HUDSPETH COUNTY COURTHOUSE
SITE IMPROVEMENTS

TECHNICAL SPECIFICATIONS

FINAL FOR CONSTRUCTION

DesignScapes
DESIGN : CONSULTING
P.O. BOX 290544 : EL PASO, TX 79929
PH : 915.497.1944

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PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Requirements.

1.2 REQUIREMENTS

A. The work to be performed under the Base Bid shall include, but is not limited to all necessary minor grading and providing materials and installing of Concrete Flatwork, Plants, Electrical/Lighting, Site Furniture, Signs, and a new Irrigation System.

B. A schedule of values shall be submitted by contractor within 15 days of Notice of Award. Parameters for the schedule of values shall be based upon the Contractor's construction schedule and total contract price.

C. All labor and materials required for construction of completely functional and operational facilities as shown on the Drawings and in these specifications is included in the general scope of work under each bid item.

PART 2- MEASUREMENT AND PAYMENT

2.1 BASE BID ITEMS

A. BID ITEM 1 - MOBILIZATION

1. Mobilization shall include temporary construction fencing, a construction sign, required insurance and bonding requirements.

2. Measurement shall be on a Lump Sum basis and Payment shall be made at the stated unit price for Mobilization in accordance with project specifications.

3. Payment shall not exceed 5% of the total bid price.

B. BID ITEM 2 – CONCRETE FLATWORK : 4” DEPTH

1. Concrete Flatwork : 4” depth (broom finish) shall include installation of 4” depth concrete flatwork, as indicated on the Contract Documents.

2. Measurement shall be per square foot for Concrete Flatwork : 4” depth broom finish complete in place.

3. Payment shall be made at the stated unit price for Concrete Flatwork : 4” depth in accordance with project specifications for total square footage installed.

C. BID ITEM 3 – INSTALLATION OF 2” ROCK MULCH

1. Install 2” Rock Mulch as indicated on the Construction Documents. Rock mulch will be donated and delivered by the rock quarry, size of the mulch is approximate, but will range in size from 1 ½” – 2-1/2”. The unit price shall include installation and any incidentals necessary for completing the work.

2. Measurement shall be per square foot for rock mulch installed complete in place.

3. Payment shall be made at the stated unit price for rock mulch installed in accordance with project specifications.

D. BID ITEM 4 –INSTALLATION OF SCREENINGS

1. Install Screenings as indicated on the Construction Documents. Screenings will be donated and delivered by the rock quarry. The unit price shall include installation and any incidentals necessary for completing the work.

2. Measurement shall be per square foot for screenings installed complete in place.

3. Payment shall be made at the stated unit price for screenings installed in accordance with project specifications.

E. BID ITEM 5 - INSTALLATION OF BOULDERS

1. Install Boulders as indicated on the Construction Documents. Boulders will be donated and delivered by the rock quarry, size of the boulders is approximate, but will range in size from 2’x2’x2’, 3’x3’x3’ and 4’x4’x4’. The unit price shall include installation and any incidentals necessary for completing the work.

2. Measurement shall be per each for boulders installed complete in place.

3. Payment shall be made at the stated unit price for boulders installed in accordance with project specifications.

F. BID ITEM 6 – TREE : 2” CALIPER AND/OR 24” BOX

1. Provide and install the Tree : 2” Caliper and/or 24” Box as indicated on the Construction Documents. The unit price shall include storage, delivery and any incidentals necessary for completing the work.

2. Measurement shall be per item for Tree : 2” Caliper and/or 24” Box complete in place.

3. Payment shall be made at the stated unit price for Tree : 2” Caliper and/or 24” Box installed in accordance with project specifications.

G. BID ITEM 7 – TREE : 15 GALLON

1. Provide and install the Tree : 15 Gallon as indicated on the Construction Documents. The unit price shall include storage, delivery and any incidentals necessary for completing the work.

2. Measurement shall be per item for Tree : 15 Gallon complete in place.

3. Payment shall be made at the stated unit price for Tree : 15 Gallon installed in accordance with project specifications.

H. BID ITEM 8 – SHRUB : 5 GALLON

1. Provide and install the Shrub : 5 Gallon as indicated on the Construction Documents. The unit price shall include storage, delivery and any incidentals necessary for completing the work.

2. Measurement shall be per item for Shrub : 5 Gallon complete in place.

3. Payment shall be made at the stated unit price for Shrub : 5 Gallon installed in accordance with project specifications.

I. BID ITEM 9 – SHRUB : 1 GALLON

1. Provide and install the Shrub : 1 Gallon as indicated on the Construction Documents. The unit price shall include storage, delivery and any incidentals necessary for completing the work.

2. Measurement shall be per item for Shrub : 1 Gallon complete in place.

3. Payment shall be made at the stated unit price for Shrub : 1 Gallon installed in accordance with project specifications.

J. BID ITEM 10 – ACCENT PLANT : OCOTILLO

1. Provide and install the Accent Plant : Ocotillo as indicated on the Construction Documents. The unit price shall include storage, delivery and any incidentals necessary for completing the work.

2. Measurement shall be per item for Accent Plant : Ocotillo complete in place.

3. Payment shall be made at the stated unit price for Accent Plant : Ocotillo installed in accordance with project specifications.

K. BID ITEM 11 – ACCENT PLANT : 5 GALLON

1. Provide and install the Accent Plant : 5 Gallon as indicated on the Construction Documents. The unit price shall include storage, delivery and any incidentals necessary for completing the work.

2. Measurement shall be per item for Accent Plant : 5 Gallon complete in place.

3. Payment shall be made at the stated unit price for Accent Plant : 5 Gallon installed in accordance with project specifications.

L. BID ITEM 12 – POTS WITH PLANTING SOIL

1. Provide and install the Pots with Planting Soil as indicated on the Construction Documents. The unit price shall include storage, delivery and any incidentals necessary for completing the work.

2. Measurement shall be per item for Pots with Planting Soil complete in place.

3. Payment shall be made at the stated unit price for Pots with Planting Soil installed in accordance with project specifications.

M. BID ITEM 13 - NEW IRRIGATION SYSTEM

1. Provide and install the New Irrigation System as indicated on the Construction Documents. The unit price shall include storage, delivery and any incidentals necessary for completing the work.

2. Measurement shall be Lump Sum for the New Irrigation System, complete in place.

3. Payment shall be made at the stated unit price for the New Irrigation System installed in accordance with project specifications.

N. BID ITEM 14 – TYPE “C” AND “D” LIGHT FIXTURES

1. The Furnishing and installation of Type “C” and “D” light fixtures and associated concrete base shall include modifications to existing electrical panel “A”, lighting controls and any incidentals necessary for completing the work.

2. Measurement shall be made for each installed light fixture and concrete base.

3. Payment shall be made at the stated unit price for furnishing and installing each light fixture and concrete base and in accordance with project specifications.

O. BID ITEM 15 – TYPE “B” LIGHT FIXTURES

1. The Furnishing and installation of Type “B” light fixtures on existing concrete base and shall include and any incidentals necessary for completing the work.

2. Measurement shall be made for each installed light fixture on existing concrete base.

3. Payment shall be made at the stated unit price for furnishing and installing each light fixture and on existing concrete base and in accordance with project specifications.

P. BID ITEM 16 – TYPE “A” LIGHT FIXTURES

1. The Furnishing and installation of Type “A”, light fixtures and associated concrete base and shall include and any incidentals necessary for completing the work.

2. Measurement shall be made for each installed light fixture on the existing concrete base.

3. Payment shall be made at the stated unit price for furnishing and installing each light fixture and concrete base and in accordance with project specifications.

Q. BID ITEM 17 – CONDUIT, WIRING, SUPPORTS, PULL BOXES, ETC.

1. The furnishing and installation of conduit, wiring, supports, pull boxes, receptacle and trenching for circuits A-1, A-2, A-3 and A-6 shall be as stated on the construction documents and shall include and any incidentals necessary for completing the work.

2. Measurement shall be made per lot for Furnishing and install conduit, wiring, supports, pull boxes, receptacle and trenching for circuits A-1, A-2, A-3 and A-6

3. Payment shall be made at the stated unit price for Furnishing and installing of conduit, wiring, supports, pull boxes, receptacle and trenching for circuits A-1, A-2, A-3 and A-6 and in accordance with project specifications.

R. BID ITEM 18 – CONNECTION OF NEW CIRCUITS TO EXISTING BREAKERS IN PANEL “A” AND NEW LIGHTING CONTROLS

1. The Connection of new circuits to existing breakers in panel “A” and new lighting controls shall be as stated on the construction documents and shall include and any incidentals necessary for completing the work.

2. Measurement shall be made for Connection of new circuits to existing breakers in panel “A” and new lighting controls

3. Payment shall be made at the stated unit price for Connection of new circuits to existing breakers in panel “A” and new lighting controls and in accordance with project specifications.

S. BID ITEM 19 - BUILDING NAME SIGN ON BOULDER

1. Provide and install Building Name Sign on the Existing Boulder as indicated on the Construction Documents. The unit price shall include manufacturing, storage, delivery and any incidentals necessary for completing the work.

2. Measurement shall be lump sum for the Building Name Sign on the Existing Boulder complete in place.

3. Payment shall be made at the stated unit price for Building Name Sign on Boulder in accordance with project specifications.

2.2 ADDITIVE ALTERNATE ITEMS

AA. BID ITEM A1 – MINOR SITE DEMOLITION

1. Provide Minor Site Demolition of existing items to accommodate site improvements as indicated on the Construction Documents.
2. Measurement shall be made for the completion of the Minor Site Demolition on a lump sum basis.
3. Payment shall be made at the stated unit price for the Minor Site Demolition in accordance with project specifications. Payment shall also include any incidentals necessary for completing the work.

AB. BID ITEM A2 – MINOR GRADING

1. Provide Minor Grading of existing items to accommodate site improvements as indicated on the Construction Documents.
2. Measurement shall be made for the completion of the Minor Grading on a lump sum basis.
3. Payment shall be made at the stated unit price for the Minor Grading in accordance with project specifications. Payment shall also include any incidentals necessary for completing the work.

AC. BID ITEM A3 – CONCRETE FLATWORK : 4” DEPTH, SALT FINISH

1. Concrete Flatwork : 4” depth (salt finish) shall include installation of 4” depth concrete flatwork, as indicated on the Contract Documents.
2. Measurement shall be per square foot for Concrete Flatwork : 4” depth salt finish complete in place.
3. Payment shall be made at the stated unit price for Concrete Flatwork : 4” depth in accordance with project specifications for total square footage installed.

AD.BID ITEM A4 – LOW VOLTAGE LANDSCAPE LIGHTING

1. Provide and install the Low Voltage Landscape Lighting as indicated on the Construction Documents. The unit price shall include storage, delivery and any incidentals necessary for completing the work.
2. Measurement shall be Lump Sum for the Low Voltage Landscape Lighting, complete in place.
3. Payment shall be made at the stated unit price for the Low Voltage Landscape Lighting installed in accordance with project specifications.

AE. BID ITEM A5 – BENCH

1. Provide and install Bench as indicated on the Construction Documents. The unit price shall include storage, delivery and any incidentals necessary for completing the work.
2. Measurement shall be per item for each Bench complete in place.
3. Payment shall be made at the stated unit price for installed Bench in accordance with project specifications.

AF. BID ITEM A6 – TRASH RECEPTACLE

1. Provide and install the Trash Receptacle as indicated on the Construction Documents. The unit price shall include manufacturing, storage, delivery and any incidentals necessary for completing the work.
2. Measurement shall be per item for each Trash Receptacle complete in place.
3. Payment shall be made at the stated unit price for Trash Receptacle completed and installed in accordance with project specifications.

AG. BID ITEM A7 – INTERPRETIVE SIGN

1. Provide and install the Interpretive Sign as indicated on the Construction Documents. The unit price shall include manufacturing, storage, delivery and any incidentals necessary for completing the work.
2. Measurement shall be per item for Interpretive Sign complete in place.

3. Payment shall be made at the stated unit price for Interpretive Sign completed and installed in accordance with project specifications.

AH. BID ITEM A8 – ACCENT PLANT : 15 GALLON

1. Provide and install the Accent Plant : 15 Gallon as indicated on the Construction Documents. The unit price shall include storage, delivery and any incidentals necessary for completing the work.

2. Measurement shall be per item for Accent Plant : 15 Gallon complete in place.

3. Payment shall be made at the stated unit price for Accent Plant : 15 Gallon installed in accordance with project specifications.

AI. BID ITEM A9 – FLAG POLE, MOVE AND REINSTALL

1. Move and Reinstall the Flag Pole as indicated on the Construction Documents. The unit price shall include removal, new footing and any incidentals necessary for completing the work.

2. Measurement shall be lump sum for Move and Reinstall the Flag Pole complete in place.

3. Payment shall be made at the stated unit price for Move and Reinstall the Flag Pole in accordance with project specifications.

AJ. BID ITEM A10 – TYPE “A” LIGHT FIXTURES

1. The Furnishing and installation two Type “A”, light fixtures and associated concrete base and make all connections.

2. Measurement shall be made for each installed light fixture and concrete base.

3. Payment shall be made at the stated unit price for furnishing and installing each light fixture and concrete base and in accordance with project specifications. Payment shall also include any incidentals necessary for completing the work.

AK. BID ITEM A11 – CONDUIT, WIRING, SUPPORTS, PULL BOXES, ETC.

1. Furnishing and install conduit, wiring, supports, pull boxes, receptacle and trenching for circuits A-4 and A-5.

2. Measurement shall be made per lot for Furnishing and install conduit, wiring, supports, pull boxes, receptacle and trenching for circuits A-4 and A-5.

3. Payment shall be made at the stated unit price for Furnishing and install conduit, wiring, supports, pull boxes, receptacle and trenching for circuits A-4 and A-5 and in accordance with project specifications. Payment shall also include any incidentals necessary for completing the work.

