
Yale University

# Yale University

## IT Infrastructure Construction Standards

New Haven, Connecticut

## Appendix G

## OUTLINE SPECIFICATIONS

## DIVISIONS 27 AND 28

**July 31, 2020**
**Revision 1.0**

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DIVISION SECTION TITLE



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# OUTLINE SECTION 270000 - GENERAL COMMUNICATIONS PROVISIONS

## PART 1 - GENERAL

### 1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including Project Conditions and Division 01 Specification Sections, apply to this Section.

### 1.2 SUMMARY

A. This Section includes the following:

1. Scope of Work.
2. Intent of Drawings.
3. Pre-Bid Site Visit.
4. Definitions.
5. General Standards of Materials.
6. Products and Substitutions.
7. Applicable Codes.
8. Guarantees and Certificates.
9. Quiet Operation and Vibration Control.
10. Temporary Shutdown of Existing Systems.
11. Coordination.
12. Shop Drawings, Product Data, and Samples.
13. Owner Instruction.

### 1.3 SCOPE OF WORK

A. The scope of the work included under Division 27 of the specifications shall include complete systems as shown in the Contract Documents and specified herein. Any work reasonably inferable or required to result in a complete installation or the intended operation and performance of the systems, shall be included in the Base Bid except where there is specific reference to exclusion and incorporation in other quotations.

B. A brief written Scope of Work appears in Division 01.

C. Contractor shall be solely responsible for all parts, labor, testing, documentation and all other processes and physical apparatus necessary to turn over the completed cabling system and associated infrastructure fully warranted and operational for acceptance by the Owner.

D. Provide the telecommunication system conduit (with pull string), boxes, cable tray, and raceways in complete accordance with the specifications and the information found on the drawings.

E. This section specifies work to be provided by the network communications contractor, to include furnishing and installation of cabling, jacks, terminal blocks and terminations.

Installation of communications cabling and performing any terminations in the MDF or IDF closets and at all room voice and data jacks will be the responsibility of this cabling contractor.

F. This specification includes structured cabling design considerations, product specifications and installation guidelines for low-voltage network systems and associated infrastructure including, but not limited to:

1. Horizontal Copper
2. Intrabuilding Backbone Cabling
3. Interbuilding Backbone Cabling
4. Telecommunications Pathways
5. Communications Racks and Cable Managers
6. Communications Grounding Systems
7. Cabling Labeling and Administration
8. Audiovisual Systems Infrastructure
9. Security Systems Infrastructure

1.4 QUALITY ASSURANCE

1.5 INTENT OF DRAWINGS

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OUTLINE SECTION 270500 - COMMON WORK FOR COMMUNICATIONS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including Project Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

1.3 DEFINITIONS

1.4 SUBMITTALS

1.5 EXCAVATING AND BACKFILLING

1.6 WATERPROOFING

1.7 WEATHERPROOFING LOCATIONS (WP)

1.8 CUTTING AND PATCHING

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1.10 PAINTING

1.11 EQUIPMENT FOUNDATIONS, SUPPORTS, PIERS AND ATTACHMENTS

1.12 CLEANING, PROTECTING AND ADJUSTING

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1.14 WELDING

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1.16 FIRESTOPPING

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# OUTLINE SECTION 270526 - GROUNDING AND BONDING FOR COMMUNICATIONS SYSTEMS

## PART 1 - GENERAL

### 1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including Project Conditions and Division 01 Specification Sections, apply to this Section.

### 1.2 SUMMARY

A. Section Includes:

1. Grounding conductors.
2. Grounding connectors.
3. Grounding busbars.
4. Grounding labeling.

### 1.3 DEFINITIONS

### 1.4 ACTION SUBMITTALS

### 1.5 INFORMATIONAL SUBMITTALS

### 1.6 CLOSEOUT SUBMITTALS

### 1.7 QUALITY ASSURANCE

## PART 2 - PRODUCTS

### 2.1 SYSTEM DESCRIPTION

A. Comply with TIA-607-D Generic Telecommunications Bonding and Grounding (Earthing) for Customer Premises and BICSI Telecommunications Distribution Methods Manual, latest edition for grounding and bonding installation and methods.

2.2 CONDUCTORS

2.3 CONNECTORS

2.4 GROUNDING BUSBARS

2.5 GROUND RODS

2.6 IDENTIFICATION

PART 3 - EXECUTION

3.1 EXAMINATION

3.2 INSTALLATION

3.3 APPLICATION

3.4 GROUNDING BUSBARS

3.5 CONNECTIONS

3.6 IDENTIFICATION

3.7 FIELD QUALITY CONTROL

END OF SECTION 270526

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# OUTLINE SECTION 270528 - PATHWAYS FOR COMMUNICATIONS SYSTEMS

## PART 1 - GENERAL

### 1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including Project Conditions and Division 01 Specification Sections, apply to this Section.

### 1.2 SUMMARY

A. Section Includes:

1. Metal conduits and fittings.
2. Nonmetallic conduits and fittings.
3. Optical-fiber-cable pathways and fittings.
4. Metal wireways and auxiliary gutters.
5. Nonmetallic wireways and auxiliary gutters.
6. Metallic surface pathways.
7. Nonmetallic surface pathways.
8. Boxes, enclosures, and cabinets.
9. Polymer-concrete handholes and boxes for exterior underground cabling.

B. Provide raceways as required for the following low voltage systems:

1. Data/Voice/Video Premise Wiring System
2. Audiovisual Cabling Systems
3. Security Systems

### 1.3 DEFINITIONS

### 1.4 ACTION SUBMITTALS

### 1.5 SUBMITTALS

## PART 2 - PRODUCTS

### 2.1 METAL CONDUITS AND FITTINGS

2.2 NONMETALLIC CONDUITS AND FITTINGS

2.3 OPTICAL-FIBER-CABLE PATHWAYS AND FITTINGS

2.4 METAL WIREWAYS AND AUXILIARY GUTTERS

2.5 SURFACE METAL PATHWAYS

2.6 SURFACE NONMETALLIC PATHWAYS:

2.7 BOXES, ENCLOSURES, AND CABINETS

2.8 OPEN TOP CABLE SUPPORTS

PART 3 - EXECUTION

3.1 PATHWAY APPLICATION

A. Outdoors: Apply pathway products as specified below unless otherwise indicated:

1. Exposed Conduit: GRC.
2. Concealed Conduit, Aboveground: IMC.
3. Underground Conduit: Type EPC-40-PVC.
4. Boxes and Enclosures, Aboveground: NEMA 250, Type 3R, Type 4.

B. Indoors: Apply pathway products as specified below unless otherwise indicated:

1. Exposed, Not Subject to Physical Damage: EMT.
2. Exposed, Not Subject to Severe Physical Damage: EMT.
3. Exposed and Subject to Severe Physical Damage: GRC. Pathway locations include the following:

    a. Loading dock.
    b. Corridors used for traffic of mechanized carts, forklifts, and pallet-handling units.
    c. Mechanical rooms.

4. Concealed in Ceilings and Interior Walls and Partitions: EMT.
5. Damp or Wet Locations: IMC.
6. Pathways for Optical-Fiber or Communications Cable in Spaces Used for Environmental Air: Plenum-type, optical-fiber-cable pathway,EMT.
7. Pathways for Optical-Fiber or Communications-Cable Risers in Vertical Shafts: Riser-type, optical-fiber-cable pathway, EMT.

8. Pathways for Concealed General-Purpose Distribution of Optical-Fiber or Communications Cable: General-use, optical-fiber-cable pathway, Riser-type, optical-fiber-cable pathway, Plenum-type, optical-fiber-cable pathway, EMT.
9. Boxes and Enclosures: NEMA 250, Type 1, except use NEMA 250, Type 4 stainless steel units in damp or wet locations.

C. Minimum Pathway Size: 1 inch for optical-fiber cables.

D. Pathway Fittings: Compatible with pathways and suitable for use and location.

1. Rigid and Intermediate Steel Conduit: Use threaded rigid steel conduit fittings unless otherwise indicated. Comply with NEMA FB 2.10.
2. PVC Externally Coated, Rigid Steel Conduits: Use only fittings listed for use with this type of conduit. Patch and seal all joints, nicks, and scrapes in PVC coating after installing conduits and fittings. Use sealant recommended by fitting manufacturer and apply in thickness and number of coats recommended by manufacturer.
3. EMT: Use compression, steel fittings. Comply with NEMA FB 2.10.

