

UNIVERSITY OF IDAHO

STRUCTURED CABLING STANDARD

VERSION 2.5



University of Idaho
Office of Information Technology

Office of Information Technology

Network Team

875 Perimeter Drive, Moscow, Idaho 83844

netteam@uidaho.edu

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1. INTRODUCTION

1.1. PURPOSE

The purpose of these requirements is to assist Departments, Engineers, Architects and Contractors in creating a robust infrastructure to support present technologies and to ensure the future addition of emerging technologies in education.

Product specifications, general design considerations, and installation guidelines are provided in this document. Any cabling contractor ("Contractor") performing structured cabling work for the University of Idaho must meet or exceed all requirements for the cabling system described in this document.

Communication technologies are a critical element in the design of virtually all new and renovation building projects. Whether it be voice, data and video transmission, security and fire alarm systems, audio/visual systems, multimedia, or other communication technologies, it is important that a team of experienced professionals are involved in the design to ensure that University of Idaho (UI) has a technology infrastructure that provides users with reliable, high-speed connectivity to internal and external network-based resources.

In addition to technical assistance, the Guidelines also recognize the important educational and fiscal implications of "future proofing." That is, careful planning of the technology infrastructure will extend the life of the investment and prevent premature obsolescence. For example, there is an ever-growing demand for bandwidth for telecommunications/network systems in educational environments. Typically, when departments start to use networks, the 10Mbps range is found satisfactory for text-based uses such as e-mail. Digital Imaging, Multimedia and Internet graphic files are now prevalent so the 100 Mbps range is required. Increasingly necessary, however, is full motion video, which may require up to 1 Gbps, depending upon video compression technology. This upward trend in higher bandwidths will continue as computer assisted medical imaging, education and research become more sophisticated and will require speeds of 10Gbps. Planning for future technological evolution is therefore essential and needs to be part of every construction/ renovation project.

Finally, a Structured Cabling Plant is a key concept in enabling the Office of Information Technology for UI. For future projections, the Guidelines have provided more detail that respond to the needs of renovation and modernization. They also apply, however, to new construction projects as well.

1.2. GENERAL SPECIFICATIONS

This specification may impact other trades. When there is a conflict in the construction document between trades, this Structured Cabling System Technical Minimum Specification prevails. As an example, the construction document may instruct the electrical contractor to provide telecommunications grounding/bonding and conduit runs in the electrical section of the construction document. If there is a conflict between the electrical specification and the telecommunications specification, the telecommunications specification prevails.

These specifications provide a minimum configuration that must be used for new construction or major remodeling of an existing facility. All manufacturers and part numbers are for performance standards only. Other

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manufacturers meeting the same performance standards as well as a minimum 20-year warranty will be considered with prior approval in writing. Contractor must receive written approval from the UI OIT Representative to use a different manufacturer than specified in this document.

1.3. PROJECT MANAGEMENT

Contractor must establish a single point of contact with the General Contractor who will be responsible for reporting progress and updating the UI OIT Representative with issues that UI must address to facilitate the cabling system installation. Contractor's point of contact (POC) must provide regular written reports to the UI OIT Representative detailing progress. Requests for access to limited access or restricted areas must be made at a minimum (1 week prior to the required access).

UI must designate, in writing, an OIT Representative for each project. Contractor will work with the OIT Representative for the entire project. If not specified, the UI OIT Network Manager will be the UI OIT Representative. Information critical to the completion of the task or project must be communicated to the UI OIT Representative as the requirement becomes known. Casual information must be passed during the scheduled progress report.

Contractor must maintain UI's facility in a neat and orderly manner during the installation of the communications cabling system. At the completion of work in each area, Contractor will perform a final cleaning of debris prior to moving the installation crew to the next work area. Some areas of the facility will require additional precautions to prevent the spread of dust and debris. Prior to commencing work, consult with the designated UI OIT Representative for specifics.

Contractor should establish baseline of structured cabling system when performing work on a project with adjacent or affected existing structured cabling. OIT expects to find existing structured cabling in working condition upon completion of new work in a location with existing cabling. Contractor should test (see section 10) existing cabling before working on new cables and/or relocating or modification of existing structured cabling. Contractor is responsible for producing post work test results on all structured cabling within the work area.

Contractor must complete repairs required to bring existing cable back into working condition at conclusion of new work, unless existing non-working cable is identified by Contractor and accepted by OIT representative before start of construction. Contractor is strongly encouraged to establish baseline of structured cabling before beginning construction.

Note: If debris not directly related to the current installation is encountered within the ceiling plenum/telecom areas, Contractor must notify the UI OIT Representative and provide pricing for clean-up necessary to remedy.

1.4. APPLICABLE STANDARDS & CODES

All work must conform to the latest edition of the National Electrical Code®, the Building Code, and all local codes and ordinances, as applicable.

- *This Technical Specification and Associated Drawings*

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- *ANSI/TIA/EIA-568-B.1 and addenda*
"Commercial Building Telecommunications Cabling Standard - Part 1: General Requirements"
- *ANSI/TIA/EIA-568-B.2 and addenda*
"Commercial Building Telecommunications Cabling Standard - Part 2: Balanced Twisted-Pair"
- *ANSI/TIA/EIA-568-B.3 and addenda*
"Commercial Building Telecommunications Cabling Standard - Part 3: Optical Fiber Cabling and Components Standard"
- *ANSI/TIA/EIA-569-A and addenda*
"Commercial Building Standard for Telecommunications Pathways and Spaces"
- *ANSI/TIA/EIA-606 and addenda*
"Administration Standard for the Telecommunications Infrastructure of Commercial Buildings"
- *ANSI/TIA/EIA-607 and addenda*
"Commercial Building Grounding and Bonding Requirements for Telecommunications"
- *Building Industries Consulting Services International (BICSI) Telecommunications Distribution Methods Manual (TDMM) – latest edition*
- *National Fire Protection Agency (NFPA) – NFPA 70, National Electrical Code (NEC) - 2008*
- *Leviton Premier Network Design and Installation Contractor Agreement (current)*

If a conflict exists between applicable documents, then the order in the list above shall dictate the order of precedence in resolving conflicts. This order of precedence must be maintained unless a lesser order document has been adopted as code by a local, state or federal entity, and is therefore enforceable as law by a local, state or federal inspection agency.

If this document and any of the documents listed above are in conflict, then the more stringent requirement must apply. All documents listed are believed to be the most current releases of the documents; Contractor is responsible to determine and adhere to the most recent release when developing the proposal for installation.

1.5. CONTRACTOR QUALIFICATIONS

Contractor must be fully capable of installing cabling of low voltage infrastructure to support applications such as, but not limited to data, voice and imaging network systems. Contractor must at a minimum possess the following qualifications:

Possess those licenses/permits required to perform telecommunications installations in the specified jurisdiction.

Personnel trained and certified to design and install BERK-TEK/LEVITON Products.

Provide proof of all LEVITON Installer Certificates and have at minimum of (4) current LEVITON Certified Installer Technicians in the local area within (100 miles) of where work is to be performed.

Provide references of the type of installation provided in this specification.

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Personnel trained in the LEVITON Certified Installer course and be competent in Termination, Splicing, Testing, Trouble Shooting Fiber and Copper Products.

Personnel knowledgeable in Idaho local, state, province and national codes, and regulations. All work must comply with the latest revision of the codes or regulations. When conflict exists between local or national codes or regulations, the most stringent codes or regulations shall be followed.

Be in business a minimum of five (5) years and successfully engaged in the routine installation of structured cabling systems (i.e. voice, data, fiber, video, etc.) of similar size and complexity.

Must have personnel fluent in the use of Computer Aided Design and possess and operate CAD software using .DWG or .DXF format and Microsoft Visio.

Must possess current liability insurance certificates.

Must be a LEVITON PREMIER NETWORK CONTRATOR current and in good standing thru the completion of any project with UI.

Must have a BICSI certified RCDD review and meet with the UI OIT representative to discuss the project and to ensure that a structured cabling system is installed that provides a comprehensive telecommunications infrastructure.

1.6. PRODUCT GUARANTEE AND WARRANTY

All BERK-TEK/LEVITON non-consumable products have a minimum 20-year guarantee. In order to qualify, the structured cabling system must be installed per the following:

Meet all TIA/EIA commercial building wiring standards

Use BERK-TEK/LEVITON products purchased from BERK-TEK/LEVITON Authorized Distributors

Products must be installed per BERK-TEK/LEVITON instructions and BERK-TEK/LEVITON Certified Installer training.

Materials and workmanship hereinafter specified and furnished must be fully guaranteed by Leviton for 20 years from transfer of title against any defects. Contractor must correct defects that may occur as the result of faulty materials or workmanship within 20 Years after installation and acceptance by the Customer, at no additional cost to The Customer. Contractor must promptly, at no cost to The Customer, correct or re-perform (including modifications or additions as necessary) any nonconforming or defective work within 20 Years after completion of the project of which the work is a part. The period of Contractor's warranty for any items herein are not exclusive remedies, and The Customer has recourse to any warranties of additional scope given by The Manufacturer to The Customer and all other remedies available at law or in equity. Contractor and Manufacturer warranties must commence with acceptance of/or payment for the work in full.

All Contractor procured equipment, or materials, must warranted against defects in materials and workmanship to the extent such warranties are reasonably obtainable.

Contractor must pass along to The Customer any additional warranties offered by the manufacturers, at no additional costs to The Customer, should said warranties extend beyond the 20-year period specified herein.

This warranty shall in no manner cover equipment that has been damaged or rendered unserviceable due to negligence, misuse, acts of vandalism, or tampering by The Customer or anyone other than employees or agents

of Contractor. Contractor's obligation under its warranty is limited to the cost of repair of the warranted item or replacement thereof. Insurance covering said equipment from damage or loss is to be borne by Contractor until full acceptance of equipment and services.

