

## SECTION 16700

### BASIC TELECOMMUNICATION REQUIREMENTS

#### **PART I GENERAL**

##### **1.1 SUMMARY**

- A. Section Includes:  
Basic requirements specifically related to Division 16 and common to several Division 16 Sections.
- B. Related Sections:
  - 1. Division 1 - General Requirements
  - 2. Notice to Bidders - Substitutions
  - 3. Division 3 - Concrete

#### **PART 2 PRODUCTS**

##### **2.1 MANUFACTURERS**

- A. Verify that Medeco lock cylinders are specified in Division 8 for locking devices requirement on equipment room doors for equipment specified in Division 16.
- B. Product Data
  - 1. Require shop drawings submittals on the following products to verify that material standards are being satisfied.
    - a. Generator equipment.
    - b. Battery power systems.
    - c. Special systems equipment.
    - d. Cabinets and enclosures.
    - e. Modular wiring systems.
    - f. Supporting devices.

##### **2.2 RACEWAYS**

- A. Section Includes:
  - 1. Rigid metal conduit and fittings.
  - 2. Intermediate metal conduit and fittings.
  - 3. Electrical metallic conduit and fittings.
  - 4. Flexible metal conduit and fittings.
  - 5. Liquid tight flexible metal conduit and fittings.
  - 6. Non-metallic conduit and fittings.
  - 7. Cable trays.
  - 8. Underfloor duct.
  - 9. Surface wireways
- B. Related Sections:
  - 1. Section 01045 - Cutting and Patching
  - 2. Section 02225 - Trenching, Excavation and Backfill
  - 3. Section 03300 - Cast-In-Place Concrete: Protective envelope or cap for underground conduit installations.

4. Section 07620 - Sheet Metal Flashing and Trim

**2.3 REFERENCES**

- A. Specify Underwriters Laboratories (UL) listed equipment, assemblies and materials.
- B. Where appropriate, refer to current ANSI and NEMA Standards for material ratings.
- C. National Electrical Code (NEC) (Current Edition).
- D. EIA/TIA - 568 & 569 Commercial building wiring standards and pathway and spaces.
- E. CSA T530 Design Guidelines.

**2.4 MATERIALS**

- A. Rigid Metal Conduit:
  - 1. Galvanized steel with threaded fittings.
- B. Intermediate Metal Conduit:
  - 1. Galvanized steel with threaded fittings.
- C. Electrical Metallic Tubing:
  - 1. Electrical metallic tubing for sizes over 2" diameter may be utilized only by special permission of the University of Colorado Department of Telecommunication Services.
  - 2. All steel double set screw fittings 3/4" and larger.
  - 3. Insulated metallic busings 3/4" and larger.
- D. Flexible Metal Conduit:
  - 1. Galvanized steel with all steel fittings. Compression type fittings (squeeze types).
- E. Liquid Tight flexible Metal Conduit:
  - 1. Galvanized steel with plastic jacket.
- F. Non-metallic Conduit and Fittings:
  - 1. PVC plastic schedule 40/Type "C".
  - 2. Impregnated fiber duct (underground).
- G. Prohibited Materials:
  - 1. Use of aluminum conduit is specifically prohibited unless special permission is given by Department of Telecommunication Services.
  - 2. Use of extra-flexible, non-labeled conduit is prohibited.
  - 3. ENMT (or Electrical Non-Metallic Tubing) is prohibited.
  - 4. Plastic bushings.
- H. Cable Trays:
  - 1. Galvanized steel, ladder type, electrically continuous grounding type, in all areas except telephone equipment rooms and steam tunnels.
  - 2. Steel ladder trays in equipment rooms and steam tunnels.
- I. Underfloor Duct:
  - 1. Steel with corrosion resistant finish.

2. Specify manufacturers with minimum of five (5) years service and installation representation in the area. Require proof of suitable representation. Specify entire assembly of one manufacturer.
  3. System may be of either trench or duct header type. Review selection with Department of Telecommunication Service prior to design.
  4. Coordinate type of service fitting (flush, surface, etc.) and type of trim ring and fitting material (plastic, brass, aluminum, etc.) with Department of Telecommunication Services.
- J. Surface Wireways:
1. Steel with factory applied paint finish or natural brushed or stainless steel finish. Coordinate finish selection of Department of Facilities management prior to final design.
  2. Identify all raceway with Telecommunications labeling as directed.

