

**SECTION 25130**  
**INTERIOR COMMUNICATION PATHWAYS**

**PART 1 - GENERAL**

1.1 SUMMARY

• SCOPE

1. This section includes minimum requirements for the following:
  - a) Interior Horizontal Cabling Communication Pathways
  - b) Interior Backbone Cabling Communication Pathways
2. Minimum composition requirements and installation methods for the following pathways:
  - a) Conduit
  - b) Innerduct
  - c) Sleeves
  - d) Cable tray
  - e) Cable hangers
  - f) Wireways and wire troughs
  - g) Power/communication poles
  - h) Underfloor duct
  - i) Floor Boxes and Poke Throughs
  - j) Surface Raceways – Metallic
  - k) Surface Raceways – Non-Metallic
  - l) Outlet Boxes
  - m) Related Sections include the following:
    - 1) 17150 Backbone Cabling Requirements
    - 2) 17160 Horizontal Cabling Requirements

1.2 QUALITY ASSURANCE

- A. All pathways and associated equipment shall be installed in a neat and workmanlike manner. All methods of construction that are not specifically described or indicated in the contract documents shall be subject to the control and approval of the Network & Telecommunications Department. Equipment and materials shall be of the quality and manufacture indicated. The equipment specified is based upon the acceptable manufacturers listed. Where "approved equal" is stated, equipment shall be equivalent in every way to that of the equipment specified and subject to approval.
- B. Materials and work specified herein shall comply with the applicable requirements of:
  1. National Electric Code (NFPA 70) including the following Articles:

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- a) 318 - Cable Trays
  - b) 331 - Electrical Nonmetallic tubing
  - c) 348 - Electrical metallic tubing
  - d) 349 - Flexible metallic tubing
  - e) 350 - Flexible metal conduit
  - f) 351 – Liquid-Tight Flexible metal conduit and Liquid-Tight flexible nonmetallic conduit.
  - g) 352A - Surface Metal Raceways
  - h) 352B - Surface Nonmetallic raceways
  - i) 353 – Multioutlet Assembly
  - j) 354 - Underfloor raceways
  - k) 362 - Metal Wireways and nonmetallic Wireways
  - l) 370 - Outlet, Device, Pull and Junction Boxes, Conduit Bodies and Fittings
  - m) 645 - Information Technology Equipment
  - n) 770 - Optical Fiber Cables and Raceways
  - o) 800 - Communications Circuits
2. The following American National Standards Institute (ANSI) standards:
    - ANSI-C80.3 Specification for Electrical Metallic Tubing, Zinc-coated
  3. The following Telecommunication Industry Association (TIA) standards.
    - a) ANSI/TIA/EIA – 568-B Commercial Building Telecommunications Cabling Standard
    - b) ANSI/TIA/EIA – 569-A Commercial Building Standard for Telecommunications Pathway and Spaces
    - c) EIA/TIA-606-A Administration Standard for the Telecommunications Infrastructure of Commercial Buildings
    - d) EIA/TIA-607 Commercial Building Grounding and Bonding requirements for Telecommunications
  4. The following BICSI guidelines
    - a) BICSI Telecommunications Distribution Design Manual (9<sup>th</sup> edition)
    - b) BICSI Customer Owned Outside Plant Design Manual (2<sup>nd</sup> edition)
    - c) BICSI Telecommunications Cabling Installation Manual (2<sup>nd</sup> edition)
  5. The following UL Standards:
    - a) UL 1, 2000 Flexible Metal Electrical Conduit

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- b) UL 3, 1999 Flexible Nonmetallic Tubing for Electric Wiring
- c) UL 5, 1996 Surface Metal Electrical Raceways and Fittings
- d) UL 360, 1996 Liquid-Tight Flexible Steel Conduit, Electrical
- e) UL 514B, 1996 Fittings for Conduit and Outlet Boxes.
- f) UL 797, 1997 Electrical Metallic Tubing
- g) UL 870, 1995 Electrical Wireways, Auxiliary Gutters and Associated Fittings

