes shall be constructed of precast concrete or cast-in - place concrete. A maximum of 12 inches of brick risers may be used for precast units. If cast in place is used, no allowance for riser changes will be allowed with brick.

Concrete shall be Class I, as specified by the Florida Department of Transportation Standard Specifications for Road and Bridge Construction Latest Edition.

Mortar for brick masonry shall be of one (1) part portland cement to three (3) parts sand. Hydrated lime in an amount not to exceed ten percent (10%) of the amount of cement used may, at the Contractor's option, be added to the mortar. Masonry cement, delivered in packages properly identified with the brand name of the manufacturer and showing the net weight as well as whether it is Type 1 or Type 2, may be used in lieu of mixed mortar, provided it has not been in storage for more than six (6) months.

Grating and frames fabricated from structural steel shall be galvanized in accordance with the requirements of ASTM A123.

Forms may be of wood or metal construction, shall be constructed true to line and grade and shall be approved by the Engineer before being filled with concrete.

The Contractor may substitute precast inlets, manholes and junction boxes in lieu of cast-in-place units. Such precast units shall be in accordance with ASTM C478 or with Florida Department of Transportation Standards.

### PART-3 - EXCAVATION

#### 3.01 INLETS AND MANHOLES:

Excavation shall be in accordance with Section 02222 of these Specifications.

If the Contractor elects to construct units of cast-in-place concrete, the concrete shall be placed in the approved forms to the depths shown on the plans and thoroughly vibrated. After the concrete has hardened sufficiently, it shall be covered with suitable material and kept moist for not less than three days.

Reinforcing steel for cast-in-place construction shall be in place, securely tied and properly spaced prior to placement of the concrete.

After the concrete or mortar has cured, the frame of the casting shall be set in a full mortar bed composed of one part portland cement to two parts fine aggregate. Inlet and outlet pipes shall be of the same size and kind as the connection pipe. They shall extend through the walls for a distance beyond the outside surface sufficient for the intended connections and the concrete constructed around them so as to prevent leakage along their outer surface. The inlet and outlet pipe ends shall be flush with the inside face of the wall.

Inlets, manholes and junction boxes shall be backfilled completely by use of mechanical tampers and in six-inch (6") compacted layers.

#### 3.02 PIPES AND PIPE CULVERTS:

Trenches for pipe culverts, storm sewers, sanitary sewers, water lines and other conductors shall be excavated to the required depth and to a width sufficient to provide adequate working room. For pipe lines placed above the natural ground line, the embankment shall be placed and compacted to an elevation of at least two feet (2') above the top of pipe and at least four (4) pipe diameters each side of the pipe before excavating the pipe trench. It is the express intent of this specification that all pipes will be placed in trenches.

For all pipe culverts, storm sewers and sanitary sewers of 24 inches or more inside diameter the pipe bedding shall be shaped to conform to the outside of the pipe, for a depth of not less than ten percent (10%) of its total outside height and recesses provided to receive the bell. For pipes of less than 24 inches inside diameter, the trench bottom may be either flat or shaped to fit the pipe, except that the recesses for bells are required in any event. The pipe barrel shall be fully supported by the trench bottom.

Where rock, boulders or other hard, lumpy or unyielding materials are encountered in the trench bottom, they shall be removed to a depth at least twelve inches (12") below the bottom of pipe and the resultant excavation backfilled. Muck or other soft material considered by the Engineer to be unsuitable as foundation for the pipe shall be removed to the depth required to obtain a firm foundation and backfilled.

All pipes shall be carefully laid, true to line and grade, with hubs up-grade and the tongue end fully entered into the hub. When pipe with quadrant reinforcement, or circular pipe with elliptical reinforcement, is used the pipe shall be installed in a position such that the manufacturer's marks designating "top" and "bottom" of the pipe shall not be more than five degrees from the vertical plane through the longitudinal axis of the pipe. Any pipe which is not in true alignment or which shows any settlement after laying shall be taken up and re-laid without additional compensation.

For all round concrete pipe, other than side drain pipe, the pipe joints shall be sealed by use of round rubber gaskets. Those gaskets shall meet the requirements of Article 5.9 of ASTM C361. Pipe joints shall meet the requirements of Article 941-1.5 of the Florida Department of Transportation Standard Specifications for Road and Bridge Construction, Latest Edition. The gasket and joints shall be free of grit, dirt and other foreign matter at the time the joints are made. In order to facilitate closure of the joint, application of an approved vegetable soap lubricant immediately prior to closing the joint will be permitted. For concrete pipe used as side drain the joints shall be welded before the inside mortar is placed and before succeeding section of the pipe are laid, the lower half of the joint portion of the pipe in place shall be filled with cement mortar and the upper half of the tongue portion of the next joint wiped with cement mortar, both in sufficient thickness to bring the inner surface of the abutting pipe flush and even when the pipe is laid. After the pipe is laid, the inside of the joint shall be wiped and finished smooth and a mortar bead not less than 3/4 inches thick shall be formed completely around the outside of the joint.

For concrete pipe laid with rubber gasket joints, any deviation from true alignment or grade which would result in a displacement from the normal position of the gasket of as much as 1/4 inch, or which would produce a gap exceeding 1/2 inch between sections of pipe for more than 1/3 of the circumference of the inside of the pipe will not be acceptable and, where such occurs, the pipe shall be re-laid without additional compensation. Where minor imperfections in the manufacturing of the pipe causes a gap greater than 1/2 inch between pipe sections, the joint will be acceptable provided the gap does not extend more than 1/3 the circumference of the inside of the pipe. No mortar, joint compound, or other filler which would tend to restrict the flexibility of the gasket joint will be applied to the gap.

Corrugated steel pipe shall be field jointed with locking bands as specified by AASHTO M36-70. The joints shall be gasketed with a rubber or neoprene gasket of a design shown to secure a soil tight or water tight joint. The gasket for annular pipe joints shall be at least seven inches wide and at least 3/8 inch thick and at least one inch thick and at least one inch (1") and five inches (5") wide for helical pipe joints. Suitable alternate joints will be considered by the Engineer if the Contractor requests such consideration. Field joints for aluminum pipe except the material used in the bands and band connectors shall be of the same alloy as the culvert sheeting and shall meet the requirements of AASHTO M196.

Immediately prior to final inspection, coated corrugated steel pipe shall be cleaned and inspected for breaks or other damage to the coating or to the pipe itself and any repairs necessary shall be made by the Contractor. Grade required shall be cut down or extended and made to conform to the required grade.

PVC pipe laying shall proceed up grade with spigot ends pointing in the direction of flow. Before pipe is joined, gaskets shall be cleared of all dirt and stones and other foreign material. The spigot ends of the pipe shall be lubricated lightly with a lubricant specified by the pipe manufacturer and approved by the project engineer. Sufficient pressure shall be applied to the pipe so as to properly seat the socket in the bell of the pipe. All pipes shall be laid straight, true to the lines and grades shown on the plan.

Where manholes are to be raised, the adjustment may be made, if the Contractor so chooses, by the use of adjustable extension rings of the type which do not require the removal of the existing manhole frame. The extension device shall provide positive locking action and shall permit adjustment in height as well as diameter. The particular type of device used shall meet the approval of the Engineer.

### 3.03 CONCRETE CURB & SIDEWALK:

#### A. Concrete Curb

All concrete curb shall be constructed in accordance with the Florida Department of Transportation Standard Specifications of Road and Bridge Construction,

Section 520.

B. Concrete Sidewalk

This work shall consist of constructing cement concrete sidewalks in accordance with these specifications and within reasonable close conformity to the lines, grades and dimensions shown on the drawings established by the Engineer. Materials for sidewalk construction shall be 2500 psi, concrete and Class I (DOT) steel wire fabric AASHTO Designation M-55. The foundation for the bed shall be formed a depth of 4 inches below and parallel with the finished surface of the sidewalks, unless otherwise indicated on the drawings or specified. Unsuitable material shall be removed and replaced with approved material, and the foundation shall be thoroughly compacted and finished to a firm, even surface. Edge dimensions shall conform to the plan details, with one #5 continuous bar on each side.

Forms shall be of wood or metal, straight, free from warp, and of sufficient strength when staked to resist the pressure of the concrete without springing. If wood, they shall be nominal 2-inch planks surfaced on the inside and the top; or if of metal, they shall be of approved section. Forms shall have a depth equal to the depth of the concrete and shall be thoroughly cleaned and oiled before concrete is placed against them. Forms that are worn, bent, or damaged shall not be used.

Sidewalks shall be constructed in separate slabs 15 feet in length except for closures. These slabs shall be separated by transverse premolded expansion joint filler, if an inch in thickness, for the full depth of the concrete. Transverse premolded expansion joint filler shall also be placed adjacent to existing structures where directed. The slabs between expansion joints shall be divided into blocks 5 feet in length, by scoring transversely. Where the slabs are more than 5 feet in width they shall be scored longitudinally in the center. Transverse and longitudinal scoring shall extend for a depth of at least the thickness of the concrete slab.

Premolded expansion joint filler, of an inch in thickness for the full depth of the concrete, shall be placed longitudinally where the sidewalk slab is to be constructed in contact with curbs.

Where existing light standards, poles, fire hydrants, and similar structures are within the limits of the sidewalk area, the concrete around such structures shall be scored in a block 8 inches wider than the maximum dimension of the structure at the sidewalk elevation. Prior to placing the concrete around such structures, premolded expansion joint filler, of an inch in thickness, shall be placed around the structure for the full depth of the concrete in the sidewalk.

The concrete shall be placed in the forms and tamped and spaded to prevent



honeycomb and until the tip of the structure can be floated smooth and the edges rounded to the radius shown in the plans. A light broom finish shall be applied once the concrete has set enough to be permanently marked.

Side forms shall not be removed within 12 hours after the concrete has been placed. After removal of the forms, minor honeycombed areas shall be filled with mortar composed of 1 part of cement and 2 parts of fine aggregate. Major honeycombed areas will be considered as defective work, and shall be removed and replaced at no expense to the Owner.

All expansion joints, and scoring cracks where required, shall be sealed with joint sealing material having ASTM designation D1190.

After the concrete has cured for a period of not less than 72 hours, the spaces adjacent to the sidewalk shall be backfilled with approved material in layers of not more than 4 inches in depth, which shall be thoroughly compacted mechanically to the required elevation and cross-section.

END OF SECTION

**SECTION 02500 - ROADWAY BASE COURSE**

PART 1 - GENERAL

1.01 SCOPE OF WORK:

Furnish and install roadway and parking area base course in accordance with the contract drawings and specifications.

REFERENCED PUBLICATIONS:

A. Florida Department of Transportation "standard specifications for road and bridge construction" latest edition, hereafter referred to as FDOT Standard Specifications.

RELATED SECTIONS:

Section 02200 – Earthwork

Section 02511 – Asphaltic Concrete Paving

PART 2 - PRODUCTS

2.01 Base course material shall be in accordance with FDOT Standard Specifications, Section 200, Limerock Base or Section 204, Graded Aggregate Base.

A. Limerock may be of either Miami or Ocala formation and shall meet the following requirements:

- 1) Minimum percentage of carbonates of calcium and magnesium in the limerock material shall be seventy (70) percent.
- 2) Maximum percentage of water sensitive clay material shall be three (3) percent by weight.
- 3) Maximum Liquid Limit shall not exceed thirty-five (35).
- 4) Plastic Index shall not exceed ten (10).
- 5) At least ninety-seven (97) percent of the material, by weight, shall pass a three and one half (3 1/2) inch sieve and the material shall be graded uniformly down to dust. All crushing or breaking-up, which is necessary to meet this requirement, shall be done before the material is placed on the roadbed.
- 6) Material shall not contain cherty or other extremely hard pieces, or lumps, balls or pockets of sand or clay size materials in sufficient quantity as to be detrimental to the proper bonding, finishing or strength of the limerock base.

2.02 PRIME COAT:

A. Materials

Unless otherwise called for on the plans or in Special Provisions, material used in the prime coat shall be Cut-Back Asphalt, Grade RC-70 or RC-250 or Emulsified Asphalt, Grade RS-2. Cutback Asphalt shall meet the requirements of AASHTO M81 except that the penetration range shall be 60-120 instead of 80-120. Emulsified Asphalt shall meet the requirements of AASHTO M140 (for anionic) and M208 (for cationic). The viscosity requirements for Grade RS-2 shall not apply. Other types and grades of bituminous material may be allowed if it can be shown that the alternate material will properly perform the function of prime coat material.

Cover material shall consist of a sand bituminous hot- mix containing from two (2) to four (4) percent Asphalt Cement, viscosity Grade AC-20 and fine aggregate consisting of a clean sand or screenings. Sand shall contain no more than ten (10) percent material by weight, passing the No.200 sieve. Screenings shall not contain any material retained on a three eighth (3/8) inch sieve and not more than ten (10) percent, by weight, passing the No.200 sieve.

PART 3 - EXECUTION

3.01 Equipment

Limerock shall be spread by mechanical rock spreaders equipped with a device to strike the rock off uniformly to laying thickness and capable of producing an even distribution of the rock. In areas where the use of a mechanical spreader is impractical, and with the approval of the Architect, limerock may be spread by means of a dozer or grader blade.

Hauling, Spreading And Compacting: As much as possible, rock shall be hauled over rock previously placed. Hauling over the subgrade is permitted, provided that any soft spots that develop in the subgrade as a result of that hauling shall be immediately repaired to the satisfaction of the Architect.

When the specified compacted thickness of the base is six (6) inches or less, the base shall be constructed in one (1) layer. For bases of greater than six (6) inch thickness, the base shall be constructed in two (2) or more layers, with the final layer approximately one-half (1/2) the total thickness, but in no case less than four (4) inches. Before compaction effort starts, all segregated areas of fine or coarse rock shall be removed and replaced with properly graded rock.

After the limerock has been spread, it shall be brought to the proper moisture content by wetting or drying. When water is added, it shall be uniformly mixed-in by disking to the full depth of the course which is being compacted. Wetting or drying operations shall be across the full width and the full depth of the course being compacted.

The limerock base for roadways shall be compacted to a density of not less than ninety-five (95) percent of the maximum density as determined by AASHTO T180. Limerock base for shoulder

paving or under sidewalks or driveways shall be compacted to a density of not less than ninety-five (95) percent of the maximum density as determined by AASHTO T180.

Density tests shall be made on each day's final compaction operation on each course. The frequency of those tests shall be as specified herein. All bladeing, manipulation or other operations shall be complete prior to performing the tests.

If, at any time, subgrade material should become mixed with the base material, the contaminated base material shall be removed and replaced with suitable material. If the subgrade has been affected to the degree its integrity is questionable, then that subgrade shall be replaced as well.

### 3.02 FINISHING BASE:

Limerock base shall be finished to true line, grade and cross-section. As soon as the finishing operation is complete the finished surface shall be checked with a template cut to the required cross-section and with a fifteen (15) foot straightedge laid parallel to the road. The straightedge shall be placed in alternating overlaps to assure complete coverage. Any straightedge shall be placed in alternating overlaps to assure complete coverage. Any irregularities greater than three eighths (3/8) inch shall be corrected by scarifying and removing or adding rock as needed after which the area shall be re-compacted and re-tested.

Thickness of base shall be measured at the intervals as specified herein. Base which is deficient by more than five (5) percent of its planned thickness shall be corrected by scarifying, adding rock, reshaping and recompacting for a distance of one hundred (100) feet each side of the edge of the deficient area. As an exception to this requirement, where only one area is deficient and that area is less than twenty (20) feet long, or less than one (1) percent of the total day's base work, whichever is smaller, then the Architect may waive the requirement for reconstructing the area providing the deficiency is less than ten (10) percent of the planned thickness.

### 3.03 APPLICATION OF PRIME COAT:

Before any bituminous material is applied, all loose material, dust, caked clay, dirt and other foreign material which might prevent proper bond with the existing surface shall be removed for the full width of the application.

Bituminous material shall be applied by pressure distributor equipped with pneumatic tires having a sufficient width of rubber in contact with the road surface to avoid breaking the bond or forming a rut in the surface. The outside nozzle at each end of the spray bar shall have an opening of not less than twenty-five (25) percent nor more than seventy-five (75) percent in excess of the interior nozzles. All other nozzles shall have uniform

openings and shall be spaced so as to provide an even distribution of the bituminous material on the surface.

The surface to be primed shall be lightly sprinkled with water and rolled with a traffic roller immediately before applying the bituminous material.

The moisture content of the base material shall not exceed ninety (90) percent of the optimum moisture of the material at the time the prime material is applied. The bituminous material shall be applied by a pressure distributor at a temperature between 100 degrees F. and 150 degrees F., that will insure even distribution.

The rate of application shall be not less than 0.10 gallon per square yard. Sand-bituminous hot-mix shall be applied at the rate of ten (10) pounds of mix per square yard.

The entire surface, after covering, shall be rolled with a traffic roller to obtain a reasonable dense mat.

### 3.03 FIELD QUALITY CONTROL:

An Independent Testing Laboratory approved by the Owner and paid by the contractor, shall be retained to perform construction testing on site except as may be amended in the supplemental conditions.

Fill Placed in Areas to be Paved: At least one compaction test of every 2,000 sq. ft. of each eight (8) lift or layer.

If compaction requirements are not complied with at any time during construction process, remove and recompact deficient areas until proper compaction is obtained at no additional expense to Owner.

The following tests shall be performed on each type of material used as compacted fill as part of construction testing requirements:

Moisture and Density Relationship: ASTM D 698.

Mechanical Analysis: AASHTO T-88.

Plasticity Index: ASTM D 424.

Field density tests for in-place materials shall be performed according to one of the following standards as part of construction testing requirements.

Sand-Cone Method: ASTM D 1556.

Nuclear Method: ASTM D 2922.

Base course construction testing shall be performed as follows:

Base Material Thickness: Perform one test for each 8,000 sq. ft. in-place base course.

Base Course Compaction: Perform one test for each 2,000 sq. ft. of in-place course.

Test each source of material for base course in accordance with applicable state highway specifications.

Owner, Engineer and Contractor shall be provided with copies of reports within twenty-four (24) hours of time test was performed.

In event that any test performed fails to meet these Specifications, Owner and Contractor shall be notified immediately by Independent Testing Laboratory.

Owner reserves right to employ Independent Testing Laboratory and to direct any testing that is deemed by Owner to be necessary. Contractor shall provide free access to site of testing activities.

END OF SECTION

**SECTION 02511 - ASPHALTIC CONCRETE PAVING**

PART 1 - GENERAL

1.01 SCOPE OF WORK:

Furnish and install asphaltic concrete paving, including prime and tack coat in accordance with the contact drawings and specifications.

1.02 REFERENCED PUBLICATIONS:

A. "Standard Specifications for Road and Bridge Construction," Florida Department of Transportation (latest edition), hereafter referred to as "FDOT Standard Specifications"

1.03 RELATED SECTIONS:

Section 02500 – Roadway Base Course

1.04 SUBMITTALS

A. Design Mix:

Before any asphalt surface is constructed, the Contractor shall submit actual design mix for asphalt to the Project Manager for acceptance.

B. Material Certificates:

Furnish copies of materials certificates signed by material producer and Contractor certifying that each material item complies with, or exceeds, specified requirements.

1.04 JOB CONDITIONS

A. Weather Limitations:

Apply prime and tack coats when ambient temperature is above 50 percent, and when temperature has not been below thirty-five (35) degrees for twelve (12) hours immediately prior to application. Do not apply when base is wet or contains excess moisture.

Construct asphalt concrete surface course when atmospheric temperature is above forty (40) degrees and when base is dry. Base course may be placed when air temperature is above thirty (30) degrees and rising.

B. Grade control:

Establish and maintain required lines and elevations.

## PART 2 - PRODUCTS

### 2.01 ASPHALTIC CONCRETE

This section specifies the material, the compositions, and the job mix formula for Type S asphaltic concrete pavements as specified in Section 331 of the Standard Specifications. The requirements for plant and equipment for these pavements are specified in Section 320 of the FDOT Standard Specifications. The Contractor shall submit a job mix formula as required by FDOT Standard Specification, Section 331.4.3, prior to the start of production.

### 2.02 PRIME AND TACK COAT

Governing specifications for materials shall be as per FDOT Standard Specifications, Section 300, Prime and Tack Coats for Base Courses.

## PART 3 - EXECUTION

### 3.01 PREPARATION

Remove loose material from compacted base surface to check for unstable areas and areas requiring additional compaction. Do not begin paving work until deficient base areas have been corrected and are ready to receive paving.

### 3.02 PRIME COAT

Apply bituminous prime coat to base surfaces where asphaltic concrete paving will be constructed.

Apply bituminous prime coat in accordance with FDOT Standard Specification, Section 300-6.

Apply at minimum rate of 0.20 to 0.50 gal./sq. yd. over compacted base. Apply material to penetrate and seal, but not flood, surface.

Cure and dry as long as necessary to attain penetration and evaporation of volatile.

### 3.03 TACK COAT

Apply to contact surfaces of previously constructed asphalt or portland cement concrete and surfaces abutting or projecting into asphalt concrete and surfaces abutting or projecting into asphalt concrete pavement.



Apply tack coat to full depth asphalt and sand asphalt base. Apply emulsified asphalt tack coat between each lift or layer of full depth asphalt and sand asphalt bases and on surface of such bases where asphaltic concrete paving will be constructed.

Apply emulsified asphalt tack coat in accordance with FDOT Standard Specification Section 300-7.

Distribute at rate of 0.05 to 0.15 gal./sq.yd. of surface.

Allow tack coat to dry until at proper condition to receive paving.

### 3.04 PLACING MIX

Place asphalt concrete mixture on prepared surface, spread, and strike off. Spread mixture at following minimum temperatures:

When ambient temperature is between forty (40) degrees F and fifty (50) degrees F: Two hundred eight-five (285) degrees F.

When ambient temperature is between fifty (50) degrees and sixty (60) degrees F: Two hundred eighty (280) degrees F.

When ambient temperature is higher than sixty (60) degrees F. Two hundred seventy-five (275) degrees F.

Place inaccessible and small areas by hand. Please each course to required grade, cross-section, and compacted thickness.

### 3.05 PAVER PLACING

Place in strips not less than 10'-0" wide, unless otherwise acceptable to Owner. After first strip has been placed and rolled, place succeeding strips and extend rolling to overlap previous strips. Complete base course for section before placing surface course.

### 3.06 JOINTS

Make joints between old and new pavements, or between successive days work, to ensure continuous bond between adjoining work. Construct joints to have same texture, density, and smoothness as other sections of asphalt concrete course. Clean contact surfaces and apply tack coat.

### 3.07 ROLLING

Begin rolling when mixture will bear roller weight without excessive displacement.

Compact mixture with hot hand tampers or vibrating plate compactors in areas inaccessible to rollers.

### 3.08 BREAKDOWN ROLLING

Accomplish breakdown or initial rolling immediately following rolling of joints and outside edge. Check surface after breakdown rolling, and repair displaced areas by loosening and filling, if required, with hot material.

### 3.09 SECOND ROLLING

Follow breakdown rolling as soon as possible, while mixture is hot. Continue second rolling until mixture has been thoroughly compacted.

### 3.10 FINISH ROLLING

Perform finish rolling while mixture is still warm enough for removal of roller marks. Continue rolling until roller marks are eliminated and course has attained maximum density.

### 3.11 PATCHING

Remove and replace paving areas mixed with foreign materials and defective areas. Cut out such areas and fill with fresh, hot asphalt concrete. Compact by rolling to maximum surface density and smoothness.

### 3.12 PROTECTION

After final rolling, do not permit vehicular traffic on pavement until it has cooled and hardened.

Erect barricades to protect paving from traffic until mixture has cooled enough not to become marked.

### 3.13 FIELD QUALITY CONTROL

Independent Testing Laboratory, selected and paid by Contractor, shall be retained to perform construction testing of in-place asphalt concrete courses for compliance with requirements for thickness and surface smoothness. Asphalt surface and base course shall be randomly cored at a rate of one core for every 20,000 square feet of paving. However, no less than three cores in light duty areas and three cores in heavy-duty areas shall be obtained. Asphalt pavement samples shall be tested for aggregate gradation and bitumen content for conformance with the mix design. The asphalt pavement shall also have Extraction and Marshall Stability tests taken on the material placed each day. Density of asphaltic concrete surface course shall be 93 percent of job mix Marshall Laboratory density.

### ACCEPTANCE OF MIXTURE

### Plant Mixture

1. Acceptance of the bituminous mixture at the plant will be based on the Contractor's testing lab results. Asphalt must meet a minimum Marshall Stability of 1500 lbs. Extraction and Gradation results shall meet the variance acceptable values provided in Table 331-6. One sample shall be tested in the morning and one in the afternoon for each day's paving.

Any load or loads of mixture, which in the opinion of the Project Manager or Owner are unacceptable due to being segregated, aggregates improperly coated, or an excessively high or low temperature, shall be rejected for use in the work. The Owner may reject the asphalt or direct the Contractor to remove the asphalt due to failure to meet any F.D.O.T. requirements.

### Field Density Requirements

Field density requirements shall conform to F.D.O.T. – Section 330-10.3.

#### 3.15 THICKNESS

In-place compacted thickness shall not be less than thickness specified on the drawings.

#### 3.16 SURFACE SMOOTHNESS

Test finish surface of each asphalt concrete course for smoothness, using 10'-0" straightedge applied parallel with, and at right angles to centerline of paved area. Surfaces will not be acceptable if exceeding following tolerances for smoothness:

Base Course Surface: 1/4"

Wearing Course Surface: 3/16"

Check surface areas at intervals necessary to eliminate ponding areas.

Repair or remove and replace unacceptable paving as directed by Owner.

Areas of deficient paving thickness shall receive a minimum 3/4" overlay until specified thickness of the course is met or exceeded.

END OF SECTION

## **SECTION 02520 - SITWORK CONCRETE**

### **PART 1 - GENERAL**

#### **1.01 DESCRIPTION**

A. Construction of concrete curb and gutter, concrete valley gutters and sidewalk, as shown on the Drawings and as herein specified.

B. Related Work Specified Elsewhere

1. Section 02221: Trenching, Backfilling and Compacting

C. Supplementary Specifications

1. All Florida Department of Transportation Standard Specifications for Road and Bridge Construction - 1991 (FDOT Standard Specs) herein referred to and/or herein amended form a part of these technical specifications.

#### **1.02 QUALITY ASSURANCE**

A. Qualifications of Installer

1. At all times during execution of this portion of the work, provide at least 1 person who is thoroughly familiar with the type of materials being installed and is directly responsible for all work performed under this section.

B. Quality Control Requirements

1. Requirements shall be as set forth in other related specifications as herein referred to.

### **PART 2 - PRODUCTS**

#### **2.01 MATERIALS**

A. Concrete

1. All work under this section shall be of Class II concrete, as set forth in FDOT Standard Specifications.

B. Steel

1. All reinforcing steel shall be Grade 60 Reinforcement, in accordance with the provisions set forth in FDOT Standard Specifications Section 415 "Reinforcing Steel".

C. Joint Materials

1. All joint materials shall be in accordance with the provisions set forth in FDOT Standard Specifications Section 932-1 "Joint Materials".

PART 3 - EXECUTION

3.01 CONSTRUCTION

A. Concrete Gutter, Curb Elements and Traffic Separator

1. Concrete curb and gutter and concrete valley gutter construction shall be in accordance with FDOT Standard Specifications 520 "Concrete Gutter, Curb Elements and Traffic Separator", except as hereinafter amended and as shown on the Drawings.

B. Concrete Sidewalks

1. Construction shall be in accordance with FDOT Standard Specifications Section 522 "Concrete Sidewalk", except as hereinafter amended and as shown on the Drawings.

END OF SECTION

**SECTION 02577 - PAVEMENT MARKINGS**

**PART-1 - GENERAL**

**1.01 SCOPE OF WORK:**

Furnish all tools, equipment, materials, machinery, appurtenances and labor, unless otherwise specified to establish all pavement markings for fire lanes, lane striping, parking, stall striping, handicapped symbols and other necessary striping for traffic control and public safety.

The Contractor shall maintain access for vehicular and pedestrian traffic as required for other construction activities.

Flagman shall be utilized, where necessary, along with barricades, warning signs, and warning lights.

**1.02 RELATED WORK**

Florida Department of Transportation Standard Specifications for road and bridge construction latest edition (referred to herein as "Standard Specifications").

**PART-2 - PRODUCTS**

**2.01 MATERIALS:**

The paint utilized for striping shall be Thermoplastic compound meeting AASHTO M 249-79 as detailed in Section 711-2 of the Standard Specifications. The paint colors shall be selected as follows:

Exterior Sidewalk Curbs:	Yellow (Per D.O.E.)
Lane Striping:	White
Handicapped Symbols:	Blue
Parking Stall Striping:	White

**PART-3 - EXECUTION**

**3.01 PREPARATION:**

Application surface shall be swept and cleaned to eliminate loose materials and dust per Section 710-6.3 of the FDOT Standard Specifications.

**3.02 APPLICATION:**

All paint shall be applied in accordance with the manufacturer's recommendations and Section 711-4 of the FDOT Standard Specifications.

Paint shall be applied with mechanical equipment to provide uniform and straight edges.

END OF SECTION

**SECTION 02900 – IRRIGATION WATER WELL**

**PART 1 GENERAL**

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

- A. This Section specifies requirements for temporary installation of the irrigation well.
- B. The irrigation well and pump shall provide 100 gallons per minute of groundwater.
- C. The construction of the irrigation well shall be performed by a State of Florida licensed water well contractor who shall comply with all standards set forth by the Florida Department of Environmental Protection, St. Johns River Water Management District, American Water Works Association and Orange County Construction Codes.
- D. The irrigation well shall be installed in the proximity to the location shown on the Plans.

**PART 2 PRODUCTS**

2.01 MATERIALS

- A. General: All casing material shall be new. Casings to be used as a part of the permanent drainage well shall be black steel. The surface casing shall be standard weight line pipe. The outer casing shall have a minimum wall thickness of 0.375 inches. The Contractor shall submit shop drawings to the Project Engineer to show compliance with the physical properties of the casings specified herein.
- B. Fabrication: The well casing sections shall be fabricated in accordance with standard practice for water well casing construction. All casing shall be made of steel conforming to the latest revision of ASTM A53, Grade B or approved equal. Shop drawings indicating compliance with these requirements shall be furnished to the Project Engineer prior to shipment of the casing to the well site.



- C. Casing Section Length: The well casing sections shall be factory-assembled in not less than 20-foot lengths and shall contain one longitudinal seam parallel to the casing axis and not more than one circumferential seam in 10 feet. Longitudinal and circumferential seams shall be butt-welded from the exterior against copper faced mandrels and shielded arc electrodes to protect the weld metal from the atmosphere while cooling and to assure full fusion with parent metal and complete penetration. The ends of each joint shall be machine beveled perpendicular to the casing axis to ensure straightness of each assembled section.
- D. Welding: Each section of steel casing shall be joined to another section by butt welding in the field by a Certified Welder to the depth specified in the Plans. Special care shall be exercised to ensure a tight seal with straight and plumb casing. If the casing should collapse or break, it shall be withdrawn and replaced at the Contractor's expense. All field welding shall be performed in accordance with American Welding Society Standards.
- E. Neat Cement Grout: Provide potable water approved by local health authorities.
- F. Neat Cement Grout: All cement used on the job shall be standard brand Portland cement conforming to the to the specification for Portland Cement ASTM Designation C 150, Type II Moderate Sulfate Resistant, except that the requirement regarding insoluble residue is waived. Up to 4 percent bentonite may be added to the cement. The grout shall contain 6 gallons of clean, potable water per bag of cement.
- G. Drilling Fluid: Drilling mud shall consist only of high grade approved drilling compounds in common usage for water well drilling. Drilling with a mixture of unprocessed mud, clay or other objectionable materials is not permitted. The drilling fluid shall possess characteristics as are required to adequately condition the walls of the borehole to prevent caving of the walls as drilling progresses.
- The Contractor shall construct a mud sump or provide other means for handling the drilling fluid. Upon completion of the drilling and grouting, mud and cuttings from the well shall be disposed of to the satisfaction of the Project Engineer and Orange County. If a mud sump is used, the Contractor shall clean all drilling mud and cuttings from the sump, backfill the sump with clean soil, and thoroughly compact and restore the ground surface to its original condition.
- H. Centralizers: Centralizers are to be installed on all casing. Centralizers shall be Stave-type steel centralizers held in place by welding. The centralizers shall be attached approximately 5 feet from the bottom of the casing, at maximum 20-foot intervals and 5 feet from the top of the casing string, at 0, 90, 180 and 270 degrees around the well casing. All centralizers shall be aligned vertically one above the other.

2.02 EQUIPMENT

- A. General: The Contractor shall furnish capable personnel and equipment to construct the irrigation well. The work shall be performed with equipment which is adequate to perform all phases of the project.

**PART 3 EXECUTION**

3.01 WELL INSTALLATION

- A. Contractor shall furnish, install by driving one 5-inch diameter steel casing to an approximate depth of 180 feet using percussion (cable tool) or dual rotary method. The casing shall be installed and grouted into rock of the Floridan aquifer and shall extend a minimum of 10 feet into rock.
- B. Drill one (1) nominal 5-inch diameter open borehole to a depth from approximately 180 feet to 500 feet.
- C. Furnish, install, and operate well development pumping and piping, equipment to complete well development.
- D. Conduct Geophysical and Video Logging (Includes Caliper, Resistivity, Gamma, Spontaneous Potential, & Video).
- E. Contractor shall construct around the irrigation well casing a 2-foot by 2-foot, 6-inch thick concrete pad, sloping from the casing to the perimeter such that water will drain away from the irrigation well. The bottom of the concrete pad should be installed 2-inches below surrounding ground level with 4-inches above the ground surface. Smooth trowel the pad surface.

3.02 GEOPHYSICAL AND VIDEO LOGGING

- A. Geophysical and video logging is required to document the as-built condition of the well. Any log that is not usable or is inaccurate because of equipment failure, reproduction quality or individual error shall be re-logged at no additional expense to Orange County. No payment shall be made for re-mobilization because of failure of equipment, hole condition, or lack of preparation by the Contractor.
- B. Geophysical Log: The Contractor shall run the following logs in the well:
  - a. Caliper
  - b. Gamma Ray
  - c. Electric

- i. Spontaneous potential
- ii. Single point resistivity
- iii. Short normal resistivity
- iv. Long normal resistivity

The Contractor may run the logs in any order desired. All geophysical logging instruments shall be calibrated prior to the completion of the log. All logs shall be run at the rates specific by the manufacturer of the unit to obtain the maximum definition of formation characteristics.

- C. Downhole Video Logging: The Contractor is responsible for ensuring that video logging is performed under clear, turbid-free conditions throughout the full depth of the well and that the video log provides clear definition of the well casing and open borehole. The video log shall include at least one pass from the top of the well to the bottom of the well and another pass from the bottom of the well to the top of the well. The Contractor is advised that flushing the wells with clean, turbid-free water may be necessary to achieve clear conditions within the well. If the Project Engineer determines that the video log is not usable due to high turbidity, equipment failure, reproduction quality or individual error, the Contractor shall re-run the video log at no additional expense to Orange County. No payment shall be made for re-mobilization because of failure of equipment or lack of Contractor preparation.

**END OF SECTION 02900**

## **SECTION 03100 - CONCRETE FORMWORK**

### PART 1 - GENERAL

#### 1.01 DESCRIPTION

A. The work included in this Section consists of providing all labor, materials and equipment necessary for providing and installing formwork for concrete.

B. Related Work Described Elsewhere:

1. Concrete Reinforcement: Section 03200.
2. Concrete Joints and Waterstops: Section 03262.
3. Cast-in-Place Concrete: Section 03300.

C. General Design and Responsibility:

Structural design responsibility: All forms and shoring shall be designed at the Contractor's expense by a Professional Engineer registered in the State of Florida. Formwork shall be designed and erected in accordance with the requirements of ACI 301 and ACI 318 and as recommended in ACI 347 and shall comply with all applicable regulations and codes. The design shall consider any special requirements due to the use of plasticized and/or retarded set concrete. The Contractor shall be responsible for safety in its construction and removal.

#### 1.02 QUALITY ASSURANCE

A. Qualifications: Formwork shall be constructed in accordance with the specified standards, as well as all pertinent codes and regulations. Where provisions of pertinent codes conflict with the requirements of this section of these specifications, the more stringent provisions shall govern.

B. Standards: Unless otherwise indicated, all materials, workmanship and practices shall conform to the following standards:

1. American Concrete Institute (ACI):
  - a. ACI 347 - Guide for Concrete Formwork.
  - b. ACI 301 - Specifications for Structural Concrete for Buildings.
  - c. ACI 318 - Building Code Requirements for Reinforced Concrete.
2. American Plywood Association (APA):
  - a. Material grades and designations as specified.

3. Building Codes:

a. Florida Building Code

b. Local Codes and regulations.

C. Preplacement checklist. The Contractor, as part of his Quality Control Plan, shall develop and submit for approval a Preplacement Checklist form to cover the following items:

1. Reference Drawings covering the placement for all trades and disciplines.
2. Date and time scheduled for placement and the actual date and time of placement.
3. Foreman name, placement number, number of truckloads and number of cylinders.
4. Checklist items such as embeds (list each), subgrade, rebar, forms, alignment, plumbness, etc.
5. Signoff's for foreman, Contractor's Quality Control representative, each subcontractor foreman (major subs, mechanical, electrical, plumbing, etc.) and Engineer.

D. No concrete may be placed until the checklist is properly and completely signed off. Failure to comply with this provision can be grounds for rejecting the work. The checklist shall be weather protected and located with the foreman or at the foreman's station.

1.03 SUBMITTALS

A. Submit shop drawings and product data in accordance with Section 01340, showing materials of construction and details of installation for:

1. Location and sequence of the concrete placements. Indicate locations of joints and panel sizes and patterns. Show location of form ties on architectural surfaces.
2. Review of pour sequence, form system, and panel layout shall be for appearance and strength of the completed structure only. Review by the Engineer of forming plans or procedures shall not relieve the Contractor of responsibility for the strength, safety or correctness of methods used, the adequacy of equipment, or from carrying out the work in full compliance with the requirements of the Drawings and Specifications.

B. Samples:

1. The Contractor shall demonstrate to the Engineer on a designated area of the concrete substructure exterior surface that the form release agent will not adversely affect concrete surfaces to be painted, coated or otherwise furnished and will not affect the forming materials.

## PART 2 - PRODUCTS

### 2.01 MATERIALS

A. Form Lumber: Use form lumber when in contact with exposed concrete, conforming to one (1) of the following, a combination thereof, or equivalent as approved by the Engineer.

1. Lumber: Southern Pine No. 2 grade, seasoned, surfaced on four (4) sides.

2. Plywood: Shall be new and unused "Plyform", Class I or II, bearing the label of the American Plywood Association (Minimum 3/4 inch thickness).

a. All joints or gaps in forms shall be taped, gasketed, plugged, and/or caulked with an approved material so that the joint will remain watertight and will withstand placing pressures without bulging outward or creating surface patterns.

B. Form Ties: Use form ties which do not leave an open hole through the concrete and which permit neat and solid patching at every hole. Use embedded rods with integral waterstops and cones to provide a 1½ inch breakback. Wire ties and wood spreaders will not be permitted.

C. Form Release Agent:

1. Coat all forming surfaces in contact with concrete using an effective, nonstaining, non-residual, water based, bond-breaking form coating that leaves the concrete with a paintable surface unless otherwise noted. Form release agents used in potable water containment structures shall be suitable for use in contact with potable water and shall be non-toxic and free of taste or odor.

D. Chamfer Strips and Moldings: Chamfer strips shall be polyvinyl strips or approved equal, designed to be nailed in the forms to provide a 3/4 inch chamfer (unless indicated otherwise) at exposed edges of concrete members. Rectangular or trapezoidal moldings shall be placed in locations requiring sealants where specified or shown on the Drawings. Sizes of moldings shall conform to the sealants manufacturer's recommendations.

E. Metal Forms: Metal forms may be used when approved by the Engineer and shall be of an appropriate type for the class of work involved.

## PART 3 - EXECUTION

### 3.01 INSTALLATION

A. Construction of Formwork: Forms shall be sufficiently strong to withstand the pressure resulting from the placement and vibration of concrete and shall be sufficiently rigid to maintain specified tolerances. Forms shall be sufficiently tight to prevent loss of mortar, and shall be adequately braced against lateral, upward or downward movement.

B. Coating of Forms: Apply form coating to board forms prior to placing reinforcing. Keep form coatings off steel reinforcing, items to be embedded and previously placed concrete.

C. Form Erection:

1. Provide a means of holding adjacent edges and ends of panels and sections tightly together and in accurate alignment so as to prevent the formation of ridges, fins, offsets, or similar surface defects of the finished concrete. Insure that forms may be removed without injury to the surface of the finished concrete.

2. Provide a positive means of adjustment of shores and struts. Insure that all settlement is taken up during concrete placing.

3. Temporary openings shall be provided in wall forms to limit the free fall of concrete to a maximum of 6 feet unless an elephant trunk is used. Such openings shall be located to facilitate placing and consolidation and shall be spaced no more than 8 feet apart. Temporary openings shall also be provided in the bottom of wall and column forms and elsewhere as necessary to facilitate cleaning and observation immediately prior to placing.

4. Do not embed any form-tying device or part thereof other than metal in concrete.

5. Form surfaces of concrete members except where placement of the concrete against the ground is shown on the drawings. The dimensions of concrete members shown on the Drawings apply to formed surfaces, except where otherwise indicated.

D. Formwork Reuse: Reuse only forms which maintain a uniform surface texture on exposed concrete surfaces. Apply light sanding between uses to obtain such a uniform texture. All surfaces to be in contact with concrete shall be thoroughly cleaned, all damaged places repaired, all projecting nails withdrawn and all protrusions smoothed. Plug unused tie rod holes with corks, shave flush, and sandpaper on the concrete surface side. Reuse of wooden forms for other than rough finish will be permitted only if a "like new" condition of the form is maintained.

E. Metal Forms:

Metal forms shall be thoroughly cleaned and mill scale and other ferrous deposits shall be sandblasted or otherwise removed from the contact surface for all forms, except those utilized for surfaces receiving a rough finish. All forms shall have the contact surfaces coated with a release agent.

### 3.02 TOLERANCES

A. Concrete Tolerance:

1. Vertical, lateral, and level alignments and cross-sectional dimensions shall comply with ACI 117.

2. The following table indicates tolerances or allowable variations from dimensions or positions of structural concrete work:

Maximum Tolerance	(inches)
Sleeves and Inserts	+1/4 to -1/4
Projected ends of anchors	+1/4 to 0.0
Anchor bolt setting	+1/4 to -1/4
Finished concrete, all locations	+1/4 to -1/4 per in. 10-feet of length

The planes or axes from which the above tolerances are to be measured shall be as follows:

Sleeves and Inserts	Centerline of sleeve or insert
Projected Ends of Anchor	Plane perpendicular to the end of the anchor as located on the Drawings.
Anchor Bolt Setting	Centerline of anchor bolt
Finish Concrete	The concrete surface as located on the Drawings.

3. Where equipment is to be installed, comply with manufacturer's tolerances if more severe than above.

B. Form Tolerances:

1. Forms shall be surfaced, designed, and constructed in accordance with the recommendations of ACI 347 and shall meet the following additional requirements for the specified finishes.

2. Formed Surface Exposed to View: Edges of all form panels in contact with concrete shall be flush within 1/32-inch and forms for plane surfaces shall be such that the concrete will be plane within 1/16-inch in four feet. Forms shall be tight to prevent the passage of mortar, water and grout. The maximum deviation of the finish wall surface at any point shall not exceed 1/4-inch from the intended surface as shown on the Drawings. Form panels shall be arranged symmetrically and in an orderly manner to minimize the number or seams.

3. Formed surfaces not exposed to view or buried shall meet requirements of Class "C" Surface in ACI 347.

4. Formed rough surfaces including mass concrete, pipe encasement, electrical duct encasement, and other similar installations shall have no minimum requirements for surface smoothness and surface deflections. The overall dimensions of the concrete shall be plus or minus 1-inch



5. Formed concrete Surfaces to Receive Paint: Surface deflections shall be limited to 1/32-inch at any point and the variation in wall deflection shall not exceed 1/16-inch per 4 feet. The maximum deviation of the finish wall surface at any point shall not exceed 1/4-inch from the intended surface as shown on the Drawings.

C. Formed Openings: Openings shall be of sufficient size to permit final alignment of the items within it without deflection or offsets of any kind and to allow space for packing where the items pass through the wall to ensure water tightness around openings so formed. Provide openings with continuous keyways with waterstops where required, and provide a slight flare to facilitate grouting and the escape of entrained air during grouting. Provide formed openings with reinforcement as indicated and specified. Reinforcing steel shall be at least 2 inches clear from the opening.

D. Embedded Items: Set anchor bolts and other embedded items accurately and hold securely in position in the forms until the concrete is placed and set. Check all special castings, channels, or other metal parts that are to be embedded in the concrete prior to and again after concreting. Check all nailing, blocks, plugs and strips necessary for the attachment of trim, finish and similar work prior to concreting.

E. Pipes and Wall Spools Cast in Concrete:

1. Install wall spools, wall flanges and wall anchors before placing concrete. Do not weld, tie or otherwise connect the wall spools to the reinforcing steel.

2. Support pipe and fabricated fittings to be encased in concrete on concrete piers or pedestals. Carry concrete supports to firm foundations so that no settlement will be possible during construction.

### 3.03 REMOVAL OF FORMS

A. The Contractor shall be responsible for all damage resulting from removal of forms. Forms and shoring for structural slabs or beams shall remain in place in accordance with ACI 301 and ACI 347. Form removal shall conform to the requirements specified in Section 03300, Cast-in-Place Concrete.

### 3.04 INSPECTION

A. The Engineer shall be notified when the forms are complete and ready for inspection at least six hours prior to the proposed concrete placement.

B. Failure of the forms to comply with the requirements specified herein, or to produce concrete complying with requirements of these Specifications, shall be grounds for rejection of that portion of the concrete work. Rejected work shall be repaired or replaced as approved by the Engineer at not addition cost to the Owner. Such repair or replacement shall be subject to the requirements of these Specifications and approval of the Engineer.

NEW SOCCER FIELDS AT BARBER PARK  
ORANGE COUNTY, FLORIDA

SECTION 03100  
CONCRETE FORMWORK

END OF SECTION

## **SECTION 31 31 00 – SOIL TREATMENT**

### **PART 1 – GENERAL**

#### **1.1 RELATED DOCUMENTS**

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

#### **1.2 SUMMARY**

A. Section includes pre-construction soil treatment for underslab and foundation wall perimeters.

#### **1.3 SUBMITTALS**

A. Submit the following according to Division 01 requirements.

B. Product Data:

1. Chemicals and products used
2. Application instructions
3. Certification that products used comply with U.S. Environmental Protection Agency (EPA) regulations for termiticides.
4. Information that soil treatment conforms to specified requirements

C. Provide information regarding the type of equipment to be used to apply the soil treatment, size of volume mixing tank, the pump capacity in gallons per minute, and the application tools with in-line flow meter devices attached.

D. Certificate of Compliance: Submit as part of the Close Out Documents the following statement from the pest control company: “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.”

E. Submit job site log book.

F. Submit warranty.

#### **1.4 QUALITY ASSURANCE**

A. In addition to requirements of these specifications, comply with manufacturer's instructions and recommendations for preparing substrate and application.

B. Engage a professional pest control operator who is licensed according to regulations of the State of Florida.

C. Use only termiticides that bear a federal registration number of the EPA and are approved by local authorities having jurisdiction.

### 1.5 JOB CONDITIONS

A. Restrictions: Do not apply soil treatment solution until excavating, filling, and grading operations are completed, except as otherwise required in construction operations.

B. To ensure penetration, do not apply soil treatment to excessively wet soils or during inclement weather. Comply with handling and application instructions of the soil toxicant manufacturer.

### 1.6 REGULATORY REQUIREMENTS

A. Minimum requirements for application as authorized by the State of Florida to fulfill the work according to manufacturer's specifications.

### 1.7 PROJECT RECORD DOCUMENTATION

A. Log Book to be kept at job site and to include:

1. Project name
2. Company providing treatment
3. Applicator's name
4. Time of arrival and departure
5. Product name
6. Record date of all applications
7. Rate of application to all required areas of the designated site
8. All areas to be treated
9. The soil treatment trade name
10. Quantity of concentrate delivered to the site
11. Quantity used for the designated treated areas
12. The percentage of active ingredient in diluted form
13. Finished gallons of soil treatment for each application
14. Linear and square footage amount to determine total finished soil treatment used

B. Owner's representative will observe both the amount of concentrate delivered to the site and the empty units that total the amount used to the treated areas. The Owner's representative shall sign the logbook as noted.

### 1.8 DELIVERY

A. The State Registered products must be delivered to the jobsite in the original sealed and labeled containers of the manufacturer. Use a synthetic dye for proper identification on the surface areas treated.

## 1.9 WARRANTY

A. Warranty: Furnish written warranty, executed by Applicator and Contractor, certifying that applied soil termiticide treatment will prevent infestation of subterranean termites. If subterranean termite activity is discovered during warranty period, re-treat soil and repair or replace damage caused by termite infestation.

B. Warranty Period: 5 years from Date of Substantial Completion, or the minimum more than 5 years if prevailing local laws require.

C. The warranty shall not deprive the Owner of other rights the Owner may have under other provisions of the Contract Documents and will be in addition to and run concurrent with other warranties made by the Contractor under requirements of the Contract Documents.

## PART 2 - PRODUCTS

### 2.1 SOIL TREATMENT SOLUTION

A. Use an emulsible, concentrated termiticide that dilutes with water, specially formulated to prevent termite infestation. Fuel oil will not be permitted as a diluent. Provide a solution consisting of one of following chemical elements.

B. Acceptable Manufacturers: Subject to compliance with requirements, products that may be incorporated in the Work include, but are not limited to, the following:

1. Products: Subject to compliance with requirements, provide one of the following:

a. Permethrin:

1) "Dagnet SFR" manufactured by FMC Corp.

2) "Prelude "manufactured by Zeneca.

b. Cypermethrine: "Prevail FT" manufactured by FMC Corp.

c. Chloronicotinyl: "Premise 75" manufactured by Bayer Corp.

C. Dilute with water to concentration level recommended by manufacturer.

## PART 3 - EXECUTION

### 3.1 APPLICATION

A. Surface Preparation: Remove foreign matter that could decrease treatment effectiveness on areas to be treated. Loosen, rake, and level soil to be treated, except previously compacted areas under slabs and foundations. Toxicants may be applied before placing compacted fill under slabs if recommended by toxicant manufacturer.

B. Application Rates: Apply the soil treatment listed above as a water emulsion at not less than the percentage (in finished solution) designated according to manufacturer's label specification.

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

D. Reapply soil treatment solution to areas disturbed by subsequent excavation, rain, landscape grading, or other construction activities following application.

E. Provide all items and accessories as required for a complete and total application in every respect.

F. Spaces in floor slab that are boxed out or cut away shall use a metal form of sufficient depth to eliminate any planned soil disturbances after initial chemical treatment.

END OF SECTION 31 31 00

## **SECTION 31 31 18 - PEST CONTROL**

### **PART 1 - GENERAL**

#### **1.1 RELATED DOCUMENTS**

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

#### **1.2 SUMMARY**

A. Provide treatment for pest control.

#### **1.3 SUBMITTALS**

A. Product Data: Submit manufacturer's technical data and application instructions in accordance with Division 01 requirements.

B. Submit specific product warranty as specified herein.

#### **1.4 QUALITY ASSURANCE**

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

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

C. Use only chemicals that bear a Federal registration number of the U.S. Environmental Protection Agency.

#### **1.5 SPECIFIC PRODUCT WARRANTY**

A. Furnish written warranty, certifying that applied insecticide treatment will prevent infestation of common household insects such as cockroaches, ants, and fleas for a one year period. Retreat if insect activity is discovered during warranty period.

### **PART 2 - PRODUCTS**

#### **2.1 PEST CONTROL SOLUTION**

A. Use an emulsible concentrated insecticide for dilution with water, specially formulated to prevent infestation by insects. Fuel oil will not be permitted as a diluent.

1. Exterior use; "Termidor SC" by BASF – EPA Registered
2. Interior use; "Demand CS" by Syngenta – EPA Registered

B. Other solutions may be used as recommended by Applicator if also acceptable to Architect and approved for intended application by jurisdictional authorities. Use only insecticide treatment solutions that are not injurious to planting.

### PART 3 - EXECUTION

#### 3.1 APPLICATION

A. Surface Preparation: Remove foreign matter that could decrease treatment effectiveness on areas to be treated.

B. Application Rates: Mix chemicals (from sealed containers) with water, at the job-site, and then apply concentrate solution only at rates described by the manufacturer on the product label and in compliance with State of Florida laws.

C. Apply to all interior floor-to-wall corners and around building perimeter at existing grades.

D. Apply pest control to all interior spaces of buildings included but not limited to each side of bottom of interior walls, interior side of exterior walls, bottom of vinyl bases, perimeter of windows, bottom of exterior side of exterior wall and any other areas/openings on exterior side of building(s).

1. The Owners Grounds and Pest Control department shall be contacted at least one (1) week prior to the first application in order to verify planned treatments and to confirm the appropriateness of the products to be used.

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

F. Re-apply concentrate solution to areas disturbed by construction activities following application.

G. Applicator shall mix all treatment on-site and the Owner's representative shall witness mixing.

H. Three treatments will be required.

1. Immediately after building is considered dried-in by the Architect.
2. One week prior to the expected Date of Substantial Completion.
3. After the eleventh month, prior to the expiration of the one-year warranty period. This treatment will be considered an item on the Warranty Corrections and Completions List.

I. Applicator shall treat all interior spaces of buildings including but not limited to each side of bottom of interior walls, interior side of exterior walls, bottom of vinyl bases, Perimeter of windows, bottom of exterior side of exterior wall, and any other areas/ openings on exterior side of building.

END OF SECTION 31 31 18



**SECTION 03200 - CONCRETE REINFORCEMENT**

PART 1 - GENERAL

1.01 DESCRIPTION

A. Scope of Work: The work in this Section consists of providing all labor, materials, equipment and incidentals required to install all steel bars, steel wire and wire fabric required for the reinforcement of concrete, as shown on the Drawings, and as specified herein.

B. Related Work Described Elsewhere:

1. Concrete Formwork: Section 03100.
2. Concrete Joints and Waterstops: Section 03262.
3. Cast-in-Place Concrete: Section 03300.

