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# SECTION 260536 (16139) - CABLE TRAYS

**Verify that Section titles referenced in this Section are correct for this Project's Specifications; Section titles may have changed.**

## PART 1 - GENERAL

**Specifier Note**: Section numbers and titles are from *MasterFormat 2004 Edition* with numbers and titles from *MasterFormat 1995 Edition* as well.

### **1.1 SECTION INCLUDES**

A. Continuous, rigid, welded steel or stainless steel wire mesh cable management system.

B. Cable tray systems are defined to include, but are not limited to, straight sections, supports and accessories.

### **1.2 RELATED DOCUMENTS**

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

### **1.3 SUMMARY**

A. Related Sections include the following:

*2004 Edition*

 1. Section 26 05 13 - Medium-Voltage Cables.

 2. Section 26 05 19 - Low-Voltage Electrical Power Conductors and Cables.

 3. Section 26 05 23 - Control-Voltage Electrical Power Cables.

 4. Section 26 05 33 - Raceway and Boxes for Electrical Systems.

 5. Section 27 05 28.36 - Cable Trays for Communications Systems.

 6. Section 27 10 00 - Structured Cabling.

 7. Section 28 05 13 - Conductors and Cables for Electronic Safety and Security.

 8. Section 28 05 28.36 - Cable Trays for Electronic Safety and Security.

*1995 Edition*

1. Section 16120 - Conductors and Cables.

2. Section 16130 - Raceway and Boxes.

3. Section 16140 - Wiring Devices.

4. Section 16150 - Wiring Connections.

5. Section 16200 - Electrical Power.

6. Section 16700 – Communications.

B. References:

1. IEC 61537 (2001) – Cable Tray Systems and Cable Ladder Systems for Cable Management

2. NEMA VE 1-2002/CSA C22.2 No. 126.1-02 – Metal Cable Tray Systems

3. ANSI/NFPA 70 (2005) – National Electrical Code (NEC)

4. TIA 569-A (1998) – Commercial Building Standard for Telecommunications Pathways & Spaces

5. ASTM A 510 - Specification for General Requirements for Wire Rods and Coarse Round Wire, Carbon Steel

6. ASTM A 380 – Specification for Standard Practice for Cleaning, Descaling, and Passivation of Stainless Steel Parts, Equipment, and Systems

7. ASTM B 633 – Specification for Electrodeposited Coatings of Zinc on Iron and Steel

8. ASTM A 123 – Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products

9. ASTM A 653 - Specification for Steel Sheet, Zinc-Coated (Galvanized) by the Hot-Dip Process, Structural (Physical) Quality

10. Norm NF/A 91-131 for Galvanized Steel

11. Norm NF/EN 12-329 for Electrozinc Coating

12. Norm NF/EN/ISO 14-61 for Hot-Dipped Galvanized Steel

13. Norm NF 10-088-2 for Stainless Steel

### **1.4 SUBMITTALS**

A. Comply with requirements of Section 01330 – Submittal Procedures.

B. Product Data: Submit manufacturer’s product data sheets for cable tray indicating dimensions, materials, and finishes, including UL Classification and NEMA/CSA Certification.

C. Shop Drawings: Submit shop drawings indicating materials, finish, dimensions, accessories, layout, supports, splices, and installation details.

D. Design Calculations: Verify loading capacities for supports.

E. Coordination Drawings: Include floor plans and sections drawn to scale. Include scaled cable tray layout and relationships between components and adjacent structural and mechanical elements. Data presented on these drawings are as accurate as preliminary surveys and planning can determine. Field verification of all dimensions, routing, etc., is directed.

### **1.5 QUALITY ASSURANCE**

A. Source Limitations: Obtain cable tray components through one source from a single manufacturer.

B. Approval and Labeling: Provide cable trays and accessories specified in this Section that are approved and labeled.

1. The Terms “Classified” pertaining to cable trays (rather than “Listed”) and "Labeled": As defined in NFPA 70, Article 100.

