

SECTION 27 05 28 - PATHWAYS FOR COMMUNICATIONS

PART 1 - GENERAL

1.1 REFERENCES

- A. General provisions of Contract, including General and Supplementary Conditions and Division-1 Specification sections.
- B. Architectural, Electrical, and Technology Drawings. Other systems drawings may apply. Division 26 Basic Electrical Materials and Methods sections apply to work of this section.

1.2 SUMMARY

- A. Systems Performance Requirements
 - 1. Provide pathways for converged low voltage systems such as telephone, data networking, security access control, closed circuit TV, community antenna TV, building automation systems, overhead-paging systems, and similar systems. Coordinate all pathways with the Office of Information Technology (OIT). Systems outside this scope require separate cable trays.

1.3 SUBMITTALS

- A. General: Submit the following in accordance with Conditions of contract and Division 1 Specification Section.
- B. Product Data for the following products:
 - 1. Raceways and fittings.
 - 2. Wireways and fittings.
 - 3. Boxes and fittings.
- C. Installation Instructions: Manufacturer's written installation instructions for wireway, surface raceway, and nonmetallic raceway products.
- D. Submit a combination ductwork, piping, and cable tray plan for coordination, providing section views of areas as required, in according with the requirements of Section 26 05 00.

1.4 QUALITY ASSURANCE

- A. Electrical Component Standard: Components and installation shall comply with NFPA 70 "National Electrical Code."
- B. NEMA Compliance: Comply with applicable requirements of NEMA standards pertaining to raceways.
- C. UL Compliance and Labeling: Comply with applicable requirements of UL standards pertaining to electrical raceway systems. Provide raceway products and components listed and labeled by UL.
- D. Manufacturers: Firms regularly engaged in manufacture of electrical boxes and fittings, of types, sizes, and capacities required, whose products have been in satisfactory use in similar service for not less than five years.
- E. Installer's Qualifications: Firms with at least five years of successful installation experience on projects utilizing electrical boxes and fittings similar to those required for this project.

- F. NEC Compliance: Comply with NEC as applicable to construction and installation of electrical wiring boxes and fittings.
- G. UL Compliance: Comply with applicable requirements of UL 50, UL 514-Series, and UL 886 pertaining to electrical boxes and fittings. Provide electrical boxes and fittings which are UL-listed and labeled.
- H. NEMA Compliance: Comply with applicable requirements of NEMA Stds/Pub No.'s OS1, OS2 and PUB 250 pertaining to outlet and device boxes, covers and box supports.
- I. Federal Specification Compliance: Comply with applicable requirements of FS W-C 586, "Electrical Cast Metal Conduit Outlet Boxes, Bodies, and Entrance Caps."

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Refer to Section 27 05 00 for requirements that shall be fulfilled as part of this specification section.

1.6 SEQUENCING AND SCHEDULING

- A. Refer to Section 27 05 00 for requirements that shall be fulfilled as part of this specification section.

1.7 PROJECT SITE CONDITIONS

- A. Refer to Section 27 05 00 for requirements that shall be fulfilled as part of this specification section.

1.8 WARRANTY

- A. Refer to Section 27 05 00 for requirements that shall be fulfilled as part of this specification section.

1.9 SPECIFICATION RESPONSE

- A. Refer to Section 27 05 00 for requirements that shall be fulfilled as part of this specification section.

1.10 DEFINITIONS

- A. Refer to Section 27 05 00 for requirements that shall be fulfilled as part of this specification section.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Acceptable Manufactures: subject to requirements, provide products by the following:
 - 1. Chalfant Manufacturing Company
 - 2. B-Line Systems, Inc
 - 3. Square-D Company
 - 4. TJ Cope, Inc.

2.2 GENERAL MATERIALS

- A. Ladder Type Cable Tray:
 - 1. Description: NEMA VE 1, Class 20C ladder type tray, ventilated with solid sides.
 - 2. Material: Aluminum that complies with the Aluminum Association's alloy 6063-T6 for rails, rungs, and cable trays and alloy 5052-H32 or alloy 6061-T6 for fabricated parts.
 - 3. Protect steel hardware against corrosion by galvanization according to ASTM B 633 or cadmium plating according to ASTM B 766.

