

Product Guide Specification

Specifier Notes: This product guide specification is written according to the Construction Specifications Institute (CSI) 3-Part Format, including *MasterFormat*, *SectionFormat*, and *PageFormat*, as described in *The Project Resource Manual—CSI Manual of Practice*.

The section must be carefully reviewed and edited by the Architect to meet the requirements of the project and local building code. Coordinate this section with other specification sections and the Drawings. Delete all “Specifier Notes” when editing this section.

Section numbers and titles are from *MasterFormat* 1995 Edition, with numbers and titles from *MasterFormat* 2004 Edition in parentheses. Delete version not required.

SECTION 16400 (26 27 00)

LOW VOLTAGE MODULAR NETWORK CABLING SYSTEM

CATEGORY 5e – Plenum Spaces

PART 1 GENERAL

1.1 SECTION INCLUDES

Specifier Notes: Edit the following list as required for the project.

- A. Modular Horizontal Cabling System
 - 1. Trunk Cables
 - 2. Consolidation Point Hardware
 - 3. Transition Cables
- B. Work Area Patch Cord Cable Assemblies

1.2 RELATED SECTIONS

Specifier Notes: Edit the following list of related sections as required for the project. List other sections with work directly related to this section.

- A. Section 10270 (09 69 00) – Access Flooring.
- B. Section 12700 (12 59 00) – Systems Furniture.
- C. Section 15840 (23 36 00) – Air Terminal Units.
- D. Section 15850 (23 37 13) – Diffusers, Registers, and Grilles.
- E. Section 16050 (26 05 00) – Basic Electrical Materials and Methods (Common Work Results for Electrical).

- F. Section 16100 (26 05 00) – Wiring Methods (Common Work Results for Electrical).
- G. Section 16130 (26 05 36) – Cable Trays (Cable Trays for Electrical Systems).
- H. Section 16125 (26 27 20) – Electrical Distribution

1.3 REFERENCES

Specifier Notes: List standards referenced in this section, complete with designations and titles. This article does not require compliance with standards, but is merely a listing of those used.

- A. This Technical Specification and Associated Drawings
- B. ANSI/TIA-568-C.1 “*Commercial Building Telecommunications Cabling Standard*”, published 2009
- C. ANSI/TIA-568-C.2, “*Balanced Twisted-Pair Telecommunication Cabling and Components Standard*”, published 2009
- D. National Fire Protection Agency (NFPA) - 70, National Electrical Code (NEC) - 2014
- E. UL Standard for Safety 444, Communications Cables

1.4 SYSTEM DESCRIPTION

- A. Modular telecommunications horizontal cabling system shall ensure efficient voice and data signal transmission from patch panels in the telecommunications closet to the workstation outlets. System shall be prefabricated and totally flexible, with true plug-and-play modularity. System shall be designed and approved for use below raised access floor systems and above suspended ceiling spaces.
- B. Modular cabling system is based on zone cabling requirements. Distribution is achieved above suspended ceiling or below access floor through the use of twenty-four (24) cable bundle trunk cable assemblies of non-plenum rated cables installed in flexible metal conduit, consolidation points, and factory terminated plenum rated transition cables. Trunk cable assemblies route telecommunication signals from patch panels located in the telecommunications closet to consolidation points located strategically throughout the occupied spaces of the building. For each patch panel in the telecommunications closet there shall be a corresponding patch panel in a consolidation point. Transition cable assemblies distribute telecommunication signals from the consolidation point to the work area outlet(s).
- C. Cut-to-length factory terminated trunk and transition cables significantly reduces installation time and costs and eliminates the need for individual Home Run cabling. Bundling pre-terminated non-plenum rated trunk cables into a 24-cable assembly within flexible metal conduit further reduces material costs and installation time; laying out a 24-cable single run bundle takes little more time than running one individual cable, and, both ends of all cables are already terminated.

1.5 SUBMITTALS

- A. Cabling System Labeling: The contractor shall develop and submit for approval a labeling system for the cable installation based on ANSI/TIA 568-C.1 standard. The owner or the owner’s representative will negotiate an appropriate labeling scheme with the successful contractor. At a minimum, the labeling system shall clearly identify all components of the system: cables, panels and outlets. The labeling system shall designate the cables origin and destination and a unique identifier for the cable within the system. All test documents shall reflect the appropriate labeling scheme.

All label printing will be machine generated using labeling software and laser printers obtained from cabling system manufacturer. Self-laminating labels will be used on cable jackets, appropriately sized to the OD of the cable, and placed within view at the termination point on each cable end. Outlet labels will be the manufacturer's labels made of white card stock or self-adhesive polyester where applicable.

