



Trenton Hansen, Ph.D.
Superintendent

4850 Pedley Road, Jurupa Valley, CA 92509 T (951) 360-4100

Date: January 20, 2026

Re: 25-26-08MOIB - P&D Portable Relocation – Addendum #2

TO ALL BIDDERS:

The following changes, omissions, and/or additions to the Bid Documents and/or Project Manual and/or Drawings shall apply to proposals made for and to the execution of the various parts of the work affected thereby, and all other conditions shall remain the same. All parties of interest shall take careful note of the addendum so that the proper allowances may be made in strict accordance with the Addendum.

Bidder shall acknowledge receipt of this addendum in the space provided on the Bid Form. Failure to do so may subject Bidder disqualification.

In case of conflict between Drawings, bid documents and this addendum, this addendum shall govern.

ITEM #1 **Question:** We are asking about the background check process: Background Check Certification w/ Attachment “A” (List of Employees)”. Do we need to get a specific code for live scanning or go do a specific process? Please advise.

Answer: Contractors are required to self-certify one of the three selections available on the Certification Regarding Background Checks form. We do not require that the DOJ automatically notify us in the event of an arrest. However, the contractor must take all reasonable actions to protect the District in the event of such an arrest.

ITEM #2 **District Clarification - Allowance and REVISED Bid Form**

Answer: As clarified in Addendum #1, the District has provided a REVISED Bid Form, attached to Addendum #1. Please ensure that the **REVISED Bid Form** is used when submitting sealed bid.

Category	Allowance
01 – General Contractor	\$10,000
02 – HVAC	\$1,000
03 – Low Voltage	\$1,000

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ITEM #3 **Question:** Intrusion / Security System - Is an intrusion or security system required as part of the C-7 Low Voltage scope for this project? If so, please identify the drawings and specification sections that define this work.

Answer: No Security system work is not required as part of this project's scope.

ITEM #4 **Question:** Fire Alarm System - Is a fire alarm system required under this project scope? If yes, please clarify whether this work is included in the C-7 package or assigned to another prime, and reference the applicable plans and specific

Answer: No, fire alarm systems are not included in this project's scope.

ITEM #5 **Question:** MDF Conduit Pathway – Junction Box and Core - The conduit pathway to the MDF appears to require a core drill and installation of a junction box. Please clarify which trade is responsible for:

Core drilling
Furnishing and installing the junction box
(C-7 Low Voltage vs. General Contractor or other prime)

Answer: This is to be completed by C-7 Low Voltage.

ITEM #6 **Question:** Electrical Scope Responsibility - Please confirm which prime contractor is responsible for electrical work on this project, including power to the modular building, electrical rough-in, terminations, and any electrical devices associated with low-voltage systems.

Answer: General Contractor will be responsible for all electrical, including receptacles, power to devices, power up to disconnect for HVAC units, all lighting, completing work for electrical panels, and power to exhaust fan. This work is to include all areas.

ITEM #7 **Question:** Fiber-Optic Cable Requirements - Please confirm the required fiber-optic cable specifications, including:

Number of strands required
Fiber type (single-mode or multi-mode)
Termination locations (MDF)

Answer: Please see supporting documents.

ITEM #8 **Question:** Portable Restroom Ramp - The existing metal ramp is significantly deteriorated and cannot be reinstalled. Could the District please consider having the contractor provide a DSA-approved aluminum ramp? Alternatively, please let us know if the District prefers to provide a specific type and brand for this installation.

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Answer: The existing metal ramps will NOT be reused. Step & landing based on (TMP Services Design). Legs to be 1-1/4" x 1-1/4" 16 gauge sq. Tubing, Handrail to be 1-1/2"X1-1/2" Sq. Tubing, Decking to be 12 ga. plate, 12 ga. 3x3 base plate for legs. 1.5"x1.5"x1.5"x0.053 edge and perimeter channel.

ITEM #9 **Question:** T1-11 Wood Siding Damage - We have noted damage at the bottom of the T1-11 wood siding on the sidewalls of both the portable restroom and the triple-wide portable. As this was not included in the original scope of work, please clarify if the District would like this added.

Answer: The damaged siding on the triple wide and portable restroom are to be added to the scope.

ITEM #10 **Question:** In line item 6 under Bid Package – Category 1, is there a specific layout that is to be followed for all the stairs being constructed?

Answer: See attached details for more information.

ITEM #11 **Question:** Will there be an installation of z-bar for the siding of the portables that is being replaced?

Answer: Yes, the Z-bar will be required between the sheets of T-111.

ITEM #12 **Question:** Is the existing casework inside the triple wide modular building going to be demoed out by the district or the contractor?

Answer: The triple wide kitchenette case work has been demoed, and triple wide restroom casework is to be reused.

ITEM #13 **Question:** Will the damaged FRP in the restrooms be cleaned, painted over, or replaced entirely ?

Answer: The damaged FRP in the restroom portable will be cleaned and painted.

ITEM #14 **Question:** Will plans be forthcoming?

Answer: No.

ITEM #15 **Question:** Please provide a layout for the cabinets to be provided and installed

Answer: Corner cabinet installation. No layout will be provided.

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- ITEM #16 **Question:** Please provide sizes of the cabinets, are they all lower cabinets, or upper and lower, etc.?
- Answer:** 36"x36"x24" lazy Susan for the corner and a 36"x24" cabinet with a sink for lowers and one 12"x6' upper cabinets.
- ITEM #17 **Question:** How many cabinets will be locking?
- Answer:** No locking cabinets.
- ITEM #18 **Question:** Will cabinet knobs and/or pulls need to be provided and installed? If so please provide quantity and spec
- Answer:** 11x Solid 4 in. Center-to-Center Brushed Nickel Kitchen Cabinet Drawer T-Bar Pull Handle Pull.
- ITEM #19 **Question:** Please provide layout /overall size of countertop. (Only main run size was provided)
- Answer:** 6' main run and a 36" return over the lazy Susan with mitered joint.
- ITEM #20 **Question:** Please provide size/dimensions of access panel to be provided and installed.
- Answer:** 14"x14"
- ITEM #21 **Question:** Please provide linear feet of rain gutter runs needed to complete the rain gutter on the front side of the buildings
- Answer:** 55' Front of portable restroom including downspout.
- ITEM #22 **Question:** Are the rain gutters to be galvanized, painted, etc.? Please provide finish.
- Answer:** Galvanized and painted semi-gloss.
- ITEM #23 **Question:** What are the dimensions of the triple wide building ramp to be painted with Dex coating for weather protection and slip resistance?
- Answer:** 49 1/2" x 27'
- ITEM #24 **Question:** What is the current finish of the triple wide building ramp to be painted with Dex coating?
- Answer:** The skirting on the ramp has not been painted and the ramp has a dex coating on it and the rails have old paint.

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- ITEM #25 **Question:** Entry/Access: Please provide dimensions and elevations for the new steps at the entry door of the 12' x 40' triple wide modular building. Please provide finish.
- Answer:** 3 steps approx. 6-3/4" each. See attached detail.
- ITEM #26 **Question:** Entry/Access: Please provide dimensions and elevations of the new steps and landings for the portable restrooms.
- Answer:** There will be (2) separate steps and landings: (1) at single door will be 5'x5'-6"x21" tall, with two steps, three risers to landing. (1) for multiple doors will be 21'x5'x 21" tall, with two steps, three risers to landing. (See attached detail)
- ITEM #27 **Question:** The scope states "Inspect and adjust all doors throughout the triple-wide modular building and portable restrooms to ensure they close and latch properly" and the material specs provide part numbers. Please confirm initial scope is only to adjust as opposed to replace?
- Answer:** Correct, the scope is to adjust so that the doors close properly.
- ITEM #28 **Question:** Is a chlorination test required?
- Answer:** No, a chlorination test is not required.
- ITEM #29 **Question:** Please provide a engineer's estimate for this project.
- Answer:** The estimate for the whole project is \$90,000.
- ITEM #30 **Question:** Please clarify if portable restrooms will be required to bid this project.
- Answer:** Yes, per the contract documents, the portable restroom is included in the 01-General Contractor bid package.
- ITEM #31 **Question:** If available, please provide a start date for this project.
- Answer:** Within a week of the NTP date. NTP TBD by the approved contract.
- ITEM #32 **Question:** Please provide the specifications for the paint required to complete the paint scope of work for this project.
- Answer:** Paint specifications are in the Bid Documents - Project Specifications - Finishes.

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- ITEM #33 **Question:** Please clarify the exact size of the new siding patch work to be done at the exterior restroom modular.
- Answer:** We would like the portable restroom siding patch work to be 30" high by 40' long.
- ITEM #34 **Question:** Please provide the specifications and measurements of the complete run for all the casework.
- Answer:** 10 linear ft by 24" deep
- ITEM #35 **Question:** What is the height of L-shaped cabinets?
- Answer:** 34.5" tall
- ITEM #36 **Question:** Are the toilets to be installed in the existing location?
- Answer:** Yes, toilets will be installed at existing locations.
- ITEM #37 **Question:** Is it possible to get the details of the triple wide modular ramp where the step are being installed; as well as the details of the steps & landing of the restroom portables?
- Answer:** Please see attached drawing for the steps and landing layout.

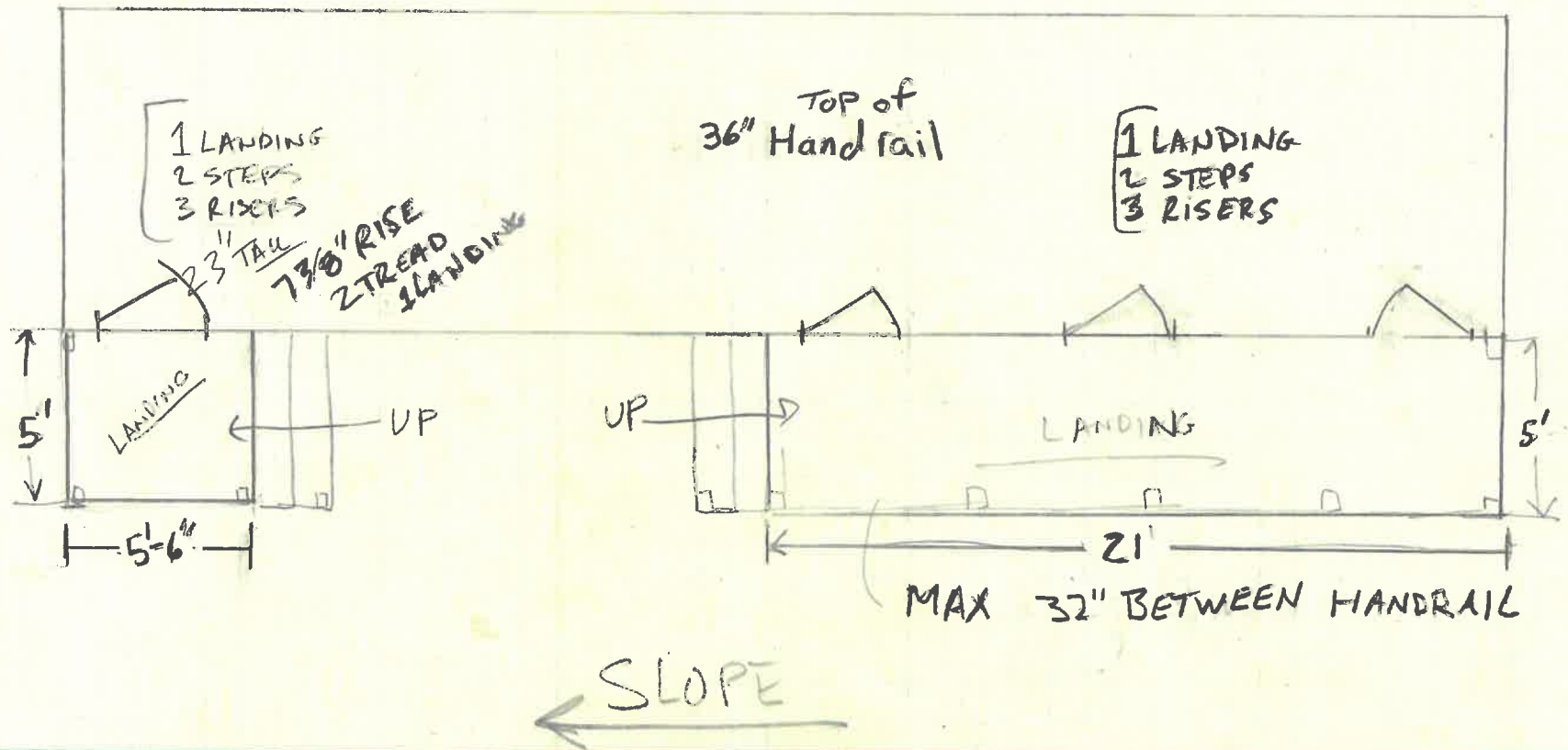
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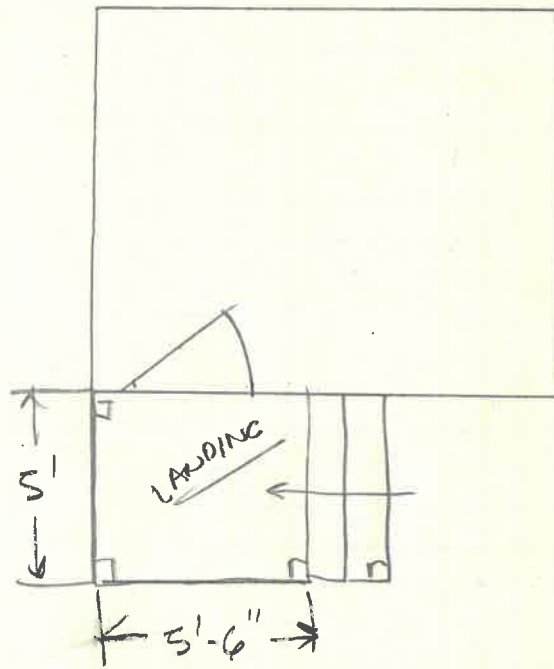
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Restroom Bldg.

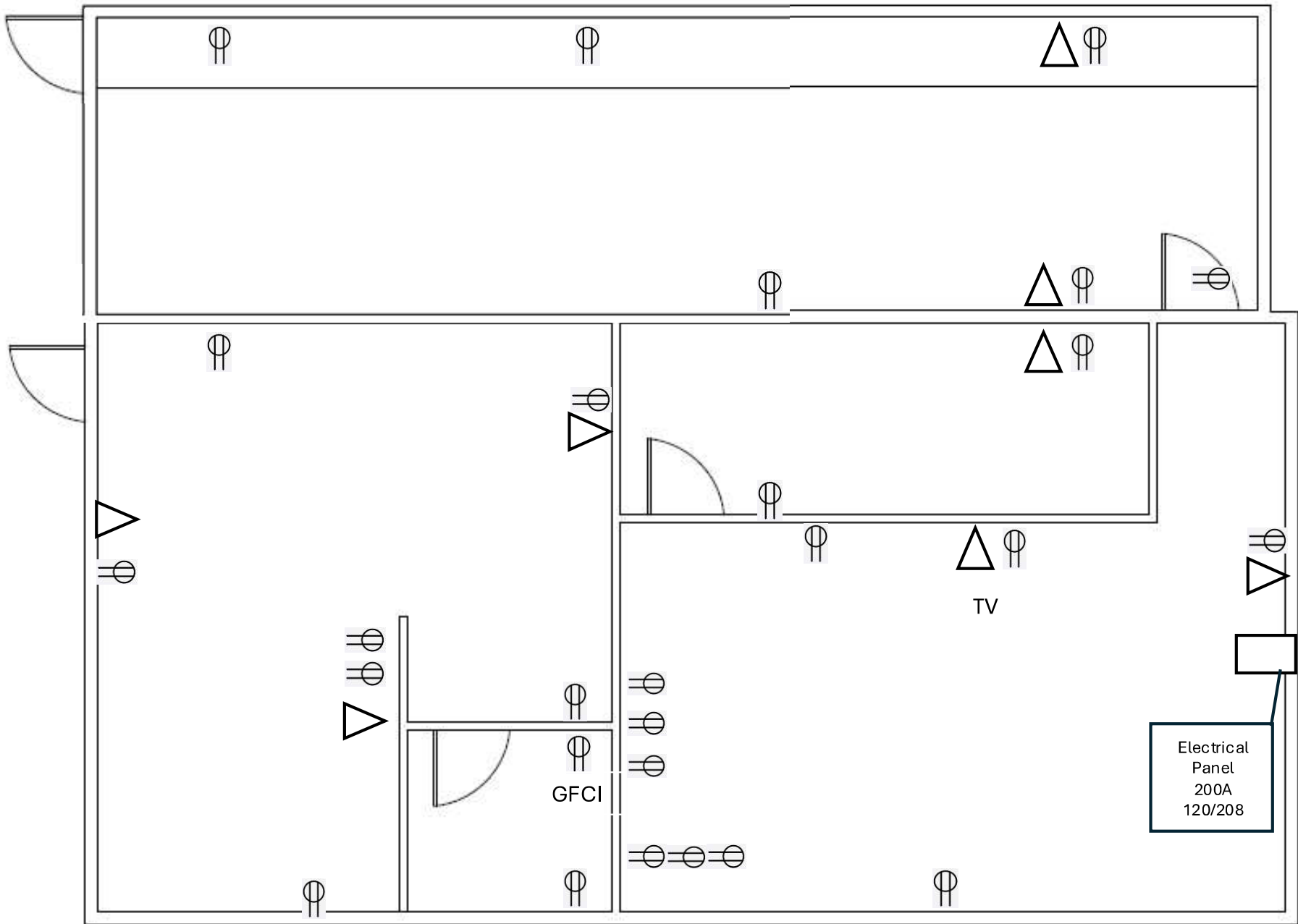
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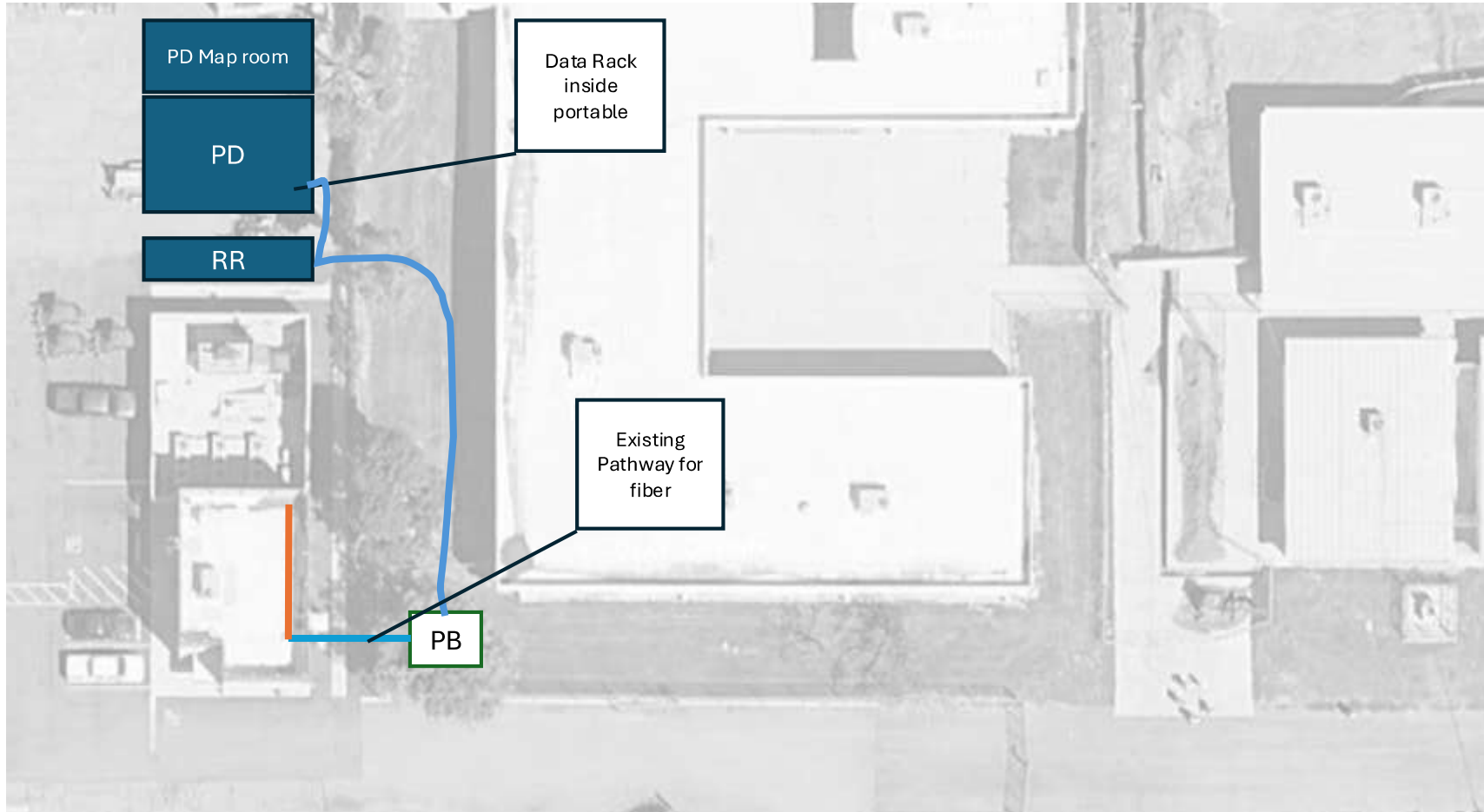
TRIPLE WIDE PORTABLE LANDING & STEPS

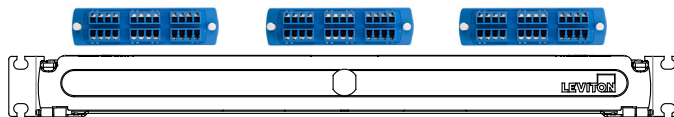
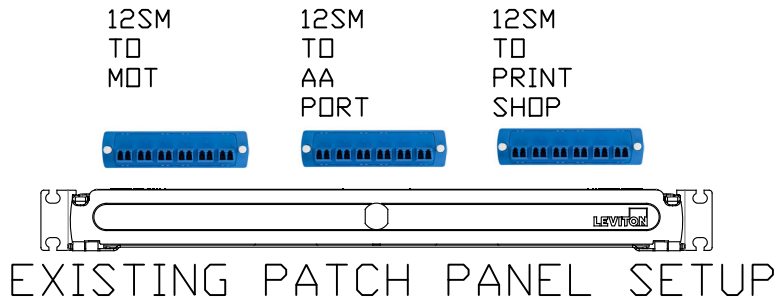


1 LANDING
2 STEPS
3 RISERS









CONTRACTOR SHALL:

1. PROVIDE AND INSTALL (3) LEVITON 5F100-4LL.
2. RELOCATE 12SM FROM OLD FIRST PANEL TO TOP HALF OF NEW 24 STRAND FIRST PANEL. RELABEL.
3. RELOCATE 12SM FROM OLD SECOND PANEL TO BOTTOM HALF OF NEW 24 STRAND FIRST PANEL. RELABEL.
4. RELOCATE 12SM FROM OLD THIRD PANEL TO TOP HALF OF NEW 24 STRAND SECOND PANEL. RELABEL
5. TERMINATE NEW 12SM FROM P&D TO LC SM TERMINATIONS AND INSTALL IN BOTTOM HALF OF NEW 24 STRAND SECOND PANEL.

Section Format for Division 27 00 00 Communications

Part 1 – General

1.01 References

- A. ANSI/TIA-568-C.0 Generic Telecommunications Cabling for Customer Premises
- B. ANSI/TIA-568-C.1 Commercial Building Telecommunications Cabling Standard
- C. ANSI/TIA-568-C.2 Balanced Twisted Pair Cabling Components
- D. ANSI/TIA-568-C.3 Optical Fiber Cabling Components Standard
- E. ANSI/TIA/EIA 569-E Commercial Building Standards For Telecommunications Pathways And Spaces
- F. ANSI/TIA/EIA 606-B The Administration Standard For The Telecommunications Infrastructure Of Commercial Building
- G. ANSI/J-STD-607-C Commercial Building Grounding And Bonding Requirements For Telecommunications
- H. ANSI/TIA/EIA-862 Building Automation Systems Cabling Standard for Commercial Buildings
- I. ASTM D 4566-05, Standard Test Methods for Electrical Performance Properties of Insulations and Jackets for Telecommunications Wire and Cable, 2005
- J. BICSI Telecommunications Distribution Methods Manual (TDMM) Current Edition
- K. BICSI Information Transport Installation Manual (ITSM) Current Edition
- L. ISO/IEC 11801 – Information Technology – Generic Cabling for Customer Premise
- M. IEEE 802.3 Standard for Information technology -Telecommunications and information exchange between systems - Local and metropolitan area networks – Specific requirements Part 3: Carrier Sense Multiple Access with Collision Detection (CSMA/CD) Access Method and Physical Layer Specifications
- N. IEC 61156-1, Multicore and Symmetrical Pair/Quad Cables for Digital Communications – Part 1: Generic Specification, 2005
- O. NFPA-70 National Electrical Code Current Edition
- P. NECA/BICSI-568-A Standard for Installing Commercial Building Telecommunications Cabling
- Q. Federal Communications Commission Part 15 and Part 68
- R. UL 444 – Standard for Safety of Communications Cable
- S. UL 1666 – Standard for Safety of Flame Propagation Height
- T. NFPA 262 – Flame Travel and Smoke of Wires and Cables

U. Local Authority Having Jurisdiction

1.02 Definitions / Terms / Acronyms

- A. ANSI – American Northern Standards Institute
- B. AWG – American Wire Gauge
- C. BICSI – Building Industry Consulting Service International
- D. EIA – Electronics Industry Alliance
- E. ETL – Intertek Semko Labs
- F. FCC – Federal Communications Commission
- G. IEC – International Electrotechnical Commission
- H. IEEE – Institute of Electrical and Electronic Engineers
- I. IDC – Insulation displacement contact
- J. ISO – International Standards Organization
- K. J-STD – Joint Standard
- L. NECA – National Electrical Contractors Association
- M. NFPA – National Fire Protection Agency
- N. SC – Subscriber Channel
- O. TIA – Telecommunications Industry Association
- P. UL – Underwriters Laboratory
- Q. 1GBase-T – networking protocol capable of transmitting 1 billion bits of information per second over copper twisted pair
- R. 10GBase-T – networking protocol capable of transmitting 10 billion bits of information per second over copper twisted pair
- S. 10GBase-SX – networking protocol capable of transmitting 10 billion bits of information per second over optical fiber at 850 nanometers
- T. Contractor: The term "Contractor" refers to the installation Contractor responsible for the furnishing and installation of all work indicated within this Specification.
- U. Construction Manager: The terms "Construction Manager" mean the Owner's appointed representative.
- V. Furnish: The term "furnish" is used to mean "purchase, supply, provide and deliver to the Project site, protect and provide interim storage and be ready for unloading, unpacking, assembly, installation, and similar operations in accordance with Manufacturer's specifications."

- W. Provide: The terms "provide" means to "furnish and install, complete and ready for the intended use".
- X. Install: The term "install" is used to describe operations at project site including the actual "unloading, unpacking, rigging in place, assembly, erection, placing, anchoring, applying, working to dimension, finishing, curing, protecting, cleaning, and similar operations".
- Y. Installer: The "Installer" is the Contractor, Subcontractor and/or supplier who uses their own employees for performance of all construction activity related to their specified responsibilities, including installation, erection, application, and similar operations. Installers are required to be experienced in the operations they are engaged to perform and the "Installers" must be an authorized Manufacturers representative, certified, experienced and qualified to provide, install, program, troubleshoot, train, warrant and service all the systems in this section in their entirety.
- Z. If Applicable: The term "if applicable" will be that work which maybe required for completed construction at applicable locations, but is not necessarily shown or described in the Contract Documents.
- AA. As Necessary: The term "as necessary" will be that work which is required for completed construction, but is not necessarily shown or described in the Contract Documents.
- BB. As Required: The term "as required" will be that work which is required for completed construction and is shown on the drawings or described in the project Specification.
- CC. Concealed: The Term "concealed" means hidden from sight, buried as in chases, furred spaces, shafts, fixed ceiling or embedded in construction.
- DD. Exposed: The term "exposed" means bare, open to the elements, out in the open, uncovered.
- EE. Product: The term "product" will mean any item of equipment, material, fixture, apparatus, appliance or accessory installed under this Division.
- FF. "Substantial Completion" is deemed that the project is sufficiently complete to be utilized for its intended use as stated in the body of this written Specification.
- GG. Governmental: The term "governmental" means all municipal, state and federal government agencies.
- HH. Words in the singular will also mean and include the plural, wherever the context so indicates, and words in the plural will mean the singular, wherever the context so indicates.
- II. Cabling: The term "cabling" will mean cable assembly, raceway, conductors, fittings and any other necessary accessories to make a complete wiring system.
- JJ. Backbone: A facility (e.g., pathway, cable or conductors) between telecommunications rooms, or floor distribution terminals, the entrance facilities and equipment rooms within or between buildings.
- KK. Backbone Cabling: Cabling and connecting hardware that provides interconnections between telecommunications rooms, equipment rooms, and entrance facilities.
- LL. Horizontal Cabling: The cabling between and including the work area outlet/connector and the horizontal cross-connect/patch cord in the telecommunications room.

MM. Telecommunications: A branch of technology concerned with the transmission, emission, and reception of signs, signals, writing, images, and sounds; that is, information, of any nature by cable, radio, optical, or other electromagnetic systems.

NN. Pull Point: A Pull Point is a space used to transition between floors for backbone and horizontal cabling within a building riser system.

OO. Equipment Outlet (EO): A device also known as the outlet or information outlet placed at the user workstation for termination using connectors (jacks) of horizontal media for connectivity of data and voice at teacher work area outlet, multimedia equipment. These outlets provide the connection point to voice, data, and other media services.