1.02 QUALITY ASSURANCE

A. Standards: Unless otherwise indicated, all materials, workmanship and practices shall conform to the following standards:

1. American Concrete Institute (ACI)
  - a. ACI 117 - Standard Tolerance for Concrete Construction and Materials.
  - b. ACI 301 - Specifications for Structural Concrete.
  - c. ACI 318 - Building Code Requirements for Reinforced Concrete.
  - d. ACI 350R - Environmental Engineering Concrete Structures.
  - e. ACI 315 - ACI Detailing Manual.
2. American Society for Testing and Materials (ASTM)
  - a. ASTM A82 - Specification for Steel Wire, Plain, for Concrete Reinforcement.
  - b. ASTM A184 - Specification for Fabricated Deformed Steel Bar Mats for Concrete Reinforcement.
  - c. ASTM A185 - Specification for Steel Welded Wire Fabric, Plain, for Concrete Reinforcement.
  - d. ASTM A496 - Specification for Steel Wire Deformed, for Concrete Reinforcement.

- e. ASTM A497 - Specification for Welded Deformed Steel Wire Fabric for Concrete Reinforcement.
- f. ASTM A615 - Specification for Deformed and Plain Billet-Steel Bars for Concrete Reinforcement.
- g. ASTM A767 - Specification for Zinc-Coated (Galvanized) Steel Bars for Concrete Reinforcement.
- h. ASTM A775 - Specification for Epoxy-Coated Reinforcing Steel Bars.
- i. ASTM A884 - Specification for Epoxy-Coated Steel Wire and Welded Wire Fabric for Reinforcement.

3. American Welding Society (AWS)

- a. AWS D1.4 Structural Welding Code - Reinforcing Steel.

4. Concrete Reinforcing Steel Institute (CRSI)

- a. CRSI Manual of Standard Practices.

5 Building Codes

- a. Florida Building Code.
- b. Local codes and regulations.

1.03 SUBMITTALS

A. Materials and Shop Drawings:

- 1. Submit mill test certificates identifying chemical and physical analyses for each load of reinforcing steel delivered.

B. Submit shop drawings for review in accordance with Section 01300: Shop Drawings, Working Drawings and Samples. Submit reinforcing bending lists and placing drawings for all reinforcing. Placing drawings shall include wall elevations, plan views, and sections to clearly show the reinforcing placing procedures. Placing drawings shall indicate all openings (mechanical, electrical, equipment), including additional reinforcing at openings and intersecting wall, beam and footing arrangements as indicated on the structural drawings and specified herein. Placing drawings shall be coordinated with the concrete placing schedule. Each bending list and placing drawing submitted shall be complete for each major element of a structure (grade slabs, footings, walls, floor or beams), including all dowels and other bars as required.

Furnishing such lists shall not be construed that the list will be reviewed for accuracy. The Contractor shall be wholly and completely responsible for the accuracy of the lists and for furnishing and placing reinforcing steel in accordance with the details shown on the plans and as specified.

#### 1.04 PRODUCT DELIVERY, STORAGE AND HANDLING

A. Reinforcement shall be shipped to the work with bars of the same size and shape fastened in bundles with metal identification tags with waterproof markings giving size and mark securely wired on. The identification tags shall be labelled with the same designation as shown on the submitted bar lists and shop drawings.

B. All bars shall be stored off the ground and shall be protected from moisture and be kept free from dirt, oil, or injurious contaminants.

### PART 2 - PRODUCTS

#### 2.01 MATERIALS

A. Concrete reinforcement in sizes No. 3 (3/8 inch) and larger shall be deformed steel bars of the same sizes and shapes indicated on the Drawings. The steel shall be newly rolled stock of domestic manufacture, substantially free from mill scale, rust, dirt, grease, or other foreign matter. Bars shall be of intermediate grade, deformed billet steel conforming to ASTM Specification A-615, Grade 60, including all supplementary requirements.

B. Rail-steel bars will not be allowed in the work.

C. Reinforcement shall be accurately fabricated to the dimensions indicated on the Drawings. Particular care shall be exercised not to have stirrups oversized in order to maintain proper coverage of concrete. Stirrups and tie bars shall be made around a pin having a diameter not less than two (2) times the maximum thickness of the bar. Bends for other bars shall be made around a pin having a diameter not less than five (5) times the minimum thickness of the bar except for bars larger than 1 inch, in which case the bends shall be made around a pin of eight (8) bar diameters. All bars shall be bent cold. Bars reduced in section or with kinks or bends not shown on the Drawings will not be accepted.

D. Wire fabric shall conform to ASTM Specification A-185, galvanized for Welded Steel Wire Fabric for Concrete Reinforcement. Welded wire fabric shall be furnished in flat sheets, rolled WWF is not permitted.

E. Wire tie shall be 16-gauge minimum, zinc coated annealed, conforming to ASTM Specification A82.

F. Bar supports in beams and slabs exposed to view after for stripping shall be galvanized or plastic coated. Use concrete supports for reinforcing in concrete placed on grade.

G. Coupler Splice Devices: Tension couplers capable of developing the ultimate strength of the bar as manufactured by Erico Products Inc., Solon, Ohio, or equal and where approved by the Engineer.

#### H. Reinforcing Steel Accessories

1. Plastic Protected Bar Supports: CRSI Bar Support Specifications, Class 1 - Maximum Protection.

2. Stainless Steel Protected Bar Supports: CRSI Bar Support Specifications, Class 2 - Moderate Protection.

3. Precast Concrete Block Bar Supports: CRSI Bar Support Specifications, Precast Blocks.

### PART 3 - EXECUTION

#### 3.01 INSTALLATION

A. Surface condition, bending, spacing, and tolerances of placement of reinforcement shall comply with the CRSI. The CONTRACTOR shall be solely responsible for providing an adequate number of bars and maintaining the spacing and clearances shown on the Drawings.

B. Except as otherwise indicated on the Drawings, the minimum concrete cover of reinforcement shall be as follows:

1. Concrete cast against and permanently exposed to earth: 3-in.

2. Concrete exposed to soil, water, sewage, or weather: 2-in.

3. Concrete not exposed to soil, water, sewage, or weather:

a. Slabs (top and bottom cover), walls and joists: 3/4 in.

b. Beams and columns (principal reinforcement, ties, spirals, and stirrups) 1-1/2 inc.

C. Reinforcement which will be exposed for a considerable length of time after being placed shall be coated with a heavy coat of neat cement slurry.

D. No reinforcing steel bars shall be welded either during fabrication or erection unless specifically shown on the Drawings or specified, or unless prior written approval has been obtained from the Engineer. All bars that have been welded, including tack welds, without such approval shall be immediately removed from the work. When welding of reinforcement is approved or called for, it shall comply with AWS D1.4.

E. Reinforcing steel interfering with the location of other reinforcing steel, conduits or embedded items, may be moved within the specified tolerances or one bar diameter, whichever is greater. Greater displacement of bars to avoid interference, shall only be made with the approval of the Engineer. Do not cut reinforcement to install inserts, conduits, mechanical openings or other items without the prior approval of the Engineer.

F. Securely support and tie reinforcing steel to prevent movement during concrete placement by using zinc coated wire ties of not less than No. 16 gauge or suitable clips at intersections. Secure dowels in place before placing concrete.

G. Do not press dowels into the concrete after the concrete has been placed.

H. Flat sheet wire mesh shall be placed as follows. Support and tie mesh to prevent movement during concrete placement. Support welded wire fabric by high chairs or bolster with baseplates, all plastic supports, and concrete blocks. It is not permissible to place the WWF on the subbase and pulling it up or laying the WWF on top of the concrete and walking it into the concrete. Extend fabric to within 2 inches of the edges of the slab and lap splices at least 1-1/2 courses of the fabric and a minimum of 6 inches. Tie laps and splices securely at ends and at least every 24 inches with 16 gauge annealed steel wire.

I. Reinforcing steel bars shall not be field bent except where shown on the Drawings or specifically authorized in writing by the Engineer. If authorized, bars shall be cold-bent around the standard diameter spool specified in the CRSI. Do not heat bars. Closely inspect the reinforcing steel for breaks. If the reinforcing steel is damaged, replace, Cadweld or otherwise repair as approved by the Engineer. Do not bend reinforcement after it is embedded in concrete unless specifically shown otherwise on the Drawings.

### 3.02 REINFORCEMENT AROUND OPENINGS

A. Unless specific additional reinforcement around openings is shown on the Drawings, provide additional reinforcing steel on each side of the opening equivalent to one half of the cross-sectional area of the reinforcing steel interrupted by an opening. The bars shall have sufficient length to develop bond at each end beyond the opening or penetration.

### 3.03 SPLICING OF REINFORCEMENT

A Splices designated as compression splices on the Drawings, unless otherwise noted, shall be 30 bar diameters, but not less than 12-in. The lap splice length for column vertical bars shall be based on the bar size in the column above.

B. Tension lap splices shall be provided at all laps in compliance with the applicable tables in the ACI 315. Splices in adjacent bars shall be staggered. Class A splices shall be used when 50 percent or less of the bars are splices within the required lap length. Class B splices shall be used at all other locations.

C. Except as otherwise indicated on the Drawings, splices in circumferential reinforcement in circular walls shall be Class B tension splices and shall be staggered. Adjacent bars shall not be spliced within the required lap length.

D. Install wire fabric in as long lengths as practicable. Splices in welded wire fabric shall be lapped in accordance with the requirements of ACI-318 but not less than 12-in. The splices fabrics shall be tied together with wire ties spaced not more than 24-in on center and laced with wire of the same diameter as the welded wire fabric. Do not position laps midway between supporting beams, or directly over beams of continuous structures. Offset splices in adjacent widths to prevent continuous splices.

### 3.04 ACCESSORIES

A. The Contractor shall be solely responsible for determining, providing and installing accessories such as chairs, chair bars, and the like in sufficient quantities and strength to adequately support the reinforcement and prevent its displacement during the erection of the reinforcement and the placement of concrete.

B. Use precast concrete blocks where the reinforcing steel is to be supported over soil.

C. Stainless steel bar supports or steel chairs with stainless steel tips shall be used where the chairs are set on forms for a concrete surface that will be exposed to weather, high humidity, or liquid (including bottom of slabs over liquid containing areas). Use of galvanized or plastic tipped metal chairs is permissible in all other locations unless otherwise noted on the Drawings or specified.

D. Alternate methods of supporting top steel in slabs, such as steel channels supported on the bottom steel or vertical reinforcing steel fastened to the bottom and top mats, may be used if approved by the Engineer.

### 3.05 INSPECTION

A. In no case shall any reinforcing steel be covered with concrete until the installation of the reinforcement, including the size, spacing and position of the reinforcement has been observed by the Engineer and the Engineer's release to proceed with the concreting has been obtained. The Engineer shall be given at least 24 hours advance notice of the readiness of placed reinforcement for observation. The forms shall be kept open until the Engineer has finished his observations of the reinforcing steel.

END OF SECTION

## **SECTION 03262 – CONCRETE JOINTS AND WATERSTOPS**

### **PART 1 - GENERAL**

#### **1.01 DESCRIPTION**

A. Scope of Work: The work included in this section consists of providing all labor, materials and equipment necessary to install expansion joints, construction joints, and waterstops.

B. Related Work Described Elsewhere:

1. Concrete Formwork: Section 03100.
2. Concrete Reinforcement: Section 03200.
3. Cast-in-place Concrete: Section 03300.

#### **1.02 SUBMITTALS**

A. Materials: Submit manufacturer's literature, materials and samples of waterstops in accordance with Section 01340: Shop Drawings, Working Drawings and Samples including a statement of compliance with ASTM and U.S. Federal Specifications. Manufacturer shall demonstrate five (5) years, minimum, of continuous, successful experience in their product line.

1. Waterstops: Product data including catalog cut, technical data, storage requirements, splicing methods, and conformance to ASTM standards.

2. Premolded joint fillers: Product data including catalog cut, technical data, storage requirements, installation requirements, location of use, and conformance to ASTM standards.

3. Bond breaker: Product data including catalog cut, technical data, storage requirements, installation requirements, location of use, and conformance to ASTM standards.

4. Expansion joint dowels: Product data on the complete assembly including dowels, coatings, lubricants, spacers, sleeves, expansion caps, installation requirements, and conformance to ASTM standards.

5. Compressible joint filler: Product data including catalog cut, technical data, storage requirements, installation requirements, location of use, and conformance to ASTM standards.

6. Bonding agents: Product data including catalog cut, technical data, storage requirements, product life, application requirements, and conformance to ASTM standards.

B. Certifications

1. Certification from the manufacturer that all materials used within the joint system are compatible with each other.

#### 1.04 REFERENCE STANDARDS

##### A. American Society for Testing and Materials (ASTM)

1. A615 - Dowel Bars, Plain Steel

2. ASTM C881 - Epoxy-Resin-Base Bonding Systems for Concrete. 3. ASTM C1059 - Latex Agnets for Bonding Fresh to Hardened Concrete. 4. ASTM D1751 - Preformed Expansion Joint Fillers for Concrete Paving and Structural Construction.

5. ASTM D1752 - Preformed sponge rubber and cork expansion joint fillers for concrete paving and structural construction.

##### B. U.S. Army Corps of Engineers (CRD)

1. CRD C572 - Specification for Polyvinylchloride Waterstops.

#### 1.05 DELIVERY, STORAGE, AND HANDLING

A. Store all products under tarps to protect from oil, dirt and sunlight.

### PART 2 - PRODUCTS

#### 2.01 GENERAL

A. The use of manufacture's name and model or catalog number is for the purpose of establishing the standard of quality and general configuration desired.

B. All materials used together in a given joint (bond breakers, backer rods, joint fillers, sealants, etc.) shall be compatible with one another. Coordinate selection of suppliers and products to ensure compatibility.

#### 2.02 MATERIALS

A. Waterstops: Waterstops shall be extruded from a PVC compound and shall be 9 inches by 3/8 inch non-tapered ribbed profile as shown on the Drawings. Corners, tees, and crosses shall be supplied by factory. Waterstops shall comply with Corps of Engineers Specification CRD-C-572. All material shall be virgin material. The uses of reworked PVC or other substitute will not be permitted. Natural color, off white, milky color.

##### B. Premolded Joint Filler

1. Premolded joint filler - structures. Self-expanding cork, premolded joint filler shall conform to ASTM D1752 Type III. The thickness shall be 3/4-in unless otherwise shown on the Drawings.



2. Premolded joint filler - sidewalk and roadway concrete pavements. Joints where fiber is specifically noted on the Drawings, shall be asphalt-impregnated fiber board. Joint filler shall conform to ASTM D1751. Thickness shall be 3/4-in unless otherwise shown on the Drawings.

#### C. Bond Breaker

1. Bond breaker tape shall be an adhesive-backed glazed butyl or polyethylene tape which will satisfactorily adhere to the premolded joint filler or concrete surface as required. The tape shall be the same width as the joint.

2. Bond breaker for concrete other than where tape is specifically called for shall be either bond breaker tape or a nonstaining type bond prevention coating.

#### D. Expansion Joint Dowel

1. Dowels shall be smooth steel conforming to ASTM A615, Grade 60. Dowels must be straight and clean, free of loose flaky rust and loose scale. Bars shall be coated with a bond breaker on the expansion end of the dowel. Expansion caps shall be provided on the expansion end.

#### E. Bonding Agent

1. Epoxy bonding agent shall be a two-component, solvent-free, moisture insensitive, epoxy resin material conforming to ASTM C881, Type V.

2. Latex bonding agent shall be a non-reemulsifiable acrylic-polymer latex conforming to ASTM C1059 Type II.

#### F. Compressible Joint Filler

1. The joint filler shall be a non-extruded watertight strip materials use to fill expansion joints between structures. The material shall be capable of being compressed at least 40 percent for 70 hours at 68 degrees F and subsequently recovering at least 20 percent of its original thickness in the first one-half hour after unloading. Compressible Joint filler shall be Evasote 380 E.S.P., by E-Poxy Industries, Inc., Ravena, NY or equal.

#### G. Joint Sealant

1. Joint sealant for continuous immersion shall be a multipart, gray, polyurethane sealant meeting U.S. Federal Specification TT-S-00227E (3) Type I, Class A for horizontal joints and Type II, Class A for vertical joints. Additionally, the sealant must be recommended by the manufacturer for continuous immersion in water.

### PART 3 - EXECUTION

#### 3.01 INSTALLATION

A. Construction Joints:

1. Provide construction joints where shown on the Drawings, or as recommended by the Contractor and approved by the Engineer. In case of emergency, place additional construction joints. (An interval of 45 minutes between two consecutive batches of concrete shall constitute cause for an emergency construction joint.)
2. Construction joints shall be keyed, unless otherwise detailed. Form keyways by beveled strips or boards placed at right angles to the direction of shear. Except where otherwise shown on the Drawings or specified, keyways shall be at least 1- 1/2 inches in depth over at least 25 percent (25%) of the area of the section.
3. When it is necessary to make a joint because of an emergency, furnish and place reinforcing dowels across the joint. Embed dowels 48 bar diameters each side of the joint. Size and number of dowels shall match reinforcing in the member. Furnishing and placing such reinforcing steel shall be at the Contractor's expenses.
4. After the pour has been completed to the construction joint and the concrete has hardened, thoroughly clean the entire surface of the joint of surface laitance, loose or defective concrete, and foreign material, and expose clean aggregate by sandblasting the surface of construction joints before placing the new concrete. At least two hours before and again shortly before the new concrete is deposited, the joints shall be dampened, but not saturated. After glistening water disappears, the joints shall be given a thorough coating of neat cement slurry mixed to the consistency of very heavy paste. The surfaces shall receive a coating at least 1/8-in thick, well scrubbed-in by means of stiff bristle brushes whenever possible. New concrete shall be deposited before the neat cement dries.

B. Expansion Joints:

1. Provide expansion joints of sizes and at locations as shown on the Drawing.
2. Place expansion joint fillers every 30 feet in straight runs of walkways, at right angles turns and wherever concrete butts into vertical surfaces.

C. Time Between Pours: At least 2 hours shall elapse after depositing concrete in columns or walls before depositing in beams, girders or slabs supported thereon. Place beams, girders, brackets, column capitals and haunches monolithically as part of the floor or roof system.

D. Joint Sealants: Joint sealants shall be required where indicated on the Drawings. Preparation of surfaces, priming and the handling and preparation of materials shall be in complete compliance with the manufacture's instructions as approved.

E. Waterstops:

1. Waterstops shall be properly heat spliced at ends and intersections to ensure continuity. Construct forms for construction joints in such a manner as to prevent injury to waterstops. Installed waterstops in construction joints in hydraulic structures which will contain liquid or resist the entry of groundwater.
2. Make field splices with a thermostatically controlled heating iron in conformance with the manufacturer's current recommendations. Allow at least 10 minutes before pulling or straining the new splice in any way. The finished splices shall provide a cross section that is dense and free of porosity with tensile strength of not less than 80 percent (80%) of the unspliced materials.
3. Center waterstop in joint and secure waterstop in correct position using hog rings or grommets spaced at 12 inches on center along the length of the waterstop and wire tie to adjacent reinforcing steel.
4. Provide factory made waterstop fabrications for all changes of direction, intersections, and transitions leaving only straight butt joint splices for the field.

END OF SECTION

**SECTION 03300 - CAST-IN-PLACE CONCRETE**

PART 1 - GENERAL

1.01 DESCRIPTION

A. Scope of Work: The Contractor shall furnish all labor and materials required and install cast-in-place concrete complete as shown on the Drawings and as specified herein.

B. Related Work Described Elsewhere:

1. Concrete Formwork: Section 03100.
2. Concrete Reinforcement: Section 03200.
3. Concrete Joints and Waterstops: Section 03262.

1.02 QUALITY ASSURANCE

A. Standards: Unless otherwise indicated, all materials, workmanship and practices shall conform to the requirements of the following standards:

1. American Concrete Institute (ACI)
  - a. ACI 301 - Specifications for Structural Concrete.
  - b. ACI 304 - Guide for Measuring, Mixing, Transporting, and Placing Concrete.
  - c. ACI 305 - Hot Weather Concreting.
  - d. ACI 306 - Cold Weather Concreting.
  - e. ACI 308 - Standard Practice for Curing Concrete.
  - f. ACI 309 - Guide for Consolidation of Concrete.
  - g. ACI 318 - Building Code Requirements for Reinforced Concrete.
  - h. ACI 347 - Guide for Concrete Formwork.
  - i. ACI 350 - Environmental Engineering Concrete Structures.

2. American Society for Testing and Materials (ASTM)

- a. ASTM C31 - Making and Curing Concrete Test Specimens in the Field.
- b. ASTM C33 - Concrete Aggregates.
- c. ASTM C39 - Compressive Strength of Cylindrical Concrete Specimens.
- d. ASTM C42 - Obtaining and Testing Drilled Cores and Sawed Beams of Concrete.
- e. ASTM C94 - Standard Specification for Ready-mix Concrete.
- f. ASTM C143 - Slump for Portland Cement Concrete.
- g. ASTM C150 - Standard Specification for Portland Cement.
- h. ASTM C171 - Standard Specification for Sheet Materials for Curing Concrete.
- i. ASTM C173 - Air Content of Freshly Mixed Concrete by the Volumetric Method.
- j. ASTM C231 - Air Content of Freshly Mixed Concrete by the Pressure Method.
- k. ASTM C260 - Air Entraining Admixtures for Concrete.
- l. ASTM C309 - Liquid Membrane-Forming Compounds for Curing Concrete.
- m. ASTM C494 - Chemical Admixtures for Concrete.
- n. ASTM C618 - Fly Ash and Raw or Calcined Natural Pozzolan for Use as a Mineral Admixture in Portland Cement Concrete.

3. Building Codes

- a. Florida Building Code.
- b. Local Codes and Regulations.

B. Plant Qualification: Plant equipment and facilities shall meet all requirements of the Check List for Certification of Ready Mixed Concrete Production Facilities of the National Ready Mixed Concrete Association and ASTM C-94.

C. Evaluation And Acceptance Of Concrete: Evaluation and acceptance of concrete will be in accordance with ACI-318, Chapter 4.

1. Watertightness

All structures to contain wastewater or water shall be watertight and shall be free from any perceptible leakage, as determined by the Engineer.

1.03 SUBMITTALS

A. Materials and Shop Drawings: The following information shall be submitted for approval in accordance with Section 01300: Shop Drawings, Working Drawings and Samples. No concrete shall be furnished until submittal has been approved.

1. Plant Qualification: Satisfactory evidence shall be submitted indicating compliance with the specified qualification requirements.

2. Materials: Satisfactory evidence shall be submitted indicating that materials to be used, including cement, aggregates and admixtures meet the specified requirements. Provide catalog data, chemical and mechanical analysis, and conformance with ASTM requirements.

a. Sources of cement, pozzolan and aggregates.

b. Air-entraining admixture.

c. Water reducing admixture.

d. High range water-reducing admixture (plasticizer).

e. Sheet curing material.

f. Liquid curing compound.

3. Design Mix: The design mix to be used shall be prepared by qualified persons and submitted for approval. The design of the mix is the responsibility of the Contractor subject to the limitations of the Specifications. Approval of this submission will be required only as minimum requirements of the Specifications have been met. Such approval will in no way alter the responsibility of the Contractor to furnish concrete meeting the requirements of the Specifications relative to strength and slump.

4. Ready Mix Concrete: Provide delivery tickets or weighmasters certificate per ASTM C-94, including weights of cement and each size aggregate, amount of water in the aggregate, and amount of water added at the plant. Write in the amount of water added on the job.

## 2.01 MATERIALS

### A. Cement

1. Cement for all concrete shall be domestic Portland cement that conforms to the requirements of ASTM Designation C-150 Type I, Type II or Type III. All sanitary sewer manholes, wet wells, pumping stations, and structures exposed to wastewater shall be constructed with Type II cement. Type III cement for high early strength concrete shall be used only for special locations and only with the approval of the Engineer. Type I cement may be used for buildings and tremie concrete.

2. Only one (1) brand of cement shall be used in any individual structure unless approved by the Engineer. Cement which has become damaged, partially set, lumpy or caked shall not be used and the entire contents of the sack or container which contains such cement will be rejected. No salvaged or reclaimed cement shall be used.

### B. Pozzolan

1. Fly ash shall be Class C or F conforming to the requirements of ASTM C618, including the requirements of Table 1 except the loss of ignition, LOI, shall be limited to 3% maximum. Fly ash shall not exceed 20% of the cementitious content of the mix.

### C. Aggregates

1. ASTM C-33. Coarse aggregates shall be size No. 67 (3/4 inch). Block cell fill shall be size #8.

2. In addition to requirements of ASTM C-33 for structures exposed to wastewater the following shall apply:

a. Soft particles: 3.0 percent (3%).

a. Chert as a soft impurity (defined in Table 3 of ASTM C-33): 2.0 percent (2%).

b. Total of soft particles and chert as a soft impurity: 5.0 percent (5%).

c. Flat and elongated particles (long dimension greater than 5 times short dimension): 15.0 percent (15%).

D. Water: Clean and free from injurious amounts of deleterious materials.

E. Air Entraining Admixture: ASTM C-260.

F. Water Reducing and Retarding Admixtures:

1. For concrete without superplasticizer: ASTM C-494, Type D, and shall contain no calcium chloride by weight of cement.

2. For concrete with superplasticizer

a. ASTM C-494, Type F or G. The admixture shall be a second generation type, free of chlorides and alkalis (except for those attributable to water) and composed of a synthesized sulfonated complex polymer. The concrete shall be capable of maintaining its rheoplastic state in excess of two (2) hours if necessary. Superplasticizers admix shall be induced at the batch plant only, job site redosage shall not be permitted without prior approval from the Engineer.

b. Approved Materials:

(1) Rheobuild 716 as manufactured by MAC-USA, Inc., Boca Raton, Florida, telephone: (407) 368-0121 or Rheobuild 716 as manufactured by Master Builders Technologies, Cleveland, Ohio.

(2) Daracem 100 as manufactured by W.R. Grace & Co. Construction Products Division, Pompano Beach, Florida.

c. Manufacturer's job site representation: A competent field service representative from the manufacturer of each of the admixtures (superplasticizer) selected for use shall be available at the job site to provide advice and consultation on the use of the admixture materials, including the effect on the concrete in place. The representative shall be available on short call at any time requested by the Owner, Contractor, or concrete producer.

d. Manufacturer's representative will be responsible to recommend maximum discharge time for superplasticizer and to recommend method and procedure to induce superplasticizer into mixer.

e. Manufacturer's representative will be responsible to recommend quantities of admixtures to be used if variations are required because of temperature/humidity, wind, or other environmental considerations.

f. Concrete with super plasticizer shall be used for all cast-in place walls of structures.

G. Curing Compound: ASTM C-309, Type 1. The compound shall contain no ingredient which will adversely affect the bond of coatings or toppings. Curing compound shall be approved for use in contact with potable water after 30 days.



1. Curing compound for exposed concrete not to receive special finishes, protective coatings and/or concrete toppings shall be "Super Rez-Seal", as manufactured by Euclid Chemical Co., Cleveland, Ohio or equal.
  2. Curing compound for exposed concrete to receive special finishes, protective coatings and/or concrete toppings shall be "Kurez-DR", as manufactured by Euclid Chemical Co., Cleveland, Ohio or equal.
- H. Mortar for Repair of Concrete: Mortar used for repair of concrete shall be made of the same materials as used for concrete, except that the coarse aggregate shall be omitted and the mortar shall consist of not more than one (1) part cement to two and one-half (2-1/2) parts sand by damp loose volume. The quantity of mixing water shall be no more than necessary for handling and placing.
- I. Burlap Mats: Conform to AASHTO Specification M-182.
- J. Epoxy Bonding Agent: Sikadur 32 Hi Mod, or equal.

## 2.02 MIXES

### A. General Requirements:

1. Mix Design: Proportioning shall be on the basis of field experience and/or trial mixtures as specified in ACI-318, Section 4.3. Data on consecutive compression tests and standard deviation shall be submitted. Proportioning for small structures may be by the water/cement ratio under special approval by the Engineer. Concrete mix design shall comply with the Standard Building Code requirements.
2. Air Content: Range 3.5 to 6% for Class A and B.
3. Slump:
  - 4 inches plus or minus 1 inch for Class A and B without superplasticizer.
  - 8 inches plus or minus 1 inch for concrete with superplasticizer.
  - 6 inches plus or minus 1 inch for tremie concrete.
4. Water cement ratio =
  - 0.45 (Class A Concrete) without superplasticizer.
  - = 0.55 (Class B Concrete) without superplasticizer.
  - = 0.37 Concrete with superplasticizer.
5. Minimum Compressive Strength at 28 days:

a. Class A, 4,000 psi: Wastewater structures inclusive of mat foundations, footings, tanks, ditches, pumping station, tremie concrete and other structures in contact with treated waters.

b. Class B, 3,000 psi: Slab on grade, masonry fillcell grout, encasements, thrust blocks, and pipe supports, concrete curbs, fills and sidewalks, etc. not in contact with treated waters.

c. Slab on grade shall include all slabs 10 inches thick or less and requires Class B 3000 psi concrete. Exception: Sludge Loading Station, 10-inch Slab Drawing S-39 shall be Class A 4000 psi.

B. Production of Concrete:

1. General: Concrete shall be ready mixed and shall be batched, mixed and transported in accordance with ASTM C-94, except as otherwise indicated.

2. Air Entraining Admixture: Air entraining admixture shall be charged into the mixture as a solution and shall be measured by means of an approved mechanical dispensing device. The liquid shall be considered a part of the mixing water.

3. Water Reducing and Retarding Admixture: Water reducing and retarding admixture shall be added and measured as recommended by the manufacturer. The addition of the admixture shall be separate from the air entraining admixture. The addition of the admixture shall be completed within one minute after addition of water to the cement has been completed, or prior to the beginning of the last three-quarters of the required mixing, whichever occurs first. Admixtures shall be stored, handled and batched in accordance with the recommendation of ASTM C-94.

C. Delivery Tickets: In addition to the information required by ASTM C-94, delivery tickets shall indicate the cement content and the water/cement ratio.

D. Temperatures: The temperature of the concrete upon delivery from the truck shall not exceed 95 degrees Fahrenheit (°F), otherwise ice shall be used to reduce the temperature of the concrete as recommended by ACI.

E. Modifications To The Mix: No modifications to the mix shall be made in the plant or on the job which will decrease the cement content or increase the water-cement ratio beyond that specified. No modifications of any kind shall be made except by a qualified and responsible representative of the concrete producer.

1. Any addition of water must be approved by the Engineer. Added water shall be incorporated by additional mixing of at least 35 revolutions. All added water shall be metered and the amount of water added shall be shown on each delivery ticket. Addition of water shall follow procedures of ASTM C-94 for slump adjustment.

PART 3 - EXECUTION

3.01 PREPARATION

A. Preparations Before Placing: No concrete shall be placed until the approval of the Engineer has been received. Approval will not be granted until forms are thoroughly clean, and reinforcing and all other items required to be set in concrete have been placed and thoroughly secured. The Engineer shall be notified a minimum of 24 hours before concrete is placed.

B. Conveying:

1. General: Concrete shall be handled from the truck to the place of final deposit as rapidly as practicable by methods which will prevent segregation or loss of ingredients to maintain the quality of the concrete. No concrete shall be placed more than 90 minutes after mixing has begun for that particular batch.

2. Buckets and Hoppers: Buckets and hoppers shall have discharge gates with a clear opening equal to no less than one-third of the maximum interior horizontal area, or five (5) times the maximum aggregate size being used. Side slopes shall be no less than 60 degrees. Controls on gates shall permit opening and closing during the discharge cycle. It is suggested the Contractor provide one (1) standby bucket and hopper for use in case of equipment failure.

3. Runways: Extreme care shall be exercised to avoid displacement of reinforcing during the placing of concrete.

4. Elephant Trunks: Hoppers and elephant trunks shall be used to prevent the free fall of concrete for more than 6 feet.

5. Chutes: Chutes shall be metal or metal lined, and shall have a slope not exceeding one vertical to two horizontal, and not less than one vertical to three horizontal. Chutes more than 20 feet long and chutes not meeting the slope requirements, may be used only if they discharge into a hopper before distribution.

6. Pumping Equipment: Pumping equipment and procedures, if used, shall conform to the recommendations contained in the report of ACI Committee 304 on "Placing Concrete by Pumping Methods", ACI 304.2R. The specified slump shall be measured at the point of discharge. The loss of slump in pumping shall not exceed 1-1/2 inches.

7. Conveying Equipment Construction: Aluminum or aluminum alloy pipe for tremies or pump lines and chutes, except for short lengths at the truck mixer shall not be permitted.

8. Cleaning: Conveying equipment shall be cleaned at the end of each concrete operation.

### 3.02 APPLICATION

#### A. Placing:

1. General: Concrete shall be deposited continuously, or in layer of such thickness (not exceeding 2 feet in depth) that no concrete will be deposited on concrete that has hardened sufficiently to cause the formation of seams or planes of weakness.
2. Supported Elements: At least 2 hours shall elapse after depositing concrete in columns or walls before depositing in beams, girders, or slabs supported thereon.
3. Segregation: Concrete shall be deposited as nearly as practicable in its final position to avoid segregation due to rehandling or flowing. Concrete shall not be subjected to procedures which will cause segregation.
4. Concrete Under Water: All concrete, except that indicated on the Drawings as Tremie concrete, shall be placed in the dry.
5. Concrete Fill and Tank Bottom Slab: Concrete fill for the tank bottoms, where shown on Drawings, shall be placed within the tolerances described in this Section and as per equipment manufacturer's recommendations

#### B. Seals and Tremie Concrete:

##### 1. General:

- a. Wherever practicable, all foundation excavations shall be dewatered and the concrete deposited in the dry. Where conditions are encountered which render it impracticable to dewater the foundation before placing concrete, a concrete foundation seal shall be placed. The foundation shall then be dewatered, and the balance of the concrete placed in the dry.
  - b. When seal concrete is required to be placed, the satisfactory performance of the seal in providing a watertight excavation for placing structural concrete shall be the responsibility of the Contractor. Seal concrete placed by the Contractor, which subsequently fails to perform properly, shall be repaired as necessary to perform its required function, at the expense of the Contractor.
2. Method of Placing: Concrete deposited under water shall be carefully placed in the space in which it is to remain by means of a tremie, a closed-bottom dump bucket of not less than one cubic yard capacity, or other approved method, and shall not be disturbed after it is deposited. All seal concrete shall be deposited in one (1) continuous pour. No concrete shall be placed in running water. All form work designed to retain concrete under water shall be watertight, and the

design of the form work and excavation sheeting shall be by a Professional Engineer, registered in the State of Florida.

3. Use of Tremie: The tremie shall consist of a tube having a minimum inside diameter of 10 inches, and shall be constructed in sections having tight joints. No aluminum parts which have contact with the concrete will be permitted. The discharge end shall be entirely seated at all times and the tremie tube kept full to the bottom of the hopper. When a batch is dumped into the hopper the tremie shall be slightly raised (but not out of the concrete at the bottom) until the batch discharges to the bottom of the hopper, after which the flow shall be stopped by lowering the tremie. The means of supporting the tremie shall be such as to permit the free movement of the discharge end over the entire top surface of the work, and shall permit it being lowered rapidly when necessary to choke off or retard the flow. The flow shall preferably be continuous and in no case shall be interrupted until the work is completed. Special care shall be exercised to maintain still water at the point of deposit.

4. Use of Bottom-dump Bucket: When the concrete is placed by means of a bottom-dump bucket, the bucket shall be lowered gradually and carefully until it rests upon the concrete already placed. The bucket shall then be raised very slowly during the discharge travel; the intent being to maintain, as nearly as possible, still water at the point of discharge and to avoid agitating the mixture. Aluminum buckets will not be permitted.

5. Time of Beginning Pumping: Pumping to dewater a sealed cofferdam shall not commence until the seal has set sufficiently to withstand the hydrostatic pressure, and in no case earlier than 72 hours after placement of the concrete.

#### C. Consolidating Concrete:

1. General: Concrete, with the exception of slabs less than 8 inches thick, shall be consolidated by means of internal vibrators operated by competent workmen. a. Concrete Slabs: Concrete for slabs less than 8 inches shall b consolidate with vibrating screeds: slabs 8-inches to 12-inches thick shall be compacted with internal vibrators and (optionally) with vibrating screeds. Vibrators shall always to placed into concrete vertically and shall not be laid horizontally or laid over.

2. Vibrators: Vibrators shall have a minimum head diameter of at least 2 inches, a minimum centrifugal force of 700 and a minimum frequency of 8,000 vibrations per minute.

3. Vibrators for Confined Areas: In confined areas, the specified vibrators shall be supplemented by others having a minimum head diameter of 1-1/2 inches, a minimum centrifugal force of 300 pounds and a minimum frequency of 9,000 vibrations per minute.

4. Spare Vibrator: One (1) spare vibrator for each three (3) in use shall be kept on the site during all concrete placing operations.

5. Use of Vibrators: Vibrators shall be inserted and withdrawn at points approximately 18 inches apart. The duration of each insertion shall be from 5 to 15 seconds. Concrete shall not be transported in the forms by means of vibrators. D. Protection: Rainwater shall not be allowed to increase the mixing water, nor to damage the surface finish. Concrete shall be protected from construction overloads. Design loads shall not be applied until the specified strength has been attained.

E. Construction Joints: Except as otherwise indicated on the Drawings, horizontal construction joints shall be provided at top of foundation members and slabs on grade and at the soffit of supported slabs and beams. Other horizontal and vertical construction joints shall be located as indicated on the Drawings. Joints will not be permitted except in the locations shown, unless recommended by the Contractor and approved by the Engineer.

F. Bonding: Before depositing new concrete on or against concrete that has set, the surfaces of the set concrete shall be thoroughly cleaned so as to expose the coarse aggregate and be free of laitance, coating, foreign matter and loose particles. Forms shall be retightened. The hardened concrete of joints shall be dampened, but not saturated, and then thoroughly covered with a coat of cement grout of similar proportions to the mortar in the concrete. The grout shall be as thick as possible on vertical surfaces and at least 1/2 inches thick on horizontal surfaces. The fresh concrete shall be placed before the grout has attained its initial set.

G. Embedded Items: In addition to steel reinforcement, pipes, inserts and other metal objects as shown, specified or ordered shall be built into, set in or attached to the concrete. All necessary precautions shall be taken to prevent these objects from being displaced, broken or deformed. Before concrete is placed, care shall be taken to determine that all embedded parts are firmly and securely fastened in place as indicated. They shall be thoroughly clean and free from paint or other coating, rust, scale, oil, or any foreign matter. No wood shall be embedded in concrete. The concrete shall be packed tightly around pipes and other metal work to prevent leakage and to secure proper adhesion. Drains shall be adequately protected from intrusion of concrete.

H. Concrete Finishes: Complete concrete surfaces in accordance with the following schedule:

1. Finish

Designation Area Applied

F-1 Exterior walls below grade not exposed to water. Repair defective concrete, fill depressions deeper than 1/2 inch and fill tie holes.

F-2 Exterior and interior walls of all structures. Repair defective concrete, remove fins, fill depressions and fill tie holes.

F-3 Walls of all structures or buildings exposed to public view and the underside of formed floors or slabs that will not be finish coated or sealed. In addition to Finish F-2, fill depressions and airholes with mortar. Dampen surfaces and then spread a slurry within 72 hours of removing forms consisting of one part cement and one and one-half parts sand by volume on the surface with clean burlap pads or sponge rubber floats. Remove any surplus by scraping and then rubbing with clean burlap.

F-4 Walls of all structures and buildings exposed to public view and the underside of formed floors or slabs that will be finish per the Drawings. In addition to Finish F-2, surfaces shall be sand blasted and holes patched and depressions and airholes filled with a patching compound consisting of sand, portland cement and a liquid, acrylic-polymer bonding additive. Refer to Section 03300 Cast-In-Place Concrete, for concrete surface preparation requirements.

S-1 Slabs and floors not water bearing. Smooth steel trowel finish.

S-2 Slabs and floors which are water bearings. Slab Surfaces on which mechanical equipment moves. Steel trowel finish free from trowel marks and all irregularities.

S-3 Slabs and floors of structures or building exposed to view. Steel trowel finish without local depressions or high points and apply a light hair-broom finish. Do not use stiff bristle brooms or brushes. Leave hair-broom lines parallel to the direction of slab drainage.

S-4 Slabs and floors at slopes greater than 10 percent. Steel trowel finish without local depressions or high points. Apply a stiff bristle broom finish. Leave broom lines perpendicular to the direction of slope drainage.

E-1 Exposed edges of slabs, floors and tops of walls. Finish with a 1/4 inch radius edge if a chamfer is not indicated. E-2 Tops of walls, beams and similar unformed surfaces occurring adjacent to formed surfaces shall be struck smooth after concrete is placed and shall be floated to a texture reasonably consistent with that of formed surfaces.

2. General: As soon as forms can safely be removed, all irregular projections shall be chipped off flush with the concrete surfaces. All voids produced by spacers or any honeycombing shall be pointed up with grout and troweled flush with the concrete surface immediately after removal of forms and water cured to prevent shrinkage. Honeycombing shall be cut out to expose a sound concrete surface prior to pointing. The use of mortar pointing or patching shall be confined to the repair of small defects in relatively green concrete. Where in the opinion of the Engineer substantial repairs are required, the defective concrete shall be cut out to sound concrete and repaired with gunite or the concrete shall be removed and reconstructed as directed.

3. All concrete slabs to be troweled shall receive a floated finish. After floating, all concrete slabs except as otherwise indicated and in areas to receive roofing, insulation, tile or topping

shall be troweled and immediately light broom finished. Stair treads shall receive a light broomed finish.

4. Floated Finish: After concrete has been placed. Consolidated, struck off and leveled, it shall not be worked further until water sheen has disappeared and the surface has hardened sufficiently to permit floating, the planeness of the slab shall be checked with a 10 foot straightedge applied at no less than two (2) angles. All high spots shall be cut down and all low spots shall be filled to produce a surface having a Class B Tolerance throughout. The slab shall then be refloated to a uniform sandy texture.

5. Light Broomed Finish: After floating, slabs to receive a light broomed finish shall be power troweled and finished struck with a soft broom rag. The troweling shall produce a smooth surface, relatively free of defects and a Class B Tolerance. Before the surface sets, the soft broom drag shall be passed over the surface to produce a surface uniform in texture and appearance.

6. Troweled Finish: After floating, slabs to receive a troweled finish shall be power troweled and finally hand troweled. The first troweling after power floating shall produce a smooth surface, relatively free of defects. Surfaces shall be hand troweled after the surface has hardened sufficiently. The final troweling shall be done by hand when a ringing sound is produced as the trowel is moved over the surfaces. Hand troweling shall produce a surface which is thoroughly consolidated, free from trowel marks, uniform in texture and appearance and plane to a Class B tolerance.

7. Finishing Tolerance: Surfaces shall be true planes within the following limits: a. Class B: 1/4 inch in 10 feet is determined by a 10 foot straightedge placed anywhere on the slab in any direction.

I. Saw cut Joints: Joints that are to be saw cut shall be cut not sooner than 2 hours after the concrete is poured and not later than 8 hours after the pour.

### 3.03 PROTECTING

#### A. Curing:

1. All exposed surfaces, including slabs, walls, beams and columns shall receive a spray coat of curing compound applied in accordance with the manufacturer's recommendations. Exposed steel keyways and other embedded items shall be protected from the curing compound. Concrete surfaces to be exposed to wastewater and are to be coated with an epoxy system, shall be cured by the wet burlap method. Curing compounds shall not be used on surfaces to be coated and exposed to sewage or wastewater.



2. Curing compound shall be uniformly applied to the surfaces to be cured, in a single coat, continuous film by a mechanical sprayer. Application shall be in compliance with the manufacturer's recommendations.

3. Curing compound shall be applied in accordance with manufacturer's instructions. Should the film become damaged from any cause within the repaired curing period, the damaged portions shall be required immediately with additional compound. Upon removal of forms, the newly exposed surfaces shall immediately be coated to provide a curing treatment equal to that provided for the surface.

B. Wet Burlap Curing Method: All concrete for wastewater/water retaining structures to be cured by the wet burlap method. All concrete shall be covered with a double thickness of burlap, cotton mats, or other approved material kept thoroughly saturated with water. The forms shall be kept wet until removed and upon removal, the curing specified herein shall be started immediately. Concrete shall be cured for a period of 7 days for normal Portland cement or 4 days for high early strength cement. Concrete poured in the dry shall not be submerged until it has attained sufficient strength to adequately sustain the stress involved nor shall it be subjected to flowing water across its surface until it has cured 4 days. Curing the gunite shall be started as soon as possible without damaging surface and not later than 2 hours after placing. Begin wet cure as soon as concrete attains an initial set and maintain wet cure 24 hours a day.

C. Sheet Material Curing: Cover entire surface with sheet material. Securely anchor sheeting to prevent wind and air from lifting the sheeting or entrapping air under the sheet. Place and secure sheet as soon as initial concrete set occurs.

### 3.04 REMOVAL OF FORMS

A. Except as otherwise specifically authorized by the Engineer, forms shall not be removed before the concrete has attained a strength of at least 70 percent of the 28 day compressive strength prescribed by the design, nor before reaching the following number of day-degrees of curing (whichever is the longer):

<u>Forms for</u>	<u>Degree Days</u>
Beams and slabs	500
Walls and vertical surfaces	100

B. Shores shall not be removed until the concrete has attained at least 60 percent of the specified strength and also sufficient strength to support safely its own weight and the construction live loads upon it.

### 3.05 TESTING

A. An independent testing laboratory employed by the Contractor will make such tests required.

B. Standard laboratory compressive test cylinders will be obtained by the laboratory when concrete is discharged at the point placing (i.e., discharge end of pumping equipment), and cylinders will be made and cured in accordance with the requirements of ASTM Designation C-31. A set of five (5) cylinders will be obtained for each 50 cubic yards, or fraction thereof placed each day, nor less than once for each 5,000 sq. ft. or surface area of slabs or walls for each type of concrete. The cylinders will be cured under laboratory conditions and will be tested in two groups of two (2) at 7 and 28 days of age, with one (1) group held until released by the Engineer in accordance with the requirements of ASTM Designation C-39.

C. The laboratory will conduct tests of Class A and Class B concrete as it is discharged from the mixer at the point of placing. Slump tests will be made for each truckload of concrete. Slump tests may be made on any batch, and failure to meet specified slump requirements will be sufficient cause for rejection of the batch. If water is added after initial test then the "load" shall be tested.

D. Air content of the concrete mixture will be tested on every other truck in accordance with ASTM C173 or ASTM C231.

E. Historical strength/break data may be submitted with mix design and may be used in the approval process provided the mix design is otherwise acceptable. If the mix design required modifications, a test batch may still be required.

### 3.06 FIELD CONTROL

A. The Contractor shall advise the Engineer of his readiness to proceed at least twenty four (24) working hours prior to each concrete placement. The Engineer will inspect the preparations for concreting including the preparation of previously placed concrete, the reinforcing and the alignment and tightness of formwork. No placement shall be made without the prior approval of the Engineer.

1. The Contractor's Superintendent shall submit a certification that indicates preparedness to place concrete and is in accord with contract drawings and specifications. This certification shall be submitted on forms provided by the Engineer.

B. The Engineer may have cores taken from any questionable area in the concrete work such as construction joints and other locations as required for determination of concrete quality. The results of test on such cores shall be the basis for acceptance, rejection or determining the continuation of concrete work.

C. The Contractor shall cooperate in obtaining cores by allowing free access to the Work and permitting the use of ladders, scaffolding and such incidental equipment as may be required. The

Contractor shall repair all core holes. The work of cutting and testing the cores will be at the expense of the Owner.

### 3.07 FAILURE TO MEET REQUIREMENTS

A. Should the strengths shown by the test specimens made and testing in compliance with the previous provisions fall below the values given in Section 2.02.A.5, the Engineer shall have the right to require changes in proportions outlined to apply on the remainder of the Work. Furthermore, the Engineer shall have the right to require additional curing on those portions of the structure represented by the test specimens which failed. The cost of such additional curing shall be at the Contractor's expense. In the event that such additional curing does not give the strength required, as evidenced by core and/or load tests, the Engineer shall have the right to require strengthening or replacement of those portions of the structure which fail to develop the required strength. The cost of all such core borings and/or load tests and any strengthening or concrete replacement required because strengths of test specimens are below that specified, shall be entirely at the expense of the Contractor. In cases of failure to meet strength requirements the Contractor shall adjust the concrete mix to meet contract requirements.

B. When the tests on control specimens of concrete fall below the required strength, the Engineer will permit check tests for strengths to be made by means of typical cores drilled from the structure in compliance with ASTM C42 and C39. In case of failure of the core, the Engineer, in addition to other recourses, may require, at the Contractor's expense, load tests on any one of the slabs, beams, piles, caps, and columns in which such concrete was used. Test need not be made until concrete has aged 60 days.

C. Should the strength of test cylinders fall below 85 percent of the required minimum 28 day strength, the concrete shall be rejected and shall be removed and replaced.

### 3.08 PATCHING

A. As soon as the forms have been stripped and the concrete surfaces exposed, fins and other projections shall be removed, recesses left by the removal of form ties shall be filled, and surface defect which do not impair structural strength shall be repaired. Clean all exposed concrete surfaces and adjoining work stained by leakage of concrete, to approval of the Engineer.

B. Immediately after removal of forms remove plugs and break off metal ties as required by Section 03100-Concrete Formwork. Holes are then to be promptly filled upon stripping as follows: Moisten the hole with water, followed by a 1/16-inch brush coat of neat cement slurry mixed to the consistency of a heavy paste. Immediately plug the hole with a 1 to 1.5 mixture of cement and concrete sand mixed slightly damp to the touch. Compact the grout into the hole until dense and an excess of paste appears on the surface. Trowel smooth with heavy pressure. Avoid burnishing.

C. When patching exposed surfaces the same source of cement and sand as used in the parent concrete shall be employed. Adjust color if necessary by addition of proper amounts of white cement. Rub lightly with a fine Carborundum stone at an age of one to five days if necessary to bring the surface down to the adjacent concrete. Exercise care to avoid damaging or staining the surrounding concrete. Wash thoroughly to remove all rubbed matter.

### 3.09 REPAIRS

A. It is the intent of these Specifications to require quality work including adequate forming, proper mixture and placement of concrete and curing so completed concrete surfaces will not require patching.

B. Defective concrete and honeycombed areas as determined by the Engineer shall be repaired as specified.

1. General: Surface defects, including tie holes shall be repaired immediately after form removal. The areas to be patched and an area at least 6 inches wide surrounding it shall be dampened to prevent absorption of water from the patching mortar. The Engineer shall be notified prior to commencing operations.

2. Removal of Defective Concrete: All honeycombed and other defective concrete shall be removed down to sound concrete. Edges shall be cut perpendicular to the surface or slightly under cut. Sand blast surfaces to receive repair.

3. Bonding Grout: Surfaces to be patched shall be thoroughly dampened and shall receive a coat of bonding grout brushed into the surface. Grout shall consist of one part cement to one part fine sand passing a No. 30 sieve. Grout shall be the consistency of thick cream.

4. Placing Patching Mortar: After the bonding grout begins to lose its water sheen, a premixed patching mortar shall be applied. Patching mortar shall be thoroughly consolidated into place and stuck off so as to leave the patch slightly higher than the surrounding surface. It shall be left undisturbed for one hour to permit initial shrinkage and then finally finished.

5. Tie Holes: After being cleaned and thoroughly dampened, the tie holes shall be filled solid with patching mortar.

### 3.10 MISCELLANEOUS WORK

A. All bolts, anchors, miscellaneous metals or other sleeves and steel work required to be set in the concrete forms for attachment of masonry, structural, and mechanical equipment shall be set or installed under this Section. The Contractor shall be fully responsible for the setting of such materials in the forms and shall correct all such not installed in a proper location or manner at his

own expense. Contractor shall coordinate the activities of other trades for installation of these items.

B. Electric conduits shall be installed in the concrete as required by the Drawings and specified elsewhere in these Specifications. Outlet boxes and fixtures shall be located in reference to the final floor, wall or ceiling finish and shall be as secured that they will not be displaced by concrete placing.

C. Pipes or conduits for embedment, other than those merely passing through shall not be larger in outside diameter than one-third the thickness of the slab, wall, or beam in which they are embedded, unless indicated on the Drawings, nor shall they be spaced closer than three (3) diameters on center, nor so located as to unduly impair the strength of the construction. The Engineer shall approve the location of all conduits and fixtures.

D. Concrete foundations, supports and bases for all equipment and machinery shall be built to the equipment manufacturer's requirements, as approved by the Engineer, with anchor bolts installed.

END OF SECTION

**SECTION 03800 – LEAKAGE TESTING OF HYDRAULIC STRUCTURES**

PART 1 - GENERAL

1.01 DESCRIPTION

A. Test concrete hydraulic structures for leakage as described herein.

PART 2 - PRODUCTS

2.01 GENERAL

A. Water: Potable.

B. Piping: As required to fill and empty structures.

C. Equipment: As required to fill and empty structures.

PART 3 - EXECUTION

3.01 INSTALLATION

A. Hydrostatically test concrete structures which are intended to contain liquid to determine that they are watertight and free of detectable leaks.

3.02 INSPECTION AND TESTING

A. Prior to testing, clean exposed surfaces by thorough hosing and remove all loosened matter and wash water from the structures.

B. Conduct testing before backfill is placed against walls and after all concrete has attained the specified compressive strength.

C. Fill hydraulic structures to be subjected to leakage tests with water to the normal liquid level line. Do not fill more than 36 inches of water depth per day, unless otherwise approved by the Engineer. Repair any running leaks which appear during filling before continuing. After the structure has been kept full for 48 hours, it will be assumed, for the purposes of the tests, that the absorption of moisture by the concrete in the structure is complete. Then, close all valves and gates to the structure and measure the change in water surface each day for a five-day period.

D. During the test period, examine all exposed portions of the structure, and mark all visible leaks or damp spots. Repair such leaks or damp spots later. If the drop in water surface in a 24

hour period exceeds 1/10 of 1 percent of the normal volume of liquid contained in the structure, the leakage will be considered excessive.

E. If the leakage is excessive, drain the structure, repair leaks and damp spots, refill the structure and again test for leakage. Continue this process until the drop in water surface in a 24 hour period, with the structure full, is less than 1/10 of 1 percent of the volume.

F. Evaporation and precipitation rates shall be independently measured as part of the leakage test.

G. Make repairs and additional tests at no additional cost to the Owner.

H. Apply specified coatings only after acceptance of leakage testing by the Engineer.

### 3.03 REPAIR METHODS

A. Repair concrete not passing the leakage test in conformance with the applicable provisions of Division 3 and to the satisfaction of the Engineer.

END OF SECTION

**SECTION 06 500 – PLASTIC & COMPOSITES**

**PART 1 - GENERAL**

Architects Source Product Specifications for EPDM Pour-In-Place Safety Surfacing  
Design Criteria or approved equal:

A. The Safety Surface System shall have been marketed in the United States for at least five (5) years.

B. The installation of the Safety Surfacing specified herein and indicated on the Drawings shall be performed by firm who can furnish supporting evidence of installation experience to performed by firm who can furnish supporting evidence of installation experience to perform this work and who has regularly been engaged in this work on a full time basis for a period of not less than 5 years.

