

SECTION 10 14 00 - SIGNAGE

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes the following types of signs:
 - 1. Sign including metal bridge and metal skyline panels.

1.2 PERFORMANCE REQUIREMENTS

- A. Delegated Design: Design including comprehensive engineering analysis by a qualified professional engineer, using performance requirements and design criteria for the site's windloads.
- B. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes acting on exterior metal fabrications by preventing buckling, opening of joints, overstressing of components, failure of connections, and other detrimental effects.

1.3 SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Shop Drawings: Show fabrication and installation details for all sign elements including bridge, metal panels, sign box, back panel, and footings.
 - 1. Show fabrication and installation details for metal fabrications.
 - a. Include plans, elevations, sections, and details of metal fabrications and their connections. Show anchorage and accessory items. Show sign mounting heights, connections, fasteners, footings, and accessories.
 - 2. Provide message list, typestyles, and layout for each sign.
 - 3. Wiring Diagrams: Power, signal, and control wiring.
 - 4. Wind load studies and structural support calculations for sign and footings.
 - 5. Paint colors and finishes.
- C. Samples for Verification: For each of the following products and for the full range of color, texture, and sign material indicated, of sizes indicated:
 - 1. Paint Samples: 4 by 4 inches for each color required.
 - 2. Vinyl Sheet: 4 by 4 inches for each color required.
- D. Delegated-Design Submittal: For installed products indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified Iowa professional engineer responsible for their preparation.
- E. Maintenance Data: For all sign types include maintenance manuals.
- F. Warranty: Special warranty specified in this Section. Minimum 5 years.

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1.4 QUALITY ASSURANCE

- A. Installer Qualifications: Fabricator and installer of sign products with minimum 5 years experience installing signs of the types listed.
- B. Fabricator Qualifications: Shop that employs skilled workers who custom-fabricate products similar to those required for this Project and whose products have a record of successful in-service performance.
- C. Regulatory Requirements: Comply with applicable local ordinances and rules governing sign locations.
- D. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.
- E. Welding Qualifications: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code - Steel."
- F. Welding Qualifications: Qualify procedures and personnel according to the following:
 - 1. AWS D1.1/D1.1M, "Structural Welding Code - Steel."
 - 2. AWS D1.2/D1.2M, "Structural Welding Code - Aluminum."

1.5 COORDINATION

- A. Coordinate selection of shop primers with topcoats to be applied over them. Comply with paint and coating manufacturers' written recommendations to ensure that shop primers and topcoats are compatible with one another.

1.6 WARRANTY

- A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of signs that fail in materials or workmanship within specified warranty period.
 - 1. Failures include, but are not limited to, the following:
 - a. Deterioration of metal and polymer finishes beyond normal weathering.
 - b. Deterioration of embedded graphic image colors and sign lamination.
 - c. Failure of internal lighting units
 - 2. Warranty Period: Five years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MATERIALS - GENERAL

- A. METALS, GENERAL
 - 1. Metal Surfaces, General: Provide materials with smooth, flat surfaces unless otherwise indicated. For metal fabrications exposed to view in the completed Work, provide materials without seam marks, roller marks, rolled trade names, or blemishes.

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- B. Aluminum Sheet and Plate: ASTM B 209, alloy and temper recommended by aluminum producer and finisher for type of use and finishes indicated, and with at least the strength and durability properties of Alloy 5005-H32.
- C. Aluminum Extrusions: ASTM B 221, alloy and temper recommended by aluminum producer and finisher for type of use and finish indicated, and with at least the strength and durability properties of Alloy 6063-T5.
- D. Steel:
 - 1. Galvanized Steel Sheet: ASTM A 653/A 653M, G90 coating, either commercial or forming steel.
 - 2. Steel Tubing: ASTM A 500, cold-formed steel tubing.
 - 3. Steel Pipe: ASTM A 53/A 53M, standard weight (Schedule 40).
 - 4. Steel Sheet: Uncoated, cold-rolled, ASTM A 1008/A 1008M, commercial steel, Type B, exposed.
 - 5. Steel Members Fabricated from Plate or Bar Stock: ASTM A 529/A 529M or ASTM A 572/A 572M, 42,000-psi minimum yield strength.
 - 6. For steel exposed to view on completion, provide materials having flat, smooth surfaces without blemishes. Do not use materials whose surfaces exhibit pitting, seam marks, roller marks, rolled trade names, or roughness.
 - 7. Corten Steel - Cor-Ten A or B
- E. Polycarbonate Sheet: Of thickness indicated, manufactured by extrusion process, coated on both surfaces with abrasion-resistant coating:
 - 1. Impact Resistance: 16 ft-lbf/in. (854 J/m) per ASTM D 256, Method A.
 - 2. Tensile Strength: 9000 lbf/sq. in. (62 MPa) per ASTM D 638.
 - 3. Flexural Modulus of Elasticity: 340,000 lbf/sq. in. (2345 MPa) per ASTM D 790.
 - 4. Heat Deflection: 265 deg F (129 deg C) at 264 lbf/sq. in. (1.82 MPa) per ASTM D 648.
 - 5. Abrasion Resistance: 1.5 percent maximum haze increase for 100 revolutions of a Taber abraser with a load of 500 g per ASTM D 1044.
- F. Applied Vinyl: Die-cut characters from vinyl film of nominal thickness of 3 mils (0.076 mm) with pressure-sensitive adhesive backing, suitable for exterior applications. Colors as detailed.
- G. Concrete Bases: Iowa DOT Class C concrete.
- H. LED Internal Lighting: Provide internal LED lighting units suitable for use in exterior applications. LED lighting to be UL approved.

