



Part 1 - General

1.1 Scope of Work

- A. This document describes the requirements for the contractors, products and installation relating to furnishing and installing a Structured Cabling Plant.
- B. The Cabling System as described in this document is comprised of cabling, infrastructure and termination hardware to provide an approved TIA/EIA Data Networking and Voice Communication Structured Cabling System.
- C. Provide all labor, materials, tools and equipment required for the complete installation of work called for on the Construction Drawings and described in the Specifying Documentation.
- D. 271000 contractors shall be complete with work including all testing and labeling prior to 272000 contractor work start. Owner requires a minimum of 5 days to review test documents prior to network start up.

1.2 Contractor Qualifications/Quality Assurance

- A. **Safety and Indemnity**
 - 1. Contractors will submit the necessary documentation to demonstrate their compliance with Section 270000 “1.5 A. Safety & Indemnity”.
- B. **Contractor Qualifications**
 - 1. Contractors will submit the necessary documentation to demonstrate their compliance with Section 270000 “1.5 B. Contractor Qualification”.
- C. **Quality Assurance**
 - 1. Contractor shall comply with all requirements as specified in Section 270000 “1.5 C. Quality Assurance”.
- D. **Warranty**
 - 1. Contractor shall comply with all requirements as specified in Section 270000 “1.8. Acceptance & Warranties”.
 - 2. The bid package shall be accompanied by a warranty commitment binding the awarded contractor and manufacturer to a Lifetime Structured Cabling Warranty with guaranteed performance criteria set forth in this document and/or set forth by the Manufacturer. Contractor must be trained and certified in the installation of the Manufacturer system proposed. Contractor shall submit proof of current certification in the Certified Installer Program as a Premier or Authorized Network Installer in order to install and fully warrant the Cabling System. Copy of current Certificate must be included in Proposal if not already on file with Architect/Consultant/Owner.
 - 3. A Lifetime warranty (or 25yr minimum) for the structured cabling system shall be provided for an end-to-end permanent link model installation which covers the performance of the cable, connecting hardware and the labor cost for the repair or replacement of the link.
 - 4. Links failing test parameters or producing marginal pass results will be retested or replaced at Contractor expense until link test results passing TIA/EIA Standard parameters for the category rating or better are achieved.
 - 5. Warranty application is to be submitted in advance of the project start, and full test reports shall be delivered to Manufacturer within 15 days of project completion. Lifetime Manufacturer warranty processing is to be completed by Contractor and warranty certificate delivered to owner upon project completion.

1.3 Submittal Documentation

- A. The successful contractor shall provide their submittal package in accordance with the Section 01 20 00 1.06 Submittal Schedule, and Section 270000 “1.6 Submittal Documentation”.

1.4 Equivalent Products

- A. All Products Leviton, Berk-Tek, Superior Essex, and Chatsworth form the basis of design for this Specification. Part numbers, where provided, exemplify the feature set expected to be provided for this Structured Cabling Plant.
- B. Pre-Approved Equals:
 - 1. **None, all alternate materials must be submitted for approval prior to bid.**
- C. Structured cabling manufacture system warranties shall be Limited Lifetime or 25 year.
- D. Contractors wishing to approve a system other than those specified in this document shall do so in accordance with Section 270000 "1.7 Equivalent Products".

1.5 Typical configurations

- A. All room configurations are based on the "Learning Wall" and entry door. All locations shall be installed per plan. Classrooms shall have on average 17 Cat6 cables in each room;
 - 1. Entry door shall have ONE Cat6 cable for IP wall phone (one voice).
 - 2. Four (4) Cat6 cables, with two on each side of the whiteboard (two data, two voice)
 - 3. Student work area shall have eight (8) Cat6 cables (8 data)
 - 4. Ceiling area shall have four (4) Cat6 cables (one for the A/V projector, one spare, and two for wireless access point). **A red colored dot is to be placed on the ceiling grid to mark the location of these four cables.**
 - 5. Depending on the orientation of the room, two additional Cat6 cables may be added to allow for teacher flexibility.
- B. Computer labs shall have 48 Cat6 cables in each room
 - 1. Entry door shall have ONE Cat6 cable for IP wall phone (one voice).
 - 2. Computer labs shall have FORTY Cat6 cables.
 - 3. Standard A/V classroom install is included: Two input modules and either wall or pole mounted projector.
 - 4. Ceiling area shall have four Cat6 cables (one A/V projector, one spare, two wireless access point). **A red colored dot is to be placed on the ceiling grid to mark the location of these four cables.**
 - 5. Three Cat6 for the teacher (phone, computer, and printer).
- C. All rooms shall be field verified prior to installation.

Part 2 - Products

2.1 Work Area Subsystem

The Work Area shall consist of the connectivity equipment used to connect the horizontal cabling subsystem and the equipment in the work area. The connectivity equipment shall include the following options:

- Patch Cords
 - Modular Inserts and Jacks
 - Faceplates
- 1. Category 6 and Category 6A Outlet Patch Cords
 - *OWNER PROVIDED*
 - B. Modular Inserts and Jacks
 - 1. Category 6A Keystone Jack (for Wireless and other uses as specified)
 - Jacks must meet or exceed the Category 6A standard.
 - Jacks shall be 8-position 8-conductor RJ45-style and must have "retention-force technology" or equivalent feature to prevent time damage over the life of the jack regardless of use
 - Jacks shall be 8 position un-keyed

- Jack shall be rear-terminated industry- standard 110 IDC. Lead-frame jacks shall not be used in this Cable Plant.
 - Jacks shall have a designation indicating Category 6A on the nose which can be plainly seen from the front of the faceplate. Bottom of jack shall have date code.
 - Jacks shall utilize a paired punch down sequence. Cable pair twists shall be maintained up to the IDC, terminating all conductors adjacent to its pair mate to better maintain pair characteristics designed by the cable manufacturer.
 - Jacks shall terminate 22-26 AWG stranded or solid conductors.
 - Jacks shall be compatible with single conductor 110 impact termination tools.
 - Jacks shall have an attached color coded wiring instruction label housed between the IDC termination towers.
 - Jacks shall be manufactured in the USA
 - Jacks shall be compatible with TIA/EIA 606 color code, and have removable high-visibility color labels designating pair locations. Split-colored T568A/B labels are not approved.
 - Jacks shall utilize pair-separation towers for ease of untwisting pairs, and shall employ a snap-on rear termination cover designed for suppression and isolate of cross-talk of neighboring connectors.
 - Jacks will be terminated according to the T568B wiring scheme.
 - **Color:**
 Data Jacks will be **BLUE**
 Voice Jacks will be **WHITE**
 Wireless Jacks will be **YELLOW**
 A/V Jacks will be **GRAY**
 Camera Jacks will be **PURPLE**
 Access Control Jacks will be **GREEN**
 Environmental Sensor Jacks will be **BLACK**
 - **Quantity:** Contractor will provide and install one jack for every outlet cable shown on the drawings.
Part#:
 Data Jacks will be 61110-RL6
 Voice Jacks will be 61110-RW6
 Wireless Jacks will be 61110-RY6
 A/V Jacks will be 61110-RG6
 Camera Jacks will be 61110-RP6
 Access Control Jacks will be 61110-RP6
 Environmental Sensor Jacks 61110-RP6
2. Category 6 Keystone Jack (for General-Purpose Data/Voice applications)
- Jacks must exceed the Category 6 standard, and must be Component-Rated for performance.
 - Jacks shall be 8-position 8-conductor RJ45-style and must have "retention-force technology" or equivalent feature to prevent time damage over the life of the jack regardless of use
 - Jacks shall be 8 position un-keyed
 - Jack shall be rear-terminated industry- standard 110 IDC. Lead-frame jacks shall not be used in this Cable Plant.
 - Jacks shall have a designation indicating Category 6 on the nose which can be plainly seen from the front of the faceplate. Bottom of jack shall have date code.
 - Jacks shall utilize a paired punch down sequence. Cable pair twists shall be maintained up to the IDC, terminating all conductors adjacent to its pair mate to better maintain pair characteristics designed by the cable manufacturer.
 - Jacks shall terminate 22-26 AWG stranded or solid conductors.
 - Jacks shall be compatible with single conductor 110 impact termination tools.