C. The installation of the Safety Surfacing shall be performed by an applicator that can furnish evidence of approval and training by the manufacturer, unless installed by the manufacturer.

D. The installation of the Safety Surface shall be overseen by a factory representative.

E. The following specifications, standards and codes shall hereby form a part of this specification.

1. American Standard for Testing and Materials (ASTM)
2. Consumer Products Safety Commission (CPSC}
3. National Bureau of Standards

F. Material must successfully pass an "ASTM sulfur pill fire testing"

G. Material shall be vandal resistant, firmly secured so that it cannot be pulled away from the playground surface.

H. Installed Safety Surface shall meet or exceed CPSC performance guidelines with respect to the Critical Heights of the proposed in-place play equipment.

I. Material is used in construction of the Safety Surface System shall be tested for conformance with requirements of ASTM F 1292.

J. Manufacturer must possess a certificate of endorsement as an active Licensed General Contractor in the State of Florida.



K. Manufacturer must be capable of material supply and completed installation within a (14) day performance window of each individual project.

L. Manufacturer must supply preventative maintenance program recommendations along with clear and definitive cleaning instructions of the product supplied.

M. Manufacturer must be capable of providing performance bond if required.

**Submittals:**

A. If a substitute is proposed as an "approved equal" to an item named in this Section, comply with Division 1 Subsection 6.01 and submit sufficient evidence to prove objectivity that the item conforms to this Section and is equal to the named entity.

B. General: Submit the following in accordance with Conditions of Contract.

C. Certified Test Data that Safety Surfacing meets or exceeds the following:

1. Current Consumer Product Safety Commission (CPSC) guidelines issued in "A Handbook for Public Playground Safety~ (Latest Edition) for a minimum fall height of 6 Feet.
2. Current Americans with Disabilities Act Guidelines (ADAG).
3. Current ASTM F- 1292 requirements.

D. Certifications

1. State of Florida General Contractor License.

E. Samples

1. Submit Samples of the following for approval by the Engineer.
  - A. 12 inch x 12 inch samples of the safety surface in thickness specified.
  - B. 4" round sample of actual surfacing material, all colors available for color selection.
  - C. 1 foot long pieces of the material to be used for the patterns if patterned work is to be performed.

F. Manufacturer's Review: Submit written statement, signed by safety surfacing installer stating that Drawings and Specifications have been reviewed by qualified representatives of materials manufacturer, and that they are in agreement that materials and system to be used for safety surfacing are proper and adequate for applications shown.

G. Substrate Acceptability: Submit a certified statement issued by manufacturer of Safety Surfacing materials and countersigned by applicator, attesting that areas and surfaced designated to receive safety surfacing have been inspected and found satisfactory for reception of work

covered under this Section: and are not in conflict with ~ Warranty" requirements. Application of materials will be constructed as acceptance of surfaces.

H. Statement of Supervision: Upon completion of Work, submit a written statement signed by manufacturer stating that field supervision of manufacturer's representative was sufficient to insure proper application of materials to assure that Work was installed in accordance with Contract Documents, and that installation is acceptable to manufacturer.

I. Certification: Furnish certificate-accompanying delivery of Safety Surface material indicating compliance with the Contract Documents.

Material Testing:

A. Shock Absorbency: When tested in accordance with ASTM F-1292, Test Method F355, Procedure C (Metal Headform), the surface shall not impart to the Headform upon impact, a peak deceleration exceeding 200 times the acceleration due to Gravity (200 G's). Drop heights used in this test shall be the heights relevant to the proposed play structures used in conjunction with the safety surfacing areas indicated on the Drawings.

B. Weathering: After being subjected to a freeze-thaw cycle in accordance with ASTM C 67 and after being subject 200 Degrees F for seven days in accordance with ASTM D 573, the sample shall be retested in compliance with ASTM F-1292 at 72 Degrees F only. A peak deceleration rereading not exceeding 200 G's shall be maintained.

C. Slip Resistance: Wet dynamic reading shall not be less than 40 when tested in accordance with ASTM E 303, using British Portable Skid Resistance Tester

D. Flammability: Minimum Critical radiant flux of 0.22 Watts/CM<sup>2</sup> when tested in accordance with ASTM E 648.

Warranty:

A. Provide a written warranty stating that work executed under this Section will be free from defects of materials and workmanship for a period of two years' from date of Substantial Completion, and that material breakdown and unraveling will be remedied on written notice at no additional cost to the Owner. The Warranty shall be in writing and shall be signed by the Contractor, the Safety Surface materials manufacturer. Warranty shall include removal and replacement of materials as required to repair safety surfacing, at no cost to the Owner.

Site Conditions:

A. Conditions of substrates with respect to structural performance shall be evaluated and approved by the applicator prior to applying the safety surfacing.

B. Safety Surfacing shall not be placed when the ambient temperature is below 40 Degrees Fahrenheit, when there is frost in the base, when rain or frost is forecasted, or any other time when weather conditions are unsuitable for the type of material being placed.

C. At the time of application ambient air temperature shall be 40 Degrees Fahrenheit or greater and remain so for at least 7 days after installation is complete.

D. Adjacent Material and the Safety Surfacing shall be protected during installation, while curing and / or unattended from weather and other damage.

**Delivery, Storage, and Handling:**

A. All materials for the work of this Section shall be delivered, stored and handled so as to preclude damage of any sort. Materials showing evidence of damage shall not be used and shall be removed from the site.

B. Materials in manufacturer's unopened containers or bundles must be fully identified with brand, type, grade, and born on date of manufacture.

C. Store materials in original tightly sealed containers or unopened packages. Materials shall be stores out of weather, off the ground, in dry area, in compliance with manufacturer's maximum storage temperature range.

D. Materials must be delivered and off-loaded by installation personnel.

**Job Conditions:**

A. Maintain manufacturer's current installation instructions at the job site at all times for safety surface material to be used on the Project.

B. Maintain material storage area at minimum 60 degrees Fahrenheit, but not above 90 degrees Fahrenheit for 48 hours prior to application.

C. Proceed with work of this section only after substrate construction and penetrating work have been completed.

D. Do not proceed with work during inclement weather. Comply with manufacturer's recommendations for application and curing under specific climatic conditions.

E. Coordinate application of safety surfacing with work of other trades.

**Protection:**

- A. Protect the safety surface from damage, resulting from spillage, dripping, and dropping of mater. Prevent materials from entering and clogging drains. Repair, restore or replace work, which is soiled or damaged in connection with the performance of the work.

**PART 2 - PRODUCTS:**

**General:**

- A. All materials used in the production of the safety surfacing shall be obtained from the same source.

**Materials:**

- A. Primer: Single component moisture cured polyurethane primer.
- B. Binder: An elastic polyurethane pre-polymer with minimal odor, excellent weathering and binding characteristics. The use of Stockmeier PS # 106 binder is a prerequisite.
1. 100% MDI based binder.
- C. Rubber: RTH - EPOM 1 -3 mm granules.
- D. Thinner: A thinner, approved by the safety surface manufacturer shall be used for cleaning tools.

**E. Safety Surfacing System:**

1. Shall have been tested for shock attenuation under ASTM F-1292 and HIC.
2. Shall have been tested for non-slip characteristics under ASTM E-303.
3. Shall have been tested for ease of ignition under BS 5696 and ASTM 0 -2859.
4. Shall have been tested for fire resistance under UL94.
5. Shall contain no latex.

- F. Authenticity of raw materials to be verified by staff upon arrival to job site area.

**Mixing and Preparation:**

- A. Mixture of binder and Rubber will be determined by the system, which is specified. Verify with manufacturer for specific detailing.
- B. Colors shall be selected by the Engineer from the manufacturer's full line.

**General:**

- A. Safety Surfacing shall be installed in the presence of a factory trained service representative to insure the highest quality installation.
- B. Installation of Safety Surfacing shall be over bituminous concrete sub-base as per manufacturer's instructions and as detailed. The safety surfacing in itself shall not create new

hazards; hence all installations shall be done as carefully as possible in a neat and workmanlike manner.

C. Layout of areas of safety surfacing shall be reviewed by the manufacturer's representative to insure that the proper thickness of safety surface is installed. A minimum of ½" EPDM wear course is mandatory.

D. For the base, follow all manufacturer guidelines and instructions.

**Inspection:**

- A. Examine areas and conditions where safety surfacing is to be installed and curing of the safety surfaces.

**PART 3 – EXECUTION**

A. Safety Surface shall be installed to thicknesses indicated on the Drawings. Minimum thicknesses indicated on the Drawings are based on the performance standards of Play Space Services j Rubber Designs.

- 1. The use of minimum base executed within Play Space Services j Rubber Designs playground safety surfacing system is solely for the purpose of setting a performance standard. It does not indicate a proprietary item, nor does it preclude products of other manufactures so long as the raw material requirements, tenured experience specifications, and all other applicable provisions of the contract documents are met.

- 2. Thicknesses of safety surfacing must meet all safety requirements and codes for fall heights of specified play equipment.

B. Primer shall be applied to the substrate at a rate of 300 square feet per gallon using a short nap roller.

- 1. Base mat and Top Coat.
- 2. Using trowel. SBR/Binder mix shall be spread in a consistent density to specified thickness. Compact and allow to dry for a minimum of 24 hours (necessary time varies based on temperature and humidity).

**Cleaning and Protection:**

A. Clean, repair or replace work of trades soiled or damaged by safety surface installation work.

B. The General Contractor shall be responsible for protection of finished surfaces until completion of construction and sign off.

END SECTION

06 500-6

**SECTION 107300 - SPECIALTIES MANUFACTURERS OF PROTECTIVE COVERS**

PART 1 - GENERAL

1.1 DESCRIPTION OF PRODUCT

A. Steel shelter construction system Custom SQR 24 with Perforated Walls and Doors over primary roof.

B. ROOF SLOPE: 6:12

C. UPB HEIGHT: Eight Feet. Under Perimeter Beam is the clearance height under the structure. It indicates the lowest height of a member from finish grade for clearance under the structure. This is generally the clearance under the eave fascia board.

1.2 REFERENCES

A. REFERENCE STANDARDS:

1. AISC - American Institute of Steel Construction Manual of Steel Construction.
2. ASTM - American Society for Testing and Materials.
3. AWS - American Welding Society.
4. LEED - Leadership in Energy and Environmental Design.
5. OSHA – Occupational Safety and Health Administration Steel Erection Standard 29 CFR 1926 Subpart R-Steel Erection.
6. PCI - Powder Coating Institute.
7. SSPC - Steel Structures Painting Council.

1.3 SUBMITTALS

A. GENERAL SUBMITTAL:

Submit nine (9) sets of submittal drawings and nine (9) sets of calculation books, both signed and sealed by a Professional Engineer licensed in the State of Florida.

B. PRODUCT DESIGN REQUIREMENTS:

The building shall meet the following design requirements as shown on the drawings:

1. Building Code: See drawings.
2. Basic Wind Design Criteria: See drawings.

C. SUBMITTAL REQUIREMENTS:

Calculations and Submittal drawings shall include, at a minimum:

1. Calculations:

- a. References to building codes and design manuals used for calculations.
- b. Identification of lateral force resisting system.
- c. Formulas used for determining snow, wind, and seismic loads to specific project location.
- d. Three dimensional modeling input, model geometry, and analysis results.
- e. Member design results and controlling load combinations.
- f. Connection design for structural bolts, welds, plate thicknesses, and anchorage to the foundation.
- g. Foundation designs must include the required combinations of gravity and lateral loads.

2. Submittal Drawings:

- a. Anchor bolt layout.
- b. Foundation design.
- c. Three dimensional views of frame.
- d. Member sizes and locations.
- e. Structural connection details, including bolt sizes and plate thicknesses.
- f. Roof trim and connection details.

D. FOUNDATION DESIGN:

The shelter shall be set on prepared foundations designed by an engineer retained by owner using the column reactions provided by manufacturer.

E. ANCHOR BOLTS:

Anchor bolts shall be provided by contractor.

1.4 QUALITY ASSURANCE

A. MANUFACTURER QUALIFICATIONS:

1. Minimum of 10 years in the shelter construction industry.
2. Full time on-staff Licensed Engineer.
3. Full time on-staff AWS Certified Welding Inspector.
4. Full time on-staff Quality Assurance Manager.
5. Full time on-staff LEED AP.
6. All welders AWS Certified.
7. Manufacturer owned and controlled finishing system to include shot blast, pretreatment, primer, and top coat.
8. Published Quality Management System.
9. Annual audit of Quality System and Plant Processes by Third Party Agency.
10. Annual audit of powder coat finish system by Third Party Agency (PCI).

1. PCI 4000 S Certified, Certification thru PCI for original equipment manufacturers (OEMs) to evaluate process on entire finish system to add powder coat over steel.
2. Miami Dade County Certificate of Competency for Structural Steel and Miscellaneous Metal Products and Assemblies.

#### 1.5 FIELD OR SITE CONDITIONS

- A. Foundations shall be at the same elevation unless specifically noted otherwise on the drawings.

#### 1.6 MANUFACTURER WARRANTY

- A. Shelter must have a 10-year limited warranty on steel frame members.
- B. Shelter must have a 20-year limited warranty on paint system.
- C. Pass through warranty of Metal Roof manufacturer shall be provided.

### PART 2 - PRODUCTS

#### 2.1 SHELTER SYSTEM AND MATERIALS

##### A. MANUFACTURERS:

1. Basis of Design: Poligon, a Product of PorterCorp, 4240 N 136th Ave., Holland, MI 49424; 616.399.1963; E-mail: info@poligon.com; www.poligon.com. Receive pricing from Nathan Almon at Rep Services, Inc 407-831-9658, or approved equal.

2. The product shall be designed, produced, and finished at a facility operated and directly supervised by the supplier who has a minimum of ten years in the business making premanufactured shelters.

##### B. PRODUCT REQUIREMENTS AND MATERIALS:

1. GENERAL: The pre-engineered package shall be pre-cut unless otherwise noted and prefabricated which will include all parts necessary to field construct the shelter. The shelter shall be shipped knocked to minimize shipping expenses. Field labor will be kept to a minimum by premanufactured parts. Onsite welding is not necessary.

##### 2. REINFORCED CONCRETE:



a. Concrete shall have minimum 28-day compressive strength of 3,000 psi and slump of 4" (+/- 1"), unless otherwise noted on the drawings.

b. Reinforcing shall be ASTM A615, grade 60.

### 3. STEEL COLUMNS:

a. Hollow structural steel tube minimum ASTM A500 grade B with a minimum wall thickness of 3/16".

b. Unless columns are direct buried, columns shall be anchored directly to concrete foundation with a minimum of four anchor rods to meet OSHA requirement 1926.755(a)(1).

### 4. STRUCTURAL FRAMING:

Hollow Structural Steel tube minimum ASTM500 grade B. "I" beams, tapered columns, or open channels shall not be accepted for primary beams. Frame will have a STANDARD POLI-5000. Color chosen from manufacturer's standard color chart to match existing and approved by the County.

### 5. COMPRESSION MEMBERS:

Compression rings of structural channel or welded plate minimum ASTM A36 or compression tubes or structural steel tube minimum ASTM A500 grade B shall only be used.

### 6. CONNECTION REQUIREMENTS:

a. Anchor bolts shall be ASTM F1554 (Grade 36) unless otherwise noted.

b. Structural fasteners shall be zinc plated ASTM A325 high strength bolts and A563 high strength nuts.

c. All structural fasteners shall be hidden within framing members wherever possible.

d. No field welding shall be required to construct the shelter.

e. All welds shall be free of burrs and inconsistencies.

f. All exposed fasteners shall be painted by manufacturer prior to shipment to match frame or roof colors as applicable.

g. Manufacturer shall provide extra structural and roofing fasteners.

### 7. ROOFING MATERIALS:

a. PRIMARY ROOF DECK OF "R" PANEL METAL ROOFING:

- 1) Roofing shall be 24 gauge ribbed galvalume steel sheets, with ribs 1 3/16" high and 12" on center.
- 2) Roof surface shall be painted with Kynar 500 to the manufacturer's standard color to match existing and approved by the County. Ceiling surface shall be a "wash coat" primer.
- 3) Roof panels shall be factory pre-cut to size and angled to provide ease of one-step installation.
- 4) Metal roofing trim shall match the color of the roof and shall be factory made of 26 gauge Kynar 500 painted steel.
- 5) Trim shall include panel ridge caps, hip caps, eave trim, splice channels, rake trim, roof peak cap, and corner trim as applicable for model selected. Trim may need to be cut to length and notched. Reference drawings for additional information.
- 6) Ridge, hip, and valley caps shall be pre-formed with a single central bend to match the roof pitch and shall be hemmed on the sides.
- 7) Roof peak cap shall be pre-manufactured.
- 8) Manufacturer must supply painted screws and butyl tape.

8. FINISHES:

a. STANDARD POLI-5000 FINISH:

- 1) Steel shall be cleaned, pretreated, and finished at a facility owned and directly supervised by the manufacturer.
- 2) Steel shall be shot blasted to SSPC-SP10 near-white blast cleaning. SSPC-SP2 hand tool cleaning will not be an acceptable alternative.
- 3) Parts shall be pretreated in a 3 stage iron phosphate or equal washer.
- 4) Epoxy primer powder coat shall be applied to parts for superior corrosion protection.
- 5) Top coat of Super Durable TGIC powder coat shall be applied over the epoxy primer.
- 6) Finish shall not have any VOC emissions.
- 7) Sample production parts shall have been tested and meet the following criteria:

a) Salt spray resistance per ASTM B 117/ ASTM D 1654 to 5,000 hours with no creep from scribe line and rating of 10.

b) Humidity resistance per ASTM D2247-02 to 3,000 hours with no loss of adhesion or blistering.

c) Color/UV resistance per ASTM G154-04 to 2,000 hours exposure, alternate cycles with results of no chalking, 75% color retention, color variation maximum 3.0 E variation CIE formula (before and after 2,000 hours exposure).

8) The manufacturer shall be PCI 4000 S Certified

9) Exposed fasteners for frame and ornamentation shall be powder coated to match structure.

#### 9. ACCESSORIES

##### b. ELECTRICAL ACCESS:

1) Electrical access to be provided per manufacturer's electrical access sheet.

##### 2) Perforated Metal Screens:

a) Perforated metal screens shall be made of picture frame sections with perforated 14 gauge carbon steel inserts which shall be powder coated to match the color of the steel frame of the shelter.

b) Perforated metal shall be sized to be 1/4" diameter holes with 5/16" staggered centers, 12 holes PSI, 58% overall open area.

c) Screens shall be cross bent to add rigidity and reduce vibration.

d) Screens will have a STANDARD POLI-5000.

e) See Finish Schedule, Specification 09999 for color selection.

#### PART 3 - EXECUTION

##### 3.1 INSTALLERS STORAGE AND HANDLING

A. Protect building products after arrival at destination from weather, sunlight, and damage.

B. Installer shall store product elevated from soils to allow air circulation and to not introduce mold, fungi decay or insects to the product.

C. Product must be handled with protective straps or padded forks if lifting with mechanical equipment. Use of chain or cable to lift product into place will not be accepted.

### 3.2 ERECTION

#### A. FOUNDATIONS:

The shelter shall be placed on foundations designed by an engineer retained by owner, with materials provided by others. Design approved by the Engineer of Record identified in Section 1.3 D.

#### FOUNDATION DESIGN.

#### B. INSTALLATION:

Install all components according to manufacturer's installation instructions and these specifications.

#### C. GENERAL CONTRACTOR:

Interface with other work is to be coordinated by the customer or the customer's agent. Certain designs have electrical or other plumbing requirements that are not supplied by Manufacturer.

#### D. TOLERANCES:

Tolerances on steel structural members are set according to AISC construction practices, abided in the factory, and cannot be increased. No field slotting or opening of holes will be allowed. It is therefore essential that contractors conform to the tolerances specified on the installation drawings for anchor bolt or column layout details.

#### E. OSHA COMPLIANCE:

OSHA Compliance to Steel Erection Standard 29CFR 1926 Subpart R-Steel Erection.

### 3.3 REPAIR

A. Do not attempt any field changes without first contacting Poligon.

### 3.4 FIELD OR SITE QUALITY CONTROL

A. Field or Site Tests and Inspections are not required by Manufacturer but may be required by the customer or by the local building inspector.

END OF SECTION 107300

SECTION 131143 - AQUATIC PLAY FEATURES AND FILTRATION SYSTEM

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 DEFINITIONS

A. Definitions in this Article do not change or modify the meaning of other terms used in the Contract Documents.

1. Products are items purchased for incorporation in the Work, regardless of whether they were specifically purchased for the project or taken from the Contractor's previously purchased stock. The term Product as used herein includes the terms "material," "equipment," "system" and other terms of similar intent.

2. Named Products, are products identified by use of the manufacturer's name for a product, including such items as a make or model designation, as recorded in published product literature, of the latest issue as of the date of the contract documents.

3. Materials, are products that must be substantially cut, shaped, worked, mixed, motorized or manually operated, and in particular, a product that requires service connections such as wiring or piping.

4. Equipment is defined as a product with operational parts, regardless of whether motorized or manually operated, and in particular, a product that requires service connections such as wiring or piping.

1.3 PRODUCT CONSTRUCTION

A. Play Products: All aquatic play products installed above and below grade shall be manufactured from 304/304L stainless steel. The anchoring system and associated fastening hardware shall be manufactured from 304/304L stainless steel. Rigid centricast fiber reinforced (FRP) and/or molded fiberglass, PVC, filament wound tubing, Galvanized Steel, or Aluminum shall not be utilized for any above or below grade play product structures.

B. Mounting and Assembly Hardware: All hardware and anchoring systems shall be 304/304L stainless steel. All Play Products and Ground Spay systems shall include an integrated anchoring and leveling system facilitating installation and a flush surface finish. Exposed and accessible

hardware shall be tamper resistant, requiring a special tool for removal to deter vandalism and theft.

C. Spray nozzles, caps and heads: Shall be manufactured from C360 brass and shall use tamper resistant tools for installation and removal. PVC, Nylon, and Delrin™, shall not be utilized. All grade level play products are to be furnished with appropriate winterization caps.

D. Painted Finish: Shall be a polyester smooth glossy heat-cured powder coat that is UV and chemical resistant and suitable for public spaces.

E. Material for Paneling, Signage, Water Deflection, and Toe Guards: All Polyethylene, Polyurethane, Elastomers, and Seeflow Polymers used for paneling, signage or water deflection shall be resistant to chlorinated water and be ultraviolet stabilized to inhibit sunlight fading.

F. Safety & Craftsmanship: All accessible edges shall be machined to a rounded finish. All welds shall be watertight, buffed smooth, or polished to a non-visible finish and factory pressure tested. Accessible nozzles and spray heads shall be recessed to ensure a completely safe play environment with no pinch points, head entrapments or protrusion hazards. All products shall be designed in accordance with ASTM F1487, ASTM F-2461 and CSA Z614- 98 regulations for public playgrounds.

G. Lexan Polymer: The Lexan Polymer shall be specially selected for aquatic play products and shall have the following characteristics: translucent, highly resistant to shock and impact, vandalism and must be non-flammable. The polymer shall present dimensional stability a high resistance towards chemical products, ultra violets rays and be transparent presenting crystal clear surface throughout.

H. Seeflow Polymer: The Seeflow Polymer shall be specially selected for aquatic play products and shall have the following characteristics: translucent, highly resistant to shock and impact, vandalism and must be non-flammable. The polymer shall present dimensional stability a high resistance towards chemical products, ultra violets rays and be transparent presenting crystal clear surface throughout.

### 1.3.1 RECIRCULATION, FILTER AND CHEMICAL TREATMENT SYSTEM

A. The Filter and recirculation system shall be a self contained design which includes a fiberglass skid equipment unit that shall contain all pumps, filters, pipe, valves, fittings, electrical panels, wiring and chemical control equipment as per the plans provided by Orange County. It shall comply with the Florida public pool code 64E-9 under the Florida Building Code. The complete system shall be certified under the UL1081 standard for Swimming Pool Pumps, Filters and Chlorinators and shall be marked with the testing lab certification. The equipment manufacturer shall provide start up and a minimum of 2 hours operation and maintenance training, on site, with the owner's maintenance department. The instructor shall be

ORANGE COUNTY, FLORIDA AQUATIC PLAY FEATURES AND FILTRATION SYSTEM

an employee of the filter and recirculation manufacture with a minimum of 10 years onsite training and startup experience of interactive water feature systems where the feature water is treated by a recirculation system.

B. The filter system shall be designed such that 100% of the feature flow is filtered. Each sand filter may be backwashed or maintained while only reducing the operational flow of the feature system by approximately 35% at any time.

C. The chemical control system must be capable of treating water to the collector tank, as well as all feature discharge water, with chemicals being injected at a point prior to the feature valve manifold but after the filter(s). The chemical controller manufacturer shall provide start up and a minimum of 2 hours operation and maintenance training, on site, with the owner's maintenance department. The instructor shall be an employee of the chemical controller company or an employee of the company that represents that company with at least 5 years of field experience with interactive water feature chemical control systems.

D. The feature system shall be designed with the use of slow closing 3way actuator valves which distributes the flow between the splash pad feature and the collector tank without water hammer. **Solenoid valves shall not be used as a substitute for the 3way actuator valves.** Manual bypass lines shall be used to regulate feature manifold flow

#### 1.4 PLAY PRODUCT INSTALLATION

A. When applicable, templates shall be supplied to facilitate the installation of embedded anchoring equipment.

B. All play products shall have electrical grounding studs incorporated into their associated anchoring equipment. All play products shall be grounded by the installer per local codes.

C. All installation conduit wiring including electrical supply panel, PVC connections, piping, elbows, tees, play product assembly if required and other items relating to the installation shall be supplied by the general contractor.

D. Drawings and Instructions: Product drawings and installation manuals shall be supplied by the manufacturer for ease of installation.

#### 1.5 PRODUCT DELIVERY, STORAGE AND HANDLING

A. All aquatic play products and associated equipment must be properly wrapped and secured in place while in transport to the project site. Care shall be observed during offloading and handling to prevent excessive stress and abrasions.

B. At the site, the play products and associated equipment are to be stored in safe areas, out of the way of traffic and other construction activities, until the actual time of installation. If required, safety barricades or other like precautions must be taken for the protection of public and adjacent property.

C. Protective wrapping on the aquatic play features must be left in place until construction work for the Splashpad is complete.

#### 1.6 COMMISSIONING OF THE SPLASHPAD

A. Upon completion of construction, the general contractor shall provide the owner/operator adequate training on facility operations and maintenance. The contractor may request that the equipment manufacturer and/or manufacturer's representative provide on-site start-up and training for the owner/operator.

#### 1.7 SPLASHPAD QUALITY ASSURANCE

Provide evidence of commitment of quality craftsmanship as demonstrated by the following:

Splashpad Manufacturer Qualifications:

A. A full time licensed engineer must be on-staff

B. A full time quality control manager must be on-staff

#### 1.8 SPLASHPAD EQUIPMENT WARRANTIES

A. A 25 Year Warranty on stainless steel Play Events/Products, stainless steel anchoring systems and aluminum spheres.

B. A 10 Year Warranty on the reinforced fiberglass skid, sand filter fiberglass tank and cartridge filter fiberglass tank.

C. A 5 Year Warranty on brass components including; spray nozzles, spray caps and spray heads. High-density polyethylene components, polyurethane components, and ultra high molecular weight polyethylene components. The Subterranean vault (enclosure and access hatches), stainless steel automated water distribution manifold, drain boxes, strainers, electrical enclosures, and chemical controllers.

D. A 2 Year Warranty on color coatings, stainless steel hardware & moving parts, fiberglass products, Seeflow Polymers, Soft Touch Elastomers (Toe Guards), subterranean water containments system, circulation pumps, chemical injection pumps, chlorinator systems, acid feed systems, polyvinyl chloride (PVC); piping, fittings, ball valves, check valves, cartridge elements, pressure gauges, chemical sensing probes, motor starters, electrical relays, terminal



blocks, actuated valves, programmable logic controller (PLC controller), time switches, manual switches, transformers, breakers, electrical wiring and connections.

E. All warranties are to be managed by the equipment supplier.

#### 1.9 ADDITIONAL REQUIREMENTS/ Options: Filtration/ Chemical Treatment

A. The manufacturer is required to offer a complete water quality management system to accommodate the specified aquatic play products. This complete Splashpad automation package, consisting of a FRP water containment system, single loop water filtration system, automated chemical treatment system, automated water distribution system, Splashpad operational control and failsafe monitoring systems, Motor starter protection circuitry, and a user activated controller to regulate the use of the play events and their hours of operation.

B. This water quality management system must be pre-assembled, factory tested, and come complete with all the necessary plumbing, pre-wired control systems, pumps, and solenoid valves. The manufacturer must have the capacity to provide technical documentation, operations and maintenance manuals, and technical support for the entire system.

### PART 2 - PRODUCTS

#### 2.0 MANUFACTURERS:

A. Basis of Design: Vortex (Local Representative is Gerry Moffa, (407) 227-6623) or approved equal and VakPak (Local Representative is Tommy Karst, (904) 626-0616) or approved equal.

#### 2.1 SUBSTITUTIONS

A. Conditions: The Architect will receive and consider the Contractor's request for substitution when one or more of the following conditions are satisfied, as determined by the Architect. If the following conditions are not satisfied, the Architect will return the requests without action except to record noncompliance with these requirements.

1. Extensive revisions to the Contract Documents are not required.
2. Proposed changes are in keeping with the general intent of the Contract Documents.
3. The request is timely, fully documented, and properly submitted.
4. The Architect will not consider the request if the specified product or method cannot be provided as a result of the Contractor failure to pursue the Work promptly or coordinate activities properly

5. The requested substitution offers the Owner a substantial advantage, in cost, time, energy conservation, or other considerations.

6. The specified product or method of construction cannot receive necessary approval by a governing authority, and the requested substitution can be approved.

7. The specified product or method of construction cannot be provided in a manner that is compatible with other materials and where the Contractor certifies that the substitution will overcome the incompatibility.

8. The specified product or method of construction cannot be coordinated with other materials and where the Contractor certifies that the proposed substitution can be coordinated.

9. The specified product or method of construction cannot provide a warranty required by the Contract Documents and where the Contractor certifies that the proposed substitution provides the required warranty.

B. The Contractor's submittal and the Architect's acceptance of Shop Drawings, Product Data, or Samples for construction activities not complying with the Contract Documents do not constitute an acceptable or valid request for substitution, nor do they constitute approval.

### PART 3: EXECUTION

#### 3.0 EXECUTION

A. Should the bidder wish to substitute products other than the products specified herein, the bidder shall list products and submit a written Substitution Form of Proposal at least 10 calendar days prior to the date of receipt of bids. The bidder shall submit specifications, cut sheets, and performance data, along with an itemization listing each and every deviation from the specifications herein.

B. The manufacturer shall furnish the purchaser with at least two sets of complete installation and operating manuals. The installation manual will illustrate the installation of the entire system. It shall describe the start-up procedure and day- to- day operation of the system.

#### 3.1 PLAY PRODUCT INSTALLATION

A. When applicable, templates shall be supplied to facilitate the installation of embedded anchoring equipment.

B All play products shall have electrical grounding studs incorporated into their associated anchoring equipment. All play products shall be grounded by the installer per local codes.

C. All installation conduit wiring including electrical supply panel, PVC connections, piping, elbows, tees, play product assembly if required and other items relating to the installation shall be supplied by the general contractor.

D. Drawings and Instructions: Product drawings and installation manuals shall be supplied by the manufacturer for ease of installation.

### 3.2 PRODUCT DELIVERY, STORAGE AND HANDLING

A. All aquatic play products and associated equipment must be properly wrapped and secured in place while in transport to the project site. Care shall be observed during offloading and handling to prevent excessive stress and abrasions.

B. At the site, the play products and associated equipment are to be stored in safe areas, out of the way of traffic and other construction activities, until the actual time of installation. If required, safety barricades or other like precautions must be taken for the protection of public and adjacent property.

C. Protective wrapping on the aquatic play features must be left in place until construction work for the Splashpad is complete.

### 3.2 COMMISSIONING OF THE SPLASHPAD

A. Upon completion of construction, the general contractor shall provide the owner/operator adequate training on facility operations and maintenance. The contractor may request that the equipment manufacturer and/or manufacturer's representative provide on-site start-up and training for the owner/operator.

### 3.3 Play Product Specifications:

A. Play Product Structure: The Ground Gusher VOR-300.4000 shall be constructed of 304/304L stainless steel with an outside diameter of 4½" (11.4cm). The brass spray cap and winter cap shall be fastened to the gusher body using tamper-resistant fasteners. Tamper resistant winter caps shall be included. The anchoring system shall have an integrated levelling system facilitating installation and a plumb finished to the activity deck surface. Ground Sprays can be fitted with several interchangeable compatible spray head styles however, The spray zone layouts between the different products must be similar or must be planned to accommodate the various spray effects. When multiple ground sprays are plumbed together on a single water line, the connected ground sprays must have similar hydraulic requirements.

B. Overall play product dimensions: The overall height of the Play Product shall be 0" (0 cm).

a. Play Product Interactivity: Users can feel the more powerful water spray near the ground, and lighter pressure near the top of the gusher.

b. Hydraulic Activity/Components: The spray cap shall have a thirty-six (36)-hole spray pattern angled at 5° from vertical so that multiple streams spray water straight up from a concentrated circle.

c. Hydraulic Requirements: The hydraulic requirements shall be 20-40 gpm (76-151 lpm) @ 5-15 psi (0.3 – 1 bar).

C. Play Product Specifications:

a. Play Product Structure: The Rooster Tail VOR-303.4000 shall be constructed of 304/304L stainless steel with an outside diameter of 4½" (11.4cm). The brass spray cap and winter cap shall be fastened to the body using tamper-resistant fasteners. Tamper resistant winter caps shall be included. The anchoring system shall have an integrated levelling system facilitating installation and a plumb finished to the activity deck surface. Ground Sprays can be fitted with several interchangeable compatible spray head styles. However, the spray zone layouts between the different products must be similar or must be planned to accommodate the various spray effects. When multiple ground sprays are plumbed together on a single water line, the connected ground sprays must have similar hydraulic requirements.

b. Overall play product dimensions: The overall height of the Play Product shall be 5" (13cm).

c. Play Product Interactivity: Users can enjoy the far-reaching double-fan spray effect of the rooster tail.

d. Hydraulic Activity/Components: The spray cap shall have a thirteen (13) hole- pattern angled at 33° and 45° from the vertical divided into two (2) rows. The upper row shall consist of seven (7) holes equally spaced and angled at 33°. The lower row shall consist of six (6) holes equally spaced and angled at 45°, thus creating a fan-like spray pattern.

e. Hydraulic Requirements: The hydraulic requirements shall be 10-15 gpm (38-57 lpm) @ 5-10 psi (0.3 – 0.7 bar).

D. Play Product Specifications:

a. Play Product Structure: The Directional Water Jet VOR-305.4000 shall be constructed of 304/304L stainless steel with an outside diameter of 3" (7.6cm) and a wall thickness of ¾" (2cm). The spray head housing shall be fitted with a spray cap assembly consisting of a brass locking ring and an adjustable brass spray sphere. The nozzle system shall be free of finger entrapment hazards. The anchoring system shall have an integrated levelling system facilitating installation and a plumb finished to the activity deck surface.

b. Overall play product dimensions: The overall height of the Play Product shall be 5" (13cm).

c. Play Product Interactivity: The high or low streaming arc of water produced by the Directional Water Jet creates visual interest.

d. Hydraulic Activity/Components: The water effect from the spray head shall produce a single soft stream adjustable from the vertical position to a maximum of 25° from vertical. Rotating the adjustable spray nozzle 90° from the vertical position sets the spray head to its water-tight winterized position.

e. Hydraulic Requirements: The hydraulic requirements shall be 3-5 gpm (11 – 19 lpm) @ 5-10 psi (0.3 – 0.7 bar) Low consumption nozzles that minimize water usage while maximizing spray effects are also available.

#### E. Play Product Specifications:

a. Play Product Structure: The Cylinder Spray VOR-307.0000 shall be constructed of 304/304L stainless steel structural tubing with an outside diameter of 1.9" (4.8cm) and a wall thickness of .109" (.28cm). It shall be rolled in circular pattern with a 36" (91cm) centerline diameter with twelve (12) equally spaced 3" (7.6cm) diameter stainless steel spray head housings welded to it. Each spray head housing shall be fitted with a spray cap assembly consisting of a brass locking ring and an adjustable brass spray sphere. All nozzle systems shall be free of finger entrapment hazards. The Embedded anchoring and leveling system shall be used.

b. Overall play product dimensions: The overall height of the Play Product shall be 12.2" (31cm).

c. Play Product Interactivity: Creates visual interest with twelve water jets arranged in a circle that form an impressive fountain. By sending water straight up with the right amount of pressure, the streams cascade down in an elegant symmetrical pattern.

d. Hydraulic Activity/Components: The water effect from each spray head shall produce a single soft stream adjustable from the vertical position to a maximum of 25° from vertical. Rotating the adjustable spray nozzle 90° from the vertical position sets the spray head to its water-tight winterized position.

e. Hydraulic Requirements: The combined hydraulic requirements of all twelve (12) spray nozzles shall be 35-50 gpm (132 – 189 lpm) @ 5-10 psi (0.3 – 0.7 bar). Low consumption nozzles that minimize water usage while maximizing spray effects are also available.

#### F. Play Product Specifications:

a. Play Product Structure: The Water Jelly No. 1 VOR-7010.0002 shall be constructed of 304/304L stainless steel structural tubing with an outside diameter of 4½" (11.4cm) and a wall

thickness of .120" (3mm). The brass spray head and winter cap shall be threaded into the spray head body using a tamper-resistant tool. The Embedded anchoring and leveling system shall be used.

b. Overall play product dimensions: The overall height of the structure shall be no less than 5" (13cm)

c. Play Product Interactivity: Creates a soft, laminar spray with a unique texture that even young users can touch. A cone of water starts small and gently grows out and flows over in a soft, inviting cascade.

d. Hydraulic Activity/Components: The spray head shall produce an inverted laminar bell spray effect.

e. Hydraulic Requirements: The hydraulic requirements shall be 10-12 gpm (38 – 45 lpm) @ 1-2 psi (0.069 – 0.14 bar).

#### G. Play Product Specifications:

a. Play Product Structure: The Watergarden Crab N°1 post VOR-7208.2XXX shall be constructed of stainless steel structural tubing with an outside diameter of 4.50" (11.4cm) and a wall thickness of 0.337" (8.5mm). The structure shall be bent with no ripples or joints. The body of the crab N°1 shall consist of two welded stainless steel domes with an outside diameter of 20" (508mm) and a wall thickness of 0.120" (3mm). The crab antennae shall consist of two (2) 5" (12.7cm) sphere with a wall thickness of 0.120" (3mm). The crab claws shall consist of two (2) rounded Seeflow Polymer panel fins fastened to the body with tamper resistant hardware. The feature is anchored to the deck surface by means of the Safeswap Anchor.

b. Overall play product dimensions: The overall height of the Play Product shall be no less than 26" (66cm).

c. Play Product Interactivity: A 4.5" (11.43cm) solid lead free brass 360° degree rotational joint consisting of a stainless steel bearing collar will allow the head to rotate 360° degrees. The rotational joint shall be free of pinch points and protrusion hazards and contain no flexible hoses

d. Hydraulic Activity/Components: The Watergarden Crab N°1 shall have one (1) spray cap on the top of the main body, which produces six (6) small laminar stream jet affect. The spray cap is tamper resistance and requires a specialized tool for removal.

e. Hydraulic Requirements: The combined hydraulic requirements (for the regular product only) shall be 3-5 gpm (11-19lpm) @ 10-15 psi (0.7-1.0 bar).

#### H. Play Product Specifications:

a. Play Product Structure: The Watergarden Turtle N°1 post VOR-7212.2XXX shall be constructed of stainless steel structural tubing with an outside diameter of 4.50" (11.4cm) and a wall thickness of 0.337" (8.5mm). The structure shall be bent with no ripples or joints. The body of the Watergarden Turtle N°1 shall consist of two welded stainless steel domes with an outside diameter of 20" (508mm) and a wall thickness of 0.120" (3mm). The turtle head shall consist of one (1) 6" (15.2cm) sphere with a wall thickness of 0.120" (3mm). The turtle fins shall consist of four (4) rounded Seeflow Polymer panel fins fastened to the body with tamper resistant hardware. The feature is anchored to the deck surface by means of the Safeswap Anchor.

b. Overall play product dimensions: The overall height of the Play Product shall be no less than 23" (59cm).

c. Play Product Interactivity: The users could enjoy the jet from the 6 Rivozzles and from the water jelly coming thru the body of the turtle.

d. Hydraulic Activity/Components: The Watergarden Turtle N°1 shall have six (6) Rivozzles on the top of the main body, which produces a small laminar stream jet effect. In the center of the body will be a water jelly spray nozzle that produces a laminar cone effect. All spray nozzle are tamper resistance and require a specialized tool for removal.

e. Hydraulic Requirements: The combined hydraulic requirements (for the regular product only) shall be 8-10 gpm (30-38lpm) @ 5-10 psi (0.3-0.7 bar).

#### I. Play Product Specifications:

a. Play Product Structure: The Watergarden Jellyfish N°1 VOR-7215.2XXX shall be constructed of two stainless steel structural domes with an outside diameter of 40" (101.6cm) and a wall thickness of 0.120" (3mm). The main body will be supported by three legs. The legs shall be constructed from stainless steel structural tubing with an outside diameter of 3.50" (8.9cm). The leg structures shall be bent with no ripples or joints. The Watergarden Jellyfish N°1 crown shall consist of one (1) rounded Seeflow Polymer panel fastened to the head with tamper resistant hardware. The feature is anchored to the deck surface by means of the Safeswap Anchor.

b. Overall play product dimensions: The overall height of the structure shall be no less than 108" (275 cm) with a head clearance of no less than 89" (226cm). The width shall be 40" (102cm) and the depth 42" (108cm).

c. Play Product Interactivity: Statically Interactive

d. Hydraulic Activity/Components: The water effect for the Watergarden Jellyfish N°1 will be a continuous laminar sheet that exists the mid point of the two domes. The laminar sheet will break before reaching the ground. The water effect is 360 degree around the feature.

e. Hydraulic Requirements: The combined hydraulic requirements (for the regular product only) shall be 80-100 gpm (302-379lpm) @ 5-10 psi (0.3-0.7 bar).

J. Play Product Specifications:

a. Play Product Structure: The Magic Mist No. 1 VOR-7510.0000 shall be constructed of 304/304L stainless steel structural tubing with an outside diameter of 4.5" (11.4cm) and a wall thickness of 0.120" (3mm). The powder coat painted stainless steel spray cap shall be fastened to the body using tamper-resistant fasteners. The spray cap has to be removable and shall have three stainless steel (3) Rivozzles™ staggered around the domed spray cap. Each Rivozzles™ shall be formed to the surface of the structure to eliminate finger entrapment and protrusion hazards. The Safeswap anchoring and leveling system shall be used.

b. Overall play product dimensions: The overall height of the structure shall be no less than 1" (2.54cm).

c. Play Product Interactivity: The spray effect that produces the Magic Mist No 1 creates visual interest.

d. Hydraulic Activity/Components: The Magic Mist shall contain three (3) stainless steel Rivozzles™ secured on the spray cap creating a water mist effect.

e. Hydraulic Requirements: The hydraulic requirements shall be 6 - 9 gpm (23 – 34 lpm) @ 10-25 psi (0.7 – 1.7 bar). Low consumption nozzles that minimize water usage while maximizing spray effects are also available.

K. Play Product Specifications:

a. Play Product Structure: The Jet Stream VOR-7512.0000 shall be constructed of 304/304L stainless steel structural tubing with an outside diameter of 3" (7.6cm). The lead-free brass spray cap and winter cap shall be threaded into the stainless steel spray head housing using a tamper-resistant tool. The Embedded anchoring and leveling system shall be used.

b. Overall play product dimensions: The overall height of the Play Product shall be 5" (13cm).

c. Play Product Interactivity: Creates visual interest as a concentrated jet of water sprays up in a sleek Jet Stream.

d. Hydraulic Activity/Components: The lead-free brass spray cap shall have a single ¼" (6mm) spray hole projecting a vertical stream.



e. Hydraulic Requirements: The hydraulic requirements shall be 2-3 gpm (7.6 – 11.3 lpm) @ 5-10 psi (0.4 – 0.7 bar).

L. Play Product Specifications:

a. Play Product Structure: The Split Stream VOR-7516.0000 shall be constructed of 304/304L stainless steel structural tubing with an outside diameter of 4½" (11.4cm) and a wall thickness of 0.120" (3mm). The interchangeable brass spray cap and winter cap shall be fastened to the body using tamper-resistant fasteners. The spray cap shall have two (2) nozzle orifices angled to provide a V-shaped spray effect. The nozzle system shall be free of finger entrapment hazards. The Embedded anchoring and leveling system shall be used.

b. Overall play product dimensions: The overall height of the structure shall be no less than 5' 1/16" (13cm).

c. Play Product Interactivity: Users can enjoy the two water arcs created by the Split Stream.

d. Hydraulic Activity/Components: The Split Stream produce two (2) soft stream from its two (2) orifices.

e. Hydraulic Requirements: The hydraulic requirements shall be 5-10 gpm (19 -38 lpm) @ 5-10 psi (0.3 – 0.7 bar).

M. Play Product Specifications:

a. Play Product Structure: The Side Winder VOR-7518.0000 shall be constructed of 304/304L stainless steel structural tubing with an outside diameter of 4½" (11.4cm). The lead-free brass spray cap and winter cap shall be fastened to the body using tamper-resistant fasteners. The Embedded anchoring and leveling system shall be used.

b. Overall play product dimensions: The overall height of the Play Product shall be 5" (13cm).

c. Play Product Interactivity: Users can enjoy the eighteen water arcs created by the Side Winder.

d. Hydraulic Activity/Components: The spray cap shall have an eighteen (18) hole spray pattern angled at 5° from vertical.

e. Hydraulic Requirements: The hydraulic requirements shall be 10-20 gpm (38-76 lpm) @ 5-15 psi (0.3-1.0 bar).

N. Play Product Specifications:

## ORANGE COUNTY, FLORIDA AQUATIC PLAY FEATURES AND FILTRATION SYSTEM

a. Play Product Structure: The Debris Trap with Rain Diverter Valve shall consist of one (1) access door, one (1) vault, one (1) basket and one (1) rain diverter valve. The access door shall be constructed of Aluminium. The door shall include a lockable access hatch. The exterior dimensions of the door are 42" X 42". The Vault shall be constructed of High Density Polyethylene and shall be 30" inside diameter and an overall height of 47" and suitable for public spaces. The basket shall be constructed of 304/304L, structurally strong, durable, and resistant to corrosive environments. The Debris trap shall act as the second stage of the filtration process. The debris trap is grade sensitive due to gravity drainage. 1 % grade minimum. The Water containment system elevation of the Debris Trap cannot exceed the deck elevation. The rain diverter port shall be used to drain rain and the system purge water. The maximum flow rate is 450 gallon per minute. The Stainless Steel anchoring system shall have an integrated levelling system facilitating installation and a flush finished to the concrete slab surface without any protruding bolts or hardware. The water treatment product shall be fastened directly to the Anchoring system.

b. Overall play product dimensions: The overall height of the structure shall be no less than 50 3/8" (127 cm)

c. Play Product Interactivity: N.A.

d. Hydraulic Activity/Components: N.A.

e. Hydraulic Requirements: N.A.

O. Play Product Specifications:

a. Play Product Structure: The Ground Geyser VOR-301.4000 shall be constructed of 304/304L with an outside diameter of 3" (7.62cm) and a wall thickness of 3/4" (1.9cm). The brass spray cap and winter cap shall be threaded into the geyser body using a tamper-resistant tool. Tamper resistant winter caps shall be included. The anchoring system shall have an integrated levelling system facilitating installation and a plumb finished to the activity deck surface.

b. Overall play product dimensions: The overall height of the Play Product shall be 5" (13cm).

c. Play Product Interactivity: Users can touch the soft frothy water falling down in contrast to the more powerful streams spraying up from the centre.

d. Hydraulic Activity/Components: The spray cap shall have a ten (10)-hole spray pattern angled at 5° (degrees) from vertical so that multiple streams spray water out at symmetrical angles forming an elegant fountain effect.

e. Hydraulic Requirements: The hydraulic requirements shall be 5-10 gpm (19 – 38 lpm) @ 5-10 psi (0.3 – 0.7 bar). Low consumption nozzles that minimize water usage while maximizing spray effects are also available.

P. Play Product Specifications:

a. Play Product Structure: The Watergarden Activator No.2 VOR-613.2008 shall be constructed of bent 304/304L stainless steel structural tubing with an outside diameter of 3½" (8.9cm) and a wall thickness of ⅛" (3mm). The activator shall have no moving parts and run on a low voltage electrical supply. A 14AWG (2.5mm<sup>2</sup>)-2 wire conductor shall be used for electrical connection. The activation cap shall consist of a high impact resistant protection cap and a piezo switch. The protection cap shall be constructed of polished stainless steel and shall be secured in place to the main structure with a seeflow polymer plastic panel using tamper-resistant fasteners.

b. Overall play product dimensions: It shall have an overall height of 39" (99cm) above the final grade.

c. Play Product Interactivity: The Watergarden Activator shall be the direct interface between the users of the aquatic play area and the aquatic Play Products. The preprogrammed sequences of the aquatic Play Products shall be activated only when the touch-activated sensor cap on the Watergarden Activator is touched by the user.

d. Hydraulic Activity/Components: Not applicable.

e. Hydraulic Requirements: Not applicable.

Q. Play Product Specifications:

a. Play Product Structure: The Playsafe Drain No1, VOR-1001.4000 consists of a frame and a removable cover. The frame shall be constructed of a 1/8" thickness X 2" width X 30" outside diameter bent flat bar and a 29 3/4" outside diameter bent square tube. The deckgrating cover shall be constructed with 29 1/2" diameter and 1/4" thickness. This removable cover has an antiskid surface. The Playsafe Drain No1 has also an optional strainer basket. A form with the playsafe drain which has the capabilities to be leveled shall be inserted in the hole to create concrete drain box pit. Once the drain box pit is created, the form shall be removed. The Playsafe Drain No1 allows for multi drain access points. Each water line outlet connected to the drain box shall be 8" in diameter which will allow a maximum of 233 GPM flow rate. By adding more water line outlets the flow rate can be increased to 629 GPM.

b. Overall play product dimensions: The overall height of the Playsafe Drain No1 shall be no less than 12 1/8" (30.8cm). The diameter of this feature shall be no less than 30" (76.2cm).

END OF SECTION 131143

## **SECTION 260500 - COMMON WORK RESULTS FOR ELECTRICAL**

### **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. Electrical equipment coordination and installation.
  - 2. Sleeves for raceways and cables.
  - 3. Sleeve seals.
  - 4. Grout.
  - 5. Common electrical installation requirements.

#### **1.3 DEFINITIONS**

- A. EPDM: Ethylene-propylene-diene terpolymer rubber.
- B. NBR: Acrylonitrile-butadiene rubber.

#### **1.4 SUBMITTALS**

- A. Product Data: For sleeve seals.

#### **1.5 COORDINATION**

- A. Coordinate arrangement, mounting, and support of electrical equipment:
  - 1. To allow maximum possible headroom unless specific mounting heights that reduce headroom are indicated.
  - 2. To provide for ease of disconnecting the equipment with minimum interference to other installations.
  - 3. To allow right of way for piping and conduit installed at required slope.
  - 4. So connecting raceways, cables, wireways, cable trays, and busways will be clear of obstructions and of the working and access space of other equipment.
- B. Coordinate installation of required supporting devices and set sleeves in cast-in-place concrete, masonry walls, and other structural components as they are constructed.

- C. Coordinate location of access panels and doors for electrical items that are behind finished surfaces or otherwise concealed. Access doors and panels are specified in Division 08 Section "Access Doors and Frames."
- D. Coordinate sleeve selection and application with selection and application of firestopping specified in Division 07 Section "Penetration Firestopping."

## PART 2 - PRODUCTS

### 2.1 SLEEVES FOR RACEWAYS AND CABLES

- A. Steel Pipe Sleeves: ASTM A 53/A 53M, Type E, Grade B, Schedule 40, galvanized steel, plain ends.
- B. Cast-Iron Pipe Sleeves: Cast or fabricated "wall pipe," equivalent to ductile-iron pressure pipe, with plain ends and integral waterstop, unless otherwise indicated.
- C. Sleeves for Rectangular Openings: Galvanized sheet steel.
  - 1. Minimum Metal Thickness:
    - a. For sleeve cross-section rectangle perimeter less than 50 inches and no side more than 16 inches thickness shall be 0.052 inch
    - b. For sleeve cross-section rectangle perimeter equal to, or more than, 50 inches and 1 or more sides equal to, or more than, 16 inches, thickness shall be 0.138 inch.

### 2.2 SLEEVE SEALS

- A. Description: Modular sealing device, designed for field assembly, to fill annular space between sleeve and raceway or cable.
  - 1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include the following:
  - 2. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:
    - a. Advance Products & Systems, Inc.
    - b. Calpico, Inc.
    - c. Metraflex Co.
    - d. Pipeline Seal and Insulator, Inc.

3. Sealing Elements: EPDM interlocking links shaped to fit surface of cable or conduit. Include type and number required for material and size of raceway or cable.
4. Pressure Plates: Stainless steel. Include two for each sealing element.
5. Connecting Bolts and Nuts: Stainless steel of length required to secure pressure plates to sealing elements. Include one for each sealing element.

### 2.3 GROUT

- A. Nonmetallic, Shrinkage-Resistant Grout: ASTM C 1107, factory-packaged, nonmetallic aggregate grout, noncorrosive, nonstaining, mixed with water to consistency suitable for application and a 30-minute working time.

## PART 3 - EXECUTION

### 3.1 COMMON REQUIREMENTS FOR ELECTRICAL INSTALLATION

- A. Comply with NECA 1.
- B. Measure indicated mounting heights to bottom of unit for suspended items and to center of unit for wall-mounting items.
- C. Headroom Maintenance: If mounting heights or other location criteria are not indicated, arrange and install components and equipment to provide maximum possible headroom consistent with these requirements.
- D. Equipment: Install to facilitate service, maintenance, and repair or replacement of components of both electrical equipment and other nearby installations. Connect in such a way as to facilitate future disconnecting with minimum interference with other items in the vicinity.
- E. Right of Way: Give to piping systems installed at a required slope.