SECTION 260519 - LOW-VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

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

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Product Schedule: Indicate type, use, location, and termination locations.

1.3 INFORMATIONAL SUBMITTALS

A. Field quality-control reports.

PART 2 - PRODUCTS

2.1 COPPER BUILDING WIRE

A. Description: Flexible, insulated, and uninsulated, drawn copper current-carrying conductor with an overall insulation layer or jacket, or both, rated 600 V or less.

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

1. Okonite Company (The).
2. Southwire Company.

C. Standards:

1. Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and use.
2. Conductor and Cable Marking: Comply with wire and cable marking according to UL's "Wire and Cable Marking and Application Guide."

D. Conductors: Copper, complying with ASTM B3 for bare annealed copper and with ASTM B8 for stranded conductors.

E. Conductor Insulation:
   1. Type THWN-2: Comply with UL 83.

2.2 CONNECTORS AND SPLICES

A. Description: Factory-fabricated connectors, splices, and lugs of size, ampacity rating, material, type, and class for application and service indicated; listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and use.

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

   1. 3M Electrical Products.
   2. ILSCO.

C. Jacketed Cable Connectors: For steel jacketed cables, zinc die-cast with set screws, designed to connect conductors specified in this Section.

D. Lugs: One piece, seamless, designed to terminate conductors specified in this Section.

   1. Material: Copper.
   2. Type: One hole with standard barrels.
   3. Termination: Compression.

PART 3 - EXECUTION

3.1 CONDUCTOR MATERIAL APPLICATIONS

A. Feeders:

   1. Copper; solid for No. 10 AWG and smaller; stranded for No. 8 AWG and larger.

B. Branch Circuits:

   1. Copper, Solid for No. 10 AWG and smaller; stranded for No. 8 AWG and larger.

C. Power-Limited Fire Alarm and Control: Solid for No. 12 AWG and smaller.

3.2 CONDUCTOR INSULATION AND MULTICONDUCTOR CABLE APPLICATIONS AND WIRING METHODS

A. Service Entrance: Type THHN/THWN-2, single conductors in raceway Type USE, single conductor in raceway Multiconductor cable, Type SE.

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

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

3.3 INSTALLATION OF CONDUCTORS AND CABLES

A. Conceal cables in finished walls, ceilings, and floors unless otherwise indicated.

B. Complete raceway installation between conductor and cable termination points according to Section 260533 "Raceways and Boxes for Electrical Systems" prior to pulling conductors and cables.

C. Use manufacturer-approved pulling compound or lubricant where necessary; compound used must not deteriorate conductor or insulation. Do not exceed manufacturer's recommended maximum pulling tensions and sidewall pressure values.

D. Use pulling means, including fish tape, cable, rope, and basket-weave wire/cable grips, that will not damage cables or raceway.

E. Install exposed cables parallel and perpendicular to surfaces of exposed structural members, and follow surface contours where possible.

F. Support cables according to Section 260529 "Hangers and Supports for Electrical Systems."

3.4 CONNECTIONS

A. Tighten electrical connectors and terminals according to manufacturer's published torque-tightening values. If manufacturer's torque values are not indicated, use those specified in UL 486A-486B.

B. Make splices, terminations, and taps that are compatible with conductor material and that possess equivalent or better mechanical strength and insulation ratings than unspliced conductors.

3.5 IDENTIFICATION

A. Identify and color-code conductors and cables according to Section 260553 "Identification for Electrical Systems."

B. Identify each spare conductor at each end with identity number and location of other end of conductor, and identify as spare conductor.

3.6 FIRESTOPPING

A. Apply firestopping to electrical penetrations of fire-rated floor and wall assemblies to restore original fire-resistance rating of assembly according to Section 078413 "Penetration Firestopping."

END OF SECTION

SECTION 260526 - GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes:

1. Grounding and bonding conductors.
2. Grounding and bonding clamps.
3. Grounding and bonding bushings.
4. Grounding and bonding connectors.
5. Grounding (earthing) electrodes.

1.02 ACTION SUBMITTALS

A. Product Data:

1. For each type of product indicated.

B. Field Quality-Control Submittals:

1. Field quality-control reports.

PART 2 - PRODUCTS

2.01 GROUNDING AND BONDING CONDUCTORS

A. Equipment Grounding Conductor:

1. General Characteristics: 600 V, THHN/THWN-2 or THWN-2, copper or tinned-copper wire or cable, green color, in accordance with Section 260519 "Low-Voltage Electrical Power Conductors and Cables."

B. ASTM - Bare Copper Grounding and Bonding Conductor:

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

a. ERICO; brand of nVent Electrical plc.

2. Referenced Standards: Complying with one or more of the following:

a. Soft or Annealed Copper Wire: ASTM B3
b. Concentric-Lay Stranded Copper Conductor: ASTM B8.
c. Tin-Coated Soft or Annealed Copper Wire: ASTM B33.
d. 19-Wire Combination Unilay-Stranded Copper Conductor: ASTM B787/B787M.

2.02 GROUNDING AND BONDING CLAMPS

A. Description: Clamps suitable for attachment of grounding and bonding conductors to grounding electrodes, pipes, tubing, and rebar. Grounding and bonding clamps specified in this article are also suitable for use with communications applications; see Section 270526 "Grounding and Bonding for Communications Systems," for selection and installation guidelines.

B. Source Limitations: Obtain products from single manufacturer.

C. Performance Criteria:

1. Regulatory Requirements:

a. Listed and labeled in accordance with NFPA 70, by qualified electrical testing laboratory recognized by authorities having jurisdiction, and marked for intended location and application.

2. Listing Criteria:

a. Grounding and Bonding Equipment: UL CCN KDER; including UL 467.
b. Grounding and Bonding Equipment for Communications: UL CCN KDSH; including UL 467.

D. UL KDER and KDSH - Hex-Fitting-Type Pipe and Rod Grounding and Bonding Clamp:
1. General Characteristics:

a. Two pieces with zinc-plated bolts.
b. Clamp Material: Die-cast zinc alloy.
c. Listed for outdoor use.

E. UL KDER and KDSH - U-Bolt-Type Pipe and Rod Grounding and Bonding Clamp:

1. <Double click here to find, evaluate, and insert list of manufacturers and products>
2. General Characteristics:

a. Clamp Material: Tinned brass.
b. Listed for outdoor use.

F. UL KDER and KDSH - Strap-Type Pipe and Rod Grounding and Bonding Clamp:
1. General Characteristics:

a. Clamp Material: Copper.
b. Listed for outdoor use.

2.03 GROUNDING AND BONDING BUSHINGS

A. Description: Bonding bushings connect conduit fittings, tubing fittings, threaded metal conduit, and unthreaded metal conduit to metal boxes and equipment enclosures and have one or more bonding screws intended to provide electrical continuity between bushing and enclosure. Grounding bushings have provision for connection of bonding or grounding conductor and may or may not also have bonding screws.

B. Source Limitations: Obtain products from single manufacturer.

C. Performance Criteria:

1. Regulatory Requirements:

a. Listed and labeled in accordance with NFPA 70, by qualified electrical testing laboratory recognized by authorities having jurisdiction and marked for intended location and application.

2. Listing Criteria:

a. Grounding and Bonding Equipment: UL CCN KDER; including UL 467.

D. UL KDER - Bonding Bushing:
1. General Characteristics: Threaded bushing with insulated throat.

E. UL KDER - Grounding Bushing:
1. General Characteristics: Threaded bushing with insulated throat and mechanical-type wire terminal.

2.04 GROUNDING AND BONDING HUBS

A. Description: Hubs with certified grounding or bonding locknut.

B. Source Limitations: Obtain products from single manufacturer.

C. Performance Criteria:

1. Regulatory Requirements:

a. Listed and labeled in accordance with NFPA 70, by qualified electrical testing laboratory recognized by authorities having jurisdiction and marked for intended location and application.

2. Listing Criteria:

a. Grounding and Bonding Equipment: UL CCN KDER; including UL 467.

D. UL KDER - Grounding and Bonding Hub:
1. General Characteristics: Insulated, gasketed, watertight hub with mechanical-type wire terminal.

2.05 GROUNDING AND BONDING CONNECTORS

A. Source Limitations: Obtain products from single manufacturer.

B. Performance Criteria:

1. Regulatory Requirements:

a. Listed and labeled in accordance with NFPA 70, by qualified electrical testing laboratory recognized by authorities having jurisdiction and marked for intended location and application.

2. Listing Criteria:

a. Grounding and Bonding Equipment: UL CCN KDER; including UL 467.
b. Grounding and Bonding Equipment for Communications: UL CCN KDSH; including UL 467.

C. UL KDER - Crimped Pressure-Type Grounding and Bonding Cable Connector:

1. <Double click here to find, evaluate, and insert list of manufacturers and products>
2. General Characteristics: Crimp-and-compress connectors that bond to conductor when connector is compressed around conductor.

a. Copper, C and H shaped.

D. UL KDER - Split-Bolt Pressure-Type Grounding and Bonding Cable Connector:

1. <Double click here to find, evaluate, and insert list of manufacturers and products>
2. General Characteristics: Bolts that surround cable and bond to cable under compression when nut is tightened.

a. Copper.

2.06 GROUNDING (EARTHING) ELECTRODES

A. Description: Grounding electrodes include rod electrodes, ring electrodes, metal underground water pipes, metal building frames, concrete-encased electrodes, and pipe and plate electrodes.

B. Source Limitations: Obtain products from single manufacturer.

C. Performance Criteria:

1. Regulatory Requirements:

a. Listed and labeled in accordance with NFPA 70, by qualified electrical testing laboratory recognized by authorities having jurisdiction and marked for intended location and application.

2. Listing Criteria:

a. Grounding and Bonding Equipment: UL CCN KDER; including UL 467.

D. UL KDER - Rod Electrode:
1. General Characteristics: Copper-clad steel; 3/4 inch by 10 ft.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Examine facility's grounding electrode system and equipment grounding for compliance with requirements for maximum ground-resistance level and other conditions affecting performance of grounding and bonding of electrical system.

B. Inspect test results of grounding system measured at point of electrical service equipment connection.

C. Prepare written report, endorsed by Installer, listing conditions detrimental to performance of the Work.

D. Proceed with connection of electrical service equipment only after unsatisfactory conditions have been corrected.

3.02 SELECTION OF GROUNDING AND BONDING CONDUCTORS

A. Conductors: Install solid conductor for 8 AWG and smaller, and stranded conductors for 6 AWG and larger unless otherwise indicated.

B. Custom-Length Insulated Equipment Bonding Jumpers: 6 AWG, 19-strand, Type THHN.

C. Bonding Cable: 28 kcmil, 14 strands of 17 AWG conductor, 1/4 inch in diameter.

D. Bonding Conductor: 4 AWG or 6 AWG, stranded conductor.

E. Bonding Jumper: Copper tape, braided conductors terminated with copper ferrules; 1-5/8 inch wide and 1/16 inch thick.

F. Tinned Bonding Jumper: Tinned-copper tape, braided conductors terminated with copper ferrules; 1-5/8 inch wide and 1/16 inch thick.

G. Underground Grounding Conductors: Install bare tinned-copper conductor, 2/0 AWG minimum.

1. Bury at least 30 inch below grade.

3.03 SELECTION OF CONNECTORS

A. 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.

3.04 INSTALLATION

A. Comply with manufacturer's published instructions.

B. Reference Standards:
1. Consult Architect for resolution of conflicting requirements.

C. Special Techniques:

1. Conductors:

a. 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.

2. Connections: Make connections so possibility of galvanic action or electrolysis is minimized. Select connectors, connection hardware, conductors, and connection methods so metals in direct contact are galvanically compatible.

a. Use electroplated or hot-tin-coated materials to ensure high conductivity and to make contact points closer in order of galvanic series.
b. Make connections with clean, bare metal at points of contact.
c. Make aluminum-to-steel connections with stainless steel separators and mechanical clamps.
d. Make aluminum-to-galvanized-steel connections with tin-plated copper jumpers and mechanical clamps.
e. Coat and seal connections having dissimilar metals with inert material to prevent future penetration of moisture to contact surfaces.
f. 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 adjacent parts.
2) Bonding to Equipment Mounted on Vibration Isolation Hangers and Supports: Install bonding so vibration is not transmitted to rigidly mounted equipment.
3) Use exothermic-welded connectors for outdoor locations; if disconnect-type connection is required, use bolted clamp.

3. Electrodes:

a. Ground Rods: Drive rods until tops are 2 inch 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) Use exothermic welds for below-grade connections.

b. For grounding electrode system, install at least three rods spaced at least one-rod length from each other and located at least same distance from other grounding electrodes, and connect to service grounding electrode conductor.
c. Test Wells: Ground rod driven through drilled hole in bottom of handhole. Handholes are specified in Section 260543 "Underground Ducts and Raceways for Electrical Systems," and must be at least 12 inch deep, with cover.

1) Install at least one test well for each service unless otherwise indicated. Install at ground rod electrically closest to service entrance. Set top of test well flush with finished grade or floor.

4. Equipment Grounding:

a. Install insulated equipment grounding conductors with 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.

c. Poles Supporting Outdoor Lighting Fixtures: Install grounding electrode and separate insulated equipment grounding conductor in addition to grounding conductor installed with branch-circuit conductors.

3.05 FIELD QUALITY CONTROL

A. Tests and Inspections:

1. After installing grounding system but before permanent electrical circuits have been energized, test for compliance with requirements.
2. Inspect physical and mechanical condition. Verify tightness of accessible, bolted, electrical connections with calibrated torque wrench in accordance with manufacturer's published instructions.
3. Test completed grounding system at each location where maximum ground-resistance level is specified, at service disconnect enclosure grounding terminal. Make tests at ground rods before conductors are connected.

a. Measure ground resistance no fewer than two full days after last trace of precipitation and without soil being moistened by 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 in accordance with IEEE Std 81.
c. Excessive Ground Resistance: If resistance to ground exceeds specified values, notify Architect promptly and include recommendations to reduce ground resistance.

