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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

Specifier Notes: This section covers the AMP NETCONNECT modular network cabling system. Consult AMP NETCONNECT for assistance in editing this section for the specific application.

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 cable assemblies.
 - 2. Consolidation point hardware.
 - 3. Transition cable assemblies.

- 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/EIA 568-B.2-1 Addendum 1 – Transmission Performance Specification for 4-Pair 100 Ω Category 5e Cabling – June 2002
- C. ANSI/TIA/EIA-568-B Commercial Building Telecommunications Cabling Standard – April, 2001
- D. ANSI/TIA/EIA-569-A Commercial Building Standard for Telecommunications Pathways and Spaces - February, 1998
- E. ANSI/TIA/EIA-606-A Administration Standard for the Telecommunications Infrastructure of Commercial Buildings - May, 2002
- F. ANSI/J-STD--607-A Commercial Building Grounding (Earthing) and Bonding Requirements for Telecommunications - October, 2002
- G. Building Industries Consulting Services, International (BICSI) Telecommunications

- Distribution Methods Manual (TDMM) – 10th edition, 2003
- H. National Fire Protection Agency (NFPA) - 70, National Electrical Code (NEC) -2002
 - I. AMP NETCONNECT Design and Installation Contractor Agreement (current)

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 drop ceiling spaces.
- B. Modular cabling system is based on zone cabling requirements. Distribution is achieved above suspended ceiling or below access floor through use of twenty-four (24) bundle factory terminated trunk cable assemblies installed in flexible metal conduit at the manufacturer's facility, consolidation points and factory terminated transition cable assemblies. This method of cabling eliminates need for individual home run cabling. 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 is a corresponding patch panel in a consolidation point. Transition cable assemblies distribute telecommunication signals from the consolidation point to the work area outlet.

1.5 SUBMITTALS

- A. **Cabling System Labeling:** The contractor shall develop and submit for approval a labeling system for the cable installation based on TIA/EIA-606-A standards. Customer 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 labeling information shall be recorded on the as-built drawings and 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 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 of horizontal and backbone cables, and grounding conductors 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, cable routing, and all administration labeling for the cabling system. 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: Test documentation shall be provided by the installing contractor in a three ring binder(s) within three weeks after 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). The binder shall be divided by major heading tabs, Horizontal and Backbone. Each major heading shall be further sectioned by test type. Within the horizontal and backbone sections, scanner test results, fiber optic attenuation test results, OTDR traces, and green light test results shall be segregated by tab. Test data within each section shall be presented in the sequence listed in the administration records. 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 8-1/2" x 11" paper. Hand written test results (attenuation results and green light results) shall be documented on the attached test form (Appendix C). OTDR test results shall be printed or attached and copied on 8-1/2" x 11" paper for inclusion in the test documentation binder.

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.

- D. Warranty: 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.

1.6 QUALITY ASSURANCE

Each cable shall be tested for continuity on all pairs and/or conductors. Twisted-pair voice cables shall be tested for continuity, pair reversals, shorts, and opens using a "green light" type test set. Twisted-pair data cables shall be tested for the all of the above requirements, plus tests that indicate installed cable performance. These data cables shall be tested using a Level III cable scanner.

A. Continuity

Each pair of each installed cable shall be tested using a "green light" 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.

B. Length

Each installed cable shall be tested for installed length using 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/EIA-568-B Standard. Cable lengths shall be recorded, referencing the cable identification number and circuit or pair number. For multi-pair cables, the longest pair length shall be recorded as the length for the cable.

C. Performance Verification

Category 5e data cabling systems shall be performance verified 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:

Pair-to-Pair Near End Crosstalk (NEXT)
Power Sum Near End Crosstalk (PSNEXT)
Insertion Loss
Return Loss
Equal Level Far End Crosstalk (ELFEXT)
Power Sum Equal Level Far End Crosstalk (Power Sum ELFEXT)
Attenuation to Crosstalk Ratio (ACR)

Category 5e data cable shall be performance verified using an automated test set. Test results shall be automatically evaluated by the equipment, using the most up-to-date criteria from the ANSI/TIA/EIA-568-B.2.1 Standard, and the result shown as pass/fail. Test results shall be printed directly from the test unit or from a download file using an application from the test equipment manufacturer. The printed test results shall include all tests performed, the expected 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

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 one year 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
The contractor shall facilitate a 25-year system performance warranty between the manufacturer and the Owner. A component warranty shall be provided which warrants functionality of all components used in the system for 25 years from the date of acceptance. The performance warranty shall warrant the installed horizontal copper, and both the horizontal and the backbone optical fiber portions of the cabling system. Copper links shall be warranted against the performance

minimum expected results defined in ANSI/TIA/EIA-568-B.2-1. Fiber optic links shall be warranted against the link and segment performance minimum expected results defined in ANSI/TIA/EIA-568-B.1.

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 MANUFACTURER

- A. Tyco Electronics, Inc., AMP NETCONNECT Division, 2900 Fulling Mill Road, Middletown, Pennsylvania, 17057. Toll Free (800) 553-0938. Web Site: HYPERLINK "http://www.ampnetconnect.com" www.ampnetconnect.com.
- B. Approved equal.