Approved equal must be made available only upon request by following the formal process of RFI.

1.7. EXCEPTION PROCESS

Any exceptions to the requirements in this document must be approved in writing by the UI OIT Representative.

2. SCOPE OF PROJECT / SCOPE OF WORK

2.1. HORIZONTAL CABLING

2.1.1. GENERAL INFORMATION

The Horizontal Structured Cabling System shall consist of Category 6 and Category 6 Augmented cables placed from the Telecommunications Room (TR) designated to the outlets as shown on drawings. All horizontal cables must terminate in the designated TR on 48-port patch panels having the capability to house Category 6 and Category 6A cabling. Wire management must be black in color and used to provide cable management above, below and to each side of the patch panel (2RU double-sided horizontal wire managers with cable radius guides and 8' high, double-sided vertical managers). A detailed parts list with quantities, part numbers of selected manufacturers components, and unit pricing per item must be submitted with each quote, or the quote will not be evaluated. Quotes without this information shall be considered incomplete.

The standard outlet configuration is (3) cables. Refer to drawings, if applicable, for category and quantity for any discrepancies from the minimum acceptable cables.

The pin-out for all horizontal cabling is to be 568A.

The horizontal cable run from the TR to the Work Area Outlet (WAO) must not exceed 295 feet and contain no splices. These cables are to provide service for voice, data, and multimedia as an integrated communications system. Horizontal cabling runs not meeting these criteria will not be accepted except in unusual cases whereby Contractor must inform UI of the situation and request approval in writing by the UI OIT Representative prior to installation.

All horizontal cabling must be blue, white, or yellow in color (for both voice and data).

For all Moves, Adds, and Changes (MAC) work, horizontal cabling must be rated for installation within a plenum (CMP) unless otherwise stated. If, by local codes, CMP is not required Contractor may request written approval from UI for an exception to use riser-rated (CMR) cable. For each project, UI will specify whether CMP or CMR cabling is to be used.

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A 40% maximum fill-ratio must be maintained where cables enter a conduit (sleeve, stub-up, conduit run, etc.). 1" conduit is the minimum required size for structured cabling.

Unacceptable Installation: Twisted pair cable can easily be damaged preventing CERTIFICATION. Twisting, jacket tearing, and kinks in the cable are not allowed and must be replaced. This damage is easily prevented by installers using proper pulling procedures. Remember the maximum tension allowed for the cable being used. Above that amount and the cable has BEEN DAMAGED.

Contractor must provide all materials to place and terminate all outlet types.

Category 6 modules must match the faceplate color as well as accept icon designators.

2.1.2. OUTLET TYPES / CABLE QUANTITY

- Devices

Wall Phones: must have a minimum of one WAO with one Category 6 cable per location; (refer to drawings for project specification).

Wallplate Wireless Access Points: must have a minimum of one WAO with three category 6 cable per location at standard electrical outlet height. (refer to drawings for project specifications). **OIT defaults to Wallplate Wireless Access Points**

Overhead/Outdoor Wireless Access Points: must have a minimum of one WAO with two category 6 cable per location. (refer to drawings for project specifications). **Overhead and outdoor Wireless Access Points must be coordinated with OIT Network Team**

Cameras: must have a minimum of one WAO with two Category 6 cables per location; (refer to drawings for project specifications).

Projectors: must have a minimum of one WAO with three Category 6 cables per location; (refer to drawings for project specifications).

Digital Displays: must have a minimum of one WAO with three Category 6 cables per location; (refer to drawings for project specifications).

- Rooms

Offices: must have a minimum of one WAO with three Category 6 cables and a second WAO with conduit raceway and pull string for future; (refer to drawings for project specifications).

Conference Rooms: must have a minimum of one WAO with three Category 6 cables and a second WAO with conduit raceway and pull string for future; (refer to drawings for project specifications).

Classrooms: must have a minimum of one WAO with six Category 6 cables and a second WAO with conduit raceway and pull string for future; (refer to drawings for project specifications).

Unless specified, height to match typical electrical receptacle for designated outlet.

2.2. BACKBONE-FIBER

The Backbone Fiber Riser System must consist of fiber cables with minimal 12-strand 8.3/9-um single mode placed from the telecommunications room on each floor to the inter-building telecom room (usually the “A” closet). All fiber terminations must terminate with LC connectors. All fiber enclosures will be managed with jumper trays below the enclosure. There will also be a required OSP minimum 24 strand single mode fiber from the fiber core building closets (Admin, Gibb, Library and/or McClure) to the inter-building telecom room (usually the “A” closet) of any new building. Note: A building may have more than one inter-building telecom room.

Backbone OSP fiber conduit must be in conduit with pull string and tracer wire. See **Section 2.9** for details.

Backbone Riser fiber conduit must be 2-inch conduit or larger with pull string. See **Section 6.2.1** for details

2.3. “SADDLE BAGS OR J HOOKS”

The cabling from the cable tray pathway must be routed to their respective outlets utilizing “saddle bags” (Caddy CableCat or similar) above ceiling. Cables must be bundled in groups of less than 50 and placed no more than 5’ apart following the pathway from the cable tray to WAO. “Saddle bags” and all mounting hardware as well as any placement of these devices are the responsibility Contractor. Horizontal cabling shall be routed through “saddle bags” placed above ceiling as needed to accomplish proper cable routing to work areas. “Saddle bags” and all cable pathways they create must follow building lines and allow access to cabling from hallway and open area locations and not be placed over other end user offices.

2.4. RACK HARDWARE

Rack Hardware must be utilized in the Telecommunications Room on each floor and Main Cross-Connect facility to house terminated Category 6 patch panels, fiber termination hardware, and network switch equipment. Each closet contains, typically, three (3) racks with vertical and horizontal wire management. All Rack hardware must be black in color and secured to the floor with appropriate hardware and overhead by cable tray. All racks will be 7 feet in height and 19 inches wide with 3-inch channels.

If project does not require a 7 foot, two post rack, a 12 RU or larger, 24-inch deep fully enclosed, wall mount rack may be substituted with approval from OIT representative.

Vertical cable management must be utilized between each rack and at the end of each rack to manage vertical patch cables (in front) and horizontal cable runs (in back). Full height, front and rear, 6”-8” wide vertical managers must be used in between and at the sides of each 2-post or 4-post rack to provide cable management.

Horizontal wire management must be provided so there is wire management above and below each copper patch panel.

All rack hardware must be grounded to an approved building ground as described in TIA-942.

2.5. CABLE TRAY

2.5.1. HORIZONTAL DISTRIBUTION

Main corridors shall utilize wire basket-type cable tray, minimum 18" width and 6" depth. Any change in direction or elevation of tray or cable must have factory-recommended hardware (Tee's, 90's, waterfalls, proper fastening hardware, etc.). The only exception will be where cable exits tray for another distribution method (i.e. saddle bag (see Section 2.3) pathway, conduit, conduit stub-up, etc.) **AND** no pinch points exist from doing so. All cable trays must be grounded to an approved building ground as described in TIA-942.

2.5.2. TELECOMMUNICATIONS ROOMS

Cable tray (ladder type) must be black in color and placed inside the Telecommunications Rooms to provide a pathway into the room from corridor cable tray and routing the cables to the rack mounted termination hardware. Cable tray will be 18" wide and mounted to walls and racks as shown on drawings. Tray must be mounted above racks and doors to allow a natural cable drop from the tray to the rack. Cable tray must also act as a vertical brace for racks (i.e. secured to the wall with wall angle brackets to prevent any movement in top of rack). All cable trays must be grounded to an approved building ground as described in TIA-942.

2.6. FIRE-STOPPING SYSTEMS DIV 26

Suitable fire-stopping must be used to prevent the spread of smoke and fire throughout the building. Contractor must be responsible for installing fire-stopping system for every wall or floor penetration as required by code. Contractor shall use Hilti CP firestop sleeve or STI's EZ-Path (44 Series for Telecom Rooms and 33 Series for Corridor Firewalls). Contractor to install size and appropriate quantity as to maintain a 40% fill ratio.

2.7. FLOOR BOX/POKE-THRU DIV 26

Floor box/poke-thru devices must be provided for floor locations within Conference Rooms. These devices must include box/poke-thru and frames to allow an outlet to be placed into them. Coordinate with UI's OIT Representative to ensure plate will accept UI-selected manufacturer's connectors.

Poke-thru devices may be provided for access into modular furniture. These devices must offer a 2" pathway to route cables into modular furniture. Contractor must be responsible for any additional protection required to route cables into modular furniture.

2.8. GROUNDING DIV 26

Contractor must provide a ground bar at each termination location (Telecommunications Rooms) Contractor shall provide a #6 AWG stranded copper wire cable between ground bars located at each TR and ER to the building main service ground point. This ground conductor must be utilized for grounding termination equipment, equipment rack and cable tray. Grounding system components must be installed as described in TIA-942.

2.9. CONDUITS, TRENCHING AND DIRECTIONAL BORING DIV 26

Contractor option – Directional Bore or Trench to install conduit between locations identified on prints. Trenching may not be used through asphalt / concrete locations unless indicated on prints.

Contractor to maintain minimum of 24" cover required along length of directional bore / trenching

Contractor Shall Place 3" HDPE Communication Duct (conduit) in trench / bore hole to create communications pathway.

- JM Eagle Schedule 80 or UI OIT approved equal

Contractor Shall Provide Tracer Wire full length of pathway.

- 12 gauge solid copper with thermoplastic insulation
- Terminate in each handhole using triple nut anchorage.

Contractor Shall Provide Pull String full length of pathway.

