Standards of Installation
for
Network Cabling
at the
University of Texas at Arlington
Arlington, Texas

OIT Campus Network Services

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Chapter 1 – General Specifications & Material

1. General Work Area Outlet (WAO) Guidelines

Note: TIA/EIA 568B Wiring Standards are the foundation of UTA's network practices. The following are specific parts and techniques used in conjunction with the TIA/EIA 568B Cabling Standard. UTA Network requires that installers be BICSI Commercial Installer Level 1 Certified and follow BICSI Telecommunication Cabling Installation Procedures, as well as the TIA/EIA 568B Cabling Standard.

A. Number of WAOs per Room

A standard WAO for a new installation will consist of (3) Cat 5e/6 cables unless specified by the UTA representative. Two of these cables will be terminated with a blue jack, denoting use as a data cable. The third Cat 5e/6 cable will be terminated with a yellow jack, denoting use as a voice cable.

★ **Faculty/Staff Offices** - A minimum of one standard WAO will be installed for each 100 square feet in each office. Additional WAOs may be installed on a case by case basis.
★ **General Office Space Utilization and Conference Rooms** - A minimum of one standard WAO will be installed in each room. Additional drops will be installed as required on a case by case basis.
★ **Lab and Classroom** space in general require only one standard drop that consists of a 2/1 data/voice WAO. Additional WAOs in these areas will usually consist only of data cables since there is no need for additional voice. These additional WAOs can consist of up to 12 additional data cables and are determined by location and necessity. These additional WAOs will be installed as required on a case by case basis.

To determine identifying WAOs and labeling scheme, stand at the rooms' main entrance. Label the proposed WAOs sequentially from the left and moving around the room in a clockwise direction. See **Diagram 1**. If more than one entrance exists, determine an entrance to start at, and label drops sequentially in clockwise direction. In multiple rooms with multiple entrances, select the same entrance in each room to maintain a consistent start point in each room.
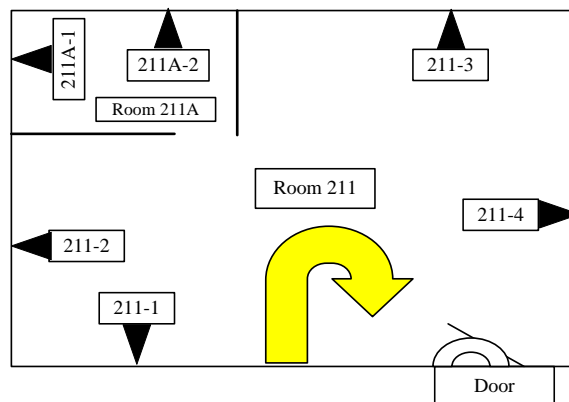
Diagram 1: How to identify location of WAOs and assign labeling to the WAOs.

B. Network Data and Voice Cable Specifications

★ Belden manufactured UTP Category 5e or Category 6 plenum and non-plenum rated cable will be used on all Data and Voice cable installations. See parts list below.

★ The Belden Cat 5e/6 cable will be installed under the Belden guidelines for that particular cable.

★ Plenum rated cable will be *Yellow* in color and non-plenum rated cable will be *Blue* in color, unless specifically stated otherwise by UTA.

★ The cable will be in reels of 1000' minimum when cable is purchased for the bid project.

★ Subsequent shorter runs on the same project will take advantage of leftover short spools of cable.

★ A minimum of three (3) Cat 5e/6 cables will be run to each room.

★ Cable must be Plenum rated unless specifically stated otherwise by UTA.

★ For other types of Belden cable such as outdoor, Enhanced Cat 6, or Media Twist, refer to Appendix A – UTA Standards Part List on page A-1.

Item	Manufacturer	Part #	Description
Cat 5e UTP	Belden	Datatwist 350-1701A	copper plenum twisted pair (yellow)
Cat 5e UTP	Belden	Datatwist 350-1700A	copper non-plenum twisted pair (blue)
Cat 6 UTP	Belden	Datatwist-7882A	copper plenum twisted pair (yellow)
Cat 6 UTP	Belden	Datatwist-7881A	copper non-plenum twisted pair (blue)

★ Below is the recommended fill chart for Belden Cat 5e **Datatwist350 (1701A**) and Cat 6 **Datatwist-7882A** cables in areas where conduits are used.

Note: These numbers are only valid for cables with outside diameters of approximately 0.200 inches for Cat 5e or 0.220 inches for Cat 6. The below chart is based on the NEC at a 40% fill ratio.

Conduit Fill Chart for twisted pair copper cabling

	Cat 5e	Cat 6
Trade Size	*Number of Cables*	*Number of Cables*
¾"	6	5
1"	10	9
1-1/4"	19	15
1-1/2"	25	21
2"	42	35
2-1/2"	74	61
3"	112	93
3-1/2"	147	121
4"	187	155

Table 1 – Conduit Fill Chart

C. Telephone Trunk Cable Specifications

All telephone trunk cables of 25 pair and up shall be 24 awg, solid conductor cables. Cables shall be in standard increments of 25, 50, 100, 300, 600, 800, 1000 or 1200 pair. The cables will be punched down on 66 style punch down blocks. Punch-down order should follow traditional USOC color code order for multi-pair telephone cables punched down on 66-50 Blocks.
See Table 2 – 25 Pair Telephone Cable Color Codes and Breakdown on page 1-13.

Any left over cable will be turned over to the UTA Network Representative upon completion of the project.

2. General Main Distribution Facility (MDF) and Intermediate Distribution Facility (IDF) Design Guidelines

Whenever a new building needs to be wired for data/telecomm services, or an existing building is re-wired, provisions for MDF/IDF rooms need to be incorporated into the design of the building. These MDF/IDF rooms are where the cable distribution system connects to the electronics distribution portion of the overall telecommunications infrastructure. In addition to the MDF/IDF rooms themselves pathways between the rooms, as well as all or part of the actual cable pathway system need to be considered in the overall design.

A. MDF/IDF Size Requirement Guidelines

★ In general the MDF/IDF room size should not be smaller than 10 X 10 feet or, 100 square feet. An average used to calculate total room requirements is 100 square feet of room space for every 15,000 square feet of assignable space.

★ Space savings can be achieved by having fewer rooms at the price of having less flexibility of where the rooms are located in the building structure. The main constraint determining an acceptable location being that all work outlets must be reachable within a maximum of 90 meters (295') of actual cable path. This is mandated by the standards that the data communications network equipment is designed to work with.

★ Larger areas may require larger MDF/IDF rooms, or more than one room per floor spread apart to accommodate the wiring distance constraint.

★ Even if the customer does not anticipate any growth, the MDF/IDF room should include adequate space to support equipment changes with minimal disruption.

B. MDF/IDF Location Guidelines

★ In general the raw distance from the MDF or IDF room to any desired service location should be no greater than 250 ft. To minimize the horizontal cable lengths (with a maximum of 90 m [295ft.]), locate the MDF/IDF rooms as close as possible to the center of, and on the same floor as the area it is intended to serve. This distance must allow for the path of the cable and required cable slack loops of ten (10') feet on the MDF/IDF end, and fifteen (15') feet at the WAO end.

★ In cases of structures having multiple floors, the MDF/IDF rooms should be stacked on top of each other to facilitate inter-connecting cabling.

★ If there needs to be more than one IDF room per floor they should be as symmetrically located as possible depending on the building design, hopefully using the same criteria on each floor to achieve stacked rooms.

★ Ensure that MDF/IDF rooms are accessible from the hallway.

★ There should be at least one IDF room per floor, unless the design of the building is such that all WAOs can be reached within the maximum distance constraint from one IDF room.

★ In residential buildings where there are typically no false ceilings installed, it is best to design the system so that the WAOs on each floor are stacked on top of each other. This allows for a vertical conduit pathway from the attic to each WAO.

C. **Unacceptable MDF/IDF Location Guidelines**

★ Equipment not related to the support of the MDF/IDF room such as piping, duct work, and distribution of building power should not be located in, or pass through, the MDF/IDF room.
★ The MDF/IDF room should not be shared with building or custodial services that may interfere with telecommunication systems. For example, slop sinks and cleaning materials such as mops, buckets, or solvents must not be located or stored in the MDF/IDF room.
★ Avoid locating equipment in any place that may be subject to:
  ★ Water infiltration, steam infiltration, humidity from nearby water or steam, heat (e.g., direct sunlight), and any other corrosive atmosphere or environmental conditions

Caution: Avoid locations that are below water level unless preventive measures against water infiltration are employed.   The room must be free of plumbing and electrical utilities that are not directly required to support the telecommunication function.   A floor drain is required if there is a risk of water entering the facility.

★ Avoid shared use of MDF/IDF room space with other building facilities. Locations that tend to be unsatisfactory for MDF/IDF rooms include space in or adjacent to:
  ★ Boiler rooms, washrooms, janitor's rooms, storage rooms, loading docks
★ Avoid any space that contains:
  ★ Sources of excessive EMI, hydraulic equipment and other heavy machinery that caused vibrations, steam pipes, drains, clean-outs
★ Avoid using the MDF/IDF room as a means of accessing the spaces listed above.

D. **MDF/IDF Environmental Factor Guidelines**

★ Temperature   64 degrees F to 80 degrees F
★ Relative Humidity   30 percent to 55 percent
★ Heat Dissipation   750 to 5000 BTUs per hour per cabinet

E. **Other Uses of MDF/IDF for Related Support Services**

★ MDF/IDF rooms should be dedicated to the telecommunication function and related support services such as CCTV, Simplex, Mav Express, Video conferencing, and Environmental control.

F. **MDF/IDF Power Guidelines**

★ Branch circuits for equipment power should be dedicated 20Amp 3-wire 120V AC duplex circuits. Each MDF/IDF room should have a minimum of one on each wall of these power outlets. It is preferred that these circuits should be split between two load centers to allow for redundancy. It is recommended that all Isolated Ground circuits originate from power panels dedicated exclusively for Isolated Ground circuits in order to be isolated from other noisy in house circuits.
★ A convenience outlet should also be included in each MDF/IDF room.
★ Each MDF/IDF room will be equipped with a minimum of one (1) 120V-20 amp duplex outlets with independent circuits (with isolated-ground if possible) on each wall where the plywood is mounted.

G. MDF/IDF Fire Protection Guidelines

★ Provide fire protection for the MDF/IDF room if required by applicable codes.
★ If sprinkler heads are provided, install wire cages to prevent accidental operation.
★ For wet pipe systems, drainage troughs are recommended to protect equipment from any leakage that may occur.
★ To prevent water damage, consider using "dry" sprinkler systems.

H. MDF/IDF Grounding Guidelines

★ Each MDF/IDF room should be provided with a #6 building ground wire and grounding bus bar. The telecommunications Installer will use this ground wire to ground equipment racks, ladder rack, outside plant armored fiber optic cable and electronic equipment.

I. MDF/IDF to WAO Pathway Guidelines

★ To avoid electromagnetic interference (EMI), all pathways should provide clearances of at least:
  ★ 4 feet from large motors or transformers
  ★ 1 foot from conduit and cables used for electrical power distribution
  ★ 1 foot from fluorescent lighting
★ Access between MDF/IDF rooms is typically provided by several 4 to 6 inch conduits with appropriate sleeves and fire-stop material.
★ Vertical cable pathway is typically provided by conduit in walls for WAOs and to provide access between MDF/IDF rooms on different floors.
★ In the case of an area that has a false ceiling there should be a conduit stubbed out in the ceiling for each WAO. These conduits should be ¾ inch in diameter, and the WAO should be no further than 10 feet from the electronic equipment they serve. There should be no more than two elbows or sweep ninety degree turns in a conduit run before an accessible junction box is installed. It is preferred that use of conduit be minimized and is only required to provide access from the WAO to some accessible area such as above a false ceiling or similar access point. If an area has a firewall between it and the hallway area, there needs to be provisions for penetrating the firewall. All penetrations will be sealed with appropriate material to meet fire safety code requirements. *See Chapter 5 – Safety, paragraph 3 and Fire Stopping, page 5-1.*
★ In cases where the pathway between the MDF or IDF to the WAO is not entirely constructed of conduit, it is preferred that the pathway from the MDF or IDF to where the conduit is provided for each individual WAO be installed by the Installer as part of the cable system.
★ Current recommendations for overhead cable pathway involve use of J-Hooks and cable support bags suspended from a series of dedicated grid wires. UTA Network prefers that pathway and cable be installed after the building ceiling infrastructure has been completed but before the ceiling is installed. Since cable pathway of this type has some inherent flexibility it provides the benefit of being able to work around piping, ventilation, and other obstructions that might not have as much location flexibility. This method will more easily allow for available space considerations.

Caution: Ceiling grid wires are not to be used as a means of supporting the cable pathway. Installers will install dedicated grid wire using a Hilti gun needed to support the additional cable pathway

★ Buildings that have no false ceilings or alternate access methods present special challenges that are probably best addressed on a case-by-case basis. In existing buildings there are wall mounted external raceway or conduit systems that can be used in conjunction with boring techniques to retrofit a usable distribution system.

★ In a newly constructed building one method is to have conduit installed when the walls are built. These conduits should be ¾ inch in diameter, and the WAO should be no further than 10 feet from the electronic equipment they serve. There should be no more than two elbows or two sweep ninety degree turns in a conduit run before an accessible junction box is installed. This method will result in a conduit from each WAO back to the MDF/IDF room or most convenient accessible location. This method can be modified depending on the availability or lack of special access areas.

★ Another method in a newly constructed building involves special coordination efforts between the building contractor and the telecommunications Installer. This basically involves coordinating the installation of the wiring with the building of the walls and other support structures. While this method can work there are several problems that may arise with this approach that may render some of the wiring plant unusable. Since the wiring is not protected by conduit and is installed before the construction is finished there is opportunity for damage to the cable caused by standard construction techniques. The potential for cable damage combined with the prohibitive cost of cable repair post construction tend to offset the cost of the preferred method of installing a conduit system during construction.

3. MDF/IDF Requirements

A. MDF/IDF Design Requirements

★ All MDF/IDF rooms use designators in accordance with *BICSI TDMM Ch. 7 Equipment Rooms* and *TIA/EIA 568B Procedures and Guidelines*.

★ Where possible, MDF/IDF rooms shall have direct access to the hallway or other such corridor and should not be shared with other building services, such as Electrical (i.e. electrical distribution panels or transformers) or Mechanical (i.e. air handlers). Supporting codes are found in both BICSI TDMM and the EIA/TIA 568A wiring standard unequivocally against multi-use closets.

★ MDF/IDF rooms shall not contain any type of sink, be used as Custodial supplies storage or be used as general storage areas (books, furniture, etc.).

★ Floors in MDF/IDF rooms shall be sealed concrete or tile, carpeted flooring is not acceptable.

★ Each MDF/IDF room will have four inch (4") sleeved core holes between floors as requested by UTA.

★ Empty core holes will be properly fire-stopped with fire pillows.

★ A minimum space of 10' X 10' is required for all single floor MDF/IDF rooms.

★ A minimum space of 10' X 15' is required for all multi-floor MDF/IDF rooms.

★ All walls of a MDF/IDF rooms will be covered from floor to ceiling in ¾" fire-rated plywood or plywood which is painted with at least two coats of flame retardant white paint.

★ All MDF/IDF rooms will be equipped with a grounding bus bar that is tied back to the building's ground. The grounding conductor will be attached to an approved electrode per *NEC 1999 standards*, as referenced in *TIA J-STD-607 (2002)*.
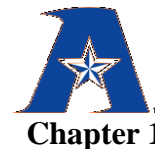
★ Each MDF/IDF room will be equipped with a minimum of one (1) 120V-20 amp duplex outlets with independent circuits (with isolated-ground if possible) on each wall where the plywood is mounted.

Note: All Installers must be BICSI Commercial Installer Level 1 certified and properly trained to install jacks according to PANDUIT specifications. New installations are wired with Cat 5e/6 unless otherwise specified by UTA.

B. Cat 5e Termination

★ Standard Data Termination – use blue Cat 5e jack
★ Cross-Connect Termination – use orange Cat 5e jack
★ Telephone/voice Termination – use yellow Cat 5e jack

Item	Manufacturer	Part #	Description
blue Cat 5e jack	Panduit	CJ5E88TGBU	blue Panduit Cat 5e jack
orange Cat 5e jack	Panduit	CJ5E88TGOR	orange Panduit Cat 5e jack
yellow Cat 5e jack	Panduit	CJ5E88TGYL	orange Panduit Cat 5e jack

Note: Cat 5e terminations will use either T568A or T568B wiring scheme which will be determined on a case by case basis.

C. Cat 6 Termination

★ Standard Data Termination – use blue Cat 6 jack
★ Cross-Connect Termination – use orange Cat 6 jack
★ Telephone/voice Termination – use yellow Cat 6 jack

Item	Manufacturer	Part #	Description
blue Cat 6 jack	Panduit	CJ688TPBU	blue Panduit Cat 6 jack
orange Cat 6 jack	Panduit	CJ688TPOR	orange Panduit Cat 6 jack
yellow Cat 6 jack	Panduit	CJ688TPYL	yellow Panduit Cat 6 jack

Note: Cat 6 terminations will use only T568B wiring scheme.

D. UTP Patch Panels / Wall Brackets

★ Patch Panel - use 24 port patch panel which will allow the termination of 24 mini-com TX style modular jacks or 48 port patch panel which will allow for 48 jacks
★ Wall Mount Bracket – use a 2RU or 4RU space bracket

Item	Manufacturer	Part #	Description
patch panel	Panduit	CPP24WBLY	24 port patch panel
patch panel	Panduit	CPP48WBLY	48 port patch panel
wall mount bracket	Panduit	WBH2	2 space wall mount bracket
wall mount bracket	Panduit	WBH4	4 space wall mount bracket

E. Patch Panel Jack Labels

Labels follow practices set forth in ***ANSI/TIA/EIA – 606A ADMINSTRATION***.
The Installer will generate labels to identify the jacks terminated at both the WOA and the MDF/IDF room patch panel, according to the following criteria:

★ For all mini-com jacks, the font for this label is an Arial 10 point (102A-1A, 102A-1B, 102A-1VA,). Use smaller fonts to fit longer circuit ID numbers.
★ Jack labels will be wrapped around the jacks properly.

The labeling scheme for terminated jacks is as follows. There are three parts to each jack label. Example: 102A-1A

★ The first part identifies the room number 102A
★ The second part identifies the WAO and/or sequence of WAOs in a particular room.
  Example: 102A-**1**A, 102A-**1**B, 102A-**2**A, 102A-**2**B, 102A-**3**A
  1A and 1B are in WAO 1, 2A and 2B are in WAO 2, 3A is in WAO 3, all are in room 102A
★ The third part identifies the jack and/or sequence of jacks in a particular WAO
  Example: 102A-1**A**, 102A-1**B**, 102A-1**C**, 102A-1**D**
  A, B, C, D represent 4 cables in WAO 1
★ The Voice jack has an additional identifier, "**V**" represents a voice jack, added to the front of the jack letter. There is usually only one Voice jack per drop.
  Example: 102A-1A, 102A-1B, 102A-1**V**A
★ The Ceiling jack has an additional identifier, "**C**" represents a ceiling jack, added to the front of the jack letter. All jacks in the ceiling should have this identifier.
  Example: 102A-1**C**A, 102A-1**C**B, 102A-1**C**C

Note: Installers will not cut or tear ends off and stick jack labels on while they are snapped in the panel or faceplate. These labels must be installed centered, then wrapped around the jack. Failure to properly install these labels will be repaired by the Installer who will provide replacement labels.

★ Each end of the Cat 5e/6 cable will have a label placed approximately 3 to 6 inches from the network data jack with a clear cable label using Arial 12 point font.

