

SECTION 27 05 28
PATHWAYS FOR COMMUNICATIONS SYSTEMS

PART 1 - GENERAL

1.01 SUMMARY

A. Work Included:

1. Electrical Metallic Tubing and Fittings
2. Conduit Accessories
3. Penetration Sealing Systems
4. Telecommunications Outlet Boxes
5. Innerduct
6. Innerduct Fittings
7. Wire Basket Runway
8. J-Hooks

- B. This Section specifies the requirements to provide communications conduit raceways, boxes, cable trays, innerduct and fittings.

1.02 RELATED SECTIONS

- A. Contents of Division 27, Communications and Division 01, General Requirements apply to this Section.

1.03 REFERENCES AND STANDARDS

- A. References and Standards as required by Section 27 00 00, Communications Basic Requirements and Division 01, General Requirements.

1.04 SUBMITTALS

- A. Submittals as required by Section 27 00 00, Communications Basic Requirements and Division 01, General Requirements.
- B. Provide plan drawings showing completions and as-built corrections which indicate type, size, placement, routing and/or length for raceway and cable tray components; e.g., manholes, handholes, conduit, boxes, enclosures, etc.

1.05 QUALITY ASSURANCE

- A. Quality assurance as required by Section 27 00 00, Communications Basic Requirements and Division 01, General Requirements.

1.06 WARRANTY

- A. Warranty of materials and workmanship as required by Section 27 00 00, Communications Basic Requirements and Division 01, General Requirements.

1.07 DEFINITIONS

- A. Conduit: Round raceway.
- B. Conduit Body: Separate portion of a conduit or tubing system that provides access through removable cover(s) to the interior of the system at a junction of two or more sections of the system or at a terminal point of the system.
- C. Pull Box Enclosure: Box with a cover installed in one or more runs of raceway to facilitate pulling conductors through the raceway system. There are no openings in the cover.
- D. Raceway: Enclosed channel designed expressly for holding wires or cables. Metal or insulating material and the term includes conduit, tubing, wireways, underfloor raceways and surface raceways; does not include cable tray.
- E. Wire Basket Runway Systems: Includes, but are not limited to straight sections of type wire basket runway cable trays, bends, tees, elbows, drop-outs, supports and accessories.

PART 2 - PRODUCTS

**2.01 MANUFACTURE
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- A. Electrical Metallic Tubing and Fittings:
 - 1. Allied Tube and Conduit
 - 2. Or approved equivalent.
- B. Conduit Accessories:
 - 1. Duct Spacers:
 - a. Carlon
 - b. Or approved equivalent.
 - 2. Expansion/Deflection Fittings:
 - a. Appleton
 - b. Or approved equivalent.
 - 3. Pulltape:
 - a. Greenlee
 - b. Or approved equivalent.
 - 4. Duct Plugs:

- a. Carlon
 - b. Or approved equivalent.
- C. Penetration Sealing Systems:
 - 1. SEMCO
 - 2. Or approved equivalent.
 - D. Telecommunications Outlet Boxes:
 - 1. Raco
 - 2. Or approved equivalent.
 - E. Innerduct:
 - 1. Carlon
 - 2. Or approved equivalent.
 - F. Innerduct Fittings:
 - 1. Carlon
 - 2. Or approved equivalent.
 - G. Wire Basket Runway:
 - 1. Cablofil
 - 2. Or approved equivalent.
 - H. J-Hooks:
 - 1. Erico
 - 2. Or approved equivalent.
- 2.02 ELECTRICAL METALLIC TUBING AND FITTINGS**
 - A. Type EMT: Electrogalvanized steel tubing.
 - B. Fittings and Conduit Bodies:
 - 1. In-line straight-through steel or malleable iron fittings and Type C conduit bodies only; do not use bends or tees, e.g. Lbs.
 - 2. Wet Areas: Steel compression-type couplings and nipples.
 - 3. Dry Areas: Set screw-type couplings and nipples.
 - 4. Bonding Locknuts:
 - a. Malleable iron with set screws and lug screws.
 - b. Insulated Bushing: Malleable iron with integral insulated throat, rated for 150C.
 - c. Bonding and Grounding Bushing: Malleable iron with integral insulated throat, rated for 150C, with solderless lugs or lug

screws.

2.03 CONDUIT ACCESSORIES

- A. Duct Spacers:
 - 1. Nonmetallic base and intermediate duct spacers with locking keyways designed specifically for use with nonmetallic conduit; e.g., Carlon SNAP-LOC duct spacers for 4-inch diameter conduit with 1-1/2-inch separation.
 - 2. Base Spacer: S288NHN.
 - 3. Intermediate Spacer: S289NHN.
- B. Expansion/Deflection Fittings: Similar to Crouse-Hinds XD expansion/deflection coupling or Appleton DF Series deflection and expansion coupling.
- C. Pulltape: Measuring and pulling tape constructed of synthetic fiber with plastic jacket, printed with accurate sequential footage marks; e.g., George-Ingraham 1/2-inch tape 9216-JK.
- D. Duct Plugs:
 - 1. Aboveground Conduit Openings: Tapered PVC plugs with tab for pulltape; e.g., Carlon 4-inch PVC plugs with pull tab, P258NT.
 - 2. Underground or Underslab Conduit Openings: Removable screwtight compression type duct plugs with wing-nut and corrosion resistant hardware; e.g. Vikimatic 4-inch, Part Number 40D402U. Use appropriate part number according to duct size.