- Jacks shall have an attached color-coded wiring instruction label housed between the IDC termination towers.
- Jacks shall be manufactured in the USA
- Jacks shall be compatible with TIA/EIA 606 color code, and have removable high-visibility color labels designating pair locations. Split-colored T568A/B labels are not approved.
- Jacks shall utilize pair-separation towers for ease of untwisting pairs and shall employ a snap-on rear termination cover designed for suppression and isolate of cross-talk of neighboring connectors.
- Jacks will be terminated according to the T568B wiring scheme.
- **Color:**
 Data Jacks will be **BLUE**
 Voice Jacks will be **WHITE**
 Wireless Jacks will be **YELLOW**
 A/V Jacks will be **GRAY**
 Camera Jacks will be **PURPLE**
 Access Control Jacks will be **GREEN**
 Environmental Sensor Jacks will be **BLACK**
- **Quantity:** Contractor will provide and install one jack for every outlet cable shown on the drawings.
Part#:
 Data Jacks will be 61110-RL6
 Voice Jacks will be 61110-RW6
 Wireless Jacks will be 61110-RY6
 A/V Jacks will be 61110-RG6
 Camera Jacks will be 61110-RP6
 Access Control Jacks will be 61110-RP6
 Environmental Sensor Jacks 61110-RP6

C. Wall Mount and Modular Furniture Faceplates

1. Wall Plates

- Faceplates shall be UL Listed and CSA Certified
- Faceplates shall be 2.75" W x 4.5" H (69.8 mm x 114.3 mm)
- Faceplates shall provide for TIA/EIA 606 compliant station labeling.
- Faceplates shall have plastic covers over the mounting screws that can be replaced with a clear plastic window over a printable paper insert.
- Faceplates shall have an industry-standard KEYSTONE opening style, and shall accept any Keystone modular insert.
- Faceplates shall be made in the U.S.A.
- **Color:** Faceplate to be **WHITE**
- **Quantity:** Contractor will provide and install one single gang faceplate for each outlet shown on the drawings.
- **Part#:**
 6 Port Face Plate, PN# 42080-6WS
 4 Port Face Plate, PN# 42080-4WS
 2 Port Face Plate, PN# 42080-2WS

2. Blank Insert

- **Color:** Blank Insert to match device plate or raceway.
- **Quantity:** Contractor will provide and install one insert for every unused port in a faceplate.
- **Part#: 41084-B*B**

3. Blank Wall Plates

- Faceplate shall be constructed from stainless steel.

- Faceplates shall be UL Listed and CSA Certified
 - Faceplates shall be 2.75" W x 4.5" H (69.8 mm x 114.3 mm) for single gang.
 - **Color:** Faceplate to be **STAINLESS STEEL**
 - **Quantity:** Contractor will provide and install one faceplate for each unused data/voice/video/intercom outlet shown on the drawings.
 - **Part#:** 84014-40
4. Surface Mount Raceway Insert
 Inserts for Wiremold's 4050, 5450 and 5550 Device Mounting Brackets
- Insert shall allow for two category 6 jacks to be mounted flush.
 - Insert shall match the color of the Raceway installed.
 - **Color:** Faceplate to be **IVORY**
 - **Quantity:** Contractor will provide and install one 2-port insert for each outlet in the Surface Mount Raceway shown on the drawings.
 - **Part#:** Equal to Wiremold, PN# 5507-FRJ

2.2 Horizontal Distribution Cabling

The horizontal distribution cabling system is the portion of the telecommunications cabling system that extends from the Work Area (WA) telecommunications outlet/connector to the horizontal cross-connect in the Telecommunications Room (TR).

- Cabling Support System
- Copper Station Cabling
- Copper Cross-Connect Cabling

A. Copper Station Cable

1. Category 6A Unshielded Twisted Pair (UTP) Cable

- Cable will meet or exceed the proposed requirements of ANSI/TIA 568-C.2 and ISO/IEC 11801 Category 6 Cable Standard for: NEXT and ELFEXT (Pair-To-Pair and Power Sum), Insertion Loss (Attenuation), Return Loss, PSANEXT, and Delay Skew.
- Cable shall be proven to support 10 Gigabit Ethernet / 10GBASE-T, Gigabit Ethernet / IEEE 802.3an, Gigabit Ethernet / 1000BASE-T / IEEE 802.3ab, ATM up to 155 Mbps, IEEE 802.3af Power Over Ethernet for VoIP, 100 Mbps Fast Ethernet / 100BASE-T / IEEE 802.3, ANSI.X3.263 FDDI TP-PMD, Ethernet / 10BASE-T / IEEE 802.3, 4 & 16 Mbps Token Ring / IEEE 802.5, T1/E1, xDSL, ISDN, 550 MHz Broadband Video and standards under development such as ATM at 622 Mbps, 1.2 and 2.4 Gbps.
- The cable shall consist of four unshielded twisted pairs of thermoplastic insulated bare copper enclosed in a thermoplastic jacket.
- All cable shall conform to the requirements for communications circuits defined by the California Electrical Code (Article 800) and the Canadian Building Code. Cable listed to CEC Article 800-51(a) will be used for "Plenum" installations. Cable listed to CEC Article 800-51(b) shall be installed in vertical runs penetrating more than one floor.
- Cable shall have been certified with the UL 1666 Vertical Tray Flame Test.
- Cable shall be available in a Plenum, Riser and Indoor/Outdoor rated jackets.
- Contractor will use the indoor/outdoor rated cable for all locations where the cable pathway goes underground and/or run in exterior conduit.
- Cables shall be made in the U.S.A.
- The listed Category 6A cables in this specification are manufactured by Berk-Tek
- **Color:**
 Data cable jacket will be **BLUE**
Data cable jacket for wireless will be YELLOW
 Data cable for Security Cameras will be **PURPLE**
Data cable for Access Control will be GREEN

- **Quantity:** See Drawing for quantity and installation details.
 - **Part#:**
For Riser Application:
 Berk-Tek LANmark-10G2, PN# 11084689
For Plenum Application:
 Berk-Tek LANmark-10G2, PN# 11085339
For Indoor/Outdoor Application:
 Berk-Tek LANmark 10G OSP
2. Category 6 Unshielded Twisted Pair (UTP) Cable
- Cable will meet or exceed the proposed requirements of ANSI/TIA/EIA 568-C.2, 568-B.2 Addendum #1 and ISO/IEC 11801 Category 6 Cable Standard for: NEXT and ELFEXT (Pair-To-Pair and Power Sum), Insertion Loss (Attenuation), Return Loss, and Delay Skew.
 - Cable shall be proven to support Gigabit Ethernet / 1000BASE-T / IEEE 802.3ab, ATM up to 155 Mbps, IEEE 802.3af Power Over Ethernet for VoIP, 100 Mbps Fast Ethernet / 100BASE-T / IEEE 802.3, ANSI.X3.263 FDDI TP-PMD, Ethernet / 10BASE-T / IEEE 802.3, 4 & 16 Mbps Token Ring / IEEE 802.5, T1/E1, xDSL, ISDN, 550 MHz Broadband Video and standards under development such as ATM at 622 Mbps, 1.2 and 2.4 Gbps.
 - The cable shall consist of four unshielded twisted pairs of thermoplastic insulated bare copper enclosed in a thermoplastic jacket.
 - All cable shall conform to the requirements for communications circuits defined by the California Electrical Code (Article 800) and the Canadian Building Code. Cable listed to CEC Article 800-51(a) will be used for "Plenum" installations. Cable listed to CEC Article 800-51(b) shall be installed in vertical runs penetrating more than one floor.
 - Cable shall have been certified with the UL 1666 Vertical Tray Flame Test.
 - Cable shall be available in a Plenum, Riser and Indoor/Outdoor rated jackets.
 - Contractor will use the indoor/outdoor rated cable for all locations where the cable pathway goes underground and/or run in exterior conduit.
 - Cables shall be made in the U.S.A.
 - The listed Category 6 cables in this specification are manufactured by Berk-Tek
 - **Color:**
 Data cable jacket will be **BLUE**
Data cable jacket for wireless will be YELLOW
 Data cable for Security Cameras will be **PURPLE**
Data cable for Access Control will be GREEN
 - **Quantity:** See Drawing for quantity and installation details.
 - **Part#:**
For Riser Application:
 Superior Essex PN# 77-240-2A or Berk-Tek PN# 10136339
For Plenum Application:
 Superior Essex PN# 77-240-2B or Berk-Tek PN# 10136226
For Indoor/Outdoor Application:
 Mohawk CDT PN# M58772 (all cable jackets will be **BLACK**)

B. Horizontal Copper Cross-Connect Cabling

1. Voice Cross-Connect Cabling
- Cable shall meet and/or exceed the UL Listed Type CMR and the ANSI/ICEA S-80-576 standard.
 - Cables shall be made in the U.S.A.
 - Core Construction
 - Conductors: Solid-copper conductors, 24 AWG.
 - Insulation: Flame retardant semi-rigid PVC.

- Core Assembly: Cable core will be made up of 100 pair units consisting of four (4) 25 pair sub-units. Each group individually identifiable by color coded unit binders.
- Jacket: Gray, flame retardant PVC jacket.
- **Color:** Voice cable jacket will be **GRAY**
- **Quantity:** See Drawing for quantity and installation details. The number of 25-pair cable between the MDF and the IDF shall be derived by multiplying the number of pairs required for the cross-connect by 1.25 to the nearest 25-pair increment.
- **Part#:**
- | | |
|--------------------------|-----------|
| Superior Essex Cable: | Berk-Tek: |
| 25 pair = PN# 18-475-33 | 10032396 |
| 50 pair = PN# 18-579-33 | 10032471 |
| 100 pair = PN# 18-789-33 | 10032472 |

2.3 Backbone Cabling

The backbone cabling system is the portion of the telecommunications cabling system that extends from the Intermediate Distribution Frame (IDF) to the Main Distribution Frame (MDF). It also includes cabling between district sites (WAN/MAN).