Item	Manufacturer	Part #	Description
jack label	Panduit	C138X019FJJ	label for mini-com jack
cable label	Panduit	S100X125YAJ	label for cable

F. Equipment Racks

All copper cabling, fiber optic cabling and equipment will be installed in a floor mount rack. At the discretion of the authorized UTA Network Representative, a wall mount bracket or a wall mount enclosure may be used instead.

★ **Floor Rack** – Black 7' rack will be used for floor mount installations. The rack should be anchored at all four points using a Concrete Floor Kit of either a ½" or $^3/_8$" size. The bolts should be flush to the base plate of the rack and the rack shall be level.
  ★ A black ladder-style cable raceway should be secured to the rack via a black rack-to-raceway mounting plate and secured to at least one wall via a black wall angle bracket support unit. Any exposed ends of the ladder-style cable raceway should be covered with end caps.

★ At the discretion of UTA, one or both sides of the rack should have a black Vertical Cable Management Front/Back 45RU cabling management section installed.

★ A vertical power strip will be installed on each rack that electronics will be installed in. At the discretion of UTA, more than one vertical power strip may be required.

★ Installers should follow Chatsworth and Panduit published Installation Instructions.

Item	Manufacturer	Part #	Description
7' floor rack	Chatsworth	55053-703	7' black floor rack
½" concrete anchors	Chatsworth	40604-003	concrete floor kit
3/8 " concrete anchors	Chatsworth	40604-001	concrete floor kit
ladder rack	Chatsworth	10250-712	ladder style cable raceway
mounting plate	Chatsworth	10595-712	rack to raceway mounting plate
wall angle bracket	Chatsworth	11421-712	wall angle support bracket
end caps	Chatsworth	10642-001	rubber end caps
vertical management	Panduit	WMPV45E	NetRunner vertical cable management front/back 45RU
vertical power strip	Chatsworth	12851-706	20 amp vertical strip

Photo 1
Two rows of properly mounted Chatsworth racks.

Note: *Ladder-style cable raceway attached to wall to provide support and a cable path between racks.*

★ **Wall Mount Swing Gate** – use a clear aluminum wall mount swing gate for wall mount installations. The unit will be mounted onto a sheet of ¾" plywood which is securely fastened to the wall studs and will be secured using #6 - 1" to 1 ¼" screws, or larger, in all of the rack's mounting holes. Reference Chatsworth's published Installation Instructions.

★ **Wall Mount Enclosure, Secured** – use a computer white secured enclosure with a fan unit in those situations where UTA determines that a lockable enclosure is warranted. The unit will be mounted on a sheet of ¾" plywood which is securely fastened to the wall studs and will be secured using #6 - 1" to 1 ¼" screws, or larger, in all of the rack's mounting holes.

★ **Wall Mount Bracket** – use a clear aluminum wall mount bracket where UTA determines that a smaller rack is suitable.

★ **Grounding** – The equipment rack will be properly grounded as specified on ***page 4-1, Chapter 4 - Grounding***, of this document, braided grounding straps will be used to connect separate pieces of ladder-style cable raceway and equipment racks to form a continuous ground that connects to the MDF/IDF rooms grounding bus bar.

Item	Manufacturer	Part #	Description
wall mount swing gate	Chatsworth	11348-519	clear aluminum wall mount swing gate
wall mount enclosure	Chatsworth	11685-219	white wall mount secure enclosure
enclosure fan unit	Chatsworth	11755-003	wall mount secure enclosure fan unit
wall mount bracket	Chatsworth	11583-519	4RU clear aluminum wall mount bracket
ground busbar	Panduit	GB2B0306TPI-1	ground busbar (1.4" x 2" x 12")
ground busbar	Panduit	GB2B0304TPI-1	ground busbar (1.4" x 2" x 10")
braided ground straps			

G. 66-Block Voice Termination
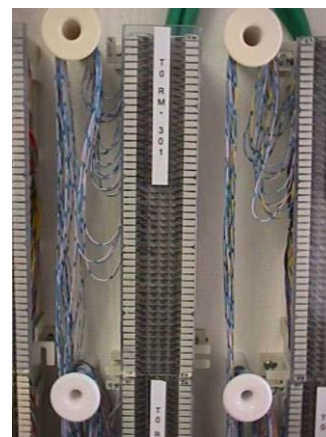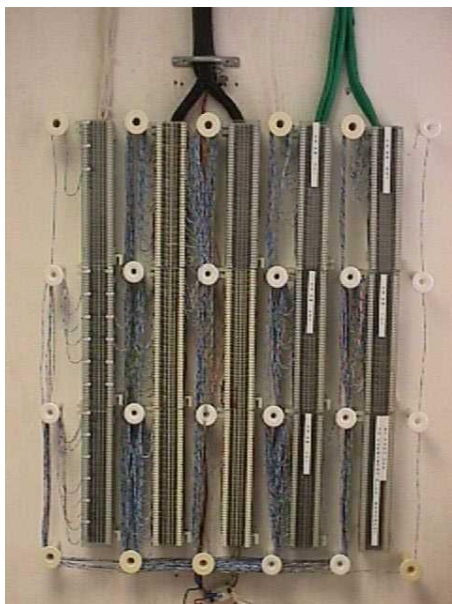
Photo 2a: 66 style IDC blocks mounted on plywood backboard.
Photo 2b: Blow-up of 66 style block with clear plastic block covers.

★ Use a pre-wired 66-50 standard punch down block for the Office/Classroom Voice cables.
★ Use a standard punch down block including wall mount bracket for the Voice feeder.
★ Voice building feeder cables that enter the building from tunnels or outside of the building shall be properly ground per *NEC-1999 Article 800*.
★ Wire Routing Spools (a.k.a. Mushrooms) will be mounted at all four corners of the 66-blocks to allow easy routing of jumper wire between the Building Feeder cables and the Office/Classroom WAO cables.
★ Label the Circuit ID on the Voice punch down blocks with a fine point, permanent marker pen for the Office/Classroom WAO cables.
★ Cover finished blocks with plastic 66 block covers. Print labels for Circuit ID and attach covers.
★ When installing Outside Plant (OSP) cable that is filled with water repellent gel in a MDF/IDF room, the Installer will properly use cleaning agents (ex. *D-gel*) to remove the gel filling from the individual cable pairs. Also, any residue or damage incurred during the termination and clean up of the gel filled trunk cables will be performed by the Installer before the scope of work is considered complete, to the original or better condition. 66-Blocks will be free of any (*ikky-pic*) gel or D-gel residue.
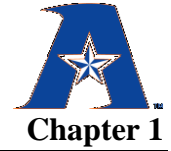
Item	Manufacturer	Part #	Description
Voice punch down block	Siemon	M2-5T-128LR-TP	pre-wired 66-50 termination block
voice feeder punch down block	Siemon	66M1-50	66-50 termination block
wall mount bracket	Siemon	S-89B	wall mount bracket for 66 block
punch down block labels	Panduit	C138X019FJJ	punch down block labels for voice

Conceptual Telecommunication Room Layout
Category 5e wiring

Yellow Patch Cord

Ladder Rack

Cable Management

Patch Panel (48 pt)

Cable Management

Station 66 Blocks
(P/N M2-5T-128LR-TP)

Cable Management

Patch Panel (48 pt)

Cable Management

Patch Panel (48 pt)

Cable Management

123-1A	123-1B	123-1VA
•	•	•

Feeder 66 Blocks
(P/N S66M1-50)

Patch Panel Rack

Phone Feeder
Cable

Cat 5e Data Jacks (Blue)
CJ5E88TBU

Cat 5e Data Jacks (Yellow)
CJ5E88TYL

Diagram 2:
Conceptual Drawing using Cat 5e/6 for the Voice cables terminated into the equipment rack patch panel.

- ★ **Diagram 2** indicates that the designated Voice cabling will be terminated via a yellow Panduit jack and connected to the 66 punch down block via a yellow patch cord of the appropriate length.
- ★ The 66 punch down blocks will be located on a suitable wall, mounted to flame retardant ¾" plywood or ¾" plywood which has been painted with a minimum of two coats of white flame retardant paint.

Splitting Phone Circuits off a single Cat5e Cable

Panduit 4 port Exec
Series Faceplate
(P/N CFPE4IW)

Panduit Cat 5e TX
Jack (Yellow)
P/N CJ5E88TYL

Panduit Cat 5e TX
Jack (Blue)
P/N CJ5E88TBU

Panduit Mini-Com
Blank Module (White)
P/N CMBIW-X

Yellow Cat 5e Patch Cable
conencts to patch panel

RJ-45
Connector

Siemon Modular
4-Way Splitter
P/N YT4-4U1

RJ-12
Connectors

Siemon 66 Block
(P/N M2-5T-128LR-TP)

YT4-4U1 Pin Out
1 2 3 4 5 6 7 8

1 2 3 4 5 6   1 2 3 4 5 6   1 2 3 4 5 6   1 2 3 4 5 6
Jack 1   Jack 2   Jack 3   Jack 4

Diagram 3:
Detail for running multiple phone circuits via a single Cat 5E/6 wire.

★ **Diagram 3** details the methodology for running up to four independent Voice circuits via one Cat 5e/6 cable.

Terminate punch down blocks following traditional Voice color code order.

25 Pair Voice cable (Colors are main color - strip color)

Pair#	Ring Color	Tip Color
1	White-Blue	Blue-White
2	White-Orange	Orange-White
3	White-Green	Green-White
4	White-Brown	Brown-White
5	White-Slate	Slate-White
6	Red-Blue	Blue-Red
7	Red-Orange	Orange-Red
8	Red-Green	Green-Red
9	Red-Brown	Brown-Red
10	Red-Slate	Slate-Red
11	Black-Blue	Blue-Black
12	Black-Orange	Orange-Black
13	Black-Green	Green-Black
14	Black-Brown	Brown-Black
15	Black-Slate	Slate-Black
16	Yellow-Blue	Blue-Yellow
17	Yellow-Orange	Orange-Yellow
18	Yellow-Green	Green-Yellow
19	Yellow-Brown	Brown-Yellow
20	Yellow-Slate	Slate-Yellow
21	Violet-Blue	Blue-Violet
22	Violet-Orange	Orange-Violet
23	Violet-Green	Green-Violet
24	Violet-Brown	Brown-Violet
25	Violet-Slate	Slate-Violet

Binder#	Color
1	White-Blue
2	White-Orange
3	White-Green
4	White-Brown
5	White-Slate
6	Red-Blue
7	Red-Orange
8	Red-Green
9	Red-Brown
10	Red-Slate
11	Black-Blue
12	Black-Orange
13	Black-Green
14	Black-Brown
15	Black-Slate
16	Yellow-Blue

Table 2 – *25 pair Voice cable color codes and breakdown.*

H. Wire Management

★ **Vertical Wire Management** – the vertical cable management front/back 45RU shall be used as previously defined on *page 1-9, Chapter 1, paragraph 3.F. Equipment Racks* under the bullet *"Floor Rack"*.

★ **Horizontal Wire Management** – front and back horizontal management is used where 1RU or 2RU, double-sided management is required. The back wire management ensures proper bend radius compliance for cables coming from the Office/Classroom and installed into the patch panel. The front side is used to manage patch cords installed from the front of the patch panel to the Network Equipment.

★ **Horizontal Wire Management** – front only horizontal management is used where 1RU or 2RU, front only management is required. This is primarily used to manage patch cords connecting to the network distribution equipment and is installed between the 2RU space separating the network distribution equipment.

★ **Cable Runway** – use black 10' sections of ladder-style cable raceway.

★ **End Caps** – end caps should be used on all exposed ends of the ladder-style cable raceway. All ends shall be filed down to remove any sharp edges before caps are installed.

★ All rack and raceway mounting hardware shall all be CHATSWORTH Brand fittings.

★ Velcro straps are preferred to plastic tie straps in MDF/IDF rooms wherever practical when securing cabling to cable runway. Velcro should be of sufficient length to wrap around cable bundle twice to accommodate future expansion.

★ Tie straps used to dress cable will not be over tightened. Tie straps that deform the outer cable jacket and that can't be slid easily along the length of the cable bundle are too tight.

★ Tie straps used in plenum airways must be plenum rated.

Item	Manufacturer	Part #	Description
vertical management	Panduit	WMPV45E	NetRunner vertical cable management front/back 45RU
horizontal management	Panduit	WMPSEY	1RU front and back management
horizontal management	Panduit	WMP1EY	2RU front and back management
horizontal management	Panduit	WMPFSEY	1RU front management only
horizontal management	Panduit	WMPF1EY	2RU front management only
ladder rack	Chatsworth	10250-712	10' sections of ladder style cable raceway
end caps	Chatsworth	10642-001	rubber end caps
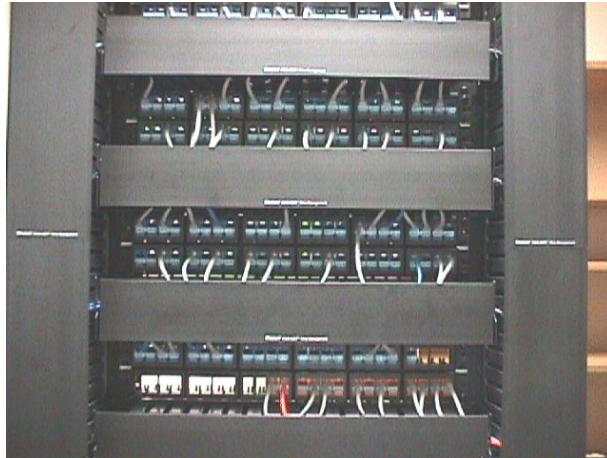
Photo 3: *Proper use of both Vertical and Horizontal Cable Management*
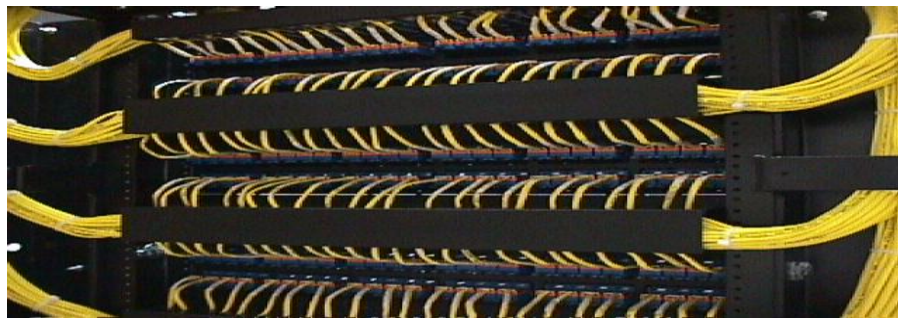
Photo 4: *Cables routed properly from the back of a WMPSE into the patch panel to ensure the Cat 5e/6 Bend Radius*
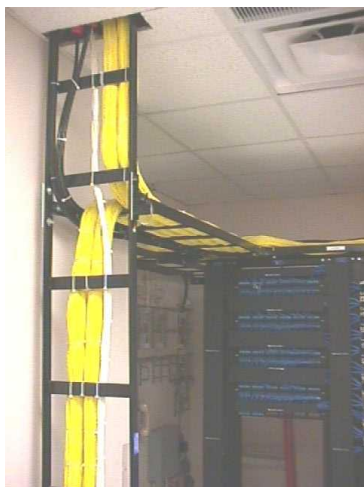
Photo 5.
Properly supported ladder rack allowing cable transition between floors.

I. Transition Between Floors

★ When cables come off a 7 ft. rack and over a ladder way and are ran down vertically, they must be properly secured to the vertical section of ladder rack covering the entire vertical span of the run. Use a rounded transition fitting (water-fall) bracket to ensure proper cable management and bend radius.
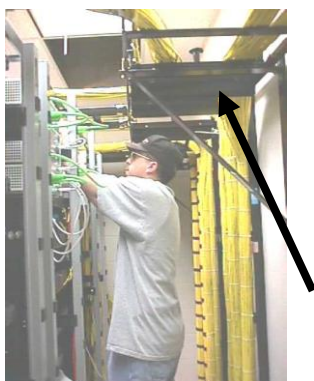
Photo 6. *Proper use of waterfall (rounded transition) fittings for cable changing from a horizontal path to a vertical one. This maintains the minimum bend radius for Cat 5e/6 cable.*

Photo 7. *Proper transition between floors. Bundles are correctly secured to vertical ladder sections by cable ties or Velcro straps.*

★ Cables going through risers between floors must be properly supported for their weight, especially for high pair-count Voice feeder cables and large cable bundles. A wall mount support or strut mount support is required.

★ When pulling a cable in conduits between floors, replace the pull string or rope for future use and properly fire-stop the conduits.

Item	Manufacturer	Part #	Description
wall mount support	Erico Caddy	CAT600WM	wall mount support for cables between floors
wall strut mount	Erico Caddy	CAT600R	wall strut support for cables between floors
water-fall	Chatsworth	12100-712	Cable Runway Radius Drop, 12" (black), install on crossmember
water-fall	Chatsworth	12101-701	Cable Runway Radius Drop, Stringer 10-1/4" (black), install on side stringer

J. Patch Cord Colors in MDF/IDF Rooms

★ **Standard MDF/IDF Rooms**: use blue patch cords for new installations. For existing installations, match the color currently in use in the MDF/IDF room.

★ **Special Cases**: UTA may request that patch cords of differing colors be used to denote special circumstances.

★ **Cross-connect Cables**: use **Orange** patch cords for connections between MDF/IDF rooms.

★ **Voice Cables**: use **Yellow** patch cords for connections between patch panels and Voice blocks.

★ **Cross-over Cables**: **Black** cables are pinned out so that 1 & 3 and 2 & 6 are swapped. These cables are used to inter-connect the network distribution equipment.

K. Patch Cord Specifications and Pin-Outs

Below is the pin assignment for **TIA/EIA 568A** compliant patch cords. All patch cords should be made from a minimum of 4 pair 24AWG stranded cable Cat 5e/6.

