

SECTION 27 05 28

CONDUIT AND BACKBOXES FOR COMMUNICATIONS SYSTEMS

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.02 SUMMARY

- A. Provide all materials and labor for the installation of a pathway system for inside plant communications circuits. This section includes requirements for horizontal and building backbone raceways, fittings, and boxes specific to communications circuits (cabling) for voice and data.
- B. Related Sections:
 - 1. Division 26 Section — "Basic Electrical Materials and Methods"
 - 2. Division 27 Section — "Grounding and Bonding for Communications Systems"
 - 3. Division 27 Section — "Inside Plant Communications Systems"

1.03 REFERENCES

- A. Incorporate by reference the applicable portions of the following specifications, standards, codes into this specification section.
 - 1. General:
 - a. National Electrical Code (NEC)
 - b. National Electrical Safety Code (NESC)
 - c. Occupational Safety and Health Act (OSHA)
 - 2. Communications:
 - a. ANSI/TIA/EIA - 568: Commercial Building Telecommunications Cabling Standard
 - b. ANSI/TIA/EIA - 569: Commercial Building Standard for Telecommunication Pathways and Spaces
 - c. ANSI/TIA/EIA - 606: The Administration Standard for the Telecommunications Infrastructure of Commercial Buildings
 - d. ANSI/TIA/EIA - 607: Commercial Building Grounding and Bonding Requirements for Telecommunications
 - e. ISO/IEC IS 11801: Generic Cabling for Customer Premises
 - f. BICSI: BICSI Telecommunications Cabling Installation Manual
 - g. BICSI: BICSI Telecommunications Distribution Methods Manual (TDMM)

1.04 DEFINITIONS

- A. "EMT" shall mean Electrical Metallic Tubing.

- B. “RMC” shall mean Rigid Metal Conduit.
- C. “SMR” shall mean Surface Metal Raceway.
- D. “Raceway” shall mean any enclosed channel for routing wire, cable or busbars.
- E. “TMGB” shall mean *Telecommunications Main Grounding Busbar*. There is typically one TMGB per building, located in the main telecommunications room. This busbar is directly bonded to the electrical service ground.
- F. “TGB” shall mean *Telecommunications Grounding Busbar*. There is typically one TGB per telecommunications room. The TGB is connected both to the TMGB and to building structural steel or other permanent metallic systems.
- G. “TBB” shall mean *Telecommunications Bonding Backbone*. The TBB is a conductor used to connect TMGBs to the TGBs.
- H. “Pullbox” shall mean a metallic box with a removable cover, used to facilitate pulling cable through conduit runs longer than 100’ or in which there are more than 180 degrees of bends.
- I. “Junction box” shall mean a pullbox wherein a feeder conduit transitions to multiple distribution conduits.

1.05 SYSTEM DESCRIPTION

- A. Furnish, install, and place into satisfactory and successful operation all materials, devices, and necessary appurtenances to provide a complete Raceway system as hereinafter specified and/or shown on the Contract Documents. The Raceway system shall support an ANSI/TIA/EIA and ISO/IEC compliant communications Structured Cabling System (SCS) as specified in 271500 - Inside Plant Communications Systems
- B. The work shall include materials, equipment and apparatus not specifically mentioned herein or noted on the Contract Documents but which are necessary to make a complete working Raceway system.

1.06 SUBMITTALS

- A. Product Data Submittals: Provide submittal information for review before materials are delivered to the job site. Provide product data submittals for all products at the same time.
 - 1. Submit a letter stating that the materials will be provided as specified, and specifically listing any items that will not be provided as specified. The letter shall also state that the Contractor has reviewed the specified items and agrees that they are applicable to this project in all respects.
 - 2. For those items noted as allowing “or equal,” and which are not being provided as specifically named, submit standard manufacturer's cut sheets or other descriptive information, along with a written description detailing the reason for the substitution.
 - 3. Provide standard manufacturer’s cut sheets and the operating and maintenance (O&M) instructions at the time of submittal review for each device in the system, regardless of whether it is submitted as specified or as an approved equal. These

instructions shall detail how to install and service the equipment and shall include information necessary for rough-in and preparation of the building facilities to receive the materials.

