

## **SECTION 270501 - BASIC MATERIALS & METHODS**

### **PART 1 - GENERAL**

#### **1.1 SUMMARY**

- A. Section Includes: Requirements applicable to work of this Division.
  - 1. Basic materials, methods and installation guidelines applicable to the installation of all communication systems.

#### **1.2 QUALITY ASSURANCE**

- A. Explosives
  - 1. Use of explosives at the project site shall not be permitted.
- B. Welding
  - 1. Welding at the project site, where necessary, shall be performed only by persons licensed to perform such work at the project site(s). Welding shall require a permit and the approval of the Owner's Representative. Request for permission to perform onsite welding shall be submitted in writing through designated project channels.

### **PART 2 - PRODUCTS**

#### **2.1 CABLE BUNDLING HARDWARE**

- A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
  - 1. Hellermann Tyton.
  - 2. Millepede, Inc.
  - 3. Panduit.
  - 4. Velcro.
- B. General: Provide reusable, adjustable cable straps.
  - 1. Hook and Loop Fastener:
    - a. Shall be utilized within all cabinets and racks and below the ceiling of Telecommunications and Equipment rooms.
    - b. Provide plenum rated ties in plenum environments.
    - c. Minimum cable strap width shall be 3/4-inch.
    - d. Basis of Design: Velcro One-Wrap Qwik Ties.

## **PART 3 - EXECUTION**

### **3.1 COORDINATION**

- A. High Voltage Wiring
  - 1. Review all high voltage provisions for This Contractor's work with the Division 26 electrical contractor. Coordinate specific device termination, loading and circuiting requirements with the electrical contractor.
- B. Coordinate installation of new pathways with parties and the Work that will utilize the pathways, prior to installation.
- C. Review pre-existing pathways prior to installation of the Work, and report to the Designer any discrepancies between specified pre-existing pathway conditions and actual existing pathway conditions.
- D. Participate in coordination efforts through the preparation of shop drawings and details prior to fabrication or installation of any products. Coordinate actual clearance requirements of installed products.
- E. Begin coordination immediately upon award of contract. Coordinate the Work with other parties and adjust equipment locations accordingly. Participate in the preparation of coordination drawings.
- F. Devices and equipment shall be located symmetrical with architectural elements and shall be installed at the heights and locations shown on the Drawings. If a height or location is in question, seek immediate clarification from the Designer.
- G. Evaluate the Contract Documents and existing conditions to gain an understanding of the peculiarities and limitations of the spaces where the Work is to be performed. The final Work shall be accessible for servicing. Although the locations of equipment and conduit may be shown on the Drawings in certain positions, the architectural details and conditions existing on the Project shall guide the Contractor, coordinating the Work with that of others. Provide necessary offsets to provide a neat workmanlike arrangement.
- H. The Drawings are generally diagrammatic and indicate the design intent, required sizes, points of termination and, in some cases, suggested routes of raceways. However, it is not intended that the Drawings indicate fully coordinated routing and placement or necessary offsets.
- I. Refer to each Drawing, including enlarged plans, elevations, sections, and details for additional information that may include dimensions and greater resolution and notes that serve to refine the intent and further assist and guide installation.
- J. Work in harmony with other parties performing work at the project site so as not to cause any delays in pouring concrete or erecting masonry walls. Consult each Contract

Drawing, including those predominately used by other trades, before installing Work so as to ensure that performance of Work will not interfere with or be adversely affected by Work of others.

- K. Attend each regularly scheduled project meeting as well as any special meetings called to coordinate and/or resolve special issues that arise during the course of the Project.
- L. Conflicts in equipment and materials shall be corrected prior to installation. Should there be a conflict with drawings of other trades, work with the other trades to correct the conflict while coordinating the Project (prior to installation). If a conflict cannot be resolved, seek the direction of the Owner's representative. Refer to the drawings used by other trades for details, dimensions and locations of their work and route around their work so as not to conflict. Work installed that creates a conflict shall be removed and readjusted to the satisfaction of the Owner's representative at the Contractor's expense.

