SECTION 16110

CONDUITS, BOXES, AND FITTINGS

# GENERAL

## DESCRIPTION

### This section includes material, installation, and testing for conduit, boxes, and fittings.

## RELATED WORK SPECIFIED ELSEWHERE

### Section 02223: Trenching, Backfilling, and Compacting.

### Section 16010: General Electrical Requirements.

### Section 16450: Grounding.

## SUBMITTALS

### Submit shop drawings in accordance with the General Conditions.

### Submit product data for the following:

#### Conduit and fittings for each type specified.

#### Boxes.

## QUALITY CONTROL

### **NEMA Compliance:** Comply with NEMA standards pertaining to conduits and components.

### **UL Compliance and Labeling:** Comply with requirements of UL standards pertaining to electrical conduits and components. Provide conduits and components listed and labeled by UL.

## MEASUREMENT AND PAYMENT

### Payment for the work in this section shall be included as part of the lump-sum bid amount stated in the Proposal.

# MATERIALS

## RIGID STEEL CONDUIT AND FITTINGS

### **Rigid Steel Conduit and Fittings:** Conform to ANSI C80.1, NEMA RN2, and UL-6, hot-dipped galvanized after threading. The zinc coating shall be flexible and shall not crack during bending.

### **Fittings:**

#### **Locknuts:** Steel or malleable iron.

#### **Bushings:** Threaded type, steel or malleable iron, with 105°C rated plastic insulated throat and grounding and bonding lug. Plastic bushings with a temperature rating of 105°C may be used for conduits 1 inch and smaller where hubs are not required and circuit conductors are supplying less than 480 volts.

#### **Box Connectors for Damp and Wet Locations:** Provide a watertight threaded hub on enclosure consisting of sealing fitting with tapered conduit thread, neoprene O-ring, and 105°C rated insulating throat with grounding and bonding lug. Sealing locknuts are allowed but are not a substitute for threaded watertight hubs or sealing fittings.

#### **Couplings:** Threaded, hot-dipped galvanized after fabrication.

### No running threads will be permitted. Provide union fittings for these locations.

## INTERMEDIATE METAL CONDUIT (IMC) AND FITTINGS

### **Material:** Hot-dipped galvanized IMC manufactured in accordance with UL-1242.

### **Accessories:** Same as specified for rigid steel conduit.

## PVC-COATED RIGID STEEL CONDUIT AND FITTINGS

### Conduit:

#### All conduits, prior to coating, shall conform to ANSI C80.1 and UL-6. Conduits shall be hot-dipped galvanized after threading.

#### The zinc surface shall be treated prior to coating to enhance the bond between metal and plastic.

#### Both interior and exterior of the conduit shall be coated with an epoxy acrylic primer of approximately 0.5-mil thickness.

#### The exterior coating shall be applied by dipping in liquid plastisol or other equal method which will produce a finished product conforming to NEMA 5-19-1986.

#### The thickness of the PVC coating shall be a minimum of 40 Mil the full length of the conduit except the threads.

#### The bond between the PVC coating and the conduit surface shall be greater than the tensile strength of the plastic.

#### A chemically cured urethane coating of a nominal thickness of 2 mils shall be applied to the interior of all conduit.

#### The conduit shall be bendable without damage to the PVC or urethane coatings.

#### All threads shall have an added protection of a 2-mil clear urethane coating.

#### The PVC-coated rigid galvanized steel conduit shall be certified and authorized to apply the ETL verification mark “ETL Verified to PVC-001.” ETL certified to Intertek ETL SEMKO High Temperature H2O PVC Coating Adhesion Test Procedure.

#### Test results shall be available to confirm coating adhesion under the following conditions:

##### Conduit immersed in boiling water with a minimum mean time to adhesion failure of 24 hours (ASTM D870).

##### Conduit and conduit bodies’ exposure to 150°F and 95% relative humidity with a minimum mean time failure of seven days (ASTM D1151).

### Fittings:

#### Fittings and elbows shall be coated similar to the conduits.

#### A loose coupling shall be furnished with each length of conduit. A PVC coating shall be bonded to the outer surface of the coupling, and a PVC sleeve equal to the outside diameter of the uncoated conduit shall extend beyond both ends of the coupling approximately one pipe diameter or 2 inches whichever is smaller. The wall thickness of the sleeve shall be the same as the plastic coating on the pipe.