- B. Closeout Submittals: Provide submittal information for review as follows:
 - 1. O&M Manual for Communications - At the completion of the project, submit all O&M information from product data submittals (above), updated to reflect any changes during the course of construction, to Mason ITU in the telecommunications-specific O&M Manual for Communications binder labeled with the project name and description.
 - 2. Records - Maintain at the job site a minimum of one set of Record Drawings, Specification, and Addenda. Record Drawings shall consist of redline markups of drawings, specifications and spreadsheets, including maintenance hole/handhole butterfly drawings.
 - a. Document changes to the system from that originally shown on the Contract Documents and clearly identify system component labels and identifiers on Record Drawings.
 - b. Keep Record Drawings at the job site and make available to the Owner and Designer at any time.
 - c. Keep Record Drawings current throughout the course of construction. ("Current" is defined as not more than one week behind actual construction).
 - d. Show identifiers for major infrastructure components on Record Drawings.

1.07 CONTRACTOR WARRANTY:

- A. Provide a Contractor-endorsed one-year service warranty against defects in materials and workmanship.
 - 1. Provide labor attributable to the fulfillment of this warranty at no cost to the Owner.
 - 2. The Contractor Warranty period shall commence upon Owner acceptance of the work.

1.08 QUALITY ASSURANCE

- A. Listing and Labeling: Provide raceways and boxes specified in this Section that are listed and labeled.
 - 1. The Terms "Listed" and "Labeled": As defined in NEC, Article 100.
 - 2. Listing and Labeling Agency Qualifications: A "Nationally Recognized Testing Laboratory" as defined in OSHA Regulation 1910.7.
- B. Comply with NECA's "Standard of Installation."
- C. Comply with NEC.

1.09 COORDINATION

- A. Coordinate layout and installation of raceways and boxes with other construction elements to ensure adequate headroom, working clearance, and access.

PART 2 - PRODUCTS

2.01 GENERAL

- A. Materials shall consist of conduit, surface metal raceway, outlet boxes, fittings, enclosures, pull boxes, and other raceway incidentals and accessories as required for inside plant communications circuits.

2.02 MATERIALS

- A. Conduit:
1. EMT. 1" minimum conduit size. Flexible metal conduit (FMC) is not acceptable.
 - a. Conduit: Galvanized steel tubing meeting ANSI C80.3.
 - b. Couplings: Steel, cast iron, or malleable iron compression type employing a split, corrugated ring and tightening nut, with integral bushings and locknuts. Indent-type and setscrew-type couplings are not permitted.
 2. RMC. 1" minimum conduit size.
 - a. Conduit: Hot dipped galvanized steel with threaded ends meeting ANSI C80.1.
 - b. Couplings: Unsplit, NPT threaded steel cylinders with galvanizing equal to the conduit.
 - c. Nipples: Same as conduit, factory-made up to 8 inches in diameter, no running threads.
- B. Sleeves: EMT conduit, with insulated throat bushings for each end
- C. Surface Raceway: Wiremold V2400 series or equivalent – Two piece, steel, single channel surface raceway.
- D. Outlet boxes: Minimum 4"x4" size, 2 1/8" minimum depth, with extension rings (if needed) and single gang covers (i.e. mud rings), unless otherwise noted on the Contract Documents. Combined interior depth of outlet box, extension ring and cover shall be a minimum 2-1/2". Stamped steel, deep drawn one piece (without welds or tab connections), galvanized, with knockouts for 1" trade size conduit or connector entrance, meeting NEMA OS 1.
1. Acceptable manufacturers:
 - a. Appleton, Raco, Steel City, or equal
 2. Wiremold Extra Deep Switch and Receptacle Box: V5744-2 (two gang), or equal
- E. Junction Boxes and Pull Boxes: Stamped steel, deep drawn one piece (without welds or tab connections), galvanized, with knockouts for conduit or connector entrance. Boxes 6"x6"x4" or larger may be code gauge fabricated steel continuously welded at seams and painted after fabrication.
1. Dry locations: meeting NEMA OS 1.
 2. Wet locations: NEMA OS 3R.
- F. Miscellaneous Fittings:
1. Locknuts and conduit bushings: Malleable iron
 - a. Appleton, Crouse Hinds, OZ Gedney, or equal
 2. Through wall seals and floor seals shall be:
 - a. OZ Gedney FS and WS series, or equal.