### 3.2 SLEEVE INSTALLATION FOR ELECTRICAL PENETRATIONS

- A. Electrical penetrations occur when raceways, cables, wireways, cable trays, or busways penetrate concrete slabs, concrete or masonry walls, or fire-rated floor and wall assemblies.
- B. Concrete Slabs and Walls: Install sleeves for penetrations unless core-drilled holes or formed openings are used. Install sleeves during erection of slabs and walls.
- C. Use pipe sleeves unless penetration arrangement requires rectangular sleeved opening.

- D. Fire-Rated Assemblies: Install sleeves for penetrations of fire-rated floor and wall assemblies unless openings compatible with firestop system used are fabricated during construction of floor or wall.
- E. Cut sleeves to length for mounting flush with both surfaces of walls.
- F. Extend sleeves installed in floors 2 inches above finished floor level.
- G. Size pipe sleeves to provide 1/4-inch annular clear space between sleeve and raceway or cable, unless indicated otherwise.
- H. Seal space outside of sleeves with grout for penetrations of concrete and masonry
  - 1. Promptly pack grout solidly between sleeve and wall so no voids remain. Tool exposed surfaces smooth; protect grout while curing.
- I. Interior Penetrations of Non-Fire-Rated Walls and Floors: Seal annular space between sleeve and raceway or cable, using joint sealant appropriate for size, depth, and location of joint. Comply with requirements in Division 07 Section "Joint Sealants."
- J. Fire-Rated-Assembly Penetrations: Maintain indicated fire rating of walls, partitions, ceilings, and floors at raceway and cable penetrations. Install sleeves and seal raceway and cable penetration sleeves with firestop materials. Comply with requirements in Division 07 Section "Penetration Firestopping."
- K. Roof-Penetration Sleeves: Seal penetration of individual raceways and cables with flexible boot-type flashing units applied in coordination with roofing work.
- L. Aboveground, Exterior-Wall Penetrations: Seal penetrations using steel pipe sleeves and mechanical sleeve seals. Select sleeve size to allow for 1-inch annular clear space between pipe and sleeve for installing mechanical sleeve seals.
- M. Underground, Exterior-Wall Penetrations: Install cast-iron pipe sleeves. Size sleeves to allow for 1-inch annular clear space between raceway or cable and sleeve for installing mechanical sleeve seals.

### 3.3 SLEEVE-SEAL INSTALLATION

- A. Install to seal exterior wall penetrations.
- B. Use type and number of sealing elements recommended by manufacturer for raceway or cable material and size. Position raceway or cable in center of sleeve. Assemble mechanical sleeve seals and install in annular space between raceway or cable and sleeve. Tighten bolts against pressure plates that cause sealing elements to expand and make watertight seal.

3.4 FIRESTOPPING

- A. Apply firestopping to penetrations of fire-rated floor and wall assemblies for electrical installations to restore original fire-resistance rating of assembly. Firestopping materials and installation requirements are specified in Division 07 Section "Penetration Firestopping."

END OF SECTION 260500



THIS PAGE IS INTENTIONALLY LEFT BLANK

SECTION 260519 - LOW-VOLTAGE ELECTRICAL POWER CONDUCTORS AND  
CABLES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. This Section includes the following:
  - 1. Building wires and cables rated 600 V and less.
  - 2. Connectors, splices, and terminations rated 600 V and less.
  - 3. Sleeves and sleeve seals for cables.

1.3 DEFINITIONS

- A. EPDM: Ethylene-propylene-diene terpolymer rubber.
- B. NBR: Acrylonitrile-butadiene rubber.

1.4 SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Qualification Data: For testing agency.
- C. Field quality-control test reports.

1.5 QUALITY ASSURANCE

- A. Testing Agency Qualifications: An independent agency, with the experience and capability to conduct the testing indicated, that is a member company of the InterNational Electrical Testing Association or is a nationally recognized testing

laboratory (NRTL) as defined by OSHA in 29 CFR 1910.7, and that is acceptable to authorities having jurisdiction.

1. Testing Agency's Field Supervisor: Person currently certified by the InterNational Electrical Testing Association or the National Institute for Certification in Engineering Technologies to supervise on-site testing specified in Part 3.
- B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.
- C. Comply with NFPA 70.

## 1.6 COORDINATION

- A. Set sleeves in cast-in-place concrete, masonry walls, and other structural components as they are constructed.

## PART 2 - PRODUCTS

### 2.1 CONDUCTORS AND CABLES

- A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include the following:
- B. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  1. Alcan Products Corporation; Alcan Cable Division.
  2. American Insulated Wire Corp.; a Leviton Company.
  3. General Cable Corporation.
  4. Senator Wire & Cable Company.
  5. Southwire Company.
- C. Aluminum and Copper Conductors: Comply with NEMA WC 70.
- D. Conductor Insulation: Comply with NEMA WC 70 for Types THW, THHN-THWN.
- E. Multiconductor Cable: Comply with NEMA WC 70 for metal-clad cable, Type MC with ground wire.

## 2.2 CONNECTORS AND SPLICES

- A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include the following:
- B. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - 1. AFC Cable Systems, Inc.
  - 2. Hubbell Power Systems, Inc.
  - 3. O-Z/Gedney; EGS Electrical Group LLC.
  - 4. 3M; Electrical Products Division.
  - 5. Tyco Electronics Corp.
- C. Description: Factory-fabricated connectors and splices of size, ampacity rating, material, type, and class for application and service indicated.

## 2.3 SLEEVES FOR CABLES

- A. Steel Pipe Sleeves: ASTM A 53/A 53M, Type E, Grade B, Schedule 40, galvanized steel, plain ends.
- B. Cast-Iron Pipe Sleeves: Cast or fabricated "wall pipe," equivalent to ductile-iron pressure pipe, with plain ends and integral waterstop, unless otherwise indicated.
- C. Sleeves for Rectangular Openings: Galvanized sheet steel with minimum 0.052- or 0.138-inch thickness as indicated and of length to suit application.
- D. Coordinate sleeve selection and application with selection and application of firestopping specified in Division 07 Section "Penetration Firestopping."

## 2.4 SLEEVE SEALS

- A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include the following:
- B. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
- C. Basis-of-Design Product: Subject to compliance with requirements, provide the product indicated on Drawings or a comparable product by one of the following:

1. Advance Products & Systems, Inc.
  2. Calpico, Inc.
  3. Metraflex Co.
  4. Pipeline Seal and Insulator, Inc.
- D. Description: Modular sealing device, designed for field assembly, to fill annular space between sleeve and cable.
1. Sealing Elements: EPDM interlocking links shaped to fit surface of cable or conduit. Include type and number required for material and size of raceway or cable.
  2. Pressure Plates: Stainless steel. Include two for each sealing element.
  3. Connecting Bolts and Nuts: Stainless steel of length required to secure pressure plates to sealing elements. Include one for each sealing element.

### PART 3 - EXECUTION

#### 3.1 CONDUCTOR MATERIAL APPLICATIONS

- A. Feeders: Copper for feeders smaller than No. 4 AWG; copper or aluminum for feeders No. 4 AWG and larger. Solid for No. 10 AWG and smaller; stranded for No. 8 AWG and larger.
- B. Branch Circuits: Copper. Solid for No. 10 AWG and smaller; stranded for No. 8 AWG and larger.

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

- A. Service Entrance: Type THHN-THWN, single conductors in raceway
- B. Exposed Feeders: Type THHN-THWN, single conductors in raceway; Metal-clad cable, type MC.
- C. Feeders concealed in Ceilings, Walls, Partitions, and Crawlspace: TYPE THHN-THWN, single conductors in raceway; Metal-clad cable, type AC
- D. Feeders Concealed in Concrete, below Slabs-on-Grade, and Underground: Type THHN-THWN, single conductors in raceway

- E. Feeders Installed below Raised Flooring: Type THHN-THWN, single conductors in raceway; Metal-clad cable, Type MC.
- F. Feeders in Cable Tray: Type THHN-THWN, single conductors in raceway; Metal-clad cable, Type MC.
- G. Exposed Branch Circuits, Including in Crawlspace: Type THHN-THWN, single conductors in raceway; Metal-clad cable, Type MC.
- H. Branch Circuits Concealed in Ceilings, Walls, and Partitions: Type THHN-THWN, single conductors in raceway; Metal-clad cable, Type MC.
- I. Branch Circuits Concealed in Concrete, below Slabs-on-Grade, and Underground: Type THHN-THWN, single conductors in raceway.
- J. Branch Circuits Installed below Raised Flooring: Type THHN-THWN, single conductors in raceway; Metal-clad cable, Type MC.
- K. Branch Circuits in Cable Tray: Type THHN-THWN, single conductors in raceway; Metal-clad cable, Type MC.
- L. Cord Drops and Portable Appliance Connections: Type SO, hard service cord with stainless-steel, wire-mesh, strain relief device at terminations to suit application.
- M. Class 1 Control Circuits: Type THHN-THWN, in raceway.
- N. Class 2 Control Circuits: Type THHN-THWN, in raceway

### 3.3 INSTALLATION OF CONDUCTORS AND CABLES

- A. Conceal cables in finished walls, ceilings, and floors, unless otherwise indicated.
- B. Use manufacturer-approved pulling compound or lubricant where necessary; compound used must not deteriorate conductor or insulation. Do not exceed manufacturer's recommended maximum pulling tensions and sidewall pressure values.
- C. Use pulling means, including fish tape, cable, rope, and basket-weave wire/cable grips, that will not damage cables or raceway.
- D. Install exposed cables parallel and perpendicular to surfaces of exposed structural members, and follow surface contours where possible.
- E. Support cables according to Division 26 Section "Hangers and Supports for Electrical Systems."

- F. Identify and color-code conductors and cables according to Division 26 Section "Identification 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 and UL 486B.
- B. Make splices 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 and tap conductor for aluminum conductors.
- C. Wiring at Outlets: Install conductor at each outlet, with at least 6 inches of slack.

### 3.5 SLEEVE INSTALLATION FOR ELECTRICAL PENETRATIONS

- A. Coordinate sleeve selection and application with selection and application of firestopping specified in Division 07 Section "Penetration Firestopping."
- B. Concrete Slabs and Walls: Install sleeves for penetrations unless core-drilled holes or formed openings are used. Install sleeves during erection of slabs and walls.
- C. Use pipe sleeves unless penetration arrangement requires rectangular sleeved opening.
- D. Rectangular Sleeve Minimum Metal Thickness:
  - 1. For sleeve rectangle perimeter less than 50 inches and no side greater than 16 inches, thickness shall be 0.052 inch.
  - 2. For sleeve rectangle perimeter equal to, or greater than, 50 inches and 1 or more sides equal to, or greater than, 16 inches, thickness shall be 0.138 inch.
- E. Fire-Rated Assemblies: Install sleeves for penetrations of fire-rated floor and wall assemblies unless openings compatible with firestop system used are fabricated during construction of floor or wall.
- F. Cut sleeves to length for mounting flush with both wall surfaces.
- G. Extend sleeves installed in floors 2 inches above finished floor level.

- H. Size pipe sleeves to provide 1/4-inch annular clear space between sleeve and cable unless sleeve seal is to be installed.
- I. Seal space outside of sleeves with grout for penetrations of concrete and masonry and with approved joint compound for gypsum board assemblies.
- J. Interior Penetrations of Non-Fire-Rated Walls and Floors: Seal annular space between sleeve and cable, using joint sealant appropriate for size, depth, and location of joint according to Division 07 Section "Joint Sealants."
- K. Fire-Rated-Assembly Penetrations: Maintain indicated fire rating of walls, partitions, ceilings, and floors at cable penetrations. Install sleeves and seal with firestop materials according to Division 07 Section "Penetration Firestopping."
- L. Roof-Penetration Sleeves: Seal penetration of individual cables with flexible boot-type flashing units applied in coordination with roofing work.
- M. Aboveground Exterior-Wall Penetrations: Seal penetrations using sleeves and mechanical sleeve seals. Size sleeves to allow for 1-inch annular clear space between pipe and sleeve for installing mechanical sleeve seals.
- N. Underground Exterior-Wall Penetrations: Install cast-iron "wall pipes" for sleeves. Size sleeves to allow for 1-inch annular clear space between cable and sleeve for installing mechanical sleeve seals.

### 3.6 SLEEVE-SEAL INSTALLATION

- A. Install to seal underground exterior-wall penetrations.
- B. Use type and number of sealing elements recommended by manufacturer for cable material and size. Position cable in center of sleeve. Assemble mechanical sleeve seals and install in annular space between cable and sleeve. Tighten bolts against pressure plates that cause sealing elements to expand and make watertight seal.

### 3.7 FIRESTOPPING

- A. Apply firestopping to electrical penetrations of fire-rated floor and wall assemblies to restore original fire-resistance rating of assembly according to Division 07 Section "Penetration Firestopping."

### 3.8 FIELD QUALITY CONTROL



- A. Testing Agency: Engage a qualified testing agency to perform tests and inspections and prepare test reports.
- B. Perform tests and inspections and prepare test reports.
- C. Tests and Inspections:
  - 1. After installing conductors and cables and before electrical circuitry has been energized, test for compliance with requirements.
  - 2. Perform each visual and mechanical inspection and electrical test stated in NETA Acceptance Testing Specification. Certify compliance with test parameters.
  - 3. Infrared Scanning: After Substantial Completion, but not more than 60 days after Final Acceptance, perform an infrared scan of each splice in cables and conductors No. 3 AWG and larger. Remove box and equipment covers so splices are accessible to portable scanner.
    - a. Follow-up Infrared Scanning: Perform an additional follow-up infrared scan of each splice 11 months after date of Substantial Completion.
    - b. Instrument: Use an infrared scanning device designed to measure temperature or to detect significant deviations from normal values. Provide calibration record for device.
    - c. Record of Infrared Scanning: Prepare a certified report that identifies splices checked and that describes scanning results. Include notation of deficiencies detected, remedial action taken, and observations after remedial action.
- D. Test Reports: Prepare a written report to record the following:
  - 1. Test procedures used.
  - 2. Test results that comply with requirements.
  - 3. Test results that do not comply with requirements and corrective action taken to achieve compliance with requirements.
- E. Remove and replace malfunctioning units and retest as specified above.

END OF SECTION 260519

SECTION 260526 - GROUNDING AND BONDING 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. This Section includes methods and materials for grounding systems and equipment, plus the following special applications:
  - 1. Underground distribution grounding.
  - 2. Common ground bonding with lightning protection system.

1.3 SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Other Informational Submittals: Plans showing dimensioned as-built locations of grounding features specified in Part 3 "Field Quality Control" Article, including the following:
  - 1. Test wells.
  - 2. Ground rods.
  - 3. Ground rings.
  - 4. Grounding arrangements and connections for separately derived systems.
  - 5. Grounding for sensitive electronic equipment.
- C. Qualification Data: For testing agency and testing agency's field supervisor.
- D. Field quality-control test reports.
- E. Operation and Maintenance Data: For grounding to include the following in emergency, operation, and maintenance manuals:

1. Instructions for periodic testing and inspection of grounding features at test wells based on NETA MTS
  - a. Tests shall be to determine if ground resistance or impedance values remain within specified maximums, and instructions shall recommend corrective action if they do not.
  - b. Include recommended testing intervals.

#### 1.4 QUALITY ASSURANCE

- A. Testing Agency Qualifications: An independent agency, with the experience and capability to conduct the testing indicated, that is a member company of the InterNational Electrical Testing Association or is a nationally recognized testing laboratory (NRTL) as defined by OSHA in 29 CFR 1910.7, and that is acceptable to authorities having jurisdiction.
  1. Testing Agency's Field Supervisor: Person currently certified by the InterNational Electrical Testing Association to supervise on-site testing specified in Part 3.
- B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.
- C. Comply with UL 467 for grounding and bonding materials and equipment.

### PART 2 - PRODUCTS

#### 2.1 CONDUCTORS

- A. Insulated Conductors: Copper wire or cable insulated for 600 V unless otherwise required by applicable Code or authorities having jurisdiction.
- B. Bare Copper Conductors:
  1. Solid Conductors: ASTM B 3.
  2. Stranded Conductors: ASTM B 8.
  3. Tinned Conductors: ASTM B 33.
  4. Bonding Cable: 28 kcmil, 14 strands of No. 17 AWG conductor, 1/4 inch 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 wide and 1/16 inch thick.

7. Tinned Bonding Jumper: Tinned-copper tape, braided conductors, terminated with copper ferrules; 1-5/8 inches wide and 1/16 inch thick.

C. Bare Grounding Conductor and Conductor Protector for Wood Poles:

1. No. 4 AWG minimum, soft-drawn copper.
2. Conductor Protector: Half-round PVC or wood molding. If wood, use pressure-treated fir or cypress or cedar.

D. Grounding Bus: Rectangular bars of annealed copper, 1/4 by 2 inches in cross section, unless otherwise indicated; with insulators.

## 2.2 CONNECTORS

A. Listed and labeled by a nationally recognized testing laboratory acceptable to authorities having jurisdiction for applications in which used, and for specific types, sizes, and combinations of conductors and other items connected.

B. Bolted Connectors for Conductors and Pipes: Copper or copper alloy, bolted pressure-type, with at least two bolts.

1. Pipe Connectors: Clamp type, sized for pipe.

C. Welded Connectors: Exothermic-welding kits of types recommended by kit manufacturer for materials being joined and installation conditions.

## 2.3 GROUNDING ELECTRODES

A. Ground Rods: Copper-clad steel, sectional type; 3/4 inch by 10 feet in diameter.

B. Chemical-Enhanced Grounding Electrodes: Copper tube, straight or L-shaped, charged with nonhazardous electrolytic chemical salts.

1. Termination: Factory-attached No. 4/0 AWG bare conductor at least 48 inches long.
2. Backfill Material: Electrode manufacturer's recommended material.

## 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 below grade.
  - 2. Duct-Bank Grounding Conductor: Bury 12 inches above duct bank when indicated as part of duct-bank installation.
- C. Isolated Grounding Conductors: Green-colored insulation with continuous yellow stripe. On feeders with isolated ground, identify grounding conductor where visible to normal inspection, with alternating bands of green and yellow tape, with at least three bands of green and two bands of yellow.
- D. Grounding Bus: Install in electrical and telephone equipment rooms, in rooms housing service equipment, and elsewhere as indicated.
  - 1. Install bus on insulated spacers 1 inch minimum, from wall 6 inches 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, down to specified height above floor, and connect to horizontal bus.
- E. 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 OVERHEAD LINES

- A. Comply with IEEE C2 grounding requirements.
- B. Install 2 parallel ground rods if resistance to ground by a single, ground-rod electrode exceeds 25 ohms.
- C. Drive ground rods until tops are 12 inches below finished grade in undisturbed earth.

- D. Ground-Rod Connections: Install bolted connectors for underground connections and connections to rods.
- E. Lightning Arrester Grounding Conductors: Separate from other grounding conductors.
- F. Secondary Neutral and Transformer Enclosure: Interconnect and connect to grounding conductor.
- G. Protect grounding conductors running on surface of wood poles with molding extended from grade level up to and through communication service and transformer spaces.

### 3.3 GROUNDING UNDERGROUND DISTRIBUTION SYSTEM COMPONENTS

- A. Comply with IEEE C2 grounding requirements.
- B. Grounding Manholes and Handholes: Install a driven ground rod through manhole or handhole floor, close to wall, and set rod depth so 4 inches will extend above finished floor. If necessary, install ground rod before manhole is placed and provide No. 1/0 AWG bare, tinned-copper conductor from ground rod into manhole through a waterproof sleeve in manhole wall. Protect ground rods passing through concrete floor with a double wrapping of pressure-sensitive insulating tape or heat-shrunk insulating sleeve from 2 inches above to 6 inches below concrete. Seal floor opening with waterproof, nonshrink grout.
- C. Grounding Connections to Manhole Components: Bond exposed-metal parts such as inserts, cable racks, pulling irons, ladders, and cable shields within each manhole or handhole, to ground rod or grounding conductor. Make connections with No. 4 AWG minimum, stranded, hard-drawn copper bonding conductor. Train conductors level or plumb around corners and fasten to manhole walls. Connect to cable armor and cable shields as recommended by manufacturer of splicing and termination kits.
- D. 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 from the foundation.

### 3.4 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.
  9. Computer and Rack-Mounted Electronic Equipment Circuits: Install insulated equipment grounding conductor in branch-circuit runs from equipment-area power panels and power-distribution units.
- C. Air-Duct Equipment Circuits: Install insulated equipment grounding conductor to duct-mounted electrical devices operating at 120 V and more, including air cleaners, heaters, dampers, humidifiers, and other duct electrical equipment. Bond conductor to each unit and to air duct and connected metallic piping.
- D. 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.
- E. Isolated Grounding Receptacle Circuits: Install an insulated equipment grounding conductor connected to the receptacle grounding terminal. Isolate conductor from raceway and from panelboard grounding terminals. Terminate at equipment grounding conductor terminal of the applicable derived system or service, unless otherwise indicated.
- F. Isolated Equipment Enclosure Circuits: For designated equipment supplied by a branch circuit or feeder, isolate equipment enclosure from supply circuit raceway with a nonmetallic raceway fitting listed for the purpose. Install fitting where raceway enters enclosure, and install a separate insulated equipment grounding conductor. Isolate conductor from raceway and from panelboard grounding terminals. Terminate at equipment grounding conductor terminal of the applicable derived system or service, unless otherwise indicated.
- G. Signal and Communication Equipment: For telephone, alarm, voice and data, and other communication equipment, provide No. 4 AWG minimum insulated grounding

conductor in raceway from grounding electrode system to each service location, terminal cabinet, wiring closet, and central equipment location.

1. Service and Central Equipment Locations and Wiring Closets: Terminate grounding conductor on a 1/4-by-2-by-12-inch grounding bus.
  2. Terminal Cabinets: Terminate grounding conductor on cabinet grounding terminal.
- H. Metal Poles Supporting Outdoor Lighting Fixtures: Install grounding electrode and a separate insulated equipment grounding conductor in addition to grounding conductor installed with branch-circuit conductors.

### 3.5 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. Common Ground Bonding 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 below finished floor or final grade, unless otherwise indicated.
1. Interconnect ground rods with grounding electrode conductor below grade and as otherwise indicated. Make connections without exposing steel or damaging coating, if any.
  2. For grounding electrode system, install at least three rods spaced at least one-rod length from each other and located at least the same distance from other grounding electrodes, and connect to the service grounding electrode conductor.
- D. Test Wells: Ground rod driven through drilled hole in bottom of handhole. Handholes are specified in Division 26 Section "Underground Ducts and Raceways for Electrical Systems," and shall be at least 12 inches deep, with cover.
1. Test Wells: Install at least one test well for each service, unless otherwise indicated. Install at the ground rod electrically closest to service entrance. Set top of test well flush with finished grade or floor.



- E. 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 so vibration is not transmitted to rigidly mounted equipment.
  - 3. Use exothermic-welded connectors for outdoor locations, but if a disconnect-type connection is required, use a bolted clamp.
  
- F. Grounding and Bonding for Piping:
  - 1. Metal Water Service Pipe: Install insulated copper grounding conductors, in conduit, from building's main service equipment, or grounding bus, to main metal water service entrances to building. Connect grounding conductors to main metal water service pipes, using a bolted clamp connector or by bolting a lug-type connector to a pipe flange, using one of the lug bolts of the flange. Where a dielectric main water fitting is installed, connect grounding conductor on street side of fitting. Bond metal grounding conductor conduit or sleeve to conductor at each end.
  - 2. Water Meter Piping: Use braided-type bonding jumpers to electrically bypass water meters. Connect to pipe with a bolted connector.
  - 3. Bond each aboveground portion of gas piping system downstream from equipment shutoff valve.
  
- G. Bonding Interior Metal Ducts: Bond metal air ducts to equipment grounding conductors of associated fans, blowers, electric heaters, and air cleaners. Install bonding jumper to bond across flexible duct connections to achieve continuity.
  
- H. Grounding for Steel Building Structure: Install a driven ground rod at base of each corner column and at intermediate exterior columns at distances not more than 60 feet apart.
  
- I. Ground Ring: Install a grounding conductor, electrically connected to each building structure ground rod and to each steel column, extending around the perimeter of building.
  - 1. Install tinned-copper conductor not less than No. 2/0 AWG for ground ring and for taps to building steel.
  - 2. Bury ground ring not less than 24 inches from building foundation.
  
- J. Ufer Ground (Concrete-Encased Grounding Electrode): Fabricate according to NFPA 70, using a minimum of 20 feet of bare copper conductor not smaller than No. 4 AWG.

1. If concrete foundation is less than 20 feet long, coil excess conductor within base of foundation.
2. Bond grounding conductor to reinforcing steel in at least four locations and to anchor bolts. Extend grounding conductor below grade and connect to building grounding grid or to grounding electrode external to concrete.

### 3.6 FIELD QUALITY CONTROL

- A. Testing Agency: Owner will engage a qualified testing and inspecting agency to perform field tests and inspections and prepare test reports.
- B. Testing Agency: Engage a qualified testing and inspecting agency to perform the following field tests and inspections and prepare test reports:
- C. Perform the following tests and inspections and prepare test reports:
  1. After installing grounding system but before permanent electrical circuits have been energized, test for compliance with requirements.
  2. Test completed grounding system at each location where a maximum ground-resistance level is specified, at service disconnect enclosure grounding terminal, at ground test wells. Make tests at ground rods before any conductors are connected.
    - a. Measure ground resistance not less than two full days after last trace of precipitation and without soil being moistened by any means other than natural drainage or seepage and without chemical treatment or other artificial means of reducing natural ground resistance.
    - b. Perform tests by fall-of-potential method according to IEEE 81.
  3. 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.
- D. Report measured ground resistances that exceed the following values:
  1. Power and Lighting Equipment or System with Capacity 500 kVA and Less: 10 ohms.
  2. Power and Lighting Equipment or System with Capacity 500 to 1000 kVA: 5 ohms.

3. Power and Lighting Equipment or System with Capacity More Than 1000 kVA:  
3 ohms.
  4. Power Distribution Units or Panelboards Serving Electronic Equipment: 1  
ohm(s).
  5. Substations and Pad-Mounted Equipment: 5 ohms.
  6. Manhole Grounds: 10 ohms.
- E. Excessive Ground Resistance: If resistance to ground exceeds specified values, notify Architect promptly and include recommendations to reduce ground resistance.

END OF SECTION 260526

## **SECTION 260529 - HANGERS AND SUPPORTS 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. This Section includes the following:
  - 1. Hangers and supports for electrical equipment and systems.
  - 2. Construction requirements for concrete bases.

#### **1.3 DEFINITIONS**

- A. EMT: Electrical metallic tubing.
- B. IMC: Intermediate metal conduit.
- C. RMC: Rigid metal conduit.

#### **1.4 PERFORMANCE REQUIREMENTS**

- A. Delegated Design: Design supports for multiple raceways, including comprehensive engineering analysis by a qualified professional engineer, using performance requirements and design criteria indicated.
- B. Design supports for multiple raceways capable of supporting combined weight of supported systems and its contents.
- C. Design equipment supports capable of supporting combined operating weight of supported equipment and connected systems and components.

- D. Rated Strength: Adequate in tension, shear, and pullout force to resist maximum loads calculated or imposed for this Project, with a minimum structural safety factor of five times the applied force.

#### 1.5 SUBMITTALS

- A. Product Data: For the following:
  - 1. Steel slotted support systems.
  - 2. Nonmetallic slotted support systems.
- B. Shop Drawings: Show fabrication and installation details and include calculations for the following:
  - 1. Trapeze hangers. Include Product Data for components.
  - 2. Steel slotted channel systems. Include Product Data for components.
  - 3. Nonmetallic slotted channel systems. Include Product Data for components.
  - 4. Equipment supports.
- C. Welding certificates.

#### 1.6 QUALITY ASSURANCE

- A. Welding: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code - Steel."
- B. Comply with NFPA 70.

#### 1.7 COORDINATION

- A. Coordinate size and location of concrete bases. Cast anchor-bolt inserts into bases. Concrete, reinforcement, and formwork requirements are specified in Division 03.
- B. Coordinate installation of roof curbs, equipment supports, and roof penetrations. These items are specified in Division 07 Section "Roof Accessories."

### PART 2 - PRODUCTS

2.1 SUPPORT, ANCHORAGE, AND ATTACHMENT COMPONENTS

- A. Steel Slotted Support Systems: Comply with MFMA-4, factory-fabricated components for field assembly.
1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include the following:
  2. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. Allied Tube & Conduit.
    - b. Cooper B-Line, Inc.; a division of Cooper Industries.
    - c. ERICO International Corporation.
    - d. GS Metals Corp.
    - e. Thomas & Betts Corporation.
    - f. Unistrut; Tyco International, Ltd.
    - g. Wesanco, Inc.
  3. Metallic Coatings: Hot-dip galvanized after fabrication and applied according to MFMA-4.
  4. Nonmetallic Coatings: Manufacturer's standard PVC, polyurethane, or polyester coating applied according to MFMA-4.
  5. Painted Coatings: Manufacturer's standard painted coating applied according to MFMA-4.
  6. Channel Dimensions: Selected for applicable load criteria.
- B. Nonmetallic Slotted Support Systems: Structural-grade, factory-formed, glass-fiber-resin channels and angles with 9/16-inch- diameter holes at a maximum of 8 inches o.c., in at least 1 surface.
1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include the following:
  2. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. Allied Tube & Conduit.
    - b. Cooper B-Line, Inc.; a division of Cooper Industries.
    - c. Fabco Plastics Wholesale Limited.
    - d. Seasafe, Inc.

3. Fittings and Accessories: Products of channel and angle manufacturer and designed for use with those items.
  4. Fitting and Accessory Materials: Same as channels and angles except metal items may be stainless steel.
  5. Rated Strength: Selected to suit applicable load criteria.
- C. Raceway and Cable Supports: As described in NECA 1 and NECA 101.
- D. Conduit and Cable Support Devices: Steel hangers, clamps, and associated fittings, designed for types and sizes of raceway or cable to be supported.
- E. Support for Conductors in Vertical Conduit: Factory-fabricated assembly consisting of threaded body and insulating wedging plug or plugs for non-armored electrical conductors or cables in riser conduits. Plugs shall have number, size, and shape of conductor gripping pieces as required to suit individual conductors or cables supported. Body shall be malleable iron.
- F. Structural Steel for Fabricated Supports and Restraints: ASTM A 36/A 36M, steel plates, shapes, and bars; black and galvanized.
- G. 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.
    - a. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include the following:
    - b. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
      - 1) Hilti Inc.
      - 2) ITW Ramset/Red Head; a division of Illinois Tool Works, Inc.
      - 3) MKT Fastening, LLC.
      - 4) Simpson Strong-Tie Co., Inc.; Masterset Fastening Systems Unit.
  2. Mechanical-Expansion Anchors: Insert-wedge-type, stainless steel, for use in hardened portland cement concrete with tension, shear, and pullout capacities appropriate for supported loads and building materials in which used.

- a. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include the following:
  - b. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - 1) Cooper B-Line, Inc.; a division of Cooper Industries.
    - 2) Empire Tool and Manufacturing Co., Inc.
    - 3) Hilti Inc.
    - 4) ITW Ramset/Red Head; a division of Illinois Tool Works, Inc.
    - 5) MKT Fastening, LLC.
3. Concrete Inserts: Steel or malleable-iron, slotted support system units similar to MSS Type 18; complying with MFMA-4 or MSS SP-58.
  4. Clamps for Attachment to Steel Structural Elements: MSS SP-58, type suitable for attached structural element.
  5. Through Bolts: Structural type, hex head, and high strength. Comply with ASTM A 325.
  6. Toggle Bolts: All-steel springhead type.
  7. Hanger Rods: Threaded steel.

## 2.2 FABRICATED METAL EQUIPMENT SUPPORT ASSEMBLIES

- A. Description: Welded or bolted, structural-steel shapes, shop or field fabricated to fit dimensions of supported equipment.
- B. Materials: Comply with requirements in Division 05 Section "Metal Fabrications" for steel shapes and plates.

## PART 3 - EXECUTION

### 3.1 APPLICATION

- A. Comply with NECA 1 and NECA 101 for application of hangers and supports for electrical equipment and systems except if requirements in this Section are stricter.
- B. Maximum Support Spacing and Minimum Hanger Rod Size for Raceway: Space supports for EMT, IMC, and RMC as required by NFPA 70. Minimum rod size shall be 1/4 inch in diameter.



- C. Multiple Raceways or Cables: Install trapeze-type supports fabricated with steel slotted support system, sized so capacity can be increased by at least 25 percent in future without exceeding specified design load limits.
  - 1. Secure raceways and cables to these supports with two-bolt conduit clamps.
- D. Spring-steel clamps designed for supporting single conduits without bolts may be used for 1-1/2-inch 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, IMC, and RMC may be supported by openings through structure members, as permitted in NFPA 70.
- C. Strength of Support Assemblies: Where not indicated, select sizes of components so strength will be adequate to carry present and future static loads within specified loading limits. Minimum static design load used for strength determination shall be weight of supported components plus 200 lb.
- 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 thick or greater. Do not use for anchorage to lightweight-aggregate concrete or for slabs less than 4 inches thick.
  - 6. To Steel: Welded threaded studs complying with AWS D1.1/D1.1M, with lock washers and nuts.
  - 7. To Light Steel: Sheet metal screws.
  - 8. Items Mounted on Hollow Walls and Nonstructural Building Surfaces: Mount cabinets, panelboards, disconnect switches, control enclosures, pull and junction

boxes, transformers, and other devices on slotted-channel racks attached to substrate.

- E. Drill holes for expansion anchors in concrete at locations and to depths that avoid reinforcing bars.

### 3.3 INSTALLATION OF FABRICATED METAL SUPPORTS

- A. Comply with installation requirements in Division 05 Section "Metal Fabrications" for site-fabricated metal supports.
- B. Cut, fit, and place miscellaneous metal supports accurately in location, alignment, and elevation to support and anchor electrical materials and equipment.
- C. Field Welding: Comply with AWS D1.1/D1.1M.

### 3.4 CONCRETE BASES

- A. Construct concrete bases of dimensions indicated but not less than 4 inches larger in both directions than supported unit, and so anchors will be a minimum of 10 bolt diameters from edge of the base.
- B. Use 3000-psi 28-day compressive-strength concrete. Concrete materials, reinforcement, and placement requirements are specified in Division 03 Section "Cast-in-Place Concrete."
- C. Anchor equipment to concrete base.
  - 1. Place and secure anchorage devices. Use supported equipment manufacturer's setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
  - 2. Install anchor bolts to elevations required for proper attachment to supported equipment.
  - 3. Install anchor bolts according to anchor-bolt manufacturer's written instructions.

### 3.5 PAINTING

- A. Touchup: Clean field welds and abraded areas of shop paint. Paint exposed areas immediately after erecting hangers and supports. Use same materials as used for shop painting. Comply with SSPC-PA 1 requirements for touching up field-painted surfaces.
  - 1. Apply paint by brush or spray to provide minimum dry film thickness of 2.0 mils.

- B. Touchup: Comply with requirements in Division 09 painting Sections for cleaning and touchup painting of field welds, bolted connections, and abraded areas of shop paint on miscellaneous metal.
- C. Galvanized Surfaces: Clean welds, bolted connections, and abraded areas and apply galvanizing-repair paint to comply with ASTM A 780.

END OF SECTION 260529

## **SECTION 260533 - RACEWAY AND BOXES 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. This Section includes raceways, fittings, boxes, enclosures, and cabinets for electrical wiring.

#### **1.3 DEFINITIONS**

- A. EMT: Electrical metallic tubing.
- B. ENT: Electrical nonmetallic tubing.
- C. EPDM: Ethylene-propylene-diene terpolymer rubber.
- D. FMC: Flexible metal conduit.
- E. IMC: Intermediate metal conduit.
- F. LFMC: Liquidtight flexible metal conduit.
- G. LFNC: Liquidtight flexible nonmetallic conduit.
- H. NBR: Acrylonitrile-butadiene rubber.
- I. RNC: Rigid nonmetallic conduit.

#### **1.4 SUBMITTALS**

- A. Product Data: For surface raceways, wireways and fittings, floor boxes, hinged-cover enclosures, and cabinets.

- B. Shop Drawings: For the following raceway components. Include plans, elevations, sections, details, and attachments to other work.
  - 1. Custom enclosures and cabinets.
  - 2. For handholes and boxes for underground wiring, including the following:
    - a. Duct entry provisions, including locations and duct sizes.
    - b. Frame and cover design.
    - c. Grounding details.
    - d. Dimensioned locations of cable rack inserts, and pulling-in and lifting irons.
    - e. Joint details.
  
- C. Samples for Initial Selection: For nonmetallic wireways and surface raceways with factory-applied texture and color finishes.
  - 1. Size: 12”
  
- D. Samples for Verification: For each type of exposed finish required for nonmetallic wireways and surface raceways, prepared on Samples of size indicated below.
  - 1. Size: 12”
  
- E. Coordination Drawings: Conduit routing plans, drawn to scale, on which the following items are shown and coordinated with each other, based on input from installers of the items involved:
  - 1. Structural members in the paths of conduit groups with common supports.
  - 2. HVAC and plumbing items and architectural features in the paths of conduit groups with common supports.

## 1.5 QUALITY ASSURANCE

- A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.
  
- B. Comply with NFPA 70.

## PART 2 - PRODUCTS

### 2.1 METAL CONDUIT AND TUBING

- A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include the following:
- B. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - 1. AFC Cable Systems, Inc.
  - 2. Alflex Inc.
  - 3. Allied Tube & Conduit; a Tyco International Ltd. Co.
  - 4. Anamet Electrical, Inc.; Anaconda Metal Hose.
  - 5. Electri-Flex Co.
  - 6. Manhattan/CDT/Cole-Flex.
  - 7. Maverick Tube Corporation.
  - 8. O-Z Gedney; a unit of General Signal.
  - 9. Wheatland Tube Company.
- C. Rigid Steel Conduit: ANSI C80.1.
- D. Aluminum Rigid Conduit: ANSI C80.5.
- E. IMC: ANSI C80.6.
- F. PVC-Coated Steel Conduit: PVC-coated rigid steel conduit.
  - 1. Comply with NEMA RN 1.
  - 2. Coating Thickness: 0.040 inch minimum.
- G. EMT: ANSI C80.3.
- H. FMC: Zinc-coated steel.
- I. LFMC: Flexible steel conduit with PVC jacket.
- J. Fittings for Conduit (Including all Types and Flexible and Liquidtight), EMT, and Cable: NEMA FB 1; listed for type and size raceway with which used, and for application and environment in which installed.
  - 1. Conduit Fittings for Hazardous (Classified) Locations: Comply with UL 886.
  - 2. Fittings for EMT: Steel, set-screw type.
  - 3. Coating for Fittings for PVC-Coated Conduit: Minimum thickness, 0.040 inch, with overlapping sleeves protecting threaded joints.

- K. Joint Compound for Rigid Steel Conduit or IMC: Listed for use in cable connector assemblies, and compounded for use to lubricate and protect threaded raceway joints from corrosion and enhance their conductivity.

## 2.2 NONMETALLIC CONDUIT AND TUBING

- A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include the following:
- B. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - 1. AFC Cable Systems, Inc.
  - 2. Anamet Electrical, Inc.; Anaconda Metal Hose.
  - 3. Arnco Corporation.
  - 4. CANTEX Inc.
  - 5. CertainTeed Corp.; Pipe & Plastics Group.
  - 6. Condux International, Inc.
  - 7. ElecSYS, Inc.
  - 8. Electri-Flex Co.
  - 9. Lamson & Sessions; Carlon Electrical Products.
  - 10. Manhattan/CDT/Cole-Flex.
  - 11. RACO; a Hubbell Company.
  - 12. Thomas & Betts Corporation.
- C. ENT: NEMA TC 13.
- D. RNC: NEMA TC 2, Type EPC-40-PVC, unless otherwise indicated.
- E. LFNC: UL 1660.
- F. Fittings for ENT and RNC: NEMA TC 3; match to conduit or tubing type and material.
- G. Fittings for LFNC: UL 514B.

## 2.3 METAL WIREWAYS

- A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include the following:
- B. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Cooper B-Line, Inc.
  2. Hoffman.
  3. Square D; Schneider Electric.
- C. Description: Sheet metal sized and shaped as indicated, NEMA 250, Type 1, unless otherwise indicated.
- D. Fittings and Accessories: Include couplings, offsets, elbows, expansion joints, adapters, hold-down straps, end caps, and other fittings to match and mate with wireways as required for complete system.
- E. Wireway Covers: Screw-cover type.
- F. Finish: Manufacturer's standard enamel finish.

#### 2.4 NONMETALLIC WIREWAYS

- A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include the following:
- B. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. Hoffman.
  2. Lamson & Sessions; Carlon Electrical Products.
- C. Description: Fiberglass polyester, extruded and fabricated to size and shape indicated, with no holes or knockouts. Cover is gasketed with oil-resistant gasket material and fastened with captive screws treated for corrosion resistance. Connections are flanged, with stainless-steel screws and oil-resistant gaskets.
- D. Description: PVC plastic, extruded and fabricated to size and shape indicated, with snap-on cover and mechanically coupled connections with plastic fasteners.
- E. Fittings and Accessories: Include couplings, offsets, elbows, expansion joints, adapters, hold-down straps, end caps, and other fittings to match and mate with wireways as required for complete system.

#### 2.5 SURFACE RACEWAYS

- A. Surface Metal Raceways: Galvanized steel with snap-on covers. Manufacturer's standard enamel finish in color selected by Architect.



1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include the following:
2. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - a. Thomas & Betts Corporation.
  - b. Walker Systems, Inc.; Wiremold Company (The).
  - c. Wiremold Company (The); Electrical Sales Division.

B. Surface Nonmetallic Raceways: Two-piece construction, manufactured of rigid PVC with texture and color selected by Architect from manufacturer's standard colors.

1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include the following:
2. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - a. Butler Manufacturing Company; Walker Division.
  - b. Enduro Systems, Inc.; Composite Products Division.
  - c. Hubbell Incorporated; Wiring Device-Kellems Division.
  - d. Lamson & Sessions; Carlon Electrical Products.
  - e. Panduit Corp.
  - f. Walker Systems, Inc.; Wiremold Company (The).
  - g. Wiremold Company (The); Electrical Sales Division.

## 2.6 BOXES, ENCLOSURES, AND CABINETS

- A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include the following:
- B. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  1. Cooper Crouse-Hinds; Div. of Cooper Industries, Inc.
  2. EGS/Appleton Electric.
  3. Erickson Electrical Equipment Company.
  4. Hoffman.
  5. Hubbell Incorporated; Killark Electric Manufacturing Co. Division.
  6. O-Z/Gedney; a unit of General Signal.
  7. RACO; a Hubbell Company.

8. Robroy Industries, Inc.; Enclosure Division.
9. Scott Fetzer Co.; Adalet Division.
10. Spring City Electrical Manufacturing Company.
11. Thomas & Betts Corporation.
12. Walker Systems, Inc.; Wiremold Company (The).
13. Woodhead, Daniel Company; Woodhead Industries, Inc. Subsidiary.

- C. Sheet Metal Outlet and Device Boxes: NEMA OS 1.
- D. Cast-Metal Outlet and Device Boxes: NEMA FB 1, ferrous alloy, Type FD, with gasketed cover.
- E. Nonmetallic Outlet and Device Boxes: NEMA OS 2.
- F. Metal Floor Boxes: Sheet metal, fully adjustable rectangular.
- G. Nonmetallic Floor Boxes: Nonadjustable, round.
- H. Small Sheet Metal Pull and Junction Boxes: NEMA OS 1.
- I. Cast-Metal Access, Pull, and Junction Boxes: NEMA FB 1, cast aluminum with gasketed cover.
- J. Hinged-Cover Enclosures: NEMA 250, Type 1, with continuous-hinge cover with flush latch, unless otherwise indicated.
1. Metal Enclosures: Steel, finished inside and out with manufacturer's standard enamel.
  2. Nonmetallic Enclosures: Plastic, finished inside with radio-frequency-resistant paint.
- K. Cabinets:
1. NEMA 250, Type 1, galvanized-steel box with removable interior panel and removable front, finished inside and out with manufacturer's standard enamel.
  2. Hinged door in front cover with flush latch and concealed hinge.
  3. Key latch to match panelboards.
  4. Metal barriers to separate wiring of different systems and voltage.
  5. Accessory feet where required for freestanding equipment.

## 2.7 HANDHOLES AND BOXES FOR EXTERIOR UNDERGROUND WIRING

- A. Description: Comply with SCTE 77.

1. Color of Frame and Cover: Gray.
  2. Configuration: Units shall be designed for flush burial and have open bottom, unless otherwise indicated.
  3. Cover: Weatherproof, secured by tamper-resistant locking devices and having structural load rating consistent with enclosure.
  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.
  7. Handholes 12 inches wide by 24 inches long and larger shall have inserts for cable racks and pulling-in irons installed before concrete is poured.
- B. Polymer-Concrete Handholes and Boxes with Polymer-Concrete Cover: Molded of sand and aggregate, bound together with polymer resin, and reinforced with steel or fiberglass or a combination of the two.
1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include the following:
  2. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  3. Basis-of-Design Product: Subject to compliance with requirements, provide the product indicated on Drawings or a comparable product by one of the following:
    - a. Armorcast Products Company.
    - b. Carson Industries LLC.
    - c. CDR Systems Corporation.
    - d. NewBasis.
- C. Fiberglass Handholes and Boxes with Polymer-Concrete Frame and Cover: Sheet-molded, fiberglass-reinforced, polyester-resin enclosure joined to polymer-concrete top ring or frame.
1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include the following:
  2. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  3. Basis-of-Design Product: Subject to compliance with requirements, provide the product indicated on Drawings or a comparable product by one of the following:
    - a. Armorcast Products Company.

- b. Carson Industries LLC.
  - c. Christy Concrete Products.
  - d. Synertech Moulded Products, Inc.; a division of Oldcastle Precast.
- D. Fiberglass Handholes and Boxes: Molded of fiberglass-reinforced polyester resin, with covers of polymer concrete.
- 1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include the following:
  - 2. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - 3. Basis-of-Design Product: Subject to compliance with requirements, provide the product indicated on Drawings or a comparable product by one of the following:
    - a. Carson Industries LLC.
    - b. Christy Concrete Products.
    - c. Nordic Fiberglass, Inc.

## 2.8 SLEEVES FOR RACEWAYS

- A. Steel Pipe Sleeves: ASTM A 53/A 53M, Type E, Grade B, Schedule 40, galvanized steel, plain ends.
- B. Cast-Iron Pipe Sleeves: Cast or fabricated "wall pipe," equivalent to ductile-iron pressure pipe, with plain ends and integral waterstop, unless otherwise indicated.
- C. Sleeves for Rectangular Openings: Galvanized sheet steel with minimum 0.052- or 0.138-inch thickness as indicated and of length to suit application.
- D. Coordinate sleeve selection and application with selection and application of firestopping specified in Division 07 Section "Penetration Firestopping."

## 2.9 SLEEVE SEALS

- A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include the following:
- B. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
- C. Basis-of-Design Product: Subject to compliance with requirements, provide the product indicated on Drawings or a comparable product by one of the following:

1. Advance Products & Systems, Inc.
2. Calpico, Inc.
3. Metraflex Co.
4. Pipeline Seal and Insulator, Inc.

D. Description: Modular sealing device, designed for field assembly, to fill annular space between sleeve and cable.

1. Sealing Elements: EPDM interlocking links shaped to fit surface of cable or conduit. Include type and number required for material and size of raceway or cable.
2. Pressure Plates: Stainless steel. Include two for each sealing element.
3. Connecting Bolts and Nuts: Stainless steel of length required to secure pressure plates to sealing elements. Include one for each sealing element.

## 2.10 SOURCE QUALITY CONTROL FOR UNDERGROUND ENCLOSURES

A. Handhole and Pull-Box Prototype Test: Test prototypes of handholes and boxes for compliance with SCTE 77. Strength tests shall be for specified tier ratings of products supplied.

1. Tests of materials shall be performed by a independent testing agency.
2. Strength tests of complete boxes and covers shall be by either an independent testing agency or manufacturer. A qualified registered professional engineer shall certify tests by manufacturer.
3. Testing machine pressure gages shall have current calibration certification complying with ISO 9000 and ISO 10012, and traceable to NIST standards.

## 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 .
2. Concealed Conduit, Aboveground: Rigid steel conduit, EMT
3. Underground Conduit: RNC, Type EPC-40-PVC, direct buried.
4. Connection to Vibrating Equipment (Including Transformers and Hydraulic, Pneumatic, Electric Solenoid, or Motor-Driven Equipment): LFMC.
5. Boxes and Enclosures, Aboveground: NEMA 250, Type 4x.

6. Application of Handholes and Boxes for Underground Wiring:
  - a. Handholes and Pull Boxes in Driveway, Parking Lot, and Off-Roadway Locations, Subject to Occasional, Nondeliberate Loading by Heavy Vehicles: Polymer concrete, SCTE 77, Tier 15 structural load rating.
  - b. Handholes and Pull Boxes in Sidewalk and Similar Applications with a Safety Factor for Nondeliberate Loading by Vehicles: Polymer-concrete units, SCTE 77, Tier 8 structural load rating.
  - c. Handholes and Pull Boxes Subject to Light-Duty Pedestrian Traffic Only: Fiberglass-reinforced polyester resin, structurally tested according to SCTE 77 with 3000-lbf vertical loading.
  
- B. Comply with the following indoor applications, unless otherwise indicated:
  1. Exposed, Not Subject to Physical Damage: EMT.
  2. Exposed, Not Subject to Severe Physical Damage: EMT.
  3. Exposed and Subject to Severe Physical Damage: Rigid steel conduit. Includes raceways in the following locations:
    - a. Loading dock.
    - b. Corridors used for traffic of mechanized carts, forklifts, and pallet-handling units.
    - c. Mechanical rooms.
  
  4. Concealed in Ceilings and Interior Walls and Partitions: EMT.
  5. Connection to Vibrating Equipment (Including Transformers and Hydraulic, Pneumatic, Electric Solenoid, or Motor-Driven Equipment): FMC, except use LFMC in damp or wet locations.
  7. Boxes and Enclosures: NEMA 250, Type 1, except use NEMA 250, Type 4x, stainless steel in damp or wet locations.
  
- C. Minimum Raceway Size: 1/2-inch 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.
  2. PVC Externally Coated, Rigid Steel Conduits: Use only fittings listed for use with that material. Patch and seal all joints, nicks, and scrapes in PVC coating after installing conduits and fittings. Use sealant recommended by fitting manufacturer.

- E. Install nonferrous conduit or tubing for circuits operating above 60 Hz. Where aluminum raceways are installed for such circuits and pass through concrete, install in nonmetallic sleeve.
- F. Do not install aluminum conduits in contact with concrete.

### 3.2 INSTALLATION

- A. Comply with NECA 1 for installation requirements applicable to products specified in Part 2 except where requirements on Drawings or in this Article are stricter.
- B. Keep raceways at least 6 inches away from parallel runs of flues and steam or hot-water pipes. Install horizontal raceway runs above water and steam piping.
- C. Complete raceway installation before starting conductor installation.
- D. Support raceways as specified in Division 26 Section "Hangers and Supports for Electrical Systems."
- E. Arrange stub-ups so curved portions of bends are not visible above the finished slab.
- F. Install no more than the equivalent of three 90-degree bends in any conduit run except for communications conduits, for which fewer bends are allowed.
- G. Conceal conduit and EMT within finished walls, ceilings, and floors, unless otherwise indicated.
- H. Raceways Embedded in Slabs:
  - 1. Run conduit larger than 1-inch trade size, parallel or at right angles to main reinforcement. Where at right angles to reinforcement, place conduit close to slab support.
  - 2. Arrange raceways to cross building expansion joints at right angles with expansion fittings.
  - 3. Change from ENT to RNC, Type EPC-40-PVC, rigid steel conduit, or IMC before rising above the floor.
- I. 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.
- J. Raceway Terminations at Locations Subject to Moisture or Vibration: Use insulating bushings to protect conductors, including conductors smaller than No. 4 AWG.

- K. Install pull wires in empty raceways. Use polypropylene or monofilament plastic line with not less than 200-lb tensile strength. Leave at least 12 inches of slack at each end of pull wire.
- L. Install raceway sealing fittings at suitable, approved, and accessible locations and fill them with listed sealing compound. For concealed raceways, install each fitting in a flush steel box with a blank cover plate having a finish similar to that of adjacent plates or surfaces. Install raceway sealing fittings at the following points:
1. Where conduits pass from warm to cold locations, such as boundaries of refrigerated spaces.
  2. Where otherwise required by NFPA 70.
- M. Expansion-Joint Fittings for RNC: Install in each run of aboveground conduit that is located where environmental temperature change may exceed 30 deg F, and that has straight-run length that exceeds 25 feet.
1. Install expansion-joint fittings for each of the following locations, and provide type and quantity of fittings that accommodate temperature change listed for location:
    - a. Outdoor Locations Not Exposed to Direct Sunlight: 125 deg F temperature change.
    - b. Outdoor Locations Exposed to Direct Sunlight: 155 deg F temperature change.
    - c. Indoor Spaces: Connected with the Outdoors without Physical Separation: 125 deg F temperature change.
    - d. Attics: 135 deg F temperature change.
  2. Install fitting(s) that provide expansion and contraction for at least 0.00041 inch per foot of length of straight run per deg F of temperature change.
  3. Install each expansion-joint fitting with position, mounting, and piston setting selected according to manufacturer's written instructions for conditions at specific location at the time of installation.
- N. Flexible Conduit Connections: Use maximum of 72 inches of flexible conduit for recessed and semirecessed lighting fixtures, equipment subject to vibration, noise transmission, or movement; and for transformers and motors.
1. Use LFMC in damp or wet locations subject to severe physical damage.



2. Use LFMC or LFNC in damp or wet locations not subject to severe physical damage.
- O. Recessed Boxes in Masonry Walls: Saw-cut opening for box in center of cell of masonry block, and install box flush with surface of wall.
- P. Set metal floor boxes level and flush with finished floor surface.
- Q. Set nonmetallic floor boxes level. Trim after installation to fit flush with finished floor surface.