PP. Connector 8P8C (Jack): A female connector that has eight positions and eight conductors. Jacks are typically used to terminate eight conductor category rated cable at the user end and are inserted into faceplates to create a connection point for the user's equipment cord.

1.03 Submittal Requirements

A. Under the provisions of this request for proposal, as a part of the bid submission, the Structured Cabling System Contractor will:

- 1) Submit copies of the certification of the company and names of staff that will be performing the installation and termination of the installation to provide proof of compliance of this spec.
- 2) Submit proof from Manufacturer of Contractor's good standing in Manufacturer's program.
- 3) Submit appropriate cut sheets and samples for all products, hardware and cabling.

B. Prior to the start of work, the Structured Cabling System Contractor will:

- 1) Submit appropriate cut sheets for all products, hardware, and cabling.

C. Work will not proceed without the Owner's approval of the submitted items.

D. The Structured Cabling Systems Contractor will receive approval from the Owners on all substitutions of material. No substituted materials will be installed except by written approval from the Owner.

E. Refer to other applicable sections for additional submittals requirements.

1.04 Contractor Qualifications

A. Comply with below qualification requirements.

B. The Installer (Firm and Employees) will be experienced in the operations they are engaged to perform. Demonstrate at least five years of continuous recent experience on similar projects. The Installer will hold recent, up-to-date licenses, certifications and training certificates in the area the project is located and for the equipment to be installed.

C. Provide names of contacts from the last five similar projects including the General Contractor, Owner's Representative, Architect and Engineer. Indicate project locations, scope and current phone numbers that the contacts can be reached at.

D. Qualified Structured Cabling System Installation firms will have demonstrable design and installation training with certifications of competence. Certified training will be industry recognized and at least equal to:

- 1) Building Industry Consulting Service International, Inc. (BISCI) Registered Installer.

- 2) Certified Berk-Tek / Leviton Technologies Installer.
- E. Provide a full time on site foreman who personally has been certified as described above. Submit all documentation under this Section.
- F. Provide an on-call Project Manager to supervise the project.
- G. Each Foreman and Installer working on this project will be trained to the qualified level as specified by the Manufacturer(s) for installation and maintenance of equipment being provided on this project. The training will consist of at least a minimum of proper installation techniques of their specific equipment in order to have a complete operating system meeting or exceeding the requirements as specified herein. Each Foreman and Installer working on this project will have documentation from the Manufacturer indicating that they have been adequately trained prior to the start of the project. Only Foreman and Installers who have been properly trained and documented by the Manufacturer whose equipment is being provided on this project will be allowed to install same.

1.05 Bidder Qualifications

- A. Bidding Contractor shall be a licensed to install telecommunications systems with a valid California C7 license.
- B. Bidding Contractor shall have a minimum of 3 years experience installing structured cabling for telecommunications.
- C. Bidding Contractor shall have the capability to bond project in its entirety.
- D. Bidding Contractor shall be able to provide insurance at the request of the owner.
- E. Contractor performing work must be listed on the BerkTek Leviton authorized installers, valid and able to provide full warranty.

1.06 Delivery, Storage, and Protection

- A. Contractor shall ensure that materials delivery to work area shall be coordinated with construction site manager responsible for materials distribution to all trades.
- B. Contractor is responsible for all materials, tools and vehicles left on the job site.
- C. Contractor shall coordinate a disposal bin for the removal of all trash produced by the Contractor's associated personnel during the project.
- D. Contractor shall ensure materials are stored in an environmental area where:
 - 1) Temperature does not exceed 120 degrees Fahrenheit nor below 32 degrees Fahrenheit.
 - 2) Humidity does not exceed 80 %.
 - 3) No direct exposure to sunlight.
- E. Cable shall be stored according to Manufacturer's recommendations as a minimum. In addition, cable must be stored in a location protected from vandalism and weather. If cable is stored outside, it must be covered with opaque plastic or canvas with provision for ventilation

to prevent condensation and for protection from weather. If air temperature at cable storage location will be below 40 degrees F., the cable shall be moved to a heated (50 degrees F. minimum) location. If necessary, cable will be stored off site at the Contractor's expense.

- F. Deliver equipment in individual shipping splits for ease of handling, mount on shipping skids and wrap for protection.
- G. Inspect and report concealed damage to carrier within specified time.
- H. Store in a clean, dry space. Maintain factory protection or cover with heavy canvas or plastic to keep out dirt, water, construction debris, and traffic. Heat enclosures to prevent condensation. Meet the requirements and recommendations of NFPA 70B and the Manufacturer. Location will be protected to prevent moisture from entering enclosures and material.
- I. Handle in accordance with NEMA and the Manufacturer's recommendations and instructions to avoid damaging equipment, installed devices and finish.
- J. The equipment will be kept upright at all times. When equipment has to be tilted for ease of passage through restricted areas during transportation, the Manufacturer will be required to brace the equipment suitably to insure that the tilting does not impair the functional integrity of the equipment.

1.07 Project Conditions

A. Environmental Requirements

- 1) Contractor shall ensure that any pollutants produced during the work is disposed off according to local, state or national regulations. Follow the most stringent guidelines.
- 2) It is preferred that the Communications Contractor recycle any used or un-used components during the course of the construction project.
- 3) Coordinate with LEED project manager if cabling system or components will be used for points in a LEED certified project.

B. Existing conditions

- 1) See Section 01 51 33 for Temporary Telecommunications requirements
- 2) The school has an existing computer network that must remain running, unless otherwise identified in writing.
- 3) The school has an existing telephony and paging/Bells system that must remain running, unless otherwise noted in writing.

C. Field Measurements

- 1) Contractor shall coordinate with electrical engineer on project that the main electrical service ground has a resistance to earth of less than 5 ohms.
- 2) Contractor shall ensure that all grounding busbars for all equipment network rooms shall have a resistance of less than 1 ohm back to the main electrical service ground.
- 3) Contractor shall ensure that all field testers have been calibrated from the Manufacturer within 1 year.

1.08 Sequencing

- A. Contractor shall coordinate with Owner's project manager on sequencing of various trades and construction teams for the lifecycle of the project.
- B. Cooperation and coordination with other trades.
 - 1) The work will be so performed that the progress of the entire building construction, including all other trades, will not be delayed and not interfered with. Materials and apparatus will be installed as fast as conditions of the building will permit and must be installed promptly when and as directed.
 - 2) Telecommunications network must be operational and in place by identified scheduling milestones, as a prerequisite for other network enabled low voltage and building management systems. Delays to installation may cause liquidated damages, for compensation of stacking resources by district and other contractor trades.
 - 3) Keep fully informed as to the shape, size and position of all openings required for all apparatus and give information in advance to build openings into the work. Furnish and set in place all sleeves, pockets, supports and incidentals.
 - 4) Coordinate exact locations and roughing in dimensions of all work before installation and make all final connections as required. Any changes required to avoid interferences or to provide adequate clearances for Code and maintenance requirements will be made at no additional costs.
 - 5) Structural elements of the project will not be relocated, altered or changed to accommodate the work without written authorization from the Owner/Architect.
 - 6) Work that is installed before coordination with other trades or that causes interference with the work of other trades will be changed to correct condition at no additional cost to the Owner.
 - 7) Obtain a complete set of Project Drawings and Specifications for coordination and to determine the full scope of work.
 - 8) Attend project coordination meetings to coordinate work of this Section, pathways, work of other trades phasing and other project requirements.

1.09 Continuity of Service and Scheduling of Work

- A. Contractor shall provide a detailed construction schedule with hard dates for completion of roughing in cables, terminations and testing once scheduling sequence has been determined to the Owner's Project Manager. Schedule shall include milestones when owner is to return to install and configure active network electronics.
- B. Cabling schedule shall be in a software program designated by the Owner's Project Manager.
- C. Continuity of all services will be maintained in all areas that will be occupied or temporarily relocated during the construction period. If an interruption of service becomes necessary, such will be scheduled in advance, made only upon consent of the Owner and at a time outside normal working hours as the Owner will designate. The Contractor will schedule the shutdown with seven days in advance. Arrange work to minimize shutdown time.
- D. Should services be inadvertently interrupted, immediately notify the Owner. Be prepared to immediately furnish labor, materials and the equipment necessary for prompt restoration of interrupted service.
- E. Refer to the overall scheduling of the work of the project. Schedule work, process Submittals and order materials and equipment to neither conform to this schedule and install work to not delay nor interfere with the progress of the project.

- F. Inform General Contractor and Architect immediately of any delays or potential delays. Furnish Manufacturer's letter to verify order date, equipment delays, expected shipment date, order number, and potential remedies to speed up delivery. Any costs to speed up delivery will be implemented at no cost to the project if the equipment or material was not ordered as soon as possible after Contract award or within the time frames indicated with the Submittals.
- G. Include premium time required to comply with the project scheduling and phasing.
- H. Be aware of, and plan for, project scheduling and phasing. Provide for complete continuous operation of all systems. Coordinate scheduling and phasing with the Architect, Owner, other Trades, and the General Contractor.
- I. Demolition of existing systems being updated will take place only after the new or replacement system is completely installed, operational, tested and certified. This work may be required on a "per-phase" basis.

1.10 Protection of Work and Property

- A. Be responsible for the care and protection of all work included under this Section until it has been tested and accepted.
- B. Protect all equipment and materials from damage from all causes including theft. All materials and equipment damaged or stolen will be replaced with equal material or equipment at the option of the Architect and Owner.
- C. Materials and equipment stored for this project will be protected and maintained according to the Manufacturer's recommendations and requirements and according to the applicable requirements of NFPA 70B.
- D. Protect all equipment, outlets and openings with temporary plugs, caps and covers. Protect work and materials of other trades from damage that might be caused by work or workmen and make good any damage caused.
- E. Use caution to avoid damage to existing work, and to prevent harm to personnel working in all areas.
- F. Observe all safety precautions and requirements for the construction.
- G. The General Contractor and the Installer are responsible for initiating, maintaining, and supervising all safety precautions and requirements during construction.
- H. Coordinate installations with all other trades in order to not damage equipment or cables during construction. Any work that is damaged during construction will not be repaired. Replace damaged work completely, with no splices in cabling, at no additional cost to the Owner.

Part 2 – Products

- 2.01 *Refer to 27 05 26 for Bonding and Grounding Specifications*
- 2.02 *Refer to 27 11 00 for Equipment Room Fittings*
- 2.03 *Refer to 27 13 00 for Communications Backbone Cabling*
- 2.04 *Refer to 27 15 00 for Communications Horizontal Cabling*
- 2.05 *Refer to 27 16 00 for Communications Connecting Cords, Devices and Adapters*

Part 3 – Execution

3.01 General

- A. Verify the exact location prior to bid of all items that may be indicated and determine exact location of all electrical items that are not indicated on the Drawings.
- B. Include the cost of all work including sub-letting of any work that may be required to complete the work indicated in order to avoid work stoppages and jurisdictional disputes. The work to be sublet will conform to precedent agreements and decisions of record. Jurisdictional assignment will be a responsibility under this Section's contractual obligation.
- C. Do not install equipment and materials that have not been reviewed by the Architect. Equipment and materials which are installed without the Architect's review or without complying to comments issued with the review will be removed from the project when so instructed by the Architect. No payment will be made for unapproved or removal if it is ordered removed. The Installer will be responsible for any ancillary costs incurred because of its removal and the installation of the correct equipment and materials.
- D. Obtain detailed information on installation requirements from the Manufacturers of all equipment to be furnished, installed or provided. At the start of construction, check all Contract Documents include all Drawings and all Sections of the specifications for equipment requiring electrical connections and service and verify electrical characteristics of equipment prior to roughing.
- E. Equipment and systems will not be installed without first coordinating the location and installation of equipment and systems with the General Contractor and all other Trades.
- F. Any and all material installed or work performed in violation of above requirements will be re-adjusted and corrected by the Installer without charge.
- G. Refer to all Drawings associated with the project, prior to the installation or roughing-in of the electrical outlets, conduit and equipment, to determine the exact location of all outlets.
- H. After installation, equipment will be protected to prevent damage during the construction period. Openings in conduits and boxes will be closed to prevent the entrance of foreign materials.
- I. Home runs indicated are not to be combined or reduced without written consent from the Architect.

- J. All connections to equipment will be made as required, if applicable, and in accordance with the approved submittal and setting drawings.
- K. Site Observation:
 - i. Site observation visits will be performed randomly during the project by the Architect and owner. Reports will be generated noting observations. Deficiencies noted on the site visit reports will be corrected. All work will comply with the Contract Documents, applicable Codes, regulations and local Authorities whether or not a particular deficiency has been noted in a site visit report.
 - ii. Be responsible to notify the Architect ten working days prior to closing in work behind walls, raised access floors, ceilings, etc., so that installed work can be observed prior to being concealed.
 - iii. Areas will stay accessible until deficiencies are corrected and accepted. Notify the Architect when all deficiencies are corrected. Return reports with items indicated as corrected prior to re-observation by the Architect.
- L. Change Orders, Modifications, Revisions and Directives:
 - i. When change orders, modifications, revisions or Architect's Directives are issued or authorized, provide the required additional material, equipment, personnel and workers to prevent delays in the work, and to complete the work within the time limit of the Contract unless a specific time extension is requested with the change and accepted. Include costs for expediting deliveries where required.
 - ii. Requests for additional compensation will be submitted broken down and associated by item, tasks and Drawing or sketch number with material and labor costs, so quantities can be easily verified.
 - iii. Requests will be properly and adequately identified so the scope of work can be clearly determined. Indicate who originated change in work.
 - iv. Submit on all credits broken down as requested for adds. Credits will be separately identified and accounted for. Do not indicate as net changes with adds.
 - v. Unit costs for labor and material will be equal for adds, deletes and credits.
- M. Loose materials will not be stored on-site. A "gang box" is acceptable to be placed in a location agreeable to the Owner and the General Contractor. The Installer is responsible for all equipment and materials and for their delivery until the system is deemed complete and accepted by the Owner.
- O. A trailer may be used for the storage of materials to be located on the Owner's property at a location designated by the Owner and the General Contractor. Such on-site storage will be kept locked by the Installer. Security for the trailer and its contents will be strictly the responsibility of the Installer.
- P. Protect existing spaces where work is being performed; protect it from damage and from the accumulation of dirt and debris.
- Q. Any ceilings, walls, floors, furniture, equipment, furnishings, etc., damaged by the work of this Section will be replaced, or at the Owner's option, repaired with similar materials, workmanship and quality.
- R. Work includes field survey of existing conditions, systems, equipment and tracing of existing circuits in order to determine scope of work.
- S. Maintain the existing building in operation at all times during the entire construction period. If it is necessary to have a system shutdown, a written request for approval will be submitted in advance stating the estimated shutdown time. Work will be planned to minimize shutdown. Shutdowns will be at the convenience of the Owner and, if necessary, on premium time.

- T. Clean and touch up all equipment, materials and work sites at the completion of work in each area.
- U. Certain portions of the work area may be occupied during construction. Determine which areas and schedule work accordingly and include necessary premium time.
- V. Make sure necessary provisions to provide continuous service of all existing systems throughout all occupied areas.

3.02 Cable Pathways

- A. Install cables in pathways.
- B. Provide all equipment and cabling for a complete installed operating system. Pathways, outlet boxes and grounding are provided by the Electrical Subcontractor.
- C. All pathways provided under this Section will comply with fill capacities as per Code, TIA/EIA 569 and BICSI.
- D. Cable bending radius will not be less than minimum required by TIA/EIA and BICSI.
- E. Cabling installed concealed will be supported from the building structure (e.g. cable trays, J-Hooks, etc.).
- F. Cables will be installed no closer than 12 inches (305mm) to electrical equipment and wiring. When cables are required to cross power wiring, they will only do so perpendicular to the power wiring. Cable and power wiring will only cross each other the minimal number of times as required due to building design limitations.
- G. Clearances: Clearances between cabling and other building systems as required by TIA/EIA 569 and BICSI will be maintained throughout the building.
- H. All cables will be installed in a neat and workman-like manner. Cables will be installed parallel and perpendicular to building elements.
- I. Provide expansion fittings and adequate cable slack at all building expansion joints.
- J. Fire/smoke seal all conduits, raceways, sleeves, slots, etc. where cables pass from one location to another.

3.03 Work Area Outlets

- A. All work area outlet locations will be as indicated on the Drawings. Uniquely label each work area outlet and jack within the outlet according to the numbering convention outlined in the section on labeling.
- B. Labeling shall be sequential in order, do not reuse a number throughout the entire infrastructure.
- C. Work area outlets installed in casework will have their cables installed within the conduit or raceway provided.
- D. Install jack and connector modules as indicated in the details and on the Drawings.

- E. Work area outlets will be seated properly and will be installed level on walls and parallel to building elements as required.

3.04 Installation Practices

- A. Follow and adhere to installation practices specified by the applicable Telecommunications Industry Association standards.
- B. Follow and adhere to installation practices specified by BICSI Information Transport System Installation Manual 5th Edition.
- C. Follow and adhere to installation practices specified by BICSI Telecommunications Distribution Methods Manual 11th Edition.
- D. Follow and adhere to installation practices specified by NFPA-70 National Electric Code, Edition 2008.
- E. Follow and adhere to installation practices specified by the Manufacturers.
- F. The general topology will be a "hierarchal star" configuration. All segments will originate in NRTL listed patch panels located in the telecommunication equipment racks/cabinets and end at the work area outlets.

4) Routing:

- a. All cabling will be installed in conduit where indicated on plans or will be installed open using "J" hooks and routed on cable trays located as shown on plans.
- b. Cables will be routed, in large groups, down main cable pathways, until a direct path to the point of access to the workstation outlet can be taken. At that point, cables will be routed, above all building systems, to the outlet location in accordance with standard installation practices, as described herein.
- c. Multiple cables to individual rooms will be pulled as a bundle and terminated at each end in sequential order so that labeling within a room location is in sequence.
- d. When not in conduit or tray, cables will be supported to the deck and/or beams, every five feet throughout the length of their installed run. Hangers, clips, and other methods of grouping the cables and keeping them away from other systems installed in the building are to be provided and installed. Ensure that hangers and other methods of securing cable do not compress cable or damage insulation.
- e. Cables will be attached to beams with minimal disruption of the fireproofing. Care should be taken to assure that fireproofing removal is not excessive. The Contractor will be responsible of restoring the fireproofing to appropriate levels. Restoration will be verified by the General Contractor.
- f. Cable routes will be with 90-degree angles whenever possible. Cables will not be installed randomly or diagonally through the building.
- g. Cables installed partially or fully within the telecommunications room will be routed through and secured in the cable tray wherever possible. No cables are to be routed across the rooms at angles, or are the cables to be run from one portion of the room or tray to another. Cables placed in the cable tray are to be laced frequently to keep them neatly bundled and not permitted to shift from one side of the tray to the other as they are routed in the tray.
- h. Station cables will be routed to fixed wall locations through EMT to back box. Secure and store four feet of slack cable above ceiling at cable entrance to EMT.

- 5) Separation from EMI Sources:
 - i. Comply with BICSI TDMM and TIA-569-B recommendations for separating unshielded copper voice and data communication cable from potential EMI sources, including electrical power lines and equipment.
 - j. Separation between open communications cables or cables in nonmetallic raceways and unshielded power conductors and electrical equipment will be as follows:
 - 1. Electrical Equipment Rating Less Than 2 kVA: A minimum of 5 inches (127 mm).
 - 2. Electrical Equipment Rating between 2 and 5 kVA: A minimum of 12 inches (300 mm).
 - 3. Electrical Equipment Rating More Than 5 kVA: A minimum of 24 inches (610 mm).
- 6) Separation between communications cables in grounded metallic raceways and unshielded power lines or electrical equipment will be as follows:
 - 1. Electrical Equipment Rating Less Than 2 kVA: A minimum of 2-1/2 inches (64 mm).
 - 2. Electrical Equipment Rating between 2 and 5 kVA: A minimum of 6 inches (150 mm).
 - 3. Electrical Equipment Rating More Than 5 kVA: A minimum of 12 inches (300 mm).
- 7) Separation between communications cables in grounded metallic raceways and power lines and electrical equipment located in grounded metallic conduits or enclosures will be as follows:
 - 1. Electrical Equipment Rating Less Than 2 kVA: No requirement.
 - 2. Electrical Equipment Rating between 2 and 5 kVA: A minimum of 3 inches (76 mm).
 - 3. Electrical Equipment Rating More Than 5 kVA: A minimum of 6 inches (150 mm).
- 8) Separation between Communications Cables and Electrical Motors and Transformers, 5 kVA or HP and Larger: A minimum of 48 inches (1200 mm).
- 9) Separation between Communications Cables and Fluorescent Fixtures: A minimum of 5 inches (127 mm).
- G. All cables will have both ends completely terminated at their respective patch panel and work area outlet. Individual conductors will be trimmed flush with IDC block. Cables indicated to be "spare" will have one end terminated at their respective patch panel or cross-connect block and the other end will be hermetically sealed with a polyolefin heat-shrinkable cap. Provide Brother TZ or approved equivalent after testing. Tape will not be approved.
- H. The total length of permanently installed cable for any complete segment will not exceed 295 feet (90m). Do not splice or otherwise re-terminate any cable used, terminate only at the patch panels, cross connect blocks and work area outlets. Route cables [minimum of 12 inches (305mm) away] to avoid light ballasts, transformers, power wiring and other electrical devices so that there is no EMI or RFI interference with data transmission. Permanently label all cables six inches from the connector at each end, according to the numbering convention outlined in the section on labeling. All cables will be terminated at outlets, patch panels or cross connect blocks ONLY.

- I. Maximum pulling tension will not exceed 25 lbs/ft. when installing cables.

3.05 Labeling

- A. Labeling procedure will meet EIA/TIA 568A, 606-A (Class 2 Administration) and BICSI Standards.
- B. The labeling scheme will be provided as follows at all locations within the cable infrastructure:
- C. Labeling will be as follows:
 - 1) Location identification will start from the left, as you walk in the doorway, and continue around the room in a clockwise direction.
 - 2) Data drops will be labeled based on the serving zone and patch panel. The cable terminated in zone 2 (IDF2) to patch panel B on port 32 will be "2-B32". The cable terminated in zone 1 (MDF) to patch panel E on port 18 will be "1-E18". The letters I and O will not be used for patch panels.
 - 3) Labeling shall be sequential in order, do not reuse a number throughout the entire infrastructure.
 - 4) Hand-written and embossed type labels are specifically prohibited. In addition, provide the following:
 - k. Label each outlet with permanent self-adhesive label with minimum 3/16 in. high characters.
 - l. Label each cable with permanent self-adhesive label with minimum, 1/8 in. high characters, in the following locations:
 - m. Inside receptacle box at the work area.
 - n. Behind the communication room patch panel or punch block.
 - o. Use labels on face of data patch panels. Provide facility assignment records in a protective cover at each telecommunications room location that is specific to the facilities terminated therein.
 - p. Use color-coded labels for each termination field that conforms to ANSI/TIA/EIA-606(A) standard color codes for termination blocks.
 - q. Mount termination blocks on color-coded backboards.
 - r. Labels will be machine-printed. Hand-lettered labels will not be acceptable.
 - 1. Use industry standard EIA/TIA and BICSI color codes as specified herein and maintain consistent color-coding throughout the building.

3.06 Firestopping

- A. Work, in general, includes furnishing and installing fire and smoke barrier penetration seals for openings in floor, walls, and other elements of construction.
- B. Comply with requirements in Division 07 Section "Penetration Firestopping."
- C. Comply with TIA/EIA-569-A, Annex A, "Firestopping."
- D. Comply with BICSI TDMM, "Firestopping Systems" Article.
- E. Applicator Qualifications: Two years experience installing UL classified firestopping.
- F. Performance of materials will have been tested to provide fire rating equal to that of the construction.

G. Shop Drawings:

- 1) Submit shop drawings showing each condition requiring penetration seals indicating proposed UL systems materials, anchorage, methods of installation, and actual adjacent construction.
- 2) Submit a copy of UL illustration of each proposed system indicating Manufacturer approved modifications. Submitting a single product is insufficient.

H. Manufacturer's Data: Submit copies of Manufacturer's specifications, recommendations, installation instructions, and maintenance data for each type of material required. Include letter indicating that each material complies with the requirements and is recommended for the applications shown.

I. Applicator's Qualification Statement: List past projects indicating required experience.

J. Existing Project Conditions:

- 1) Verify existing conditions and substrates before starting work. Correct unsatisfactory conditions before proceeding.
- 2) Proceed with installation only after penetrations of the substrate and supporting brackets have been installed.

K. Environmental Requirements:

- 1) Furnish adequate ventilation if using solvent.
- 2) Furnish forced air ventilation during installation if required by Manufacturer.
- 3) Keep flammable materials away from sparks or flame.
- 4) Provide masking and drop cloths to prevent contamination of adjacent surfaces by firestopping materials.

L. Warranties: Submit copies of written warranty, minimum of one year, agreeing to repair or replace joint sealers which fail in joint adhesion, cohesion, abrasion resistance, weather resistance, extrusion resistance, migration resistance, stain resistance, or general durability or appear to deteriorate in any other manner not clearly specified by submitted Manufacturer's data as an inherent quality of the material for the exposure indicated. The guarantee period will be one year from date of substantial completion.

M. Acceptable Manufacturers: Subject to compliance with requirements, provide products of Nelson Fire Protection Products or Engineers approved equal as further defined in the Systems and Applications Schedule in Part 3 of this section.

N. Materials:

- 1) Provide materials classified by UL to provide Fire Barrier equal to time rating of construction being penetrated.
- 2) Provide asbestos free materials that comply with applicable codes and have been tested in accordance with UL 1479 or ASTM E-814.

O. Preparation: Clean surfaces to be in contact with penetration seal materials of dirt, grease, oil, loose materials, rust, or other substances that may affect proper fitting, adhesion, or the required fire resistance.

P. Installation:

- 1) Install penetration seal materials in accordance with printed instructions of the UL Building Materials Directory and in accordance with Manufacturer's instructions.

- 2) Seal holes or voids made by penetration to ensure an effective smoke barrier.
- 3) Where floor openings without penetrating items are more than four inches in width and subject to traffic or loading, install firestopping materials capable of supporting same loading as floor.
- 4) Protect materials from damage on surfaces subject to traffic.

Q. Field Quality Control:

- 1) Examine penetration sealed areas to ensure proper installation before concealing or enclosing areas.
- 2) Keep areas of work accessible until inspection by applicable code authorities.
- 3) Perform under this section patching and repairing of firestopping caused by cutting or penetration by other trades.

R. Adjusting and Cleaning:

- 1) Clean up spills of liquid components.
- 2) Neatly cut and trim materials as required.
- 3) Remove equipment, materials and debris, leaving area in undamaged clean condition.

3.07 Sealing of Penetrations and Openings

- A. All firestop systems will be manufactured by Specified Technologies Inc. All firestop will be installed in accordance with the Manufacturer's recommendations and will be completely installed and available for inspection by the local inspection authorities prior to cable system acceptance.
- B. Provide a seal around raceways or cables penetrating full height walls (slab to slab), floors or ventilation or air handling ducts so that the spread of fire or products of combustion will not be substantially increased.
- C. Penetrations through fire-resistant-rated walls, partitions, floors or ceilings will be fire stopped using approved methods and NRTL listed products to maintain the fire resistance rating.
- D. Installation restrictions of the listing agencies will be strictly adhered to {e.g. 24 inch (610 mm) minimum horizontal separation between boxes on opposite sides of the wall, maximum square inch opening in wall}.
- E. Fire stopping in sleeves or in areas having small openings that may require the addition or modification of installed cables or raceways will be soft, pliable, non-hardening fire stop putty. Putty will be water resistant and intumescent.
- F. Fire stopping in locations not likely to require frequent modification will be NRTL listed putty or caulk to meet the required fire resistance rating.
- G. Box penetrations into a fire rated wall or shaft will have a fire-stopping pad installed on the back of the box.
- H. Fire stopping of cable trays through walls will be with NRTL listed bags to meet the required fire resistive rating and that will not allow products of combustion to pass through the protected opening. The NRTL listed bags will be installed inside and on both sides of the opening as required to meet the required resistive fire rating of the wall.

- I. Fire stopping materials will be NRTL listed to UL 1479 (ASTM E814). Installation methods will conform to a UL fire stopping system. Submit specifications and installation drawings for the type of material to be used. Fire stopping materials will be as manufactured by Specified Technologies, Inc., or approved equal.

3.08 Cable Supports

- A. Provide hook and loop (Velcro) cable wraps at all panels, equipment racks and cabinets. Tie wraps are specifically prohibited.
- B. Tie wraps for horizontal cables will be secured with minimum required compression in order to secure the cables properly without impeding the signal transmission rating (geometry) of the cable. Hook and loop (Velcro) cable wraps may be used in lieu of cable ties for copper cables only.
- C. Provide J-Hook supports from the building structure as required for cable runs to the cable drop location. Maximum distance between supports will be five feet (1500mm) depending on the structural elements of the building. Maximum number of cables per support will be thirty. Provide additional supports as required when cable quantities exceed thirty and to maintain required bending radius of cables. Cables installed exposed or in areas subject to abuse {below 10 feet (3m) above finished floor} or in accessible areas will be installed in conduit.
- D. All cables will be supported directly from building structure. Under no circumstance will cable be installed using cross bracing, plumbing/sprinkler pipes, ceiling systems or any other system that is not a specifically approved method to independently support cables. Cables will not be allowed to rest on ceiling tiles, duct work, piping, etc. Supports will be provided as required for cables to avoid contact with any other building system. Bundle cables in groups by Room.