#### The PVC coating on the coupling shall be ribbed to enhance installation.

#### All hubs shall have PVC sleeves equal to those on the couplings.

#### All screws on Form 7 fittings shall be of stainless steel with encapsulated plastic heads.

#### All U bolts and RA clamps shall be sized to fit conduit, and the nuts shall be encapsulated in plastic.

#### Fittings shall otherwise be same as specified for rigid steel.

#### Elbows or bends exceeding 45 degrees shall be of the same dimensions as specified for rigid steel long-radius elbows.

#### Conduit bodies, where applicable, shall be Form 8 with a tongue-in-groove (V-seal) gasket to effectively seal out corrosive elements.

### Conduits and fittings shall conform to NEMA RN-1 and shall be manufactured by Robroy, Ocal Inc., or equal.

## ELECTRICAL METALLIC TUBING (EMT) AND FITTINGS

### EMT Not Allowed.

## RIGID NONMETALLIC CONDUIT (PVC) AND FITTINGS

### **Conduit:** PVC Schedule 80, 90°C rise rating. Conforming to NEMA TC-2 Type EC-40 and UL-651.

### **Elbows (90 Degrees):** PVC Schedule 80 conduit of the same dimension as specified for steel conduit.

### **Couplings, Adapters, Bell Ends, Expansion Couplings, Elbows, and Turns of 30 Degrees:** Factory made to NEMA TC-2 and TC-3.

### **Joint Cement:** As recommended by manufacturer as suitable for the climate, furnished with instructions to achieve watertight joints.

### **Manufacturers:** Carlon, Condux, or equal.

## LIQUIDTIGHT FLEXIBLE METAL CONDUIT AND FITTINGS

### **Conduit:** Steel, UL-360 listed, PVC jacketed.

### **Fittings:**

#### Conform to ASME C33.84, UL listed for use with the conduit.

#### In sizes 1-1/4 inches and less UL listed for grounding.

#### Made of steel or malleable iron, zinc plated, 105°C insulated throat, grounding and bonding lug. Provide with T&B sealing rings (5262 =1/2” 5263 =3/4” 5264 =1”) or approved equal.

## CONDUIT BODIES

### Provide types, shapes, and sizes to suit individual applications. Provide matching gasketed cast-iron covers, secured with at least two captive corrosion-resistant stainless steel screws.B. Bodies connecting to rigid conduit shall be of the same material and material coating as the conduit, with metal threaded hubs. Provide with gasketed “clip on” covers secured with at least two corrosion-resistant stainless steel captive screws. As manufactured by Appleton, O-Z/ Gedney, or equal.

### Bodies connecting to nonmetallic conduit shall be nonmetallic conduit bodies conforming to UL 514B.

## CORROSION PROTECTIVE COATINGS FOR METAL CONDUIT

### Manufacturer provided touch-up coatings or Zinc enriched paint are to be applied on cut threads and inside the conduit where factory coating is damage by reaming. Threads are to be coated with Kopr-Shield by Thomas and Betts or equal.

## OUTLET BOXES

### Concealed and Flush-Mounted Boxes:

#### Galvanized steel boxes sized as required by code. Do not use sectional boxes for multi-gang applications.

#### Receptacle Device Boxes: 4 by 4 by 1.5 inches with:

##### Square cornered tile type rings for exposed masonry wall construction.

##### Square corner tile type covers with ribs or extensions for casting in concrete.

##### Plaster ring for plaster and drywall construction.

### Exposed Boxes:

#### Cast iron with threaded hubs. Provide boxes with mounting flanges.

#### Conduit bodies may be used instead of boxes except where boxes contain devices.

#### Outlet boxes connecting to PVC-coated rigid conduit shall be of the same material and material coating as the conduit, with metal threaded hubs. Provide with gasketed covers secured with at least two corrosion-resistant captive screws.

## JUNCTION AND PULL BOXES

### Provide factory-made standard sizes, and shop fabricate when nonstandard size boxes are shown. Comply with UL and NEMA standards.

### **NEMA 1:** Sheet steel, hot-dipped galvanized after fabrication. Finish with one coat of metal primer and one coat of primer sealer.