- Fiber Optic Backbone Cabling
- Copper Backbone Cabling

A. Fiber Optic Backbone Cabling

1. Data System Backbone Cabling

- Cable shall be UL/cUL OFNR/OFN FTA rated and be Flame Resistant in accordance with the UL 1666.
- Cable shall an OSP.
- Cable shall be constructed utilizing a loose tube design.
- Cable will be fully water blocked combining overall water blocking tape and a moisture blocking gel for each individual tube.
- Cable will maintain the following:
 - Crush Resistance (EIA-455-41) = 2000 N/cm
 - Impact Resistance (EIA-455-25) = 2000 Impacts w/1.6 N-m
 - Min Bend Radius:
 - Long Term - No Load = 15x Cable diameter
 - Short Term – Load = 20x Cable diameter
 - Operating Temp. = -40°C to +70°C
 - Storage Temp. = -40°C to +80°C
- Cable shall be constructed of 50/125µ Laser Optimized rated glass capable of:
 - 1 Gigabit Ethernet Link at 1000m/600m (@850nm/1300nm)
 - 10 Gigabit Ethernet Link at 300m/300m (@850nm/1300nm)
- ALL FIBER SHALL BE FUSION SPLICED
- The Fiber Optic Cable in this specification is manufactured by Berk-Tek
- **Color:** Fiber Optic cable jacket will be **Black**
- **Quantity:** See Drawing for quantity and installation details.
- **NOTE: HYBRID CABLES ARE PREFERRED OVER SEPARATE RUNS OF EACH TYPE OF CABLE. PROVIDE JUSTIFICATION IF YOU ARE NOT ABLE TO USE THE HYBRID CABLE.**
- **FOR ARMORED CABLE LISTED BELOW. CONTRACTOR IS REPOSNBILE TO VERIFY DIAMETER OF CABLES NEEDED VERSUS AVAILBLE CONDUIT PATHWAY. ARMORED CABLE IS ONLY PREFERRED WHEN THE FULL CONDUIT PATHWAY IS VERIFIED AS EMPTY/NEW. IF ARMORED CABLE CANNOT BE USED, CONTRACTOR TO NOTIFY OWNER IN WRITING AT A MIMUMUM OF 30 WORKING DAYS PRIOR TO CABLE INSTALLATION.**

- **Field Breakout Kits: Leviton PN# 49887-12S is to be used for all cables more than 6 strands. Six strand cables will use 49887-06S. Provide two kits per buffer tube to be terminated.**

6 Strand Armored Single Mode Fiber (needs two breakout kits)
Equal to Berk-Tek, PN# LTRK006AB0403

12 Strand Armored Single Mode Fiber (needs two breakout kits)
Equal to Berk-Tek, PN# LTRK012AB0403

24 Strand Armored Single Mode Fiber (needs four breakout kits)
Equal to Berk-Tek, PN# LTRK12B024AB0403

36 Strand Armored Single Mode Fiber (needs six breakout kits)
Equal to Berk-Tek, PN# LTRK12B036AB0403

48 Strand Armored Single Mode Fiber (needs eight breakout kits)
Equal to Berk-Tek, PN# LTRK12B048AB0403

60 Strand Armored Single Mode Fiber (needs ten breakout kits)
Equal to Berk-Tek, PN# LTRK12B060AB0403

72 Strand Armored Single Mode Fiber (needs twelve breakout kits)
Equal to Berk-Tek, PN# LTRK12B072AB0403

Hybrid 6 Armored Strand Multi Mode, 6 Strand Single Mode Fiber
(needs 2 breakout kits)
Equal to Berk-Tek, PN# LTRK012-006EB3010/25-006AB0403

Hybrid 12 Armored Strand Multi Mode, 12 Strand Single Mode Fiber
(needs 4 breakout kits)
Equal to Berk-Tek, PN# LTRK12B024-012EB3010/25-012AB0403

Hybrid 18 Armored Strand Multi Mode, 18 Strand Single Mode Fiber
(needs 6 breakout kits)
Equal to Berk-Tek, PN# LTRK12B036-018EB3010/25-018AB0403

Hybrid 24 Armored Strand Multi Mode, 24 Strand Single Mode Fiber
(needs 8 breakout kits)
Equal to Berk-Tek, PN# LTRK12B048-024EB3010/25-024AB0403

Hybrid 36 Armored Strand Multi Mode, 36 Strand Single Mode Fiber
(needs 12 breakout kits)
Equal to Berk-Tek, PN# LTRK12B072-036EB3010/25-036AB0403

Hybrid 48 Armored Strand Multi Mode, 48 Strand Single Mode Fiber
needs 16 breakout kits)
Equal to Berk-Tek, PN# LTRK12B096-048EB3010/25-048AB0403

Hybrid 60 Armored Strand Multi Mode, 60 Strand Single Mode Fiber
(needs 20 breakout kits)
Equal to Berk-Tek, PN# LTRK12B120-060EB3010/25-060AB0403

Hybrid 72 Armored Strand Multi Mode, 72 Strand Single Mode Fiber
(needs 24 breakout kits)
Equal to Berk-Tek, PN# LTRK12B144-072EB3010/25-072AB0403

NON-ARMORED CABLE – NOTIFY OWNER WITH JUSTIFICATION AS TO WHY THE NON-ARMORED CABLE IS RECOMMEND FOR USE BY CONTRACTOR AT LEAST 30 WORKING DAYS PRIOR TO SCHEDULE INSTALLATION.

6 Strand Single Mode Fiber (needs two breakout kits)
Equal to Berk-Tek, PN# LTR006AB0403

12 Strand Single Mode Fiber (needs two breakout kits)
Equal to Berk-Tek, PN# LTR012AB0403

24 Strand Single Mode Fiber (needs four breakout kits)
Equal to Berk-Tek, PN# LTR12B024AB0403

36 Strand Single Mode Fiber (needs six breakout kits)
Equal to Berk-Tek, PN# LTR12B036AB0403

48 Strand Single Mode Fiber (needs eight breakout kits)
Equal to Berk-Tek, PN# LTR12B048AB0403

60 Strand Single Mode Fiber (needs ten breakout kits)
Equal to Berk-Tek, PN# LTR12B060AB0403

72 Strand Single Mode Fiber (needs twelve breakout kits)
Equal to Berk-Tek, PN# LTR12B072AB0403

Hybrid 6 Strand Multi Mode, 6 Strand Single Mode Fiber
(needs 2 breakout kits)
Equal to Berk-Tek, PN# LTR012-006EB3010/25-006AB0707

Hybrid 12 Strand Multi Mode, 12 Strand Single Mode Fiber
(needs 4 breakout kits)
Equal to Berk-Tek, PN# LTR024-012EB3010/25-012AB0403

Hybrid 18 Strand Multi Mode, 18 Strand Single Mode Fiber
(needs 6 breakout kits)
Equal to Berk-Tek, PN# LTR036-018EB3010/25-018AB0403

Hybrid 24 Strand Multi Mode, 24 Strand Single Mode Fiber
(needs 8 breakout kits)
Equal to Berk-Tek, PN# LTR048-024EB3010/25-024AB0403

Hybrid 36 Strand Multi Mode, 36 Strand Single Mode Fiber
(needs 12 breakout kits)
Equal to Berk-Tek, PN# LTR12B072-036EB3010/25-036AB0403

Hybrid 48 Strand Multi Mode, 48 Strand Single Mode Fiber
(needs 16 breakout kits)
Equal to Berk-Tek, PN# LTR12B096-048EB3010/25-048AB0403

Hybrid 60 Strand Multi Mode, 60 Strand Single Mode Fiber
(needs 20 breakout kits)
Equal to Berk-Tek, PN# LTR12B120-060EB3010/25-060AB0403

Hybrid 72 Strand Multi Mode, 72 Strand Single Mode Fiber
(needs 24 breakout kits)
Equal to Berk-Tek, PN# LTR12B144-072EB3010/25-072AB0403

B. Copper System Backbone Cabling

1. Voice System Backbone Cabling

- Cable shall meet or exceed those specified in RUS Bulletin 1753F-208 (REA PE-89)
- Cables shall be made in the U.S.A.
- Core Construction
 - Conductors: Solid, annealed copper, 24 AWG unless otherwise noted on design documents.
 - Insulation: Dual insulation consisting of an inner layer of foamed polyolefin skin, colored coded in accordance with industry standards
 - Core Assembly: Cables of 25 pairs and less formed by assembling pairs together in a single group. Cables of more than 25 pairs formed by twisted pairs arranged in groups with each group having a color coded unit binder.
 - Filling Compound: The entire core assembly completely filled with ETPR compound, filling the interstices between the pairs and under the core tape.
 - Core Wrap: Non-hygroscopic dielectric tape applied longitudinally with an overlap.
 - Sheath Construction
 - Aluminum Shield: Corrosion protected plastic coated, corrugated 0.008" aluminum tape.
- Jacket: Black, linear low-density polyethylene.
- **Color:** Voice cable jacket will be **BLACK**
- **Quantity:** See Drawing for quantity and installation details. The number of 25-pair cable between the MDF and the IDF shall be derived by multiplying the number of pairs serving the individual telephone handsets by 1.25 to the nearest 25-pair increment.
- **Part#:** Equal to Superior Essex Cable:
 - 25 pair = PN# 09-097-02
 - 50 pair = PN# 09-100-02
 - 100 pair = PN# 09-104-02
 - 200 pair = PN# 09-108-02

2.4 Telecommunication Room

The Telecommunication Room (TR) includes those products that terminate horizontal and backbone cabling subsystems and connect them to the network equipment.

