SECTION 33 52 43.31 - FUEL SYSTEM CONDUIT FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Galvanized steel rigid metal conduit (RMC).

B. PVC-coated galvanized steel rigid metal conduit (RMC).

C. Electrical metallic tubing (EMT).

D. Conduit fittings.

E. Accessories.

1.2 RELATED REQUIREMENTS

A. Section 26 05 29 - Hangers and Supports for Electrical Systems.

B. Section 33 52 43.33 - Fuel System Identification for Electrical Systems: Identification products and requirements.

1.3 REFERENCE STANDARDS

A. ANSI C80.1 - American National Standard for Electrical Rigid Steel Conduit (ERSC) 2020.

B. ANSI C80.3 - American National Standard for Electrical Metallic Tubing -- Steel (EMT-S) 2020.

C. ANSI C80.6 - American National Standard for Electrical Intermediate Metal Conduit 2018.

D. NECA 1 - Standard for Good Workmanship in Electrical Construction 2015.

E. NECA 101 - Standard for Installing Steel Conduits (Rigid, IMC, EMT) 2013.

F. NECA 111 - Standard for Installing Nonmetallic Raceways (RNC, ENT, LFNC) 2017.

G. NEMA FB 1 - Fittings, Cast Metal Boxes, and Conduit Bodies for Conduit, Electrical Metallic Tubing, and Cable 2014.

H. NEMA RN 1 - Polyvinyl-Chloride (PVC) Externally Coated Galvanized Rigid Steel Metal Conduit and Intermediate Metal Conduit 2018.

I. NEMA TC 2 - Electrical Polyvinyl Chloride (PVC) Conduit 2020.

J. NEMA TC 3 - Polyvinyl Chloride (PVC) Fittings for Use with Rigid PVC Conduit and Tubing 2021.

K. NFPA 70 - National Electrical Code Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

L. UL 1 - Flexible Metal Conduit Current Edition, Including All Revisions.

M. UL 6 - Electrical Rigid Metal Conduit-Steel Current Edition, Including All Revisions.

N. UL 360 - Liquid-Tight Flexible Metal Conduit Current Edition, Including All Revisions.

O. UL 514B - Conduit, Tubing, and Cable Fittings Current Edition, Including All Revisions.

P. UL 651 - Schedule 40, 80, Type EB and A Rigid PVC Conduit and Fittings Current Edition, Including All Revisions.

Q. UL 797 - Electrical Metallic Tubing-Steel Current Edition, Including All Revisions.

R. UL 1203 - Explosion-Proof and Dust-Ignition-Proof Electrical Equipment for Use in Hazardous (Classified) Locations Current Edition, Including All Revisions.

S. UL 1242 - Electrical Intermediate Metal Conduit-Steel Current Edition, Including All Revisions.

1.4 ADMINISTRATIVE REQUIREMENTS

A. Coordination:

1. Coordinate minimum sizes of conduits with the actual conductors to be installed, including adjustments for conductor sizes increased for voltage drop.
2. Coordinate the arrangement of conduits with structural members, ductwork, piping, equipment and other potential conflicts installed under other sections or by others.
3. Verify exact conduit termination locations required for boxes, enclosures, and equipment installed under other sections or by others.
4. Notify Engineer of any conflicts with or deviations from the contract documents. Obtain direction before proceeding with work.

B. Sequencing:

1. Do not begin installation of conductors and cables until installation of conduit is complete between outlet, junction and splicing points.

1.5 SUBMITTALS

A. Product Data: Provide manufacturer's standard catalog pages and data sheets for conduits and fittings.

B. Shop Drawings:

1. Indicate proposed arrangement for conduits to be installed within structural concrete slabs, where permitted.

C. Project Record Documents: Record actual routing for conduits installed underground, conduits embedded within concrete slabs, and conduits 2 inch (53 mm) trade size and larger.

1.6 QUALITY ASSURANCE

A. Conform to requirements of NFPA 70.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Receive, inspect, handle, and store conduit and fittings in accordance with manufacturer's instructions.

PART 2 - PRODUCTS

2.1 CONDUIT APPLICATIONS

A. Do not use conduit and associated fittings for applications other than as permitted by NFPA 70 and product listing.

B. Unless otherwise indicated and where not otherwise restricted, use the conduit types indicated for the specified applications. Where more than one listed application applies, comply with the most restrictive requirements. Where conduit type for a particular application is not specified, use galvanized steel rigid metal conduit.