2. Listing and Labeling Agency Qualifications: A "Nationally Recognized Testing Laboratory" as defined in OSHA Regulation 1910.7.

C. Comply with NFPA 70, *National Electrical Code, Article 392: Cable Trays*; provide UL Classification and labels*.*

D. Comply with IEC 61537, Cable Tray Systems and Cable Ladder Systems for Cable Management.

E. Comply with NEMA VE 1/CSA C22.2 No. 126.1, *Metal Cable Tray Systems*, for materials, sizes, and configurations; provide cCSAus Certificate and labels.

### **1.6 COORDINATION**

A. Coordinate layout and installation of cable tray with other installations.

1. Revise locations and elevations from those indicated as required to suit field conditions and as approved by the Architect.

2. Storage and Handling: Avoid breakage, denting and scoring finishes. Damaged products will not be installed. Store cable trays and accessories in original cartons and in clean dry space; protect from weather and construction traffic. Wet materials will be unpacked and dried before storage.

## PART 2 - PRODUCTS

### **2.1 MANUFACTURERS**

A. nVent CADDY WBT Performance Tray, LLC.., 115 Harting Road, Centralia, IL 62801. Phone: (618) 918-3821. Toll-Free: (888) 492 8729. Fax: (618) 918 3825. Website: [www.wbtray.com](http://www.wbtray.com/) Email: Mike.Abraham@nVent.com or Mikez@CaseySales.com

*B.* *[Approved Alternates: Select one of the following, if applicable.]*

*1.* *[Hoffmann]*

*2.* *[Chatsworth]*

*3.* *[Hubbell]*

### **2.2 MATERIALS AND FINISHES**

A. Cable Tray Materials: select one of the following:

*1.* *[Carbon steel wire, ASTM A 510, Grade 1008. Wire welded, bent, and surface treated after manufacture.]*

**OR**

*2.* *[Carbon steel wire, ASTM A653, Continuous galvanization before fabrication.] Additional finishing not required.*

B. Cable Tray Finishes:

1. Finish for Carbon Steel Wire after welding and bending of mesh; select one of the following:

*a.* *[Electrodeposited Zinc Plating: ASTM B 633, Type III, SC-1.]*

*b.* *[Hot-Dip Galvanizing After Fabrication: ASTM A 123.]*

*c.* *[Powder-Coated:]*

*1)* *[Black powder-coated surface treatment.*

*2)* *[Custom Color Powder-Coated surface treatment.*

2. Finish for Stainless Steel Wire: According to ASTM B 380.

C. Cable tray will consist of continuous, rigid, welded steel wire mesh cable management system, to allow continuous ventilation of cables and maximum dissipation of heat, with UL Classified splices where tray acts as Equipment Grounding Conductor (EGC). Wire mesh cable tray will have continuous T-welded top wire to protect cable insulation and installers. All cross wires to be WBT’s **SHAPE** wire for maximum support.

D. Provide splices, supports, and other fittings necessary for a complete, continuously grounded system.

1. Mesh: 2 x 4 inches (50 x 100 mm).

2. Straight Section Lengths: 118 inches (3,000 mm).

3. Wire Diameter: 5mm and 6mm as specified by manufacturer.

4. Continuous T-Weld top wire to protect cable insulation and installers’ hands.

5. Fittings: Wire mesh cable tray fittings are field-fabricated from straight tray sections, in accordance with manufacturer’s instructions and Item 2.3.