- Patch Cords
- Horizontal Cabling Termination Equipment
- Backbone Cabling Termination Equipment
- Cabinets, Racks, and Enclosures
- Cable Support System

A. Patch Cords

1. Copper Patch Cords

1.1 Category 6 and Category 6A Data/Voice TR Patch Cords

- *OWNER PROVIDED*

1.2 Data to Voice TR Patch Cords

- *OWNER PROVIDED*

2. Fiber Patch Cords

2.1 Fiber Optic TR Multimode Patch Cords

- *OWNER PROVIDED*

2.2 Fiber Optic TR Singlemode Patch Cords

- *OWNER PROVIDED*

B. Horizontal Cable Termination Equipment

1. Copper Termination Equipment

1.1 Data Category 6 and 6A Patch Panels

- Panels shall be made of black 16-gauge steel in 24 port configurations.
- Panels shall have optional rear cable support bar for strain relief. Cable support bar shall attach to the rear of the patch panel itself without the use of additional fasteners or screws.
- Panels shall have write-on blocks and port numbers are silk-screened in white.
- Panels shall provide wiring identification & color code and maintain an in-line, paired punch down sequence that does not require the splitting of conductors from individual cable pairs.
- The panel shall accept all QuickPort modules and feature white write-on front labels.
- Panels shall be ANSI/TIA/EIA-568-C.1, C.2 and ISO/IEC 11801 category 6 compliant.
- Panels shall be UL LISTED 1863 and CSA certified.
- Panels shall be made by an ISO 9002 Certified Manufacturer.
- Panels shall be made in the U.S.A.
- **Color:** Patch Panel shall be **BLACK**
- **Quantity:** See Drawing for quantity and installation details. The number of patch panels to be supplied shall be derived by multiplying the number of data/voice cables being terminated at the individual TR by 1.25 and providing additional panels in the nearest 24 port increment.
- **Part#:**
24-port Category 6 flat patch panel, **LEVITON 49255-L24**

INSTALLATION NOTE: When installing the 24-port patch panel, install two together and provide 1U of rack space for equipment installation then two panels, 1U of space, etc. VERIFY WITH OWNER RACK/CABINET LAYOUT PRIOR TO INSTALLATION.

1.2 Voice Termination Block (Intercom Backbone and Intercom Devices)

- Pair Capacity 50
- Blocks shall be wall mounted.
- Terminates 22 - 26 AWG (0.81 - 0.41mm) solid insulated cable or 18 - 19 AWG (1.02 - 0.91mm) solid stripped cable
- Blocks shall have stand-off legs included for all locations; S89 series stand-off bracket
- Made from High impact flame retardant thermoplastic
- Height: 254mm (10 in.), width: 86.4mm (3.4 in.), depth: 30.5mm (1.2 in.)
- **Part#: Leviton or equal**
Termination block, 40066-M50
Mounting bracket, 40089-00D

C. Backbone Cable Termination Equipment

1. Connectors

1.1 Fiber Optic Connectors

- **Anaerobic & Mechanical terminations will not be accepted.**

1.2 Fusion-Fiber Pigtail Fusion Splice Module

- Integrated module adapter bulkhead for 12 or 24 fibers with self-contained splice holders

- Individual compartments provide slack storage and bend radius guides for respective backbone cable, 900µm tight buffer pigtails, and fusion spliced fibers
- 12-fiber color-coded 900µm tight buffer pigtails 1.5m length are pre-loaded in module per specific configuration
- Modular design allows for ease of maintenance of individual spliced fiber and allows for scaling up without impacting existing fibers
- Included accessory kit consists of heat shrink style splice sleeves, tie wraps, and mesh sleeve
- Installs in Leviton's Opt-X rack mount (Ultra, 1000i, and 500i) and wall mount fiber enclosures
- Zirconia ceramic ferrules and sleeves used
- 12-fiber splice module configurations will utilize duplex LC adapters
- 24-fiber splice module configurations will utilize quad LC adapters
- ALL FIBER SHALL BE FUSION SPLICED
- **Quantity:** See Drawing for quantity and installation details.
- **Part #: Leviton or equal**
- 12-strand Singlemode, SPLCS-12L
- 24-strand Singlemode, SPLCS-24L
- 12-strand Singlemode Fusion Splice pigtail kit, UPPLC-KIT

2. Fiber Termination Panels

2.1 IDF Rack Mount Fiber Panel

- Fiber panels shall be constructed of durable polycarbonate plastic and black powder-coated 16-gauge steel
- Panel shall have a sliding tray which removes completely from enclosure to facilitate field terminations and splicing
- Sliding tray with front and rear stop shall glide forward and backward providing accessibility to front and rear of bulkhead after installation
- Panel shall have a 17" depth for high-density fiber termination and/or splicing
- Front saddles shall pivot for improved patch cord routing and organization
- Removable transparent hinged doors and slide-away covers shall allow for easy access during install and visibility of interior after install
- Panel shall employ patch cord bend radius guides to minimize macro bending
- Stackable and adjustable fiber rings simplify cable management
- Panel shall be no more than 1 rack unit in height and shall hold up to 3 adapter plates.
- Panel shall be Made in the U.S.A
- ALL FIBER SHALL BE FUSION SPLICED
- COLOR: black with translucent blue cover panels
- **Quantity:** See Drawing for quantity and installation details.
- **Part#: Leviton Opt-X SDZ 2000i no exceptions**
1U - 5R1UH-S03

2.2 IDF Wall Mount Fiber Enclosure

- Panels shall be constructed of cold rolled 16 gauge steel with a black powder paint finish and provide for fully enclosed fiber termination.
- Panel shall have a door design. One door shall be lockable for the "technician side" that secures the incoming and outgoing fiber cables. The second door shall accessible to provide fiber patching as needed.
- Panels shall accept four adapter panels for 24 port configurations.
- Panels shall have a splice tray mounting stud incorporated into the base for mounting of mechanical or fusion splice trays. Panel shall have cable

management anchor points and come with cable anchors allowing for the maintenance of the incoming cable with the proper minimum bend radius.

- Panels shall have cable entrance ports on the top and bottom with removable plastic dust covers.
- ALL FIBER SHALL BE FUSION SPLICED
- **Color:** Fiber Panel will be **BLACK**
- **Quantity:** See Drawing for quantity and installation details.
- Part: 5WMED-04C, 5L000-KAL

2.3 MDF Rack Mount Fiber Panel

- Fiber panels shall be constructed of durable polycarbonate plastic and black powder-coated 16-gauge steel
- Panel shall have a sliding tray which removes completely from enclosure to facilitate field terminations and splicing
- Sliding tray with front and rear stop shall glide forward and backward providing accessibility to front and rear of bulkhead after installation
- Panel shall have a 17" depth for high-density fiber termination and/or splicing
- Front saddles shall pivot for improved patch cord routing and organization
- Removable transparent hinged doors and slide-away covers shall allow for easy access during install and visibility of interior after install
- Panel shall employ patch cord bend radius guides to minimize macro bending
- Stackable and adjustable fiber rings simplify cable management
- Panel shall be 2 or 4 rack units in height and shall hold up to 6 or 12 adapter plates, respectively
- Panel shall be Made in the United States
- ALL FIBER SHALL BE FUSION SPLICED
- COLOR: black with translucent blue cover panels
- **Quantity:** See Drawing for quantity and installation details.
- **Part#: Leviton Opt-X SDX 2000i no exceptions**
2U - 5R2UH-S06
4U - 5R4UH-S12

2.4 Premise Splice Enclosures – Portable Classroom Distribution

- Modular wall-mount enclosures used to directly splice outside plant or intra-building cables
- Four fusion/mechanical splice trays; 4" Standard Splice Tray, 4" x 11.75" x 0.25" # **T5LHS-P06**
- Constructed of cold-rolled steel
- ALL FIBER SHALL BE FUSION SPLICED
- CPS-24, Customer Premise Splice Enclosure, empty (2 tray capacity)
- **Part#: 5WMED-04C**

2.5 Fiber Optic Adapter Plates

- The Fiber adapter plate shall precision molded and compatible with all approved panels and enclosures (rack- or wall-mount).
- The adapter plate shall be offered in LC style in 12 or 24 fiber configurations per plate.
- The adapter plate shall be compliant to TIA-568-C.3 (for performance) and respective TIA-604-X (for intermate ability) standards.
- Adapter plates shall use zirconia ceramic sleeves and be offered in standard fiber type colors pursuant to TIA-568-C.3 standards.
- The adapter and plate shall be integrated using precision-molded injection manufacturing methods, to eliminate "rattle" and loose fit.