- Poly-line 210 lbs tensile strength or better

Contractor Shall Provide Handhole (24"x36" minimum) at each end of pathway within 5' of building foundation

- Hubbell Power Systems PG2436BA24 – LABEL = "COMMUNICATION" or approved equal
 - Larger sizes are available from Hubbell as needed. Coordinate with OIT Network Team
- Drainage must be installed in vault for any vault connected to a building conduit entry point that is at a higher elevation
 - Drainage plan must be reviewed and approved by Project civil engineer

Contractor Shall Coordinate location for building entry with the UI OIT Representative

- If building entry is below connected vault elevation, watertight seal at vault side is required.
- Link-Seal Modular Seal, Polywater/Hauff-Technik Mechanical Seal, or UI OIT approved equal

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- If entry is above grade, transition to 3" Rigid Metal Conduit with long-sweep elbows. Provide weathertight seal at entry to building using all weather polyurethane sealant, color to match surrounding finishes.

If entry is through slab on grade, handhole may be eliminated, and HDPE Communication duct may be swept up to grade (near vertical) and cut off approximately 2" above slab. Contractor is responsible for calling for all utility locates and shall pothole all critical crossings prior to boring.

Contractor shall protect all open trenches.

Site Restoration:

Contractor Shall:

- Repair all damage to existing systems prior to closing trench.
- Backfill all trenches and borehole openings using "jumping jack" / Plate Compactor type compaction equipment. Add water to achieve adequate compaction to prevent future settling.
- SOD AREAS
 - Scrape / Retain topsoil (+/- 6" deep) separate from trench spoils. Replace topsoil over well compacted soil. Grade to match existing.
 - Place new sod (New sod shall be equivalent of a ninety-nine percent improved variety blue grass sod).
 - Coordinate sod placement / maintenance with UI Facilities Management.
- PAVED AREAS
 - Replace pavement (concrete / asphalt) to match existing thickness
 - Minimum of 4" thick
 - Protect new pavement from damage until cured

3. WORK AREA OUTLETS

All work area outlets (WAO) must be Category 6 at a minimum and mounted in extra deep (**minimum 2 1/8" depth**) double gang electrical boxes. The WAO must consist of either three (3) RJ-45 or six (6) RJ-45 ports (these are outlet standards but refer to drawings for exact requirements for every location). If surface-mounted raceway

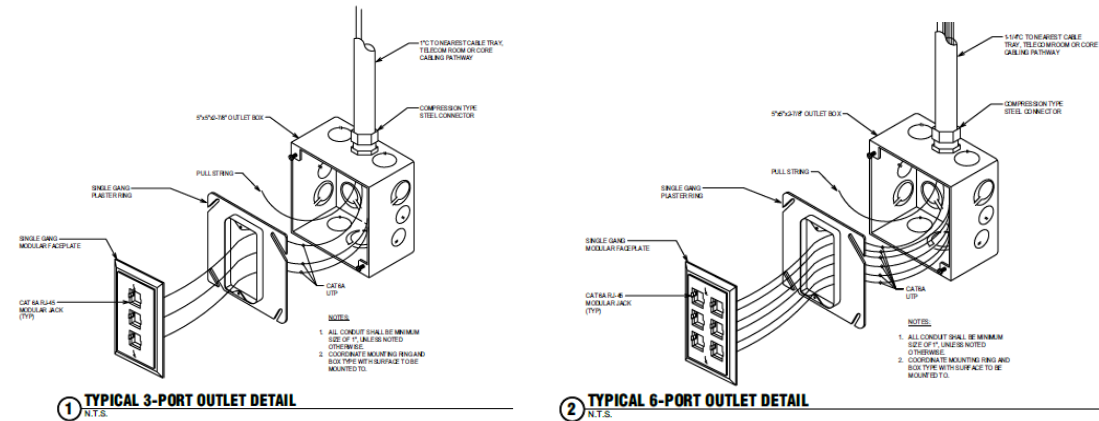
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is utilized, then raceway manufacturer's extra deep (**minimum 2 1/8" depth**) double gang box solution must be required.

Work area outlets (WAO) require a 1/2 in. raised single gang mud ring installed on double gang electrical boxes.

Unless specified, height to match typical electrical receptacle for designated work area outlet (WAO) with a minimum of six (6) inches clearance around all sides of the work area outlet (WAO)

Where work area outlets are installed above acoustical tile, they shall be within 8" of ceiling tile for access.



3.1. RENOVATION CONCEALED OR FLUSH-MOUNTED

Work area outlets must be capable of reconfiguring, replacing or repairing the connector interface without re-terminating or recertifying the horizontal cabling.

Terminate all jacks according to manufacturer and latest amendment of EIA/TIA 568B guidelines.

Concealed drops should be restricted to hollow wall spaces that are made up of sheet rock on at least one side with no fire blocks. Wall openings shall have a wall-box eliminator (to be Caddy NPLS or NPLS2) installed for the purpose of mounting the faceplate. The wall-box eliminator must be securely fastened to the opening by mechanical means, top and bottom of bracket to ensure snug fit.

Electronic stud finders must be used at all times and before holes are cut in walls. This will eliminate hitting wall studs or in wall cross bracing.

Each cable must be uniquely identified and must have the same I.D. at the jack and telecommunication closet. All numbering must begin with a number provided by the UI OIT Representative and must continue sequentially in the MDF and IDF(s). Any out of sequence terminations must be corrected by Contractor. All jacks must be numbered with the same number as attached cable.

3.2. RENOVATION EXPOSED OR SURFACE-MOUNTED DIV 26

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Exposed pathways down walls or columns must be installed with metallic latching ducts of the appropriate size that must sufficiently accommodate the cables being routed.

If AC power is run in the same pathway there must be physical separation between the power channel and the data channel of at least ½" and it must contain a metallic barrier (i.e. channeled raceway).

Care should be taken to ensure that cables are not exposed anywhere along the pathway. This means that proper fittings are required for all transition points. (i.e. splice covers and drop ceiling fittings.)

Double-sided tape alone is *not sufficient* to hold the duct and should only be used in conjunction with anchoring devices mounted a minimum of every (6) six feet. Failure to comply must be corrected at Contractor's expense.

A Minimum of Two (2) - 1/4" anchors must also be used at every device and/or junction box. Failure to comply must be corrected at Contractor's expense.

If surface mount- raceway is utilized, then raceway Manufacturer extra deep solution will be required to house any required amount of cables while still maintaining fill ratios and bend radii.

Each cable must be uniquely identified and must have the same I.D. at the jack and telecommunication closet and within 6" of termination; both workstation and cross connect sides.

3.3. NEW CONSTRUCTION DIV 26

Coax cable outlets must be double gang outlet boxes with 1" conduit to the nearest cable tray or saddle bag system (see Section 2.3) used to carry other low voltage cable that is not Category 6 data or telephone cable.

Conduit must have a pull-box after every cumulative 180-degree changes in direction. Pull-boxes must be in readily accessible locations.

No LB type fittings of any size are to be used for communication conduit.

Exposed conduit/surface-mount is not allowed in new construction and can only be used with written permission from the project manager.

No PVC conduit or PVC sleeves are to be used for communications cabling.

Minimum radii for bends shall be 9 ½" for ¾" conduit, 10 ½" for 1" conduit, and the equivalent of long radius bends for larger sizes.

Label all pull and junction boxes.

A nylon pull string must be run in every communication conduit prior to cable installation. A follow string must be left in conduits after cable is installed for future use if the fill does not exceed 40%. In the cable tray it is required to leave a clean unwrapped mule tape for future cabling.

Any conduit pull box, or junction box that is not accessible or does not provide a clear and workable pathway must be replaced at Contractor's expense.

3.4. ADDITIONAL COPPER CABLING MODULES

Additional Adapter Modules for copper must include the following:

- F-Type coax coupler module, male-male threaded
- Blank module to reserve space for future additions

The connectors must snap into all LEVITON outlets and modular patch panels.

3.5. FACEPLATE CONFIGURATION

W.A.O.'s that require a three (3) port faceplate; jacks must be placed in the faceplate to follow the sequential labeling from top to bottom.

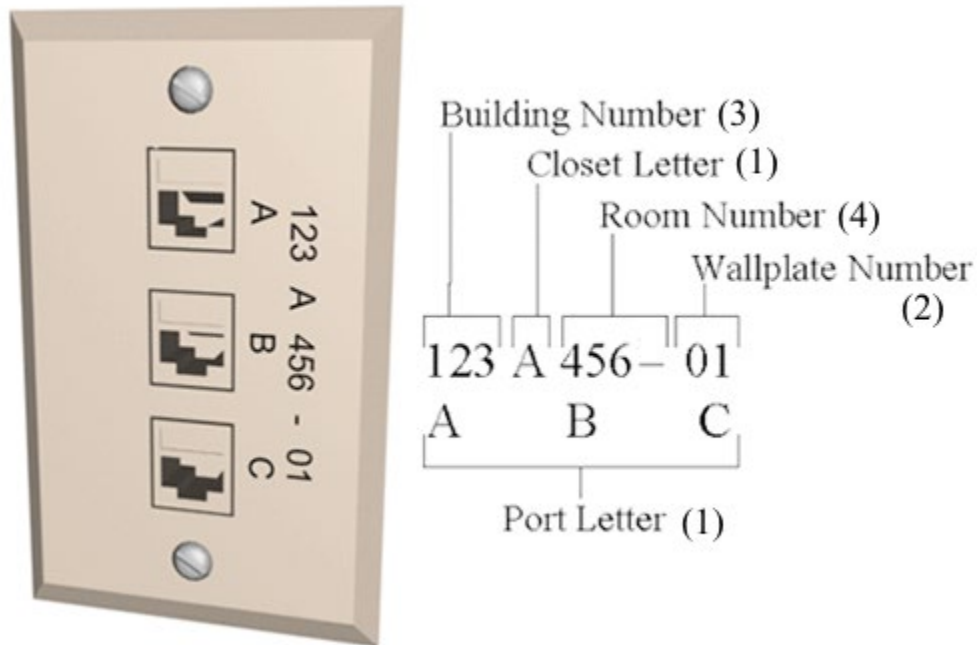
Each cable must be uniquely identified and will have the same I.D. at the jack and telecommunication closet.