6. Cable Tray Size:

*a.* Depth: Cable tray depth will be (unless otherwise shown on drawings):

*1)* *[2 inches]*

*2)* *[4 inches]*

*3)* *[6 inches]*

*4)* *[8 inches]*

*b.* Width: Cable tray width will be (unless otherwise shown on drawings):

*1)* *[2 inches (50 mm)]*

*2)* *[4 inches (100 mm)]*

*3)* *[6 inches (150 mm)]*

*4)* *[8 inches (200 mm)]*

*5)* *[12 inches (300 mm)]*

*6)* *[18 inches (450 mm)]*

*7)* *[20 inches (500 mm)]*

*8)* *[24 inches (600 mm)]*

c. Length: Cable tray section length will be 118 inches (3000mm) unless otherwise shown on drawings.

d. Fill Ratio: Cable tray may be filled to *[40%] [50%] [60%] [100%]* of total fill capacity. Size cable tray to accommodate future cabling changes or additions.

e. Load Span Criteria:

1) Install and support cable management system in accordance with one of the following:

*a)* *[IEC 61537, with load span criteria of L/200 (to exceed standard requirements of L/100) and a Safety Factor of 1.7]*

**OR**

*b)* *[NEMA VE-1 (2002), with Safety Factor of 1.5]*

2) Cable tray will be capable of carrying a uniformly distributed load of \_\_\_\_\_\_ pounds per foot on a \_\_\_\_\_\_ support span, according to load tests of standard shown in Item A above.

**CABLE TRAY SUPPORTS & ACCESSORIES**

Fittings/Supports: Wire mesh cable tray fittings are field-fabricated from straight tray sections, in accordance with manufacturer’s instructions.

*7.* Ceiling-mounted supports mount to ceiling structure directly or with ¼”, 3/8” or ½” threaded rod.

8. Wall-mounted supports.

9. Underfloor supports mount directly to floor or to floor posts.

10. Splices, including those approved for electrical continuity (bonding), as recommended by cable tray manufacturer.

*11.* Accessories: As required to protect, support, and install a cable tray system.

### **2.3 EQUIPMENT GROUNDING CONDUCTOR FUNCTION & GROUNDING**

A. UL Classified cable trays may act as Equipment Grounding Conductors. Contact WBT for approved sizes.

1. Use UL Classified splicing methods as recommended by WBT.

a. Ground cable trays at end of continuous run.

b. Ground continuous cable tray runs every 60 feet.

2. Cable trays that are not UL Classified will be grounded per NEC requirements and manufacturer recommendations.

a. Ground cable trays against fault current, noise, lightning, and electromagnetic interference by mounting grounding wire to each 10’ cable tray section with WBT part#: Ground Bolt.

## PART 3 - EXECUTION

### **3.1 EXAMINATION**

A. Examine substrates for compliance with requirements for installation tolerances and other conditions affecting performance of cable trays. Do not proceed with installation until unsatisfactory conditions have been corrected.

### **3.2 INSTALLATION**

A. Install cable tray level and plumb according to manufacturer's written instructions, Coordination Drawings, original design, and referenced standards.

1. Cutting: Field-fabricate changes in direction & elevation by cutting & bending cable tray.

a. Cut cable tray wires in accordance with manufacturer’s instructions.

b. Cable tray wires must be cut with side-action bolt cutters with offset head to ensure integrity of protective galvanic layer.

c. Remove burrs and sharp edges from cable trays.

**END OF SECTION 260536 (16139)**

# SECTION 27 0528 - PATHWAYS FOR COMMUNICATIONS SYSTEMS

**Verify that Section titles referenced in this Section are correct for this Project's Specifications; Section titles may have changed.**

## PART 1 - GENERAL

### **1.1 GENERAL REQUIREMENTS**

A. Applicable requirements of Division 27 Communications shall be considered a part of this section and shall have the same force as if printed herein full.

B. This document describes the products and execution requirements relating to Pathways for Communications Systems.

C. Product specifications, general design considerations, and installation guidelines are provided in this document. Locations of interior telecommunications pathways and typical installation details will be provided on Drawings as an attachment to this document. If the bid documents are in conflict, the Drawings shall take precedence. The successful vendor shall meet or exceed all requirements described in this document.

### **1.2 SUBMITTALS**

A. Provide product data.

### **1.3 WORK INCLUDED**

A. The work included under this Specification consists of furnishing all labor, equipment, materials, supplies and performing all operations necessary to complete the installation. The Contractor will provide and install all of the required material whether specifically addressed in the technical specifications or not.