- B. As-Built Drawings: The installation contractor will be provided with 2 sets of D or E-size drawings at the start of the project. One set will be designated for as the central location to document all as-built information as it occurs throughout the project. The central set will be maintained by the Contractor's foreman on a daily basis, and will be available to the Technical representative upon request during the course of the project. Anticipated variations from the build-to drawings may be for such things as cable routing and actual outlet placement. No variations will be allowed to the planned termination positions unless approved in writing by the Owner.

The contractor shall provide the central drawing set to the owner at the conclusion of the project. The marked up drawing set will accurately depict the as-built status of the system including termination locations and cable routing. In addition, a narrative will be provided that describes any areas of difficulty encountered during the installation that could potentially cause problems to the telecommunications system.

- C. Test Documentation:

Specifier Notes: Edit the list below to set the testing documentation requirements for this project.

1. Test documentation shall be provided by the installing contractor in a three ring binder(s) within three weeks of the completion of the project. The binder(s) shall be clearly marked on the outside front cover and spine with the words "Test Results", the project name, and the date of completion (month and year). Horizontal Cabling test data shall be presented in a sequential manner, by building, floor, and section or department. The test equipment by name, manufacturer, model number and last calibration date will also be provided at the end of the document. Unless a more frequent calibration cycle is specified by the manufacturer, an annual calibration cycle is anticipated on all test equipment used for this installation. The test document shall detail the test method used and the specific settings of the equipment during the test.

Scanner tests shall be printed on 8½" x 11" paper. When repairs and re-tests are performed, the problem found and corrective action taken shall be noted, and both the failed and passed test data shall be collocated in the binder.

2. Test documentation shall be provided by the installing contractor in electronic media form, [CD ROM]; [Thumb Drive] within three weeks of the completion of the project. Horizontal Cabling test data shall be presented in a sequential manner, by building, floor, and section or department. The test equipment by name, manufacturer, model number and last calibration date will also be provided at the end of the document. Unless a more frequent calibration cycle is specified by the manufacturer, an annual calibration cycle is anticipated on all test equipment used for this installation. The test document shall detail the test method used and the specific settings of the equipment during the test.

When repairs and re-tests are performed, the problem found and corrective action taken shall be noted, and both the failed and passed test data shall be collocated in the report.

- D. Warranty: The contractor shall provide a written system warranty covering the installed cabling system against defects in workmanship, components, and performance, and follow-on support after project completion.

1.6 QUALITY ASSURANCE

- A. Each cable shall be tested for continuity on all pairs and/or conductors, pair reversals, shorts, and opens in addition to tests that indicate installed cable performance. All cabling covered by this section of the specification shall be tested using a Level III or better cable scanner.
- B. Continuity
Each pair of each installed cable shall be tested using a test set that shows opens, shorts, polarity and pair-reversals. Shielded/screened cables shall be tested with a device that verifies shield continuity in addition to the above stated tests. The test shall be recorded as pass/fail as indicated by the test set in accordance with the manufacturers recommended procedures, and referenced to the appropriate cable identification number and circuit or pair number. Any faults in the wiring shall be corrected and the cable re-tested prior to final acceptance.
- C. Length
Each installed cable shall be tested for installed length using an automated test set or a TDR type device. The cables shall be tested from patch panel to patch panel, block to block, patch panel to outlet or block to outlet as appropriate. The cable length shall conform to the maximum distances set forth in the ANSI/TIA-568-C.1 standard. Cable lengths shall be recorded, referencing the cable identification number and circuit or pair number.
- D. Performance Verification
Performance verification shall be accomplished in 2 phases. Phase 1 performance verification shall certify all pre-terminated trunk and transition cables to the Cat 5e performance standard, as published in the ANSI/TIA-568-C.2 standard, prior to shipment to the job site. Phase 2 and Phase 3 performance verification testing shall be accomplished after installation of the cabling system at the jobsite is complete. It shall be the responsibility of the installing contractor to ensure all permanent links, from the jack in the Telecommunications Room/Closet patch panel, through any Consolidation Point, (CP) that may be employed in the circuit routing, to the Telecommunications Outlet, (TO) in the work area meet Cat 5e performance criteria published in the ANSI/TIA-568-C.2 standard. All testing shall be accomplished using an automated test set. This test set shall be capable of testing for the continuity and length parameters defined above, and provide results for the following tests:
1. Phase 1 - Performance verification tests of trunk and transition cables prior to shipment to jobsite. One hundred percent of the provided cables shall be tested and must pass all test criteria:
 - a. Insertion Loss (IL)
 - b. Near End Crosstalk (NEXT)
 - c. Power Sum Near End Crosstalk (PSNEXT)
 - d. Attenuation to Crosstalk Ratio – Near End (ACR-N)
 - e. Power Sum Attenuation to Crosstalk Ratio – Near End (PSACR-N)
 - f. Attenuation to Crosstalk Ratio – Far End (ACR-F)
 - g. Power Sum Attenuation to Crosstalk Ratio – Far End (PSACR-F)
 - h. Return Loss (RL)
 - i. Wire Map
 - j. Propagation Delay
 - k. Delay Skew
 - l. Length
 2. Phase 2 - Performance verification tests of permanent links at the jobsite. One hundred percent of the installed links shall be tested and must pass all test criteria:
 - a. Insertion Loss (IL)
 - b. Near End Crosstalk (NEXT)
 - c. Power Sum Near End Crosstalk (PSNEXT)
 - d. Attenuation to Crosstalk Ratio – Near End (ACR-N)