E. Do not install aluminum conduits, boxes, or fittings in contact with concrete or earth.

F. Install surface pathways only where indicated on Drawings.

G. Do not install nonmetallic conduit where ambient temperature exceeds 120 deg F.

## 3.2 INSTALLATION

A. Comply with the following standards for installation requirements except where requirements on Drawings or in this Section are stricter:

1. NECA 1.
2. NECA/BICSI 568.
3. TIA-569-D.
4. NECA 101
5. NECA 102.
6. NECA 105.
7. NECA 111.

B. Comply with NFPA 70 limitations for types of pathways allowed in specific occupancies and number of floors.

C. Comply with requirements in Section 078413 "Penetration Firestopping" for firestopping materials and installation for penetrations through fire-rated walls, ceilings, and assemblies.

D. Comply with requirements in Section 270529 "Hangers and Supports for Communications Systems" for hangers and supports.

E. Keep pathways at least 6 inches away from parallel runs of flues and steam or hot-water pipes. Install horizontal pathway runs above water and steam piping.

F. Complete pathway installation before starting conductor installation.

G. Contractor shall size conduit large enough to accommodate at least 50% growth. I.e. conduit for 4 cables shall be sized to accommodate 6 cables at less than 40% calculated fill based on cable OD.

H. Interior cable pathways shall utilize 4 inch conduits as connecting points to the communications rooms unless space constraints prevent installation.

I. Additional conduit to the communications rooms shall be installed to provide a 4 to 1 ratio of 40% full conduit to a single empty conduit for future use.

J. Coordinate exact location of backboxes with Architectural drawings prior to installation of raceways and backboxes and before construction of walls and floors.

K. Recessed wall outlet backboxes shall be double ganged, 4 11/16” x 4 11/16” x 2 1/8” minimum size. Provide trim ring on outlet box as required for specific wall construction and size of faceplate.

L. Do not install any Division 27 raceway or conduit below slab on grade unless shown or stated otherwise or approved by the Engineer.

M. Each telecommunication system wall outlet shall have a dedicated outlet box and not be ganged together with power receptacles unless otherwise stated.

N. Do not “daisy-chain” conduit between outlet back boxes for data/voice/video systems unless otherwise stated in specific cases.

O. Coordinate the length and routing of raceway runs to meet cabling length requirements of TIA/EIA 568/569 Standards.

P. Arrange stub-ups so curved portions of bends are not visible above finished slab.

Q. Install no more than the equivalent of two 90-degree bends in any pathway run. Support within 12 inches of changes in direction. Utilize long radius ells for all optical-fiber cables.

R. Conceal rigid conduit within finished walls, ceilings, and floors unless otherwise indicated. Install conduits parallel or perpendicular to building lines.

S. Support conduit within 12 inches of enclosures to which attached.

T. Pathways Embedded in Slabs:

1. Run conduit larger than 1-inch trade size, parallel or at right angles to main reinforcement. Where at right angles to reinforcement, place conduit close to slab support. Secure pathways to reinforcement at maximum 10-foot intervals.
2. Arrange pathways to cross building expansion joints at right angles with expansion fittings. Comply with requirements for expansion joints specified in this article.
3. Arrange pathways to keep a minimum of 2 inches of concrete cover in all directions.
4. Do not embed threadless fittings in concrete unless specifically approved by Architect for each specific location.
5. Change from nonmetallic conduit and fittings to RNC and fittings before rising above floor.

U. Stub-ups to Above Recessed Ceilings (only where exposed cable installation is permitted):

1. Use EMT, IMC, or RMC for pathways.
2. Use a conduit bushing or insulated fitting to terminate stub-ups not terminated in hubs or in an enclosure.

V. Threaded Conduit Joints, Exposed to Wet, Damp, Corrosive, or Outdoor Conditions: Apply listed compound to threads of pathway and fittings before making up joints. Follow compound manufacturer's written instructions.

W. Coat field-cut threads on PVC-coated pathway with a corrosion-preventing conductive compound prior to assembly.

X. Terminate threaded conduits into threaded hubs or with locknuts on inside and outside of boxes or cabinets. Install insulated bushings on conduits terminated with locknuts.

Y. Install pathways square to the enclosure and terminate at enclosures with locknuts. Install locknuts hand tight plus one additional quarter-turn.

Z. Do not rely on locknuts to penetrate nonconductive coatings on enclosures. Remove coatings in the locknut area prior to assembling conduit to enclosure, to assure a continuous ground path.

AA. Cut conduit perpendicular to the length. For conduits of 2-inch trade size and larger, use roll cutter or a guide to ensure cut is straight and perpendicular to the length.

BB. Install pull wires in empty pathways. Use polypropylene or monofilament plastic line with not less than 200-lb tensile strength. Leave at least 12 inches of slack at each end of pull wire. Secure pull wire, so it cannot fall into conduit. Cap pathways designated as spare alongside pathways in use.

CC. Surface Pathways:

1. Install surface pathway for surface telecommunications outlet boxes only where indicated on Drawings.
2. Install surface pathway with a minimum 2-inch radius control at bend points.
3. Secure surface pathway with screws or other anchor-type devices at intervals not exceeding 48 inches and with no less than two supports per straight pathway section. Support surface pathway according to manufacturer's written instructions. Tape and glue are not acceptable support methods.

DD. Pathways for Optical-Fiber and Communications Cable: Install pathways, metal and nonmetallic, rigid and flexible, as follows:

1. 3/4-Inch Trade Size and Smaller: Install pathways in maximum lengths of 50 feet.
2. 1-Inch Trade Size and Larger: Install pathways in maximum lengths of 75 feet.
3. Install with a maximum of two 90-degree bends or equivalent for each length of pathway unless Drawings show stricter requirements. Separate lengths with pull or junction boxes or terminations at distribution frames or cabinets where necessary to comply with these requirements.

EE. Install pathway-sealing fittings at accessible locations according to NFPA 70 and fill them with listed sealing compound. For concealed pathways, install each fitting in a flush steel box with a blank cover plate having a finish similar to that of adjacent plates or surfaces. Install pathway-sealing fittings according to NFPA 70.

FF. Install devices to seal pathway interiors at accessible locations. Locate seals, so no fittings or boxes are between the seal and the following changes of environments. Seal the interior of all pathways at the following points:

1. Where conduits pass from warm to cold locations, such as boundaries of refrigerated spaces.
2. Where an underground service pathway enters a building or structure.
3. Where otherwise required by NFPA 70.

GG. Comply with manufacturer's written instructions for solvent welding PVC conduit and fittings.

HH. Expansion-Joint Fittings:

1. Install in each run of aboveground RNC that is located where environmental temperature change may exceed 30 deg F, and that has straight-run length that exceeds 25 feet. Install in each run of aboveground RMC that is located where environmental temperature change may exceed 100 deg F, and that has straight-run length that exceeds 100 feet.
2. Install type and quantity of fittings that accommodate temperature change listed for each of the following locations:

    a. Outdoor Locations Not Exposed to Direct Sunlight: 125 deg F temperature change.
    b. Outdoor Locations Exposed to Direct Sunlight: 155 deg F temperature change.
    c. Indoor Spaces Connected with Outdoors without Physical Separation: 125 deg F temperature change.
    d. Attics: 135 deg F temperature change.

3. Install fitting(s) that provide expansion and contraction for at least 0.00041 inch per foot of length of straight run per deg F of temperature change for PVC conduits. Install fitting(s) that provide expansion and contraction for at least 0.000078 inch per foot of length of straight run per deg F of temperature change for metal conduits.
4. Install expansion fittings at all locations where conduits cross building or structure expansion joints.
5. Install each expansion-joint fitting with position, mounting, and piston setting selected according to manufacturer's written instructions for conditions at specific location at time of installation. Install conduit supports to allow for expansion movement.

II. Mount boxes at heights indicated on Drawings. If mounting heights of boxes are not individually indicated, give priority to ADA requirements. Install boxes with height measured to center of box unless otherwise indicated.

JJ. Recessed Boxes in Masonry Walls: Saw-cut opening for box in center of cell of masonry block, and install box flush with surface of wall. Prepare block surface to provide a flat surface for a raintight connection between box and cover plate or supported equipment and box.

KK. Horizontally separate boxes mounted on opposite sides of walls, so they are not in the same vertical channel.