2.04 PENETRATION SEALING SYSTEMS

- A. Firestopping: Provide fire barrier penetration sealing materials as specified in Division 07, Firestopping Section.
- B. Duct Water Seal: Products suitable for closing underground and entrance duct openings, where innerduct or cable is installed, to prevent entry of gases, liquids, or rodents into the structure; e.g., SEMCO PR 851.

2.05 TELECOMMUNICATIONS OUTLET BOXES

- A. Sheet Metal Outlet Boxes: Minimum 4-inch square by 2-1/8-inch deep, galvanized steel for use with single-gang plaster rings.
- B. Five Square Outlet Boxes: Minimum 5-inch square by 2-7/8-inch deep with built-in cable management for use with single-gang plaster rings. Randl P/N T-55017 approved.
- C. Nonmetallic Outlet Boxes: Minimum 4-inch square by 2-1/2-inch-deep. Provide gasketed, watertight single-gang cover.
- D. Cast Boxes: 4-inch square by 2-1/8-inch deep cast Feralloy, gasketed single-gang cover, threaded hubs.

- E. Floor Boxes for Installation in Cast-In-Place Concrete Floors: Flush mounted and fully adjustable formed steel as shown on the Drawings. Floor boxes provided by Division 26, Electrical.

2.06 INNERDUCT

- A. Outdoor Innerduct: 1-inch inside diameter corrugated, ribbed, or smooth walled, semi rigid PVC or heavy-wall polyethylene tubing.
- B. Indoor Innerduct: 1-inch inside diameter corrugated, ribbed, or smooth walled, semi rigid nonflammable PVC tubing, which meets UL94V-O vertical flame test for general applications.
- C. Plenum-Listed Indoor Innerduct: 1-inch inside diameter corrugated walled innerduct for use in plenum air handling spaces.

2.07 INNERDUCT FITTINGS

- A. Couplings: Metallic or nonmetallic quick-connect, reverse threaded and Schedule 40 couplings for connecting sections of installed innerduct.
- B. Conduit Plugs: Compression-type conduit plugs with locking nuts for sealing and securing the outside walls of one or more innerduct ends to the inside wall of 4-inch inside diameter conduits, e.g.:
 - 1. Four 1-inch innerduct configuration.
 - 2. Three 1-1/4-inch innerduct configuration.
- C. Innerduct Caps: Removable push-in caps for plugging 1-inch innerduct.

2.08 WIRE BASKET RUNWAY

- A. Tray sizes have 4-inch side height.
- B. Supply straight sections in standard 120-inches, except where shorter lengths are permitted to facilitate tray assembly lengths as shown on Drawings.
- C. Tray Widths: 12-inches.
- D. Make splice plates the fast splice type as indicated below for each tray type.
 - 1. Make splice plates of yellow zinc dichromate steel.
 - 2. Furnish splice plates with straight sections and fittings as required by manufacturer.
 - 3. Finish: Electro zinc.
- E. Wire Basket Runway Supports: Trapeze style supports.
- F. Materials and Finish: Continuous steel welded and formed wire mesh, electro zinc finish.

- G. Loading Capacities: Wire basket runways to meet NEMA Class Designations.
- H. Manufacturers: Subject to compliance with these Specifications, install wire basket runway.

2.09 J-HOOKS

- A. Constructed of galvanized steel, stainless steel or hot dipped zinc.
- B. Wires or all-thread supports mounted to structure.

PART 3 - EXECUTION

3.01 GENERAL INSTALLATION REQUIREMENTS

- A. Workmanship:
 - 1. Provide, condition, apply, install, connect and test manufactured products, materials, equipment and components in accordance with the manufacturer's specifications and printed instructions.
 - 2. The installation of system components to be carried out under the direction of qualified personnel. Appearance to be considered as important as mechanical and electrical efficiency. Workmanship to meet or exceed industry standards.
 - 3. Place support for raceways, cable trays, backboards, equipment racks and cabinets.
- B. Protection During Construction: Protect products from the effects of moisture, corrosion and physical damage during construction. Except during installation activity in a section, keep openings in conduit, tubing and wireway capped with manufactured seals during construction.
- C. Concrete Sleeves: Conduits routed perpendicular through floors, walls, or other concrete structures to pass through cast-in-place conduit sleeve openings wherever possible, or appropriate size holes to be bored to accommodate the installation of conduit sleeves. The size and location of the holes to not impair the structure's integrity.
 - 1. Concrete Boring: Bore a hole in the concrete with a diameter of 1/2 to 1-inch larger than the conduit sleeve to be installed. Grout around the conduit sleeve and finish to match existing surroundings.
 - 2. Conduits that rise vertically through a slab to be stubbed 6-inches above the floor and capped pending future use.
- D. Drywall/Gypsum Board Sleeves: Install insulating throat bushings on both ends of conduit sleeves placed in fire-rated walls using drywall construction.
- E. Where conduit enters a structure through a concrete roof or membrane waterproofed wall or floor:

1. Provide a watertight seal.
 2. With Concrete Encasement: Install watertight entrance seal device on the accessible side.
 3. Securely anchor malleable iron body of watertight entrance seal device into construction with one or more integral flanges.
 4. Secure membrane waterproofing to watertight entrance seal device in a permanent, watertight manner.
- F. Provide continuous sleeving through walls, floors and ceilings separating each telecom outlet from its respective MER/TR room, using sleeve conduit size as required per Standards. Restore penetrations through rated assemblies to original fire rating per NFPA and local codes.
- G. Locate sleeves as shown on Drawings. Where sleeves are not shown on Drawings, install sleeves above suspended ceilings and locate to minimize length of pathway for future cable from telecom outlet to MER/TR rooms.
- H. Where sleeves are routed between rooms with floating ceilings, extend conduits horizontally 2-feet over edge of floating ceiling to avoid exposed cabling from being seen at floor level.
- I. Make floor penetrations no more than 4-inches from wall. Install conduit stubs to extend 4-inches from floor base. Cap conduits for protection.
- J. Provide removable heat-expanding pillows at fire barrier penetrations as specified in Firestopping section and described as Firestop Material Type 7 (indicated as FSM-7).
- K. Grounding: Provide ground connections and bonding continuity between raceway and wire basket runway sections, boxes, enclosures, cabinets and fittings as required per code and industry standard.
- L. Provide plenum rated products, components and accessories for installation in plenums.

3.02 ELECTRICAL METALLIC TUBING AND FITTINGS

- A. Reference 3.01, General Installation Requirements.
- B. Install per manufacturer's written instructions and recommendations.
- C. Minimum Backbone Conduit Requirements: Install two 4-inch conduits from MER to each TR, unless otherwise noted on Drawings.
- D. Conduit Type:
1. Install the following types of circular communications raceway in the locations listed unless otherwise indicated on the Drawings.
 - a. Interior Dry Locations, Exposed: EMT with set screw fittings.
 - b. Interior Dry Locations, Concealed (Not Embedded in Concrete):

EMT with set screw fittings.

c. Interior Wet Locations: EMT with compression fittings.

E. Conduit Bends and Sweeps:

1. Make changes in direction of communications conduit runs with sweeps of the longest possible radius.
2. Make sweeps in parallel or banked runs of conduits, 2-inches and larger in diameter, from the same center or centerline so that sweeps are parallel and of neat appearance.
3. Field-Made Bends and Sweeps:
 - a. Use an acceptable hickey or conduit-bending machine.
 - b. Do not heat metal raceways to facilitate bending.
 - c. Before installing 4-inch field-made sweeps in duct banks, pull a 3-1/2-inch diameter by 12-inch long mandrel through duct sections to verify circularity and sweep radius.
4. The angular sum of the bends between pull points and/or pull boxes to not exceed 180 degrees.
5. Minimum Inside Bend Radius for Communications Conduit Bends, Sweeps, Boxes and Fittings:
 - a. One-inch conduit, 11-inches
 - b. Two-inch conduit, 21-inches
 - c. Three-inch conduit, 36-inches
 - d. Four-inch conduit, 48-inches
 - e. Other sizes, 10 times the inside diameter of the conduit.
6. Do not install boxes, bends, elbows, tees, conduit bodies and other conduit fittings, which do not provide for the minimum inside cable bend radius specified in paragraph E above.
 - a. Conduit Bodies: In-line straight-through Type C conduit fittings can be used as pull boxes for conduit up to a maximum of 2-inches ID. Other conduit fittings, which include direction changes such as E, L, LB, LR, LL, LRT, TA, TB and X, are not allowed.
 - b. Refer design or installation conflicts with these requirements to the Architect.

3.03 CONDUIT ACCESSORIES

- A. Reference 3.01, General Installation Requirements.
- B. Install per manufacturer's written instructions and recommendations.
- C. Duct Spacers: Install per manufacturer's recommendation.

- D. Expansion/Deflection Fittings: Install per manufacturer's recommendation.
- E. Pulltape: Install per manufacturer's recommendation.
- F. Duct Plugs: Install per manufacturer's recommendation.

