~~~~~ ***PROJECT NOTE*** ~~~~~~

ARCHITECT OF RECORD/ENGINEER OF RECORD IS RESPONSIBLE FOR REVIEWING THIS SPECIFICATION SECTION IN DETAIL FOR COORDINATION WITH THE PROJECT SCOPE OF WORK.

ALL "PROJECT NOTE" TEXT IS TO BE REMOVED FOLLOWING REVIEW OF THE CONTENT OF EACH NOTE BY THE ARCHITECT OF RECORD/ENGINEER OF RECORD.

EDIT THE DOCUMENT FOOTER TO INCLUDE THE PROJECT NAME AND NUMBER.

EDIT THE DOCUMENT HEADER TO INDICATE THE ARCHITECT OF RECORD PROJECT ISSUE" DATE. THE "CPS CONTROL" DATE SHOULD NOT BE EDITED.

ANY MODIFICATIONS TO THE TECHNICAL STANDARDS IN THIS SECTION - INCLUDING THE REMOVAL OR ADDITION OF MANUFACTURERS - MUST BE APPROVED BY CPS. REQUESTS FOR MODIFICATION ARE TO BE SUBMITTED TO THE DESIGN MANAGER DURING THE DESIGN PHASE FOR REVIEW AND APPROVAL.

~~~ ***END OF PROJECT NOTE*** ~~~~

SECTION 26 05 33.13
CONDUIT FOR ELECTRICAL SYSTEMS

PART 1 GENERAL

~~~~~ ***PROJECT NOTE*** ~~~~~~

CONDUIT TYPES BELOW AND ASSOCIATED FITTINGS TO BE SELECTED BASED OFF PROJECT SCOPE. COORDINATE INSTALLATION OF ALL DEVICES AND AREAS WITH CONDUIT TYPES REQUIRED.

~~~ ***END OF PROJECT NOTE*** ~~~~

1.01 SECTION INCLUDES

A. Galvanized steel rigid metal conduit (RMC).
B. Aluminum rigid metal conduit (RMC).
C. Galvanized steel intermediate metal conduit (IMC).
D. Flexible metal conduit (FMC).
E. Liquidtight flexible metal conduit (LFMC).
F. Galvanized steel electrical metallic tubing (EMT).
G. Rigid polyvinyl chloride (PVC) conduit.
H. Liquidtight flexible nonmetallic conduit (LFNC).
I. Conduit fittings and accessories.

1.02 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. City of Chicago Electrical Code - Chicago Construction Codes, Title 14E, based on the National Electrical Code with amendments Current Edition.
E. NECA 1 - Standard for Good Workmanship in Electrical Construction 2015.
F. NECA 101 - Standard for Installing Steel Conduits (Rigid, IMC, EMT) 2020.
G. NECA 102 - Standard for Installing Aluminum Rigid Metal Conduit 2004.
H. NECA 111 - Standard for Installing Nonmetallic Raceways (RNC, ENT, LFNC) 2017.
I. NEMA FB 1 - Fittings, Cast Metal Boxes, and Conduit Bodies for Conduit, Electrical Metallic Tubing, and Cable 2014.
J. NEMA TC 2 - Electrical Polyvinyl Chloride (PVC) Conduit 2020.
K. NEMA TC 3 - Polyvinyl Chloride (PVC) Fittings for Use with Rigid PVC Conduit and Tubing 2021.
L. NFPA 70 - National Electrical Code Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.
M. TIA-569-D - Telecommunications Pathways and Spaces 2015d, with Addendum (2016).
N. UL 1 - Flexible Metal Conduit Current Edition, Including All Revisions.
O. UL 6 - Electrical Rigid Metal Conduit-Steel Current Edition, Including All Revisions.
P. UL 360 - Liquid-Tight Flexible Metal Conduit Current Edition, Including All Revisions.
Q. UL 514B - Conduit, Tubing, and Cable Fittings Current Edition, Including All Revisions.
R. UL 651 - Schedule 40, 80, Type EB and A Rigid PVC Conduit and Fittings Current Edition, Including All Revisions.
S. UL 797 - Electrical Metallic Tubing-Steel Current Edition, Including All Revisions.
T. UL 1203 - Explosion-Proof and Dust-Ignition-Proof Electrical Equipment for Use in Hazardous (Classified) Locations Current Edition, Including All Revisions.
U. UL 1242 - Electrical Intermediate Metal Conduit-Steel Current Edition, Including All Revisions.
V. UL 1660 - Liquid-Tight Flexible Nonmetallic Conduit Current Edition, Including All Revisions.
W. UL 2419 - Outline of Investigation for Electrically Conductive Corrosion Resistant Compounds Current Edition, Including All Revisions.

