

SECTION 271000
STRUCTURED CABLING

PART 1 – GENERAL

1.01 RELATED DOCUMENTS:

- A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division-01 Specification sections, apply to work of this section.
- B. Division 26, Basic Materials and Methods sections apply to work specified in this section.

1.02 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.CAAB – Detail Specification for Class IVa Dispersion-Unshifted Single-Mode Optical Fibers with Low Water Peak. Current Edition
- C. ANSI/TIA-568-C.0 – Generic Communications Cabling for Customer Premises.
- D. ANSI/TIA-568-C.1 – Commercial Building Communications Cabling Standard Part 1: General Requirements.
- E. ANSI/TIA-568-C.2 – Balanced Twisted-Pair Telecommunications Cabling and Components Standards
- F. ANSI/TIA-568-C.3 – Optical Fiber Cabling Components Standard
- G. ANSI/TIA-569-C – Commercial Building Standard for Telecommunications Pathways and Spaces.
- H. ANSI/TIA-606-B – Administration Standard for the Commercial Telecommunications Infrastructure.
- I. ANSI/JSTD-607-B – Commercial Building Bonding and Grounding (Earthing) Requirements for Telecommunications.
- J. NFPA 70 – National Electrical Code (NEC).
- K. BICSI – TDMM, Building Industries Consulting Services International, Telecommunications Distribution Methods Manual (TDMM)

1.03 DESCRIPTION OF WORK:

- A. The extent of telephone/data system work is indicated and is hereby defined to include, but not be limited to cable, raceway, outlet boxes, device plates, backboard, cabinets, grounding and miscellaneous items required for complete system.
- B. Provide complete cable and outlet system as indicated and described herein. Work includes cable, jacks, terminal blocks, wire management, labeling, transient voltage surge suppression,

patch cords, and all terminations. Every cable, conductor and fiber strand installed under this Project shall be properly terminated at both ends and tested.

- C. Refer to other Division sections for requirements for raceways, boxes and fittings, wiring devices, and supporting devices, and other sections, as applicable.
- D. Provide system testing as described herein.

1.04 QUALITY ASSURANCE:

- A. Comply with applicable portions of NEC as to type products used and installation of components. Provide products and materials, which have been UL-listed and labeled. Comply with NEMA standards for low loss extended frequency cable and EIA/TIA TSB-36. Comply with EIA/TIA 568-A, EIA/TIA 569 and manufacturer's recommendations. Comply with EIA/TIA testing standards for horizontal cabling.

1.05 SUBMITTALS AND SUBSTITUTIONS:

- A. Submit manufacturer's data and installation details for all devices, plates, cable, terminal blocks, patch cords, TVSS, wire management, labels and similar equipment.
- B. Submit a copy of certification documents.
- C. Any substitution requests must be submitted in writing, and approved by Owner or Owner's Representative in writing prior to acceptance of bid.
- D. Substitution requests may only be made for products equal to or better than as specified in this document. Proof of "equal or better" status is imposed on the contractor, not the Owner.
- E. Where a specific manufacturer is called out by name, this is the preferred standard. If substitutions are allowed, they are at the discretion of the Owner and based on performance, suitability, quality, administrative requirements, warranty and other factors deemed important to the Owner.
- F. For the purposes of this Specification, "or approved equal" is implied for all specified, named products.

1.06 CONTRACTOR QUALIFICATIONS AND TRAINING:

- A. The contractor shall be fully conversant and capable in the cabling of low voltage applications such as, but not limited to data, voice and imaging network systems. The Contractor shall at a minimum possess the following qualifications:
 - 1. Possess those licenses/permits required to perform telecommunications installations in the specified jurisdiction.
 - 2. Provide references of the type of installation detailed in this specification.
 - 3. Personnel trained and certified in fiber optic cabling, splicing, termination and testing techniques. Personnel must have experience using a light meter and OTDR.
 - 4. Personnel trained in the installation of pathways and support for housing horizontal and backbone cabling.
 - 5. Personnel knowledgeable in local, state, province and national codes, and regulations. All work shall comply with the latest revision of the codes or regulations. When conflict exists

between local or national codes or regulations, the most stringent codes or regulations shall be followed.

6. Be in business a minimum of five (5) continuous years with a Contractor's license in the state where the project is located, and appropriate for the type of work expected herein.
7. Member in good standing of the Certified Installer network associated with the products listed in this Specification and authorized for use in this Project. Contractor must be a member of this installer program before, during, and through completion of the system installation. Supporting documentation will be required as part of the submittal.
8. Maintain a certified RCDD on staff and utilize certified BICSI Installers for this project.

1.07 WARRANTY:

- A. A Limited Lifetime Product & Performance Warranty covering all components, equipment and workmanship shall be provided to the Owner, submitted in writing with system documentation. The warranty period shall begin on the system's first use by the owner.
 1. Horizontal channels shall be completed with end to end solutions, such as the Berk-Tek Leviton Technologies Solutions. Factory-terminated copper and/or fiber optic patch cords from the solutions provider must be used in order to be eligible for the applicable channel performance guarantees.
 2. The Contractor must pre-register the project with the Manufacturer before installation has begun. Following project completion, contractor is responsible for completing all warranty registration procedures on behalf of Owner.
 3. Should the cabling system fail to perform its expected operation within this warranty period due to inferior or faulty material and/or workmanship, the contractor shall promptly make all required corrections without cost to the owner.
- B. Certified Installer shall provide labor, materials, and documentation in accordance with Manufacturer requirements necessary to ensure that the Owner will be furnished with the maximum available Manufacturer's Warranty in force at the time of this project.
- C. The installed structured cabling system shall provide a warranty guaranteeing a minimum channel performance above the ANSI/TIA 568-C requirements for all category-rated solutions in this Specification. See Products section for performance criteria. Standards-compliant channel or permanent link performance tests shall be performed in the field with a Manufacturer-approved certification tester in the appropriate channel or permanent link test configuration.
- 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. Installer shall submit test results to Manufacturer 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. Certified Contractor/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.