### 3.3 INSTALLATION OF UNDERGROUND CONDUIT

#### A. Direct-Buried Conduit:

1. Excavate trench bottom to provide firm and uniform support for conduit. Prepare trench bottom as specified in Division 31 Section "Earth Moving" for pipe less than 6 inches in nominal diameter.
2. Install backfill as specified in Division 31 Section "Earth Moving."
3. After installing conduit, backfill and compact. Start at tie-in point, and work toward end of conduit run, leaving conduit at end of run free to move with expansion and contraction as temperature changes during this process. Firmly hand tamp backfill around conduit to provide maximum supporting strength. After placing controlled backfill to within 12 inches of finished grade, make final conduit connection at end of run and complete backfilling with normal compaction as specified in Division 31 Section "Earth Moving."
4. Install manufactured duct elbows for stub-ups at poles and equipment and at building entrances through the floor, unless otherwise indicated. Encase elbows for stub-up ducts throughout the length of the elbow.
5. Install manufactured rigid steel conduit elbows for stub-ups at poles and equipment and at building entrances through the floor.
  - a. Couple steel conduits to ducts with adapters designed for this purpose, and encase coupling with 3 inches of concrete.
  - b. For stub-ups at equipment mounted on outdoor concrete bases, extend steel conduit horizontally a minimum of 60 inches from edge of equipment pad or foundation. Install insulated grounding bushings on terminations at equipment.
6. Warning Planks: Bury warning planks approximately 12 inches above direct-buried conduits, placing them 24 inches o.c. Align planks along the width and along the centerline of conduit.

### 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 sieve to No. 4 sieve and compacted to same density as adjacent undisturbed earth.
- C. Elevation: In paved areas, set so cover surface will be flush with finished grade. Set covers of other enclosures 1 inch above finished grade.
- D. Install handholes and boxes with bottom below the frost line, below grade.
- E. Install removable hardware, including pulling eyes, cable stanchions, cable arms, and insulators, as required for installation and support of cables and conductors and as indicated. Select arm lengths to be long enough to provide spare space for future cables, but short enough to preserve adequate working clearances in the enclosure.
- F. 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 INSTALLATION FOR ELECTRICAL PENETRATIONS

- A. Coordinate sleeve selection and application with selection and application of firestopping specified in Division 07 Section "Penetration Firestopping."
- B. Concrete Slabs and Walls: Install sleeves for penetrations unless core-drilled holes or formed openings are used. Install sleeves during erection of slabs and walls.
- C. Use pipe sleeves unless penetration arrangement requires rectangular sleeved opening.
- D. Rectangular Sleeve Minimum Metal Thickness:
  - 1. For sleeve cross-section rectangle perimeter less than 50 inches and no side greater than 16 inches, thickness shall be 0.052 inch .
  - 2. For sleeve cross-section rectangle perimeter equal to, or greater than, 50 inches and 1 or more sides equal to, or greater than, 16 inches thickness shall be 0.138 inch.

- E. Fire-Rated Assemblies: Install sleeves for penetrations of fire-rated floor and wall assemblies unless openings compatible with firestop system used are fabricated during construction of floor or wall.
- F. Cut sleeves to length for mounting flush with both surfaces of walls.
- G. Extend sleeves installed in floors 2 inches above finished floor level.
- H. Size pipe sleeves to provide 1/4-inch annular clear space between sleeve and raceway unless sleeve seal is to be installed.
- I. Seal space outside of sleeves with grout for penetrations of concrete and masonry and with approved joint compound for gypsum board assemblies.
- J. Interior Penetrations of Non-Fire-Rated Walls and Floors: Seal annular space between sleeve and raceway, using joint sealant appropriate for size, depth, and location of joint. Refer to Division 07 Section "Joint Sealants" for materials and installation.
- K. Fire-Rated-Assembly Penetrations: Maintain indicated fire rating of walls, partitions, ceilings, and floors at raceway penetrations. Install sleeves and seal with firestop materials. Comply with Division 07 Section "Penetration Firestopping."
- L. Roof-Penetration Sleeves: Seal penetration of individual raceways with flexible, boot-type flashing units applied in coordination with roofing work.
- M. Aboveground, Exterior-Wall Penetrations: Seal penetrations using sleeves and mechanical sleeve seals. Select sleeve size to allow for 1-inch annular clear space between pipe and sleeve for installing mechanical sleeve seals.
- N. Underground, Exterior-Wall Penetrations: Install cast-iron "wall pipes" for sleeves. Size sleeves to allow for 1-inch annular clear space between raceway and sleeve for installing mechanical sleeve seals.

### 3.6 SLEEVE-SEAL INSTALLATION

- A. Install to seal underground, exterior wall penetrations.
- B. Use type and number of sealing elements recommended by manufacturer for raceway material and size. Position raceway in center of sleeve. Assemble mechanical sleeve seals and install in annular space between raceway and sleeve. Tighten bolts against pressure plates that cause sealing elements to expand and make watertight seal.

3.7 FIRESTOPPING

- A. Apply firestopping to electrical penetrations of fire-rated floor and wall assemblies to restore original fire-resistance rating of assembly. Firestopping materials and installation requirements are specified in Division 07 Section "Penetration Firestopping."

3.8 PROTECTION

- A. Provide final protection and maintain conditions that ensure coatings, finishes, and cabinets are without damage or deterioration at time of Substantial Completion.
  - 1. Repair damage to galvanized finishes with zinc-rich paint recommended by manufacturer.
  - 2. Repair damage to PVC or paint finishes with matching touchup coating recommended by manufacturer.

END OF SECTION 260533

THIS PAGE IS INTENTIONALLY LEFT BLANK

## **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. This Section includes the following:
  - 1. Identification for raceway and metal-clad cable.
  - 2. Identification for conductors and communication and control cable.
  - 3. Underground-line warning tape.
  - 4. Warning labels and signs.
  - 5. Instruction signs.
  - 6. Equipment identification labels.
  - 7. Miscellaneous identification products.

#### **1.3 SUBMITTALS**

- A. Product Data: For each electrical identification product indicated.
- B. Identification Schedule: An index of nomenclature of electrical equipment and system components used in identification signs and labels.
- C. Samples: For each type of label and sign to illustrate size, colors, lettering style, mounting provisions, and graphic features of identification products.

#### **1.4 QUALITY ASSURANCE**

- A. Comply with ANSI A13.1 and ANSI C2.
- B. Comply with NFPA 70.
- C. Comply with 29 CFR 1910.145.

## 1.5 COORDINATION

- A. Coordinate identification names, abbreviations, colors, and other features with requirements in the Contract Documents, Shop Drawings, manufacturer's wiring diagrams, and the Operation and Maintenance Manual, and with those required by codes, standards, and 29 CFR 1910.145. Use consistent designations throughout Project.
- B. Coordinate installation of identifying devices with completion of covering and painting of surfaces where devices are to be applied.
- C. Coordinate installation of identifying devices with location of access panels and doors.
- D. Install identifying devices before installing acoustical ceilings and similar concealment.

## PART 2 - PRODUCTS

### 2.1 RACEWAY AND METAL-CLAD CABLE IDENTIFICATION MATERIALS

- A. Comply with ANSI A13.1 for minimum size of letters for legend and for minimum length of color field for each raceway and cable size.
- B. Color for Printed Legend:
  - 1. Power Circuits: Black letters on an orange field.
  - 2. Legend: Indicate system or service and voltage, if applicable.
- C. Self-Adhesive Vinyl Labels: Preprinted, flexible label laminated with a clear, weather- and chemical-resistant coating and matching wraparound adhesive tape for securing ends of legend label.
- D. Snap-Around Labels: Slit, pretensioned, flexible, preprinted, color-coded acrylic sleeves, with diameter sized to suit diameter of raceway or cable it identifies and to stay in place by gripping action.
- E. Snap-Around, Color-Coding Bands: Slit, pretensioned, flexible, solid-colored acrylic sleeves, 2 inches long, with diameter sized to suit diameter of raceway or cable it identifies and to stay in place by gripping action.

- F. Self-Adhesive Vinyl Tape: Colored, heavy duty, waterproof, fade resistant; 2 inches wide; compounded for outdoor use.

## 2.2 CONDUCTOR AND COMMUNICATION- AND CONTROL-CABLE IDENTIFICATION MATERIALS

- A. Color-Coding Conductor Tape: Colored, self-adhesive vinyl tape not less than 3 mils thick by 1 to 2 inches wide.
- B. Marker Tapes: Vinyl or vinyl-cloth, self-adhesive wraparound type, with circuit identification legend machine printed by thermal transfer or equivalent process.
- C. Aluminum Wraparound Marker Labels: Cut from 0.014-inch thick aluminum sheet, with stamped, embossed, or scribed legend, and fitted with tabs and matching slots for permanently securing around wire or cable jacket or around groups of conductors.
- D. Metal Tags: Brass or aluminum, 2 by 2 by 0.05 inch , with stamped legend, punched for use with self-locking nylon tie fastener.
- E. Write-On Tags: Polyester tag, 0.010 inch thick, with corrosion-resistant grommet and polyester or nylon tie for attachment to conductor or cable.
  - 1. Marker for Tags: Permanent, waterproof, black ink marker recommended by tag manufacturer.

## 2.3 UNDERGROUND-LINE WARNING TAPE

- A. Description: Permanent, bright-colored, continuous-printed, polyethylene tape.
  - 1. Not less than 6 inches wide by 4 mils thick.
  - 2. Compounded for permanent direct-burial service.
  - 3. Embedded continuous metallic strip or core.
  - 4. Printed legend shall indicate type of underground line.

## 2.4 WARNING LABELS AND SIGNS

- A. Comply with NFPA 70 and 29 CFR 1910.145.
- B. Self-Adhesive Warning Labels: Factory printed, multicolor, pressure-sensitive adhesive labels, configured for display on front cover, door, or other access to equipment, unless otherwise indicated.



- C. Baked-Enamel Warning Signs: Preprinted aluminum signs, punched or drilled for fasteners, with colors, legend, and size required for application. 1/4-inch grommets in corners for mounting. Nominal size, 7 by 10 inches.
- D. Metal-Backed, Butyrate Warning Signs: Weather-resistant, nonfading, preprinted, cellulose-acetate butyrate signs with 0.0396-inch galvanized-steel backing; and with colors, legend, and size required for application. 1/4-inch grommets in corners for mounting. Nominal size, 10 by 14 inches.
- E. Warning label and sign shall include, but are not limited to, the following legends:
  - 1. Multiple Power Source Warning: "DANGER - ELECTRICAL SHOCK HAZARD - EQUIPMENT HAS MULTIPLE POWER SOURCES."
  - 2. Workspace Clearance Warning: "WARNING - OSHA REGULATION - AREA IN FRONT OF ELECTRICAL EQUIPMENT MUST BE KEPT CLEAR FOR 36 INCHES."

## 2.5 INSTRUCTION SIGNS

- A. Engraved, laminated acrylic or melamine plastic, minimum 1/16 inch thick for signs up to 20 sq. in. and 1/8 inch thick for larger sizes.
  - 1. Engraved legend with black letters on white face.
  - 2. Punched or drilled for mechanical fasteners.
  - 3. Framed with mitered acrylic molding and arranged for attachment at applicable equipment.

## 2.6 EQUIPMENT IDENTIFICATION LABELS

- A. Adhesive Film Label: Machine printed, in black, by thermal transfer or equivalent process. Minimum letter height shall be 3/8 inch.
- B. Adhesive Film Label with Clear Protective Overlay: Machine printed, in black, by thermal transfer or equivalent process. Minimum letter height shall be 3/8 inch. Overlay shall provide a weatherproof and ultraviolet-resistant seal for label.
- C. Self-Adhesive, Engraved, Laminated Acrylic or Melamine Label: Adhesive backed, with white letters on a dark-gray background. Minimum letter height shall be 3/8 inch.

- D. Engraved, Laminated Acrylic or Melamine Label: Punched or drilled for screw mounting. White letters on a dark-gray background. Minimum letter height shall be 3/8 inch.
- E. Stenciled Legend: In nonfading, waterproof, black ink or paint. Minimum letter height shall be 1 inch.

## 2.7 MISCELLANEOUS IDENTIFICATION PRODUCTS

- A. Cable Ties: Fungus-inert, self-extinguishing, 1-piece, self-locking, Type 6/6 nylon cable ties.
  - 1. Minimum Width: 3/16 inch.
  - 2. Tensile Strength: 50 lb, minimum.
  - 3. Temperature Range: Minus 40 to plus 185 deg F.
  - 4. Color: Black, except where used for color-coding.
- B. Paint: Paint materials and application requirements are specified in Division 09 painting Sections.
  - 1. Exterior Concrete, Stucco, and Masonry (Other Than Concrete Unit Masonry):
    - a. Semigloss Acrylic-Enamel Finish: One finish coat over a primer.
      - 1) Primer: Exterior concrete and masonry primer.
      - 2) Finish Coats: Exterior semigloss acrylic enamel.
  - 2. Exterior Concrete Unit Masonry:
    - a. Semigloss Acrylic-Enamel Finish: One finish coat over a block filler.
      - 1) Block Filler: Concrete unit masonry block filler.
      - 2) Finish Coats: Exterior semigloss acrylic enamel.
  - 3. Exterior Ferrous Metal:
    - a. Semigloss Alkyd-Enamel Finish: One finish coat over a primer.
      - 1) Primer: Exterior ferrous-metal primer.
      - 2) Finish Coats: Exterior semigloss alkyd enamel.
  - 4. Exterior Zinc-Coated Metal (except Raceways):

- a. Semigloss Alkyd-Enamel Finish: One finish coat over a primer.
  - 1) Primer: Exterior zinc-coated metal primer.
  - 2) Finish Coats: Exterior semigloss alkyd enamel.
5. Interior Concrete and Masonry (Other Than Concrete Unit Masonry):
  - a. Semigloss Alkyd-Enamel Finish: One finish coat over a primer.
    - 1) Primer: Interior concrete and masonry primer.
    - 2) Finish Coats: Interior semigloss alkyd enamel.
6. Interior Concrete Unit Masonry:
  - a. Semigloss Acrylic-Enamel Finish: One finish coat over a block filler.
    - 1) Block Filler: Concrete unit masonry block filler.
    - 2) Finish Coats: Interior semigloss acrylic enamel.
7. Interior Gypsum Board:
  - a. Semigloss Acrylic-Enamel Finish: One finish coat over a primer.
    - 1) Primer: Interior gypsum board primer.
    - 2) Finish Coats: Interior semigloss acrylic enamel.
8. Interior Ferrous Metal:
  - a. Semigloss Acrylic-Enamel Finish: One finish coat over a primer.
    - 1) Primer: Interior ferrous-metal primer.
    - 2) Finish Coats: Interior semigloss acrylic enamel.
9. Interior Zinc-Coated Metal (except Raceways):
  - a. Semigloss Acrylic-Enamel Finish: One finish coat over a primer.
    - 1) Primer: Interior zinc-coated metal primer.
    - 2) Finish Coats: Interior semigloss acrylic enamel.
- C. 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 APPLICATION

- A. Accessible Raceways and Metal-Clad Cables, 600 V or Less, for Service, Feeder, and Branch Circuits More Than 30 A: Identify with orange self-adhesive vinyl label.
- B. Accessible Raceways and Cables of Auxiliary Systems: Identify the following systems with color-coded, self-adhesive vinyl tape applied in bands:
  - 1. Fire Alarm System: Red.
  - 2. Fire-Suppression Supervisory and Control System: Red and yellow.
  - 3. Combined Fire Alarm and Security System: Red and blue.
  - 4. Security System: Blue and yellow.
  - 5. Mechanical and Electrical Supervisory System: Green and blue.
  - 6. Telecommunication System: Green and yellow.
  - 7. Control Wiring: Green and red.
- C. Power-Circuit Conductor Identification: For primary and secondary conductors No. 1/0 AWG and larger in vaults, pull and junction boxes, manholes, and handholes use color-coding conductor tape. Identify source and circuit number of each set of conductors. For single conductor cables, identify phase in addition to the above.
- D. Branch-Circuit Conductor Identification: Where there are conductors for more than three branch circuits in same junction or pull box, use color-coding conductor tape. Identify each ungrounded conductor according to source and circuit number.
- E. Conductors to Be Extended in the Future: Attach write-on tags to conductors and list source and circuit number.
- F. Auxiliary Electrical Systems Conductor Identification: Identify field-installed alarm, control, signal, sound, intercommunications, voice, and data connections.
  - 1. Identify conductors, cables, and terminals in enclosures and at junctions, terminals, and pull points. Identify by system and circuit designation.
  - 2. Use system of marker tape designations that is uniform and consistent with system used by manufacturer for factory-installed connections.
  - 3. Coordinate identification with Project Drawings, manufacturer's wiring diagrams, and Operation and Maintenance Manual.

- G. Locations of Underground Lines: Identify with underground-line warning tape for power, lighting, communication, and control wiring and optical fiber cable. Limit use of underground-line warning tape to direct-buried cables.
- H. Warning Labels for Indoor Cabinets, Boxes, and Enclosures for Power and Lighting: Comply with 29 CFR 1910.145 and apply self-adhesive warning labels. Identify system voltage with black letters on an orange background. Apply to exterior of door, cover, or other access.
  - 1. 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 connection.
  - 2. Equipment Requiring Workspace Clearance According to NFPA 70: Unless otherwise indicated, apply to door or cover of equipment but not on flush panelboards and similar equipment in finished spaces.
- I. Instruction Signs:
  - 1. Operating Instructions: Install instruction signs to facilitate proper operation and maintenance of electrical systems and items to which they connect. Install instruction signs with approved legend where instructions are needed for system or equipment operation.
  - 2. Emergency Operating Instructions: Install instruction signs with white legend on a red background with minimum 3/8-inch high letters for emergency instructions at equipment used for power transfer.
- J. Equipment Identification Labels: On each unit of equipment, install unique designation label that is consistent with wiring diagrams, schedules, and Operation and Maintenance Manual. Apply labels to disconnect switches and protection equipment, central or master units, control panels, control stations, terminal cabinets, and racks of each system. Systems include power, lighting, control, communication, signal, monitoring, and alarm systems unless equipment is provided with its own identification.
  - 1. Labeling Instructions:
    - a. Indoor Equipment: Engraved, laminated acrylic or melamine label. Unless otherwise indicated, provide a single line of text with 1/2-inch high letters on 1-1/2-inch high label; where 2 lines of text are required, use labels 2 inches high.
    - b. Outdoor Equipment: Engraved, laminated acrylic or melamine label.

- c. Elevated Components: Increase sizes of labels and letters to those appropriate for viewing from the floor.
2. Equipment to Be Labeled:
- a. Panelboards, electrical cabinets, and enclosures.
  - b. Access doors and panels for concealed electrical items.
  - c. Electrical switchgear and switchboards.
  - d. Transformers.
  - e. Electrical substations.
  - f. Emergency system boxes and enclosures.
  - g. Motor-control centers.
  - h. Disconnect switches.
  - i. Enclosed circuit breakers.
  - j. Motor starters.
  - k. Push-button stations.
  - l. Power transfer equipment.
  - m. Contactors.
  - n. Remote-controlled switches, dimmer modules, and control devices.
  - o. Battery inverter units.
  - p. Battery racks.
  - q. Power-generating units.
  - r. Voice and data cable terminal equipment.
  - s. Master clock and program equipment.
  - t. Intercommunication and call system master and staff stations.
  - u. Television/audio components, racks, and controls.
  - v. Fire-alarm control panel and annunciators.
  - w. Security and intrusion-detection control stations, control panels, terminal cabinets, and racks.
  - x. Monitoring and control equipment.
  - y. Uninterruptible power supply equipment.
  - z. Terminals, racks, and patch panels for voice and data communication and for signal and control functions.

### 3.2 INSTALLATION

- A. Verify identity of each item before installing identification products.
- B. Location: Install identification materials and devices at locations for most convenient viewing without interference with operation and maintenance of equipment.
- C. Apply identification devices to surfaces that require finish after completing finish work.

- D. Self-Adhesive Identification Products: Clean surfaces before application, using materials and methods recommended by manufacturer of identification device.
- E. Attach nonadhesive signs and plastic labels with screws and auxiliary hardware appropriate to the location and substrate.
- F. System Identification Color Banding for Raceways and Cables: Each color band shall completely encircle cable or conduit. Place adjacent bands of two-color markings in contact, side by side. Locate bands at changes in direction, at penetrations of walls and floors, at 50-foot maximum intervals in straight runs, and at 25-foot maximum intervals in congested areas.
- G. Color-Coding for Phase and Voltage Level Identification, 600 V and Less: Use the colors listed below for ungrounded service, feeder, and branch-circuit conductors.
  - 1. Color shall be factory applied or, for sizes larger than No. 10 AWG if authorities having jurisdiction permit, field applied.
  - 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. Field-Applied, Color-Coding Conductor Tape: Apply in half-lapped turns for a minimum distance of 6 inches from terminal points and in boxes where splices or taps are made. Apply last two turns of tape with no tension to prevent possible unwinding. Locate bands to avoid obscuring factory cable markings.
- H. Aluminum Wraparound Marker Labels and Metal Tags: Secure tight to surface of conductor or cable at a location with high visibility and accessibility.
- I. Underground-Line Warning Tape: During backfilling of trenches install continuous underground-line warning tape directly above line at 6 to 8 inches below finished grade. Use multiple tapes where width of multiple lines installed in a common trench or concrete envelope exceeds 16 inches overall.
- J. Painted Identification: Prepare surface and apply paint according to Division 09 painting Sections.

NEW SOCCER FIELDS AT BARBER PARK  
ORANGE COUNTY, FLORIDA

SECTION 260553  
IDENTIFICATION FOR  
ELECTRICAL SYSTEMS

END OF SECTION 260553



THIS PAGE IS INTENTIONALLY LEFT BLANK

## **SECTION 260923 - LIGHTING CONTROL DEVICES**

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

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

#### 1.2 SUMMARY

- A. This Section includes the following lighting control devices:
  - 1. Time switches.
  - 2. Outdoor photoelectric switches.
  - 3. Lighting contactors.
- B. Related Sections include the following:
  - 1. Division 26 Section "Wiring Devices" for wall-box dimmers and manual light switches.

#### 1.3 DEFINITIONS

- A. LED: Light-emitting diode.

#### 1.4 SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Shop Drawings: Show installation details.
  - 1. Interconnection diagrams showing field-installed wiring.
- C. Field quality-control test reports.
- D. Operation and Maintenance Data: For each type of product to include in emergency, operation, and maintenance manuals.

1.5 QUALITY ASSURANCE

- A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

PART 2 - PRODUCTS

2.1 TIME SWITCHES

- A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include the following:
- B. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
- C. Basis-of-Design Product: Subject to compliance with requirements, provide the product indicated on Drawings or a comparable product by one of the following:
  - 1. Area Lighting Research, Inc.; Tyco Electronics.
  - 2. Grasslin Controls Corporation; a GE Industrial Systems Company.
  - 3. Intermatic, Inc.
  - 4. Leviton Mfg. Company Inc.
  - 5. Lightolier Controls; a Genlyte Company.
  - 6. Lithonia Lighting; Acuity Lighting Group, Inc.
  - 7. Paragon Electric Co.; Invensys Climate Controls.
  - 8. Square D; Schneider Electric.
  - 9. TORK.
- D. Electronic Time Switches: Electronic, solid-state programmable units with alphanumeric display; complying with UL 917.
  - 1. Contact Configuration: SPST .
  - 2. Contact Rating: 20-A ballast load, 120/240-V ac.
  - 3. Program: 8 on-off set points on a 24-hour schedule and an annual holiday schedule that overrides the weekly operation on holidays.
  - 4. Program: 2 on-off set points on a 24-hour schedule, allowing different set points for each day of the week and an annual holiday schedule that overrides the weekly operation on holidays.
  - 5. Programs: 8 channels; each channel shall be individually programmable with 8 on-off set points on a 24-hour schedule.
  - 6. Circuitry: Allow connection of a photoelectric relay as substitute for on-off function of a program on selected channels.

7. Astronomic Time: Selected channels.
8. Battery Backup: For schedules and time clock.

## 2.2 OUTDOOR PHOTOELECTRIC SWITCHES

- A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include the following:
- B. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
- C. Basis-of-Design Product: Subject to compliance with requirements, provide the product indicated on Drawings or a comparable product by one of the following:
  1. Area Lighting Research, Inc.; Tyco Electronics.
  2. Grasslin Controls Corporation; a GE Industrial Systems Company.
  3. Intermatic, Inc.
  4. Lithonia Lighting; Acuity Lighting Group, Inc.
  5. Novitas, Inc.
  6. Paragon Electric Co.; Invensys Climate Controls.
  7. Square D; Schneider Electric.
  8. TORK.
- E. Description: Solid state, with SPST dry contacts rated for 1800 VA to operate connected load, relay, or contactor coils; complying with UL 773.
  1. Light-Level Monitoring Range: 1.5 to 10 fc with an adjustment for turn-on and turn-off levels within that range.
  2. Time Delay: 30-second minimum, to prevent false operation.
  3. Lightning Arrester: Air-gap type.
  4. Mounting: Twist lock complying with IEEE C136.10, with base.

## 2.3 LIGHTING CONTACTORS

- A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include the following:
- B. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
- C. Basis-of-Design Product: Subject to compliance with requirements, provide the product indicated on Drawings or a comparable product by one of the following:
  1. Allen-Bradley/Rockwell Automation.

2. ASCO Power Technologies, LP; a division of Emerson Electric Co.
  3. Eaton Electrical Inc.; Cutler-Hammer Products.
  4. GE Industrial Systems; Total Lighting Control.
  5. Grasslin Controls Corporation; a GE Industrial Systems Company.
  6. Hubbell Lighting.
  7. Lithonia Lighting; Acuity Lighting Group, Inc.
  8. MicroLite Lighting Control Systems.
  9. Square D; Schneider Electric.
- D. Description: Electrically operated and mechanically held, combination type with fusible switch, complying with NEMA ICS 2 and UL 508.
1. Current Rating for Switching: Listing or rating consistent with type of load served, including tungsten filament, inductive, and high-inrush ballast (ballast with 15 percent or less total harmonic distortion of normal load current).
  2. Fault Current Withstand Rating: Equal to or exceeding the available fault current at the point of installation.
  3. Enclosure: Comply with NEMA 250.
  4. Provide with control and pilot devices as scheduled, matching the NEMA type specified for the enclosure.
- E. BAS Interface: Provide hardware interface to enable the BAS to monitor and control lighting contactors.
1. Monitoring: On-off status
  2. Control: On-off operation

## 2.4 CONDUCTORS AND CABLES

- A. Power Wiring to Supply Side of Remote-Control Power Sources: Not smaller than No. 12 AWG. Comply with requirements in Division 26 Section "Low-Voltage Electrical Power Conductors and Cables."
- B. Classes 2 and 3 Control Cable: Multiconductor cable with stranded-copper conductors not smaller than No. 18 AWG. Comply with requirements in Division 26 Section "Low-Voltage Electrical Power Conductors and Cables."
- C. Class 1 Control Cable: Multiconductor cable with stranded-copper conductors not smaller than No. 14 AWG. Comply with requirements in Division 26 Section "Low-Voltage Electrical Power Conductors and Cables."

## PART 3 - EXECUTION

3.1 CONTACTOR INSTALLATION

- A. Mount electrically held lighting contactors with elastomeric isolator pads, to eliminate structure-borne vibration, unless contactors are installed in an enclosure with factory-installed vibration isolators.

3.2 WIRING INSTALLATION

- A. Wiring Method: Comply with Division 26 Section "Low-Voltage Electrical Power Conductors and Cables." Minimum conduit size shall be 1/2 inch.
- B. Wiring within Enclosures: Comply with NECA 1. Separate power-limited and nonpower-limited conductors according to conductor manufacturer's written instructions.
- C. Size conductors according to lighting control device manufacturer's written instructions, unless otherwise indicated.
- D. Splices, Taps, and Terminations: Make connections only on numbered terminal strips in junction, pull, and outlet boxes; terminal cabinets; and equipment enclosures.

3.3 IDENTIFICATION

- A. Identify components and power and control wiring according to Division 26 Section "Identification for Electrical Systems."
  - 1. Identify controlled circuits in lighting contactors.
- B. Label time switches and contactors with a unique designation.

3.4 FIELD QUALITY CONTROL

- A. Perform the following field tests and inspections and prepare test reports:
  - 1. After installing time switches and after electrical circuitry has been energized, adjust and test for compliance with requirements.
  - 2. Operational Test: Verify operation of each lighting control device, and adjust time delays.
- B. Lighting control devices that fail tests and inspections are defective work.

3.5 DEMONSTRATION

- A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain lighting control devices. Refer to Division 01 Section "Demonstration and Training."

END OF SECTION 260923

## **SECTION 262416 - PANELBOARDS**

### 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. Distribution panelboards.
  - 2. Lighting and appliance branch-circuit panelboards.
  - 3. Load centers.

#### 1.3 DEFINITIONS

- A. SVR: Suppressed voltage rating.
- B. TVSS: Transient voltage surge suppressor.

#### 1.4 SUBMITTALS

- A. Product Data: For each type of panelboard, switching and overcurrent protective device, transient voltage suppression device, accessory, and component indicated. Include dimensions and manufacturers' technical data on features, performance, electrical characteristics, ratings, and finishes.
- B. Shop Drawings: For each panelboard and related equipment.
  - 1. Include dimensioned plans, elevations, sections, and details. Show tabulations of installed devices, equipment features, and ratings.
  - 2. Detail enclosure types and details for types other than NEMA 250, Type 1.
  - 3. Detail bus configuration, current, and voltage ratings.
  - 4. Short-circuit current rating of panelboards and overcurrent protective devices.
  - 5. Include evidence of NRTL listing for series rating of installed devices.



6. Detail features, characteristics, ratings, and factory settings of individual overcurrent protective devices and auxiliary components.
  7. Include wiring diagrams for power, signal, and control wiring.
  8. Include time-current coordination curves for each type and rating of overcurrent protective device included in panelboards. Submit on translucent log-log graph paper; include selectable ranges for each type of overcurrent protective device.
- C. Qualification Data: For qualified testing agency.
- D. Field Quality-Control Reports:
1. Test procedures used.
  2. Test results that comply with requirements.
  3. Results of failed tests and corrective action taken to achieve test results that comply with requirements.
- E. Panelboard Schedules: For installation in panelboards. Submit final versions after load balancing.
- F. Operation and Maintenance Data: For panelboards and components to include in emergency, operation, and maintenance manuals. In addition to items specified in Division 01 Section "Operation and Maintenance Data," include the following:
1. Manufacturer's written instructions for testing and adjusting overcurrent protective devices.
  2. Time-current curves, including selectable ranges for each type of overcurrent protective device that allows adjustments.
- 1.5 QUALITY ASSURANCE
- A. Testing Agency Qualifications: Member company of NETA or an NRTL.
1. Testing Agency's Field Supervisor: Currently certified by NETA to supervise on-site testing.
- B. Source Limitations: Obtain panelboards, overcurrent protective devices, components, and accessories from single source from single manufacturer.
- C. Product Selection for Restricted Space: Drawings indicate maximum dimensions for panelboards including clearances between panelboards and adjacent surfaces and other items. Comply with indicated maximum dimensions.

- D. 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.
- E. Comply with NEMA PB 1.
- F. Comply with NFPA 70.

#### 1.6 DELIVERY, STORAGE, AND HANDLING

- A. Remove loose packing and flammable materials from inside panelboards; install temporary electric heating (250 W per panelboard) to prevent condensation.
- B. Handle and prepare panelboards for installation according to NECA 407.

#### 1.7 PROJECT CONDITIONS

- A. Environmental Limitations:
  - 1. Do not deliver or install panelboards until spaces are enclosed and weathertight, wet work in spaces is complete and dry, work above panelboards is complete, and temporary HVAC system is operating and maintaining ambient temperature and humidity conditions at occupancy levels during the remainder of the construction period.
  - 2. Rate equipment for continuous operation under the following conditions unless otherwise indicated:
    - a. Ambient Temperature: Not exceeding 23 deg F to plus 104 deg F.
    - b. Altitude: Not exceeding 6600 feet.
- B. Service Conditions: NEMA PB 1, usual service conditions, as follows:
  - 1. Ambient temperatures within limits specified.
  - 2. Altitude not exceeding 6600 feet.
- C. Interruption of Existing Electric Service: Do not interrupt electric service to facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary electric service according to requirements indicated:
  - 1. Notify Owner no fewer than two days in advance of proposed interruption of electric service.

2. Do not proceed with interruption of electric service without Owner's written permission.
3. Comply with NFPA 70E.

#### 1.8 COORDINATION

- A. Coordinate layout and installation of panelboards and components with other construction that penetrates walls or is supported by them, including electrical and other types of equipment, raceways, piping, encumbrances to workspace clearance requirements, and adjacent surfaces. Maintain required workspace clearances and required clearances for equipment access doors and panels.
- B. Coordinate sizes and locations of concrete bases with actual equipment provided. Cast anchor-bolt inserts into bases. Concrete, reinforcement, and formwork requirements are specified in Division 03.

#### 1.9 WARRANTY

- A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace transient voltage suppression devices that fail in materials or workmanship within specified warranty period.
  1. Warranty Period: Five years from date of Substantial Completion.

#### 1.10 EXTRA MATERIALS

- A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
  1. Keys: Two spares for each type of panelboard cabinet lock.
  2. Circuit Breakers Including GFCI and Ground Fault Equipment Protection (GFEP) Types: Two spares for each panelboard.
  3. Fuses for Fused Switches: Equal to 10 percent of quantity installed for each size and type, but no fewer than three of each size and type.
  4. Fuses for Fused Power-Circuit Devices: Equal to 10 percent of quantity installed for each size and type, but no fewer than three of each size and type.

### PART 2 - PRODUCTS

#### 2.1 GENERAL REQUIREMENTS FOR PANELBOARDS

- A. Enclosures: Surface-mounted cabinets.
  - 1. Rated for environmental conditions at installed location.
    - a. Indoor Dry and Clean Locations: NEMA 250, Type 1
    - b. Outdoor Locations: NEMA 250, Type 4x, stainless steel.
    - c. Kitchen Areas: NEMA 250, Type 4X, stainless steel
    - d. Other Wet or Damp Indoor Locations: NEMA 250, Type 4
    - e. Indoor Locations Subject to Dust, Falling Dirt, and Dripping Noncorrosive Liquids: NEMA 250, Type 5.
  - 2. Front: Secured to box with concealed trim clamps. For surface-mounted fronts, match box dimensions; for flush-mounted fronts, overlap box.
  - 3. Hinged Front Cover: Entire front trim hinged to box and with standard door within hinged trim cover.
  - 4. Skirt for Surface-Mounted Panelboards: Same gage and finish as panelboard front with flanges for attachment to panelboard, wall, and ceiling or floor.
  - 5. Gutter Extension and Barrier: Same gage and finish as panelboard enclosure; integral with enclosure body. Arrange to isolate individual panel sections.
  - 6. Finishes:
    - a. Panels and Trim: Galvanized steel, factory finished immediately after cleaning and pretreating with manufacturer's standard two-coat, baked-on finish consisting of prime coat and thermosetting topcoat.
    - b. Back Boxes: Galvanized steel..
    - c. Fungus Proofing: Permanent fungicidal treatment for overcurrent protective devices and other components.
  - 7. Directory Card: Inside panelboard door, mounted in transparent card holder.
- B. Incoming Mains Location: Bottom.
- C. Phase, Neutral, and Ground Buses:
  - 1. Material: Hard-drawn copper, 98 percent conductivity.
  - 2. Equipment Ground Bus: Adequate for feeder and branch-circuit equipment grounding conductors; bonded to box.
  - 3. Isolated Ground Bus: Adequate for branch-circuit isolated ground conductors; insulated from box.
  - 4. Split Bus: Vertical buses divided into individual vertical sections.
- D. Conductor Connectors: Suitable for use with conductor material and sizes.
  - 1. Material: Hard-drawn copper, 98 percent conductivity.

2. Main and Neutral Lugs: Compression type.
  3. Ground Lugs and Bus-Configured Terminators: Compression type.
  4. Feed-Through Lugs: Compression type, suitable for use with conductor material. Locate at opposite end of bus from incoming lugs or main device.
  5. Subfeed (Double) Lugs: Compression type suitable for use with conductor material. Locate at same end of bus as incoming lugs or main device.
  6. Gutter-Tap Lugs: Compression type suitable for use with conductor material. Locate at same end of bus as incoming lugs or main device.
- E. Service Equipment Label: NRTL labeled for use as service equipment for panelboards or load centers with one or more main service disconnecting and overcurrent protective devices.
- F. Future Devices: Mounting brackets, bus connections, filler plates, and necessary appurtenances required for future installation of devices.
- G. Panelboard Short-Circuit Current Rating: Rated for series-connected system with integral or remote upstream overcurrent protective devices and labeled by an NRTL. Include size and type of allowable upstream and branch devices, listed and labeled for series-connected short-circuit rating by an NRTL.

## 2.2 DISTRIBUTION PANELBOARDS

- A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include the following:
- B. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:
1. Eaton Electrical Inc.; Cutler-Hammer Business Unit.
  2. General Electric Company; GE Consumer & Industrial - Electrical Distribution.
  3. Siemens Energy & Automation, Inc.
  4. Square D; a brand of Schneider Electric.
- C. Panelboards: NEMA PB 1, power and feeder distribution type.
- D. Doors: Secured with vault-type latch with tumbler lock; keyed alike.
1. For doors more than 36 inches high, provide two latches, keyed alike.
- E. Mains: Lugs only.
- F. Branch Overcurrent Protective Devices for Circuit-Breaker Frame Sizes 125 A and Smaller: Bolt-on circuit breakers.

- G. Branch Overcurrent Protective Devices for Circuit-Breaker Frame Sizes Larger Than 125 A: Bolt-on circuit breakers; plug-in circuit breakers where individual positive-locking device requires mechanical release for removal.

## 2.3 LIGHTING AND APPLIANCE BRANCH-CIRCUIT PANELBOARDS

- A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include the following:
- B. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:
  - 1. Eaton Electrical Inc.; Cutler-Hammer Business Unit.
  - 2. General Electric Company; GE Consumer & Industrial - Electrical Distribution.
  - 3. Siemens Energy & Automation, Inc.
  - 4. Square D; a brand of Schneider Electric.
- C. Panelboards: NEMA PB 1, lighting and appliance branch-circuit type.
- D. Mains: lugs only.
- E. Branch Overcurrent Protective Devices: Bolt-on circuit breakers, replaceable without disturbing adjacent units.
- F. Doors: Concealed hinges; secured with flush latch with tumbler lock; keyed alike.

## 2.4 LOAD CENTERS

- A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include the following:
- B. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:
  - 1. Eaton Electrical Inc.; Cutler-Hammer Business Unit.
  - 2. General Electric Company; GE Consumer & Industrial - Electrical Distribution.
  - 3. Siemens Energy & Automation, Inc.
  - 4. Square D; a brand of Schneider Electric.
- C. Load Centers: Comply with UL 67.
- D. Mains: Circuit breaker.

- E. Branch Overcurrent Protective Devices: Plug-in circuit breakers, replaceable without disturbing adjacent units.
- F. Conductor Connectors: Mechanical type for main, neutral, and ground lugs and buses.

## 2.5 DISCONNECTING AND OVERCURRENT PROTECTIVE DEVICES

- A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include the following:
- B. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:
  - 1. Eaton Electrical Inc.; Cutler-Hammer Business Unit.
  - 2. General Electric Company; GE Consumer & Industrial - Electrical Distribution.
  - 3. Siemens Energy & Automation, Inc.
  - 4. Square D; a brand of Schneider Electric.
- C. Molded-Case Circuit Breaker (MCCB): Comply with UL 489, with series-connected rating to meet available fault currents.
  - 1. Thermal-Magnetic Circuit Breakers: Inverse time-current element for low-level overloads, and instantaneous magnetic trip element for short circuits. Adjustable magnetic trip setting for circuit-breaker frame sizes 250 A and larger.
  - 2. Adjustable Instantaneous-Trip Circuit Breakers: Magnetic trip element with front-mounted, field-adjustable trip setting.
  - 3. Electronic trip circuit breakers with rms sensing; field-replaceable rating plug or field-replicable electronic trip; and the following field-adjustable settings:
    - a. Instantaneous trip.
    - b. Long- and short-time pickup levels.
    - c. Long- and short-time time adjustments.
    - d. Ground-fault pickup level, time delay, and  $I^2t$  response.
  - 4. Current-Limiting Circuit Breakers: Frame sizes 400 A and smaller; let-through ratings less than NEMA FU 1, RK-5.
  - 5. GFCI Circuit Breakers: Single- and two-pole configurations with Class A ground-fault protection (6-mA trip).
  - 6. Ground-Fault Equipment Protection (GFEP) Circuit Breakers: Class B ground-fault protection (30-mA trip).
  - 7. Arc-Fault Circuit Interrupter (AFCI) Circuit Breakers: Comply with UL 1699; 120/240-V, single-pole configuration.
  - 8. Molded-Case Circuit-Breaker (MCCB) Features and Accessories:

- a. Standard frame sizes, trip ratings, and number of poles.
  - b. Lugs: Compression style, suitable for number, size, trip ratings, and conductor materials.
  - c. Application Listing: Appropriate for application; Type SWD for switching fluorescent lighting loads; Type HID for feeding fluorescent and high-intensity discharge (HID) lighting circuits.
  - d. Ground-Fault Protection: Integrally mounted relay and trip unit with adjustable pickup and time-delay settings, push-to-test feature, and ground-fault indicator.
  - e. Shunt Trip: 120-V trip coil energized from separate circuit, set to trip at 55 percent of rated voltage.
  - f. Undervoltage Trip: Set to operate at 35 to 75 percent of rated voltage without intentional time delay.
  - g. Auxiliary Contacts: One SPDT switch with "a" and "b" contacts; "a" contacts mimic circuit-breaker contacts and "b" contacts operate in reverse of circuit-breaker contacts.
  - h. Alarm Switch: Single-pole, normally open contact that actuates only when circuit breaker trips.
  - i. Key Interlock Kit: Externally mounted to prohibit circuit-breaker operation; key shall be removable only when circuit breaker is in off position.
  - j. Zone-Selective Interlocking: Integral with electronic trip unit; for interlocking ground-fault protection function with other upstream or downstream devices.
  - k. Multipole units enclosed in a single housing or factory assembled to operate as a single unit.
  - l. Handle Padlocking Device: Fixed attachment, for locking circuit-breaker handle in on or off position.
  - m. Handle Clamp: Loose attachment, for holding circuit-breaker handle in on position.
- D. Fused Switch: NEMA KS 1, Type HD; clips to accommodate specified fuses; lockable handle.
1. Fuses, and Spare-Fuse Cabinet: Comply with requirements specified in Division 26 Section "Fuses."
  2. Fused Switch Features and Accessories: Standard ampere ratings and number of poles.
  3. Auxiliary Contacts: One normally open and normally closed contact(s) that operate with switch handle operation.

## 2.6 PANELBOARD SUPPRESSORS



- A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include the following:
  
- B. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:
  - 1. Current Technology; a subsidiary of Danahar Corporation.
  - 2. Eaton Electrical Inc.; Cutler-Hammer Business Unit.
  - 3. General Electric Company; GE Consumer & Industrial - Electrical Distribution.
  - 4. Liebert Corporation.
  - 5. Siemens Energy & Automation, Inc.
  - 6. Square D; a brand of Schneider Electric.
  
- C. Surge Protection Device: IEEE C62.41-compliant, integrally mounted, solid-state, parallel-connected, non-modular type, with sine-wave tracking suppression and filtering modules, UL 1449, second edition, short-circuit current rating matching or exceeding the panelboard short-circuit rating, and with the following features and accessories:
  - 1. Accessories:
    - a. LED indicator lights for power and protection status.
    - b. Audible alarm, with silencing switch, to indicate when protection has failed.
    - c. One set of dry contacts rated at 5 A and 250-V ac, for remote monitoring of protection status.
  
- D. Surge Protection Device: IEEE C62.41-compliant, integrally mounted, wired-in, solid-state, parallel-connected, modular (with field-replaceable modules) type, with sine-wave tracking suppression and filtering modules, UL 1449, second edition, short-circuit current rating matching or exceeding the panelboard short-circuit rating, and with the following features and accessories:
  - 1. Accessories:
    - a. Fuses rated at 200-kA interrupting capacity.
    - b. Fabrication using bolted compression lugs for internal wiring.
    - c. Integral disconnect switch.
    - d. Redundant suppression circuits.
    - e. Redundant replaceable modules.
    - f. Arrangement with wire connections to phase buses, neutral bus, and ground bus.
    - g. LED indicator lights for power and protection status.
    - h. Audible alarm, with silencing switch, to indicate when protection has failed.
    - i. Form-C contacts rated at 5 A and 250-V ac, one normally open and one normally closed, for remote monitoring of system operation. Contacts shall reverse position on failure of any surge diversion module or on opening of

- any current-limiting device. Coordinate with building power monitoring and control system.
- j. Four-digit, transient-event counter set to totalize transient surges.
2. Peak Single-Impulse Surge Current Rating: 160 kA per mode/320 kA per phase.
  3. Minimum single-impulse current ratings, using 8-by-20-mic.sec. waveform described in IEEE C62.41.2.
    - a. Line to Neutral: 70,000 A.
    - b. Line to Ground: 70,000 A.
    - c. Neutral to Ground: 50,000 A.
  4. Withstand Capabilities: 12,000 IEEE C62.41, Category C3 (10 kA), 8-by-20-mic.sec. surges with less than 5 percent change in clamping voltage.
  5. Protection modes and UL 1449 SVR for grounded wye circuits with 208Y/120-V, three-phase, four-wire circuits shall be as follows:
    - a. Line to Neutral: 400 V for 208Y/120.
    - b. Line to Ground: 400 V for 208Y/120.
    - c. Neutral to Ground: 400 V for 208Y/120.
  6. Protection modes and UL 1449 SVR for 240/120-V, single-phase, three-wire circuits shall be as follows:
    - a. Line to Neutral: 400 V.
    - b. Line to Ground: 400 V.
    - c. Neutral to Ground: 400 V.

## 2.7 ACCESSORY COMPONENTS AND FEATURES

- A. Accessory Set: Include tools and miscellaneous items required for overcurrent protective device test, inspection, maintenance, and operation.
- B. Portable Test Set: For testing functions of solid-state trip devices without removing from panelboard. Include relay and meter test plugs suitable for testing panelboard meters and switchboard class relays.

## PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. Receive, inspect, handle, and store panelboards according to NECA 407.

- B. Examine panelboards before installation. Reject panelboards that are damaged or rusted or have been subjected to water saturation.
- C. Examine elements and surfaces to receive panelboards for compliance with installation tolerances and other conditions affecting performance of the Work.
- D. Proceed with installation only after unsatisfactory conditions have been corrected.

### 3.2 INSTALLATION

- A. Install panelboards and accessories according to NECA 407.
- B. 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.
- C. Install overcurrent protective devices and controllers not already factory installed.
  - 1. Set field-adjustable, circuit-breaker trip ranges.
- D. Install filler plates in unused spaces.
- E. Arrange conductors in gutters into groups and bundle and wrap with wire ties after completing load balancing.
- F. Comply with NECA 1.

### 3.3 IDENTIFICATION

- A. Identify field-installed conductors, interconnecting wiring, and components; provide warning signs complying with Division 26 Section "Identification for Electrical Systems."
- B. Create a directory to indicate installed circuit loads after balancing panelboard loads; incorporate Owner's final room designations. Obtain approval before installing. Use a computer or typewriter to create directory; handwritten directories are not acceptable.

- C. Panelboard Nameplates: Label each panelboard with a nameplate complying with requirements for identification specified in Division 26 Section "Identification for Electrical Systems."
- D. Device Nameplates: Label each branch circuit device in distribution panelboards with a nameplate complying with requirements for identification specified in Division 26 Section "Identification for Electrical Systems."

### 3.4 FIELD QUALITY CONTROL

- A. Testing Agency: Engage a qualified testing agency to perform tests and inspections.
- B. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect, test, and adjust components, assemblies, and equipment installations, including connections.
- C. Perform tests and inspections.
  - 1. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect components, assemblies, and equipment installations, including connections, and to assist in testing.
- D. Acceptance Testing Preparation:
  - 1. Test insulation resistance for each panelboard bus, component, connecting supply, feeder, and control circuit.
  - 2. Test continuity of each circuit.
- E. Tests and Inspections:
  - 1. Perform each visual and mechanical inspection and electrical test stated in NETA Acceptance Testing Specification. Certify compliance with test parameters.
  - 2. Correct malfunctioning units on-site, where possible, and retest to demonstrate compliance; otherwise, replace with new units and retest.
  - 3. Perform the following infrared scan tests and inspections and prepare reports:
    - a. Initial Infrared Scanning: After Substantial Completion, but not more than 60 days after Final Acceptance, perform an infrared scan of each panelboard. Remove front panels so joints and connections are accessible to portable scanner.
    - b. Follow-up Infrared Scanning: Perform an additional follow-up infrared scan of each panelboard 11 months after date of Substantial Completion.
    - c. Instruments and Equipment:

- 1) Use an infrared scanning device designed to measure temperature or to detect significant deviations from normal values. Provide calibration record for device.

- F. Panelboards will be considered defective if they do not pass tests and inspections.
- G. Prepare test and inspection reports, including a certified report that identifies panelboards included and that describes scanning results. Include notation of deficiencies detected, remedial action taken, and observations after remedial action.

### 3.5 ADJUSTING

- A. Adjust moving parts and operable component to function smoothly, and lubricate as recommended by manufacturer.
- B. Set field-adjustable circuit-breaker trip ranges as specified in Division 26 Section "Overcurrent Protective Device Coordination Study."
- C. Load Balancing: After Substantial Completion, but not more than 60 days after Final Acceptance, measure load balancing and make circuit changes.
  1. Measure as directed during period of normal system loading.
  2. Perform load-balancing circuit changes outside normal occupancy/working schedule of the facility and at time directed. Avoid disrupting critical 24-hour services such as fax machines and on-line data processing, computing, transmitting, and receiving equipment.
  3. After circuit changes, recheck loads during normal load period. Record all load readings before and after changes and submit test records.
  4. Tolerance: Difference exceeding 20 percent between phase loads, within a panelboard, is not acceptable. Rebalance and recheck as necessary to meet this minimum requirement.

### 3.6 PROTECTION

- A. Temporary Heating: Apply temporary heat to maintain temperature according to manufacturer's written instructions.

END OF SECTION 262416

## **SECTION 262713 - ELECTRICITY METERING**

### **PART 1 - GENERAL**

#### **1.1 RELATED DOCUMENTS**

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

#### **1.2 SUMMARY**

- A. This Section includes equipment for utility company's electricity metering.

#### **1.3 SUBMITTALS**

- A. Product Data: Include construction details, material descriptions, dimensions of individual components and profiles, and finishes. Describe electrical characteristics, features, and operating sequences, both automatic and manual. Include the following:
  - 1. Electricity-metering equipment.
- B. Shop Drawings for Electricity-Metering Equipment:
  - 1. Dimensioned plans and sections or elevation layouts.
  - 2. Wiring Diagrams: Power, signal, and control wiring specific to this Project. Identify terminals and wiring designations and color codes to facilitate installation, operation, and maintenance. Indicate recommended types, wire sizes, and circuiting arrangements for field-installed wiring, and show circuit protection features.
  - 3. Mounting and anchoring devices recommended by manufacturer.

#### **1.4 QUALITY ASSURANCE**

- A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

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

- A. Receive, store, and handle modular meter center as specified in NECA 400.

## 1.6 PROJECT CONDITIONS

- A. Interruption of Existing Electrical Service: Do not interrupt electrical service to facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary electrical service according to requirements indicated:
  - 1. Notify Owner no fewer than two days in advance of proposed interruption of electrical service.
  - 2. Do not proceed with interruption of electrical service without Owner's written permission.

## 1.7 COORDINATION

- A. Electrical Service Connections: Coordinate with utility companies and components they furnish as follows:
  - 1. Comply with requirements of utilities providing electrical power and communication services.
  - 2. Coordinate installation and connection of utilities and services, including provision for electricity-metering components.

## PART 2 - PRODUCTS

### 2.1 MANUFACTURERS

- A. In other Part 2 articles where titles below introduce lists, the following requirements apply to product selection:
  - 1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include manufacturers specified.
  - 2. Manufacturers: Subject to compliance with requirements, provide products by one of the manufacturers specified.

### 2.2 EQUIPMENT FOR ELECTRICITY METERING BY UTILITY COMPANY

- A. Current-Transformer Cabinets: Comply with requirements of electrical power utility company.
- B. Meter Sockets: Comply with requirements of electrical power utility company.

### PART 3 - EXECUTION

#### 3.1 INSTALLATION

- A. Comply with equipment installation requirements in NECA 1.
- B. Install equipment for utility company metering. Install raceways and equipment according to utility company's written requirements. Provide empty conduits for metering leads and extend grounding connections as required by utility company.

END OF SECTION 262713



THIS PAGE IS INTENTIONALLY LEFT BLANK

## **SECTION 262726 - WIRING DEVICES**

### **PART 1 - GENERAL**

#### **1.1 RELATED DOCUMENTS**

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

#### **1.2 SUMMARY**

- A. This Section includes the following:
  - 1. Receptacles, receptacles with integral GFCI, and associated device plates.
  - 2. Twist-locking receptacles.
  - 3. Receptacles with integral surge suppression units.
  - 4. Wall-box motion sensors.
  - 5. Isolated-ground receptacles.
  - 6. Hospital-grade receptacles.
  - 7. Snap switches and wall-box dimmers.
  - 8. Solid-state fan speed controls.
  - 9. Wall-switch and exterior occupancy sensors.
  - 10. Communications outlets.
  - 11. Pendant cord-connector devices.
  - 12. Cord and plug sets.
  - 13. Floor service outlets, poke-through assemblies, service poles, and multioutlet assemblies.

#### **1.3 DEFINITIONS**

- A. EMI: Electromagnetic interference.
- B. GFCI: Ground-fault circuit interrupter.
- C. Pigtail: Short lead used to connect a device to a branch-circuit conductor.
- D. RFI: Radio-frequency interference.
- E. TVSS: Transient voltage surge suppressor.

- F. UTP: Unshielded twisted pair.

#### 1.4 SUBMITTALS

- A. Product Data: For each type of product indicated.
- 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.
- D. Field quality-control test reports.
- E. Operation and Maintenance Data: For wiring devices to include in all manufacturers' packing label warnings and instruction manuals that include labeling conditions.

#### 1.5 QUALITY ASSURANCE

- A. Source Limitations: Obtain each type of wiring device and associated wall plate through one source from a single manufacturer. Insofar as they are available, obtain all wiring devices and associated wall plates from a single manufacturer and one source.
- B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.
- C. Comply with NFPA 70.

#### 1.6 COORDINATION

- A. Receptacles for Owner-Furnished Equipment: Match plug configurations.
  - 1. Cord and Plug Sets: Match equipment requirements.

#### 1.7 EXTRA MATERIALS

- A. Furnish extra materials described in subparagraphs below that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
  - 1. Service/Power Poles: One for every 10, but no fewer than one.

2. Floor Service Outlet Assemblies: One for every 10, but no fewer than one .
3. Poke-Through, Fire-Rated Closure Plugs: One for every five floor service outlets installed, but no fewer than two.
4. TVSS Receptacles: One for every 10 of each type installed, but no fewer than two of each type.