### 1.3 SUBMITTALS

- Provide product data for the following:
  - 1. Conduit
  - 2. Sleeves
  - 3. Cable tray
  - 4. Cable hangers
  - 5. Wireways and wire troughs
  - 6. Power/communication poles
  - 7. Underfloor duct
  - 8. Floor Boxes and Poke Throughs
  - 9. Surface Raceways – Metallic
  - 10. Surface Raceways – Non-Metallic
  - 11. Outlet Boxes

## PART 2 - PRODUCTS

### 2.1 CONDUIT

- A. Rigid Galvanized Steel Conduit
  - Shall be hot-dipped galvanized steel, including threads.
- B. Electrical Metallic Tubing
  - Electrical Metallic Tubing shall be electro-galvanized steel.
- C. Rigid Non-Metallic PVC Conduit
  - 1. Extra-Heavy wall conduit: Schedule 80, constructed of polyvinyl chloride, rated for use with 90 degree C conductors, and UL listed for direct burial and normal above ground use.
  - 2. Heavy wall conduit: Schedule 40, constructed of polyvinyl chloride, rated for use with 90 degree C conductors, and UL listed for direct burial and concrete encasement.
- D. Fittings
  - 1. Rigid galvanized steel fittings shall be fully threaded and shall be of the same material as the respective raceway system.

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2. Fittings for electrical metallic tubing shall be single screw indenter fittings for conduits up to 2" and double screw indenter fittings for conduits 2" and larger.
3. Fittings for rigid non-metallic conduit shall be solvent cemented in accordance with the manufacturer's instructions.
4. Connectors shall have insulated throat up to and including 1" size. For sizes 1-1/4" and larger, provide plastic insulating bushing.
5. Die-cast or pressure cast fittings are not permitted.
6. Provide conduit body types, shapes and sizes as required to suit application and NEC requirements. Provide matching gasketed covers secured with corrosion-resistant screws.

E. Expansion Fittings

1. Provide expansion fittings with external grounding straps at building expansion joints.
2. Galvanized steel expansion joints for RGS or EMT conduit, PVC for PVC conduit.
3. Minimum 4" movement in either direction.
4. Weatherproof for outdoor applications.
5. At expansion joints in concrete pours, provide Deflection/Expansion fittings capable of movement of 3/4" in all directions from the normal.

F. Waterproofing Seals

1. Provide watertight expanding link-type seals for installation between the conduit and the sleeve or core drilled hole.
2. Design Make: Link Seal, or approved equal

G. Pull and Junction Boxes

- Shall be constructed of not less than 14 gauge galvanized steel with trim for flush or surface mounting in accordance with the location to be installed. Provide screw-on type cover boxes installed in damp or wet locations shall be of rain-tight construction with gasketed cover and threaded conduit hubs. In no case shall boxes be sized smaller than as indicated in Article 370 of the National Electrical Code for conduit and conductor sizes installed. Boxes shall be NEMA approved for the environmental condition of the location where they will be installed.

H. Flush floor junction boxes

- Flush floor junction boxes shall be recessed cover boxes designed for flush mounting in masonry. (Approved by Network & Telecommunications Department)

2.2 INNERDUCT

- A. Shall be constructed of a PVC Riser rated or plenum rated plastic as required.
- B. Shall be 1" or 1 1/4" in diameter as called for on the drawings.
- C. Shall be orange in color.

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D. Shall be UL listed to 2024 standard.

2.3 CABLE TRAY

A. Trough Bottom Cable Trays shall be aluminum construction including accessories. Maximum rung spacing 8 in. on centers is welded to side rails with flanges in 4-in. wide channel rungs. Aluminum alloy side rails and rungs. Standard lengths 12 ft. - 0 in. long. Cover required where called for. Provide divider strip where called for. Minimum radius of horizontal elbows shall be 12 in. Provide special radius elbows where required for field conditions.

Loading Data:

<u>Useable Tray Width</u>	<u>Load Depth</u>	<u>NEMA Depth</u>	<u>Std.</u>	<u>Span</u>	<u>Lbs /Ft</u>	<u>Deflection</u>
6"	4"					
8"	4"					
12"	4"	3"	12A	10'	81	1.20"
12"	6"	5"	12B	10'	112	0.59"
18"	4"	3"	12A	10'	81	1.20"
18"	6"	5"	12B	19'	112	0.59"
24"	4"	3"	12A	10'	81	1.20"
24"	6"	5"	12B	10'	112	0.59"

- Provide a safety-loading factory of 1.5 for uniformly distributed loads when supported as a simple span in accordance with the NEMA standard listed.