3.09 Cable Protection

- A. Provide bushings in all metal studs and the like where cables will pass through. Bushings will be of two (2)-piece construction with one piece inserted through the opening and the second piece locking it into place. Single piece bushings with locking tabs or friction fit are specifically prohibited.
- B. Cables to be installed in existing enclosed open bays or furred spaces where conduit stubs are not provided, will be protected from chafing or any damage. The Installer will verify that the warranty will not be violated before installing any cabling in these locations.
- C. Provide cutting, coring, sleeves and bushings and seal as required at all penetrations.
- D. Cables damaged during installation will not be repaired. They will be completely replaced with new cable at no cost to the Owner.

3.10 Grounding & Bonding

- A. Refer to 270526 for Grounding and Bonding requirements.

3.11 Documentation

- A. Label all equipment as herein specified.

B. Provide:

- 1) Provide Building Structured Cabling Systems Administration Report indicating TIA/EIA-606 required information.
- 2) Documentation of test results for every cable segment and link will be turned over in native tester form and PDF. Documents will include measured values as well as whether or not the test passed. Test results to be turned over prior to punchwalk. Labeling of cable in test results must match field conditions.
- 3) "Record" drawings indicating location of all equipment including but not limited to work area outlets, patch panels, cross connect blocks, on each segment and cable routing. Indicate labeling for each piece of equipment.
- 4) Record drawings indicating actual cable routes and outlet identifiers. Provide respective copies mounted in each telecommunications room, and the main cross connect.

C. Provide "as-built" Drawings on AutoCAD Version 12 or higher to the Owner. Obtain copy of original Drawings from the Architect.

D. Submit NRTL certification that the structured cabling system meets the transmission requirements of TIA-568-C.0.

3.12 Training

A. As a minimum training sessions will consist of the following:

- 1) General project information and review will be by the General Foreman or Superintendent of the Trade.
- 2) Specific system training will be by a Factory Trained Representative.
- 3) Provide a complete review of the project and systems including, but not limited to, the following:
 - a. Review each Record Drawing (use of typicals is acceptable).
 - b. Note equipment layouts, locations and control points.
 - c. Review each system.
 - d. Review system design operation and philosophy.
 - e. Review alarms and necessary responses.
 - f. Review standard troubleshooting techniques for each system.
 - g. Review areas served by equipment.
 - h. Identify color codes used.
 - i. Review features and special functions.
 - j. Review maintenance requirements.
 - k. Review operation and maintenance manuals.
 - l. Respond to questions (record questions and answers).
- 4) After training, walk the entire project, review each equipment room and typical locations. Explain equipment and proper operation.

B. During the instruction period the Owner and Maintenance Manual will be used and explained.

C. The Owner and Maintenance Manual material will be bound in 3-ring binders and indexed. On the edge of the binder provide a clear see-through plastic holder with a typed card indicating the Project name, the Architect's name, the installer's name and the Volume number (e.g., Vol. No.1 of 2).

- D. Provide name, address and telephone number of the Manufacturer's representative and Service Company for all items supplied so that the source of replacement parts and service can be readily obtained.
 - 1) Include copies of Manufacturer's and installer's warranties and maintenance contracts and performance bonds properly executed and signed by an authorized representative.
 - 2) Include copies of all test reports and certifications.

3.13 Cleaning

- A. In all telecom room spaces - a thorough sweeping, vacuuming and wet mopping shall be performed on a weekly basis or more frequently as directed by the owner. Cleaning shall include floors, rafters, floor joists, exposed structural members, exposed mechanical/electrical equipment and ductwork/piping/conduits, walls, ladder trays, tops of cabinets/racks, existing/new passive and active components, or per manufacturer recommendations.
- B. All non-metallic cable managers and snap covers shall be wiped clean, both inside and outside of front, including rear channels. All clear covers and doors shall be cleaned, both front and rear per manufacturer recommendations.
- C. Inside of fiber optic enclosure and patch panels shall be blown clean of settled dust. Cleaning shall be performed for all new construction projects or where gypsum sanding has been performed.
- D. All scraps, boxes, spools, pull-line and trash shall be removed and properly disposed of.
- E. All residual cable lubricant shall be cleaned from floors and walls with an appropriate degreaser.

3.14 Project Closeout

- A. Provide close out submittals as required herein and include the following close out submittals.
 - Operation and Maintenance Manuals
 - Record Drawings
 - Test Reports
 - Warranty certification form Manufacturer's
 - Extra Materials
 - Provide factory calibration report of field test equipment
- B. Obtain written receipts of acceptance close out submittals submitted. Receipts will specifically detail what is being delivered (description, quantity and specification section) and will be dated and signed by firm delivering materials and by the Owner's Representative.
- C. Provide patch cables as follows:
 - 1) Provide one UTP patch cable for each horizontal cable terminated within the patch panel.
 - 2) Coordinate patch cable lengths and color with the Owner prior to ordering.
- D. Provide equipment cords as follows:

- 1) Provide one 15-foot equipment cord for each data connector installed in data Work Area Outlets. Provide one 5-foot equipment cord for each data connector at wifi and AV projector outlets.
 - 2) Coordinate equipment cord lengths and color with the Owner prior to ordering.
- E. Provide record drawings indicating actual cable routing and cable terminations including all required identifiers.
- F. Provide a half size laminated set of drawings mounted in the Main Equipment Room.
- G. All sketches, drawings, and charts herein are for the purpose of providing for specifications in a simplified format. Errors and omissions in such do not relieve the Contractor of the responsibility for providing a fully complete, secure and properly operating structured cabling system suitable for the intended use. Bidders must obtain a complete set of Project Drawings and Specifications to determine the full scope of work. In case of conflict, the Project Drawings and Specifications will prevail.

End of Section

SECTION 271123 - CABLE MANAGEMENT AND LADDER RACKS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

Section Includes:

1. Vertical Cable Management for Racks and Frames.
2. Horizontal Cable Management for Racks and Frames.
3. Ladder Racks.

Related Requirements:

1. Section 271116 "Communications Cabinets, Racks, Frames, and Enclosures" for cabinets, racks, frames and enclosures.
2. Section 271126 "Communications Rack Mounted Power Protection and Power Strips" for rack-mounted power distribution units
3. Section 270536 "Cable Trays for Communications Systems" for cable trays and accessories serving communications systems.

1.3 DEFINITIONS

BICSI: Building Industry Consulting Service International

- A. EIA: Electronic Industries Alliance.
- B. TIA: Telecommunications Industry Association
- C. ANSI: American National Standard Institute

1.4 ACTION SUBMITTALS

Product Data: For each type of product.

Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for cable management and ladder racks.

1. Include rated capacities, operating characteristics, electrical characteristics, and furnished specialties and accessories.

Shop Drawings: For communications equipment room fittings. Include plans, elevations, sections, details, and attachments to other work.

Detail equipment assemblies and indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.

2. Include workspace requirements and access for cable connections.
3. Grounding: Indicate bonding requirements and location of bonding bus bar.

PART 2 - PRODUCTS

2.1 VERTICAL CABLE MANAGEMENT FOR RACKS AND FRAMES

No vertical cable management is included in this scope.

Basis-of-Design Product: Subject to compliance with requirements, provide Chatsworth Products (CPI); MCS Master Cabling Section.

Double-Sided MCS, for 3 inch Deep Channel Racks:

Configuration: The front of the vertical cable manager will have cable openings along both sides of the trough. The openings will be formed by evenly-spaced T-shaped cable guides. The T-shaped cable guides will be made from a composite plastic material (not metal) and will have rounded edges to protect cables. When the cable manager is attached to a rack/frame, each cable opening will align with a rack-mount space (RMU) on the rack/frame. Each opening will pass a minimum of 24 each 0.25 inch (6 mm) OD patch cords. The rear of the cable manager will be an open through with integrated evenly-spaced spinning latches to secure cables. The manager will include a front door that securely latches in the closed position.

- a. Width: **10 inches (250 mm)**].
- b. Depth: 12.24 inches (311 mm).
- c. Height: **84 inches (2.1 m)**.
- d. Finishes and colors: Powder coat paint in **black**. Edge-protectors, T-shaped cable guides and latch hardware is black.

2.2 HORIZONTAL CABLE MANAGEMENT FOR RACKS AND FRAMES

Basis-of-Design Product: Subject to compliance with requirements, provide Neatpatch Horizontal Cable Manager. P/N: NP2

- A. This project includes the installation of owner provided horizontal cable management.
 - a. Width: **19 inches (482 mm)**.
 - b. RMU:2.
 - c. Finishes and colors: **black**. Edge-protectors, T-shaped cable guides and latch hardware is black.
 - d. Many of the horizontal cable management are existing. Please see

quantities below:

- 1) P&D portable-3

2.3 LADDER RACKS

Basis-of-Design Product: Subject to compliance with requirements, provide Chatsworth Products (CPI); Universal Cable Runway.

Description:

- Size: 1.5 inches (38 mm) high by 0.4 inches (10 mm) wide high tubular steel with 0.065 inch (1.65 mm) wall thickness.
- a. Stringers: 9 feet 11-1/2 inches (3 m) long.
 - b. Cross Members: Welded in between stringers on 12 inch (300 mm) intervals/centers beginning 5-3/4 inches (146 mm) with 10 cross members per ladder rack. Open space of 10-1/2 inches (267 mm) between each cross member.

Width: **12 inches (300 mm).**

Finish and Color: Powder coat paint in **black**.

2.4 LADDER RACK ACCESSORIES

Horizontal 90° Turns (Cable Runway E-Bend): 1-1/2 inches (38 mm) by 3/8 inch (9.5 mm) wide tubular steel with 0.065 inch (1.65 mm) wall thickness.

Width: **12 inches (300 mm).**

1. Finish and Color: Powder coat paint in **black**.

Vertical-To-Horizontal 90° Turns (Cable Runway Outside Radius Bend): 1-1/2 inches (38 mm) by 3/8 inch (9.5 mm) wide tubular steel with 0.065 inch (1.65 mm) wall thickness.

Width: **12 inches (300 mm).**

2. Finish and Color: Powder coat paint in **black**.

Horizontal-To-Vertical 90° Turns (Cable Runway Inside Radius Bend): 1-1/2 inches (38 mm) by 3/8 inch (9.5 mm) wide tubular steel with 0.065 inch (1.65 mm) wall thickness.

Width: **12 inches (300 mm).**

3. Finish and Color: Powder coat paint in **black**.

Corner Brackets (Cable Runway Corner Bracket): 1-1/2 inches (38 mm) by 3/8 inch (9.5 mm) wide tubular steel with 0.065 inch (1.65 mm) wall thickness.

Width: **15 inches (381 mm) and 24 inches (600 mm).**

4. Finish and Color: Powder coat paint in **black**.

Ladder Rack Splices: Mechanically connects ladder rack sections and turns together end-to-end or side-to-end to form a continuous pathway for cables.

Finish and Color: Powder coat paint in **black**.

Butt-Splice Kit.

- a. Junction-Splice Kit.
- b. Heavy-Duty Butt-Splice Kit.
- c. Heavy-Duty Junction-Splice Kit.
- d. Adjustable Junction-Splice Kit.
- e. Runway-Splice Kit.
- f. Butt Swivel Splice Kit.
- g. Junction Swivel Splice Kit.
- h. Vertical Swivel Splice Kit.

Grounding Kit, zinc.

5. Insulator Bar Kit, white.

Ladder Rack Supports: Sized to match the width of the ladder rack that is supported.

Finish and Color: Powder coat paint in **black**.

Triangular Support Bracket.

- a. Wall Angle Support Kit.
- b. Foot Kit.
- c. Adjustable Floor Support Channel.
- d. Threaded Ceiling Kit.
- e. Center Support Kit.
- f. Rack-to-Runway Mounting Plate.
- g. Cable Runway Elevation Kit.
- h. Vertical Wall Brackets.

Miscellaneous Accessories:

Tool-less Pathway Dividers: 6.8 inches (173 mm) high by 1.5 inches (38 mm) wide by 2.2 inches (55.9 mm) deep Polycarbonate/Acrylonitrile Butadiene Styrene (PC/ABS) thermoplastic material.

6. Tool-less Cross Member Radius Drops: 0.060 inch (1.5 mm) thick Steel and measure 4.6 inches (117 mm) high by 6.1 inches (155 mm).
7. Tool-less Stringer Radius Drops: 0.060 inch (1.5 mm) thick steel and measure 4.6 inches (117 mm) high by 4.6 inches (117 mm) deep.
8. Saf-T-Grip Reusable Cable Management Straps: **Open loop series, End Grommet and Buckle Series.**
9. Cable Retaining Post.
10. Cable Runway Protective End Caps.
11. Touch-Up Paint: Spray Can in **black**.
12. Miscellaneous Hardware: Includes **cable runway support brackets, ceiling support brackets, cable runway slotted support brackets, slip-on cable runway support brackets, slip-on lock nuts, hex nuts, split lock washers, washers, hex lag screws, and anchors.**

PART 3 - EXECUTION

3.1 VERTICAL CABLE MANAGER INSTALLATION

Attach vertical cable managers to the side of the rack/frame using the manufacturer's installation instructions and included hardware.

- A. When a single vertical cable manager is used in between two racks/frames, attach the vertical cable manager to both racks/frames.
- B. When more than one cable manager is used on a rack/frame or group of racks/frames, use the same make and style of vertical cable manager on the rack/frame or in between racks/frames.
- C. The color of the rack(s)/frame(s) and cable manager(s) must match.
- D. Doors should be attached to the cable manager and in the closed position after cabling is complete.

3.2 HORIZONTAL CABLE MANAGER INSTALLATION

When more than one horizontal cable manager is used on a rack/frame/cabinet or group of racks/frames/cabinets, use the same make, and style of cable manager on the rack/frame/cabinet or racks/frames/cabinets.

- A. The color of the rack(s)/frame(s)/cabinet(s) and cable manager(s) must match.
- B. Attach horizontal cable managers to the rack/frame/cabinet with four screws according to the manufacturer's installation instructions. Each cable manager should be centered within the allocated rack-mount space (RMU or U).
- C. Horizontal managers will be located so that the number of ports (cables) they support will not exceed the cable fill capacity of the cable manager.
- D. Covers should be attached to the cable manager and in the closed position after cabling is complete.

3.3 LADDER RACK INSTALLATION

Install with side stringers facing down so the runway forms an inverted U-shape and that the hardware between the stringers and cross members face away from cables.

Secure to the structural ceiling, building truss system, wall, floor or tops of equipment racks and/or cabinets using the manufacturer's recommended supports and appropriate hardware, as defined by local code or the authority having jurisdiction (AHJ).

- A. Support requirements:

Ladder Rack (cable runway): 5 feet (1.5 m) or less in accordance with TIA-569-B.

1. Splices: Within 2 feet (0.6 m)
2. Intersections: Within 2 feet (0.6 m) on all sides of every intersection.
3. Changes in Elevation: Within 2 feet (0.6 m) on both sides.
4. Attached vertically to wall: 2 feet (0.6 m).

Secure to each support with included hardware with a minimum of two fasteners.

B. Splices: Place mid-span, not over a support, with the manufacturer's recommended splice hardware.

C. Overhead installation clearances:

Above ladder rack: 12 inches (300 mm) minimum.

1. From building or ceiling structure: 12 inches (300 mm) minimum.
2. Between ladder rack and the tops of equipment racks and/or cabinets: 3 inches (75 mm).
3. Multiple ladder rack tiers: 12 inches (300 mm) minimum.
4. Above acoustical ceilings: 3 inches (75 mm).

Within each telecommunications room, bond ladder rack together, electrically continuous, and bonded to the telecommunications bonding busbar, unless otherwise noted. Bond ladder rack and turns across each splice with a UL Classified Splice Kit or other accepted method as recommended by the AHJ. Bond cable runway to the bonding busbar using an approved ground lug with a wire sized per local code, ANSI/TIA-607-C, or as recommended by the AHJ. Verify the bonds at splices and intersections between individual ladder rack sections and turns, as well as the bonding busbar.

D. On Adjustable Cable Runway, use thread-forming screws to cut through paint in order to create a bond between the Cross Member and the Stringer.

E. Cable fill tolerances:

Maximum: 6 inches (150 mm) high.

1. Over 2 inches (50 mm) or non-secured cables: Install 8 inch (200 mm) high cable retaining posts or 6 inch (150 mm) high pathway dividers.

Quantity of cables: Not to exceed a whole number value equal to 50 percent of the interior area of the ladder rack, divided by the cross-sectional area of the cable. The interior area of ladder rack will be considered to be the width of the ladder rack multiplied by a height of 2 inches (50 mm), unless cable retaining posts/pathway dividers are added to the runway. The interior area of ladder rack equipped with cable retaining posts/pathway dividers will be considered to be the width of the ladder rack multiplied by a height of 6 inch (150 mm). Actual cable fill for ladder rack that is not equipped with cable retaining posts/pathway dividers will not exceed 2 inches (50 mm) in height. Actual cable fill for ladder rack equipped with cable retaining posts/pathway dividers will not exceed 6 inch (150 mm) in height.

Weight of cables: Not to exceed the stated load capacity of the ladder rack as stated in the manufacturer's product specifications or design tables.

F. Secure cables (cable bundles) to the cross members with 3/4 inch (19 mm) wide

reusable velcro straps. Straps are not required when ladder rack is equipped with cable retaining posts/pathway dividers.

- G. Cover the exposed ends of the ladder rack that do not terminate against a wall, the floor or the ceiling with fire-retardant black colored end caps made from a rubberized material or an end closing kit consisting of a flat bar of ladder rack stringer material factory cut to the width of the ladder rack and secured to the ladder rack with a junction splice kit.
- H. Separate different cable media types within the ladder rack using pathway dividers. Treat each type of cable media separately when determining cable fill limits.
- I. Where cable exits or enters the end, middle or side of overhead ladder rack to access a rack, frame, cabinet or wall-mounted rack, cabinet or termination field, a radius drop shall be used to guide the cable.
- J. Maintain a minimum separation of 2 feet (0.6 m) between ladder rack used for communications cables and pathways for other utilities or building services.
- K. Touch-up paint color-matched to the finish on the component and will correct any minor cosmetic damage (chips, small scratches, etc.) resulting from normal handling during the installation process prior to delivery to the owner. If a component is cosmetically damaged to the extent that correction in the field is obvious against the factory finish, the component will be replaced with a new component finished from the factory. If a component is physically damaged due to mishandling or modification during the installation process, it shall not be used as part of the ladder rack system.

END OF SECTION 271123

Section Format for Division 27 13 00 Communications Backbone Cabling

Part 1 – General

1.01 Additional Information

A. Refer to the general conditions and the related sections for the following information

- 1) References
- 2) Definitions / Terms / Acronyms
- 3) Submittal Requirements
- 4) Contractor Qualifications
- 5) Manufacturer Qualifications
- 6) Bidder Qualifications
- 7) Testing Agency Qualifications
- 8) Delivery, Storage and Protection
- 9) Project conditions
- 10) Sequencing
- 11) Continuity of Service and Scheduling of Work
- 12) Protection of Work and Property
- 13) Warranty

1.02 Products Installed but not Supplied Under This Section

- A. All conduit and EMT required for Communications cabling pathway in/out of cross connect closets and in/out of wall cavities at the work area. EMT or Conduit for pathways shall have no more than two 90 degree bends and no continuous section over 100'.
- B. All core holes and poke through devices in the floor for the installation of Communications cabling.
- C. All core holes and EMT sleeves between floors for the routing of Communications cabling.
- D. Basket tray or ladder racking to support main pathway cable bundles.

1.03 Backbone Cabling Description

- A. Backbone cabling system will provide interconnections between communications equipment rooms, main terminal space, and entrance facilities in the telecommunications cabling system structure. Cabling system consists of backbone cables, intermediate and main cross-connects, mechanical terminations, and patch cords or jumpers used for backbone-to-backbone cross-connection.
- B. Backbone cabling cross-connects may be located in telecommunication rooms or at the entrance facilities.

Communications Backbone Cabling

1.04 Work Included

- A. The Work of this Section shall consist of the labor, materials and equipment required for furnishing and installing backbone cabling as part of a complete and operating telecommunications cabling system.
- B. All items specified or included in this section shall be furnished and installed by Telecommunications Contractor, wired and connected by Telecommunications Contractor and tested by Telecommunications Contractor, unless noted otherwise. "Contractor" as used herein shall mean Telecommunications Contractor or Telecommunications Contractor's sub-contractor.
- C. All items specified or included in this section shall be furnished and installed by Electrical Contractor, wired and connected by Electrical Contractor and tested by Electrical Contractor, unless noted otherwise. "Contractor" as used herein shall mean Electrical Contractor or Electrical Contractor's sub-contractor.

1.05 Submittals

- A. Submit for approval in accordance with specified submittal procedures:
- B. Components of the telecommunications system, as specified herein.

1.06 Coordination

- A. Contractor shall furnish and install the following:
 - 1) Inside plant copper backbone cables, if noted.
 - 2) Inside plant fiber optic backbone cables.
 - 3) Outside plant copper backbone cables, if noted.
 - 4) Outside plant fiber optic backbone cables
- B. Electrical Contractor shall furnish and install the following:
 - 1) Telecommunications raceways within the building.
 - 2) Telecommunications duct banks, handholes and manholes.

Part 2 – Products

2.01 Fiber Optic Cables

- A. Acceptable Manufacturer: Berk-Tek.
- B. Cable may be either of composite cable construction or standard cable containing single-mode fibers in one cable sheath and multi-mode fibers in a separate cable sheath. Contractor shall verify raceway fill requirements when furnishing and installing two standard cable constructions to meet composite strand count requirements.
- C. Fiber Cable Specification No. 3 – Outside Plant/Inside Plant, Plenum
 - 1) Cable Construction:
 - a. Tight Buffered
 - b. Dry water-blocking tape.
 - c. Epoxy glass central strength member.
 - 2) Jacket Material: Flame retardant UV stabilized , OFNP rated

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- 3) Fiber Count: As indicated on Drawings (single mode/multimode).
- 4) Fiber Type:
 - a. Single-mode: 8.2/125.
 - b. Multimode: 50/125.
- 5) Color coded 900 micron buffered fibers.
- 6) Color Code: TIA/EIA-598-A, Optical Fiber Cable Color Coding.
- 7) Jacket Color: Black
- 8) Maximum Pulling Tension:
 - a. Up to 12 strand: 1335 N (300 lb/f) during installation, 400 N (90 lb/f) installed
 - b. 18 strand and above: 2670 N (600 lb/f) during installation, 801 N (180 lb/f) installed
- 9) Storage Temperature: -40 to +70 degrees C (-40 to +158 degrees F).
- 10) Installation Temperature: 0 to +60 degrees C (+32 to +140 degrees F).
- 11) Operating Temperature: -40 to +70 degrees C (-40 to +158 degrees F).

D. Glass Transmission Media - Single Mode

- 1) Acceptable Manufacturer: Berk-Tek.
- 2) Dispersion unshifted, low water peak.
- 3) Proof tested to 100 kpsi
- 4) Cable cutoff wave length <1260 nm.
- 5) Glass Geometry:
 - a. Fibercurl: > 4.0mm radius of curvature.
 - b. Cladding Diameter: $125.0 \pm 0.7 \mu\text{m}$
 - c. Core: Clad Concentricity: $- < 0.50 \mu\text{m}$
 - d. Cladding Non Circularity: < 1.0%.
- 6) Cabled Fiber Optical Performance:
 - a. 1310 nm: $- < 0.4 \text{ dB/Km}$, maximum
 - b. 1383 nm: $\pm 3 \text{ nm} \leq 22 \text{ dB/Km}$
 - c. 1550 nm: $< 0.20 \text{ dB/Km}$, maximum
 - d. Zero Dispersion Wave Length: $1302 \leq \text{wavelength} \leq 1322$
 - e. Zero Dispersion Slope: $0.086 \text{ psi}/(\text{nm.km})$
 - f. Refractive Index Difference: 0.36%
 - g. Numerical Aperture: 0.14
 - h. In compliance with TIA/EIA 492-CAAB and Telecordia's GR-20.
 - i. Enhanced water peak at 1383 nm.

E. Glass Transmission Media – Multimode 50/125

- 1) Acceptable Manufacturer: Berk-Tek
- 2) The multimode fiber shall meet EIA/TIA-492AAAC-A, "Detail Specification for 50- μm Core Diameter/125- μm Cladding Diameter, Graded-Index, Multimode Optical Fibers."

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- 3) 100 Kpsi Proof Tested
- 4) Glass Geometry
 - a. Core Diameter: (μm) 50 ± 2.5
 - b. Core Non-Circularity: $< 5\%$
 - c. Cladding Diameter: (μm) 125.0 ± 2.0
 - d. Cladding Non-Circularity: (μm) $< 1.0\%$
 - e. Core-to-Cladding Concentricity: (μm) < 1.5
 - f. Numerical Aperture: 0.200 ± 0.015
 - g. Coating Diameter: (μm) 245 ± 5
 - h. Coating – Cladding Concentricity $< 12 \mu\text{m}$
- 5) Cabled Optical Fiber Performance
 - a. Attenuation (dB/km): 850 nm < 3.0 , 1300 nm < 1.0
 - b. Minimum LED Bandwidth: 850 nm, 1500; 1300 nm 500
 - c. Cabled Effective Modal Bandwidth: (MHz•Km): 850 nm > 2000
 - d. IEEE 802.3 GbE Distance (m): 850 nm, 1000; 1300 nm, 600
 - e. IEEE 802.3 10GbE Distance (m): 850 nm, 300

F. Fiber Optic Cable Shipping Requirements

- 1) All cabled optical fibers > 1000 meters in length shall be 100% attenuation tested. The attenuation of each fiber shall be provided with each cable reel.
- 2) Top and bottom ends of the cable shall be available for testing on the shipping reel.
- 3) Both ends of the cable shall be sealed to prevent the ingress of moisture.
- 4) Each reel shall have a weather resistant reel tag attached identifying the reel and cable. The reel tag shall include the following information:
 - a. Cable Number, Gross Weight
 - b. Shipped Cable Length in Meters, Job Order Number
 - c. Manufacturer Product Number, Customer Order Number
 - d. Date Cable was Tested, Manufacturer Order Number
 - e. Cable Length Markings, Item Number
 - i Top (inside end of cable)
 - ii Bottom (outside end of cable)
- 5) Each cable shall be accompanied by a cable data sheet. The cable data sheet shall include the following information:
 - a. Manufacturer Cable Number, Manufacturer Product Number
 - b. Manufacturer Factory Order Number, Customer Name
 - c. Customer Purchase Order Number
 - d. Mark for Information Ordered Length
 - e. Maximum Billable Length, Actual Shipped Length
 - f. Measured Attenuation of Each Fiber Bandwidth Specification (for lengths > 1000 m)

- G. The cable manufacturer shall provide installation procedures and technical support concerning the items contained in this specification.

2.02 *Fiber Optic panels*

- A. FIBER OPTIC TERMINATION ENCLOSURES and SPLICE TRAYS
- 1) For OM4 and OS2 Fiber Optic Systems:

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- 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.
- b. 1RU Opt-X Ultra rack-mount Fiber Optic Enclosure, empty, with sliding tray. Capacity: 72 fiber strands (LC), 3 fiber adapter plates and 3 splice trays, or 3 MTP modules. Part Number: Leviton 5R1UH-S03. Use at all IDF locations.
- c. 4RU Opt-X Ultra rack-mount Fiber Optic Enclosure, empty, with sliding tray. Capacity: 288 fiber strands (LC), 12 fiber adapter plates and 12 splice trays, or 12 MTP modules. Part Number: Leviton 5R4UH-S12. Use at all MDF locations. One is needed for every six zones served from the IDF.
- B. Splice Trays
 - 1) Use splice sleeves that come with splice cassettes.
- C. Splice Cassettes
 - 1) Opt-X 12-Fiber LC OM3 Splice Module. Part Number: Leviton SPLCS-12A
 - 2) Opt-X 12-Fiber LC OS2 Splice Module. Part Number: Leviton SPLCS-12L

2.03 Fiber Optic jumpers (patch cords)

- A. OM3, aqua. Factory-terminated, double-ended, 2-strand multimode cordage.
 - 1) Duplex LC-Duplex LC: Leviton 5LDLC-M03 (3 meter) for all wallmount IDF racks and enclosures. Leviton 5LDLC-M05 (5 meter) for all standing racks and enclosures.
- B. OS2, yellow. Factory-terminated, double-ended, 2-strand multimode cordage, UPC polish.
 - 1) Duplex LC- Duplex LC: Leviton UPDLC-S03 (3 meter) for all wall mount IDF racks and enclosures. Leviton UPDLC-S05 (5 meter) for all standing racks and enclosures.
- C. Provide quantify for all fiber stands to each zone. One will be required for each pair of strands at the MDF, one will be required for each pair of strands at the IDF.