### 3.2 INSTALLATION

#### A. General:

1. Cabling installed within open ceilings shall be ran in conduit or fully concealed from view behind the building structure.
2. Work installed in finished areas shall be concealed.
3. Sequence, coordinate, and integrate installations of communications materials and equipment with the work of other trades for efficient flow of the Work.
4. Install systems, materials, and equipment to conform to reviewed submittal data, including coordination drawings.
5. Install systems, materials, and equipment level and plumb, parallel and perpendicular to other building systems and architectural/structural components (prevailing building lines), except as expressly detailed otherwise or required for proper form, function or Designer intended operation. Except where otherwise specified, detailed or directed by the Designer, install visible products level to within 1/8-inches per 100-feet.
6. Install equipment to facilitate servicing, maintenance, and repair or replacement of equipment components. Connect equipment for ease of disconnecting, with minimum of interference with other installations.
7. Install systems, materials, and equipment giving right-of-way priority to systems required to be installed at a specified slope.
8. Protect the structure, furnishings, finishes, and adjacent materials not indicated or scheduled to be removed.
9. Verify dimensions by field measurements. Take measurements and be responsible for exact size and locations of all openings required for the installation of work. Figured dimensions are reasonably accurate and should govern in setting out work. Where detailed method of installation is not indicated or where variations exist between described work and approved practice, direction of the owner's representative on job shall be followed.

10. If during construction it becomes apparent that certain minor changes in layout would result in a neater appearance or better arrangement, such alterations shall be made as part of the Contract. Designer's review shall be obtained before making such changes.
11. Workmanship throughout shall conform to the standards of best practice. Marks, dents or finish scratches shall not be permitted on any exposed materials, fixtures or fittings. Interiors of panels and equipment boxes shall be left clean.

## B. Cabling

1. Use caution not to exceed the manufacturer allowed bending radius for cables and not to compromise the integrity of the cables during installation by pulling cable management devices too tightly, damaging cables. Raceway/cabling bending radii shall be minimum as directed by cable manufacturer. Use pulling compound or lubricant where necessary to ensure cable does not experience tension beyond manufacturer limits during installation. Compounds used shall be compatible with the cable and pathway products and shall not cause deterioration of either.
2. Where indicated, provide color-coded jackets to identify runs of different systems.
  - a. See related specifications and drawings for applicable color coding.
3. Neatly route cables parallel and perpendicular to building architectural lines.
  - a. Cables and cable assemblies shall be run as straight as possible and symmetrical (perpendicular to or parallel with) with architectural items and at a consistent elevation. Work installed diagonal to building members shall not be permitted.
4. Neatly comb out multiple cable bundled runs to remove tangling and crossing of cables within the bundles. Neatly dress all cable work and provide vertical and horizontal cable management (or other approved method) for properly dressing all work at racks, control panels, backboards etc. See detail(s) if applicable.
  - a. To avoid Alien Crosstalk, do not cinch UTP cables into tight bundles.
5. Cable shall be installed within approved pathways. Cables not installed within raceway, cable tray or ladder rack shall be supported by discrete cable supports. Support cables at box and faceplate.
6. All penetrations to walls and floors designed to shall include metal sleeves. All sleeves shall be mechanically secured in place and sealed between the sleeve and structure. Apply firestop to the interior of the sleeve.
7. Loosely bundle cables within racks, ladder racks, cable trays and in discrete cable supports. Utilize reusable cable bundling hardware. Utilize plenum-rated hardware in plenum spaces.
8. Plenum-rated cable ties shall be used wherever wire ties are permitted and wherever plenum rated cable is used.

9. Cable ties shall never be used in a manner that causes deformation of the cable jacket, damage to the cable, or has any adverse effect on the usability, specifications or longevity of the cable(s) on which it is applied.
10. Velcro type wire ties shall be used in non-plenum spaces; in equipment racks; in rack cabinets, and; in related equipment housing enclosures and backboards.