3.04 PENETRATION SEALING SYSTEMS

- A. Reference 3.01, General Installation Requirements.
- B. Install per manufacturer's written instructions and recommendations.
- C. Seal conduit entering structures at the first box or outlet to prevent the entrance of gases, liquids, or rodents into the structure.
 - 1. Empty Conduits: Removable screwtight duct plugs.
 - 2. Innerduct Installed: Suitable duct water seal between conduit and innerduct. Manufactured seals in empty innerduct.
 - 3. Cable Installed: Suitable duct water seal between conduit and cable, or between innerduct and cable.

3.05 TELECOMMUNICATIONS OUTLET BOXES

- A. Reference 3.01, General Installation Requirements.
- B. Install per manufacturer's written instructions and recommendations.
- C. Provide 4-inch by 4-inch by 2-1/8-inch deep outlet boxes for mounting telecommunications outlets with single-gang plaster rings as required, or as indicated on the Drawings.
- D. Do not install outlet boxes back to back in walls. Provide minimum 6-inch separation, except provide minimum 24-inch separation in acoustic-rated walls.
- E. Locate outlet boxes in masonry walls to require cutting of masonry unit corner only. Coordinate masonry cutting to achieve neat openings for outlet boxes. Use boxes with sufficient depth to permit conduit hubs to be located in masonry void spaces.
- F. Provide knockout closures for unused openings.
- G. Support telecommunications outlet boxes independently of conduit.
- H. Use multiple-gang boxes where more than one device is mounted together; do not use sectional outlet boxes.
- I. Install outlet boxes in walls without damaging wall insulation.
- J. Coordinate mounting heights and locations of outlet boxes mounted above counters, benches and backsplashes.
- K. Provide recessed outlet boxes in finished areas; secure boxes to interior wall and partition studs, accurately positioning to allow for surface finish thickness. Use stamped steel stud bridges for flush

outlet boxes in hollow stud wall.

- L. Provide cast outlet boxes in exterior and wet locations.

3.06 INNERDUCT

- A. Reference 3.01, General Installation Requirements.
- B. Install per manufacturer's written instructions and recommendations.
- C. Innerduct Type:
 - 1. Underslab and Underground Conduit Installation: Outdoor innerduct.
 - 2. Aboveground and Interior Conduit Installations: Indoor innerduct.
 - 3. Interior Exposed Locations Including Cable Tray Installations:
 - a. Nonplenum Areas: Indoor innerduct.
 - b. Plenum Areas: Plenum-listed innerduct.
- D. Provide innerduct for all fiber optic cables for the entire length of the cable run.
- E. Pull innerduct through conduit or place innerduct in cable trays using continuous unspliced lengths of innerduct between pull boxes and/or section termination points as indicated on the Drawings.
- F. Cut innerduct square. Deburr cut ends.
- G. Bring innerduct to the shoulder of fittings and couplings and fasten securely.
- H. Wipe innerduct and fittings clean and dry before joining. Apply full, even coat of cement to entire area that will be inserted into fitting. Let joint cure for 20 minutes minimum.
- I. Provide suitable innerduct slack in pull boxes and at turns to ensure that there is no kinking or binding of the tubing.
- J. Make changes in direction of communications innerduct runs with sweeps of the longest possible radius and at least 10 times the inside diameter of the innerduct.
- K. During innerduct pulling, avoid excessive tension which can damage the innerduct. Inspect innerduct following placement and replace damaged sections.
- L. Indoor Conduit Installation:
 - 1. Arrange innerduct neatly, cut to proper length and remove surplus. Provide trained and bundled innerduct pigtails extending at least 18-inches beyond exposed conduit openings.
 - 2. At locations where the ends of innerduct sections appear in a pull box, join the pulltape and then splice innerduct sections together using couplers which do not reduce the inside diameter of the innerduct.
- M. Cable Tray Installation: Tie wrap innerduct to one side of vertical

ladder rack every 2-feet minimum and to one side of horizontal ladder-type cable tray every 5-feet minimum.

- N. Following installation, visually inspect innerduct, remove burrs at openings and, if necessary, clean innerduct interior.
- O. Innerduct Pull Tape and Duct Plug Installation:
 - 1. Following innerduct installation, install pulltape (muletape) with preprinted foot markers in innerduct sections. Tie the pulltape securely at each end.
 - 2. Verify lengths at the time of installation and provide as-built documentation.
 - 3. Following innerduct and pulltape installation, cap or plug innerduct with manufactured seals to prevent moisture or foreign matter from entering until cable installation starts. Seal duct openings in underground or underslab innerduct sections immediately after installation using screwtight, removable, watertight and dust-tight duct plugs.

3.07 INNERDUCT FITTINGS

- A. Reference 3.01, General Installation Requirements.
- B. Install per manufacturer's written instructions and recommendations.
- C. Wipe fittings clean and dry before joining. Apply full, even coat of cement to entire area that will be inserted into the fitting. Allow joints/assembly to cure for 20 minutes, minimum.
- D. Install per manufacturer's recommendations.