4. Prepare dimensioned Drawings locating each test well, ground rod and ground-rod assembly, and other grounding electrodes. Identify each by letter in alphabetical order, and key to record of tests and observations. Include 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.

B. Nonconforming Work:

1. Grounding system will be considered defective if it does not pass tests and inspections.
2. Remove and replace defective components and retest.

C. Collect, assemble, and submit test and inspection reports.

1. Report measured ground resistances that exceed the following values:

a. Power and Lighting Equipment or System with Capacity of 500 kVA and Less: 10 Ω.

3.06 PROTECTION

A. After installation, protect grounding and bonding cables and equipment from construction activities. Remove and replace items that are contaminated, defaced, damaged, or otherwise caused to be unfit for use prior to acceptance by Owner.

END OF SECTION

SECTION 260533.13 - CONDUITS FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes:
   1. Type EMT-S duct raceways and elbows.
   2. Type ERMC-S duct raceways, elbows, couplings, and nipples.
   3. Type FMC-S and Type FMC-A duct raceways.
   4. Type LFMC duct raceways.
   5. Type PVC duct raceways and fittings.
   6. Fittings for conduit, tubing, and cable.
   7. Electrically conductive corrosion-resistant compounds for threaded conduit.

1.02 DEFINITIONS

A. Conduit: A structure containing one or more duct raceways.

B. Duct Raceway: A single enclosed raceway for conductors or cable.

C. Duct Bank: An arrangement of conduit providing one or more continuous duct raceways between two points.

1.03 ACTION SUBMITTALS

A. Product Data:
   1. Type EMT-S duct raceways and elbows.
   2. Type ERMC-S duct raceways, elbows, couplings, and nipples.
   3. Type FMC-S and Type FMC-A duct raceways.
   4. Type LFMC duct raceways.
   5. Type PVC duct raceways and fittings.
   6. Fittings for conduit, tubing, and cable.
   7. Electrically conductive corrosion-resistant compounds for threaded conduit.

1.04 INFORMATIONAL SUBMITTALS

A. Manufacturers' Published Instructions:
   1. Type EMT-S duct raceways and elbows.
   2. Type ERMC-S duct raceways, elbows, couplings, and nipples.
   3. Type FMC-S and Type FMC-A duct raceways.
   4. Type LFMC duct raceways.
   5. Type PVC duct raceways and fittings.

6. Fittings for conduit, tubing, and cable.

PART 2 - PRODUCTS

2.01 TYPE EMT-S DUCT RACEWAYS AND ELBOWS

A. Performance Criteria:

1. Regulatory Requirements: Listed and labeled in accordance with NFPA 70, by qualified electrical testing laboratory recognized by authorities having jurisdiction, and marked for intended location and application.
2. Listing Criteria: UL CCN FJMX; including UL 797.

B. Source Quality Control:

1. Product Data: Prepare and submit catalog cuts, brochures, and performance data illustrating size, physical appearance, and other characteristics of product.
2. Manufacturer's Published Instructions: Prepare and submit installation, testing, and operating instructions for product.

C. UL FJMX - Steel Electrical Metal Tubing (EMT-S) and Elbows:
1. Material: Steel.
2. Options:

a. Exterior Coating: Zinc.
b. Interior Coating: Zinc with organic top coating.
c. Minimum Trade Size: Metric designator 16 (trade size 1/2).
d. Colors: As indicated on Drawings.

2.02 TYPE ERMC-S DUCT RACEWAYS, ELBOWS, COUPLINGS, AND NIPPLES

A. Performance Criteria:

1. Regulatory Requirements: Listed and labeled in accordance with NFPA 70, by qualified electrical testing laboratory recognized by authorities having jurisdiction, and marked for intended location and application.
2. Listing Criteria: UL CCN DYIX; including UL 6.

B. Source Quality Control:

1. Product Data: Prepare and submit catalog cuts, brochures, and performance data illustrating size, physical appearance, and other characteristics of product.
2. Manufacturer's Published Instructions: Prepare and submit installation, testing, and operating instructions for product.

C. UL DYIX - Galvanized-Steel Electrical Rigid Metal Conduit (ERMC-S-G), Elbows, Couplings, and Nipples:
   1. Exterior Coating: Zinc.
   2. Options:

      a. Interior Coating: Zinc with organic top coating.
      b. Minimum Trade Size: Metric designator 16 (trade size 1/2).
      c. Colors: As indicated on Drawings.

2.03 TYPE LFMC DUCT RACEWAYS

A. Performance Criteria:

   1. Regulatory Requirements: Listed and labeled in accordance with NFPA 70, by qualified electrical testing laboratory recognized by authorities having jurisdiction, and marked for intended location and application.
   2. Listing Criteria: UL CCN DXHR; including UL 360.

B. Source Quality Control:

   1. Product Data: Prepare and submit catalog cuts, brochures, and performance data illustrating size, physical appearance, and other characteristics of product.
   2. Manufacturer's Published Instructions: Prepare and submit installation, testing, and operating instructions for product.

C. UL DXHR - Steel Liquidtight Flexible Metal Conduit (LFMC-S):
   1. Material: Steel.
   2. Options:

      a. Minimum Trade Size: Metric designator 16 (trade size 1/2).
      b. Colors: As indicated on Drawings.

2.04 TYPE PVC DUCT RACEWAYS AND FITTINGS

A. Performance Criteria:

   1. Regulatory Requirements: Listed and labeled in accordance with NFPA 70, by qualified electrical testing laboratory recognized by authorities having jurisdiction, and marked for intended location and application.
   2. Listing Criteria: UL CCN DZYR; including UL 651.

B. Source Quality Control:

   1. Product Data: Prepare and submit catalog cuts, brochures, and performance data illustrating size, physical appearance, and other characteristics of product.

2. Manufacturer's Published Instructions: Prepare and submit installation, testing, and operating instructions for product.

C. UL DZYR - Schedule 40 Rigid PVC Conduit (PVC-40) and Fittings:
1. Dimensional Specifications: Schedule 40.
2. Options:

a. Minimum Trade Size: Metric designator 16 (trade size 1/2).
b. Markings: For use with maximum 90 deg C wire.

2.05 FITTINGS FOR CONDUIT, TUBING, AND CABLE

A. Performance Criteria:

1. Regulatory Requirements: Listed and labeled in accordance with NFPA 70, by qualified electrical testing laboratory recognized by authorities having jurisdiction, and marked for intended location and application.

B. Source Quality Control:

1. Product Data: Prepare and submit catalog cuts, brochures, and performance data illustrating size, physical appearance, and other characteristics of product.
2. Manufacturer's Published Instructions: Prepare and submit installation, testing, and operating instructions for product.

C. UL DWTT - Fittings for Type ERMC, Type IMC, Type PVC, Type HDPE, Type EPEC, and Type RTRC Duct Raceways:
1. Listing Criteria: UL CCN DWTT; including UL 514B.
2. Options:

a. Material: Steel.
b. Coupling Method: Compression coupling.
c. Expansion and Deflection Fittings: UL 651 with flexible bonding jumper.

D. UL FKAV - Fittings for Type EMT Duct Raceways:
1. Listing Criteria: UL CCN FKAV; including UL 514B.
2. Options:

a. Material: Steel.
b. Coupling Method: Compression coupling.
c. Expansion and Deflection Fittings: UL 651 with flexible bonding jumper.

E. UL ILNR - Fittings for Type FMC Duct Raceways:
1. Listing Criteria: UL CCN ILNR; including UL 514B.

F. UL DXAS - Fittings for Type LFMC and Type LFNC Duct Raceways:
1. Listing Criteria: UL CCN DXAS; including UL 514B.

PART 3 - EXECUTION

3.01 SELECTION OF CONDUITS FOR ELECTRICAL SYSTEMS

A. Unless more stringent requirements are specified in Contract Documents or manufacturers' published instructions, comply with NFPA 70 for selection of duct raceways. Consult Architect for resolution of conflicting requirements.

B. Outdoors:

1. Exposed and Subject to Severe Physical Damage: ERMC.
2. Exposed and Subject to Physical Damage: ERMC.
    a. Locations less than 2.5 m (8 ft) above finished floor.
3. Exposed and Not Subject to Physical Damage: ERMC.
4. Concealed Aboveground: EMT PVC-80 PVC-40 RTRC-AG.
5. Direct Buried: PVC-40
6. Concrete Encased Not in Trench: PVC-40.
7. Concrete Encased in Trench: PVC-40.
8. Connection to Vibrating Equipment (Including Transformers and Hydraulic, Pneumatic, Electric Solenoid, or Motor-Driven Equipment): LFMC.

C. Duct Fittings: Select fittings in accordance with NEMA FB 2.10 guidelines.

1. ERMC and IMC: Provide threaded-type fittings unless otherwise indicated.

3.02 INSTALLATION OF CONDUITS FOR ELECTRICAL SYSTEMS

A. Comply with manufacturer's published instructions.

B. Reference Standards for Installation: Unless more stringent installation requirements are specified in Contract Documents or manufacturers' published instructions, comply with the following:
1. Type EMT-S: Article 358 of NFPA 70 and NECA NEIS 101.
2. Type ERMC-S: Article 344 of NFPA 70 and NECA NEIS 101.
3. Type LFMC: Article 350 of NFPA 70 and NECA NEIS 101.
4. Type PVC: Article 356 of NFPA 70 and NECA NEIS 111.
5. Expansion Fittings: NEMA FB 2.40.
6. Consult Architect for resolution of conflicting requirements.

C. Special Installation Techniques:

1. General Requirements for Installation of Duct Raceways:
    a. Complete duct raceway installation before starting conductor installation.

b. Provide stub-ups through floors with coupling threaded inside for plugs, set flush with finished floor. Plug coupling until conduit is extended above floor to final destination or a minimum of 2 ft above finished floor.
c. Install no more than equivalent of three 90-degree bends in conduit run. Support within 12 inch of changes in direction.
d. Make bends in duct raceway using large-radius preformed ells except for parallel bends. Field bending must be in accordance with NFPA 70 minimum radii requirements. Provide only equipment specifically designed for material and size involved.
e. Conceal conduit within finished walls, ceilings, and floors unless otherwise indicated. Install conduits parallel or perpendicular to building lines.
f. Support conduit within 12 inch of enclosures to which attached.
g. Install duct sealing fittings at accessible locations in accordance with NFPA 70 and fill them with listed sealing compound. For concealed duct raceways, install fitting in flush steel box with blank cover plate having finish similar to that of adjacent plates or surfaces. Install duct sealing fittings in accordance with NFPA 70.
h. Install devices to seal duct raceway interiors at accessible locations. Locate seals so no fittings or boxes are between the seal and the following changes of environments. Seal interior of duct raceways at the following points:

    1) Where conduits pass from warm to cold locations, such as boundaries of refrigerated spaces.
    2) Where an underground service duct raceway enters a building or structure.
    3) Conduit extending from interior to exterior of building.
    4) Conduit extending into pressurized duct raceway and equipment.
    5) Conduit extending into pressurized zones that are automatically controlled to maintain different pressure set points.
    6) Where otherwise required by NFPA 70.

i. Do not install duct raceways or electrical items on "explosion-relief" walls or rotating equipment.
j. Do not install conduits within 2 inch of the bottom side of a metal deck roof.
k. Keep duct raceways at least 6 inch away from parallel runs of flues and steam or hot-water pipes. Install horizontal duct raceway runs above water and steam piping.
l. Cut conduit perpendicular to the length. For conduits metric designator 53 (trade size 2) and larger, use roll cutter or a guide to make cut straight and perpendicular to the length. Ream inside of conduit to remove burrs.
m. Install pull wires in empty duct raceways. Provide polypropylene or monofilament plastic line with not less than 200 lb tensile strength. Leave at least 12 inch of slack at both ends of pull wire. Cap underground duct raceways designated as spare above grade alongside duct raceways in use.

n. Install duct raceways square to the enclosure and terminate at enclosures without hubs with locknuts on both sides of enclosure wall. Install locknuts hand tight, plus one-quarter turn more.

1) Termination fittings with shoulders do not require two locknuts.

o. Terminate threaded conduits into threaded hubs or with locknuts on inside and outside of boxes or cabinets. Install bushings on conduits up to metric designator 35 (trade size 1-1/4) and insulated throat metal bushings on metric designator 41 (trade size 1-1/2) and larger conduits terminated with locknuts.

2. Types ERMC and IMC:

a. Threaded Conduit Joints, Exposed to Wet, Damp, Corrosive, or Outdoor Conditions: Apply listed compound that maintains electrical conductivity to threads of duct raceway and fittings before making up joints. Follow compound manufacturer's published instructions.

3. Types PVC:

a. Do not install Type PVC, conduit where ambient temperature exceeds 122 deg F. Conductor ratings must be limited to 75 deg C except where installed in a trench outside buildings with concrete encasement, where 90 deg C conductors are permitted.
b. Comply with manufacturer's published instructions for solvent welding and fittings.

4. Duct Raceways Embedded in Slabs:
a. Arrange duct raceways to cross building expansion joints with expansion fittings at right angles to the joint.
b. Arrange duct raceways to ensure that each is surrounded by minimum of 2 inch of concrete without voids.
c. Do not embed threadless fittings in concrete unless locations have been specifically approved by Architect.
d. Change from ENT to ERMC or IMC before rising above floor.

5. Stub-ups to Above Recessed Ceilings:

a. Provide EMT, IMC, or ERMC for duct raceways.
b. Provide a conduit bushing or insulated fitting to terminate stub-ups not terminated in hubs or in an enclosure.

6. Duct Raceway Terminations at Locations Subject to Moisture or Vibration:

a. Provide insulating bushings to protect conductors, including conductors smaller than 4 AWG..