LL. Support boxes of three gangs or more from more than one side by spanning two framing members or mounting on brackets specifically designed for the purpose.

MM. Fasten junction and pull boxes to or support from building structure. Do not support boxes by conduits.

NN. Set metal floor boxes level and flush with finished floor surface.

OO. Set nonmetallic floor boxes level. Trim after installation to fit flush with finished floor surface.

3.3 OPEN TOP CABLE SUPPORTS

A. Size to allow a minimum of 50 percent future capacity without exceeding design capacity limits.

B. Do not use ceiling grid support wire or support rods.

C. Hook spacing shall allow no more than 6 inches of slack. The lowest point of the cables shall be no less than 6 inches adjacent to ceilings, mechanical ductwork and fittings, luminaires, power conduits, power and telecommunications outlets, and other electrical and communications equipment.

D. Space hooks no more than 4 feet o.c.

E. Provide a hook at each change in direction

3.4 FIRESTOPPING

3.5 PROTECTION

END OF SECTION 270528

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# OUTLINE SECTION 270529 - HANGERS AND SUPPORTS FOR COMMUNICATIONS SYSTEMS

## PART 1 - GENERAL

### 1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including Project Conditions and Division 01 Specification Sections, apply to this Section.

### 1.2 SUMMARY

A. Section Includes:

1. Steel slotted support systems for communication raceways.
2. Aluminum slotted support systems for communication raceways.
3. Nonmetallic slotted support systems for communication raceways.
4. Conduit and cable support devices.
5. Support for conductors in vertical conduit.
6. Structural steel for fabricated supports and restraints.
7. Mounting, anchoring, and attachment components, including powder-actuated fasteners, mechanical expansion anchors, concrete inserts, clamps, through bolts, toggle bolts, and hanger rods.
8. Fabricated metal equipment support assemblies.

### 1.3 ACTION SUBMITTALS

### 1.4 INFORMATIONAL SUBMITTALS

### 1.5 QUALITY ASSURANCE

## PART 2 - PRODUCTS

### 2.1 PERFORMANCE REQUIREMENTS

### 2.2 SUPPORT, ANCHORAGE, AND ATTACHMENT COMPONENTS

### 2.3 FABRICATED METAL EQUIPMENT SUPPORT ASSEMBLIES

PART 3 - EXECUTION

3.1 APPLICATION

3.2 SUPPORT INSTALLATION

3.3 INSTALLATION OF FABRICATED METAL SUPPORTS

3.4 PAINTING

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# OUTLINE SECTION 270534 FLOOR BOXES FOR ELECTRICAL AND COMMUNICATIONS SYSTEMS

## PART 1 - GENERAL

### 1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract including Project Conditions and Division 01 Specification Sections, apply to this Section.

### 1.2 SCOPE

A. The floor box provides the interface between power and communication cabling in a concrete floor, and the workstation where both power and communication device outlets are required. The box provides recessed device outlets that will not obstruct the floor area.

B. These poke-thru devices provide the interface between power, communication and audio/ visual (A/V) cabling in an above grade concrete floor and the workstation or activation location where power communication and/or A/V device outlets are required. These poke-thru devices provide recessed device outlets that will not obstruct the floor area.

### 1.3 CLASSIFICATION AND USE

## PART 2 - PRODUCTS

### 2.1 MANUFACTURER

### 2.2 FLOOR BOXES

A. Classification and Use: Floor boxes shall have been examined and tested by Underwriters Laboratories Inc. to meet UL514A and UL514C. Floor boxes shall also conform to the standards set in Section 300-21 of the National Electrical Code. Floor boxes shall meet UL scrub water requirements, but are not suitable for wet or damp locations, or other areas subject to saturation with water or other liquids. Floor boxes shall also have been evaluated by UL to meet the applicable U.S. and Canadian safety standards for scrub water exclusion when used on tile, bare concrete, terrazzo, wood, and carpet covered floors. Floor boxes shall be suitable for use in air handling spaces in accordance with Section 300-22 (C) of the National Electrical Code.

### 2.3 POKE THROUGH

A. Poke-Thru Assembly

B. Activation Cover

C. Communication Modules Mounting Accessories

PART 3 - EXECUTION

3.1 INSTALLATION

A. Floor Boxes

1. The floor box shall contain four leveling legs to provide full pre-concrete pour adjustment. Additionally, the box shall ship with a disposable cover to prevent the entry of debris during the construction phase. Alternate disposable covers to provide terrazzo pour stops is to be available from the manufacturer. The floor box shall be warranted for one year from the date of final acceptance.

2. Provide conduits to the floor box for various services as required.

3. Field verify final location of all floor boxes.

4. Provide lid activation covers of type, finish, and configuration as required. Final configuration shall be approved by the Architect.

5. Provide finished flooring material within recessed areas of the lid activation covers designed to accept finished flooring. The finished flooring shall match the surrounding floor finishes. Coordinate with the flooring contractor.

6. Provide additional supplemental support for the floor box as needed to securely set it at the proper elevation prior to pour.

7. The contractor shall identify the final finished floor type prior to installation. Consult with the manufacturer for directions and elevations for installing the floor box with that type of floor finish. Provide the complete installation as required for that finished floor type.

8. Provide device brackets for mounting power and communications devices and jacks. Coordinate with the Architect for the final configurations and types required for each floor box. The Contractor shall provide any configuration and type required.

9. Provide floor box lids (activation covers) for every floor box. Coordinate with the Architect for the final lid configuration and type required for each floor box. The contractor shall provide any configuration and type required.

B. Poke Throughs

1. The poke through use is defined by the UL Fire Resistance Directory as a minimum spacing of 2 ft. [610mm] on center and not more than one device per each 65 sq. ft. [6m2] of floor area in each span."

2. Installation shall be completed by pushing unit down into the cored hole. Prior to and during installation, refer to system layout and/or approval drawings. Installer shall comply with detailed manufacturer's instruction sheet included with each device. The unit shall contain a retainer for securing the device in the slab, as well as the necessary intumescent material to seal the cored-hole under fire conditions.

3. Provide conduits to the poke throughs for various services as required.

4. Field verify final location of all poke throughs.

5. Provide lid activation covers of type, finish, and configuration as required. Final configuration shall be approved by the Architect.

6. Provide additional supplemental support for the poke through as needed to securely set it at the proper elevation.

7. The contractor shall identify the final finished floor type prior to installation. Consult with the manufacturer for directions and elevations for installing the floor box with that type of floor finish. Provide the complete installation as required for that finished floor type.

8. Provide device brackets for mounting power and communications devices and jacks. Coordinate with the Architect for the final configurations and types required for each floor box. The Contractor shall provide any configuration and type required.

9. Provide activation covers for every poke through. Coordinate with the Architect for the final lid configuration and type required for each floor box. The contractor shall provide any configuration and type required.

3.2 CLEANING AND PROTECTION

A. Clean exposed surfaces using non-abrasive materials and methods recommended by manufacturer.

B. Protect boxes until acceptance.

END OF SECTION 270534

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# OUTLINE SECTION 270536 - CABLE TRAYS FOR COMMUNICATIONS SYSTEMS

## PART 1 - GENERAL

### 1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

### 1.2 SUMMARY

A. Section Includes:

1. Wire-mesh cable tray.
2. Cable runway
3. Cable tray accessories.
4. Warning signs.

### 1.3 REFERENCES

### 1.4 ACTION SUBMITTALS

### 1.5 INFORMATIONAL SUBMITTALS

### 1.6 QUALITY ASSURANCE

### 1.7 DELIVERY, STORAGE, AND HANDLING

### 1.8 PROJECT CONDITIONS

### 1.9 COORDINATION

## PART 2 - PRODUCTS

### 2.1 GENERAL REQUIREMENTS FOR CABLE TRAYS

2.2 GENERAL REQUIREMENT FOR CABLE TRAY

2.3 WIRE-MESH CABLE TRAY

A. Cable tray shall 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 side wire to protect cable insulation and installers.

1. Cable tray systems shall include, but are not limited to, straight sections, supports and accessories.
2. Provide splices, supports, and other fittings necessary for a complete, continuously grounded system.

    a. Mesh: 2 by 4 inches.
    b. Straight Section Lengths: 118 inches.
    c. Wire Diameter: Patented design includes varying wire sizes to meet application load requirements; to optimize tray strength; and to allow tray to remain lightweight.
    d. Fittings: Wire mesh cable tray fittings shall be field-fabricated from straight tray sections, in accordance with manufacturer's instructions.
    e. Tape: Painted wire mesh cable tray to include metallic conductive UL tape.