2.4 CABLE HANGERS

- A. Provide prefabricated, zinc coated, carbon steel hangers designed specifically for UTP and Optical Fiber cable installations.
- B. Hangers shall have open top, rolled edges and a 3" or 4" minimum diameter loop.
- C. Provide beam clamps, rod fasteners, flange clips and brackets as job conditions require.
- \* Hangers must be approved by Network & Telecommunications Department.

2.5 WIREWAYS AND WIRE TROUGH

A. Wireway shall be steel, enclosed type. Provide hinged, JIC sectional NEMA dust resistant, oil tight type where subjected to moisture, in Pump Rooms, Mechanical, Electric and Fan Rooms, exterior walls, Maintenance Shops, and similar locations. Size to meet NEC fill requirements or larger as noted on Contract Documents. Provide knockouts along runs. Provide all elbows, tees, pull-boxes, fittings, hangers, reducers, supports, etc., to meet installation requirements.

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- B. Cover: Hinged Screw cover with full gasketing
- C. Connector: [Slip-in] [Flanged].
- D. Fittings: Lay-in type with removable top.
- E. Finish: Electro-coated ASA-49 Gray Epoxy Paint over Phosphate Primer.
- Approved by Network & Telecommunications Department.

## 2.6 POWER/COMUNICATION POLES

- A. Poles shall contain a communication and power divider and be nominally 2-1/4" square by height required.
- B. Constructed of a minimum of .070" thick, anodized aluminum extrusion, with removable trim plate and cover.
- C. Unit shall be furnished with top plate mounting assembly for easy installation to accessible ceiling; bushings need to be installed.
- Approved by Network & Telecommunications Department.

## 2.7 FLOOR BOXES

- Flush Floor Box:
    - 1. Boxes shall be fully adjustable constructed of cast iron, nominally 4.38"L x 3.19"w x 3.19"D (single gang) 4.38"L x 6.38"w x 3.19"D (two gang)
    - 2. Boxes shall house leveling screws for adjusting box to accept floor flange after pour.
    - 3. Boxes shall have 1" conduit hubs on each end and 3/4" conduit hubs on each side.
    - 4. Provide Brass floor rings and brass cover-plate with duplex flaps.
- Acceptable manufacturer: Wiremold
- a) Raised Floor Box ( mfg # AC8850, AC8105, AC8840, AC104 )
  - b) Concrete Floor Box ( mfg # RFB4-SS with RAKMII cover ( ss = shallow steel )
  - c) Concrete Floor Box ( mfg # RFB4-4DB with RAKMII cover )

## 2.8 SURFACE METALLIC RACEWAY

- A. Single channel suitable for up to (10) 0.2" O.D. Cables
  - Two piece raceway with single compartment, length as indicated on the drawings. Nominal 1-9/32" x 3/4" with snap on cover. Color shall be ivory. [Approved by Network & Telecommunications Department]
- B. Single channel suitable for up to (50) 0.2" O.D. Cables
  - Two piece raceway with single compartment, length as indicated on the drawings. Nominal 2-3/4" x 1-7/16" with flush, snap on cover. Color shall be ivory. Provide devices in the raceway as indicated on plans. [Approved by Network & Telecommunications Department]

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- C. Two channel with devices suitable for up to (48) #12 AWG conductors or (50) 0.2" O.D. Cables.
  - Two piece raceway with divider for power and communications, length as indicated on the drawings. Nominal 4-3/4" x 1-3/4" with flush, snap on cover. Color shall be gray. Provide devices in the raceway as shown on plans  
[Approved by Network & Telecommunications Department]
- D. One-piece raceway
  - 1. Shall have Ivory finish
  - 2. Size race way as required based on the following:
    - a) .025" steel suitable for (2) 0.2" O.D. cables
    - b) .040" steel suitable for (3) 0.2" O.D. cables
    - c) .040" steel suitable for (5) 0.2" O.D. cables  
[Approved by Network & Telecommunications Department ]
- E. Provide miscellaneous boxes, fittings and supports designed and manufactured by the raceway manufacturer as required to make a complete job.  
  