Part 3 – Execution

3.01 Additional Information

- A. Refer to Section 27 00 00 for the following Part 3 - Execution information
 - 1) General
 - 2) Cable Pathways
 - 3) Work Area Outlets
 - 4) Installation Practices
 - 5) Labeling
 - 6) Firestopping
 - 7) Sealing of Penetrations and Openings
 - 8) Cable Supports
 - 9) Cable Protection
 - 10) Grounding
 - 11) Documentation
 - 12) Training
 - 13) Cleaning
 - 14) Project Closeout

3.02 Installation

- A. General

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- 1) All cable and associated hardware shall be placed so as to make efficient use of available space in coordination with other uses. All cable and associated hardware shall be placed so as to not impair the use or capacity of other building systems, equipment, or hardware placed by others (or existing).
- 2) Where cable is placed in ceiling areas or other non-exposed areas, cables shall be installed in cable trays or in non-continuous cable support system. Non-continuous cable supports shall be placed at random intervals no greater than 48 inches. Cables in non-continuous support systems shall be bundled using hook and loop type fasteners. Cable sag between supports shall not exceed 3 inches. Attaching wire to pipes or other mechanical items is not permitted. Cables shall not be bundled or tied in conduits, and in cable trays above ceilings.
- 3) All cabling shall be routed so as to avoid interference with any other service or system, operation, or maintenance purposes such as access boxes, network equipment, mechanical equipment access doors and covers, switches or electrical panels, and lighting fixtures. Avoid crossing areas horizontally just above or below any riser conduit. Lay and dress cables to allow other cables to enter the conduit/riser at a later time by maintaining a working distance from these openings. All cable shall be installed to allow for simple installation and removal of cables in the future.
- 4) Unless noted, all interior wiring shall be installed in raceways, Raceway Specification No. 2, one inch minimum. Wiring above accessible ceilings may be installed in cable tray and exposed on "J" hooks.
- 5) All cables not in raceways shall be riser or plenum rated.
- 6) All cables running outside the building shall be rated for outside plant installation.
- 7) Backbone cables shall be grouped separately from horizontal distribution cables. Cable for other systems shall be grouped separately from cables for telephone and data.
- 8) All inside cable shall be installed neatly above accessible ceilings using cable tray and "J" hooks supported from building structure. Do not attach to pipes, conduits, ducts, etc. Do not allow cable to rest on pipes, conduits, ducts, ceiling tiles, etc. Do not attach to wires used for supporting suspended ceilings. Do not use tie wires or bridle rings.
- 9) All wires shall be marked at all junction boxes, pull boxes, cabinets, boxes and terminations. Each cable run between terminating locations shall be one continuous cable (no splices or connections).
- 10) The Contractor shall install cable in such a manner as to prevent stretching, kinking or sharp bends. Cable damaged during installation or not passing required testing shall be removed and replaced at no additional cost to Owner.
- 11) The Contractor shall replace or rework cables showing evidence of improper handling including stretches, kinks, short radius bends, over tightened bindings, loosely twisted and over twisted pairs at terminations, and too much jacket removed.
- 12) Minimum bend radius and maximum pulling tension for all cables shall be maintained during and after installation. Install cable in accordance with manufacturer's ratings and instructions.
- 13) Cables shall not be installed near power sources or other items where interference could develop. Cables shall not be placed within 18 inches of light fixtures and within 3 feet of motors, transformers, copy machines, or solid state motor starters unless cable

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is installed in conduit. Contractor shall furnish and install a grounding conduit system where these minimum clearances cannot be maintained.

- 14) In telecommunications spaces, cables shall be routed as close as possible to the ceiling, floor, or corners to insure that adequate wall or backboard space is available for current and future equipment and for cable terminations. Cables shall not be tie-wrapped to existing electrical conduit or other equipment. Minimum bend radius shall be observed.
- 15) Dress and attach cables to the backboard along the shortest possible route run square (horizontal and vertical) to the backboard. Bundle similarly routed cables together and attach by means of clamps or distribution rings. Cable dress and attachment shall minimize obstruction to future installations of equipment, backboard, or other cables.
- 16) Cables shall be neatly bundled with hook and loop type fasteners. Nylon tire wraps are not acceptable. Cables must be neatly bundled in the telecommunications spaces and at the cable service loop.
- 17) Cable service loops shall be provided at both ends of backbone cable runs.
 - a. At the telecommunications room, provide a minimum 8 foot service loop stored in a figure eight pattern in the cable tray above the racks/cabinets.
 - b. At the telecommunications room, provide sufficient slack to properly dress and terminate cables at the racks and cabinets.
 - i. Provide sufficient slack so that swing gate type racks and cabinets can open fully
 - ii. Provide sufficient slack so that cables do not catch or bind at swing gate type rack or cabinet hinge and the cables do not pull taught across the hinge or edge.
 - c. A minimum 25 foot service loop shall be maintained at each building entrance and exit.
- 18) All interior fiber optic cables shall be installed in plenum rated innerduct above accessible ceilings.
 - a. Innerduct shall be installed to within 12 inches of termination enclosure.
 - b. Install pull boxes, 12" x 12" minimum, as required to limit cable pulls to two 90 degree bends or 150 feet.
 - c. Innerduct shall not be kinked or tightly bent in any way.
- 19) All exterior fiber optic cables shall be installed in innerduct.
- 20) A break-away link shall be used for installation of cables with a cable-puller or winch. The break-away link shall be designed to separate at or below the recommended maximum tension of the cable being installed.
- 21) Any damage to Owner's existing cabling or existing cable owned by others, caused as a result of work performed under this scope, shall be brought to the Owner's attention and repaired or replaced within 48 hours.
- 22) Contractor shall use only cable lubricants recommended by the manufacturer for use with the specific cable construction.
- 23) Should a cable become kinked, skinned or stretched during installation, the cable shall be removed and replaced at no additional cost to the Owner. Splicing at points other than those specified will not be acceptable.

B. Outside Plant Cable

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- 1) Cable service loops shall be included in each manhole to allow for proper cable dressing, splicing the cable outside the manhole in a controlled space and for repairing damaged cable.
- 2) Cable service loops shall be provided as indicated herein, and as otherwise indicated elsewhere in the contract documents and on the Drawings.
- 3) Install sufficient cable slack to remove cable from the manhole for splicing in a splice van or tent.
- 4) In addition to the cable slack required for proper termination/splicing in a splice enclosure, the Contractor shall install sufficient cable slack to form at least one loop of cable along the inner perimeter of the manhole.
- 5) Where no cable splice is planned for a manhole, the contractor shall leave sufficient slack to form at least two loops of cable along the inner perimeter of the manhole.
- 6) Cable service loop lengths shall be adjusted based on manhole size, manhole depth and existing conditions.
- 7) Cables slack shall be securely fastened to all four walls of the manhole. Furnish and install bracket arms for securing and mounting of all cables where built-in racking exists.
- 8) If racking is not furnished in a manhole, furnish and install a cable sling of weather, water, oil and solvent resistant material to support the cable(s) on those walls without built in racking.
- 9) Cable splice enclosures shall be security fastened to mounting arm brackets attached to manhole racking. Furnish and install racking and mounting arm brackets to support splice cases. Cable splice enclosures shall be attached to at least two racks in the manhole.
- 10) All cables shall be secured to bracket arms using cable ties and straps resistant to weather, water, oil, fuel and solvents. Plastic or stainless steel ties/straps rated for this application shall be acceptable for use.
- 11) All cable dressing in manholes shall be performed so that the minimum bend radius of cables is not exceeded.
- 12) All cable splice enclosures shall be mounted either on the long wall of the manhole or on the wall parallel with the main cable run entry and exit conduits.
- 13) Wherever possible in existing manholes, and as a standard for manholes furnished and installed under this or an associated project, optical cable splice enclosures shall be mounted on one long wall (or parallel wall as previously defined) and copper cable splice enclosures, if needed, shall be mounted on the opposite wall.
- 14) Wherever possible, large pair count copper cable enclosures shall be mounted at the vertical mid-line of the manhole and fiber cable splice enclosures shall be mounted at or above the vertical mid-line.
- 15) All cables shall be spliced in splice enclosures as specified herein.
 - a. Furnish and install the maximum slack in each enclosure as recommended by the cable, splice system and enclosure manufacturer.

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- b. Furnish and install all splice trays, splice holders, splice tray holders, mounting brackets, frames, grounding and other ancillary hardware and materials as required by the cable manufacturer, splice system manufacturer, splice enclosure manufacturer and standard industry practices.
 - c. Only technicians trained in the proper assembly of enclosures, splices and splicing procedures shall be permitted to splice cables.
- B. 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.
 - c. Carefully monitor pulling tension so as not to exceed limits specified by manufacturer.

3.03 Fiber Optic Cable Testing

- A. Fiber Optic Cable Test Equipment:
 - 1) Cable tester will be NRTL certified for TIA/EIA TSB95.
 - 2) Cable testers will be Optical Power Meter and High Resolution Optical Time Domain Reflectometer (OTDR). The cable tester will be NRTL certified for compliance to latest TIA/EIA Standard 568B performance requirements at 850, 1300 and 1550 nm.
 - 3) Testers will have been calibrated at least one year prior to use on this project. Contractor to provide proof to Owner if requested.
 - 4) Submit software copy of test results, in original tester software format, to the Owner and to the Manufacturer (either Berk-Tek or Leviton).
- B. Cable segments and links will be tested from both ends of the cable for each of the construction phases. (Verify that cable labeling matches at both ends).
- C. The system will not be considered certified until the tester has acknowledged that the performance of the physical layer of the system has been fully tested and is operational at the completion of the installation phase.
- D. Testing Procedures:
 - 1) Perform each visual and mechanical inspection and electrical test, including optional procedures, stated in NETA ATS, Section 7.25. Certify compliance with test parameters and manufacturer's written recommendations. Test optical performance with optical power meter capable of generating light at all appropriate wavelengths.
 - 2) Prior to testing, all connectors will be properly cleaned with an approved product manufactured specifically for this purpose.
 - 3) Prior to beginning testing, confirm that all testing equipment is fully charged or operating on building power. If the test equipment power levels drop below 50%, recharge unit or continue testing with a different (fully charged) tester.
 - 4) Initially test optical cable with a light source and power meter utilizing procedures as stated in TIA TSB-140, ANSI/TIA/EIA-526-7, ANSI/TIA/EIA-526-14A, OFSTP-14A Optical Power Loss Measurements of Installed Multi-mode Fiber Cable Plant and ANSI/TIA/EIA-526-7 Measurement of Optical Power Loss in installed Single-Mode Fiber cable plant.

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- 5) Measured results will be plus/minus 1 dB of submitted loss budget calculations. If loss figures are outside this range, test cable with Optical Time Domain Reflectometer (OTDR) to determine cause of variation. Correct improper splices and replace damaged cables at no charge to the Owner.

E. Multi-Mode Fiber Optic Cables:

- 1) Will be tested bi-directionally for length and attenuation at both the short and long wavelengths for Multi-Mode (850 and 1300 nm). This is Tier 1 testing as specified in TIA TSB-140. Test all Multi-Mode strands to ensure they are capable of transmitting 10 Gigabit Ethernet speeds.
- 2) The maximum insertion loss measured at 23 degrees C. will be 3.75dB/km @ 850 nm and 1.5 dB/km @ 1300 nm.

F. Single-Mode Fiber Optic Cables:

- 1) Will be tested bi-directionally for length and attenuation at both the short and long wavelengths for Single-Mode fiber (1310 and 1550 nm). This Tier 1 testing as specified in TIA TSB-140.
- 2) Single-mode fibers will be dual wave length and provide attenuated wavelength of the 1310 nm and 1550 nm. 850 nm for single-mode fiber will not be acceptable under any circumstances.

G. All cables will be tested after termination using a cable certification tester that contains the test equipment manufacturer's most current version of firmware.

H. Test all fiber optic cable segments end-to-end from the fiber optic backbone patch panel in the Equipment Room to each fiber optic backbone patch panel in each Telecommunications Room.

I. Broken or faulty strands will not be accepted. Any cable not fully functional with all strands usable will be replaced at no cost to the Owner.

J. Upon completion of testing, all connectors will be capped with a product made for that specific function by the connecting hardware manufacturer to prevent the contamination of the fiber from construction debris or other foreign objects.

K. Test Results:

- 1) The test results information for each link will be recorded in the memory of the field tester upon completion of the test. The tester will be capable of storing test data in either internal or external memory. The external media used will be left to the discretion of the user.
- 2) Test results saved by the tester will be transferred into a Windows based database utility that allows for maintenance, inspection and archiving of these test records. A guarantee must be made that the measurement results are transferred to the PC unaltered as well as any printed reports generated from the software application.
- 3) The test results information for each link will be recorded in the memory of the field tester upon completion of the test. The tester will be capable of storing test data in either internal or external memory. The external media used will be left to the discretion of the user.

Communications Backbone Cabling

- 4) Test results saved by the tester will be transferred into a Windows based database utility that allows for maintenance, inspection and archiving of these test records. A guarantee must be made that the measurement results are transferred to the PC unaltered as well as any printed reports generated from the software application.
 - 5) Optional formats of data reporting are: comma separated variable (.csv), Portable Document File (.pdf) or compatible, plain text (.txt), or hypertext markup language (.html/.htm). Test results will be turned over to owner's representative prior to cutover.
 - 6) Test results will include the following:
 - a. Telecommunications Room number
 - b. Location of fiber pull i.e. (Equipment Room # to Telecom Room #)
 - c. Patch panel # and location
 - d. Connector type
 - e. Distance
 - f. Wavelength tested
 - g. Technician who performed the testing
- L. The Owner and Engineer reserve the right to observe testing and/or randomly sample completed links for conformance to project specifications.

End of Section

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-568.0-D – Generic Communications Cabling for Customer Premises.
- B. ANSI/TIA-568.1-D – Commercial Building Communications Cabling Standard Part 1: General Requirements.
- C. ANSI/TIA 568-C.2 – Balanced Twisted-Pair Telecommunications Cabling and Components Standards
- D.
- E. ANSI/TIA-569-D – Commercial Building Standard for Telecommunications Pathways and Spaces.
- F. ANSI/TIA-606-B – Administration Standard for the Commercial Telecommunications Infrastructure.
- G. ANSI/JSTD-607-C – Commercial Building Bonding and Grounding (Earthing) Requirements for Telecommunications.
- H. NFPA 70 – National Electrical Code (NEC).

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

1.4 PRE-INSTALLATION MEETINGS

- A. Convene pre-installation meeting 4 weeks before start of installation of communications horizontal cabling. Should occur with construction manager, owner representatives, and contractor project manager and project foreman.
- B. 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 Class D, Class E, and/or Class Ea.
 - 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 or to Berk-Tek, in the certification tester's original software files. A copy of test results must be submitted to the district.
 - 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: Combination of the following types of cables from TR to TO:
 - 1. Category 6A, cables from TRs to Wireless access point TOs
 - 2. Category 6, (100-Ohm, 4-pair, unshielded twisted pair) cables from TRs to remaining TOs.
- C. Communications Horizontal Cabling System: Includes cables, jacks, patch panels, connecting blocks, patch cords, 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.
- 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: **CX6650 Cat 6A Enhanced UTP System**
 - 1. 100 ohm, Category 6A, 23 AWG, 4-pair unshielded twisted pair, LANmark-10G2, CMP rated.
 - a. Color: Blue.
 - b. Part Numbers: Reel: 10130484 Reel in Box: 11085339
 - c. Electrical Characteristics: Characterized to 750 MHz.
 - d. Cable: Third-party verified by ETL.
 - e. Maximum Cable Diameter: 0.300 inch.
 - f. Berk-Tek LANmark-10G2 CMP
 - 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.
 - 2. Channel margin guarantees for a **CX6650 Cat 6A Enhanced UTP System** (margin vs. ANSI/TIA-568-C.2 and margin guarantees are for a 4-conductor channel).
 - a. Insertion Loss 3 %
 - b. NEXT 4 dB
 - c. PSNEXT 5 dB
 - d. ACR-F (ELFEXT) 7 dB
 - e. PSACR-F (PSELFEXT) 8 dB
 - f. Return Loss 3 dB
 - g. ACR-N 6 dB
 - h. PSACR-N 7 dB
 - i. PSANEXT 1 dB
 - j. PSAACR-F 1 dB

B. Category 6 Unshielded Twisted Pair: **CX6200 Cat 6 Premium UTP System.**

1. 100 ohm, Category 6, 23 AWG, 4-pair unshielded twisted pair, LANmark 2000, CMP rated.
 - a. Color: Blue. O.D. 0.220"
 - b. Part Number: 10163222 (reel) 10063780 (reel-in-a-box).
 - c. Electrical Characteristics: Characterized to 600 MHz.
 - d. Each Pair in Cable: Insulated with FEP.
 - e. Cable: Third-party verified by ETL.
 - f. Berk-Tek LANmark-2000 CMP
 - 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
2. Channel margin guarantees for a **CX6200 Cat 6 Premium UTP System** (margin vs. ANSI/TIA-568-C.2 and margin guarantees are for a 4-conductor channel).
 - a. Insertion Loss 5 %
 - b. NEXT 8 dB
 - c. PSNEXT 8 dB
 - d. ACR-F (ELFEXT) 9 dB
 - e. PSACR-F (PSELFEXT) 10 dB
 - f. Return Loss 5 dB
 - g. ACR-N 9 dB
 - h. PSACR-N 10 dB

2.4 MODULAR JACKS AND FIBER ADAPTERS FOR WORKSTATION OUTLETS

A. Category 6A Modular Jacks: **CX6650 Cat 6A Enhanced 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 5e, 6 and 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 line 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 with 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.
22. Color: blue.
23. Part Numbers: Standard version: 6AUJK-RL6 (blue).

B. Category 6 Modular Jacks: **CX6200 Cat 6 Premium UTP System**

1. 8-position eXtreme QuickPort modular jack, Category 6, IDC terminals, T568A/B wiring scheme.
2. Component-rated jack.
3. Each Jack: Identified on its face as CAT 6.
4. Color: blue.
5. Part Number: Leviton 61110-RL6 (blue).

2.5 WORK AREA OUTLETS

A. Flush-Mounted Plastic Faceplates:

1. 1-port single-gang plastic wallplate with ID windows.
 - a. Colors: white
 - b. Part Number: Leviton 42080-1WS (white).
2. 2-port single-gang plastic wallplate with ID windows.
 - a. Colors: white
 - b. Part Number: Leviton 42080-2WS (white).
3. 3-port single-gang plastic wallplate with ID windows.
 - a. Colors: white
 - b. Part Number: Leviton 42080-3WS (white).
4. 4-port single-gang plastic wallplate with ID windows.

- a. Colors: white
 - b. Part Number: Leviton 42080-4WS (white).
5. 6-port single-gang plastic wallplate with ID windows.
 - a. Colors: white
 - b. Part Number: Leviton 42080-6WS (white).
6. 1-port dual-gang plastic wallplate with ID windows.
 - a. Colors: white
 - b. Part Number: Leviton 42080-1WP (white).
7. 2-port dual-gang plastic wallplate with ID windows.
 - a. Colors: white
 - b. Part Number: Leviton 42080-2WP (white).
8. 3-port dual-gang plastic wallplate with ID windows.
 - a. Colors: white
 - b. Part Number: Leviton 42080-3WP (white).
9. 4-port dual-gang plastic wallplate with ID windows.
 - a. Colors: white
 - b. Part Number: Leviton 42080-4WP (white).
10. 6-port dual-gang plastic wallplate with ID windows.
 - a. Colors: white
 - b. Part Number: Leviton 42080-6WP (white).
11. 8-port dual-gang plastic wallplate with ID windows.
 - a. Colors: white
 - b. Part Number: Leviton 42080-8WP (white).
12. 12-port dual-gang plastic wallplate with ID windows.
 - a. Colors: white
 - b. Part Number: Leviton 42080-12W (white).

B. Flush-Mounted Stainless Steel Faceplates: Scope to identify if Stainless is needed in a particular location.

1. 1-port QuickPort faceplate with mounting lugs for wall phone, stainless steel, mounts onto single-gang wall box.
 - a. Part Number: Leviton 4108W-0SP (flush plate) or 4108W-1SP(jack area recessed).
2. 1-port QuickPort single-gang stainless steel wallplate, with ID windows
 - a. Part Number: Leviton 43080-1L1.
3. 2-port QuickPort single-gang stainless steel wallplate, with ID windows
 - a. Part Number: Leviton 43080-1L2.
4. 3-port QuickPort single-gang stainless steel wallplate, with ID windows
 - a. Part Number: Leviton 43080-1L3.
5. 4-port QuickPort single-gang stainless steel wallplate, with ID windows
 - a. Part Number: Leviton 43080-1L4.
6. 6-port QuickPort single-gang stainless steel wallplate, with ID windows
 - a. Part Number: Leviton 43080-1L6.
7. 2-port QuickPort dual-gang stainless steel wallplate, with ID windows
 - a. Part Number: Leviton 43080-2L2.
8. 4-port QuickPort dual-gang stainless steel wallplate, with ID windows
 - a. Part Number: Leviton 43080-2L4.
9. 6-port QuickPort dual-gang stainless steel wallplate, with ID windows
 - a. Part Number: Leviton 43080-2L6.
10. 8-port QuickPort dual-gang stainless steel wallplate, with ID windows
 - a. Part Number: Leviton 43080-2L8.
11. 12-port QuickPort dual-gang stainless steel wallplate, with ID windows

- a. Part Number: Leviton 43080-L12.

C. Surface-Mounted Outlet Boxes:

- 1. 1-port QuickPort surface-mount box, plastic, with ID window.
 - a. Color: white
 - b. Part Number: Leviton 41089-1WP (white).
- 2. 2-port QuickPort surface-mount box, plastic, with ID window.
 - a. Color: white
 - b. Part Number: Leviton 41089-2WP (white).
- 3. 4-port QuickPort surface-mount box, plastic, with ID window.
 - a. Color: white
 - b. Part Number: Leviton 41089-4WP (white).
- 4. 6-port QuickPort surface-mount box, plastic, with ID window.
 - a. Color: white
 - b. Part Number: Leviton 41089-6WP (white).
- 5. 12-port QuickPort surface-mount box, plastic, with ID window.
 - a. Color: white
 - b. Part Number: Leviton 41089-12W (white)
- 6. 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)
 - c. This is the box to be used above the ceiling grid for WiFi jacks.
- 7. 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)
- 8. Surface Box Colors: part numbers shown are for white. Also available: Ivory, Grey, and Black. Coordinate with Architect to match finish.

D. 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.
- E. Mounting Frames for QuickPort Jacks and Connectors | Not used in this project.
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.

2.6 TERMINATION BLOCKS

- A. Termination Blocks: May be used for Consolidation Point terminations, or for termination of multi-pair copper (analog voice) backbone cabling.
- B. Category 6, 110-Style Blocks: **CX6200 Cat 6 Premium UTP System**,
1. Category 6, 288 pair, 110-style, with mounting legs, wall mount.
 - a. Part Number: Leviton 41AB6-3F4.
 2. Category 6, 96 pair, 110-style, with mounting legs, wall mount.
 - a. Part Number: Leviton 41AB6-1F4.
 3. Category 6, 288 pair, 110-style, rack mount.
 - a. Part Number: Leviton 41DR6-3F4.
 4. Category 6, 96 pair, 110-style, rack mount.
 - a. Part Number: Leviton 41DR6-1F4.

2.7 PATCH PANELS

- A. QuickPort-Style Patch Panels: **CX6650 Cat 6A Enhanced UTP System, CX6200 Cat 6 Premium UTP System**
 - 1. 24-port, 1RU, QuickPort, flat metal, patch panel, empty.
 - a. Part Number: Leviton 49255-H24.
 - 2. 48-port, 1RU, QuickPort, flat metal, patch panel, empty.
 - a. Part Number: Leviton 49255-H48.
 - 3. Contractor shall provide 48 port patch panels for terminations, unless otherwise specifically noted in writing.

2.8 PATCH CORDS/JUMPERS

- A. Jurupa Unified School District has a standardized color scheme for all patch and station cords.
 - 1. Blue(L)-Computer/VoIP phone
 - 2. Yellow(Y)-WiFi
 - 3. Red(R)-Security/Access Control
 - 4. Green(G)-Energy Management/Building Management/Facility systems
- B. High-Flex Category 6A Modular Patch Cords: **CX6650 Cat 6A Enhanced 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 H6A10-1Y (1 foot, Yellow). Patch
 - 2) Leviton H6A10-10Y (3 feet, Yellow). Station/Device
- C. eXtreme Category 6 Modular Patch Cords: **CX6200 Cat 6 Premium UTP System,**
 - 1. Slim-Line style, Category 6 UTP patch cord, 4-pair, stranded wire construction.
 - a. Color: 7 colors available.
 - b. Part Numbers:
 - 1) Leviton 6D460-01L (1 foot, Blue). Patch

PART 3 EXECUTION

3.1 EXAMINATION

- A. Examine areas to receive communications horizontal cabling.
- B. Notify Construction manager of conditions that would adversely affect installation or subsequent use.
- C. Do not begin installation until unacceptable conditions are corrected.

3.2 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 Patch Cords and Jumpers: Not allowed.
- C. Copper Patch Cords: Manufactured by Leviton Network Solutions.
- 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. Cable Ties and Other Cable Management Clamps:
 - 1. No more than hand tightened.
 - 2. Fit snugly, but not compress, crimp, or otherwise change physical characteristics of cable jacket or distort placement of twisted-pair components.
 - 3. Replace cables exhibiting stresses due to over tightening of cable management devices.
 - 4. Use plenum-rated cable ties in plenum spaces.
 - 5. Velcro wraps are to be used for cable bundle management. Plenum-rated Velcro wraps are available from Leviton. Nylon cable ties should not be used during installation or for finishing.
- K. Where possible, route cables in overhead cable trays and inside wire management systems attached to equipment cabinets and racks.
 - 1. Use Velcro or ducts 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. Any supports needed above the ceiling shall be independent of the ceiling grid system.
- 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.

3.3 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. These locations must be approved in writing, or specified explicitly in construction documents.
- 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.

3.4 INSTALLATION – UNSHIELDED TWISTED-PAIR TERMINATION

- 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 TDDMM, and manufacturer's instructions.
- C. Terminate 4-pair cables on jack and patch panels using T568-B or T568-A wiring scheme.
- D. Pair Untwist at Termination: Do not exceed 12 mm (1/2 inch).
- E. 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.
- F. Maintain cable jacket to within 25 mm (1 inch) of termination point.
- G. 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.

3.5 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 Berk-Tek and Leviton Network Solutions instructions
 - 1. If any of these are in conflict, bring discrepancies to the attention of the Construction manager 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 required.**

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. Provide test results in approved certification testers original software format on CD, with the following minimum information per cable:
 - a. Circuit ID. Final circuit ID as identified by labeling and as-builts.
 - 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.
7. An occasional asterisk-Pass (*Pass) will be accepted by Leviton or Berk-Tek 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.
8. 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 (either Berk-Tek or Leviton).
9. Submit fully functional version of tester software for use by the Owner in reviewing test results.
10. 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).

3.6 LABELING

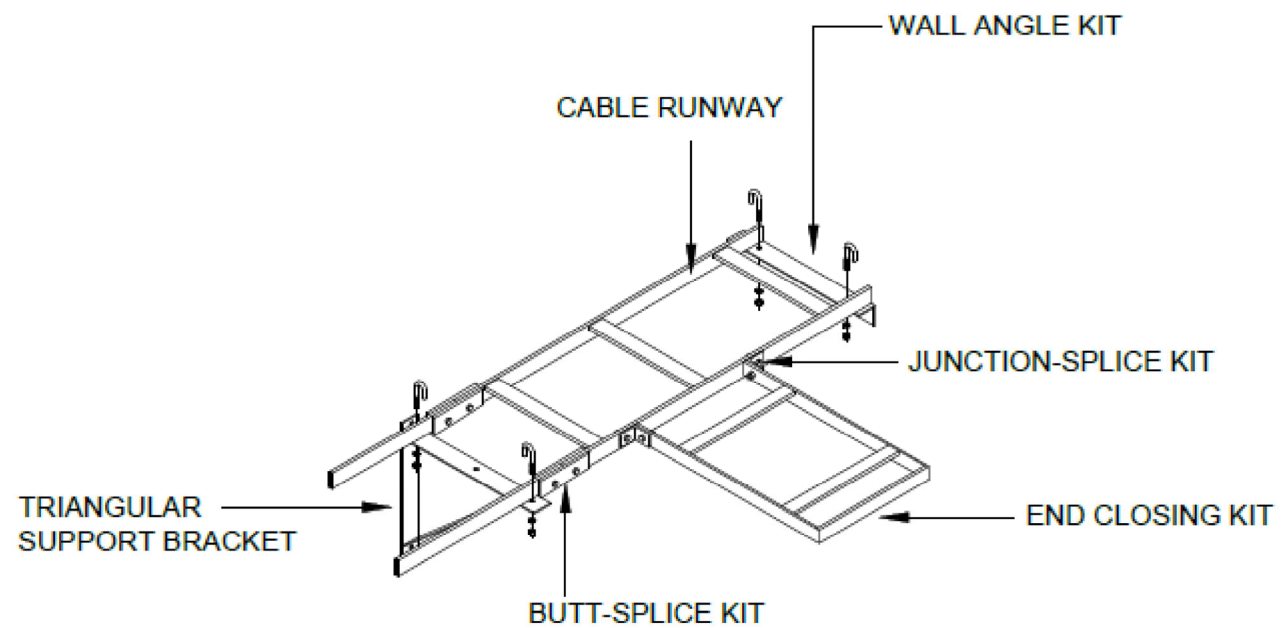
- A. All labeling is to be in accordance with ANSI/TIA-606-B and manufacturer's instructions.

- B. Label horizontal cables using machine-printed label at each end of cable at approximately 12 inches from termination point.
 - 1. Sharpie and 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. 2-A43 for telecommunications zone 2, patch panel A, cable number 43. The MDF is zone 1, IDF 2 is zone 2.
 - 1. Owner may provide specific labeling requirements. Coordinate with the Owner.
- E. Note labeling information on shop drawings, redlines, and final as-builts.