- G. Pull Strings: Plastic or nylon with a minimum test rating of 200 lb.

2.03 FIRESTOPPING

- A. Material: Conform to both Flame (F) and Temperature (T) ratings as required by local building codes and as tested by nationally accepted test agencies per ASTM E814 or UL 1479 fire test in a configuration that is representative of the actual field conditions.

2.04 LABELING AND ADMINISTRATION

- A. Labels: As recommended in ANSI/TIA/EIA 606. Permanent (i.e. not subject to fading or erasure), permanently affixed, typed, and created by a hand-carried label maker or an approved equivalent software-based label making system. Handwritten labels are not acceptable.

1. Hand-carried label maker:
 - a. Brady: ID Pro Plus (or approved equal).
2. Labels:

Brady: Bradymaker Wire Marking Labels WML-511-292 (or approved equal)

PART 3 - EXECUTION

3.01 GENERAL

- A. The Contractor is solely responsible for the safety of the public and workers in accordance with all applicable rules, regulations, building codes and ordinances.
- B. All work shall comply with applicable safety rules and regulations including OSHA. All work shall comply with the requirements of the National Electrical Safety Code (NESC) and the NEC except where local codes and/or regulations are more stringent, in which case the local codes and/or regulations shall govern.
- C. All work shall comply with the standards, references and codes listed in PART 1 -- REFERENCES above. Where questions arise regarding which standards, references, or codes apply, the more stringent shall prevail.
- D. All work shall comply with the requirements and recommendations of the product manufacturers. Where questions arise regarding which requirements and recommendations apply, the more stringent shall prevail.
- E. Install the raceway system in a manner ensuring that communications circuits, when installed, are able to fully comply with the ANSI/TIA/EIA and other references listed in Part 1 — References, above.
- F. Replace and/or repair to original (or better) condition any existing structures, materials, equipment, etc. inadvertently demolished or damaged by the Contractor during the course of construction at no additional cost to the Owner.
- G. Remove surplus material and debris from the job site and dispose of legally.

3.02 EXAMINATION

- A. Examine surfaces and spaces to receive raceways, boxes, enclosures, and cabinets for compliance with installation tolerances and other conditions affecting performance of raceway installation. Do not proceed with installation until unsatisfactory conditions have been corrected.