7. Duct Fittings: Install fittings in accordance with NEMA FB 2.10 guidelines.

    a. ERMC-S-PVC: Provide only fittings listed for use with this type of conduit. Patch and seal joints, nicks, and scrapes in PVC coating after installing conduits and fittings. Provide sealant recommended by fitting manufacturer and apply in thickness and number of coats recommended by manufacturer.
    b. EMT: Provide compression, steel fittings. Comply with NEMA FB 2.10.
    c. Flexible Conduit: Provide only fittings listed for use with flexible conduit type. Comply with NEMA FB 2.20.

8. Expansion-Joint Fittings:

    a. Install in runs of aboveground PVC that are located where environmental temperature change may exceed 30 deg F and that have straight-run length that exceeds 25 ft. Install in runs of aboveground ERMC and EMT conduit that are located where environmental temperature change may exceed 100 deg F and that have straight-run length that exceeds 100 ft.
    b. Install type and quantity of fittings that accommodate temperature change listed for the following locations:

        1) Outdoor Locations Not Exposed to Direct Sunlight: 125 deg F temperature change.
        2) Outdoor Locations Exposed to Direct Sunlight: 155 deg F temperature change.
        3) Indoor Spaces Connected with Outdoors without Physical Separation: 125 deg F temperature change.
        4) Attics: 135 deg F temperature change.
        5) .

    c. 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 for PVC conduits. Install fitting(s) that provide expansion and contraction for at least 0.000078 inch per foot of length of straight run per deg F of temperature change for metal conduits.
    d. Install expansion fittings at locations where conduits cross building or structure expansion joints.
    e. Install expansion-joint fitting with position, mounting, and piston setting selected in accordance with manufacturer's published instructions for conditions at specific location at time of installation. Install conduit supports to allow for expansion movement.

9. Duct Raceways Penetrating Rooms or Walls with Acoustical Requirements: Seal duct raceway openings on both sides of rooms or walls with acoustically rated putty or firestopping.
10. Identification: Provide labels for conduit assemblies, duct raceways, and associated electrical equipment.

a. Provide warning signs.

3.03 PROTECTION

A. Protect coatings, finishes, and cabinets from damage and deterioration.

1. Repair damage to galvanized finishes with zinc-rich paint recommended by manufacturer.
2. Repair damage to PVC coatings or paint finishes with matching touchup coating recommended by manufacturer.

END OF SECTION

SECTION 260533.16 - BOXES AND COVERS FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes:

1. Metallic outlet boxes, device boxes, rings, and covers.
2. Junction boxes and pull boxes.
3. Cover plates for device boxes.

1.02 ACTION SUBMITTALS

A. Product Data:

1. Metallic outlet boxes, device boxes, rings, and covers.
2. Junction boxes and pull boxes.
3. Cover plates for device boxes.

B. Shop Drawings:

1. Shop drawings for floor boxes.

1.03 INFORMATIONAL SUBMITTALS

A. Manufacturers' Published Instructions:

1. Metallic outlet boxes, device boxes, rings, and covers.
2. Junction boxes and pull boxes.
3. Cover plates for device boxes.

PART 2 - PRODUCTS

2.01 METALLIC OUTLET BOXES, DEVICE BOXES, RINGS, AND COVERS

A. Performance Criteria:

1. Regulatory Requirements: Listed and labeled in accordance with NFPA 70, by qualified electrical testing laboratory recognized by authorities having jurisdiction and marked for intended location and application.
2. Listing Criteria: UL CCN QCIT; including UL 514A.

B. Source Quality Control:

1. Product Data: Prepare and submit catalog cuts, brochures, and performance data illustrating size, physical appearance, and other characteristics of product.
2. Manufacturer's Published Instructions: Prepare and submit installation, testing, and operating instructions for product.

C. UL QCIT - Metallic Outlet Boxes and Covers:

1. Description: Box having pryout openings, knockouts, threaded entries, or hubs in either the sides of the back, or both, for entrance of conduit, conduit or cable fittings, or cables, with provisions for mounting outlet box cover, but without provisions for mounting wiring device directly to box.
2. Options:

a. Material: Sheet steel.
b. Sheet Metal Depth: Minimum 2.5 inch.
c. Cast-Metal Depth: Minimum 2.4 inch.
d. Luminaire Outlet Boxes and Covers: Nonadjustable, listed and labeled for attachment of luminaire weighing up to 50 lb.

D. UL QCIT - Metallic Conduit Bodies:

1. Description: Means for providing access to interior of conduit or tubing system through one or more removable covers at junction or terminal point. In the United States, conduit bodies are listed in accordance with outlet box requirements.

E. UL QCIT - Metallic Device Boxes:

1. Description: Box with provisions for mounting wiring device directly to box.
2. Options:

a. Material: Sheet steel.
b. Sheet Metal Depth: minimum 2.5 inch.
c. Cast-Metal Depth: minimum 2.4 inch.

F. UL QCIT - Metallic Extension Rings:

1. Description: Ring intended to extend sides of outlet box or device box to increase box depth, volume, or both.

2.02 JUNCTION BOXES AND PULL BOXES

A. Performance Criteria:

1. Regulatory Requirements: Listed and labeled in accordance with NFPA 70 and marked for intended location and use.

2. Listing Criteria: UL CCN BGUZ; including UL 50 and UL 50E.

B. Source Quality Control:

1. Product Data: Prepare and submit catalog cuts, brochures, and performance data illustrating size, physical appearance, and other characteristics of product.

2. Manufacturer's Published Instructions: Prepare and submit installation, testing, and operating instructions for product.

C. UL BGUZ - Indoor Sheet Metal Junction and Pull Boxes:

1. Description: Box with a blank cover that serves the purpose of joining different runs of raceway or cable.
2. Options:

a. Degree of Protection: Type 1.

D. UL BGUZ - Outdoor Sheet Metal Junction and Pull Boxes:

1. Description: Box with a blank cover that serves the purpose of joining different runs of raceway or cable.
2. Options:

a. Degree of Protection: Type 3R.

E. UL BGUZ - Outdoor Cast-Metal Junction and Pull Boxes:

1. Description: Box with a blank cover that serves the purpose of joining different runs of raceway or cable.
2. Options:

a. Degree of Protection: Type 3R.

F. UL BGUZ - Outdoor Polymeric Junction and Pull Boxes:

1. Description: Box with a blank cover that serves the purpose of joining different runs of raceway or cable.
2. Options:

a. Degree of Protection: Type 3R Type 3RX Type 3S Type 3SX Type 4 Type 4X Type 6 Type 6P.

2.03 COVER PLATES FOR DEVICES BOXES

A. Performance Criteria:

1. Regulatory Requirements: Listed and labeled in accordance with NFPA 70 and marked for intended location and use.
2. Listing Criteria: UL CCN QCIT or UL CCN QCMZ; including UL 514D.
3. Wall plate-Securing Screws: Metal with head color to match wall plate finish.

B. Source Quality Control:

1. Product Data: Prepare and submit catalog cuts, brochures, and performance data illustrating size, physical appearance, and other characteristics of product.

2. Manufacturer's Published Instructions: Prepare and submit installation, testing, and operating instructions for product.

C. UL QCIT or QCMZ - Metallic Cover Plates for Device Boxes:
1. Options:

a. Damp and Wet Locations: Listed, labeled, and marked for location and use. Provide gaskets and accessories necessary for compliance with listing.
b. Wall plate Material: 0.032 inch thick, Type 302/304 non-magnetic stainless steel with brushed finish.

PART 3 - EXECUTION

3.01 PREPARATION

3.02 SELECTION OF BOXES AND COVERS FOR ELECTRICAL SYSTEMS

A. Unless more stringent requirements are specified in Contract Documents or manufacturers' published instructions, comply with NFPA 70 for selection of boxes and enclosures. Consult Architect for resolution of conflicting requirements.

B. Degree of Protection:

1. Outdoors:

a. Type 3R unless otherwise indicated.

C. Exposed Boxes Installed Less Than 2.5 m (8 ft) Above Floor:

1. Provide cast-metal boxes.
2. Provide exposed cover. Flat covers with angled mounting slots or knockouts are prohibited.

3.03 INSTALLATION OF BOXES AND COVERS FOR ELECTRICAL SYSTEMS

A. Comply with manufacturer's published instructions.

B. Reference Standards for Installation: Unless more stringent installation requirements are specified in Contract Documents or manufacturers' published instructions, comply with the following:

1. Outlet, Device, Pull, and Junction Boxes: Article 314 of NFPA 70.
2. Consult Architect for resolution of conflicting requirements.

C. Special Installation Techniques:

1. Provide boxes in wiring and raceway systems wherever required for pulling of wires, making connections, and mounting of devices or fixtures.
2. Mount boxes at heights indicated on Drawings. If mounting heights of boxes are not individually indicated, give priority to ADA requirements. Install boxes with height measured to bottom of box unless otherwise indicated.
3. Recessed Boxes in Masonry Walls: Saw-cut opening for box in center of cell of masonry block and install box flush with surface of wall. Prepare block surfaces to provide a flat surface for a raintight connection between box and cover plate or supported equipment and box, whether installed indoors or outdoors.
4. Horizontally separate boxes mounted on opposite sides of walls, so they are not in the same vertical channel.
5. Locate boxes so that cover or plate will not span different building finishes.
6. Support boxes in recessed ceilings independent of ceiling tiles and ceiling grid.
7. Support boxes of three gangs or more from more than one side by spanning two framing members or mounting on brackets specifically designed for purpose.
8. Fasten junction and pull boxes to, or support from, building structure. Do not support boxes by conduits.
9. Do not rely on locknuts to penetrate nonconductive coatings on enclosures. Remove coatings in the locknut area prior to assembling conduit to enclosure to ensure a continuous ground path.
10. Boxes and Enclosures in Areas or Walls with Acoustical Requirements:

    a. Seal openings and knockouts in back and sides of boxes and enclosures with acoustically rated putty.
    b. Provide gaskets for wall plates and covers.

11. Identification: Provide labels for boxes and associated electrical equipment.

    a. Identify field-installed conductors, interconnecting wiring, and components.
    b. Provide warning signs.
    c. Label each box with engraved metal or laminated-plastic nameplate.

3.04 CLEANING

A. Remove construction dust and debris from boxes before installing wall plates, covers, and hoods.

3.05 PROTECTION

A. After installation, protect boxes from construction activities. Remove and replace items that are contaminated, defaced, damaged, or otherwise caused to be unfit for use prior to acceptance by Owner.

END OF SECTION

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. Section Includes:
   1. GFCI receptacles, 125 V, 20 A.

1.3 DEFINITIONS

A. GFCI: Ground-fault circuit interrupter.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Shop Drawings: List of legends and description of materials and process used for premarking wall plates.

1.5 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For wiring devices to include in all manufacturers' packing-label warnings and instruction manuals that include labeling conditions.

PART 2 - PRODUCTS

2.1 GENERAL WIRING-DEVICE REQUIREMENTS

A. Wiring Devices, Components, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and use.

B. Comply with NFPA 70.

C. RoHS compliant.

D. Comply with NEMA WD 1.

E. Devices that are manufactured for use with modular plug-in connectors may be substituted under the following conditions:

1. Connectors shall comply with UL 2459 and shall be made with stranding building wire.
2. Devices shall comply with requirements in this Section.

F. Device Color:

1. Wiring Devices Connected to Normal Power System: As selected by Architect unless otherwise indicated or required by NFPA 70 or device listing.

G. Wall Plate Color: For plastic covers, match device color.

H. Source Limitations: Obtain each type of wiring device and associated wall plate from single source from single manufacturer.

2.2 GFCI RECEPTACLES, 125 V, 20 A

A. Duplex GFCI Receptacles, 125 V, 20 A:
1. Description: Integral GFCI with "Test" and "Reset" buttons and LED indicator light. Two pole, three wire, and self-grounding.
2. Configuration: NEMA WD 6, Configuration 5-20R.
3. Type: Non-feed through.
4. Standards: Comply with UL 498, UL 943 Class A, and FS W-C-596.

2.3 WALL PLATES

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

B. Wet-Location, Weatherproof Cover Plates: NEMA 250, complying with Type 3R, weather-resistant with lockable cover.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Comply with NECA 1, including mounting heights listed in that standard, unless otherwise indicated.

B. Conductors:

1. Do not strip insulation from conductors until right 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 comply with NFPA 70, Article 300, without pigtails.

C. Device Installation:

1. Replace devices that have been in temporary use during construction and that 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, two-thirds to three-fourths of the way around terminal screw.
6. Use a torque screwdriver when a torque is recommended or required by 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.

D. Receptacle Orientation:

1. Install ground pin of vertically mounted receptacles down, and on horizontally mounted receptacles to the right.

E. Device Plates: Do not use oversized or extra-deep plates. Repair wall finishes and remount outlet boxes when standard device plates do not fit flush or do not cover rough wall opening.

3.2 GFCI RECEPTACLES

A. Install non-feed-through GFCI receptacles where protection of downstream receptacles is not required.

3.3 IDENTIFICATION

A. Identify each receptacle with panelboard identification and circuit number. Use hot, stamped, or engraved machine printing with white-filled lettering on face of plate, and durable wire markers or tags inside outlet boxes.

3.4 FIELD QUALITY CONTROL

A. Test Instruments: Use instruments that comply with UL 1436.

B. Test Instrument for Receptacles: Digital wiring analyzer with digital readout or illuminated digital-display indicators of measurement.

C. Perform the following tests and inspections:
   1. Test Instruments: Use instruments that comply with UL 1436.
   2. Test Instrument for Receptacles: Digital wiring analyzer with digital readout or illuminated digital-display indicators of measurement.

D. Tests for Receptacles:

   1. Line Voltage: Acceptable range is 105 to 132 V.
   2. Percent Voltage Drop under 15-A Load: A value of 6 percent or higher is unacceptable.
   3. Ground Impedance: Values of up to 2 ohms are acceptable.
   4. GFCI Trip: Test for tripping values specified in UL 1436 and UL 943.
   5. Using the test plug, verify that the device and its outlet box are securely mounted.
   6. 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.