1.03 ADMINISTRATIVE REQUIREMENTS

A. Coordination:
   1. Coordinate minimum sizes of conduits with actual type and quantity of conductors to be installed, including adjustments for conductor sizes increased for voltage drop.
   2. Coordinate arrangement of conduits with structural members, ductwork, piping, equipment, and other potential conflicts.
   3. Verify exact conduit termination locations required for boxes, enclosures, and equipment.
   4. Coordinate work to provide roof penetrations that preserve integrity of roofing system and do not void roof warranty.
   5. Coordinate painting in finished areas and where exposed to view at exterior and interior areas of the building; exposed pipes, conduit, boxes, hangers, brackets and supports, and electrical equipment, unless otherwise indicated. Refer to 09 91 13 - Exterior Painting and 09 91 23 - Interior Painting as required.
   6. Notify Architect/Engineer of Record of conflicts with or deviations from Contract Documents. Obtain direction before proceeding with work.
B. Sequencing:
   1. Do not begin installation of conductors and cables until installation of conduit between termination points is complete.

1.04 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements for submittals procedures.

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

1. Indicate each type and size of conduit to be utilized within project.
2. Indicate each type and size of conduit fitting to be utilized within project.

C. Shop Drawings:

1. Indicate proposed arrangement for conduits to be installed within structural concrete slabs, where permitted.
2. Include proposed locations of roof penetrations and proposed methods for sealing.

D. Project Record Documents: Record actual routing for conduits installed underground, conduits embedded within concrete slabs, and conduits 2 inch trade size and larger.

1.05 QUALITY ASSURANCE

A. Comply with NECA's "Standard of Installation".

B. Comply with the ANSI/IEEE 802.7.

C. Product Listing Organization Qualifications: An organization recognized by OSHA Regulation 1910.7 as a Nationally Recognized Testing Laboratory (NRTL) and acceptable to authorities having jurisdiction.

1.06 DELIVERY, STORAGE, AND HANDLING

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

B. Effectively protect all materials, accessories, and components from any damage or injury from the time of fabrication until final Board acceptance.

C. Store equipment in spaces with environments controlled within manufacturer's ambient temperature and humidity tolerances for non-operating equipment.

PART 2 PRODUCTS

~~~~~ PROJECT NOTE ~~~~~~

CONDUIT APPLICATIONS TO BE COORDINATED WITH SCOPE OF WORK FOR PROJECT (I.E. EXTERIOR WORK, INTERIOR WORK, HAZARDOUS LOCATIONS).

~~~ END OF PROJECT NOTE ~~~~

2.01 CONDUIT APPLICATIONS

A. Do not use conduit and associated fittings for applications other than as permitted by the City of Chicago Electrical Code and product listing.

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

C. Underground:

1. Under Slab on Grade: Use galvanized steel rigid metal conduit.
2. Exterior, Direct-Buried: Use rigid PVC conduit where permitted by the City of Chicago Electrical Code..

3. Service Entrance: Use galvanized steel rigid metal conduit or PVC conduit when permitted by the City of Chicago Electrical Code for underground concrete encased service entrance.
4. Exterior, Embedded Within Concrete: Use galvanized steel rigid metal conduit.
5. Where rigid polyvinyl chloride (PVC) conduit is provided, transition to galvanized steel rigid metal conduit (RMC) where emerging from underground.
6. Where rigid polyvinyl (PVC) conduit larger than 2 inch trade size is provided, use galvanized steel rigid metal conduit elbows for bends.
7. Where steel conduit is installed in direct contact with earth where soil has a resistivity of less than 2000 ohm-centimeters or is characterized as severely corrosive based on soils report or local experience, use corrosion protection tape to provide supplementary corrosion protection.
8. Where steel conduit emerges from concrete into soil, use corrosion protection tape to provide supplementary corrosion protection for a minimum of 4 inches on either side of where conduit emerges.

D. Embedded Within Concrete:
1. Within Slab on Grade (within structural slabs only where approved by Structural Engineer): Use galvanized steel rigid metal conduit.
2. Within Slab Above Ground (within structural slabs only where approved by Structural Engineer): Use galvanized steel rigid metal conduit.
3. Within Concrete Walls Above Ground: Use galvanized steel rigid metal conduit.

