SECTION 26 05 34
CONDUIT

PART 1 GENERAL

1.01 THE CONTRACTOR IS REFERRED TO THE "SPECIAL NOTICE TO CONTRACTORS"; SPECIAL CONDITIONS, THE "FORM OF PROPOSAL"; THE "FORM OF BID BOND"; "DIVISION 01 - GENERAL REQUIREMENTS" OF THE CONTRACT SPECIFICATIONS"; THE "CONTRACT DRAWINGS" AND ALL AMENDMENTS AND ADDENDA THERETO; ALL OF WHICH GOVERN THE WORK OF THIS SECTION. THESE SPECIFICATIONS COMPLEMENT AND SUPPLEMENT THE CONTRACT DRAWINGS. ANY VARIATIONS, DISCREPANCY OR CONFLICTING INFORMATION FOUND BY THE CONTRACTOR SHALL BE BROUGHT TO THE ATTENTION OF NYCHA FOR RESOLUTION.

1.02 SECTION INCLUDES

A. Galvanized steel rigid metal conduit (RMC).

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

C. Flexible metal conduit (FMC).

D. Liquidtight flexible metal conduit (LFMC).

E. Electrical metallic tubing (EMT).

F. Conduit fittings.

G. Accessories.

H. RELATED REQUIREMENTS
   1. Section 07 84 00 - Firestopping.
   2. Section 26 05 19 - Low-Voltage Electrical Power Conductors and Cables: Metal clad cable (Type MC), armored cable (Type AC), and manufactured wiring systems, including uses permitted.
   3. Section 26 05 26 - Grounding and Bonding for Electrical Systems.
   4. Section 26 05 29 - Hangers and Supports for Electrical Systems.
   5. Section 26 05 35 - Surface Raceways.
   6. Section 26 05 37 - Boxes.
   7. Section 26 05 53 - Identification for Electrical Systems: Identification products and requirements.
   8. Section 27 10 05 - Structured Cabling for Voice and Data: Additional requirements for communications systems conduits.

I. REFERENCE STANDARDS
   1. ANSI C80.1 - American National Standard for Electrical Rigid Steel Conduit (ERSC); 2005.
   2. ANSI C80.3 - American National Standard for Steel Electrical Metallic Tubing (EMT); 2005.
   3. NECA 1 - Standard for Good Workmanship in Electrical Construction; National Electrical Contractors Association; 2010.
   4. NECA 101 - Standard for Installing Steel Conduits (Rigid, IMC, EMT); National Electrical Contractors Association; 2006.
   5. NEMA FB 1 - Fittings, Cast Metal Boxes, and Conduit Bodies for Conduit, Electrical Metallic Tubing, and Cable; National Electrical Manufacturers Association; 2012 (ANSI/NEMA FB 1).

6. NEMA RN 1 - Polyvinyl-Chloride (PVC) Externally Coated Galvanized Rigid Steel Conduit and Intermediate Metal Conduit; National Electrical Manufacturers Association; 2005.
7. NFPA 70 - National Electrical Code; National Fire Protection Association; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.
8. UL 1 - Flexible Metal Conduit; Current Edition, Including All Revisions.
9. UL 6 - Electrical Rigid Metal Conduit-Steel; Current Edition, Including All Revisions.
10. UL 360 - Liquid-Tight Flexible Steel Conduit; Current Edition, Including All Revisions.
11. UL 514B - Conduit, Tubing, and Cable Fittings; Current Edition, Including All Revisions.
12. UL 797 - Electrical Metallic Tubing-Steel; Current Edition, Including All Revisions.

J. 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. Coordinate the work with other trades to provide roof penetrations that preserve the integrity of the roofing system and do not void the roof warranty.
5. Notify Architect 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.

K. SUBMITTALS
1. See Section 01 30 00 - Administrative Requirements for submittals procedures.
2. Product Data: Provide manufacturer's standard catalog pages and data sheets for conduits and fittings.
3. Shop Drawings:

    a. Include proposed locations of roof penetrations and proposed methods for sealing.
    a. Prepare shop drawings showing proposed conduit routing, size and wiring for approval by NYCHA. Shop drawing shall show equipment served and circuiting.
4. Project Record Documents: Record actual routing for conduits installed underground and conduits 2 inch (53 mm) trade size and larger.