## PART 2 - PRODUCTS

### 2.1 MANUFACTURERS

- A. Manufacturers' Names: Shortened versions (shown in parentheses) of the following manufacturers' names are used in other Part 2 articles:
  1. Cooper Wiring Devices; a division of Cooper Industries, Inc. (Cooper).
  2. Hubbell Incorporated; Wiring Device-Kellems (Hubbell).
  3. Leviton Mfg. Company Inc. (Leviton).
  4. Pass & Seymour/Legrand; Wiring Devices & Accessories (Pass & Seymour).

### 2.2 STRAIGHT BLADE RECEPTACLES

- A. Convenience Receptacles, 125 V, 20 A: Comply with NEMA WD 1, NEMA WD 6 configuration 5-20R, and UL 498.
  1. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include the following:
  2. Products: Subject to compliance with requirements, provide one of the following:
    - a. Cooper; 5351 (single), 5352 (duplex).
    - b. Hubbell; HBL5351 (single), CR5352 (duplex).
    - c. Leviton; 5891 (single), 5352 (duplex).
    - d. Pass & Seymour; 5381 (single), 5352 (duplex).
- B. Hospital-Grade, Duplex Convenience Receptacles, 125 V, 20 A: Comply with NEMA WD 1, NEMA WD 6 configuration 5-20R, and UL 498 Supplement SD.
  1. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include the following:
  2. Products: Subject to compliance with requirements, provide one of the following:
    - a. Cooper; 8300 (duplex).
    - b. Hubbell; HBL8310 (single), HBL8300H (duplex).
    - c. Leviton; 8310 (single), 8300 (duplex).

- d. Pass & Seymour; 9301-HG (single), 9300-HG (duplex).
- C. Isolated-Ground, Duplex Convenience Receptacles, 125 V, 20 A: Comply with NEMA WD 1, NEMA WD 6 configuration 5-20R, and UL 498.
1. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include the following:
  2. Products: Subject to compliance with requirements, provide one of the following:
    - a. Hubbell; CR 5253IG.
    - b. Leviton; 5362-IG.
    - c. Pass & Seymour; IG6300.
  3. Description: Straight blade; equipment grounding contacts shall be connected only to the green grounding screw terminal of the device and with inherent electrical isolation from mounting strap. Isolation shall be integral to receptacle construction and not dependent on removable parts.
- D. Tamper-Resistant Convenience Receptacles, 125 V, 20 A: Comply with NEMA WD 1, NEMA WD 6 configuration 5-20R, and UL 498.
1. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include the following:
  2. Products: Subject to compliance with requirements, provide one of the following:
    - a. Cooper; TR8300.
    - b. Hubbell; HBL8300SG.
    - c. Leviton; 8300-SGG.
    - d. Pass & Seymour; 63H.
  3. Description: Labeled to comply with NFPA 70, "Health Care Facilities" Article, "Pediatric Locations" Section.

### 2.3 GFCI RECEPTACLES

- A. General Description: Straight blade, feed-through type. Comply with NEMA WD 1, NEMA WD 6, UL 498, and UL 943, Class A, and include indicator light that is lighted when device is tripped.
- B. Duplex GFCI Convenience Receptacles, 125 V, 20 A:
1. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include the following:
  2. Products: Subject to compliance with requirements, provide one of the following:

- a. Cooper; GF20.
  - b. Pass & Seymour; 2084.
- C. Hospital-Grade, Duplex GFCI Convenience Receptacles, 125 V, 20 A: Comply with UL 498 Supplement SD.
1. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include the following:
  2. Products: Subject to compliance with requirements, provide one of the following:
    - a. Cooper; HGF20.
    - b. Hubbell; HGF8300.
    - c. Leviton; 6898-HG.
    - d. Pass & Seymour; 2091-SHG.

## 2.4 TVSS RECEPTACLES

- A. General Description: Comply with NEMA WD 1, NEMA WD 6, UL 498, and UL 1449, with integral TVSS in line to ground, line to neutral, and neutral to ground.
1. TVSS Components: Multiple metal-oxide varistors; with a nominal clamp-level rating of 400 volts and minimum single transient pulse energy dissipation of 240 J, according to IEEE C62.41.2 and IEEE C62.45.
  2. Active TVSS Indication: Visual and audible, with light visible in face of device to indicate device is "active" or "no longer in service."
- B. Duplex TVSS Convenience Receptacles:
1. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include the following:
  2. Products: Subject to compliance with requirements, provide one of the following:
    - a. Cooper; 5362BLS.
    - b. Hubbell; HBL5362SA.
    - c. Leviton; 5380.
  3. Description: Straight blade, 125 V, 20 A; NEMA WD 6 configuration 5-20R.
- C. Isolated-Ground, Duplex Convenience Receptacles:
1. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include the following:
  2. Products: Subject to compliance with requirements, provide one of the following:

- a. Cooper; IG5362BLS.
  - b. Hubbell; IG5362SA.
  - c. Leviton; 5380-IG.
3. Description: Straight blade, 125 V, 20 A; NEMA WD 6 configuration 5-20R. Equipment grounding contacts shall be connected only to the green grounding screw terminal of the device and with inherent electrical isolation from mounting strap. Isolation shall be integral to receptacle construction and not dependent on removable parts.
- D. Hospital-Grade, Duplex Convenience Receptacles: Comply with UL 498 Supplement SD.
1. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include the following:
  2. Products: Subject to compliance with requirements, provide one of the following:
    - a. Cooper; 8300BLS.
    - b. Hubbell; HBL8362SA.
    - c. Leviton; 8380.
  3. Description: Straight blade, 125 V, 20 A; NEMA WD 6 configuration 5-20R.
- E. Isolated-Ground, Hospital-Grade, Duplex Convenience Receptacles:
1. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include the following:
  2. Products: Subject to compliance with requirements, provide one of the following:
    - a. Cooper; IG8300HGBLS.
    - b. Hubbell; IG8362SA.
    - c. Leviton; 8380-IG.
  3. Description: Straight blade, 125 V, 20 A; NEMA WD 6 configuration 5-20R. Comply with UL 498 Supplement SD. Equipment grounding contacts shall be connected only to the green grounding screw terminal of the device and with inherent electrical isolation from mounting strap. Isolation shall be integral to receptacle construction and not dependent on removable parts.

## 2.5 HAZARDOUS (CLASSIFIED) LOCATION RECEPTACLES

- A. Wiring Devices for Hazardous (Classified) Locations: Comply with NEMA FB 11 and UL 1010.

1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include the following:
2. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - a. Cooper Crouse-Hinds.
  - b. EGS/Appleton Electric.
  - c. Killark; a division of Hubbell Inc.

## 2.6 TWIST-LOCKING RECEPTACLES

- A. Single Convenience Receptacles, 125 V, 20 A: Comply with NEMA WD 1, NEMA WD 6 configuration L5-20R, and UL 498.
  1. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include the following:
  2. Products: Subject to compliance with requirements, provide one of the following:
    - a. Cooper; L520R.
    - b. Hubbell; HBL2310.
    - c. Leviton; 2310.
    - d. Pass & Seymour; L520-R.
- B. Isolated-Ground, Single Convenience Receptacles, 125 V, 20 A:
  1. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include the following:
  2. Products: Subject to compliance with requirements, provide one of the following:
    - a. Hubbell; IG2310.
    - b. Leviton; 2310-IG.
  3. Description: Comply with NEMA WD 1, NEMA WD 6 configuration L5-20R, and UL 498. Equipment grounding contacts shall be connected only to the green grounding screw terminal of the device and with inherent electrical isolation from mounting strap. Isolation shall be integral to receptacle construction and not dependent on removable parts.

## 2.7 PENDANT CORD-CONNECTOR DEVICES



- A. Description: Matching, locking-type plug and receptacle body connector; NEMA WD 6 configurations L5-20P and L5-20R, heavy-duty grade.
  - 1. Body: Nylon with screw-open cable-gripping jaws and provision for attaching external cable grip.
  - 2. External Cable Grip: Woven wire-mesh type made of high-strength galvanized-steel wire strand, matched to cable diameter, and with attachment provision designed for corresponding connector.

## 2.8 CORD AND PLUG SETS

- A. Description: Match voltage and current ratings and number of conductors to requirements of equipment being connected.
  - 1. Cord: Rubber-insulated, stranded-copper conductors, with Type SOW-A jacket; with green-insulated grounding conductor and equipment-rating ampacity plus a minimum of 30 percent.
  - 2. Plug: Nylon body and integral cable-clamping jaws. Match cord and receptacle type for connection.

## 2.9 SNAP SWITCHES

- A. Comply with NEMA WD 1 and UL 20.
- B. Switches, 120/277 V, 20 A:
  - 1. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include the following:
  - 2. Products: Subject to compliance with requirements, provide one of the following:
    - a. Cooper; 2221 (single pole), 2222 (two pole), 2223 (three way), 2224 (four way).
    - b. Hubbell; CS1221 (single pole), CS1222 (two pole), CS1223 (three way), CS1224 (four way).
    - c. Leviton; 1221-2 (single pole), 1222-2 (two pole), 1223-2 (three way), 1224-2 (four way).
    - d. Pass & Seymour; 20AC1 (single pole), 20AC2 (two pole), 20AC3 (three way), 20AC4 (four way).
- C. Pilot Light Switches, 20 A:
  - 1. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include the following:

2. Products: Subject to compliance with requirements, provide one of the following:
    - a. Cooper; 2221PL for 120 V and 277 V.
    - b. Hubbell; HPL1221PL for 120 V and 277 V.
    - c. Leviton; 1221-PLR for 120 V, 1221-7PLR for 277 V.
    - d. Pass & Seymour; PS20AC1-PLR for 120 V.
  3. Description: Single pole, with neon-lighted handle, illuminated when switch is "ON."
- D. Key-Operated Switches, 120/277 V, 20 A:
1. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include the following:
  2. Products: Subject to compliance with requirements, provide one of the following:
    - a. Cooper; 2221L.
    - b. Hubbell; HBL1221L.
    - c. Leviton; 1221-2L.
    - d. Pass & Seymour; PS20AC1-L.
  3. Description: Single pole, with factory-supplied key in lieu of switch handle.
- E. Single-Pole, Double-Throw, Momentary Contact, Center-Off Switches, 120/277 V, 20 A; for use with mechanically held lighting contactors.
1. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include the following:
  2. Products: Subject to compliance with requirements, provide one of the following:
    - a. Cooper; 1995.
    - b. Hubbell; HBL1557.
    - c. Leviton; 1257.
    - d. Pass & Seymour; 1251.
- F. Key-Operated, Single-Pole, Double-Throw, Momentary Contact, Center-Off Switches, 120/277 V, 20 A; for use with mechanically held lighting contactors, with factory-supplied key in lieu of switch handle.
1. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include the following:
  2. Products: Subject to compliance with requirements, provide one of the following:
    - a. Cooper; 1995L.
    - b. Hubbell; HBL1557L.

- c. Leviton; 1257L.
- d. Pass & Seymour; 1251L.

## 2.10 WALL-BOX DIMMERS

- A. Dimmer Switches: Modular, full-wave, solid-state units with integral, quiet on-off switches, with audible frequency and EMI/RFI suppression filters.
- B. Control: Continuously adjustable slider; with single-pole or three-way switching. Comply with UL 1472.
- C. Incandescent Lamp Dimmers: 120 V; control shall follow square-law dimming curve. On-off switch positions shall bypass dimmer module.
  - 1. 600 W; dimmers shall require no derating when ganged with other devices.
- D. Fluorescent Lamp Dimmer Switches: Modular; compatible with dimmer ballasts; trim potentiometer to adjust low-end dimming; dimmer-ballast combination capable of consistent dimming with low end not greater than 20 percent of full brightness.

## 2.11 FAN SPEED CONTROLS

- A. Modular, 120-V, full-wave, solid-state units with integral, quiet on-off switches and audible frequency and EMI/RFI filters. Comply with UL 1917.
  - 1. Continuously adjustable slider, 5 A.
  - 2. Three-speed adjustable slider, 1.5 A.

## 2.12 WALL PLATES

- A. Single and combination types to match corresponding wiring devices.
  - 1. Plate-Securing Screws: Metal with head color to match plate finish.
  - 2. Material for Finished Spaces: Steel with white baked enamel, suitable for field painting thick anodized aluminum.
  - 3. Material for Unfinished Spaces: Galvanized steel.
  - 4. Material for Damp Locations: Thermoplastic with spring-loaded lift cover, and listed and labeled for use in "wet locations."
- B. Wet-Location, Weatherproof Cover Plates: NEMA 250, complying with type 3R weather-resistant, die-cast aluminum with lockable cover.

2.13 FLOOR SERVICE FITTINGS

- A. Type: Modular, flush-type, dual-service units suitable for wiring method used.
- B. Compartments: Barrier separates power from voice and data communication cabling.
- C. Service Plate: Rectangular, die-cast aluminum with satin finish.
- D. Power Receptacle: NEMA WD 6 configuration 5-20R, gray finish, unless otherwise indicated.

2.14 MULTIOUTLET ASSEMBLIES

- A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include the following:
- B. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - 1. Hubbell Incorporated; Wiring Device-Kellems.
  - 2. Wiremold Company (The).
- C. Components of Assemblies: Products from a single manufacturer designed for use as a complete, matching assembly of raceways and receptacles.
- D. Raceway Material: Metal, with manufacturer's standard finish.
- E. Wire: No. 12 AWG.

2.15 SERVICE POLES

- A. Description: Factory-assembled and -wired units to extend power and voice and data communication from distribution wiring concealed in ceiling to devices or outlets in pole near floor.
  - 1. Poles: Nominal 2.5-inch square cross section, with height adequate to extend from floor to at least 6 inches above ceiling, and with separate channels for power wiring and voice and data communication cabling.
  - 2. Mounting: Ceiling trim flange with concealed bracing arranged for positive connection to ceiling supports; with pole foot and carpet pad attachment.
  - 3. Finishes: Manufacturer's standard painted finish and trim combination.

4. Wiring: Sized for minimum of five No. 12 AWG power and ground conductors and a minimum of four, 4-pair, Category 3 or 5 voice and data communication cables.
5. Power Receptacles: Two duplex, 20-A, heavy-duty, NEMA WD 6 configuration 5-20R units.

## 2.16 FINISHES

- A. Color: Wiring device catalog numbers in Section Text do not designate device color.
  1. Wiring Devices Connected to Normal Power System: Grey.
  2. Wiring Devices Connected to Emergency Power System: Red.
  3. TVSS Devices: Blue.
  4. Isolated-Ground Receptacles: Orange.

## PART 3 - EXECUTION

### 3.1 INSTALLATION

- A. Comply with NECA 1, including the mounting heights listed in that standard, unless otherwise noted.
- B. Coordination with Other Trades:
  1. Take steps to insure that devices and their boxes are protected. Do not place wall finish materials over device boxes and do not cut holes for boxes with routers that are guided by riding against outside of the boxes.
  2. Keep outlet boxes free of plaster, drywall joint compound, mortar, cement, concrete, dust, paint, and other material that may contaminate the raceway system, conductors, and cables.
  3. Install device boxes in brick or block walls so that the cover plate does not cross a joint unless the joint is troweled flush with the face of the wall.
  4. Install wiring devices after all wall preparation, including painting, is complete.
- C. Conductors:
  1. Do not strip insulation from conductors until just before they are spliced or terminated on devices.
  2. Strip insulation evenly around the conductor using tools designed for the purpose. Avoid scoring or nicking of solid wire or cutting strands from stranded wire.
  3. The length of free conductors at outlets for devices shall meet provisions of NFPA 70, Article 300, without pigtails.
  4. Existing Conductors:

- a. Cut back and pigtail, or replace all damaged conductors.
- b. Straighten conductors that remain and remove corrosion and foreign matter.
- c. Pigtailling existing conductors is permitted provided the outlet box is large enough.

D. Device Installation:

1. Replace all devices that have been in temporary use during construction or that show signs that they were installed before building finishing operations were complete.
2. Keep each wiring device in its package or otherwise protected until it is time to connect conductors.
3. Do not remove surface protection, such as plastic film and smudge covers, until the last possible moment.
4. Connect devices to branch circuits using pigtails that are not less than 6 inches in length.
5. When there is a choice, use side wiring with binding-head screw terminals. Wrap solid conductor tightly clockwise,  $2/3$  to  $3/4$  of the way around terminal screw.
6. Use a torque screwdriver when a torque is recommended or required by the manufacturer.
7. When conductors larger than No. 12 AWG are installed on 15- or 20-A circuits, splice No. 12 AWG pigtails for device connections.
8. Tighten unused terminal screws on the device.
9. When mounting into metal boxes, remove the fiber or plastic washers used to hold device mounting screws in yokes, allowing metal-to-metal contact.

E. Receptacle Orientation:

1. Install ground pin of vertically mounted receptacles up, and on horizontally mounted receptacles to the right.
2. Install hospital-grade receptacles in patient-care areas with the ground pin or neutral blade at the top.

F. Device Plates: Do not use oversized or extra-deep plates. Repair wall finishes and remount outlet boxes when standard device plates do not fit flush or do not cover rough wall opening.

G. Dimmers:

1. Install dimmers within terms of their listing.
2. Verify that dimmers used for fan speed control are listed for that application.
3. Install unshared neutral conductors on line and load side of dimmers according to manufacturers' device listing conditions in the written instructions.

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

### 3.2 IDENTIFICATION

- A. Comply with Division 26 Section "Identification for Electrical Systems."
  - 1. Receptacles: Identify panelboard and circuit number from which served. Use hot, stamped or engraved machine printing with black-filled lettering on face of plate, and durable wire markers or tags inside outlet boxes.

### 3.3 FIELD QUALITY CONTROL

- A. Perform tests and inspections and prepare test reports.
  - 1. Test Instruments: Use instruments that comply with UL 1436.
  - 2. Test Instrument for Convenience Receptacles: Digital wiring analyzer with digital readout or illuminated LED indicators of measurement.
- B. Tests for Convenience Receptacles:
  - 1. Line Voltage: Acceptable range is 105 to 132 V.
  - 2. Percent Voltage Drop under 15-A Load: A value of 6 percent or higher is not acceptable.
  - 3. Ground Impedance: Values of up to 2 ohms are acceptable.
  - 4. GFCI Trip: Test for tripping values specified in UL 1436 and UL 943.
  - 5. Using the test plug, verify that the device and its outlet box are securely mounted.
  - 6. The tests shall be diagnostic, indicating damaged conductors, high resistance at the circuit breaker, poor connections, inadequate fault current path, defective devices, or similar problems. Correct circuit conditions, remove malfunctioning units and replace with new ones, and retest as specified above.

END OF SECTION 262726

## SECTION 262813 - FUSES

### 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. Cartridge fuses rated 600-V ac and less for use in control circuits, enclosed switches and enclosed controllers.
2. Spare-fuse cabinets.

#### 1.3 SUBMITTALS

- A. Product Data: For each type of product indicated. Include construction details, material, dimensions, descriptions of individual components, and finishes for spare-fuse cabinets. Include the following for each fuse type indicated:

1. Ambient Temperature Adjustment Information: If ratings of fuses have been adjusted to accommodate ambient temperatures, provide list of fuses with adjusted ratings.
  - a. For each fuse having adjusted ratings, include location of fuse, original fuse rating, local ambient temperature, and adjusted fuse rating.
  - b. Provide manufacturer's technical data on which ambient temperature adjustment calculations are based.
2. Dimensions and manufacturer's technical data on features, performance, electrical characteristics, and ratings.
3. Current-limitation curves for fuses with current-limiting characteristics.
4. Time-current coordination curves (average melt) and current-limitation curves (instantaneous peak let-through current) for each type and rating of fuse. Submit on translucent log-log graph paper.
5. Coordination charts and tables and related data.
6. Fuse sizes for elevator feeders and elevator disconnect switches.



- B. Operation and Maintenance Data: For fuses to include in emergency, operation, and maintenance manuals. In addition to items specified in Division 01 Section "Operation and Maintenance Data," include the following:
  - 1. Ambient temperature adjustment information.
  - 2. Current-limitation curves for fuses with current-limiting characteristics.
  - 3. Time-current coordination curves (average melt) and current-limitation curves (instantaneous peak let-through current) for each type and rating of fuse. Submit on translucent log-log graph paper.
  - 4. Coordination charts and tables and related data.

#### 1.4 QUALITY ASSURANCE

- A. Source Limitations: Obtain fuses, for use within a specific product or circuit, from single source from single manufacturer.
- B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- C. Comply with NEMA FU 1 for cartridge fuses.
- D. Comply with NFPA 70.
- E. Comply with UL 248-11 for plug fuses.

#### 1.5 PROJECT CONDITIONS

- A. Where ambient temperature to which fuses are directly exposed is less than 40 deg F or more than 100 deg F, apply manufacturer's ambient temperature adjustment factors to fuse ratings.

#### 1.6 COORDINATION

- A. Coordinate fuse ratings with utilization equipment nameplate limitations of maximum fuse size and with system short-circuit current levels.

#### 1.7 EXTRA MATERIALS

- A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
  - 1. Fuses: Equal to 10 percent of quantity installed for each size and type, but no fewer than two of each size and type.

## PART 2 - PRODUCTS

### 2.1 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include the following:
  - 1. Cooper Bussmann, Inc.
  - 2. Edison Fuse, Inc.
  - 3. Ferraz Shawmut, Inc.
  - 4. Littelfuse, Inc.

### 2.2 CARTRIDGE FUSES

- A. Characteristics: NEMA FU 1, nonrenewable cartridge fuses with voltage ratings consistent with circuit voltages.

### 2.3 SPARE-FUSE CABINET

- A. Characteristics: Wall-mounted steel unit with full-length, recessed piano-hinged door and key-coded cam lock and pull.
  - 1. Size: Adequate for storage of spare fuses specified with 15 percent spare capacity minimum.
  - 2. Finish: Gray, baked enamel.
  - 3. Identification: "SPARE FUSES" in 1-1/2-inch high letters on exterior of door.
  - 4. Fuse Pullers: For each size of fuse, where applicable and available, from fuse manufacturer.

## PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. Examine fuses before installation. Reject fuses that are moisture damaged or physically damaged.
- B. Examine holders to receive fuses for compliance with installation tolerances and other conditions affecting performance, such as rejection features.
- C. Examine utilization equipment nameplates and installation instructions. Install fuses of sizes and with characteristics appropriate for each piece of equipment.
- D. Evaluate ambient temperatures to determine if fuse rating adjustment factors must be applied to fuse ratings.
- E. Proceed with installation only after unsatisfactory conditions have been corrected.

### 3.2 FUSE APPLICATIONS

- A. Cartridge Fuses:
  - 1. Service Entrance: Class L, fast acting.
  - 2. Feeders: Class L, fast acting.
  - 3. Motor Branch Circuits: Class RK1, time delay.
  - 4. Other Branch Circuits: Class RK1, time delay.
  - 5. Control Circuits: Class CC, fast acting.

### 3.3 INSTALLATION

- A. Install fuses in fusible devices. Arrange fuses so rating information is readable without removing fuse.
- B. Install spare-fuse cabinet(s).

### 3.4 IDENTIFICATION

- A. Install labels complying with requirements for identification specified in Division 26 Section "Identification for Electrical Systems" and indicating fuse replacement information on inside door of each fused switch and adjacent to each fuse block, socket, and holder.

END OF SECTION 262813

## **SECTION 262816 - ENCLOSED SWITCHES AND CIRCUIT BREAKERS**

### **PART 1 - GENERAL**

#### **1.1 RELATED DOCUMENTS**

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

#### **1.2 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.

#### **1.3 DEFINITIONS**

- A. NC: Normally closed.
- B. NO: Normally open.
- C. SPDT: Single pole, double throw.

#### **1.4 SUBMITTALS**

- A. Product Data: For each type of enclosed switch, circuit breaker, accessory, and component indicated. Include dimensioned elevations, sections, weights, and manufacturers' technical data on features, performance, electrical characteristics, ratings, accessories, and finishes.
  - 1. Enclosure types and details for types other than NEMA 250, Type 1.
  - 2. Current and voltage ratings.

3. Short-circuit current ratings (interrupting and withstand, as appropriate).
  4. Include evidence of NRTL listing for series rating of installed devices.
  5. Detail features, characteristics, ratings, and factory settings of individual overcurrent protective devices, accessories, and auxiliary components.
  6. 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. Submit on translucent log-log graph paper.
- B. Shop Drawings: For enclosed switches and circuit breakers. Include plans, elevations, sections, details, and attachments to other work.
1. Wiring Diagrams: For power, signal, and control wiring.
- C. Qualification Data: For qualified testing agency.
- D. Field quality-control reports.
1. Test procedures used.
  2. Test results that comply with requirements.
  3. Results of failed tests and corrective action taken to achieve test results that comply with requirements.
- E. Manufacturer's field service report.
- F. Operation and Maintenance Data: For enclosed switches and circuit breakers to include in emergency, operation, and maintenance manuals. In addition to items specified in Division 01 Section "Operation and Maintenance Data," include the following:
1. Manufacturer's written instructions for testing and adjusting enclosed switches and circuit breakers.
  2. 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. Submit on translucent log-log graph paper.

## 1.5 QUALITY ASSURANCE

- A. Testing Agency Qualifications: Member company of NETA or an NRTL.
1. Testing Agency's Field Supervisor: Currently certified by NETA to supervise on-site testing.

- B. Source Limitations: Obtain enclosed switches and circuit breakers, overcurrent protective devices, components, and accessories, within same product category, from single source from single manufacturer.
- C. 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.
- D. 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.
- E. Comply with NFPA 70.

#### 1.6 PROJECT CONDITIONS

- A. Environmental Limitations: Rate equipment for continuous operation under the following conditions unless otherwise indicated:
  - 1. Ambient Temperature: Not less than minus 22 deg F and not exceeding 104 deg F.
  - 2. Altitude: Not exceeding 6600 feet.
- B. Interruption of Existing Electric Service: Do not interrupt electric service to facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary electric service according to requirements indicated:
  - 1. Notify Owner no fewer than seven days in advance of proposed interruption of electric service.
  - 2. Indicate method of providing temporary electric service.
  - 3. Do not proceed with interruption of electric service without Owner's written permission.
  - 4. Comply with NFPA 70E.

#### 1.7 COORDINATION

- 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.

1.8 EXTRA MATERIALS

- A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
  - 1. Fuses: Equal to 10 percent of quantity installed for each size and type, but no fewer than three of each size and type.
  - 2. Fuse Pullers: Two for each size and type.

PART 2 - PRODUCTS

2.1 FUSIBLE SWITCHES

- A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include the following:
- B. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:
  - 1. Eaton Electrical Inc.; Cutler-Hammer Business Unit.
  - 2. General Electric Company; GE Consumer & Industrial - Electrical Distribution.
  - 3. Siemens Energy & Automation, Inc.
  - 4. Square D; a brand of Schneider Electric.
- C. Type GD, General Duty, Single Throw, 240-V ac, 800 A and Smaller: UL 98 and NEMA KS 1, horsepower rated, with cartridge fuse interiors to accommodate specified fuses, lockable handle with capability to accept two padlocks, and interlocked with cover in closed position.
- D. Type HD, Heavy Duty, Single Throw, 240-V ac, 1200 A and Smaller: UL 98 and NEMA KS 1, horsepower rated, with clips or bolt pads to accommodate specified fuses, lockable handle with capability to accept three padlocks, and interlocked with cover in closed position.
- E. Type HD, Heavy Duty, Six Pole, Single Throw, 240-V ac, 200 A and Smaller: UL 98 and NEMA KS 1, horsepower rated, with clips or bolt pads to accommodate specified fuses, lockable handle with capability to accept three padlocks, and interlocked with cover in closed position.
- F. Type HD, Heavy Duty, Double Throw, 240-V ac, 1200 A and Smaller: UL 98 and NEMA KS 1, horsepower rated, with clips or bolt pads to accommodate specified fuses, lockable handle with capability to accept three padlocks, and interlocked with cover in closed position.

G. 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, capable of being grounded and bonded; 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. Auxiliary Contact Kit: One NO/NC (Form "C") auxiliary contact(s), arranged to activate before switch blades open.
6. Hookstick Handle: Allows use of a hookstick to operate the handle.
7. Lugs: Mechanical type, suitable for number, size, and conductor material.
8. Service-Rated Switches: Labeled for use as service equipment.
9. Accessory Control Power Voltage: Remote mounted and powered; 120-V ac.

2.2 NONFUSIBLE SWITCHES

- A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include the following:
- B. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:
  1. Eaton Electrical Inc.; Cutler-Hammer Business Unit.
  2. General Electric Company; GE Consumer & Industrial - Electrical Distribution.
  3. Siemens Energy & Automation, Inc.
  4. Square D; a brand of Schneider Electric.
- C. Type GD, General Duty, Single Throw, 600 A and Smaller: UL 98 and NEMA KS 1, horsepower rated, lockable handle with capability to accept two padlocks, and interlocked with cover in closed position.
- D. Type HD, Heavy Duty, 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.
- E. Type HD, Heavy Duty, Six Pole, Single Throw, 240-V ac, 200 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.



- F. Type HD, Heavy Duty, Double 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.
- G. 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, capable of being grounded and bonded; labeled for copper and aluminum neutral conductors.
  - 4. Auxiliary Contact Kit: One NO/NC (Form "C") auxiliary contact(s), arranged to activate before switch blades open.
  - 5. Hookstick Handle: Allows use of a hookstick to operate the handle.
  - 6. Lugs: Mechanical type, suitable for number, size, and conductor material.
  - 7. Accessory Control Power Voltage: Remote mounted and powered; 120-V ac.

### 2.3 RECEPTACLE SWITCHES

- A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include the following:
- B. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:
  - 1. Eaton Electrical Inc.; Cutler-Hammer Business Unit.
  - 2. General Electric Company; GE Consumer & Industrial - Electrical Distribution.
  - 3. Siemens Energy & Automation, Inc.
  - 4. Square D; a brand of Schneider Electric.
- C. Type HD, Heavy-Duty, Single-Throw Fusible Switch: 240-V ac, 30, 60, 100 A; UL 98 and NEMA KS 1; horsepower rated, with clips or bolt pads to accommodate specified fuses; lockable handle with capability to accept three padlocks; interlocked with cover in closed position.
- D. Type HD, Heavy-Duty, Single-Throw Nonfusible Switch: 240-V ac, 30, 60, 100 A; UL 98 and NEMA KS 1; horsepower rated, lockable handle with capability to accept three padlocks; interlocked with cover in closed position.
- E. Interlocking Linkage: Provided between the receptacle and switch mechanism to prevent inserting or removing plug while switch is in the on position, inserting any plug

other than specified, and turning switch on if an incorrect plug is inserted or correct plug has not been fully inserted into the receptacle.

- F. Receptacle: Polarized, three-phase, four-wire receptacle (fourth wire connected to enclosure ground lug).

## 2.4 SHUNT TRIP SWITCHES

- A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include the following:
- B. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:
  - 1. Cooper Bussmann, Inc.
  - 2. Ferraz Shawmut, Inc.
  - 3. Littelfuse, Inc.
- C. General Requirements: Comply with ASME A17.1, UL 50, and UL 98, with 200-kA interrupting and short-circuit current rating when fitted with Class J fuses.
- D. Switches: Three-pole, horsepower rated, with integral shunt trip mechanism and Class J fuse block; lockable handle with capability to accept three padlocks; interlocked with cover in closed position.
- E. Control Circuit: 120-V ac; obtained from integral control power transformer, with primary and secondary fuses, with a control power transformer of enough capacity to operate shunt trip, connected pilot, and indicating and control devices.
- F. Accessories:
  - 1. Oiltight key switch for key-to-test function.
  - 2. Oiltight red ON pilot light.
  - 3. Isolated neutral lug; 100 percent rating.
  - 4. Mechanically interlocked auxiliary contacts that change state when switch is opened and closed.
  - 5. Form C alarm contacts that change state when switch is tripped.
  - 6. Three-pole, double-throw, fire-safety and alarm relay; 120-V ac coil voltage.
  - 7. Three-pole, double-throw, fire-alarm voltage monitoring relay complying with NFPA 72.

## 2.5 MOLDED-CASE CIRCUIT BREAKERS

- A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include the following:
- B. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:
  - 1. Eaton Electrical Inc.; Cutler-Hammer Business Unit.
  - 2. General Electric Company; GE Consumer & Industrial - Electrical Distribution.
  - 3. Siemens Energy & Automation, Inc.
  - 4. Square D; a brand of Schneider Electric.
- C. General Requirements: Comply with UL 489, NEMA AB 1, and NEMA AB 3, with interrupting capacity to comply with available fault currents.
- D. Thermal-Magnetic Circuit Breakers: Inverse time-current element for low-level overloads and instantaneous magnetic trip element for short circuits. Adjustable magnetic trip setting for circuit-breaker frame sizes 250 A and larger.
- E. Adjustable, Instantaneous-Trip Circuit Breakers: Magnetic trip element with front-mounted, field-adjustable trip setting.
- F. Electronic Trip Circuit Breakers: Field-replaceable rating plug, rms sensing, with the following field-adjustable settings:
  - 1. Instantaneous trip.
  - 2. Long- and short-time pickup levels.
  - 3. Long- and short-time time adjustments.
  - 4. Ground-fault pickup level, time delay, and  $I^2t$  response.
- G. Current-Limiting Circuit Breakers: Frame sizes 400 A and smaller, and let-through ratings less than NEMA FU 1, RK-5.
- H. Integrally Fused Circuit Breakers: Thermal-magnetic trip element with integral limiter-style fuse listed for use with circuit breaker and trip activation on fuse opening or on opening of fuse compartment door.
- I. Ground-Fault, Circuit-Interrupter (GFCI) Circuit Breakers: Single- and two-pole configurations with Class A ground-fault protection (6-mA trip).
- J. Ground-Fault, Equipment-Protection (GFEP) Circuit Breakers: With Class B ground-fault protection (30-mA trip).
- K. Features and Accessories:

1. Standard frame sizes, trip ratings, and number of poles.
2. Lugs: Mechanical type, suitable for number, size, trip ratings, and conductor material.
3. Application Listing: Appropriate for application; Type SWD for switching fluorescent lighting loads; Type HID for feeding fluorescent and high-intensity discharge lighting circuits.
4. Ground-Fault Protection: Comply with UL 1053; integrally mounted, self-powered type with mechanical ground-fault indicator; relay with adjustable pickup and time-delay settings, push-to-test feature, internal memory, and shunt trip unit; and three-phase, zero-sequence current transformer/sensor.
5. Shunt Trip: Trip coil energized from separate circuit, with coil-clearing contact.
6. Undervoltage Trip: Set to operate at 35 to 75 percent of rated voltage without intentional time delay.
7. Auxiliary Contacts: One SPDT switch with "a" and "b" contacts; "a" contacts mimic circuit-breaker contacts, "b" contacts operate in reverse of circuit-breaker contacts.
8. Alarm Switch: One NO contact that operates only when circuit breaker has tripped.
9. Key Interlock Kit: Externally mounted to prohibit circuit-breaker operation; key shall be removable only when circuit breaker is in off position.
10. Zone-Selective Interlocking: Integral with electronic trip unit; for interlocking ground-fault protection function.
11. Electrical Operator: Provide remote control for on, off, and reset operations.
12. Accessory Control Power Voltage: Integrally mounted, self-powered.

## 2.6 MOLDED-CASE SWITCHES

- A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include the following:
- B. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:
  1. Eaton Electrical Inc.; Cutler-Hammer Business Unit.
  2. General Electric Company; GE Consumer & Industrial - Electrical Distribution.
  3. Siemens Energy & Automation, Inc.
  4. Square D; a brand of Schneider Electric.
- C. General Requirements: MCCB with fixed, high-set instantaneous trip only, and short-circuit withstand rating equal to equivalent breaker frame size interrupting rating.
- D. Features and Accessories:

1. Standard frame sizes and number of poles.
2. Lugs: Mechanical type, suitable for number, size, trip ratings, and conductor material.
3. Ground-Fault Protection: Comply with UL 1053; remote-mounted and powered type with mechanical ground-fault indicator; relay with adjustable pickup and time-delay settings, push-to-test feature, internal memory, and shunt trip unit; and three-phase, zero-sequence current transformer/sensor.
4. Shunt Trip: Trip coil energized from separate circuit, with coil-clearing contact.
5. Undervoltage Trip: Set to operate at 35 to 75 percent of rated voltage without intentional time delay.
6. Auxiliary Contacts: One SPDT switch with "a" and "b" contacts; "a" contacts mimic switch contacts, "b" contacts operate in reverse of switch contacts.
7. Alarm Switch: One NO contact that operates only when switch has tripped.
8. Key Interlock Kit: Externally mounted to prohibit switch operation; key shall be removable only when switch is in off position.
9. Zone-Selective Interlocking: Integral with ground-fault shunt trip unit; for interlocking ground-fault protection function.
10. Electrical Operator: Provide remote control for on, off, and reset operations.
11. Accessory Control Power Voltage: Integrally mounted, self-powered.

## 2.7 ENCLOSURES

- A. Enclosed Switches and Circuit Breakers: NEMA AB 1, NEMA KS 1, NEMA 250, and UL 50, to comply with environmental conditions at installed location.
  1. Indoor, Dry and Clean Locations: NEMA 250, Type 1.
  2. Outdoor Locations: NEMA 250, Type 4X, stainless steel..
  3. Kitchen Areas: NEMA 250, Type 4X, stainless steel.
  4. Other Wet or Damp, Indoor Locations: NEMA 250, Type 4.
  5. Indoor Locations Subject to Dust, Falling Dirt, and Dripping Noncorrosive Liquids: NEMA 250, Type 12.

## PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. Examine elements and surfaces to receive enclosed switches and circuit breakers for compliance with installation tolerances and other conditions affecting performance of the Work.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

### 3.2 INSTALLATION

- A. Install individual wall-mounted switches and circuit breakers with tops at uniform height unless otherwise indicated.
- B. Temporary Lifting Provisions: Remove temporary lifting eyes, channels, and brackets and temporary blocking of moving parts from enclosures and components.
- C. Install fuses in fusible devices.
- D. Comply with NECA 1.

### 3.3 IDENTIFICATION

- A. Comply with requirements in Division 26 Section "Identification for Electrical Systems."
  - 1. Identify field-installed conductors, interconnecting wiring, and components; provide warning signs.
  - 2. Label each enclosure with engraved metal or laminated-plastic nameplate.

### 3.4 FIELD QUALITY CONTROL

- A. Testing Agency: Engage a qualified testing agency to perform tests and inspections.
- B. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect, test, and adjust components, assemblies, and equipment installations, including connections.
- C. Perform tests and inspections.
  - 1. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect components, assemblies, and equipment installations, including connections, and to assist in testing.
- D. Acceptance Testing Preparation:
  - 1. Test insulation resistance for each enclosed switch and circuit breaker, component, connecting supply, feeder, and control circuit.

2. Test continuity of each circuit.

E. Tests and Inspections:

1. Perform each visual and mechanical inspection and electrical test stated in NETA Acceptance Testing Specification. Certify compliance with test parameters.
2. Correct malfunctioning units on-site, where possible, and retest to demonstrate compliance; otherwise, replace with new units and retest.
3. Perform the following infrared scan tests and inspections and prepare reports:
  - a. Initial Infrared Scanning: After Substantial Completion, but not more than 60 days after Final Acceptance, perform an infrared scan of each enclosed switch and circuit breaker. Remove front panels so joints and connections are accessible to portable scanner.
  - b. Follow-up Infrared Scanning: Perform an additional follow-up infrared scan of each enclosed switch and circuit breaker 11 months after date of Substantial Completion.
  - c. Instruments and Equipment: Use an infrared scanning device designed to measure temperature or to detect significant deviations from normal values. Provide calibration record for device.
4. Test and adjust controls, remote monitoring, and safeties. Replace damaged and malfunctioning controls and equipment.

F. Enclosed switches and circuit breakers will be considered defective if they do not pass tests and inspections.

G. Prepare test and inspection reports, including a certified report that identifies enclosed switches and circuit breakers and that describes scanning results. Include notation of deficiencies detected, remedial action taken, and observations after remedial action.

### 3.5 ADJUSTING

- A. Adjust moving parts and operable components to function smoothly, and lubricate as recommended by manufacturer.
- B. Set field-adjustable circuit-breaker trip ranges as specified in Division 26 Section "Overcurrent Protective Device Coordination Study".

END OF SECTION 262816

**SECTION 264313 - TRANSIENT-VOLTAGE SUPPRESSION FOR LOW-VOLTAGE  
ELECTRICAL POWER CIRCUITS**

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. This Section includes TVSSs for low-voltage power, control, and communication equipment.
- B. Related Sections include the following:
  - 1. Division 26 Section "Wiring Devices" for devices with integral TVSSs.
  - 2. Division 26 Section "Panelboards" for factory-installed TVSSs.

1.3 DEFINITIONS

- A. ATS: Acceptance Testing Specifications.
- B. SVR: Suppressed voltage rating.
- C. TVSS: Transient voltage surge suppressor.

1.4 SUBMITTALS

- A. Product Data: For each type of product indicated. Include rated capacities, operating weights, operating characteristics, furnished specialties, and accessories.
- B. Product Certificates: For transient voltage suppression devices, signed by product manufacturer certifying compliance with the following standards:
  - 1. UL 1283.
  - 2. UL 1449.



- C. Qualification Data: For testing agency.
- D. Field quality-control test reports, including the following:
  - 1. Test procedures used.
  - 2. Test results that comply with requirements.
  - 3. Failed test results and corrective action taken to achieve requirements.
- E. Operation and Maintenance Data: For transient voltage suppression devices to include in emergency, operation, and maintenance manuals.
- F. Warranties: Special warranties specified in this Section.

#### 1.5 QUALITY ASSURANCE

- A. Testing Agency Qualifications: An independent testing agency, with the experience and capability to conduct the testing indicated, that is a member company of the InterNational Electrical Testing Association or is a nationally recognized testing laboratory (NRTL) as defined by OSHA in 29 CFR 1910.7, and that is acceptable to authorities having jurisdiction.
  - 1. Testing Agency's Field Supervisor: Person currently certified by the InterNational Electrical Testing Association or the National Institute for Certification in Engineering Technologies to supervise on-site testing specified in Part 3.
- B. Source Limitations: Obtain suppression devices and accessories through one source from a single manufacturer.
- C. Product Options: Drawings indicate size, dimensional requirements, and electrical performance of suppressors and are based on the specific system indicated. Refer to Division 01 Section "Product Requirements."
- D. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.
- E. Comply with IEEE C62.41, "IEEE Guide for Surge Voltages in Low Voltage AC Power Circuits," and test devices according to IEEE C62.45, "IEEE Guide on Surge Testing for Equipment Connected to Low-Voltage AC Power Circuits."
- F. Comply with NEMA LS 1, "Low Voltage Surge Protection Devices."

- G. Comply with UL 1283, "Electromagnetic Interference Filters," and UL 1449, "Transient Voltage Surge Suppressors."

#### 1.6 PROJECT CONDITIONS

- A. Existing Utilities: Do not interrupt utilities serving facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary utility services according to requirements indicated:
  - 1. Notify Architect not less than two days in advance of proposed utility interruptions.
  - 2. Do not proceed with utility interruptions without Architect's written permission.
- B. Service Conditions: Rate surge protection devices for continuous operation under the following conditions, unless otherwise indicated:
  - 1. Maximum Continuous Operating Voltage: Not less than 115 percent of nominal system operating voltage.
  - 2. Operating Temperature: 30 to 120 deg F.
  - 3. Humidity: 0 to 85 percent, noncondensing.
  - 4. Altitude: Less than 20,000 feet above sea level.

#### 1.7 COORDINATION

- A. Coordinate location of field-mounted surge suppressors to allow adequate clearances for maintenance.

#### 1.8 WARRANTY

- A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of surge suppressors that fail in materials or workmanship within five years from date of Substantial Completion.
- B. Special Warranty for Cord-Connected, Plug-in Surge Suppressors: Manufacturer's standard form in which manufacturer agrees to repair or replace electronic equipment connected to circuits protected by surge suppressors.

#### 1.9 EXTRA MATERIALS

- A. Furnish extra materials described below that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
  - 1. Replaceable Protection Modules: One of each size and type installed.

## PART 2 - PRODUCTS

### 2.1 MANUFACTURERS

- A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include the following:
- B. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - 1. Advanced Protection Technologies, Inc.
  - 2. Atlantic Scientific.
  - 3. Current Technology, Inc.
  - 4. Cutler-Hammer, Inc.; Eaton Corporation.
  - 5. Entrelec International.
  - 6. General Electric Company.
  - 7. Innovative Technology, Inc.
  - 8. Intermatic, Inc.
  - 9. LEA International.
  - 10. Leviton Mfg. Company Inc.
  - 11. Liebert Corporation; a division of Emerson.
  - 12. Northern Technologies, Inc.
  - 13. Siemens Energy & Automation, Inc.
  - 14. Square D; Schneider Electric.
  - 15. Surge Suppression Incorporated.
  - 16. Sutton Designs Inc.
  - 17. Transtector Systems, Inc.
  - 18. Tycor; Cutler-Hammer, Inc.
  - 19. United Power Corporation.
  - 20. Zero Surge Inc.

### 2.2 SERVICE ENTRANCE SUPPRESSORS

- A. Surge Protection Device Description: Non-modular, sine-wave-tracking type with the following features and accessories:

1. LED indicator lights for power and protection status.
  2. Audible alarm, with silencing switch, to indicate when protection has failed.
  3. One set of dry contacts rated at 5 A and 250-V ac, for remote monitoring of protection status.
- B. Surge Protection Device Description: Modular design with field-replaceable modules, sine-wave-tracking type with the following features and accessories:
1. Fuses, rated at 200-kA interrupting capacity.
  2. Fabrication using bolted compression lugs for internal wiring.
  3. Integral disconnect switch.
  4. Redundant suppression circuits.
  5. Redundant replaceable modules.
  6. Arrangement with copper bus bars and for bolted connections to phase buses, neutral bus, and ground bus.
  7. Arrangement with wire connections to phase buses, neutral bus, and ground bus.
  8. LED indicator lights for power and protection status.
  9. Audible alarm, with silencing switch, to indicate when protection has failed.
  10. One set of dry contacts rated at 5 A and 250-V ac, for remote monitoring of protection status. Coordinate with building power monitoring and control system.
  11. Surge-event operations counter.
- C. Peak Single-Impulse Surge Current Rating: 320 kA per phase.
- D. Connection Means: Permanently wired.
- E. Protection modes and UL 1449 SVR for grounded wye circuits with voltages of 208Y/120, 3-phase, 4-wire circuits shall be as follows:
1. Line to Neutral: 400 V for 208Y/120.
  2. Line to Ground: 400 V for 208Y/120.
  3. Neutral to Ground: 400 V for 208Y/120.
- F. Protection modes and UL 1449 SVR for 240/120-V, single-phase, 3-wire circuits shall be as follows:
1. Line to Neutral: 400 V.
  2. Line to Ground: 400 V.
  3. Neutral to Ground: 400 V.

## 2.3 PANELBOARD SUPPRESSORS

- A. Surge Protection Device Description: Non-modular, sine-wave-tracking type with the following features and accessories:
1. LED indicator lights for power and protection status.
  2. Audible alarm, with silencing switch, to indicate when protection has failed.
  3. One set of dry contacts rated at 5 A and 250-V ac, for remote monitoring of protection status.
- B. Surge Protection Device Description: Modular design with field-replaceable modules, sine-wave-tracking type with the following features and accessories:
1. Fuses, rated at 200-kA interrupting capacity.
  2. Fabrication using bolted compression lugs for internal wiring.
  3. Integral disconnect switch.
  4. Redundant suppression circuits.
  5. Redundant replaceable modules.
  6. Arrangement with wire connections to phase buses, neutral bus, and ground bus.
  7. LED indicator lights for power and protection status.
  8. Audible alarm, with silencing switch, to indicate when protection has failed.
  9. One set of dry contacts rated at 5 A and 250-V, ac, for remote monitoring of protection status. Coordinate with building power monitoring and control system.
  10. Surge-event operations counter.
- C. Peak Single-Impulse Surge Current Rating: 160 kA per phase.
- D. Protection modes and UL 1449 SVR for grounded wye circuits with voltages of 208Y/120, 3-phase, 4-wire circuits shall be as follows:
1. Line to Neutral: 400 V for 208Y/120
  2. Line to Ground: 400 V for 208Y/120
  3. Neutral to Ground: 400 V for 208Y/120
- E. Protection modes and UL 1449 SVR for 240/120-V, single-phase, 3-wire circuits shall be as follows:
1. Line to Neutral: 400 V.
  2. Line to Ground: 400 V.
  3. Neutral to Ground: 400 V.

## 2.4 SUPPRESSORS FOR ELECTRONIC-GRADE PANELBOARDS

- A. Surge Protection Device Description: Sine-wave-tracking type, panel-mounted design with the following features and accessories:

1. LED indicator lights for power and protection status.
  2. Audible alarm, with silencing switch, to indicate when protection has failed.
  3. One set of dry contacts rated at 5 A and 250-V ac, for remote monitoring of protection status.
  4. Arrangement with wire connections to phase buses, neutral bus, and ground bus.
- B. Peak Single-Impulse Surge Current Rating: 160 kA per phase.
- C. Protection modes and UL 1449 SVR for grounded wye circuits with voltages of 208Y/120, 3-phase, 4-wire circuits shall be as follows:
1. Line to Neutral: 400 V for 208Y/120
  2. Line to Ground: 400 V for 208Y/120
  3. Neutral to Ground: 400 V for 208Y/120.
- D. Protection modes and UL 1449 SVR for 240/120-V, single-phase, 3-wire circuits shall be as follows:
1. Line to Neutral: 400 V.
  2. Line to Ground: 400 V.
  3. Neutral to Ground: 400 V.

## 2.5 PLUG-IN SURGE SUPPRESSORS

- A. Description: Non-modular, plug-in suppressors with at least four 15-A, 120-V ac, NEMA WD 6, Configuration 15-15R receptacles, suitable to plug into a NEMA WD 6, Configuration 15-15R receptacle; with the following features and accessories:
1. LED indicator lights for power and protection status.
  2. LED indicator lights for reverse polarity and open outlet ground.
  3. Circuit breaker and thermal fusing. When protection is lost, circuit opens and cannot be reset.
  4. Circuit breaker and thermal fusing. Unit continues to supply power if protection is lost.
  5. Cord connected with 15-foot line cord.
  6. Rocker-type on-off switch, illuminated when in the on position.
  7. One RJ11/12C telephone line protector, suitable for modem connection. Maximum clamping voltage 220 peak on pins No. 3 and No. 4.
- B. Peak Single-Impulse Surge Current Rating: 33 kA per phase.
- C. Protection modes and UL 1449 SVR shall be as follows:

1. Line to Neutral: 475 V.
2. Line to Ground: 475 V.
3. Neutral to Ground: 475 V.

## 2.6 ENCLOSURES

- A. NEMA 250, with type matching the enclosure of panel or device being protected.

## PART 3 - EXECUTION

### 3.1 INSTALLATION OF SURGE PROTECTION DEVICES

- A. Install devices at service entrance on load side, with ground lead bonded to service entrance ground.
- B. Install devices for panelboard and auxiliary panels with conductors or buses between suppressor and points of attachment as short and straight as possible. Do not exceed manufacturer's recommended lead length. Do not bond neutral and ground.
  1. Provide multipole, 30-A circuit breaker as a dedicated disconnect for suppressor, unless otherwise indicated.

### 3.2 PLACING SYSTEM INTO SERVICE

- A. Do not energize or connect service entrance equipment to their sources until surge protection devices are installed and connected.

### 3.3 FIELD QUALITY CONTROL

- A. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect, test, and adjust equipment installation, including connections, and to assist in field testing. Report results in writing.
  1. Verify that electrical wiring installation complies with manufacturer's written installation requirements.
- B. Testing: Engage a qualified testing and inspecting agency to perform field tests and inspections and prepare test reports:

- C. Testing: Perform the following field tests and inspections and prepare test reports:
  - 1. After installing surge protection devices, but before electrical circuitry has been energized, test for compliance with requirements.
  - 2. Complete startup checks according to manufacturer's written instructions.
  - 3. Perform each visual and mechanical inspection and electrical test stated in NETA ATS, "Surge Arresters, Low-Voltage Surge Protection Devices" Section. Certify compliance with test parameters.
  
- D. Remove and replace malfunctioning units and retest as specified above.

### 3.4 DEMONSTRATION

- A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain transient voltage suppression devices. Refer to Division 01 Section "Demonstration and Training."

END OF SECTION 264313



THIS PAGE IS INTENTIONALLY LEFT BLANK

## **SECTION 265600 - EXTERIOR LIGHTING**

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

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

#### 1.2 SUMMARY

- A. This Section includes the following:
  - 1. Exterior luminaires with lamps and ballasts.
  - 2. Luminaire-mounted photoelectric relays.
  - 3. Poles and accessories.
- B. Related Sections include the following:
  - 1. Division 26 Section "Interior Lighting" for exterior luminaires normally mounted on exterior surfaces of buildings.

#### 1.3 DEFINITIONS

- A. CRI: Color-rendering index.
- B. HID: High-intensity discharge.
- C. Luminaire: Complete lighting fixture, including ballast housing if provided.
- D. Pole: Luminaire support structure, including tower used for large area illumination.
- E. Standard: Same definition as "Pole" above.

#### 1.4 STRUCTURAL ANALYSIS CRITERIA FOR POLE SELECTION

- A. Dead Load: Weight of luminaire and its horizontal and vertical supports, lowering devices, and supporting structure, applied as stated in AASHTO LTS-4.

- B. Live Load: Single load of 500 lbf (2224 N), distributed as stated in AASHTO LTS-4.
- C. Ice Load: Load of 3 lbf/sq. ft. (143.6 Pa), applied as stated in AASHTO LTS-4.
- D. Wind Load: Pressure of wind on pole and luminaire, calculated and applied as stated in AASHTO LTS-4.
  - 1. Wind speed for calculating wind load for poles exceeding 50 feet in height is 110 mph.
  - 2. Wind speed for calculating wind load for poles 50 feet or less in height is 110 mph.