### **NEMA Type 4X:** Type 304 stainless steel, with gasketed covers and Type 304 stainless steel bolts or screws.

### **NEMA 4:** Code gauge steel, hot-dipped galvanized after fabrication. Provide cover with Type 303 stainless steel bolts.

### **NEMA 3R:** Sheet steel, hot-dipped galvanized after fabrication. Factory painted with corrosion-resistant coatings.

### **NEMA 12:** Code gauge steel, hot-dipped galvanized after fabrication. Provide continuous hinged cover and three-point latch or Type 303 stainless steel bolts and clamps.

### Provide terminal junction boxes with terminal strips or terminal blocks with a separate connection point for each conductor entering or leaving the box. Provide 25% spare terminal points.

### Junction boxes shall be manufactured by Hoffman, Wiegmann, or equal.

## HAZARDOUS LOCATIONS

### Conform with NEC Articles 501 and 502 for areas identified as "Hazardous Areas."

### Provide threaded cast boxes and fittings for junction boxes and pull boxes in Class I areas. Unless otherwise indicated, boxes and fittings shall be UL listed for installation in Class I, Groups A, B, C, and D.

### Cl 1,Div1 sealing hubs are preferred for conduit entering panels from the bottom where conductor fill is 25% or less. Use Appleton ES Series or equal.

### EYS-type sealing fittings suitable for Class I, Division 1 areas. Use EYD-type drain sealing fittings suitable for Class I, Division 1 areas where shown in the drawings. Use sealing fiber and compound approved for Class I, Division 1 areas.

### Fixture hangers for pendant-mounted lighting fixtures shall conform to Class I, Division 1 requirements

## TELEPHONE TERMINAL CABINETS AND TERMINAL BOARDS

### **Terminal Boards:** Three-quarter-inch marine plywood, painted gray with non-turpentine based paint. Dimensions shall be as shown on the drawings.

### Terminal Cabinets:

#### Provide cabinets with 5/8-inch-thick finished plywood apparatus mounting backboards.

#### Sheet metal with a hinged cover, hasp for padlocking. Benner-Nawman, Inc.; Cook Electric; or equal.

#### Provide one duplex 20A 120VAC receptacle.

## CONDUIT SEALANT

### **Moisture Barrier Types:** Sealant shall be Duo-fill 400 or equal.

### **Fire-Retardant Types:** Fire stop material shall be a reusable, nontoxic, asbestos-free, expanding, putty-type material with a three-hour rating in accordance with UL-35L4.

## PROHIBITED MATERIALS

### Do not provide aluminum conduits, fittings, supports, or boxes.

## BEND RADIUS

| Conduit Size (inches) | Minimum Radius (inches) |
| --- | --- |
| 3/4 through 1 1/4 | 12 |
| 2 and 2 1/2 | 15 |
| 3 and 3 1/2 | 18 |
| 4 | 30 |
| 5 | 36 |
| 6 | 42 |

# EXECUTION

## CONDUIT USAGE SCHEDULE

### Install the following types of conduits and fittings in locations listed, unless otherwise noted in the drawings. Definitions and requirements of NEC apply unless specifically modified below. Installation of all buried or concealed conduit work shall be witnessed and approved by a DISTRICT representative.

### Exterior, Exposed:

#### Material: Rigid steel conduit or IMC for conduit larger than 3 inches.

#### Minimum Size: 3/4 inch.

### Exposed, Where Area is Indicated as Corrosive Area:

#### Material: PVC-coated rigid steel conduit.

#### Minimum Size: 3/4 inch.

### Interior, Exposed, Dry, Wet, and Damp Locations:

#### Material: Rigid steel conduit or IMC for conduit larger than 3 inches

#### Minimum Size: 3/4 inch.

### Interior, Concealed, Damp Locations:

#### Material: Rigid steel conduit or IMC for conduit larger than 3 inches.

#### Minimum Size: 3/4 inch.

### Embedded in Concrete Slabs or Walls and Masonry Walls:

#### Material: PVC Schedule 40.

#### Minimum Size: 3/4 inch.

### In Earth, Below Concrete Slabs or Underground:

#### **Material:** Rigid nonmetallic conduit (Schedule 80 PVC) or PVC-coated rigid steel conduit.

#### **Minimum Size:** 3/4 inch.

#### **Conduit Stub-Ups in Exposed Areas:** Provide PVC-coated rigid steel conduit and elbows for stub-ups which connect to underground rigid PVC conduit. Extensions from elbows below grade shall be PVC-coated rigid steel for a minimum of 6 inches above grade. Stub-ups into free-standing electrical gear, such as motor control centers, free-standing VFDs, or switchboards, may be Schedule 80 rigid PVC conduit, in which case terminate the conduits with appropriate end bells. Exposed stub-ups shall extend a minimum of 6 inches above grade.