L. QUALITY ASSURANCE
1. Conform to requirements of NFPA 70.
2. Products: Listed and classified by Underwriters Laboratories Inc. as suitable for purpose specified and shown.

M. DELIVERY, STORAGE, AND HANDLING

A. Receive, inspect, handle, and store conduit and fittings in accordance with manufacturer's instructions.
2. Accept conduit on site. Inspect for damage.
3. Protect conduit from corrosion and entrance of debris by storing above grade. Provide appropriate covering.
4. Protect PVC coated conduit from sunlight.

PART 2 PRODUCTS

2.01 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. Concealed Within Masonry Walls: Use galvanized steel rigid metal conduit.

D. Concealed Within Hollow Stud Walls: Use flex metallic conduit (FMC).

E. Concealed Above Accessible Ceilings: Use electrical metallic tubing (EMT).

F. Interior, Damp or Wet Locations: Use galvanized steel rigid metal conduit..Conduit shall be supported 1/2" (min) off the wall with galvanized steel struts (damp) or stainless steel struts (wet)

G. Exposed, Interior, Not Subject to Physical Damage: Use EMT.

H. 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 6 feet, except within electrical and communication rooms or closets.

I. Exposed, Exterior: Use PVC-coated galvanized steel rigid metal conduit.

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

K. Connections to Luminaires Above Accessible Ceilings: Use flexible metal conduit.
   1. Maximum Length: 3 feet.

L. Connections to devices and accessories in Hollow Metal Walls: Use Flex conduit (FMC).

M. Boiler Rooms, Tanks Rooms, Paint Shops, Gas Meter Rooms: Use galvanized steel rigid metal conduit.

N. Connections to Vibrating Equipment:
   1. Dry Locations: Use flexible metal conduit.
   2. Boiler room: Use liquidtight flexible metal conduit.
   3. Damp, Wet, or Corrosive Locations: Use liquidtight flexible metal conduit.
   4. Maximum Length: 3 feet unless otherwise indicated.
   5. Vibrating equipment includes, but is not limited to:
      a. Motors.
      b. Pumps.

O. Fished in Existing Walls, Where Necessary: Use flexible metal conduit.

P. Fire Alarm and Safety Equipment: Use RMS conduit.

2.02 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. Communications Systems Conduits: Also comply with Section 27 10 05.

C. Fittings for Grounding and Bonding: Also comply with Section 26 05 26.

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

E. Provide products listed, classified, and labeled by Underwriter's Laboratories Inc. (UL) or testing firm acceptable to authority having jurisdiction as suitable for the purpose indicated.

F. Minimum Conduit Size, Unless Otherwise Indicated:
   1. Branch Circuits: 3/4 inch trade size.
   2. Branch Circuit Homeruns: 1 inch (27 mm) trade size.
   3. Control Circuits: 3/4 inch (21 mm) trade size.
   4. Flexible Connections to Luminaires: 3/8 inch (12 mm) trade size.

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

2.03 GALVANIZED STEEL RIGID METAL CONDUIT (RMC)

A. Manufacturers:
   1. Allied Tube & Conduit: www.alliedeg.com.
   2. Republic Conduit: www.republic-conduit.com.
   3. Wheatland Tube Company: www.wheatland.com.

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.
      b. O-Z/Gedney, a brand of Emerson Industrial Automation: www.emersonindustrial.com.
      c. Thomas & Betts Corporation: www.tnb.com.
   2. Non-Hazardous Locations: Use 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 threaded type fittings only. Threadless set screw and compression (gland) type fittings are not permitted.

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

A. Manufacturers:
   1. Allied Tube & Conduit: www.alliedtube.com.
   2. Thomas & Betts Corporation: www.tnb.com.
   3. Robroy Industries: www.robroy.com.

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.

D. Interior Coating: Urethane, minimum thickness of 2 mil.

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. Material: Use steel or malleable iron.
   4. Exterior Coating: Polyvinyl chloride (PVC), minimum thickness of 40 mil.
   5. Interior Coating: Urethane, minimum thickness of 2 mil.