	Pin	Wire Color
Pair 3 { T3	1	White/Green
Pair 3 { R3	2	Green
T2	3	White/Orange
Pair 2 { Pair 1 { R1	4	Blue
Pair 1 { T1	5	White/Blue
R2	6	Orange
Pair 4 { T4	7	White/Brown
Pair 4 { R4	8	Brown
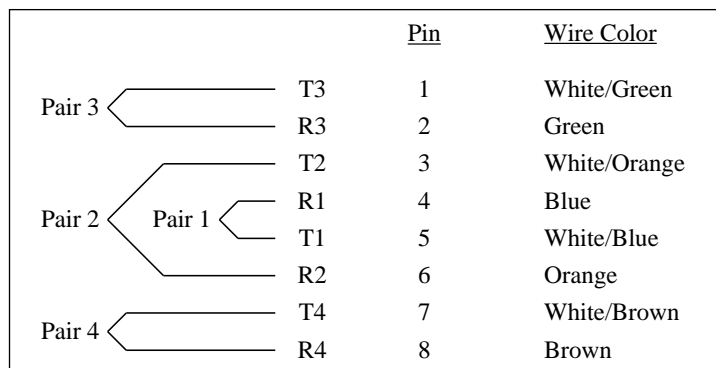
Figure 1 – Standard EIA/TIA T568A pin-out

	Pin	Wire Color
Pair 2 { T2	1	White/Orange
Pair 2 { R2	2	Orange
T3	3	White/Green
Pair 3 { Pair 1 { R1	4	Blue
Pair 1 { T1	5	White/Blue
R3	6	Green
Pair 4 { T4	7	White/Brown
Pair 4 { R4	8	Brown
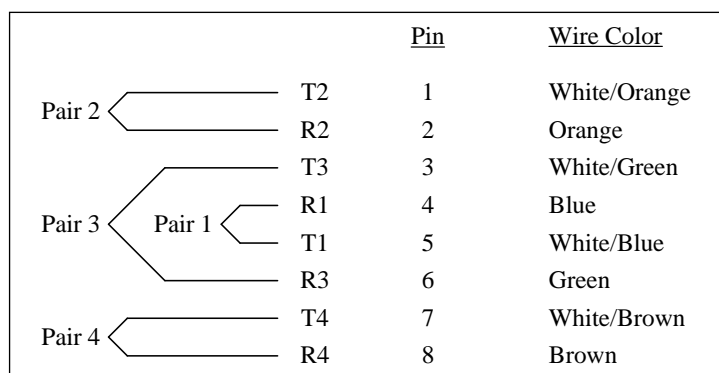
Figure 2 – Standard EIA/TIA T568B pin-out

Cross-over Cable Pin-out (RJ-45 between network distribution equipment)

```
         Hub or                                    Hub or
        Repeater                                  Repeater

      3  TxD+  ─────────────        ────────────  3  TxD+
      6  TxD+  ─────────────  ╲  ╱  ────────────  6  TxD+
                                ╳
      1  RxD+  ─────────────  ╱  ╲  ────────────  1  RxD+
      2  RxD+  ─────────────        ────────────  2  RxD+
```
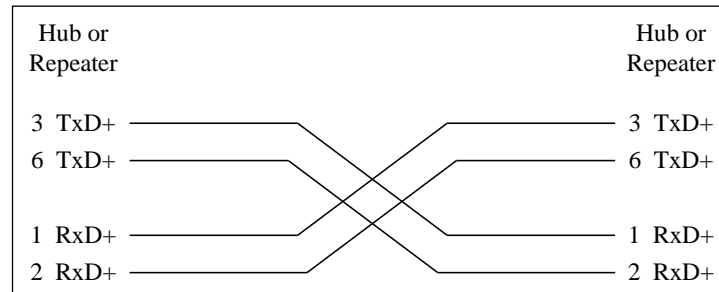
Figure 3 – Cross-over patch cord pin-out

Note*: All other pins are terminated straight through.*

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Chapter 2 - Copper Cabling Installation Guidelines

1. General Copper Cabling Installation

Belden manufactured UTP Category 5e or Category 6 plenum and non-plenum rated cable will be used on all Data and Voice cable installations.

★ The Belden Cat 5e/6 cable will be installed under the Belden guidelines for that particular cable.
★ Plenum rated cable will be *Yellow* in color and non-plenum rated cable will be *Blue* in color, unless specifically stated otherwise by UTA.
★ The cable will be in reels of 1000' minimum when cable is purchased for the bid project.

A. Cable Trauma

Twisted pair cable can easily be damaged and the twisted pair unraveled that prevents them from passing Cat 5e or Cat 6 certification. The cable Installers are expected to prevent twisting and kinks during installation. Remember the maximum tension allowed on a twisted pair cable is 25 foot/pounds of force. Above that amount and the cable has been damaged.

Examples of unacceptable cable trauma.
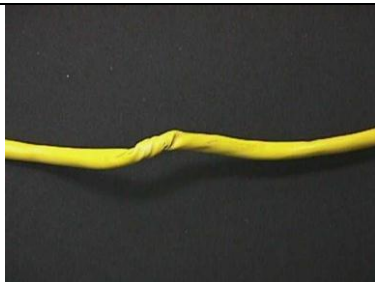
Photo 8: A kink that has been pulled through with excessive force.	*Photo 9*: A cable that has been bent back upon itself.
Photo 10: Another example of a loop in the cable that has been forced straight, causing severe cable trauma	*Photo 11*: A cable that has been smashed or crushed. *Note the cuts in the outer cable jacket*

★ Care shall be taken to prevent nicks, abrasions, burning, and scuffing of cable during installation. Cables found to be damaged will be replaced at the Installer's expense regardless of the test results of the cable.

B. Cable Pathways

★ Cables shall follow pre-designed, UTA approved pathways. Design of the pathway will follow the standards set forth in the ***TIA/EIA 569-B (2004) Commercial Building Standard for Telecommunications Pathways and Spaces*** document.
★ These pathways will be constructed using J-hooks hung from dedicated grid wire installed with powder-actuated (ex. Hilti gun) devices.
★ J-Hooks shall be attached to dedicated grid wire and not attached to the existing drop ceiling grid wiring as the added weight from the cables can cause distortion to the existing grid system. Refer to Photo 12.
★ Adjustable Cable Support (Caddy Bags) will be used on higher cable count runs, properly mounted per product specifications. They will be secured to the ceiling by all-thread or attached to I-beams.

Item	Manufacturer	Part #	Description
j-hook	Erico Caddy	CAT324Z34	j-hooks for securing cabling above ceiling
caddy bag	Erico Caddy	CAT425WM	cable support caddy bag for above ceiling

Photo 12*: Proper use of CADDY J-Hooks.*

Caution:
Grid wire used for the actual ceiling grid, cannot and must not be used with Caddy-Bags due to the cable's weight. Use all-thread or similar attached to building concrete.

★ Cable Tray systems will be used at UTA's discretion. Specifics to be determined by the <mark>UTA Network Representative</mark> on case by case basis.
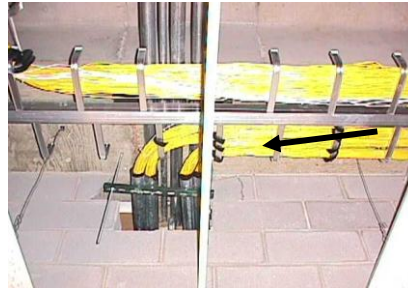
***Photo 13**. Cable tray installed above drop ceiling.*

Note photo above:
Finished section going into conduits that has been properly bundled to ladder tray with velcro strips. Conduit bushings were installed on the end of the conduits to prevent the cable being nicked or abraded on rough conduit edges during pulling.

★ Some buildings on Campus use ceiling run or slab run conduit systems. When using this type of system, be sure to pull a new pull string with the cabling. Do not tie-strap the pull string in the cable bundle.

<mark>EMT stub-outs in support of network WAOs shall be a minimum of ¾'' and will have no more than two 90 degree sweep bends.</mark>

★ J-Hooks <mark>installed on a dedicated grid wire</mark> secured to the concrete deck is the preferred method of installation. Ceiling support shall be at a maximum of four (4) foot intervals and should be placed as close to the deck as possible. Cable pathways shall be so configured to avoid **Electromagnetic Field (EMF)** and **Radio Frequency Interference (RFI)** also referred to as **Electromagnetic Interference (EMI)**. Common causes of this interference are fluorescent lighting fixtures, air handling motors and many kinds of electrical controls including starters, power distribution panels and <mark>Simplex alarm sensors</mark>.

***Photo 14**.*
Multiple problems.

1st J-Hooks are attached to ceiling grid.

2nd the cable bundle is practically laying on the fluorescent light.

★ Always follow proper procedure to assure the bend radius is not exceeded when branching off to other areas along a pathway. Always make a branch off immediately after the nearest j-hook.

Photo 15. Wrong:
Cables should never branch out away from a supporting J-hook. This places undue stress on the cable that might result in future cable failures.
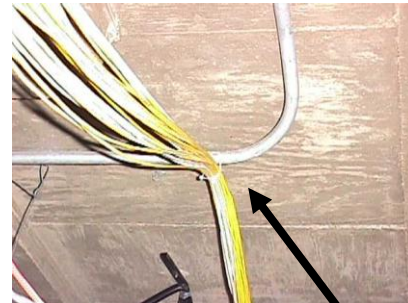
Photo 16. Wrong:
Cables should never be attached directly to electrical conduits or by only using a tie strap. Shoot a dedicated grid wire and attach a J-Hook.

★ Avoid running cable parallel to electrical conduits and never use conduits or piping as cable supports.
★ Every cable shall be properly supported by a series of dedicated grid wires with attached J-Hooks, creating an independent cable pathway system.

★ All cable pathways shall keep the cable bundle at least one foot (12 inches) above the ceiling grid system. **UTA Network Representative must approve exceptions**.
★ Wherever possible, cables shall be grouped together in pathways.
★ For each WAO, leave a minimum of fifteen (15) feet service loop, installed in a J-Hook attached to a dedicated grid wire, for each WAO. A **UTA Network Representative must approve exceptions**.
★ Never cinch plastic cable ties overly tight. If it deforms the outer cable jacket it is too tight. The ties should be trimmed flush of any excess length and be snug only. **The use of mechanical or powered cable tightening devices is strictly prohibited**. Avoid trimming cable ties at an angle and creating a sharp point.
★ Never attach cables directly to grid wire with tie straps. Always use a J-hook.
★ Cables should be properly supported and not sag between J-hooks. If the cable does sag it means that an additional dedicated grid wire and J-hook is required for proper support.

Photo 17. Wrong
1st - Never attach cables directly to grid wire. Also the cable has stress at the point due to the cable tie violating the minim bend radius.

2nd - Notice this is a ceiling grid wire. An independent grid wire will be installed with a J-Hook attached.

2. Work Area Outlet (WAO)

★ A standard WAO consists of 2ea Data wires and 1ea Voice wire of Cat 5e or Cat 6.
★ The standard WAO will be used for most office installations.
★ A minimum of 2ea Data wires will be ran to each WAO. The only exception will be for CCTV IP cameras and any individual case approved by a UTA Network Representative.

A. Ceiling WAO

★ Ceiling WAOs will be installed and terminated in the ceiling and used for data connectivity to wireless access points, projectors, and CCTV.
★ The WAO will be left in the ceiling with a 15' service loop hanging on a j-hook from a dedicated grid wire.
★ Labeling will be done in accordance to guidelines set forth in Chapter 2, and will follow the next WAO identifier in sequence, labeling will use a "C" as an identifier in the label, example: 204-1CA.
★ A P-touch label, with the WAO identifier, will be placed on the ceiling grid where the ceiling WAO is located.
★ Wireless access points – a maximum of 2ea Data wires will be installed and terminated with blue jacks.
★ Projector – a maximum of 2ea Data wires will be installed and terminated with blue jacks.
★ CCTV – a maximum of 1ea Data wire will be installed and terminated with a blue jack.
  ★ For external camera installations, the WAO will be located inside the building and Network Services will arrange for the building penetration and a temporary plug/weather seal for the penetration. The camera installer will be responsible to sleeve the penetration, weather seal the penetration, install whatever external conduit is required to support the camera and provide their own patch cables from the WAO to the camera.

B. Interior (Concealed or Flush Mounted) and Exterior (Outside Wall or Surface Mount) WAO

★ The Standard WAO cable count will be used for most interior and exterior wall installations.
★ Kiosks WAOs will consist of 2ea Data wires installed and terminated with blue jacks.
  ★ The cabling will either need to be run into the housing of the kiosk via some sort of tamper resistant method (cored through the floor, via EMT conduit, flex duct, etc.) or that the WAO be installed beneath the kiosk. This method can only be used if the kiosk is attached to the floor and completely blocks access to the WAO.

C. WAO Parts Specifications

Note: All *Installers* must be BICSI Commercial Installer Level 1 certified and properly trained to install jacks according to PANDUIT specifications. New installations are wired with Cat 5e or Cat 6 unless otherwise specified by UTA.

1) For Cat 5e installations, use these parts:
★ Standard Data Termination – use blue Cat 5e jack
★ Cross-Connect Termination – use orange Cat 5e jack
★ Telephone/voice Termination – use yellow Cat 5e jack
★ Faceplate – use 4 port faceplate on in-wall installations, 6 port or 10 port faceplate may be used where 4 ports is insufficient.
★ Surface Mount – use 4 port Surface Mount Box on surface installations, 6 port or 12 port surface mount may be used where 4 ports is insufficient.

Item	Manufacturer	Part #	Description
blue Cat 5e jack	Panduit	CJ5E88TGBU	blue Panduit Cat 5e jack
orange Cat 5e jack	Panduit	CJ5E88TGOR	orange Panduit Cat 5e jack
yellow Cat 5e jack	Panduit	CJ5E88TGYL	orange Panduit Cat 5e jack
4 port faceplate	Panduit	CFPE4IWY	4 port executive faceplate
6 port faceplate	Panduit	CFPE6IWY	6 port executive faceplate
10 port faceplate	Panduit	CFPE10IW-2GY	10 port executive faceplate
4 port surface mount	Panduit	CBX4IW-AY	4 port surface mount box
6 port surface mount	Panduit	CBXD6IW-AY	6 port surface mount box
12 port surface mount	Panduit	CBX12IW-AY	12 port surface mount box

Note: Cat 5e terminations will use either T568A or T568B wiring scheme which will be determined on a case by case basis.
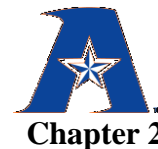
2) For Cat 6 installations, use these parts:
★ Standard Data Termination – use blue Cat 6 jack
★ Cross-Connect Termination – use orange Cat 6 jack
★ Telephone/Voice Termination – use yellow Cat 6 jack
★ Faceplate and Surface Mount parts as specified under the Cat 5e installations section above.

Item	Manufacturer	Part #	Description
blue Cat 6 jack	Panduit	CJ688TPBU	blue Panduit Cat 6 jack
orange Cat 6 jack	Panduit	CJ688TPOR	orange Panduit Cat 6 jack
yellow Cat 6 jack	Panduit	CJ688TPYL	yellow Panduit Cat 6 jack

Note: Cat 6 terminations will use only T568B wiring scheme.

D. Interior WAO and Parts

★ In areas, such as offices that get two data lines and a Voice, the faceplate shall be a (4) four port faceplate including a blank insert, unless specified by a UTA Network Representative.
★ In areas where a faceplate needs to be larger than 4 ports and up to 6 ports, a six port faceplate may be used.
★ When more than 6 ports are required at a location one of the following is acceptable:
  ★ Install a second faceplate with the adequate openings required for the number of drops.

Note-Remember this second faceplate will have a separate circuit ID number.

★ When either a double gang outlet box or a double gang bracket has been installed, a 10 port faceplate may be used.

Item	Manufacturer	Part #	Description
4 port faceplate	Panduit	CFPE4IWY	4 port executive faceplate
6 port faceplate	Panduit	CFPE6IWY	6 port executive faceplate
10 port faceplate	Panduit	CFPE10IW-2GY	10 port executive faceplate
double gang wall bracket	Erico Caddy	MPLS2	double gang wall bracket

E. Interior WAO (Concealed or Flush Mounted) Installation Guidelines

★ Terminate all jacks according to 568A and PANDUIT PAN-JACK guidelines.
★ Concealed (in-wall) WAOs 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 single gang bracket installed for the purpose of mounting the faceplate. The bracket shall be securely fastened to the opening by means of sheet rock screws and bracket anchor points at both top and bottom of the bracket to ensure a snug fit. ***Levels should be used to ensure that faceplates are mounted correctly***. Faceplates should be mounted at the same height from the floor as electrical outlets, unless otherwise specified.

Item	Manufacturer	Part #	Description
single gang wall bracket	Erico Caddy	MPLS	single gang wall bracket

★ Electronic stud finders will be used at all times and before holes are cut in the sheet rock. This will eliminate the hitting of wall studs or problems due to in-wall cross bracing. ***This will also prevent the Installer from cutting into possibly Asbestos containing wall joint compound***.

F. Exterior WAO and Parts

★ A PANDUIT four (4) port surface mount box
★ A PANDUIT six (6) port surface mount box
★ A PANDUIT twelve (12) port surface mount box
★ Use a PANDUIT one-piece deep surface mount box with a standard four (4) port faceplate

Item	Manufacturer	Part #	Description
4 port faceplate	Panduit	CFPE4IWY	4 port executive faceplate
deep surface mount box	Panduit	JB1IW-A	one piece deep surface mount box
4 port surface mount	Panduit	CBX4IW-AY	4 port surface mount box
6 port surface mount	Panduit	CBXD6IW-AY	6 port surface mount box
12 port surface mount	Panduit	CBX12IW-AY	12 port surface mount box

Photo 18: *Example of 4-port PANDUIT surface mount box (**P/N CBX4IW-AY**).*

NOTE: The UTAnet and Circuit ID labels have been made with a P-Touch label maker.

 Photo 19: *Example of one-piece single gang junction box (**P/N JB1IW-A**) mounted to a power pole to feed the top caps of modular furniture. Junction boxes are faced with PANDUIT Brand Executive style Mini-Com faceplate (**P/N CFPE6IWY**).*

G. Exterior WAO (Outside Wall or Surface Mount) Installation Guidelines

★ Exposed pathways down walls or columns shall be installed with PANDUIT Brand latch ducts of the appropriate size that will sufficiently accommodate the cables being routed.

★ 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 latch duct and should only be used in conjunction with ¼" anchoring devices installed at the top and bottom of the latch duct and in between the top and bottom with a minimum of (2) two feet intervals.

★ A Minimum of two (2) - ¼" anchors shall also be used at every device and/or junction box. Also use # 6 screws that are at least ¾" long.

★ Use a ceiling grid/drop ceiling fitting on all new exposed or surface mounted installations.

★ **Failure to comply with the above guidelines will be corrected at the Installer's expense.**

Item	Manufacturer	Part #	Description
LD3 latch duct	Panduit	LD3IW8-A	LD3 latch duct
LD5 latch duct	Panduit	LD5IW8-A	LD5 latch duct
LD10 latch duct	Panduit	LD10IW8-A	LD10 latch duct
LD3 drop ceiling fitting	Panduit	DCF3IW-X	LD3 drop ceiling fitting
LD5 drop ceiling fitting	Panduit	DCF5IW-X	LD5 drop ceiling fitting
LD10 drop ceiling fitting	Panduit	DCF10IW-X	LD10 drop ceiling fitting

Photo 20*: Example of exposed raceway application. Attached to the pillar.*

Photo 21*: Example of exposed raceway application. Mounted on a non-hollow wall above the level of the modular furniture.*

Photo 22:
An example of a Panduit LD-3
Drop Ceiling Fitting.

H. WAO Copper Terminations

1) RJ-45 Type

★ All Cat 5e jacks shall be terminated either ***TIA/EIA T568A or TIA/EIA T568B*** and be determined by UTA Network Representative on a case by case basis.

★ All Cat 6 jacks shall be terminated using only ***TIA/EIA T568B***.

		Pin	Wire Color
Pair 3	T3	1	White/Green
	R3	2	Green
	T2	3	White/Orange
	R1	4	Blue
Pair 2 / Pair 1	T1	5	White/Blue
	R2	6	Orange
Pair 4	T4	7	White/Brown
	R4	8	Brown
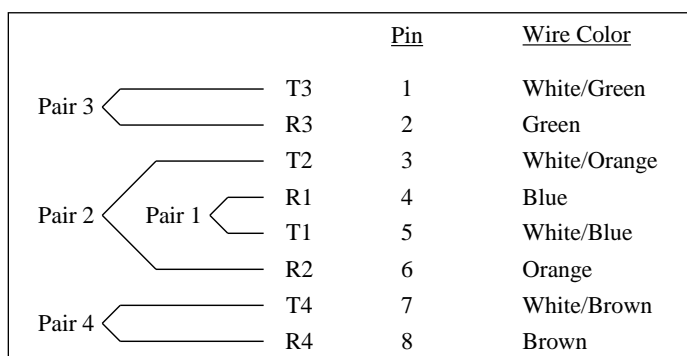
Figure 4 – Standard EIA/TIA T568A pin-out

		Pin	Wire Color
Pair 2	T2	1	White/Orange
	R2	2	Orange
	T3	3	White/Green
	R1	4	Blue
Pair 3 / Pair 1	T1	5	White/Blue
	R3	6	Green
Pair 4	T4	7	White/Brown
	R4	8	Brown
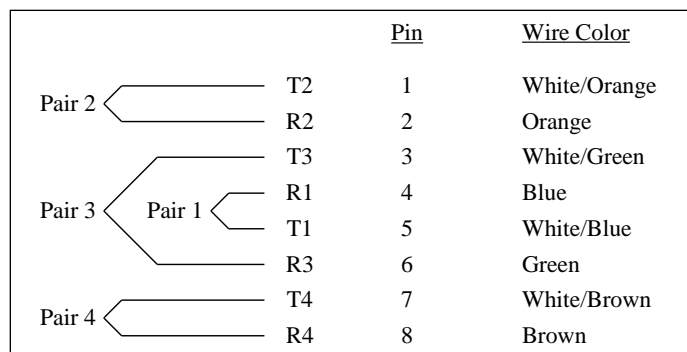
Figure 5 – Standard EIA/TIA T568B pin-out

2) **Jack Colors**
   ★ Standard Category 5e/6 data jacks shall be **blue** in color.
   ★ Voice/telephone Category 5e/6 jacks shall be **yellow** in color.
   ★ Backbone or cross-connect Category 5e/6 data jacks shall be **orange** in color (between MDF or IDF rooms).
   ★ Blank Inserts shall be **international white** in color.