#### C. Cable Support

1. All cables shall be supported/anchored every 5 feet (or less) and within 12" of device boxes, outlets, racks/cabinets and cable tray.
2. Use J-Hook type cable supports for all cables run outside of conduit or cable tray. Bridle rings shall not be used for Communications Technology cables.
  - a. Use separate J-Hook cable support systems for cables belonging to different systems and for cables carrying different operating levels. See Cable Separation guidelines in this section.
3. Loosely secure cables at each J-Hook.
4. Cables shall not be directly or indirectly supported by a suspended ceiling or any other surface, support, material or structure not permissible for this use by all applicable codes and standards.
5. Cable pathway
  - a. Use and positioning
    - 1) Pathway shall be installed to form a reusable pathway system.
    - 2) Totally enclosed raceways (i.e. conduit, wireway, etc.) shall be utilized to span in-accessible or working spaces (i.e. offices, classrooms, etc.).
    - 3) Cable trays and discreet cable supports shall be utilized to support cables.
      - a) To form an open-top reusable pathway
      - b) Shall be used in accessible ceiling cavities and areas not accessible by the public (i.e. mechanical and service areas).
      - c) Shall follow corridors unless specifically noted otherwise.
      - d) Shall provide usable clearances above, below and beside for access space for the re-use of the pathway. Minimum 6" below and beside and 12" above.

#### D. Cable Separation:

1. Low-voltage cables shall be kept as far from electrical cables and equipment as possible. Avoid running low-voltage cables parallel to medium and high-voltage cables. When parallel runs cannot be avoided, keep low-voltage cables at least 24 inches away and cross cables at 90 degrees to minimize the risk of interference
2. Low-voltage cables shall not be permitted in the same conduit with high-voltage electrical cables.

3. Avoid running low-voltage cables any closer than 24 inches to any ballast type lighting fixture or other high RF energy producing device.
4. Cables for each system shall be installed separately and isolated from cables from other systems.
5. Cables carrying signals of different types and different nominal operating levels shall be kept separated to reduce the risk of undesirable interference and cross-talk between cables.
  - a. As a general rule, for each 25dBV difference in nominal operating level between cables, provide at least 6 inches of separation. Example 1: Cables with a 75dBV level difference between them shall be separated by 18 inches or greater. Example 2: Cables with a 13dBV difference between them shall be separated by 3 inches or greater.
  - b. Contractor shall provide additional separation to prevent and to remedy any crosstalk that adversely affects the performance and usability of the system, or that exceeds specific crosstalk performance guidelines defined elsewhere in these specifications.
  - c. Provide greater separation than this guideline where the contractor believes and/or determines it is necessary to prevent or remedy interference between cables.
6. Keep length of parallel runs to a minimum. Cross cables of different nominal levels at 90 degrees.
7. In common areas where cables from multiple systems are run in general proximity to one another, cables from each system shall be labeled to identify the system the cables serve.
8. Additional pathway devices/systems shall be provided as required to comply with cable separation requirements, including, but not limited to, conduits, sleeves, discrete pathway devices and cable tray.

E. Cable Splices:

1. Splices shall not be permitted in any cable except where expressly specified and/or approved by the Designer.
2. In cases where splices are specified and/or otherwise reviewed and permitted, splices shall be made within UL listed junction or device boxes. Open air connections shall not be permitted.

F. Cable Terminations:

1. Termination types shall correctly match cable and device termination. As an illustration, if “spade lug” type of termination is appropriate, then the spade lug cable entry size shall match the cable used. The spade lug shall also have the correct stud size to match the terminal to which it is connected. Terminations shall be completed with tools designed and sized for the specific application and connector.

2. Where field installed cables connect to manufactured products via pig-tails or connectorized cable assemblies, terminations shall be made within the product enclosure or within a UL approved box. Exposed and open air splices shall not be permitted.

G. Strain Relief:

1. Permanently installed cables shall be properly secured with an approved device. Strain relief shall be applied typically within 6 inches from the point of entry into a product enclosure, junction box, pull box, or device box. When properly applied, the strain relief device shall not damage the cable being secured and shall not permit movement of the cable in any way that may adversely affect the long-term integrity of nearby connections.