C. Interior, Damp or Wet Locations: Use galvanized steel rigid metal conduit.

D. Exposed, Interior, Not Subject to Physical Damage: Use galvanized steel rigid metal conduit or electrical metallic tubing (EMT).

E. Exposed, Interior, Subject to Physical Damage: Use galvanized steel rigid metal conduit.

1. Locations subject to physical damage include, but are not limited to:

    a. Where exposed below 8 feet (2.4 m), except within electrical and communication rooms or closets.

F. Exposed, Exterior: Use galvanized steel rigid metal conduit.

G. Concealed, Exterior, Not Embedded in Concrete or in Contact With Earth: Use galvanized steel rigid metal conduit.

H. Corrosive Locations Above Ground: Use PVC-coated galvanized steel rigid metal conduit.

I. Connections to Vibrating Equipment:

1. Dry Locations: Use flexible metal conduit.
2. Damp, Wet, or Corrosive Locations: Use liquidtight flexible metal conduit.
3. Maximum Length: 6 feet (1.8 m) unless otherwise indicated.
4. Vibrating equipment includes, but is not limited to:

    a. Transformers.
    b. Motors.

2.2 CONDUIT REQUIREMENTS

A. Existing Work: Where existing conduits are indicated to be reused, they may be reused only where they comply with specified requirements, are free from corrosion, and integrity is verified by pulling a mandrel through them.

B. Provide all conduit, fittings, supports, and accessories required for a complete raceway system.

C. Provide products listed, classified, and labeled as suitable for the purpose intended.

D. Minimum Conduit Size, Unless Otherwise Indicated:

1. Control Circuits: 3/4 inch (21 mm) trade size.

E. Where conduit size is not indicated, size to comply with NFPA 70 but not less than applicable minimum size requirements specified.

2.3 GALVANIZED STEEL RIGID METAL CONDUIT (RMC)

A. Manufacturers:

1. Allied Tube & Conduit: www.alliedeg.com/#sle.
2. Republic Conduit: www.republic-conduit.com/#sle.
3. Wheatland Tube, a Division of Zekelman Industries: www.wheatland.com/#sle.
4. Approved equal.

B. Description: NFPA 70, Type RMC galvanized steel rigid metal conduit complying with ANSI C80.1 and listed and labeled as complying with UL 6.

C. Fittings:

1. Manufacturers:

a. Bridgeport Fittings Inc: www.bptfittings.com/#sle.
b. O-Z/Gedney, a brand of Emerson Electric Co: www.emerson.com/#sle.
c. Thomas & Betts Corporation: www.tnb.com/#sle.
d. Approved equal.

2. Non-Hazardous Locations: Use fittings complying with NEMA FB 1 and listed and labeled as complying with UL 514B.
3. Hazardous (Classified) Locations: Use fittings listed and labeled as complying with UL 1203 for the classification of the installed location.
4. Material: Use steel or malleable iron.

a. Do not use die cast zinc fittings.

5. Connectors and Couplings: Use threaded type fittings only. Threadless set screw and compression (gland) type fittings are not permitted.

2.4 PVC-COATED GALVANIZED STEEL RIGID METAL CONDUIT (RMC)

A. Manufacturers:

1. Thomas & Betts Corporation: www.tnb.com.
2. Robroy Industries: www.robroy.com.

3. Approved equal.

B. Description: NFPA 70, Type RMC galvanized steel rigid metal conduit with external polyvinyl chloride (PVC) coating complying with NEMA RN 1 and listed and labeled as complying with UL 6.

C. Exterior Coating: Polyvinyl chloride (PVC), nominal thickness of 40 mil (1.02 mm).

D. Interior Coating: Urethane, minimum thickness of 2 mil (0.05 mm).

E. PVC-Coated Fittings:

1. Manufacturer: Same as manufacturer of PVC-coated conduit to be installed.
2. Non-Hazardous Locations: Use fittings listed and labeled as complying with UL 514B.
3. Hazardous (Classified) Locations: Use fittings listed and labeled as complying with UL 1203 for the classification of the installed location. Provide expanded fill type conduit sealing fittings where required to meet conduit fill requirements of conduit system.
4. Material: Use steel or malleable iron.
5. Exterior Coating: Polyvinyl chloride (PVC), minimum thickness of 40 mil (1.02 mm).
6. Interior Coating: Urethane, minimum thickness of 2 mil (0.05 mm).