1.08 BACKBONE SUBSYSTEMS:

- A. 19" racks, cabinets, patch panels, rack mounting kits for switch and hubs, wire management components, and patch cables shall be furnished and installed by Contractor.
- B. Backbone copper and fiber systems form an interconnected infrastructure between MDF, IDF, and zone enclosures, both inside and between buildings. All cable, connectors, panels and support systems shall be installed and tested by contractor.
- C. Typical Fiber backbone will be Singlemode low-water-peak (OS2) fiber optic cable or Laser-Optimized Multimode (OM3) fiber optic cable as noted below and on plan drawings. Singlemode is typically run between buildings and Multimode fiber is run within the building. Singlemode fiber will be terminated on LC connectors using pre-polished connectors or fusion splice pigtails. Multimode fiber may be terminated on LC connectors using pre-polished connectors or fusion splice pigtails, or may be factory pre-terminated onto MTP multi-fiber connectors.
- D. No splicing of cables will be required or allowed between endpoints. Armored cable must be grounded at both ends if run outdoors. With armored fiber, no innerduct will be required. Check plans for clarification or exceptions.

1.09 WORK AREA SUBSYSTEM:

- A. The connection between the information outlet and the station equipment in the work area is provided by the Work Area Subsystem. It consists of cords, outlets, adapters, and other filters/impedance matching devices.

1.010 HORIZONTAL SUBSYSTEM:

- A. The Horizontal Subsystem is the portion of the telecommunications cabling system that extends from the work area telecommunications outlet/connector to the horizontal cross-connect in the telecommunications room/closet. It consists of the telecommunications outlet/connector, the horizontal cables, optional consolidation point, wireless access point cabling, and that portion of the cross-connect in the telecommunications room/closet serving the horizontal cable. Each floor of a building should be served by its own Horizontal Subsystem.

1.011 ADMINISTRATION SUBSYSTEMS:

- A. The Administration Subsystem links the Horizontal Subsystem and the Backbone Subsystem together. It consists of labeling hardware for providing circuit identification and patch cords or cross connect wire used for creating circuit connection at the cross connects.

PART 2 - PRODUCTS

2.01 GENERAL:

- A. Provide complete raceway, outlet boxes and miscellaneous items as required.
- B. Provide minimum 4-11/16" square outlet box at each outlet location with single gang plaster or tile ring and 1.25" conduit to cable tray, backboard, or accessible ceiling or floor space.
- C. Provide a complete data cabling and device system as described herein.

2.02 HORIZONTAL CABLING SYSTEMS:

- D. NETWORK DATA CABLES

1. Provide 4-pair, 100-Ohm balanced unshielded twisted pair (UTP) Cables for each data outlet designated.
2. All UTP cables passing through air handling space shall be PLENUM-rated (CMP). Cables not passing through air handling spaces may be PVC (CMR) jacketed. Some buildings will require the use of Plenum cable. The contractor is solely responsible for verifying the construction requirements and installing the correct cable. Failure to provide CMP cable in Plenum required spaces will result in the contractor removing and replacing the cable at their own expense.
3. CAT6A UTP cable shall conform to the following requirements:
 - a. All cables shall be made in the USA of solid annealed copper conductors, 23 AWG, with four individually twisted pairs in a single round cable sheath.
 - b. Characterized to 750 MHz, 250 MHz greater than the standard
 - c. Outer diameter 0.300" (7.6mm), CMP
 - d. Be made by an ISO 9001 and 14001 Certified Manufacturer.
 - e. Channel margin guarantees for ANSI/TIA 568-C.2 CAT6A and ISO/IEC 11801 Class E_A (margin vs. ANSI/TIA-568-C.2 and margin guarantees are for a standard 2-connector channel).

Insertion Loss	3%
NEXT	2 dB
PSNEXT	3 dB
ACR-F (ELFEXT)	5 dB
PSACR-F (PSELFEXT)	6 dB
Return Loss	1 dB
ACR-N	4 dB
PSACR-N	5 dB

Approved Products:

Berk-Tek:

Category 6A LANmark XTP, CMP #11082057 (1000' reel)

Category 6A LANmark XTP, CMR #11082062 (1000' reel)

Category 6 Premium LM2000, CMP # 10163222 (1000' reel)

Category 6 Premium LM2000, CMR # 10167476 (1000' reel)

* Color as noted on drawings/district standard (verify prior to submittal)

E. DATA INFORMATION OUTLETS:

1. COPPER PATCH PANELS

- a. Integrated 110-style patch panels shall exceed requirements for Category 6A described in ANSI/TIA-568-C.2 and Class E_A and Class E component requirements (respectively) as described in ISO/IEC 11801 in a typical standard-density (48 ports per 2RU) configuration.
- b. Integrated 110-style patch panels shall be available in flat or angled styles, 24 ports per RU in an un-staggered horizontal layout.
- c. Modular (unloaded) patch panels shall accept the same Universal jacks as are used at the workstation area outlets. No special "panel jacks" shall be required.
- d. Modular patch panels shall be available in flat, angled, Recessed and recessed angled varieties, in 1RU 24 and 48-port versions or 2RU 48 and 72-port configurations.
- e. Patch panels shall be sized to fit an EIA standard, 19 inch relay rack, and made of 16-gauge steel and powder-coated black with white silkscreened lettering.

Approved Product examples:

Leviton CAT6A 110-style Flat 1RU 24-port Patch Panel, # 6A586-U24
Leviton CAT6A 110-style Angled 2RU 48-port Patch Panel, # 6A9587-U48
Leviton QuickPort® 1RU Flat 48-port Patch Panel, # 49255-Q48

2. CAT6A JACKS: Provide modular type Category 6A information outlets for 23-AWG copper cable. These Category 6A (CAT6A) connectors shall be individual snap-in style, and exceed compliance with TIA/EIA-568-C.2 specifications. The connectors shall comply with the following:
- a. Be 8-position/ 8 conductor (8P8C, RJ45-style) modular jacks.
 - b. Utilize a universal Keystone-style insertion footprint as the manufacturer's main "flagship" line of products.
 - c. Comply with FCC Part 68; UL listed and CSA Certified. Verified to exceed all channel performance requirements in TIA-568-B.2-10 from 1 MHz to 500MHz to support the IEEE 802.3an standard for 10 Gigabit Ethernet over UTP Cable.
 - d. Each 10G connector is to feature an injection molded Cone of Silence™ technology to eliminate alien crosstalk (AXT).
 - e. Every 10G connector to include polymer springs above the tines ("Retention Force Technology" or similar functionality) to promote return of tines to original position and protect against deformation due to stress of patch cords or inappropriate materials insertion
 - f. Connector shall have Pair Separation Towers on IDC to facilitate quick, easy terminations without a complete untwist of each pair of conductors.
 - g. The connector shall be rear 110-type insulation displacement connectors (IDC) with solder-plated phosphor bronze contacts, configured in a 180° orientation such that the punch down field is in the back, allowing for rear termination.
 - h. The connector shall provide a ledge directly adjacent to the 110-style termination against which the wires can be directly terminated and cut in one action by the installation craftsman.
 - i. Connector wiring label shall provide installation color codes for both T568A and T568B wiring schemes on separate labels.