3.6. FACEPLATE LABELING

Labels follow practices set forth in ANSI/TIA/EIA -606 ADMINISTRATION

Labels and numbering format for both the W.A.O and Telecommunications Rooms (TR) will be assigned by UI's OIT Representative. See below.

First WAO Example: 123 A 456- 01 A,B,C or Information Outlet designation can be on Line 2 at WAO location face plate. Second WAO Example with windows: 123 A 456- on top window and alphanumeric port letter next to each outlet jack.



All labels must be computer generated, wrap-around, self-laminating, and must be permanent. No permanent markers are to be used for final labeling.

Double gang outlets must be numbered left top to bottom, right top to bottom.

Single gang outlets must be numbered top to bottom.

Jack labels must be numbered with the same number as attached cable.

Each end of the Category 6 cable must be labeled at approximately 6" from the Network Data Jack / point of termination.

TR labels must be machine printed on appropriate label holders.

3.7. WALL PHONE FACEPLATES

Wall phone faceplates must be mounted per ADA forward reach specifications. Wall phone faceplates must be required as shown on the communications drawings. Wall phone locations must have only one (1) Category 6 cable pulled to each location.

3.8. MODULAR JACK COLORS

UI Structured Cabling Standard

Category 6 jacks must match faceplate in color. Unless otherwise stated to visually indicate Cat6 1 GIG or Cat6A 10 GIG capability.

Blank Inserts must match faceplate in color.

BNC Coaxial bulkheads must match faceplate in color.

Blank covers for empty outlet boxes must match faceplate in color.

4. HORIZONTAL CABLING SUBSYSTEM

4.1. GENERAL GUIDELINES

UI does not pull separate cable for telephone. Telephone connections are included as one of the Category 6 cables at every location. Maximum cable length is 90 meters (295').

All cable must be installed according to BERK-TEK/LEVITON and the EIA/TIA cable installation specifications included by reference within this document. Cable must have a non-coiled slack loop in the TR by taking the longest usable route to terminate and a 3' coiled service loop at stub-up/out location.

Care must be taken to ensure that during the installation nicks, abrasions, burning, and scuffing of cable is prevented. Cables found to be damaged must be replaced at Contractor's expense regardless of whether the cable passes Category 6 testing standards.

All workstation cables must terminate on Category 6/6A, 48-port patch panels that allow the insertion of a disconnect device for independent testing of each side of the circuit for fault isolation without re-termination or re-certification of the installed cable. All labeling must be approved by UI's OIT Representative prior to labeling commencing.

The patch panel layout must be in this format: faceplate 1 ports A, B, C, followed by faceplate 2, ports A, B, C. Here are additional guidelines for patch panel port organization:

























- Patch panel cable terminations should be sorted (top to bottom and left to right) by room number starting with lowest number first.
- Three-port faceplate must start with the A port in either
 - The leftmost position of a six-port group in a patch panel, or
 - The fourth position from the left of a six-port group in a patch panel.
- Two-port and one-ports faceplates may be grouped as three or six cables by
 - Combining three two-port faceplate in a six-port group, or
 - Combining a two-port with a one-port in three-port group.
 - In addition, it is acceptable to group all the one-port and two-port faceplates into their own dedicated patch panel(s) and group placed at the end of the patch panels.
- It is required that an empty space be left, so that
 - The leftmost position in each six-port block of the patch panel always with an A port
 - In addition, place black electrician's tape over the unused port.

UI Structured Cabling Standard

Patch panel labels should:

- Prepend with one, or two, zeros for rooms with 2 and 1 digit room numbers
 - 006-
 - 020-
- Room number should be followed by a “-”, or a sub-room letter
 - 006-
 - 007A
 - 100B
- Where label space is tight due to
 - Two-port label, the first 4 characters (building and closet) should be omitted.
 - One-port label, the extra white spacing may be removed in addition to the first 4 characters

Here are several examples patch panel label scenarios described above:

844 A	306 -	11	844 A	306 -	12	844 A	306 -	13	306 -	14	306 -15
A	B	C	A	B	C	A	B	C	A	B	A
											
309 -	01	309 -	02	309 -	03	309 -	04	(No Label)	844 A	309 -	15
A	B	A	B	A	B	A	B		A	B	C
											

See Appendix A for products and part number examples.

5. TELECOMMUNICATIONS ROOM

The telecommunication rooms (TR) shall house racks, voice termination fields and required cable routing hardware. Racks must be placed in a manner that must allow a minimum of 3' of clearance from the front and rear mounting surfaces. If the rack is to have electronic equipment in it, then the 3' measurement must be between the back end of the electronic device and the wall. If one mounting rail of the rack is placed against a wall, the mounting rail must be no closer than 6" to the wall to allow room for vertical management. Where there is more than one rack, the racks must be ganged with vertical management hardware to provide inter-bay management.

UI Structured Cabling Standard

Ganged rack frames must be placed in a manner that must allow a minimum of 3' of clearance from the front and rear mounting surfaces and on one side of the finished assembly.

The number of TRs will depend on the number of end user locations and the distance from any given location to the TR. The maximum distance between the faceplate and the TR termination is 295 feet.

The TR includes those products that connect the networking equipment to the horizontal and backbone cabling subsystems. These products include termination hardware (connectors and patch cords), racks, cable management products and cable routing products.

Minimum of two 4" sleeves from the communications room to the horizontal infrastructure must be installed (more as required by NEC fill requirements).

Tie into building fire detection / prevention system.

Cross connecting all Telephone and Data services shall be the responsibility of UI.

Location: TR shall be located such that no single horizontal workstation cable shall exceed 90 meters from the Work Area Outlet to the TR/ER termination.

Floor Size: Minimum communications room size is 8' x 10'.

Floor Surface: Non-static asphalt tile floor or 2 coats Non-static concrete floor seal is to be used in TR's.

Ceiling Height: No ceiling is to be installed in the TR unless at a minimum of 8' 6" above finished floor.

Door Size: 3' wide and 6' 7" tall with 180-degree swing away from backboards and racks.

Wall Lining (backboard): AC-grade 3/4" x 4' x 8' sheets plywood, with no voids, covered on all sides with two coats flat black fire-retardant paint.

Lighting: 2-bulb LED light fixtures will be provided. Minimum 500 lux measured at 3' above finished floor.

Power: Minimum one (1) 20-amp, 120-volt non-switched circuit with isolated ground, terminated with NEMA 5-20R receptacles, shall be installed above each equipment rack, one for each rail (due to probability of no ceiling, the outlet box will need to be affixed with uni-strut, work to be coordinated with electrical contractor). Closets designated as an MDF require an additional 30-amp, 120-volt non-switched circuit terminated with a NEMA L5-30R receptacle above each equipment rack.

If the building has an emergency generator, one (1) 20-amp, 120-volt circuits shall be connected to emergency power, with NEMA 5-20R receptacles, as well as one 30-amp, 120-volt circuit terminated with a NEMA L5-30R receptacle connected to emergency power.

Grounding and Bonding: Install a contiguous Intra-building grounding and bonding system in compliance with TIA/EIA-607 using a minimum conductor size of 6 AWG to be located on each plywood backboard with Grounding Bus Bar as directed.

HVAC: Environmentally conditioned (air conditioning) air must be provided to each TR. Maintain constant temperature of 64 - 75 F with minimum of one air change per hour. Networking/Telecommunications equipment

heat dissipation is estimated at 3000 Watts per hour. $3.7 \times 3000 = 11,100$ BTU per hour. HVAC equipment locations must be coordinated with OIT.

Fire Protection: As required by applicable codes. Both vertical and horizontal penetrations are to be fire stopped.

Equipment Rack: 7' x 19" equipment rack with wire management (as specified in materials list) and ladder rack shall be provided and installed as directed.

Racks must be securely attached to the concrete floor using 3/8" hardware.

All racks must be grounded to the telecommunications grounding bus bar.

6. BACKBONE CABLING SYSTEM

6.1. COPPER BACKBONE

Minimum backbone cross-connects for POTS connectivity shall be two (2) x Cat6 cables, terminated on wall-mount 110-type frames for a total of eight (8) pairs.

Backbone cross-connects for POTS connectivity shall be wall-mount 110-type frames. Wiring blocks, connecting blocks and horizontal troughs shall be constructed of polycarbonate molding compound. Wiring blocks shall be marked black every fifth pair. Connecting block terminals shall be constructed of phosphor bronze, plated with a minimum of 150µin of tin-lead over a 50µin minimum nickel underplate. 25-pair frames shall be used as required by the backbone pair counts to be terminated in a given closet. Backbone frames must employ 5-pair connecting blocks on each 25-pair row.

Cables of 25-pair or greater must be a minimum of 24-AWG Category 3, solid conductor cables. Cables must be riser/plenum rated and in standard increments to the size of the project (one pair per ten pair installed horizontal cable fed from respective telecommunications room). Punch-down order should follow traditional USOC color code order for Multi-pair telephone cables.

Each cable must have four labels, specifically a label at each end of the cable and a label on each termination block, or WAO. All termination blocks must utilize a label holder, all labels must be machine printed on one side and have laminate protective cover and adhere well to cable or label holder. Each cable label must be located within 6" of the termination block, or WAO. Each cable label must be machine printed and adhere well to the cable.

6.2. FIBER BACKBONE

6.2.1. FIBER OPTIC RISER CABLES

UI Structured Cabling Standard

Riser cables are intra-building cables running between telecom rooms. These cables are run inside innerduct that is attached to a cable tray, J hook system or inside a separate 2" conduit connecting telecom rooms.