E. Wiring device will be considered defective if it does not pass tests and inspections.

F. Prepare test and inspection reports.

END OF SECTION 26 27 26

SECTION 26 56 13 - LIGHTING POLES AND STANDARDS

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

A. Section Includes:
   1. Poles and accessories for support of luminaires.

1.03 DEFINITIONS

A. EPA: Equivalent projected area.

B. Luminaire: Complete luminaire.

C. Pole: Luminaire-supporting structure, including tower used for large-area illumination.

D. Standard: See "Pole."

1.04 ACTION SUBMITTALS

A. Product Data: For each pole, accessory, and luminaire-supporting and -lowering device, arranged as indicated.
   1. Include data on construction details, profiles, EPA, cable entrances, materials, dimensions, weight, rated design load, and ultimate strength of individual components.
   2. Include finishes for lighting poles and luminaire-supporting devices.
   3. Anchor bolts.
   4. Manufactured pole foundations.

B. Shop Drawings:
   1. Include plans, elevations, sections, and mounting and attachment details.
   2. Include details of equipment assemblies. Indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
   3. Detail fabrication and assembly of poles and pole accessories.
   4. Foundation construction details, including material descriptions, dimensions, anchor bolts, support devices, and calculations, signed and sealed by a professional engineer licensed in the state of installation.

5. Anchor bolt templates keyed to specific poles and certified by manufacturer.
6. Method and procedure of pole installation. Include manufacturer's written installations.

1.05 INFORMATIONAL SUBMITTALS

A. Pole and Support Component Certificates: Signed by manufacturers of poles, certifying that products are designed for indicated load requirements according to AASHTO LTS-6-M and that load imposed by luminaire and attachments has been included in design. The certification shall be based on design calculations signed and sealed by a professional engineer.

B. Seismic Qualification Data: For accessories, and components, from manufacturer.
1. Basis for Certification: Indicate whether withstand certification is based on actual test of assembled components or on calculation.
2. Dimensioned Outline Drawings of Equipment Unit: Identify center of gravity and locate and describe mounting and anchorage provisions.
3. Detailed description of equipment anchorage devices on which the certification is based and their installation requirements.

C. Material Test Reports:
1. For each foundation component, by a qualified testing agency.
2. For each pole, by a qualified testing agency.

D. Source quality-control reports.

E. Field quality-control reports.

F. Sample Warranty: Manufacturer's standard warranty.

G. Soil test reports

1.06 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For poles to include in emergency, operation, and maintenance manuals.
1. In addition to items specified in Section 01 78 23 "Operation and Maintenance Data," include pole inspection and repair procedures.

1.07 MAINTENANCE MATERIAL SUBMITTALS

A. Pole repair materials.

1.08 DELIVERY, STORAGE, AND HANDLING

A. Store poles on decay-resistant skids at least 12 inches above grade and vegetation. Support poles to prevent distortion and arrange to provide free air circulation.

B. Retain factory-applied pole wrappings on metal poles until right before pole installation. Handle poles with web fabric straps.

1.09 WARRANTY

A. Special Warranty: Manufacturer agrees to repair or replace components of pole(s) 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 a specified warranty period. Manufacturer may exclude lightning damage, hail damage, vandalism, abuse, or unauthorized repairs from special warranty period.
   1. Warranty Period: Five years from date of Substantial Completion.
   2. Warranty Period for Corrosion Resistance: Five years from date of Substantial Completion.
   3. Warranty Period for Color Retention: Five years from date of Substantial Completion.

PART 2 - PRODUCTS

2.01 PERFORMANCE REQUIREMENTS

A. Delegated Design: Engage a qualified professional engineer, as defined in Section 01 40 00 "Quality Requirements," to design pole foundation and pole power system.
   1. The term "withstand" means "the system will remain in place without separation of any parts when subjected to the seismic forces specified."
   2. Component Importance Factor: 1.5.

B. Wind Load: Pressure of wind on pole and luminaire, calculated and applied according to AASHTO LTS-6-M.
   1. Basic wind speed for calculating wind load for poles 50 feet high or less is 100 mph.
      a. Wind Importance Factor: 1.0.
      b. Minimum Design Life: 25 years.
      c. Velocity Conversion Factor: 1.0.

C. Strength Analysis: For each pole, multiply the actual EPA of luminaires and brackets by a factor of 1.1 to obtain the EPA to be used in pole selection strength analysis.

D. Luminaire Attachment Provisions: Comply with luminaire manufacturers' mounting requirements. Use stainless-steel fasteners and mounting bolts unless otherwise indicated.

2.02 PRESTRESSED CONCRETE POLES

A. Poles: Refer to Light Fixture Schedule and electrical plans for details.

2.03 POLE ACCESSORIES

2.04 GENERAL FINISH REQUIREMENTS

A. Protect mechanical finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.

B. Appearance of Finished Work: Noticeable variations in same piece are unacceptable. Variations in appearance of adjoining components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Examine areas and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.

B. Examine poles, luminaire-mounting devices, and pole accessories before installation. Components that are scratched, dented, marred, wet, moisture damaged, or visibly damaged are considered defective.

C. Examine roughing-in for foundation and conduit to verify actual locations of installation.

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

3.02 POLE FOUNDATION

A. Direct-Buried Foundations: Install to depth indicated on Drawings. Add backfill in 6-inch to 9-inch layers, tamping each layer before adding the next. To ensure a plumb installation, continuously check pole orientation with plumb bob while tamping.

3.03 POLE INSTALLATION

A. Alignment: Align poles as indicated.

3.04 CORROSION PREVENTION

A. Steel Conduits: Comply with requirements in Section 26 05 33 "Raceways 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.

3.05 GROUNDING

A. Ground Metal Poles and Support Structures: Comply with requirements in Section 26 05 26 "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.

3.06 IDENTIFICATION

A. Identify system components, wiring, cabling, and terminals. Comply with requirements for identification specified in Section 26 05 53 "Identification for Electrical Systems."

3.07 FIELD QUALITY CONTROL

A. Special Inspections: Perform the following special inspections:
   1. Inspect poles for nicks, mars, dents, scratches, and other damage.
   2. System function tests.

END OF SECTION

SECTION 26 56 19 - LED EXTERIOR LIGHTING

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

A. Section Includes:
   1. Luminaire types.
   2. Materials.
   3. Luminaire support components.

B. Related Requirements:
   1. Section 26 56 13 "Lighting Poles and Standards" for poles and standards used to support exterior lighting equipment.

1.03 DEFINITIONS

A. CCT: Correlated color temperature.

B. CRI: Color rendering index.

C. Fixture: See "Luminaire."

D. IP: International Protection or Ingress Protection Rating.

E. Lumen: Measured output of lamp and luminaire, or both.

F. Luminaire: Complete lighting unit, including lamp, reflector, and housing.

1.04 ACTION SUBMITTALS

A. Product Data: For each type of luminaire.
   1. Arrange in order of luminaire designation.
   2. Include data on features, accessories, and finishes.
   3. Include physical description and dimensions of luminaire.
   4. Lamps, include life, output (lumens, CCT, and CRI), and energy-efficiency data.
   5. Photometric data and adjustment factors based on laboratory tests, complying with IES Lighting Measurements Testing and Calculation Guides, of each

luminaire type. The adjustment factors shall be for lamps and accessories identical to those indicated for the luminaire as applied in this Project.

a. Manufacturer's Certified Data: Photometric data certified by manufacturer's laboratory with a current accreditation under the NVLAP for Energy Efficient Lighting Products.
b. Testing Agency Certified Data: For indicated luminaires, photometric data certified by a qualified independent testing agency. Photometric data for remaining luminaires shall be certified by manufacturer.

6. Wiring diagrams for power, control, and signal wiring.
7. Photoelectric relays.
8. Means of attaching luminaires to supports and indication that the attachment is suitable for components involved.

B. Shop Drawings: For nonstandard or custom luminaires.
1. Include plans, elevations, sections, and mounting and attachment details.
2. Include details of luminaire assemblies. Indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
3. Include diagrams for power, signal, and control wiring.

C. Product Schedule: For luminaires and lamps. Use same designations indicated on Drawings.

D. Delegated-Design Submittal: For luminaire supports.
1. Include design calculations for luminaire supports and seismic restraints.

1.05 INFORMATIONAL SUBMITTALS

A. Coordination Drawings: Plans, drawn to scale, on which the following items are shown and coordinated with each other, using input from installers of the items involved:
1. Luminaires.
2. Structural members to which equipment and luminaires will be attached.
3. Underground utilities and structures.
4. Existing underground utilities and structures.
5. Above-grade utilities and structures.
6. Existing above-grade utilities and structures.
7. Building features.
8. Vertical and horizontal information.
9. .

B. Qualification Data: For testing laboratory providing photometric data for luminaires.

C. Seismic Qualification Data: For luminaires, accessories, and components, from manufacturer.
1. Basis for Certification: Indicate whether withstand certification is based on actual test of assembled components or on calculation.

2. Dimensioned Outline Drawings of Equipment Unit: Identify center of gravity and locate and describe mounting and anchorage provisions.
3. Detailed description of equipment anchorage devices on which the certification is based and their installation requirements.

D. Product Test Reports: For each luminaire, for tests performed by a qualified testing agency.

E. Source quality-control reports.

F. Sample warranty.

1.06 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For luminaires to include in operation and maintenance manuals.
1. Provide a list of all lamp types used on Project. Use ANSI and manufacturers' codes.
2. Provide a list of all photoelectric relay types used on Project; use manufacturers' codes.

1.07 QUALITY ASSURANCE

A. Luminaire Photometric Data Testing Laboratory Qualifications:
1. Luminaire manufacturers' laboratory that is accredited under the NVLAP for Energy Efficient Lighting Products.
2. 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, accredited under the NVLAP for Energy Efficient Lighting Products and complying with applicable IES testing standards.

B. Provide luminaires from a single manufacturer for each luminaire type.

1.08 DELIVERY, STORAGE, AND HANDLING

A. Protect finishes of exposed surfaces by applying a strippable, temporary protective covering prior to shipping.

1.09 FIELD CONDITIONS

A. Verify existing and proposed utility structures prior to the start of work associated with luminaire installation.

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

1.10 WARRANTY

A. Warranty: Manufacturer and Installer agree to repair or replace components of luminaires that fail in materials or workmanship within specified warranty period.
   1. Failures include, but are not limited to, the following:
      a. Structural failures, including luminaire support components.
      b. Faulty operation of luminaires and accessories.
      c. Deterioration of metals, metal finishes, and other materials beyond normal weathering.
      d. .
   2. Warranty Period: 2 year(s) from date of Substantial Completion.

PART 2 - PRODUCTS

2.01 PERFORMANCE REQUIREMENTS

A. Seismic Performance:
   1. Luminaires shall withstand the effects of earthquake motions determined according to ASCE/SEI 7.
   2. The term "withstand" means "the luminaire will remain in place without separation of any parts when subjected to the seismic forces specified."

2.02 LUMINAIRE REQUIREMENTS

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

B. NRTL Compliance: Luminaires shall be listed and labeled for indicated class and division of hazard by an NRTL.

C. UL Compliance: Comply with UL 1598 and listed for wet location.

D. Source Limitations:
   1. Obtain luminaires from single source from a single manufacturer.
   2. For luminaires, obtain each color, grade, finish, type, and variety of luminaire from single source with resources to provide products of consistent quality in appearance and physical properties.

2.03 LUMINAIRE TYPES

A. Refer to Light Fixture Schedule for Exterior Light Fixtures for Specifications and Requirements.

2.04 MATERIALS

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

B. Doors, Frames, and Other Internal Access: Smooth operating, free of light leakage under operating conditions. 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.

2.05 FINISHES

A. Variations in Finishes: Noticeable variations in same piece are unacceptable. Variations in appearance of adjoining components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

B. 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.

2.06 LUMINAIRE SUPPORT COMPONENTS

A. Comply with requirements in Section 26 05 29 "Hangers and Supports for Electrical Systems" for channel and angle iron supports and nonmetallic channel and angle supports.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.

B. Examine roughing-in for luminaire electrical conduit to verify actual locations of conduit connections before luminaire installation.

C. Examine walls, roofs, and canopy ceilings and overhang ceilings for suitable conditions where luminaires will be installed.

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

3.02 GENERAL INSTALLATION REQUIREMENTS

A. Comply with NECA 1.

B. Use fastening methods and materials selected to resist seismic forces defined for the application and approved by manufacturer.

C. Fasten luminaire to structural support.

D. Supports:
   1. Sized and rated for luminaire weight.
   2. Support luminaires without causing deflection of finished surface.
   3. Luminaire-mounting devices shall be capable of supporting a horizontal force of 100 percent of luminaire weight and a vertical force of 400 percent of luminaire weight.

E. Wall-Mounted Luminaire Support:
   1. Attached to structural members in walls.

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

G. Install luminaires at height and aiming angle as indicated on Drawings.

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

I. Adjust luminaires that require field adjustment or aiming.

J. Comply with requirements in Section 26 05 19 "Low-Voltage Electrical Power Conductors and Cables" and Section 26 05 33 "Raceways and Boxes for Electrical Systems" for wiring connections and wiring methods.

3.03 INSTALLATION OF INDIVIDUAL GROUND-MOUNTED LUMINAIRES

A. Aim as indicated on Drawings.

B. 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 Section 03 30 00 "Cast-in-Place Concrete."

3.04 CORROSION PREVENTION

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

B. Steel Conduits: Comply with Section 26 05 33 "Raceways 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.

3.05 IDENTIFICATION

A. Identify system components, wiring, cabling, and terminals. Comply with requirements for identification specified in Section 26 05 53 "Identification for Electrical Systems."

3.06 FIELD QUALITY CONTROL

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

B. Perform the following tests and inspections:
   1. Operational Test: After installing luminaires, switches, and accessories, and after electrical circuitry has been energized, test units to confirm proper operation.
   2. Verify operation of photoelectric controls.

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

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.