3. Wire-Basket Depth: 4-inch usable loading depth, unless otherwise indicated on the drawings.
4. Length: Cable tray section length shall be 118.1 inches unless otherwise shown on drawings.
5. Cable Tray Material: Carbon steel wire, ASTM A 510, Grade 1008. Wire welded, bent, and surface treated after manufacture.

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

6. Load Span Criteria:

    a. Install and support cable management system in accordance with NEMA VE-1, with Safety Factor of 1.5.

7. Fittings/Supports: Wire mesh cable tray fittings are field-fabricated from straight tray sections, in accordance with manufacturer's instructions. Supports shall include the FAS (Fast Assembly System) where possible so that screws, bolts, and additional tools are not required for cable tray mounting to reduce installation time; and tray path can adapt to installation obstacles without the need for additional parts. Place supports so that support span does not exceed that shown on the drawings and is capable of supporting total fill capacity loading.

    a. Ceiling-mounted supports mount to ceiling structure directly or with threaded rod sized for total fill capacity.
    b. Wall-mounted supports.
    c. Splices, including those approved for electrical continuity (bonding), as recommended by cable tray manufacturer.

8. Cable tray shall 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).

    a. Cable tray systems shall include, but are not limited to, straight sections, supports and accessories.
    b. Configuration: Wires are formed into a standard 2 inches by 4 inches (50 by 100 mm) wire mesh pattern with intersecting wires welded together. Mesh sections shall have at least one bottom longitudinal wire along entire length of section.
    c. Materials: High-strength-steel longitudinal wires with "T" weld.
    d. Safety Provisions: Wire ends along wire-basket sides (flanges) rounded during manufacturing to maintain integrity of cables and installer safety.
    e. Straight sections shall be furnished in standard 118.1 inches lengths.

9. Connector Assemblies: Listed Snap in couplers or factory assembled bolted couplers that mechanically join adjacent tray wires to splice sections together or to create horizontal fittings.
10. Hardware and Fasteners:

    a. ASTM F 593 and ASTM F 594 stainless steel, Type 316.
    b. Steel, zinc plated according to ASTM B 633.

11. Steel Material: Straight section and fitting side rails and rungs shall comply with the minimum mechanical properties of ASTM A 1008/A 1008M.
12. Steel Tray Splice Plates: ASTM A 1008/A 1008M.
13. Fasteners: Steel complies with the minimum mechanical properties of ASTM A 510/A 510M, Grade 1008.
14. Cable tray supports and connectors, including bonding jumpers, as recommended by cable tray manufacturer.

## 2.4 TELECOMMUNICATIONS ROOM CABLE RUNWAY

A. Size: 1.5 inches high by 0.4 inches wide high tubular steel with 0.065 inch wall thickness.

B. Stringers: 9 feet 11-1/2 inches long.

C. Cross Members: Welded in between stringers on 12 inch intervals/centers beginning 5-3/4 inches with 10 cross members per ladder rack. Open space of 10-1/2 inches between each cross member.

D. Finish and Color: Powder coat paint in black.

E. Provide width as shown on the drawings.

F. Supports shall be positioned as recommended by manufacturer and anchored to the building structure.

G. Cable runway shall be steel and meet ASTM A570.

H. Cable runway shall be finished black.

I. Bond each cable runway joint with a UL listed grounding device and ground tray according to manufacturer's recommendations to maintain UL and NEC grounding requirements and listings.

J. Cable runway shall have UL listing.

2.5 CABLE TRAY ACCESSORIES

A. Horizontal 90° Turns

B. Vertical-To-Horizontal 90° Turns

C. Horizontal-To-Vertical 90° Turns

D. Corner Brackets

E. Splices

F. Grounding Kit

G. Ladder Rack Supports

H. Foot Kit

I. Threaded Ceiling Kit

J. Center Support Kit

K. Rack-to-Runway Mounting Plate

L. Cable Runway Elevation Kit

M. Vertical Wall Brackets.

N. Tool-less Pathway Dividers

O. Cable Retaining Post.

P. Cable Runway Protective End Caps.

Q. Touch-Up Paint: Spray Can in black.

2.6 WARNING SIGNS

2.7 SOURCE QUALITY CONTROL

PART 3 - EXECUTION

## 3.1 CABLE TRAY INSTALLATION

A. Install cable trays according to NEMA VE 2.

B. Install cable trays as a complete system, including fasteners, hold-down clips, support systems, barrier strips, adjustable horizontal and vertical splice plates, elbows, reducers, tees, crosses, cable dropouts, adapters, covers, and bonding.

C. Install cable trays so that the tray is accessible for cable installation and all splices are accessible for inspection and adjustment.

D. Remove burrs and sharp edges from cable trays.

E. Join aluminum cable tray with splice plates; use four square neck-carriage bolts and locknuts.

F. Fasten cable tray supports to building structure.

G. Place supports so that spans do not exceed maximum spans on schedules and provide clearances shown on Drawings. Install intermediate supports when cable weight exceeds the load-carrying capacity of the tray rungs.

H. 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.

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

J. Locate and install supports according to NEMA VE 2. Do not install more than one cable tray splice between supports.

K. Support wire-basket cable trays with trapeze hangers and wall brackets.

L. Support trapeze hangers for wire-basket trays with 3/8-inch- (10-mm-) diameter rods.

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

N. Install expansion connectors where cable trays cross building expansion joints and in cable tray runs that exceed dimensions recommended in NEMA VE 2. Space connectors and set gaps according to applicable standard.

O. Make changes in direction and elevation using manufacturer's recommended fittings.

P. Make cable tray connections using manufacturer's recommended fittings.

Q. Seal penetrations through fire and smoke barriers.

R. Install capped metal sleeves for future cables through firestop-sealed cable tray penetrations of fire and smoke barriers.

S. Install cable trays with enough workspace to permit access for installing cables.

T. Install warning signs in visible locations on or near cable trays after cable tray installation.

3.2 CABLE TRAY GROUNDING

3.3 CABLE INSTALLATION

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

B. Fasten cables on horizontal runs with cable clamps or cable ties according to 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. Fasten cables on vertical runs to cable trays every 18 inches (450 mm).

D. Fasten and support cables that pass from one cable tray to another or drop from cable trays to equipment enclosures. Fasten cables to the cable tray at the point of exit and support cables independent of the enclosure. The cable length between cable trays or between cable tray and enclosure shall be no more than 72 inches (1800 mm).

3.4 CONNECTIONS

3.5 FIELD QUALITY CONTROL

3.6 PROTECTION

END OF SECTION 270536

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# OUTLINE SECTION 270543 - UNDERGROUND PATHWAYS AND STRUCTURES FOR COMMUNICATION SYSTEMS

## 1.1 STANDARD

A. Comply with TIA-569-C and TIA-758-C.

## 1.2 COMPONENTS

A. Metal conduits and fittings.

B. Rigid nonmetallic duct.

C. Flexible nonmetallic duct.

D. Duct accessories, including rigid and fabric innerduct.

E. Precast concrete handholes and boxes.

F. Handholes and Boxes Other Than Precast Concrete:

G. Precast and Cast-in-place concrete manholes.

H. Utility Structure Accessories:

1. Iron frames and covers.
2. Chimney components.
3. Sump frame and grate.
4. Pulling eyes.
5. Pulling-in and lifting irons.
6. Bolting inserts for concrete utility structure cable racks and other attachments.
7. Ground rod sleeve.
8. Expansion anchors.
9. Cable rack assemblies.
10. Fixed ladders.

## 1.3 SOURCE QUALITY CONTROL

END OF SECTION 270543

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# OUTLINE SECTION 270544 - SLEEVES AND SLEEVE SEALS FOR COMMUNICATIONS PATHWAYS AND CABLING

## 1.1 ROUND SLEEVES

A. Steel Pipe Sleeves Description: ASTM A53/A53M, Type E, Grade B, Schedule 40, zinc coated steel, plain ends and integral waterstop.

B. Wall Sleeves, Cast Iron:

1. Description: Cast or fabricated "wall pipe," equivalent to ductile-iron pressure pipe, with plain ends and integral waterstop.