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

G. Fittings and Conduit Bodies: NEMA FB 1; steel fittings with external PVC coating to match conduit.

2.05 FLEXIBLE METAL CONDUIT (FMC)

A. Manufacturers:
   1. AFC Cable Systems, Inc: www.afcweb.com.
   2. Electri-Flex Company: www.electriflex.com.
   3. International Metal Hose: www.metalhose.com.
   4. Substitutions: See Section 01 60 00 - Product Requirements.

B. Description: NFPA 70, Type FMC standard wall steel flexible metal conduit listed and labeled as complying with UL 1, and listed for use in classified firestop systems to be used.

C. Fittings:
   1. Manufacturers:
      a. Bridgeport Fittings Inc: www.bptfittings.com.
      b. O-Z/Gedney, a brand of Emerson Industrial Automation: www.emersonindustrial.com.
      c. Thomas & Betts Corporation: www.tnb.com.
   2. Description: Fittings complying with NEMA FB 1 and listed and labeled as complying with UL 514B.
   3. Material: Use steel or malleable iron.

D. Description: Interlocked steel construction.

E. Fittings: NEMA FB 1.

2.06 LIQUIDTIGHT FLEXIBLE METAL CONDUIT (LFMC)

A. Manufacturers:
   1. AFC Cable Systems, Inc: www.afcweb.com.
   2. Electri-Flex Company: www.electriflex.com.
   3. International Metal Hose: www.metalhose.com.

B. Description: NFPA 70, 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 ELECTRICAL METALLIC TUBING (EMT)

A. Manufacturers:
   1. Allied Tube & Conduit: www.alliedeg.com.
   2. Republic Conduit: www.republic-conduit.com.
   3. Beck Manufacturing, Inc: www.beckmfg.com.
   4. Picoma;: www.picoma.com.
   5. Wheatland Tube Company: www.wheatland.com.

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.
      b. O-Z/Gedney, a brand of Emerson Industrial Automation: www.emersonindustrial.com.
      c. Thomas & Betts Corporation: www.tnb.com.
   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) type.
    a. Do not use indenter type connectors and couplings.
    b. Do not use set-screw type connectors and couplings.

D. Description: ANSI C80.3; galvanized tubing.

E. Fittings and Conduit Bodies: NEMA FB 1; steel or malleable iron compression type.

2.08 ACCESSORIES

A. Corrosion Protection Tape: PVC-based, minimum thickness of 20 mil.

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

C. Pull Strings: Use nylon cord with average breaking strength of not less than 200 pound-force.

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

E. Modular Seals for Conduit Penetrations: Rated for minimum of 40 psig; Suitable for the conduits to be installed.

F. Description: NEMA TC 2.

G. Fittings and Conduit Bodies: NEMA TC 3.
    1. Arrange conduit to provide no more than 150 feet between pull points.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that field measurements are as shown on drawings.

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

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

D. Verify routing and termination locations of conduit prior to rough-in.

E. Size of conduits shall be as shown on drawings. Where not shown on drawings, the size of conduit shall meet New York Electrical Code 2011, NEC and manufacturer's recommendation. Where there is a conflict in size, the largest conduit shall be installed.

3.02 INSTALLATION

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

B. Install conduit in a neat and workmanlike manner in accordance with NECA 1.

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

D. Use clamp back spacer with conduit strap for damp and wet locations to provide space between conduit and mounting surface.

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

F. Use metal channel (strut) with accessory conduit clamps to support multiple parallel surface-mounted conduits. Provide 20% spare capacity.

G. Use trapeze hangers assembled from threaded rods and metal channel (strut) with accessory conduit clamps to support multiple parallel suspended conduits.Provide 20% spare capacity.

H. Use non-penetrating rooftop supports to support conduits routed across rooftops (only where approved).

I. Use of spring steel conduit clips for support of conduits is not permitted.

J. Where the Contractor selects and installs an item of equipment which are required either additional conduit, boxes, fittings, etc., or a modification of the conduit system indicated on the

Drawings, such additional conduit, boxes, fittings, etc., shall be furnished and installed and such modifications shall be performed by the Contractor as a part of this Contract and without additional cost to NYCHA.

K. The Contractor shall coordinate the work with that of the other tradesman so that the completed installation, particularly partitions and walls, will present a finished appearance. There shall be no structural malformation caused by improper installation of electrical equipment and no observable spaces between electrical equipment and the structure. Deficiencies shall be corrected at no additional cost to NYCHA.