H. Identification:

1. General:

- a. Identification shall be in English, except as otherwise noted.
- b. Where identification is applied to surfaces that require a finish, install identification after the surface finish is applied.
- c. Labeling products, color, sizes, nomenclature and location of the identification product are subject to the review of the Designer.

2. Cables:

- a. Each cable shall be uniquely labeled at each end.
- b. Labels shall be permanent and feature computer generated type-written text.
- c. Label text shall be bold-type and clearly readable by a person with average sight, and under the lighting conditions typical within the area of installation.
- d. Labels shall be applied approximately 4-6 cable-inches from the point of termination.
  - 1) Adjust application to make legible during service/maintenance of system.
- e. Systems cables installed for "Future Use" shall be clearly identified as such at both ends. Such cables shall be labeled to identify where the opposite end of the cable can be found.
  - 1) Not applicable for Structured Cabling for voice/data connectivity.
- f. Each cable installed shall be recorded on the as-built drawings.

3. Boxes:

- a. Junction boxes and pull boxes shall be labeled on their interior and on their exterior covers with the identity of the system(s) the box serves along with the function of the box. Interior markings shall be made using permanent

marker. Permanent marker may also be used on the cover of boxes installed in concealed areas (above accessible ceilings, for example). Exposed boxes shall be labeled with engraved plastic labels. Labels shall closely match the color of the box.

- b. Device boxes, when first installed, shall be identified on its interior as to the system(s) served and the device(s) the box will contain.
    - 1) Where conduit feeding the device box is concealed, label the exterior of the conduit with permanent marker.
4. Equipment Racks, Cabinets, Enclosures:
    - a. Equipment racks and enclosures shall be labeled.
    - b. The nomenclature, color, size, installed location, and type of labels are subject to the Designer's review.
  5. System Equipment:
    - a. Each individual instance of system equipment shall be labeled.
    - b. Front panel controls of equipment shall be labeled with nomenclature meaningful to the end user based on the intended use of the equipment in the system. Examples include, but are not limited to:
      - 1) Label router/matrix control panels with system specific input/output names.
      - 2) Label patch panels with meaningful input/output destination names.
      - 3) Label mixer input and output controls to identify the signal source and destination.
    - c. Professionally prepared, installed and readily visible "cheat sheets" may be acceptable under select circumstances with the approval of the Designer.
    - d. The nomenclature, color, size, installed location, and type of labels are subject to the Designer's review and approval.
- I. High Voltage Cabling (greater than 70.7 Volts):
    1. Cabling that carries voltages higher than 70.7 Volts RMS AC or DC shall be installed and terminated by persons licensed to perform such work.
  - J. Plates and Panels:
    1. Box covers and faceplates shall be installed flush against the surface over which it is mounted. There shall be no visible gap between the backside of a plate/panel and the wall, ceiling or floor; there shall be no visible gap between the backside of plate/panel and a surface mount box to which the plate/panel mounts). Advanced craftsmanship and construction techniques shall be employed where necessary to achieve this.
      - a. The same shall apply to other wall and ceiling mounted products.



2. Plates and panels shall be installed with all screw holes filled and fastened securely.

K. Device Boxes, Pull-Boxes, Junction Boxes:

1. Boxes installed in walls and ceilings shall be installed so that the box does not stand proud (protrude out beyond) of the finished surface. Boxes shall be installed such that when the mounted devices and cover plates are installed, the backside of the cover plate rests flush with the finished surface of the wall or ceiling. Advanced craftsmanship and construction techniques shall be employed where necessary to achieve this.

### **3.3 GROUNDING**

- A. Equipment shall be properly bonded to ground for the safety of personnel and property and as additionally necessary to satisfactory performance of the equipment.
- B. Comply with Section "Grounding and Bonding for Communications."

