Telecommunications Infrastructure Cabling Specification

2017-2018

Scope of Work

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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 CSI Construction Specifications Practice Guide.*

Section numbers and titles are from *MasterFormat 2011 Update.*

SECTION 27 15 00

COMMUNICATIONS HORIZONTAL CABLING

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Horizontal (distribution) communications wiring and connecting hardware from Telecommunications Room (TR) to Telecommunication Outlets (TO).

1.2 RELATED REQUIREMENTS

A. Section 27 05 26 – Grounding and Bonding for Communications Systems.

B. Section 27 05 28 – Pathways for Communications Systems.

C. Section 27 10 00 – Structured Cabling.

D. Section 27 11 00 – Communications Equipment Room Fittings.

E. Section 27 13 00 – Communications Backbone Cabling.

F. Section 27 16 00 – Communications Connecting Cords, Devices, and Adapters.

1.3 REFERENCE STANDARDS

A. ANSI/TIA-492-AAAC-B – Detail Specification for 850-nm Laser-Optimized, 50-um Core Diameter/125-um Cladding Diameter Class 1a Graded-index Multimode Optical Fibers (OM3/OM4). Current Edition

B. ANSI TIA-492-A – Data Center Cabling

C. ANSI/TIA 526 – OFSTP-19 Optical Signal-to-Noise Ratio Measurement Procedures for Dense Wavelength-Division Multiplexed Systems.

D. ANSI/TIA-568-0-D – Generic Communications Cabling for Customer Premises..

E. ANSI/TIA-568-1-D – Commercial Building Communications Cabling Standard Part 1: General Requirements.

F. ANSI/TIA 568-C.2 – Balanced Twisted-Pair Telecommunications Cabling and Components Standards

G. ANSI/TIA 568-C.3 – Optical Fiber Cabling Components Standard

H. ANSI/TIA-569-D – Commercial Building Standard for Telecommunications Pathways and Spaces.

I. ANSI/TIA-606-B – Administration Standard for the Commercial Telecommunications Infrastructure.

J. ANSI/JSTD-607-C – Commercial Building Bonding and Grounding (Earthing) Requirements for Telecommunications.

K. NFPA 70 – National Electrical Code (NEC).

L. BICSI – TDMM, Building Industries Consulting Services International, Telecommunications Distribution Methods Manual (TDMM)

1.4 PRE-INSTALLATION MEETINGS

A. Convene pre-installation meeting 2 weeks before start of installation of communications horizontal cabling.

B. Require attendance of parties directly affecting work of this section, including Contractor, Architect, installer, and manufacturer’s representative.

C. Review materials, installation, field quality control, labeling, protection, and coordination with other work.

1.5 SUBMITTALS

A. Comply with Section 01 33 00 – Submittal Procedures.

B. Product Data: Submit manufacturer's product data sheets, including installation instructions verifying that materials comply with specified requirements and are suitable for intended application.

C. Installer's Project References: Submit installer's list of successfully completed communications horizontal cabling projects, including project name and location, name of architect, and type and quantity of communications horizontal cabling installed.

1.6 QUALITY ASSURANCE

A. Manufacturer's Qualifications: Manufacturer regularly engaged, for past 10 years, in manufacture of communications horizontal cabling of similar type to that specified.

B. Installer's Qualifications:
   1. Approved Leviton Optimized Installer or Berk-Tek Oasis Optimized Integrator Optimized before, during, and through completion of the system installation. Supporting documentation will be required as part of the submittal.
   2. Responsible for workmanship and installation practices in accordance with Leviton Optimized Installer Program and Berk-Tek Oasis Program.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Delivery and Acceptance Requirements: Deliver materials to site in manufacturer's original, unopened containers and packaging, with labels clearly identifying product name and manufacturer.

B. Storage and Handling Requirements:
   1. Store and handle materials in accordance with manufacturer's instructions.
   2. Keep materials in manufacturer's original, unopened containers and packaging until installation.
   3. Store materials in clean, dry area indoors.
   4. Protect materials during storage, handling, and installation to prevent damage.

1.8 WARRANTY

A. The horizontal communications cabling system installed shall be eligible for coverage by a Limited Lifetime Warranty to the end user.
   1. Horizontal channels shall be completed with Leviton Network Solutions factory-terminated copper and/or fiber optic patch cords in order to be eligible for the applicable Berk-Tek or Leviton Warranty with channel performance guarantees.
   2. Approved product shall be listed on the most recent version of the applicable Berk-Tek Leviton Technologies data sheets for each Berk-Tek Leviton Technologies solution.

B. Optimized Installer/Optimized Integrator shall provide labor, materials, and documentation in accordance with Berk-Tek and Leviton Network Solutions requirements necessary to ensure that the Owner will be furnished with a Limited Lifetime Warranty.

C. The installed structured cabling system shall provide a warranty guaranteeing installed channel performance above the ANSI/TIA 568-C requirements for Cat 5e, Cat 6, and/or Cat 6A cabling systems or ISO 11801 requirements for Cass D, Class E, and/or Class E_a.

1. Standards-compliant channel or permanent link performance tests shall be performed in the field with a Berk-Tek Leviton Technologies approved certification tester in the appropriate channel or permanent link test configuration. See 1.8 A.1 above for channel requirements.

D. Necessary documentation for warranty registration shall be provided to the manufacturer by the installer (within 10 days) following 100 percent testing of cables.
   1. Submit test results to Leviton Network Solutions, in the certification tester's original software files.
   2. Installer shall ensure that the warranty registration is properly submitted, with all required documentation within 10 days of project completion.
   3. Optimized Contractor/Optimized Integrator must adhere to the terms and conditions of the respective manufacturer's warranty programs.

E. Installer shall ensure that the Owner receives the manufacturer issued project warranty certificate within 60 calendar days of warranty registration.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Leviton Network Solutions, 2222 222nd Street SE, Bothell, Washington 98021. Phone 425-486-2222. Fax 425-485-3373. Website www.leviton.com.

Berk-Tek, A Nexans Company, 132 White Oak Road, New Holland, PA 17557 Phone: 717-354-6200. Fax 717-354-7944. Website www.berktek.com.

2.2 SYSTEM DESCRIPTION

A. Horizontal Distribution Subsystem: Intra-building twisted-pair and fiber optic communications cabling connecting Telecommunication Rooms (TRs) to Telecommunication Outlets (TOs) located at individual work areas.

B. Horizontal Cabling: **PERMENENT LINK ONLY** Combination of the following types of cables from TR to TO:
   1. Three (3) Category 6A, cables from TRs to TOs, (100-Ohm, 4-pair, shielded twisted pair) cables from TRs to TOs. Port 1, 2 and 3, Blank shall be inserted in port 4.

C. Communications Horizontal Cabling System: Includes cables, jacks, patch panels, connecting blocks, patch cords, fiber connectors, fiber adapter plates, fiber enclosures, jumpers, and necessary support systems, such as cable managers and faceplates.