- Adapter plates shall be made in the United States of America.
- Meets TIA-604-10B (LC) for connector intermate ability
- ALL FIBER SHALL BE FUSION SPLICED
- COLOR: Aqua for Multimode, Blue for Single mode, Black for blank plates
- Part #:
 - 6-port Duplex LC MM Adapter Panel, 5F100-2QL
 - 6-port Duplex LC SM Adapter Panel, 5F100-2LL
 - Blank Adapter Panel, 5F100-PLT

2.6 Fiber Optic OSP Splice Enclosures

- Used to directly splice outside plant or intra-building cables.
- Accommodates various splice tray designs, Maximum Capacity: 96 single fibers using 5" x 7" and 4" x 7" trays
- Enclosure made from 16-gauge steel, Hinges shall be Stainless steel
- Two-year limited product warranty.
- Durable powder-coat finish COLOR: Beige
- Size 16" x 15" x 3.4"
- ALL FIBER SHALL BE FUSION SPLICED
- Part #: Leviton CPS Customer Premise Splice Enclosure, Single Door, 24 Fiber Trays # **CPS24-STD**
 - Injection Molded Mini Splice Tray, Heat Shrink style (accepts standard sleeves), up to 12 fiber splicing # **T5PLS-12F**
 - Splice Tray Mounting Hardware Kit # SPLMT-HKT
 - Splice Sleeve, 40 mm # **FSSSD-040**
 - Cable clamp kit # 5RCMP-KIT
 - Grounding kit # DPGRD-KIT
 - Key Locking kit # 5L000-KAL

3. Copper Termination Panels

3.1 OSP Protection Panels (Intercom Backbone Headend)

- 16 AWG Powder Coated Steel Construction
- Equipped with an Internal 26 AWG Fuse Link
- External Ground Connectors Accept 6 - 14 AWG Wire
- Industry Standard 5 Pin Design
- Exceeds UL497 Primary Protection Standards
- Stackable with Connection Grommets Included
- 66 Block Accepts 22 - 26 AWG Wire/18 - 19 AWG Stripped Solid Copper Wire
- **Color:** NA
- **Quantity:** See Drawing for quantity and installation details.
- **Part#: Circa Enterprise inc.**
 - 25 pair block, PN# 1890ECT1-25
 - 50 pair block, PN# 1890ECT1-50
 - 100 pair block, PN# 1890ECT1-100

3.2 OSP Protection Fuses

- 240VDC (RUS Approved)
- Nanosecond response time
- External failsafe mechanism that permanently carbon arrestors grounds the module under sustained high current conditions
- Integrated Test Points
- UL & cUL listed
- Designed to meet or exceed Telcordia standards

- ISO 9002 Certified Manufacturer
- **Color:** RED
- **Quantity:** See Drawing for quantity and installation details.
Part#: Circa Enterprise inc. 4B1SF-240
**Provide 100% fuse density for all installed Protection Panels.*

3.3 Voice Termination Block (Intercom Backbone building/TC and Intercom Devices)

- Pair Capacity 50
- Blocks shall be wall mounted.
- Terminates 22 - 26 AWG (0.81 - 0.41mm) solid insulated cable or 18 - 19 AWG (1.02 - 0.91mm) solid stripped cable
- Blocks shall have stand-off legs included for all locations; S89 series stand-off bracket
- Made from High impact flame retardant thermoplastic
- Height: 254mm (10 in.), width: 86.4mm (3.4 in.), depth: 30.5mm (1.2 in.)
- **Part#:**
Leviton 66-Style Termination block, 40066-M50
Leviton 66-Style Mounting bracket, 40089-00D

D. Cabinets, Racks, and Enclosures

Contractor will provide the following 'HC' Enclosures and components based on the number of cables to that will be terminated:

1. Cabinets:

- Wall-mounted cabinets shall be manufactured from steel sheet.
- Each cabinet will have a rear panel that attaches to the wall, a hinged cabinet body that swings open from the rear panel providing easy access to the rear of equipment and a locking front door.
- The rear panel will provide cable access with pre-punched knockouts, up to 3", for conduit along the top and bottom edges of the panel. There will also be cutouts in the back of the rear panel so that cables can enter the panel through the wall. The rear panel will provide attachment points for accessory equipment mounting brackets and cable tie points within the panel (cabinet).
- The cabinet body will include a single pair of vertical 19" EIA equipment mounting rails. The mounting rails will be EIA-310-D compliant with the Universal hole pattern. Mounting holes will have #12-24 threads.
- Mounting rails will be adjustable in depth so that they can be positioned at any point within the cabinet body. The design of all cabinets will allow an additional pair of mounting rails (for a total of two pairs of mounting rails per cabinet) to be added to the cabinet.
- The wall-mount cabinet shall provide a hinge design that attaches the cabinet body and the rear panel and allow the rear panel to be removed during installation. The hinge design will allow the cabinet body to open at least 90°. The hasp used to secure the rear panel and the cabinet body together will assist in drawing the components together during the locking action.
- The cabinet body will include vents that are designed to accept fan kits.
- The front door will be hinged and locking. The front door and rear panel will be keyed alike. The front door will have rounded edges and corners. The cabinet body will allow the front door to be attached so that it will swing open from the right or left. The cabinet manufacture shall provide an option for a solid or a tinted plexi-glass window front door. The plexi-glass in doors shall be bronze acrylic (not clear) with a UL flammability classification of 94HB or better.
- Finish shall be epoxy-polyester hybrid powder coat (paint).

- The cabinet shall have the option of being delivered fully assembled. All cabinets will include installation hardware (hex lag screws) for wood studs and 50 each #12-24 equipment mounting screws.
- Load bearing capacity for cabinets that wall-mount will be a minimum of 200 pounds per cabinet.
- Cabinets that are wall-mount only will be certified and UL Listed to standard UL 60950 under category NWIN.
- **CONTRACTOR TO INSTALL PROFESSIONALLY SO OWNER PROVIDED EQUIPMENT FITS IN THE RACK. VERIFY RAILS ARE PROPERLY ALIGNED SO ALL EQUIPMENT FITS (including UPS, Network equipment, cables, cords, power strip, etc.) AND DOORS CLOSE. VERIFY SPACING BETWEEN PANELS IS ADEQUATE FOR EQUIPMENT INSTALLATION. VERIFY WITH OWNER CABINET LAYOUT FOR PATCH PANELS, ETC BEFORE INSTALLATION.**
- **Color:** Wall Mount Cabinet will be **BLACK**
- **Quantity:** See Drawing for size, quantity and installation details.
- **Part#:**
Wall Mount Cabinet
 18U Cabinet equal to Chatsworth Products, PN# 11900-736
 26U Cabinet equal to Chatsworth Products, PN# 11900-748
**Contractor will provide an additional set of mounting rails for each wall mount cabinet, equal to Chatsworth Products PN# 12787-5xx.*
Wall/Floor Mount Cabinet
 33U Cabinet equal to Chatsworth Products, PN# 13495-760
 40U Cabinet equal to Chatsworth Products, PN# 13495-772
**Contractor will provide an additional set of mounting rails for each wall mount cabinet, equal to Chatsworth Products PN# 13276-7xx.*
Fan Kit/Filter Kit
 Equal to Chatsworth Products Fan Kit, PN# 12804-701
 Equal to Chatsworth Products Filter Kit, PN# 12805-701
Grounding Kit
 Equal to Chatsworth Products, PN# 10610-019
Power Strip with Surge Suppression
 Leviton 5500-192

2. Floor Mount 2-post Racks

- Each rack shall have two L-shaped top angles, two L-shaped base angles and two C-shaped equipment-mounting channels. The rack shall assemble with nut and bolt hardware. The base angles shall be pre-punched for attachment to the floor.
- Equipment mounting channels shall be 3" (76 mm) deep and punched on the front and rear flange with the EIA-310-D Universal hole pattern, 1-3/4" (44.45 mm) rack-mount spaces (U), to provide 45U, 52U or 58U for equipment. Each mounting space (U) shall be marked and numbered on the mounting channel.
- When assembled with top and bottom angles, equipment-mounting channels shall be spaced to allow attachment of 19" EIA rack-mount equipment. Equipment attachment points shall be threaded with 12-24 roll-formed threads. The rack shall include assembly and equipment-mounting hardware. Racks shall include 50 each combination pan head, pilot point mounting screws.
- The assembled rack shall measure 7' (2.1 m)/84" (2133 mm) high, 8' (2.4 m)/96" (2438 mm) high or 9' (2.7 m)/108" (2743 mm) high; 20.3" (515.9 mm) wide and 15" (381.0 mm) deep. The sides (webs) of the equipment-mounting

channels shall be punched to allow attachment of vertical cable managers along the sides of the rack or for rack-to-rack baying.