F. PVC-Coated Supports: Furnish with exterior coating of polyvinyl chloride (PVC), minimum thickness of 15 mil (0.38 mm).

2.5 ELECTRICAL METALLIC TUBING (EMT)

A. Manufacturers:

1. Allied Tube & Conduit: www.alliedeg.com.
2. Republic Conduit: www.republic-conduit.com/#sle.
3. Wheatland Tube Company: www.wheatland.com.
4. Approved equal.

B. Description: NFPA 70, Type EMT steel electrical metallic tubing complying with ANSI C80.3 and listed and labeled as complying with UL 797.

C. Fittings:

1. Manufacturers:

a. Bridgeport Fittings Inc: www.bptfittings.com/#sle.
b. O-Z/Gedney, a brand of Emerson Electric Co: www.emerson.com/#sle.
c. Thomas & Betts Corporation: www.tnb.com/#sle.
d. Approved equal.

2. Description: Fittings complying with NEMA FB 1 and listed and labeled as complying with UL 514B.
3. Material: Use steel or malleable iron.

a. Do not use die cast zinc fittings.

4. Connectors and Couplings: Use compression (gland) or set-screw type.

a. Do not use indenter type connectors and couplings.
b. Do not use set-screw type connectors and couplings.

5. Damp or Wet Locations (where permitted): Use fittings listed for use in wet locations.
6. Embedded Within Concrete (where permitted): Use fittings listed as concrete-tight. Fittings that require taping to be concrete-tight are acceptable.

2.6 ACCESSORIES

A. Corrosion Protection Tape: PVC-based, minimum thickness of 20 mil (0.51 mm).

1. Product: 3M Scotchrap Tape 51 or approved equal..
2. Approved equal.

B. Conduit Joint Compound: Corrosion-resistant, electrically conductive; suitable for use with the conduit to be installed.

C. Solvent Cement for PVC Conduit and Fittings: As recommended by manufacturer of conduit and fittings to be installed.

D. Pull Rope: Use nylon cord with average breaking strength of not less than 200 pounds for conduit in interior locations and 2000 pounds for conduit in exterior locations. Install metallic location cables where indicated..

E. Sealing Compound for Sealing Fittings: Listed for use with the particular fittings to be installed.

F. Fire and smoke stop materials shall be, rock wool fiber, silicone foam, or silicone sealant, U.L. rated to maintain the fire floor and fire wall partition rating. Each penetration shall be certified per DFW standards and inspected by fire marshal.

G. Warning tape: 6-inch wide continuous yellow plastic warning tape 6 inches below surface over cables or conduit, or as indicated, before final backfill. Tape to indicate buried electrical cables below.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify that field measurements are as indicated.

B. Verify that mounting surfaces are ready to receive conduits.

C. Verify that conditions are satisfactory for installation prior to starting work.

3.2 INSTALLATION

A. Install products in accordance with manufacturer's instructions.

B. Perform work in accordance with NECA 1 (general workmanship).

C. Install galvanized steel rigid metal conduit (RMC) in accordance with NECA 101.

D. Install PVC-coated galvanized steel rigid metal conduit (RMC) using only tools approved by the manufacturer.

E. Conduit Routing:

1. Unless dimensioned, conduit routing indicated is diagrammatic.
2. When conduit destination is indicated without specific routing, determine exact routing required.
3. Conceal all conduits unless specifically indicated to be exposed.
4. Conduits in the following areas may be exposed, unless otherwise indicated:
    a. Electrical rooms.
    b. Mechanical equipment rooms.
    c. Within joists in areas with no ceiling.
5. Unless otherwise approved, do not route conduits exposed:
    a. Across floors.
    b. Across roofs.
    c. Across top of parapet walls.
6. Arrange conduit to maintain adequate headroom, clearances, and access.
7. Arrange conduit to provide no more than the equivalent of four 90 degree bends between pull points.
8. Arrange conduit to provide no more than 150 feet (46 m) between pull points, unless indicated otherwise.
9. Route conduits above water and drain piping where possible.
10. Arrange conduit to prevent moisture traps. Provide drain fittings at low points and at sealing fittings where moisture may collect.
11. Maintain minimum clearance of 6 inches (150 mm) between conduits and piping for other systems.
12. Group parallel conduits in the same area together on a common rack.