I. WAO – Identifying and Labeling Scheme

To determine identifying WAOs and labeling scheme, stand at the rooms' main entrance. Label the proposed WAOs sequentially from the left and moving around the room in a clockwise direction.
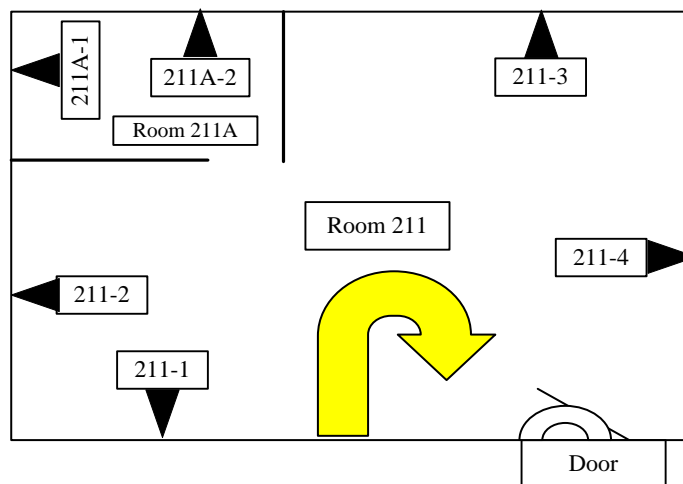
Diagram 4: *The proper way to assign Circuit ID Numbers in the room where cable drops are being installed.*

J. WAO Faceplate Labels

Labels follow practices set forth in *ANSI/TIA/EIA – 606A ADMINSTRATION*.

The Installer will generate labels for both the Office/Classroom and MDF/IDF rooms according to the following criteria:
★ The upper window is a downloadable custom designed Campus Network Services logo and will be provided by the UTA Network Representative.
★ The lower window is always an Arial bold 22 point font (ex. **102A-1**) and is used to identify the WAO. Template available for download.
★ For all mini-com jacks, the font for this label is an Arial 10 point (102A-1A, 102A-1B, 102A-1VA,). Use smaller fonts to fit longer circuit ID numbers. Template available for download.
★ Jack labels will be wrapped around the jacks properly.

The labeling scheme for terminated jacks is as follows. There are three parts to each jack label. Example: 102A-1A
★ The first part identifies the room number 102A
★ The second part identifies the WAO and/or sequence of WAOs in a particular room.
Example: 102A-**1**A, 102A-**1**B, 102A-**2**A, 102A-**2**B, 102A-**3**A
1A and 1B are in WAO 1, 2A and 2B are in WAO 2, 3A is in WAO 3, all are in room 102A
★ The third part identifies the jack and/or sequence of jacks in a particular WAO
Example: 102A-1**A**, 102A-1**B**, 102A-1**C**, 102A-1**D**
A, B, C, D represent 4 cables in WAO 1
★ The Voice jack has an additional identifier, "**V**" represents a voice jack, added to the front of the jack letter. There is usually only one Voice jack per drop.
Example: 102A-1A, 102A-1B, 102A-1**V**A
★ The Ceiling jack has an additional identifier, "**C**" represents a ceiling jack, added to the front of the jack letter. All jacks in the ceiling should have this identifier.
Example: 102A-1**C**A, 102A-1**C**B, 102A-1**C**C

Note: Installers will not cut or tear ends off and stick jack labels on while they are snapped in the panel or faceplate. These labels must be installed centered then wrapped around the jack. Failure to properly install these labels will be repaired by the Installer who will provide replacement labels.

★ Each end of the Cat 5e/6 cable will have a label placed approximately 3 to 6 inches from the network data jack with a PANDUIT Brand clear cable label using Arial 12 point font.
★ If an office or classroom requires more than a four (4) port faceplate, jacks shall be labeled from upper left to upper right, then lower left to lower right.

Item	Manufacturer	Part #	Description
jack label	Panduit	C138X019FJJ	label for mini-com jack
cable label	Panduit	S100X125YA	label for cable
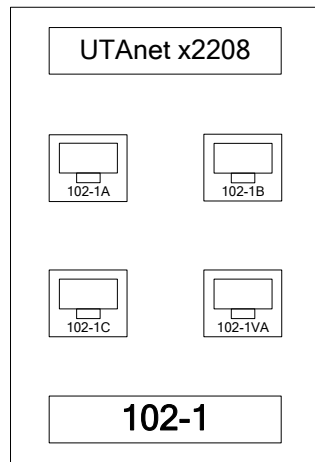
Diagram 5
Faceplate Configuration

Photo 23*:*
Picture of Proper Faceplate Configuration

K. Modular Furniture WAO Installation

★ Follow rules outlined in ***EIA/TIA 568B*** for consolidation points and multi-user WAOs for open office areas using modular furniture.

★ Modular furniture cable installations will be handled on a case by case basis.

★ There are many styles and configurations of modular furniture. Most modular furniture have a channel located at either the top or bottom of the modular furniture used to house data/voice and power cabling. High voltage power and low voltage cabling, such as data and voice, should be housed in separate channels.

★ Power poles are used to house power and data/voice cabling. The power pole has separate channels. One is used for power and the other for voice/data.
  ★ The power pole extends into the ceiling and cabling is routed into the power pole from the ceiling into the top of the power pole.

★ Modular furniture up against a wall or close to a wall, provide different methods of installation and connectivity.
  ★ Data/Voice can be terminated on the wall and jumpers can be installed and routed through the channels of the modular furniture. Newer furniture will have a knock out where the jumper can be routed from out of the furniture to the device being connected.
  ★ Data/Voice can be installed above the ceiling into and down the wall, into and through the modular furniture and terminated at the appropriate WAO location in the furniture.

★ Modular furniture, in an open area, provides different methods of installation and connectivity.
  ★ Floor boxes provide connectivity for data/voice and power. Power and data/voice should be kept separate. The data/voice can be terminated in the floor box. Jumpers can be installed in the floor box and routed through the furniture to the device needing connectivity.

★ Power poles provide connectivity for data/voice and power. Both are run in separate channels. If data/voice is terminated on the power pole, jumpers are routed through channels in the furniture to the device needing connectivity. Data/Voice can be routed through the power pole, through the furniture and terminated at the appropriate WAO location in the furniture.

Photo 24: *Example of single gang surface mount boxes with executive faceplates mounted on a power pole feeding top-caps.*

L. WAO Floor Drops

There are two different types of floor boxes used for floor drops at UTA, a round Hubble Poke Through system or a flip up square floor box. Both should be installed flush with the flooring being used. Both should have conduits attached coming from the floor below. The conduit should be installed in such a way as to be used as a pathway for the cabling and the conduit will stub out into a hallway.

★ Cabling, for floor drops that poke down into the floor below, needs to be routed along a pathway back to the IDF on the floor from which the drop originated.

★ When installing PANDUIT data or Voice jacks in a floor box that was originally intended for mounting a 110V duplex power outlet, a PANDUIT Brand 106 Duplex Module Frame will be used to secure the jacks. This frame will accommodate up to four (4) Mini-Com jacks. Standard color pattern will be used to denote Voice (**yellow**) and data (**blue**).

Item	Manufacturer	Part #	Description
106 module frame	Panduit	CF1064IWY	106 duplex module frame

Photo 25*: Mini-Com "106" Duplex Module Frame PANDUIT Brand **P/N CF1064IWY**.*
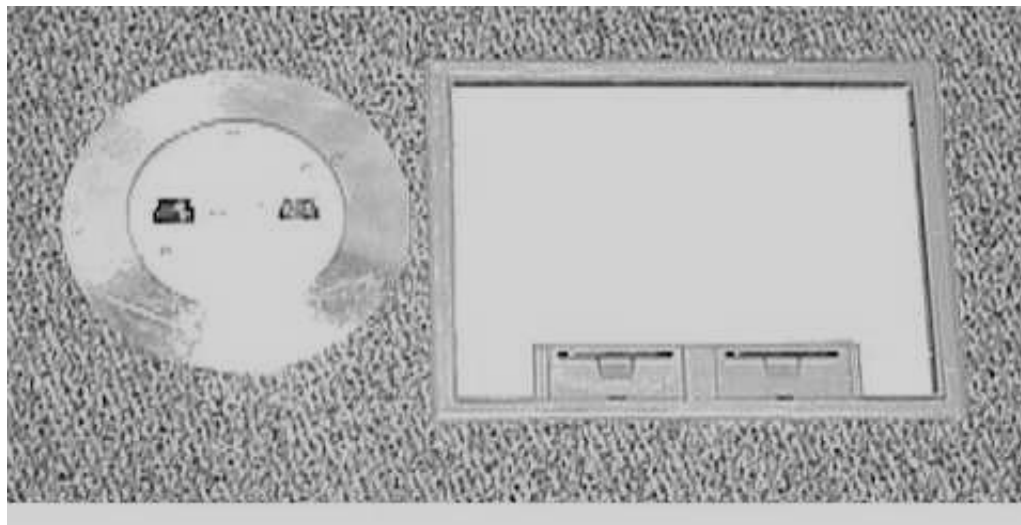
Photo 26*:*

Two different styles of floor boxes. The one on the left is a round Hubble Poke Through system. The one on the right is a flip up square floor box with conduits coming from the floor below. Inside the square box on the right a 106 adapter.

M. Modular Furniture WAO Connector Installation

★ **Keystone Termination (*Data*)** – blue Cat 5e network data jacks or Cat 6 shall be used to terminate into appropriate modular furniture using the custom made metal adapter fitting as needed.

★ **Keystone Termination (*Voice*)** – If Voice jacks are required, yellow Cat 5e or Cat 6 jacks shall be used to terminate into appropriate modular furniture using the custom made metal adapter fitting as needed.

Item	Manufacturer	Part #	Description
Keystone Cat 5e jack blue	Panduit	NK5E88MBUY	used to terminate into modular furniture
Keystone Cat 6jack blue	Panduit	NK688MBU	used to terminate into modular furniture
Keystone Cat 5e jack yellow	Panduit	NK5E88MYLY	used to terminate into modular furniture
Keystone Cat 6jack yellow	Panduit	NK688MYL	used to terminate into modular furniture

Photo 27: *KI PowerUp Module with Panduit Keystone jacks installed.*
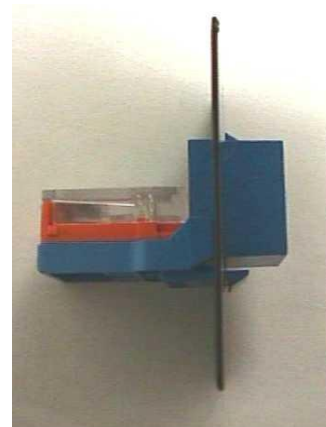
Photo 28: *Panduit Keystone Jack in Metal KI PowerUp adapter plate (side view).*

4. WAO Testing and Documentation

★ Testing cabling both-ways per ***TIA/EIA TSB # 67,*** Test Chapter Reference in 568A with documentation is mandatory. All testing will adhere to the ***TIA TSB 67*** for certifying installations or the installed medium's required CATEGORY certifications test requirements (i.e. 5e or Cat 6).

★ See your UTA Network Representative for tester set-up instructions.

★ Test results and documentation will be provided to UTA in both hard copy and electronic versions.

Chapter 3 - Fiber Optic Cable Guidelines and Specifications

> *Note*: The **ANSI/TIA 568-C (2009) Generic Telecommunications Cabling for Customer Premises** *wiring standards are the foundation of UTA's* **Fiber Optic Cabling** *Network installation requirements. The following are specific parts and techniques* *recommended in the TIA 568-C* *cabling standard.*

> *Caution*
> *Remember that fiber optic systems can employ the use of lasers. Never look directly into the end of a fiber system under power. Take all recommended safety precautions for the installation and testing of fiber optic systems, including the proper disposal of all fiber shards and related debris.*

References:

* ★ *ANSI/TIA 568-C (2009) Generic Telecommunications Cabling for Customer Premises*
* ★ *TIA-758-A (2004) Customer-Owned Outside Plant Telecommunications Infrastructure Standard*
* ★ *TIA 598-C (2005) Optical Fiber Cable Color Coding*
* ★ *TIA J-STD-607 (2002) Commercial Building Grounding (Earthing) and Bonding Requirements for Telecommunications*

Fiber Optic Industry Standards, Acronyms, Terms, and Definitions

Modal Bandwidth (MB) – The capacity of an optical fiber measured in MHz-km (megahertz over one kilometer). One MHz-km equals approximately .7 to .8 Mbps. Thus, a 100 MHz-km fiber can carry about 70 to 80 Mbps of data

Effective Modal Bandwidth (EMB) – also known as laser bandwidth, is determined by a combination of the modal structure of the lasers, the modal delay structure of the fiber, and the coupling between the laser and the fiber modes for OM3 and OM4 fibers, used in testing in Mhz in the 850 nm wavelength

Differential Mode Delay (DMD) – method used to determine EMB and involves scanning the fiber's core in small increments to see how the signal travels in various regions of the core, characterizes a single fiber's modal performance in high detail including both modal time delay and coupling as a function of radial position

Effective Modal Bandwidth Calculated (EMBc) – fiber performance characterized by a set of representative sources which are chosen to span across a range of over 10,000 standards-compliant VCSELs.

Optical Multimode (OM) – term used as designator for types of fiber OM1, OM2, OM3, OM4

Light-Emitting Diode (LED) – a transmitted electrical signal converted into a light signal and launched into a fiber, primarily used with 62.5 micron multimode fiber in the 850 and 1300 nm wavelength range for 1Gb transmission speeds and less

Laser Optimized Multi-mode Fiber (LOMMF) – fiber specifically designed, fabricated and tested for efficient and reliable use with VCSELs

Vertical-Cavity Surface-Emitting Laser (VCSEL) – laser emitted in a much smaller beam than a LED, primarily used with 50 micron multimode fiber in the 850 nm wavelength range for 1Gb and 10Gb transmission speed

Bend Optimized Multi-mode (BOMM) OM3/OM4 – capable of confining almost all the energy of the different modes even in the most challenging bending scenarios, specified for use in tighter bends than all other conventional multi-mode fiber types, loss is almost ten (10) times less than conventional multi-mode fiber

Attenuation –is defined as the optical power loss measured in decibels (dB) and is the primary field test parameter in optical fiber systems.
★ Cables, connectors, splices and patch cords all contribute to the system's overall attenuation
★ Additional loss may also be induced by tight bends or excessive forces placed on the cabling during transport and installation
★ Testing should be done after installation to ensure cable system attenuation specifications

End-to-End Attenuation Testing – is the measure of optical power loss between cable termination points. Acceptable loss values are dependent upon the system length, wavelength and number and type of connectors and splices. The end-to-end loss should always be less than the link-loss budget calculated in the system design.

Three distinct methods have been developed to accurately characterize system bandwidth for multimode systems using both transmitter types and for speeds up to 10Gb/sec.

Overfilled Launch (OFL) – intended to determine the information carrying capacity of systems using multimode with LED transmitters, LED transmitters fully flood the fiber core, accurate predictor of EMB for sub-gigabit, LED based systems, does not accurately characterize system performance when the fiber is used at Gigabit speeds with VCSELs

Restricted Mode Launch (RML) - intended to determine the information carrying capacity of systems using multimode with VCSEL transmitters, launch conditions in this RML method simulate a VCSEL rather than a LED, the scrambled light from the test transmitter is "restricted" using a 23.5mm core fiber to produce a narrow beam of light similar to what is produced by a VCSEL, does not accurately characterize system performance when the fiber is used in LED-based systems or VCSEL-based systems operating at 10Gb/sec

Differential Mode Delay (DMD) – intended to determine the information carrying capacity of systems using 850 nm laser optimized 50/125 micron multimode fiber used at 1 Gb/sec and 10 Gb/sec with VCSEL transmitters, scans radially across the fiber core measuring pulse delay differentials, accurate predictor for systems using 850 nm laser optimized 50/125 micron fiber in 10 Gb/sec VCSEL based systems, not used to characterize system performance for either the LED-based systems or VCSEL-based systems operating at 1 Gb/sec

Insertion Loss Method – is used to measure the attenuation of an installed cable system. This method uses an optical source and optical meter to compare the difference in two optical levels – first measuring how much light is put into the cable at the near end, and then measuring how much light exits the far end.

★ A 1-jumper reference provides the most accurate test for your system. It is used to test only through the system patch panels.

★ A 2-jumper reference is used when a system begins at a near end patch panel and ends with an attached jumper to the far end patch panel simulating attachment to equipment.

★ A 3-jumper reference is used when a system has jumpers attached to both the near end patch panel and far end patch panel simulating attachment to equipment on both ends.

Multi-Mode Fiber		Attenuation		Application Max Channel Length (meters)				Bandwidth (Mhz Km)		
Designation /Microns	TIA Standard	db/Km @ 850nm	db/Km @ 1300nm	1Gb/s Ethernet @ 850nm	10Gb/s Ethernet @ 850nm	1Gb/s Ethernet @ 1300nm	10Gb/s Ethernet @ 1300nm	OFL @ 850nm	OFL @ 1300nm	DMD @850nm
OM1 (62.5)	492-AAAA	3.0	1.0	275 meters	33 meters	550 meters	220/300 meters	200	500	220
OM2 (50)	492-AAAB	3.5	1.5	550 meters	82 meters	550 meters	220/300 meters	500	500	510
OM3 (50) laser optimized	492-AAAC	3.0	1.5	800 meters	300 meters	550 meters	220/300 meters	1500	500	2000
OM4 (50) laser optimized	492-AAAD	3.0	1.5	1100 meters	550 meters	550 meters	220/300 meters	3500	500	4700

Table 3 – OM1, OM2, OM3 and OM4 Multi-Mode Fiber Optic Cable Industry Specs

Single-Mode Fiber		Attenuation		Application Max Channel Length (meters)				Bandwidth (Mhz Km)		
Designation /Microns	TIA Standard	db/Km @ 1310nm	db/Km @ 1550nm	1Gb/s Ethernet @ 1310nm	10Gb/s Ethernet @ 1310nm	1Gb/s Ethernet @ 1550nm	10Gb/s Ethernet @ 1550nm	OFL @ 1310nm	OFL @ 1550nm	DMD @ 1310/1550 nm
9 micron	492-CAAB	.40	.30	5000 meters	10000 meters	does not apply	40000 meters	does not apply	does not apply	does not apply

Table 4 – Single-Mode Fiber Optic Cable Industry Specs

Loose tube cable are designed primarily for outside plant environments and campus backbone applications.
★ they isolate the fibers from mechanical stresses
★ provide stable and highly reliable optical transmission characteristics over a wide temperature range
★ fibers are placed in individual waterblocked buffer tubes to isolate them from external forces
★ the buffer tubes are stranded around a fiberglass central strength member
★ in some designs, dielectric strength members are applied over the cable core to provide additional tensile strength
★ gel free waterblocking materials protect the buffer tubes and gapped spaces of the cable against water

Tight buffered cables are designed for use in building and data center backbones, horizontal applications and patch cords and equipment cables.
★ They have the ability to meet building fire code requirements as well as physical flexibility, smaller bend radius and easier handling characteristics
★ more sensitive to temperature extremes and mechanical disturbances
★ do not have water blocking material

Outside plant cables are jacketed with a medium-density polyethylene (MDPE) outer sheath which provides excellent flexibility and a low friction for easy installation. The MDPE sheath contains carbon black to provide superior UV resistance.