#### **Conduit Stub-Ups Concealed Inside Floor or Pad-Mounted Equipment:** Provide PVC Schedule 80 elbows and stub-ups between 2 and 4 inches above floor or pad. Align conduit stub-ups neatly in rows with all conduits cut level and at same height.

### Final Connections to Motors, Transformers, Vibrating Equipment, or Instruments:

#### **Material:** Liquid-tight flexible conduit.

#### **Minimum Size:** ½ inch.

#### Length of liquid-tight flexible conduit shall be 3 feet or less, unless otherwise authorized by the DISTRICT.

### Hazardous (NEC-Classified) Locations:

#### **Material:** PVC-coated rigid steel conduit.

#### **Minimum Allowable Size:** 3/4 inch.

#### All XP Fittings are to be PVC-coated

## CONDUIT FILL

### For runs that are not sized in drawings, compute the maximum conduit fill using NEC requirements for Type THW conductors (larger if applicable), although the actual wiring may be with types of conductors having smaller cross-sections.

### For single multi-conductor cables, size conduit to no more than 50% fill considering overall outside diameter of multi-conductor cable. Multi-conductor maximum fill shall be 50%.

## CONDUIT INSTALLATION, GENERAL

### Install conduit exposed unless specifically noted otherwise. All concealed and underground conduits shall be inspected by DISTRICT Representative prior to concealment.

### Run exposed conduits parallel and perpendicular to surface or exposed structural members and follow surface contours as much as practicable to provide a neat appearance.

### Make right-angle bends in conduit runs with standard or long-radius elbows or conduits bent to radii not less than those specified for standard or long-radius elbows depending on wire pull conditions.

### Buried conduits shall penetrate surfaces at 90 degrees.

### Make bends and offsets so that the inside diameter of conduit is not effectively reduced. Unless otherwise indicated, keep the legs of a bend in the same plane and the straight legs of offsets parallel.

### Cap all conduits immediately after installation to prevent entrance of foreign matter.

### Do not use diagonal runs except when specifically noted in the drawings.

### Route exposed conduit to preserve headroom, access space, and work space.

### Treat threaded joints of rigid steel conduit with T&B "Kopr-Shield" before installing fittings where conduit is in slabs and other damp or corrosive areas.

### For PVC-coated rigid conduits, use manufacturer's recommended style threading and installation tools. The manufacturer shall certify the installer before installation can proceed.

### Conduit Terminations:

#### In interior dry areas only, terminate conduits with locknuts and bushings except where threaded hubs are specified.

#### Install conduits squarely to the box and provide one locknut outside the box and one locknut and bushing inside the box.

#### Install locknuts with dished side against the box.

#### When terminating in threaded hubs, screw the conduit or fitting tight into the hub so that the end bears against the fire protection shoulder.

#### When chase nipples are used, install conduits and coupling square to the box and tighten the chase nipple leaving no exposed threads. Chase nipples are allowed in interior dry areas only.

#### Exposed terminated conduit shall be tagged with a unique label at both ends of the conduit. Conduit tags shall be labeled with conduit number. If conduits have been added or are spares they shall be labeled with a unique number and shown on the as-built drawings. Tags shall be 1” SS, laser etched attached to the conduit using SS safety wire.

### Install exposed, parallel, or banked conduits together. Make bends in parallel or banked runs from the same centerline so that the bends are parallel. Factory elbows may be used in banked runs only where they can be installed parallel.

### Conduit runs are shown schematically. Supports, pull boxes, junction boxes, and other ancillary equipment are not usually shown in drawings. If not shown, provide as required by NEC except that bends shall not exceed 270 degrees in total, between pull points. Provide additional boxes to permit pulling of wires without damage to the conductors or insulation.