B. The work shall include, but not be limited to the following:

1. Furnish and install complete Conduit System – Reference Electrical Specifications.

2. Furnish and install all Telecommunications Outlet Boxes.

3. Furnish and install all Pull Boxes.

4. Furnish and install complete Cable Tray System.

5. Furnish and install all Velcro Straps.

## PART 2 PRODUCTS

### **2.1 APPROVED PRODUCTS**

A. Approved Velcro Strap manufacturer(s):

1. Panduit

2. Tyco

3. Hubbell

4. Or Approved Equal

B. Innerduct

1. Exposed innerduct shall be rated CMP (plenum), corrugated plastic equipped with pull string or mule tape.

2. Sizes shall be 2”, 1-1/4” & 1” inside diameter.

3. See Drawings for innerduct details.

### **2.2 PULL BOXES**

A. Pull boxes shall be constructed of galvanized steel with flat, removable covers fastened with plated steel screws.

B. Pull boxes shall be equipped with keyhole screw slots in the cover to permit removal of the cover without extracting the screws.

C. Pull boxes shall have provisions for grounding.

### **2.3 CABLE TRAY**

A. Cable Tray Materials: select one of the following:

1. [Carbon steel wire, ASTM A 510, Grade 1008. Wire welded, bent, and surface treated after manufacture.]

OR

2. [Carbon steel wire, ASTM A653, Continuous galvanization before fabrication.] Additional finishing not required.

B. Cable Tray Finishes:

1. Finish for Carbon Steel Wire after welding and bending of mesh; select one of the following:

a. [Electrodeposited Zinc Plating: ASTM B 633, Type III, SC-1.]

b. [Hot-Dip Galvanizing After Fabrication: ASTM A 123.]

c. [Powder-Coated:]

1) [Black powder-coated surface treatment.

2) [Custom Color Powder-Coated surface treatment.

2. Finish for Stainless Steel Wire: According to ASTM B 380.

C. Cable tray will consist of continuous, rigid, welded steel wire mesh cable management system, to allow continuous ventilation of cables and maximum dissipation of heat, with UL Classified splices where tray acts as Equipment Grounding Conductor (EGC). Wire mesh cable tray will have continuous T-welded top wire to protect cable insulation and installers. All cross wires to be WBT’s SHAPE wire for maximum support.

D. nVent CADDY WBT Performance Tray, LLC.., 115 Harting Road, Centralia, IL 62801. Phone: (618) 918-3821. Toll-Free: (888) 492 8729. Fax: (618) 918 3825. Website: [www.wbtray.com](http://www.wbtray.com/) Email: Mike.Abraham@nVent.com or Mikez@CaseySales.com

D. Provide splices, supports, and other fittings necessary for a complete, continuously grounded system.

1. Mesh: 2 x 4 inches.

2. Straight Section Lengths: 118 inches.

3. Wire Diameter: 5mm and 6mm as specified by manufacturer drawings.

4. Continuous T-Weld top wire to protect cable insulation and installers’ hands.

5. Fittings: Wire mesh cable tray fittings are field-fabricated from straight tray sections, in accordance with manufacturer’s instructions and Item 2.3.

6. Cable Tray Size:

a. Depth: Cable tray depth will be (unless otherwise shown on drawings):

1) [2 inches]

2) [4 inches]

3) [6 inches]

4) [8 inches]

b. Width: Cable tray width will be (unless otherwise shown on drawings):

1) [2 inches (50 mm)]

2) [4 inches (100 mm)]

3) [6 inches (150 mm)]

4) [8 inches (200 mm)]

5) [12 inches (300 mm)]

6) [18 inches (450 mm)]

7) [20 inches (500 mm)]

8) [24 inches (600 mm)]

c. Length: Cable tray section length will be 118 inches (3000mm) unless otherwise shown on drawings.

d. Fill Ratio: Cable tray may be filled to [40%] [50%] [60%] [100%] of total fill capacity. Size cable tray to accommodate future cabling changes or additions.

e. Load Span Criteria:

1) Install and support cable management system in accordance with one of the following:

a) [IEC 61537, with load span criteria of L/200 (to exceed standard requirements of L/100) and a Safety Factor of 1.7]

OR

b) [NEMA VE-1 (2002), with Safety Factor of 1.5]

2) Cable tray will be capable of carrying a uniformly distributed load of \_\_\_\_\_\_ pounds per foot on a \_\_\_\_\_\_ support span, according to load tests of standard shown in Item A above.