Indoor cables are jacketed with specialty compounds in compliance to the NEC flame-retardant and smoke generation requirements.

Overview of NEC Requirements
Article 770 of the National Electric Code (NEC) identifies three different intrabuilding regions with regard to optical fiber placement. Listed most to least stringent are plenum, riser, and general purpose areas.
★ Plenum area is a compartment or chamber that forms part of the air distribution system and to which one or more air ducts are connected. Any space with a primary function of air handling is also considered a plenum space. These cables must be listed Optical Fiber Non-Conductive Plenum (OFNP) or Optical Fiber Conductive Plenum (OFCP).
★ Riser area is an opening or shaft through which cables may pass vertically from floor to floor in a building. These cables must be listed Optical Fiber Non-Conductive Riser (OFNR) or Optical Fiber Conductive Riser (OFCR)
★ General purpose is all other indoor areas that are not plenum or riser. These cables must be listed Optical Fiber Non-Conductive (OFN) or Optical Fiber Conductive (OFC).

The NEC does allow for a cable with a more stringent listing to be used in an application requiring a lesser listing, but a lesser listing cannot be used in a more stringent listing. For example, a type OFNP cable can be used in a riser application, but a OFNR cable cannot be used in a plenum environment.

A conductive cable contains some type of conductive element (metallic component). These cables are listed as OFCP, OFCR and OFC.

The NEC requires metallic components to be grounded as closely as possible to the point of building entry. This requirement is generally for outside plant cables coming into a building.

The NEC allows the use of unlisted cable (outside plant cable) for inside plant applications with some restrictions. Unlisted cables must enter a building from the outside and be terminated within fifty feet (50') from the point of building entry. If the cable termination point is more than fifty feet (50') from the building entrance, cables must be installed in conduit in accordance with the NEC.

Cable Description	Designation	Substitutions
Non-Conductive Plenum	OFNP	
Conductive Plenum	OFCP	
Non-Conductive Riser	OFNR	OFCP/OFNP
Conductive Riser	OFCR	OFCP/OFNP
Non-Conductive Optical Fiber General Purpose	OFNG	OFCP/OFNP OFCR/OFNR
Non-Conductive Optical Fiber	OFN	OFCP/OFNP OFCR/OFNR
Conductive Optical Fiber	OFC	OFCP/OFNP OFCR/OFNR

Table 5 – NEC Industry Standard for Intrabuilding Regions for Fiber Optic Cable

1. UTA Fiber Optic Cable General Specifications

★ The standard fiber optic cable for UTA is **Corning**. A UTA Network Representative must approve substitutes.
★ All new fiber optic cable installations will have a minimum 25-50' slack loop on each end.
★ Central tube construction is not used at UTA
★ The installation of an outside plant (OSP) cable will have each buffer tube of separate color, following the standard order for fiber colors as set forth in *TIA 598-C (2005) Optical Fiber Cable Color Coding*. The first set of buffer tubes will contain the Single Mode fibers and the last set of buffer tubes will contain the Multi-Mode fibers.
★ OM1 Multi-Mode fiber shall be 62.5/125 micron, 3.0/1.0 dB/km @ 850/1300 nm.
★ OM2 Multi-Mode fiber shall be 50/125 micron, 3.5/1.5 dB/km @ 850/1300 nm.
★ OM3 laser optimized Multi-Mode fiber shall be 50/125 micron, 3.0/1.5 dB/km @ 850/1300 nm
★ OM4 laser optimized Multi-Mode fiber shall be 50/125 micron, 3.0/1.5 dB/km @ 850/1300 nm
★ Single-Mode Indoor/Outdoor fiber shall be 9.0 x 125 micron, 0.5/.05 dB/km @1310/1550 nm

Note: 1000Base-SX Multi-Mode Giganet (Gigabit) circuits have a loss budget that will not exceed 7.5 dB and a maximum length of 220 meters.

A. Fiber Optic Outside Plant Cable Specifications

★ The only UTA acceptable manufacturer of fiber optic cable is **Corning**.
★ The OSP cable will be of a loose tube type with each tube having an outside diameter of 3.0 mm.
★ Each buffer tube will be filled with water blocking gel or dryblock.
★ The cable will be flooded with a water blocking gel or use a water-swelling compound system.
★ The cable will have a polyethylene outer jacket.
★ OM1 Multi-mode FO cable will be 62.5/125 µm graded index and at least FDDI grade fiber.
★ OM2 Multi-Mode FO cable shall be 50 x 125 µm.
★ OM3 laser optimized and OM4 laser optimized Multi-Mode FO cable shall be 50 x 125 µm.
★ Single-mode FO cable will be 9.0/125 µm.
★ *All outside plant (OSP) fiber cable will contain interlocking armor.*
★ The cable will come with at least one rip cord, preferably two rip cords.
★ The cable will have an operating range of –40 to 70 degrees Celsius.

As of 1 October 2011, the only outdoor plant cable acceptable for installation at UTA is the FREEDM Loose Tube Gel-Free Interlocking Armored Cable. This cable is flame-retardant, indoor/outdoor, riser-rated designed for inter-building and intrabuilding backbones in arial, duct and riser applications. This cable is encased in a spirally wrapped, aluminum interlocking armor for ruggedness and superior crush resistance. The riser rating precludes the need for a transition splice when entering the building. This cable is available in 50 micron multimode, 62.5 micron multimode, 9 micron singlemode, and hybrid versions with fiber counts up to 288 fibers. This cable is listed as OFCR and OFC.

	LANscape 62.5	LANscape Pretium 150	LANscape Pretium 300	LANscape Pretium 550	LANscape Pretium 600	Single-Mode
Fiber Code	K	C	S	S	S	E
Performance Option Code	30	31	80	90	91	01
Fiber Type in Microns	62.5	50	50	50	50	9
Nomenclature	OM1	OM2	OM3	OM3	OM3	OS2
Wavelength	850/1300	850/1300	850/1300	850/1300	850/1300	1300/1383/1550
Max Attenuation (dB/Km)	3.4/1	3.0/1	3.0/1	3.0/1	3.0/1	.4/.4/.3
OFL Bandwidth MHz/Km	200/500	700/500	1500/500	1500/500	1500/500	n/a
EMB Bandwidth MHz/Km	220/n/a	950/n/a	2000/n/a	4700/n/a	5350/n/a	n/a
1 Gig Ethernet Distance (m)	300/550	750/600	1000/600	1000/600	1000/600	5000/na/na
10 Gig Ethernet Distance (m)	33/n/a	150/n/a	300/n/a	550/n/a	600/n/a	10000/na/40000

Table 6 - *FREEDM Loose Tube Gel-Free Interlocking Armored Cable Specifications*

Note: The newer water swelling tape or powder cables can be used if they can properly demonstrate at least the same amount of water protection provided by traditional gel filled OSP cables

B. Fiber Optic Indoor Cable Specifications

★ The standard for UTA is Corning. A UTA Network Representative must approve substitutes.
★ Fiber cable will be MIC interlocking armored PLENUM rated unless otherwise specified by a UTA Network Representative.
★ No inner-duct required if using MIC interlocking armored plenum cables.
★ Must come with at least one ripcord.
★ Each separate fiber will be 900μm tight-buffered 250μm fiber.
★ OM1 Multi-mode FO cable will be 62.5/125 μm graded index and at least FDDI grade fiber.
★ OM2 Multi-Mode FO cable shall be 50 x 125 μm.
★ OM3 laser optimized and OM4 laser optimized Multi-Mode FO cable shall be 50 x 125 μm.
★ Single-mode FO cable will 9.09.0/125 μm.
★ Below is the UTA Fiber Optic Standard reference for Indoor Fiber Optic jacket color:

Fiber Type			Outer Jacket Color
62.5 micron	OM1	Multi-mode	Orange
50 micron	OM2	Multi-mode	Aqua
50 micron	OM3	Multi-mode	Aqua
50 micron	OM4	Multi-mode	Aqua
9 micron	OS2	Single-mode	Yellow

Table 7 – UTA Standard for Indoor Fiber Optic Jacket Color

★ Below is the UTA Fiber Optic Standard reference for Fiber Optic jumper jacket and connector color:

Fiber Type			Transmission Speed	Jacket Color	Connector Color
62.5 micron	OM1	Multi-mode	1Gb	Orange	Tan
50 micron	OM2	Multi-mode	1Gb	Aqua	Black or Tan
50 micron	OM3	Multi-mode	10Gb	Aqua	Aqua
50 micron	OM4	Multi-mode	10Gb	Aqua	Aqua
9 micron	n/a	Single-mode	1Gb	Yellow	Blue
9 micron	n/a	Single-mode	10Gb	Blue	Blue

Table 8 – UTA Standard for Fiber Optic Jumper Jacket and Connector Color

C. Standard Fiber Optic Cable Strand Counts

★ Five (5) basic fiber strand count cables are used at UTA. They are:
  ★ CORNING **six (6)** fiber Multi-Mode plenum rated
  ★ CORNING **Twelve (12)** Single-Mode/**twelve (12)** Multi-Mode Plenum Rated Fiber
  ★ CORNING **Twelve (12)** Single-Mode/**eighteen (18)** Multi-Mode OSP Rated Fiber
  ★ CORNING **Twelve (12)** Single-Mode/**twenty-four (24)** Multi-Mode OSP Rated Fiber
  ★ CORNING **twenty-four (24)** Single-Mode/**twenty-four (24)** Multi-Mode OSP Rated Fiber

2. Fiber Optic Cable Wall Mount Enclosures

A. Wall Mount Enclosure Specifications

★ The standard for UTA Wall Mount Fiber Enclosure is **Corning**.
★ The minimum size wall enclosure for FO cable install will be a 6 bulkhead enclosure unless otherwise specified by UTA Network Representative.
★ All new fiber optic cable installations will have a minimum 25-50' slack loop on each end.
★ Wall Mount Fiber Enclosures used at UTA are listed below:

Item	Manufacturer	Part #	Description
6 bulkhead enclosure	Corning	WCH-06P	6 bulkhead enclosure
12 bulkhead enclosure	Corning	WCH-12P	12 bulkhead enclosure

Photo 29*: Wall Mount Enclosure and Fiber Slack Enclosure.*

★ Wall mount enclosures will be populated with the appropriate Corning brand bulkheads listed below.

Type	50 micron OM3/4 Multi-Mode	62.5 micron OM1 Multi-Mode	9 micron OS2 Single- Mode
SC	CCH-CP06-E7	CCH-CP06-91	CCH-CP06-59
SC	CCH-CP12-E7	CCH-CP12-91	CCH-CP12-59
LC	CCH-CP06-E4	CCH-CP06-A8	CCH-CP06-A9
LC	CCH-CP12-E4	CCH-CP12-A8	CCH-CP12-A9
LC	CCH-CP24-E4	CCH-CP24-A8	CCH-CP24-A9

Table 9 *– Corning Brand Bulkheads*

B. Surface Mount Box Specifications

★ The standard for UTA surface mount fiber enclosure is **Panduit**.
★ A six (6) port or twelve (12) port surface mount box can be utilized when the indoor fiber optic cable has twelve (12) strands or less and the existing rack mount enclosure or wall mount enclosure will not accommodate a new FO cable installation.
★ When using a surface mount enclosure, a Mini-Com Duplex FO Adapter Module must be used to house the connectors.

★ Surface mount box enclosures and adapters used at UTA are listed below:

Item	Manufacturer	Part #	Description
6 port surface mount box	Panduit	CBXF6IW-AY	6 port surface mount box
12 port surface mount box	Panduit	CBXF12IW-AY	12 port surface mount box
single-mode SC duplex mini-com adapter module	Panduit	CMDBUSCZBU	mini-com SC blue duplex adapter used to house 2ea single-mode fiber optic connectors, installed in a Panduit surface mount box
multi-mode SC duplex mini-com adapter module	Panduit	CMDEISCEI	mini-com SC electric ivory duplex adapter used to house 2ea multi-mode fiber optic connectors, installed in a Panduit surface mount box
single-mode SC single mini-com adapter module	Panduit	CMSTZBU	mini-com SC blue single adapter used to house 1ea single-mode fiber optic connectors, installed in a Panduit surface mount box
multi-mode SC single mini-com adapter module	Panduit	CMSTEI	mini-com SC electric ivory single adapter used to house 1ea multi-mode fiber optic connectors, installed in a Panduit surface mount box

C. Wall Mount Enclosure Installation Guidelines

★ A wall mount enclosure will be used on fiber optic cable installations when a rack mount enclosure cannot be installed.

★ Location and installation of the wall mount enclosure must be approved by a UTA Network Representative.

★ All new fiber optic cable installations will have a minimum 25-50' slack loop on each end, unless otherwise specified by UTA Network Representative.

★ All wall mount enclosures and slack loops will be mounted on ¾" fire rated plywood.

★ Location and construction of slack loop for new fiber optic cable installations must be determined and approved by UTA Network Representative.

   ★ Approved hardware to be used in methods of construction for slack loop include Velcro, j-hooks, d-rings, etc.

D. Surface Mount Box Installation Guidelines

★ The Wall Mount Enclosure Installation Guidelines used in paragraph 2. C. above will also apply to the installation of the surface mount box.

★ A six (6) port or twelve (12) port surface mount box can be utilized when the indoor fiber optic cable has twelve (12) strands or less and the existing rack mount enclosure or wall mount enclosure will not accommodate a new FO cable installation. This will be determined by a UTA Network Representative.

★ Location and installation of the surface mount box must be approved by a UTA Network Representative.

3. Fiber Optic Cable Rack Mount Enclosures

A. Rack Mount Enclosure Specifications

★ The standard for UTA Rack Mount Fiber Enclosure is **Corning**.
★ The minimum size rack enclosure for FO cable install will be a 3RU enclosure unless otherwise specified by UTA Network Representative.
★ Rack Mount Fiber Enclosures used at UTA are listed below:

Item	Manufacturer	Part #	Description
6 bulkhead enclosure	Corning	CCH-03U	6 bulkhead enclosure
12 bulkhead enclosure	Corning	CCH-04U	12 bulkhead enclosure

★ Rack mount enclosures will be populated with the appropriate Corning bulkheads. Refer above to *Corning Brand Bulkheads* listed on page 3-8.

B. Rack Mount Enclosure Installation Guidelines

★ Fiber Distribution Centers shall be installed rack mounted where possible; otherwise a wall mount enclosure will be installed.
★ For each cable in an enclosure with vertical bulkheads, the Single Mode bulkheads are installed first from left to right followed by the Multi-Mode bulkheads. In situations where there are multiple cables, the next set of Single Mode bulkheads go in after the preceding cables Multi-Mode bulkheads.
★ Properly secure the fiberglass center member to the designed anchor points inside the enclosures according to the products design.
★ All new fiber optic cable installations will have a minimum 25-50' slack loop on each end, unless otherwise specified by UTA Network Representative.
★ All slack loops will be mounted on ¾" fire rated plywood.
★ Location and construction of slack loop for new fiber optic cable installations must be approved by UTA Network Representative.
    ★ Approved hardware to be used in methods of construction for slack loop include Velcro, j-hooks, d-rings, etc.

4. Fiber Optic Cable Connectors

★ Fiber Optic Cable Connectors used at UTA are listed below:

Item	Type	Manufacturer	Part #	Description
SC Connector	MM 50 micron	Corning	95-051-41-SP-X	SC multimode connector
LC Connector	MM 50 micron	Corning	95-051-98-SP-X	LC multimode connector
SC Connector	MM 62.5 micron	Corning	95-101-41-SP	SC multimode connector
LC Connector	MM 62.5 micron	Corning	95-101-98-SP	LC multimode connector
SC Connector	SM 9 micron	Corning	95-201-41-SP	SC singlemode connector
LC Connector	SM 9 micron	Corning	95-201-98-SP	LC singlemode connector

Note: These connectors will be polished according to the guidelines outlined by CORNING for polishing. The end will have a mirror finish and the raw pedestal tip will be completely polished away.

A. Fiber Optic Cable Termination

★ Fiber shall be terminated by or under close supervision of a certified Fiber Optic Installer. The preferred certification is the *CORNING S-07 or S-07+*. Proof will be required upon request.

★ Fiber shall be terminated with SC style connectors unless otherwise specified.

★ All loose buffer tube gel filled cables will have CORNING Brand fan-out kits installed (*No Substitutions*).

★ Fiber Optic Cable Fan Out Kits used at UTA are listed below:

Item	Manufacturer	Part #	Description
6 fiber fan out kit 25"	Corning	FAN-BT25-06	6 tube fiber fan out kit 25"
12 fiber fan out kit 25"	Corning	FAN-BT25-12	12 tube fiber fan out kit 25"
12 fiber fan out kit 47"	Corning	FAN-BT47-12	12 tube fiber fan out kit 47"
grounding kit	Corning	FDC-CABLE-GRND	armored cable grounding kit

Caution: A fan out kit will always be used when installing fiber connectors, never install fiber connectors directly onto the loose tube fiber. Failure to comply will be corrected at the Installer's expense.

★ All armored Outside Plant fiber optic cables will have grounding kits installed at both ends and be properly grounded in the telecommunication rooms per the *TIA J-STD-607 Commercial Building Grounding (Earthing) and Bonding Requirements for Telecommunications* procedures. Also these cables will be grounded per the guidelines set forth in *Article 250 Grounding and Article 770-33 Fiber Optic Building Entrance Point Grounding* located in the 1999 edition of the *National Electric Code (NEC)*. Also refer to *page 4-1, Chapter 4 - Grounding* of this document for further information.

5. Fiber Optic Cable – Identifying and Labeling

★ Labeling on cabinets shall be accomplished by a P-touch (Brother labeler) or similar machine.

★ Use black on white tape.

★ Label will identify the strand count associated with bulkhead and location of end point.

★ **Example shown below in Diagram 8: *12sm(A,B) – 12mm (C) to University Hall***

★ **Vertical** bulkheads are identified, labeled, and installed from *left to right* in alphabetical order. A,B,C, etc. See example below in Diagram 6.

  ★ The color coded strands are identified and installed into the bulkhead *left to right* in numeric order. 1,2,3, etc. See example below in Diagram 6.

★ **Horizontal** bulkheads are identified, labeled, and installed from *bottom to top* in alphabetical order. A,B,C, etc. See example below in Diagram 7.

  ★ The color coded strands are identified and installed into the bulkhead *bottom to top* in numeric order. 1,2,3, etc. See example below in Diagram 7.

★ A plastic self laminating 2" x 3.5" tag PANDUIT label with the legend "*CAUTION FIBER OPTIC CABLE*" will also be placed approximately 2 feet from each end of the fiber cable, outside of the fiber termination box. The proper fiber information (end location to end location and fiber strand count) will be written on the tag with a permanent marker.

Item	Manufacturer	Part #	Description
fiber cable label	Panduit	PST-FO	2"x3.5" fiber cable label

★ Surface Mount Boxes have 1 row of six connectors for a 6 port and 2 rows of six connectors for a 12 port. On the 12 port, the primary colors will be located on the back row and secondary colors on the front row.