2.2 MODULAR HORIZONTAL CABLING SYSTEM

A. Trunk Cable Assemblies:

1. Category 5e Cabling:
Horizontal cabling shall be 23 AWG, 4-pair UTP, UL/NEC/NFPA CMR rated, with a PVC jacket. Cable jacketing shall be lead-free. Cable shall be 3rd party verified to ANSI/TIA/EIA-568-B.2.1 and meet the standard Category 5e performance requirements. Cable shall be supplied on wooden reels or in reel-in-box. Cable shall be safety listed to ANSI/UL 1666. Cable shall be UL Listed for safety, and UL verified for performance as well as be a part of the UL verification program.
2. Trunk Cable Assemblies:
Trunk cable assemblies shall consist of 24 individual pre-terminated cable assemblies that are bundled and installed within flexible metal conduit, 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 as shown on project drawings.
3. Trunk cable assemblies shall consist of 24 individual cable assemblies pre-terminated with Category 5e RJ45 modular jacks. All modular jacks shall be wired to the T568B wiring pattern. Modular jacks shall be constructed with a housing of polyphenylene oxide, 94V-0 rated. Modular jacks shall be terminated using a 110-style pc board connector (made of 94V-0 rated polycarbonate), color-coded for both T568A and T568B wiring. The 110 connector shall terminate 22-24 AWG solid conductors with a maximum insulation diameter of .050 inches. The modular jack contacts shall be plated with a minimum of 50 microinches of gold in the contact area over a 50 microinch minimum nickel underplate. Modular jacks shall be compatible with panel thicknesses of .058" - .063".

Category 5e modular (data) jacks shall be unkeyed 4-pair and shall be terminated using a 110-style pc board connector, color-coded for both T568A and T568B wiring. Each jack shall be wired to T568B.

4. Individual cable assemblies 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 .75" increments at the other end for clean cable dress-out in the patch panel in the telecommunications closet.
- B. Consolidation Point Hardware
1. Consolidation Point:
Consolidation Points, (CP) shall be 21" x 21" x 4" deep and designed to be installed in a standard 6 inch raised access flooring system. The CP shall be constructed of 16 gauge galvanized cold rolled steel. Consolidation points must contain 2U of standard 19" telecommunications rack space on an angled bracket on each side of the enclosure for a total of 4U of rack space. It shall be approved for use in environmental air handling spaces in accordance with National Electrical Code Article 300-22(c). The CP shall be designed to accept the flexible metal conduit of the Trunk Cables.
 2. Patch Panels
Patch panels shall have a capacity of 24 ports and be 1U of rack space high. Ports shall be blank to accept snap-in unshielded RJ45 jacks in four snap-in interface housings, six jacks per housing. Patch panel base shall be constructed of 16 gauge cold rolled steel and powder coated with a polyurethane finish. Interface housings shall be constructed of UL 94V-0 rated polyphenylene oxide and provide space for port identification labeling.
- C. Transition Cable Assemblies
1. Category 5e Cabling: Plenum
Horizontal cabling shall be 23 AWG, 4-pair UTP, UL/NEC/NFPA CMP rated, with a plenum-rated PVC jacket. Individual conductors shall be FEP insulated. Cable jacketing shall be lead-free. Cable shall meet the standard Category 5e performance requirements. Cable shall be safety listed to NFPA 262/UL910. Cable shall be ETL Listed for safety, and ETL verified for performance as well as be a part of the ETL verification program.
 2. Transition Cable Assemblies
Transition cable assemblies shall consist of a single cable pre-terminated with an RJ45 plug at one end and an RJ45 jack on the other end.

Category 5e modular jacks shall be wired to the T568B wiring pattern. Modular jacks shall be constructed with a housing of polyphenylene oxide, 94V-0 rated. Modular jacks shall be terminated using a 110-style pc board connector (made of 94V-0 rated polycarbonate), color-coded for both T568A and T568B wiring. The 110 connector shall terminate 22-24 AWG solid conductors with a maximum insulation diameter of .050 inches. The modular jack contacts shall be plated with a minimum of 50 microinches of gold in the contact area over a 50 micro inch minimum nickel underplate.

Modular jacks shall be compatible with panel thicknesses of .058" - .063".

Category 5e modular (data) jacks shall be unkeyed 4-pair and shall be terminated using a 110-style pc board connector, color-coded for both T568A and T568B wiring. Each jack shall be wired to T568B.

Category 5e modular (data) plugs shall be unkeyed. Modular plug housings shall be constructed of clear polycarbonate and color-coded for both T568A and T568B wiring. Each plug shall be wired to T568B.

WORK AREA PATCH CORD CABLE ASSEMBLIES

- A. Patch 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 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.
2. Cable raceways shall not be filled greater than the NEC maximum fill for the particular raceway type.
3. Cables shall be installed in continuous lengths from origin to destination (no splices) unless specifically addressed in this document.
4. The cable's minimum bend radius and maximum pulling tension shall not be exceeded.
5. Any cable damaged or exceeding recommended installation parameters during installation shall be replaced by the contractor prior to final acceptance at no cost to the Owner.
6. 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.
7. Unshielded twisted pair cable shall be installed so that there are no bends less than four times the cables outside diameter (4 X cable O.D.) at any point in the run.

8. Pulling tension on 4-pair UTP cables shall not exceed 25-pounds for a single cable or cable bundle.
- B. Coordinate installation of modular network cabling system with other work in progress.

END OF SECTION