**CABLE TRAY SUPPORTS & ACCESSORIES**

Fittings/Supports: Wire mesh cable tray fittings are field-fabricated from straight tray sections, in accordance with manufacturer’s instructions.

7. Ceiling-mounted supports mount to ceiling structure directly or with ¼”, 3/8” or ½” threaded rod.

8. Wall-mounted supports.

9. Underfloor supports mount directly to floor or to floor posts.

10. Splices, including those approved for electrical continuity (bonding), as recommended by cable tray manufacturer.

11. Accessories: As required to protect, support, and install a cable tray system.

### **2.4 VELCRO STRAPS**

A. Velcro Straps

1. Cables shall be fastened to support structures with Velcro straps.

2. Velcro straps installed in air handling spaces must be plenum rated.

a. Plenum Velcro strap color shall be red.

3. Use 1-inch wide Velcro to secure cables to all support structures.

## PART 3 - EXECUTION

### **3.1 CABLE TRAY INSTALLATION**

A. Comply with recommendations in NEMA VE 2. Install as a complete system, including all necessary fasteners, hold-down clips, splice-plate support systems, barrier strips, hinged horizontal and vertical splice plates, elbows, reducers, tees, and crosses.

B. Remove burrs and sharp edges from cable trays.

C. Fasten cable tray supports to building structure.

1. Design each fastener and support to carry load indicated by seismic requirements.

2. Place supports so that spans do not exceed maximum spans on schedules.

3. Construct supports from channel members, threaded rods, and other appurtenances furnished by cable tray manufacturer. Arrange supports in trapeze or wall-bracket form as required by application.

4. Support bus assembly to prevent twisting from eccentric loading.

5. Manufacture center-hung support, designed for 60 percent versus 40 percent eccentric loading condition, with a safety factor of 3.

6. Locate and install supports according to NEMA VE 1.

D. Make connections to equipment with flanged fittings fastened to cable tray and to equipment. Support cable tray independent of fittings. Do not carry weight of cable tray on equipment enclosure.

E. Install expansion connectors where cable tray crosses building expansion joint and in cable tray runs that exceed dimensions recommended in NEMA VE 1. Space connectors and set gaps according to applicable standard.

F. Make changes in direction and elevation using standard fittings.

G. Make cable tray connections using standard fittings.

H. Sleeves for Future Cables: Install capped sleeves for future cables through firestop-sealed cable tray penetrations of fire and smoke barriers.

I. Workspace: Install cable trays with enough space to permit access for installing cables.

J. Install barriers to separate cables of different systems, such as power, communications, and data processing; or of different insulation levels, such as 600, 5000, and 15 000 V.

K. After installation of cable trays is completed, install warning signs in visible locations on or near cable trays.

### **3.2 CABLE INSTALLATION**

A. Install cables only when cable tray installation has been completed and inspected.

B. Fasten cables on horizontal runs with cable clamps or cable ties as recommended by NEMA VE 2. Tighten clamps only enough to secure the cable, without indenting the cable jacket. Install cable ties with a tool that includes an automatic pressure-limiting device.

C. On vertical runs, fasten cables to tray every 18 inches (457 mm). Install intermediate supports when cable weight exceeds the load-carrying capacity of the tray rungs.