3.07 DEMONSTRATION

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

3.08 ADJUSTING

A. Occupancy Adjustments: When requested within 12 months of date of Substantial Completion, provide on-site assistance in adjusting the direction of aim of luminaires to suit occupied conditions. Make up to two visits to Project during other-than-normal hours for this purpose. Some of this work may be required during hours of darkness.
   1. During adjustment visits, inspect all luminaires. Replace lamps or luminaires that are defective.
   2. Parts and supplies shall be manufacturer's authorized replacement parts and supplies.
   3. Adjust the aim of luminaires in the presence of the Architect.

END OF SECTION

SECTION 32 84 00 : LANDSCAPE IRRIGATION

PART 1 – GENERAL

1.1 SUMMARY

A. This Section includes:
1. Installation of a complete underground irrigation system as shown on the construction documents and as specified herein.
2. Contractor requirement to furnish all labor, equipment, materials, permits necessary for the complete irrigation system installation.
3. Trenching, excavating, boring, backfilling and compacting. for installation.
4. Backflow prevention, pipe, valves, emission devices, boxes to protect components.
5. Accessories.

B. Related Sections:
1. SECTION 32 90 00 : LANDSCAPE PLANTING

1.2 SUBMITTALS

A. Product data. Unless otherwise indicated, submit the following for each type of product specified including rated capacities, operating characteristics, electrical characteristics and furnished specialties and accessories.

B. Qualifications: Irrigation Contractor shall provide project references that clearly show the required minimum 5 years of experience installing projects of similar size and scope and submit the licenses of the Texas Licensed Irrigator, licensed irrigation installers and technicians that will be assigned to the project. No irrigation work shall be performed if individuals whose license has been submitted for the project are not present on-site.

C. Close-out:
1. Operation and Maintenance Data: Operation and maintenance manuals for controllers, automatic control valves and emissions devices.
2. Field Testing Reports: Backflow, main and lateral line pressure tests and drip valve tests.
3. Battery backup in controller.
4. Extra components: minimum 5 emission devices for each type specified.
5. As-built irrigation marked-up drawing to Landscape Architect.
6. Laminated as-built irrigation layout and irrigation schedule from Contract Documents installed within controller cover.

1.3 APPLICABLE STANDARDS AND REFERENCES

A. Contractor shall be familiar with and comply with all applicable Local, State and Federal requirements.

B. Technical Standards

1. American Society for Testing and Materials (ASTM) : Current Editions

D-1784	Specification for Rigid Poly Vinyl Chloride (PVC) Compounds and Chlorinated Poly Vinyl Chloride Compounds (CPVC)
D-1785	Specification for Poly Vinyl Chloride (PVC) Plastic Pipe : Schedule 40, 80 and 120
D-1875	Specification for Test Method for Density of Adhesives in Fluid Form
D-2241	Specification for Poly Vinyl Chloride (PVC) Pressure-Rated Pipe
D-2466	Specification for Poly Vinyl Chloride (PVC) Plastic Pipe Fittings : Schedule 40
D-2467	Specification for Socket-Type Poly Vinyl Chloride (PVC) Plastic Pipe Fittings : Schedule 80
D-2564	Specification for Solvent Cements for Poly Vinyl Chloride (PVC) Plastic Pipe and Fittings
D-2774	Recommended Practices : Underground Installation of Thermoplastic Pressure Piping
D-2855	Recommended Practice for Making Solvent-Cemented Joints with Poly Vinyl Chloride (PVC) Plastic Pipe and Fittings
D-3139	Specification for Joints for Plastic Pressure Pipe Using Flexible Elastomeric Seals

1.4 DEFINITIONS

A. Point of Connection: Location to access water supply for irrigation system.

B. Backflow Device: Component located between Point of Connection and Irrigation System piping which controls backflow and back pressure as required by Texas Commission on Environmental Quality (TCEQ) and local water purveyance authority. Backflow prevention is not required for Irrigation Systems connected to Reclaimed Water (Purple pipe) or Greywater water supply systems.

C. Main Line Piping: Pipe located downstream of Point of Connection and/or Master Valve and distributes irrigation water to Zone Control Valve. Piping is under pressure when irrigation system is active and Master Valve is installed. Piping is always under pressure when irrigation system is active and no Master Valve is installed.

D. Master Valve: Valve installed after Backflow Device on Main Line and controls pressurized water in main line. Addition minimizes potential for water waste due to leaks in mainline when irrigation system is not active.

E. Pressure Reducing Valve: Valve installed after Backflow Device on Main Line and controls pressure of water in main line.

F. Zone Control Valve: Valve located between mainline and lateral piping. Controls water conveyance into lateral piping.

G. Lateral Piping: Downstream from control valve to emissions devices. Piping is under pressure when Zone Control Valve is open.

H. Emission Devices: Component delivering irrigation water to landscape, i.e. sprinkler heads, bubblers, drip emitters, etc.

I. Low Voltage: As defined in NFPA70 for circuits and equipment operating at less than 50V or remote-control, signaling power-limited circuits.
J. Automatic Controller and Zone Control Valves: Shall indicate controller and valves that are connected by low-voltage connections and allows communication from Point of Connection to emission devices on a set schedule.
K. Automatic Controller Timing Schedule: Timed Settings for each Zone Control Valve indicated on Automatic Controller.

1.5 QUALITY ASSURANCE

A. Installer's Qualifications: Engage an experienced Texas Licensed Irrigator with a minimum of five (5) years of experience and a Texas Licensed Installer with a minimum of two (2) years of experience with work in drip irrigation installation and automatic controller at a commercial location.
B. CONTRACTOR shall convene a pre-installation meeting with the LANDSCAPE ARCHITECT via minimum two (2) day written notice a minimum one (1) week prior to commencing work of this Section and require attendance of all parties directly affecting or affected by Work of this Section. Pre-installation meeting shall include review of conditions, schedule, inspections, environmental procedures, and include coordination with other contractors.

PART 2 - PRODUCTS

2.1 GENERAL

A. All materials shall be new and without flaws or defects of any type and shall be the best of their class and kind. All materials shall be of the brands and types noted on the plans or as specified herein or approved equal.
B. The irrigation system was designed with equipment manufactured by specific companies as a standard. Approved as equal equipment by other manufacturers may only be used with the written approval of the LANDSCAPE ARCHITECT.

2.2 WARRANTIES

A. All materials shall have a minimum guarantee of one year against material defects or defective workmanship.

2.3 CONTROLLER

A. 120 VAC input Water Sense certified light commercial irrigation modular controller that is able to control 4 to 22 stations and supports 4 programs, 6 start times, flow monitoring and seasonal adjustment with multiple watering schedule options. Can be operated automatically or manually. Contains back lit LCD screen, time adjustment for stations from 1 minute to 6 hours.

B. Provide WiFi Module that allows connection to WiFi and control through free app on smart devices.

2.4 BACKFLOW PREVENTION

A. Shall be Reduced Pressure Zone Assembly that protects against hazards of cross-connection contamination that complies with all AWWA, ASSE, CSA specifications and state and local cross connection regulations. Shall include spring loaded “Y” type check valves, replaceable seat rings, low head loss and covered and freeze protected by specified cover that has a minimum R-25 insulation.
B. Backflow prevention device is not required for irrigation systems connected to reclaimed or greywater supply sources.

2.5 PRESSURE REDUCING VALVE

A. Standard : ASSE 1003
Body Material: Bronze for NPS 2 (DN50) and smaller; cast iron with interior lining complying with AWWA C550 or that is FDA approved for NPS 2 1/2 and NPS 3 (DN65 and DN80)
B. Pressure Rating: Initial pressure of 150 psi (1035 k Pa)
C. End Connections: Threaded for NPS2 (DN50) and smaller; flanged for NPS 2 1/2 and NPS 3 (DN65 and DN80).

2.6 MASTER VALVE

A. Standard: MSS SP-80, Type 2
B. Class: 125
C. Body: ASTM B 62 Bronze with integral seat and screw-in bonnet.
D. Ends: Threaded or solder joint.
E. Stem: Bronze, non-rising
F. Disc: Solid wedge; bronze.
G. Packaging: Asbestos free.
H. Hand-wheel: Malleable iron, bronze or aluminum.

2.7 ISOLATION VALVE

A. Brass ball valve with stainless steel ball and stem. 2 piece, full port, bottom-loaded blowout-proof stem, virgin PTFE seats, thrust washer, fluorocarbon elastomer stem O-ring and adjustable stem packing gland, stem packing nut, 304 stainless steel ball, brass adapter and steel handle. Pressure rating: 600 psi WOG and 250 psi WSP.

2.8 RAIN/FREEZE SENSOR

A. High grade, UV resistant polymer, 24VAC with signal transmission distance up to 700 feet line of sight. Adjustable rainfall settings from 1/8” - 1/2” (3-13 mm), adjustable low temperature settings from 33 degrees F to 41 degrees F, three irrigation modes

(programmed, suspended irrigation for 72 hours, override sensor for 72 hours) with quick shut off to suspend active irrigation cycle within two (2) minutes.

2.9 FLOW SENSOR

A. Designed for outdoor and underground application on standard 18g irrigation wire. sends flow data to irrigation controller for accurate flow monitoring. Glass filled nylon body monitors flow for low or excessive flow conditions caused by broken lines or heads. Designed to withstand potential winter high-burst pressure blowouts.

2.10 ZONE VALVE

A. Automatic Drip Valve Kit shall include valve, pressure regulating filter and ball valve.
B. Valve: Inline electrically controlled valve, shall be diaphragm activated and hydraulically operated solenoid valves with flow range: 0.3 gpm to 20 gpm.
C. Pressure Regulating Basket Filter: regulates to 40 psi, 200 mesh (75 micron) screen filter. Inlet pressure: 15 to 150 psi (1.0 to 10.3 bar), temperature: up to 150 degrees F (66 degrees C) includes indicator window with easy to read indicator.

2.11 VALVE BOXES

A. Valve Boxes and Covers: Valve boxes shall be heavy duty, made of structural foam high density polyethylene (HDPE) with UV inhibitors, truss reinforced walls, chemical and water resistant, flat cover with locking mechanism. Color for lid and box shall match finish material.

2.12 DRIP IRRIGATION SPECIALTIES

A. Emitter Devices: With 1/2 in. (15/21) FPT threaded inlet six (6) free flowing 1/4 inch barb outlets to deliver water.
    1. Body Material: Plastic
    2. Inlet: 1/2 inch (15/21) FPT inlet threads
    3. Outlet: Easily removable factory sealed with plastic caps for unused outlets. attaches to 1/4 in. drip distribution tubing.
B. Drip Outlets: 2.0 GPH pressure compensating, barbed inlet with check valve, UV resistant plastic button-type outlet

2.13 PIPING, TUBING AND FITTINGS

A. Comply with requirements in the piping schedule for applications of pipe, tube and fitting materials and for joining methods for specific services, service locations and pipe sizes. All pipe and fittings shall be made in the United States of America.
B. PVC Pipe shall be produced in 20 foot lengths and conform with applicable ASTM section and be continuously marked with identification of the manufacture, type, class,

size and material. Pipe shall be free of holes, foreign material, blisters, wrinkles, dents or sun scald at all times.

C. Copper Pipe: Shall be Type K

D. Specialty Pipe and Fittings: Pipe other than PVC or Copper pipe shall be considered specialty pipe. All specialty pipe and fittings shall meet applicable ASTM requirements and shall be installed per manufacturer's recommendations. Joints shall be solvent welded. Solvent joints shall meet ASTM D2774 and D2855 requirements.

D. PVC Fittings: Fittings including Risers and Threaded Nipples shall be Schedule 80 PVC and comply with applicable ASTM.

E. 1/4” (0.170 in. ID x 0.250 in OD) Polyethylene or vinyl distribution tubing with UV inhibitors for drip irrigation.

2.14 PIPE JOINING MATERIALS

A. Pipe Flange Gasket Materials: AWWA C110, rubber, flat face, 1/8 inch (3.2mm) thick unless otherwise indicated full-face or ring type unless otherwise indicated.

B. Metal Pipe-Flange Bolts and Nuts: ASME B18.2.1 carbon steel unless otherwise indicated.

C. Solvent Cements: Cleaners/primers and compounds for joining PVC piping. Shall comply with ASTM D2564 and primer shall comply with ASTM F656.

1. Cement shall be No. 2200 series Uni-Weld or Rectorseal Gold low temperature plastic pipe cement or approved equal for use on all sizes and schedules of PVC pipe and fittings. Cement must be NSF approved and meet ASTM D 2564 specifications.
2. Cleaner/primer shall be No. 8700 United Elchem hi-etch cleaner-primer or approved equal. Cleaner/primer must be any color other than clear.
3. All threaded connections between PVC and metal pipe shall be made using Rectorseal No. 100 virgin heavy duty sealing past of plasto-joint stick as manufactured by Lake Chemical company or Teflon tape.
4. All metal to metal connections shall be made using Rectorseal No. 5 slow dry, soft set pipe thread compound or approved equal. All PVC to PVC threaded connections shall use Teflon tape.
5. “0” ring gasket and pipe spigot ends shall be lubricated using the lubricant recommended or supplied by the pipe manufacturer. If the pipe manufacturer does not provide a lubricant for the pipe, use IPS Weld-On No. 787 gasket lube as manufactured by Industrial Polychemical Service or approved equal.

D. Metal Pipe-Flange Bolts and Nuts: Type and material recommended by piping system manufacturer unless otherwise indicated.

2.15 WIRE

A. Low-Voltage Wire (24 Volts) Branch-Circuit Cables shall be solid copper, PVC insulated, UL approved for direct burial. Common wires shall be No. 12 AWG, white, minimum between controllers and automatic control valves, color coded different from

feeder circuit cable jacket color; with jackets of different colors for multiple cable installation in same trench.