3.08 WIRE BASKET RUNWAY

- A. Reference 3.01, General Installation Requirements.
- B. Install per manufacturer's written instructions and recommendations.
- C. Cut standard straight sections of materials to length in the field.
- D. Deburr and file rough edges and cut sections.
- E. Locations shown on the Drawings are approximate unless dimensioned.
- F. Install as shown on the Drawings and securely attach under the provisions of this section.
- G. Entire length of wire basket runway to be accessible.
- H. Maintain minimum 6-inch clearance between cable tray and piping. Locate a minimum of 12-inches away from heat sources such as parallel runs of flues, steam or hot water pipes and heating appliances.
- I. Run exposed and concealed cable tray parallel or perpendicular to walls, structural members, or intersections of vertical planes to maintain headroom and provide a neat appearance.

- J. Do not obstruct passageways.
- K. Route wire basket runway within the assigned communications utility space.
- L. Install appropriate cable tray bends, dropouts and other accessories to protect minimum cable bend radius and provide adequate support at locations where cable direction changes occur.
- M. Cable tray to be installed a minimum of 12-inches above the accessible ceiling.

3.09 J-HOOKS

- A. Install J-hooks rated for Category 6A cable for support of cabling from the wire basket tray to the outlet location.
- B. J-hooks are to be installed on dedicated wires or all thread rods mounted to structure. J-hooks are not to attach to ceiling grid wires.

END OF SECTION

SECTION 27 15 00
COMMUNICATIONS HORIZONTAL CABLING

PART 1 - GENERAL

1.01 SUMMARY

- A. Work Included:
 - 1. Station Cabling
 - 2. Modular Jacks
 - 3. Work Area Outlets
 - 4. Patch Panels
 - 5. Patch Cords

1.02 RELATED SECTIONS

- A. Contents of Division 27, Communications and Division 01, General Requirements apply to this Section.
- B. Use this Section in conjunction with other Division 27, Communications specifications and related Contract Documents to establish the total general requirements for the project communications systems and equipment.

1.03 REFERENCES AND STANDARDS

- A. References and Standards as required by Section 27 00 00, Communications Basic Requirements and Division 01, General Requirements.
- B. Meet requirements of NFPA 780, Standard for the Installation of Lightning Protection Systems.

1.04 SUBMITTALS

- A. Submittals as required by Section 27 00 00, Communications Basic Requirements and Division 01, General Requirements.
- B. In addition, provide:
 - 1. Procedures for cable labeling and identification, long term documentation methods and numbering scheme in accordance with ANSI/TIA/EIA-606A.
 - 2. A copy of certified installer certificates and warranty certificates for products proposed.

1.05 QUALITY ASSURANCE

- A. Quality assurance as required by Section 27 00 00, Communications

Basic Requirements and Division 01, General Requirements.

- B. Manufacturers to have a recognized certified installer program in place for system components proposed. Cable will be approved with manufacturer system installed.

1.06 WARRANTY

- A. Warranty of materials and workmanship as required by Section 27 00 00, Communications Basic Requirements and Division 01, General Requirements.
- B. In addition, provide:
 - 1. Labor, materials and documentation according to selected manufacturer requirements necessary to ensure that the Owner will be furnished with an Extended Product Warranty and Application Assurance of a minimum of 20 years in length. The Application Assurance Warranty will cover the failure of the wiring system to support

current or future applications that are designed for the link/channel specifications of ANSI/TIA/EIA-568-C.1. These applications include, but are not limited to, 10BASE-T, 100BASE-T, 1000BASE-T, 10GBASE-T and 155 Mb/s ATM.
 - 2. A warranty on the physical installation.
 - 3. Necessary documentation required by the manufacturer immediately following 100 percent testing of cables.
- C. Administer the warranty process with the responsible manufacturer's representative. Provide warranty directly to the Owner from the manufacturer. Ensure that the manufacturer provides the Owner with the appropriate warranty certification within 90 calendar days of the final project completion.

1.07 SYSTEM DESCRIPTION

- A. Provide a standards-based cable system to serve horizontal communication systems requirements as specified and as shown on Drawings. Closely follow ANSI/TIA/EIA, IEEE and ISO standards.
- B. The horizontal distribution subsystem refers to intrabuilding twisted-pair communications cabling connecting telecommunications rooms (TRs) to telecommunications outlets (TOs) located at individual work areas and consists of the following:
 - 1. Category 6 cable for work area outlets and Category 6A for wireless outlets and camera outlets.
 - 2. The horizontal system includes cables, jacks, patch panels and patch cords, as well as the necessary support systems, such as cable managers and faceplates.