D. Cables: Route through conduit, cable trays, spaces below raised floors, open ceiling areas, non-ventilated spaces above ceiling tile, and through plenum air-handling spaces above ceiling tile. 1-1/4" vertical stub out conduit shall be used at all outlets. B-line BCH type j-hooks shall be used.

E. Furnish and install all materials necessary for a complete and working communications horizontal cabling system.

2.3 STATION CABLING

A. Category 6A Unshielded Twisted Pair with innovative crosstalk prevention (XTP) technology: **CX6850 Cat 6A Premium+ UTP System**

1. 100 ohm, Category 6A, 23 AWG, 4-pair unshielded twisted pair with innovative crosstalk prevention (XTP) technology. LANmark-XTP, CMP rated.
   a. Color: Blue.
   b. Part Number: 11082057.
   c. Electrical Characteristics: Characterized to 750 MHz.
   d. Cable: Third-party verified by ETL.
   e. Maximum Cable Diameter: 0.275 inch.
   f. Berk-Tek LANmark-XTP CMR
      Part Number: 11082062
   g. All category cabling manufacturers must be able to provide documentation from an independent third-party testing agency that verifies through random sampling that cable components perform at or above the levels contained on their product specifications, not simply at or above the standard.
   h. on their product specifications, not simply at or above the standard.

2. Channel margin guarantees for a **CX6850 Cat 6A Premium+ UTP System** (margin vs. ANSI/TIA-568-C.2 and margin guarantees are for a 4-connector channel).

a.	Insertion Loss	3 %
b.	NEXT	5 dB
c.	PSNEXT	6 dB
d.	ACR-F (ELFEXT)	10 dB
e.	PSACR-F (PSELFEXT)	10 dB
f.	Return Loss	4 dB
g.	ACR-N	7 dB
h.	PSACR-N	7 dB
i.	PSANEXT	5 dB
j.	PSAACR-F	11 dB

B. Optical Fiber Cable. **OM3 Fiber Optic System**:

1. Each Multimode Fiber shall be:
   a) Graded-index optical fiber wave-guide with nominal **50/125µm**-core/cladding diameter.
   b) The fiber shall comply with the latest revision of ANSI/EIA/TIA-492AAAC.
   c) Attenuation shall be measured in accordance with ANSI/EIA/TIA-455-78.
   d) Information transmission capacity shall be measured in accordance with the latest revision of ANSI/EIA/TIA-455-204.
   e) The measurements shall be performed at 23°C ± 5°C.
   f) Maximum attenuation dB/km @ 850/1300 nm: 3.0/1.0
   g) EMB Bandwidth 2000 MHz-km @ 850nm.
   h) OFL Bandwidth 500 MHz-km @ 1300nm.

i) Optical Fiber shall be Bend-insensitive Laser Optimized and guarantee 1Gigabit Ethernet distances of 1000m/600m for 850nm and 1300nm, respectively.
j) Optical fiber shall guarantee a 10 Gigabit Ethernet distance of 300m at 850nm

2. Physical Characteristics:
   a) Shall be suitable for use in indoors or in indoor/outdoor applications.
   b) Appropriately flame rated optical cable shall be suitable for use in risers, plenums and horizontal applications.
   c) Plenum rated optical cables shall have and be marked with an UL-OFNP and OFN FT6 Flame Rating. Riser rated optical cables shall have and be marked with an UL-OFNR and OFN FT4 Flame Rating
   d) Shall comply with the requirements of ICEA S-83-596 (Premises), ICEA S-104-696 (I/O), or ANSI/ICEA S-87-640 (Outside Plant, OSP).
   e) Suitable for underground or aboveground conduits.
   f) Optical cables and fibers shall be color coded in accordance with EIA/TIA-598-C.
   g) Shall have a ripcord for overall jacket.

3. Design Make:
   a) **Berk-Tek Plenum optical fiber cable with OM3 Bend-insensitive Laser Optimized 50/125 micron fiber**
      LTPxxxEB3010/25, (006 to 012 Bend-insensitive Laser Optimized optical fibers, I/O Loose Tube)
      LTP12BxxxEB3010/25, (012 to 432 Bend-insensitive Laser Optimized optical fibers, I/O Loose Tube)
      PDPxxxEB3010/25 (006 to 024 Bend-insensitive Laser Optimized optical fibers, Indoor Tight Buffer)
      PDP12BxxxEB3010/25, (036 to 144 Bend-insensitive Laser Optimized optical fibers, Indoor Tight Buffer)

   b) **Berk-Tek Riser optical fiber cable with OM3 Bend-insensitive Laser Optimized 50/125 micron fiber**
      LTRxxxEB3010/25, (006 to 012 Bend-insensitive Laser Optimized optical fibers, I/O Loose Tube)
      LTR12BxxxEB3010/25, (012 to 432 Bend-insensitive Laser Optimized optical fibers, I/O Loose Tube)
      PDRxxxEB3010/25 (006 to 024 Bend-insensitive Laser Optimized optical fibers, Indoor Tight Buffer)
      PDR12BxxxEB3010/25, (036 to 144 Bend-insensitive Laser Optimized optical fibers, Indoor Tight Buffer)

   c) **Berk-Tek OSP optical fiber cable with OM3 Bend-insensitive Laser Optimized 50/125 micron fiber**
      OPDxxxEB3010/25, (001 to 012 Bend-insensitive Laser Optimized optical fibers, Loose Tube, gel buffer tube)
      OPDD12BxxxEB3010/25, (012 to 288 Bend-insensitive Laser Optimized optical fibers, Loose Tube, gel buffer tube)

C. Optical Fiber Cable. **OM4 Fiber Optic System**:

1. Each Multimode Fiber shall be:

a) Graded-index optical fiber wave-guide with nominal **50/125μm**-core/cladding diameter.
b) The fiber shall comply with the latest revision of ANSI/EIA/TIA-492AAAD.
c) Attenuation shall be measured in accordance with ANSI/EIA/TIA-455-78.
d) Information transmission capacity shall be measured in accordance with the latest revision of ANSI/EIA/TIA-455-204.
e) The measurements shall be performed at 23°C ± 5°C.
f) Maximum attenuation dB/km @ 850/1300 nm: 3.0/1.0
g) EMB Bandwidth 4700 MHz-km @ 850nm.
h) OFL Bandwidth 500 MHz-km @ 1300nm.
i) Optical Fiber shall be Bend-insensitive Laser Optimized and guarantee 1Gigabit Ethernet distances of 1040m/600m for 850nm and 1300nm, respectively.
j) Optical fiber shall guarantee a 10 Gigabit Ethernet distance of 550m at 850nm

2. Physical Characteristics:
   a) Shall be suitable for use in indoors or in indoor/outdoor applications.
   b) Appropriately flame rated optical cable shall be suitable for use in risers, plenums and horizontal applications.
   c) Plenum rated optical cables shall have and be marked with an UL-OFNP and OFN FT6 Flame Rating. Riser rated optical cables shall have and be marked with an UL-OFNR and OFN FT4 Flame Rating
   d) Shall comply with the requirements of ICEA S-83-596 (Premises), ICEA S-104-696 (I/O), or ANSI/ICEA S-87-640 (Outside Plant, OSP).
   e) Suitable for underground or aboveground conduits.
   f) Optical cables and fibers shall be color coded in accordance with EIA/TIA-598-C.
   g) Shall have a ripcord for overall jacket.