2.2 SIGN BOX & BACK PANEL

- A. Exterior Signs: Provide smooth sign panel surfaces constructed to remain flat under installed conditions within a tolerance of plus or minus 1/16 inch measured diagonally from corner to corner, complying with the following requirements:
 - 1. Aluminum Sheet: 0.125-inch-thick.
 - 2. LED interior illumination of sign. 3500-4000K temp.
 - 3. 3/4" push-through acrylic letters
 - 4. Vinyl-as indicated on the drawings.
 - 5. Power: per electrical drawings.
 - 6. Sign Cabinet Corner Condition: Square.
 - 7. Mounting: As indicated.

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- a. Manufacturer's standard non-corroding anchors for substrates encountered.
8. Colors: As indicated.
9. Character Size: As indicated.
10. Text/Message As indicated.

- B. Brackets: Fabricate brackets and fittings for bracket-mounted signs from extruded aluminum to suit panel sign construction and mounting conditions indicated. Factory paint brackets in color matching background color of panel sign

2.3 ACCESSORIES

- A. Anchors and Inserts: Provide nonferrous-metal or hot-dip galvanized anchors and inserts for exterior installations and elsewhere as required for corrosion resistance. Use toothed steel or lead expansion-bolt devices for drilled-in-place anchors.

2.4 FABRICATION

- A. Shop Assembly: Preassemble items in the shop to greatest extent possible. Disassemble units only as necessary for shipping and handling limitations. Use connections that maintain structural value of joined pieces. Clearly mark units for reassembly and coordinated installation.
- B. Cut, drill, and punch metals cleanly and accurately. Remove burrs and ease edges to a radius of approximately 1/32 inch (1 mm) unless otherwise indicated. Remove sharp or rough areas on exposed surfaces.
- C. Form bent-metal corners to smallest radius possible without causing grain separation or otherwise impairing work.
- D. Form exposed work with accurate angles and surfaces and straight edges.
- E. Weld corners and seams continuously to comply with the following:
- F. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
- G. Obtain fusion without undercut or overlap.
- H. Remove welding flux immediately.
- I. Conceal fasteners if possible; otherwise, locate fasteners where they will be inconspicuous.
- J. At exposed connections, finish exposed welds and surfaces smooth and blended so no roughness shows after finishing.
- K. Form exposed connections with hairline joints, flush and smooth, using concealed fasteners or corrosion resistant welds where possible. Where exposed fasteners are required, use Phillips flat-head (countersunk) fasteners unless otherwise indicated. Locate joints where least conspicuous.
- L. Fabricate seams and other connections that will be exposed to weather in a manner to exclude water. Provide weep holes where water may accumulate.

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- M. Cut, reinforce, drill, and tap metal fabrications as indicated to receive finish hardware, screws, and similar items.

2.5 FINISHES, GENERAL

- A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.
- B. Finish metal fabrications after assembly.
- C. Finish exposed surfaces to remove tool and die marks and stretch lines, and to blend into surrounding surface.
- D. Protect mechanical finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.
- E. Appearance of Finished Work: Variations in appearance of abutting or adjacent pieces are acceptable if they are within one-half of the range of approved Samples. Noticeable variations in the same piece are not acceptable. Variations in appearance of other components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

2.6 ALUMINUM FINISHES

- A. Baked-Enamel Finish: AA-C12C42R1x (Chemical Finish: cleaned with inhibited chemicals; Chemical Finish: acid-chromate-fluoride-phosphate conversion coating; Organic Coating: as specified below). Apply baked enamel complying with paint manufacturer's written instructions for cleaning, conversion coating, and painting.
 - 1. Organic Coating: Thermosetting, modified-acrylic enamel primer/topcoat system complying with AAMA 2603 except with a minimum dry film thickness of 1.5 mils (0.04 mm), medium gloss.

2.7 STEEL FINISHES

- A. Surface Preparation: Remove mill scale and rust, if present, from uncoated steel, complying with a minimum of SSPC-SP 3, "Power Tool Cleaning." "
- B. Factory Priming for Painted Finish: Apply shop primer specified below immediately after surface preparation and pretreatment.
 - 1. Shop Primer: Manufacturer's or fabricator's standard, fast-curing, lead- and chromate-free, universal primer, selected for resistance to normal atmospheric corrosion, for compatibility with substrate and field-applied finish paint system indicated, and for capability to provide a sound foundation for field-applied topcoats despite prolonged exposure.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of work.
- B. Verify that items, including electrical power, are sized and located to accommodate signs.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

- A. Locate signs and accessories where indicated, using mounting methods of types described and complying with manufacturer's written instructions and shop drawings.
 - 1. Install signs level, plumb, and at heights indicated, with sign surfaces free of distortion and other defects in appearance.
 - 2. Direct bury steel support post(s) as necessary to accommodate design wind loads on the signs. Provide concrete footings as necessary.
 - 3. Cutting, Fitting, and Placement: Perform cutting, drilling, and fitting required for installing metal fabrications. Set metal fabrications accurately in location, alignment, and elevation; with edges and surfaces level, plumb, true, and free of rack; and measured from established lines and levels.
 - 4. Fit exposed connections accurately together to form hairline joints. Weld connections that are not to be left as exposed joints but cannot be shop welded because of shipping size limitations. Do not weld, cut, or abrade surfaces of exterior units that have been hot-dip galvanized after fabrication and are for bolted or screwed field connections.
 - 5. Field Welding: Comply with the following requirements:
 - 6. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
 - 7. Obtain fusion without undercut or overlap.
 - 8. Remove welding flux immediately.
 - 9. At exposed connections, finish exposed welds and surfaces smooth and blended so no roughness shows after finishing and contour of welded surface matches that of adjacent surface.
 - 10. Fastening to In-Place Construction: Provide corrosion resistant anchorage devices and fasteners where metal fabrications are required to be fastened to in-place construction. Provide threaded fasteners for use with concrete and masonry inserts, toggle bolts, through bolts, lag screws, wood screws, and other connectors.
 - 11. Provide temporary bracing or anchors in formwork for items that are to be built into concrete, masonry, or similar construction.
 - 12. Fill Grade around base to ensure positive drainage away from signs.
- B. Bracket-Mounted Signs: Provide manufacturer's standard or fabricated brackets, fittings, and hardware for mounting signs that project at right angles. Attach brackets and fittings securely with concealed fasteners and anchoring devices to comply with manufacturer's written instructions.