### Provide expansion fittings for conduits crossing expansion joints in structures and in exposed straight runs exceeding 100 feet.

## REQUIREMENTS FOR RIGID NONMETALLIC (PVC) CONDUIT

### Comply with the installation provisions of NEMA TC2, except as modified below.

### Make cuts with a fine-tooth handsaw. For sizes 2 inches and larger, use a miter box or similar saw guide to assure a square cut.

### Use factory-made couplings for joining conduit.

### Cementing and joining operation shall not exceed 20 seconds. Do not disturb joint for 5 minutes, longer (up to 10 minutes) at lower temperatures. Make joints watertight. Joining procedure shall conform with detailed procedures of ASTM D 2855.

### Install expansion fittings. Expansion fittings are required when the conduit is left exposed in trenches for a period of time during which the conduit's temperature can vary more than 2 degrees. Install expansion fittings near the fixed end of the run and 100 feet on center.

### Where PVC conduit is installed above ground, provide expansion fittings and nylon or Type 316 stainless steel supports at spacings recommended by the raceway manufacturer.

## CONDUIT SEALING

### Seal conduit entries with Duo-fill 400 or equal when conduit leaves an area identified as corrosive.

## GROUNDING

### Provide grounding in accordance with Section 16450.

### Use grounding bushings for all conduits carrying a grounding conductor.

### Provide a grounding conductor in flexible conduit, size conforming to NEC Article 250.

## CONDUITS EMBEDDED IN CONCRETE AND BELOW SLABS

### Install conduits and sleeves passing through slabs, walls, or beams so as not to impair the strength of construction. Secure conduit to prevent sagging or shifting during concrete pour.

### Conduits larger than 1-1/2 inches in diameter may be embedded in structural concrete only after submittal and review of location and reinforcement details.

### Conduits and sleeves may be installed without specific permission, provided they are 1-1/2 inches or less in diameter and are spaced not less than three diameters on centers.

### Install conduits in slabs other than slabs-on-grade as close to the middle of the slabs as practical without disturbing the reinforcement. Outside diameter of the conduit shall not exceed one-third times the slab thickness. Do not space parallel runs of conduit closer than three diameters on centers, except at cabinet and outlet box locations. Conduit must be installed deep enough for elbows to penetrate perpendicular to slab.

### Conduits shown in or under slab-on-grade construction shall be installed below the floor slab and under curing or damp-proofing membranes. An exception may be made for conduit with an outside diameter not larger than 25% of the slab thickness, in which case, standards applying to slabs other than slab-on-grade may be used. Conduit must be installed deep enough for elbows to penetrate perpendicular to slab.

### Perform trenching and backfill in accordance with Section 02223 (Volume I).

### Conduit stub-ups below cabinets and boxes shall be located within the conduit entry area identified in the equipment manufacturer’s shop drawings. Brace conduits prior to concrete pour to prevent shifting of conduits during pour.

### Conduits, including fittings, which are embedded within a column, do not displace more than 4% of the cross-sectional area on which structural strength is calculated.

### Conduits and sleeves, embedded within a wall, slab, or beam, are not larger in the outside dimension than one-third the overall thickness of wall, slab, or beam in which they are embedded.

### There is a minimum of 1 1/2 inches between the conduit and reinforcement for slab and wall penetrations.

### Install expansion fittings at expansion joints.

## CONDUITS UNDERGROUND

### Where PVC conduit is installed underground in locations other than under concrete slab, provide 24-inch minimum cover. Provide 3-inch minimum 2 sack sand-cement slurry with 6 lbs of red oxide (per yard) additive on all sides of conduits. Maintain a 12-inch minimum separation between conduit and other systems. Pitch conduit to drain away from buildings. Provide 6-inch-wide red magnetically detectable warning tape 12 inches above conduits.

### All UG conduits are to be cleaned with a wire brush and swabbed with a rag. After cleaning they shall be mandrelled with the appropriate size mandrell in the presence of the Owner’s representative.

## CONDUIT SUPPORTS

### Support conduit at intervals and at locations as required by the NEC. Do not use perforated strap or plumbers tape for conduit supports.