Riser/plenum rated cable must be used for all interior installations.

A minimum of 12 single mode fibers must be installed between telecom rooms.

Fiber optic riser cables must be run without splices.

Single mode fibers must be terminated on blue LC connectors.

Single mode cable fiber optic cable must be 8.3µm/125µm.

Use of EIA/TIA-598 color-coding is required.

Fiber riser cable must be tight buffered, 900µm, mechanically strippable.

It is preferred that fiber be pulled through the cable tray/conduit system by hand power. The use of tension limiting devices is required when power winches or similar devices are utilized to pull cable.

A service loop of 50' minimum is required at each telecom room location when entering or leaving the building.

Fiber cables are to be terminated in 19" rack-mounted enclosures.

All enclosures must have covers that can be closed.

Each enclosure must be labeled with source, destination, and strand count. Each label must be machine printed with permanent ink.

Example: Admin to Library 001C032A024SM

(3-character building number with 1-character TR identifier to 3-character building number with 1-character TR identifier and 3-character fiber count with 2-character fiber type)

Only use 4-character building numbers when building is assigned a 4-character identification number.

If there is no conduit system or inner duct raceway for installation of any fiber, Armored fiber must be installed.

6.2.2. OUTSIDE PLANT FIBER OPTIC CABLE (SINGLE-MODE ONLY)

Outside plant, cable must be used for all applications where cable is run in underground conduits.

Outside plant, fiber cable must be loose tube construction.

Outside plant, fiber cable must be armored

Each tube must contain up to 12 fibers.

Single mode fibers must be terminated on LC Connectors.

Outside cable run underground must be run in conduit.

UI Structured Cabling Standard

- If an exception is approved to direct bury fiber, then a locate must be installed. See Section 2.9

Outside cable must be loose tube; gel filled utilizing non-hygroscopic, non-conductive, flooded core, homogenous gel.

Use of EIA/TIA-598 color-coding is required.

Buffer tubes requiring stripes must have co-extrusion inlaid stripes of contrasting color.

Pulling tension must not exceed 400 pounds. If mechanical assistance is required to pull cable through conduit system, then the use of a tension limiting device and a force gauge is required.

Cable must be labeled at each end point. Label must identify cable origination and termination, strand/pair count, and cable type. Label must be UV-resistant.

Example: 001A032A024SM

(3-character building number with 1-character TR identifier to 3-character building number with 1-character TR identifier and 3-character fiber count with 2-character fiber type)

Only use 4-character building numbers when building is assigned a 4-character identification number.

6.2.3. TESTING – RISER, AERIAL, AND UNDERGROUND FIBER OPTIC CABLE

All fibers must be tested after the termination process is complete.

It is the responsibility of Contractor to supply all equipment necessary to test and document all dark and terminated fiber.

All fiber must be tested to EIA/TIA specifications and standards.

All fiber must be tested on the spool before it is pulled to ensure delivery of fiber that is not damaged.

All fiber must be tested in one direction with an OTDR.

All fiber must be tested in both directions with a power meter and source.

All multimode fiber must be tested at 850nm and 1300nm.

All single mode fiber must be tested at 1310nm and 1550nm.

As built drawings for all fiber optic cable are required.

After testing, any fiber that is determined to have excessive attenuation due to broken fiber, excessive bending, bad splices, or defective connectors must be replaced by Contractor at their own expense.

6.3. COAX BACKBONE

UI Structured Cabling Standard

(1) Hard-line .500 coax riser cable, or other approved coax riser cable, shall be used to connect building IDF's (Intermediate Distribution Frame / Horizontal cross-connect) to the MDF (Main Distribution Frame / Main cross-connect). One (1) minimal 2" EMT conduit must be installed between termination points. No open cabling shall be installed from IDF to MDF. The above cable runs must be terminated with F type modular connectors these connectors shall be mounted into 19" modular jack patch panel.

7. PATHWAYS AND SPACES

7.1. PATHWAY GUIDELINES

Communications pathways are the single most critical component of structured cable system. In general, UI requires 1" conduit from the wall box to the cable tray. In renovations where cable tray cannot be installed the use of J-hooks or saddlebags are required, however, saddlebags are preferred over J-hooks.

Specifications for conduit runs must be included in Architect's design and drawings.

Cables must follow pre-designed pathways approved by the UI OIT Representative. Design of Pathway must follow the standards set forth in the TIA/EIA 569-A Commercial Building Standard for Telecommunications Pathways and Spaces document. These pathways must be constructed from saddlebags, J-hooks, or properly sized cable tray hung from ceiling but above drop ceiling.

Saddlebags or other cable routing/hanging devices must be attached to independent grid wire and not attached to the existing drop ceiling grid wiring. REASON: The added weight from the cables can cause distortion to the existing grid system.

Conduit must not run through areas in which flammable materials may be stored or over or adjacent to boilers, incinerators, hot water lines, or steam lines.

No cable shall be pulled until complete raceway has been inspected and accepted by the UI OIT Representative.

Conduit runs must be designed to follow the most direct route possible with no more than 180-degree bends between pull boxes and contain no continuous sections longer than 100 feet. Pull boxes must be accessible (after all mechanical systems are in place) and used for runs that exceed 100 feet in length. Conduit must be bonded to ground on one or both ends. All pull boxes must have the insulated bushing installed before cable is pulled.

When multiple conduits are pulled to one box, the minimum box size should be 24"x24"x6". All conduits must maintain run direction through the pull box (i.e. no changing of direction inside the box). The size of pull boxes is determined by the size of conduit leaving the pull box going to the IDF and size of conduit entering the pull box (refer to latest version of BICSI TDMM for sizing).

Cable racks or trays must be used on horizontal cable runs where there is sufficient cable to warrant it. Where possible, directional changes of 90-degree should be made by combining two 45-degree turns or utilizing "T" sections with rounded corners.

Cable trays must be secured using angled wall supports or a standard trapeze type support system. Center-hung supports are unacceptable. They must be secured to the ceiling by either all thread or to I-beams. Grid wire cannot be used with Cable Tray due to cable's weight.

Cable tray must be supported per manufacturers' recommendations for appropriate load rating of cable to be installed plus 50%. Example: If a cable tray is to be placed in a corridor supporting 300 cables, install structural support hardware and spacing sufficient to support a load rating of 450 cables.

UI Structured Cabling Standard

Cable trays must be used only over areas with ceiling access and must transition to a minimum of three 3-inch conduits when routed over fixed ceiling spaces larger than 10 feet.

Cable trays must be bonded end-to-end.

Cable trays must extend to within 24" of EZ-Path sleeves in corridors and outside the TR.

Primary cable trays must be basket/ snake or aluminum ladder trays. They must be 18 inches wide and at least 6 inches deep. Secondary tray sections may utilize a 12-inch-wide tray. Cable tray must be installed to manufactures recommendations using proper junctions, corners or elevation changes.

After all of the building systems i.e. HVAC, sprinkler, electrical are installed the cable tray must be accessible for the entire length. "Accessible" is the ability to install cable rigging / pulling attachments and be able to retrofit the cable tray with cable isolation devices and attachments. For cable tray sections where a minimum of 12" clearance above and on at least one side (assuming no obstructions below tray exists, preventing access to tray) cannot be maintained, a cable pulley system may need to be installed by Contractor (coordinate with the UI OIT Representative). Failure to comply with this requirement will result in the correction performed at Contractor's expense. No material must penetrate or abstract the pathway. All supports must be from the outside of rail not from center support inside tray.

A pull string for all directional pulls must be installed. Pull a new pull string separate of the cabling. Replacing the string frequently will prevent burning or damaging of cable. Cable pathway must be inspected throughout the project for cleanliness and consistency of following the standard separations. A pull string must be left in place whenever new cables are being pulled.

Ceiling support must be at four to five-foot intervals maximum. Cable pathways must be designed to avoid EMF and RFI interference. Common causes of this interference are fluorescent lighting fixtures, air handling motors and many kinds of electrical controls including starters and power distribution panels. All cable runs must follow BICSI recommendations for distances to be maintained between all voltages from all fluorescent lights and EMF sources. Any violations of this rule must be corrected at Contractor's expense.

Always follow cable manufacturers' recommendations and procedures to assure the bend radius is not exceeded when branching off to other areas along a pathway.

Only run parallel with electrical conduits if within cable manufacturers' recommendations. Route must exceed cable manufactures' recommendations for cable distances dependent on the voltage of the devices or conduit in close proximity. Never strap cable runs to electrical conduits.

Properly-rated Velcro cable ties are to be used. Plastic cable ties are not to be used.

Every cable, whether an individual or many grouped together, must be supported. This means shooting grid wire and installing all "saddle bags" on an independent cable pathway system. Remember **NEVER** use the ceiling grid wire system. Install a separate grid wire. A Saddle bag (see Section 2.3) must be used, **DO NOT** wrap bare grid wire around the cable bundle for support. Plastic cable ties are NOT to be used as fasteners.

Using the ceiling grid system is a violation of TIA/ EIA 569 and NEC requirements.

All cable pathways must keep the cable bundle at least six (6) inches off the ceiling grid system. UI's OIT Representative must approve exceptions.

UI Structured Cabling Standard

Never attach cables directly to grid wire with tie straps; always use a Saddle bag (see Section 2.3).

Cables should be properly supported and not sag between Saddle bag (see Section 2.3). If the cable does sag it means you need another Saddle bag (see Section 2.3).

Other low voltage trades (i.e. HVAC controls, security/access control, nurse call, etc.) **except** fire alarm, and Audio/Visual Equipment (AV) will be allowed, with prior coordination only, to share tray space, where allowed by code. Those contractors must be required to place physical separators for each system so as to avoid any interference. A minimum of 3" of separation must be maintained throughout. If this is not possible, the voice/data contractor has priority. This does not apply to saddle bags/j-hooks.