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3.3 CLEANING AND PROTECTION

- A. After installation, clean soiled sign surfaces according to manufacturer's written instructions. Protect signs from damage until acceptance by Owner.
- B. Touchup Painting: Immediately after erection, clean field welds, bolted connections, and abraded areas. Paint uncoated and abraded areas with the same material as used for shop painting to comply with SSPC-PA 1 for touching up shop-painted surfaces. Provide one (1) can of touch up paint to the owner.
 - 1. Apply by brush or spray to provide a minimum 2.0-mil dry film thickness.

END OF SECTION 10 14 00

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SECTION 26 05 13 - WIRE AND CABLE

PART 1 - GENERAL

1.1 SECTION INCLUDES

- A. Wire

1.2 REFERENCES

- A. NEMA WC 70 - Power Cables Rated 2,000V or Less for the Distribution of Electrical Energy
- B. UL 44 - Thermoset-Insulated Wires and Cables
- C. UL 83 - Thermoplastic-Insulated Wires and Cables
- D. UL 854 - Service-Entrance Cables
- E. UL 1581 - Standard for Electrical Wires, Cables, and Flexible Cords

PART 2 - PRODUCTS

2.1 WIRE

- A. Feeders and Branch Circuits 6 AWG and Smaller: Copper conductor, 600 volt insulation, THHN/THWN. 6 and 8 AWG, stranded conductor; smaller than 8 AWG, solid or stranded conductor, unless otherwise noted on the drawings.
- B. Control Circuits: Copper, stranded conductor 600 volt insulation, THHN/THWN.

PART 3 - EXECUTION

3.1 WIRE AND CABLE INSTALLATION SCHEDULE

- A. Exterior Locations: Wire in raceways.
- B. Underground Locations: Wire in raceways.

3.2 GENERAL WIRING METHODS

- A. Use no wire smaller than 12 AWG for power and lighting circuits, and no smaller than 14 AWG for control wiring.

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- B. The ampacity of multiple conductors in one conduit shall be derated per National Electrical Code, Article 310. In no case shall more than 4 conductors be installed in one conduit to such loads as motors larger than 1/4 HP, panelboards, motor control centers, etc.
- C. Splice only in junction or outlet boxes.
- D. Neatly train and lace wiring inside boxes, equipment, and panelboards.
- E. All conductors shall be continuous in conduit from last outlet to their termination.

3.3 WIRING INSTALLATION IN RACEWAYS

- A. Pull all conductors into a raceway at the same time. Use UL listed wire pulling lubricant for pulling 4 AWG and larger wires.
- B. Pulling shall be continuous without unnecessary stops and starts with wire or cable only partially thru raceway.
- C. Where reels of cable or wire are used, they shall be set up on jacks close to the point where the wire or cable enters the conduit or duct so that the cable or wire may be unreeled and run into the conduit or duct with a minimum of change in the direction of the bend.
- D. Cables or wires shall not be laid out on the ground before pulling.
- E. Cables or wires shall not be dragged over earth or paving.
- F. Care shall be taken so as not to subject the cable or wire to high mechanical stresses that would cause damage to the wire and cable.
- G. Conductors shall not be pulled through conduits until plastering or masonry work is completed and conduits are free from moisture. Care shall be taken so that long pulls of wire or pulls around several bends are not made where the wire may be permanently stretched and the insulation damaged.
- H. Only nylon rope shall be permitted to pull cables into conduit and ducts.
- I. At least six (6) inch loops or ends shall be left at each outlet for installation connection of fixtures or other devices.
- J. All wires in outlet boxes not connected to fixtures or other devices shall be rolled up, spliced if continuity of circuit is required, and insulated.
- K. Completely and thoroughly swab raceway system before installing conductors.

3.4 CABLE INSTALLATION

- A. Provide protection for exposed cables where subject to damage.
- B. Use suitable cable fittings and connectors.
- C. Run all open cable in a neat and symmetrical manner. Follow the routing as illustrated on the drawings as closely as possible. If routing is not illustrated then the Contractor shall choose his own routing, but in any case it shall be run in a manner previously stated.

- D. Open cable shall only be installed where specifically shown on the drawings, or permitted in these specifications.