Panel A	Panel B	Panel C		Panel D		Panel E	Panel F
A1	B1	C1	C2	D1	D2		
A2	B2	C3	C4	D3	D4		
A3	B3	C5	C6	D5	D6		
A4	B4	C7	C8	D7	D8		
A5	B5	C9	C10	D9	D10		
A6	B6	C11	C12	D11	D12		
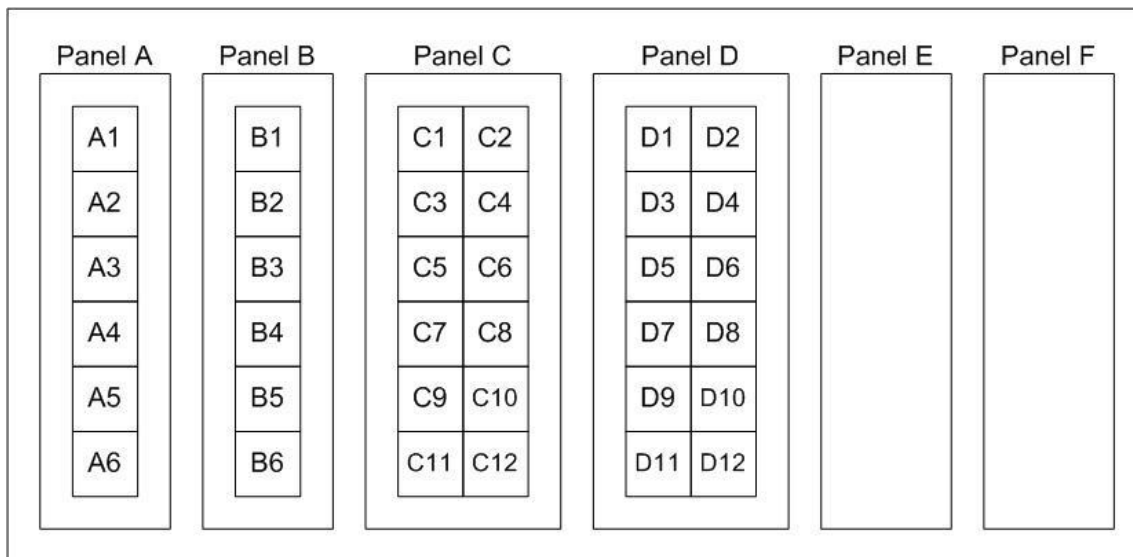
Diagram 6 – Vertical bulkhead layout

Panel C

C2	C4	C6	C8	C10	C12
C1	C3	C5	C7	C9	C11

Panel F

F2	F4	F6	F8	F10	F12
F1	F3	F5	F7	F9	F11

Panel B

B1	B2	B3	B4	B5	B6

Panel E

Panel A

A1	A2	A3	A4	A5	A6

Panel D
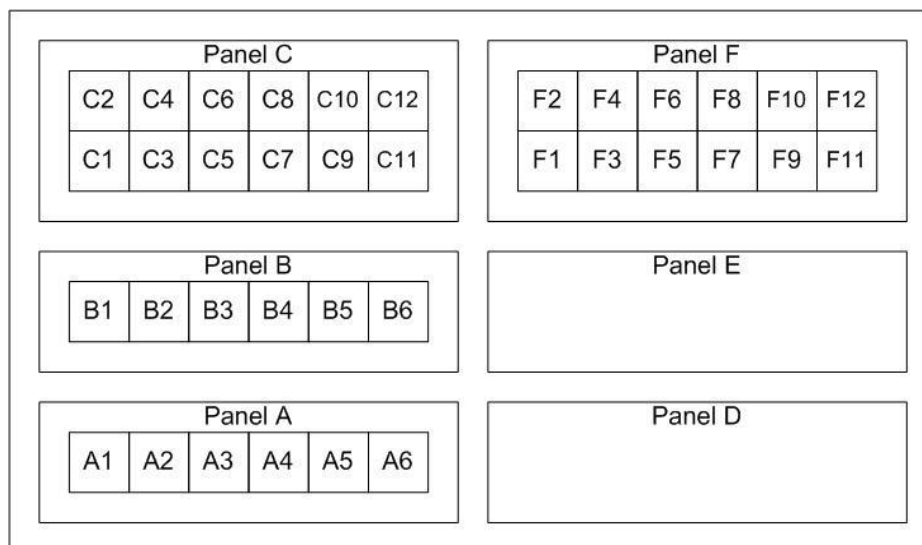
Diagram 7 – Horizontal bulkhead layout
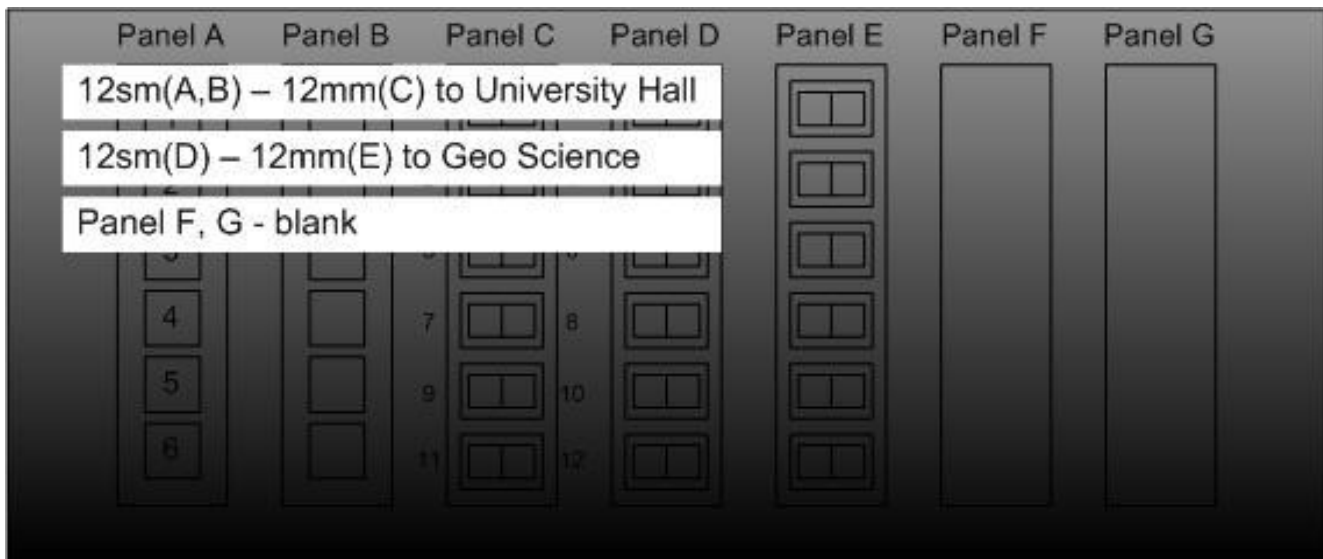
Diagram 8: Labeling in front of enclosure identifying the strand count associated with bulkhead and location of end point.

6. Fiber Optic Cable – Testing and Documentation

★ UTA uses the Overfilled Launch (OFL) test method with a light source and optical meter tester to test all FO cable systems. Other test methods such as Differential Mode Delay (DMD) used for 50 micron may be required at the UTA Network Representative's discretion.

★ Every fiber shall be tested and documented.

★ Every fiber shall be tested with a light source and optical meter tester; OTDR testing may be required at the UTA Network Representative's discretion. Testing with either a light source and optical meter or an OTDR shall be done in both directions.

★ Locations of any mechanical or fusion splice should be noted in the OTDR information.

★ Light meter tests for Multi-mode will be Dual wavelength (850nm, 1300nm).

★ Light meter tests for Single mode will be Dual wavelength (1310nm, 1550nm).

★ All tests should be received by UTA in both a hard copy and electronic version of the file.

★ All information should be delivered to the UTA Campus Network Services department in an accurate and timely manner.

★ A general rule of thumb for acceptable attenuation losses for connector pairs are -0.5dB for a multimode termination, -0.3dB for a single mode termination and -0.1dB for each splice. However, please see below, paragraph *6.A. Fiber System Loss Budget Calculation* as to the preferred method of calculating an acceptable dB loss for a circuit.

A. Fiber Optic Cable - System Loss Budget Calculation

★ Acceptable Multi-Mode Fiber Cable Attenuations:
Wave Length 850nm   3.0dB/km
Wave Length 1300nm   1.00dB/km
Wave Length 1310nm   0.50dB/km
Wave Length 1550nm   0.50dB/km
★ Acceptable Connector Attenuation: 0.75dB/connector link
★ Acceptable Splice Attenuation: 0.10dB/splice

★ Formula for calculation:
  ★ (Cable Footage * Fiber Attenuation / 3281 ft) + (# of connector pairs * 0.75db) +
    (# of splices * 0.10db)
  ★ Cable Footage is the actual length of the fiber run in feet.
  ★ **Fiber Attenuation / 3281 ft** is the Acceptable Fiber Attenuation reference for the
    wavelength being tested divided by 3281 to convert the measurement from kilometers to feet.
  ★ # of connector pairs indicate the number of patch panel connection points. This will be 2
    unless the strand of fiber contains multiple hops.
  ★ # of splices indicate the number of splices of any type, if any, in the fiber path

★ Example Calculation:
  ★ The job calls for a fiber optic run of 3000 ft.
  ★ We wish to test it at the 850nm wavelength.
  ★ This is a single hop test, so there are only 2 connection points, one at either end of the run.
  ★ There are no splices in the fiber run.
  ★ The acceptable db loss for this test would be 4.70db.
  ★ The calculation would be:
  = (3000ft * 3.5db / 3281ft) + (2 [connector pair at either end] * 0.75db) + (0 [no splices] * 0.10db)
  = (3.20db) + (1.50db) + (0db)
  = 4.70db
★ Result
  ★ If the fiber optic cable installation in this instance is over 4.70db loss when testing at 850nm
    wavelength, the cable installation does not meet UTA minimum standards. Whatever is
    required to bring the test results up to UTA minimum standards is at the Installer's expense.

7. Fiber Optic Cable - Splicing Procedures

Only qualified technicians using the proper tools and products rated for the job will perform fiber
optic cable splicing at UTA. All splices will be properly tested and documented, noting the point of
the splice in all documentation. Technicians will supply all the equipment required to professionally
and properly complete the splicing work.
★ All splices are handled on a case by case basis.
★ Splicing can also be used for installing pre-connectorized pigtails onto a Fiber Optic Cable.
★ The specific Corning splice enclosure will be determined by UTA on a case by case basis.

★ On a composite cable, containing both multi-mode and single mode fiber, the Installer will provide the proper test equipment to completely test both types of fiber.
★ This test equipment will be on-site ready for use as soon as the splice has been completed.
★ When finished with the splicing work the technician will test the impacted fiber according to the listed documentation and test requirements listed in paragraph 10.B. for standard fiber testing at UTA.
★ Test results will be provided to the UTA Campus Network Services department in both a hard copy and electronic version.

Caution
Remember that fiber optic systems can employ the use of lasers. Never look directly into the end of a fiber system under power. Take all recommended safety precautions for the installation and testing of fiber optic systems, including the proper disposal of all fiber shards and related debris.

A. Fiber Optic Cable - Inside Plant Splice Enclosures

★ The specific Corning splice enclosure will be determined by UTA on a case by case basis.
★ Spliced fiber will be properly secured in splice trays to ensure reliable operation.

B. Fiber Optic Cable - Outside Plant Splice Enclosures

★ Outside Plant fiber splice enclosures will be watertight and properly installed to ensure that the product remains watertight.
★ Spliced fiber will be properly secured in splice trays to ensure reliable operation.
★ The remaining slack fiber cable from OSP pull vaults will be properly coiled and replaced into vault.
★ Any grounding system disconnected or cut during the course of splicing will be repaired and reconnected. This includes where the metal foil of an armored cable has been cut apart to perform the required splice. It must be restored with its original grounded state. If a cable was not properly grounded to start with, the Installer should bring this immediately to the UTA Network Representative or said Installer *WILL* be held responsible for its repair.

C. Fiber Optic Cable - Testing and Required Documentation for Splices

The requirements for testing and documenting the fiber splices are the same as those found on *page 3-13, Chapter 3, paragraph 6 - Fiber Optic Cable – Testing and Documentation*.

8. Fiber Optic Cable - Outside Plant

All Outside Plant Work will follow the guidelines set forth in ***TIA-758-A (2004) Customer-Owned Outside Plant Telecommunications Infrastructure Standard***.

A. Fiber Optic Cable - Outside Plant Pathways

★ All outside plant fiber optic cables shall be installed in inner-duct rated for outside burial.

★ All outside plant inner-duct is to be orange, schedule 40 or better and a minimum size of 2" diameter.
★ A minimum of two spare inner-ducts shall be placed with the inner-duct being used, for future use.
★ All spare conduits and inner-ducts will have mule-tape or a pull string provided for future use.
★ At points were the inner-duct needs to be spliced, proper fittings will be used, either a threaded screw on watertight splice or heat fusion type splice. See **Diagram 9** below.

Item	Manufacturer	Part #	Description
coupling unit for interduct	Cabletec	PE1.660	2 piece coupling unit used for 1.25" interduct
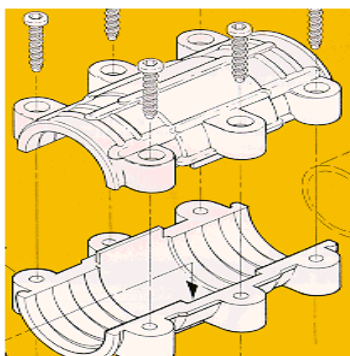
Diagram 9: Cabletec"s 2 piece coupling unit (P/N PE1.660) used for 1.25" inner-duct

★ All unused conduits in outdoor pull boxes will be properly plugged with removable watertight plugs.
★ UTA has an extensive underground tunnel network. In these locations PVC inner-duct 1.25" trade size of orange coloring shall be used. This inner-duct shall be supported at a minimum of 4 feet intervals.
★ All OSP work will be properly documented and the Auto-CADD information including cable depths and accurate routing will be provided to UTA in both electronic and hard copy version.

B. Fiber Optic Cable - Outside Plant Outdoor Pull Points

★ Cable service loops are required at each hand-hold opening and shall be installed within proper distances: 100' loop per opening between hand holes.
★ Pull points shall be strategically designed and placed to permit the installation of fiber cables within the manufacturer specifications. Pull points will be no further than 400 ft. apart.
★ Pull points shall be designed to use a Newbasis Greenline or Quazite hand-hole no smaller than 30" X 48" X 20" deep with a wire screen bottom. They shall be load rated to 20,000 lb. with bolt down two-piece lids. They shall have a 6" minimum of medium wash rock base. See **Diagram 10** below.
★ Where a pathway enters a building above ground there may be placed a 24" X 24" X 12" minimum weather-tight junction box to accommodate the transition and provide pulling access.

★ During the pulling of OSP fiber optic cable, the Installer will use proper figure-8 technique to stage the slack fiber cable between pull points. This shall be done to insure the cable does not get damaged during installation.
★ Installers will use breakaway swivels rated at no greater than 600 lbs.
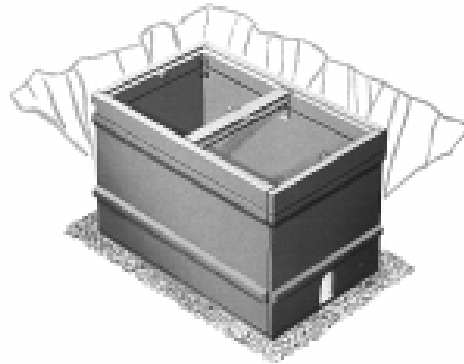
***Diagram 10**: Illustration of a Quazite fiber slack enclosure. It is also used as an outdoor pull point.*

C. Fiber Optic Cable - Outside Plant Conduits and Inner-ducts

★ At no place along the pathway should the fiber cable be exposed.
★ When outside rated Schedule 40 inner-duct transitions to the thinner wall indoor style inner-duct an outdoor rated, watertight coupler will be used to connect the two types together.
★ All conduits shall be reamed and bushed.
★ All conduits shall be installed according to the NEC and any local authority having jurisdiction.
★ All spare conduits and inner-ducts will have mule-tape or a pull string provided for future use.

9. Fiber Optic Cable - Building Entrance Point and Indoor Fiber Pathways

★ A service loop of 50' will be left at every building entrance.
★ At no time shall an Outside Plant rated cable run inside a building further than 50 feet unless it is encased in rigid metal conduit. Otherwise there must be a transition from outside plant cable to a Plenum rated fiber optic cable which will then be run through a Plenum Rated inner-duct. This transition can be accomplished by a fusion splice, a mechanical splice or by a Fiber Wall Mount Enclosure at UTA's discretion.

A. **Fiber Optic Cable - Indoor Fiber Pathways**

1) **General**
    ★ Pathway, from end to end, will consist of a dedicated grid wire system with j-hooks installed at intervals no greater than 4'. Wire ties will be used to secure the fiber cable to the j-hooks.
    ★ A pull string will be provided for future use.
    ★ Pathway, into the MDF/IDF and to the fiber enclosure along with service loop location, will be determined by a UTA Network Representative. In the MDF/IDF, velcro will be used to secure the fiber cable.

2) **Armored indoor fiber**
    ★ All future installations will require the installation of MIC interlocking armored plenum rated cable. Any substitutions must be approved by a UTA Network Representative.
    ★ The MIC interlocking armored plenum does not require the installation of inner-duct.

3) **Non-armored indoor fiber**
    ★ Specifications for when interlocking armored plenum fiber cable is not used.
    ★ All pathways will consist of inner-duct, conduit or a combination of both.
    ★ If broken or split, this inner-duct shall be spliced with the proper fittings.
    ★ Inner-duct and fiber cable ran through Plenum airways will be Plenum rated.
    ★ Where it enters a junction box or slack box the inner-duct will be connected to the wall mount box with the proper fitting to securely fasten the inner-duct to the enclosure.
    ★ Cables and inner-duct shall be rated according to TIA/EIA and NEC codes for the environment in which they are installed.
    ★ Support for inner-duct shall be no greater than 4' intervals.
    ★ All spare inner-duct will have a pull string provided for future use.

B. **Fiber Optic Cable - Indoor Pull-points**

★ Pull points shall be installed or used at intervals not to exceed the manufacturer's specifications for the cable being placed.
★ No service loops shall be left at indoor pull points.
★ Service loops shall be installed only where a cable leaves a building or is terminated. Those loops shall be between 25 and 50 feet in length.

Chapter 4 - Grounding

All telecommunication rooms will adhere to the grounding and bonding guidelines set forth in ***TIA J-STD-607 (2002) Commercial Building Grounding (Earthing) and Bonding Requirements for Telecommunications*** plus any applicable codes in Articles (*250 – Grounding)* and *(800 – Communications Systems)* of the NEC 1999.

★ For an explanation of what constitutes a proper ground point for the telecommunications bus bar to which the equipment will be grounded, see ***NEC-1999 Article 800-40***. ***TIA J-STD-607 (2002) Commercial Building Grounding (Earthing) and Bonding Requirements for Telecommunications*** as well as any additional codes in Articles *(250 – Grounding)* and *(800 - Communications Systems)* of the NEC 1999.

★ The location of the building ground will determine in which MDF/IDF the Telecommunications Main Grounding Busbar (TMGB), which is used to interconnect the telecommunications bonding infrastructure to the service equipment (power) ground of the building, will be located. The TMGB will be connected using at least a #6 solid or stranded copper wire with a green insulated jacket.

★ All MDF/IDF rooms will have a Telecommunications Grounding Busbar (TGB) installed.

★ The TGB of each MDF/IDF will be connected to the TMGB using at least a #6 solid or stranded copper wire with a green insulated jacket.

★ All system components (i.e. ladder-style cable raceway, equipment racks, etc.) will be bonded together and will eventually connect to the TGB in the MDF/IDF with at least a #6 solid or stranded copper wire with a green insulation jacket.