Approved Products:

Leviton Atlas-X1 CAT6A QuickPort Module # 61UJK--R*6

Where * = one of 13 colors. See drawings or check with Owner for application.

3. FACEPLATES: Faceplates provide information outlets to the work area. Contractor shall provide and install single gang faceplate kits to allow up to six data or voice jacks as required for all work area outlets, workstation base feeds, and unused telecom backboxes and furniture openings. Faceplates shall:
- a. Utilize a Quickport ("keystone"-style) footprint to match the approved connectivity manufacturer, and be made by the same manufacturer as the connectors.
 - b. Match colors and materials of the power wiring device plates.
 - c. Support any connectivity media type, including fiber and copper applications.
 - d. Have write-on designation labels for circuit identification together with a clear plastic cover.
 - e. Be available in single-gang and double-gang configurations.
 - f. Have surface-mount boxes and standoff rings available for both single and double gang faceplates.
 - g. Have single-port matching color blank inserts available in packs of 10.
 - h. Shall be stainless steel when installed above accessible ceiling.

Approved Products:

Leviton QuickPort Single-Gang, Plain, # 41080-#xP

Leviton QuickPort Single-Gang with ID Windows, # 42080-#xS

Leviton QuickPort Blank Inserts, pack of 10, # 41084-BxB

Leviton QuickPort Stainless Steel wallphone plate, # 4108W-0SP

Where:

= number of ports: 1, 2, 3, 4, 6

x = color: White (W), Ivory (I), Light Almond (T), Gray (G), Black (E)

Check drawings for requirements

2.03 BACKBONE CABLING SYSTEMS

F. BACKBONE CABLES:

1. GENERAL

- a. The cable route within a building, connecting closet to closet or closet to the equipment room is the Intrabuilding Backbone Subsystem. It links the Main Distribution Frame (MDF) in the equipment room to Intermediate Distribution Frame (IDF) and Horizontal Cross-connects (HC) in the Telecommunications Room/Closets (TC). It consists of the backbone transmission media between these locations and the associated connecting hardware terminating this media. These fiber optic cables are typically Multimode.
- b. Cables run from building to building in a campus, or from campus to campus are part of the Interbuilding Backbone System. It consists of the backbone transmission media between these locations and the associated connecting hardware terminating these media. These fiber optic cables are typically Singlemode.
- c. Cables allowed for use in the backbone shall support voice, data, video, wireless and building infrastructure applications. The bending radius and pulling strength requirements of all backbone cables shall be observed during handling and installation. All cables shall conform to ANSI/TIA/EIA-568-C Commercial Building Telecommunications Cabling Standard. These cables include:
 - 1) 4-pair 100-ohm unshielded twisted-pair 100% annealed-copper solid-conductor cables, 100-ohm UTP multi-pair copper cables
 - 2) 50/125 μ m (micron) Laser-Optimized Multi-Mode Fiber (LOMMF) cables (OM3 or better)
 - 3) 8.3 μ m low-water peak singlemode optical fiber cables compliant with ITU-T G.652D (OS2).

2. VOICE COPPER BACKBONE CABLE

- a. Power-Sum Multi-Pair Category 3 cable, 24 AWG solid-copper conductors in 25-pair binder groups to support 10BASE-T, 100BASE-T and Analog Voice communications at 16Mhz.

Approved Products:

Berk-Tek # 10032111, 25-pr CMP, Gray.

Berk-Tek # 10032396, 25-pr CMR, Gray

Other multiples of 25 acceptable (50, 100, 200, 300 pair as required)

3. SINGLEMODE FIBER OPTIC CABLE

- a. Singlemode fiber optical fiber cables shall meet all of the requirements delineated within the specifications of ANSI/TIA/EIA-568-A. Must be a minimum of 12 strands of nominal 8.3 micron optical fiber, and must be appropriate for the environment in which it is installed (Indoor, Indoor/Outdoor, Outside Plant, OFNP or OFNR).
- b. Fiber optic cables will utilize an interlocking armor outer cover around an integrated Loose-Tube (indoor/outdoor) cable construction.
- c. Loose tube fibers shall utilize a fan-out kit to fit 250 micron fibers into a 900 micron protective sheath when terminating.

- d. See plans and scope of work for total strand count between locations.

Approved Manufacturers

Berk-Tek Adventum Indoor/Outdoor Dry Loose-Tube Plenum cable,
12-strand SM, armored, # LTPK12AB0403
Berk-Tek Adventum Indoor/Outdoor Dry Loose-Tube Plenum cable,
24-strand SM, armored, # LTPK12B024AB0403
Berk-Tek Adventum Indoor/Outdoor Dry Loose-Tube OFNR cable,
12-strand SM, armored, # LTRK12AB0403
Berk-Tek Adventum Indoor/Outdoor Dry Loose-Tube OFNR cable,
24-strand SM, armored, # LTRK12B024AB0403
Leviton 12-fiber, 24" fan-out Kit, # 49887-12S

G. COPPER TERMINATION BLOCKS

1. Provide termination blocks for Category 3 Backbone Cabling Systems that support up to Category 5e applications and facilitate cross-connection using twisted pair wiring.
2. The connecting hardware block shall support the appropriate Category 3 to 5e voice (non-VOIP) applications and facilitate cross-connection and/or inter-connection using cross-connect wire. The cross-connect hardware shall be of 66-type (telephone) AND:
3. The cross-connect shall be Category 5e 110-style wiring bases, mountable to wall or backboard to provide 110 termination capable of supporting voice, security, and Category 5e data applications, including high megabit and shared-sheath applications when used with Category 5e rated cabling.
4. The components shall be UL listed and ANSI/TIA-568-C compliant. Bases shall support 50, 100 or 300 pair densities with provision for ANSI/TIA-606-B compliant labeling. Plastic bases and blocks shall be made of fire-retardant plastic rated UL 94V-0.
5. Cross-connect blocks shall be available in a variety of insulation displacement clips (IDC) with and without tails, and support wire sizes: Solid: Wire Ranges 22-26 AWG (0.64mm - 0.40mm).