B. Wire Splicing Materials: All wire splices shall be made watertight using 3M DBR/Y7 wire connectors or approved equal. All wiring installed under sidewalks, roadways, parking lots, etc. shall be in stalled in 2” Schedule 40 PVC sleeve. Wires in the PVC pipe shall not exceed 40% fill of the conduits total available space. All boxes for wire splices shall be installed in ten (10) inch round boxes.

PART 3 - EXECUTION

3.1 GENERAL

A. All materials and equipment shall be installed in a neat and workmanlike manner according to manufacturer's published recommendations and specifications, local and state codes and as shown on the Construction Documents and as specified herein.

3.2 PRODUCT HANDLING

A. The CONTRACTOR shall be responsible for correct procedures in loading, unloading, staking, transporting and handling all materials to be used in the system. The CONTRACTOR shall avoid rough handling which could affect the useful life of the system's components. Pipe shall be handled in accordance with the manufacturer's published recommendations on loading, unloading and storage.

3.3 EXCAVATION AND TRENCHING

A. The CONTRACTOR shall mark or stake out the location of each run of pipe and all valves and sprinkler heads prior to trenching taking all underground utilities, existing trees, planned improvements, planned trees, and swales into account. Each run of the system shall be approved by Irrigation Designer before actual installation is started. Prior to trenching, the CONTRACTOR shall have all underground lines spotted and marked a minimum of two (2) working days in advance of any excavation. Trench for wire shall be a minimum twelve (12) inches away from edge of any excavated pipe trench.

B. Excavation and trenching for pipe shall be true to line and only necessary trenches shall be excavated. The width of the trenches shall not be greater than necessary to permit proper installation. After completion of installation and testing for each section, proper bedding, backfilling and tamping shall be completed as quickly as possible to minimize unnecessary open trenches and damage to pipe and components.

C. In areas where existing trees to remain are present, trench lines shall be adjusted on the site to install trenches beyond the drip line of the tree. If line route is determined by the Landscape Architect that the line route cannot be adjusted, the CONTRACTOR shall use hand tools for digging and trenching to avoid damaging the tree's roots.

D. Excavation for components and trench depths shall be achieved prior to installing drainage rock and components or bedding material and pipe to allow sufficient space for

proper depths of boxes and pipe cover. If boulders or rocks larger than one (1) inch, trash, deleterious or unsuitable materials are encountered, they shall be be removed prior to installing bedding material and pipe or components with no additional charge to the OWNER. Upon completion of installation, soil shall be backfilled with native soil if it is suitable for use as backfill and then tamped and additional backfill installed if necessary to minimize a drop in the soil above the excavation and/or trench. Top of valve boxes for valves and components shall include extensions as necessary to ensure top of valve box is installed flush with the finish grade. Final Valve Box lid top elevation shall not exceed one half (1/2) inch above finish grade. If native soil is not suitable for backfill, the CONTRACTOR shall import suitable backfill clean, free of trash and weed seeds and approved by LANDSCAPE ARCHITECT. The CONTRACTOR shall be responsible for removing and properly disposing of all unsuitable materials removed from the trench that cannot be used in the backfill operation.

3.4 PIPE AND FITTINGS INSTALLATION

A. Installation of plastic pipe and fittings shall be in accordance with the manufacturer's published recommendations and procedures and as specified in the CONSTRUCTION DOCUMENTS. Manufacturer's published recommended procedures for making solvent weld fittings shall be strictly adhered to, including all waiting and setting times.

B. Caution shall be exercised by the CONTRACTOR in handling, loading, unloading and storing of PVC pipe and fittings. All PVC pipe shall be stored and transported in a vehicle with a bed long enough to allow the pipe to lie flat without subjecting it to undue bending or concentrated external load at any point. Any section of pipe that has been dented or damaged or in any other way found to be defective, either before, or after laying shall be replaced with sound pipe without additional expense to the OWNER.

C. Before installation, the inside of the pipe shall be cleaned of all direct and foreign matter and shall be kept in cleaned condition during and after laying and connecting pipe. When work is not in progress, open ends of pipe and fittings shall be secured so that native soil, trench water and foreign substances will not enter the pipe. Where pipe ends are left for future expansion or connections, they shall be capped or valved or as directed on the plans or as approved by the LANDSCAPE ARCHITECT.

D. All PVC pipe and fittings shall be assembled to permit the pipe or fittings to be joined at the true parallel continuous position of the pipe and fitting. Placement of pipe in curving trenches which causes bending and stress on the pipe and fittings will not be permitted. No excess piping or fittings shall be permitted in the installation of the system, which can increase pressure loss or potential leaks or blockage.

E. Excavation and trenching shall be true to line and depth indicated on the Construction Documents. Before installing the pipe, all trash, debris, or rocks one (1) inch in diameter or greater shall be removed from the trenches prior to installing a bedding material. The bedding material shall be installed in the trench prior to pipe. Pipe shall rest solidly upon the bottom of the trench on the native soil or bedding material.

F. Pipe shall be installed in dry weather when temperature is above 40 degrees F (5 degree C). and shall not be installed in water or when trench or weather conditions are unsuitable for the work. Any water which may be encountered or may accumulate in the

trenches or excavation shall be pumped out or otherwise removed as necessary to keep the bottom of the trench or excavation free and clear of water during the progress of the work.

G. All pipe installed under new hard surfaces such as sidewalks, roadways, parking lots, etc. shall be sleeved. Sleeves shall be sleeved prior to installation of the hardscape components. Where pipe must pass underneath existing hardscape, it shall be bored or washed and is dependent upon the site conditions, including soil, distance and obstacles. CONTRACTOR shall investigate site conditions and review with the LANDSCAPE ARCHITECT for approval.

H. After the main line, valves, and thrust blocks have been installed. the control valve shall be opened and a full head of water pressure used to flush out the system. After the system is thoroughly flushed, valves shall be closed and the main line pressure tested in accordance with the testing section. At the conclusion of the pressure test the lateral lines with risers shall be installed and temporarily capped and pressure tested in accordance with the testing section. Allow joints to cure at least 24 hours at temperatures above 40 degrees F (5 degree C). After each pipe section's pressure test, as performed in Section 3.12 below, is successful, backfill may be installed in the applicable trench.

3.5 JOINT CONSTRUCTION AND SOLVENT WELDING PROCEDURE

A. Prepare pipe and fittings by removing scale, slag, dirt and debris from inside and outside of pipe and fittings before assembly.
Clean and dry joining surfaces. Join pipe and fittings according to the following:
1. Comply with ASTM F402 of safe-handling practice of cleaners, primers and solvent cements.
2. PVC Pressure Piping: Join schedule number, ASTM D1785, PVC pipe and PVC socket fittings according to ASTM D2672. Join other than the scheduled number PVC pipe and socket fittings according to ASTM D2855.
3. Non-pressure PVC Piping: Join according to ASTM D2855
4. PVC Plastic Pipe shall be cut straight and squarely.
5. Burrs left from cutting shall be wiped off with a clean, dry cloth.
6. Utilizing a cleaner/primer, thoroughly clean the mating pipe end and the fitting socket with a clean dry cloth.
7. Apply a uniform coat of solvent cement to the outside of the pipe end with a synthetic brush or dauber.
8. In like manner, apply a thin coating of solvent cement to the inside of the fitting socket.
9. Re-apply a light coat of solvent cement to the pipe and quickly insert it into the fitting to the full depth of the fitting socket.
10. Rotate the pipe or fitting approximately 1/4 turn to ensure even distribution of the solvent cement.
11. Hold in position for approximately 30 seconds.
12. Wipe off any excess solvent cement that forms as a bead around the outer shoulder.
13. Care should be taken so as not to use an excess amount of solvent cement that could cause burrs or obstructions to form on the inside of the pipe joint.

14. Solvent weld joints shall be allowed to cure for at least twenty four (24) hours before pressure is applied to the system such as the pressure testing of the system.

B. Threaded Joints: Thread pipe with tapered pipe threads according to ASME B1.20.1. Cut threads full and clean using sharp dies. Ream threaded pipe ends to remove burrs and restore full ID (interior diameter). Join pipe fittings and valves as follows:
1. Apply appropriate tape or thread compound to external pipe threads unless dry seal threading is specified.
2. Do not use pipe or pipe fittings that are damaged, corroded or cracked.

C. Saddle Taps: Saddle Taps are not permitted unless approved in writing in advance by LANDSCAPE ARCHITECT.

3.6 BACKFILLING:

A. Trenches shall not be backfilled until pressure testing has been completed. In no case shall pipe connections be covered until lines have passed the pressure test. If stability for pipe is required for testing, minimal amounts of backfill may be installed between connections to provide the necessary stability. Upon completion of the hydrostatic test and acceptance by the LANDSCAPE ARCHITECT, the backfill operation for that pipe may be completed.

B. All backfill material shall be subject to approval of the LANDSCAPE ARCHITECT. Backfill materials shall be free from rubbish, rock, lare stones, brush, sod, frozen material or other unsuitable substances that may damage pipe during the backfilling operations.

C. In the event the native soil from the trenching excavation is found to be unsuitable for backfill use, it shall be removed from the site and properly disposed of by the CONTRACTOR at his own expense. The CONTRACTOR shall then, at no additional cost to the OWNER, supply suitable backfill material at no additional cost to the OWNER. Backfill shall consisting of earth, loam, sandy loam, sandy clay, sand or other approved materials free of large clods or sharp stones and a representative sample must be approved by the LANDSCAPE ARCHITECT prior to its arrival at the project site.

D. In rocky areas, the trench depth shall be three (3) inches below the normal trench depth to allow for three (3) inches of suitable bedding backfill as padding for the pipe. In like manner, there shall be at least three (3) inches of padding on either side of the pipe as a padding against the rock in the walls of the trench.

E. Backfill shall be thoroughly tamped, rolled, or otherwise compacted to original density or better to minimize settling. Backfill shall be placed to the original ground level or to the limits designated on the Construction Documents. CONTRACTOR shall thoroughly water the trenches after the backfill has been installed and if settlement occurs, CONTRACTOR shall top-dress trenched areas to achieve a level surface. If further settling of soil occurs such that trench lines are visible, CONTRACTOR shall further

top-dress until a level surface is achieved. After a level surface is achieved, CONTRACTOR shall then install the finish material.

3.7 SLEEVE CROSSINGS

A. CONTRACTOR shall install all sleeving prior to installation of hard surfaces or improvements. All pipe installed under hard surfaces and improvements, including but not limited to sidewalks, roadways, trails, parking lots, plazas, etc., shall be sleeved with Schedule 40 PVC pipe, two sizes larger than the total diameter of the pipe housed within and at the finish pipe depth required on either side of the sleeved surface. CONTRACTOR shall not bend pipe before or after sleeve.

B. Wire shall be sleeved in a separate two (2) inch Schedule 40 PVC sleeve, even if the wire crosses the hard surface or improvement in the same area.

C. If CONTRACTOR is required to install sleeves below existing hard surfaces, they shall be bored or washed under existing surface with due care to minimize damage to existing hard surface. Any damage to existing hard surfaces or improvements shall be repaired by CONTRACTOR to the satisfaction of the OWNER and LANDSCAPE ARCHITECT and there shall be no additional cost to the OWNER. In the event an open cut is authorized in writing by LANDSCAPE ARCHITECT, CONTRACTOR shall repair open cut finish surface in material and construction method as closely as possible to the original or better.

3.8 THRUST BLOCKS

A. CONTRACTOR shall install thrust blocks to resist system pressure at all direction changes, valves, terminations, or at any other points of the system that will result In an unbalanced thrust line for equipment two (2) inches and greater.
B. Thrust blocks shall not obstruct the outlets of fittings which are intended for future connections.
C. Thrust blocks shall be installed against undisturbed earth and in accordance with the details indicated in the Construction Documents.

3.9 SPRINKLERS HEADS

A. CONTRACTOR shall install Sprinkler Heads at the locations and of the type and make specified in the Construction Documents.
B. Sprinkler heads shall be installed at the final finish soil level and installed vertically and level for all flat grades and at the angle of the slope for sloped grades.
C. Sprinklers shall be installed after hydrostatic testing on the lateral lines has been satisfactorily completed.
D. Heads shall be installed at least two (2) inches but no more than twelve (12) inches from any hard surface and shall not overspray onto hard surfaces. Water on the hard surface is

prohibited and heads shall be adjusted when wind speeds are under 5 mph to ensure all areas are watered, but irrigation water does not overspray onto hard surfaces.

E. CONTRACTOR shall verify all area dimensions and stake or mark all sprinkler head locations to achieve uniform coverage. After CONTRACTOR has verified that site verified dimensions will accommodate sprinkler head layout to ensure uniform coverage. CONTRACTOR shall request written approval of head layout by the LANDSCAPE ARCHITECT prior to installation.

F. After all pipe and risers are in place and before installation of sprinkler heads, each control valve shall be fully opened with a full head of water pressure to flush the line. After pipe line has been flushed, each valve shall be closed and the heads installed immediately.

G. CONTRACTOR shall complete head installation with native soil packed under and around head to ensure it remains at the levels and orientation indicated in 3.9.B above.

H. When complete, but before Final Acceptance, CONTRACTOR shall have irrigation system with sprinkler heads audited by independent Irrigation Auditor or water authority irrigation auditors associated with the project site's water authority.

3.10 DRIP IRRIGATION

A. CONTRACTOR shall install zone valve, pressure regulator, filter, or combination and air release valve for each drip irrigation zone as indicated in the Construction Documents. Drip Irrigation requires pressure regulation and an air relief valve (at the highest point on the drip zone) after the zone valve to function correctly.

B. CONTRACTOR shall install pipe and emitter manifold or multiple outlet emitter system on riser, as necessary, in the general area indicated on the Construction Documents and below grade but no greater than six (6) inches below finish material grade.

C. CONTRACTOR shall install drain valve, at low point or end of each drip lateral pipe. Install drain valve so that it will drain into swale. Close drain valve and before or after installation of emitter manifold or multiple outlet emitter system, depending on the system used, the control valve shall be opened and a full head of water pressure used to flush out the system.