Cable tray must be installed to be accessible. 12" of space above, 3" below, and 12" on one side must be free of other ceiling-mounted systems (i.e. mechanical, electrical, and plumbing). Contractor installing tray must coordinate with those trades prior to tray installation for best routing.

Cable may also be installed using raised floor in an approved pathway (no cables to be placed directly on floor) and architecturally designed soffit systems that permit ease of reentrance for future additions.

It is required that proper distances be maintained between cable routes and sources of heat, electromagnetic producing devices such as lighting ballasts, electric motors, and electronic controls.

Entire length of cable pathways must be cleaned by the end of the project. No debris such as clipped cable ties, junk pull string, wall penetration packaging or pieces or other trash is to be left in the ceiling. UI's OIT Representative will perform an inspection of the pathway with Contractor before closing of the ceiling or walls.

Note: If debris not directly related to the current installation is encountered within the pathway, Contractor must notify UI's OIT Representative and provide pricing for clean-up necessary to remedy.

7.2. FIRESTOP GUIDELINES

A firestop system is comprised of: the item or items penetrating the fire rated structure; the opening in the structure and the materials and assembly of the materials used to seal the penetrated structure. Firestop systems comprise an effective block for fire, heat, vapor and pressurized water stream.

All penetrations through fire rated building structures (walls and floors) must be sealed with an appropriate firestop system. This requirement applies to through penetrations (complete penetration) and membrane penetrations (through one side of a hollow fire rated structure). Any penetrating items i.e., riser slots and sleeves, cables, conduit, cable tray, and raceways, etc. must be properly fire stopped. When penetrating fire-rated corridor/chase walls, a minimum of (2) engineered firestop devices (STI's EZ-Path Series 33) shall be used. Contractor responsible for the final quantity of sleeves based on cable quantity.

If Contractor penetrates a wall or uses an existing penetration for a cable pass-through, he/she must seal the penetration regardless of who punched initial hole.

Note: If improper/inadequate firestopping not directly related to the current installation is encountered within the ceiling plenum/between floors, Contractor must notify UI's OIT Representative and provide pricing for firestopping necessary to remedy.

7.3. FLOOR BOXES/POKE-THRU DEVICES

When installing poke-thru and floor boxes a complete manufacturer/Leviton solution will be required to permit installation and termination of all Category 6 cables (usually 3 cables per location) this solution must take into account the size, length, position, and number of bends to the supply conduit. A separate metal channel or conduit must be supplied for electrical and communication cables. The installer of floor boxes and poke-thru devices will be responsible to provide University of Idaho with a complete solution including all covers, top plates, carpet rings, angle connectors, conduit, flex tube, jacks, and hinged covers which must provide a complete and useable cabling system. The floor box/poke-thru must not pinch patch cables exiting the box. If the box does not permit installation of selected manufacturer's jacks, a 3-port decora quick port type bracket must be used.

- Legrand 8AT Evolution Series or Approved Equal by the UI OIT Representative.

NOTE: Designers of systems, which use floor devices that will be installed in tile floors, must consider and take into account UI's use of floor buffers and liquid floor wax and design accordingly.

8. GROUNDING

The facility must be equipped with a Telecommunications Bonding Backbone (TBB). This backbone must be used to ground all telecommunications cable shields, equipment, racks, cabinets, raceways, and other associated hardware that has the potential for acting as a current carrying conductor. The TBB must be installed independent of the buildings electrical and building ground and must be designed in accordance with the recommendations contained in the ANSI/TIA/EIA-607-A Telecommunications Bonding and Grounding Standard.

The TBB must be designed and/or approved by a qualified PE, licensed (actual or reciprocal). Installation and termination of the main bonding conductor to the building service entrance ground, at a minimum, must be performed by a licensed electrical contractor.

The ground bar must be no less than 3"x12" in size. Grounding conductors entering IDF's or MDF's must be no less than 4-AWG and labeled "TMGB - Do not disconnect".

All vaults must be grounded back to the main telecom closets ground. Each IDF must tie to the main grounding buss in the MDF. All grounding of racks must be installed by the telecom installer within the IDF or MDF. Grounding must meet EIA/TIA, factory recommendations and all local electrical codes.

All grounding and bonding (racks, cables, cable tray, etc.) must meet the National Electrical Code (NEC®) and be installed as described in TIA-942 as well as local codes, which specify additional grounding and/or bonding requirements.

9. AS-BUILT DRAWINGS

Contractor will be provided with 2 sets of D or E-size drawings at the start of the project. One set will be designated as the central location to document all as-built information as it occurs throughout the project. The central set must be maintained by Contractor's Foreman on a daily basis and must be available to UI's OIT Representative upon request during the course of the project. Anticipated variations from the build-to drawings may be for such

things as cable routing and actual outlet placement. No variations will be allowed to the planned termination positions of horizontal and backbone cables, and grounding conductors unless approved in writing by UI's OIT Representative.

Contractor must provide the central drawing set to UI's OIT Representative at the conclusion of the project. The marked-up drawing set must accurately depict the as-built status of the system including termination locations, cable routing, and all administration labeling for the cabling system. In addition, a narrative must be provided that describes any areas of difficulty encountered during the installation that could potentially cause problems to the communications system. A separate and complete set of as-built drawings in digitized (current Visio and AutoCAD) format on USB Thumb drive must be supplied to the OIT Representative.

10. CABLE SYSTEM TESTING

All cables and termination hardware must be 100% tested for defects in installation and to verify cable performance under installed conditions. All conductors and fibers of each installed cable must be verified useable by Contractor prior to system acceptance. Any defect in the cabling system installation including but not limited to cable, connectors, feed-through couplers, patch panels, and connector blocks must be repaired or replaced in order to ensure 100% useable conductors in all installed cables.

All cables must be tested in accordance with this document, the BERK-TEK/LEVITON PREMIER Contract agreement, and best industry practices. If any of these are in conflict, Contractor must bring any discrepancies to the attention of the OIT Representative for clarification and/or resolution.

Each cable must be tested for continuity on all pairs and/or conductors. Twisted-pair cables must be tested for continuity, pair reversals, shorts, and opens plus tests that indicate installed cable performance.

Test documentation must be provided in the original electronic format (Fluke Linkware) as well as a PDF document via an email attachment or USB Thumb drive. The UI OIT Representative must review and approve the test documentation before final payment is approved. Scanner test results (Category 3, 5e or 6), fiber optic attenuation test results, OTDR traces, and power meter test results must be included. Test data must be presented in the sequence listed in the administration records. The test equipment by name, manufacturer, model number and last calibration date must also be provided at the end of the document. Unless a more frequent calibration cycle is specified by the manufacturer, an annual calibration cycle is anticipated on all test equipment used for this installation. The test document must detail the test method used and the specific settings of the equipment during the test.

Handwritten or excel or word typed test results will not be accepted.

When repairs and re-tests are performed, the problem found, and corrective action taken must be noted. Only "Pass" results and not Marginal Pass* will be accepted unless prior approval is received in writing from UI's OIT Representative due to excessive length.

10.1. COPPER TESTING

10.1.1. CONTINUITY

Each twisted pair of every installed cable must be tested using a “green light” test set that shows opens, shorts, polarity and pair-reversals. The test must be recorded as pass/fail as indicated by the test set in accordance with the manufacturers recommended procedures and referenced to the appropriate cable identification number and circuit or pair number. Any faults in the wiring must be corrected and the cable re-tested prior to final acceptance.

10.1.2. LENGTH

Each installed cable must be tested for installed length using a TDR type device. The cables must be tested from patch panel to patch panel, block to block, patch panel to outlet or block to outlet as appropriate. The cable length must conform to the maximum distances set forth in the ANSI/TIA/EIA-568-B Standard. Cable lengths must be recorded, referencing the cable identification number and circuit or pair number. For multi-pair cables, the longest pair length must be recorded as the length for the cable.

10.1.3. PERFORMANCE VERIFICATION

Category 6 cable must be performance verified using a Fluke DTX Level IV tester at minimum. The tester must have been factory-calibrated within the last 12 months (submit copy of calibration when requested). Test reports generated from a tester without a valid calibration certificate will not be accepted. The test set must be capable of testing for the continuity and length parameters defined above, and provide results for the following tests:

Insertion Loss

Pair-to-Pair Near End Crosstalk (NEXT)

Power Sum Near End Crosstalk (PSNEXT)

Equal Level Far End Crosstalk (ELFEXT)

Power Sum Equal Level Far End Crosstalk (PSELFEXT)

Return Loss (RL)

All Category 6 cable runs must be tested in accordance with the field test specifications defined in the “Commercial Building Telecommunications Cabling Standard” TIA/EIA-568-B.1. The test equipment must comply with the accuracy levels defined in TIA/EIA 568-B.1 Section 11 “Cabling Transmission Performance and Test Requirements”.

Test results must be automatically evaluated by the equipment, using the most up-to-date criteria from the TIA/EIA Standard, and the result shown as pass/fail. Test results must be printed directly from the test unit or from a download file using an application from the test equipment manufacturer. The printed test results must include all tests performed, the expected test result and the actual test result achieved.

All Category 6 cable runs must be tested in accordance with the field test specifications defined in the “Transmission Performance Specifications for 4-pair 100 Ω Category 6 Cabling” by the Telecommunications Industry Association (TIA); ANSI/TIA/EIA-568-B.2.1. This document must be referred to as the Cat 6 Standard.

UI Structured Cabling Standard

The test equipment must comply with the accuracy requirements for the level III field testers as defined in the TIA Cat 6 Document. Level IV testers as specified in Draft IEC61935-1 are also permitted.