[Approved by Network & Telecommunications Department ]

## 2.9 SURFACE NON-METALLIC RACEWAY

- A. Manufactured of rigid UV stabilized PVC compound with matte texture with "office white" finish. Provide the manufacturers standard fittings as required for the installation. All system components shall meet UL 94 requirements for nonflammable, self-extinguishing characteristics.
- B. Shall have a voltage rating of 300 V AC maximum.
- C. Shall be UL listed.
- D. Fitting shall comply with EIA/TIA UTP/Optical Fiber bend radii requirements.
- E. Raceways shall have the following wiring capacities:
  - 1. One Piece, Single Channel - .32 sq. in. suitable for (5) 0.18" O.D. cables
  - 2. One Piece, Dual Channel - .97 sq. in. suitable for (6) 0.18" O.D. cables
  - 3. Two Piece, Single Channel - .29 sq. in. or .87 sq. in. suitable for (4) 0.18" O.D. cables or .87 sq. in. suitable for (13) 0.18" O.D. cables
  - 4. Two Piece, Triple Channel – 1.514 sq. in. per channel suitable for (24) 0.18" O.D. cables per channel without devices.
- F. Design Make:
  - 1. One-Piece Raceway:
  - 2. Two-Piece Raceways, Single Channel Raceway:
  - 3. Two-Piece Raceway, Triple Channel Raceway:
    - a) Provide Communication devices as specified in wiring devices and indicated on the drawings.

- b) Provide divider in raceways utilized for power and communications.

[Approved by Network & Telecommunications Department ]

## 2.10 OUTLET BOXES

### A. Outlet Boxes and Covers

1. Shall be galvanized steel, not less than 2 3/4" deep X 4 11/16" square or octagonal, with knockouts.
2. Outlet boxes exposed to moisture, exterior, wet or damp locations shall be cadmium cast alloy complete with threaded hubs and gasketed screw fastened covers.
3. Boxes shall be approved for the environmental condition of the location where they will be installed.
4. Install with mud ring where possible

[Approved by Network & Telecommunications Department ]

### B. Non Metallic Surface Outlet Boxes

1. Shall be Manufactured of rigid UV stabilized PVC compound with matte texture with "office white" finish. Provide the manufacturers standard fittings as required for the installation. All system components shall meet UL 94 requirements for nonflammable, self-extinguishing characteristics.
2. Shall have a voltage rating of 300 V AC maximum.
3. Shall be UL listed.
4. Shall be of size indicated drawings.
5. Shall be of sufficient depth to maintain CAT 6 bend radii requirements.

[Approved by Network & Telecommunications Department ]

### C. Low Voltage Mounting Brackets

1. Shall mount to any wall thickness from 1/4" – 1".
2. Shall be constructed of a non-metallic material.

[Approved by Network & Telecommunications Department]

## 2.11 SUPPORTING DEVICES

- A. Supports, support hardware and fasteners shall be protected with zinc coating or treatment of equivalent corrosion resistance using approved alternative treatment, finish or inherent material characteristic. Products used in outdoor applications shall be hot dipped galvanized.
- B. Provide clevis hangers, riser clamps, conduit straps, threaded c clamps with retainers, ceiling trapeze hangers, wall brackets and spring steel clamps as applicable.
- C. 14 gauge U-Channel systems with 9/16 inch diameter holes at a minimum of 1 7/8 inches on center in the top surface. Provide fittings and accessories that match and mate channel.

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- D. Provide carbon steel or wedge or sleeve type expansion anchors, steel springhead toggle bolts and heat-treated steel power driven threaded stud fastening equipment as required by construction types.
- E. Provided field fabricated supporting devices such as angles, channels, pipe supports, etc. All fabricated supports shall be of metal construction as called for in 2.1.