### **3.4 CONNECTIONS**

A. Ground cable trays according to manufacturer's written instructions.

B. Install an insulated equipment grounding conductor with cable tray, in addition to those required by NFPA 70.

### **3.5 FIELD QUALITY CONTROL**

A. After installing cable trays and after electrical circuitry has been energized, survey for compliance with requirements. Perform the following field quality-control survey:

1. Visually inspect cable insulation for damage. Correct sharp corners, protuberances in cable tray, vibration, and thermal expansion and contraction conditions, which may cause or have caused damage.

2. Verify that the number, size, and voltage of cables in cable tray do not exceed that permitted by NFPA 70. Verify that communication or data-processing circuits are separated from power circuits by barriers.

3. Verify that there is no intrusion of such items as pipe, hangers, or other equipment that could damage cables.

4. Remove deposits of dust, industrial process materials, trash of any description, and any blockage of tray ventilation.

5. Visually inspect each cable tray joint and each ground connection for mechanical continuity. Check bolted connections between sections for corrosion. Clean and retorque in suspect areas.

6. Check for missing or damaged bolts, bolt heads, or nuts. When found, replace with specified hardware.

7. Perform visual and mechanical checks for adequacy of cable tray grounding; verify that all takeoff raceways are bonded to cable tray.

B. Report results in writing.

### **3.6 PROTECTION**

A. Protect installed cable trays.

1. Repair damage to galvanized finishes with zinc-rich paint recommended by cable tray manufacturer.

2. Repair damage to PVC or paint finishes with matching touchup coating recommended by cable tray manufacturer.

3. Install temporary protection for cables in open trays to protect exposed cables from falling objects or debris during construction. Temporary protection for cables and cable tray can be constructed of wood or metal materials until the risk of damage is over.

### **3.7 PENETRATIONS**

A. Holes through concrete and masonry in new and existing structures shall be cut with a diamond core drill or concrete saw upon approval of the structural engineer of record for the base of building. Impact electric, hand or manual hammer type drills shall not be allowed, except where permitted by the Project Manager as required by limited working space. X ray all floor penetrations accordingly.

B. Holes shall be located so as not to affect structural sections such as ribs or beams.

C. Holes shall be laid out in advance. The Project Manager shall be advised prior to drilling through structural sections, for determination of proper layout.

D. Structural Penetrations: Where conduits, wireways and other raceways pass through fire partitions, fire walls or walls and floors provide a code compliant effective barrier against the spread of fire, smoke and gases.

E. All penetrations where conduit is not used shall be sleeved.

F. No gaps or rough edges shall be allowed between wall and conduit/sleeve.

### **3.8 CONDUIT SYSTEM**

A. All conduit shall not be less than 3/4” trade size.

B. No more than two 90 degree sweep bends or the equivalent shall be permitted between junction boxes, pull boxes, cabinets, or cable access points.

C. Conduit shall be provided as a continuous run perpendicular from the cable tray to the work area outlet. All cables shall be enclosed in conduit or cable tray for protection.

D. Conceal all conduits, except in unfinished spaces such as equipment rooms or as indicated by symbol on the Drawings.

E. Leave all empty conduits with a 200 pound test nylon cord pull line.

F. A 200 pound test nylon cord pull line shall be co-installed with all cable installed in any conduit.

G. Flattened, dented, or deformed conduits are not permitted and shall be removed and replaced.

H. Fasten conduit support device to structure with wood screws on wood, toggle bolts on hollow masonry, anchors as specified on solid masonry or concrete, and machine bolts, clamps, or spring steel clips, on steel.

I. Install conduit with wiring, including homeruns as indicated on the Drawings. Any change resulting in a savings in labor or materials is to be made only in accordance with a contract change. Deviations shall be made only where necessary to avoid interferences and when approved by Engineer by written authorization.

J. Conduit shall be run parallel or at right angles to existing walls, ceilings, and structural members.

K. Attach backbone conduits larger than one inch trade diameter to or from structure on intervals not exceeding twelve feet with conduit beam clamps, one hole conduit straps or trapeze type support.