E. Concealed Within Masonry Walls: Use electrical metallic tubing (EMT).
F. Concealed Within Hollow Stud Walls: Use electrical metallic tubing (EMT).
G. Concealed Above Accessible Ceilings: Use electrical metallic tubing (EMT).
H. Exposed, Interior, Damp or Wet Locations: Use galvanized steel rigid metal conduit.
I. Exposed, Interior, Not Subject to Physical Damage: Use electrical metallic tubing (EMT).
J. 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, except within electrical and communication rooms or closets.
b. Loading dock.
c. Mechanical rooms.

K. Exposed, Exterior: Use intermediate metal conduit (IMC).
L. Concealed, Exterior, Not Embedded in Concrete or in Contact With Earth: Use intermediate metal conduit (IMC).
M. Hazardous (Classified) Locations: Use galvanized steel rigid metal conduit.
N. Flexible Connections to Luminaires Above Accessible Ceilings: Use flexible metal conduit (FMC).
1. Maximum Length: 6 feet.

O. Flexible Connections to Vibrating Equipment:
1. Dry Locations: Use flexible metal conduit (FMC).
2. Damp, Wet, or Corrosive Locations: Use liquidtight flexible metal conduit (LFMC).
3. Maximum Length: 6 feet unless otherwise indicated.

2.02 CONDUIT - GENERAL REQUIREMENTS

A. Electrical Service Conduits: Also comply with Section 26 21 00 - Low-Voltage Electrical Service Entrance.
B. Fittings for Grounding and Bonding: See Section 26 05 26 for additional requirements.
C. Provide conduit, fittings, supports, and accessories required for complete raceway system.
D. Provide products listed, classified, and labeled as suitable for purpose intended.
E. Minimum Conduit Size, Unless Otherwise Indicated:
   1. 3/4-inch trade size.
F. Where conduit size is not indicated, size to comply with the City of Chicago Electrical Code but not less than applicable minimum size requirements specified.
G. Paint in finished areas and where exposed to view at exterior and interior areas of the building; exposed pipes, conduit, boxes, hangers, brackets and supports, and electrical equipment, unless otherwise indicated. Refer to 09 91 13 - Exterior Painting and 09 91 23 - Interior Painting as required.

2.03 GALVANIZED STEEL RIGID METAL CONDUIT (RMC)

A. Manufacturers:
   1. Allied Tube & Conduit, a division of Atkore International: www.alliedeg.com
   2. O-Z/Gedney, a brand of Emerson Industrial Automation; www.emersonindustrial.com
   3. Tenaris (formerly Maverick Tube Corporation); www.tenaris.com
   4. Wheatland Tube, a division of Zekelman Industries: www.wheatland.com/#sle.
B. Description: City of Chicago Electrical Code, Type RMC galvanized steel rigid metal conduit complying with ANSI C80.1 and listed and labeled as complying with UL 6.
C. Fittings:
   1. Nonhazardous Locations: Use fittings complying with NEMA FB 1 and listed and labeled as complying with UL 514B or UL 6.
   2. Hazardous/Classified Locations: Use fittings listed and labeled as complying with UL 1203 for classification of installed location.
   3. Material: Use steel or malleable iron.
      a. Do not use die cast zinc fittings.
   4. Connectors and Couplings: Use threaded type fittings only. Threadless set screw and compression (gland) type fittings are not permitted.

2.04 GALVANIZED STEEL INTERMEDIATE METAL CONDUIT (IMC)

A. Manufacturers:
   1. Allied Tube & Conduit, a division of Atkore International: www.alliedeg.com/#sle.
   2. O-Z/Gedney, a brand of Emerson Industrial Automation; www.emersonindustrial.com
   3. Tenaris (formerly Maverick Tube Corporation); www.tenaris.com
   4. Wheatland Tube, a division of Zekelman Industries: www.wheatland.com/#sle.
B. Description: City of Chicago Electrical Code , Type IMC galvanized steel intermediate metal conduit complying with ANSI C80.6 and listed and labeled as complying with UL 1242.
C. Fittings:
   1. Nonhazardous Locations: Use fittings complying with NEMA FB 1 and listed and labeled as complying with UL 514B or UL 1242.
   2. Hazardous/Classified Locations: Use fittings listed and labeled as complying with UL 1203 for classification of installed location.
   3. Material: Use steel or malleable iron.