[Approved by Network & Telecommunications Department ]

## PART 3 - EXECUTION

### 3.1 CONDUIT

1. Electrical Metallic Tubing, Rigid Metal Conduit and Rigid PVC are allowed conduit types. Flexible metal conduit is not allowed.
2. Install with a minimum of bends and offsets. Bends shall not kink or destroying the interior cross section of the raceway. Factory made bends shall be used for raceway's 1" trade size and larger. Bends radius shall be 6 times the internal diameter for conduit sizes up to 2 inches. A conduit greater than 2 inch shall have bend radius at least 10 times the diameter of the conduit.
3. Runs exceeding 100 feet or 180 degrees total bends shall be broken with suitable sized pull or splice boxes. (LB or similar conduit fittings are not acceptable for runs of riser cables. [Must be approved by the Network & Telecommunications ]
4. Do not locate riser pull boxes at bends without prior review and approval by Network & Telecommunications Department. Where possible use instead sweeps for the bend and locate in a straight pull nearby.
5. Conduit runs to work areas shall serve no more than one (1) communication outlet.
6. Conduits shall be sized to accept 40% future growth; sizing shall account for fire code capacity restrictions.
7. Plug the ends of each roughed-in raceway with an approved cap or disc to prevent the entrance of foreign materials during construction.
8. Secure within three feet of each outlet box, junction box, cabinet or fitting.
9. Provide a #14 AWG fish wire in all "Spare" or "Empty" conduit runs to facilitate future installation of cables.
10. Install raceways in concrete floor slabs as follows:
  - a) All conduits in concrete floor slabs shall be rigid galvanized steel with concrete tight threaded fittings.
  - b) Provide expansion fittings where conduits cross building expansion joints.
  - c) Install conduit below the reinforcing mesh.
  - d) Locate conduits to provide a minimum of 2" of concrete around conduit.
  - e) Obtain approval from the Network & Telecommunication Department prior to installing conduit larger than 1" trade size in concrete slabs.
  - f) Wherever a cluster of four-(4) or more conduits rise out of floor exposed, provide neatly formed 4-in. high concrete envelope, with chamfered edges, around raceways.
11. Provide conduit supports based on the following table:

<u>Conduit Trade Size</u>	<u>Type of Run</u>	<u>Horizontal Spacing in Feet</u>	<u>Vertical Spacing in Feet</u>
1", 1 ¼"	Concealed	8	10
1 ½", & LARGER	Concealed	10	10
½", ¾"	Exposed	5	7
1", 1 ¼"	Exposed	7	8
1 ½" & larger	Exposed	10	10

12. Where conduits puncture roof, install pitch pockets as required in order that the roof warranty is maintained.
13. Conduit System Installation:
  - a) Cable in exterior, above grade locations: Rigid Galvanized Steel
  - b) Interior locations: Electrical Metallic Tubing
  - c) Cable below grade: PVC Schedule 40
14. Identification: Clearly label conduit at exposed ends indicating closet or outlet where conduit terminates and the length of the conduit. Label pull boxes indicating destination of conduits entering and exiting.
15. Include intra- and inter-building raceways. Including conduits, sleeves and trays for the placement of cables from the communications center to communications rooms, from the communications center to the entrance room or space and from communication center to communication center in different building in a campus environment.

B. Conduit fill shall be as follows:

<u>Trade Size</u>	<u>Area of Conduit</u> <u>(square inches)</u>	<u>1 Cable</u> <u>53% Fill</u> <u>(sq. in.)</u>	<u>2 Cables</u> <u>31% Fill</u> <u>(sq. in.)</u>	<u>3 Cables &amp; Over</u> <u>40% Fill</u> <u>(sq. in.)</u>
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1"	0.87	0.46	0.27	0.35
1 ¼"	1.51	0.80	0.47	0.60
1 ½"	2.05	1.09	0.64	0.82
2"	3.39	1.80	1.05	1.36
2 ½"	4.82	2.56	1.49	1.93
3"	7.45	3.95	2.31	2.98
3 ½"	9.96	5.28	3.09	3.98
4"	12.83	6.80	3.98	5.13
5"	20.15	10.68	6.25	8.06