C. Sheet Metal Sleeves, Galvanized Steel, Round:

## 1.2 RECTANGULAR SLEEVES

A. Sheet Metal Sleeves, Galvanized Steel, Rectangular:

## 1.3 ENGINEERED THROUGH PENETRATION FIRESTOP SLEEVES

A. Classification and Use

1. The fire-rated pathway shall contain a built-in fire sealing system sufficient to maintain the hourly fire rating of the barrier being penetrated. The self-contained sealing system shall adjust to the installed cable loading and shall permit cables to be installed, removed, or retrofitted without the need to remove or reinstall firestop materials.

2. The firestop device for use in through-penetration firestop systems shall have been examined and tested by Underwriters Laboratories Inc. to UL1479 (ASTM E 814) and bear the U.S. UL Classification Mark.

3. The device shall be classified for use in one-, two-, three-, and four-hour rated gypsum, concrete and block walls. The device shall be classified for use in one-, two-, and three-hour rated concrete floors having a minimum 4 1/2" (114mm) thick reinforced lightweight or normal weight (100-150 pcf) (1600-2400 kg/m3). The devices shall also been tested by Underwriters Laboratories Inc. to UL2043 and determined to be suitable for use in air handling spaces.

4. For retrofit applications where no conduit is installed in the wall to protect existing cables, split conduit assembly should be used to protect cables. After installing the split conduit within the wall, a wall plate should be installed to cover any irregularly shaped hole cut in the wall. The firestop device is then installed onto the conduit.

1.4 ENGINEERED SMOKE AND ACOUSTICAL SLEEVES

A. The smoke and acoustical sleeve shall be used to maintain an effective barrier against the spread of smoke and hot gases, and to restore the STC rating in through penetrations in non-fire rated wall and floor assemblies.

B. The smoke and acoustical sleeve pathway shall permit cables to penetrate nonrated walls and floors without the need for smoke sealing. Cables shall be easily added or removed at any time without the need to remove or reinstall caulking materials.

1.5 SLEEVE SEAL SYSTEMS

A. Description: Modular sealing device, designed for field assembly, to fill annular space between sleeve and pathway or cable or between pathway and cable.

1. Sealing Elements: [**EPDM**] [**Nitrile (Buna N)**] rubber interlocking links shaped to fit surface of pipe. Include type and number required for pipe material and size of pipe.
2. Pressure Plates: [**Carbon steel**] [**Fiber-reinforced plastic**] [**Stainless steel**].
3. Connecting Bolts and Nuts: [**Carbon steel, with corrosion-resistant coating,**] [**Stainless steel**] of length required to secure pressure plates to sealing elements.

1.6 GROUT

1.7 POURABLE SEALANTS

1.8 FOAM SEALANTS

1.9 SLEEVE INSTALLATION FOR COMMUNICATIONS PENETRATIONS

A. Communications penetrations occur when raceways, cables, wireways, or cable trays penetrate concrete slabs, concrete or masonry walls, fire-rated floor, or wall assemblies.

B. Concrete Slabs and Walls: Install sleeves for penetrations unless core-drilled holes or formed openings are used. Install sleeves during erection of slabs and walls.

C. Use pipe sleeves unless penetration arrangement requires rectangular sleeved opening.

D. Fire-Rated Assemblies: Install sleeves for penetrations of fire-rated floor and wall assemblies unless openings compatible with firestop system used are fabricated during construction of floor or wall.

E. Extend sleeves installed in floors 2 inches (50 mm) above finished floor level.

F. Size pipe sleeves to provide 1/4-inch (6.4-mm) annular clear space between sleeve and raceway or cable, unless indicated otherwise.

G. Seal space outside of sleeves with grout for penetrations of concrete and masonry

1. Promptly pack grout solidly between sleeve and wall so no voids remain. Tool exposed surfaces smooth; protect grout while curing.

H. Interior Penetrations of Non-Fire-Rated Walls and Floors

1. Provide fabricated steel sleeves of diameter required for penetrations through walls and floors. Seal annular space between sleeve and wall, using joint sealant appropriate for size, depth, and location of joint.

2. Provide re-enterable sealant suitable for cabling systems and plenum environments within the annular space between the sleeve and cabling bundle.

3. Where shown on the drawings, provide Engineered Smoke & Acoustic Sleeves in lieu of fabricated steel sleeves to serve cable bundle penetrations through walls and floors.

I. Fire-Rated-Assembly Penetrations

1. Maintain indicated fire rating of walls, partitions, ceilings, and floors at raceway and cable penetrations.

2. Install sleeves and seal raceway and cable penetration sleeves with firestop materials.

3. Provide non-curing, re-penetrable, intumescent firestop materials around communications cable trays or ladder racks penetrating through a fire rated wall.

4. Where shown on the drawings, provide Engineered Through Penetration Fire Stop Sleeves in lieu of fabricated steel sleeves to serve cable bundle penetrations through walls and floors.

J. Roof-Penetration Sleeves: Seal penetration of individual raceways and cables with flexible boot-type flashing units applied in coordination with roofing work.

K. Aboveground, Exterior-Wall Penetrations: Seal penetrations using steel pipe sleeves and mechanical sleeve seals. Select sleeve size to allow for 1-inch (25-mm) annular clear space between pipe and sleeve for installing mechanical sleeve seals.

L. Underground, Exterior-Wall Penetrations: Install cast-iron pipe sleeves. Size sleeves to allow for 1-inch (25-mm) annular clear space between raceway or cable and sleeve for installing mechanical sleeve seals.

END OF SECTION 270544

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OUTLINE SECTION 270553 - IDENTIFICATION FOR COMMUNICATIONS SYSTEMS

1.1 PRODUCTS

A. Labels:

1. Vinyl wraparound labels.
2. Snap-around labels.
3. Self-Adhesive Wraparound Labels: flexible labels with pressure-sensitive adhesive.
4. Self-Adhesive Labels: multicolor, weather- and UV-resistant, pressure-sensitive adhesive labels.

B. Bands and Tubes:

1. Snap-around color-coding bands.

C. Underground-line warning tape.

D. Signs:

1. Baked-enamel signs.
2. Metal-backed butyrate signs.
3. Laminated acrylic or melamine plastic signs.

E. Cable Ties:

1. General-purpose cable ties.
2. UV-stabilized cable ties.
3. Plenum-rated cable ties.

END OF SECTION 270553

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# OUTINE SECTION 271100 - COMMUNICATIONS EQUIPMENT ROOM FITTINGS

## PART 1 - GENERAL

### 1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including Project Conditions and Division 01 Specification Sections, apply to this Section.

### 1.2 SUMMARY

A. Section Includes:

1. Telecommunications mounting elements.
2. Backboards.
3. Telecommunications equipment racks.
4. Grounding.

B. Related Requirements:

1. Section 270536 "Cable Trays for Communications Systems" for cable trays and accessories.
2. Section 271513 "Communications Copper Horizontal Cabling" for copper data cabling associated with system panels and devices.

C. The intent of this section is to furnish of all necessary labor, supervision, materials, and equipment to fit out all Telecommunication rooms/spaces as shown on the drawings.

D. Provide cable supports, pull boxes, tube supports, fiber distribution units and accessories in telecommunication room/spaces (as indicated on drawings).

E. Provide plywood backboards as required to support newly installed equipment. Anchors for plywood will be sufficient to support equipment apparatus, with attaching hardware flush or not protruding out from the plywood surface.

F. Provide equipment racks, grounding and all necessary hardware in the room to support the low voltage systems.

G. Contractor shall modify rooms and rack equipment to install new equipment with approval from the Owner or Owners Representative prior to installation.

H. Communication grounding and bonding shall be in accordance with applicable codes and regulations. The requirements of TIA-607D shall be observed throughout the entire cabling system.

1.3 DEFINITIONS

1.4 ACTION SUBMITTALS

1.5 INFORMATIONAL SUBMITTALS

1.6 QUALITY ASSURANCE

1.7 RECORD DOCUMENTS

PART 2 - PRODUCTS

2.1 BACKBOARDS

2.2 RACKS/CABINETS

2.3 GROUNDING

2.4 LABELING

PART 3 - EXECUTION

3.1 ENTRANCE FACILITIES

3.2 INSTALLATION

A. Comply with NECA 1.

B. Comply with BICSI's "Telecommunications Distribution Methods Manual" for layout of communications equipment spaces.

C. Comply with BICSI's "Information Technology Systems Installation Methods Manual" for installation of equipment in communications equipment spaces.