F. Conduit Support:

1. Secure and support conduits in accordance with NFPA 70 and using suitable supports and methods approved by the authority having jurisdiction.
2. Provide independent support from building structure. Do not provide support from piping (unless indicated otherwise), ductwork, or other systems.
3. Use conduit strap to support single surface-mounted conduit.
    a. Use clamp back spacer with conduit strap for damp and wet locations to provide space between conduit and mounting surface.
4. Use metal channel (strut) with accessory conduit clamps to support multiple parallel surface-mounted conduits.
5. Use conduit clamp to support single conduit from beam clamp or threaded rod.
6. Use trapeze hangers assembled from threaded rods and metal channel (strut) with accessory conduit clamps to support multiple parallel suspended conduits.
7. Use non-penetrating rooftop supports to support conduits routed across rooftops (only where approved).
8. Use of spring steel conduit clips for support of conduits is not permitted.
9. Use of wire for support of conduits is not permitted.
10. Where conduit support intervals specified in NFPA 70 and NECA standards differ, comply with the most stringent requirements.

G. Connections and Terminations:

1. Use approved zinc-rich paint or conduit joint compound on field-cut threads of galvanized steel conduits prior to making connections.
2. Where two threaded conduits must be joined and neither can be rotated, use three-piece couplings or split couplings. Do not use running threads.
3. Use suitable adapters where required to transition from one type of conduit to another.
4. Terminate threaded conduits in boxes and enclosures using threaded hubs or double lock nuts for dry locations and raintight hubs for wet locations.
5. Where spare conduits stub up through concrete floors and are not terminated in a box or enclosure, provide threaded couplings equipped with threaded plugs set flush with finished floor.
6. Provide insulating bushings or insulated throats at all conduit terminations to protect conductors.
7. Secure joints and connections to provide maximum mechanical strength and electrical continuity.

H. Penetrations:

1. Do not penetrate or otherwise notch or cut structural members, including footings and grade beams, without approval of Structural Engineer.
2. Make penetrations perpendicular to surfaces unless otherwise indicated.
3. Provide sleeves for penetrations as indicated or as required to facilitate installation. Set sleeves flush with exposed surfaces unless otherwise indicated or required.
4. Conceal bends for conduit risers emerging above ground.
5. Seal interior of conduits entering the building from underground at first accessible point to prevent entry of moisture and gases.
6. Where conduits penetrate waterproof membrane, seal as required to maintain integrity of membrane.
7. Install firestopping to preserve fire resistance rating of partitions and other elements.

I. Conduit Movement Provisions: Where conduits are subject to movement, provide expansion and expansion/deflection fittings or approved flexible connections (abovegrade only) to prevent damage to enclosed conductors or connected equipment.This includes, but is not limited to:

1. Where conduits cross structural joints intended for expansion, contraction, or deflection.
2. Where calculated in accordance with NFPA 70 for rigid polyvinyl chloride (PVC) conduit installed above ground to compensate for thermal expansion and contraction.
3. Where conduits are subject to earth movement by settlement or frost.

J. Condensation Prevention: Where conduits cross barriers between areas of potential substantial temperature differential, provide sealing fitting or approved sealing compound at an accessible point near the penetration to prevent condensation. This includes, but is not limited to:

1. Where conduits pass from outdoors into conditioned interior spaces.
2. Where conduits pass from unconditioned interior spaces into conditioned interior spaces.

K. Provide pull string in all empty conduits and in conduits where conductors and cables are to be installed by others. Leave minimum slack of 12 inches (300 mm) at each end.

L. Identify conduits in accordance with Section 33 52 43.33.

3.3 FIELD QUALITY CONTROL

A. Repair cuts and abrasions in galvanized finishes using zinc-rich paint recommended by manufacturer. Replace components that exhibit signs of corrosion.

B. Where coating of PVC-coated galvanized steel rigid metal conduit (RMC) contains cuts or abrasions, repair in accordance with manufacturer's instructions.

C. Correct deficiencies and replace damaged or defective conduits.

3.4 CLEANING

A. Clean interior of conduits to remove moisture and foreign matter.

3.5 PROTECTION

A. Immediately after installation of conduit, use suitable manufactured plugs to provide protection from entry of moisture and foreign material and do not remove until ready for installation of conductors.

END OF SECTION 33 52 43.31