## **2.5 ERECTION/INSTALLATION/APPLICATION**

### **A. Conduit Sizing, Arrangement and Support:**

1. Conduit Size:
  - a. Unless directed otherwise, conduit shall be sized per attached sketch 8.05, labeled "Typical Jack Detail".
  - b. Minimum conduit size shall be 3/4".
  - c. Size conduit (for power circuits only) to meet requirements of National Electric Code Table 3C.
2. Flexible Conduit (generally Flexible Conduit is prohibited, except as allowed by special permission of Telecommunication Services. Where permitted, it shall be as follows):
  - a. Minimum flexible conduit size shall be 3/4".
  - b. Size flexible conduit to meet requirements of National Electric Code Table 3C.
  - c. Maximum length of flexible conduit 3' except for fished outlets in existing walls.
3. Conduit Straps and Hangers:
  - a. Heavy-duty malleable iron or steel.
  - b. For locations above grade which are subject to moisture or corrosion, specify corrosion resisting steel.
  - c. Perforated pipe strap or wire hangers are not permitted.
  - d. Support conduits above suspended ceilings from building structure by suitable hangers. Supporting conduits from ceiling suspension wires is not permitted.
  - e. Provide conduit support within 18" of each termination, and a maximum of 7'0" between supports along conduit.
4. Conduit Racks:
  - a. For electrical and telecommunications conduit use only.
  - b. Multi-use suspension systems for plumbing and other piping along with electrical and Telecommunication conduits are not permitted, except by special permission.

5. Conduit Anchors:
    - a. Power actuated anchors are prohibited.
    - Plastic or fiber expansion anchors are prohibited.
    - c. Drive pin anchors are prohibited.
- B. Conduit Installation - Interior
1. Rigid Metal Conduit: Specify for the following locations:
    - a. In any concrete pour.
    - b. In any type exterior walls, below grade.
    - c. Surface applications from floor level to +4'-0" above finished floor.
    - d. Corrosive and/or hazardous locations. Provide plastic jacket or coating in corrosive installation.
  2. Intermediate Metal Conduit: Specify as an optional material for all rigid, galvanized installations. Obtain special permission from Department of Telecommunication Services prior to allowing this material to be installed.
  3. Electrical Metallic Tubing: Specify for the following locations:
    - a. Interior partitions.
    - b. Above ceilings.
    - c. Surface applications above 4'-0" from finished floor.
    - d. Prohibited in hazardous or corrosive areas.
    - e. Exterior walls, above grade.
    - f. Prohibited in concrete slabs or walls.
    - g. Prohibited below grade.
  4. Electrical Metallic Conduits: Provide insulated metallic bushings for all conduits. Provide grounding lug bushings where conduits enter telephone cabinets.
  5. Non-Metallic Conduit: Prohibited for interior use and in concrete slabs and walls.
  6. Expansion Joints: Specify suitable expansion fittings where conduits cross expansion joints. Specify fittings which provide grounding continuity.
  7. Incompatible Materials: Do not permit use of dissimilar metal fittings on raceway systems. All fittings and Conduits must be compatible.
  8. Maximum length and bends: Riser conduit runs shall not exceed 100'-0" in length between openings
  9. All conduits shall have no more than 180° of bends between pull boxes; of the 180 degrees, offsets and kicks cannot exceed 30 degrees.
  10. Collector/Distribution: Conduit shall be 2 5' +- 5' between junction boxes. Conduits and boxes shall be upsized per fill in area. Conduit runs shall be so installed, that no cable run shall exceed 150'-0" in length from telephone terminal room, to farthest outlet. Where building conditions prohibit meeting this requirement, additional terminal rooms shall be provided.
  11. Conduits terminating into cable trays shall be no more than 6" away from cable tray.
  12. Provide 3/32" o.d., 200 lbs. strength polyethylene pull line all telephone raceways.

13. All surface conduit shall be painted.
- C. Conduit Installation - Exterior
1. Underground Communication Raceways: Specify the following: (See Details 8.01 and 8.03)
    - a. Electrical non-metallic conduit.
    - b. Transition to PVC coated rigid metal conduit 5' from building outside wall, and manhole penetrations.
    - c. Standard duct size 4".
    - d. Provide rigid steel offsets and sweep bends with PVC coating.
    - e. Provide 3" wide polyethylene film tape for buried cable marker. Bury 1'-0" above telecommunications conduit. Require wording, "Caution - Telephone Cable Below", or similar.
    - f. Pull mandrel through all ducts to verify duct integrity. Type of mandrel shall be designated by Telecommunication Services.
    - g. Provide spare conduits as required.
  2. Small Underground Raceways shall be as follows unless directed otherwise by Telecommunication Services:
    - a. Schedule 40 PVC non-metallic conduit.
    - b. PVC non-metallic conduit fittings must be installed with solvent applied couplings.
    - c. Provide steel bends with PVC coating.
  3. Underground Raceways (Ducts) General Requirements;
    - a. Cross ducts below gas piping.
    - b. Slope ducts to manholes. Where conditions require duct banks to be sloped toward building, provide a manhole adjacent to building and connect manhole drain to site (or waste water) drain. See detail 8.0.
    - c. Locate ducts below frost line, and two feet away from electrical lines and electrical conduits.
    - d. Route ducts as straight as possible between points. Do not exceed 180° of bends between pull points, of the 180 degrees, offsets and kicks cannot exceed 30 degrees..
    - e. Size #2 reinforcing rods in concrete encasement for duct banks located under areas subject to heavy traffic.
    - f. Use approved conduit spacers for multiple conduit runs in same trench (ductbanks).
    - g. Require that each raceway be proved clean, clear and useable, with a type TW pull wire size #12 left in place. Install duct plugs for finished raceways and secure pull wire.
    - h. Backfill material will be clean and free of stones.
    - i. Concrete blocks are prohibited for duct spacers.
    - j. Nylon tie downs will be used to hold ducts to spacers.
    - k. Wire duct tie downs are prohibited.
    - l. Where duct banks enter buildings, manholes, etc., require minimum 4 #2 rebar dowels in 4" concrete cap to prevent shearing of ducts.