The Pass or Fail condition for the cabling run under test is determined by the results of the required individual tests. Any Fail or Fail* result yields a Fail for the cabling run under test. In order to achieve an overall Pass condition, the results for each individual test parameter must be a Pass.

A Pass* or Fail result for each parameter is determined by comparing the measured values with the specified test limits for that parameter. The test result of a parameter must be marked with an asterisk (*) when the result is closer to the test limit than the accuracy of the field tester. Not acceptable as a Pass.

10.2. FIBER OPTIC TESTING

Each fiber strand must be tested for attenuation with an optical power meter and light source. Cable length must be verified using sheath markings. If splices are used, splice attenuation must be verified with an OTDR. The guidelines and procedures established for Tier 1 testing in TIA/TSB-140 must apply.

10.2.1. ATTENUATION

Horizontal distribution single-mode optical fiber attenuation must be measured in one direction at either 1310 nanometers (nm) or 1550 nm using an LED light source and power meter. This measurement is consistent with the loss which network equipment will see under normal installation and use. Backbone single-mode fiber must be tested at both 1310 nm and 1550 nm in one direction. Test set-up and performance must be conducted in accordance with ANSI/TIA/EIA-526-7 Standard, Method B. Test results evaluation for the panel to panel (backbone) or panel to outlet (horizontal) must be based on the values set forth in ANSI/TIA/EIA-568-B.3.

Attenuation testing must be performed with a stable launch condition using two-meter jumpers to attach the test equipment to the cable plant. The light source must be left in place after calibration and the power meter moved to the far end to take measurements. Maximum attenuation for installed cables must be evaluated based on the following formula: manufacturer's maximum attenuation per kilometer divided by 1000 and then multiplied by the installed cable length in meters (the length based on cable length measurements marked on the jacket is suitable, but if OTDR testing is performed in accordance with 8.2.2, then the actual measured length must be used). Conversion from metric to US Standard measurement must use 3.2808 as a constant with the result rounded to the next highest whole number.

The adjusted cable attenuation value must be added to the manufacturer's mean loss per mated pair of connectors multiplied by the number of mated pairs under test (the testing for this project measures the loss over the installed cable plus two jumpers which accounts for three mated pairs of connectors - subtract one mated pair for the equipment interface to arrive at a total of two mated pairs under test).

The expected results for each cable (or group of cables of the same nominal length) must be calculated before the start of testing and recorded in a space provided on Contractor's test matrix. Each strand of fiber in the respective cable must be evaluated against this target number. Any fibers that exceed this value must be repaired or replaced at no cost to The Customer.

10.2.2. LENGTH AND SPLICE LOSS

Each cable must be verified for length using sheath markings, a length-capable power meter or an Optical Time Domain Reflectometer (OTDR). Splices, if used, must be verified for loss using an OTDR. The OTDR measurements for length, if taken, must be performed in accordance with ANSI/TIA/EIA-455-60 (FOTP-60). The measurements to determine splice loss must be performed in accordance with manufacturer's recommendations and best industry practices. Refer to TIA/TSB-140 for additional guidelines. OTDR traces must be taken if one or more of the following conditions exist.

OTDR testing is specifically requested by UI (refer to Tier 2 testing in TIA/TSB-140)

Each strand of all outside plant cables

Each optical fiber splice (fusion or mechanical)

A representative strand of each fiber cable over 300m in length

Where abnormal or unexpected results are obtained during attenuation testing

Where the cable has been subjected to extreme conditions or stresses during installation

11. SYSTEMS ACCEPTANCE

UI's OIT Representative will make periodic inspections of the project in progress and will approve each step of the project to include raceway, roughing in of cable, all terminations before faceplates are secured to wall, labeling, etc. One inspection will be performed at the conclusion of cable pathway installation, prior to closing the ceiling, to inspect the method of cable routing and support, and the fire stopping of penetrations. A second inspection will be performed at the completion of cable termination to validate that cables were dressed and terminated in accordance with ANSI/TIA/EIA specifications for jacket removal and pair untwist, compliance with manufacturer's minimum bend radius, and that cable ends are labeled, and dressed neatly and orderly to UI's satisfaction. Any variance from this will be corrected at Contractor's expense.

All test results and As-Builts must be submitted electronically to the UI OIT Representative before the job or system will be considered complete.

APPENDIX A

APPROVED PRODUCT LIST

The Berk-Tek/Leviton approved product list must consist of the following:

Cat6 Unshielded Twisted Pair Plenum: White- 10136265 or 10136230

Cat6 Unshielded Twisted Pair Non-Plenum: White- 10136343 or 10136340

UI Structured Cabling Standard

Cat6A Unshielded Twisted Pair Plenum: White- 10137384 or 11089901
Cat6A Unshielded Twisted Pair Non-Plenum: White- 10137703 or 11084689
48-Port QuickPort Patch Panel: 49255-H48
Cat6 8P8C Modular/QuickPort Jacks: Black- 61110-RB6
Cat6A 8P8C Modular/QuickPort Jacks: Black- 6110G-RE6
Cat6 8P8C Modular/QuickPort Jacks: Ivory- 61110-RIB
Cat6A 8P8C Modular/QuickPort Jacks: Ivory- 6110G-RI6
Compression F Connector: 40985-CPF
F Connector Modular/QuickPort Insert: Ivory- 40831-BI
2 port QuickPort Faceplates with Identification Windows: Ivory- 42080-2IS
4 port QuickPort Faceplates with Identification Windows: Ivory- 42080-4IS
Blank Inserts: Ivory- 41084-BI
Surface Mount 1 Port Box to be used for non-Flush mount locations: Ivory- 41089-1IP
Surface Mount 2 Port Box to be used for non-Flush mount locations: Ivory- 4109-2IP
Surface Mount 4 Port Box to be used for non-Flush mount locations: Ivory- 4109-4IP
Premise Distribution Indoor/Outdoor 12 Strand Single Mode Plenum: PDP012AB0707
Premise Distribution Indoor/Outdoor 12 Strand Single Mode Non-Plenum: PDR012AB0707
Premise Distribution Indoor/Outdoor 24 Strand Single Mode Plenum: PDP024AB0707
Premise Distribution Indoor/Outdoor 24 Strand Single Mode Non-Plenum: PDR024AB0707
OSP 12 Strand Loose Tube gel filled Single Mode Fiber Cable: OPA012AB0403
OSP 24 Strand Loose Tube gel filled Single Mode Fiber Cable: OPAD024AB0403
1U Fiber Optic Patch Panel: 5R1UM-S03
2U Fiber Optic Patch Panel: 5R2UM-S06
3U Fiber Optic Patch Panel: 5R3UM-F12
4U Fiber Optic Patch Panel: 5R4UM-F12
Single Mode 12 Port LC Optical Adapter Panels: 5F100-2LL
Single Mode 24 Port LC Optical Adapter Panels: 5F100-4LL
Blank Adapter Panels: Black- 5F100-PLT
Anaerobic Field Polish Fast-Cure Type LC Single Mode Connectors: 49990-SDL

APPENDIX B

BERK-TEK/LEVITON APPROVED EQUAL REQUIREMENTS

Any exceptions to the requirements in this document must be approved in writing by the UI OIT Representative.

To request an alternate manufacturer solution, provide the following supporting documents:

- *Alternate Equal Premier Network Design and Installation Contractor Agreement (current)*
- *Personnel trained and certified to design and install Alternate Equal Products.*
- *Provide proof of all Alternate Equal Installer Certificates and have at minimum of (4) current Alternate Equal Certified Installer Technicians in the local area within (100 miles) of where work is to be performed.*
- *Provide references of the type of installation provided in this specification.*
- *Personnel trained in the Alternate Equal Certified Installer course and be competent in Termination, Splicing, Testing, Trouble Shooting Fiber and Copper Products.*
- *Must be an Alternate Equal Contractor current and in good standing through the completion of any project with UI.*
- *Alternate Equal non-consumable products must have a minimum 20-year guarantee.*
- *Alternate Equal Appendix A Product List for review.*

APPENDIX C

DIVISION 27 STRUCTURED CABLING CONSTRUCTION VERIFICATION CHECKLIST

Contractor to ensure all drawings, pathways, cables, installation, labels, as-builts, and testing comply with the requirements listed in this document prior to having the UI OIT Representative verify adherence and craftsmanship. Any substandard or improper installation practices will need to be corrected and reviewed once remediation is complete.

UI Structured Cabling Standard

Equipment Identification/Tag: _____
 Location: _____

A) Labeling

Date	Description of Work Performed	% Complete	Initials	Questions (See details below)										
				1)	2)	3)	4)	5)	6)	7)	8)	9)	10)	
				YES NO	YES NO	YES NO	YES NO	YES NO	YES NO	YES NO	YES NO	YES NO	YES NO	YES NO
				YES NO	YES NO	YES NO	YES NO	YES NO	YES NO	YES NO	YES NO	YES NO	YES NO	YES NO
				YES NO	YES NO	YES NO	YES NO	YES NO	YES NO	YES NO	YES NO	YES NO	YES NO	YES NO
				YES NO	YES NO	YES NO	YES NO	YES NO	YES NO	YES NO	YES NO	YES NO	YES NO	YES NO
				YES NO	YES NO	YES NO	YES NO	YES NO	YES NO	YES NO	YES NO	YES NO	YES NO	YES NO
				YES NO	YES NO	YES NO	YES NO	YES NO	YES NO	YES NO	YES NO	YES NO	YES NO	YES NO
				YES NO	YES NO	YES NO	YES NO	YES NO	YES NO	YES NO	YES NO	YES NO	YES NO	YES NO
				YES NO	YES NO	YES NO	YES NO	YES NO	YES NO	YES NO	YES NO	YES NO	YES NO	YES NO
<input type="checkbox"/> CHECKLIST GROUP COMPLETE				INITIALS: _____		DATE: _____								

Question Details

- 1) Equipment Outlet faceplates labeled as specified.
- 2) Cabling at Equipment Outlet labeled as specified.
- 3) Modular Patch Panels for Horizontal Copper Cable labeled as specified.
- 4) Termination Blocks for Horizontal Copper Cable (if applicable) labeled using correct color-coded (BLUE) Designation Strips.
- 5) Termination Blocks for Backbone Copper Cable (if applicable) labeled using correct color-coded (WH, GR, BRN) Designation Strips.
- 6) Fiber Optic Patch Panels for backbone fiber optic cabling labeled as specified.
- 7) Copper Cabling at Modular Patch Panels and Termination Blocks at Main Telecom Room(s) labeled in accordance with specification requirements.
- 8) Fiber Optic Cabling at Patch Panels at Main Telecom Room(s) labeled in accordance with specification requirements.
- 9) Innerduct for backbone fiber optic cabling (if applicable) labeled as specified.
- 10) Backboard, Equipment Racks and Cabinets, and Enclosures labeled as specified.