## 1.5 SUBMITTALS

- A. Product Data: For each luminaire, pole, and support component, arranged in order of lighting unit designation. Include data on features, accessories, finishes, and the following:
  - 1. Physical description of luminaire, including materials, dimensions, effective projected area, and verification of indicated parameters.
  - 2. Details of attaching luminaires and accessories.
  - 3. Details of installation and construction.
  - 4. Luminaire materials.
  - 5. Photometric data based on laboratory tests of each luminaire type, complete with indicated lamps, ballasts, and accessories.
    - a. For indicated luminaires, photometric data shall be certified by a qualified independent testing agency. Photometric data for remaining luminaires shall be certified by manufacturer.
    - b. Photometric data shall be certified by manufacturer's laboratory with a current accreditation under the National Voluntary Laboratory Accreditation Program for Energy Efficient Lighting Products.
  - 6. Photoelectric relays.
  - 7. Ballasts, including energy-efficiency data.
  - 8. Lamps, including life, output, and energy-efficiency data.
  - 9. Materials, dimensions, and finishes of poles.
  - 10. Means of attaching luminaires to supports, and indication that attachment is suitable for components involved.
  - 11. Anchor bolts for poles.
  - 12. Manufactured pole foundations.
- B. Shop Drawings:
  - 1. Anchor-bolt templates keyed to specific poles and certified by manufacturer.

2. Design calculations, certified by a qualified professional engineer, indicating strength of screw foundations and soil conditions on which they are based.
  3. Wiring Diagrams: Power and control wiring.
- C. Samples for Verification: For products designated for sample submission in Exterior Lighting Device Schedule. Each sample shall include lamps and ballasts.
- D. Pole and Support Component Certificates: Signed by manufacturers of poles, certifying that products are designed for indicated load requirements in AASHTO LTS-4 and that load imposed by luminaire has been included in design.
- E. Qualification Data: For agencies providing photometric data for lighting fixtures.
- F. Field quality-control test reports.
- G. Operation and Maintenance Data: For luminaires and poles to include in emergency, operation, and maintenance manuals.
- H. Warranty: Special warranty specified in this Section.

#### 1.6 QUALITY ASSURANCE

- A. Luminaire Photometric Data Testing Laboratory Qualifications: Provided by manufacturers' laboratories that are accredited under the National Volunteer Laboratory Accreditation Program for Energy Efficient Lighting Products.
- B. Luminaire Photometric Data Testing Laboratory Qualifications: Provided by an independent agency, with the experience and capability to conduct the testing indicated, that is an NRTL as defined by OSHA in 29 CFR 1910.7.
- C. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.
- D. Comply with IEEE C2, "National Electrical Safety Code."
- E. Comply with NFPA 70.

#### 1.7 DELIVERY, STORAGE, AND HANDLING

- A. Package aluminum poles for shipping according to ASTM B 660.

- B. Store poles on decay-resistant-treated skids at least 12 inches above grade and vegetation. Support poles to prevent distortion and arrange to provide free air circulation.
- C. Handle wood poles so they will not be damaged. Do not use pointed tools that can indent pole surface more than 1/4 inch deep. Do not apply tools to section of pole to be installed below ground line.
- D. Retain factory-applied pole wrappings on fiberglass and laminated wood poles until right before pole installation. Handle poles with web fabric straps.
- E. Retain factory-applied pole wrappings on metal poles until right before pole installation. For poles with nonmetallic finishes, handle with web fabric straps.

## 1.8 WARRANTY

- A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace products that fail in materials or workmanship; that corrode; or that fade, stain, perforate, erode, or chalk due to effects of weather or solar radiation within specified warranty period. Manufacturer may exclude lightning damage, hail damage, vandalism, abuse, or unauthorized repairs or alterations from special warranty coverage.
  - 1. Warranty Period for Luminaires: Five years from date of Substantial Completion.
  - 2. Warranty Period for Metal Corrosion: Five years from date of Substantial Completion.
  - 3. Warranty Period for Color Retention: Five years from date of Substantial Completion.
  - 4. Warranty Period for Lamps: Replace lamps and fuses that fail within 12 months from date of Substantial Completion; furnish replacement lamps and fuses that fail within the second 12 months from date of Substantial Completion.
  - 5. Warranty Period for Poles: Repair or replace lighting poles and standards that fail in finish, materials, and workmanship within manufacturer's standard warranty period, but not less than three years from date of Substantial Completion.

## 1.9 EXTRA MATERIALS

- A. Furnish extra materials described below that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
  - 1. Lamps: 10 for every 100 of each type and rating installed. Furnish at least one of each type.

2. Glass and Plastic Lenses, Covers, and Other Optical Parts: 10 for every 100 of each type and rating installed. Furnish at least one of each type.
3. Ballasts: 10 for every 100 of each type and rating installed. Furnish at least one of each type.
4. Globes and Guards: 10 for every 20 of each type and rating installed. Furnish at least one of each type.

## PART 2 - PRODUCTS

### 2.1 MANUFACTURERS

- A. In other Part 2 articles where titles below introduce lists, the following requirements apply to product selection:
- B. In Exterior Lighting Device Schedule where titles below are column or row headings that introduce lists, the following requirements apply to product selection:
  1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, manufacturers specified.
  2. Manufacturers: Subject to compliance with requirements, provide products by one of the manufacturers specified.
  3. Basis of Design Product: The design of each item of exterior luminaire and its support is based on the product named. Subject to compliance with requirements, provide either the named product or a comparable product by one of the other manufacturers specified.

### 2.2 LUMINAIRES, GENERAL REQUIREMENTS

- A. Luminaires shall comply with UL 1598 and be listed and labeled for installation in wet locations by an NRTL acceptable to authorities having jurisdiction.
- B. Comply with IESNA RP-8 for parameters of lateral light distribution patterns indicated for luminaires.
- C. Metal Parts: Free of burrs and sharp corners and edges.
- D. Sheet Metal Components: Corrosion-resistant aluminum, unless otherwise indicated. Form and support to prevent warping and sagging.
- E. Housings: Rigidly formed, weather- and light-tight enclosures that will not warp, sag, or deform in use. Provide filter/breather for enclosed luminaires.

- F. 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. Designed to disconnect ballast when door opens.
- G. Exposed Hardware Material: Stainless steel.
- H. Plastic Parts: High resistance to yellowing and other changes due to aging, exposure to heat, and UV radiation.
- I. Light Shields: Metal baffles, factory installed and field adjustable, arranged to block light distribution to indicated portion of normally illuminated area or field.
- J. 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.
- K. Lenses and Refractors Gaskets: Use heat- and aging-resistant resilient gaskets to seal and cushion lenses and refractors in luminaire doors.
- L. Luminaire Finish: Manufacturer's standard paint applied to factory-assembled and -tested luminaire before shipping. Where indicated, match finish process and color of pole or support materials.
- M. Factory-Applied Finish for Steel luminaires: Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.
  - 1. Surface Preparation: Clean surfaces to comply with SSPC-SP 1, "Solvent Cleaning," to remove dirt, oil, grease, and other contaminants that could impair paint bond. Grind welds and polish surfaces to a smooth, even finish. Remove mill scale and rust, if present, from uncoated steel, complying with SSPC-SP 5/NACE No. 1, "White Metal Blast Cleaning," or SSPC-SP 8, "Pickling."
  - 2. Exterior Surfaces: Manufacturer's standard finish consisting of one or more coats of primer and two finish coats of high-gloss, high-build polyurethane enamel.
    - a. Color: As selected from manufacturer's standard catalog of colors.
    - b. Color: Match Architect's sample of manufacturer's standard color.
    - c. Color: As selected by Architect from manufacturer's full range.

- N. Factory-Applied Finish for Aluminum Luminaires: Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.
1. Finish designations prefixed by AA comply with the system established by the Aluminum Association for designating aluminum finishes.
  2. Natural Satin Finish: Provide fine, directional, medium satin polish (AA-M32); buff complying with AA-M20; and seal aluminum surfaces with clear, hard-coat wax.
  3. Class I, Clear Anodic Finish: AA-M32C22A41 (Mechanical Finish: medium satin; Chemical Finish: etched, medium matte; Anodic Coating: Architectural Class I, clear coating 0.018 mm or thicker) complying with AAMA 611.
  4. Class I, Color Anodic Finish: AA-M32C22A42/A44 (Mechanical Finish: medium satin; Chemical Finish: etched, medium matte; Anodic Coating: Architectural Class I, integrally colored or electrolytically deposited color coating 0.018 mm or thicker) complying with AAMA 611.
    - a. Color: Black.

### 2.3 LUMINAIRE-MOUNTED PHOTOELECTRIC RELAYS

- A. Comply with UL 773 or UL 773A.
- B. Contact Relays: Factory mounted, single throw, designed to fail in the on position, and factory set to turn light unit on at 1.5 to 3 fc (16 to 32 lx) and off at 4.5 to 10 fc (48 to 108 lx) with 15-second minimum time delay. Relay shall have directional lens in front of photocell to prevent artificial light sources from causing false turnoff.
1. Relay with locking-type receptacle shall comply with NEMA C136.10.
  2. Adjustable window slide for adjusting on-off set points.

### 2.4 FLUORESCENT BALLASTS AND LAMPS

- A. Low-Temperature Ballast Capability: Rated by its manufacturer for reliable starting and operation of indicated lamp(s) at temperatures 0 deg F (minus 18 deg C) and higher.
- B. Ballast Characteristics:
1. Power Factor: 90 percent, minimum.
  2. Sound Rating: A.
  3. Total Harmonic Distortion Rating: Less than 10 percent.



4. Electromagnetic Ballasts: Comply with ANSI C82.1, energy-saving, high power factor, Class P, automatic-reset thermal protection.
  5. Case Temperature for Compact Lamp Ballasts: 65 deg C, maximum.
  6. Transient-Voltage Protection: Comply with IEEE C62.41 Category A or better.
- C. Low-Temperature Lamp Capability: Rated for reliable starting and operation with ballast provided at temperatures 0 deg F (minus 18 deg C) and higher.
- D. Fluorescent Lamps: Low-mercury type. Comply with the EPA's toxicity characteristic leaching procedure test; shall yield less than 0.2 mg of mercury per liter when tested according to NEMA LL 1.

## 2.5 BALLASTS FOR HID LAMPS

- A. Comply with ANSI C82.4 and UL 1029 and capable of open-circuit operation without reduction of average lamp life. Include the following features, unless otherwise indicated:
1. Ballast Circuit: Constant-wattage autotransformer or regulating high-power-factor type.
  2. Minimum Starting Temperature: Minus 22 deg F (Minus 30 deg C).
  3. Normal Ambient Operating Temperature: 104 deg F (40 deg C).
  4. Ballast Fuses: One in each ungrounded power supply conductor. Voltage and current ratings as recommended by ballast manufacturer.
- B. Auxiliary, Instant-On, Quartz System: Factory-installed feature automatically switches quartz lamp on when fixture is initially energized and when momentary power outages occur. System automatically turns quartz lamp off when HID lamp reaches approximately 60 percent of light output.
- C. High-Pressure Sodium Ballasts: Electromagnetic type with solid-state igniter/starter and capable of open-circuit operation without reduction of average lamp life. Igniter/starter shall have an average life in pulsing mode of 10,000 hours at an igniter/starter-case temperature of 90 deg C.
1. Instant-Restrike Device: Integral with ballast, or solid-state potted module, factory installed within fixture and compatible with lamps, ballasts, and mogul sockets up to 150 W.
    - a. Restrike Range: 105- to 130-V ac.
    - b. Maximum Voltage: 250-V peak or 150-V ac RMS.
  2. Minimum Starting Temperature: Minus 40 deg F (Minus 40 deg C).

## 2.6 HID LAMPS

- A. High-Pressure Sodium Lamps: ANSI C78.42, CRI 21 (minimum), color temperature 1900 K, and average rated life of 24,000 hours, minimum.
  - 1. Dual-Arc Tube Lamp: Arranged so only one of two arc tubes is lighted at one time and, when power is restored after an outage, the cooler arc tube, with lower internal pressure, lights instantly, providing an immediate 8 to 15 percent of normal light output.
- B. Metal-Halide Lamps: ANSI C78.1372, with a minimum CRI 65, and color temperature 4000 K.
- C. Pulse-Start, Metal-Halide Lamps: Minimum CRI 65, and color temperature 4000 K.
- D. Ceramic, Pulse-Start, Metal-Halide Lamps: Minimum CRI 80, and color temperature 4000 K.

## 2.7 POLES AND SUPPORT COMPONENTS, GENERAL REQUIREMENTS

- A. Structural Characteristics: Comply with AASHTO LTS-4.
  - 1. Wind-Load Strength of Poles: Adequate at indicated heights above grade without failure, permanent deflection, or whipping in steady winds of speed indicated in Part 1 "Structural Analysis Criteria for Pole Selection" Article, with a gust factor of 1.3.
  - 2. Strength Analysis: For each pole, multiply the actual equivalent projected area of luminaires and brackets by a factor of 1.1 to obtain the equivalent projected area to be used in pole selection strength analysis.
- B. Luminaire Attachment Provisions: Comply with luminaire manufacturers' mounting requirements. Use stainless-steel fasteners and mounting bolts, unless otherwise indicated.
- C. Mountings, Fasteners, and Appurtenances: Corrosion-resistant items compatible with support components.
  - 1. Materials: Shall not cause galvanic action at contact points.
  - 2. Anchor Bolts, Leveling Nuts, Bolt Caps, and Washers: Hot-dip galvanized after fabrication, unless stainless-steel items are indicated.
  - 3. Anchor-Bolt Template: Plywood or steel.

- D. Concrete Pole Foundations: Cast in place, with anchor bolts to match pole-base flange. Concrete, reinforcement, and formwork are specified in Division 03 Section "Cast-in-Place Concrete."
- E. Power-Installed Screw Foundations: Factory fabricated by pole manufacturer, with structural steel complying with ASTM A 36/A 36M and hot-dip galvanized according to ASTM A 123/A 123M; and with top-plate and mounting bolts to match pole base flange and strength required to support pole, luminaire, and accessories.
- F. Breakaway Supports: Frangible breakaway supports, tested by an independent testing agency acceptable to authorities having jurisdiction, according to AASHTO LTS-4.

## 2.8 STEEL POLES

- A. Poles: Comply with ASTM A 500, Grade B, carbon steel with a minimum yield of 46,000 psig (317 MPa); 1-piece construction up to 40 feet in height with access handhole in pole wall.
  - 1. Shape: Square, straight.
  - 2. Mounting Provisions: Butt flange for bolted mounting on foundation or breakaway support.
- B. Steel Mast Arms: Single-arm type, continuously welded to pole attachment plate. Material and finish same as pole.
- C. Brackets for Luminaires: Detachable, cantilever, without underbrace.
  - 1. Adapter fitting welded to pole and bracket, then bolted together with stainless-steel bolts.
  - 2. Cross Section: Tapered oval, with straight tubular end section to accommodate luminaire.
  - 3. Match pole material and finish.
- D. Pole-Top Tenons: Fabricated to support luminaire or luminaires and brackets indicated, and securely fastened to pole top.
- E. Steps: Fixed steel, with nonslip treads, positioned for 15-inch vertical spacing, alternating on opposite sides of pole; first step at elevation 10 feet above finished grade.
- F. Intermediate Handhole and Cable Support: Weathertight, 3-by-5-inch handhole located at midpoint of pole with cover for access to internal welded attachment lug for electric cable support grip.

- G. Grounding and Bonding Lugs: Welded 1/2-inch threaded lug, complying with requirements in Division 26 Section "Grounding and Bonding for Electrical Systems," listed for attaching grounding and bonding conductors of type and size listed in that Section, and accessible through handhole.
- H. Cable Support Grip: Wire-mesh type with rotating attachment eye, sized for diameter of cable and rated for a minimum load equal to weight of supported cable times a 5.0 safety factor.
- I. Platform for Lamp and Ballast Servicing: Factory fabricated of steel with finish matching that of pole.
- J. Prime-Coat Finish: Manufacturer's standard prime-coat finish ready for field painting.
- K. Galvanized Finish: After fabrication, hot-dip galvanize complying with ASTM A 123/A 123M.
- L. Factory-Painted Finish: Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.
  - 1. Surface Preparation: Clean surfaces to comply with SSPC-SP 1, "Solvent Cleaning," to remove dirt, oil, grease, and other contaminants that could impair paint bond. Grind welds and polish surfaces to a smooth, even finish. Remove mill scale and rust, if present, from uncoated steel, complying with SSPC-SP 5/NACE No. 1, "White Metal Blast Cleaning," or SSPC-SP 8, "Pickling."
  - 2. Interior Surfaces of Pole: One coat of bituminous paint, or otherwise treat for equal corrosion protection.
  - 3. Exterior Surfaces: Manufacturer's standard finish consisting of one or more coats of primer and two finish coats of high-gloss, high-build polyurethane enamel.
    - a. Color: As selected by Architect from manufacturer's full range.

## 2.9 ALUMINUM POLES

- A. Poles: Seamless, extruded structural tube complying with ASTM B 429, Alloy 6063-T6 with access handhole in pole wall.
- B. Poles: ASTM B 209 (ASTM B 209M), 5052-H34 marine sheet alloy with access handhole in pole wall.
  - 1. Shape Square, straight.
  - 2. Mounting Provisions: Butt flange for bolted mounting on foundation or breakaway support.

- C. Pole-Top Tenons: Fabricated to support luminaire or luminaires and brackets indicated, and securely fastened to pole top.
- D. Grounding and Bonding Lugs: Welded 1/2-inch threaded lug, complying with requirements in Division 26 Section "Grounding and Bonding for Electrical Systems," listed for attaching grounding and bonding conductors of type and size listed in that Section, and accessible through handhole.
- E. Brackets for Luminaires: Detachable, with pole and adapter fittings of cast aluminum. Adapter fitting welded to pole and bracket, then bolted together with stainless-steel bolts.
  - 1. Tapered oval cross section, with straight tubular end section to accommodate luminaire.
  - 2. Finish: Same as luminaire.
- F. Prime-Coat Finish: Manufacturer's standard prime-coat finish ready for field painting.
- G. Aluminum Finish: Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.
  - 1. Finish designations prefixed by AA comply with the system established by the Aluminum Association for designating aluminum finishes.
  - 2. Natural Satin Finish: Provide fine, directional, medium satin polish (AA-M32); buff complying with AA-M20; and seal aluminum surfaces with clear, hard-coat wax.
  - 3. Class I, Clear Anodic Finish: AA-M32C22A41 (Mechanical Finish: medium satin; Chemical Finish: etched, medium matte; Anodic Coating: Architectural Class I, clear coating 0.018 mm or thicker) complying with AAMA 611.
  - 4. Class I, Color Anodic Finish: AA-M32C22A42/A44 (Mechanical Finish: medium satin; Chemical Finish: etched, medium matte; Anodic Coating: Architectural Class I, integrally colored or electrolytically deposited color coating 0.018 mm or thicker) complying with AAMA 611.
    - a. Color: As selected by Architect from manufacturer's full range.

## 2.10 FIBERGLASS POLES

- A. Poles: Comply with ANSI C136.20, with access handhole in pole wall.
  - 1. Mounting: Embedded.
  - 2. Mounting Provisions: Butt flange for bolted mounting on foundation or breakaway support.

- B. Resin Color: provide uniform coloration throughout entire wall thickness.
- C. Surface Finish: Pigmented polyurethane, with a minimum dry film thickness of 1.5 mils.

## 2.11 PRESTRESSED CONCRETE POLES

- A. Poles: Manufactured by centrifugal spin-casting process.
  - 1. Shape: Square, straight.
  - 2. Mounting Provisions: Embedded.
  - 3. Finishing: Capped at top and plugged at bottom. Seat each steel reinforcing strand with epoxy adhesive.
  - 4. Grounding: Continuous copper ground wire cast into pole. Terminate at top of pole and attach to 24-inch lightning rod.
- B. Cure with wet steam and age for a minimum of 15 days before installation.
- C. Fabricate poles with a hard, nonporous surface that is resistant to water, frost, and road and soil chemicals and that has a maximum water-absorption rate of 3 percent.
- D. Cast aluminum nameplate into pole wall at approximately 5 feet above ground line, listing name of manufacturer, Project identifier, overall height, and approximate weight.
- E. Pole Brackets: Comply with ANSI C136.13.
- F. Finish Color: Provided by color material complying with ASTM C 979, uniformly impregnated throughout the pole concrete. Color material shall provide a uniform, stable, permanent color and be as follows:
  - 1. Inert, and carbon free.
  - 2. Unaffected by environmental conditions and contaminants including, but not limited to, UV solar radiation, salts, and alkalis.
- G. Finish Texture: Etched exposed aggregate.

## PART 3 - EXECUTION

### 3.1 LUMINAIRE INSTALLATION

- A. Install lamps in each luminaire.
- B. Fasten luminaire to indicated structural supports.
  - 1. Use fastening methods and materials selected to resist seismic forces defined for the application and approved by manufacturer.
- C. Adjust luminaires that require field adjustment or aiming. Include adjustment of photoelectric device to prevent false operation of relay by artificial light sources.

### 3.2 POLE INSTALLATION

- A. Align pole foundations and poles for optimum directional alignment of luminaires and their mounting provisions on the pole.
- B. Clearances: Maintain the following minimum horizontal distances of poles from surface and underground features, unless otherwise indicated on Drawings:
  - 1. Fire Hydrants and Storm Drainage Piping: 60 inches.
  - 2. Water, Gas, Electric, Communication, and Sewer Lines: 10 feet.
  - 3. Trees: 15 feet.
- C. Concrete Pole Foundations: Set anchor bolts according to anchor-bolt templates furnished by pole manufacturer. Concrete materials, installation, and finishing requirements are specified in Division 03 Section "Cast-in-Place Concrete."
- D. Foundation-Mounted Poles: Mount pole with leveling nuts, and tighten top nuts to torque level recommended by pole manufacturer.
  - 1. Use anchor bolts and nuts selected to resist seismic forces defined for the application and approved by manufacturer.
  - 2. Grout void between pole base and foundation. Use nonshrink or expanding concrete grout firmly packed to fill space.
  - 3. Install base covers, unless otherwise indicated.
  - 4. Use a short piece of 1/2-inch diameter pipe to make a drain hole through grout. Arrange to drain condensation from interior of pole.
- E. Embedded Poles with Tamped Earth Backfill: Set poles to depth below finished grade indicated on Drawings, but not less than one-sixth of pole height.
  - 1. Dig holes large enough to permit use of tampers in the full depth of hole.
  - 2. Backfill in 6-inch layers and thoroughly tamp each layer so compaction of backfill is equal to or greater than that of undisturbed earth.

- F. Embedded Poles with Concrete Backfill: Set poles in augered holes to depth below finished grade indicated on Drawings, but not less than one-sixth of pole height.
  - 1. Make holes 6 inches in diameter larger than pole diameter.
  - 2. Fill augered hole around pole with air-entrained concrete having a minimum compressive strength of 3000 psi (20 MPa) at 28 days, and finish in a dome above finished grade.
  - 3. Use a short piece of 1/2-inch diameter pipe to make a drain hole through concrete dome. Arrange to drain condensation from interior of pole.
  - 4. Cure concrete a minimum of 72 hours before performing work on pole.
- G. Poles and Pole Foundations Set in Concrete Paved Areas: Install poles with minimum of 6-inch- (150-mm-) wide, unpaved gap between the pole or pole foundation and the edge of adjacent concrete slab. Fill unpaved ring with pea gravel to a level 1 inch (25 mm) below top of concrete slab.
- H. Raise and set poles using web fabric slings (not chain or cable).

### 3.3 BOLLARD LUMINAIRE INSTALLATION

- A. Align units for optimum directional alignment of light distribution.
- B. Install on concrete base with top 4 inches above finished grade or surface at bollard location. Cast conduit into base, and shape base to match shape of bollard base. Finish by troweling and rubbing smooth. Concrete materials, installation, and finishing are specified in Division 03 Section "Cast-in-Place Concrete."

### 3.4 INSTALLATION OF INDIVIDUAL GROUND-MOUNTING LUMINAIRES

- A. Install on concrete base with top 4 inches 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 Division 03 Section "Cast-in-Place Concrete."

### 3.5 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 Division 26 Section "Raceway and Boxes for Electrical Systems." In concrete foundations, wrap conduit with 0.010-inch thick, pipe-wrapping plastic tape applied with a 50 percent overlap.



### 3.6 GROUNDING

- A. Ground metal poles and support structures according to Division 26 Section "Grounding and Bonding for Electrical Systems."
  - 1. Install grounding electrode for each pole, unless otherwise indicated.
  - 2. Install grounding conductor pigtail in the base for connecting luminaire to grounding system.
- B. Ground nonmetallic poles and support structures according to Division 26 Section "Grounding and Bonding for Electrical Systems."
  - 1. Install grounding electrode for each pole.
  - 2. Install grounding conductor and conductor protector.
  - 3. Ground metallic components of pole accessories and foundations.

### 3.7 FIELD QUALITY CONTROL

- A. Inspect each installed fixture for damage. Replace damaged fixtures and components.
- B. Illumination Observations: Verify normal operation of lighting units after installing luminaires and energizing circuits with normal power source.
  - 1. 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 IESNA testing guide(s):
    - a. IESNA LM-5, "Photometric Measurements of Area and Sports Lighting."
    - b. IESNA LM-50, "Photometric Measurements of Roadway Lighting Installations."
    - c. IESNA LM-52, "Photometric Measurements of Roadway Sign Installations."
    - d. IESNA LM-64, "Photometric Measurements of Parking Areas."
    - e. IESNA LM-72, "Directional Positioning of Photometric Data."
- D. 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.

3.8 DEMONSTRATION

- A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain luminaire lowering devices. Refer to Division 01 Section "Demonstration and Training."

END OF SECTION 265600

THIS PAGE IS INTENTIONALLY LEFT BLANK

## **SECTION 26 56 68 – EXTERIOR ATHLETIC LIGHTING**

Lighting System with LED Light Source

### **PART 1 – GENERAL**

#### **1.1 SUMMARY**

- A. Work covered by this section of the specifications shall conform to the contract documents, engineering plans as well as state and local codes.
- B. The purpose of these specifications is to define the lighting system performance and design standards for Barber Park using an LED Lighting source. The manufacturer / contractor shall supply lighting equipment to meet or exceed the standards set forth in these specifications.
- C. The sports lighting will be for the following venues:
  - 1. 3 - 360' x 225' Soccer fields
- E. The primary goals of this sports lighting project are:
  - 1. **Guaranteed Light Levels:** Selection of appropriate light levels impact the safety of the players and the enjoyment of spectators. Therefore light levels are guaranteed to not drop below specified target values for a period of 25 years.
  - 2. **Environmental Light Control:** It is the primary goal of this project to minimize spill light to adjoining properties and glare to the players, spectators and neighbors. The LED design should provide better control than a good HID design as described in section 1.3
  - 3. **Life-cycle Cost:** In order to reduce the operating budget, the preferred lighting system shall be energy efficient and cost effective to operate. All maintenance costs shall be eliminated for the duration of the warranty.
  - 4. **Control and Monitoring:** To allow for optimized use of labor resources and avoid unneeded operation of the facility, customer requires a remote on/off control system for the lighting system. Fields should be proactively monitored to detect luminaire outages over a 25-year life cycle. All communication and monitoring costs for 25-year period shall be included in the bid.
- F. All lighting designs shall comply with Manatee County Lighting Ordinance.

#### **1.2 LIGHTING PERFORMANCE**

- A. **Illumination Levels and Design Factors:** Playing surfaces shall be lit to an average target illumination level and uniformity as specified in the chart below. Lighting calculations shall be developed and field measurements taken on the grid spacing with the minimum number of grid points specified below. Appropriate light loss factors shall be applied and submitted for the basis of design. Average illumination level shall be measured in accordance with the IESNA LM-5-04 (IESNA Guide for Photometric Measurements of Area and Sports Lighting Installations). Illumination levels shall not to drop below desired target values in accordance to IES RP-6-15, Page 2, Maintained Average Illuminance and shall be guaranteed for the full warranty period.

<b>Area of Lighting</b>	<b>Average Target Illumination Levels</b>	<b>Maximum to Minimum Uniformity Ratio</b>	<b>Grid Points</b>	<b>Grid Spacing</b>
Soccer 1	30fc	2.0:1	96	30' x 30'
Soccer 2	30fc	2.0:1	96	30' x 30'
Soccer 3	30fc	2.0:1	96	30' x 30'

B. Hours of usage: Designs shall be based on the following hours of usage

<b>Area of Lighting</b>	<b>Annual Usage Hours</b>	<b>25 year Usage Hours</b>
All Venues	600	15,000

C. Color: The lighting system shall have a minimum color temperature of 5700K and a CRI of 65+.

D. Mounting Heights: To ensure proper aiming angles for reduced glare and to provide better playability, minimum mounting heights shall be as described below. Higher mounting heights may be required based on photometric report and ability to ensure the top of the field angle is a minimum of 10 degrees below horizontal.

<b>Field</b>	<b>Pole Designation</b>	<b>Pole Height</b>
Soccer	S1, S2, S7, S8	70'
Soccer	S3 - S6	90'

**1.3 ENVIRONMENTAL LIGHT CONTROL**

- A. Light Control Luminaires: All luminaires shall utilize spill light and glare control devices including, but not limited to, internal shields, louvers and external shields. No symmetrical beam patterns are accepted.
- B. Glare Control: Maximum candela at a distance of 125’ should be better than that of a comparable HID design. These values are defined for the sports field listed below. Environmental glare impact scans must be submitted showing the maximum candela from the field edge

Typical Field Type	Maximum Candela at 125’
Soccer	<136 candela

- C. The first page of a photometric report for all luminaire types proposed showing horizontal and vertical axial candle power shall be provided to demonstrate the capability of achieving the specified performance. Reports shall be certified by a qualified independent testing laboratory with a minimum of five years experience or by a manufacturer’s laboratory with a current accreditation under the National Voluntary Laboratory Accreditation Program for Energy Efficient Lighting Products. A summary of the horizontal and vertical aiming angles for each luminaire shall be included with the photometric report.

**1.4 LIFE-CYCLE COSTS**

- A. Manufacturer shall submit a 25-year life cycle cost calculation as outlined in the required submittal information.
- B. Preventative and Spot Maintenance: Manufacturer shall provide all preventative and spot maintenance, including parts and labor for 25 years from the date of equipment shipment. Individual outages shall be repaired when the usage of any field is materially impacted. Owner agrees to check fuses in the event of a luminaire outage.

**PART 2 – PRODUCT**

**2.1 SPORTS LIGHTING SYSTEM CONSTRUCTION**

- A. Manufacturing Requirements: All components shall be designed and manufactured as a system. All luminaires, wire harnesses, drivers and other enclosures shall be factory assembled, aimed, wired and tested.
- B. Fixtures are to be labeled individually for ease of installation and identification for warranty purposes

- C. Durability: All exposed components shall be constructed of corrosion resistant material and/or coated to help prevent corrosion. All exposed carbon steel shall be hot dip galvanized per ASTM A123. All exposed aluminum shall be powder coated with high performance polyester or anodized. All exterior reflective inserts shall be anodized, coated, and protected from direct environmental exposure to prevent reflective degradation or corrosion. All exposed hardware and fasteners shall be stainless steel of 18-8 grade or better, passivated and coated with aluminum-based thermosetting epoxy resin for protection against corrosion and stress corrosion cracking. Structural fasteners may be carbon steel and galvanized meeting ASTM A153 and ISO/EN 1461 (for hot dipped galvanizing), or ASTM B695 (for mechanical galvanizing). All wiring shall be enclosed within the cross-arms, pole, or electrical components enclosure.
- D. System Description: Lighting system shall consist of the following:
1. Galvanized steel poles and cross-arm assembly. Alternate: Concrete pole with a minimum of 8,000 psi and installed with concrete backfill will be an acceptable alternative provided building code, wind speed and foundation designs per specifications are adhered to.
  2. Non-approved pole technology:
    - a. Square static cast concrete poles will not be accepted.
    - b. Direct bury steel poles which utilize the extended portion of the steel shaft for their foundation will not be accepted due to potential for internal and external corrosive reaction to the soils and long term performance concerns.
  3. Pre-stressed concrete base embedded in concrete backfill allowed to cure for 12-24 hours before pole stress is applied. Alternate may be an anchor bolt foundation designed such that the steel pole and any exposed steel portion of the foundation is located a minimum of 18 inches above final grade. The concrete for anchor bolt foundations shall be allowed to cure for a minimum of 28 days before the pole stress is applied unless shorter cure time approved by structural engineer of record.
  4. Manufacturer will remote all drivers and supporting electrical equipment in aluminum enclosures mounted approximately 10 feet above grade. The enclosures shall be touch-safe and include drivers and fusing with indicator lights on fuses to notify when a fuse is to be replaced for each luminaire. Disconnect per circuit for each pole structure will be located in the enclosure. Integral driver fixtures will not be accepted.
  5. Manufacturer shall provide surge protection at the pole equal to or greater than 40kA for each line to ground (Common Mode) as recommended by IEEE C62.41.2\_2002.
  6. Wire harness complete with an abrasion protection sleeve, strain relief and plug-in connections for fast, trouble-free installation.
  7. All luminaires, visors, and cross-arm assemblies shall withstand 150 mph winds and maintain luminaire aiming alignment.
  8. Control cabinet to provide remote on-off control and monitoring of the lighting system. Cabinet shall be constructed of aluminum and be rated NEMA Type 4. Communication method shall be provided by manufacturer. Cabinet shall contain custom configured contactor modules for 30, 60, and 100 amps, labeled to match field diagrams and electrical design. Manual off-on-auto selector switches shall be provided.

9. Lightning Protection: Manufacturer shall provide integrated lightning grounding via concrete encased electrode grounding system as defined by NFPA 780 and be UL Listed per UL 96 and UL 96A. If grounding is not integrated into the structure, the manufacturer shall supply grounding electrodes, copper down conductors, and exothermic weld kits. Electrodes and conductors shall be sized as required by NFPA 780. The grounding electrode shall be minimum size of 5/8 inch diameter and 8 feet long, with a minimum of 10 feet embedment. Grounding electrode shall be connected to the structure by a grounding electrode conductor with a minimum size of 2 AWG for poles with 75 feet mounting height or less, and 2/0 AWG for poles with more than 75 feet mounting height.
10. Enhanced corrosion protection package: Due to the potentially corrosive environment for this project, manufacturers must provide documentation that their products meet the following enhanced requirements in addition to the standard durability protection specified above:
  - a) Exposed carbon steel horizontal surfaces on the crossarm assembly shall be galvanized to no less than a five (5) mil average thickness.
  - b) Exposed die cast aluminum components shall be Type II anodized per MIL-STD-8625 and coated with high performance polyester.
  - c) Exposed extruded aluminum components shall be Type II anodized per MIL-STD-8625 and coated with high performance polyester.

E. Safety: All system components shall be UL listed for the appropriate application.

## **2.2 ELECTRICAL**

- A. Electric Power Requirements for the Sports Lighting Equipment:
  1. Electric power: 480 Volt, 3 Phase
  2. Maximum total voltage drop: Voltage drop to the disconnect switch located on the poles shall not exceed five (5) percent of the rated voltage.
- B. Energy Consumption: The average kW consumption for the field lighting system shall be 102kW. The max kW consumption for the field lighting system shall be 102kW.

## **2.3 STRUCTURAL PARAMETERS**

- A. Wind Loads: Wind loads shall be based on the 2014 Florida Building Code. Wind loads to be calculated using ASCE 7-10, an ultimate design wind speed of 140 and exposure category C

## **2.1 CONTROL**

- A. Instant On/Off Capabilities: System shall provide for instant on/off of luminaires.
- B. Remote Lighting Control System: System shall allow owner and users with a security code to schedule on/off system operation via a web site, phone, fax or email up to ten years in advance. Manufacturer shall provide and maintain a two-way TCP/IP communication link. Trained staff shall be available 24/7 to provide scheduling support and assist with reporting needs.



The owner may assign various security levels to schedulers by function and/or fields. This function must be flexible to allow a range of privileges such as full scheduling capabilities for all fields to only having permission to execute “early off” commands by phone. Scheduling tool shall be capable of setting curfew limits.

Controller shall accept and store 7-day schedules, be protected against memory loss during power outages, and shall reboot once power is regained and execute any commands that would have occurred during outage.

- C. Remote Monitoring System: System shall monitor lighting performance and notify manufacturer if individual luminaire outage is detected so that appropriate maintenance can be scheduled. The controller shall determine switch position (manual or auto) and contactor status (open or closed).
- D. Management Tools: Manufacturer shall provide a web-based database and dashboard tool of actual field usage and provide reports by facility and user group. Dashboard shall also show current status of luminaire outages, control operation and service. Mobile application will be provided suitable for IOS, Android and Blackberry devices.  
Hours of Usage: Manufacturer shall provide a means of tracking actual hours of usage for the field lighting system that is readily accessible to the owner.
  - 1. Cumulative hours: shall be tracked to show the total hours used by the facility
  - 2. Report hours saved by using early off and push buttons by users.
- E. Communication Costs: Manufacturer shall include communication costs for operating the controls and monitoring system for a period of 25 years.

### **PART 3 – EXECUTION**

#### **3.1 DELIVERY TIMING**

Delivery Timing Equipment On-Site: The equipment must be on-site 14 from receipt of approved submittals and receipt of complete order information.

#### **3.2 FIELD QUALITY CONTROL**

- A. Laser aiming is required - This can be accomplished two ways
  - 1) If the fixtures are factory aimed, the crossarm assembly as one unit
  - 2) Fixtures that are not factory aimed must be individually laser aimed for quality control.
- B. Illumination Measurements: Upon substantial completion of the project and in the presence of the Contractor, Project Engineer, Owner's Representative, and Manufacturer's Representative, illumination measurements shall be taken and verified. The illumination measurements shall be conducted in accordance with IESNA LM-5-04.
- C. Field Light Level Accountability
  - 1. Light levels are guaranteed not to fall below the target maintained light levels for the entire warranty period of 25 Years.
  - 2. The contractor/manufacturer shall be responsible for an additional inspection one year from the date of commissioning of the lighting system and will utilize the owner's light meter in the presence of the owner.

3. The contractor/manufacturer will be held responsible for any and all changes needed to bring these fields back to compliance for light levels and uniformities.

Contractor/Manufacturer will be held responsible for any damage to the fields during these repairs.

- D. Correcting Non-Conformance: If, in the opinion of the Owner or his appointed Representative, the actual performance levels including footcandles and uniformity ratios are not in conformance with the requirements of the performance specifications and submitted information, the Manufacturer shall be required to make adjustments to meet specifications and satisfy Owner.

### **3.4 WARRANTY AND GUARANTEE**

- A. 25-Year Warranty: Each manufacturer shall supply a signed warranty covering the entire system for 25 years from the date of shipment. Warranty shall guarantee specified light levels. Manufacturer shall maintain specifically-funded financial reserves to assure fulfillment of the warranty for the full term. Warranty does not cover weather conditions events such as lightning or hail damage, improper installation, vandalism or abuse, unauthorized repairs or alterations, or product made by other manufacturers.

- 1) Manufacturer shall maintain specifically-funded financial reserves to assure fulfillment of the warranty for the full term.

- 2) Manufacturer must have employees/technicians to service the equipment located within a 60 mile radius. This is in addition to a network of contractors used to service the system.

- 3) If the control system is not provided by the manufacturer of the lighting system, the manufacturer of the Control System must have employees/technicians to service the equipment located within a 60 mile radius. This is in addition to a network of contractors used to service the system.

- B. Maintenance: Manufacturer shall monitor the performance of the lighting system, including on/off status, hours of usage and luminaire outage for 25 years from the date of equipment shipment. Individual luminaire outages shall be repaired when the usage of any field is materially impacted. Owner agrees to check fuses in the event of a luminaire outage.

## **PART 4 – DESIGN APPROVAL**

### **4.0 PRE-BID SUBMITTAL REQUIREMENTS (Non-Musco)**

- A. Design Approval: The owner / engineer will review pre-bid submittals per section **4.0.B** from all the manufacturers to ensure compliance to the specification 10 days prior to bid. If the design meets the design requirements of the specifications, a letter and/or addendum will be issued to the manufacturer indicating approval for the specific design submitted.
- B. Approved Product: Musco's TLC LED light source is the approved product. All substitutions must provide a complete submittal package for approval as outlined in Submittal Information at the end of this section at least 10 days prior to bid. Special manufacturing to meet the standards of this specification may be required. An addendum will be issued prior to bid listing any other approved lighting manufacturers and designs.

- C. All listed manufacturers not pre-approved shall submit the information at the end of this section at least 10 days prior to bid. An addendum will be issued prior to bid; listing approved lighting manufacturers and the design method to be used.
- D. Bidders are required to bid only products that have been approved by this specification or addendum by the owner or owner's representative. Bids received that do not utilize an approved system/design, will be rejected.

**PART 5 – DESIGN APPROVAL**

**5.0 POST BID SUBMITTAL**

- A. In the event that a manufacturer provides a submittal that is deemed to be incomplete, that manufacturer has 2 weeks maximum to provide all requested information. If the manufacturer does not comply with this timeline, they will be deemed non-compliant and the submittals will be rejected.

**REQUIRED SUBMITTAL INFORMATION FOR ALL MANUFACTURERS (NOT PRE-APPROVED) 10 DAYS PRIOR TO BID**

*All items listed below are mandatory, shall comply with the specification and be submitted according to pre-bid submittal requirements. Complete the Yes/No column to indicate compliance (Y) or noncompliance (N) for each item. **Submit checklist below with submittal.***

Yes / No	Tab	Item	Description
	A	Letter/ Checklist	Listing of all information being submitted must be included on the table of contents. List the name of the manufacturer's local representative and his/her phone number. Signed submittal checklist to be included.
	B	Equipment Layout	Drawing(s) showing field layouts with pole locations
	C	On Field Lighting Design	Lighting design drawing(s) showing: <ul style="list-style-type: none"> <li>a. Field Name, date, file number, prepared by</li> <li>b. Outline of field(s) being lighted, as well as pole locations referenced to the center of the field (x &amp; y), Illuminance levels at grid spacing specified</li> <li>c. Pole height, number of fixtures per pole, horizontal and vertical aiming angles, as well as luminaire information including wattage, lumens and optics</li> <li>d. Height of light test meter above field surface.</li> <li>e. Summary table showing the number and spacing of grid points; average, minimum and maximum illuminance levels in foot candles (fc); uniformity including maximum to minimum ratio, coefficient of variance (CV), coefficient of utilization (CU) uniformity gradient; number of luminaries, total kilowatts, average tilt factor; light loss factor.</li> </ul>
	D	Environmental Light Control Design	Environmental glare impact scans must be submitted showing the maximum candela from the field edge on a map of the surrounding area
	F	Photometric Report	Provide first page of photometric report for all luminaire types being proposed showing candela tabulations as defined by IESNA Publication LM-35-02. Photometric data shall be certified by laboratory with current National Voluntary Laboratory Accreditation Program or an independent testing facility with over 5 years experience.

<b>G</b>	Performance Guarantee	Provide performance guarantee including a written commitment to undertake all corrections required to meet the performance requirements noted in these specifications at no expense to the owner. Light levels must be guaranteed to not fall below target levels for warranty period.
<b>H</b>	Structural Calculations	Pole structural calculations and foundation design showing foundation shape, depth backfill requirements, rebar and anchor bolts (if required). Pole base reaction forces shall be shown on the foundation drawing along with soil bearing pressures. Design must be stamped by a structural engineer in the state of FL, if required by owner. (May be supplied upon award).
<b>I</b>	Control & Monitoring System	Manufacturer of the control and monitoring system shall provide written definition and schematics for automated control system to include monitoring. They will also provide 10 references of customers currently using proposed system in the state of FL
<b>J</b>	Electrical Distribution Plans	Manufacturer bidding an alternate product must include a revised electrical distribution plan including changes to service entrance, panels and wire sizing, signed by a licensed Electrical Engineer in the state of FL
<b>K</b>	Warranty	Provide written warranty information including all terms and conditions. Provide 10 references of customers currently under specified warranty in the state of FL
<b>L</b>	Project References	Manufacturer to provide a list of 10 projects where the technology and specific fixture proposed for this project has been installed in the state of FL. Reference list will include project name, project city, installation date, and if requested, contact name and contact phone number.
<b>M</b>	Product Information	Complete bill of material and current brochures/cut sheets for all product being provided.
<b>N</b>	Delivery	Manufacturer shall supply an expected delivery timeframe from receipt of approved submittals and complete order information.
<b>O</b>	Non-Compliance	Manufacturer shall list all items that do not comply with the specifications. If in full compliance, tab may be omitted.

The information supplied herein shall be used for the purpose of complying with the specifications for FFF Boggy Creek. By signing below I agree that all requirements of the specifications have been met and that the manufacturer will be responsible for any future costs incurred to bring their equipment into compliance for all items not meeting specifications and not listed in the Non-Compliance section.

**Manufacturer:** \_\_\_\_\_ **Signature:** \_\_\_\_\_

**Contact Name:** \_\_\_\_\_ **Date:** \_\_\_\_/\_\_\_\_/\_\_\_\_

**SECTION 32 84 00 – PLANTING IRRIGATION**

PART 1 – GENERAL

1.1 RELATED DOCUMENTS

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

1.2 DESCRIPTION OF WORK

A. This Section includes piping, valves, sprinklers, specialties, controls, and wiring for an automatic control irrigation system.

1.3 PERFORMANCE REQUIREMENTS

A. Installer's qualifications: Have satisfactorily installed irrigation systems on at least five (5) other projects of comparable complexity.

B. Location of Sprinklers and Specialties: Design layout is diagrammatic. Make minor adjustments necessary to avoid plantings and fixed obstructions. Maintain 100 percent water coverage of landscape areas indicated.

1.4 SUBMITTALS

A. Submit manufacturer's product data and installation instructions for each of the system components for the following. Product Data: Include pressure ratings, rated capacities, and settings of selected models for the following:

1. Electric Valves.
2. Gate Valves
3. Rain Sensor
4. Controller
5. Purple Mainline
6. Purple Lateral Lines
7. Wiring/Control Cables.
8. Purple Control Valve Box
9. Sprinklers.
10. Any other components for a complete system.

B. Record Drawings: Contractor responsible for providing Owner with As-Built drawings of the irrigation system as installed. Show piping and major system components. Legibly mark

drawings to record actual construction. Indicate horizontal and vertical locations reference to permanent surface improvements. Identify field changes of dimension and detail and changes made in the field.

C. Operation and Maintenance Data: For irrigation systems, to include in emergency, operation, and maintenance manuals. In addition to items specified in Division 01 Section "Closeout Procedures" include data for the following:

1. Automatic-control valves.
2. Sprinklers.
3. Controllers.

### 1.5 QUALITY ASSURANCE

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

### 1.6 DELIVERY, STORAGE, AND HANDLING

A. Deliver irrigation system components in manufacturer's original undamaged and unopened containers with labels intact and legible.

B. Store plastic piping protected from direct sunlight. Support to prevent sagging and bending.

### 1.7 PROJECT CONDITIONS

A. Protect existing trees, plants lawns and other features designed to remain as part of the final landscape work.

B. Promptly notify the Landscape Architect of unexpected subsurface conditions.

## PART 2 - PRODUCTS

### 2.1 GENERAL

A. Provide only new materials without flaws or defects and of the highest quality of their specified class and kind.

B. Comply with pipe sizes indicated. No substitution of smaller pipes will be permitted. Larger sizes may be subject to acceptance of the Landscape Architect. Remove damaged and defective pipe.

C. Provide pipe continuously and permanently marked with manufacturer's name or trademark, size schedule and type of pipe, working pressure at 73 degrees F.

## 2.2 PIPES, TUBES, AND FITTINGS

A. Polyvinyl chloride pipe: ASTM D2241, rigid, unplasticized PVC, extruded from virgin parent material. Provide pipe homogeneous throughout and free from visible cracks, holes, foreign materials, blisters, wrinkles and dents. See plan for type.

B. PVC pipe fittings: ASTM D2241 schedule 40 PVC molded fittings suitable for solvent weld, slip joint ring tight seal, or screwed connections. Fittings made of other materials are not permitted.

C. All pipe under paved areas will be sleeved with Schedule 40 P.V.C. The Contractor will provide a minimum of 2" Schedule 40 P.V.C. under all paved areas to produce access for electrical control wire.

## 2.3 VALVE BOXES

A. Plastic Valve Boxes: Box and cover, with open bottom and openings for piping; designed for installing flush with grade. Include size as required for valves and service.

1. Box: Tapered enclosure of rigid plastic material comprised of fibrous components chemically inert and unaffected by moisture corrosion and temperature changes. 2. Cover Material: Provide lid of same material, purple in color.

## 2.4 SPRINKLERS

A. Refer to drawing's materials list.

1. Sprinklers: All Sprinkler heads shall be as indicated on the drawings. All sprinkler heads on risers of 12 inches or more shall be secure in plumb position using a 30 inch angle iron stake and stainless steel clamps. All risers shall be painted; color to be determined by Landscape Architect.

## 2.5 AUTOMATIC-CONTROL SYSTEM

A. Refer to drawing's materials list.

1. Controller: Irrigation contractor shall furnish electric controller as indicated on the drawing. Controller shall be installed in the area shown on the drawing. Power from the electrical panel to the irrigation controller shall be furnished by others. All wiring from the irrigation controller to



the remote control valves shall be furnished and installed by the irrigation contractor in the same trench as the main line.

B. Wiring: UL 493, Type UF-B multi-conductor, with solid-copper conductors and insulated cable; suitable for direct burial.

1. Wire color code: Provide control or "hot" wires red in color. Provide common or "ground" wires white in color.

2. Splicing Materials: Manufacturer's packaged kit consisting of insulating, spring-type connector or crimped joint and epoxy resin moisture seal; suitable for direct burial.

### PART 3 - EXECUTION

#### 3.1 INSPECTION

A. Examine final grades and installation conditions. Do not start irrigation system work until unsatisfactory conditions are corrected.

#### 3.2 PREPARATION

A. Layout and stake the locations of each pipe run and all sprinkler heads and sprinkler valves. Obtain Owners Representative acceptance of layout prior to excavating.

B. Schedule 40 sleeves to be used under paved vehicular use areas shall be placed prior to compaction of paved areas. Coordinate all sleeve placement with general contractor.

C. Place sleeves as indicated for installation of piping and control wire.

#### 3.3 INSTALLATION

A. Excavating and backfilling:

1. All excavation shall be considered and unclassified excavation and include all materials encountered.

2. Excavate trenches of sufficient depth and width to permit proper handling of installation of pipe and fittings.

3. Excavate to depths required to provide 2" depth of earth fill or sand bedding for piping when rock or other unsuitable bearing materials in encountered.

4. Fill to match adjacent grade elevations with approved earth fill material. Place and compact fill in layers not greater than 8" depth.

a. Provide approved earth fill or sand to a point 4" above the top of the pipe.

- b. Fill to within 6" of final grade with approved excavated fill materials free of lumps or rocks larger than 3" in any dimension.
- c. Provide clean topsoil fill free of rocks and debris for top 6" of fill.
- 5. Except as indicated, install irrigation mains with a minimum cover of 18" based on finished grades. Install irrigation laterals with a minimum cover of 12" based on finished grades.
- 6. Excavate trenches and install piping and fill during the same working day. Do not leave open trenches or partially filled trenches open overnight.
- 7. Replace stripped sod in sufficient time to allow for satisfactory sod recovery and growth. Water stripped and reinstalled sod until irrigation system is placed in operation.

B. Plastic pipe:

- 1. Install plastic pipe in accordance with manufacturer's installation instructions. Provide for thermal expansion and contraction.
- 2. Saw cut plastic pipe. Use a square-in-sawing vice to ensure a square cut. Remove burrs and shavings at cut ends prior to installation.
- 3. Make plastic to plastic joints with solvent weld joints or slip seal joints. Use only sol-vent recommended by the pipe manufacturer. Install plastic pipe fittings in accordance with pipe manufacturer's instructions. Contractor shall make arrangements with pipe manufacturer for all necessary field assistance.
- 4. Make plastic to metal joints with plastic male adapters.
- 5. Make solvent weld joints in accordance with manufacturer's recommendations.
- 6. Allow joints to set at last 24 hours before pressure is applied to the system.

C. Sprinklers, fittings, valves and accessories:

- 1. Install fittings, valves, sprinkler heads, risers and accessories in accordance with manufacturer's instructions, except as otherwise indicated.
  - a. Provide concrete thrust blocks where required at fittings and valves.
- 2. Set sprinkler heads perpendicular to finished grades, except as otherwise indicated.
- 3. Obtain Landscape Architect's review and acceptance of height for proposed sprinkler heads and valves prior to installation.
- 4. Locate sprinkler heads to assure proper coverage of indicated areas. Do not exceed sprinkler head spacing distances indicated.
- 5. Install risers for spray heads in shrub or flower bed areas and planters of sufficient height to prevent interruption of the stream by the plan material.
  - a. Provide risers of 1/2" PVC pipe, threaded each end.
  - b. Paint exposed galvanized risers with 1 coat black paint.
  - c. Set risers in a row with top level and in-line.
- 6. Install pop-up gear driven sprinklers with flex-pipe connected to a barbed ell.
- 7. Install controller as detailed.
- 8. Install in-ground control valves in a valve access box as indicated.

9. Install valve access boxes on a suitable base of gravel to provide a level foundation at proper grade and to provide drainage of the access box.
10. Seal threaded connections on pressure side of control valves with teflon tape or approved plastic joint type compound.

D. Control wiring.

1. Install electric control cable in the piping trenches wherever possible. Place wire in trench adjacent to pipe. Install wire with slack to allow for thermal expansion and contraction. Expansion joints in wire may be provided at 200-foot intervals by making 5-6 turns of the wire around a piece of 1/2" pipe instead of slack. Where necessary to run wire in a separate trench, provide a minimum cover of 12".
2. Provide sufficient slack at site connections at remote control valves in control boxes and at all wire splices to allow raising the valve bonnet or splice to the surface without disconnecting the wires when repair is required.
3. Connect each remote control valve to one station of a controller except as otherwise indicated.
4. Connect remote valves to common ground wire system.
5. Make wire connections to remote control electric valves and splices of wire in the field, using wire connectors and sealing cement in accordance with manufacturer's recommendations.
6. Provide tight joints to prevent leakage of water and corrosion build-up of the joint.

E. Sleeves:

1. Provide new sleeves for all locations where existing sleeves are not indicated. Install new sleeves prior to paving installation wherever possible. Coordinate with general contractor.
2. Install pipe sleeves under existing concrete or asphalt surface by jacking, boring, or hydraulic driving of the sleeve. Remove and replace existing concrete and asphalt surfaces where cutting is necessary. Obtain Owner's permission before cutting existing concrete and asphalt surfaces. Where piping is shown under paved areas which are adjacent to turf areas, install the piping in the turf areas.

F. Flushing, testing and adjustment:

1. After sprinkler piping and risers are installed and before sprinkler heads are installed, open control valves and flush out the system with full head of water.
2. Perform system testing upon completion of each section. Make necessary repairs and retest repaired sections as required.
3. Adjust sprinklers after installation for proper and adequate distribution of the water over the coverage patten. Adjust for the proper arc of coverage.
4. Tighten nozzles on spray type sprinklers after installation. Adjust sprinkler adjusting screw on lateral line or circuit as required for proper radius. Interchange nozzles' pat-terns as directed by the Landscape Architect to give best arc of coverage.