3. Design Make:
   a) **Berk-Tek Plenum optical fiber cable with OM4 Bend-insensitive Laser Optimized 50/125 micron fiber**
      LTPxxxFB3010/F5, (006 to 012 Bend-insensitive Laser Optimized optical fibers, I/O Loose Tube)
      LTP12BxxxFB3010/F5, (012 to 432 Bend-insensitive Laser Optimized optical fibers, I/O Loose Tube)
      PDPxxxFB3010/F5 (006 to 024 Bend-insensitive Laser Optimized optical fibers, Indoor Tight Buffer)
      PDP12BxxxFB3010/F5, (036 to 144 Bend-insensitive Laser Optimized optical fibers, Indoor Tight Buffer)

   b) **Berk-Tek Riser optical fiber cable with OM4 Bend-insensitive Laser Optimized 50/125 micron fiber**
      LTRxxxFB3010/F5, (006 to 012 Bend-insensitive Laser Optimized optical fibers, I/O Loose Tube)
      LTR12BxxxFB3010/F5, (012 to 432 Bend-insensitive Laser Optimized optical fibers, I/O Loose Tube)
      PDRxxxFB3010/F5 (006 to 024 Bend-insensitive Laser Optimized optical fibers, Indoor Tight Buffer)
      PDR12BxxxFB3010/F5, (036 to 144 Bend-insensitive Laser Optimized optical fibers, Indoor Tight Buffer)

c) **Berk-Tek OSP optical fiber cable with OM4 Bend-insensitive Laser Optimized 50/125 micron fiber**

OPDxxxFB3010/F5, (001 to 012 Bend-insensitive Laser Optimized optical fibers, Loose Tube, gel buffer tube)
OPDD12BxxxFB3010/F5, (012 to 288 Bend-insensitive Laser Optimized optical fibers, Loose Tube, gel buffer tube)

1. Each Single-mode Fiber shall be:
   a) Dispersion - unshifted single mode optical fibers with Low Water Peak complying with ITU-T G.652.D and with improved bending loss complying with ITU-T G.657.A1.
   b) The zero dispersion wavelength shall be between 1300 nm and 1320 nm. The ANSI/EIA/TIA-455-168 maximum value of the dispersion slope shall be no greater than 0.090 ps/km-nm^2. Dispersion measurements shall be made in accordance with ANSI/EIA/TIA-455-169 or ANSI/EIA/TIA-455-175-B.
   c) The nominal mode field diameter shall be 9.2 μm with a tolerance of $\pm$ 0.4 μm at 1310 nm when measured in accordance with ANSI/EIA/TIA-455-191-B.
   d) Transmission Characteristics:
   e) Maximum cabled attenuation for loose tube fibers shall be 0.4/0.3 dB/km @ 1310/1550 nm.
   f) Maximum cabled attenuation for tight buffer fibers shall be 0.7/0.7 dB/km @ 1310/1550 nm.
   g) The cabled cutoff wavelength shall be $\leq$1260 nm when measured in accordance with ANSI/EIA/TIA-455-80-C.

2. Physical Characteristics:
   a) Shall be suitable for use in indoors or in indoor/outdoor applications.
   b) Appropriately flame rated optical cable shall be suitable for use in risers, plenums and horizontal applications.
   c) Plenum rated optical cables shall have and be marked with an UL-OFNP and OFN FT6 Flame Rating. Riser rated optical cables shall have and be marked with an UL-OFNR and OFN FT4 Flame Rating
   d) Shall comply with the requirements of ICEA S-83-596 (Premises), ICEA S-104-696 (I/O), or ANSI/ICEA S-87-640 (Outside Plant, OSP).
   e) Suitable for underground or aboveground conduits.
   f) Optical cables and fibers shall be color coded in accordance with EIA/TIA-598-C.
   g) Shall have a ripcord for overall jacket.

3. Design Make:
   a) **Berk-Tek Plenum optical fiber cable with OS2 (Low Water Peak) Bend-insensitive Singlemode fiber**

      LTPxxxAB0403, (006 to 012 Bend-insensitive optical fibers, I/O Loose Tube)
      LTP12BxxxAB0403, (012 to 432 Bend-insensitive optical fibers, I/O Loose Tube)
      PDPxxxAB0707 (006 to 024 Bend-insensitive optical fibers, Indoor Tight Buffer)
      PDP12BxxxAB0707, (036 to 144 Bend-insensitive optical fibers, Indoor Tight Buffer)

   b) **Berk-Tek Riser optical fiber cable with OS2 (Low Water Peak) Bend-insensitive Singlemode fiber**

      LTRxxxAB0403, (006 to 012 Bend-insensitive optical fibers, I/O Loose Tube)
      LTR12BxxxAB0403, (012 to 432 Bend-insensitive optical fibers, I/O Loose Tube)

PDRxxxAB0707 (006 to 024 Bend-insensitive optical fibers, Indoor Tight Buffer)
PDR12BxxxAB0707, (036 to 144 Bend-insensitive optical fibers, Indoor Tight Buffer)

c) **Berk-Tek OSP optical fiber cable with OS2 (Low Water Peak) Bend-insensitive Singlemode fiber**
OPDxxxAB0403, (001 to 012 Bend-insensitive optical fibers, Loose Tube, gel buffer tube)
OPDD12BxxxAB0403, (012 to 288 Bend-insensitive optical fibers, Loose Tube, gel buffer tube)

D. TELECOM INTERCONNECT CABLING
1. 25 pair, Power Sum, Category 3 cable shall be installed in areas detailed in Statement of Work.

2.4 MODULAR JACKS AND FIBER ADAPTERS FOR WORKSTATION OUTLETS

A. Category 6A Modular Jacks: **CX6850 Cat 6A Premium+ UTP System**,

1. 8-position modular jack, Category 6A, IDC terminals, T568A/B wiring scheme.
2. The modular connector shall exceed all component performance requirements in the ANSI/TIA-568-C.2 standard for Augmented Category 6 from 1 MHz to 500 MHz to support the IEEE 802.3an standard for 10GBASE-T network performance
3. The Modular Connector shall be terminated without the need for any punch down tool or other specialized or proprietary termination tool.
4. The Connector Module shall feature a termination wire manager that holds individual conductors in place during termination.
5. The Category 6A Modular Connector termination method shall be consistent with the termination method available for Category 5e and Category 6 UTP modules from the same manufacturer. The same termination method shall also be consistent with Category 6A shielded modules from the same manufacturer.
6. The Modular Connector shall be reusable and support multiple termination and re-termination cycles and be facilitated by simple termination release levers.
7. The modular connector shall be independently tested and verified by Intertek (ETL) to exceed Category 6A component performance.
8. The eight-position connector module shall utilize a method of tine tensioning that prevents six-position modular plug insertion from damaging either the cord or the module.
9. The connector body shall be made of die-cast zinc and all plastic components shall be made of high-impact, fire-retardant plastic rated UL 94V-0.
10. The connector shall also be in compliance will all National Electrical Codes; compliant with ANSI/TIA-1096-A (formerly FCC Part 68); cULus Listed; and independently tested for component compliance.
11. In addition to Category 6A component compliance, the connector shall have the ability to support high megabit and shared sheath applications.
12. Connector wiring shall be universal and will accommodate both T568A and T568B pair/pin assignments.
13. The connector shall incorporate a triple-stage compensation design with integrated flexible circuit design that enhances link and channel performance.
14. The modular connector shall fit a range of telecommunications faceplates, outlets, and field-configurable patch panels.
15. The modular connector shall be available in 13 TIA 606-A compatible colors.