- Assembly hardware shall electrically bond the top angles, side channels and base angles together when assembled, and there shall be a masked ground attachment point with 1/4-20 threaded studs spaced 5/8" apart on the inside of the side channel to attach a ground lug allowing easy attachment to the Telecommunications Ground.
 - The rack shall be rated for 1,000 lb (453.6 kg) of equipment.
 - Certifications: Communications Circuit Accessory, DUXR and DUXR7 category, file number 140851
 - Material: Steel and aluminum extrusion
 - Construction: Bolted assembly, Ships unassembled
 - **VERIFY RACK LAYOUT WITH OWNER PRIOR TO INSTALLATION.**
 - **Color: BLACK**
 - **Quantity:** See Drawing for quantity and installation details.
 - **Part#: Chatsworth Products Inc.**
Floor Mount 2-Post Rack
CPI# 55053-703
Vertical Wire Managers
Equal to Leviton, PN# 8980L-VFR
Power Strip with Surge Suppression
Leviton 5500-192
3. Floor Mount 4-post Racks
- Four-post frame with threaded mounting holes used to support 19" wide rack-mount communications equipment and shelves
 - For indoor use only, in environmentally controlled areas; may not be used outdoors, in industrial or harsh environments, or in plenum spaces
 - Includes: (1) top pan, (1) bottom pan, (4) mounting channels, (2) base angles, (2) top angles
 - Assembly hardware; (100) #12-24 equipment mounting screws
 - Equipment Support: Front and rear pairs of 3" deep C-shaped equipment mounting channels, Fixed in place, 29" apart front-to-rear, 19" wide, EIA-310-D compliant hole pattern
 - 1-3/4" high rack-mount units (RMU); RMU spaces are marked and numbered on the channels
 - Universal hole pattern, 5/8"-5/8"-1/2" vertical hole spacing
 - Threaded #12-24 equipment mounting holes, Includes 100 each #12-24 equipment mounting screws
 - Load capacity: 2000 lb of equipment
 - Material: Aluminum extrusion, Aluminum sheet
 - Construction: Bolted assembly, Ships unassembled
 - **VERIFY WITH OWNER RACK LAYOUT PRIOR TO INSTALLATION.**
 - **Color: BLACK**
 - **Quantity:** See Drawing for quantity and installation details.
 - **Part#: Chatsworth Products Inc.**
Floor Mount 4-Post Open Frame Rack
CPI# 15053-703
Grounding Kit
10610-019
Power Strip with Surge Suppression
Leviton 5500-192
4. Floor Mount Cabinets
- Four-post frame with threaded mounting holes used to support 19" wide rack-mount communications equipment and shelves

- For indoor use only, in environmentally controlled areas; may not be used
 - outdoors, in industrial or harsh environments, or in plenum spaces
 - Includes: (1) top pan, (1) bottom pan, (4) mounting channels, (2) base angles, (2) top angles
 - Assembly hardware; (100) #12-24 equipment mounting screws
 - Equipment Support: Front and rear pairs of 3" deep C-shaped equipment mounting channels, Fixed in place, 29" apart front-to-rear, 19" wide, EIA-310-D compliant hole pattern
 - 1-3/4" high rack-mount units (RMU); RMU spaces are marked and numbered on the channels
 - Universal hole pattern, 5/8"-5/8"-1/2" vertical hole spacing
 - Threaded #12-24 equipment mounting holes, Includes 100 each #12-24 equipment mounting screws
 - Load capacity: 2000 lb of equipment
 - Material: Aluminum extrusion, Aluminum sheet
 - Construction: Bolted assembly, Ships unassembled
 - VERIFY WITH OWNER CABINET LAYOUT PRIOR TO INSTALLATION.
 - **Color: BLACK**
 - **Quantity:** See Drawing for quantity and installation details.
 - **Part#: Chatsworth Products Inc.**
Floor Mount Cabinet
CPI# M1050-741
Grounding Kit
10610-019
Power Strip with Surge Suppression
Leviton 5500-192
5. Outdoor Wireless Access Point Enclosure
- Non-glass-filled polyester material, UV resistance; Overlapping tongue-and-groove raised cover and gasket provide secure Type 4X seal
 - Removable snap-hinge cover allows for easy access to cover and body for modifications
 - Molded layout grid on inside of body and solid covers assists with component mounting
 - Molded-in embosses for rear panel mounting
 - Internal rail system and adjustable panel blocks allow
 - UL 508A Listed, NEMA/EEMAC Type 4
 - Material: Non-glass-filled polyester
 - **Color: Light-Gray**
 - **Quantity:** See Drawing for quantity and installation details.
 - **Part#: Pentair**
 - **Polypro Wifi, PN# D16148WF**
- E. Cable Support System
1. Ladder Rack Cable Runway
- Stringers shall be fabricated from 16ga .375" x 1.5" Cold Rolled Steel tubing.
 - Rungs shall be fabricated from 16ga .5" x 1.0" Cold Rolled Steel tubing
 - Rungs shall be spaced at 9.0" center to center
 - A straight length of ladder shall be capable of supporting 45 pounds per foot when a 10' length is tested according to NEMA VE-1.
 - Ladder Rack shall have a powder coat finished.
 - Ladder Rack shall be available in standard 6ft. and 10ft. lengths.
 - Ladder rack shall be a part of a total system that includes: manufacture bends, wall supports, joining hardware, etc.

- Ladder Rack shall be grounding per the TIA/EIA 607-A.
- **Color:** Ladder Rack will be **BLACK**
- **Quantity:** See Drawing for quantity and installation details.
- **Part#:** Equal to Chatsworth Products Cable Raceway, PN# 11252-71X

Part 3 - Backbone slack loops

- Storage rings may be used to store coiled slack loops on backboard.
- Part #:
 - Fiber storage rings, Indoor fiber: 48900-IFR
 - Fiber storage rings, Outdoor fiber: 48900-OFR

Part 4 - Execution

4.1 Installation

A. Work Area Outlets Installation

- No more than 12" of cable shall be stored in an outlet box, modular furniture raceway, or insulated walls.
- Bend radius of the cable in the termination area shall not be less than 4 times the outside diameter of the cable.
- The cable jacket shall be maintained to within 12.7mm (½ inch) of the termination point.
- All UTP cables shall have no more than 6.4mm (1/4 inch) of pair *untwisted* at the termination point.
- Data jacks, unless otherwise noted in drawings, shall be located in the top position(s) of each faceplate. Data jacks in horizontally oriented faceplates shall occupy the left-most position(s).
- Voice jacks, unless otherwise noted in drawings, shall occupy the next position(s) below the data on the faceplate. Voice jacks in horizontally oriented faceplates shall occupy the position left of the data jack.
- Video jacks, unless otherwise noted in drawings, shall occupy the bottom position(s) on the faceplate. Video jacks in horizontally oriented faceplates shall occupy the position left of the data/voice jack.
- All faceplates installed shall be level.
- All outlets will be labeled according to the approved labeling scheme.
- Each faceplate shall be machine labeled. The labeling shall be placed on the faceplate so that the individual jack can be clearly identified by its associated label.
- Cables shall be identified by a self-adhesive label in accordance with the Identification and Labeling section of this specification and ANSI/TIA/EIA-606. The cable label shall be applied to the cable no further than 6" behind termination module, behind the faceplate on a section of cable that can be accessed by removing the cover plate.

B. Horizontal Distribution Cable Installation

- Cable shall be installed in accordance with manufacturer's recommendations and best industry practices.
- Nylon or plastic locking cable ties, e.g. "Zip-Ties", shall not be used on this project.
- Contractor will provide at least a three foot "service loop" for all station cables. The service loop will be coiled and secured using Velcro in the accessible ceiling at the conduit stub to the work area outlet box.
- Tie Wraps will not be allowed for supporting, bundling and/or dressing of any station cables on this project.

- Contractor will provide at least a three foot “service loop” for all station cables. The service loop will be coiled and secured using Velcro in the accessible ceiling at the conduit stub to the work area outlet box.
- A pull cord (nylon; 1/8" minimum) shall be co-installed with all cable installed in all “common” conduit runs. “Common” Conduit Runs are those that house more than one cable or set of cables that do not specifically feed a Work Station Outlet. Examples of “Common” Conduit Runs are: floor/ceiling penetrations, stub-throughs, distribution conduits, all conduits between J-boxes, etc.
- Cable raceways shall not be filled greater than the Owner’s 40% fill ratio. Contact Owner as needed to understand the Owner’s fill ratio requirement.
- Cables shall be installed in continuous lengths from origin to destination (no splices) except for transition points, or consolidation points.
- The cable’s minimum bend radius and maximum pulling tension shall not be exceeded.
- Pulling tension on 4-pair UTP cables shall not exceed 25-lb for a four-pair UTP cable.
- The Cable Support System shall be installed in such a way that will allow for future cables to be added and to provide sufficient protection of all cable.
- For all installs where station cables are not installed in a continuous conduit run the following guidelines will apply. The Contractor will be responsible to reinstall all cables and pathways that do not meet with the following at no additional cost to the Owner:
 - J-hooks shall be installed to support all station cables every 14” – 28” inches.
 - All pathways shall be run at right angles. No diagonal pathways will be allowed unless otherwise noted on the drawings.
 - Horizontal cables shall be bundled in groups of no more than 25 cables per Caddy’s CAT21 J-hook, no more than 40 cables per Caddy’s CAT32 J-hook, and no more than 64 cables per Caddy’s CAT64 J-hook.
 - A separate J-hook is used for each group of cable. Specifically, CAT6 cable, fiber cable, and fire alarm are to have their own J-hook.
 - At no point shall cable(s) rest on acoustic ceiling grids, acoustic panels, or lighting fixtures.
 - All cables will be installed so that there is a minimum of 3” of clearance above all ceiling grid and tiles.
 - All cables will be installed so that there is a minimum of 12” of clearance above all florescent lighting.
 - All cables will be installed so that there is a minimum of 6” of clearance from all fire alarm and electrical system conduits.
 - Cables shall not be attached to the ceiling grid or lighting fixture wires. The contractor will provide their own carriers wires to support their horizontal cabling.
 - All cables shall be installed above fire-sprinkler systems and plumbing system fixtures and devises. Cables shall not be attached to or supported by these fixtures and/or their ancillary equipment or hardware.
 - The cable system and support hardware shall be installed so that it does not obscure any valves, fire alarm conduit, boxes, or other control devices.
 - Contractor is responsible for sealing around all cables that penetrate fire rated barriers.