4. Finish: fabricate cable tray products with rounded edges and smooth surfaces
5. Width:
 - a. 24-inch in main corridors.
 - b. 18-inch feeders.
 - c. Minimum width is 12-inches
6. Inside Depth: 6-inch nominal.
7. Rung Spacing: 9-inch
8. Load: 200 pounds/foot minimum.
9. Straight Section Rung Spacing: 9-inch rung spacing.
10. Length: 14-foot sections maximum, 12-foot sections preferred.
11. Provide manufacturer's standard components such as clamps, 90-degree bends, tees, hangers, brackets, splice plates, reducer plates, blind ends, barrier strips, connectors, and grounding straps.
12. Wire Basket shall not to be used on campus.
13. Capacity of cable tray per NEC:

Cable tray width, inches	Cable tray depth, inches	"Thick" Cat 6 cable diameter, inches	Cat 6 cable area, inches	Square inches in cable tray	Number of Cat 6 cables supported in cable tray	Number of Cat 6 cables per NEC 50%* maximum fill
6	3	0.25	0.0491	18	367	183
6	4	0.25	0.0491	24	489	244
6	6	0.25	0.0491	36	733	367
9	3	0.25	0.0491	27	550	275
9	4	0.25	0.0491	36	733	367
9	6	0.25	0.0491	54	1100	550
12	3	0.25	0.0491	36	733	367
12	4	0.25	0.0491	48	978	489
12	6	0.25	0.0491	72	1467	733
18	3	0.25	0.0491	54	1100	550
18	4	0.25	0.0491	72	1467	733
18	6	0.25	0.0491	108	2200	1100
24	3	0.25	0.0491	72	1467	733
24	4	0.25	0.0491	96	1956	978
24	6	0.25	0.0491	144	2934	1467

* NEC (2008) para 392.9(B).

- B. Conduit:
1. Refer to Section 26 05 33 – Raceway and Boxes for Electrical Systems, for conduit requirements.

- C. Pull Boxes:
1. Description: galvanized code-gauge sheet steel junction and pull boxes, with screw-on covers; of types, shapes and sizes, to suit each respective location and installation; with welded seams and equipped with stainless steel nuts, bolts, screws, and washers.
 2. Refer to Part 3 – Execution for additional requirements.

PART 3 - EXECUTION

3.1 GENERAL INSTALLATION

- A. Ladder Type Cable Tray
1. Install in accordance with manufacturer's instructions.

2. Install metallic cable tray in accordance with NEMA VE 1.
3. Install cable tray in accordance with NEMA FG 1.
4. Support trays in accordance with Section 26 05 29. Provide supports at each connection point, at the end of each run, and at other points to maintain the proper loading rate. All-thread supporting cable tray shall be covered 12-inches from the base of support to prevent cable damage during installation.
5. Use expansion connectors when the cable tray run exceeds 90-feet or where required.
6. Remove burrs and sharp edges from cable tray.
7. Make cable tray connections and changes in direction and elevation using standard fittings. Cable tray shall use factory T's, sweeps, and interconnections. The cable tray shall be continuous, without gaps, opening, or breaches.
8. Install cable tray to facilitate cable placement; access to the cable tray should not be restricted.
 - a. All overhead and beneath floor infrastructure collisions should be presented in 3d CAD to the OIT PM for their review and routing approval.
 - b. A minimum of 12-inches access headroom shall be provided and maintained above the cable tray.
 - c. A minimum of 3-inches of clearance shall be maintained below the cable tray.
 - d. Clear working space adjacent to the cable tray shall be 30-inches.
 - e. Desired cable tray clearance from fluorescent light fixtures is 24-inches when parallel and 12-inches when crossing.
 - f. Cable tray installation height shall not exceed 11-feet (top of tray). Contractor shall coordinate any exceptions with the University, Architect and Engineer.
 - g. Coordinate resolution of obstructions with OIT.
9. Seal cable tray penetrations through fire and smoke barriers according to Section 26 05 29.
 - a. Cable tray shall be unbroken and suitably firestopped with re-enterable firestopping when passing through a firewall. Trade Size 4" sleeves shall be required for connection of cable tray through walls. OIT approved mechanical firestopping may be substituted for approved nonmechanical firestopping. OIT approves all firestopping substitutions.
10. Ground and bond cable tray at each section connection as per the provisions of Section 27 05 26.
 - a. Provide continuity between cable tray components.
 - b. Use anti-oxidant compound to prepare aluminum contact surfaces before assembly.
 - c. Provide a 6 AWG bare copper equipment grounding conductor through entire length of cable tray; bond to each component.
 - d. Bonding connections to cable tray may be made using mechanical or exothermic connectors.
 - e. Tighten electrical connectors and terminals according to manufacturer's published torque-tightening values. Use those specified in UL 486A if manufacturer's torque values are not indicated.
11. Warning Signs:
 - a. Install warning signs on 50-foot centers along cable tray, located to be visible.
 - b. Engraved Nameplates: 1/2-inch high black letters on yellow laminated plastic nameplate, engraved with the following wording: Warning! Do not use cable tray as walkway, ladder, or support. Use only as mechanical support for OIT low voltage cables, conduits, and innerducts.

B. Conduit

1. Telecommunications conduits shall maintain large bends and sweeps. Provided below are the ratios for minimum conduit bend radius to conduit size diameter.
 - a. 2-inches (50mm) and smaller: 6:1
 - b. Larger than 2-inches (50mm): 10:1
2. A 2" minimum reamed and bushed conduit shall be provided from the cable tray to each room. This entrance sleeve shall be shared by all low voltage systems entering the room. A larger sleeve, as specified by OIT, may be required depending upon the room's size and low voltage requirements.