4. Connectors and Couplings: Use threaded type fittings only. Threadless fittings, including set screw and compression/gland types, are not permitted.

2.05 FLEXIBLE METAL CONDUIT (FMC)

A. Manufacturers:
   1. Allied Tube & Conduit, a division of Atkore International: www.alliedeg.com
   2. O-Z/Gedney, a brand of Emerson Industrial Automation; www.emersonindustrial.com
   3. Tenaris (formerly Maverick Tube Corporation); www.tenaris.com
   4. Wheatland Tube Company; www.wheatland.com

B. Description: City of Chicago Electrical Code , Type FMC standard-wall steel flexible metal conduit listed and labeled as complying with UL 1, and listed for use in classified firestop systems.

C. Fittings:
   1. Description: Fittings complying with NEMA FB 1 and listed and labeled as complying with UL 514B.
   2. Material: Use steel or malleable iron.
      a. Do not use die cast zinc fittings.

2.06 LIQUIDTIGHT FLEXIBLE METAL CONDUIT (LFMC)

A. Manufacturers:
   1. Allied Tube & Conduit, a division of Atkore International: www.alliedeg.com
   2. O-Z/Gedney, a brand of Emerson Industrial Automation; www.emersonindustrial.com
   3. Tenaris (formerly Maverick Tube Corporation); www.tenaris.com
   4. Wheatland Tube Company; www.wheatland.com

B. Description: City of Chicago Electrical Code, Type LFMC polyvinyl chloride (PVC) jacketed steel flexible metal conduit listed and labeled as complying with UL 360.

C. Fittings:
   1. Description: Fittings complying with NEMA FB 1 and listed and labeled as complying with UL 514B.
   2. Material: Use steel or malleable iron.
      a. Do not use die cast zinc fittings.

2.07 GALVANIZED STEEL ELECTRICAL METALLIC TUBING (EMT)

A. Manufacturers:
   1. Allied Tube & Conduit, a division of Atkore International: www.alliedeg.com
   2. O-Z/Gedney, a brand of Emerson Industrial Automation; www.emersonindustrial.com
   3. Tenaris (formerly Maverick Tube Corporation); www.tenaris.com
   4. Wheatland Tube Company: www.wheatland.com

B. Description: City of Chicago Electrical Code, Type EMT galvanized steel electrical metallic tubing complying with ANSI C80.3 and listed and labeled as complying with UL 797.

C. Fittings:
   1. Description: Fittings complying with NEMA FB 1 and listed and labeled as complying with UL 514B.
   2. Material: Use steel or malleable iron.
      a. Do not use die cast zinc fittings.
   3. Connectors and Couplings: Use compression (gland) type with insulated throat.
      a. Do not use indenter type connectors and couplings.
      b. Do not use set-screw type connectors and couplings.

4. Damp or Wet Locations, Where Permitted: Use fittings listed for use in wet locations.

2.08 RIGID POLYVINYL CHLORIDE (PVC) CONDUIT

A. Manufacturers:
   1. Calconduit: www.calconduit.com
   2. Cantex Inc: www.cantexinc.com
   3. JM Eagle: www.jmeagle.com
B. Description: City of Chicago Electrical Code, Type PVC rigid polyvinyl chloride conduit complying with NEMA TC 2 and listed and labeled as complying with UL 651; Schedule 40 unless otherwise indicated, Schedule 80 where subject to physical damage; rated for use with conductors rated 90 degrees C.
C. Fittings:
   1. Manufacturer: Same as manufacturer of conduit to be connected.
   2. Description: Fittings complying with NEMA TC 3 and listed and labeled as complying with UL 651; material to match conduit.

2.09 LIQUIDTIGHT FLEXIBLE NONMETALLIC CONDUIT (LFNC)

A. Manufacturers:
   1. CertainTeed Pipe and Plastics; www.certainteed.com
   2. Electri-Flex Company: www.electriflex.com
   3. Hubbell Company, RACO products; www.hubbell-rtb.com
B. Description: City of Chicago Electrical Code, Type LFNC liquidtight flexible nonmetallic conduit listed and labeled as complying with UL 1660.
C. Fittings:
   1. Manufacturer: Same as manufacturer of conduit to be connected.
   2. Description: Fittings complying with NEMA FB 1 and listed and labeled as complying with UL 514B; suitable for type of conduit to be connected.