Approved Products:

Leviton 110 Connecting Block, 100-pair w/legs # 41AW2-100
Leviton Wire Manager w/legs, # 41A10-HCM

H. FIBER OPTIC ENCLOSURES, PANELS AND TRAYS

1. All Fiber interconnect centers, panels, enclosures and trays (units) shall provide cross-connect, inter-connect, and splicing capabilities and contain cable management for supporting and routing the fiber cables/jumpers.
2. Rack-Mounted, High Density Fiber Interconnect Center: The high density, rack mounted fiber interconnect center shall:
 - a. Fiber enclosure shall be available in 1, 2 and 4RU versions to accommodate termination and splicing of fiber. Enclosure depth shall be 17".
 - b. Enclosure shall feature a sliding tray which removes completely, front or rear, from enclosure to facilitate field terminations and splicing.
 - c. Rack-mount enclosure shall have removable transparent hinged doors and slide away covers allow easy access during install and visibility of interior after install.
 - d. Fiber Adapter Plates (bulkheads) shall accept SC and LC connectors, MTP® adapters, and plug-n-play MTP modules/cassettes.

- e. Fiber cable management for routing, storage, and protection shall accept patch cords, tight-buffer fiber, and backbone cables. Rear fiber cable management rings shall be stackable and configurable in ¼, ½, or full ring arrangements. Enclosure shall be constructed of 16-gauge steel with a powder-coated black finish and be mountable in a 19" rack or cabinet frame. An optional locking door feature shall be available.
- f. Enclosure shall be available either empty or in custom pre-loaded configurations, with or without locking doors.

Approved Products:

Leviton Opt-X Ultra Rack-Mount 1RU Enclosure, # 5R1UH-S03
Leviton Opt-X Ultra Rack-Mount 2RU Enclosure, # 5R2UH-S06
Leviton Opt-X Ultra Rack-Mount 4RU Enclosure, # 5R4UH-S12
Leviton lock and key # 5L000-KAL
Leviton armored cable ground kit, # DPGRD-KIT

3. FIBER OPTIC WALL-MOUNT ENCLOSURES

- a. The enclosure shall mount on a wall in an 8"x13", 12"x14" or 17"x15" footprint.
- b. Adapters shall be mounted in metal mounting plates and attached to the enclosure using plastic plungers.
- c. There shall be cable entrance ports in the top and bottom of the patch panel on both the distribution and patch sides.
- d. Cable entrance ports are designed with a strain relief post with a slot capable of holding a tie wrap.
- e. The enclosure shall provide strain relief in the form of a grounding lug and multiple tie wrap points.
- f. The enclosure shall have a plastic fiber management ring made of high impact UL 94V-0 rated fire-retardant plastic. This ring shall be stackable and adjustable. A port identification label/card shall be provided.
- g. The enclosure shall be made of 16-gauge steel powder coated black.

Approved Manufacturers

Leviton Wall Mount Fiber Enclosure, 2-panel, split-metal door w/key, # 5W120-00N, or larger size as appropriate.

I. FIBER TERMINATION PRODUCTS

1. FIBER ADAPTER PLATES

- a. Fiber Adapter Plates shall be used to present field-terminated or pre-terminated discrete, single-strand connectors (e.g. LC) to a fiber enclosure panel.
- b. The fiber adapter plate shall be modular and functional for use in either a wall-mount or rack-mount enclosure. The adapter plate shall be provided in LC styles, in 12- or 24-fiber configurations. 12-fiber adapter plates are used to terminate 12-fiber cables, and 24-fiber adapter plates are used to terminate 24-fiber (or greater) cables. Avoid deployment of adapter plates with unused ports at the rear.
- c. The adapter plate shall be compliant to TIA-568-C.3 (for performance) and respective TIA-604-X (for intermateability) standards. Adapter plates shall use zirconia ceramic sleeves and be offered in standard fiber type colors pursuant to TIA-568-C.3 standards.
- d. LC adapter plates shall be precision-molded in the USA and integrated to eliminate "rattle" and loose fit. All ferrules shall be zirconia-ceramic. Adapter plates shall be

offered in standard fiber type colors. Singlemode colors are typically BLUE, Multimode are typically AQUA.

Approved Products:

Leviton Opt-X Fiber Adapter Plate, 12 LC SM Blue, #5F100-2LL
Leviton Opt-X Fiber Adapter Plate, 24 LC SM Blue, #5F100-4LL
Leviton Opt-X Fiber Adapter Plate, 12 LC MM Aqua, #5F100-2QL
Leviton Opt-X Fiber Adapter Plate, 24 LC MM Aqua, #5F100-4QL

2. FIBER CONNECTORS

- a. The fiber optic connector shall meet or exceed the requirements described in ANSI/TIA-568-C.3 and ANSI/TIA-604-3 (LC) Connector Interchangeability Standards
- b. Connector shall be pre polished and field installable to eliminate the need for hand polishing, bonding, or epoxy in the field.
- c. Connector shall be provided in LC, single-mode or multimode (laser optimized) configurations, terminated on 250 or 900 μ m buffered fiber and/or 2mm or 3 mm jacketed fiber.
- d. Maximum connector insertion loss shall be no greater than 0.5 dB, with an average of 0.1 dB (MM) or 0.2dB (SM). Typical connector return loss shall be 35 dB (multimode) and 56 dB (single mode). All versions shall allow continuity to be verified by use of a visual fault locator (VFL).
- e. Connector shall utilize a precision zirconia ceramic ferrule, and be re-terminable up to 3 times during testing without loss of performance.
- f. Connector shall require the use of a cleaver with a guaranteed maximum cleaving angle of 2 degrees for multimode and 1 degree for singlemode fibers.