16. Connector Module shall be supplied with interchangeable icons (voice, data, A/V, and blank, color coded to match the connector face) for easy identification and tracking of data, voice, or other functions.
17. Additional bulk Icons for the connector shall be available in 13 colors to facilitate a broad range of connector marking/identification options.
18. Connector Modules shall be available with an internal shutter to protect against dust and debris
19. Connector Module shall have a maximum depth of 1.31”
20. Each connector shall be identified on its face as CAT 6A.
21. Basis for design: Leviton Atlas-X1 UTP Cat 6A Connector. Category 5e, 6 & 6A Plenum Rated (UL Standard 2043).
22. Color: white (13 colors available).
23. Part Numbers: Standard version: 6AUJK-RL6 (Blue).
    Shutter version: 6AUJK-SL6 (Blue).
    Additional Icons: ICONS-IC* (72 two-sided Icons)
    * = color option
24. QuickPort Duplex LC Adapter, aqua adapter for OM3/OM4 Bend-insensitive Laser Optimized multimode fiber, zirconia ceramic sleeve. Use for **OM3 Fiber Optic System**, **OM4 Fiber Optic System**
    a. Color of plastic housing: white
    b. Part Number: Leviton 41085-LLL (Blue).

B. Single Mode Fiber Modular Adapters for workstation outlets: Use for **OS2 Fiber Optic System**.

1. QuickPort Duplex LC Adapter, blue adapter for OS1/OS2 Single Mode fiber, zirconia ceramic sleeve.
   a. Color of plastic housing: white
   b. Part Number: Leviton 41085-SLL (Blue).

2.5 WORK AREA OUTLETS

A. Flush-Mounted Stainless Steel Faceplates:
1. 4-port Angled QuickPort dual-gang stainless steel wallplate, with ID windows
   a. Part Number: Leviton 43081-2L4.

B. Surface-Mounted Outlet Boxes (Plenum Rated):
1. 2-port QuickPort surface-mount box, plastic, with ID window.
   a. Color: white
   b. Part Number: Leviton 41089-2WP (white).
2. 4-port QuickPort surface-mount box, plastic, with ID window.
   a. Color: white
   b. Part Number: Leviton 41089-4WP (white).
3. 2-port QuickPort surface-mount box, plastic, with ID window, extra-deep for shielded connectors, Cat 6A, other larger bend-radius cable applications.
   a. Color: white
   b. Part Number: Leviton 4S089-2WP (white)
4. 4-port QuickPort surface-mount box, plastic, with ID window, extra-deep for shielded connectors, Cat 6A, other larger bend-radius cable applications.
   a. Color: white
   b. Part Number: Leviton 4S089-4WP (white)

5. Surface Box Colors: part numbers shown are for white. Also available: Ivory, Grey, and Black.
   a. Coordinate with Architect to match finish.
   b. (Compliant with NEC 300-22 (b)

C. Modular Furniture Faceplates:
1. 2-port furniture wallplate fits 1.38-inch by 2.63-inch furniture knockout, with ID window.
   a. Colors: white
   b. Part Number: Leviton 49910-SW2 (white).
2. 4-port furniture wallplate fits 1.38-inch by 2.63-inch furniture knockout, with ID window.
   a. Colors: white
   b. Part Number: Leviton 49910-SW4 (white).
3. 4-port furniture wallplate fits 1.38-inch by 2.63-inch furniture knockout, with ID window. Extra-deep version with additional room for cable bend radius.
   a. Colors: white
   b. Part Number: Leviton 49910-EW4 (white).
4. 2-port furniture wallplate fits 1.88-inch by 2.98-inch Hermann-Miller furniture knockout, with ID window.
   a. Colors: white
   b. Part Number: Leviton 49910-HW2 (white).
5. 4-port furniture wallplate fits 1.88-inch by 2.98-inch Hermann-Miller furniture knockout, with ID window.
   a. Colors: white
   b. Part Number: Leviton 49910-HW4 (white).
6. Furniture Faceplate Colors: Part numbers shown are for white. Also available: Ivory, grey, and black. Coordinate with Architect to match finish.

D. Mounting Frames for QuickPort Jacks and Connectors
1. 1-port QuickPort Decora-style frame. Fits in Decora-style wallplate
   a. Colors: white
   b. Part Number: Leviton 41641-00W (white).
2. 2-port QuickPort Decora-style frame. Fits in Decora-style wallplate
   a. Colors: white
   b. Part Number: Leviton 41642-00W (white).
3. 3-port QuickPort Decora-style frame. Fits in Decora-style wallplate
   a. Colors: white
   b. Part Number: Leviton 41643-00W (white).
4. 4-port QuickPort Decora-style frame. Fits in Decora-style wallplate
   a. Colors: white
   b. Part Number: Leviton 41644-00W (white).
5. 6-port QuickPort Decora-style frame. Fits in Decora-style wallplate
   a. Colors: white
   b. Part Number: Leviton 41646-00W (white)
6. 2-port QuickPort Duplex 106-style frame. Fits in Duplex electrical-style wallplate
   a. Colors: white
   b. Part Number: Leviton 41087-2WP (white).
7. Decora-style wallplates for above mounting frames
   a. Single-gang, nylon: Leviton part number 80401-0NW (white)
   b. Dual-gang, nylon: Leviton part number 80409-0NW (white)
8. 4-port QuickPort Duplex 106-style frame. Fits in Duplex electrical-style wallplate
   a. Colors: white

b. Part Number: Leviton 41087-QWP (white).

9. Duplex electrical-style wallplates for above mounting frames
   a. Single-gang, nylon: Leviton part number 80703-00W (white)
   b. Dual-gang, nylon: Leviton part number 80716-00W (white)
10. Mounting Frame colors: Part numbers shown are for white. Also available: Light almond, ivory, grey, black (and brown for the Decora-style frames). Coordinate with Architect to match finish.

E. **WAP Applications**: In-Ceiling Brackets - Mounting QuickPort Jacks, Connectors, 1 & 2 Port Surface Mounted Box, Slack Loops.
   1. QuickPort In-Ceiling 2 Port Bracket, includes clip for drop wire/rod
      a. Colors: Metal
      b. Part Number: Leviton 49223-CBC.