3.03 INSTALLATION

- A. Install raceways, boxes, enclosures, and cabinets as indicated, according to manufacturer's written instructions. Provide a raceway for each location indicated. Do not gang raceway into wireways, pullboxes, junction boxes, etc., without specific approval from the Designer.
- B. Conduit:
 - 1. Install EMT unless other conduit is shown on the Contract Documents or is required by Code.
 - 2. Install conduit as a complete, continuous system without wires, mechanically secured and electrically connected to metal boxes, fittings and equipment. Blank-off unused openings using factory-made knockout seals.
 - 3. Run conduit in the most direct route possible, parallel to building lines. Do not route conduit through areas in which flammable material may be stored.
 - 4. Keep conduit at least 6 inches away from parallel runs of flues and steam or hot-water pipes or other heat sources operating at temperatures above one-hundred degrees Fahrenheit. Install horizontal conduit runs above water piping.
 - 5. Keep conduit away from sources of electromagnetic interference as follows:
 - a. 5 inches from fluorescent lighting
 - b. 12 inches from conduit and cables used for electrical power distribution
 - c. 48 inches from motors or transformers
 - 6. Do not exceed 90 meters total length for a given conduit run to be used for distribution cabling (from outlet box to telecommunications room), including intermediate conduits and junction boxes.
 - 7. Install conduit exposed, except in finished areas or unless shown otherwise on the drawings. Do not install conduit below grade/slab unless specifically shown on the Contract Documents as being installed below grade/slab.
 - 8. Install exposed conduit in lines parallel or perpendicular to building lines or structural members except where the structure is not level. Follow the surface contours as much as practical. Do not install crossovers or offsets that can be avoided by installing the conduit in a different sequence or a uniform line.
 - a. Run parallel or banked conduits together, on common supports where practical.
 - b. Make bends in parallel or banked runs from same centerline to make bends parallel.
 - 9. Conduits concealed above ceilings, furred spaces, etc., which are normally inaccessible may be run at angles not parallel to the building lines.
 - 10. Wherever practical, route conduit with adjacent ductwork or piping and support on common racks. Base required strength of racks, hangers, and anchors on combined weights of conduit and piping.
 - 11. Where conduits cross building expansion joints, use suitable sliding or offsetting expansion fittings. Unless specifically approved for bonding, use a suitable bonding jumper.

12. Support conduits as specified in Section 16050 "Basic Electrical Materials and Methods."
 - a. Provide anchors, hangers, supports, clamps, etc. to support the conduits from the structures in or on which they are installed. Do not space supports farther apart than five feet.
 - b. Provide sufficient clearance to allow conduit to be added to racks, hangers, etc. in the future.
 - c. Support conduit within three feet of each outlet box, junction box, gutter, panel, fitting, etc.
13. Ream conduits to eliminate sharp edges and terminate with metallic insulated grounded throat bushings. Seal each conduit after installation (until cable is installed) with a removable mechanical-type seal to keep conduits clean, dry and prevent foreign matter from entering conduits.
14. Install a pull string in each conduit.
15. For conduits entering through the floor of a telecommunications room, terminate conduits 6" above the finished floor.
16. Do not install communications conduits in wet, hazardous or corrosive locations.
17. Where conduit is shown embedded in masonry, embed conduit in the hollow core of the masonry. Horizontal runs in the joint between masonry units are not permitted.
18. Where conduit is shown embedded in concrete, embed conduit a minimum of two inches from the exterior of the concrete. Do not place conduit in concrete less than 4 inches thick.
 - a. One inch trade size conduit shall be used. Conduits sized smaller than one inch trade size conduit are not permitted embedded in concrete without approval from Mason-ITU.
 - b. Run conduit parallel to main reinforcement.
 - c. Conduit crossovers in concrete are not permitted.
19. Where conduit exits from grade or concrete, provide a rigid steel elbow and adapter.
20. Where conduit enters a space through the floor and terminates in that space, terminate the conduit at 6" above the finished floor.
21. Where conduits terminate at a cable tray, the conduits shall be consistently terminated no more than 8" from the cable tray, and have a visually uniform appearance.
22. Where several circuits follow a common route, stagger pullboxes or fittings.
23. Where several circuits are shown grouped in one box, individually fireproof each conduit.
24. Bend and offset metal conduit with standard factory sweeps or conduit fittings. Keep legs of bends in the same plane and straight legs of offsets parallel, unless otherwise indicated.
 - a. Conduit sweeps:
 - 1) Sweeps shall not exceed 90 degrees.
 - 2) Do not exceed 180 degrees for the sum total of conduit sweeps for a section of conduit (between conduit termination points).
 - 3) Sweep radius shall be at least 10 times the internal diameter of the conduit.
 - 4) 90-degree condulets (LB's) and electrical elbows are not acceptable.
 - b. Factory-manufactured sweeps are required for bends in conduit larger than 1-1/4" trade size.