3.5 WIRING CONNECTIONS AND TERMINATIONS

- A. Splice and tap only in accessible junction boxes.
- B. Use solderless, tin-plated copper, compression terminals (lugs) applied with circumferential crimp for copper conductor terminations, 8 AWG and larger.
- C. Use solderless, tin-plated, compression terminals (lugs) applied with indenter crimp for copper conductor terminations, 10 AWG and smaller.
- D. Use solderless pressure connectors with insulating covers for copper wire splices and taps, 8 AWG and smaller. For 10 AWG and smaller, use insulated spring wire connectors with plastic caps.
- E. Use copper, compression connectors applied with circumferential crimp for copper wire splices and taps, 6 AWG and larger. Tape uninsulated conductors and connectors with electrical tape to 150 percent of the insulation value of conductor.
- F. Thoroughly clean wires before installing lugs and connectors.
- G. Make splices, taps and terminations to carry full ampacity of conductors without perceptible temperature rise.
- H. Terminate spare conductors with electrical tape, unless otherwise indicated on the drawings.
- I. Phase Sequence: All apparatus shall be connected to operate in the phase sequence A-B-C representing the time sequence in which the phase conductors so identified reach positive maximum voltage.
- J. As a general rule, applicable to switches, circuit breakers, starters, panelboards, switchgear and the like, the connections to phase conductors are intended thus:
 - 1. Facing the front and operating side of the equipment, the phase identification shall be:
 - a. Left to Right - A-B-C
 - b. Top to Bottom - A-B-C

3.6 FIELD QUALITY CONTROL

- A. Field inspection and testing will be performed under provisions of Division 1.
- B. Inspect wire and cable for physical damage and proper connection.
- C. Torque test conductor connections and terminations to manufacturers recommended values.
- D. Perform continuity test on all power and equipment branch circuit conductors. Verify proper phasing connections.

END OF SECTION 26 05 13

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SECTION 26 05 31 - BOXES

PART 1 - GENERAL

1.1 SECTION INCLUDES

- A. Pull and junction boxes

1.2 REFERENCES

- A. ANSI/NEMA OS 1 - Sheet-Steel Outlet Boxes, Device Boxes, Covers and Box Supports
- B. ANSI/NEMA OS 2 - Nonmetallic Outlet Boxes, Device Boxes, Covers and Box Supports
- C. NEMA 250 - Enclosures for Electrical Equipment (1000 Volts Maximum)
- D. Federal Specification A-A-50563 - Conduit Outlet Boxes, Bodies, and Entrance Caps, Electrical Cast Metal

PART 2 - PRODUCTS

2.1 OUTLET BOXES

- A. Cast Boxes: NEMA FB1, Type FD, Aluminum or cast ferrous alloy, deep type, gasketed cover, threaded hubs.

2.2 PULL AND JUNCTION BOXES

- A. Cast Metal Boxes for Outdoor and Wet Location Installations: NEMA 250; Type 4 and Type 6, flat-flanged, surface-mounted junction box, UL listed as raintight. Galvanized cast iron box and cover with ground flange, neoprene gasket, and stainless steel cover screws.
- B. Cast Metal Boxes for Underground Installations: NEMA 250; Type 4, inside flanged, recessed cover box for flush mounting, UL listed as raintight. Galvanized cast iron box and plain cover with neoprene gasket and stainless steel cover screws.
- C. Handholes for Underground Installations: Precast composite polymer concrete stackable body with conduit entry holes at center bottom of each side; composite polymer concrete cover with logo and skid resistant surface and stainless steel bolts.

PART 3 - EXECUTION

3.1 BOX INSTALLATION SCHEDULE

- A. Cast boxes shall be used in:

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1. Exterior locations.
2. Direct contact with earth.
3. Direct contact with concrete in slab on grade.
4. Wet locations.

3.2 COORDINATION OF BOX LOCATIONS

- A. Provide electrical boxes as shown on the drawings, and as required for splices, taps, wire pulling, equipment connections, and code compliance.

3.3 OUTLET BOX INSTALLATION

- A. Provide knockout closures for unused openings.
- B. Support boxes independently of conduit.
- C. Provide cast outlet boxes in exterior locations and wet locations, and where exposed rigid or intermediate conduit is used.

3.4 EXPOSED BOX INSTALLATION

- A. Boxes shall be secured to the structure with proper size screws, bolts, hanger rods, or structural steel elements.

END OF SECTION 26 05 31

SECTION 26 05 33 - CONDUIT

PART 1 - GENERAL

1.1 SECTION INCLUDES

- A. Electrical metallic tubing and fittings
- B. Flexible metallic conduit and fittings
- C. Liquidtight flexible metallic conduit and fittings
- D. Rigid non-metallic conduit and fittings

1.2 REFERENCES

- A. Definitions:
 - 1. Fittings: Conduit connection or coupling.
 - 2. Body: Enlarged fittings with opening allowing access to the conductors for pulling purposes only.
 - 3. Concealed: Not visible by the general public. Often indicates a location either above the ceiling, in the walls, in or beneath the floor slab, in column coverings, or in the ceiling construction.
 - 4. Above Grade: Not directly in contact with the earth. For example, an interior wall located at an elevation below the finished grade shall be considered above grade but a wall retaining earth shall be considered below grade.

PART 2 - PRODUCTS

2.1 ELECTRICAL METALLIC TUBING (EMT) AND FITTINGS

- A. Minimum Size Electrical Metallic Tubing: 3/4 inch, unless otherwise noted.
- B. Acceptable Manufacturers of EMT Conduit: Allied, LTV, Steelduct, Wheatland Tube Co, or approved equal.
- C. Fittings and Conduit Bodies:
 - 1. 2" Diameter or Smaller: Compression type of steel designed for their specific application.
 - 2. Acceptable Manufacturers of EMT Conduit Fittings: Appleton Electric, O-Z/Gedney Co., Electroline, Raco, Bridgeport, Midwest, Regal, Thomas & Betts, or approved equal.

2.2 RIGID NON-METALLIC CONDUIT (RNC) AND FITTINGS

- A. Minimum Size Rigid Smooth-Wall Nonmetallic Conduit: 3/4 inch, unless otherwise noted.
- B. Acceptable Manufacturers: Carlon (Lamson & Sessions) Type 40, Cantex, J.M. Mfg., or approved equal.