- C. Backbone pathways shall be in the form of 4" conduits or sleeves between the main communication equipment rooms and spaces and closets shall be provided as shown on drawings:
- D. Fire stop all pathways as called for in section 25010 of this document. This includes using 3M / EZ Path fire rated pathways by Specified Technologies, Inc. ([www.stifirestop.com](http://www.stifirestop.com)).
- E. All backbone conduits shall be marked with 1" reflective tape every 25 feet. Coordinate color with Network & Telecommunications Department.
- F. Pull boxes shall be marked with 1" wide reflective tape.
- G. Stub out conduits into closets only enough to attach connector and bushings, except conduits shall rise a minimum of 6 inches above the finished floor.
- H. Bush all conduit ends.
- I. Conduits shall be concealed except in the following areas:
  - 1. Mechanical Rooms
  - 2. Electric Rooms
  - 3. Manufacturing areas
  - 4. Garage or maintenance areas
  - 5. Unfinished basements or crawl spaces
- J. Do not install raceways adjacent to hot surfaces or in wet areas.
- K. Install conduits to edges of access boxes so as to maximize the total number of conduits that can be routed through the pull box.
- L. Provide expansion fittings with external grounding straps at building expansion joints.
- M. Do not install conduit horizontally in concrete or block partitions.

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- N. Arrange neatly to permit access to the raceway, outlet, pull, and junction boxes, and work installed by other trades.
- O. If it is necessary to burn holes through webs of beams or girders, call such points to the attention of the Network & Telecommunications Department and receive written approval both as to location and size of hole before proceeding with work. All holes shall be burned no larger than absolutely necessary.
- P. Core drill, sleeve, and fire stop all penetrations through existing floors.
- Q. Support all raceways with malleable iron pipe clamps or other approved method. In exterior or wet locations, provide minimum ¼" air space between raceway and wall. Secure raceway within 3 ft. of each outlet box, junction box, cabinet or fitting.
- R. Install junction and pull boxes in readily accessible locations. Equipment, piping, ducts and the like shall not block access to boxes. Provide all necessary junction or pull boxes required due to field conditions and size as required by the National Electrical Code.

### 3.2 SLEEVES

- 1. Enter information here about sleeve – support, firestop and size as per drawing

### 3.3 CABLE TRAYS

- A. Hang Cable tray using threaded, galvanized rod hangers, with rods extended through support steel and double nutted. Size support member within load rating of member section; and without visible deflection. Install cable tray level and straight.
- B. A minimum of 12" headroom shall be provided above all cable trays.
- C. Provide aluminum body expansion connectors at building expansion joints. Minimum 4-in. movements, greater if expansion movement conditions warrant.
- D. Provide external grounding strap at expansion joints, sleeves, crossovers and at other locations where tray continuity is interrupted.
- E. Provide necessary elbows, tees, crosses, risers, offsets, fittings, reducers, connectors, clamps, rod suspension, trapeze hangers, etc., as required to make a complete job, coordinate with the Network & Telecommunications Department.
- F. Provide conduit to tray fitting at each conduit entrance to tray.
- G. Install divider in trays where cables of different systems are carried in the same tray.
- H. Provide (1) 6" long piece of ½" EMT conduit on each threaded rod hanger to prevent scoring of cable insulation when cable is pulled in.
- I. Install fire stop wall frames around cable tray at penetrations through fire rated walls, and where called for. Seal these openings with pliable fire resistant sealant.
- J. Cable Trays shall not pass through any firewall or fire-rated soffits. Cable tray shall end before the firewall and transition to a minimum of two (2) 4" EMT sleeves with connectors and insulated bushings as called for in this specification section.

### 3.4 CABLE HANGERS

- A. Provide cable hangers a maximum of 3' on center wherever cable tray or conduit is not present.
- B. Ceiling ties and rods shall not be used to hang cable or cable supports without the approval of the Network & Telecommunications Department.
- C. Load hangers as recommended by the manufacturer. Provide hangers side by side on a common bracket where cable quantities require.
- D. Do not install cables loose above lock-in type, drywall or plaster ceilings.
- E. Cables shall be installed at least 3 in. above the ceiling tiles and shall not touch the ceiling.
- F. Do not support cable from ceiling system tie wires or grid in fire rated systems.
- G. Provide a minimum of 2 spare bracket mounted hangers in new construction.