- c. For bends in 1 ¼" trade size conduit and larger, field-manufactured bends (using a hydraulic bender with a 1 ¼" boot) are permitted only when factory-manufactured sweeps are not suitable for the conditions. In all other cases, factory-manufactured sweeps are required. "Hickey-bender" use is prohibited.
25. Connect conduit to hubless enclosures, cabinets and boxes with double locknuts and with insulating type bushings. Use grounding type bushings where connecting to concentric or eccentric knockouts. Make conduit connections to enclosures at the nearest practicable point of entry to the enclosure area where the devices are located to which the circuits contained in the conduit will connect.
26. Penetrations for raceways:
 - a. Do not bore holes in floor and ceiling joists outside center third of member depth or within two feet of bearing points. Holes shall be 1-¼" diameter maximum.
 - b. Penetrate finished walls and finished surfaces with a PVC or sheet metal sleeve with an interior diameter (ID) at least 1/4" greater than the outer diameter (OD) of the conduit, set flush with walls, pack with fiberglass, seal with silicone sealant.
 - c. Penetrate poured-in-place walls and free slabs with a cast iron sleeve (or Schedule 40 PVC black pipe sleeve for above-grade only) with retaining ring or washer. Set sleeves flush with forms or edges of slab. Pack around conduit with fiberglass and seal with silicone sealant.
27. Raceway terminations and connections:
 - a. Join conduits with fittings designed and approved for the purpose and make joints tight. Do not use set indent-type or screw-type couplings.
 - b. Make threaded connections waterproof and rustproof by applying a watertight, conductive thread compound. Clean threads of cutting oil before applying thread compound.
 - c. Make conduit terminations tight. Use bonding bushings or wedges at connections subject to vibration. Use bonding jumpers where joints cannot be made tight.
 - d. Cut ends of conduit square using a hand saw, power saw or pipe cutter. Ream cut ends to remove burrs and sharp ends. Where conduit threads are cut in the field, cut threads to have same effective length, same thread dimensions and same taper as specified for factory-cut threads.
 - e. Provide double locknuts and insulating bushings at conduit connections to boxes and cabinets. Align raceways to enter squarely and install locknuts with dished part against the box. Use grounding type bushings where connecting to concentric or eccentric knockouts.
 - f. Where conduits are terminated with threaded hubs, screw raceways or fittings tightly into the hub so the end bears against the wire protection shoulder. Where chase nipples are used, align raceways so the coupling is square to the box and tighten the chase nipple so no threads are exposed.
28. Install conduit sealing fittings according to manufacturer's written instructions. Locate fittings at suitable, approved, and accessible locations and fill them with UL-listed sealing compound. For concealed conduits, install each fitting in a flush steel box with a blank cover plate having a finish similar to that of adjacent plates or surfaces. Install raceway sealing fittings at the following points:
 - a. Where conduits pass from warm to cold locations, such as the boundaries of air conditioned or refrigerated spaces and where conduits enter or exit