Approved Products:

Leviton FastCAM LC Singlemode, # 49991-SLC
Leviton FastCAM LC Multimode, # 49991-LLC
Leviton / Lynx cleaver # 49886-LNX or equal

3. MTP® MODULES FOR PRE-TERMINATED CABLES

- a. 24-strand Multi-Mode Fiber optic MTP-MTP configured trunks which terminate in LC connectors will land on a 24-strand (12 LC Duplex Port) MTP-LC Cassette module and will utilize a 24-strand MTP connector at each end of the trunk. 12-strand Multi-Mode Fiber optic MTP-MTP configured trunks which terminate in LC connectors will land on a 12-strand (6 LC Duplex Port) MTP-LC Cassette module using 12-strand MTP connectors.
- b. 24-strand Multi-Mode Fiber optic MTP-MTP configured trunks which terminate in MTP 40G connectors will land on an MTP - MTP Cassette module with (3) 8-strand MTP connectors on the front. Trunks utilizing 2 or more 24-strand MTP connectors may land on a MTP module displaying (2) 24-strand MTP connectors in the rear, and (6) 8-strand (40G) MTP connectors in the front. Multiple modules may be required if trunk cables are configured with greater strand counts or connectors.
- c. The MTP modules shall meet the following requirements:
 - 1) Insertable directly into fiber enclosure panel openings with a push-pin/grommet latch.
 - 2) Rated for Laser Optimized Multi-mode OM3 optical fiber.
 - 3) Shall utilize a Red male MTP connection at the rear to designate the 24-strand MTP.
 - 4) Shall utilize Method B Polarity.
 - 5) Shall require one Core module at one end of a fiber trunk segment, and one Edge module at the second end to maintain correct polarity across the system.

- 6) Core modules will be used at the MDF and Edge modules at the IDF ends of the cable for consistency of design.
- 7) 40G MTP connector housings at front of module shall be Black.

Approved Products:

Leviton Method B polarity, 24-fiber MTP to LC, OM3, Core module
FM-E024CDC0BC
Leviton Method B polarity, 24-fiber MTP to LC, OM3, Edge module
FM-E024CDC0BE
Leviton Method B polarity, 24-fiber MTP to 3x8-fiber MTP, OM3 module
FM-E024NDC0E
Leviton Method B polarity, 2x24-fiber MTP to 6x8-fiber MTP, OM3 module
FM-F048NDC0B

4. SPLICE TRAYS AND CASSETTES

- a. Fiber splice trays shall mount to rear of enclosure for terminating bulk fiber optic cable to factory terminated fiber optic pigtails.
 - 1) Splice trays shall be offered in mini and high density versions with removable clear covers for viewing and inspection of fibers.
 - 2) Incoming fiber shall be secured utilizing a ratchet action foam rubber padding clamp feature or tie-down points to minimize crushing of fiber.
 - 3) The trays shall accommodate slack management of both single-mode and multimode 250 or 900µm fiber and protection of (up to) 12 or 24 fiber heat shrink style fusion splices.
 - 4) Heat shrink splice sleeves shall be included. Splice tray shall be made by the fiber enclosure manufacturer.
- b. Fiber pigtail fusion splice modules shall mount to front of fiber enclosure for terminating bulk fiber optic cable to factory terminated fiber optic pigtails, and shall be front-removable.
 - 1) Splice Modules shall be offered in 12- or 24-fiber LC for OS2 (Singlemode) and OM3 (Multimode) fiber types. Construction of module shall be of 14-gauge aluminum for robustness and light weight.
 - 2) Splice Modules shall be pre-loaded and routed with respective 3-meter, color-coded, 12-strand pigtail assembly.
 - 3) Individual pigtails shall have maximum insertion loss of 0.4 dB and 0.35 dB for OM3 and OS2 fiber types, respectively. Return Loss shall be greater than 25 dB (for OM3), 55 dB (for OS2/UPC), and 60 dB (for OS2/APC).
 - 4) Individual compartments in splice module shall provide slack storage and bend radius protection for incoming backbone fibers, 900 µm tight-buffer fibers, and fusion-spliced fibers. Incoming 250 µm backbone fibers shall be protected by an included braided mesh sleeve. Heat shrink style splice sleeves and tie wraps shall also be included with module.

Approved Products:

Leviton Mini Splice Tray, 12-strand # T5PLS-12F
Leviton High-Density Mini Splice Tray, 24-strand # T5PLS-24F
Leviton LC 12-Fiber pigtail kit, OS2, #UPPLC-KIT
Leviton LC 12-Fiber pigtail kit, OM3, #5LPLC-KIT
Or
Leviton Opt-X 12-Fiber LC OS2 Splice Module # SPLCS-12L
Leviton Opt-X 24-Fiber LC OS2 Splice Module # SPLCS-24L
Leviton Opt-X 12-Fiber LC OM3 Splice Module # SPLCS-12A
Leviton Opt-X 24-Fiber LC OM3 Splice Module # SPLCS-24A

J. COPPER AND FIBER OPTIC PATCH CORDS

1. CAT6A PATCH CORDS

- a. Provide factory terminated and tested patch cords from the manufacturer of the structured cabling components. Patch cords must meet or exceed all criteria specified in the horizontal cabling standard subsection above.
- b. Copper patch cords shall exhibit the following characteristics:
 - 1) Slimline, integrated snag-less plug design without incorporating the use of a rubber molded boot.
 - 2) A narrow profile for less congestion in higher density applications and a strain relief boot ensures long-term network performance
 - 3) Copper Category 6A patch cords shall be Component-rated per TIA 568-C.2-10 for CAT 6 and CAT6A component performance and Independently tested and verified by Intertek (ETL).
 - 4) Outside diameter of 0.225" (CAT6) or 0.240" (CAT6A).
 - 5) 26 AWG stranded conductors for maximum flexibility
 - 6) CAT6A cord complies with TIA 568-C.2-10 component requirements for connecting hardware from 1 MHz to 500 MHz, ISO 11801 Class EA, IEEE 802.3an to support 10GBASE-T networks and cULus listed.
 - 7) Available Lengths: 3', 5', 7', 10', 15', or 20'
- c. Provide factory assembled patch cords meeting or exceeding all criteria specified in the horizontal cabling standard subsection above, in the following quantities:
 - 1) (1) 10' CAT 6A patch cable per outlet location/faceplate (drop) for use at the workstation.
 - 2) (1) 5' (average) CAT 6A patch cable per outlet location/faceplate (drop) for use at the network switch in the MDF and IDF.
 - 3) (1) 3' CAT 6A patch cable per outlet location/faceplate (drop) for use at wireless access points.