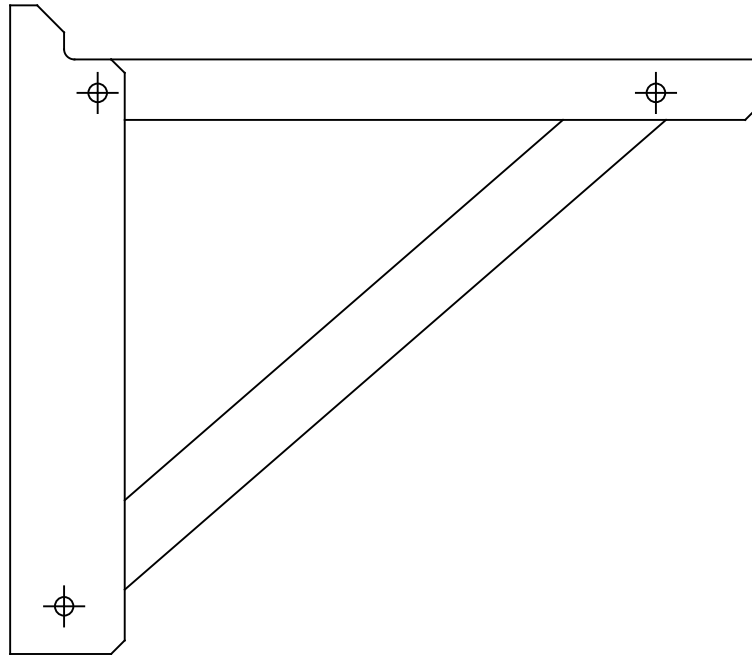
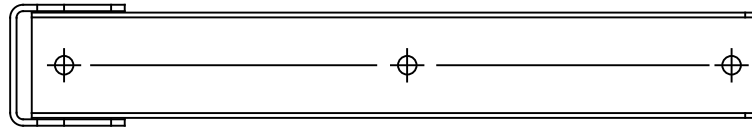
3.7 PROTECTION

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

END OF SECTION



CONTACTOR TO PROVIDE AND INSTALL CABLE RUNWAY AS ILLUSTRATED IN FLOOR PLAN.



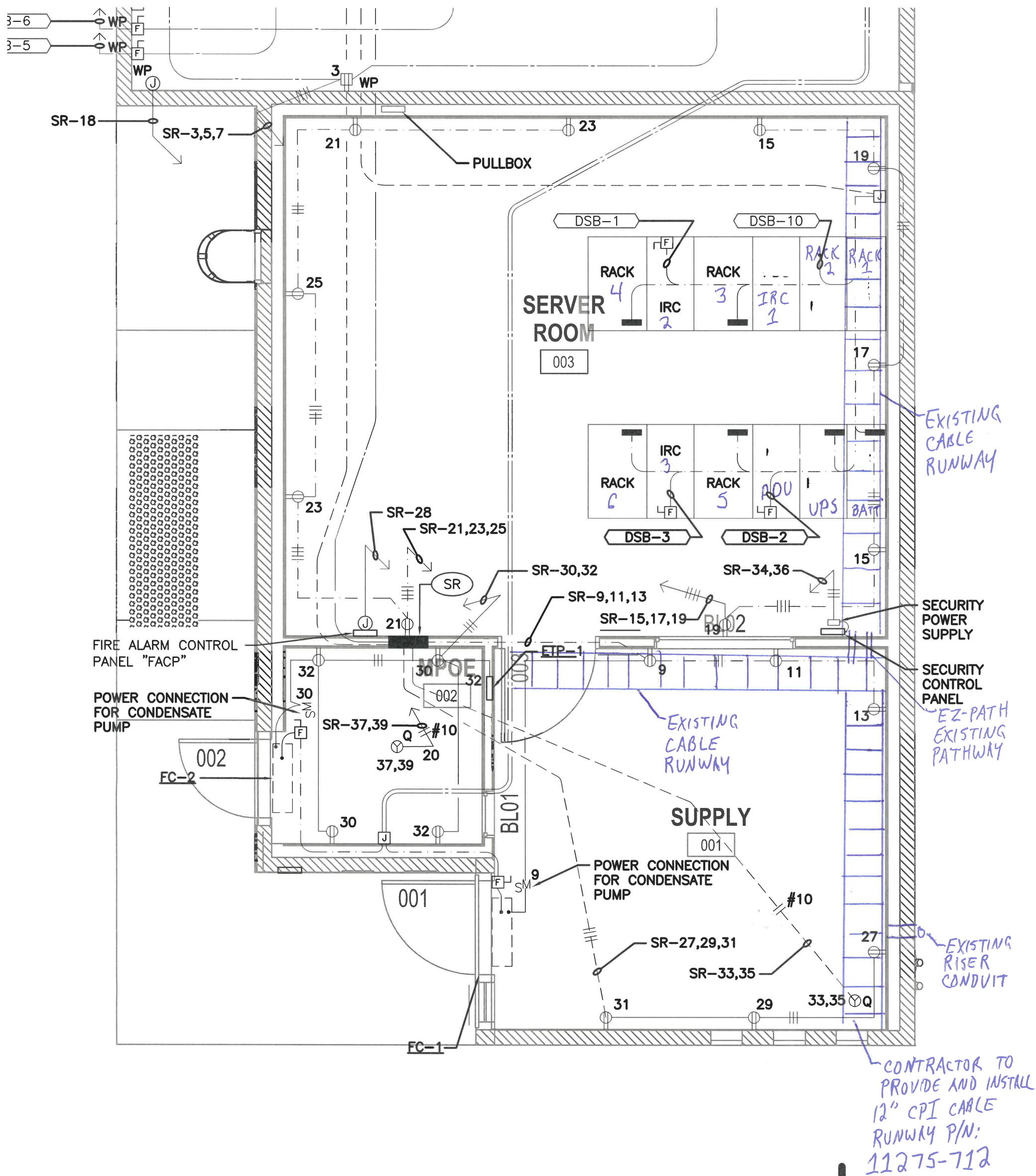
11746-X12

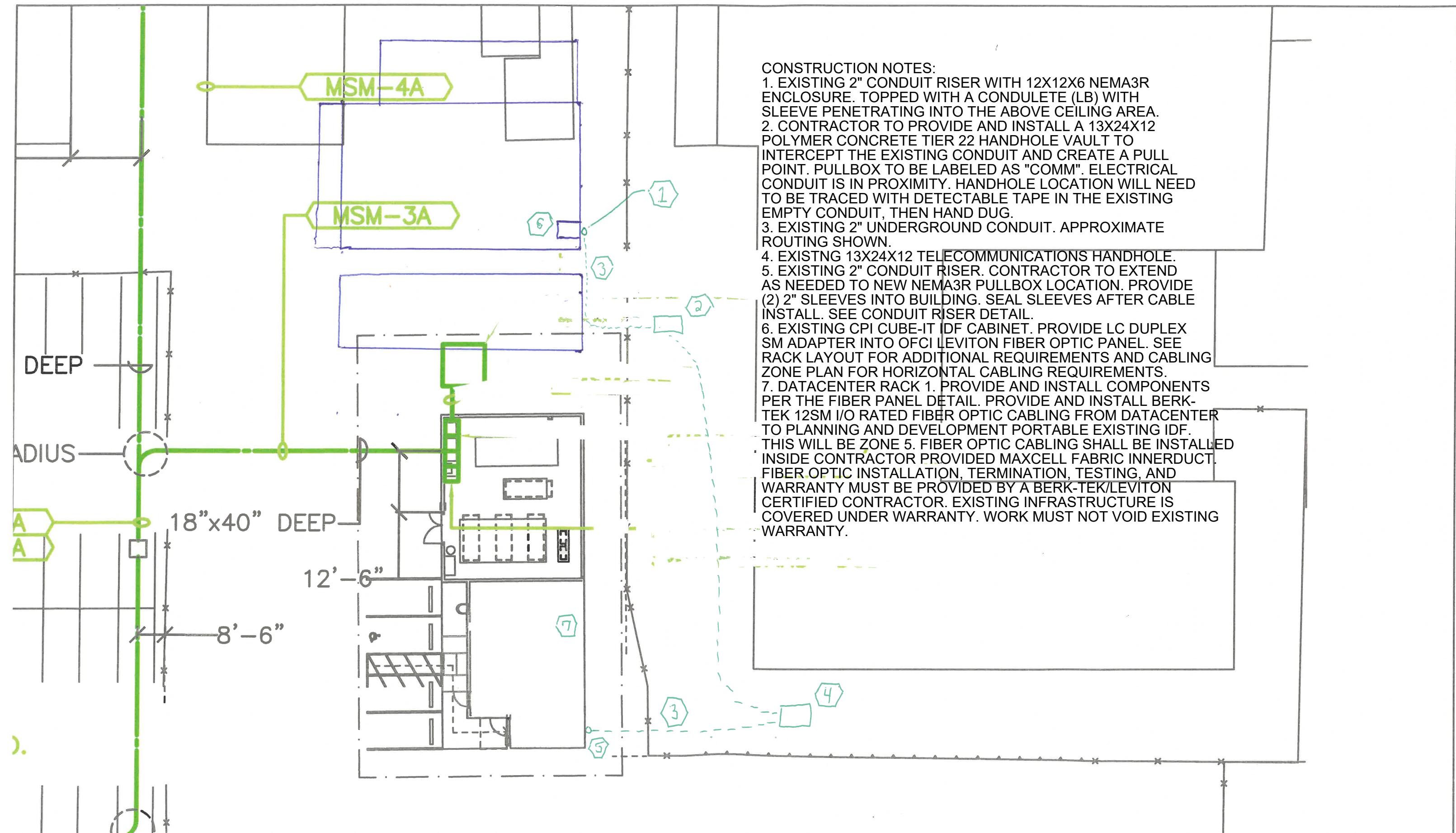
CONTRACTOR TO
PROVIDE AND
INSTALL STEEL
TRIANGULAR
SUPPORT BRACKET
P/N: 11746-712 AT
48" INTERVALS
UNDER NEW CABLE
RUNWAY IN
DATACENTER OFFICE
AREA.

DataCenter Rack 1

Rack layout	
42	////////
41	Fiber Optic Panel
40	A Patch Panel
39	
38	Wifi Patch Panel
37	Neat-Patch
36	
35	Cisco C3560
34	Fiber Optic Panel
33	
32	
31	
30	Neat-Patch
29	
28	////////
27	////////
26	////////
25	////////
24	C93180YC-FX3S
23	C93180YC-FX3S
22	CK Server
21	CK Server
20	Aruba WLC
19	Aruba WLC
18	Cisco ISR
17	////////
16	////////
15	Server
14	Firepower 4120
13	Firepower 4120
12	Server

11	////////
10	////////
9	////////
8	////////
7	Ø9500-40X
6	////////
5	////////
4	////////
3	////////
2	////////
1	////////



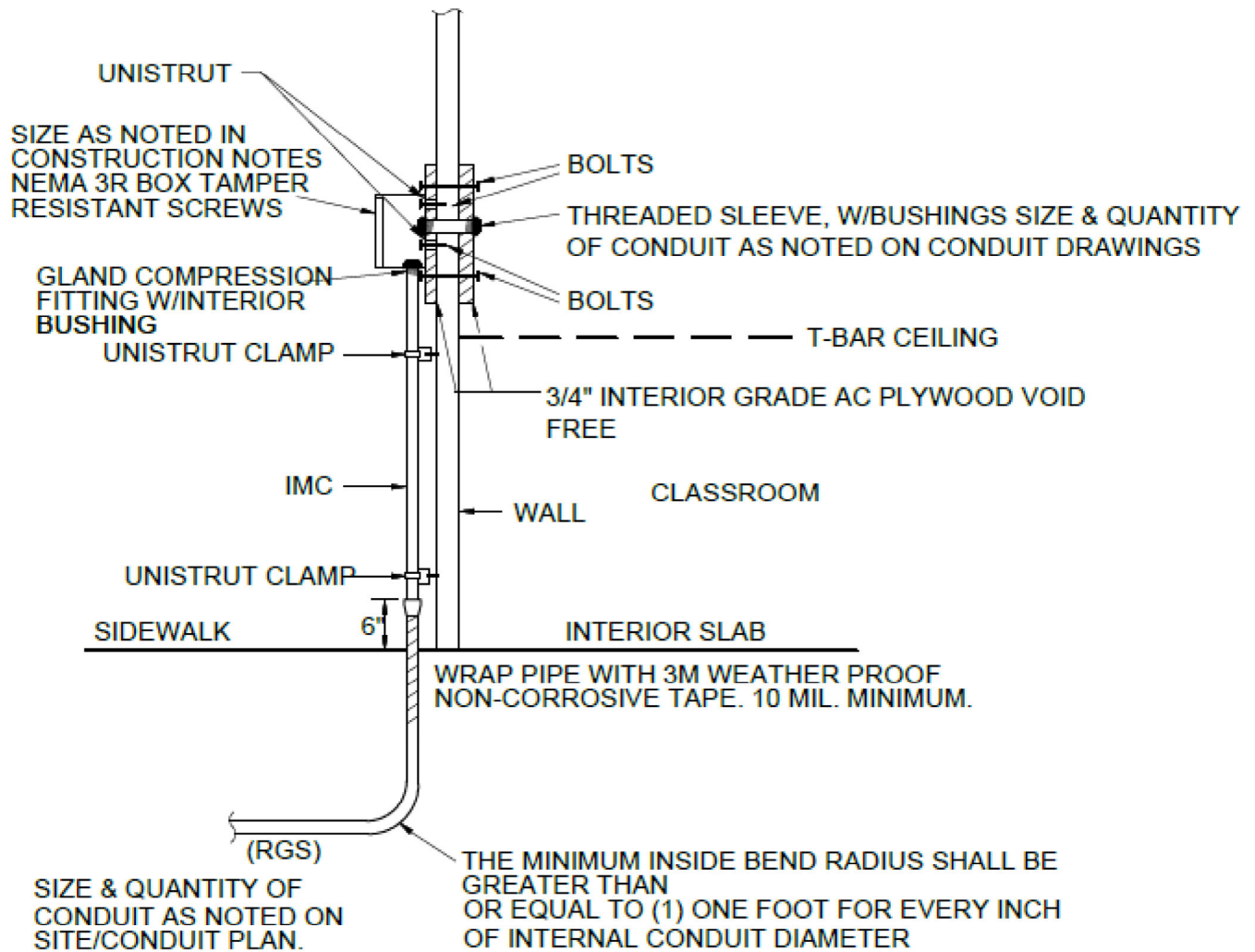


CONSTRUCTION NOTES:

1. EXISTING 2" CONDUIT RISER WITH 12X12X6 NEMA3R ENCLOSURE. TOPPED WITH A CONDULETE (LB) WITH SLEEVE PENETRATING INTO THE ABOVE CEILING AREA.
2. CONTRACTOR TO PROVIDE AND INSTALL A 13X24X12 POLYMER CONCRETE TIER 22 HANDHOLE VAULT TO INTERCEPT THE EXISTING CONDUIT AND CREATE A PULL POINT. PULLBOX TO BE LABELED AS "COMM". ELECTRICAL CONDUIT IS IN PROXIMITY. HANDHOLE LOCATION WILL NEED TO BE TRACED WITH DETECTABLE TAPE IN THE EXISTING EMPTY CONDUIT, THEN HAND DUG.
3. EXISTING 2" UNDERGROUND CONDUIT. APPROXIMATE ROUTING SHOWN.
4. EXISTING 13X24X12 TELECOMMUNICATIONS HANDHOLE.
5. EXISTING 2" CONDUIT RISER. CONTRACTOR TO EXTEND AS NEEDED TO NEW NEMA3R PULLBOX LOCATION. PROVIDE (2) 2" SLEEVES INTO BUILDING. SEAL SLEEVES AFTER CABLE INSTALL. SEE CONDUIT RISER DETAIL.
6. EXISTING CPI CUBE-IT IDF CABINET. PROVIDE LC DUPLEX SM ADAPTER INTO OFCI LEVITON FIBER OPTIC PANEL. SEE RACK LAYOUT FOR ADDITIONAL REQUIREMENTS AND CABLING ZONE PLAN FOR HORIZONTAL CABLING REQUIREMENTS.
7. DATACENTER RACK 1. PROVIDE AND INSTALL COMPONENTS PER THE FIBER PANEL DETAIL. PROVIDE AND INSTALL BERK-TEK 12SM I/O RATED FIBER OPTIC CABLING FROM DATACENTER TO PLANNING AND DEVELOPMENT PORTABLE EXISTING IDF. THIS WILL BE ZONE 5. FIBER OPTIC CABLING SHALL BE INSTALLED INSIDE CONTRACTOR PROVIDED MAXCELL FABRIC INNERDUCT. FIBER OPTIC INSTALLATION, TERMINATION, TESTING, AND WARRANTY MUST BE PROVIDED BY A BERK-TEK/LEVITON CERTIFIED CONTRACTOR. EXISTING INFRASTRUCTURE IS COVERED UNDER WARRANTY. WORK MUST NOT VOID EXISTING WARRANTY.



Rack layout	
19	OFCI Fiber Panel
18	NP2
17	
16	CFCI Leviton PP A
15	
14	NP2
13	
12	OFOI Switch
11	CFCI Leviton PP B
10	
9	NP2
8	
7	OFOI Switch
6	/////
5	/////
4	/////
3	/////
2	/////
1	/////

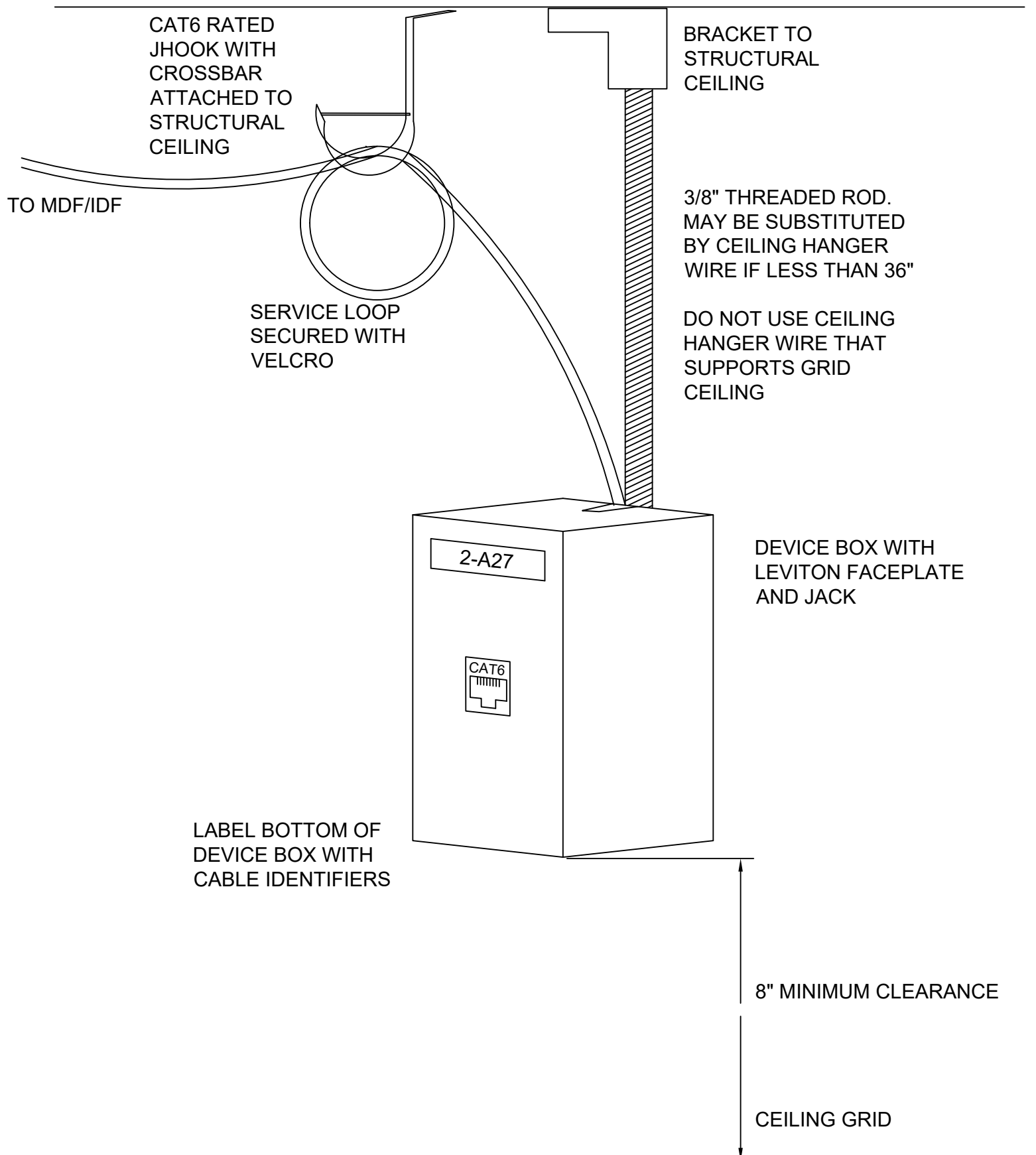


- * ALL BOXES / PLYWOOD TO BE SECURED USING MIN. 3/8" WALL ANCHORS/LAG BOLTS.
- * 50 yr. SILICONE CAULK AROUND ALL PENETRATIONS, OR ALL THREAD "AS REQUIRED"
- * SEAL ALL ENTRANCE CONDUITS AND INNERDUCT PER SPEC.
- * UNISTRUT TO RUN ACROSS ENTIRE WIDTH OF PULLBOX. ENDS SHALL ALIGN WITH EDGE OF PLYWOOD

PERMANENT BUILDING CONDUIT RISER DETAIL

T0-1
E

STRUCTURAL CEILING



- ① PROVIDED/INSTALLED BY TECHNOLOGY CONTRACTOR
- ② PROVIDED/INSTALLED BY ELECTRICAL CONTRACTOR
- ③ PROVIDED/INSTALLED BY CEILING CONTRACTOR
- ④ PROVIDED/INSTALLED BY DISTRICT PERSONNEL

CAT6A PATCH CORDS
VELCRO TOGETHER.
LOOP AND SUPPORT
OFF OF CEILING GRID, IF
NECESSARY ①

DEVICE BOX WITH
LEVITON FACEPLATE
AND JACK ①

CROSSBAR SUPPORT
WITH CEILING HANGER
SUPPORT ②

4S BOX WITH DOUBLE
GANG REDUCER
FLUSH WITH CEILING
TILE BOTTOM ②

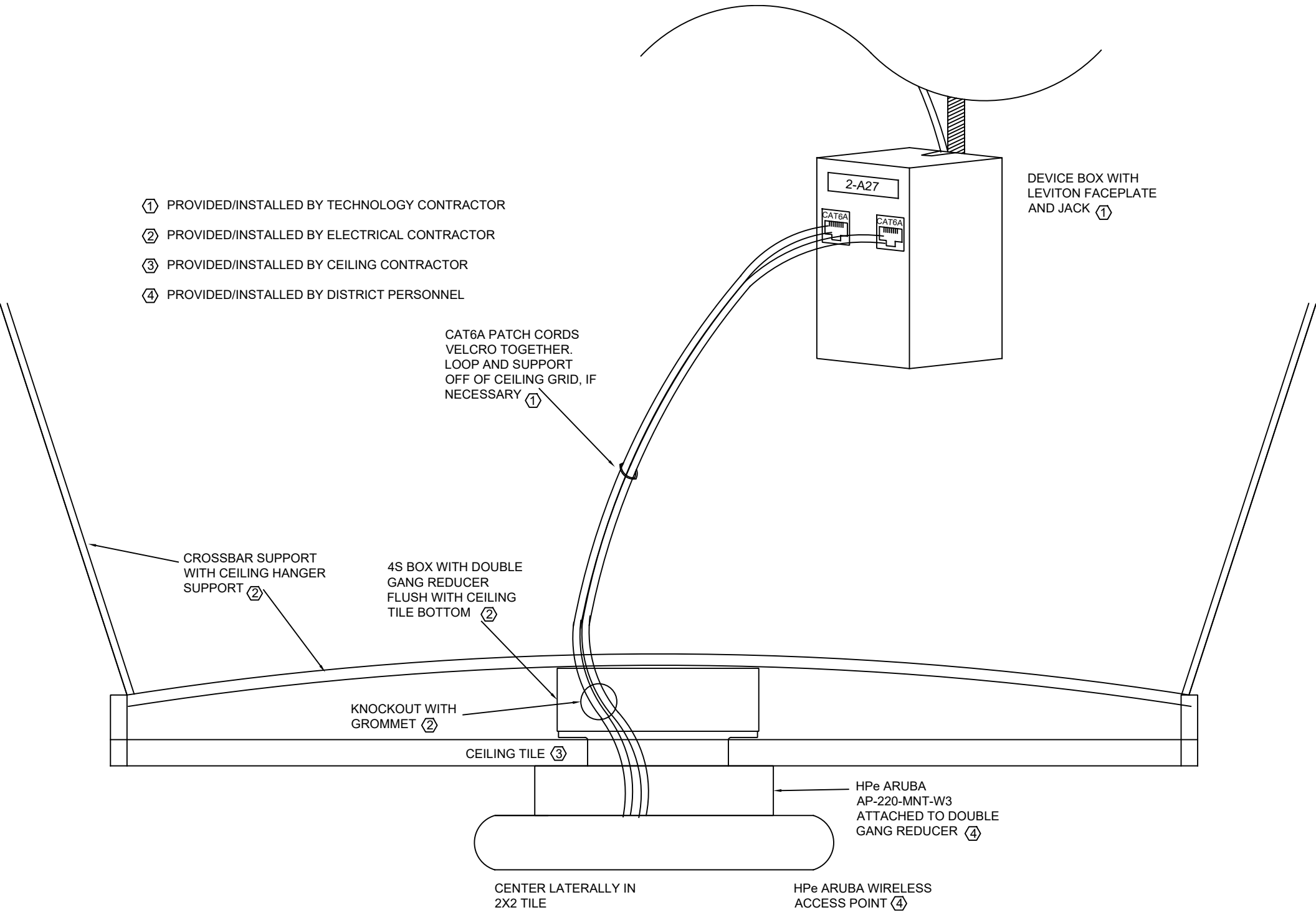
KNOCKOUT WITH
GROMMET ②

CEILING TILE ③

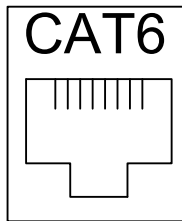
HPe ARUBA
AP-220-MNT-W3
ATTACHED TO DOUBLE
GANG REDUCER ④

CENTER Laterally IN
2X2 TILE

HPe ARUBA WIRELESS
ACCESS POINT ④

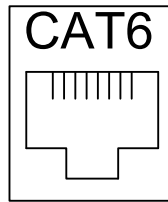
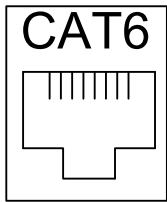
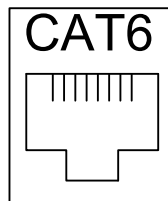
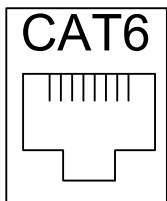


2-A27



LABELING SHALL
BE TIA-606B
COMPLIANT.
2-A27 IS IDF2,
PATCH PANEL A,
PORT #27

2-A27 2-A28



2-A29 2-A30

LABELING SHALL BE
TIA-606B
COMPLIANT.
2-A27 IS IDF2, PATCH
PANEL A, PORT #27
IDENTIFICATION
SHALL BE IN
NUMERICAL ORDER,
LEFT TO RIGHT, TOP
TO BOTTOM

Section Format for Division 27 00 00 Communications

Part 1 – General

1.01 References

- A. ANSI/TIA-568-C.0 Generic Telecommunications Cabling for Customer Premises
- B. ANSI/TIA-568-C.1 Commercial Building Telecommunications Cabling Standard
- C. ANSI/TIA-568-C.2 Balanced Twisted Pair Cabling Components
- D. ANSI/TIA-568-C.3 Optical Fiber Cabling Components Standard
- E. ANSI/TIA/EIA 569-E Commercial Building Standards For Telecommunications Pathways And Spaces
- F. ANSI/TIA/EIA 606-B The Administration Standard For The Telecommunications Infrastructure Of Commercial Building
- G. ANSI/J-STD-607-C Commercial Building Grounding And Bonding Requirements For Telecommunications
- H. ANSI/TIA/EIA-862 Building Automation Systems Cabling Standard for Commercial Buildings
- I. ASTM D 4566-05, Standard Test Methods for Electrical Performance Properties of Insulations and Jackets for Telecommunications Wire and Cable, 2005
- J. BICSI Telecommunications Distribution Methods Manual (TDMM) Current Edition
- K. BICSI Information Transport Installation Manual (ITSM) Current Edition
- L. ISO/IEC 11801 – Information Technology – Generic Cabling for Customer Premise
- M. IEEE 802.3 Standard for Information technology -Telecommunications and information exchange between systems - Local and metropolitan area networks – Specific requirements Part 3: Carrier Sense Multiple Access with Collision Detection (CSMA/CD) Access Method and Physical Layer Specifications
- N. IEC 61156-1, Multicore and Symmetrical Pair/Quad Cables for Digital Communications – Part 1: Generic Specification, 2005
- O. NFPA-70 National Electrical Code Current Edition
- P. NECA/BICSI-568-A Standard for Installing Commercial Building Telecommunications Cabling
- Q. Federal Communications Commission Part 15 and Part 68
- R. UL 444 – Standard for Safety of Communications Cable
- S. UL 1666 – Standard for Safety of Flame Propagation Height
- T. NFPA 262 – Flame Travel and Smoke of Wires and Cables

U. Local Authority Having Jurisdiction

1.02 Definitions / Terms / Acronyms

- A. ANSI – American Northern Standards Institute
- B. AWG – American Wire Gauge
- C. BICSI – Building Industry Consulting Service International
- D. EIA – Electronics Industry Alliance
- E. ETL – Intertek Semko Labs
- F. FCC – Federal Communications Commission
- G. IEC – International Electrotechnical Commission
- H. IEEE – Institute of Electrical and Electronic Engineers
- I. IDC – Insulation displacement contact
- J. ISO – International Standards Organization
- K. J-STD – Joint Standard
- L. NECA – National Electrical Contractors Association
- M. NFPA – National Fire Protection Agency
- N. SC – Subscriber Channel
- O. TIA – Telecommunications Industry Association
- P. UL – Underwriters Laboratory
- Q. 1GBase-T – networking protocol capable of transmitting 1 billion bits of information per second over copper twisted pair
- R. 10GBase-T – networking protocol capable of transmitting 10 billion bits of information per second over copper twisted pair
- S. 10GBase-SX – networking protocol capable of transmitting 10 billion bits of information per second over optical fiber at 850 nanometers
- T. Contractor: The term "Contractor" refers to the installation Contractor responsible for the furnishing and installation of all work indicated within this Specification.
- U. Construction Manager: The terms "Construction Manager" mean the Owner's appointed representative.
- V. Furnish: The term "furnish" is used to mean "purchase, supply, provide and deliver to the Project site, protect and provide interim storage and be ready for unloading, unpacking, assembly, installation, and similar operations in accordance with Manufacturer's specifications."