- buildings from outdoor areas, including underground ducts or conduit runs.
- b. Where otherwise required by the NEC.
29. Conduit shall be clean and dry.
- C. Sleeves:
1. Provide sleeves where required, sized as noted on the Contract Documents. Where not noted, sleeve sizing shall be determined by the type and quantity of cable to be routed through the sleeve per TIA/EIA 569A cable capacity standards, plus an additional 20% for future expansion.
 2. Provide roto-hammering or core drilling where required for installation.
 3. Seal between sleeve and wall or floor in which the sleeve is installed. Firestop all penetrations to restore wall or floor to pre-penetration fire-rating.
- D. Surface Raceway:
1. Provide surface raceway for all surface mounted telecommunications outlet boxes and as shown on the Contract Documents.
 2. Surface raceway shall be routed parallel to and perpendicular to surfaces or exposed structural members, and follow surface contours.
 3. Surface raceway color shall match as closely as possible the existing wall finish. Do not paint Surface Raceway.
 4. Surface raceway systems shall be completely installed, including insulating bushings and inserts as required by manufacturer's installation requirements. Unused openings in the surface raceway shall be closed using manufactured fittings.
 5. Surface raceway shall have a minimum two inch radius control at all bend points.
 6. Surface raceway shall be securely supported by screws or other anchor-type devices at intervals not exceeding 10 feet and with no less than two supports per straight raceway section. Surface raceway shall be securely supported in accordance with the manufacturer's requirements. Tape and glue are not acceptable support methods.
 7. Mechanically and electrically continuous surface raceway shall be bonded and grounded to the Telecommunications Grounding system.
- E. Outlet Boxes:
1. Provide outlet boxes and covers as shown on the Contract Documents and as needed. Verify that the appropriate cover type and depth is provided for each type of wall and finish. Provide extension rings as needed.
 2. Coordinate box locations with building surfaces and finishes to avoid bridging wainscots, joints, finish changes, etc.
 3. Install boxes in dry locations (not wet, corrosive, or hazardous).
 4. Attach boxes securely to building structure with a minimum of two fasteners. Provide attachments to withstand a force of one hundred pounds minimum, applied vertically or horizontally.
 5. Install boxes at the following heights to the bottom of the box, except where noted otherwise:
 - a. Wall mounted telephones: 48" above finished floor.
 - b. Workstation outlets: 18" above finished floor.
 - c. Place boxes for outlets on cabinets, countertops, shelves, and similar boxes located above countertops two inches above the finished surface or two inches above the back splash. Coordinate and verify size, style, and

location with the supplier or installer of these items prior to outlet box installation.

- 6. Recessed mounted outlet boxes:
 - a. Recess boxes in the wall, floor, and ceiling surfaces in finished areas. Set boxes plumb, level, square and flush with finished building surfaces within one-sixteenth inch for each condition. Set boxes so that box openings in building surfaces are within one-eighth inch of edge of material cut-out and fill tight to box with building materials. Single gang opening shall extend at least to the finished wall surface and extend not more than 1/8 inch beyond the finished wall surface. Provide backing for boxes using structural material to prevent rotation on studs or joists.
 - b. Install floor boxes level and adjust to finished floor surface.
- 7. Surface-mounted outlet boxes:
 - a. For boxes surface-mounted on finished walls, provide Wiremold outlet box or equivalent. Cut box as necessary to accept conduit.
 - b. For boxes surface-mounted on unfinished walls (i.e. electrical rooms, mechanical rooms), provide 4"x4" (minimum) outlet box with single gang cover.

F. Floor Boxes:

- 1. Provide floor boxes as shown on the Contract Documents.
- 2. Set device boxes plumb, level, square and flush with floor, within 1/16" tolerance for each condition.
- 3. For floor boxes with combined power and telecommunications circuits, provide metal dividers to separate power from telecommunications circuits.

G. Junction Boxes:

- 1. Provide junction boxes as shown on the Contract Documents and as required.
 - a. Where sizing is not shown on the Contract Documents, size junction box length and depth according to the size of the feeder conduit in the following table:

Feeder Conduit Size	Box Length	Box Depth
1"	12"	4"
1-¼"	12"	4"
1-½"	12"	4"
2"	24"	4"
2-½"	24"	6"
3	36"	6"
3-½"	48"	6"
4"	60"	6"

- b. Where sizing is not shown on the Contract Documents, size junction box width according to the following formula:
 - 1) From the table below, select the width associated with the largest conduit on the distribution side of the box. For each additional

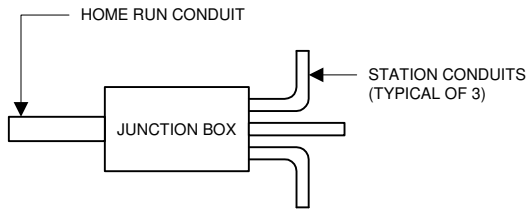
distribution conduit, add the “Increase Width” value associated with the size of that distribution conduit to the box width for the largest distribution conduit.