3. Cables are routed through conduit, spaces below raised floors, open ceiling areas, non-ventilated spaces above ceiling tile and through plenum air-handling spaces above ceiling tile.
4. Furnish and install materials necessary for a complete and working system.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

- A. Station Cabling:
 1. Category 6A: CommScope UN874035114/10.
 2. Category 6: CommScope UN874049914/10.
- B. Modular Jacks:
 1. Category 6A: CommScope USL10G-XXX.
 2. Category 6: CommScope USL600-XXX.
- C. Work Area Outlets: CommScope.
- D. Patch Panels: CommScope CPP-UDDM-SL-2U-48.
- E. Patch Cords: CommScope.

2.02 STATION CABLING

- A. Category 6A Unshielded Twisted Pair:
 1. 100 ohm, Category 6A, 23 AWG, 4-pair unshielded twisted pair, CMP rated jacket, color blue.
 2. 100 ohm, Category 6A, 23 AWG, 4-pair unshielded twisted pair, CMR rated jacket, color blue.
- B. Category 6 Unshielded Twisted Pair:
 1. 100 ohm, Category 6, 23 AWG, 4-pair unshielded twisted pair, CMP rated jacket, color blue.
 2. 100 ohm, Category 6, 23 AWG, 4-pair unshielded twisted pair, CMR rated jacket, color blue.
 3. 100 ohm, Category 6, 23 AWG, 4-pair unshielded twisted pair, Indoor/Outdoor rated, color black.

2.03 MODULAR JACKS

- A. Category 6A Modular Jacks:
 1. Eight-position modular jack, Category 6A, IDC terminals, T568A/B wiring scheme

2. Each jack must be stamped or have icons to identify it as CAT 6A.
3. Provide Jacks in the following colors:
 - a. Green: Data
 - b. White: Voice
 - c. Orange: Wireless Access Points
 - d. Yellow: Cameras
 - e. Yellow: Clock / Speakers

B. Category 6 Modular Jacks:

1. Eight-position modular jack, Category 6, IDC terminals, T568A/B wiring scheme
2. Each jack must be stamped or have icons to identify it as CAT 6.
3. Provide jacks in the following colors:
 - a. Green: Data
 - b. White: Voice
 - c. Orange: Wireless Access Points
 - d. Yellow: Cameras
 - e. Yellow: Clock / Speakers

2.04 WORK AREA OUTLETS

A. Flush Mounted Faceplate:

1. One-port faceplate with mounting lugs for wall phone, constructed from high impact thermo-plastic, mounts within a single-gang wall box.
2. Four-port faceplate, constructed from high impact thermo-plastic, with recessed label fields; mounts within a single-gang wall box as indicated on the drawings.
3. Coordinate faceplate color with building finishes. Submit to Architect for approval prior to installation. Stainless steel faceplates for items at below counter height and all LFD outlets and jacks. Thermoplastic faceplates for all outlets above counter and ceiling mounted outlets.

B. Flush Mounted Stainless Steel Faceplates:

1. Four-port stainless steel faceplate, with recessed label fields; mounts within a single gang wall box as indicated on the drawings.

- C. Dust Covers: Single port dust cover for modular openings, color to match faceplate.

2.05 PATCH PANELS

- A. Universal Patch Panels: 19-inch rack-mounted panel capable of accepting up to 48 modular jacks.

2.06 PATCH CORDS

- A. Category 6A Modular Patch Cords:
 - 1. Factory terminated double ended, eight-position to eight-position, modular, stranded conductors, 4 pair. 3-feet and 5-feet.
 - 2. Colors to be as follows:
 - a. Green: Data user/data user with VoIP phone
 - b. Blue: Phone without connected device
 - c. White: Phone over IP Infrastructure
 - d. Purple: Servers
 - e. Black: HVAC Endpoints
 - f. Red or Pink: Crossover
 - g. Orange: Wireless Access Points / UPS / Network Management
 - h. Yellow: Security / Video Surveillance Cameras
 - i. Yellow: Clock / Speakers
- B. Category 6 Modular Patch Cords:
 - 1. Factory terminated double ended, eight-position to eight-position, modular, stranded conductors, 4 pair. 3-feet and 5-feet.
 - 2. Colors to be as follows:
 - a. Green: Data user/data user with VoIP phone
 - b. Blue: Phone without connected device
 - c. White: Phone over IP Infrastructure
 - d. Purple: Servers
 - e. Black: HVAC Endpoints
 - f. Red or Pink: Crossover
 - g. Orange: Wireless Access Points / UPS / Network Management
 - h. Yellow: Security / Video Surveillance Cameras
 - i. Yellow: Clock / Speakers