- e. Power Sum Attenuation to Crosstalk Ratio – Near End (PSACR-N)
- f. Attenuation to Crosstalk Ratio – Far End (ACR-F)
- g. Power Sum Attenuation to Crosstalk Ratio – Far End (PSACR-F)
- h. Return Loss (RL)
- i. Wire Map
- j. Propagation Delay
- k. Delay Skew
- l. Length

Test results for both phases shall be automatically evaluated by the testing equipment using the most up-to-date criteria from the ANSI/TIA 568-C.2 standard, and the results shown as pass/fail. Test results shall be stored onto a portable storage file using an application from the test equipment manufacturer. All test results files shall be made available to the owner. The stored test results file shall include all tests performed, the acceptable test result and the actual test result achieved.

1.7 DELIVERY, STORAGE, AND HANDLING

- A. Delivery: Deliver materials to site in manufacturer's original, unopened, protective containers and packaging, with labels clearly identifying product name and manufacturer.
- B. Storage: Store materials in secure, clean, dry area indoors in accordance with manufacturer's instructions.
- C. Handling: Protect materials and finish from damage and moisture during handling and installation.

1.8 WARRANTY

Specifier Notes: Edit the following list as required for the project.

The contractor shall provide a system warranty covering the installed cabling system against defects in workmanship, components, and performance, and follow-on support after project completion.

- A. Installation Warranty

The contractor shall warrant the cabling system against defects in workmanship for a period of five years from the date of system acceptance. The warranty shall cover all labor and materials necessary to correct a failed portion of the system and to demonstrate performance within the original installation specifications after repairs are accomplished. This warranty shall be provided at no additional cost to the Owner.
- B. Cabling System Warranty
 - 1. The contractor shall facilitate an extended, 25-year system performance warranty between the manufacturer and the Owner. In order to facilitate this extended system performance warranty the contractor shall be a certified installer by the cable system's manufacturer.
 - 2. A component warranty shall be provided which warrants functionality of all components used in the system for 25 years from the date of acceptance. Copper links shall be warranted against the performance minimum expected results defined in ANSI/TIA 568-C.2
- C. Post Installation Maintenance

The contractor shall furnish an hourly rate with the proposal submittal which shall be valid for a period of one year from the date of acceptance. This rate will be used when cabling support is required to affect moves, adds, and changes to the system (MACs). MACs shall not void the Contractor's nor manufacturer's warranty.

PART 2 PRODUCTS

2.1 MODULAR HORIZONTAL CABLING SYSTEM

A. Trunk Cables

1. Category 5e Cabling

All horizontal trunk cabling shall be 23 AWG, 4-pair solid copper UTP, UL/NEC/NFPA CMR rated, with a PVC jacket. Cable jacketing shall be lead-free. Cable shall be certified compliant with the minimum Category 5e performance criteria set forth in ANSI/TIA/ 568-C.1. Cable shall be Listed to UL Standard for Safety 444, Communications Cables.