2.10 ACCESSORIES

A. Corrosion Protection Tape: PVC-based, minimum thickness of 20 mil, 0.020 inch.
B. Conduit Joint Compound: Corrosion-resistant, electrically conductive compound listed as complying with UL 2419; suitable for use with 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 Strings: Use nylon tape with average breaking strength of not less than 200 lbf.
E. Sealing Compound for Sealing Fittings: Listed for use with particular fittings to be installed.
F. Sealing Systems for Concrete Penetrations:
   1. Sleeves: Provide water stop ring or cement coating that bonds to concrete to prevent water infiltration.
   2. Rate for minimum of 40 psig; suitable for sealing around conduits to be installed.

PART 3 EXECUTION

3.01 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.

3.02 INSTALLATION

A. Install products in accordance with manufacturer's instructions.
B. Install conduit in accordance with NECA 1.

C. Install galvanized steel rigid metal conduit (RMC) in accordance with NECA 101.
D. Install aluminum rigid metal conduit (RMC) in accordance with NECA 102.
E. Install intermediate metal conduit (IMC) in accordance with NECA 101.
F. Install PVC-coated galvanized steel rigid metal conduit (RMC) using only tools approved by manufacturer.
G. Install rigid polyvinyl chloride (PVC) conduit in accordance with NECA 111.
H. Install liquidtight flexible nonmetallic conduit (LFNC) in accordance with NECA 111.
I. 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 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 exposed conduits:
        a. Across floors.
        b. Across roofs.
        c. Across top of parapet walls.
        d. Across building exterior surfaces. When approved, locate conduit at inside corners of building structure to minimize visual disturbance.
        e. At entire main building facade and building entrances.
    6. Conduits installed underground or embedded in concrete may be routed in shortest possible manner unless otherwise indicated. Route other conduits parallel or perpendicular to building structure and surfaces, following surface contours where practical.
    7. Arrange conduit to maintain adequate headroom, clearances, and access.
    8. Protect stub-ups from damage where conduits rise through floor slabs. Arrange stub-ups so curved portions of bends are not visible above the finished slab.
    9. Arrange conduit to provide no more than the equivalent of three 90 degree bends between pull points.
        a. For Telecommunications conduit, fewer bends are allowed.
    10. Arrange conduit to provide no more than 150 feet between pull points.
        a. For Telecommunications conduit, install pull boxes every 100 feet.
    11. Make bends and offsets so ID is not reduced. Keep legs of bends in the same plan and straight legs of offsets parallel, unless otherwise indicated.
        a. Use raceway fittings compatible with raceways and suitable for use and location.
        b. Run concealed raceways, with a minimum of bends, in the shortest practical distance considering the type of building construction and obstructions, unless otherwise indicated.
    12. Route conduits above water and drain piping where possible.
    13. Arrange conduit to prevent moisture traps. Provide drain fittings at low points and at sealing fittings where moisture may collect.
    14. Maintain minimum clearance of 6 inches between conduits and piping for other systems.

15. Maintain minimum clearance of 6 inches between conduits and hot surfaces.This includes, but is not limited to:
    a. Heaters.
    b. Hot water piping.
    c. Flues.
16. Group parallel conduits in same area on common rack.

J. Conduit Support:
1. Secure and support conduits in accordance with City of Chicago Electrical Code using suitable supports and methods approved by authorities having jurisdiction; see Section 26 05 29 - Hangers and Supports for Electrical Systems.
2. Provide independent support from building structure. Do not provide support from piping, ductwork, or other systems.
3. Installation Above Suspended Ceilings: Do not provide support from ceiling support system. Do not provide support from ceiling grid or allow conduits to lay on ceiling tiles.
4. 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.
5. Use metal channel/strut with accessory conduit clamps to support multiple parallel surface-mounted conduits.
6. Use conduit clamp to support single conduit 1 1/2 inch and smaller from beam clamp or threaded rod and for fastening raceways to trapeze supports.
7. Use trapeze hangers assembled from threaded rods and metal channel/strut with accessory conduit clamps to support multiple parallel suspended conduits.
    a. Sized so capacity can be increased by 25 percent in future without exceeding specified design load limits.
    b. Secure raceways and cables to supports with single-bolt conduit clamps.
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.