PART 3 - EXECUTION

3.01 GENERAL INSTALLATION REQUIREMENTS

- A. Miscellaneous Hardware: Provide supporting hardware, cable ties, labels, pull rope and other miscellaneous hardware for a complete and operable system.
- B. Provide like items from one manufacturer, such as jacks, patch panels, equipment connection cords and wall plates.
- C. Horizontal cabling includes cables, jacks, patch panels and patch cords, as well as the necessary support systems, such as cable managers and faceplates.
- D. Furnish and install materials necessary for a complete and working system.
- E. Contractor must be a Certified Installer for selected manufacturer prior to, during and through completion of the system installation and must be able to provide the manufacturer's extended warranty.
- F. Perform work in a neat and workmanlike manner.
- G. Install cable after interior of building has been physically protected from the weather and mechanical work likely to damage cabling has been completed.
- H. Before installing cabling, ensure cable pathways are completely and thoroughly cleaned.
 - 1. Inspect conduit, wireway, cable trays and innerduct systems prior to installation.
 - 2. Swab any additional enclosed raceway and innerduct systems.
- I. Provide protection for exposed cables where subject to damage. Provide abrasion protection for any cable or wire bundles, which pass through holes or across edges of sheet metal.
- J. Install cable ties and other cable management clamps via hand so it fits snugly. Do not over tighten or use mechanical tools which could compress, crimp, or otherwise change the physical characteristics of the cable jacket or distort the placement of twisted-pair components. Replace any cable exhibiting stresses due to over tightening of cable management devices.
- K. Where possible, route cables in overhead cable trays and inside wire management systems attached to the equipment cabinets and racks. Use Velcro ties or ducts to restrain cabling installed outside of wire management systems on racks or in cabinets.
- L. Co-install a pull cord (nylon; 1/8-inch minimum) with cable installed in conduit.
- M. Limit cable raceway fill to less than the TIA/EIA-569-B maximum fill for

the particular raceway type.

- N. If a J-hook or trapeze system is used to support cable bundles, support horizontal cables at a maximum of 48- to 60-inch intervals. Cables are prohibited to rest on acoustic ceiling grids or panels.
- O. Bundle horizontal distribution cables in groups of no more than 50 cables. Cable bundle quantities in excess of 50 cables may cause deformation of the bottom cables within the bundle and degrade cable performance.
- P. Install cable above fire-sprinkler systems and ensure that the cable does not attach to the system or any ancillary equipment or hardware. Install cable system and support hardware such that it does not obscure any valves, fire alarm conduit, boxes, or other control devices.
- Q. Do not attach cables to ceiling grid or lighting fixture wires. Where support for horizontal cable is required, install appropriate carriers to support the cabling.
- R. Any cable damaged or exceeding recommended installation parameters during installation will be replaced by the contractor prior to final acceptance at no cost to the Owner.
- S. Determine requirements for plenum rated cable and devices. When in doubt, seek determination in writing by Authority Having Jurisdiction (AHJ) prior to ordering. Without written confirmation from the AHJ, Contractor to assume that a plenum rating is required.
- T. Unshielded Twisted Pair Cable Installation Practices:
 - 1. Install cable in accordance with manufacturer's recommendations and best industry practices.
 - 2. Install cables in continuous lengths from origin to destination (no splices).
 - 3. Do not exceed the cable's minimum bend radius and maximum pulling tension.
 - 4. Install unshielded twisted pair cable so that there are no bends smaller than four times the cable outside diameter at any point in the run and at the termination field.
 - 5. Do not exceed 25-lbf pulling tension on 4-pair UTP cable.
- U. Provide the following minimum separation distances between pathways for copper communications cables and power wiring of 480 volts or less:
 - 1. Open or Nonmetal Communications Pathways:
 - a. 12-inches from electric motors, fluorescent light fixtures and unshielded power lines carrying up to 3 kVA.

- b. 36-inches from electrical equipment and unshielded power lines carrying more than 5 kVA.
 - c. 48-inches from large electrical motors or transformers.
 - 2. Grounded Metal Conduit Communications Pathways:
 - a. 2-1/2-inches from electrical equipment and unshielded power lines carrying up to 2 kVA.
 - b. 6-inches from electrical equipment and unshielded power lines carrying from 2 kVA to 5 kVA.
 - c. 12-inches from electrical equipment and unshielded power lines carrying more than 5 kVA.
 - d. 3-inches from power lines enclosed in a grounded metal conduit (or equivalent shielding) carrying from 2 kVA to 5 kVA.
 - e. 6-inches from power lines enclosed in a grounded metal conduit (or equivalent shielding) carrying more than 5 kVA.
- V. Unshielded Twisted Pair Termination:
 - 1. Coil cables in the in-wall or surface-mount boxes if adequate space is present to house the cable coil without exceeding the manufacturers bend radius. In hollow wall

installations where box-eliminators are used, excess wire can be stored in the wall. Do not store more than 12-inches of UTP in an in-wall box, modular furniture raceway, or insulated walls. Loosely coil and store excess slack in accessible ceiling space above each drop location when there is not enough space present in the outlet box to store slack cable.
 - 2. Dress and terminate cables in accordance with the recommendations made in the ANSI/TIA/EIA-568-C.1 document.
 - 3. Terminate four pair cables on the jack and patch panels using T568B wiring scheme.
 - 4. Maintain the cable jacket within 1-inch of the termination point.
 - 5. Do not exceed 0.5-inch of pair untwist at the termination point.
 - 6. Do not exceed four times the outside diameter of the cable in the termination area for bend radiance compliance.
 - 7. Neatly bundle and dress cables to their respective panels or blocks. Feed each panel or block by an individual bundle separated and dressed back to the point of cable entrance into the rack or frame.
- W. Testing Procedures:

1. Test cables and termination hardware for defects in installation and to verify cabling system performance under installed conditions according to the requirements of ANSI/TIA/EIA-568-C. Verify pairs of each installed cable prior to system acceptance. Repair or replace any defect in the cabling system installation including but not limited to cable, connectors, feed through couplers, patch panels and connector blocks in order to ensure 100 percent useable conductors in cables installed.
2. Test cables in accordance with this document, the ANSI/TIA/EIA standards, the manufacturer's procedures and best industry practice. If any of these are in conflict, bring any discrepancies to the attention of the project team for clarification and resolution.
3. Test Unshielded Twisted Pair Cables as Follows:
 - a. Test twisted-pair copper cable links for continuity, pair reversals, shorts, opens and performance as indicated below. Additional testing is required to verify Category performance. Test horizontal cabling using a Level IV test unit for Category 6A and Category 6 performance compliance as specified in ANSI/TIA/EIA-568 C.
 - b. Continuity: Test each pair of each installed cable using a test unit that shows opens, shorts, polarity and pair-reversals, crossed pairs and split pairs. Test shielded/screened cables with a device that verifies shield continuity in addition to the above stated tests. Record the test as pass/fail as indicated by the test unit in accordance with the manufacturers' recommended procedures and referenced to the appropriate cable identification number and circuit or pair number. Correct or repair any faults in the wiring and retest the cable prior to final acceptance.
 - c. Length: Test each installed cable link for installed length using a TDR type device. Test the cables from patch panel to patch panel, block to block, patch panel to outlet or block to outlet as appropriate. The cable length will conform to the maximum distances set forth in the ANSI/TIA/EIA-568-C Standard. Record cable lengths, referencing the cable identification number and circuit or pair number. For multipair cables, record the shortest pair length as the length for the cable.
4. Follow the Standards requirements established in ANSI/TIA/EIA-568-C.
5. Perform testing with a Level IV tester. The basic tests required are:
 - a. Wire Map
 - b. Length
 - c. Attenuation

- d. NEXT (Near-end Crosstalk)
- e. Return Loss
- f. ELFEXT Loss
- g. Propagation Delay
- h. Delay Skew
- i. PSNEXT (Power Sum Near-end Crosstalk Loss)
- j. PSELFEXT (Power Sum Equal Level Far-end Crosstalk Loss)
- 6. Provide test results in electronic format, with the following minimum information per cable:
 - a. Circuit ID
 - b. Test Result, "Pass" or "Fail"
 - c. Date and Time of Test
 - d. Project Name
- 7. Provide an electronic copy of the test results, in the native tester software format, to the Architect along with the printed test results.
- 8. Provide a fully functional version of the tester software for use by the Architect in reviewing the test results.
- X. Labeling:
 - 1. Label horizontal cables using a machine printed label at each end of the cable at approximately 6-inches of the termination point. Do not use handwritten labels.
 - 2. Label patch panel ports and TO ports with the cable identifier.
 - 3. Labels to be Telecom Room number, patch panel number and patch panel port number. Provide the final cable ID matrix to the Architect for approval one week prior to cable installation.
 - 4. Note labeling information at each outlet on the record drawings.
- Y. Coordination of Conditions: Structured cabling for wireless access points of a given description may be used in more than one type of ceiling or wall structure. Coordinate ceiling construction, wall types, recessing depth and other construction details prior to ordering special components indicated in the details for shipment. Where materials supplied do not match ceiling construction replace them at no cost to Owner.

3.02 STATION CABLING

- A. Reference 3.01, General Installation Requirements.
- B. Install per manufacturer's instructions and recommendations.

3.03 MODULAR JACKS

- A. Reference 3.01, General Installation Requirements.
- B. Install per manufacturer's instructions and recommendations.

3.04 WORK AREA OUTLETS

- A. Reference 3.01, General Installation Requirements.
- B. Install per manufacturer's instructions and recommendations.

3.05 PATCH PANELS

- A. Reference 3.01, General Installation Requirements.
- B. Install per manufacturer's instructions and recommendations.

3.06 PATCH CORDS

- A. Field terminated patch cords and jumpers are not allowed. At a minimum, provide equipment connection cords for one-half the total number of cables installed at each termination point. For example: A telecommunications outlet with four Category 6 cables installed would require two Category 6 equipment connection cords at the work area outlet and two Category 6 equipment connection cords in the telecommunications equipment room for a total of four Category 6 equipment connection cords.

END OF SECTION