F. Multimedia Outlet System (MOS):
   1. Single-gang Multimedia Outlet System wallplate, plastic, with ID windows. Holds a wide variety of copper, fiber, and/or audio-video inserts.
      a. Color: white
      b. Part Number: Leviton 41290-SMW (white).
   2. Dual-gang Multimedia Outlet System wallplate, plastic, with ID windows. Holds a wide variety of copper, fiber, and/or audio-video inserts.
      a. Color: white
      b. Part Number: Leviton 41290-DMW (white).
   3. Multimedia Outlet System wallplates, Stainless Steel, with ID windows. Holds a wide variety of copper, fiber, and/or audio-video inserts.
      a. Color: Stainless Steel
      b. Part Numbers: Single-gang Leviton 41290-SMS (Stainless).
         Dual-gang Leviton 41290-DMS (Stainless).
         Three-gang Leviton 41290-TMS (Stainless).
   4. Fiber storage/spacer ring, plastic. Fits Dual-gang Multimedia Outlet System wallplate.
      a. Color: white
      b. Part Number: Leviton 41290-DRW (white).
   5. 6-port Multimedia Outlet System surface-mount box, plastic, with ID window. Holds a wide variety of copper, fiber, and/or audio-video inserts.
      a. Color: white
      b. Part Number: Leviton 41296-MMW (white).
   6. Multimedia Outlet System (MOS) colors: Part numbers shown are for white. Also available: Light almond, ivory, grey, and black (ivory, grey, and black for the fiber storage/spacer ring). Coordinate with Architect to match finish.
   7. Multimedia Outlet System (MOS) Inserts: For a complete list of MOS Inserts available please visit www.leviton.com/mos

2.6 TERMINATION BLOCKS

A. Termination Blocks: May be used for Consolidation Point terminations, or for termination of multi-pair copper (voice) backbone cabling.

B. Category 6A, 110-Style Blocks: **CX6850 Cat 6A Premium+ UTP System,**
   1. Category 6A, 64 pair, 110-style, with mounting legs, wall mount.
      a. Part Number: Leviton 41D6A-1F4.

2.7 PATCH PANELS

A. Category 6A Patch Panel: **CX6850 Cat 6A Premium+ UTP System,**

1. 48-port, flat, QuickPort, Patch Panels
   a. Part Number: Leviton 49255-L48.

B. Voice Grade Patch Panel

1. 24-port, flat, 110-style, Telco Patch Panel
   b. Part Number Leviton 49013-P24

2.8 FIBER OPTIC TERMINATION ENCLOSURES and SPLICE TRAYS. Use for **OM3 Fiber Optic System**, **OM4 Fiber Optic System**, and **OS2 Fiber Optic System**

A. Opt-X Ultra Fiber Optic Enclosures: High-end appearance, metal and composite, rack mountable, holds various fiber adapter plates, splice trays, or MTP modules, based on connector choice and density requirements.
   1. 1RU Opt-X Ultra rack-mount Fiber Optic Enclosure, empty, with sliding tray.
      a. Capacity: 72 fiber strands (LC), 3 fiber adapter plates and 3 splice trays, or 3 MTP modules
      b. Part Number: Leviton 5R1UH-S03.
   2. 2RU Opt-X Ultra rack-mount Fiber Optic Enclosure, empty, with sliding tray.
      a. Capacity: 144 fiber strands (LC), 6 fiber adapter plates and 6 splice trays, or 6 MTP modules
      b. Part Number: Leviton 5R2UH-S06.
   3. 4RU Opt-X Ultra rack-mount Fiber Optic Enclosure, empty, with sliding tray.
      a. Capacity: 288 fiber strands (LC),12 fiber adapter plates and 12 splice trays, or 12 MTP modules
      b. Part Number: Leviton 5R4UH-S12.

B. Splice trays
   1. 12-fiber Mini Splice Tray, 3.74” x 5.59”
      a. Part Number: Leviton T5PLS-12F
   2. 24-fiber High-density Splice Tray, 4.5” x 7.63”
      a. Part Number: Leviton T5PLS-24F

2.9 FIBER OPTIC ADAPTER PLATES

A. 50µm Laser-optimized Multimode (LOMM) Adapter Plates, for **OM3 Fiber Optic System**, **OM4 Fiber Optic System**,
   1. 6-LC duplex (12-fiber) multimode OM3/OM4, aqua adapter plate, zirconia-ceramic sleeves.
      a. Part Number: Leviton 5F100-2QL.
   2. 6-LC quad (24-fiber) multimode OM3/OM4, aqua adapter plate, zirconia-ceramic sleeves.
      a. Part Number: Leviton 5F100-4QL.

B. Single Mode Adapter Plates, for **OS2 Fiber Optic System**.
   1. 6-LC duplex (12-fiber) multimode OS1/OS2, blue adapter plate, zirconia-ceramic sleeves.
      a. Part Number: Leviton 5F100-2LL.
   2. 6-LC quad (24-fiber) multimode OS1/OS2, blue adapter plate, zirconia-ceramic sleeves.
      a. Part Number: Leviton 5F100-4LL.

2.10 FIBER OPTIC CONNECTORS

A. OM3 and OM4 Laser-optimized Multimode (LOMM) Fiber Optic Connectors (aqua): Use for **OM3 Fiber Optic System, OM4 Fiber Optic System,**

   1. FastCam LC Connector
      a. Part Number: Leviton 49991-LLC

B. OS2 Single Mode Fiber Optic Connectors (blue): Use for **OS2 Fiber Optic System**
   1. FastCam LC Connector
      a. Part Number: Leviton 49991-SLC

2.11 PATCH CORDS/JUMPERS <u>(Contractor shall provide two (2) patch cables for each channel)</u>

A. Atlas-X1 Category 6A Modular Patch Cords: **CX6850 Cat 6A Premium+ UTP System,**.
   1. Slim-Line style, Category 6A, shielded cord (use same cord for shielded or unshielded systems) 4-pair, stranded wire construction.
      b. Color: 9 colors available.
      c. Part Numbers:
         1) Leviton 6AS10-03L (3 feet, Blue).
         2) Leviton 6AS10-05L (5 feet, Blue).
         3) Leviton 6AS10-07L (7 feet, Blue)*
         4) Leviton 6AS10-10L (10 feet, Blue).
         5) Leviton 6AS10-15L (15 feet, Blue).
         6) Leviton 6AS10-20L (20 feet, Blue).