4. Manholes: Where manholes are required in underground raceway systems, the following general requirements apply:
  - a. All manholes require prior approval of Telecommunication Services and shall be industry standard.
  - b. Locate manholes to provide workable pulling tensions.
  - c. Size manholes to provide suitable working clearances for pulling and termination. Minimum size manhole is 8' x 6' x 7' high.
  - d. Provide round 30" diameter, heavy duty manhole covers and frame with "Telephone" cast in cover as required.
  - e. Provide 30" round access chimney with climbing rings.
  - f. Install appropriate manhole hardware, including galvanized pulling eyes, inserts, cable racks, ladder and driver copper clad ground rod. Seal ground rod penetration in manhole with epoxy grout.
  - g. Require grounding of all metal parts in manhole.
  - h. Where it is not possible or practical to connect to site drain, provide minimum 12" diameter x 2' deep sealed sump well in floor of manhole to collect water seepage.

D. Cable Tray Installation:

1. Require cable trays to be supported by threaded rod hangers. Where lateral stresses are likely to be present, require lateral threaded rod braces.
2. Where trays abut walls, supports shall be provided to walls.
3. Specify cable tray supports a minimum of 8' on center and at all intersections and angles.
4. Ground all cable tray components and fittings.

E. Underfloor Duct Installation:

1. Require marker screws at the end of all duct runs.
2. Schedules shall be provided on insides of covers of junction boxes indicating distance from junction box to first insert in each run.
3. Specify coupler supports which provide electrical continuity of duct. Locate such supports not more than 5' on center and no farther than 30" from each junction box or elbow.
4. Where ducts cross expansion joints, require expansion fittings with bonding jumpers.

F. Surface Raceways:

1. Require insulated bushings at connections to outlets and corner fittings.
2. Require electrical continuity of all raceway components throughout length of system.
3. All surface raceways shall be painted to match the wall.

## 2.6 BOXES

## 2.7 SUMMARY

- A. Section Includes:
1. Wall and ceiling outlet boxes.
  2. Floor boxes.

3. Pull and junction boxes.

## **2.8 REFERENCES**

- A. Where appropriate, refer to current ANSI and NEMA standards.
- B. National Electrical Code (NEC) (Current Edition).
- C. EIA/TIA 568 & 569 commercial building wiring and pathway and spaces.
- D. CSA T530 Design guidelines.

## **2.9 OUTLET BOXES**

- A. Sheet Metal Outlet Boxes:
  1. Galvanized steel, 4" square minimum with plaster ring.
  2. Sectional boxes are prohibited, except for fished in outlets.
- B. Cast Boxes:
  1. Cast ferrous alloy, deep type with gasketed cover, threaded hubs.

## **2.10 FLOOR BOXES**

- A. Floor Boxes for Cast-In-Place Concrete Floors:
  1. Fully adjustable, cast iron or formed galvanized steel.

## **2.11 PULL AND JUNCTION BOXES**

- A. Sheet Metal Boxes:
  1. Galvanized steel.
- B. Sheet Metal Boxes Over 12" In Any Dimension:
  1. Require screw fastened cover.
- C. Cast Metal Boxes For Outdoor And Wet Locations:
  1. Flat Flanged, surface mounted, UL listed as raintight, galvanized cast iron box and cover with neoprene gasket and stainless steel cover screws.
- D. Cast Metal Boxes For Buried Flush Grade Locations:
  1. Prohibited. See Sect 4.04 Sub Section C paragraph 6.