5. Adjust all electric remote control valve flow control stems for system balance.
6. Test and demonstrate the controller by operating appropriate day, hour, and station selection features as required to automatically start and shut down irrigation cycles to accommodate plant requirements.

### 3.4 DISPOSAL OF WASTE MATERIALS

- A. Stockpile, haul from site, and legally dispose of waste materials, including unsuitable excavated materials, rock, trash, and debris.

### 3.5 ACCEPTANCE

- A. Test and demonstrate to the Landscape Architect and Owner the satisfactory operation of the system free of leaks. All main lines shall be hydrostatically tested at a pressure of 100 psi for a period of time not less than 3 hours. Should any leaks be found, it shall be repaired. The line shall then be retested until satisfactory.

- B. Instruct the Owner's designated personnel in the operation of the system, including adjustment of sprinklers, controller(s) and valves.

- C. Upon acceptance, the Owner will assume operation of the system.

### 3.6 GUARANTEES

- A. The irrigation contractor shall furnish warranties in writing certifying that the quality and workmanship of all materials and installation furnished is in accordance with these specifications and in accordance with the original manufacturers' warranties. Irrigation contractor shall further see to the fulfillment of all manufacturers' warranties. Irrigation contractor shall warrant the installation workmanship for a period of one (1) year from date of completion of acceptance of the job or any accepted portion of the job.

### 3.7 CLEANING

- A. Perform cleaning during installation of the work and upon completion of the work. Remove from site all excess materials, soil, debris, and equipment. Repair damage resulting from irrigation system installation.

END OF SECTION 32 84 00

END OF SECTION

**SECTION 32 92 00 – SODDING**

PART 1 – GENERAL

1.1 DESCRIPTION OF WORK

A. Provide sodded lawns as shown and specified. The work includes:

1. Soil preparation.
2. Sodding common areas, pavement edges, and other indicated areas.
3. Maintenance.

1.2 SUBMITTALS

A. Submit sod growers certification of grass species. Identify source location.

1.3 QUALITY ASSURANCE

A. Sod: Comply with American Sod Producers Association (ASPA) classes of sod materials.

B. Provide and pay for materials testing. Testing agency shall be acceptable to the Landscape Architect. Provide the following data:

1. Topsoil:
  - a. Ph factor.
  - b. Mechanical analysis.
  - c. Percentage of organic content.
  - d. Recommendations on type and quantity of additives required to establish satisfactory Ph factor and supply of nutrients to bring nutrients to satisfactory level for planting.

1.4 DELIVERY, STORAGE AND HANDLING

A. Cut, deliver and install sod within a 24-hour period.

1. Do not harvest or transport sod when moisture content may adversely affect sod survival.
2. Protect sod from sun, wind, and dehydration prior to installation.
3. Do not tear, stretch, or drop sod during handling and installation.

1.5 PROJECT CONDITIONS

A. Work notification: Notify Landscape Architect at least 7 working days prior to start of sodding operations.

B. Protect existing utilities, paving, and other facilities from damage caused by sodding operations.

C. Perform sodding work only after irrigation and other work affecting ground surface has been completed. The irrigation system will be installed, tested, and functional prior to sodding and sprigging. Locate, protect, and maintain the irrigation system during sodding and sprigging operations. Repair irrigation system components damaged during sodding operations at the Contractor's expense.

D. Provide hose and lawn watering equipment as required.

#### 1.6 WARRANTY

A. Provide a uniform stand of grass by watering, mowing and maintaining lawn areas until final acceptance. Re-sod areas which fail to provide a uniform stand of grass with specified materials, until all affected areas are accepted by the Landscape Architect.

### PART 2 - PRODUCTS

#### 2.1 MATERIALS

A. Sod: Argentine Bahia

B. Provide healthy, well-rooted, material, free of diseases, nematodes and soil borne insects. Provide sod uniform in color, leaf texture, density, and free of weeds, undesirable grasses, stones, roots, thatch, and extraneous material; viable and capable of growth and development when planted. 1. Furnish sod machine stripped and of Supplier's standard width, length, and thickness: Uniformly 1- 1/2" to 2" thick with clean cut edges. Mow sod before stripping.

C. Water: Free of substance harmful to sod growth. Hoses or other methods of transportation furnished by Contractor.

### PART 3 - EXECUTION

#### 3.1 INSPECTION

A. Examine finish surfaces, grades, topsoil quality and depth. Do not start sodding work until unsatisfactory conditions are corrected.

#### 3.2 PREPARATION

A. Limit preparation to areas that will be immediately sodded.

B. Loosen topsoil of lawn areas to minimum depth of 2". Remove stones over 1" in any dimension and sticks, roots, rubbish, and extraneous matter.

C. Grade lawn areas to smooth, free draining and even surface with a loose, uniformly fine texture. Roll and rake; remove ridges and fill depressions as required to drain. Grade immediately before sodding. Verify grading follows engineering plans. Contractor will be responsible for regarding if sod are not placed in a timely manner and wash out or other erosion causes grades to deviate from engineering plans.

D. Dampen dry soil prior to sodding.

E. Restore prepared areas to specified condition if eroded, settled, or otherwise disturbed after fine grading and prior to sodding.

### 3.3 INSTALLATION

#### A. Sodding:

1. Lay sod to form a solid mass with tightly-fitted joints. Butt ends and sides of sod strips. Do not overlay edges. Stagger strips to offset joints in adjacent courses. Remove excess sod to avoid smothering of adjacent grass. Provide sod pad top flush with adjacent curbs, sidewalks, and drains.

2. Do not lay dormant sod or install sod on saturated soil.

3. Water sod thoroughly with a fine spray immediately after laying.

4. Roll a minimum of four (4) times with a medium weight roller to ensure contact with sub grade.

B. Sod indicated areas within contract limits and areas adjoining contract limits disturbed as a result of construction operations.

### 3.4 MAINTENANCE

A. Maintain sodded lawn areas, including watering, spot weeding, mowing, application of herbicides, fungicides, insecticides and resodding until a full, uniform stand of grass free of weed, undesirable grass species, disease, and insects is achieved and accepted by the Landscape Architect.

1. Water sod thoroughly every day, as required to establish proper rooting. 2. Repair, rework, and resod all areas that have washed out or are eroded. Replace undesirable or dead areas with new sod.

3. Mow lawn areas as soon as lawn top growth reaches a 3" height. Cut back to 2" height. Not more than 40% of grass leaf shall be removed at any single mowing.

### 3.5 ACCEPTANCE

A. Inspection to determine acceptance of sodded lawns will be made by Landscape Architect, upon Contractor's request. Provide notification at least 7 working days before required inspection date.

1. Sodded areas will be acceptable provided all requirements, including maintenance, have been complied with, and a healthy, even-colored viable lawn is established, free of weeds, undesirable grass species, disease and insects.

B. Upon acceptance, the Owner will assume responsibility for lawn maintenance.

C. If not accepted at the time of the inspection, the Contractor will be required to prepare a maintenance schedule for all grassed areas for the City. The City may require this maintenance schedule if construction is delayed or for any reason the City deems necessary to ensure that the grass is well maintained.

### 3.6 CLEANING

A. Perform cleaning during installation of the work and upon completion of the work. Remove from site all excess materials, debris and equipment. Repair damage resulting from sodding operations.

END OF SECTION 32 92 00

END OF SECTION



**SECTION – TURF AND GRASSES (BERMUDA)**

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 DESCRIPTION OF WORK

A. This section includes the furnishing and installation of grassing materials at areas indicated on the drawings.

B. Soil preparation.

C. Soil placement and fine grading.

D. Soil testing.

E. Soil amendments as recommended by soil test results.

F. Soil treatment with pre-emergent and post-emergent herbicides.

G. Maintenance/grow-in program to include the furnishing and installation of fertilization, herbicides and insecticides and all necessary maintenance including mowing and hand weeding. Re-application of grassing materials as necessary to insure a healthy, dense, weed-free stand of grass.

H. Coordination with irrigation system installation/adjustment as shown on plans and as specified in SECTION 32 84 00 – PLANTING IRRIGATION for purposes of continued watering for turf establishment and adjustment of heads in relation to turf height to prevent head damage during mowing operations.

1.3 QUALITY ASSURANCE

A. Comply with regulations of all governing agencies when applying herbicides and pesticides. Applications shall follow manufacturer instructions.

B. Grassing shall be performed by a turf specialist knowledgeable with climate conditions and planting requirements of the geographical area and whose work has resulted in successful lawn

establishment. Installer shall maintain an experienced full-time supervisor on the project site when grassing operations are in progress.

C. Installation equipment shall be properly maintained, professional grade, and employed so as no damage to turf or field occurs.

D. A.S.P.A. (American Sod Producers Association) – Guideline Specifications to Sodding.

E. Athletic Fields: Design, Construction and Maintenance by the University of Florida – Institute of Food and Agricultural Sciences (IFAS) – Bulletin #202. 2009 Pest Control Guide for Turfgrass Managers by the University of Florida/IFAS.

F. Rootzone Construction: Standard Guide for Construction of High Performance Sand-Based Rootzones for Athletic Fields ASTM Designation: F2396-11.

G. Root zone coarse sand report: Submit analysis report for the mix specified in PART 2– MATERIALS.

1. Before delivery of root zone coarse sand (USGA Construction Sand), furnish a soil analysis produced by a licensed qualified soil testing laboratory confirming compliance with the specified horticultural requirements. This soil analysis shall include percentages of organic matter (including, but not limited to, silt, clay and organic content) and present levels of phosphorous, potassium and acidity (pH).

2. The analysis shall also include the infiltration rate performance in inches per hour. A range of 10 to 20 inches per hour is required.

3. Provide a complete laboratory analysis of the fill placed beneath the root zone coarse sand prior to the delivery of the sand to the site. That analysis shall include particle size, ph, and percentages of sand, silt, clay and organic matter. Deliver the analysis to the Owner's Representative, project engineer and the project landscape architect.

H. All sod specified herein shall be certified **Tiffway 419 Bermuda** grass. Provide sod source including name and telephone number of sod farm.

#### 1.4 DELIVERY, STORAGE; & HANDLING

A. Deliver, store, protect and handle products to site under provisions of Division 1.

B. Do not deliver more grassing materials than can be installed within 24 hours of delivery.

C. Store all chemicals off-site. Keep all pesticides, herbicides and fertilizers in a secure area when in use on-site and keep away from public.

#### 1.5 COORDINATION

A. Coordinate work under provisions of Division 01.

B. Coordinate installation of underground sprinkler system, piping and heads.

C. Utilities: Determine location of underground utilities and perform work in a manner which will avoid possible damage. Hand excavate, as required.

#### 1.6 JOB CONDITIONS

A. Planting time: Best to install sod during the active growing season.

B. When work on the project has progressed sufficiently to commence root zone placement and planting, then the planting operations shall be conducted only under favorable weather conditions which are normal for such work as determined by accepted sports field sodding practices.

#### 1.7 WARRANTY

A. Provide a **90** day warranty from the date of final completion and acceptance. After a period of **ninety** days a warranty inspection will be performed by a certified agronomist at the expense of the contractor. The warranty inspection will be performed to determine the health of the turf including the presence of any noxious weed growth, insect infestations and contamination by other grass species, overall color of the turf and general health.

B. If during the warranty and replacement period any of the turf is found to be damaged or destroyed due to vandalism, poor maintain practices, over-use, malicious mischief and/or vehicle rutting, then the responsibility of replacing those grass areas is not that of the Contractor.

#### 1.8 DEFINITIONS:

A. Weeds: Includes Torpedograss, Bahiagrass, St. Augustine, Nut Sedge, Dandelion, Goosegrass, Dollar Weed, Quackgrass, Dogfennel, Horsetweed or Maretail, Morning Glory, Rushes, Common Bermuda, and any other weed or grass noted in "Weeds of Southern Turfgrasses", as published by the University of Florida Cooperative Extension Service, Institute of Food and Agricultural Sciences.

B. Submit manufacturer data on herbicides, pesticides and fertilizers.

C. Submit maintenance/operation instructions for continuing Owner maintenance. Include seasonal cutting instructions and height, watering rates, soil amendment, fertilization, herbicide and insecticide application rates and frequencies.

1.9 SUBMITTALS

A. Submit soils analysis results for review by the Owner, architect and landscape architect for the imported soil placed beneath the root zone growing medium to assure adequacy of percolation. Provide 1 soil analysis of the soil beneath the root zone growing medium for each 1000 cubic yards placed. Provide soil analysis for the root zone growing medium at the rate of 1 test per 500 cubic yards placed. Recommend corrective measures (i.e. soil amendments, fertilizers, dolomitic lime, etc.) to eliminate deficiencies. Re-submit soil test results after corrective action to verify that soil amendments and fertilizers have brought soil fertility and pH to an acceptable level.

PART 2 - PRODUCTS

2.1 ROOT ZONE GROWING MEDIUM

A. Provide an 8” deep growing medium comprised of a finished organic content of 1% (+10%) by weight based upon ASTM F1647 testing methods, blended with root zone coarse sand, which shall be non- calcareous, clean and processed meeting the following criteria:

Size	Sieve MESH	Diameter of Sieve (mm)	Allowable Range Percent Retained
Gravel	10	2.00	Less than, equal to 3%
Very Coarse	18	1.00	Less than, equal to 7%
Coarse	35	0.50	At least 60% particles combined in the Coarse and Medium range
Medium	<b>60</b>	<b>0.25</b>	
Fine	<b>100</b>	<b>0.15</b>	20% maximum
Very Fine	<b>270</b>	<b>0.05</b>	5% maximum
Silt		<b>0.002</b>	5% maximum
Clay		Less than 0.002	3% maximum

No more than 10% including 3% fine gravel combined for sieve meshes 10 and 18. Combined fractions no more than 10% for materials less than or equal to 0.05 in size.

B. The root zone sand shall be free of any and all toxic substances, grass, roots, weeds, stones, weed seeds and insects.

C. The final ph shall be between 6.0 and **7.0**

## 2.2 IMPORTED AND/OR EXCAVATED ON-SITE SOIL PLACED FOR FILL BENEATH ROOT ZONE GROWING MEDIUM

A. Provide soil analyses (at the amount described in 1.9.A, above) to include particle size, pH, percentages of sand, silt, clay and organic matter and infiltration rate which must exceed 6 inches per hour. Deliver the analysis to the Owner, architect and landscape architect. A minimum of 12” of any fill placed beneath the root zone growing medium shall meet the infiltration requirement. Additionally, test for sting, lance, stubby-knot and root-knot nematodes. Treat for nematode infestation if population counts are high enough to potentially damage new turf and /or warrant treatment based upon recommendations noted in the 2009 Pest Control Guide for Turfgrass Managers published by the University of Florida/IFAS.

## 2.3 FERTILIZER:

A. Fertilization is specified in Section 3.1.B

## 2.4 HERBICIDES/INSECTICIDES/PESTICIDES/SOIL FUMIGANTS:

A. “Roundup” (Glyphosate) post-emergent herbicide, to kill emergent weeds prior to placement of root zone mix and as otherwise required.

B. Delay the use of post emergent herbicides as long as possible, and for at least the first four weeks, to allow the turf to become established. “Monument” may be used for nutsedge control.

C. “Ronstar” pre-emergent herbicide.

D. Pesticides: Sod Webworms, Mole Crickets – “Orthene”. Fire Ants:“Amdro”.

E. Fumigant chemicals shall be as directed by the certified agronomist.

## 2.5 SOD

A. Sod shall be **Tiffway 419 Bermuda** grass. All sod shall be “Blue Tag” certified turf grass from a certified **Bermuda Tifway 419** sod grower. Any and all replacement sod required for repairs shall be from the same grower to maintain consistent color, texture and density.

1. Sod shall be strongly rooted Tiffway 419 Bermuda sod, true-to-type, high quality grass which has been propagated in a controlled cultural environment, grown on fumigated farms not less than two years old, free of noxious weeds and undesirable native grasses. Provide only sod capable of vigorous growth and development when planted (not dormant).
2. Thickness of Cut: Turfgrass sod shall be machine cut at a uniform soil thickness of 0.60 inch (15 mm), plus or minus 0.25 inch (6 mm), at the time of cutting. Measurement for thickness shall exclude top growth and thatch.
3. Moisture Content: Turfgrass sod shall not be harvested or transplanted when its moisture content (excessively dry or wet) may adversely affect its survival.
4. Mowing Height: Before harvesting, the grass shall be mowed uniformly at a height of 1.25 to 1.50 inches (20 to 40 mm).
5. Time Limitations: Sod shall be harvested, delivered and installed/transplanted within a period of 24 hours, unless a suitable preservation method is approved by owner prior to delivery. Sod not transplanted within this period shall be inspected and approved by the inspecting officer or his representative prior to its installation.

### PART 3 - EXECUTION

#### **3.1 GRADING AND DRAINAGE**

- A. Contour the sub-grade in accordance with specifications at the same grade indicated on the finished field per the plans. The subgrade should be installed at a depth such to accommodate the final profile depth of rootzone. The subgrade should be compacted to 92% (modified proctor testing method) to prevent future settling. Subgrade should be designed to conform to surface contour of finished playing surface.
- B. Laser grade the subgrade prior to placement of the 8" root zone mix.
- C. Upon placement of the root zone mix to the grades indicated, saturate the field through the use of continuous irrigation system operation.

#### **3.2 PREPLANTING**

- A. Placement: place 8" of root zone coarse sand to achieve final elevations indicated on engineer's grading plans.

**B. Fumigate/sterilize soil after root zone placement but before final grading. Apply fumigant per label instructions in order to meet objective noted above. Allow sufficient time after soil fumigation before commencing sodding operations so turf is not damaged.**

C. Provide grades to the elevations indicated on the engineer's plan. Compact to 92% of the maximum dry unit weight according to ASTM D1557.

D. Final Grading: Remove all construction debris, vegetation, roots, rocks, weeds, depressions, undulations and irregularities. Smooth the surface with a trap rake machine with drag. Apply a pre-emergent herbicide/fertilizer (15-0-15) application (Ronstar .67% Oxadiazon), per manufacturer's instructions at the rate of 300 lbs. /acre, just prior to grassing installation.

### 3.3 SOD PLANTING & GROW IN MAINTENANCE

**A. No turfgrass sod shall be placed on soil which has been chemically treated until sufficient time has elapsed to permit dissipation of all toxic materials. Contractor shall assume full responsibility for any loss or damage to turfgrass sod arising from improper use of chemicals or due to his failure to allow sufficient time to permit dissipation of toxic residues, whether or not such materials are specified herein.**

**B. No heavy machinery such as tractors, hydrospray tanks, or trucks should be allowed on the surface, unless equipped with turf-type tires.**

C. Sodding: Sod to be installed in 48" rolls. Sod must be planted within 24 hours of harvesting. Lay sod in straight lines butted tightly together without stretching.

**D. Starter Strip: The first row of turfgrass sod shall be laid in a straight line, with subsequent rows placed parallel to and tightly against each other. Lateral joints shall be staggered to promote more uniform growth and strength. Care shall be exercised to insure that the pieces are not stretched or overlapped and that all joints are butted tightly to prevent voids that would cause air drying of the roots.**

**E. Swales and Intermittent Waterways: The installation of turfgrass sod within drainways or intermittent waterways shall be determined after considering maximum channel velocities for storms of a designated intensity. Large-roll pieces shall be laid in the direction of the flow, with temporary securing being at the discretion of the installation contractor.**

**F. As sodding is completed in any one section, the entire area shall be lightly rolled. It shall then be thoroughly watered to a depth sufficient to ensure the underside of the new sod pad and soil immediately below the pad are thoroughly wet. The general contractor shall be responsible for having adequate water available at the site prior to and during installation.**

**G. Hand Topdressing:** After the field has dried, hand topdress any cracks between sod caused by shrinkage. Allow four weeks for rooting prior to using the field for traffic and/or play.

H. Fertilization: After planting, new turf grass shall be fertilized as required. The nitrogen source during grow-in will be mostly water soluble (21-0-0 and 15-0-15). Potassium and nitrogen shall be added in a balanced ratio (15-0-15), alternating every seven days with 21- 0-0. Apply four weekly applications of fertilizer (two 15-0-15 and two 21-0-0 at the rate .50 lbs. nitrogen/potassium/1,000 sq. ft.) for the first 30 days of grow-in. Micro nutrient sprays of iron, magnesium and manganese shall be applied to aid in turf establishment. Supplemental liquid potassium and iron (such as 0-0-28, plus iron) shall be applied every two weeks in conjunction with an insecticide application, if insects are active. Any and all granular fertilizations shall be watered-in immediately to avoid foliar turf grass burn.

I. Mowing: Use reel mowers with sharp blades. The first mowing shall not be attempted until the turfgrass sod is firmly rooted and securely in place. Provide first mowing when Bermuda grass reaches one inch height, just after the field has been rolled with a 2.5 ton double steel drum, then reduce the height over time until the turf grass becomes established at  $\frac{3}{4}$ " height. Continue to mow as long as grass clipping are observed (generally 2-3 times/week). Do not mow when the turf grass is extremely wet to avoid tire rutting.

J. Weed control: Use of post-emergent herbicides for control of grassy weeds should be discouraged and avoided the first four weeks. Certified "Blue Tag" sod is guaranteed to be weed and insect free, therefore post-emergents should not be needed. Use "Monument" to control nutsedgegrass after the initial four week grow-in period. Delay herbicide applications as long as possible to allow the turf grass to become well established. Hand pulling of weeds shall be conducted if only a few weeds are present however, if many weeds emerge, the use of selective post-emergent herbicides maybe required. For the first 2-3 weeks care not to operate any heavy equipment on the newly installed sod for fear of tire rutting the field. Turf tired tractors can be used, but not on saturated soils. Apply fertilizers and pesticides on dryer fields, if at all possible initially.

K. Maintenance Rolling: Sodded areas shall be rolled throughout the grow-in period to push roots into the soil, to settle or "firm" the root zone and to smooth the surface to prevent mower scalping. Weekly rolling should be performed until the eventual permanent mowing height is achieved.

L. **Field Topdressing:** The fields should be broadcast sand topdressed using USGA construction sand, the last week of the grow-in period in order to achieve consistent coverage of exposed soil surface.



M. **Pest Control:** The fields shall be kept insect free (sod web worms, fire ants and mole crickets)during the grow-in period.

N. Clean-up: All excess soil, grass materials, stones, and other waste shall be removed from the site daily and not allowed to accumulate. Paved areas must be kept clean at all times.

O. Grow-in maintenance: The Contractor shall provide grow-in maintenance of turf to extend for 30 days after placement of all turf and playing fields or until Certificate of Occupancy has been issued, whichever is longer. Maintenance shall begin immediately upon placement of the sod and shall continue until final acceptance inspection of entire project is held. Maintenance shall include watering, fertilizer applications mowing, pesticide applications, rolling,topdressing, replanting, and all other work necessary to produce a uniform, pest-free, weed-free and healthy turf playing field.

**P. Watering: The general contractor shall supply adequate water to the site. The single most important factor in the successful rooting of newly installed turfgrass sod is adequate, regular watering. Watering should begin immediately after installation. The amount of water required will vary depending upon season, weather, temperature, wind, slope and turfgrass variety. The general contractor shall designate the party responsible to ensure adequate water supply and application.**

**1. First Week: The contractor shall provide all labor and arrange for all watering necessary for rooting of the turfgrass sod. Soil on sod pads shall be kept moist at all times. In the absence of adequate rainfall, watering shall be performed daily or as often as necessary during the first week and in sufficient quantities to maintain moist soil to a depth of at least 4 inches (100 mm). Watering should be done during the heat of the day to prevent wilting. No watering shall take place at night. The contractor shall have the irrigation water tested to assure it's acceptability for use on Bermuda sod.**

**2. Second and Subsequent Weeks: The contractor shall water the turfgrass sod as required to maintain adequate moisture in the upper 4 inches (100 mm) of soil, necessary for the promotion of deep root growth.**

### 3.4 GUARANTEE AND REPLACEMENT

A. Replacement of sod necessary during the **grow-in** maintenance period shall be the responsibility of the Contractor.

**B. The General Contract warrantee period shall also include field grading and/or settlement, sod viability, and all other aspects of installation.**

### 3.5 FINISHING:

A. During grassing work, keep pavements clean and work area in an orderly condition at all times.

### 3.6 INSPECTION AND REVIEW:

A. When grass work is completed the Owner's Representative will, upon request, make an inspection to determine acceptability to commence 30 day grow-in/guarantee period.

B. When inspected sodding work does not comply with coverage, weed-free or insect-free requirements, replace rejected work and continue specified maintenance until re-inspected by the Owner's Representative and found to be acceptable. Remove rejected grassing materials promptly from project site.

### 3.7 REQUEST FOR FINAL ACCEPTANCE

A. At the end of a minimum 30 day grow-in period the Contractor shall submit to the Owner a written request for acceptance of the field turf. The request shall be submitted at least ten days prior to the anticipated date of acceptance. **WHEN INSPECTED GRASSING WORK DOES NOT COMPLY WITH COVERAGE OR WEED REQUIREMENTS, REPLACE REJECTED WORK AND CONTINUE SPECIFIED MAINTENANCE UNTIL REINSPECTED BY THE ARCHITECT AND FOUND TO BE ACCEPTABLE. REMOVE REJECTED PLANTS AND GRASSING MATERIALS PROMPTLY FROM PROJECT SITE.**

**B. If Acceptance is denied, the contractor shall utilize all methods necessary to achieve Acceptance.**

### 3.8 PROTECTION:

A. Protect grassing work and materials from damage due to grassing operations, operations by other Contractors and trades and trespassers. Maintain protection during installation and maintenance periods. Protect sodded areas against damage from erosion as required. Treat, repair or replace damaged grass work as directed. Replace/repair turf areas damaged by improper use of fertilizers, herbicides, insecticides, fungicides, nematicides or other chemicals.

B. When applying herbicides, insecticides, fungicides or pesticides/nematicides coordinate use with university personnel. Post signs when chemicals are in-use or when areas are to be off limits to students or university personnel. Contractor shall assume responsibility for protecting public when chemicals are present or in use on project site.

END OF SECTION 32 92 01

**SECTION 32 93 00 – LANDSCAPING**

PART 1 – GENERAL

1.1 DESCRIPTION OF WORK

A. This Section includes the following:

1. Soil Preparation
2. Trees, plants, and ground covers.
3. Planting mixes.
4. Mulch and planting accessories.
5. Maintenance.

1.2 DEFINITIONS

A. Balled and Burlapped Stock: Exterior plants dug with firm, natural balls of earth in which they are grown, with ball size not less than sizes indicated; wrapped, tied, rigidly supported, and drum-laced as recommended by ANSI Z60.1.

B. Container-Grown Stock: Healthy, vigorous, well-rooted exterior plants grown in a container with well-established root system reaching sides of container and maintaining a firm ball when removed from container. Container shall be rigid enough to hold ball shape and protect root mass during shipping and be sized according to ANSI Z60.1 for kind, type, and size of exterior plant required.

C. Finish Grade: Elevation of finished surface of planting soil.

D. Planting Soil: Native soil.

E. Subgrade: Surface or elevation of subsoil remaining after completing excavation, or top surface of a fill or backfill, before placing planting soil.

1.3 SUBMITTALS

A. Submit the following material samples:

1. Mulch
2. Planting accessories.

B. Submit certifications for the following materials:

1. Topsoil source and PH value.
2. Fertilizer

C. Material Test Reports: For existing surface soil and imported topsoil.

D. Record Drawings: Contractor responsible for providing the Owner with as-built landscape plan drawings. Legibly mark drawings to record actual construction. Indicate actual planting locations and identify any field changes to size or quantity of material.

#### 1.4 QUALITY ASSURANCE

A. Installer Qualifications: A qualified landscape installer whose work has resulted in successful establishment of exterior plants.

1. Installer's Field Supervision: Require Installer to maintain an experienced full-time supervisor on project site when landscape installation is in progress.

B. Soil-Testing Laboratory Qualifications: An independent laboratory, recognized by the State Department of Agriculture, with the experience and capability to conduct the testing indicated and that specializes in types of tests to be performed.

C. Provide quality, size, genus, species, and variety of plants indicated, complying with applicable requirements in ANSI Z60.1, "American Standard for Nursery Stock."

D. Plant names indicated comply with "Standardized Plant Names" as adopted by the latest edition of the American Joint Committee of Horticultural Nomenclature. Names of varieties not listed conform generally with names accepted by the nursery trade. Provide stock true to botanical name and legibly tagged.

E. Plant material shall be graded Florida No. 1 or better as outlined under Grades and Standards for Nursery Plans, State Plant Board of Florida.

F. All plants shall be nursery grown under climatic conditions similar to those in the locality of the project for a minimum of two years.

G. Tree and Shrub Measurements: Measure according to ANSI Z60.1 with branches and trunks or canes in their normal position. Do not prune to obtain required sizes. Take caliper measurements 4 ½ ft. above grade for all trees. Measure main body of tree or shrub for height and spread; do not measure branches or roots tip-to-tip. Stock furnished shall be at least the minimum size indicated. Larger stock is acceptable, at no additional cost, and providing that the large plants will not be cut back to size indicated.

## PART 2 – PRODUCTS

### 2.1 PLANT MATERIAL

A. General: Furnish nursery-grown trees, shrubs and ground cover complying with Florida "Grades and Standards for Nursery Plants", with healthy root systems developed by transplanting or root pruning. Provide well-shaped, fully branched, healthy, vigorous stock free of disease, insects, eggs, larvae, and defects such as knots, sunscald, injuries, abrasions, and disfigurement.

B. Grade: Provide trees, shrubs and ground covers of sizes and grades complying with Florida "Grades and Standards for Nursery Plants" for type of trees, shrubs and ground cover required. Trees, shrubs and ground cover of a larger size may be used if acceptable to Landscape Architect, with a proportionate increase in size of roots or balls.

C. Dig balled and burlapped plants with firm, natural balls of earth of sufficient diameter and depth to encompass the fibrous and feeding root system necessary for full recovery of the plant. Provide ball sizes complying with the latest edition of the "American Standards for Nursery Stock." Cracked or mushroomed balls are not acceptable. Synthetic burlap is not acceptable.

D. Container-grown stock: Grown in a container for sufficient length of time for the root system to have developed to hold its soil together, firm and whole.

1. No plants shall be loose in the container.
2. Container stock shall not be pot bound

E. Provide tree species that at heights (when mature) over 25'-0" with a single main trunk. Trees that have the main trunk forming a "Y" shape are not acceptable

F. Plants planted in rows shall be matched in form.

G. The height of the trees, measured from the crown of the roots to the top of the top branch, shall not be less than the minimum size designated in the plant list.

H. No pruning wounds shall be present with a diameter of more than 1" and such wounds must show vigorous bark on all edges.

I. Shrubs and ground covers shall meet the requirements for spread and height indicated in the plant list.

1. The measurements for height shall be taken from the ground level to the average height of the top of the plant and not the longest branch.
2. Single stemmed or thin plants will not be accepted.
3. Side branches shall be generous, well twigged, and the plant as a whole well bushed to the ground.
4. Plants shall be in a moist, vigorous condition, free from dead wood, bruises or other root or branch injuries.

## 2.2 FERTILIZER

A. Commercial Fertilizer: Commercial-grade complete fertilizer of neutral character, consisting of fast and slow-release nitrogen, 50 percent derived from natural organic sources of urea formaldehyde, phosphorous, and potassium in the following composition:

1. Composition: 12 percent nitrogen, 10 percent phosphorous, and 12 percent pot ash, by weight.  $\frac{1}{4}$  of nitrogen in the form of nitrates,  $\frac{1}{4}$  in the form of ammonia salt and  $\frac{1}{2}$  in the form of organic nitrogen.

## 2.3 MULCHES

A. Organic Mulch: Free from deleterious materials and suitable as a top dressing of trees and shrubs, consisting of one of the following:

1. Type: Premium grade 'Mini Nugget' Pine Bark.

## 2.4 STAKES AND GUYS

A. Stakes for Staking: Rough-sawn, sound, new hardwood, redwood, or pressure-preservative-treated softwood, free of knots, holes, cross grain, and other defects. See construction drawings for sizes.

B. Stakes for Guying: Hardwood. See construction drawings for sizes.

C. Guy/ Staking Wire: No. 10 or 12 gauge galvanized wire.

D. Turnbuckles: Galvanized steel of size and gauge required to provide tensile strength equal to that of the wire. Turnbuckle openings shall be at least 3".

E. Staking and Guying Hose: Two-ply, reinforced garden hose not less than 1/2" inside diameter.

F. Flags: Standard surveyor's plastic flagging tape, white, 6 inches (150 mm) long.

## PART 3 – EXECUTION

### 3.1 EXAMINATION

A. Examine areas to receive landscaping for compliance with requirements and conditions affecting installation and performance. Proceed with installation only after unsatisfactory conditions have been corrected.

### 3.2 PREPARATION

A. Protect structures, utilities, sidewalks, pavements, and other facilities, and lawns and existing exterior plants from damage caused by planting operations.

B. Provide erosion-control measures to prevent erosion or displacement of soils and discharge of soil bearing water runoff or airborne dust to adjacent properties and walkways.

C. Planting shall be performed only by experienced workmen familiar with planting procedures under the supervision of a qualified supervisor.

D. Locate plants as indicated or as approved in the filed by Landscape Architect after staking by the Contractor. If obstructions are encountered that are not shown on the drawings, do not proceed with planting operations until alternate plant locations have been selected. Make minor adjustments as required.

### 3.3 INSTALLATION

A. Planting Pits: Excavate circular plant pits with vertical sides, except for plants specifically indicated to be planted in beds. Depth of pit shall accommodate the root system. Excavate circular pits with sides sloped inward. Trim base leaving center area raised slightly to support root ball and assist in drainage. Do not further disturb base. Scarify sides of plant pit smeared or smoothed during excavation. Scarify the bottom of the pit to a depth of 4".

1. Excavate approximately three times as wide as ball diameter for balled and burlapped, container-grown or fabric bag-grown stock.
2. Excavate at least 12 inches wider than root spread and deep enough to accommodate vertical roots for bare-root stock.

B. Backfill all planting pits with excavated material only.

C. Obstructions: Notify Landscape Architect if unexpected rock or obstructions detrimental to trees or shrubs are encountered in excavations.

1. Hardpan Layer: Drill 6-inch diameter holes into free-draining strata or to a depth of 10 feet whichever is less, and backfill with free-draining material if hardpan layer is detected.

D. Drainage: Notify Architect if subsoil conditions evidence unexpected water seepage or retention in tree or shrub pits.

E. Set plant material in the planting pit to proper grade and alignment. Set plants upright, plumb, and faced to give the best appearance or relationship to each other or adjacent structure. Set plant material 2" above the finish grade. No filling will be permitted around trunks or stems. Backfill the pit with planting mixture. Do not use frozen or muddy mixtures for backfilling.

1. Space ground cover plants in accordance with indicated dimensions. Adjust spacing as necessary to evenly fill planting bed with indicated quantity of plants. Plant to within 12" of the trunks of trees and shrubs within planting bed and to within 6" of edge of bed.
2. Do not use ball and burlap planting stock if root ball is cracked or broken before or during planting operation.
3. Place planting backfill around root ball in layers, tamping to settle mix and eliminate voids and air pockets. After balled and burlapped plants are set, muddle planting backfill around bases of balls and fill all voids.
4. When pit is approximately one-half backfilled, water thoroughly before placing remainder of backfill. Repeat watering until no more water is absorbed. Water again after placing and tamping final layer of backfill soil.

F. Mulching: Apply 3-inch average thickness of organic mulch extending 12 inches beyond edge of planting pit or trench. Mulch shrub and groundcover areas immediately after planting. Do not place mulch within 3 inches of trunks or stems. Thoroughly water mulched areas. After watering, rake mulch to provide a uniform finished surface.

### 3.4 GUYING AND STAKING

A. Stake/guy all trees immediately after sodding/ sprigging operations and prior to acceptance. When high winds or other conditions that may affect tree survival or appearance occur, the Landscape Architect may require immediate staking/guying.

B. Stake trees under 3" caliper.

C. Guy trees over 3" caliper.

D. All work shall be acceptable to the Landscape Architect.

### 3.5 MAINTENANCE

A. During exterior planting, keep adjacent paving and construction clean and work area in an orderly condition.

B. Protect exterior plants from damage due to landscape operations, operations by other contractors and trades, and others. Maintain protection during installation and maintenance periods. Treat, repair, or replace damaged exterior planting.

C. Maintain plantings until completion and acceptance of the entire project.

D. Maintenance shall include pruning, cultivating, weeding, watering, mowing sod, and application of appropriate insecticides and fungicides necessary to maintain plants free of insects and disease.

1. Re-set settled plants to proper grade and position. Restore planting saucer and adjacent material and remove dead material.

2. Tighten and repair guy wires and stakes as required.

3. Correct defective work as soon as possible after deficiencies become apparent and weather and season permit

### 3.6 CLEANING

A. Perform cleaning during installation of the work and upon completion of the work. Remove from site all excess materials, soil, debris, and equipment, and legally dispose of them off Owner's property. Repair damage resulting from planting operations.

### 3.7 ACCEPTANCE

A. Inspection to determine acceptance of planted areas will be made by the Landscape Architect, upon Contractor's request. Provide notification at least 10 working days before requested inspection date.

1. Planted areas will be accepted provided all requirements, including maintenance, have been compiled with and plant materials are alive in a healthy and vigorous condition.



NEW SOCCER FIELDS AT BARBER PARK  
ORANGE COUNTY, FLORIDA

SECTION 32 90 00  
LANDSCAPING

B. Upon acceptance, the Owner will assume responsibility for plant maintenance.

END OF SECTION 32 93 00

# APPENDIX A

for

NEW SOCCER FIELDS AT BARBER PARK  
ORANGE COUNTY, FLORIDA

## **Sports Lighting Information**

Musco Lighting is the Basis of Design

MUSCO Lighting is the standard for County Parks and cannot be substituted

# Barber Park Soccer

Orlando, FL

## Lighting System

Pole / Fixture Summary						
Pole ID	Pole Height	Mtg Height	Fixture Qty	Luminaire Type	Load	Group
S1-S2	70'	70'	7	TLC-LED-1150	8.05 kW	A
S3	90'	90'	7	TLC-LED-1150	8.05 kW	A
		90'	7	TLC-LED-1150	8.05 kW	B
S4	90'	90'	7	TLC-LED-1150	8.05 kW	B
		90'	7	TLC-LED-1150	8.05 kW	A
S5	90'	90'	7	TLC-LED-1150	8.05 kW	C
		90'	7	TLC-LED-1150	8.05 kW	B
S6	90'	90'	7	TLC-LED-1150	8.05 kW	B
		90'	7	TLC-LED-1150	8.05 kW	C
S7-S8	70'	70'	7	TLC-LED-1150	8.05 kW	C
<b>8</b>			<b>84</b>		<b>96.60 kW</b>	

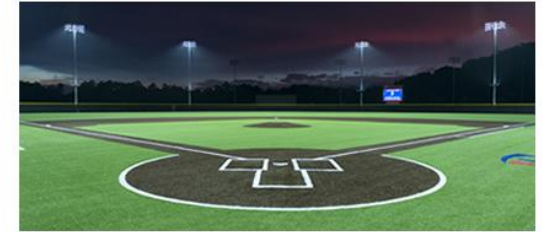
Group Summary					
Group	Description	Avg Load	Max Load	Fixture Qty	
A	Soccer 1	32.2 kW	32.2 kW	28	
B	Soccer 2	32.2 kW	32.2 kW	28	
C	Soccer 3	32.2 kW	32.2 kW	28	

Fixture Type Summary								
Type	Source	Wattage	Lumens	L90	L80	L70	Quantity	
TLC-LED-1150	LED 5700K - 75 CRI	1150W	121,000	>51,000	>51,000	>51,000	84	

## Light Level Summary

Calculation Grid Summary							
Grid Name	Calculation Metric	Illumination				Groups	Fixture Qty
		Ave	Min	Max	Max/Min		
Opposite Street Spill	Horizontal	0	0	0	0.00	A,B,C	84
Opposite Street Spill	Max Candela (by Fixture)	36.6	0	136	0.00	A,B,C	84
Opposite Street Spill	Max Vertical Illuminance Metric	0	0	0	0.00	A,B,C	84
Property Line	Horizontal	0.35	0	2.06	0.00	A,B,C	84
Property Line	Max Candela (by Fixture)	2520	0	7655	0.00	A,B,C	84
Property Line	Max Vertical Illuminance Metric	0.40	0	2.22	0.00	A,B,C	84
Soccer-1	Horizontal Illuminance	31.4	22	45	2.07	A	28
Soccer-2	Horizontal Illuminance	31.4	22	42	1.96	B	28
Soccer-3	Horizontal Illuminance	31.6	21	44	2.13	C	28

## From Hometown to Professional



**We Make It Happen.**

Not to be reproduced in whole or part without the written consent of Musco Sports Lighting, LLC. ©1981, 2017 Musco Sports Lighting, LLC.

# Barber Park Soccer

Orlando, FL

## EQUIPMENT LAYOUT

**INCLUDES:**  
 · Soccer-1  
 · Soccer-2  
 · Soccer-3

**Electrical System Requirements:** Refer to Amperage Draw Chart and/or the "Musco Control System Summary" for electrical sizing.

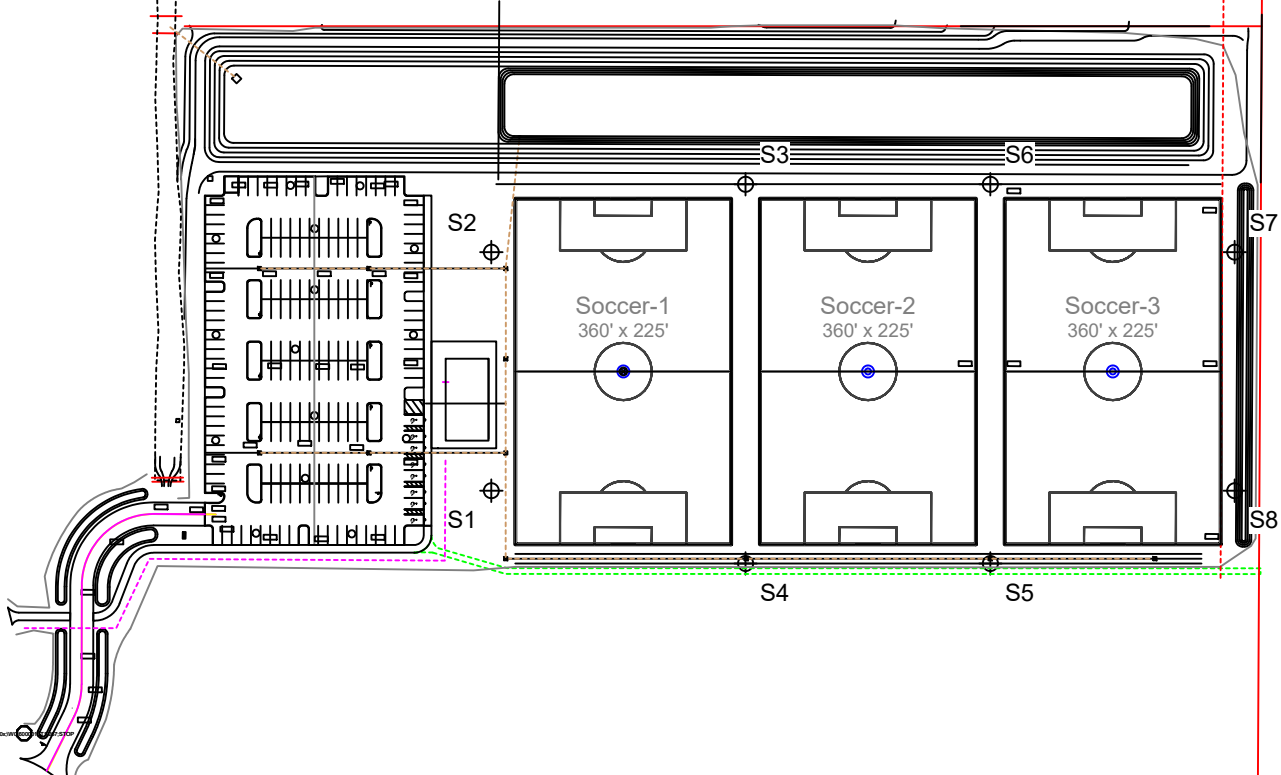
**Installation Requirements:** Results assume ± 3% nominal voltage at line side of the driver and structures located within 3 feet (1m) of design locations.

## EQUIPMENT LIST FOR AREAS SHOWN

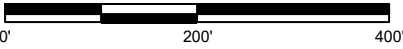
QTY	LOCATION	Pole		Luminaires		
		SIZE	GRADE ELEVATION	MOUNTING HEIGHT	LUMINAIRE TYPE	QTY / POLE
4	S1-S2 S7-S8	70'	-	70'	TLC-LED-1150	7
4	S3-S6	90'	-	90'	TLC-LED-1150	14
8	TOTALS					84

## SINGLE LUMINAIRE AMPERAGE DRAW CHART

Ballast Specifications (.90 min power factor)	Line Amperage Per Luminaire (max draw)						
	208 (60)	220 (60)	240 (60)	277 (60)	347 (60)	380 (60)	480 (60)
Single Phase Voltage	208 (60)	220 (60)	240 (60)	277 (60)	347 (60)	380 (60)	480 (60)
TLC-LED-1150	7.0	6.6	6.1	5.2	4.2	3.8	3.0



SCALE IN FEET 1 : 200



Pole location(s) ⊕ dimensions are relative to 0,0 reference point(s) ⊗



**We Make It Happen.**

Not to be reproduced in whole or part without the written consent of Musco Sports Lighting, LLC. ©1981, 2017 Musco Sports Lighting, LLC.



# Control System Summary

## Project Specific Notes:

## Project Information

Project #: 184244  
 Project Name: Barber Park Soccer  
 Date: 02/03/17  
 Project Engineer: Jake Van Polen  
 Sales Representative: Bob DeCouto  
 Control System Type: Control and Monitoring  
 Communication Type: Digital Cellular  
 Scan: 184244A  
 Document ID: 184244P1V1-0203104249  
 Distribution Panel Location or ID: SO  
 Total # of Distribution Panel Locations for Project: 1  
 Design Voltage/Hertz/Phase: 480/60/3  
 Control Voltage: 120

## Equipment Listing

DESCRIPTION	APPROXIMATE SIZE	
1. Control and Monitoring Cabinet	24 X 72	
	QTY	SIZE
Total Contactors	12	30 AMP
Total Off/On/Auto Switches:	3	

Preliminary Plans  
 Confirm all Details - voltage,  
 # of distribution panels, etc.

### Materials Checklist

#### Contractor/Customer Supplied:

- A single control circuit must be supplied per distribution panel location.
  - If the control voltage is NOT available, a control transformer is required.
- Electrical distribution panel to provide overcurrent protection for circuits
  - Thermal/Magnetic circuit breaker sized per full load amps on Circuit Summary by Zone Chart
- Wiring:
  - Dedicated control power circuit
  - Power circuit to and from lighting contactors
  - Harnesses for cabinets at remote locations
  - Means of grounding, including lightning ground protection
- Electrical conduit wireway system
  - Entrance hubs rated NEMA 4: must be die-cast zinc, PVC, or copper-free die-cast aluminum
- Mounting hardware for cabinets
- Control circuit lock-on device to prevent unauthorized power interruption to control power
- Anti-corrosion compound to apply to ends of wire, if necessary

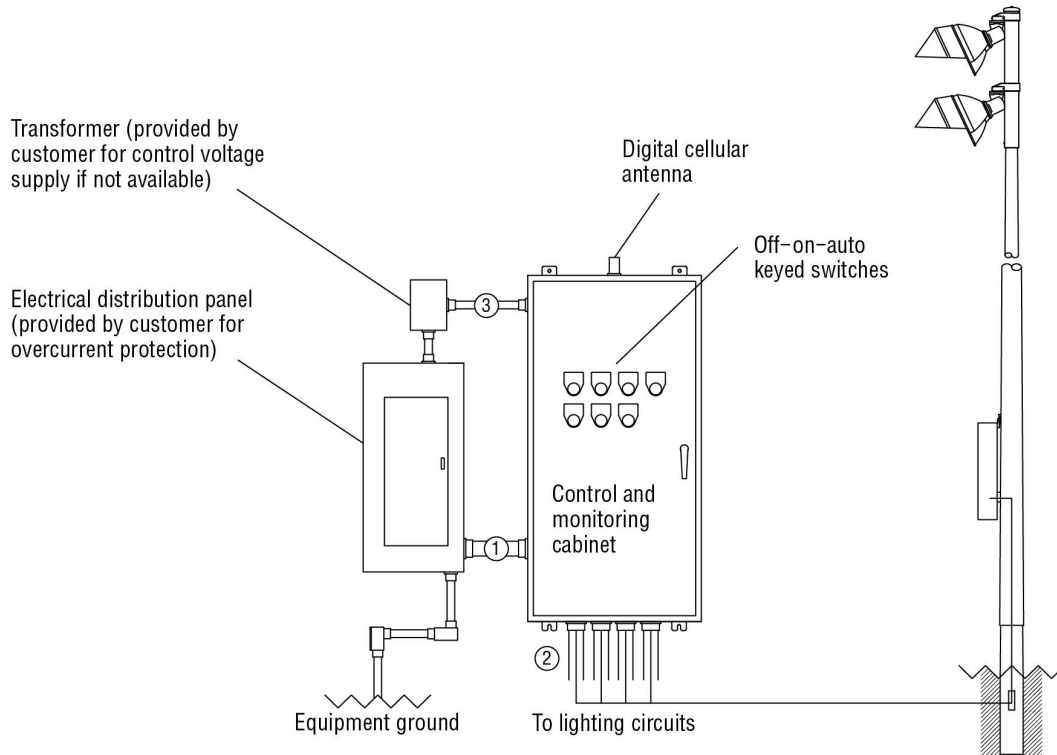
Call Control-Link Central™ operations center at 877/347-3319 to schedule activation of the control system upon completion of the installation.  
 Note: Activation may take up to 1 1/2 hours

### IMPORTANT NOTES

1. Please confirm that the design voltage listed above is accurate for this facility. Design voltage/phase is defined as the voltage/phase being connected and utilized at each lighting pole's ballast enclosure disconnect. Inaccurate design voltage/phase can result in additional costs and delays. Contact your Musco sales representative to confirm this item.
2. In a 3 phase design, all 3 phases are to be run to each pole. When a 3 phase design is used Musco's single phase luminaires come pre-wired to utilize all 3 phases across the entire facility.
3. One contactor is required for each pole. When a pole has multiple circuits, one contactor is required for each circuit. All contactors are UL 100% rated for the published continuous load. All contactors are 3 pole.
4. If the lighting system will be fed from more than one distribution location, additional equipment may be required. Contact your Musco sales representative.
5. A single control circuit must be supplied per control system.
6. Size overcurrent devices using the full load amps column of the Circuit Summary By Zone chart- Minimum power factor is 0.9.

NOTE: Refer to Installation Instructions for more details on equipment information and the installation requirements

## Control•Link® Control and Monitoring System



Wire	Description	# of Wires	Typ. Wire Size (AWG)	Max. Wire Length (FT)	Wire from Musco	Notes
1	Line power to contactors, and equipment grounding conductor	Note A	Note B	27	No	A – E
2	Load power to lighting circuits	Note A	Note B	N/A	No	A – D
3	Control power (dedicated, 20A)	3	12	N/A	No	C, D

R60-32-00\_C

- Notes:
- A. Voltage and phasing per the notes on cover page.
  - B. Calculate per load and voltage drop.
  - C. All conduit diameters should be per code.
  - D. Refer to control and monitoring system installation instructions for more details on equipment information and the installation requirements.
  - E. Contact Musco if maximum wire length from circuit breaker to contactor exceeds value in chart.

**IMPORTANT:** Control (3) wires must be in separate conduit from line and load power wiring (1, 2).



# Control System Summary

Barber Park Soccer / 184244 - 184244A  
SO - Page 3 of 4

## SWITCHING SCHEDULE

Field/Zone Description	Zones
Soccer-1	1
Soccer-2	2
Soccer-3	3

CONTROL POWER CONSUMPTION	
120V Single Phase	
VA loading of Musco Supplied Equipment	INRUSH: 3528.0
	SEALED: 402.8

## CIRCUIT SUMMARY BY ZONE

POLE	CIRCUIT DESCRIPTION	# OF FIXTURES	# OF DRIVERS	*FULL LOAD AMPS	CONTACTOR SIZE (AMPS)	CONTACTOR ID	ZONE
S1	Soccer-1	7	7	13.1	30	C1	1
S2	Soccer-1	7	7	13.1	30	C2	1
S3	Soccer-1	7	7	13.1	30	C3	1
S4	Soccer-1	7	7	13.1	30	C4	1
S3	Soccer-2	7	7	13.1	30	C5	2
S4	Soccer-2	7	7	13.1	30	C6	2
S5	Soccer-2	7	7	13.1	30	C7	2
S6	Soccer-2	7	7	13.1	30	C8	2
S5	Soccer-3	7	7	13.1	30	C9	3
S6	Soccer-3	7	7	13.1	30	C10	3
S7	Soccer-3	7	7	13.1	30	C11	3
S8	Soccer-3	7	7	13.1	30	C12	3

\*Full Load Amps based on amps per driver.



# Control System Summary

Barber Park Soccer / 184244 - 184244A  
SO - Page 4 of 4

PANEL SUMMARY						
CABINET #	CONTROL MODULE LOCATION	CONTACTOR ID	CIRCUIT DESCRIPTION	FULL LOAD AMPS	DISTRIBUTION PANEL ID (BY OTHERS)	CIRCUIT BREAKER POSITION (BY OTHERS)
1	1	C1	Pole S1	13.12		
1	1	C2	Pole S2	13.12		
1	1	C3	Pole S3	13.12		
1	1	C4	Pole S4	13.12		
1	1	C5	Pole S3	13.12		
1	1	C6	Pole S4	13.12		
1	1	C7	Pole S5	13.12		
1	1	C8	Pole S6	13.12		
1	1	C9	Pole S5	13.12		
1	1	C10	Pole S6	13.12		
1	1	C11	Pole S7	13.12		
1	1	C12	Pole S8	13.12		

ZONE SCHEDULE				
ZONE	SELECTOR SWITCH	ZONE DESCRIPTION	CIRCUIT DESCRIPTION	
			POLE ID	CONTACTOR ID
Zone 1	1	Soccer-1	S1	C1
			S2	C2
			S3	C3
			S4	C4
Zone 2	2	Soccer-2	S3	C5
			S4	C6
			S5	C7
			S6	C8
Zone 3	3	Soccer-3	S5	C9
			S6	C10
			S7	C11
			S8	C12