B. OM3, aqua. Factory-terminated, double-ended, 2-strand multimode cordage. Use for **OM3 Fiber Optic System, OM4 Fiber Optic System**
      a. Duplex LC-Duplex LC:
         1) Leviton 5LDLC-M01 (1 meter)
         2) Leviton 5LDLC-M02 (2 meter)*
         3) Leviton 5LDLC-M03 (3 meter)
         4) Leviton 5LDLC-M05 (5 meter)
         5) Leviton 5LDLC-M10 (10 meter)

C. Single Mode Fiber Optic Jumpers:

   1. OS2, yellow. Factory-terminated, double-ended, 2-strand multimode cordage, UPC polish. Use for **OS2 Fiber Optic System**
      a. Duplex LC-Duplex LC:
         1) Leviton UPDLC-S01 (1 meter)
         2) Leviton UPDLC-S02 (2 meter)*

3) Leviton UPDLC-S03 (3 meter)
4) Leviton UPDLC-S05 (5 meter)
5) Leviton UPDLC-S10 (10 meter)

2.12 PIGTAILS

1. 50.125um OM3 LC Pigtail kits
   a. 12-Fiber individual color coded
      1) Leviton 5LPLC-KIT

2.13 RACKING

i. Eaton B-Line 7’ Relay Rack SB556084XUFB

2.14 VERTICAL AND HORIZONTAL CABLE MANAGERS

1. B-Line Vertical and Horizonal Manager
   ii. Eaton B-Line 10” Vert Double Sided SB864810D084FB
   iii. Eaton B-Line 6” Vert Double Sided SB86486D084FB
   iv. Eaton B-Line 2RU Hori. Double SB87019D2FB
   v. Other Eaton B-Line components as needed

2.15 BASKET TRAY

2. Wirebasket applications (non-closet):
   i. Eaton B-Line 12’ x 4” Wirebasket FT4X12X10
   ii. Eaton B-Line 18” x 4” Wirebasket FT4X18X10
   iii. Eaton B-Line Connectors FTSWN
   iv. Eaton B-Line Hanging clip WB46H
   v. Eaton B-Line Trapeze - 12” FTB12CT
   vi. Eaton B-Line Trapeze – 18” FTB18CT
   vii. Eaton B-Line Wall brackets – 12” FTB12CS
   viii. Eaton B-Line Wall Brackets – 18” FTB18CS
   ix. Eaton B-Line Wall Termination Kit FTA9WTK
   x. Eaton B-Line Drop out DROP OUT
   xi. Eaton B-Line Rubber cups B719EB
   xii. Eaton B-Line Ground bolt GROUND BOLT
   xiii. Other Eaton B-Line components as needed

2.16 Ladder Rack (telecommunication rooms)

xiv. Eaton B-Line 12” Ladder rack SB17U12BFB
xv. Eaton B-Line 18” Ladder rack SB17U18BFB
xvi. Eaton B-Line Butt splice Kit SB2107BZ
xvii. Eaton B-Line Junction Splice SB2101ABZ
xviii. Eaton B-Line 90 Deg. Vert.- 12” SB17VRB12FB

xix.	Eaton B-Line	90 Deg. Vert.- 18”	SB17VRB18FB
xx.	Eaton B-Line	90 Deg. Hori – 12”	SB17HRB12FB
xxi.	Eaton B-Line	90 Deg. Hori – 18”	SB17HRB18FB
xxii.	Eaton B-Line	Support Kit - Kit	SB2118ABZ
xxiii.	Eaton B-Line	Wall Support Kit	SB2114AFB
xxiv.	Eaton B-Line	Foot Kit	SB2106ABZ
xxv.	Eaton B-Line	Triangular Sup – 12”	SB21312KFB
xxvi.	Eaton B-Line	Triangular Sup – 18”	SB21318KFB
xxvii.	Eaton B-Line	Wall Support – 12”	SB211312FB
xxviii.	Eaton B-Line	Wall Support – 18”	SB211318FB
xxix.	Eaton B-Line	Rack Top Plate Kit- 12”	SB21312FB
xxx.	Eaton B-Line	Rack Top Plate Kit-18”	SB21318FB
xxxi.	Eaton B-Line	Drop Out – 12”	SB2129U12FB
xxxii.	Eaton B-Line	Drop Out – 18”	SB2129U18FB
xxxiii.	Eaton B-Line	End caps	SB110A1B
xxxiv.	Eaton B-Line	Grounding Bar Kit	SBTMGB12K
xxxv.	Other Eaton B-Line components as needed		

2.17 MISCELLANEOUS PATHWAY

3. J-Hook Applications

i.	Eaton B-Line	¾” J-Hook	BCH12
ii.	Eaton B-Line	1 5/16” J-Hook	BCH21
iii.	Eaton B-Line	2” J-Hook	BCH32
iv.	Eaton B-Line	4” J-Hook	BCH64

v. Various variations based on mounting applications for above, match color of environment if exposed

2.18 FIRE STOP

1. STI Firestop

vi.	STI	36” Cu. In Tube Putty	SSP100	
vii.	STI	1” x 4” x 9” Pillow	SSB14	
viii.	STI	2” x 6” x 9” Pillow	SSB26	
ix.	STI	1” Ready Sleeve	FS100	Where specified
x.	STI	2” Ready Sleeve	FS200	Where specified
xi.	STI	4” Ready Sleeve	FS400	Where specified
xii.	STI	EZ-Path 1 ½”	EZD22	Where specified
xiii.	STI	EZ-Path 3”	EZDP33FWS	Where specified
xiv.	STI	EZ-Path 4”	EZDP44	Where specified

PART 3 EXECUTION

3.1 EXAMINATION

A. Examine areas to receive communications horizontal cabling.

B. Notify Architect of conditions that would adversely affect installation or subsequent use.

C. Do not begin installation until unacceptable conditions are corrected.

3.2 CONTRACTOR QUALIFICATIONS

A. Any contractor offering a proposal for this project must meet the minimum requirements listed below and provide written, hard copy documentation of these qualifications with their proposal:

- Certified Leviton Certified Contractor and be able to offer the Certified System Warranty.
- BICSI Corporation member organization
- RCDD on staff

B. Primary line of business communications structured cabling

C. Five (5) years' experience in the installation of optical fiber cables, including splicing, terminating and testing. Testing on optical fiber cable shall include single and multi-mode.

D. Three (3) years' experience in the installation of Category 6A Unshielded Twisted Pair copper cables for voice and data distribution systems, including splicing, terminating and testing. Testing of Category 6A copper cable shall include complete testing and verification as outlined in the TIA cable standards.

E. Five (5) references for project of equivalent scope, type and complexity of work completed within the last five (5) years. The Contractor shall submit as proof, supporting documents and the names, addresses and telephone numbers of the operating personnel who can be contacted regarding the installation system.

F. Licensed NC Contractor

G. The Contractor must have a minimum of one (1) Registered Communications Distribution Designer (RCDD) as recognized by Building Industry Consulting Service International (BICSI) The RCDD shall be responsible for compliance of work with the referenced standards and guidelines. Professional resume and proof of current registration shall be supplied for approval at the time of bid. The RCDD shall be named as the project manager for the project. All supervisors assigned to the installation of this system or any of its components shall be Building Industry Consulting Services International (BICSI) Certified Cabling Installation Technicians, Installer Level II

3.3 INSTALLATION – GENERAL

A. Install communications horizontal cabling in accordance with manufacturer's instructions, ANSI/TIA-568-C.0, ANSI/TIA-568-C.1, ANSI/TIA-569-C, BICSI TDMM, and NFPA 70.

B. Field Terminated Copper and Fiber Optic Patch Cords and Jumpers**:** **Not allowed**.

C. Copper Patch Cords and Fiber Jumpers: Manufactured by Leviton Network Solutions. Contractor SHALL provide all copper and/or fiber patch cords for every horizontal cable channel.