## **2.12 BOX EXTENSIONS**

- A. Prohibited on new construction to allow for increased area for conductor filler
- B. Permitted on remodel work to extend existing installations.

## **2.13 BOX LOCATIONS**

- A. Require boxes to accommodate wire pulling, splices, taps, equipment connections and code compliance.
- B. Coordinate access doors as required to provide access to boxes in hard ceilings and similar inaccessible areas.
- C. Provide cast box (with threaded hubs) in high traffic areas (surface installations), as specified by owner.

## **2.14 OUTLET BOX INSTALLATIONS**

- A. Back to back outlet boxes are not permitted. Separate boxes a minimum of 6" in standard walls and a minimum of 2' in acoustical walls.
- B. The exact location of outlets shall be governed by structural conditions, obstructions or other equipment. When necessary, relocated outlets so that they will be symmetrically located and not interfere with other equipment. Outlets shall be moved a distance of six (6) feet or less, with no additional cost.
- C. Unless otherwise noted, outlets shall be located as follows: (Dimensions are from finished floor to center line of boxes.)

Standard telephone outlets	1'-5"
Wall mounted telephone outlets	4'-6"
Wall mounted telephone outlets for Handicapped	4'-0"
- D. Where outlets are located in masonry walls, adjust box location to set in corner of block or brick.
- E. Where outlets of other types are located adjacent, coordinate heights to be similar, when possible.
- F. All ADA standards shall be met when applicable.

## **2.15 PLATES**

- A. Provide telephone plates to match other plates in area. Verify exact style of plate and diameter of openings with Telecommunication Services before installing.

## **2.16 CABINETS AND ENCLOSURES**

### **2.17 SUMMARY**

- A. Section Includes:
  - 1. Hinged cover enclosures.
  - 2. Cabinets.
  - 3. Terminal blocks and accessories.

### **2.18 REFERENCES**

- A. Where appropriate, refer to Current ANSI and NEMA Standards for material ratings.
- B. National Electrical Code (NEC) (Current Edition).
- C. EIA/TIA 568-569 commercial building wiring and pathway and spaces.
- D. CSA T530 Design guidelines.

### **2.19 MATERIALS**

- A. Hinged Cover Enclosures:
  - 1. NEMA rated enclosure, steel suitable for environment in which installed, with enamel finish.
  - 2. Continuous hinged cover with key lock latch.

3. 14 gauge steel enclosures suitable for mounting components, terminal blocks, etc.
- B. Cabinets:
1. Cabinet Boxes:
    - a. Galvanized steel with removable end walls. For television, telephone and other communication cabinets specify with 3/4" thick plywood backboard painted matte white.
  2. Cabinet Covers:
    - a. Steel with enamel finish, concealed hinges and flush key locked latch.

## **2.20 SUPPORTING DEVICES**

### **2.21 SUMMARY**

- A. Section Includes:
1. Conduit and equipment supports.
  2. Fastening hardware.
- B. Related Sections:
1. Raceways
  2. Boxes
  3. Cabinets and Enclosures
  4. Cast-In-Place Concrete

### **2.22 COORDINATION**

- A. Coordinate locations of concrete pads and their dimensional requirements with Architect, Structural Engineer and Telecommunication Services during design.

### **2.23 MATERIAL**

- A. Support Channels:
1. Galvanized or painted steel.
- B. Hardware:
1. Corrosion resistant metal.

### **2.24 INSTALLATION**

- A. Fastening of hanger rods, conduit clamps, outlet and junction boxes to building structure.
1. In precast structures, use cast in inserts wherever possible. Expansion anchors can be used with caution and prior approval.
  2. In hollow masonry or drywall, use toggle bolts.
  3. In cast-in-place concrete, use expansion anchors, preset inserts or self-drilling masonry anchors.
  4. In sheet metal studs, use sheet metal screws.
  5. In wood studs, use wood screws.

6. Attachment of supports to piping, ductwork, mechanical equipment or conduit is prohibited.
  7. Drilling of structural steel members is prohibited.
  8. Powder actuated anchors are prohibited.
  9. Plastic or fiber anchors are prohibited.
  10. Attachment to ceiling suspension wires is prohibited.
- B. Supports:
1. Require that supports be fabricated from structural steel, steel channel or unistrut, rigidly bolted or welded to present a neat appearance.
  2. Install free-standing telephone service equipment on concrete pads.
  3. Require that surface mounted cabinets, enclosures, and panelboards be support with a minimum of four anchors. On exterior concrete walls below grade, provide 1" steel channel stand-offs for cabinets and raceways.
  4. Use stud bridges at top and bottom of cabinets and enclosures which are flush mounted in hollow drywall walls.
  5. Use suitable vibration isolation pads for vibrating equipment.

END OF SECTION