★ The surface must be prepared to provide a proper path to ground. Any surface that is to be grounded must be free of paint or other coating that might prevent an effective grounding. Paint should be scraped or filed away until a metallic surface has been exposed. Then the proper grounding component can be attached to complete the system.

> *Caution:*
> *Under no circumstances shall fire sprinkler piping be used as a ground point.*

★ These installation procedures must meet the above specified requirements set forth in ***TIA J-STD-607 (2002) Commercial Building Grounding (Earthing) and Bonding Requirements for Telecommunications*** as well as any additional codes in ***Articles (250 – Grounding) and (800 – Communications Systems)*** of the NEC 1999.

A. Grounding Procedures in MDF/IDF Rooms
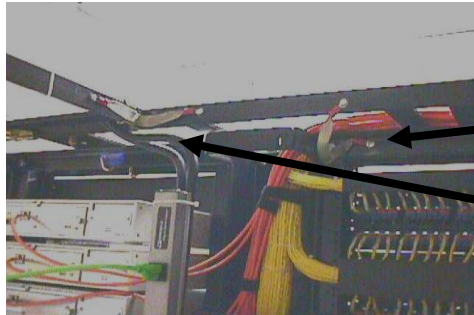
Photo 30:
An example of properly installed ground straps connecting sections of ladder-way and equipment racks together.

★ All metallic racks, ladder ways and Network/Telecommunications Equipment will be properly grounded and bonded per *TIA/EIA 607* and NEC 1999 guidelines and procedures.
★ This Equipment will eventually be tied back to the MDF/IDF rooms Grounding Bus Bar that ties back to the Building's Grounding System.
  ★ The MDF/IDF room's Grounding Bus Bar shall be equipped with a grounding conductor that is attached to an approved electrode per NEC 1999 standards by a #6 copper wire with a green colored insulator.
  ★ The wire jacket will be rated for the environment that it has been installed in, i.e., if the wire runs back to a ground electrode in a path through a plenum return airway then the cable should be plenum rated.
★ These procedures are mandatory to the completion of required work in all new Network/Telecommunications installations.
★ In existing MDF/IDF rooms that are not up to the required grounding guidelines, the UTA Network Representative will decide if the work will be completed by the Installer or brought into compliance by UTA Network Group Staff. ***Installers should bring this question of responsibility up at the time of the project walk-thru***.

Photo 31: *Example of a large grounding bus bar in a MDF room.*
Note the two connections. One goes back to the Building grounding system and the other wire to the grounded ladder-racks.

Chapter 5 – Safety

1. General Safety Practices

★ The Installer shall conform to all applicable Federal, State and Local Regulations and/or standards pertaining to worker safety; including OSHA standards.

★ All Installers will use proper safety in performing their installation tasks, i.e., wearing safety glasses around eye hazards, ladder safety, wearing dust masks under dusty conditions, etc. Installer injuries should be reported to their supervisors immediately.

★ Installers will wear approved safety harnesses when working at dangerous heights in accordance with the fall protection guidelines defined by the OSHA standards.

★ Before coring any holes, the **Environmental Health and Safety office (817-272-2185)** must be contacted, by a UTA Network Representative, to disable smoke detector sensors in the area where the core hole will be drilled.

★ After coring is complete, the **Environmental Health and Safety office (817-272-2185)** must be contacted, by a UTA Network Representative, to enable smoke detector sensors in the area where the core hole(s) were drilled.

★ *All fire or accidents will be reported to the UTA Police Department immediately at (817) 272-3003.*

★ To prevent accidents and fire hazards; *all construction debris will be cleaned up nightly*.

★ The Installer will dispose of all large empty spools of fiber and/or inner-duct in a timely manner (within a week after the job has been completed). *Spools blocking hallways or doors are a fire hazard and are not permitted. They must be removed immediately*.

2. Asbestos Clearance

★ All cabling projects must have an **ASB-1** form submitted and approved by the *UTA Asbestos Coordinator*. This form will explain any possible asbestos risks along the cable path.

★ **All Installers and employees installing network cabling and/or terminating network cabling at UTA *MUST* complete a mandatory Asbestos Awareness training course *BEFORE* beginning work at UTA.** This course is provided by UTA (conducted by a *UTA (appropriate A Team title here)* representative) at no charge to the Installer. The Installer is responsible for providing proof of each employee's completion of this training. *Failure to follow this policy will result in the dismissal of the guilty Installer*.

3. Fire-stopping

★ All penetrations into fire-walls or core holes between floors must be properly fire-stopped in accordance with the guidelines in *BICSI TDM 95 Chapter 20. Fig. 11,* and must also conform to any related NEC requirements for Fire-stopping.

★ Penetrations in fire rated walls shall be sleeved with the appropriate sized 1", 2" or 4" "*Unique Fire Stop Products*" penetrator used by UTA. Exceptions at UTA's discretion on a case by case basis.

★ Proper Fire-stopping should be performed on any hole and/or penetration of a firewall or solid wall. This may include the Installer installing Mineral Wool in the space between the sheet rock wall and then installing a sheet rock patch on both sides before installing the Fire-Stopping Material.
★ All core holes between floors will be sleeved.
★ All core holes between floors must be fire stopped.
★ When using Fire-stopping Putty in a conduit or sleeves between floors, a section of Fire-resistant Mineral Wool must be inserted to create the proper base for the putty. *Making a form out of cardboard is not acceptable*. Fire-stopping pillows are also acceptable to seal an opening that may need to be reentered at a later time.

Photo 32: *Properly Fire-stopped using SpecSeal™ Intumescent Pillows*

Item	Manufacturer	Part #	Description
1" penetrator	Unique Fire Stop Products	SP-1	1" penetrator sleeve
2" penetrator	Unique Fire Stop Products	SP-2	2" penetrator sleeve
4" penetrator	Unique Fire Stop Products	SP-4	4" penetrator sleeve

4. Environmental Health and Safety - Attachment 1.

Attachment 1: Campus Safety Guidelines

The University Of Texas At Arlington
Environmental Health & Safety

University Construction Site
Procedures For Contractors

Definitions

Pollutant, pollution, hazardous waste, hazardous substance, hazardous material, or contaminant, means any toxic or harmful substance as defined by CERCLA, SARA, and/or any similar federal, state, or local law, rule, or regulation.

Common Problems For Contractors

Equipment Cleaning
Equipment should be cleaned in a manner that does not create any discharge of cleaning agents, paints, oil, or other pollutants to a storm sewer or waterway. Soaps and detergents should never be discharged to the ground or off-site. When rinsing painting equipment outside, contain rinse water in a bucket or other container. Water based or latex paint rinse water may be discharged to the sanitary sewer. Oil-based paint wastes, including solvents & thinners, should not be disposed of in the sanitary sewer. They must be collected and disposed of through the Contractor's disposal company. Cement handling equipment should be rinsed in a contained area so there is no drainage off-site.

Asbestos Containing Materials
Before beginning work in any UTA campus buildings, the Contractor shall verify that no asbestos containing or suspect asbestos containing materials will be damaged or disturbed during any portion of the work to be performed. This can be verified through UTA Environmental Health & Safety (EH&S) Office. If the Contractor incidentally damages or disturbs asbestos containing or suspect asbestos containing materials during any portion of the work, the Contractor shall immediately stop work in that area, restrict access to the area, and contact EH&S. All personnel working on the campus that may come into contact with suspect asbestos-containing materials must attend a 2-hour asbestos awareness class that will be provided by UTA's Environmental Health & Safety Office. The training will be held on the UTA campus at a location yet to be determined. This awareness training will not meet the OSHA asbestos training requirements for workers removing asbestos containing materials or the training requirements for an asbestos competent person.

Waste Disposal

Any trash or debris must be cleaned daily, contained on-site and disposed of in a recycling bin or waste receptacle to prevent wind or rain form carrying it off-site into a storm drain or waterway. Petroleum wastes, such as waste oil and used oil filters, should be containerized for recycling or disposed by the Contractor. Non-hazardous solid wastes, such as general construction debris can be recycled or disposed of in the trash container. **Never dispose of liquid wastes of any kind in dumpsters**.

Storm Water Management

The University of Texas at Arlington (UTA) has implemented a Storm Water Management Plan covering that portion of the municipal separate storm water system within the corporate boundary of the city of Arlington operated by UTA. Prior to beginning construction, Contractors are required to submit a Storm Water Pollution Prevention Plan for review by the EH&S Office and the Storm Water Management (SWM) Team.

Erosion/Sediment Control

Proper erosion and sedimentation controls must be in place to prevent sediment or silt run-off. The Storm Water Quality Best Management Practices (BMPs) for Construction Activities Manual produced by the North Central Texas Council of Governments (NCTCOG) provides appropriate design criteria for permanent and temporary structural controls. Sediment (including cement) should never be rinsed off the site; instead, it should be cleaned up in a manner that does not allow it to reach a storm drain or waterway. Equipment tires may be rinsed before leaving the site to avoid tracking sediment into the roadway or off the site.

Construction Sites of five (5) or more acres

The Contractor will be required to obtain a National Pollutant Discharge Elimination System (NPDES) Permit issued by the Environmental Protection Agency (EPA). Operators of such sites are to implement best management practices (BMPs) to the maximum extent practicable to minimize the quantity of storm water pollutants leaving the site. Details for implementing BMPs on site should be described in the Contractors Storm Water Pollution Prevention Plan. Site operators and managers should stress and enforce such practices upon their work force, subcontractors and material suppliers in order to avoid the generation of pollutants by wind and storm water runoff.

Retain the following documents at the construction site from the date of project initiation to final stabilization.

1. SWPPP – Storm Water Pollution Prevention Plan
2. Reissued NPDES General Permit
3. Plan Certification Statement
4. NOI's
5. EPA DPDES Storm Water Program Notice
6. Inspection Reports
7. Materials List
8. Record of Construction Activities

Construction Sites of 12,000 feet to five (5) acres, and all Commercial Sites
Before starting any activity that will disturb an area between 12,000 square feet and five (5) acres of land, the contractor is required to submit a Storm Water Pollution Prevention Plan to the EH&S Office and SWM Team for review. For commercial sites, a Storm Water Pollution Prevention Plan is required regardless of the area disturbed.

Site De-watering, Tank and Pipe Testing
Discharge from de-watering, hydrostatic tank testing or pipe pressure testing must be free from sediment, chemicals, and any other pollutants. Some discharges, such as those from underground storage tank pits, will require prior approval from the City of Arlington.

Petroleum
Spills of hydraulic fluid, oil and other petroleum products should always be immediately cleaned up to prevent discharge of these fluids with storm water run-off. Petroleum contaminated soil should be cleaned up and disposed of properly. Storage containers should be kept closed, clean, and free of oily residue. Construct a liquid-tight bermed area for temporary fuel tanks used during construction.

Separators or Traps
Before removing oil/water separators or traps connected to the sanitary sewer, the materials in them must have been tested (Toxicity Characteristic Leachate Procedure, or TCLP) within the last two years before they are cleaned out. Be aware that this test may take three weeks to complete if a recent test has not been completed, so plan accordingly. Documentation of the test results must be submitted to the EH&S Office for review and approval before emptying or removing the trap.

Spill Prevention, Clean-Up and Disposal

Plan Ahead
It is cheaper to prevent spills than to clean them up. Be prepared to contain or dike spills to prevent spreading. Small areas are easier to clean than large ones. Keep sorbent materials such as clay (kitty litter), polypropylene booms and pads, rags and sawdust on hand for clean-up of spilled liquids.

Clean-up
Sorbent materials can be used to effectively clean up various materials spilled on pavement, water, and soil. Soil or other media which has been contaminated with petroleum or other pollutants should be excavated or remediated to prevent contaminated discharges to a storm drain or waterway. Excavated contaminated materials should be stored in containers or on plastic and covered so that the contamination is not flushed back onto the ground during a rainstorm.

Contaminated Material Disposal

Proper disposal of waste materials depends partly on the type of contaminant. Hazardous wastes (such as flammable petroleum products and solvents, thinners) and materials contaminated with hazardous wastes, are considered regulated wastes, and should be containerized for transport and disposal by a permitted company. Disposal also depends on the amount of contaminant. For information on testing of contaminated soil and disposal options contact EH&S, 817-272-2185.

Spill and Complaint Response Program

The University's Environmental Health & Safety Office has a program to enforce water quality regulations and assist you in compliance with those regulations. The EH&S staff respond 24 hours a day, 7 days a week to hazardous materials spills and spills which threaten surface water quality, within the University of Texas at Arlington. Investigations are conducted to determine compliance with environmental laws & regulations and ensure corrective actions are taken when necessary. Strictly prohibited are discharges of any material or substance which will or might cause pollution to surface waters. Staff have specialized training in hazardous materials response and spill clean-up regulations. For more information on spill clean-up requirements and other regulations call 817-272-2185.

General Safety

It is UTA's intention to provide a safe work environment for all individuals at this work site. For this reason, all contractors performing services on the campus must comply with and enforce all applicable local, state, federal (OSHA regulations), and our campus safety policies. This includes having implemented any required employee training and written programs.

Before providing any services under this contract, the contractor is requested to furnish a copy of all applicable required written programs and documentation of training for each employee under their control at the work site.

The following OSHA regulations may apply to the services being performed and require proper employee training, documentation of employee proficiency, and a written program by the contractor:
★ LOCKOUT/TAGOUT, 29 CFR 1910.147, Subpart J
★ HAZARD COMMUNICATION, 29 CFR 1910.1200 Subpart Z
★ RESPIRATOR PROTECTION, 29 CFR 1910.134, Subpart I
★ CONFINED SPACE (PERMIT REQUIRED), 29 CFR 1910.146, Subpart J
★ BLOODBORNE PATHOGEN, 29 CFR 1910.1030, Subpart Z

The following OSHA regulations may apply to the services being performed and require only employee training and documentation of employee proficiency by the contractor:
★ FALL PROTECTION, 29 CFR 1926.503 Subpart M
★ PERSONAL PROTECTIVE EQUIPMENT, 29 CFR 1910.132 Subpart I
★ WELDING, CUTTING, BRAZING, 29 CFR 1910.254, Subpart Q
★ ELECTRICAL SAFE WORK PRACTICES, 29 CFR 1910.332, Subpart S
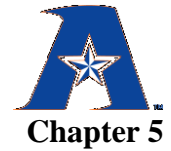
Contractors must:
- ★ Conduct daily safety inspections of all assigned area
- ★ Identify and correct hazards
- ★ Provide contractor employees with required personal protective equipment
- ★ Establish and maintain an effective Housekeeping Program

Contractor Requirements and Responsibilities

The contractor shall maintain a legible copy of a current Material Safety Data Sheet (MSDS) for each hazardous chemical brought to the construction site. MSDS(s) shall be readily available, on request, for review by University representatives.

Contractors are responsible for cleaning up and properly disposing of all spilled pollutants that you brought to the site, including oil, paint, fuels, antifreeze, solvents, etc. You should keep accurate records (such as receipts, copies of analytical results, etc.) indicating proper disposal of spilled materials. Furthermore, you are responsible for ensuring that all discharges from the site are in compliance with all applicable regulations.

In general no substance should be dumped or leaked onto the ground or allowed to run-off of a construction site that might cause pollution. Be aware that you are responsible for pollutant contaminated run-off and proper disposal of all your waste materials generated as a result of your activities.

Notification Requirements and Procedures

We should be notified immediately in the event of:
- ★ Any spill that threatens to enter a storm sewer or watercourse.
- ★ All petroleum spills, e.g. hydraulic fluid, transmission fluid, diesel, gasoline, etc.
- ★ Contact with asbestos containing or suspect asbestos containing materials.
- ★ Any hazardous or unknown material spill, e.g. many solvents, cleaners, etc.
- ★ Any discharge from your site which you suspect may be a violation of City Code or state regulations, e.g. discharges which are cloudy, foul-smelling, colored, contain chemicals or heavy sediments loads.

Environmental Health & Safety – (817) 272-2185

Call this number to contact a representative for information during office hours (8:00 a.m. to 5:00 p.m.).

(After hours call UTA Police Dispatch, 817-272-3381, who will contact an EH&S representative).

Revised: August, 2000

End Of Safety Office Attachment

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Chapter 6 – Additional Information

1. Campus Notification of Core Holes to be Drilled

★ All core holes and permanent modifications to Buildings and other structures must be first reported to the UTA Network Representative. This notification must be given in writing before the work is to be done.

★ Before coring any holes, the **Environmental Health and Safety office (817-272-2185)** must be contacted, by a UTA Network Representative, to disable smoke detector sensors in the area where the core hole will be drilled.

★ After coring is complete, the **Environmental Health and Safety office (817-272-2185)** must be contacted, by a UTA Network Representative, to enable smoke detector sensors in the area where the core hole(s) were drilled.

2. After Hours or Holiday Work

Any work to be performed by the Installer outside normal University business hours (**8:00am-5:00pm Monday - Friday**) and/or work to be done during University Holidays requires written approval be granted and access to the area must be scheduled by the University Police department. Normally this can be taken care of by the UTA Project Coordinator or UTA Network Representative.

3. Work in Hazardous or High Liability Areas

Certain areas on campus may pose a hazard to the Installer due to the nature of the department's research. Possible hazards include but are not limited to poisonous animals, high-powered lasers and reactive chemicals. For the safety of the Installer and to limit possible damage to expensive property and equipment, a departmental escort is required to be with the Installer at all times.

Certain areas on campus also use very expensive research equipment. In these areas, the department is required to provide an escort for the Contractor to ensure nothing is damaged during the required cabling work in that area.

★ Work with a departmental representative to cover any equipment that can be damaged when drilling or cutting work is performed near the equipment.

★ DO NOT touch or lean against computer or sensitive equipment. If the equipment is in the way of the installation, make arrangements with a departmental representative to have it relocated to a safe place until the work has been completed.

★ Cover machines whenever moving the ceiling tiles above them.

★ Clean up any debris and dust caused by the work performed.

★ Report any damage to furniture or equipment immediately to your foreman, the UTA Project Coordinator or the UTA Network Representative.

4. Glossary of Terms

Basic Link - This test is only for the horizontal wiring, without the patch cords. This is when the circuit is being tested by the LanMeter to certify that it meets Cat 5e/6 specifications.

Channel - The Channel includes the user's patch cord & the TC patch cords that connect the circuit to the network electronics. One should see network traffic on this circuit if it is properly working.

MM - The abbreviation for multi-mode fiber, OM1 62.5 micron or OM2, OM3, and OM4 50.0 micron in size operating at 850nm or 1310 nm wavelengths. Multi-mode fiber systems generally use LED's to transmit data; even so proper safety precautions should be taken to prevent permanent eye damage.

NEC - The abbreviation for National Electric Code, an international standards-making organization that is part of the National Fire Protection Association. They create code practices that must be adhere to on any electrical installation including have authority of low voltage

OSP - The abbreviation for Out-Side Plant, refers to any cable or work performed between Campus buildings or off of Campus property. The construction of these products must withstand the elements and is usually unsuitable for indoor use.

OTDR - The abbreviation for Optical Time Domain Reflectometer. This device is used to show breaks and loss problems in a fiber optic cable.

SM - The abbreviation for single mode fiber 8.3 μm in size 1330nm or 1550 nm wavelengths. *Since it uses lasers to transmit data, take proper safety precautions to avoid permanent eye damage.*

MDF – Main Distribution Facility, the primary point at which the main network distribution cabling, usually fiber, enters a building and is terminated, network cables are also terminated to patch panels and connected to network electronics, also referred to as Telecommunications Closet, Hub Room, or Network Distribution Room.

IDF – Intermediate Distribution Facility, the secondary point at which network distribution cabling, usually fiber is installed from the MDF to the IDF, network cables are also terminated to patch panels and connected to network electronics.