D. Bundle, lace, and train conductors and cables to terminal points without exceeding manufacturer's limitations on bending radii. Install lacing bars and distribution spools.

E. Coordinate layout and installation of communications equipment in tracks and in room. Coordinate service entrance configuration with service provider.

1. Meet jointly with systems providers, equipment suppliers, and Owner to exchange information and agree on details of equipment configurations and installation interfaces.
2. Record agreements reached in meetings and distribute them to other participants.
3. Adjust configurations and locations of distribution frames, cross-connects, and patch panels in equipment rooms to accommodate and optimize configurations and space requirements of communications equipment.
4. Adjust configurations and locations of equipment with distribution frames, cross-connects, and patch panels of cabling systems of other communications, electronic safety and security, and related systems that share space in equipment room.

F. Coordinate location of power raceways and receptacles with locations of communications equipment requiring electrical power to operate.

G. Backboards:

1. Install from 6 inches to 8 feet, 6 inches above finished floor UON. Ensure that fire-rating stamp is visible after installation. Do not paint plywood backboards.
2. Comply with requirements for backboard installation in BICSI's "Information Technology Systems Installation Methods Manual" and TIA-569-D.

3.3 GROUNDING

3.4 IDENTIFICATION

3.5 FIRESTOPPING

END OF SECTION 271100

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# OUTLINE SECTION 271313 - COMMUNICATIONS COPPER BACKBONE CABLING

## PART 1 - GENERAL

### 1.1 RELATED DOCUMENTS

### 1.2 SUMMARY

A. Section Includes:

1. High-count Category 3 twisted pair cable for intrabuilding and interbuilding backbones.
2. Grounding provisions for twisted pair cable.
3. Cabling identification.
4. Source quality control requirements for twisted pair cable.

### 1.3 DEFINITIONS

### 1.4 COPPER BACKBONE CABLING DESCRIPTION

A. Copper backbone cabling system shall provide interconnections between communications equipment rooms, main terminal space, and entrance facilities in the telecommunications cabling system structure. Cabling system consists of backbone cables, intermediate and main cross-connects, mechanical terminations, and patch cords or jumpers used for backbone-to-backbone cross-connection.

B. Copper backbones rated for intrabuilding and interbuilding outside plant applications shall be required.

C. Backbone cabling cross-connects may be located in communications equipment rooms or at entrance facilities. Bridged taps and splitters shall not be used as part of backbone cabling.

### 1.5 ACTION SUBMITTALS

### 1.6 INFORMATIONAL SUBMITTALS

### 1.7 CLOSEOUT SUBMITTALS

### 1.8 QUALITY ASSURANCE

3.7 IDENTIFICATION

3.8 FIELD QUALITY CONTROL

3.9 WARRANTY

END OF SECTION 271313

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# OUTLINE SECTION 271323 - OPTICAL FIBER BACKBONE CABLING

## PART 1 - GENERAL

### 1.1 RELATED DOCUMENTS

### 1.2 SUMMARY

A. Section Includes:

1. Optical Fiber Backbone Cabling
2. Air Blown Fiber Optic System
3. Optical Fiber Connectors
4. Optical Fiber Termination Cabinets
5. Optical Fiber Splices

### 1.2 DEFINITIONS

### 1.3 ACTION SUBMITTALS

### 1.4 INFORMATIONAL SUBMITTALS

### 1.5 CLOSEOUT SUBMITTALS

### 1.6 QUALITY ASSURANCE

### 1.7 DELIVERY, STORAGE, AND HANDLING

### 1.8 PROJECT CONDITIONS

### 1.9 COORDINATION

## PART 2 - PRODUCTS

### 2.1 MANUFACTURERS

### 2.2 OPTICAL FIBER BACKBONE CABLES

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# OUTLINE SECTION 271513 - COMMUNICATIONS COPPER HORIZONTAL CABLING

## PART 1 - GENERAL

### 1.1 RELATED DOCUMENTS

### 1.2 SUMMARY

A. Section Includes:
   1. Category 6 twisted pair cable.
   2. Category 6a twisted pair cable.
   3. Twisted pair cable hardware, including plugs and jacks.
   4. Cable management system.
   5. Cabling identification products.
   6. Grounding provisions for twisted pair cable.
   7. Source quality control requirements for twisted pair cable.

B. This document describes the products and execution requirements relating to furnishing and installing Telecommunications Cabling. The intent of this section is to define the requirements for the installation of a gigabit copper-cabling infrastructure.

C. This specification describes the actions to be taken, tasks to be performed and responsibilities of the certified Structured Cabling Contractor in order to provide and install a complete Warranted Horizontal Structured Cabling System. Unless otherwise noted all following sections, which describe such actions, tasks and responsibilities refer to the Contractor.

D. All cables and related terminations, support and grounding hardware shall be furnished, installed, wired, tested, labeled, and documented by the Telecommunications contractor.

E. The horizontal cabling system shall extend from a Telecommunication room located on the floor, or the floor above/below to the information outlet location.

F. No terms used in this specification are intended to indicate that work or equipment called for shall be less than completely executed or installed or that system shall be less than complete in any respect.

G. Install the cabling plant constructed in a physical star topology. Serve information outlets from Telecommunication Rooms (TR) by means of unshielded twisted pair (UTP) Category 6 & 6A copper, and terminate per 568B pin configuration. Some locations may exceed beyond the standard 90 meter installation, for these locations the Contractor will use the manufacturer warranted cable solution as specified.

H. Outlets shall generally consist of reuse of existing device box/ conduits. All UTP cable, information jacks and the faceplates shall be new. In some locations and where permitted by code the Contractor can install box eliminators and/or surface raceway and boxes.

I. All horizontal cabling will terminate on rack mounted patch panels in the Telecommunication Room.

1.3 DEFINITIONS

1.4 COPPER HORIZONTAL CABLING DESCRIPTION

1.5 ADMINISTRATIVE REQUIREMENTS

1.6 ACTION SUBMITTALS

1.7 INFORMATIONAL SUBMITTALS

1.8 CLOSEOUT SUBMITTALS

1.9 QUALITY ASSURANCE

1.10 WARRANTY

1.11 DELIVERY, STORAGE, AND HANDLING

1.12 PROJECT CONDITIONS

1.13 COORDINATION

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

2.2 GENERAL CABLE CHARACTERISTICS

2.3 CATEGORY 6 TWISTED PAIR CABLE

2.4 INDOOR/OUTDOOR RATED CATEGORY 6 TWISTED PAIR CABLE

2.5 CATEGORY 6A TWISTED PAIR CABLE (Wireless Access Points)

2.6 TWISTED PAIR CABLE HARDWARE

A. Patch Panel

B. Patch Cords

C. Plugs and Plug Assemblies

D. Jacks and Jack Assemblies

E. Faceplates

2.7 IDENTIFICATION PRODUCTS

2.8 GROUNDING

2.9 SOURCE QUALITY CONTROL

PART 3 - EXECUTION

3.1 WIRING METHODS

3.2 INSTALLATION OF PATCH CORDS

3.3 INSTALLATION OF PATHWAYS

3.4 INSTALLATION OF TWISTED-PAIR HORIZONTAL CABLES

3.5 FIRESTOPPING

3.6 GROUNDING

3.7 IDENTIFICATION

3.8 FIELD QUALITY CONTROL

END OF SECTION 271513

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# OUTLINE SECTION 271523 - COMMUNICATIONS OPTICAL FIBER HORIZONTAL CABLING

## PART 1 - GENERAL

### 1.1 RELATED DOCUMENTS

### 1.2 SUMMARY

A. Section Includes:

1. 62.5/125-micrometer, multimode, optical fiber cable (OM1).
2. 850 nanometer laser-optimized 50/125 micrometer multimode optical fiber cable (OM3).
3. 850 nanometer laser-optimized 50/125 micrometer multimode optical fiber cable (OM4).
4. 9/125 micrometer, single-mode, indoor-outdoor optical fiber cable (OS2).
5. Optical fiber cable connecting hardware, patch panels, and cross-connects.
6. Grounding.
7. Cabling identification products.

### 1.3 DEFINITIONS

### 1.4 OPTICAL FIBER HORIZONTAL CABLING DESCRIPTION

A. Optical fiber horizontal cabling system shall provide interconnections between MDT's/IDT's, and the equipment outlet in the telecommunications cabling system structure. Cabling system consists of horizontal cables, intermediate and main cross-connects, mechanical terminations, and patch cords or jumpers used for horizontal-to-horizontal cross-connection.