2. Trunk Cable Assemblies

- a. Trunk cable assemblies shall consist of 24 individual pre-measured, cut, and terminated cables that are bundled and installed within 1½” Reduced Wall Flexible Metal Conduit, (FMC), the length of which shall extend from its Consolidation Point to the point where the Trunk Cable Assembly exits the environmental air handling/plenum space within the telecom closet/room as shown on project drawings.
- b. Trunk cable assemblies shall consist of 24 individual cable assemblies, each pre-terminated at both ends with Category 5e RJ45 modular jacks. All modular jacks shall be:
 1. Unkeyed, wired to the T568B wiring pattern
 2. Constructed with a housing of 94V-0 rated material
 3. Color-coded for both T568A and T568B wiring
 4. Compatible with panel thicknesses of .058” - .063”
- c. Individual cables within the Trunk Cable Assembly shall be labeled 1 through 24 at each end of the cable assembly to identify corresponding jacks. Cables are to be equal length at one end of the trunk cable assembly and staggered at ¾” increments at the other end for clean cable dress-out in the patch panel in the telecommunications closet.

B. Consolidation Point Hardware

Specifier Notes: Edit the following list as required for the project. Patch panels specified in “2” below are for use with the High Profile and Standard Profile Consolidation Points

1. Consolidation Point – High Profile

Consolidation Points, (CP) shall be designed to be installed beneath a standard 6 inch finished floor height raised access flooring system. The CP shall be constructed of 18 gauge galvanized cold rolled steel. Consolidation point shall contain 2U of standard 19” telecommunications rack space adjacent each of 2 opposing sides of the enclosure for a total of 4U of 19” rack space.

1. Consolidation Point – Standard Profile

Consolidation Points, (CP) shall be designed to be installed beneath a 4 inch finished floor height raised access flooring system. The CP shall be constructed of 18 gauge galvanized cold rolled steel. Consolidation point shall contain 1U of standard 19” telecommunications rack space adjacent each of 2 opposing sides of the enclosure for a total of 2U of 19” rack space.

1. Consolidation Point – Low Profile

Consolidation Points, (CP) shall be designed to be installed beneath a low profile 2½ inch finished floor height raised access flooring system. The CP shall be constructed of 18

gauge galvanized cold rolled steel. The CP shall accommodate one 12 port telecommunications patch panel adjacent each of 2 opposing sides of the enclosure, providing for a total of up to 24 RJ 45 patch panel ports.

2. Patch Panels
Patch panels shall have a capacity of 24 ports and be 1U of rack space high. Patch panel base shall be constructed of minimum 18 gauge cold rolled steel, powder coated with a polyurethane finish.

C. Transition Cable Assemblies

1. Category 5e Cabling
All Transition cables shall be 23AWG, 4-pair UTP, UL/NEC/NFPA CMP rated, with a PVC jacket. Cable jacketing shall be lead-free. Cable shall be certified compliant with the minimum Category 5e performance criteria set forth in ANSI/TIA 568-C.1. Cable shall be Listed to UL Standard for Safety 444, Communications Cables.
2. Transition Cable Assemblies
Transition cable assemblies shall consist of a single Category 5e cable pre-terminated with a Category 5e RJ45 plug at one end and a Category 5e RJ45 jack on the other end.

Category 5e modular jacks shall be:

1. Unkeyed, wired to the T568B wiring pattern
2. Constructed with a housing of 94V-0 rated material
3. Color-coded for both T568A and T568B wiring
4. Compatible with panel thicknesses of .058" - .063".

Category 5e modular plugs shall be:

1. Unkeyed. wired to T568B
2. Constructed of 94V-0 polycarbonate
3. Color-coded for both T568A and T568B wiring

2.WORK AREA PATCH CORD CABLE ASSEMBLIES

Specifier Notes: Edit the following as required for the project.
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- A. Patch cords/device cords used at the workstation shall be Category 5e, 4-pair assemblies. Patch cords shall be factory-assembled by the manufacturer of the cabling system. Each workstation shall require one 10-foot Category 5e patch/device cord. The phone cords shall be provided by the owner.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Examine areas to receive modular network cabling system. Notify Architect of conditions that would adversely affect installation or subsequent use. Do not proceed with installation until unsatisfactory conditions are corrected.

3.2 INSTALLATION

- A. Horizontal Distribution Cable Installation
 1. Cable shall be installed in accordance with manufacturer's recommendations and best

industry practices per ANSI/TIA 568-C.1.

2. Cables shall be installed in continuous lengths from origin to destination (no splices) unless specifically addressed in this document.
 3. The cable's minimum bend radius and maximum pulling tension shall not be exceeded.
 4. Any cable damaged or determined to be outside of the recommended installation parameters during installation shall be replaced by the contractor prior to final acceptance at no cost to the Owner.
 5. Cables shall be identified by a self-adhesive label in accordance with the System Documentation Section of this specification. The cable label shall be applied to the cable behind the faceplate on a section of cable that can be accessed by removing the cover plate.
- B. Coordinate installation of modular network cabling system with other work in progress.

END OF SECTION