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- C. Construction: Schedule 40 and Schedule 80 rigid polyvinyl chloride (PVC), UL labeled for 90°C.
- D. Fittings and Conduit Bodies: NEMA TC 3; sleeve type suitable for and manufactured especially for use with the conduit by the conduit manufacturer.
- E. Plastic cement for joining conduit and fittings shall be provided as recommended by the manufacturer.

PART 3 - EXECUTION

3.1 CONDUIT SIZING

- A. Size conduit as shown on the drawings and specifications. Where not indicated in the contract documents, conduit size shall be according to N.E.C. (Latest Edition). Conduit and conductor sizing shall be coordinated to limit conductor fill to less than 40%, maintain conductor ampere capacity as required by the National Electrical Code (to include enlarged conductors due to temperature and quantity derating values) and to prevent excessive voltage drop and pulling tension due to long conduit/conductor lengths.
- B. Minimum Conduit Size (Unless Noted Otherwise):
 - 1. Above Grade: 3/4 inch. (The use of 1/2 inch would be allowed for installation conduit to individual light switches, individual receptacles and individual fixture whips from junction box.)
 - 2. Below Grade 5' or less from Building Foundation: 1 inch.
 - 3. Below Grade More than 5' from Building Foundation: 1 inch.
- C. Conduit sizes shall change only at the entrance or exit to a junction box, unless specifically noted on the drawings.

3.2 CONDUIT ARRANGEMENT

- A. Contractor shall adapt his work to the job conditions and make such changes as required and permitted by the Architect/Engineer, such as moving to clear beams and joists, adjusting at columns, avoiding interference with windows, etc., to permit the proper installation of other mechanical and/or electrical equipment.
- B. Contractor shall cooperate with all Contractors on the project. He shall obtain details of other Contractor's work in order to ensure fit and avoid conflict. Any expense due to the failure of This Contractor to do so shall be paid for in full by him. The other trades involved as directed by the Architect/Engineer shall perform the repair of work damaged as a result of neglect or error by This Contractor. The resultant costs shall be borne by This Contractor.

3.3 CONDUIT SUPPORT

- A. Conduit shall be held in place by the correct size of galvanized one-hole conduit clamps, two-hole conduit straps, patented support devices, clamp back conduit hangers, or by other means if called for on the drawings.
- B. Support individual horizontal raceways with separate, malleable-iron pipe hangers or clamps.

- C. Arrange supports in vertical runs so the weight of raceways and enclosed conductors is carried entirely by raceway supports, with no weight load on raceway terminals.
- D. Supports for metallic conduit shall be no greater than 10 feet. A smaller interval may be used if necessitated by building construction, but in no event shall support spans exceed the National Electrical Code requirements. Conduit shall be securely fastened within 3 feet of each outlet box, junction box, device box, cabinet, or fitting.
- E. Supports of flexible conduit shall be within 12 inches of each outlet box, junction box, device box, cabinet, or fitting and at intervals not to exceed 4.5 feet.
- F. Supports for non-metallic conduit shall be at sufficiently close intervals to eliminate any sag in the conduit. The manufacturer's recommendations shall be followed, but in no event shall support spans exceed the National Electrical Code requirements.
- G. Where conduit is to be installed in poured concrete floors or walls, provide concrete-tight conduit inserts securely fastened to forms to prevent conduit misplacement.
- H. Finish:
 - 1. Prime coat exposed steel hangers and supports. Hangers and supports in crawl spaces, pipe shafts, and above suspended ceiling spaces are not considered exposed.
 - 2. Trim all ends of exposed field fabricated steel hangers, slotted channel and threaded rod to within 1" of support or fastener to eliminate potential injury to personnel unless shown otherwise on the drawings. Smooth ends and install elastomeric insulation with two coats of latex paint if exposed steel is within 6'-6" of finish floor and presents potential injury to personnel.

3.4 CONDUIT INSTALLATION

- A. Conduit Connections:
 - 1. Shorter than standard conduit lengths shall be cut square using industry standards. The ends of all conduits cut shall be reamed or otherwise finished to remove all rough edges.
 - 2. Metallic conduit connections in slab on grade installation shall be sealed and one coat of rust inhibitor primer applied after the connection is made.
 - 3. Where conduits with tapered threads cannot be coupled with standard couplings, then approved split or Erickson couplings shall be used. Running threads will not be permitted.
- B. Conduit terminations for all low voltage wiring shall have nylon bushings installed on each end of every conduit run.
- C. Conduit Bends:
 - 1. Use a hydraulic one-shot conduit bender or factory elbows for bends in conduit 2" in size or larger. All steel conduit bending shall be done cold; no heating of steel conduit shall be permitted.
 - 2. All bends of rigid non-metallic conduit (RNC) shall be made with the manufacturer's approved bending equipment. The use of spot heating devices will not be permitted (i.e. blow torches).
 - 3. A run of conduit shall not contain more than the equivalent of four (4) quarter bends (360°), including those bends located immediately at the outlet or body.
 - 4. Provide product submittals, per specifications, on slip sleeves and/or gutters to the Engineer for approval prior to purchase and installation.

5. Rigid non-metallic conduit (RNC) runs longer than 100 feet or runs which have more than two 90° equivalent bends (regardless of length) shall use rigid steel factory elbows for bends.
6. Use conduit bodies to make sharp changes in direction (i.e. around beams).