1. Horizontal cabling shall contain no more than one transition point or consolidation point between the horizontal cross-connect and the equipment outlet.
2. Bridged taps and splices shall not be installed in the horizontal cabling.

B. The maximum allowable horizontal cable length is 295 feet. This maximum allowable length does not include an allowance for the length of 16 feet to the workstation equipment or in the horizontal cross-connect.

1.5 ACTION SUBMITTALS

1.6 INFORMATIONAL SUBMITTALS

1.7 CLOSEOUT SUBMITTALS

1.8 QUALITY ASSURANCE

1.9 DELIVERY, STORAGE, AND HANDLING

1.10 PROJECT CONDITIONS

1.11 COORDINATION

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

2.2 62.5/125-MICROMETER, MULTIMODE, OPTICAL FIBER CABLE (OM1)

2.3 850 NANOMETER LASER-OPTIMIZED, 50/125 MICROMETER, MULTIMODE OPTICAL FIBER CABLE (OM3)

2.4 850 NANOMETER LASER-OPTIMIZED, 50/125 MICROMETER, MULTIMODE OPTICAL FIBER CABLE (OM4)

2.5 9/125 MICROMETER, SINGLE-MODE, INDOOR-OUTDOOR OPTICAL FIBER CABLE (OS2)

2.6 OPTICAL FIBER CABLE HARDWARE

A. Cross-Connects and Patch Panels

B. Patch Cords

C. Connector Type

D. Plugs and Plug Assemblies

E. Jacks and Jack Assemblies:

F. Faceplate:

2.7 GROUNDING

2.8 IDENTIFICATION PRODUCTS

2.9 SOURCE QUALITY CONTROL

PART 3 - EXECUTION

3.1 WIRING METHODS

3.2 INSTALLATION OF OPTICAL FIBER BACKBONE CABLES

3.3 FIRESTOPPING

3.4 GROUNDING

3.5 IDENTIFICATION

3.6 FIELD QUALITY CONTROL

3.7 WARRANTY

END OF SECTION 271523

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# OUTLINE SECTION 272000 – TWO-WAY COMMUNICATION SYSTEMS

## PART 1 - GENERAL

### 1.1 RELATED DOCUMENTS

### 1.2 GENERAL DESCRIPTION

A. "Areas of Rescue Assistance" are mandated by the Americans With Disabilities Act (ADA) as a means of providing greater safety to people with disabilities in case of an emergency. An Area of Rescue Assistance system enables two-way communication between a rescue site, such as a stairwell or foyer, and a central command station, such as a main lobby, fire command station, or security office.

B. The Area of Rescue Assistance (ARA) system shall consist of a microprocessor-based Command Unit ARA Stations. This system shall meet the Federal Government's guidelines as an Areas of Rescue Assistance system under the ADA.

### 1.3 DEFINITIONS

### 1.4 ACTION SUBMITTALS

### 1.5 INFORMATIONAL SUBMITTALS

### 1.6 CLOSEOUT SUBMITTALS

### 1.7 QUALITY ASSURANCE

### 1.8 DELIVERY, STORAGE, AND HANDLING

### 1.9 PROJECT CONDITIONS

### 1.10 COORDINATION

## PART 2 - PRODUCTS

2.1 MANUFACTURERS

2.2 OPERATIONAL DESCRIPTION

2.3 FUNCTIONALITY

A. Local Command Unit Phone

B. Call Routing

C. Visual Indicators (Monitoring Panel)

D. Visual Indicator (Strobe)

E. Audible Indicator (Sounder)

F. Call Stations

2.4 INTERFACES

2.5 POWER REQUIREMENTS

2.6 ENVIRONMENTAL

PART 3 - EXECUTION

3.1 INSTALLATION

3.2 WARRANTY

END OF SECTION 272000

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# OUTLINE SECTION 275119 - SOUND MASKING SYSTEMS

## 1.1 QUALITY ASSURANCE

A. Quality Standards: NFPA 70, UL 813, and ASTM E1374.

## 1.2 PRODUCTS

A. Addressable Sound-Masking Systems: Networked with integrated controls, generators, and amplifiers.

1. Networked control panel with integral sound-masking generator.
2. Control software.

B. Zoned Sound-Masking Systems: Zoned sound-masking[ **and paging**] system. Each zone consists of one loudspeaker control unit.

1. Loudspeaker control unit with integral sound-masking generator.

C. Local Sound-Masking Systems: Single-zone sound-masking[ **and paging**] system.

1. Control unit with masking-sound generator and amplifiers.

D. Spot Sound-Masking System: Self-contained, plenum-mounted loudspeaker with sound-masking generator and controls.

E. Wire and Cable:

1. Category 6 balanced twisted pair cable and hardware.
2. Loudspeaker cable.
3. Control-circuit conductors.

## 1.3 INSTALLATION

A. Wiring Method: In raceways.

1. Except in accessible indoor ceiling spaces and attics.
2. Except in hollow gypsum board partitions.

END OF SECTION 275119

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OUTLINE SECTION 281300 – ACCESS CONTROL

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including Project Conditions and other Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. An access control system (ACS) is an electronic card reader system comprised of controllers, card readers and sensing device that manage the entrance and exit of people through secure areas.

B. The ACS shall be based upon distributed system architecture with local door controllers which communicate with an existing ACS server (AMAG). If there is a failure ta the network, the access control decisions may be made locally at the access control panel. Upon the network being restored, the stored alarms on the control panel could then be transmitted to the ACS server for storage and report writing.

C. The ACS shall utilize the campus issued identification (ID) cards.

D. This specification outlines the requirements for an integrated security management/access control system, including integrated subsystems providing VSS. All information herein is intended to present minimum standards of performance, quality and construction.

E. The intent of the ACS is to provide access control for selected portals and monitor the status of selected portals, equipped or not equipped with access control, through the use of electronic equipment.

F. The Security Contractor is responsible for coordinating the selection and installation of the security door hardware. As part of the submittal process, the Security Contractor shall generate a spreadsheet identifying all the doors to receive electronic security devices and validate that the door hardware submittal and doors submittal shall support the required security functions. Should a conflict in function be identified, the security contractor shall alert the Engineer and Architect. The security contractor shall be responsible to ensure that required security functions are met for each door location.

G. The Security Contractor shall be responsible for coordinating the installation with all other trades and shall provide final termination of all conductors, except as provided by the Electrical Contractor.

H. The Security Contractor shall provide complete initialization of the integrated ACS hardware and software. Security Contractor shall consult with Owner to determine Owner's requirements

prior to initialization. Security Contractor shall transfer and/or enter all data into the system databases, including complete hardware and software configuration, alarm point database, time zone database, employee cardholder database, reports configuration, device database, I/O database, guard tours, and any other required set-up.

I. The Security Contractor shall be responsible for coordinating the security requirements of this Section with all other trades.

J. The access control system (ACS) outlined in this section shall be an expansion of the existing operational ACS. The Security Contractor shall provide sufficient license needs to support the card readers added under this project.

K. Certain cameras associated with Access Controlled Doors shall automatically cue-up upon alarm or manually.

1.3 WORK INCLUDED

1.4 SUBMITTALS

1.5 DELIVERY, STORAGE, AND HANDLING

1.6 WARRANTY

PART 2 – PRODUCTS

2.1 MANUFACTURERS

A. Acceptable Manufacturers: Subject to compliance with requirements, provide products by one of the manufacturers specified. Any proposed alternative must meet, or exceed, the product data of the devices identified, and approval must be received by the Engineer and the Owner before supplying.

B. Final approval of security devices and equipment is to occur at the last most reasonable moment to ensure the most current and appropriate technology is installed.

2.2 ACCEPTABLE MANUFACTURERS

2.3 ACCESS CONTROL SYSTEM

A. Access Control Panels

B. Card Readers

C. Request to Exit Devices

D. Power Supplies

E. Door Position Switches

F. Cables

PART 3 – EXECUTION

3.1 GENERAL

3.2 PREPARATION

3.3 LABELING AND IDENTIFICATION

3.4 FIELD QUALITY CONTROL

3.5 TESTING

3.6 FINAL ACCEPTANCE

3.7 ON SITE COMMISSIONING AND TRAINING

END OF SECTION 281300

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OUTLINE SECTION 281600 – INTRUSION DETECTION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including Project Conditions and other Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This section includes a description of access control devices, intrusion detection devices, security access devices, relay control, alarm monitoring controllers, credential creation, and credential holder database and management.