### **Conduit on Concrete or Masonry:** Use one-hole malleable iron clamps with pipe spacers (clamp backs) or preformed galvanized steel channels. Where subject to corrosion or moisture all preformed steel channels, clamps and hardware shall be 304 SS. Anchor with metallic expansion anchors and screws or from preset insterts. Use preset inserts in pre-stressed concrete. On plaster or stucco, use one-hole malleable iron straps with toggle bolts. Stainless steel expansion anchors shall be used where subject to moisture. Galvanized expansion anchors may be used indoors except where subject to moisture, mounted on floor, or where area is identified as “corrosive.” Shot-in fasteners are not allowed.

### **Suspended Conduit [Concealed Locations]:** Use malleable iron, factory-made, split-hinged pipe rings with threaded suspension rods sized for the weight to be carried (minimum 3/8 inch diameter); Anvil, Cooper B Line, Unistrut, Superstrut, or equal. For grouped conduits, construct racks with threaded rods and tiered angle-iron or preformed channel cross members. Construct channel to limit deflection to 1/200 of span. Clamp each conduit individually to a cross member. Where rods are more than 2 feet long, provide rigid sway bracing. [Exposed Locations]: Use Type 304 stainless steel pipe hangers with Type 304 stainless steel threaded suspension rods sized for the weight to be carried (minimum 3/8-inch diameter); Unistrut, Kin-Line, or equal. For grouped conduits, construct racks with Type 304 stainless steel rods and 6063-T6 extruded aluminum preformed channel cross members. Construct channel to limit deflection to 1/200 of span. Conduit clamps shall be aluminum. Provide Type 304 stainless steel bolts and nuts.

### **Supports at Structural Steel Members:** Use Type 304 stainless steel beam clamps in exposed locations and electrogalvanized steel beam clamps in concealed locations. Drilling or welding may be used only where indicated in the drawings.

### Where area or room is identified as "Corrosive Location," supports, hangers, preformed channels, and clamps shall be Type 304 stainless steel, or fiberglass. Fiberglass support system shall be as manufactured by Omnistrut, Click, or equal. Bolts and nuts for stainless steel support systems shall be Type 304 stainless steel.

### **Conduit on Wood:** Use two-hole galvanized steel straps and wood screws.

### **Concealed Conduit on Wood:** Use two-hole galvanized steel straps nailed to the wood or hammer-driven supports of the stamped galvanized type having serrated or sawtooth edges on the driven portion and designed specifically for the size and type of conduit being supported. Drive these latter supports so that the conduit is tightly and rigidly supported. Replace dented or damaged conduit.

### **In Steel Stud Construction:** Tie conduit with 16-gauge galvanized annealed wire.

### PVC-coated channel and straps are not allowed.

## CONDUIT PENETRATIONS

### Unless otherwise indicated, dry-pack around conduits which penetrate concrete walls, floors, or ceilings.

### Maintain the integrity of all damp-proofing and waterproofing membranes that are penetrated by conduits and boxes.

### Conduits passing vertically through concrete slabs and through structural beams shall be sleeved, except where sealing and expansion/deflection fittings are required. Pack sleeves through floors and fire-rated walls with fire-rated packing. Nonrated penetrations may be packed with nonshrink grout.

### Where multiple (Duct bank) underground conduits penetrate a structure through a concrete roof or a membrane waterproofed wall or floor, a minimum 4’ length of concrete encased re-bar cage is required to be doweled into the structure to guard against shearing. In addition, provide malleable iron, watertight, entrance sealing devices for each conduit on the accessible side. When there are only single conduit runs without concrete encasement, provide the device with sealing assembly at each end with pressure bushings that may be tightened at any time.

### Install conduits passing through building sidewalls or through beams below grade with expansion/deflection fittings. Dowelling from wall or beam into the concrete encasement is allowed in lieu of fittings.

### Buried conduit shall penetrate surface at right angle.

### Conduits transitioning from underground to an existing building shall stub up adjacent to the building, run exposed vertically to ceiling height and penetrate wall using an LB fitting. Conduits may penetrate at a lesser height when entering wireways.