- Wireless and overhead cables shall be secured by an in-ceiling mounting bracket affixed to its dedicated ceiling wire or mounted to building structure.
 - 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.
- C. Horizontal Cross-Connect Installation
- Cables shall be cleaned, dressed, and terminated in accordance with the recommendations made in the TIA/EIA-568-A standard, manufacturer's recommendations and best industry practices. Contractor to verify standard network equipment can be installed without any interference from the cables. Equipment typically is installed directly above and/or below the panel.
 - The cable jacket shall be maintained to within 12.7mm (½ inch) of the termination point.
 - All UTP cables shall have no more than 6.4mm (¼ inch) of pair *untwist* at the termination point.
 - Bend radius of the cable in the termination area shall not exceed 4 times the outside diameter of the cable.
 - All cables shall be neatly bundled in groups of 24 and dressed continuously from the entrance point of the Telecommunications Room to their respective panels or blocks. Each panel or block shall be fed by an individual bundle separated and dressed back to the point of cable entrance into the rack or frame. Contractor will use Velcro strip to bundle cables together. The use of Tie –Wraps is not permitted.
 - Each cable shall be clearly labeled on the cable jacket behind the patch panel at a location that can be viewed without removing the bundle support ties. Cables labeled within the bundle, where the label is obscured from view shall not be acceptable.
- D. Backbone Cable Installation
- Backbone cables shall be installed separately from horizontal distribution cables.
 - Each individual cable is to be labeled. See details sheets for labeling examples. Cable type, installation date, and from/to are required. Each cable to be labeled at any accessible point, including, but not limited to, pull boxes, Christy boxes, junction boxes, and any pass through location.
 - Where possible the backbone and horizontal cables shall be installed in separate conduits.
 - Where possible backbone cables of the same type shall be combined in conduit runs to maximize conduit fill ratios.
 - Where backbone cables and distribution cables are installed in a cable tray or wireway, backbone cables shall be installed first and bundled separately from the horizontal distribution cables.
 - Pulling tension on Backbone cables shall not exceed the manufacture's limitations.
 - The minimum bend radius for all Backbone cables is 16 times the cable diameter or the manufactures specification, whichever is greater.
 - Cable slack shall be provided in every pull box, junction box, cabinet, entry facility, telecom room and termination enclosure.
 - * 25 feet of slack per cable shall be mounted on a service ring inside the enclosure.
 - * All cable shall be installed such that all cable is above the bottom of the enclosure. All cable shall be suspended on cable support hooks around the perimeter of the enclosure. Cable Support Hooks equal to Hubbell Power

Systems PN# **C2031124** and **C2031133** (part numbers dependent on size of enclosure, sample part numbers only, not to be used in all circumstances).

* Entry & telecom rooms & cabinets: Minimum 25' feet coiled in re-closeable storage ring.

* If 25' is not possible, contact the owner and discuss an agreeable amount of slack, followed up with an confirming RFI.

* Minimum of 25' of slack in each vault and a minimum of 15' of slack in any other type of box (pull box, Christy box, pass through space, etc).

- All OSP cables may not penetrate more than 50ft into the buildings before be terminated or splices to cable with a fire resistant jacket, unless the jacket is indoor/outdoor rated.
- A pull cord (nylon; 1/8" minimum) shall be co-installed with all cable installed in any conduit.
- All backbone cables shall be securely fastened to the sidewall of the TR on each floor.
- Backbone cables spanning more than three floors shall be securely attached at the top of the cable run with a wire mesh grip and on alternating floors or as required by local codes.
- Vertical runs of cable shall be supported to messenger strand, cable ladder, or other method to provide proper support for the weight of the cable.
- Large bundles of cables and/or heavy cables shall be attached using metal clamps and/or metal banding to support the cables.

E. Backbone Cross-Connect Installation

- Cables shall be cleaned, dressed, and terminated in accordance with the recommendations made in the TIA/EIA-568-C document, manufacturer's recommendations and best industry practices.
- Bend radius of the cable in the termination area shall not exceed 16 times the outside diameter of the cable.
- All cables shall be neatly bundled and dressed continuously from the entrance point of the Telecommunications Room to their respective panels or blocks.
- Contractor will provide a minimum of a 3 foot "service loop" for each backbone cable before terminating to allow future rearrangement. Cables will be coiled and secured above the ceiling where possible or to the Telco Backboard where entrance point is from the floor.
- Wall mounted termination block fields shall be installed with the lowest edge of the mounting frame 18" from the finished floor.
- Contractor shall provide a machine label 1ft. to 2ft. from the entrance point of the TR and 6in. to 12in. from the termination point on each backbone cable. Cable shall be easily identified and fully legible without removing the bundle support ties.

F. Cabinets, Racks, Enclosures and Ladder Rack Installation

- Wall Mount Racks/Cabinets shall be securely attached to the Telco Backboard using minimum 5/16" hardware or as required by local codes. Mounting rails shall be adjusted to the proper depth to allow for the closing of doors when populated with network electronics. Coordinate with Owner for final depth required.
- Floor Mount Racks/Cabinets shall be securely attached to the concrete floor using minimum 3/8" drop-in anchor hardware or as required by local codes.
- All Floor Mount Racks/Cabinets will be either; secured on one side to the wall or attached to the closest wall with ladder rack.
- All Racks/Cabinets shall be braced to meet Zone 4 seismic requirements.
- Contractor will maintain a minimum of 36 inches of clearance from the front of the all rack/cabinets and all other obstructions.

- Floor Mount Racks/Cabinets shall be installed to allow for a minimum of 36" from rear and all other obstructions.
- All racks shall be grounded to the telecommunications ground bus bar.
- Rack mount screws not used for installing patch panels and other hardware shall be bagged and left with the rack upon completion of the installation.
- The plywood bottom edge shall be mounted vertically no less than 12" above the finished floor.
- Contractor will provide all cutouts for the Electrical Contractors expansion rings and electric receptacles as shown on the drawings.
- Ladder Rack must be securely attached to walls, backboards, and racks/cabinets to comply with all Zone 4 seismic requirements.
- Ladder rack shall be installed so that there is a minimum of 8" of unobstructed clearance above rack.
- Ladder Rack shall be installed so that there is a minimum of 12" of clearance from all: florescent lighting, electrical conduits/circuits, and fire alarm conduits/devices.

4.2 Identification and Labeling

- A. The labeling scheme for CAT6 cable is as follows for classrooms (verify with Owner prior to printing the labels):

When entering the room (if the room has multiple doors, the door designated as the primary entry door), label numbering shall start at one (1) and then increment as data drops are added going around the room, then any drops in the ceiling, and then any drops in the floor. For each room, numbering starts over at one (1). Each jack color starts at one (1) and increments for each additional jack of the same color. Label designations are based on jack color:

Blue = **D#** White = **V#** Yellow = **W#** Gray = **A#** Purple = **C#** Green = **L#**

Patch Panel Label Format: **RM#** - _____

The first part of the label shall be the room number the data drop is located in, RM is part of the label, followed by the room number or room designation. The last part of the label shall be the type, as stated above based on jack color, then followed by the drop number. For example, RM3-D10 is room 3, data drop 10. RM3-V2 would be room 3, voice data drop 2.

The label format in the room: **RM#** - _____ - _____

The first part of the label shall be **RM**, followed by the room number/ designation the cabinet/rack is located in.

The second part of the label shall be the patch panel the cable is terminated on. The top most panel is **A** and continues down with **B**, **C**, etc... If multiple panels span more than one rack/cabinet, when standing in front of the rack/cabinets, the top left panel shall be **A**.

The last part of the label uses the label based on jack color, as stated above, and the drop number. Example, RM3-A-D10: Indicates the other end of the cable is in the cabinet/rack in room 3, terminated on panel A, and the last portion, ie D10 in this example, was the tenth data drop in this room. The last portion, D10 in this example, would match the patch panel label, RM3-D10.

Label scheme for non-classroom buildings follows the above scheme, but the label number starts at 1 (one) for each type (D, V, W, A, C) and increments throughout the building and does not reset for each room/office. Start at one and do not repeat the number anywhere in the building (for each type).