K. 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. Refer to Section 09 91 13 - Exterior Painting and 09 91 23 - Interior Painting as required.
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. Provide drip loops for liquidtight flexible conduit connections to prevent drainage of liquid into connectors.
5. Terminate threaded conduits in boxes and enclosures using threaded hubs or double lock nuts for dry locations and raintight hubs for wet locations.
6. Where spare conduits stub up through concrete floors and are not terminated in box or enclosure, provide threaded couplings equipped with threaded plugs set flush with finished floor.
7. Provide insulating bushings, insulated throats, or listed metal fittings with smooth, rounded edges at conduit terminations to protect conductors.
8. Secure joints and connections to provide mechanical strength and electrical continuity.

L. 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. Provide suitable sealing system where conduits penetrate exterior wall below grade.
   6. Where conduits penetrate waterproof membrane, seal as required to maintain integrity of membrane.
   7. Make penetrations for roof-mounted equipment within associated equipment openings and curbs where possible to minimize roofing system penetrations. Where penetrations are necessary, seal as indicated or as required to preserve integrity of roofing system and maintain roof warranty.
   8. Install firestopping to preserve fire resistance rating of partitions and other elements; see Section 07 84 00.
   9. Install sealing fittings in suitable, approved, and accessible locations.
      a. Install in flush steel box with blank cover plate.
         1) Finish similar to adjacent plates or surfaces.
      b. Install at the following locations:
         1) Where conduits pass from warm to cold locations.
         2) Where required by the City of Chicago Electrical Code.

M. Underground Installation:
   1. Provide trenching and backfilling in accordance with Section 31 23 16 - Excavation and Section 31 23 23 - Fill.
   2. Minimum Cover, Unless Otherwise Indicated or Required:
      a. Underground, Exterior: 24 inches.
      b. Under Slab on Grade: 12 inches to bottom of slab.
   3. Provide underground warning tape in accordance with Section 26 05 53 - Identification for Electrical Systems along entire conduit length.

N. Embedment Within Structural Concrete Slabs (only where approved by Structural Engineer):
   1. Maximum Conduit Size: 1-inch trade size unless otherwise approved.
   2. Install conduits within middle one third of slab thickness.
   3. Secure conduits to prevent floating or movement during pouring of concrete.

O. Concrete Encasement: Where conduits not otherwise embedded within concrete are indicated to be concrete-encased, provide concrete in accordance with Section 03 30 00 - Cast-in-Place Concrete with minimum concrete cover of 3 inches on all sides unless otherwise indicated.

P. Hazardous (Classified) Locations: Where conduits cross boundaries of hazardous (classified) locations, provide sealing fittings located as indicated or in accordance with the City of Chicago Electrical Code.

Q. Conduit Movement Provisions: Where conduits are subject to movement, provide expansion and expansion/deflection fittings 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.

R. Conduit Sealing:
1. Use foam conduit sealant to prevent entry of moisture and gases. This includes, but is not limited to:
   a. Where conduits enter building from outside.
   b. Where service conduits enter building from underground distribution system.
   c. Where conduits enter building from underground.
   d. Where conduits may transport moisture to contact live parts.
2. Where conduits cross barriers between areas of potential substantial temperature differential, use sealing fitting or approved sealing compound at accessible point near penetration to prevent condensation. This includes, but is not limited to:
   a. Where conduits pass from outdoors into conditioned interior spaces.
   b. Where conduits pass from unconditioned interior spaces into conditioned interior spaces.
   c. Where conduits penetrate coolers or freezers.

S. Provide pull string in all empty conduits and in conduits where conductors and cables are to be installed by others. Use No. 14 AWG zinc-coated steel or monofilament plastic line with not less than 200-lb tensile strength. Leave minimum slack of 12 inches at each end.

T. Provide grounding and bonding in accordance with Section 26 05 26 - Grounding and Bonding for Electrical Systems.

U. Voice and Data System Raceways, 2-Inch Trade Size and Smaller: In addition to the above requirements, install raceways in maximum lengths of 100 feet and with a maximum of two 90-degree bends or equivalent. Separate lengths with pull or junction boxes where necessary to comply with these requirements. Provide insulating bushings at all terminations. Comply with EIA/TIA-569-D.
1. Identify conduits for Voice and Data systems; see Section 26 05 53 - Identification for Electrical Systems.

3.03 FIELD QUALITY CONTROL

A. See Section 01 40 00 - Quality Requirements for additional requirements.

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

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

D. Correct deficiencies and replace damaged or defective conduits.

3.04 CLEANING

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

B. Repair damage to galvanized finishes with zinc-rich paint recommended by manufacturer.

C. Repair damage to PVC or paint finishes with matching touchup coating recommended by manufacturer.

3.05 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