### 3.5 WIREWAYS AND TROUGHS

- A. Insert installation requirements

### 3.6 POWER/COMMUNICATION POLES

- A. Insert installation requirements

### 3.7 UNDERFLOOR DUCT

1. The method of pour and depth of concrete shall determine the positioning of the duct as follows (Verify floor structure prior to submitting layout drawings):
  - a) Monolithic pour - installed at the midpoint of the slab
  - b) Slab on grade - midpoint of slab
  - c) Double pour floor - installed in structural slab, Second pour buries the duct system.
  - d) Post tensioned pour - preset inserts shall be used
  - e) Prefabricated concrete - buried in concrete topping
2. Location: Locate runs parallel to outside wall five foot on center with final runs two feet from walls. Provide cross runs as indicated on drawings.
3. Provide conduit access to cross runs as indicated on drawings.
4. Perform cutting, hole sawing and drilling necessary for installation of wiring to devices, through service fitting, from under floor raceway. Provide devices and service fittings at points of use indicated. Install raceway aligned, level, and parallel or perpendicular to building walls or as indicated. Underfloor raceways shall be free from burrs, sharp edges, dents and mechanical defects. Provide caps or plugs on open raceway ends and on boxes and openings.
5. Provide flush service boxes with trim rings and carpet or tile flanges as indicated on the plans.
6. Seal raceways, cells, inserts and trenches to prevent the entrance of water, concrete or foreign matter into the raceway system, before and

during pouring of slab or placing of fill. Provide tape or sealing compound at joints, as recommended by the duct manufacturer.

7. Install all products in accordance with manufacturer's instructions.
8. Provide expansion fittings with bonding jumper where duct crosses building expansion joints.
9. Securely hold junction boxes and raceways in place during concrete pours to avoid floating or other movement.
10. Install under-floor duct with tops of preset inserts 1/8" below finished floor line. Locate raceways as indicated on Drawings.
11. Place schedule on the inside of cover-plate of each junction box indicating distance to first insert in each direction, measured from the center of the box. Also, include the pane-board and circuit number of each circuit located in the junction box. Use self-adhesive labels for schedule.
12. Support Couplers and Supports: Join raceway lengths using combination support couplers where practical. Provide additional supports at intervals of not over 5 feet (1.5 m), within 30 inches (750 mm) each side of junction boxes, and as close as practical to elbows, bends, and terminations.
13. Install insert within 12 inches (30 mm) of edge of junction box. Align inserts on same centers for all services.
14. Do not extend inserts into special floor finishes, such as terrazzo, marble, or wood.
15. Install a duct marker in each insert adjacent to junction box, at end of each duct run, on both sides of permanent partitions, and on both sides of change of direction of duct. Install markers flush with finished floor material. In carpeted areas, install marker screws level with carpet backing.
16. Install surface service fittings after installation of floor finishes. Cut floors as necessary. Following duct manufacturer's recommendations. Replace damaged floor construction and finish.
17. Install trench duct trim flush with cover-plates; maintain covering of factory-applied tape for protection.

### 3.8 FLOOR BOXES AND POKE THROUGHES

- A. Floor outlet boxes shall be installed flush with finished floor, adjust level and tilt as required. Where finished floor is terrazzo, provide boxes specifically designed for installation in terrazzo. Where floors are to receive carpet, provide floor outlet with carpet flange.
- B. Coordinate the location of flush floor boxes with furniture layout. Provide coordination drawings for approval.

### 3.9 SURFACE RACEWAY - METALLIC

- A. Provide raceway as shown on the drawings. Leave a tagged nylon pull tape in each raceway (including raceways in use). Bush ends of all stubbed out raceways.

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- B. Cut raceways square, ream ends to remove burrs, and bush where necessary.
- C. Install raceways parallel or perpendicular to building walls, floors and ceilings.

### 3.10 SURFACE RACEWAYS – NON METALLIC

- A. Support with expansion anchors, concrete inserts, masonry inserts or toggle bolts as field conditions require. Provide supports every 4 foot on center.
- B. Provide all fittings, connectors, elbows, tees, boxes etc. as required for the installation.
- C. Surface raceway shall be filled to 40% maximum.