Negative Responses

Group /Item	Date Found	Found By	Location	Reason for Negative Response	Resolved	Date Resolved	Resolution
					YES / NO		
					YES / NO		
					YES / NO		
					YES / NO		
					YES / NO		

UI Structured Cabling Standard

Equipment Identification/Tag: _____
 Location: _____

B) Horizontal Cabling – Installation Checks

Date	Description of Work Performed	% Complete	Initials	Questions (See details below)										
				1)	2)	3)	4)	5)	6)	7)	8)	9)	10)	
				YES NO	YES NO	YES NO	YES NO	YES NO	YES NO	YES NO	YES NO	YES NO	YES NO	YES NO
				YES NO	YES NO	YES NO	YES NO	YES NO	YES NO	YES NO	YES NO	YES NO	YES NO	YES NO
				YES NO	YES NO	YES NO	YES NO	YES NO	YES NO	YES NO	YES NO	YES NO	YES NO	YES NO
				YES NO	YES NO	YES NO	YES NO	YES NO	YES NO	YES NO	YES NO	YES NO	YES NO	YES NO
				YES NO	YES NO	YES NO	YES NO	YES NO	YES NO	YES NO	YES NO	YES NO	YES NO	YES NO
				YES NO	YES NO	YES NO	YES NO	YES NO	YES NO	YES NO	YES NO	YES NO	YES NO	YES NO
				YES NO	YES NO	YES NO	YES NO	YES NO	YES NO	YES NO	YES NO	YES NO	YES NO	YES NO
<input type="checkbox"/> CHECKLIST GROUP COMPLETE				INITIALS: _____			DATE: _____							

Question Details

- 1) Exposed cabling has been visually inspected for physical damage and any damaged cabling has been replaced. Cabling jacket and insulation are in good condition.
- 2) Cable color(s) matches specification requirements for given cable type.
- 3) Cable listing (e.g. General Purpose, Riser, Plenum) as specified and appropriate for installation environments.
- 4) Cabling is splice free.
- 5) Bend radii conforms to manufacturer recommendations for each cable type.
- 6) Appropriate slack provided in length required by specifications for given cabling type and termination point.
- 7) Cabling supported via “J-hook” supports at spacing defined within specifications. Supports are independent of piping, ductwork, equipment, cable tray or other conduit.
- 8) Minimum separations provided for cabling per specifications to minimize EMI.
- 9) Penetrations through floor, non-rated walls, or rated walls are sealed as specified for the wall or floor penetrated.
- 10) Communications Cabling pulled in separate conduits from normal power, emergency power, security and control systems.

Negative Responses

Group /Item	Date Found	Found By	Location	Reason for Negative Response	Resolved	Date Resolved	Resolution
					YES / NO		
					YES / NO		
					YES / NO		
					YES / NO		
					YES / NO		

UI Structured Cabling Standard

Equipment Identification/Tag: _____
 Location: _____

C) Horizontal & Backbone Cabling in Telecom Room– Installation Checks

Date	Description of Work Performed	% Complete	Initials	Questions (See details below)										
				1)	2)	3)	4)	5)	6)	7)	8)	9)	10)	
				YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES
				NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
				YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES
				NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
				YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES
				NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
				YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES
				NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
				YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES
				NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
				YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES
				NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
				YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES
				NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
<input type="checkbox"/> CHECKLIST GROUP COMPLETE				INITIALS: _____			DATE: _____							

- 1) Modular Patch Panels and Termination Blocks provided as specified.
- 2) Cable is supported at rear of Patch Panels and at entry to Termination Blocks.
- 3) Copper Twisted Pair terminated as specified. Cable jacket is removed, and Cable pairs untwisted only to the extent required for termination and within manufacturers recommended limits.
- 4) Fiber Optic Patch Panels and Termination Blocks provided as specified.
- 5) Unused Fiber Optic Patch Panel positions fitted with blanks or cover plates as applicable.
- 6) Cable color(s) matches specification requirements for given cable type.
- 7) Cable listing (e.g. General Purpose, Riser, Plenum) as specified and appropriate for installation environments.
- 8) Cabling supported within telecom rooms and in vertical chases as specified. Supports are independent of piping, ductwork, equipment, cable tray or other conduit. Wire-mesh-type support grips or other approved means used where cable must bear stress.
- 9) Appropriate slack provided in length required by specifications for given cabling type and termination point.
- 10) Cabling is splice free.

Negative Responses

Group /Item	Date Found	Found By	Location	Reason for Negative Response	Resolved	Date Resolved	Resolution
					YES / NO		
					YES / NO		
					YES / NO		
					YES / NO		
					YES / NO		

UI Structured Cabling Standard

Equipment Identification/Tag: _____
 Location: _____

D) Testing Checks

Date	Description of Work Performed	% Complete	Initials	Questions (See details below)										
				1)	2)	3)	4)	5)	6)	7)	8)	9)	10)	
				YES NO	YES NO	YES NO	YES NO	YES NO	YES NO	YES NO	YES NO	YES NO	YES NO	YES NO
				YES NO	YES NO	YES NO	YES NO	YES NO	YES NO	YES NO	YES NO	YES NO	YES NO	YES NO
				YES NO	YES NO	YES NO	YES NO	YES NO	YES NO	YES NO	YES NO	YES NO	YES NO	YES NO
				YES NO	YES NO	YES NO	YES NO	YES NO	YES NO	YES NO	YES NO	YES NO	YES NO	YES NO
				YES NO	YES NO	YES NO	YES NO	YES NO	YES NO	YES NO	YES NO	YES NO	YES NO	YES NO
				YES NO	YES NO	YES NO	YES NO	YES NO	YES NO	YES NO	YES NO	YES NO	YES NO	YES NO
				YES NO	YES NO	YES NO	YES NO	YES NO	YES NO	YES NO	YES NO	YES NO	YES NO	YES NO
				YES NO	YES NO	YES NO	YES NO	YES NO	YES NO	YES NO	YES NO	YES NO	YES NO	YES NO
<input type="checkbox"/> CHECKLIST GROUP COMPLETE				INITIALS: _____		DATE: _____								

- 1) Maximum Horizontal Copper Cable (Voice/Data) length is less than 295' for all cables installed.
- 2) Copper Horizontal Twisted-pair Cabling Tested as specified.
- 3) Copper Backbone Twisted-pair Cabling Tested as specified.
- 4) Copper Horizontal Coax Cabling Tested as specified.
- 5) Copper Backbone Coax Cabling Tested as specified.
- 6) Fiber Optic Backbone Cabling Tested as specified.
- 7) Fiber Optic Horizontal Cabling Tested as specified.
- 8) Test Results are documented as specified and submitted for review.
- 9) Copper Category Cable Test Results Pass EIA/TIA Parameters.
- 10) Fiber Cable Test Results Pass EIA/TIA Parameters.

Negative Responses

Group /Item	Date Found	Found By	Location	Reason for Negative Response	Resolved	Date Resolved	Resolution
					YES / NO		
					YES / NO		
					YES / NO		
					YES / NO		
					YES / NO		

UI Structured Cabling Standard

Equipment Identification/Tag: _____
 Location: _____

E) Design Review & As-Builts

Date	Description of Work Performed	% Complete	Initials	Questions (See details below)										
				1)	2)	3)	4)	5)	6)	7)	8)	9)	10)	
				YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES
				NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
				YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES
				NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
				YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES
				NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
				YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES
				NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
				YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES
				NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
				YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES
				NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
				YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES
				NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
<input type="checkbox"/> CHECKLIST GROUP COMPLETE				INITIALS: _____			DATE: _____							

- 1) Equipment Rack(s) and/or Cabinet(s) Designed as specified, including clearances, anchoring to floor and side bracing.
- 2) Equipment Rack(s) configured with vertical management per specification.
- 3) Cable Runway designed per specification.
- 4) Conduit Raceways designed with minimal 40% fill ratio.
- 5) Power Circuits Verified in TR for Equipment Needs.
- 6) Schematic Design Review. Site Plan, Floor Designations, MDF/IDF/TR Requirements, Exterior Elevations, Square Footage.
- 7) Design Development Review. Fully Dimensional Floor Plan with Designated Rooms, Developed Building Sections, Developed Elevations, Specs.
- 8) Custom Specifications per Project Review. Specifications provided to Design team and applied accordingly to project.
- 9) Construction Documents Review. Completed Drawings for Construction Pricing and Installation.
- 10) As-builts Review. Labeled Correctly, Red Lined Changes, Verified Accurate Quantities and Locations.

Negative Responses

Group /Item	Date Found	Found By	Location	Reason for Negative Response	Resolved	Date Resolved	Resolution
					YES / NO		
					YES / NO		
					YES / NO		
					YES / NO		
					YES / NO		