D. Install cables after building interior has been physically protected from weather and mechanical work likely to damage cabling has been completed.

E. Ensure cable pathways are completely and thoroughly cleaned before installing cabling.

F. Inspect installed conduit, wireway, cable trays, and innerduct.

G. Clean additional enclosed raceway and innerduct systems furnished.

H. Provide protection for exposed cables where subject to damage.

I. Abrasion Protection:
   1. Provide abrasion protection for cable or wire bundles which pass through holes or across edges of sheet metal.
   2. Use protective bushings to protect cables.

J. Velcro
   1. Cable Ties SHALL not be used anywhere in the horizontal infrastructure
   2. Velcro wraps shall be used for all cable bundles where needed. Plenum-rated Velcro wraps are available from Leviton.

K. Where possible, route cables in overhead cable trays and inside wire management systems attached to equipment cabinets and racks.
   1. Use Velcro to restrain cabling installed outside of wire management systems on racks or in cabinets.
   2. Cable Trays: Do not exceed 50 percent fill.

L. Pull Cord:
   1. Nylon, 1/8-inch minimum.
   2. Co-install with cables installed in conduit.

M. Cable Raceways: Do not fill greater than ANSI/TIA-569-B maximum fill for particular raceway type.

N. Support horizontal cables at a maximum of 48-inch (1.2 to 1.5-m) **irregular intervals**, if J-hook or trapeze system is used to support cable bundles.

O. Do not allow cables to rest on acoustic ceiling grids, plumbing pipes, or electrical conduits.

P. Bundle horizontal distribution cables in groups of no more than amount of cables designed for by cable support manufacturer, based on cable OD and weight

Q. Fire-Sprinkler System:
   1. Install cables above fire-sprinkler system.
   2. Do not attach cables to fire-sprinkler system or ancillary equipment or hardware.
   3. Install cable system and support hardware so that it does not obscure valves, fire alarm conduit, boxes, or other control devices.

R. Do not attach cables to ceiling grid or lighting fixture wires.

S. Install appropriate carriers to support cabling, where support for horizontal cables are required.

T. Replace before final acceptance, cables damaged or exceeding recommended installation parameters during installation.

U. Paint SHALL NOT be applied to any part of the cable or connectivity components.

3.4 DISTRIBUTION SYSTEM

All communications manholes shall be constructed in accordance with the plan and section view drawings in the UNCP-DOIT Telecommunications Design & Standards Guideline. All new manholes shall be fitted with cable racking hardware.

A. Entrance Duct

Unless specifically directed by the UNCP-DOIT department, all new buildings will be designed with a minimum quantity of four 4 inch entrance conduits. This conduit will be of a rigid metallic construction or 4 inch Schedule 40 PVC encased in concrete pending approval and inspection by UNCP Planning & Construction and will extend from a communications manhole, designated by the UNCP-DOIT department, to the intermediate distribution frame in the building. All of these conduits shall be fitted with (1) 3” x 3 sleeve inner ducts. All conduits and inner ducts shall be installed with marked pull tapes. The service entrance conduits shall appear and be positioned in the right rear corner of the IDF (intermediate distribution frame), 4 inches from the rear wall, and shall be stubbed 4 inches above the finished floor. Plastic bushings shall be installed on each entrance duct. In general, no more than two 90 degree bends between the manhole and the building will be permitted.

Entrance Duct – continued

The use of LB, LL, or LR fittings will not be approved. All metallic entrance conduits shall be installed in accordance with National Electric Code Article 250 and 800-12C. If the service entrance ducts penetrate or appear in the building before final termination in the building’s IDF, they should transition to metallic conduit (if PVC) in an accessible and appropriately sized junction box. If the distance between the point of transition and the building IDF exceeds 50 ft., then at least one of the quantities of exposed entrance conduits **MUST** be rigid. In addition, where a transition junction box is installed, one of the other conduits that extend to the IDF shall

be fitted with three 1-1/4" rated inner ducts. Contractor shall consult with the UNCP-DOIT Networking Group when special pull boxes or junction boxes are required.

B. Duct bank between Manholes

All Telecommunications duct banks shall allow no more than 180 degrees of bends between manholes. No short radius 90 degree bends are allowed.

C. Acceptance of Ductbank

All ductbank both from the manhole to the building, and between manholes shall be inspected and approved by a representative from the University's Planning & Construction department prior to the placement of any concrete. Additionally, this ductbank shall be mandreled after completion. After a duct line is completed, a standard flexible mandrel shall be used for cleaning followed by a brush with stiff bristles. Mandrels shall be at least 12 inches long and have diameters 1/4 inch less than the inside diameter of the duct being cleaned.

3.5 INSTALLATION – UNSHIELDED TWISTED-PAIR CABLES

A. Install unshielded twisted-pair cables in accordance with manufacturer's instructions.

B. Install cables in continuous lengths from origin to destination, without splices, except for transition points or consolidation points.

C. Where transition points or consolidation points are allowed, they shall be located in accessible locations and housed in enclosure intended and suitable for the purpose.

D. Cable Minimum Bend Radius and Maximum Pulling Tension:
   1. Do not exceed bend radius for UTP = 4 X Cable OD, FTP = 4 X Cable OD.
   2. Install unshielded twisted-pair cables so that there are no bends smaller than 4 times cable outside diameter at any point in the run and at the termination field.
   3. Pulling Tension on 4-Pair UTP Cables: Do not exceed 25 ft.lb. for 4-pair UTP cable.

E. Separation from Power Lines: Provide following minimum separation distances between pathways for copper communications cables and power wiring of 480 volts or less:
   1. Open or Nonmetal Communications Pathways:
      a. Electric motors, fluorescent light fixtures, and unshielded power lines carrying up to 3 kVA: 12 inches.
      b. Electrical equipment and unshielded power lines carrying more than 5 kVA: 36 inches.
      c. Large electrical motors or transformers: 48 inches.

   2. Grounded Metal Conduit Communications Pathways:
      a. Electrical equipment and unshielded power lines carrying up to 2 kVA: 2-1/2 inches.
      b. Electrical equipment and unshielded power lines carrying from 2 kVA to 5 kVA: 6 inches.
      c. Electrical equipment and unshielded power lines carrying more than 5 kVA: 12 inches.
      d. Power lines enclosed in grounded metal conduit (or equivalent shielding) carrying from 2 kVA to 5 kVA: 3 inches.

e. Power lines enclosed in grounded metal conduit (or equivalent shielding) carrying more than 5 kVA: 6 inches.

3.6 INSTALLATION – UNSHIELDED TWISTED-PAIR TERMINATION (Permanent Link Only)

A. Coil cables to house cable coil without exceeding manufacturer's bend radius.
   1. In hollow wall installations where box eliminators are used, store excess wire in wall.
   2. Store no more than 12 inches of UTP and 36 inches of fiber slack.
   3. Loosely coil excess slack and store in ceiling above each drop location, when there is not enough space present in outlet box to store slack cables.

B. Dress and terminate cables in accordance with ANSI/TIA-568-C.0, ANSI/TIA- C.1, BICSI TDMM, and manufacturer's instructions.