### 3.11 BOXES AND CABINETS

- A. Consider location of outlets shown on drawings as approximate only. Study architectural, electrical, process piping, mechanical, plumbing, structural, roughing-in, etc., drawings and note surrounding areas in which each outlet is to be located. Locate outlet so that when fixtures, motors, cabinets, equipment, etc., are placed in position, outlet will serve its desired purpose. Where conflicts are noted between drawings, contact Network & Telecommunication Department for decision prior to installation.
- B. Outlet boxes in separate rooms shall not be installed "back-to-back" without the approval of the Network & Telecommunications Department.
- C. Outlet boxes shall be sized to accommodate the wiring device(s) to be installed.
- D. Outlet boxes installed in plaster, gypsum board or wood paneled walls shall be installed with raised plaster covers or raised tile covers.
- E. Outlet boxes installed in tile, brick or concrete block walls shall be installed with extra-deep type raised tile covers or shall be 3-1/2" deep boxes with square corners and dimensions to accommodate conductors installed.
- F. Surface ceiling mounted outlet boxes shall be minimum 4" square, 1-1/2" deep, galvanized sheet metal.
- G. Surface wall mounted metallic outlet boxes shall be cast type boxes having threaded or compression type threadless hubs. Exterior boxes shall be cast type with threaded hubs and gasketed cover plates secured by non-ferrous screws.
- H. Unless otherwise noted, mount devices and equipment at heights measured from finished floor to device/equipment centerline as follows:
  - 1. Desktop telephone outlets 18"
  - 2. Data outlets 18"
  - 3. Data or desktop telephone outlets, above hot water or steam baseboard heaters. Do not install receptacle outlets above electric baseboard heaters. 30"
  - 4. Television outlet 18"
  - 5. Wall Mounted 48"
  - 6. Bracket Mounted Television 96"

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- I. Where structural or other interference prevent compliance with mounting heights listed above, consult Network & Telecommunication Departments for approval to change location before installation.
- J. Where communications outlets are shown on, behind, below or above furniture or millwork. Verify the exact location and mounting height with the project coordinator. The communications contractor shall be responsible for moving all communications outlets that are in conflict with furniture or millwork, including cutting, patching and painting, at no cost to the Network & Telecommunication Department.
- K. Pull boxes used for angle or U pulls shall have a distance between each raceway entry inside the box and the opposite wall of the box of at least 6 times the trade-size diameter of the largest raceway. This distance being increased by the sum of the trade size diameters of the other raceways on the same wall of the box and have a distance between the nearest edges of each raceway enclosing the same conductor of at least 6 times the trade size diameter of the raceway or 6 times the trade size diameter of the larger raceway if they are of different sizes.
- L. Install outlet boxes as per sizes indicated on the drawings.
- M. Install Low Voltage Mounting Brackets for fishable wall installation location that does not have an available outlet box.

### 3.12 SUPPORTING DEVICES

- A. Hangers and Supports:
  - 1. Provide steel angles, channels and other materials necessary for the proper support of wall-mounted cabinets, racks, panels, etc.
  - 2. Cabinets, large pull boxes, and cable support boxes shall be secured to ceiling and floor slab and not supported from conduits. Small equipment boxes, etc., as approved by Network & Telecommunication Department, may be supported on walls. Racks for support of conduit and heavy equipment shall be secured to building construction by substantial structural supports.

### 3.13 FURNITURE RACEWAYS

- A. Furniture Pathways - Shall comply with UL 1286 and NEC Article 605.
- B. It shall be the contractors' responsibility to verify the furniture layout and communication outlet with respect to the furniture. Obtain approved shop drawings from the architect detailing furniture heights, cable openings etc. Prior to roughing in the outlet box, verify height and location for all communication outlets near furniture or cabinetry. Boxes roughed in the wrong location shall be relocated at the contractors' expense.
- C. Provide a concealed transition from outlet box to furniture.

### 3.14 GENERAL

- A. Support raceways from building construction. Do not support raceways from ductwork, piping, or equipment hangers.
- B. Support outlet, pull, and junction boxes independently from building construction. Do not support from raceways.

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- C. Coordinate all raceway runs with other trades.
- D. All open raceways shall be installed a minimum of 6 in. away from any light fixture or other source of EMI (Electro-magnetic interference).
- E. All horizontal pathways shall be bonded and grounded per the NEC Article 250.
- F. In all cases, horizontal pathways shall be sized for a minimum of 50% future growth.

**END OF SECTION**