### **3.4 CUTTING, PATCHING AND SEALING**

A. General:

1. Perform cutting as required for the execution of the Work. Unless directed otherwise in the field, provide related patching and painting to match surrounding methods, materials and colors. Any damage caused during the progress of Work shall be remediated. Perform cutting, fitting, and patching and materials as required to:
  - a. Uncover Work to provide for installation of ill-timed Work.
  - b. Remove and replace defective Work.
  - c. Remove and replace Work not conforming to requirements of the Contract Documents.
  - d. Remove samples of installed Work as specified for testing.
  - e. Install equipment and materials within existing structures.
2. Upon written instructions from the Owner's representative, uncover and restore Work to provide for observation of concealed Work by Owner's representative or by inspection by the Authority Having Jurisdiction.
3. During cutting and patching operations, protect adjacent installations (e.g., structure, finishes, and furnishings). Where applicable, provide and maintain temporary partitions or dust barriers adequate to prevent the spread of dust and dirt to system components and components of other trades.
4. Patch surfaces and building components using new materials matching existing materials and using experienced Installers. Refer to Division 01 for definition of experienced "Installer" or determine qualifications as directed in the field by the Owner's representative.

5. Patching through fire rated walls and enclosures shall not diminish the rating of that wall or enclosure. Materials used for patching shall be installed to meet or exceed the smoke and fire rating of the respective surface being patched.
6. Neatly cut and drill openings in walls and floors where openings are required for installation of the Work. Secure the approval of the Owner's Representative before cutting and drilling in existing facilities. Neatly patch any openings created.
7. Cutting and patching shall be held to a minimum by arranging with other parties for sleeves and openings before construction is started.
8. Provide factory-assembled watertight wall and floor seals, of types and sizes required, suitable for sealing around conduit, pipe, or tubing passing through concrete floors and walls. Construct seals with steel sleeves, malleable iron body, neoprene sealing grommets and rings, metal pressure rings, pressure clamps, and cap screws.
9. Pipe sleeves shall be fabricated from Schedule 40 rigid, heavy wall, full weight galvanized steel pipe; remove burrs. Use sleeves which are two standard sizes larger than conduit passing through respective sleeve.
10. Provide sleeve seals for piping that penetrates foundation walls below grade, or through exterior walls or roofs. Caulk between sleeve and pipe with non-toxic, UL-classified caulking material to ensure watertight seal. Elsewhere provide mechanical type seals, consisting of interlocking synthetic rubber links shaped to continuously fill annular space between pipe and sleeve, connected with bolts and pressure plates which cause rubber sealing elements to expand when tightened, providing watertight seal and electrical insulation.
11. Install standard Schedule 40 black steel pipe sleeves two sizes larger than pipes passing through floors, bearing walls, fire walls and masonry construction. Furnish and set forms required in masonry walls or foundation to accommodate pipes.

B. Grout:

1. Provide non-shrink, nonmetallic grout, pre-mixed, factory-packaged, non-staining, non-corrosive, and non-gaseous grout, recommended for interior and exterior applications.

C. General Joint Sealer Application:

1. Joint sealers, joint fillers, and other related materials compatible with each other and with joint substrates under conditions of service and application.
2. Apply joint sealers under temperature and humidity conditions within the limits permitted by the joint sealer manufacturer. Do not apply joint sealers to wet substrates.
3. Clean affected surfaces, joints, etc. immediately before applying joint sealers to comply with recommendations of joint sealer manufacturer.
4. Apply sealant primer to substrates as recommended by manufacturer. Protect adjacent areas from spillage and migration of sealant, using masking tape. Remove tape immediately after tooling without disturbing seal.

5. Comply with joint sealer manufacturers' printed application instructions applicable to products and applications indicated, except where more stringent requirements apply.
6. Immediately after sealant application and prior to time shinning or curing begins, tool sealants to form smooth, uniform beads; to eliminate air pockets; and to ensure contact and adhesion of sealant with sides of joint. Remove excess sealants from surfaces adjacent to joint. Do not use tooling agents that discolor sealants or adjacent surfaces or are not approved by sealant manufacturer.
7. Colors for exposed seals shall be as selected by the Owner's representative from manufacturer's standard colors.

### **3.5 FIRESTOPPING**

- A. Penetrations created in support of any work of this Division shall be firestopped in accordance with locally applicable codes as acceptable to the Authority Having Jurisdiction.

**END OF SECTION 270501**