D. After system has been flushed, drip tubing can be installed to base of plant below finish material. Drip ¼" (spaghetti) tubing shall not be pulled tightly and tubing outlet(s) shall be installed on top of the rootball. Plants on slopes shall have tubing installed to the top side of the rootball only. Where multiple tubing to one plant will be installed, drip ¼" (spaghetti) tubing shall be installed to ensure outlets will be evenly spaced.

E. CONTRACTOR shall install drip emitter outlet(s), stakes, and bug caps for each ¼" (spaghetti) tube.

F. Cover all ¼" (spaghetti) drip tubing, emitter outlets and box covers with a thin (approximately one (1) inch) layer of finish material so they are not easily visible to the general public, but can still be found for maintenance.

3.11 VALVE WIRING

A. All valve wiring shall be 24 volt and installation shall conform to local electrical codes.

B. Wire shall be installed in separate trench from irrigation water pipe. It shall be installed loosely in the trench to allow for contraction of the wire and the location of the trench shall be indicated on the “AS-BUILT” (RECORD) DRAWINGS.

C. Wire splices shall be created only when necessary. Wire splices shall be waterproofed using 3-M DBR/Y-6 wire connectors or approved equal and the CONTRACTOR shall leave an additional twenty four (24) inch coil of wire at each splice and installed in a dry wire splice box to facilitate testing and maintenance. Top of wire splice box shall be installed level with the top of the finish material.

D. Wire on either side of splice shall be of same color; different colored wire on either side of the splice, will not be permitted.

E. Electric control valves shall be connected to controller in the numerical sequence indicated on the plans.

3.12 FIELD QUALITY CONTROL AND TESTING

A. Upon completion of the system’s mainline and after curing times have been achieved, the CONTRACTOR shall test mainline, or section of mainline (for irrigation system additions) that has been installed, hydrostatically for a twenty-four (24) hour period at one hundred fifty (150) psi or static pressure plus fifty (50) psi, whichever is greater with the LANDSCAPE ARCHITECT present for both the pressuring up and the review at completion of test. Prior to the hydrostatic increase of pressure in the mainline, all zone valves shall be in place and closed and a pressure gauge shall be installed on the main line to aid in assessing the pressure differential. Prior to testing, the mainline shall be filled with water to remove air in the pipe and can be partially backfilled, but all joints and connections must remain exposed for visual inspection during testing. The maximum deviation from the initial pressure to the pressure twenty four (24) hours later may not exceed a two (2)% loss. If after twenty four (24) hours, the pressure deviation exceeds two (2)%, then CONTRACTOR shall assess the system for leaks and fix any leaks and retest the mainline, as many times as necessary until the mainline passes test.

B. Upon completion of the system’s lateral irrigation lines and after curing times have been achieved, CONTRACTOR shall test each lateral line hydrostatically for a two (2) hour period at the static pressure with the LANDSCAPE ARCHITECT present for both the pressure up and the review at completion of test. Prior to the pressure test, lateral line zone valve shall be in place and closed and a pressure gauge shall be installed at the furthest outlet on the lateral line to aid in assessing the pressure differential. Prior to testing, the lateral line shall be filled with water to remove air in the pipe and can be partially backfilled, but all joints and connections must remain exposed for visual inspection during testing. The maximum deviation from the initial pressure to the pressure two (2) hours later may not exceed a two (2)% loss. If after two (2) hours, the pressure deviation exceeds two (2)%, then CONTRACTOR shall assess the system for leaks and fix any leaks and retest the lateral line, as many times as necessary until the lateral line passes the test.

C. Upon completion of the irrigation system installation; the CONTRACTOR shall program controller, verify valves are functioning through controller, adjust all heads,

valves, bubblers, drip emitters to ensure they are working properly to provide optimum system performance until project's Final Acceptance.

3.13 FINAL ACCEPTANCE

A. Upon completion of the above tasks and any punch list items, the CONTRACTOR shall provide all warranty information to the OWNER and demonstrate the system's correct function to the OWNER and LANDSCAPE ARCHITECT and instruct the OWNER in its function.

B. CONTRACTOR shall install a laminated diagram of the irrigation system in the controller cover and provide a hard copy of the Irrigation As-Built (Record) Drawing mark-ups to the LANDSCAPE ARCHITECT for inclusion in the Record Drawing set provided to OWNER at the completion of the project.

C. After ALL above tasks have been completed, CONTRACTOR shall request a written NOTICE OF FINAL ACCEPTANCE.

3.14 MAINTENANCE AND WARRANTY

A. For a period of one year from FINAL ACCEPTANCE, CONTRACTOR will promptly furnish and install without cost to the OWNER, all components or materials which prove defective in material or workmanship. CONTRACTOR shall address repair within two (2) days and complete repair within four (4) days of notification.

END OF SECTION

SECTION 32 90 00 – LANDSCAPE PLANTING

PART 1 – GENERAL

1.1 SUMMARY

A. This Section includes:
1. Planting materials, including: trees, accent plants, shrubs, accent plants, ground covers and decorative grasses.
2. Topsoil and soil amendments.
3. Accessories.

B. Related Sections:
1. Section 32 84 00 – Landscape Irrigation

1.2 SUBMITTALS

A. Product data. Unless otherwise indicated, submit the following for each type of product
1. Local/Regional Materials:
a. Sourcing location(s): Indicate location of extraction, harvesting, and recovery; indicate distance between extraction, growing, harvesting and recovery and the project site.
b. Manufacturing location(s): Indicate location of growing, harvesting, or manufacturing facility; indicate distance between manufacturing facility and the project site.
c. Product Component(s) Value: Where product components are sourced or sold in separate locations, provide location information for each component.

B. Planting schedule indicating anticipated dates and locations for each type of planting.

C. Landscape Commissioning Submittals:
1. Plant list: Contractor shall provide Plant Availability including Substitution options at project's onset and a minimum of 2 weeks in advance of planned install, in writing to the LANDSCAPE ARCHITECT.

1.3 QUALITY ASSURANCE

A. Installer Qualifications: Engage an experienced Installer with minimum 3 years experience with landscaping work and planting in the Chihuahuan Desert similar in material, design, and extent to that indicated for this Project and with a record of successful landscape establishment.

B. Pre-Installation Meetings:
1. Convene a pre-installation meeting and invite Landscape Architect a minimum one week prior to commencing work of this Section.
2. Require attendance of parties directly affecting Work of this Section.
3. Review conditions of operations, procedures and coordination with related Work

4. Agenda:
    a. Tour, inspect, and discuss conditions of soil and planting materials.
    b. Review planting schedule and maintenance.
    c. Review required inspections.
    d. Review environmental procedures.

C. Coordinate installation of planting materials during normal planting seasons for each type of plant material required.

D. Label each tree and shrub with securely attached, waterproof tag bearing legible designation of botanical and common name. Do not remove tag until approved in writing by Landscape Architect.

E. Certification: Provide soil amendments and compost products that are certified to specified product parameters in accordance with the U.S. Composting Council (USCC) Seal of Testing Assurance (STA) Program.

F. Landscape Commissioning:

1. Topsoil Analysis: For areas that will receive wildflower carpet, plugs or seeding, furnish soil analysis by a qualified soil-testing laboratory stating percentages of organic matter, gradation of sand, silt and clay content; cation exchange capacity; sodium absorption ratio; deleterious material; pH; and mineral and plant-nutrient content of topsoil.
    a. 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.
    b. Perform the soil analysis within 10 calendar days of planting. If planting is delayed, re-perform tests.

2. Material Test Reports: For existing surface soil and imported topsoil, report suitability of topsoil for plant growth. State recommended quantities of nitrogen, phosphorus, and potash nutrients and soil amendments to be added to produce satisfactory topsoil as appropriate to each plant type and location.

3. Verify soil conditions are appropriate for plants indicated, provide recommended nutrients and amendments as necessary.

4. Plant list: Submit the list of plants, Indicate varieties, quantity, size, number of plants and location (if different from plan) installed. Indicate the nutrients and amendments provided.

1.4 MAINTENANCE

A. Maintenance shall commence from the time the plants are secured from the nursery and shall be sustained until one year from date of Final Acceptance.

B. Promotion of growth: Weed, water, and perform other operations necessary to promote growth and as approved by LANDSCAPE ARCHITECT and consistent with approved Integrated Pest Management Plan.

1. Inspection: Inspect plants at least once a week and perform needed maintenance promptly.

2. Herbicides and pesticides are not permitted unless specifically indicated on plan; use organic/natural techniques first for pest and disease control. Advise LANDSCAPE ARCHITECT of any witnessed issue to discuss possible solutions.
3. Remove noxious weeds common to the area from planting areas by mechanical means first and only with the written approval of the LANDSCAPE ARCHITECT can herbicides be used.

C. Mowing of ground cover and grass areas:
1. Wildflowers: Mow three times per season above high of the wildflowers (approximately 12-15 inches)
2. Native Grasses: Mow above high of native grass seedlings (approximately 3-1/2-4 inches). Mow during spring or early summer. Do not mow after early summer during the second growing season.

D. Chemical controls:
1. Wildflowers, groundcover and grasses: Do not fertilize.
2. Trees, shrubs and accents: Fertilize exterior planting materials as indicated on Construction Documents to promote healthy plant growth without encouraging excessive top foliar growth.

E. At the end of maintenance period, request End of Maintenance Period Inspection by LANDSCAPE ARCHITECT.
1. Final acceptance of wildflower and grass areas will be based upon satisfactory stand of groundcover and grasses. Stand of groundcover and grass is 95 percent ground cover of established species. Replant areas which do not have a satisfactory stand of groundcover and grasses.
2. Final acceptance of exterior plants will be based upon satisfactory health and growth of plants.
3. Provide Operation and Maintenance Manual submittals for planting materials to OWNER upon Final Acceptance.

F. When work is found to be unsatisfactory, maintenance period will be extended at no additional cost to Owner until work has been completed, inspected and accepted by LANDSCAPE ARCHITECT.

1.5 WARRANTY

A. Warranty: Warrant the following living planting materials for a period of one year after the date of Final Acceptance, against defects including death and unsatisfactory growth. Contractor shall provide concerns that affects the Warranty to LANDSCAPE ARCHITECT in writing for review prior to defect claims and 1 year warranty site visit. Warranty shall include but is not limited to:
    1. Trees.
    2. Shrubs.
    3. Ground covers.
    4. Accent Plants.
    5. Ornamental Grasses.

B. Remove and replace dead planting materials immediately. If extenuating reasons for needing a longer time to replace plants is requested, Contractor shall make request in writing to LANDSCAPE ARCHITECT for review and approval.

C. Replace planting materials that are dead or in an unhealthy condition (more than 25 percent dead) at end of warranty period. Deciduous plants shall be assessed during their growing season. Ocotillo are exempt from this replacement requirement.

PART 2 – PRODUCTS

2.1 PLANTING MATERIALS

A. As indicated on the Drawings and as follows:

1. Renewable Resources
    a. Plants as specified.
    b. Plant substitutions will be considered only if:
        1) Verification documentation is submitted indicating that specified plant is not available within 600 miles of site.
        2) Substitutions must be tolerant of site's existing soils
        3) Substitution must be acclimated to local climate at time of planting.
        4) Substitution must be a Chihuahuan Desert native or must be able to live within similar conditions to site.
        5) Substitution must have been grown within 600 miles of site and in region with similar climate.
        6) Substitutions must be submitted for written approval by Landscape Architect and shall not be procured or planted until written approval is obtained.

2.2 MULCHES

A. As specified on Contract Documents and free from noxious weeds, mold or other deleterious materials.

B. Inert Mulch Materials: Crushed concrete, rock or blast furnace slag complying with ASTM D692; Recycled porcelain or other non-traditional aggregate material complying with ASTM D6155.

2.3 TOPSOIL

A. Topsoil: Evaluate soil for use as topsoil in accordance with ASTM D 5268.

1. Reuse surface soil stockpiled on the site. Verify suitability of surface soil to produce topsoil meeting requirements and amend as necessary. Clean topsoil of roots, plants, sods, stones, clay lumps, and other extraneous materials harmful to plant growth.
2. Supplement with imported topsoil when quantities of stockpiled soil are insufficient.

2.4 WATER

A. Water: Potable

B. Irrigation Systems: Provide high efficiency irrigation systems as specified in Section 32 84 00 – Planting Irrigation.

2.5 PESTICIDES AND HERBICIDES

A. Pesticides : Not permited, without written permission of LANDSCAPE ARCHITECT.
B. Herbicides : Not permited, without written permission of LANDSCAPE ARCHITECT.

2.6 SOIL CONDITIONERS

A. Soil Conditioner. Non-toxic. Use singly or in combinations required to meet requirements for topsoil.
B. Peat. Peat humus derived from a freshwater site and conforming to ASTM D5539 and as follows.
    1. Biobased Content. Minimum 100 percent.
C. Sand. Clean and free of materials harmful to plants.
D. Rotted Manure. Well rotted horse or cattle manure containing maximum 25 percent by volume of straw, sawdust, or other bedding materials; free of seeds, stones, sticks and soil.
E. Compost. Well decomposed, stable, weed free organic matter source; derived from: agricultural, food or industrial residuals; biosolids (treated sewage sludge); yard trimmings; source-separated or mixed solid waste. The product shall contain no substances toxic to plants and shall be reasonably free (<1% by dry weight) of man-made foreign matter. The compost shall possess no objectionable odors and shall not resemble the raw material from which it was derived.

2.7 FERTILIZER

A. Fertilizer for trees, plants, shrubs. As recommended by plant supplier and as follows:
    1. Synthetic chemical fertilizers. Balanced fertilizer plant tablets.
    2. Biobased content.
        a. Fertilizers. Products formulated or processed to provide nutrients for plant growth and/or beneficial bacteria to convert nutrients into plant usable forms. Provide minimum 71% biobased content.
B. Fertilizer for cactus and accent plants. Not allowed.

END OF SECTION