L. Where conduits must pass through structural members obtain approval of Architect.

M. Install all conduits or sleeves penetrating or routed within rated firewalls or fire floors to maintain fire rating of wall or floor. Conduit shall not be installed in rated floors or walls if it compromises or violates the fire rating of floor or wall. Refer to architectural documents.

N. Provide expansion and deflection coupling where conduit passes over a building expansion joint.

O. All other conduit, unless specified herein, shall be electrical metallic tubing (EMT). PVC conduit is not allowed in exposed or concealed areas. PVC to be installed below concrete in grade. Contractor to utilize Rigid Galvanized Steel (RGS) elbows for all slab penetrations and stub-ups.

P. Telecommunications cables shall not occupy conduits with power cables.

Q. Metallic conduits shall be grounded in accordance with J-STD-607-A.

R. For runs that total more than 100 feet in length, insert pull boxes so that no segment between boxes exceeds the 100 feet limit.

S. Conduit runs shall not have more than two (2) 90-degree bends between pull points.

T. Telecommunications conduit system shall contain no condulets (also known as an LB).

U. Horizontal Conduits

1. Support horizontal conduits at intervals not exceeding ten feet and within three feet of each outlet, junction box, backboard, enclosure or cabinet. Support conduits from structural steel members with spring steel type or beam conduit clamps and to non-metallic structural members with one-hole conduit straps. For exposed conduits and where conduits must be suspended below structure, single conduit runs shall be supported from structure by hanger rod and conduit clamp assembly, and multiple conduits shall be supported by trapeze type support suspended from structure. Do not attach conduits to ceiling suspension system channels or suspension wires.

### **3.9 TELECOMMUNICATIONS OUTLET BOXES**

A. Exact locations of the outlet boxes shall be coordinated with the electrical contractor and other trades.

B. The approximate locations of the outlets are indicated on the Drawings. The exact locations shall be determined at the building. The right is reserved to change, without additional cost, the exact location of any outlet, a maximum of 10' before it is permanently installed.

C. Orientation of outlet boxes (horizontal or vertical) shall be as indicated on the architectural elevations.

D. Install all outlet boxes in finished areas flush with the wall. Maintain 1/4" or less space between outlet box front and finished wall surface.

E. Outlet boxes shall be firmly anchored in place and shall not depend on the cover plate to hold it secure to the wall.

F. Outlet boxes installed back-to-back in fire-rated walls shall be separated horizontally by a minimum of 24".

### **3.10 PULL BOXES**

A. Pull boxes shall be secured, independent of the conduit entries into the box. Pull boxes shall be secured to the building structure. In ceiling applications, pull boxes shall not be supported with ceiling wires.

B. Conduits entering pull boxes shall connect to pull boxes using die-cast zinc connectors.

C. Pull boxes shall be free from burrs, dirt and debris.

D. Pull boxes shall be installed in accordance with ANSI/TIA/EIA-569-A.

E. Pull boxes shall be grounded in accordance with J-STD-607-A.

### **3.11 CABLE TRAY SYSTEM**

A. Install trays in accordance with recognized industry practices, to ensure that the cable tray equipment complies with requirements of the NEC.

B. All open trays shall be installed a minimum of six (6) inches away from any light fixture.

C. Provide external grounding strap at expansion joints, sleeves, crossover and other locations where tray continuity is interrupted.

D. Support all pathways from building construction. Do not support pathways from ductwork, piping or equipment hangers.

E. Install cable tray level and straight.

F. Provide all hardware, accessories, fasteners, anchors, threaded rods and support channels required to provide a complete cable tray system.

G. Cable trays shall not be used to house both low voltage and power cables unless cables are separated by a grounded physical barrier.

H. Cable tray system shall be grounded in accordance with J-STD-607-A.

I. Bundle horizontal distribution cables in groups not greater than 50 cables.

### **3.12 VELCRO STRAPS**

A. Velcro straps shall be installed around cables at intervals of 12" minimum.

B. Do not over cinch cables.

### **3.13 IDENTIFICATION**

A. Refer to section 27 0553 for labeling details.

**END OF SECTION 27 05 28**