Approved Products:

Leviton Slimline CAT6A Component-rated Patch Cord, #6AS10-xx*
Leviton Slimline CAT6 Patch Cord, # 6D460-xx*

Where:

xx = Length in Feet

* = color: White (W), Yellow (Y), Red (R), Blue (L), Green (G), Grey (S), Black (E)

2. FIBER JUMPERS AND ARRAY CORDS

- a. Fiber optic LC-LC patch cords, or jumpers, will make LC connections from the rack termination points to the equipment. The jumpers will meet the following requirements:
 - 1) Factory-manufactured using 50/125 μ m Laser Optimized Multi-Mode OM3 optical fiber. Field terminations on fiber jumpers are not acceptable.
 - 2) Shall utilize A-B polarity.
 - 3) Shall exhibit <0.3 dB insertion loss and -25 dB return loss.
 - 4) Shall be thin, round, 2-strand 2mm fiber cable with duplex "Uni-boot" reversing polarity LC connector at both ends to minimize congestion at rack and in cable managers.
 - 5) Shall be available in standard lengths of 1, 2, 3, 5 and 10 meters and custom-orderable up to any length of feet or meters
- b. Fiber-Optic MTP-MTP "array cords" shall utilize 8-strand MTP (female) to 8-strand MTP (male) connectors in a 3mm breakout jacket. The array cords will meet the following requirements:

- 1) Array cords shall meet an optical insertion loss not to exceed 0.35 dB per mated connector pair.
 - 2) Array cords shall be available in 1-, 2-, 3-, 5-, and 10-meter lengths.
 - 3) Array cords shall be compliant with TIA-568-C.3 and IEEE 802.3ba and available in UL Riser or Plenum rated cables (Riser is acceptable for in-rack patching)
 - 4) Meets TIA-568-C.3 and IEEE 802.3ba standards (40/100GbE), and adheres to TIA-942 data center design guidelines.
 - 5) Boot color for 8-strand MTP array cords shall be Dark Gray.
 - 6) MTP shall be pinned on one end, unpinned on the other, and utilize Method B polarity.
- c. Provide factory assembled patch cords meeting or exceeding all criteria specified in the horizontal cabling standard subsection above, in the following quantities:
- 1) (2) 2m LC duplex fiber jumper for each backbone cable terminated in IDF and MDF
 - 2) (2) 2m MTP-MTP 8-strand fiber array cord for each backbone cable terminated in MTP ports at IDF or MDF
 - 3) Verify quantities and configuration with owner prior to delivery.

Approved Products:

Leviton LC-LC OM3 Reversing Uniboot duplex jumper, #FPC-M3RR1VVxxxMAB
Leviton LC-LC SM Reversing Uniboot duplex jumper, #FPC-S2RR1VVxxxMAB
Leviton 8-Fiber MTP(f)-MTP(m) Method B OM3 array cord, #5L8MN-BxxM

Where:

xxx or xx = Length in Meters, for example, 010 or 03 as required

K. WIRE MANAGEMENT

1. Provide wiring spindles and channels as necessary to allow neat bundling of all wire and cable on backboard. Provide wiring channel (horizontal) above and/or below each termination block or patch panel, or on the side (vertical) as appropriate. Provide wiring channels by same manufacturer of termination blocks or patch panels. Provide nylon or Velcro type ties for all cables at telephone backboard not run in conduit or channels.
2. Provide 1RU ring-style horizontal wire managers between every 2 patch panels as space allows. Provide 2RU horizontal wire manager between the Orange and Blue sets of patch panels if in the same rack, and above and below each similarly-apportioned bank of patch panels.
 - a. Cable managers shall be flat, open ring style.
 - b. Do not coil or wind patch cords inside ring-style wire managers.
 - c. Use recessed flat wire manager as needed within enclosed cabinets to route patch cords to opposite sides, where the rings of the flat wire managers would interfere with cabinet door closure.

Approved Products:

Leviton Horizontal manager, 1RU, # 49253-LPM
Leviton Horizontal manager, 2RU, # 49253-BCM
Leviton Recessed Flat Horizontal manager, 1RU, # 49253-RCM

3. Provide full height, front-and-rear, 8" wide Vertical Wire Managers at the side of and between each 2-post and/or 4-post termination rack or frame. If space will not allow, the 5" wide wire manager may be substituted at row ends only, leaving the 8" vertical wire manager between each rack. Owner approval in writing is required prior to this substitution.

- a. The vertical cable management system shall be cULus listed, PCI rated for 94V-O, ABS rated for UL94HB, and compliant with ANSI/TIA/EIA 568-B standards.
- b. Mounting hardware shall be included to insure the proper installation to infrastructure. It shall mount onto a standard TIA/EIA recognized equipment rack.
- c. The management system shall offer an assortment of accessories, including a bend radius slack loop organizer, cable retainers, and shall accommodate top, bottom, side and pass-through cable routing. Dual hinged, cable concealing covers shall be included.

Approved Products:

Leviton Vertical 80"L x 8"W x 8"D channel, black cover, #8980L-VFR

4. For enclosed cabinets, provide horizontal wire management as specified above and vertical or integrated vertical wire management as described below, pertinent to the cabinet manufacturer.

L. Power Distribution Units (PDU)

1. Provide (2) vertical PDU per rack or wall cabinet. Unswitched, non-surge suppressed. 30" length for wall cabinets and 48" for floor-mounted cabinets.
2. Utilize plug and receptacle style appropriate for installation circuits and equipment interfaces.

Approved Products

Leviton P1000 series # P1042-10L

Leviton P1000 series # P1044-10L

M. Equipment and Ladder Rack System:

- A. UL listed Chatsworth 19"W x 84"H x 15" D 45 RMU Aluminum 2 post rack P.N. 55053-703
- B. Ladder rack to wall support, Chatsworth Wall Angle Support Kit P.N. 11421-712
- C. Rack to runway support Chatsworth mounting plate P.N. 10595-712
- D. Ladder rack support system, Chatsworth Universal Cable Runway P.N. 10250-712
- E. Straight through ladder rack splice, Chatsworth Butt-Splice Kit P.N. 11301-701
- F. Ladder rack junction splice, Chatsworth Junction Splice Kit P.N. 11302-702
- G. Ladder rack protective end caps, Chatsworth Protective Rubber End Caps P.N.10642-001
- H. Wall support for cable runway Chatsworth Triangular Support Bracket P.N. 11312-712
- I. Provide two single sided equipment shelves or each rack installed, Chatsworth P.N. 40074-700.
- J. Equipment rack bonding material Chatsworth Green Ground Jumper P.N. 40159-009 and Chatsworth Green Cable Runway Ground Strap Kit P.N. 40164-001

N. LABELING:

- A. The contractor shall provide tags, straps, and adhesive labels. These tags, straps, and adhesive labels shall be of high quality that will endure heat, water, and time.