D. Conduit Placement:

1. Conduit shall be mechanically continuous from source of current to all outlets. Conduit shall be electrically continuous from source of current to all outlets, unless a properly sized grounding conductor is routed within the conduit. All metallic conduits shall be bonded per the National Electrical Code.
2. Avoid moisture traps where possible. Where unavoidable, provide a junction box with drain fitting at conduit low point.
3. Conduits, if run in concrete structure, shall be in middle one-third of slab thickness, and leave at least 3" min. concrete cover. Conduits shall run parallel to each other and spaced at least 8" apart centerline to centerline. Secure raceways to reinforcing rods to prevent sagging or shifting during concrete placement. Maximum conduit outside diameter 1".
4. Rigid non-metallic conduit (RNC) shall be installed when material surface temperatures and ambient temperature are greater than 40°F.
5. Where rigid non-metallic conduit (RNC) conduit is used below grade, in a slab, below a slab, etc., a transition to rigid galvanized steel or PVC-coated steel conduit shall be installed before conduit exits earth. The metallic conduit shall extend a minimum of 6" into the surface concealing the non-metallic conduit.
6. Contractor shall provide suitable mechanical protection around all conduits stubbed out from floors, walls or ceilings during construction to prevent bending or damaging of stubs due to carelessness with construction equipment.
7. Contractor shall provide a polypropylene pull cord with 2000 lbs. tensile strength in each empty conduit (indoor and outdoor), except in sleeves and nipples.

3.5 CONDUIT TERMINATIONS

- A. Where conduit bonding is indicated or required in the contract documents, the bushings shall be a grounding type sized for the conduit and ground bonding conductor as manufactured by O-Z/Gedney, Appleton, Thomas & Betts, Burndy, Regal, or approved equal.
- B. Conduits with termination fittings shall be threaded for one (1) lock nut on the outside and one (1) lock nut and bushing on the inside of each box.
- C. Where conduits terminate in boxes with knockouts, they shall be secured to the boxes with lock nuts and provided with approved screw type tinned iron bushings or fittings with plastic inserts.
- D. Where conduits terminate in boxes, fittings, or bodies with threaded openings, they shall be tightly screwed against the shoulder portion of the threaded openings.
- E. Rigid non-metallic conduit (RNC) conduit shall be terminated using fittings and bodies produced by the manufacturer of the conduit, unless noted otherwise. Prepare conduit as per manufacturer's recommendations before joining. All joints shall be solvent welded by applying full even coat of plastic cement to the entire areas that will be joined. Turn the conduit at least a quarter to one half turn in the fitting and let the joint cure for 1-hour minimum or as per the manufacturer's recommendations.
- F. All conduit ends shall be sealed with plastic immediately after installation to prevent the entrance of any foreign matter during construction. The seals shall be removed and the

conduits blown clear of any and all foreign matter prior to any wires or pull cords being installed.

3.6 UNDERGROUND CONDUIT INSTALLATION

A. Conduit Connections:

1. Conduit joints in a multiple conduit run shall be staggered at least one foot apart.

B. Conduit Bends (Lateral):

1. Conduits shall have long sweep radius elbows instead of standard elbows wherever special bends are indicated and noted on the drawings, or as required by the manufacturer of the equipment or system being served.

C. Conduit Elbows (vertical):

1. Minimum steel elbow radiuses shall be 30 inches for primary conduits (>600V) and 18 inches for secondary conduits (<600V). Increase radius, as required, based on pulling tension calculation requirements.

D. Conduit Placement:

1. Conduit runs shall be pitched a minimum of 4" per 100 feet to drain toward the terminations. Duct runs shall be installed deeper than the minimum wherever required to avoid any conflicts with existing or new piping, tunnels, etc.
2. Before the Contractor pulls any cables into the conduit he shall have a mandrel 1/4" smaller than the conduit inside diameter pulled through each conduit and if any concrete or obstructions are found, the Contractor shall remove them and clear the conduit. Spare conduit shall also be cleared of all obstructions.
3. Conduit terminations in manholes, masonry pull boxes, or masonry walls shall be with malleable iron end bell fittings.
4. All spare conduits not terminated in a covered enclosure shall have its terminations plugged as described above.
5. Conduit shall be installed a minimum of 24" below finished grade, unless otherwise noted on the drawings or elsewhere in these specifications.
6. All non-metallic conduit installed underground outside of a slab shall be rigid.

E. Raceway Seal:

1. Where a raceway enters a building or structure, it shall be sealed with a sealing bushing or duct seal to prevent the entry of liquids or gases. Seal must be compatible with conductors and raceway system. Spare or unused raceway shall also be sealed.

3.7 CONDUIT INSTALLATION SCHEDULE

- A. In the event the location of conduit installation represents conflicting installation requirements as specified in the following schedule, a clarification shall be obtained from the Architect/Engineer. If This Contractor is unable to obtain a clarification as outlined above, concealed rigid galvanized steel conduit installed per these specifications and the National Electrical Code shall be required.

END OF SECTION 26 05 33

SECTION 26 27 16 - CABINETS AND ENCLOSURES

PART 1 - GENERAL

1.1 SECTION INCLUDES

- A. Hinged cover enclosures
- B. Cabinets
- C. Terminal blocks and accessories

1.2 REFERENCES

- A. NEMA 250 - Enclosures for Electrical Equipment (1000 Volts Maximum)
- B. ANSI/NEMA ICS 1 - Industrial Control and Systems
- C. ANSI/NEMA ICS 4 - Terminal Blocks for Industrial Control Equipment and Systems
- D. ANSI/NEMA ICS 6 - Enclosures for Industrial Control Equipment and Systems

1.3 SUBMITTALS

- A. Shop Drawings for Equipment Panels: Include wiring schematic diagram, wiring diagram, outline drawing and construction diagram as described in ANSI/NEMA ICS 1.
- B. Include cabinets and enclosures in composite electronic coordination files.