- W. Provide: The terms "provide" means to "furnish and install, complete and ready for the intended use".
- X. Install: The term "install" is used to describe operations at project site including the actual "unloading, unpacking, rigging in place, assembly, erection, placing, anchoring, applying, working to dimension, finishing, curing, protecting, cleaning, and similar operations".
- Y. Installer: The "Installer" is the Contractor, Subcontractor and/or supplier who uses their own employees for performance of all construction activity related to their specified responsibilities, including installation, erection, application, and similar operations. Installers are required to be experienced in the operations they are engaged to perform and the "Installers" must be an authorized Manufacturers representative, certified, experienced and qualified to provide, install, program, troubleshoot, train, warrant and service all the systems in this section in their entirety.
- Z. If Applicable: The term "if applicable" will be that work which maybe required for completed construction at applicable locations, but is not necessarily shown or described in the Contract Documents.
- AA. As Necessary: The term "as necessary" will be that work which is required for completed construction, but is not necessarily shown or described in the Contract Documents.
- BB. As Required: The term "as required" will be that work which is required for completed construction and is shown on the drawings or described in the project Specification.
- CC. Concealed: The Term "concealed" means hidden from sight, buried as in chases, furred spaces, shafts, fixed ceiling or embedded in construction.
- DD. Exposed: The term "exposed" means bare, open to the elements, out in the open, uncovered.
- EE. Product: The term "product" will mean any item of equipment, material, fixture, apparatus, appliance or accessory installed under this Division.
- FF. "Substantial Completion" is deemed that the project is sufficiently complete to be utilized for its intended use as stated in the body of this written Specification.
- GG. Governmental: The term "governmental" means all municipal, state and federal government agencies.
- HH. Words in the singular will also mean and include the plural, wherever the context so indicates, and words in the plural will mean the singular, wherever the context so indicates.
- II. Cabling: The term "cabling" will mean cable assembly, raceway, conductors, fittings and any other necessary accessories to make a complete wiring system.
- JJ. Backbone: A facility (e.g., pathway, cable or conductors) between telecommunications rooms, or floor distribution terminals, the entrance facilities and equipment rooms within or between buildings.
- KK. Backbone Cabling: Cabling and connecting hardware that provides interconnections between telecommunications rooms, equipment rooms, and entrance facilities.
- LL. Horizontal Cabling: The cabling between and including the work area outlet/connector and the horizontal cross-connect/patch cord in the telecommunications room.

MM. Telecommunications: A branch of technology concerned with the transmission, emission, and reception of signs, signals, writing, images, and sounds; that is, information, of any nature by cable, radio, optical, or other electromagnetic systems.

NN. Pull Point: A Pull Point is a space used to transition between floors for backbone and horizontal cabling within a building riser system.

OO. Equipment Outlet (EO): A device also known as the outlet or information outlet placed at the user workstation for termination using connectors (jacks) of horizontal media for connectivity of data and voice at teacher work area outlet, multimedia equipment. These outlets provide the connection point to voice, data, and other media services.

PP. Connector 8P8C (Jack): A female connector that has eight positions and eight conductors. Jacks are typically used to terminate eight conductor category rated cable at the user end and are inserted into faceplates to create a connection point for the user's equipment cord.

1.03 Submittal Requirements

A. Under the provisions of this request for proposal, as a part of the bid submission, the Structured Cabling System Contractor will:

- 1) Submit copies of the certification of the company and names of staff that will be performing the installation and termination of the installation to provide proof of compliance of this spec.
- 2) Submit proof from Manufacturer of Contractor's good standing in Manufacturer's program.
- 3) Submit appropriate cut sheets and samples for all products, hardware and cabling.

B. Prior to the start of work, the Structured Cabling System Contractor will:

- 1) Submit appropriate cut sheets for all products, hardware, and cabling.

C. Work will not proceed without the Owner's approval of the submitted items.

D. The Structured Cabling Systems Contractor will receive approval from the Owners on all substitutions of material. No substituted materials will be installed except by written approval from the Owner.

E. Refer to other applicable sections for additional submittals requirements.

1.04 Contractor Qualifications

A. Comply with below qualification requirements.

B. The Installer (Firm and Employees) will be experienced in the operations they are engaged to perform. Demonstrate at least five years of continuous recent experience on similar projects. The Installer will hold recent, up-to-date licenses, certifications and training certificates in the area the project is located and for the equipment to be installed.

C. Provide names of contacts from the last five similar projects including the General Contractor, Owner's Representative, Architect and Engineer. Indicate project locations, scope and current phone numbers that the contacts can be reached at.

D. Qualified Structured Cabling System Installation firms will have demonstrable design and installation training with certifications of competence. Certified training will be industry recognized and at least equal to:

- 1) Building Industry Consulting Service International, Inc. (BISCI) Registered Installer.

- 2) Certified Berk-Tek / Leviton Technologies Installer.
- E. Provide a full time on site foreman who personally has been certified as described above. Submit all documentation under this Section.
- F. Provide an on-call Project Manager to supervise the project.
- G. Each Foreman and Installer working on this project will be trained to the qualified level as specified by the Manufacturer(s) for installation and maintenance of equipment being provided on this project. The training will consist of at least a minimum of proper installation techniques of their specific equipment in order to have a complete operating system meeting or exceeding the requirements as specified herein. Each Foreman and Installer working on this project will have documentation from the Manufacturer indicating that they have been adequately trained prior to the start of the project. Only Foreman and Installers who have been properly trained and documented by the Manufacturer whose equipment is being provided on this project will be allowed to install same.

1.05 Bidder Qualifications

- A. Bidding Contractor shall be a licensed to install telecommunications systems with a valid California C7 license.
- B. Bidding Contractor shall have a minimum of 3 years experience installing structured cabling for telecommunications.
- C. Bidding Contractor shall have the capability to bond project in its entirety.
- D. Bidding Contractor shall be able to provide insurance at the request of the owner.
- E. Contractor performing work must be listed on the BerkTek Leviton authorized installers, valid and able to provide full warranty.

1.06 Delivery, Storage, and Protection

- A. Contractor shall ensure that materials delivery to work area shall be coordinated with construction site manager responsible for materials distribution to all trades.
- B. Contractor is responsible for all materials, tools and vehicles left on the job site.
- C. Contractor shall coordinate a disposal bin for the removal of all trash produced by the Contractor's associated personnel during the project.
- D. Contractor shall ensure materials are stored in an environmental area where:
 - 1) Temperature does not exceed 120 degrees Fahrenheit nor below 32 degrees Fahrenheit.
 - 2) Humidity does not exceed 80 %.
 - 3) No direct exposure to sunlight.
- E. Cable shall be stored according to Manufacturer's recommendations as a minimum. In addition, cable must be stored in a location protected from vandalism and weather. If cable is stored outside, it must be covered with opaque plastic or canvas with provision for ventilation

to prevent condensation and for protection from weather. If air temperature at cable storage location will be below 40 degrees F., the cable shall be moved to a heated (50 degrees F. minimum) location. If necessary, cable will be stored off site at the Contractor's expense.

- F. Deliver equipment in individual shipping splits for ease of handling, mount on shipping skids and wrap for protection.
- G. Inspect and report concealed damage to carrier within specified time.
- H. Store in a clean, dry space. Maintain factory protection or cover with heavy canvas or plastic to keep out dirt, water, construction debris, and traffic. Heat enclosures to prevent condensation. Meet the requirements and recommendations of NFPA 70B and the Manufacturer. Location will be protected to prevent moisture from entering enclosures and material.
- I. Handle in accordance with NEMA and the Manufacturer's recommendations and instructions to avoid damaging equipment, installed devices and finish.
- J. The equipment will be kept upright at all times. When equipment has to be tilted for ease of passage through restricted areas during transportation, the Manufacturer will be required to brace the equipment suitably to insure that the tilting does not impair the functional integrity of the equipment.

1.07 Project Conditions

A. Environmental Requirements

- 1) Contractor shall ensure that any pollutants produced during the work is disposed off according to local, state or national regulations. Follow the most stringent guidelines.
- 2) It is preferred that the Communications Contractor recycle any used or un-used components during the course of the construction project.
- 3) Coordinate with LEED project manager if cabling system or components will be used for points in a LEED certified project.

B. Existing conditions

- 1) See Section 01 51 33 for Temporary Telecommunications requirements
- 2) The school has an existing computer network that must remain running, unless otherwise identified in writing.
- 3) The school has an existing telephony and paging/Bells system that must remain running, unless otherwise noted in writing.

C. Field Measurements

- 1) Contractor shall coordinate with electrical engineer on project that the main electrical service ground has a resistance to earth of less than 5 ohms.
- 2) Contractor shall ensure that all grounding busbars for all equipment network rooms shall have a resistance of less than 1 ohm back to the main electrical service ground.
- 3) Contractor shall ensure that all field testers have been calibrated from the Manufacturer within 1 year.

1.08 Sequencing

- A. Contractor shall coordinate with Owner's project manager on sequencing of various trades and construction teams for the lifecycle of the project.
- B. Cooperation and coordination with other trades.
 - 1) The work will be so performed that the progress of the entire building construction, including all other trades, will not be delayed and not interfered with. Materials and apparatus will be installed as fast as conditions of the building will permit and must be installed promptly when and as directed.
 - 2) Telecommunications network must be operational and in place by identified scheduling milestones, as a prerequisite for other network enabled low voltage and building management systems. Delays to installation may cause liquidated damages, for compensation of stacking resources by district and other contractor trades.
 - 3) Keep fully informed as to the shape, size and position of all openings required for all apparatus and give information in advance to build openings into the work. Furnish and set in place all sleeves, pockets, supports and incidentals.
 - 4) Coordinate exact locations and roughing in dimensions of all work before installation and make all final connections as required. Any changes required to avoid interferences or to provide adequate clearances for Code and maintenance requirements will be made at no additional costs.
 - 5) Structural elements of the project will not be relocated, altered or changed to accommodate the work without written authorization from the Owner/Architect.
 - 6) Work that is installed before coordination with other trades or that causes interference with the work of other trades will be changed to correct condition at no additional cost to the Owner.
 - 7) Obtain a complete set of Project Drawings and Specifications for coordination and to determine the full scope of work.
 - 8) Attend project coordination meetings to coordinate work of this Section, pathways, work of other trades phasing and other project requirements.

1.09 Continuity of Service and Scheduling of Work

- A. Contractor shall provide a detailed construction schedule with hard dates for completion of roughing in cables, terminations and testing once scheduling sequence has been determined to the Owner's Project Manager. Schedule shall include milestones when owner is to return to install and configure active network electronics.
- B. Cabling schedule shall be in a software program designated by the Owner's Project Manager.
- C. Continuity of all services will be maintained in all areas that will be occupied or temporarily relocated during the construction period. If an interruption of service becomes necessary, such will be scheduled in advance, made only upon consent of the Owner and at a time outside normal working hours as the Owner will designate. The Contractor will schedule the shutdown with seven days in advance. Arrange work to minimize shutdown time.
- D. Should services be inadvertently interrupted, immediately notify the Owner. Be prepared to immediately furnish labor, materials and the equipment necessary for prompt restoration of interrupted service.
- E. Refer to the overall scheduling of the work of the project. Schedule work, process Submittals and order materials and equipment to neither conform to this schedule and install work to not delay nor interfere with the progress of the project.

- F. Inform General Contractor and Architect immediately of any delays or potential delays. Furnish Manufacturer's letter to verify order date, equipment delays, expected shipment date, order number, and potential remedies to speed up delivery. Any costs to speed up delivery will be implemented at no cost to the project if the equipment or material was not ordered as soon as possible after Contract award or within the time frames indicated with the Submittals.
- G. Include premium time required to comply with the project scheduling and phasing.
- H. Be aware of, and plan for, project scheduling and phasing. Provide for complete continuous operation of all systems. Coordinate scheduling and phasing with the Architect, Owner, other Trades, and the General Contractor.
- I. Demolition of existing systems being updated will take place only after the new or replacement system is completely installed, operational, tested and certified. This work may be required on a "per-phase" basis.

1.10 Protection of Work and Property

- A. Be responsible for the care and protection of all work included under this Section until it has been tested and accepted.
- B. Protect all equipment and materials from damage from all causes including theft. All materials and equipment damaged or stolen will be replaced with equal material or equipment at the option of the Architect and Owner.
- C. Materials and equipment stored for this project will be protected and maintained according to the Manufacturer's recommendations and requirements and according to the applicable requirements of NFPA 70B.
- D. Protect all equipment, outlets and openings with temporary plugs, caps and covers. Protect work and materials of other trades from damage that might be caused by work or workmen and make good any damage caused.
- E. Use caution to avoid damage to existing work, and to prevent harm to personnel working in all areas.
- F. Observe all safety precautions and requirements for the construction.
- G. The General Contractor and the Installer are responsible for initiating, maintaining, and supervising all safety precautions and requirements during construction.
- H. Coordinate installations with all other trades in order to not damage equipment or cables during construction. Any work that is damaged during construction will not be repaired. Replace damaged work completely, with no splices in cabling, at no additional cost to the Owner.

Part 2 – Products

- 2.01 *Refer to 27 05 26 for Bonding and Grounding Specifications*
- 2.02 *Refer to 27 11 00 for Equipment Room Fittings*
- 2.03 *Refer to 27 13 00 for Communications Backbone Cabling*
- 2.04 *Refer to 27 15 00 for Communications Horizontal Cabling*
- 2.05 *Refer to 27 16 00 for Communications Connecting Cords, Devices and Adapters*

Part 3 – Execution

3.01 General

- A. Verify the exact location prior to bid of all items that may be indicated and determine exact location of all electrical items that are not indicated on the Drawings.
- B. Include the cost of all work including sub-letting of any work that may be required to complete the work indicated in order to avoid work stoppages and jurisdictional disputes. The work to be sublet will conform to precedent agreements and decisions of record. Jurisdictional assignment will be a responsibility under this Section's contractual obligation.
- C. Do not install equipment and materials that have not been reviewed by the Architect. Equipment and materials which are installed without the Architect's review or without complying to comments issued with the review will be removed from the project when so instructed by the Architect. No payment will be made for unapproved or removal if it is ordered removed. The Installer will be responsible for any ancillary costs incurred because of its removal and the installation of the correct equipment and materials.
- D. Obtain detailed information on installation requirements from the Manufacturers of all equipment to be furnished, installed or provided. At the start of construction, check all Contract Documents include all Drawings and all Sections of the specifications for equipment requiring electrical connections and service and verify electrical characteristics of equipment prior to roughing.
- E. Equipment and systems will not be installed without first coordinating the location and installation of equipment and systems with the General Contractor and all other Trades.
- F. Any and all material installed or work performed in violation of above requirements will be re-adjusted and corrected by the Installer without charge.
- G. Refer to all Drawings associated with the project, prior to the installation or roughing-in of the electrical outlets, conduit and equipment, to determine the exact location of all outlets.
- H. After installation, equipment will be protected to prevent damage during the construction period. Openings in conduits and boxes will be closed to prevent the entrance of foreign materials.
- I. Home runs indicated are not to be combined or reduced without written consent from the Architect.

- J. All connections to equipment will be made as required, if applicable, and in accordance with the approved submittal and setting drawings.
- K. Site Observation:
 - i. Site observation visits will be performed randomly during the project by the Architect and owner. Reports will be generated noting observations. Deficiencies noted on the site visit reports will be corrected. All work will comply with the Contract Documents, applicable Codes, regulations and local Authorities whether or not a particular deficiency has been noted in a site visit report.
 - ii. Be responsible to notify the Architect ten working days prior to closing in work behind walls, raised access floors, ceilings, etc., so that installed work can be observed prior to being concealed.
 - iii. Areas will stay accessible until deficiencies are corrected and accepted. Notify the Architect when all deficiencies are corrected. Return reports with items indicated as corrected prior to re-observation by the Architect.
- L. Change Orders, Modifications, Revisions and Directives:
 - i. When change orders, modifications, revisions or Architect's Directives are issued or authorized, provide the required additional material, equipment, personnel and workers to prevent delays in the work, and to complete the work within the time limit of the Contract unless a specific time extension is requested with the change and accepted. Include costs for expediting deliveries where required.
 - ii. Requests for additional compensation will be submitted broken down and associated by item, tasks and Drawing or sketch number with material and labor costs, so quantities can be easily verified.
 - iii. Requests will be properly and adequately identified so the scope of work can be clearly determined. Indicate who originated change in work.
 - iv. Submit on all credits broken down as requested for adds. Credits will be separately identified and accounted for. Do not indicate as net changes with adds.
 - v. Unit costs for labor and material will be equal for adds, deletes and credits.
- M. Loose materials will not be stored on-site. A "gang box" is acceptable to be placed in a location agreeable to the Owner and the General Contractor. The Installer is responsible for all equipment and materials and for their delivery until the system is deemed complete and accepted by the Owner.
- O. A trailer may be used for the storage of materials to be located on the Owner's property at a location designated by the Owner and the General Contractor. Such on-site storage will be kept locked by the Installer. Security for the trailer and its contents will be strictly the responsibility of the Installer.
- P. Protect existing spaces where work is being performed; protect it from damage and from the accumulation of dirt and debris.
- Q. Any ceilings, walls, floors, furniture, equipment, furnishings, etc., damaged by the work of this Section will be replaced, or at the Owner's option, repaired with similar materials, workmanship and quality.
- R. Work includes field survey of existing conditions, systems, equipment and tracing of existing circuits in order to determine scope of work.
- S. Maintain the existing building in operation at all times during the entire construction period. If it is necessary to have a system shutdown, a written request for approval will be submitted in advance stating the estimated shutdown time. Work will be planned to minimize shutdown. Shutdowns will be at the convenience of the Owner and, if necessary, on premium time.

- T. Clean and touch up all equipment, materials and work sites at the completion of work in each area.
- U. Certain portions of the work area may be occupied during construction. Determine which areas and schedule work accordingly and include necessary premium time.
- V. Make sure necessary provisions to provide continuous service of all existing systems throughout all occupied areas.

3.02 Cable Pathways

- A. Install cables in pathways.
- B. Provide all equipment and cabling for a complete installed operating system. Pathways, outlet boxes and grounding are provided by the Electrical Subcontractor.
- C. All pathways provided under this Section will comply with fill capacities as per Code, TIA/EIA 569 and BICSI.
- D. Cable bending radius will not be less than minimum required by TIA/EIA and BICSI.
- E. Cabling installed concealed will be supported from the building structure (e.g. cable trays, J-Hooks, etc.).
- F. Cables will be installed no closer than 12 inches (305mm) to electrical equipment and wiring. When cables are required to cross power wiring, they will only do so perpendicular to the power wiring. Cable and power wiring will only cross each other the minimal number of times as required due to building design limitations.
- G. Clearances: Clearances between cabling and other building systems as required by TIA/EIA 569 and BICSI will be maintained throughout the building.
- H. All cables will be installed in a neat and workman-like manner. Cables will be installed parallel and perpendicular to building elements.
- I. Provide expansion fittings and adequate cable slack at all building expansion joints.
- J. Fire/smoke seal all conduits, raceways, sleeves, slots, etc. where cables pass from one location to another.

3.03 Work Area Outlets

- A. All work area outlet locations will be as indicated on the Drawings. Uniquely label each work area outlet and jack within the outlet according to the numbering convention outlined in the section on labeling.
- B. Labeling shall be sequential in order, do not reuse a number throughout the entire infrastructure.
- C. Work area outlets installed in casework will have their cables installed within the conduit or raceway provided.
- D. Install jack and connector modules as indicated in the details and on the Drawings.

- E. Work area outlets will be seated properly and will be installed level on walls and parallel to building elements as required.

3.04 Installation Practices

- A. Follow and adhere to installation practices specified by the applicable Telecommunications Industry Association standards.
- B. Follow and adhere to installation practices specified by BICSI Information Transport System Installation Manual 5th Edition.
- C. Follow and adhere to installation practices specified by BICSI Telecommunications Distribution Methods Manual 11th Edition.
- D. Follow and adhere to installation practices specified by NFPA-70 National Electric Code, Edition 2008.
- E. Follow and adhere to installation practices specified by the Manufacturers.
- F. The general topology will be a "hierarchal star" configuration. All segments will originate in NRTL listed patch panels located in the telecommunication equipment racks/cabinets and end at the work area outlets.

4) Routing:

- a. All cabling will be installed in conduit where indicated on plans or will be installed open using "J" hooks and routed on cable trays located as shown on plans.
- b. Cables will be routed, in large groups, down main cable pathways, until a direct path to the point of access to the workstation outlet can be taken. At that point, cables will be routed, above all building systems, to the outlet location in accordance with standard installation practices, as described herein.
- c. Multiple cables to individual rooms will be pulled as a bundle and terminated at each end in sequential order so that labeling within a room location is in sequence.
- d. When not in conduit or tray, cables will be supported to the deck and/or beams, every five feet throughout the length of their installed run. Hangers, clips, and other methods of grouping the cables and keeping them away from other systems installed in the building are to be provided and installed. Ensure that hangers and other methods of securing cable do not compress cable or damage insulation.
- e. Cables will be attached to beams with minimal disruption of the fireproofing. Care should be taken to assure that fireproofing removal is not excessive. The Contractor will be responsible of restoring the fireproofing to appropriate levels. Restoration will be verified by the General Contractor.
- f. Cable routes will be with 90-degree angles whenever possible. Cables will not be installed randomly or diagonally through the building.
- g. Cables installed partially or fully within the telecommunications room will be routed through and secured in the cable tray wherever possible. No cables are to be routed across the rooms at angles, or are the cables to be run from one portion of the room or tray to another. Cables placed in the cable tray are to be laced frequently to keep them neatly bundled and not permitted to shift from one side of the tray to the other as they are routed in the tray.
- h. Station cables will be routed to fixed wall locations through EMT to back box. Secure and store four feet of slack cable above ceiling at cable entrance to EMT.

- 5) Separation from EMI Sources:
 - i. Comply with BICSI TDMM and TIA-569-B recommendations for separating unshielded copper voice and data communication cable from potential EMI sources, including electrical power lines and equipment.
 - j. Separation between open communications cables or cables in nonmetallic raceways and unshielded power conductors and electrical equipment will be as follows:
 - 1. Electrical Equipment Rating Less Than 2 kVA: A minimum of 5 inches (127 mm).
 - 2. Electrical Equipment Rating between 2 and 5 kVA: A minimum of 12 inches (300 mm).
 - 3. Electrical Equipment Rating More Than 5 kVA: A minimum of 24 inches (610 mm).
- 6) Separation between communications cables in grounded metallic raceways and unshielded power lines or electrical equipment will be as follows:
 - 1. Electrical Equipment Rating Less Than 2 kVA: A minimum of 2-1/2 inches (64 mm).
 - 2. Electrical Equipment Rating between 2 and 5 kVA: A minimum of 6 inches (150 mm).
 - 3. Electrical Equipment Rating More Than 5 kVA: A minimum of 12 inches (300 mm).
- 7) Separation between communications cables in grounded metallic raceways and power lines and electrical equipment located in grounded metallic conduits or enclosures will be as follows:
 - 1. Electrical Equipment Rating Less Than 2 kVA: No requirement.
 - 2. Electrical Equipment Rating between 2 and 5 kVA: A minimum of 3 inches (76 mm).
 - 3. Electrical Equipment Rating More Than 5 kVA: A minimum of 6 inches (150 mm).
- 8) Separation between Communications Cables and Electrical Motors and Transformers, 5 kVA or HP and Larger: A minimum of 48 inches (1200 mm).
- 9) Separation between Communications Cables and Fluorescent Fixtures: A minimum of 5 inches (127 mm).
- G. All cables will have both ends completely terminated at their respective patch panel and work area outlet. Individual conductors will be trimmed flush with IDC block. Cables indicated to be "spare" will have one end terminated at their respective patch panel or cross-connect block and the other end will be hermetically sealed with a polyolefin heat-shrinkable cap. Provide Brother TZ or approved equivalent after testing. Tape will not be approved.
- H. The total length of permanently installed cable for any complete segment will not exceed 295 feet (90m). Do not splice or otherwise re-terminate any cable used, terminate only at the patch panels, cross connect blocks and work area outlets. Route cables [minimum of 12 inches (305mm) away] to avoid light ballasts, transformers, power wiring and other electrical devices so that there is no EMI or RFI interference with data transmission. Permanently label all cables six inches from the connector at each end, according to the numbering convention outlined in the section on labeling. All cables will be terminated at outlets, patch panels or cross connect blocks ONLY.

- I. Maximum pulling tension will not exceed 25 lbs/ft. when installing cables.

3.05 Labeling

- A. Labeling procedure will meet EIA/TIA 568A, 606-A (Class 2 Administration) and BICSI Standards.
- B. The labeling scheme will be provided as follows at all locations within the cable infrastructure:
- C. Labeling will be as follows:
 - 1) Location identification will start from the left, as you walk in the doorway, and continue around the room in a clockwise direction.
 - 2) Data drops will be labeled based on the serving zone and patch panel. The cable terminated in zone 2 (IDF2) to patch panel B on port 32 will be "2-B32". The cable terminated in zone 1 (MDF) to patch panel E on port 18 will be "1-E18". The letters I and O will not be used for patch panels.
 - 3) Labeling shall be sequential in order, do not reuse a number throughout the entire infrastructure.
 - 4) Hand-written and embossed type labels are specifically prohibited. In addition, provide the following:
 - k. Label each outlet with permanent self-adhesive label with minimum 3/16 in. high characters.
 - l. Label each cable with permanent self-adhesive label with minimum, 1/8 in. high characters, in the following locations:
 - m. Inside receptacle box at the work area.
 - n. Behind the communication room patch panel or punch block.
 - o. Use labels on face of data patch panels. Provide facility assignment records in a protective cover at each telecommunications room location that is specific to the facilities terminated therein.
 - p. Use color-coded labels for each termination field that conforms to ANSI/TIA/EIA-606(A) standard color codes for termination blocks.
 - q. Mount termination blocks on color-coded backboards.
 - r. Labels will be machine-printed. Hand-lettered labels will not be acceptable.
 - 1. Use industry standard EIA/TIA and BICSI color codes as specified herein and maintain consistent color-coding throughout the building.

3.06 Firestopping

- A. Work, in general, includes furnishing and installing fire and smoke barrier penetration seals for openings in floor, walls, and other elements of construction.
- B. Comply with requirements in Division 07 Section "Penetration Firestopping."
- C. Comply with TIA/EIA-569-A, Annex A, "Firestopping."
- D. Comply with BICSI TDMM, "Firestopping Systems" Article.
- E. Applicator Qualifications: Two years experience installing UL classified firestopping.
- F. Performance of materials will have been tested to provide fire rating equal to that of the construction.

G. Shop Drawings:

- 1) Submit shop drawings showing each condition requiring penetration seals indicating proposed UL systems materials, anchorage, methods of installation, and actual adjacent construction.
- 2) Submit a copy of UL illustration of each proposed system indicating Manufacturer approved modifications. Submitting a single product is insufficient.

H. Manufacturer's Data: Submit copies of Manufacturer's specifications, recommendations, installation instructions, and maintenance data for each type of material required. Include letter indicating that each material complies with the requirements and is recommended for the applications shown.

I. Applicator's Qualification Statement: List past projects indicating required experience.

J. Existing Project Conditions:

- 1) Verify existing conditions and substrates before starting work. Correct unsatisfactory conditions before proceeding.
- 2) Proceed with installation only after penetrations of the substrate and supporting brackets have been installed.

K. Environmental Requirements:

- 1) Furnish adequate ventilation if using solvent.
- 2) Furnish forced air ventilation during installation if required by Manufacturer.
- 3) Keep flammable materials away from sparks or flame.
- 4) Provide masking and drop cloths to prevent contamination of adjacent surfaces by firestopping materials.

L. Warranties: Submit copies of written warranty, minimum of one year, agreeing to repair or replace joint sealers which fail in joint adhesion, cohesion, abrasion resistance, weather resistance, extrusion resistance, migration resistance, stain resistance, or general durability or appear to deteriorate in any other manner not clearly specified by submitted Manufacturer's data as an inherent quality of the material for the exposure indicated. The guarantee period will be one year from date of substantial completion.

M. Acceptable Manufacturers: Subject to compliance with requirements, provide products of Nelson Fire Protection Products or Engineers approved equal as further defined in the Systems and Applications Schedule in Part 3 of this section.

N. Materials:

- 1) Provide materials classified by UL to provide Fire Barrier equal to time rating of construction being penetrated.
- 2) Provide asbestos free materials that comply with applicable codes and have been tested in accordance with UL 1479 or ASTM E-814.

O. Preparation: Clean surfaces to be in contact with penetration seal materials of dirt, grease, oil, loose materials, rust, or other substances that may affect proper fitting, adhesion, or the required fire resistance.

P. Installation:

- 1) Install penetration seal materials in accordance with printed instructions of the UL Building Materials Directory and in accordance with Manufacturer's instructions.

- 2) Seal holes or voids made by penetration to ensure an effective smoke barrier.
- 3) Where floor openings without penetrating items are more than four inches in width and subject to traffic or loading, install firestopping materials capable of supporting same loading as floor.
- 4) Protect materials from damage on surfaces subject to traffic.