L. Cut conduit square using saw or pipecutter; de-burr cut ends

M. Use of wire for support of conduits is not permitted.

N. Conduit Routing:
   2. Unless dimensioned, conduit routing indicated is diagrammatic.
   3. When conduit destination is indicated and routing is not shown, determine exact routing required.
   4. Conceal all conduits unless specifically indicated to be exposed.
   1. Where conduit support intervals specified in NFPA 70 and NECA standards differ, comply with the most stringent requirements.
   5. Conduits in the following areas may be exposed, unless otherwise indicated:
      a. Electrical rooms.
      b. Mechanical equipment rooms.
   6. Unless otherwise approved, do not route conduits exposed:
      a. Across floors.
      b. Across top of parapet walls.
      c. Across building exterior surfaces.
   7. Arrange conduit to maintain adequate headroom, clearances, and access.
   8. Route conduit parallel and perpendicular to walls.
   9. Route conduit installed above accessible ceilings parallel and perpendicular to walls.
   10. Arrange conduit to provide no more than the equivalent of four 90 degree bends between pull points. Use hydraulic one shot bender to fabricate bends in metal conduit larger than 2 inch size.
   11. Route conduits above water and drain piping where possible.
   12. Arrange conduit to prevent moisture traps. Provide drain fittings at low points and at sealing fittings where moisture may collect.
   13. Maintain minimum clearance of 6 inches between conduits and piping for other systems.
   14. Maintain minimum clearance of 12 inches between conduits and hot surfaces. This includes, but is not limited to:
      a. Heaters.
      b. Hot water piping.
      c. Flues.
   15. Routing of conduits should not block areas that require future access such as windows, equipment access locations and other areas where future access is required. Coordinate with NYCHA.
   16. Group parallel conduits in the same area together on a common (trapeze) rack. **Extend space on each rack for 20% of the largest conduit for future addtional conduits**.

O. Exterior conduits in areas exposed to the public shall be a continuous run with no conduit bodies or boxes.

P. Conduit Support:
   2. Secure and support conduits in accordance with NFPA 70 and Section 26 05 29 using suitable supports and methods approved by the authority having jurisdiction.
   3. Provide independent support from building structure. Do not provide support from piping, ductwork, or other systems.
   4. Do not support conduit with wire or perforated pipe straps. Remove wire used for temporary supports.

5. 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.

Q. 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. Do not use running threads. **Three-piece couplings not permitted underground**.
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 a box or enclosure, provide threaded couplings equipped with threaded plugs set flush with finished floor.
7. Provide insulating bushings or insulated throats at all conduit terminations to protect conductors, including conducters smaller than 4 AWG,
8. Secure joints and connections to provide maximum mechanical strength and electrical continuity.

R. 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. Provide suitable modular seal where conduits penetrate exterior wall below grade.
7. Where conduits penetrate waterproof membrane, seal as required to maintain integrity of membrane.
8. **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. Include proposed locations of penetrations and methods for sealing with submittals.**
9. **Roof-Penetration Sleeves: Seal penetration of individual raceways with flexible, boot-type flashing units applied in coordination with roofing work**.
10. Provide metal escutcheon plates for conduit penetrations exposed to public view.
11. Install firestopping to preserve fire resistance rating of partitions and other elements, using materials and methods specified in Section 07 84 00.

S. 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 conduits are subject to earth movement by settlement or frost.

T. 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.
3. Where conduits enter into boiler room.

U. 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 at each end.

V. Provide grounding and bonding in accordance with Section 26 05 26.

W. Identify conduits in accordance with Section 26 05 53.

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.

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.

B. Avoid moisture traps; provide junction box with drain fitting at low points in conduit system.

C. Use suitable caps to protect installed conduit against entrance of dirt and moisture.

3.06 INTERFACE WITH OTHER PRODUCTS

A. Install conduit to preserve fire resistance rating of partitions and other elements, using materials and methods specified in Section 07 84 00.

3.07 RECORDS

A. Prepare As-built drawings showing actual conduit routing, size, wiring, equipment served, circuits and all other information necessary for maintenance and repairs.

END OF SECTION