## DAMAGED CONDUIT

### Repair or replace conduit damaged during or after installation.

### Replace crushed or clogged conduit or any conduit whose inner surface is damaged or not smooth.

### Repair minor cuts, nicks, or abrasions in the zinc coating of galvanized conduit with galvanizing repair stick, Enterprise Galvanizing "Galvabra" or equal. Conduit replacement due to damage is at the discretion of the inspector.

### Repair minor cuts, nicks, or abrasions in the PVC coating of PVC-coated conduit with the manufacturer's recommended PVC material and build up surface thickness to match the factory coating thickness and color. Conduit replacement due to damage is at the discretion of the inspector. Repair inner coating with manufactures recommended coating or Zinc Rich Paint.

## EMPTY CONDUIT

### Provide 200-pound strength pull cord in all empty conduits or cord of higher strength if so required by the utility for which the conduit is intended.

### Provide a waterproof label on each end of the pull cords to indicate the destination of the other end.

### Show coordinate dimensions of all stub-outs on record drawings. Place a 1 inch by 12-inch by 12-inch concrete marker over all stub-outs and engrave with the words “Electrical Conduit.”

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### Use multi-gang boxes and device plates where several devices are located in the same general area. Sectional boxes shall not be used. Obtain back box requirements for systems provided under other sections and provide them per those requirements.

### Mount outlets for different conduit systems shown in the same wall area not more than 6 inches on center.

### Locate switch boxes 4 inches from doorjamb. Verify rough-in dimensions for outlets occurring above counters, cabinets, mirrors, etc., to ensure that finished outlet clears all trim.

### Rigidly support boxes for wall and ceiling outlets and finish flush and straight. Front edge shall be within 1/8 inch of finished surface and plumb within 1/8 inch.

### Install outlets in exposed masonry walls, with square corner boxes or standard boxes with square corner extensions, that are sufficiently deep so that conduit offsets are not required. Saw cut openings in exposed masonry and tile walls with an opening tolerance of 1/8 inch on all sides, placing bottom of box at nearest masonry joint to specified mounting height. For other wall finishes, install with plaster or other rings. Do not activate any outlet unless these installation requirements are met.

### Install outlets and boxes securely and support them substantially. In stud walls, use rigid bar hangers, attached to hanger with stud and nut. In ceilings, attach to building structure. Anchor boxes into masonry construction with one or more integral flanges.

### No outlets shall be back-to-back. Place outlets in stud walls so that adjacent boxes facing opposite sides are separated by a stud.

### Where dedicated outlets or switches are required for a particular piece of equipment it is the contractor’s responsibility to confirm exact locations as shown on the approved submittal or by contacting the manufacturer

## HAZARDOUS LOCATIONS

### Provide conduit seals in Class I, Division I locations within 18 inches of each conduit entering an enclosure containing electrical devices, except for hermetically sealed switches and receptacles which are UL labeled for the purpose.

### Provide a conduit seal for each conduit leaving the hazardous location.

### Flexible connections to motors and other vibrating equipment in Class I, Division I locations shall be made with flexible fittings approved for Class I locations.

## OUTDOOR, WET, OR CORROSIVE LOCATIONS

### Provide NEMA 4X stainless steel junction boxes or pull boxes for these locations. Fiberglass-reinforced plastic boxes are acceptable for indoor corrosive locations.

## ADJUSTING AND CLEANING

### Upon completion of installation of conduits and boxes, inspect interiors of conduits and boxes; clear all blockages; and remove burrs, dirt, and construction debris.

## EQUIPMENT SUPPORTS

### Support wall-mounted junction boxes, pull box enclosures, and panels in damp, wet, and corrosive locations with Type 304 stainless steel preformed channels and Type 304 stainless steel concrete anchors.

## CONDUIT IDENTIFICATION

### Identify each conduit using the conduit number shown in the drawings by means of a laser etched SS tag at each end and at junction boxes, pull boxes, manholes, handholes, etc

## JUNCTION AND PULL BOX IDENTIFICATION

### Identify exposed junction and pull boxes in mechanical rooms, wire closets, and janitor closets by installing labels on their covers from outside. Identify recessed junction boxes and pull boxes by installing labels in their cover from inside. Identification shall include voltage and system type.

### Identify exit/emergency lighting and fire alarm system junction boxes by painting the covers red and attaching labels that identify the systems contained in the box and their operating voltage.

**END OF SECTION**