Q. Field Quality Control:

- 1) Examine penetration sealed areas to ensure proper installation before concealing or enclosing areas.
- 2) Keep areas of work accessible until inspection by applicable code authorities.
- 3) Perform under this section patching and repairing of firestopping caused by cutting or penetration by other trades.

R. Adjusting and Cleaning:

- 1) Clean up spills of liquid components.
- 2) Neatly cut and trim materials as required.
- 3) Remove equipment, materials and debris, leaving area in undamaged clean condition.

3.07 Sealing of Penetrations and Openings

- A. All firestop systems will be manufactured by Specified Technologies Inc. All firestop will be installed in accordance with the Manufacturer's recommendations and will be completely installed and available for inspection by the local inspection authorities prior to cable system acceptance.
- B. Provide a seal around raceways or cables penetrating full height walls (slab to slab), floors or ventilation or air handling ducts so that the spread of fire or products of combustion will not be substantially increased.
- C. Penetrations through fire-resistant-rated walls, partitions, floors or ceilings will be fire stopped using approved methods and NRTL listed products to maintain the fire resistance rating.
- D. Installation restrictions of the listing agencies will be strictly adhered to {e.g. 24 inch (610 mm) minimum horizontal separation between boxes on opposite sides of the wall, maximum square inch opening in wall}.
- E. Fire stopping in sleeves or in areas having small openings that may require the addition or modification of installed cables or raceways will be soft, pliable, non-hardening fire stop putty. Putty will be water resistant and intumescent.
- F. Fire stopping in locations not likely to require frequent modification will be NRTL listed putty or caulk to meet the required fire resistance rating.
- G. Box penetrations into a fire rated wall or shaft will have a fire-stopping pad installed on the back of the box.
- H. Fire stopping of cable trays through walls will be with NRTL listed bags to meet the required fire resistive rating and that will not allow products of combustion to pass through the protected opening. The NRTL listed bags will be installed inside and on both sides of the opening as required to meet the required resistive fire rating of the wall.

- I. Fire stopping materials will be NRTL listed to UL 1479 (ASTM E814). Installation methods will conform to a UL fire stopping system. Submit specifications and installation drawings for the type of material to be used. Fire stopping materials will be as manufactured by Specified Technologies, Inc., or approved equal.

3.08 Cable Supports

- A. Provide hook and loop (Velcro) cable wraps at all panels, equipment racks and cabinets. Tie wraps are specifically prohibited.
- B. Tie wraps for horizontal cables will be secured with minimum required compression in order to secure the cables properly without impeding the signal transmission rating (geometry) of the cable. Hook and loop (Velcro) cable wraps may be used in lieu of cable ties for copper cables only.
- C. Provide J-Hook supports from the building structure as required for cable runs to the cable drop location. Maximum distance between supports will be five feet (1500mm) depending on the structural elements of the building. Maximum number of cables per support will be thirty. Provide additional supports as required when cable quantities exceed thirty and to maintain required bending radius of cables. Cables installed exposed or in areas subject to abuse {below 10 feet (3m) above finished floor} or in accessible areas will be installed in conduit.
- D. All cables will be supported directly from building structure. Under no circumstance will cable be installed using cross bracing, plumbing/sprinkler pipes, ceiling systems or any other system that is not a specifically approved method to independently support cables. Cables will not be allowed to rest on ceiling tiles, duct work, piping, etc. Supports will be provided as required in order for cables to avoid contact with any other building system. Bundle cables in groups by Room.

3.09 Cable Protection

- A. Provide bushings in all metal studs and the like where cables will pass through. Bushings will be of two (2)-piece construction with one piece inserted through the opening and the second piece locking it into place. Single piece bushings with locking tabs or friction fit are specifically prohibited.
- B. Cables to be installed in existing enclosed open bays or furred spaces where conduit stubs are not provided, will be protected from chafing or any damage. The Installer will verify that the warranty will not be violated before installing any cabling in these locations.
- C. Provide cutting, coring, sleeves and bushings and seal as required at all penetrations.
- D. Cables damaged during installation will not be repaired. They will be completely replaced with new cable at no cost to the Owner.

3.10 Grounding & Bonding

- A. Refer to 270526 for Grounding and Bonding requirements.

3.11 Documentation

- A. Label all equipment as herein specified.

B. Provide:

- 1) Provide Building Structured Cabling Systems Administration Report indicating TIA/EIA-606 required information.
- 2) Documentation of test results for every cable segment and link will be turned over in native tester form and PDF. Documents will include measured values as well as whether or not the test passed. Test results to be turned over prior to punchwalk. Labeling of cable in test results must match field conditions.
- 3) "Record" drawings indicating location of all equipment including but not limited to work area outlets, patch panels, cross connect blocks, on each segment and cable routing. Indicate labeling for each piece of equipment.
- 4) Record drawings indicating actual cable routes and outlet identifiers. Provide respective copies mounted in each telecommunications room, and the main cross connect.

C. Provide "as-built" Drawings on AutoCAD Version 12 or higher to the Owner. Obtain copy of original Drawings from the Architect.

D. Submit NRTL certification that the structured cabling system meets the transmission requirements of TIA-568-C.0.

3.12 Training

A. As a minimum training sessions will consist of the following:

- 1) General project information and review will be by the General Foreman or Superintendent of the Trade.
- 2) Specific system training will be by a Factory Trained Representative.
- 3) Provide a complete review of the project and systems including, but not limited to, the following:
 - a. Review each Record Drawing (use of typicals is acceptable).
 - b. Note equipment layouts, locations and control points.
 - c. Review each system.
 - d. Review system design operation and philosophy.
 - e. Review alarms and necessary responses.
 - f. Review standard troubleshooting techniques for each system.
 - g. Review areas served by equipment.
 - h. Identify color codes used.
 - i. Review features and special functions.
 - j. Review maintenance requirements.
 - k. Review operation and maintenance manuals.
 - l. Respond to questions (record questions and answers).
- 4) After training, walk the entire project, review each equipment room and typical locations. Explain equipment and proper operation.

B. During the instruction period the Owner and Maintenance Manual will be used and explained.

C. The Owner and Maintenance Manual material will be bound in 3-ring binders and indexed. On the edge of the binder provide a clear see-through plastic holder with a typed card indicating the Project name, the Architect's name, the installer's name and the Volume number (e.g., Vol. No.1 of 2).

- D. Provide name, address and telephone number of the Manufacturer's representative and Service Company for all items supplied so that the source of replacement parts and service can be readily obtained.
 - 1) Include copies of Manufacturer's and installer's warranties and maintenance contracts and performance bonds properly executed and signed by an authorized representative.
 - 2) Include copies of all test reports and certifications.

3.13 Cleaning

- A. In all telecom room spaces - a thorough sweeping, vacuuming and wet mopping shall be performed on a weekly basis or more frequently as directed by the owner. Cleaning shall include floors, rafters, floor joists, exposed structural members, exposed mechanical/electrical equipment and ductwork/piping/conduits, walls, ladder trays, tops of cabinets/racks, existing/new passive and active components, or per manufacturer recommendations.
- B. All non-metallic cable managers and snap covers shall be wiped clean, both inside and outside of front, including rear channels. All clear covers and doors shall be cleaned, both front and rear per manufacturer recommendations.
- C. Inside of fiber optic enclosure and patch panels shall be blown clean of settled dust. Cleaning shall be performed for all new construction projects or where gypsum sanding has been performed.
- D. All scraps, boxes, spools, pull-line and trash shall be removed and properly disposed of.
- E. All residual cable lubricant shall be cleaned from floors and walls with an appropriate degreaser.

3.14 Project Closeout

- A. Provide close out submittals as required herein and include the following close out submittals.
 - Operation and Maintenance Manuals
 - Record Drawings
 - Test Reports
 - Warranty certification form Manufacturer's
 - Extra Materials
 - Provide factory calibration report of field test equipment
- B. Obtain written receipts of acceptance close out submittals submitted. Receipts will specifically detail what is being delivered (description, quantity and specification section) and will be dated and signed by firm delivering materials and by the Owner's Representative.
- C. Provide patch cables as follows:
 - 1) Provide one UTP patch cable for each horizontal cable terminated within the patch panel.
 - 2) Coordinate patch cable lengths and color with the Owner prior to ordering.
- D. Provide equipment cords as follows:

- 1) Provide one 15-foot equipment cord for each data connector installed in data Work Area Outlets. Provide one 5-foot equipment cord for each data connector at wifi and AV projector outlets.
 - 2) Coordinate equipment cord lengths and color with the Owner prior to ordering.
- E. Provide record drawings indicating actual cable routing and cable terminations including all required identifiers.
- F. Provide a half size laminated set of drawings mounted in the Main Equipment Room.
- G. All sketches, drawings, and charts herein are for the purpose of providing for specifications in a simplified format. Errors and omissions in such do not relieve the Contractor of the responsibility for providing a fully complete, secure and properly operating structured cabling system suitable for the intended use. Bidders must obtain a complete set of Project Drawings and Specifications to determine the full scope of work. In case of conflict, the Project Drawings and Specifications will prevail.

End of Section

SECTION 271123 - CABLE MANAGEMENT AND LADDER RACKS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

Section Includes:

1. Vertical Cable Management for Racks and Frames.
2. Horizontal Cable Management for Racks and Frames.
3. Ladder Racks.

Related Requirements:

1. Section 271116 "Communications Cabinets, Racks, Frames, and Enclosures" for cabinets, racks, frames and enclosures.
2. Section 271126 "Communications Rack Mounted Power Protection and Power Strips" for rack-mounted power distribution units
3. Section 270536 "Cable Trays for Communications Systems" for cable trays and accessories serving communications systems.

1.3 DEFINITIONS

BICSI: Building Industry Consulting Service International

- A. EIA: Electronic Industries Alliance.
- B. TIA: Telecommunications Industry Association
- C. ANSI: American National Standard Institute

1.4 ACTION SUBMITTALS

Product Data: For each type of product.

Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for cable management and ladder racks.

1. Include rated capacities, operating characteristics, electrical characteristics, and furnished specialties and accessories.

Shop Drawings: For communications equipment room fittings. Include plans, elevations, sections, details, and attachments to other work.

Detail equipment assemblies and indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.

2. Include workspace requirements and access for cable connections.
3. Grounding: Indicate bonding requirements and location of bonding bus bar.

PART 2 - PRODUCTS

2.1 VERTICAL CABLE MANAGEMENT FOR RACKS AND FRAMES

No vertical cable management is included in this scope.

Basis-of-Design Product: Subject to compliance with requirements, provide Chatsworth Products (CPI); MCS Master Cabling Section.

Double-Sided MCS, for 3 inch Deep Channel Racks:

Configuration: The front of the vertical cable manager will have cable openings along both sides of the trough. The openings will be formed by evenly-spaced T-shaped cable guides. The T-shaped cable guides will be made from a composite plastic material (not metal) and will have rounded edges to protect cables. When the cable manager is attached to a rack/frame, each cable opening will align with a rack-mount space (RMU) on the rack/frame. Each opening will pass a minimum of 24 each 0.25 inch (6 mm) OD patch cords. The rear of the cable manager will be an open through with integrated evenly-spaced spinning latches to secure cables. The manager will include a front door that securely latches in the closed position.

- a. Width: **10 inches (250 mm)**].
- b. Depth: 12.24 inches (311 mm).
- c. Height: **84 inches (2.1 m)**.
- d. Finishes and colors: Powder coat paint in **black**. Edge-protectors, T-shaped cable guides and latch hardware is black.

2.2 HORIZONTAL CABLE MANAGEMENT FOR RACKS AND FRAMES

Basis-of-Design Product: Subject to compliance with requirements, provide Neatpatch Horizontal Cable Manager. P/N: NP2

- A. This project includes the installation of owner provided horizontal cable management.
 - a. Width: **19 inches (482 mm)**.
 - b. RMU:2.
 - c. Finishes and colors: **black**. Edge-protectors, T-shaped cable guides and latch hardware is black.
 - d. Many of the horizontal cable management are existing. Please see

quantities below:

- 1) P&D portable-3

2.3 LADDER RACKS

Basis-of-Design Product: Subject to compliance with requirements, provide Chatsworth Products (CPI); Universal Cable Runway.

Description:

- Size: 1.5 inches (38 mm) high by 0.4 inches (10 mm) wide high tubular steel with 0.065 inch (1.65 mm) wall thickness.
- a. Stringers: 9 feet 11-1/2 inches (3 m) long.
 - b. Cross Members: Welded in between stringers on 12 inch (300 mm) intervals/centers beginning 5-3/4 inches (146 mm) with 10 cross members per ladder rack. Open space of 10-1/2 inches (267 mm) between each cross member.

Width: **12 inches (300 mm).**

Finish and Color: Powder coat paint in **black**.

2.4 LADDER RACK ACCESSORIES

Horizontal 90° Turns (Cable Runway E-Bend): 1-1/2 inches (38 mm) by 3/8 inch (9.5 mm) wide tubular steel with 0.065 inch (1.65 mm) wall thickness.

Width: **12 inches (300 mm).**

1. Finish and Color: Powder coat paint in **black**.

Vertical-To-Horizontal 90° Turns (Cable Runway Outside Radius Bend): 1-1/2 inches (38 mm) by 3/8 inch (9.5 mm) wide tubular steel with 0.065 inch (1.65 mm) wall thickness.

Width: **12 inches (300 mm).**

2. Finish and Color: Powder coat paint in **black**.

Horizontal-To-Vertical 90° Turns (Cable Runway Inside Radius Bend): 1-1/2 inches (38 mm) by 3/8 inch (9.5 mm) wide tubular steel with 0.065 inch (1.65 mm) wall thickness.

Width: **12 inches (300 mm).**

3. Finish and Color: Powder coat paint in **black**.

Corner Brackets (Cable Runway Corner Bracket): 1-1/2 inches (38 mm) by 3/8 inch (9.5 mm) wide tubular steel with 0.065 inch (1.65 mm) wall thickness.

Width: **15 inches (381 mm) and 24 inches (600 mm).**

4. Finish and Color: Powder coat paint in **black**.

Ladder Rack Splices: Mechanically connects ladder rack sections and turns together end-to-end or side-to-end to form a continuous pathway for cables.

Finish and Color: Powder coat paint in **black**.

Butt-Splice Kit.

- a. Junction-Splice Kit.
- b. Heavy-Duty Butt-Splice Kit.
- c. Heavy-Duty Junction-Splice Kit.
- d. Adjustable Junction-Splice Kit.
- e. Runway-Splice Kit.
- f. Butt Swivel Splice Kit.
- g. Junction Swivel Splice Kit.
- h. Vertical Swivel Splice Kit.

Grounding Kit, zinc.

5. Insulator Bar Kit, white.

Ladder Rack Supports: Sized to match the width of the ladder rack that is supported.

Finish and Color: Powder coat paint in **black**.

Triangular Support Bracket.

- a. Wall Angle Support Kit.
- b. Foot Kit.
- c. Adjustable Floor Support Channel.
- d. Threaded Ceiling Kit.
- e. Center Support Kit.
- f. Rack-to-Runway Mounting Plate.
- g. Cable Runway Elevation Kit.
- h. Vertical Wall Brackets.

Miscellaneous Accessories:

Tool-less Pathway Dividers: 6.8 inches (173 mm) high by 1.5 inches (38 mm) wide by 2.2 inches (55.9 mm) deep Polycarbonate/Acrylonitrile Butadiene Styrene (PC/ABS) thermoplastic material.

6. Tool-less Cross Member Radius Drops: 0.060 inch (1.5 mm) thick Steel and measure 4.6 inches (117 mm) high by 6.1 inches (155 mm).
7. Tool-less Stringer Radius Drops: 0.060 inch (1.5 mm) thick steel and measure 4.6 inches (117 mm) high by 4.6 inches (117 mm) deep.
8. Saf-T-Grip Reusable Cable Management Straps: **Open loop series, End Grommet and Buckle Series.**
9. Cable Retaining Post.
10. Cable Runway Protective End Caps.
11. Touch-Up Paint: Spray Can in **black**.
12. Miscellaneous Hardware: Includes **cable runway support brackets, ceiling support brackets, cable runway slotted support brackets, slip-on cable runway support brackets, slip-on lock nuts, hex nuts, split lock washers, washers, hex lag screws, and anchors.**

PART 3 - EXECUTION

3.1 VERTICAL CABLE MANAGER INSTALLATION

Attach vertical cable managers to the side of the rack/frame using the manufacturer's installation instructions and included hardware.

- A. When a single vertical cable manager is used in between two racks/frames, attach the vertical cable manager to both racks/frames.
- B. When more than one cable manager is used on a rack/frame or group of racks/frames, use the same make and style of vertical cable manager on the rack/frame or in between racks/frames.
- C. The color of the rack(s)/frame(s) and cable manager(s) must match.
- D. Doors should be attached to the cable manager and in the closed position after cabling is complete.

3.2 HORIZONTAL CABLE MANAGER INSTALLATION

When more than one horizontal cable manager is used on a rack/frame/cabinet or group of racks/frames/cabinets, use the same make, and style of cable manager on the rack/frame/cabinet or racks/frames/cabinets.

- A. The color of the rack(s)/frame(s)/cabinet(s) and cable manager(s) must match.
- B. Attach horizontal cable managers to the rack/frame/cabinet with four screws according to the manufacturer's installation instructions. Each cable manager should be centered within the allocated rack-mount space (RMU or U).
- C. Horizontal managers will be located so that the number of ports (cables) they support will not exceed the cable fill capacity of the cable manager.
- D. Covers should be attached to the cable manager and in the closed position after cabling is complete.

3.3 LADDER RACK INSTALLATION

Install with side stringers facing down so the runway forms an inverted U-shape and that the hardware between the stringers and cross members face away from cables.

Secure to the structural ceiling, building truss system, wall, floor or tops of equipment racks and/or cabinets using the manufacturer's recommended supports and appropriate hardware, as defined by local code or the authority having jurisdiction (AHJ).

- A. Support requirements:

Ladder Rack (cable runway): 5 feet (1.5 m) or less in accordance with TIA-569-B.

1. Splices: Within 2 feet (0.6 m)
2. Intersections: Within 2 feet (0.6 m) on all sides of every intersection.
3. Changes in Elevation: Within 2 feet (0.6 m) on both sides.
4. Attached vertically to wall: 2 feet (0.6 m).

Secure to each support with included hardware with a minimum of two fasteners.

B. Splices: Place mid-span, not over a support, with the manufacturer's recommended splice hardware.

C. Overhead installation clearances:

Above ladder rack: 12 inches (300 mm) minimum.

1. From building or ceiling structure: 12 inches (300 mm) minimum.
2. Between ladder rack and the tops of equipment racks and/or cabinets: 3 inches (75 mm).
3. Multiple ladder rack tiers: 12 inches (300 mm) minimum.
4. Above acoustical ceilings: 3 inches (75 mm).

Within each telecommunications room, bond ladder rack together, electrically continuous, and bonded to the telecommunications bonding busbar, unless otherwise noted. Bond ladder rack and turns across each splice with a UL Classified Splice Kit or other accepted method as recommended by the AHJ. Bond cable runway to the bonding busbar using an approved ground lug with a wire sized per local code, ANSI/TIA-607-C, or as recommended by the AHJ. Verify the bonds at splices and intersections between individual ladder rack sections and turns, as well as the bonding busbar.

D. On Adjustable Cable Runway, use thread-forming screws to cut through paint in order to create a bond between the Cross Member and the Stringer.

E. Cable fill tolerances:

Maximum: 6 inches (150 mm) high.

1. Over 2 inches (50 mm) or non-secured cables: Install 8 inch (200 mm) high cable retaining posts or 6 inch (150 mm) high pathway dividers.

Quantity of cables: Not to exceed a whole number value equal to 50 percent of the interior area of the ladder rack, divided by the cross-sectional area of the cable. The interior area of ladder rack will be considered to be the width of the ladder rack multiplied by a height of 2 inches (50 mm), unless cable retaining posts/pathway dividers are added to the runway. The interior area of ladder rack equipped with cable retaining posts/pathway dividers will be considered to be the width of the ladder rack multiplied by a height of 6 inch (150 mm). Actual cable fill for ladder rack that is not equipped with cable retaining posts/pathway dividers will not exceed 2 inches (50 mm) in height. Actual cable fill for ladder rack equipped with cable retaining posts/pathway dividers will not exceed 6 inch (150 mm) in height.

Weight of cables: Not to exceed the stated load capacity of the ladder rack as stated in the manufacturer's product specifications or design tables.

F. Secure cables (cable bundles) to the cross members with 3/4 inch (19 mm) wide

reusable velcro straps. Straps are not required when ladder rack is equipped with cable retaining posts/pathway dividers.

- G. Cover the exposed ends of the ladder rack that do not terminate against a wall, the floor or the ceiling with fire-retardant black colored end caps made from a rubberized material or an end closing kit consisting of a flat bar of ladder rack stringer material factory cut to the width of the ladder rack and secured to the ladder rack with a junction splice kit.
- H. Separate different cable media types within the ladder rack using pathway dividers. Treat each type of cable media separately when determining cable fill limits.
- I. Where cable exits or enters the end, middle or side of overhead ladder rack to access a rack, frame, cabinet or wall-mounted rack, cabinet or termination field, a radius drop shall be used to guide the cable.
- J. Maintain a minimum separation of 2 feet (0.6 m) between ladder rack used for communications cables and pathways for other utilities or building services.
- K. Touch-up paint color-matched to the finish on the component and will correct any minor cosmetic damage (chips, small scratches, etc.) resulting from normal handling during the installation process prior to delivery to the owner. If a component is cosmetically damaged to the extent that correction in the field is obvious against the factory finish, the component will be replaced with a new component finished from the factory. If a component is physically damaged due to mishandling or modification during the installation process, it shall not be used as part of the ladder rack system.

END OF SECTION 271123

Section Format for Division 27 13 00 Communications Backbone Cabling

Part 1 – General

1.01 Additional Information

A. Refer to the general conditions and the related sections for the following information

- 1) References
- 2) Definitions / Terms / Acronyms
- 3) Submittal Requirements
- 4) Contractor Qualifications
- 5) Manufacturer Qualifications
- 6) Bidder Qualifications
- 7) Testing Agency Qualifications
- 8) Delivery, Storage and Protection
- 9) Project conditions
- 10) Sequencing
- 11) Continuity of Service and Scheduling of Work
- 12) Protection of Work and Property
- 13) Warranty

1.02 Products Installed but not Supplied Under This Section

- A. All conduit and EMT required for Communications cabling pathway in/out of cross connect closets and in/out of wall cavities at the work area. EMT or Conduit for pathways shall have no more than two 90 degree bends and no continuous section over 100'.
- B. All core holes and poke through devices in the floor for the installation of Communications cabling.
- C. All core holes and EMT sleeves between floors for the routing of Communications cabling.
- D. Basket tray or ladder racking to support main pathway cable bundles.

1.03 Backbone Cabling Description

- A. Backbone cabling system will provide interconnections between communications equipment rooms, main terminal space, and entrance facilities in the telecommunications cabling system structure. Cabling system consists of backbone cables, intermediate and main cross-connects, mechanical terminations, and patch cords or jumpers used for backbone-to-backbone cross-connection.
- B. Backbone cabling cross-connects may be located in telecommunication rooms or at the entrance facilities.

Communications Backbone Cabling

1.04 Work Included

- A. The Work of this Section shall consist of the labor, materials and equipment required for furnishing and installing backbone cabling as part of a complete and operating telecommunications cabling system.
- B. All items specified or included in this section shall be furnished and installed by Telecommunications Contractor, wired and connected by Telecommunications Contractor and tested by Telecommunications Contractor, unless noted otherwise. "Contractor" as used herein shall mean Telecommunications Contractor or Telecommunications Contractor's sub-contractor.
- C. All items specified or included in this section shall be furnished and installed by Electrical Contractor, wired and connected by Electrical Contractor and tested by Electrical Contractor, unless noted otherwise. "Contractor" as used herein shall mean Electrical Contractor or Electrical Contractor's sub-contractor.

1.05 Submittals

- A. Submit for approval in accordance with specified submittal procedures:
- B. Components of the telecommunications system, as specified herein.

1.06 Coordination

- A. Contractor shall furnish and install the following:
 - 1) Inside plant copper backbone cables, if noted.
 - 2) Inside plant fiber optic backbone cables.
 - 3) Outside plant copper backbone cables, if noted.
 - 4) Outside plant fiber optic backbone cables
- B. Electrical Contractor shall furnish and install the following:
 - 1) Telecommunications raceways within the building.
 - 2) Telecommunications duct banks, handholes and manholes.

Part 2 – Products

2.01 Fiber Optic Cables

- A. Acceptable Manufacturer: Berk-Tek.
- B. Cable may be either of composite cable construction or standard cable containing single-mode fibers in one cable sheath and multi-mode fibers in a separate cable sheath. Contractor shall verify raceway fill requirements when furnishing and installing two standard cable constructions to meet composite strand count requirements.
- C. Fiber Cable Specification No. 3 – Outside Plant/Inside Plant, Plenum
 - 1) Cable Construction:
 - a. Tight Buffered
 - b. Dry water-blocking tape.
 - c. Epoxy glass central strength member.
 - 2) Jacket Material: Flame retardant UV stabilized , OFNP rated

Communications Backbone Cabling

- 3) Fiber Count: As indicated on Drawings (single mode/multimode).
- 4) Fiber Type:
 - a. Single-mode: 8.2/125.
 - b. Multimode: 50/125.
- 5) Color coded 900 micron buffered fibers.
- 6) Color Code: TIA/EIA-598-A, Optical Fiber Cable Color Coding.
- 7) Jacket Color: Black
- 8) Maximum Pulling Tension:
 - a. Up to 12 strand: 1335 N (300 lb/f) during installation, 400 N (90 lb/f) installed
 - b. 18 strand and above: 2670 N (600 lb/f) during installation, 801 N (180 lb/f) installed
- 9) Storage Temperature: -40 to +70 degrees C (-40 to +158 degrees F).
- 10) Installation Temperature: 0 to +60 degrees C (+32 to +140 degrees F).
- 11) Operating Temperature: -40 to +70 degrees C (-40 to +158 degrees F).

D. Glass Transmission Media - Single Mode

- 1) Acceptable Manufacturer: Berk-Tek.
- 2) Dispersion unshifted, low water peak.
- 3) Proof tested to 100 kpsi
- 4) Cable cutoff wave length <1260 nm.
- 5) Glass Geometry:
 - a. Fibercurl: > 4.0mm radius of curvature.
 - b. Cladding Diameter: $125.0 \pm 0.7 \mu\text{m}$
 - c. Core: Clad Concentricity: - < $0.50 \mu\text{m}$
 - d. Cladding Non Circularity: < 1.0%.
- 6) Cabled Fiber Optical Performance:
 - a. 1310 nm: - < 0.4 dB/Km, maximum
 - b. 1383 nm: $\pm 3 \text{ nm} \leq 22 \text{ dB/Km}$
 - c. 1550 nm: < 0.20 dB/Km, maximum
 - d. Zero Dispersion Wave Length: $1302 \leq \text{wavelength} \leq 1322$
 - e. Zero Dispersion Slope: 0.086 psi/(nm.km)
 - f. Refractive Index Difference: 0.36%
 - g. Numerical Aperture: 0.14
 - h. In compliance with TIA/EIA 492-CAAB and Telecordia's GR-20.
 - i. Enhanced water peak at 1383 nm.

E. Glass Transmission Media – Multimode 50/125

- 1) Acceptable Manufacturer: Berk-Tek
- 2) The multimode fiber shall meet EIA/TIA-492AAAC-A, "Detail Specification for 50- μm Core Diameter/125- μm Cladding Diameter, Graded-Index, Multimode Optical Fibers."

Communications Backbone Cabling

- 3) 100 Kpsi Proof Tested
- 4) Glass Geometry
 - a. Core Diameter: (μm) 50 ± 2.5
 - b. Core Non-Circularity: $< 5\%$
 - c. Cladding Diameter: (μm) 125.0 ± 2.0
 - d. Cladding Non-Circularity: (μm) $< 1.0\%$
 - e. Core-to-Cladding Concentricity: (μm) < 1.5
 - f. Numerical Aperture: 0.200 ± 0.015
 - g. Coating Diameter: (μm) 245 ± 5
 - h. Coating – Cladding Concentricity $< 12 \mu\text{m}$
- 5) Cabled Optical Fiber Performance
 - a. Attenuation (dB/km): 850 nm < 3.0 , 1300 nm < 1.0
 - b. Minimum LED Bandwidth: 850 nm, 1500; 1300 nm 500
 - c. Cabled Effective Modal Bandwidth: (MHz•Km): 850 nm > 2000
 - d. IEEE 802.3 GbE Distance (m): 850 nm, 1000; 1300 nm, 600
 - e. IEEE 802.3 10GbE Distance (m): 850 nm, 300

F. Fiber Optic Cable Shipping Requirements

- 1) All cabled optical fibers > 1000 meters in length shall be 100% attenuation tested. The attenuation of each fiber shall be provided with each cable reel.
- 2) Top and bottom ends of the cable shall be available for testing on the shipping reel.
- 3) Both ends of the cable shall be sealed to prevent the ingress of moisture.
- 4) Each reel shall have a weather resistant reel tag attached identifying the reel and cable. The reel tag shall include the following information:
 - a. Cable Number, Gross Weight
 - b. Shipped Cable Length in Meters, Job Order Number
 - c. Manufacturer Product Number, Customer Order Number
 - d. Date Cable was Tested, Manufacturer Order Number
 - e. Cable Length Markings, Item Number
 - i Top (inside end of cable)
 - ii Bottom (outside end of cable)
- 5) Each cable shall be accompanied by a cable data sheet. The cable data sheet shall include the following information:
 - a. Manufacturer Cable Number, Manufacturer Product Number
 - b. Manufacturer Factory Order Number, Customer Name
 - c. Customer Purchase Order Number
 - d. Mark for Information Ordered Length
 - e. Maximum Billable Length, Actual Shipped Length
 - f. Measured Attenuation of Each Fiber Bandwidth Specification (for lengths > 1000 m)

- G. The cable manufacturer shall provide installation procedures and technical support concerning the items contained in this specification.