- B. The approved system will comply with the TIA/EIA -606-A Class 2 designations and include at a minimum, identifiers for all major components of the system: telecommunication rooms, grounding bus bars, racks, cables, panels and outlets. The labeling system shall designate the cables origin and destination and a unique identifier for the cable within the system. Racks and patch panels shall be labeled to identify the location within the cable system infrastructure.
- C. All label printing will be machine generated or hand-held printers using indelible ink ribbons or cartridges. 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, patch panel and wiring block labels shall be installed on, or in, the space provided on the device.
- D. All labeling information shall be recorded on the as-built drawings and all test documents shall reflect the appropriate labeling scheme.
- E. All fiber cable labels are to include the type, count, from and to on each label. Any point the fiber is accessible shall be labeled. At a minimum, that would include the starting point, any Christy boxes, cabinets/racks, any rooms the cable passes through, and the ending point. Service loops provided and labeled at each location, a minimum of 25' in each vault and 15' minimum in a Christy box/any other box or pass through space.
- F. **Labels are to verified by Owner prior to printing.** Labels are to include building/room designations used by the site. Do NOT use building/room designations from the plans unless approved by Owner in writing.
- G. **Fiber optic cable labels are to verified by Owner prior to printing and include:**
- H.

CABLE TYPE
 FROM TO
 DATE INSTALLED

For example:
 Single Mode – 36 Count
 MDF IDF in Room XX
 INSTALLED: JULY 2017

4.3 Testing and Acceptance

- A. General
 - 1. The Owner reserves the right to be present during any & all types of tests being performed.
 - 2. Contractor will notify the Owner/Owner's Representative 24 hours before commencement of testing.
 - 3. Upon receipt of the test documentation, the Customer reserves the right to have the contractor perform a 10% witnessed "spot testing" of the cabling system to validate test results provided in the test document, at no additional cost. If a significant amount of cables are marginal and/or fail during the "spot test" Contractor will retest the entire cable plant at no additional cost.
 - 4. Contractors shall provide proof of test equipment calibration prior to testing.
 - 5. Test equipment shall have been factory calibrated within six months of project testing dates.
 - 6. All cables and termination hardware shall be 100% tested for defects in installation and to verify cabling system performance under installed conditions according to the requirements of TIA/EIA-568-C, TSB-67 and TSB-95. All pairs of each installed cable shall be verified prior to system acceptance. Any defect in the cabling system installation including but not limited to cable, connectors, feed through couplers, patch panels, and connector blocks shall be repaired or replaced in order to ensure 100% useable conductors in all cables installed.

7. All cables shall be tested in accordance with this document, the ANSI/TIA/EIA standards, the Manufacturer's Warranty guidelines and best industry practice. If any of these are in conflict, the Contractor shall bring any discrepancies to the attention of the project team for clarification and resolution.
8. Test results are required to be sent to Owner in PDF format and in FLW format. IF there are an unusual amount of cables that passed marginal, as indicated by the tester, Contractor to re-terminate all cables and re-test.

B. Copper Cable Testing

1. Twisted Pair Cable

- All twisted-pair copper cable links (including backbone cables) shall be tested for continuity, pair reversals, shorts, opens and performance as indicated below.
- Continuity - Each pair of each installed cable shall be tested using a test unit that shows opens, shorts, polarity and pair-reversals, crossed pairs and split pairs. 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 unit 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.
- Cables that are passed by the tester but marked as marginally passed, typically indicated by an asterisk (*), may be required to be re-terminated and re-tested by Owner if there are an unusually high percentage of cables that were marginally passed by the tester. Unusually high is determined by Owner.
- Length - Each installed cable link 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-A Standard. Cable lengths shall be recorded, referencing the cable identification number and circuit or pair number. For multi-pair cables, the shortest pair length shall be recorded as the length for the cable.

2. Category 6 Performance

- Follow the Standards requirements established in:
 - ANSI/TIA/EIA-568-C.0
Wire Map
Length
Attenuation
NEXT (Near end crosstalk)
 - ANSI/TIA/EIA-568-C.2
Return Loss
ELFEXT Loss
Propagation Delay
Delay skew
PSNEXT (Power sum near-end crosstalk loss)
PSELFEXT (Power sum equal level far-end crosstalk loss)
- A Level III or better test unit is required to verify category 6 performances and must be updated to include the requirements of TSB-95 and Amendment 5. Testers will be equal to or better than Fluke Network's Versiv DSX CableAnalyzer.
- All testers shall have been recalibrated **within 6 months** of use on this project. Contractor will be asked to provide proof of recalibration.
- Test results shall be automatically evaluated by the equipment, using the most up-to-date criteria from the TIA/EIA Standard, and the result shown as pass/fail. The approved Level Three tester shall provide a printed document for each test that is also available in a downloadable file using an application

from the test equipment manufacturer. The printed test results shall include a print out of all tests performed, and the individual test results for each cable. A PDF of the test results and the Fluke FLW File are required to be sent to Owner for review.

3. Category 6A Performance

- Shall meet all test parameters as stated above for Category 6, with the addition of PSANEXT, PSAACR, and PSAACR-F:

C. Fiber Optic Cable Testing

1. Backbone Fiber

- Each fiber strand shall be tested for attenuation with an Optical Power Meter and light source and with an Optical Time Domain Reflectometer (OTDR) for actual length and splice/connector loss. Cable length shall be verified using sheath markings. The guidelines and procedures established for Tier 1 testing in TIA/TSB-140 shall apply.
- All fiber optic cables shall be tested from the site's MDF to each fiber terminals located in the IDF. The results of OTDR testing to define the length of each riser cable shall be documented. The Contractor shall conduct a power meter (loss) test of each fiber optic station and riser cable at both wavelengths, 850/1300nm for MM and 1310/1550nm for SM, A to B, B to A, and OSPL (OSPL is defined as $L_a + L_b$). No individual station or riser fiber link segment (including connectors) shall measure more than 2.0 dB loss. Tests shall be conducted using ANSI/EIA/TIA/EIA-526-14A, Method B. Test results evaluation for the panel to panel (backbone) shall be based on the values set forth in ANSI/TIA/EIA-568-C.2. The Contractor shall provide an electronic printout for each strand tested with the Power Meter and the OTDR.
- Where concatenated links are installed to complete a circuit between devices, the Contractor shall test each link from end to end to ensure the performance of the system. After the link performance test has been successfully completed, each link shall be concatenated and tested. The test method shall be the same used for the test described above. The evaluation criteria shall be established between the Owner and the Contractor prior to the start of the test.
- All installed cables must meet or exceed the defined standards for performance. The Contractor shall take all steps necessary to repair or replace any optic not meeting the standard.
- Fiber optic riser and station cable test results shall be provided in electronic format to the Owner. PDF and Fluke FLV files are to be sent to Owner.

4.4 System Closeout and As-built Documentation

- A. Upon completion of the installation, the telecommunications contractor shall provide three (3) full documentation sets to the Owner's Representative/Engineer for approval. One (1) to be a hardcopy and two (2) to be electronic copies. Documentation shall include the items detailed in the sub-sections below.
- B. Documentation shall be submitted within ten (10) working days of the completion of each testing phase. This is inclusive of all test results and draft as-built drawings. Draft drawings may include annotations done by hand. Machine generated (final) copies of all drawings shall be submitted within 30 calendar days of the completion of each testing phase. At the request of the Owner's Representative/Engineer, the telecommunications contractor shall provide copies of the original test results.
- C. The Owner's Representative/Engineer will request that a 10% random field re-test be conducted on the cable system, at no additional cost, to verify documented findings. Tests shall be a repeat of those defined above. If findings contradict the documentation submitted by the telecommunications contractor, additional testing

- can be requested to the extent determined necessary by the Engineer, including a 100% re-test. This re-test shall be at no additional cost to the Owner.
- D. **Test Results** documentation shall be provided in two media, as listed above, one (1) hardcopy and one (1) on USB within three weeks after the completion of the project. The documentation shall be clearly marked on the outside front cover with the words "Project Test Documentation", the project name, and the date of completion (month and year). The results shall include a record of test frequencies, cable type, conductor pair and cable (or outlet) I.D., measurement direction, reference setup, and crew member name(s). The test equipment name, manufacturer, model number, serial number, software version and last calibration date will also be provided at the end of the document. Unless the manufacturer specifies a more frequent calibration cycle, a bi-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 as well as the software version being used in the field test equipment.
 - E. Printouts generated for each cable by the wire test instrument shall be submitted as part of the documentation package.
 - F. 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 documented.
 - G. The **As-Built** drawings are to include cable routes, outlet locations and the approved labeling identifiers. Their sequential number as defined elsewhere in this document shall identify outlet locations. Numbering, icons, and drawing conventions used shall be consistent throughout all documentation provided. These documents will be modified accordingly by the telecommunications contractor to denote as-built information as defined above and returned to the Owner.
 - H. Contractor will provide one laminated 11"x17" drawing at each IDF that includes the building layout for that IDF, along with the outlet locations and all of the approved labeling. The as-built/current layout is to be provided.
 - I. Test results are to be submitted to the manufacturer and a copy of the warranty certification is to be provided to the owner.

Sample Rack Layout in IDF:

Top of unit: Fiber distribution unit(s)
 Blank 1U.
 24-port patch panel
 24-port patch panel
 Owner provided network switch (installed by Owner)
 24-port patch panel
 24-port patch panel
 Owner provided network switch (installed by Owner)

Repeat the pattern: panel/panel/switch/panel/panel....

At the bottom on the cabinet, skip 1U above the bottom and the UPS is installed. 1U above the UPS, the power strip is installed.

END OF SECTION