PART 2 - PRODUCTS

2.1 HINGED COVER ENCLOSURES

- A. Construction: NEMA 250; Type 3R, 14 gauge steel.
- B. Finish: Manufacturer's standard polyester powder paint finish.
- C. Covers: Continuous hinge with stainless steel hinge pin. Covers longer than 24 inches shall have 3-point latching.
- D. Locks: 3-point latch kit with padlock handle.
- E. Provide interior white painted metal panel for mounting terminal blocks and electrical components.

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2.2 TERMINAL BLOCKS AND ACCESSORIES

- A. Terminal Blocks: ANSI/NEMA ICS 4; UL listed.
- B. Power Terminals: Unit construction type, closed-back type, with tubular pressure screw connectors, rated 600 volts.
- C. Signal and Control Terminals: Modular construction type, channel mounted; tubular pressure screw connectors, rated 300 volts.

2.3 FABRICATION

- A. Shop assemble enclosures and cabinets housing terminal blocks or electrical components in accordance with ANSI/NEMA ICS 6.
- B. Provide conduit hubs on enclosures.
- C. Provide protective pocket inside front cover with schematic diagram, connection diagram, and layout drawing of control wiring and components within enclosure.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install cabinets and enclosures plumb; anchor securely to wall and structural supports at each corner, minimum.
- B. Provide accessory feet for free-standing equipment enclosures.
- C. Install trim plumb.

END OF SECTION 26 27 16

SECTION 26 27 26 - WIRING DEVICES

PART 1 - GENERAL

1.1 SECTION INCLUDES

- A. Receptacles including GFCI tamper resistant and/or weather resistant

1.2 SUBMITTALS

- A. Provide product data showing configurations, finishes, dimensions, and manufacturer's instructions.

1.3 QUALITY ASSURANCE

- A. Provide similar devices from a single manufacturer.
- B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency to Authorities Having Jurisdiction and marked for intended use.
- C. Comply with NFPA 70.

1.4 COORDINATION

- A. Receptacles for Owner Furnished Equipment: Match plug configurations.

PART 2 - PRODUCTS

2.1 RECEPTACLES

- A. Coordinate with sign manufacturer for configuration and ratings.
- B. Back wired devices shall be complete with eight holes that are screw activated with metal clamps for connection to #12 or #10 copper conductors.
- C. Side wired devices shall have four binding screws that are undercut for positive wire retention.
- D. Ground Fault Circuit Interrupter (GFCI) receptacles shall comply with the 2006 edition of U.L. 943 requiring increased surge immunity, improved corrosion resistance, improved resistance to false tripping and diagnostic indication for miswiring if the line and load conductors are reversed during installation.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Drill opening for poke-through fitting installation in accordance with manufacturer's instructions.
- B. Install receptacles vertically with ground slot up or where indicated on the drawings, horizontally with ground slot to the left.
- C. Install devices and wall plates flush and level.
- D. Test receptacles for proper polarity, ground continuity and compliance with requirements.

END OF SECTION 26 27 26

SECTION 26 51 00 - LIGHTING

PART 1 - GENERAL

1.1 SECTION INCLUDES

- A. Exterior luminaires and accessories

1.2 REFERENCES

- A. ANSI C78.377-2008 - Specifications for the Chromaticity of Solid State Lighting Products
- B. ANSI C82.77-2002 - Standard for Harmonic Emission Limits and Related Power Quality Requirements for Lighting Equipment
- C. IEEE C2 - National Electrical Safety Code

1.3 SUBMITTALS

- A. Submit product data under provisions of Section 26 05 00.
- B. Submit product data sheets for luminaires and drivers. Include complete product model number with all options as specified.
- C. Include outline drawings, support points, weights, and accessory information for each luminaire type.
- D. LED luminaire submittals shall include photometric report per IESNA LM-79-08 for the latest generation system being furnished, including independent testing laboratory name, report number, date, luminaire model number, input wattage, luminaire, and light source specifications. Manufacturer origin of LED chipset and driver shall be submitted.

1.4 DELIVERY, STORAGE, AND HANDLING

- A. Deliver products to site. Store and protect from damage.
- B. Protect luminaire finishes, lenses, and trims from damage during storage and installation. Do not remove protective films until construction cleanup within each area is complete.

1.5 WARRANTY

- A. Light emitting diode (LED) light engines and drivers shall have a five-year warranty from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 EXTERIOR LUMINAIRES AND ACCESSORIES - GENERAL

- A. Listed for wet locations.
- B. Provide low temperature ballasts or LED drivers, with reliable starting to -20°F.

2.2 LIGHT EMITTING DIODE (LED) LUMINAIRE SYSTEMS

- A. Light emitting diodes used in exterior applications shall have a minimum color rendering index (CRI) of 70. Color temperature of the luminaires shall be as noted on the Plans.
- B. LED chips shall be wired so that failure of one chip does not prohibit operation of the remainder of the chip array.
- C. LED Driver:
 - 1. Solid state driver with integral heat sink. Driver shall have overheat, shortcircuit and overload protection, power factor 0.90 or above and maximum total harmonic distortion of 20%. Surge suppression device for all exterior luminaires.
 - 2. Driver shall have a minimum of 50,000 hours rated life.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install lamps in lamp holders of luminaires.
- B. Adjust aimable luminaires to obtain lighting levels on objects and areas as directed to obtain desired lighting levels.

3.2 ADJUSTING AND CLEANING

- A. Align luminaires and clean lenses and diffusers at completion of work. Clean paint splatters, dirt, and debris from installed luminaires.
- B. Touch up luminaire and pole finish at completion of work.