- a) For example, if the distribution side of the junction box has one 1-¼” distribution conduit and three 1” distribution conduits, the total distribution-side width would be 6”+2”+2”+2”=10”.
- 2) Repeat the above process for the feeder side of the junction box. Junction boxes are typically fed by a single conduit, therefore unless the box has more than one feeder conduit, the “Increase Width” part of the formula is unnecessary.
 - a) For example, if the feeder side of the junction box has two 2” feeder conduits the total feeder-side width would be 8”+5”=13”.
- 3) The larger of the two width calculations (distribution side vs. feeder side) shall be the width of the junction box to be provided.
 - a) For example, if the distribution-side width were 10” and the feeder-side width were 13”, provide a 13” wide junction box.

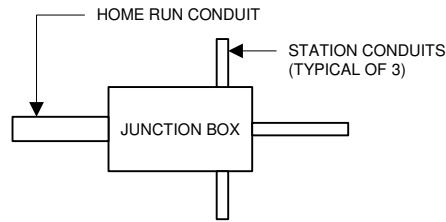
Conduit Size	Box Width	For each additional conduit Increase Width
1”	4”	2”
1-¼”	6”	3”
1-½”	8”	4”
2”	8”	5”
2-½”	10”	6”
3	12”	6”
3-½”	12”	6”
4”	15”	8”

- 2. A junction box may not be substituted for a 90-degree bend. *90 degree condulets (LB’s) are not acceptable.*
- 3. Install junction boxes in a location readily accessible both at time of construction and after building occupation. Do not install junction boxes in inaccessible interstitial building spaces.
- 4. Where junction boxes are to be mounted on ceiling structure above ceiling grid, do not mount higher than 4’ above grid.
- 5. Install hinged-cover enclosures and cabinets plumb, and supported at each corner.
- 6. Install junction boxes so that the access door opens from the side where the cable installer will normally work – typically from the bottom (floor side) of the box.
 - a. Where a junction box is installed in a ceiling space, coordinate with other trades to provide full access to the junction box door and adequate working room for both the installation personnel and for proper looping of cable during installation.

- b. Provide a lockable access cover (or junction box door if junction box is exposed) in hard lid ceilings.
- 7. Install junction boxes such that conduits enter and exit at opposite ends of the box as follows:



CORRECT INSTALLATION



INCORRECT INSTALLATION

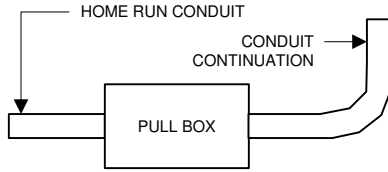
H. Pull Boxes:

- 1. Provide pull boxes as shown on the Contract Documents and as required.
 - a. Where sizing is not shown on the Contract Documents, size pull boxes as follows:

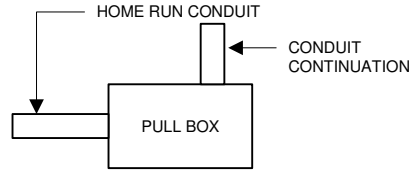
Size of Largest Conduit	Box Width	Box Length	Box Depth
1"	4"	12"	4"
1-¼"	6"	12"	4"
1-½"	8"	12"	4"
2"	8"	24"	4"
2-½"	10"	24"	6"
3"	12"	36"	6"
3-½"	12"	48"	6"
4"	15"	60"	6"

- b. Where a pull box is required with conduits 1" trade size or smaller, an outlet box may be used as a pull box. Where outlet boxes are used as pull boxes, the outlet boxes shall be dedicated for use as a pull box and shall not host cable termination hardware.
- 2. A pull box may not be substituted for a 90-degree bend. *90 degree condulets (LB's) are not acceptable.*
- 3. Install pull boxes in an accessible location, readily accessible both at time of construction and after building occupation. Do not install pull boxes in inaccessible interstitial building space.
- 4. Where pull boxes are to be mounted on ceiling structure above ceiling grid, do not mount higher than 4' above grid (mount on wall instead).
- 5. Install hinged-cover enclosures and cabinets plumb, and supported at each corner.
- 6. Install pull boxes so that the access door opens from the side where the cable installer will normally work (typically from the bottom, or floor side, of the box).
 - a. Where a pull box is installed in a ceiling space, provide full access to the junction box door and adequate working room for both the installation personnel and for proper looping of cable during installation.