2.02 Fiber Optic panels

- A. FIBER OPTIC TERMINATION ENCLOSURES and SPLICE TRAYS
- 1) For OM4 and OS2 Fiber Optic Systems:

Communications Backbone Cabling

- 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.
- b. 1RU Opt-X Ultra rack-mount Fiber Optic Enclosure, empty, with sliding tray. Capacity: 72 fiber strands (LC), 3 fiber adapter plates and 3 splice trays, or 3 MTP modules. Part Number: Leviton 5R1UH-S03. Use at all IDF locations.
- c. 4RU Opt-X Ultra rack-mount Fiber Optic Enclosure, empty, with sliding tray. Capacity: 288 fiber strands (LC), 12 fiber adapter plates and 12 splice trays, or 12 MTP modules. Part Number: Leviton 5R4UH-S12. Use at all MDF locations. One is needed for every six zones served from the IDF.
- B. Splice Trays
 - 1) Use splice sleeves that come with splice cassettes.
- C. Splice Cassettes
 - 1) Opt-X 12-Fiber LC OM3 Splice Module. Part Number: Leviton SPLCS-12A
 - 2) Opt-X 12-Fiber LC OS2 Splice Module. Part Number: Leviton SPLCS-12L

2.03 Fiber Optic jumpers (patch cords)

- A. OM3, aqua. Factory-terminated, double-ended, 2-strand multimode cordage.
 - 1) Duplex LC-Duplex LC: Leviton 5LDLC-M03 (3 meter) for all wallmount IDF racks and enclosures. Leviton 5LDLC-M05 (5 meter) for all standing racks and enclosures.
- B. OS2, yellow. Factory-terminated, double-ended, 2-strand multimode cordage, UPC polish.
 - 1) Duplex LC- Duplex LC: Leviton UPDLC-S03 (3 meter) for all wall mount IDF racks and enclosures. Leviton UPDLC-S05 (5 meter) for all standing racks and enclosures.
- C. Provide quantify for all fiber stands to each zone. One will be required for each pair of strands at the MDF, one will be required for each pair of strands at the IDF.

Part 3 – Execution

3.01 Additional Information

- A. Refer to Section 27 00 00 for the following Part 3 - Execution information
 - 1) General
 - 2) Cable Pathways
 - 3) Work Area Outlets
 - 4) Installation Practices
 - 5) Labeling
 - 6) Firestopping
 - 7) Sealing of Penetrations and Openings
 - 8) Cable Supports
 - 9) Cable Protection
 - 10) Grounding
 - 11) Documentation
 - 12) Training
 - 13) Cleaning
 - 14) Project Closeout

3.02 Installation

- A. General

Communications Backbone Cabling

- 1) All cable and associated hardware shall be placed so as to make efficient use of available space in coordination with other uses. All cable and associated hardware shall be placed so as to not impair the use or capacity of other building systems, equipment, or hardware placed by others (or existing).
- 2) Where cable is placed in ceiling areas or other non-exposed areas, cables shall be installed in cable trays or in non-continuous cable support system. Non-continuous cable supports shall be placed at random intervals no greater than 48 inches. Cables in non-continuous support systems shall be bundled using hook and loop type fasteners. Cable sag between supports shall not exceed 3 inches. Attaching wire to pipes or other mechanical items is not permitted. Cables shall not be bundled or tied in conduits, and in cable trays above ceilings.
- 3) All cabling shall be routed so as to avoid interference with any other service or system, operation, or maintenance purposes such as access boxes, network equipment, mechanical equipment access doors and covers, switches or electrical panels, and lighting fixtures. Avoid crossing areas horizontally just above or below any riser conduit. Lay and dress cables to allow other cables to enter the conduit/riser at a later time by maintaining a working distance from these openings. All cable shall be installed to allow for simple installation and removal of cables in the future.
- 4) Unless noted, all interior wiring shall be installed in raceways, Raceway Specification No. 2, one inch minimum. Wiring above accessible ceilings may be installed in cable tray and exposed on "J" hooks.
- 5) All cables not in raceways shall be riser or plenum rated.
- 6) All cables running outside the building shall be rated for outside plant installation.
- 7) Backbone cables shall be grouped separately from horizontal distribution cables. Cable for other systems shall be grouped separately from cables for telephone and data.
- 8) All inside cable shall be installed neatly above accessible ceilings using cable tray and "J" hooks supported from building structure. Do not attach to pipes, conduits, ducts, etc. Do not allow cable to rest on pipes, conduits, ducts, ceiling tiles, etc. Do not attach to wires used for supporting suspended ceilings. Do not use tie wires or bridle rings.
- 9) All wires shall be marked at all junction boxes, pull boxes, cabinets, boxes and terminations. Each cable run between terminating locations shall be one continuous cable (no splices or connections).
- 10) The Contractor shall install cable in such a manner as to prevent stretching, kinking or sharp bends. Cable damaged during installation or not passing required testing shall be removed and replaced at no additional cost to Owner.
- 11) The Contractor shall replace or rework cables showing evidence of improper handling including stretches, kinks, short radius bends, over tightened bindings, loosely twisted and over twisted pairs at terminations, and too much jacket removed.
- 12) Minimum bend radius and maximum pulling tension for all cables shall be maintained during and after installation. Install cable in accordance with manufacturer's ratings and instructions.
- 13) Cables shall not be installed near power sources or other items where interference could develop. Cables shall not be placed within 18 inches of light fixtures and within 3 feet of motors, transformers, copy machines, or solid state motor starters unless cable

Communications Backbone Cabling

is installed in conduit. Contractor shall furnish and install a grounding conduit system where these minimum clearances cannot be maintained.

- 14) In telecommunications spaces, cables shall be routed as close as possible to the ceiling, floor, or corners to insure that adequate wall or backboard space is available for current and future equipment and for cable terminations. Cables shall not be tie-wrapped to existing electrical conduit or other equipment. Minimum bend radius shall be observed.
- 15) Dress and attach cables to the backboard along the shortest possible route run square (horizontal and vertical) to the backboard. Bundle similarly routed cables together and attach by means of clamps or distribution rings. Cable dress and attachment shall minimize obstruction to future installations of equipment, backboard, or other cables.
- 16) Cables shall be neatly bundled with hook and loop type fasteners. Nylon tire wraps are not acceptable. Cables must be neatly bundled in the telecommunications spaces and at the cable service loop.
- 17) Cable service loops shall be provided at both ends of backbone cable runs.
 - a. At the telecommunications room, provide a minimum 8 foot service loop stored in a figure eight pattern in the cable tray above the racks/cabinets.
 - b. At the telecommunications room, provide sufficient slack to properly dress and terminate cables at the racks and cabinets.
 - i. Provide sufficient slack so that swing gate type racks and cabinets can open fully
 - ii. Provide sufficient slack so that cables do not catch or bind at swing gate type rack or cabinet hinge and the cables do not pull taught across the hinge or edge.
 - c. A minimum 25 foot service loop shall be maintained at each building entrance and exit.
- 18) All interior fiber optic cables shall be installed in plenum rated innerduct above accessible ceilings.
 - a. Innerduct shall be installed to within 12 inches of termination enclosure.
 - b. Install pull boxes, 12" x 12" minimum, as required to limit cable pulls to two 90 degree bends or 150 feet.
 - c. Innerduct shall not be kinked or tightly bent in any way.
- 19) All exterior fiber optic cables shall be installed in innerduct.
- 20) A break-away link shall be used for installation of cables with a cable-puller or winch. The break-away link shall be designed to separate at or below the recommended maximum tension of the cable being installed.
- 21) Any damage to Owner's existing cabling or existing cable owned by others, caused as a result of work performed under this scope, shall be brought to the Owner's attention and repaired or replaced within 48 hours.
- 22) Contractor shall use only cable lubricants recommended by the manufacturer for use with the specific cable construction.
- 23) Should a cable become kinked, skinned or stretched during installation, the cable shall be removed and replaced at no additional cost to the Owner. Splicing at points other than those specified will not be acceptable.

B. Outside Plant Cable

Communications Backbone Cabling

- 1) Cable service loops shall be included in each manhole to allow for proper cable dressing, splicing the cable outside the manhole in a controlled space and for repairing damaged cable.
- 2) Cable service loops shall be provided as indicated herein, and as otherwise indicated elsewhere in the contract documents and on the Drawings.
- 3) Install sufficient cable slack to remove cable from the manhole for splicing in a splice van or tent.
- 4) In addition to the cable slack required for proper termination/splicing in a splice enclosure, the Contractor shall install sufficient cable slack to form at least one loop of cable along the inner perimeter of the manhole.
- 5) Where no cable splice is planned for a manhole, the contractor shall leave sufficient slack to form at least two loops of cable along the inner perimeter of the manhole.
- 6) Cable service loop lengths shall be adjusted based on manhole size, manhole depth and existing conditions.
- 7) Cables slack shall be securely fastened to all four walls of the manhole. Furnish and install bracket arms for securing and mounting of all cables where built-in racking exists.
- 8) If racking is not furnished in a manhole, furnish and install a cable sling of weather, water, oil and solvent resistant material to support the cable(s) on those walls without built in racking.
- 9) Cable splice enclosures shall be security fastened to mounting arm brackets attached to manhole racking. Furnish and install racking and mounting arm brackets to support splice cases. Cable splice enclosures shall be attached to at least two racks in the manhole.
- 10) All cables shall be secured to bracket arms using cable ties and straps resistant to weather, water, oil, fuel and solvents. Plastic or stainless steel ties/straps rated for this application shall be acceptable for use.
- 11) All cable dressing in manholes shall be performed so that the minimum bend radius of cables is not exceeded.
- 12) All cable splice enclosures shall be mounted either on the long wall of the manhole or on the wall parallel with the main cable run entry and exit conduits.
- 13) Wherever possible in existing manholes, and as a standard for manholes furnished and installed under this or an associated project, optical cable splice enclosures shall be mounted on one long wall (or parallel wall as previously defined) and copper cable splice enclosures, if needed, shall be mounted on the opposite wall.
- 14) Wherever possible, large pair count copper cable enclosures shall be mounted at the vertical mid-line of the manhole and fiber cable splice enclosures shall be mounted at or above the vertical mid-line.
- 15) All cables shall be spliced in splice enclosures as specified herein.
 - a. Furnish and install the maximum slack in each enclosure as recommended by the cable, splice system and enclosure manufacturer.

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- b. Furnish and install all splice trays, splice holders, splice tray holders, mounting brackets, frames, grounding and other ancillary hardware and materials as required by the cable manufacturer, splice system manufacturer, splice enclosure manufacturer and standard industry practices.
 - c. Only technicians trained in the proper assembly of enclosures, splices and splicing procedures shall be permitted to splice cables.
- B. 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.
 - c. Carefully monitor pulling tension so as not to exceed limits specified by manufacturer.

3.03 Fiber Optic Cable Testing

- A. Fiber Optic Cable Test Equipment:
 - 1) Cable tester will be NRTL certified for TIA/EIA TSB95.
 - 2) Cable testers will be Optical Power Meter and High Resolution Optical Time Domain Reflectometer (OTDR). The cable tester will be NRTL certified for compliance to latest TIA/EIA Standard 568B performance requirements at 850, 1300 and 1550 nm.
 - 3) Testers will have been calibrated at least one year prior to use on this project. Contractor to provide proof to Owner if requested.
 - 4) Submit software copy of test results, in original tester software format, to the Owner and to the Manufacturer (either Berk-Tek or Leviton).
- B. Cable segments and links will be tested from both ends of the cable for each of the construction phases. (Verify that cable labeling matches at both ends).
- C. The system will not be considered certified until the tester has acknowledged that the performance of the physical layer of the system has been fully tested and is operational at the completion of the installation phase.
- D. Testing Procedures:
 - 1) Perform each visual and mechanical inspection and electrical test, including optional procedures, stated in NETA ATS, Section 7.25. Certify compliance with test parameters and manufacturer's written recommendations. Test optical performance with optical power meter capable of generating light at all appropriate wavelengths.
 - 2) Prior to testing, all connectors will be properly cleaned with an approved product manufactured specifically for this purpose.
 - 3) Prior to beginning testing, confirm that all testing equipment is fully charged or operating on building power. If the test equipment power levels drop below 50%, recharge unit or continue testing with a different (fully charged) tester.
 - 4) Initially test optical cable with a light source and power meter utilizing procedures as stated in TIA TSB-140, ANSI/TIA/EIA-526-7, ANSI/TIA/EIA-526-14A, OFSTP-14A Optical Power Loss Measurements of Installed Multi-mode Fiber Cable Plant and ANSI/TIA/EIA-526-7 Measurement of Optical Power Loss in installed Single-Mode Fiber cable plant.

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- 5) Measured results will be plus/minus 1 dB of submitted loss budget calculations. If loss figures are outside this range, test cable with Optical Time Domain Reflectometer (OTDR) to determine cause of variation. Correct improper splices and replace damaged cables at no charge to the Owner.

E. Multi-Mode Fiber Optic Cables:

- 1) Will be tested bi-directionally for length and attenuation at both the short and long wavelengths for Multi-Mode (850 and 1300 nm). This is Tier 1 testing as specified in TIA TSB-140. Test all Multi-Mode strands to ensure they are capable of transmitting 10 Gigabit Ethernet speeds.
- 2) The maximum insertion loss measured at 23 degrees C. will be 3.75dB/km @ 850 nm and 1.5 dB/km @ 1300 nm.

F. Single-Mode Fiber Optic Cables:

- 1) Will be tested bi-directionally for length and attenuation at both the short and long wavelengths for Single-Mode fiber (1310 and 1550 nm). This Tier 1 testing as specified in TIA TSB-140.
- 2) Single-mode fibers will be dual wave length and provide attenuated wavelength of the 1310 nm and 1550 nm. 850 nm for single-mode fiber will not be acceptable under any circumstances.

G. All cables will be tested after termination using a cable certification tester that contains the test equipment manufacturer's most current version of firmware.

H. Test all fiber optic cable segments end-to-end from the fiber optic backbone patch panel in the Equipment Room to each fiber optic backbone patch panel in each Telecommunications Room.

I. Broken or faulty strands will not be accepted. Any cable not fully functional with all strands usable will be replaced at no cost to the Owner.

J. Upon completion of testing, all connectors will be capped with a product made for that specific function by the connecting hardware manufacturer to prevent the contamination of the fiber from construction debris or other foreign objects.

K. Test Results:

- 1) The test results information for each link will be recorded in the memory of the field tester upon completion of the test. The tester will be capable of storing test data in either internal or external memory. The external media used will be left to the discretion of the user.
- 2) Test results saved by the tester will be transferred into a Windows based database utility that allows for maintenance, inspection and archiving of these test records. A guarantee must be made that the measurement results are transferred to the PC unaltered as well as any printed reports generated from the software application.
- 3) The test results information for each link will be recorded in the memory of the field tester upon completion of the test. The tester will be capable of storing test data in either internal or external memory. The external media used will be left to the discretion of the user.

Communications Backbone Cabling

- 4) Test results saved by the tester will be transferred into a Windows based database utility that allows for maintenance, inspection and archiving of these test records. A guarantee must be made that the measurement results are transferred to the PC unaltered as well as any printed reports generated from the software application.
 - 5) Optional formats of data reporting are: comma separated variable (.csv), Portable Document File (.pdf) or compatible, plain text (.txt), or hypertext markup language (.html/.htm). Test results will be turned over to owner's representative prior to cutover.
 - 6) Test results will include the following:
 - a. Telecommunications Room number
 - b. Location of fiber pull i.e. (Equipment Room # to Telecom Room #)
 - c. Patch panel # and location
 - d. Connector type
 - e. Distance
 - f. Wavelength tested
 - g. Technician who performed the testing
- L. The Owner and Engineer reserve the right to observe testing and/or randomly sample completed links for conformance to project specifications.

End of Section

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-568.0-D – Generic Communications Cabling for Customer Premises.
- B. ANSI/TIA-568.1-D – Commercial Building Communications Cabling Standard Part 1: General Requirements.
- C. ANSI/TIA 568-C.2 – Balanced Twisted-Pair Telecommunications Cabling and Components Standards
- D.
- E. ANSI/TIA-569-D – Commercial Building Standard for Telecommunications Pathways and Spaces.
- F. ANSI/TIA-606-B – Administration Standard for the Commercial Telecommunications Infrastructure.
- G. ANSI/JSTD-607-C – Commercial Building Bonding and Grounding (Earthing) Requirements for Telecommunications.
- H. NFPA 70 – National Electrical Code (NEC).

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

1.4 PRE-INSTALLATION MEETINGS

- A. Convene pre-installation meeting 4 weeks before start of installation of communications horizontal cabling. Should occur with construction manager, owner representatives, and contractor project manager and project foreman.
- B. 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 Class D, Class E, and/or Class Ea.
 - 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 or to Berk-Tek, in the certification tester's original software files. A copy of test results must be submitted to the district.
 - 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: Combination of the following types of cables from TR to TO:
 - 1. Category 6A, cables from TRs to Wireless access point TOs
 - 2. Category 6, (100-Ohm, 4-pair, unshielded twisted pair) cables from TRs to remaining TOs.
- C. Communications Horizontal Cabling System: Includes cables, jacks, patch panels, connecting blocks, patch cords, 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.
- 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: **CX6650 Cat 6A Enhanced UTP System**
 - 1. 100 ohm, Category 6A, 23 AWG, 4-pair unshielded twisted pair, LANmark-10G2, CMP rated.
 - a. Color: Blue.
 - b. Part Numbers: Reel: 10130484 Reel in Box: 11085339
 - c. Electrical Characteristics: Characterized to 750 MHz.
 - d. Cable: Third-party verified by ETL.
 - e. Maximum Cable Diameter: 0.300 inch.
 - f. Berk-Tek LANmark-10G2 CMP
 - 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.
 - 2. Channel margin guarantees for a **CX6650 Cat 6A Enhanced UTP System** (margin vs. ANSI/TIA-568-C.2 and margin guarantees are for a 4-connector channel).
 - a. Insertion Loss 3 %
 - b. NEXT 4 dB
 - c. PSNEXT 5 dB
 - d. ACR-F (ELFEXT) 7 dB
 - e. PSACR-F (PSELFEXT) 8 dB
 - f. Return Loss 3 dB
 - g. ACR-N 6 dB
 - h. PSACR-N 7 dB
 - i. PSANEXT 1 dB
 - j. PSAACR-F 1 dB

B. Category 6 Unshielded Twisted Pair: **CX6200 Cat 6 Premium UTP System.**

1. 100 ohm, Category 6, 23 AWG, 4-pair unshielded twisted pair, LANmark 2000, CMP rated.
 - a. Color: Blue. O.D. 0.220"
 - b. Part Number: 10163222 (reel) 10063780 (reel-in-a-box).
 - c. Electrical Characteristics: Characterized to 600 MHz.
 - d. Each Pair in Cable: Insulated with FEP.
 - e. Cable: Third-party verified by ETL.
 - f. Berk-Tek LANmark-2000 CMP
 - 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
2. Channel margin guarantees for a **CX6200 Cat 6 Premium UTP System** (margin vs. ANSI/TIA-568-C.2 and margin guarantees are for a 4-conductor channel).
 - a. Insertion Loss 5 %
 - b. NEXT 8 dB
 - c. PSNEXT 8 dB
 - d. ACR-F (ELFEXT) 9 dB
 - e. PSACR-F (PSELFEXT) 10 dB
 - f. Return Loss 5 dB
 - g. ACR-N 9 dB
 - h. PSACR-N 10 dB

2.4 MODULAR JACKS AND FIBER ADAPTERS FOR WORKSTATION OUTLETS

A. Category 6A Modular Jacks: **CX6650 Cat 6A Enhanced 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 5e, 6 and 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 line 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 with 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.
22. Color: blue.
23. Part Numbers: Standard version: 6AUJK-RL6 (blue).

B. Category 6 Modular Jacks: **CX6200 Cat 6 Premium UTP System**

1. 8-position eXtreme QuickPort modular jack, Category 6, IDC terminals, T568A/B wiring scheme.
2. Component-rated jack.
3. Each Jack: Identified on its face as CAT 6.
4. Color: blue.
5. Part Number: Leviton 61110-RL6 (blue).

2.5 WORK AREA OUTLETS

A. Flush-Mounted Plastic Faceplates:

1. 1-port single-gang plastic wallplate with ID windows.
 - a. Colors: white
 - b. Part Number: Leviton 42080-1WS (white).
2. 2-port single-gang plastic wallplate with ID windows.
 - a. Colors: white
 - b. Part Number: Leviton 42080-2WS (white).
3. 3-port single-gang plastic wallplate with ID windows.
 - a. Colors: white
 - b. Part Number: Leviton 42080-3WS (white).
4. 4-port single-gang plastic wallplate with ID windows.

- a. Colors: white
- b. Part Number: Leviton 42080-4WS (white).
- 5. 6-port single-gang plastic wallplate with ID windows.
 - a. Colors: white
 - b. Part Number: Leviton 42080-6WS (white).
- 6. 1-port dual-gang plastic wallplate with ID windows.
 - a. Colors: white
 - b. Part Number: Leviton 42080-1WP (white).
- 7. 2-port dual-gang plastic wallplate with ID windows.
 - a. Colors: white
 - b. Part Number: Leviton 42080-2WP (white).
- 8. 3-port dual-gang plastic wallplate with ID windows.
 - a. Colors: white
 - b. Part Number: Leviton 42080-3WP (white).
- 9. 4-port dual-gang plastic wallplate with ID windows.
 - a. Colors: white
 - b. Part Number: Leviton 42080-4WP (white).
- 10. 6-port dual-gang plastic wallplate with ID windows.
 - a. Colors: white
 - b. Part Number: Leviton 42080-6WP (white).
- 11. 8-port dual-gang plastic wallplate with ID windows.
 - a. Colors: white
 - b. Part Number: Leviton 42080-8WP (white).
- 12. 12-port dual-gang plastic wallplate with ID windows.
 - a. Colors: white
 - b. Part Number: Leviton 42080-12W (white).

B. Flush-Mounted Stainless Steel Faceplates: Scope to identify if Stainless is needed in a particular location.

- 1. 1-port QuickPort faceplate with mounting lugs for wall phone, stainless steel, mounts onto single-gang wall box.
 - a. Part Number: Leviton 4108W-0SP (flush plate) or 4108W-1SP(jack area recessed).
- 2. 1-port QuickPort single-gang stainless steel wallplate, with ID windows
 - a. Part Number: Leviton 43080-1L1.
- 3. 2-port QuickPort single-gang stainless steel wallplate, with ID windows
 - a. Part Number: Leviton 43080-1L2.
- 4. 3-port QuickPort single-gang stainless steel wallplate, with ID windows
 - a. Part Number: Leviton 43080-1L3.
- 5. 4-port QuickPort single-gang stainless steel wallplate, with ID windows
 - a. Part Number: Leviton 43080-1L4.
- 6. 6-port QuickPort single-gang stainless steel wallplate, with ID windows
 - a. Part Number: Leviton 43080-1L6.
- 7. 2-port QuickPort dual-gang stainless steel wallplate, with ID windows
 - a. Part Number: Leviton 43080-2L2.
- 8. 4-port QuickPort dual-gang stainless steel wallplate, with ID windows
 - a. Part Number: Leviton 43080-2L4.
- 9. 6-port QuickPort dual-gang stainless steel wallplate, with ID windows
 - a. Part Number: Leviton 43080-2L6.
- 10. 8-port QuickPort dual-gang stainless steel wallplate, with ID windows
 - a. Part Number: Leviton 43080-2L8.
- 11. 12-port QuickPort dual-gang stainless steel wallplate, with ID windows

- a. Part Number: Leviton 43080-L12.

C. Surface-Mounted Outlet Boxes:

- 1. 1-port QuickPort surface-mount box, plastic, with ID window.
 - a. Color: white
 - b. Part Number: Leviton 41089-1WP (white).
- 2. 2-port QuickPort surface-mount box, plastic, with ID window.
 - a. Color: white
 - b. Part Number: Leviton 41089-2WP (white).
- 3. 4-port QuickPort surface-mount box, plastic, with ID window.
 - a. Color: white
 - b. Part Number: Leviton 41089-4WP (white).
- 4. 6-port QuickPort surface-mount box, plastic, with ID window.
 - a. Color: white
 - b. Part Number: Leviton 41089-6WP (white).
- 5. 12-port QuickPort surface-mount box, plastic, with ID window.
 - a. Color: white
 - b. Part Number: Leviton 41089-12W (white)
- 6. 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)
 - c. This is the box to be used above the ceiling grid for WiFi jacks.
- 7. 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)
- 8. Surface Box Colors: part numbers shown are for white. Also available: Ivory, Grey, and Black. Coordinate with Architect to match finish.

D. 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.
- E. Mounting Frames for QuickPort Jacks and Connectors | Not used in this project.
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.

2.6 TERMINATION BLOCKS

- A. Termination Blocks: May be used for Consolidation Point terminations, or for termination of multi-pair copper (analog voice) backbone cabling.
- B. Category 6, 110-Style Blocks: **CX6200 Cat 6 Premium UTP System**,
1. Category 6, 288 pair, 110-style, with mounting legs, wall mount.
 - a. Part Number: Leviton 41AB6-3F4.
 2. Category 6, 96 pair, 110-style, with mounting legs, wall mount.
 - a. Part Number: Leviton 41AB6-1F4.
 3. Category 6, 288 pair, 110-style, rack mount.
 - a. Part Number: Leviton 41DR6-3F4.
 4. Category 6, 96 pair, 110-style, rack mount.
 - a. Part Number: Leviton 41DR6-1F4.

2.7 PATCH PANELS

- A. QuickPort-Style Patch Panels: **CX6650 Cat 6A Enhanced UTP System, CX6200 Cat 6 Premium UTP System**
 - 1. 24-port, 1RU, QuickPort, flat metal, patch panel, empty.
 - a. Part Number: Leviton 49255-H24.
 - 2. 48-port, 1RU, QuickPort, flat metal, patch panel, empty.
 - a. Part Number: Leviton 49255-H48.
 - 3. Contractor shall provide 48 port patch panels for terminations, unless otherwise specifically noted in writing.

2.8 PATCH CORDS/JUMPERS

- A. Jurupa Unified School District has a standardized color scheme for all patch and station cords.
 - 1. Blue(L)-Computer/VoIP phone
 - 2. Yellow(Y)-WiFi
 - 3. Red(R)-Security/Access Control
 - 4. Green(G)-Energy Management/Building Management/Facility systems
- B. High-Flex Category 6A Modular Patch Cords: **CX6650 Cat 6A Enhanced 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 H6A10-1Y (1 foot, Yellow). Patch
 - 2) Leviton H6A10-10Y (3 feet, Yellow). Station/Device
- C. eXtreme Category 6 Modular Patch Cords: **CX6200 Cat 6 Premium UTP System,**
 - 1. Slim-Line style, Category 6 UTP patch cord, 4-pair, stranded wire construction.
 - a. Color: 7 colors available.
 - b. Part Numbers:
 - 1) Leviton 6D460-01L (1 foot, Blue). Patch

PART 3 EXECUTION

3.1 EXAMINATION

- A. Examine areas to receive communications horizontal cabling.
- B. Notify Construction manager of conditions that would adversely affect installation or subsequent use.
- C. Do not begin installation until unacceptable conditions are corrected.

3.2 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 Patch Cords and Jumpers: Not allowed.
- C. Copper Patch Cords: Manufactured by Leviton Network Solutions.
- 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. Cable Ties and Other Cable Management Clamps:
 - 1. No more than hand tightened.
 - 2. Fit snugly, but not compress, crimp, or otherwise change physical characteristics of cable jacket or distort placement of twisted-pair components.
 - 3. Replace cables exhibiting stresses due to over tightening of cable management devices.
 - 4. Use plenum-rated cable ties in plenum spaces.
 - 5. Velcro wraps are to be used for cable bundle management. Plenum-rated Velcro wraps are available from Leviton. Nylon cable ties should not be used during installation or for finishing.
- K. Where possible, route cables in overhead cable trays and inside wire management systems attached to equipment cabinets and racks.
 - 1. Use Velcro or ducts 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. Any supports needed above the ceiling shall be independent of the ceiling grid system.
- 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.

3.3 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. These locations must be approved in writing, or specified explicitly in construction documents.
- 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.

3.4 INSTALLATION – UNSHIELDED TWISTED-PAIR TERMINATION

- 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. Terminate 4-pair cables on jack and patch panels using T568-B or T568-A wiring scheme.
- D. Pair Untwist at Termination: Do not exceed 12 mm (1/2 inch).
- E. 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.
- F. Maintain cable jacket to within 25 mm (1 inch) of termination point.
- G. 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.

3.5 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 Berk-Tek and Leviton Network Solutions instructions
 - 1. If any of these are in conflict, bring discrepancies to the attention of the Construction manager 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 required.**

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. Provide test results in approved certification testers original software format on CD, with the following minimum information per cable:
 - a. Circuit ID. Final circuit ID as identified by labeling and as-builts.
 - 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.
7. An occasional asterisk-Pass (*Pass) will be accepted by Leviton or Berk-Tek 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.
8. 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 (either Berk-Tek or Leviton).
9. Submit fully functional version of tester software for use by the Owner in reviewing test results.
10. 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).

3.6 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.
 - 1. Sharpie and 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. 2-A43 for telecommunications zone 2, patch panel A, cable number 43. The MDF is zone 1, IDF 2 is zone 2.
 - 1. Owner may provide specific labeling requirements. Coordinate with the Owner.
- E. Note labeling information on shop drawings, redlines, and final as-builts.

3.7 PROTECTION

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

END OF SECTION