- B. Shall meet the legibility, defacement, exposure, and adhesion requirements of UL 969.
- C. Shall be pre-printed using a mechanical means of printing.
- D. Where used for cable marking, provide vinyl substrate with a white printing area and a clear "tail" that self laminates the printed area when wrapped around the cable. The cable marking shall be immediately visible and within two inches from termination point.
- E. Where insert type labels are used, provide clear plastic cover over label.
- F. Copper patch panel labeling shall be completed with adhesive labeling kit specifically designed for the panel, Leviton 49257-QHD.
- G. Labeling P-touch font size 4MM bold, black on White, 3/8" labeling tape on all work stations, panels and devices.
- H. A round Avery label green in color Product Number: 5463 and a station label utilizing the same font size as on work station face plate must be installed on ceiling grid below each wireless cable location for identification. See type "D" Wireless Location Detail.
- I. Labels shall be numbered consecutively and separate for each type of use. Refer to Work Station Details for additional information.
- J. The contractor shall develop and submit for approval a labeling scheme for the cable installation. The Owner will negotiate an appropriate labeling scheme with the successful contractor. At a minimum, the labeling system shall clearly identify all components of the system: 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. All labeling information shall be recorded on the as-built drawings and all test documents shall reflect the appropriate labeling scheme. Labeling shall conform to the owner's Labeling Grammar and the TIA/EIA-606A standard.
- K. CAT6 Labeling:
 - 1. IDF side labeling should follow RM.(Room number).(X port number) example RM01.1
 - 2. Station side cabling should follow IDF(Letter).RM.(Room number).(X port number) example IDF-A.RM01.1
 - 3. IDF side WAP/Bell Locations shall be labeled RM(Room number).(W for wireless/B for bell) example RM01.W
 - 4. Station side WAP/Bell Locations shall be labeled IDF.(Letter).RM(Room number). (W for wireless / B for Bell) example IDF-A.RM01.W

PART 3 - EXECUTION

3.01 INSTALLATION OF TELEPHONE/DATA SYSTEM:

- A. Install raceway and cable system and specified equipment as indicated to comply with NEC and recognized industry practices.
- B. PRE-INSTALLATION CONFERENCE:
 - 1. Schedule a conference a minimum of five calendar days prior to beginning work of this section.
 - 2. Agenda: Clarify questions related to work to be performed, scheduling, coordination, etc.

3. Attendance: Communications system installer, General Contractor, Owners Representatives and any additional parties affected by work of this section.
4. Copy of Manufacturer warranty pre-application, RCDD qualifications, and other material not include in submittals will be provided by Contractor at this time.

C. WARRANTY:

1. A lifetime performance warranty covering all components, equipment and workmanship shall be submitted in writing with system documentation. The warranty period shall begin on the systems first use by the Owner.
2. The project must be pre-registered with Manufacturer before installation has begun.
3. Should the cabling system fail to perform within its expected operation within this warranty period due to inferior or faulty material and/or workmanship, the Contractor shall promptly make all required corrections without cost to Owner.

D. PATHWAYS AND TOPOLOGY:

1. Prior to placing any cable pathways or cable, the contractor shall survey the site to determine job conditions will not impose any obstructions that would interfere with the safe and satisfactory placement of the cables. The arrangements to remove any obstructions with the Project Manager need to be determined at that time.
2. Provide NEC-sized pullboxes for any run greater than 100 feet, or with more than two ninety-degree bends.
3. Maintain a distance of at least 12 inches from all power conduits and cables, and 6 inches from all fluorescent lighting fixtures. Do not install power feeders 100 amps or greater above or within 5 feet of telecommunications backboard. Do not install telecommunications conduits above power panels or switchboards.
4. The backbone subsystem shall include cable installed in a vertical manner between floor telecommunications room/closets (TCs or IDFs) and the main or intermediate cross-connect in a multi-story building and cable installed horizontally between telecommunications room/closets and the main or intermediate cross-connect in a long single story building.
5. Unless otherwise recommended by the Owner, all fiber cables will be encased in interlocking armor. All fibers will be terminated in the Telecom Rooms or Cabinets in new fiber enclosures equipped with sufficient ports, slack storage space and splice trays if required to terminate and secure all fibers.
6. Adequate riser sleeve/slot space shall be available with the ability to ingress the area at a later date in all Telecommunications rooms/closets, such that no drilling of additional sleeves/slots is necessary.
7. The backbone cables shall be installed in a star topology, emanating from the main cross-connect to each telecommunications room/closet. An intermediate cross-connect may be present between the main cross-connect and the horizontal cross-connect. This is known as a hierarchical star topology.

8. Backbone pathways shall be installed or selected such that the minimum bend radius of backbone cables is kept within manufacturer specifications both during and after installation.
9. Do not run fiber cables in conduits which are less than 2" in diameter.
10. All horizontal cables, regardless of media type, shall not exceed 90 m (295 ft) from the telecommunications outlets in the work area to the horizontal cross connect.
11. The combined length of jumpers, or patch cords and equipment cables in the telecommunications room/closet and the work area shall not exceed 10m (33 ft).
12. Horizontal pathways shall be installed or selected such that the minimum bend radius of horizontal cables is kept within manufacturer specifications both during and after installation.
13. For voice or data applications, 4-pair UTP or fiber optic cables shall be run using a star topology from the telecommunications room/closet serving that floor to every individual information outlet.
14. The Contractor shall observe the bending radius and pulling strength requirements of the 4-pair UTP and fiber optic cable during handling and installation.
15. Each run of UTP cable between horizontal portions of the cross-connect in the telecommunication closet and the information outlet shall not contain splices.
16. In a false ceiling environment, a minimum of 3 inches (75 mm) shall be observed between the cable supports and the false ceiling.
17. All horizontal pathways shall be designed, installed and grounded to meet applicable local and national building and electrical codes.
18. J-hooks shall be provided for all suspended cable, at a semi-irregular spacing not to exceed 5 feet between supports.
19. Install $\frac{3}{4}$ " x 4' x 8' fire-rated plywood across all walls in telecom rooms, from 6" AFF to 8'-6" AFF. Coat with 2 coats of white paint. Do not paint over fire rating stamp.
20. Contractor shall firestop all used pathways which enter or leave the telecom rooms via conduit, cable tray or slot. Contractor is responsible for installing sleeves at each wall or partition penetration, and firestopping all fire-rated penetrations. Intumescent caulk shall be applied around the outside of each sleeve, and intumescent putty inside the sleeve or conduits around the cables. Appropriate fill ratios must be followed when penetrating fire rated walls.