3. A 1" conduit shall be used to provide a pathway inside the wall to each work area outlet. The conduit shall be stubbed out to the top of the wall and be physically oriented towards the floor's cable tray. The conduit end shall be reamed and bushed.
 4. If due to obstructions, limited access ceilings, or in clinical areas, conduit shall be used in lieu of J-hooks. All conduit runs shall be coordinated with and approved by OIT.
 - a. All overhead and beneath floor infrastructure collisions should be presented in 3d CAD to the OIT PM for their review and routing approval.
 - b. No section of conduit shall be more than 100' in length or contain more than two 90° bends between pull boxes or pull points.
 - c. Boxes shall not be used in lieu of bends. Electrical 90° elbows (type LB) are not permitted. Corresponding conduit ends must be aligned within boxes.
 - d. All conduit ends shall be reamed and bushed.
 - e. Conduit shall comply with NEC and local codes, standards, and specifications. OIT may stipulate additional specifications as required.
 - f. The bend radius for < 2" conduits should be 6 times the internal diameter of the conduit. Conduits over 2" OD shall have a bend radius at least 10 times the internal diameter of the conduit. Wide sweeps shall be used for all conduits over 2".
 - g. Polyline pull strings with a strength rating of 200 pounds shall be provided for all conduit runs.
 - h. Work area outlets. A work area telecommunications outlet shall be a four-plex, deep box with a single-gang mud ring unless otherwise specified during design.
 - i. Building backbone. Building backbone (riser) conduits shall be Trade Size 4" conduit, minimum. Measured pulling tape shall be provided in all horizontal or vertical building backbone conduits.
- C. J-Hooks
1. From the stubbed work area conduit, J-hooks shall be provided and installed by the cable installer to provide a pathway to the cable tray.
 - a. The section of conduit minimum J-hook size is 2".
 - b. J-hooks are required every 48" to 60" along the pathway.
 - c. Individual J-hooks may support no more than 50 cables.
 - d. J-hooks shall not be shared with other low voltage systems. That is, all other low voltage systems require their own J-hook pathway. J-hook support rods may be shared at pathway crossings or where approved by OIT beforehand.
 - a. When J-hook support rods are shared at crossings or at OIT approved locations, a minimum clearance of 12" is needed between low voltage J-hooks and telecommunications J-hooks.
 - b. Telecommunications J-hooks shall be placed at the bottom of any shared support rod to facilitate frequent moves, adds, and changes.
 - e. Telecommunications J-hook wire supports shall be distinguished by their blue color.
 - f. J-hook wire supports shall be secured at both ends as per NEC 300.11.
- D. Junction and Pull Boxes:
1. Provide galvanized code-gauge sheet steel junction and pull boxes, with screw-on covers; of types, shapes and sizes, to suit each respective location and installation; with welded seams and equipped with stainless steel nuts, bolts, screws, and washers. Pull boxes installed in finished spaces must be flush mounted cabinets provided with trim, hinged door and flush latch and lock to match flush mounted panel board trim. Exact size shall meet minimum industry standards based on conduit quantities and stacking arrangement, as indicated in the table below:

Conduit Trade Size mm (in)	Width mm (in)	Length mm (in)	Depth mm (in)	Width Increase for Additional Conduit mm (in)
27 (1)	101 (4)	406 (16)	76 (3)	51 (2)
35 (1-1/4)	152 (6)	508 (20)	76 (3)	76 (3)
41 (1-1/2)	203 (8)	686 (27)	101 (4)	101 (4)
50 (2)	203 (8)	914 (36)	101 (4)	127 (5)
63 (2-1/2)	254 (10)	1067 (42)	127 (5)	152 (6)
78 (3)	305 (12)	1220 (48)	127 (5)	152 (6)
91 (3-1/2)	305 (12)	1370 (54)	152 (6)	152 (6)
100 (4)	381 (15)	1525 (60)	203 (8)	203 (8)

2. Size: Provide pull and J-boxes for telecommunications, signal, and other systems at least 50% larger than would be required by article 370 of NEC, or as indicated. Locate boxes strategically and provide shapes to permit easy pulling of future wires or cables of types normal for such systems

3.2 TESTING, CLEANING AND CERTIFICATION

- A. Test the installed cable tray by performing the following.
 1. Visually inspect joints and connections for mechanical continuity.
 2. Measure ground resistance of each cable tray system from the most remote element to the point where connection is made to service disconnect enclosure grounding terminal. Record results in ohms.
 3. Certify and report results of inspection and electrical connectivity tests in writing to the university Program Manager and OIT department.

END OF SECTION 27 05 28