- b. Provide a lockable access cover (or pull box door if pull box is exposed) in hard lid ceilings.
- 7. Install pull boxes such that conduits enter and exit at opposite ends of the box as follows:



CORRECT INSTALLATION



INCORRECT INSTALLATION

- I. Firestopping:
 - 1. Only employees trained/certified by the firestopping manufacturer shall apply firestopping materials.
 - 2. Maintain fire rating of penetrated fire-rated walls. Firestop and seal each penetration made during construction.
 - a. Provide firestopping material for through and membrane penetrations of fire-rated barriers.
 - b. Installation shall be performed in strict accordance with manufacturer’s detailed installation procedures.
 - c. Install firestops in accordance with fire test reports, fire resistance requirements, acceptable sample installations, manufacturer’s recommendations, local fire and building authorities, and applicable codes and standards referenced in PART 1 – REFERENCES. Apply all sealing material in a manner acceptable to the local fire and building authorities.
- J. Grounding/Bonding: Grounding and bonding work shall comply with the Virginia Uniform Statewide Building Code, Uniform Fire Code, National Electrical Code, and UL 467, ANSI/TIA/EIA standards and the references listed in PART 1 – REFERENCES above, as well as local codes which may specify additional grounding and/or bonding requirements.
 - 1. Bond metallic raceway together and to the nearest TGB (as provided under Division 27 Section — “Grounding and Bonding for Communications Systems”). Ensure that bonding breaks through paint to bare metallic surface of painted metallic hardware.

3.04 LABELS:

- A. Conduits: For any conduit extending beyond the space or room in which it starts, label each such conduit end in a clear manner by designating the location of the other end of the conduit (i.e. room name, telecommunications room name, pull box identifier, outlet identifier (use the label of the first port of the outlet as the outlet identifier), etc.). Indicate conduit length on the label.
 - 1. Where a conduit is intended for future cabling use outside of the Contract, the conduit shall be labeled in a clear manner by designating the location of the other end of the conduit (i.e. room name, telecommunications room name, pull box identifier, etc.) along with a sequential number for each spare conduit terminated into a single room. Indicate conduit length on the label.

- a. Suggestion: The second spare conduit (whether spare or in use) between Room 100 and telecommunications room 1A might be labeled in the telecommunications room as "Room 100 - #2, ___ feet." In Room 100 the same conduit might be labeled "1A - #2, ___ feet."
- B. Pull Boxes: Label each pullbox with a unique identifier. Identifiers shall be of the form "RN-Y" where "RN" is the room name of the room closest to (or containing) the pull box, and "Y" is the sequential number of the pull box for each "RN".
 1. Example: The second pull box in the vicinity of room "100" would have the label "100-2".
- C. Pull Strings: For any conduit extending beyond the space or room in which it starts, label its pull string in a clear manner by designating the location of the other end of the pull string (i.e. room name, telecommunications room name, pull box identifier, outlet identifier (use the label of the first port of the outlet as the outlet identifier), etc.).
 1. Where a pull string is installed in a conduit intended for future cabling use outside of the Contract, the pull string shall be labeled similar to the spare conduit in which it is installed.

3.05 PROTECTION

- A. Provide final protection and maintain conditions, in a manner acceptable to manufacturer and in accordance with accepted industry practice, that ensure coatings, finishes, and cabinets are without damage or deterioration at the time of Substantial Completion.
 1. Repair damage to galvanized finishes with zinc-rich paint recommended by manufacturer.
 2. Repair damage to PVC or paint finishes with matching touchup coating recommended by manufacturer.

3.06 CLEANING

- A. On completion of installation, including outlet fittings and devices, inspect exposed finish. Remove burrs, dirt, and construction debris and repair damaged finish, including chips, scratches, and abrasions.