END OF SECTION

SECTION 32 40 00 - STONE WORK

PART 1: GENERAL

1.1 SUMMARY

- A. This section includes furnishing and installation of the following
 1. Stone Wall
 2. Boulder Outcropping
 3. Maintenance Strip

- B. Related Sections include the following:
 1. Section 02000 - Grading & Excavation

1.2 SUBMITTALS

- A. Samples for verification:
 1. All stone types showing range in color, finish and variation.

1.4 QUALITY ASSURANCE

- A. Installer Qualifications: Engage an experienced Installer who has completed installations similar in material, design, and extent to that indicated for this Project and with a record of successful in-service performance.
- B. Mockups: Build mockups to verify selections made under sample submittals and to demonstrate aesthetic effects and set quality standards for materials and execution:
 1. At location on Project selected by Engineer, place and finish a continuous section of Stone Wall. The wall mock up shall be a minimum of 2 courses high and 3 stones in length.
 2. Construct mockup using processes and techniques intended for use on permanent work, Mockup shall be produced by the individual workers who will perform the work for the Project.
 3. Accepted mockup provides visual standard for work of Section.
 4. Mockup shall remain through completion of the work for use as a quality standard for finished work.
 5. Remove mockup when directed.
 6. Approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.5 DELIVERY AND STORAGE

- A. Deliver, store and handle materials in a manner to avoid breaking stone.

1.6 PROJECT CONDITIONS

- A. Protect adjacent work from damage, soiling, and staining during operations.

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PART 2: PRODUCTS

2.1 MATERIALS

A. Wall Stone

1. Type: Limestone Outcropping
 - a. To match stone used on the South Gateway Sign located on the east side of Interstate 380 between Highway 151 and 76th Avenue SW.
 - b. Size Range: 16-22" Width, 16-20" Height, 48-72" Length
 - c. Color: Similar color to Rustic Wall Stone available from Premier Brick and Stone, Inc., 2769 Stonegate Ct. Hiawatha, IA
 - d. Finish:
 - a) Sides: Natural
 - b) Top: Bedface
 - c) Bottom: Bedface
 - e. Pattern: Stacked bond with offset vertical joints

B. Boulder Outcropping

1. Type: Limestone Outcropping
 - a. To match stone used on the South Gateway Sign located on the east side of Interstate 380 between Highway 151 and 76th Avenue SW.
 - b. Size Range: 16-22" Width, 16-20" Height, 48-72" Length
 - c. Color: Similar color to Rustic Wall Stone available from Premier Brick and Stone, Inc., 2769 Stonegate Ct. Hiawatha, IA
 - d. Finish:
 - a) Sides: Natural
 - b) Top: Bedface
 - c) Bottom: Bedface

C. Dense Graded Base: Iowa DOT Gradation No. 12.

D. Maintenance Strip

1. Stone: Hard, durable stone, washed free of loam, sand, clay, and other foreign substances, of following type, size range, and color:
 - a. Size Range: 2 ½" average stone size.
 - b. Color: Readily available natural gravel color range acceptable to Architect.
2. Weed-Control Barriers
 - a. Nonwoven Geotextile Filter Fabric: Polypropylene or polyester fabric, 3 oz./sq. yd. minimum, composed of fibers formed into a stable network so that fibers retain their relative position. Fabric shall be inert to biological degradation and resist naturally-encountered chemicals, alkalis, and acids.

PART 3: EXECUTION

3.1 PREPARATION

- A. Obtain Engineer's approval on boulder composition and placement in all areas.
- B. Inspection: Examine finished surfaces and grades before commencing work. Do not begin work until unsatisfactory conditions are corrected.
- C. Excavate as needed to 'seat' Stones in landscape areas. See plan details.

3.2 CONSTRUCTION

A. Stone Wall

1. Excavate trench the appropriate size for the dense graded base
2. Place and compact aggregate base.
 - a. Compact sub-base and shape to configure to wall stone shape
3. Stone placement
 - a. Install wall stones so they appear level across each stone.
 - b. Place stone so approximately 2/3 of stone is exposed and 1/3 of stone is buried with a maximum of 8" buried for bottom course.
 - c. Stones may vary between vertical courses, but shall be consistent throughout each horizontal course.
 - d. Select and/or work stones to adhere to tolerances listed.
 - e. Joints: Vertical & Horizontal. Tight abutted joints, typ. Field trimmed as necessary keeping filler pieces to a minimum. A minimum of 75% of joints to be 2" or less. Remaining joints as tight as possible.
 - f. Vertical joints between wall stones should be off-set.
 - g. Backfill and compact around wall stone with dense graded base so as to keep stones from rocking or shifting in soil areas.

B. Boulder Outcropping

1. Excavate the appropriate depth for stone.
2. Compact sub-base and shape to configure stone shape.
3. Place stone in landscape so approx. 2/3 of stone is visible, maximum 6" buried depth.
4. Backfill around stones in landscape.

C. Maintenance Strip

1. Install weed-control barriers where indicated on the drawings before placing stone according to manufacturer's written instructions. Completely cover area, overlapping edges a minimum of 6 inches and secure seams with galvanized pins.
2. Apply 4-inch minimum, 6-inch maximum thickness of stone over whole surface of maintenance strip area, and finish level with adjacent finish grades.

3.3 ADJUSTING AND CLEANING

- A. Remove and replace stone units that are broken, stained, or otherwise damaged. Provide new matching units and install as specified.
- B. Clean stonework not less than 6 days after completion of the project. Use clean water.
- C. Adjust stones with input from the Engineer to enhance the aesthetic effect.
- C. Upon completion of the work, remove all excess materials, debris tools, and equipment from the site. Repair damage resulting from stone masonry work operations.

END OF SECTION 32 40 00