C. As a general rule for new construction, recessed outlet boxes will be used for voice, data, and video services. Outlet boxes shall be double gang 4" x 4" x 2-1/8" deep and shall be fitted with a double gang plaster or raised ring. Each outlet box will extend 11/4" conduit and each conduit will have no more than two 90 degree bends between the outlet and the designated TR or cable tray. If more than two 90 degree bends are required, a fully accessible pull box must be installed with locations of pull boxes shown on the as-built drawings. The use of LB, LL, and LR fittings will not be approved. Telecommunications outlets are not be to be "looped" in the same run of conduit.

D. Terminate 4-pair cables on jack and patch panels using T568-B or T568-A wiring scheme.

E. Pair Untwist at Termination: Do not exceed 12 mm (1/2 inch).

F. Bend Radius of Horizontal Cables:
   1. Not less than 4 times OD of UTP cables.
   2. Not less than 4 times OD of FTP cables.

G. Maintain cable jacket to within 25 mm (1 inch) of termination point.

H. Neatly bundle cables and dress to their respective panels or blocks.
   1. Feed each panel or block by individual bundle separated and dressed back to point of cable entrance into rack or frame.

3.7 INSTALLATION – OPTICAL FIBER CABLES

A. Place fiber optic cables to maintain minimum cable bend radius limits specified by manufacturer or 15 times cable diameter, whichever is larger.

B. Use care when handling fiber optic cables.
   1. Carefully monitor pulling tension so as not to exceed limits specified by manufacturer.

C. Do not splice horizontal fiber optic cables.

3.8 FIELD QUALITY CONTROL

A. Cables and Termination Hardware: Test 100 percent for defects in installation and verify cabling system performance under installed conditions in accordance with ANSI/TIA-568-C.0.
   1. Verify all pairs of each installed cable before system acceptance.
   2. Defects in cabling system installation, including but not limited to cables, connectors, patch panels, and connector blocks shall be repaired or replaced to ensure 100 percent useable conductors in all cables installed.

B. Test all cables in accordance with this specification section, ANSI/TIA-568-C.2, and ANSI/TIA-568-C.3 standards, and Leviton Network Solutions instructions
   1. If any of these are in conflict, bring discrepancies to the attention of the Architect for clarification and resolution.

C. Cables, Jacks, Connecting Blocks, and Patch Panels:
   1. Verify all pairs of each installed cable before system acceptance.
   2. Defects in cabling system installation, including but not limited to cables, connectors, patch panels, and connector blocks shall be repaired or replaced to ensure 100 percent useable conductors in all cables installed.

D. Testing Unshielded Twisted-Pair Cables: (**NOTE: Permanent Link Test results are recommended, and required for all UNC Pembroke installation projects** – unless patch cords will remain installed at the work area and cross-connect are also being tested, in which case Channel Test results would be expected and accepted).

   1. Test twisted-pair copper cable links for continuity, pair reversals, shorts, opens, and performance as specified.
      a. Additional testing is required to verify Category performance.
      b. Test horizontal cabling using approved certification tester for Category 6A, Category 6, and Category 5e performance compliance in accordance with ANSI/TIA-568-C.2. (NOTE: Appropriate Fluke, Agilent, Ideal, or JDSU certification testers may be used).
      c. Category 6A shall conform to ANSI/TIA-568-C.2 for augmented Category 6 to 500 MHz.
   2. Follow ANSI/TIA-568-C.2.
   3. Basic Tests Required:
      a. Wire map.
      b. Length (feet).
      c. Insertion loss (dB), formerly attenuation.
      d. NEXT (Near end crosstalk) (dB).
      e. Return loss (dB).
      f. ELFEXT (dB).
      g. Propagation delay (ns).
      h. Delay skew (ns).
      i. PSNEXT (Power sum near-end crosstalk loss) (dB).
      j. PSELFEXT (Power sum equal level far-end crosstalk loss) (dB).
   4. Test Category 6A by auto test to 500 MHz.
      a. Alien Crosstalk (AXT) testing and AXT test results are NOT required by Leviton or Berk-Tek for warranty of a Category 6A system. (**Note**: AXT testing may be required by the customer, in which case these tests WOULD have to be performed).
   5. Test Category 6 by auto test to 250 MHz.
   6. Test Category 5e by auto test to 100 MHz.

7. Provide test results in approved certification testers original software format on CD, with the following minimum information per cable:
   a. Circuit ID.
   b. Information from specified basic tests required.
   c. Test Result: "Pass" or "Fail".
   d. Date and time of test.
   e. Project name.
   f. NVP.
   g. Software version.
8. An occasional asterisk-Pass (*Pass) will be accepted by Leviton at the manufacturer's discretion, but rework of these links should be done in an attempt to achieve clean "Pass" results prior to submission of test results.
9. To receive Manufacturer's Warranty for the project, submit software copy of test results, in original tester software format, to the Owner and to the Manufacturer (Leviton).
10. Submit fully functional version of tester software for use by the Owner in reviewing test results.
11. Report in writing to the Owner immediately, along with copy of test results, failed test results that cannot be remedied through re-termination (as in the case of reversed or split pairs).

E. Optical Fiber:
   1. Testing procedures shall be in accordance with the following:
      a. ANSI/TIA-568-C.3.
      b. ANSI/TIA-526-7, Method B.
      c. Proposed TSB-140 Tier One Fiber Certification, C.
      d. Encircled Flux testing per the TSB-4979 and TIA-526-14-B standard.
   2. Test Equipment: Certification tester (Note: Fluke or Agilent testers may be used).
   3. Testing:
      a. Test optical fibers at both 850 nm and 1300 nm wavelengths for multimode, 1310 nm and 1550 nm wavelengths for singlemode, end-to-end insertion loss, Telecommunications Room (TR) to Telecommunications Outlet (TO), Telecommunications Outlet (TO) to Telecommunications Room (TR).
      b. Maximum insertion loss for horizontal fiber optic cables without consolidation point: 2.0 dB.
      c. Test horizontal fiber runs TR to TO, TO to TR, at wavelength of operation to desktop applications.
   4. Submit software copy of test results, in original tester software format, to the Owner and to the Manufacturer (Leviton).

3.9 LABELING

A. All labeling is to be in accordance with ANSI/TIA-606-B and manufacturer's instructions.

B. Label horizontal cables using machine-printed label at each end of cable at approximately 12 inches from termination point and again at approximately 48 inches from termination point.
   1. Handwritten Labels: **Not acceptable**.

C. Label patch panel ports and TO ports with cable identifier.

D. Labels: Denote TO ID and unique cable number for that TO, i.e. A-001-A for cable number 1, A-001-B for cable number 2, and so forth.

1. UNC Pembroke may provide specific labeling requirements. Coordinate with UNC Pembroke contacts:

   Reese Bell, 910-775-4215
   or
   Bari Snyder, 910-775-4638

E. Note labeling information on as-built drawings.

3.10 PROTECTION

A. Protect installed communications horizontal cabling from damage during construction.

Document Owner	**Bari A. Snyder (Networking Lead)**

END OF SECTION