E. GROUNDING:

1. All grounding / earthing and bonding shall be done to applicable codes, standards and regulations.
2. Telecom Contractor shall bond and ground all telecom room metals. Telecom Contractor shall provide and install TIA-rated Telecommunications Grounding Busbar (TGB) at all MDF and IDF locations, and an in-cabinet grounding busbar at each remote wall-mounted cabinet or telecom enclosure. All ground lugs shall be 2-hole make-up.
3. Electrician will provide connection between TGB and building ground; Telecom contractor (if separate, otherwise electrician) will provide a busbar and ground all equipment and telecom metals to the busbar.

4. Telecom installer will ground and bond all armored and/or shielded cables, racks, cabinets, cable tray, ladder racking, and shielded panels to telecom grounding busbar.
5. All grounding and bonding conductors shall be copper and may be insulated. When conductors are insulated, the sheath shall be green or marked with a distinctive green color, and shall be listed for the application. The minimum bonding conductor size shall be #6 AWG.
6. The Telecommunications Ground Busbar (TGB) shall be dedicated and pre-drilled copper busbar provided with holes for use with standard sized lugs. This busbar shall have minimum dimensions of .25 inch thick, 4 inches wide, and be variable in length.
7. Two-hole compression ground lugs shall be Chatsworth 40162-901, 40162-904, 40162-909, and 40162-911, or equal, based on the size of the copper conductor to be terminated.
8. All low voltage systems in this project shall be grounded and bonded.

F. CABLES AND TERMINATIONS:

1. Check plans and symbology for final determination of faceplate constitution or consult with Owner prior to bid.
2. Install additional cables as indicated on the drawings. Do not exceed manufacturers' recommendations for maximum allowable pulling tension, side wall pressure or minimum bending radius. Use pulling compound as recommended by cabling manufacturer.
3. Install CAT6A cables for Wireless Access Points and cameras, and CAT6 everywhere else unless otherwise noted.
4. Provide a full-size service loop (at least once around the inside edge of the box) in each J-box in the communications system.
5. Install all cable in plenum spaces with J-hooks of at least 1" in width to disperse the weight on the bottom cables. Homerun all cable to nearest TR Cabinet.
6. Coordinate with EIA/TIA 569 tables 4.4-1 and 4.4-2 for conduit and splice box sizing.
7. Install modular jacks at all outlets shown; one data jack for each data cable at each faceplate or termination point. Install additional cables and modular jacks as indicated on the drawings.
8. Terminate cables at each jack location and at termination board or patch panel. Follow industry guidelines and manufacturers' recommendations and procedures as required. All termination hardware shall be rated to exceed Category 6 specifications as specified above.
9. Label and identify each outlet and cable for data circuits. Label at outlet end and at termination board or patch panel with matching designations.
10. Provide data outlets in surface raceway at 26" on center unless otherwise indicated.

3.02 TERMINAL BLOCKS AND PATCH PANELS:

- A. Arrange all terminal blocks in a manner that allows natural wiring progression and minimizes crossing of wires.

3.03 PATCH CORDS:

- A. Contractor to provide fiber and copper patch cords in quantities as described as outlined above in section 2.4.G. Neatly install (minimum) one 3', 5' or 7' CAT6 or CAT6A patch cord (as appropriate to reduce unnecessary length in wire managers) at the equipment cabinet between patch panel and owner-provided switches for each classroom and computer location. Dress and bundle patch cords as appropriate for final installation. Provide unused patch cables to Owner upon completion of project.
- B. Patch cables and fiber optic jumpers must be supplied and installed by the vendor for all terminated data drops, between network switches, building hubs, etc. so that building-wide networking will be operational once all installation is complete.
- C. All fiber patch cords and required workstation/equipment patch cords not installed shall be provided in hand to Owners Representative prior to project closeout.

3.04 LABELING:

- A. Provide labels appropriate for all components supplied and installed.
- B. Each faceplate, cable or data outlet (drop) will be numbered with a unique identifier based on coordination with Owner prior to labeling. Contractor must present labeling system for approval, with all shop drawings, prior to start of construction.

3.05 TESTING:

- A. Test all equipment and each outlet, horizontal cable, termination block, patch cords, etc. to verify compliance with requirements. Testing shall consist of attenuation and NEXT across all splices and devices installed in the field and shall meet latest requirements of EIA/TIA. Re-terminate any cable or connection found to be defective.
- B. Tester is to be configured with the specific cable installed, and the Permanent Link test will be performed according to the CAT6A standard methodology. All parameters must exhibit a PASS test result prior to project completion. PASS*, FAIL* or FAIL test results will not be accepted.
- C. Repair and resolve any shortcomings in the test results. Mitigation efforts may require re-termination or replacement of the jack, outlet or cable. Repairs or attempts to resolve test failures will be completed solely at the expense of the Contractor.
- D. Provide test results to Manufacturer and Owner representative in native Tester format. Upon request, provide a copy of the tester software and license, if needed, at no charge to Owner representative.
- E. Include PDF of full test results, summary index in electronic format on CD or memory stick in the O&M package upon project completion.

Approved Tester Products:

Fluke DTX or VERSIV platform Cable Certification testers
Linkware Record Management Software

3.06 PROJECT CLOSEOUT:

- A. Operating and maintenance manuals shall be submitted prior to testing of the system. A total of (4) manuals shall be delivered to the Owner. Manuals shall include all service, installation, and programming information.

- B. Provide a full set of "as-built" (redline) drawings in AutoCAD DWG and PDF format. Drawings to depict final location and drop/cable identification numbers and labels which match the test reports. Include (1) hard copy paper format of all as-builts in 30"x42" size or equivalent.
 - C. Contractor to provide all warranty information to Leviton for processing. Leviton will send warranty document direct to Owner.
- 3.07 TRAINING:
- A. Provide four (8) hours training on the operation and installation of the data system, at job site, at no cost to owner.

END OF SECTION