B. The intrusion detection system (IDS) is an electronic system comprised of sensors and process to detect unauthorized entry into, or occupancy of, a space that is restricted to a level pre-defined or time based.

C. The intrusion detection system components will be continuously monitored for normal, alarm, supervisory, and trouble conditions:

1. Normal: Reports the system is, and sensing devices, are in proper working order and that no alarm conditions are active.

2. Alarm: Reports that a sensing device has changed state from “normal” to “alarm" due to a breach or attempted breach.

3. Supervisory: Reports a condition that a device or controller is not functioning as specified.

4. Trouble: Reports a condition that the system is not fully functional. The “trouble” alarm will be used to indicate problems with system component alarms, such as battery failure, open or shorted transmission wiring or a controller failure.

D. The security contractor is responsible to review the design of the intrusion detection system, utilizing DMP as the selected system, and note any proposed modifications and configurations to the head-end layout and wiring configuration during the bid process.

1.3 WORK INCLUDED

1.4 SUBMITTALS

1.5 DELIVERY, STORAGE, AND HANDLING

1.6 WARRANTY

PART 2 – PRODUCTS

2.1 MANUFACTURERS

A. Acceptable Manufacturers: Subject to compliance with requirements, provide products by one of the manufacturers specified. Any proposed alternative must meet, or exceed, the product data of the devices identified, and approval must be received by the Engineer and the Owner before supplying.

B. Final approval of security devices and equipment is to occur at the last most reasonable moment to ensure the most current and appropriate technology is installed.

2.2 ACCEPTABLE MANUFACTURERS

2.3 INTRUSION DETECTION DEVICES

A. Door Position Switch

B. Ceiling Mounted Passive Infrared Motion Detector

C. Wall Mounted Motion Detector

D. Panic/Duress Device

E. Glass Break Detector

F. Laser Detector

G. Shock Senor

H. Plunger Switch

I. Power Supplies

PART 3 – EXECUTION

3.1 GENERAL

3.2 PREPARATION

3.3 LABELING AND IDENTIFICATION

3.4 FIELD QUALITY CONTROL

3.5 TESTING

3.6 FINAL ACCEPTANCE

3.7 ON SITE COMMISSIONING AND TRAINING

END OF SECTION 281600

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OUTLINE SECTION 282300 – VIDEO SURVEILLANCE

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including Project Conditions and other Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This specification outlines the requirements for a video surveillance system (VSS). All information herein is intended to present minimum standards of performance, quality and construction.

B. The VSS system shall be able to be displayed on any Owner workstation connected to the Owner's network with the appropriate permissions. The cameras added under this project will connect to the Owner's existing operational video surveillance system. The Security Integrator shall provide the required number of licenses to support the cameras added under this project.

C. The new network video recorders associated with this project are to be installed at the Yale Central Command.

D. Pan/Tilt/Zoom (PTZ) camera shall be utilized for the Help Point Intercom / Blue Light Phone. Upon activation of the help point intercom, the PTZ shall be automatically be called to a preset position to allow an operator to assess the emergency.

E. The primary functions of the VSS shall be for alarm assessment, access control verification purposes and general surveillance.

F. The VSS system shall be based upon the use of IP cameras control and managed from a network video management system. The IP cameras shall utilize the structured cabling system (SCS) and the Owner's data network for the transmission and management of the VSS video.

G. The VSS shall be calculated based on the following parameters:

1. Camera Resolution

a. Fixed (standard): 3MP

b. Fixed (elevator): 10809

c. 180° Panoramic: 15MP (SMP/imager)

d. 360° Fisheye: 12MP

e. PTZ: 1080p

2. FPS: 15

3. Video Retention: 30 days

H. The electrical contractor shall provide a data outlet adjacent to the VSS camera. The SCS shall run to the nearest IT closet and terminate into a patch panel. The electrical contractor shall provide a patch connection from the security patch panel to the Owner identified network switch port. The network port will provide IEEE compliant PoE to the IP cameras. The Security Integrator is responsible to coordinate with the electrical contractor as to the locations required for data outlets. Two (2) data outlets shall be provided for each camera. The data outlets, where possible, shall be located in an accessible location.

I. The cameras shall be configured to record per the Owner's standard record rates.

J. The system shall begin real-time recording of designated pre-set alarm positions under an alarm condition. Under the alarm condition, the VSS shall automatically flag the alarm event far easy retrieval. For calculating storage requirements, the security contractor shall assume 60 alarm conditions within a 30 day time frame (video storage requirement).

1.3 WORK INCLUDED

1.4 SUBMITTALS

1.5 DELIVERY, STORAGE, AND HANDLING

1.6 WARRANTY

PART 2 – PRODUCTS

2.1 MANUFACTURERS

A. Acceptable Manufacturers: Subject to compliance with requirements, provide products by one of the manufacturers specified. Any proposed alternative must meet, or exceed, the product data of the devices identified, and approval must be received by the Engineer and the Owner before supplying.

B. Final approval of security devices and equipment is to occur at the last most reasonable moment to ensure the most current and appropriate technology is installed.

2.2 ACCEPTABLE MANUFACTURERS

2.3 VIDEO SURVEILLANCE DEVICES

A. Video Surveillance Camera

B. Network Video Recorder

C. Cables

D. Power Supplies

PART 3 – EXECUTION

3.1 GENERAL

3.2 PREPARATION

3.3 LABELING AND IDENTIFICATION

3.4 FIELD QUALITY CONTROL

3.5 TESTING

3.6 FINAL ACCEPTANCE

3.7 ON SITE COMMISSIONING AND TRAINING

END OF SECTION 282300

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OUTLINE SECTION 285100 – SECURITY INTERCOMMUNICATION SYSTEM

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including Project Conditions and other Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This section includes a description of access control devices, intrusion detection devices, security access devices, relay control, alarm monitoring controllers, credential creation, and credential holder database and management.

B. 2-way voice communication system between a control point (door station) and a control room (main station).

C. 1-way video to allow operator to visually assess individual initiating the call and the surrounding area.

D. Ability to remote release an electronically access controlled door associated with the door station from the main station through an interface with the AMAG access control system.

E. Ability to call an outside line, Yale Central Command.

F. Health Point Intercom System (HPI) to be connected to the existing Yale University emergency phone system.

G. 2-way emergency voice communication between an individual (help point intercom) and a control room (main station).

H. 1-way video through the use of separately mounted PTZ camera attached to the same pole which will allow the operator to visually assess the individual initiating the call and the surrounding area.

I. Ability for an individual to easily identify the location of a help point intercom through the use a steady blue light illuminates directly above the unit.

J. Ability for attention to be drawn to the help point intercom when an emergency call is initiated.

K. Ability to make a mass notification announcement through a separate speaker unit mounted to HPI.

1.3 WORK INCLUDED

1.4 SUBMITTALS

1.5 DELIVERY, STORAGE, AND HANDLING

1.6 WARRANTY

PART 2 – PRODUCTS

2.1 MANUFACTURERS

A. Acceptable Manufacturers: Subject to compliance with requirements, provide products by one of the manufacturers specified. Any proposed alternative must meet, or exceed, the product data of the devices identified, and approval must be received by the Engineer and the Owner before supplying.

B. Final approval of security devices and equipment is to occur at the last most reasonable moment to ensure the most current and appropriate technology is installed.

2.2 ACCEPTABLE MANUFACTURERS

2.3 SECURITY INTERCOMMUNICATION SYSTEM DEVICES

A. Door Station

1. Door station to be equipped with a single button for initiation of a call.

2. Device shall allow for 2-way audio communication.

3. Device shall equipped with a camera to capture and stream video to the operator receiving the call.

4. Device shall be IP-based.

B. Main Station

1. 2-way audio communication, monitoring of video captured by door station and door release shall be performed by a computer workstation or mobile device with appropriate app installed.

PART 3 – EXECUTION

3.1 GENERAL

3.2 PREPARATION

3.3 LABELING AND IDENTIFICATION

3.4 FIELD QUALITY CONTROL

3.5 TESTING

3.6 FINAL ACCEPTANCE

3.7 ON SITE COMMISSIONING AND TRAINING

END OF SECTION 285100

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