WAO - The abbreviation for Work Area Outlet. This is the faceplate location at the user site.

5. Relevant Campus Phone Numbers

Campus Network Telecommunications Services

David Caldwell (Director - Network Telecommunications Services)...........................(817) 272-3622

Patrick Jordan (Assistant Director - Network Telecommunications Services) ....(817) 272-9292

Brad Samek (IT Manager) ....(817) 272-3633

Scott Brasher (PBX Switch Room Operations) ....(817) 272-2064

Office Of Enviromental Health & Safety

Leah Hoy (Director)..(817) 272-2185

Melissa Jones (Fire Marshall) ....(817) 272-2185

Physical Plant

Jeff Johnson (Associate Director)..(817) 272-3571

Bryan Sims (Associate Director) ....(817) 272-7000

Emergency Number ....(817) 272-2000

Campus Police

Police (Emergency)...(817) 272-3003

Police (Non-Emergency) ....(817) 272-3381

Police Dispatch (Building Access) ....(817) 272-3381

Campus Information Center

Information ....(817) 272-2222

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Appendix A – UTA Standards Parts List

Part Number	Description
Belden	
1701A	DataTwist 350 Cat 5e data cable, Plenum, 1000' spool (yellow)
1700A	DataTwist 350 Cat 5e data cable, PVC, 1000' spool (blue)
7882A	DataTwist Cat 6 data cable, Plenum, 1000' spool (yellow)
7881A	DataTwist Cat 6 data cable, PVC, 1000' spool (blue)
7852A	DataTwist Enhanced Cat 6 data cable, Plenum, 1000' spool (yellow)
7851A	DataTwist Enhanced Cat 6 data cable, PVC, 1000' spool (blue)
7997A	DataTwist, Cat 5e Outdoor, 1000' spool (black)
1874A	MediaTwist, Cat 6 data cable, Plenum, 1000' spool (blue)
Chatworth	
10250-712	Universal Cable Runway, 10' length, 12" width (black)
10595-712	Channel Rack-To-Runway Mounting Plate, 3" (black)
10608-001	Runway Wall Brackets (pair)
10642-001	Protective End Caps, Cable Runway (pair)
10723-712	Cable Runway Radius Bend, 90 degree Outside Bend, 12" (black)
10724-712	Cable Runway Radius Bend, 90 degree Inside Bend, 12" (black)
10822-712	Cable Runway E-Bends, 12" (black)
11301-001	Cable Runway Junction, Butt-Splice Kit
11302-001	Cable Runway Junction, Junction-Splice Kit
11348-519	Universal Swing Gate Rack (clear)
11374-703	Single-Sided Wide Vertical Cabling Section (black)
11421-712	Wall Angle Support Kit, Cable Runway, 12" (black)
11583-519	Flush Mounted Wall Bracket (clear), 4RU
11685-219	Wall-Mount Cabinet (computer white)
11755-003	Wall-Mount Cabinet Accessories, Fan/Filter Kit
12100-712	Cable Runway Radius Drop, cross member 12" (black), installs on cross members of ladder rack
12101-701	Cable Runway Radius Drop, Stringer, 10-1/4" (black), installs on side of ladderrack
12847-702	Offset Rack-Mount Bracket, 9.1" (black), to install power strip
12847-703	Offset Rack-Mount Bracket, 11.7" (black), to install power strip
12851-706	Vertical Power Strip, 66.25" overall height, 20Amp, Surge Protect, Standard Plug, 20 outlet (20), Nema 5-20P inlet plug, Nema 5-20R outlets
40604-001	Rack and Frame Installation Kit, Concrete Floor Kit, 3/8" thread
40604-003	Rack and Frame Installation Kit, Concrete Floor Kit, 1/2" thread
55053-703	Standard Rack, 7' x 19" (black)
Commscope	
5NF4RLBLK	Gel-Filled Cat 5e data cable, PVC, 1000' spool (black)
Corning	
Corning - Connectors	
95-051-52-SP-X	Fiber Optic Connector, ST, Multi-Mode, (OM3/4 50 micron) Ceramic Ferrule and Metal Hardware, metal housing, aqua boot
95-051-41-SP-X	Fiber Optic Connector, SC, Multi-Mode, (OM3/4 50 micron) Ceramic Ferrule and Composite Hardware, black housing, aqua boot
95-051-98-SP-X	Fiber Optic Connector, LC, Multi-Mode, (OM3/4 50 micron) Ceramic Ferrule and Composite Hardware, black housing, aqua boot
95-101-52-SP	Fiber Optic Connector, ST, Multi-Mode, (OM1 62.5 micron) Ceramic Ferrule and Metal Hardware, metal housing, beige boot
95-101-41-SP	Fiber Optic Connector, SC, Multi-Mode, (OM1 62.5 micron) Ceramic Ferrule and Composite Hardware, beige housing, beige boot

Part Number	Description
95-101-98-SP	Fiber Optic Connector, **LC, Multi-Mode, (OM1 62.5 micron)** Ceramic Ferrule, ceramic hardware, beige housing, beige boot
95-201-52-SP	Fiber Optic Connector, **ST, Single-Mode, (OS2 9 micron)** Ceramic Ferrule and Metal Hardware, metal housing, white boot
95-201-41-SP	Fiber Optic Connector, **SC, Single-Mode, (OS2 9 micron)** Ceramic Ferrule and composite hardware, blue housing, white boot
95-201-98-SP	Fiber Optic Connector, **LC, Single-Mode, (OS2 9 micron)** Ceramic Ferrule, composite hardware, blue housing, blue boot
Corning – Splice and Accessories	
95-000-04	Fiber Optic CamSplice mechanical splice
M67-031	Aluminum Splice Tray, stores 12 CamSplice mechanical splices, type 2S
M67-053	Aluminum Splice Tray, stores 6 CamSplice mechanical splices, type 2R
M67-061	Aluminum Splice Tray, stores 6 CamSplice mechanical splices, type 2R
M67-070	Aluminum Splice Tray, stores 12 CamSplice mechanical splices, type 4S
UST-024	Plastic Splice Tray, stores 24 CamSplice mechanical splices, type 4A
Corning - Enclosures / Connector Panel *** Note:*** CCH (Closet Connector Housing), used for mounting in racks, and WCH (Wall-Mountable Closet Housing), used for mounting on walls, are the new generation enclosures.	
CCH-01U	**1RU** Rack Mount Enclosure, **holds 2 CCH** connector panels (bulkheads)
CCH-02U	**2RU** Rack Mount Enclosure, **holds 4 CCH** connector panels (bulkheads)
CCH-03U	**3RU** Rack Mount Enclosure, **holds 6 CCH** connector panels (bulkheads)
CCH-04U	**4RU** Rack Mount Enclosure, **holds 12 CCH** connector panels (bulkheads)
CCH	Closet Connector Housing
WCH-02P	Wall Mount Enclosure, **holds 2 CCH** connector panels (bulkheads)
WCH-04P	Wall Mount Enclosure, **holds 4 CCH** connector panels (bulkheads)
WCH-06P	Wall Mount Enclosure, **holds 6 CCH** connector panels (bulkheads)
WCH-12P	Wall Mount Enclosure, **holds 12 CCH** connector panels (bulkheads)
WIC-04P	Wall mount interconnect center, **holds 4 WIC** connector panels (bulkheads)
WJG-02R	Wall-mountable jumper storage guides for WCH series closet
CCH-CP06-H3	CCH Connector Panel, **Multi-Mode (OM3/4) (50 micron)** (aqua housing) **6 ST adapters**, ceramic insert, metal housing
CCH-CP12-H3	CCH Connector Panel, **Multi-Mode (OM3/4) (50 micron)** (aqua housing) **12 ST adapters**, ceramic insert, metal housing
CCH-CP06-E7	CCH Connector Panel, **Multi-Mode (OM3/4) (50 micron)** (aqua housing) **3 SC duplex adapters (6ea)**, ceramic insert, composite housing
CCH-CP12-E7	CCH Connector Panel, **Multi-Mode (OM3/4) (50 micron)** (aqua housing) **6 SC duplex adapters (12ea)**, ceramic insert, composite housing
CCH-CP06-E4	CCH Connector Panel, **Multi-Mode (OM3/4) (50 micron)** (aqua housing) **3 LC duplex adapters (6ea)**, ceramic insert, composite housing
CCH-CP12-E4	CCH Connector Panel, **Multi-Mode (OM3/4) (50 micron)** (aqua housing) **6 LC duplex adapters (12ea)**, ceramic insert, composite housing
CCH-CP24-E4	CCH Connector Panel, **Multi-Mode (OM3/4) (50 micron)** (aqua housing) **12 LC duplex adapters (24ea)**, ceramic insert, composite housing
CCH-CP06-15T	CCH Connector Panel, **Multi-Mode (OM1) (62.5 micron)** (beige housing) **6 ST adapters,** ceramic insert, metal housing
CCH-CP12-15T	CCH Connector Panel, **Multi-Mode (OM1) (62.5 micron)** (beige housing) **12 ST adapters,** ceramic insert, metal housing
CCH-CP06-91	CCH Connector Panel, **Multi-Mode (OM1) (62.5 micron)** (beige housing) **3 SC duplex adapters (6ea)**, metal insert, composite housing
CCH-CP12-91	CCH Connector Panel, **Multi-Mode (OM1) (62.5 micron)** (beige housing) **6 SC duplex adapters (12ea)**, metal insert, composite housing

Part Number	Description
CCH-CP06-A8	CCH Connector Panel, **Multi-Mode (OM1) (62.5 micron)** (beige housing) **3 LC duplex adapters (6ea)**, ceramic insert, composite housing
CCH-CP12-A8	CCH Connector Panel, **Multi-Mode (OM1) (62.5 micron)** (beige housing) **6 LC duplex adapters (12ea)**, ceramic insert, composite housing
CCH-CP24-A8	CCH Connector Panel, **Multi-Mode (OM1) (62.5 micron)** (beige housing) **12 LC duplex adapters (24ea)**, ceramic insert, composite housing
CCH-CP06-19T	CCH Connector Panel, **Single-Mode (OS2) (9 micron)** (blue housing) **6 ST adapters,** ceramic insert, metal housing
CCH-CP12-19T	CCH Connector Panel, **Single-Mode (OS2) (9 micron)** (blue housing) **12 ST adapters,** ceramic insert, metal housing
CCH-CP06-59	CCH Connector Panel, **Single-Mode (OS2) (9 micron)** (blue housing) **3 SC duplex adapters (6ea)**, ceramic insert, composite housing
CCH-CP12-59	CCH Connector Panel, **Single-Mode (OS2) (9 micron)** (blue housing) **6 SC duplex adapters (12ea)**, ceramic insert, composite housing
CCH-CP06-A9	CCH Connector Panel, **Single-Mode (OS2) (9 micron)** (blue housing) **3 LC duplex adapters (6ea)**, ceramic insert, composite housing
CCH-CP12-A9	CCH Connector Panel, **Single-Mode (OS2) (9 micron)** (blue housing) **6 LC duplex adapters (12ea)**, ceramic insert, composite housing
CCH-CP24-A9	CCH Connector Panel, **Single-Mode (OS2) (9 micron)** (blue housing) **12 LC duplex adapters (24ea)**, ceramic insert, composite housing
Corning - Cable & Accessories	
006E88-31131-29	**6 strand Single-Mode, (OS2) (9 micron),** Plenum, Yellow Flame Retardant Outer Jacket
06E88-33131-A3	**6 strand Single-Mode (OS2) (9 micron),** Tight Buffered, Plenum, Interlocking Armor, Yellow Outer Jacket
012E88-33131-A3	**12 strand Single-Mode (OS2) (9 micron),** Tight Buffered, Plenum, Interlocking Armor, Yellow Outer Jacket
024E88-33131-A3	**24 strand Single-Mode (OS2) (9 micron),** Tight Buffered, Plenum, Interlocking Armor, Yellow Outer Jacket
036E88-61131-A3	**36 strand Single-Mode (OS2) (9 micron),** Tight Buffered, Plenum, Interlocking Armor, Yellow Outer Jacket
048E88-61131-A3	**48 strand Single-Mode (OS2) (9 micron),** Tight Buffered, Plenum, Interlocking Armor, Yellow Outer Jacket
018X88-A9045-29	**Hybrid, 6 Single-Mode (OS2) (9 micron), 12 Multi-Mode (OM1) (62.5 micron),** Plenum, Interlocking Armor
012K88-33130-A3	**12 strand, Multi-Mode (OM1) (62.5 micron),** Tight Buffered, Plenum, Interlocking Armor, Orange Outer Jacket
024K88-33130-A3	**24 strand, Multi-Mode (OM1) (62.5 micron),** Tight Buffered, Plenum, Interlocking Armor, Orange Outer Jacket
036K88-61130-A3	**36 strand, Multi-Mode (OM1) (62.5 micron),** Tight Buffered, Plenum, Interlocking Armor, Orange Outer Jacket
048K88-61130-A3	**48 strand, Multi-Mode (OM1) (62.5 micron),** Tight Buffered, Plenum, Interlocking Armor, Orange Outer Jacket
012T88-33180-A3	**12 strand, Multi-Mode (OM3) (50 micron),** Tight Buffered, Plenum, Interlocking Armor, Aqua Outer Jacket
024T88-33180-A3	**24 strand, Multi-Mode (OM3) (50 micron),** Tight Buffered, Plenum, Interlocking Armor, Aqua Outer Jacket
036T88-33180-A3	**36 strand, Multi-Mode (OM3) (50 micron),** Tight Buffered, Plenum, Interlocking Armor, Aqua Outer Jacket
048T88-33180-A3	**48 strand, Multi-Mode (OM3) (50 micron),** Tight Buffered, Plenum, Interlocking Armor, Aqua Outer Jacket
012E88-33131-D3	**12 strand, Single-Mode (OS2) (9 micron),** Plenum, Dielectric Strength Members, Non-Conductive, Yellow Outer Jacket
024E88-33131-D3	**24 strand, Single-Mode (OS2) (9 micron),** Plenum, Dielectric Strength Members, Non-Conductive, Yellow Outer Jacket

Part Number	Description
012K88-33130-D3	**12 strand, Multi-Mode (OM1) (62.5 micron),** Plenum, Dielectric Strength Members, Non-Conductive, Orange Outer Jacket
024K88-33130-D3	**24 strand, Multi-Mode (OM1) (62.5 micron),** Plenum, Dielectric Strength Members, Non-Conductive, Orange Outer Jacket
012T88-31180-D3	**12 strand, Multi-Mode (OM3) (50 micron),** Plenum, Dielectric Strength Members, Non-Conductive, Aqua Outer Jacket
024T88-31180-D3	**24 strand, Multi-Mode (OM3) (50 micron),** Plenum, Dielectric Strength Members, Non-Conductive, Aqua Outer Jacket
FAN-BT25-06	Fiber Indoor Buffer 6 Tube Fan-Out Kit, 25"
FAN-BT25-12	Fiber Indoor Buffer 12 Tube Fan-Out Kit, 25"
FAN-BT47-06	Fiber Indoor Buffer 6 Tube Fan-Out Kit, 47"
FAN-BT47-12	Fiber Indoor Buffer 12 Tube Fan-Out Kit, 47"
FAN-OD25-12	Fiber Outdoor Buffer 12 Tube Fan-Out Kit, 25"
Erico	
MPLS	Single Gang Wall Mount Bracket
MPLS2	Double Gang Wall Mount Bracket
CAT32BCB	J-Hook with beam clamp
CAT324Z34	J-Hook with spring clamp
CAT425	Adjustable Cable Support for horizontal surface (Caddy Bag)
CAT425WM	Adjustable Cable Support for vertical surface (Caddy Bag)
CAT600R	Strut Mount Support
CAT600WM	Wall Mount Support
Hilti	
00310223	Grid Wire, 4'
Panduit	
Network Jacks	
CJ5E88TBU	TX Style Cat 5e Modular Jack (blue)
CJ5E88TYL	TX Style Cat 5e Modular Jack (yellow)
CJ5E88TOR	TX Style Cat 5e Modular Jack (orange)
CJ88IWY	Mini-Com Cat 3 Modular Jack (international white)
CJ688TPBU	TX Style Cat 6 Modular Jack (blue)
CJ688TPYL	TX Style Cat 6 Modular Jack (yellow)
CJ688TPOR	TX Style Cat 6 Modular Jack (orange)
CJ5E88TGBU	Mini-Com TX5e Jack Module (blue)
CJ5E88TGYL	Mini-Com TX5e Jack Module (yellow)
CJ5E88TGOR	Mini-Com TX5e Jack Module (orange)
CJ688TGBU	Mini-Com TX6 PLUS Jack Module (blue)
CJ688TGYL	Mini-Com TX6 PLUS Jack Module (yellow)
CJ688TGOR	Mini-Com TX6 PLUS Jack Module (orange)
NK5E88MBUY	NetKey Category 5e UTP Jack Module (blue)
NK5E88MYLY	NetKey Category 5e UTP Jack Module (yellow)
NK688MBU	NetKey Category 6 Jack Module (blue)
NK688MYL	NetKey Category 6 Jack Module (yellow)
Panduit - Termination Tools	
CGJT	Module Termination Tool, Giga-TX style terminations
EGJT	Module Termination Tool, Enhanced Giga-TX style terminations
CWST	Copper Wire Snipping Tool
CJAST	Cable Jacket Stripping Tool

Part Number	Description
Panduit - Face Plates	
CBX2IW-AY	Mini-Com Surface Mount Box, 2 Modular Space (international white)
CBX4IW-AY	Mini-Com Surface Mount Box, 4 Modular Space (international white)
CBXC4IW-AY	Mini-Com Surface Mount Box, 4 Modular Space (international white)
CBXD6IW-AY	Mini-Com Surface Mount Box, 6 Modular Space (international white)
CBX12IW-AY	Mini-Com Surface Mount Box, 12 Modular Space (international white)
CBXF6IW-AY	Mini-Com Multi-Media/Fiber Surface Mount Box, 6 Modular Space (international white)
CBXF12IW-AY	Mini-Com Multi-Media/Fiber Surface Mount Box, 12 Modular Space (international white)
CFPE2IWY	Mini-Com Executive Series Vertical Faceplates, 2 modular space, Single Gang (IW)
CFPE4IWY	Mini-Com Executive Series Vertical Faceplates, 4 modular space, Single Gang (IW)
CFPE6IWY	Mini-Com Executive Series Vertical Faceplates, 6 modular space, Single Gang (IW)
CFPE10IW-2GY	Mini-Com Executive Series Vertical Faceplates, 10 modular space, Double Gang (IW)
CMBIW-X	Mini-Com Blank Module (IW)
JB1IW-A	Pan-Way Low Voltage Surface Mount Outlet Box, Single Gang
MIWBAIW	In-Wall Faceplate Adaptor, Double gang to single gang adapter
EFPK-XY	Label/Label Cover Kit with Screws (single gang)
CF1062IWY	Mini-Com 106 Duplex Module Frame (international white), 2 port
CF1064IWY	Mini-Com 106 Duplex Module Frame (international white), 4 port
Panduit - Patch Panels	
UICFFP4BL	Mini-Com Ultimate ID Modular Furniture Faceplate, 4 Modular Space (black)
CFFP4BL	Mini-Com Snap-On Modular Furniture Faceplates, 4 Modular Space (black)
CPP24WBLY	Mini-Com Modular Patch Panel, 24 port (black) with CFFP4 style snap-in faceplates
CPP48WBLY	Mini-Com Modular Patch Panel, 48 port (black) with CFFP4 style snap-in faceplates
CPP48HDWBLY	Mini-Com High Density Modular Patch Panel, 48 port (black)
Panduit - Cable Management	
C4BL6	Fiber-Duct Slotted Wall Channel Cover, 6 ft section (black)
E4X4BL6	Fiber-Duct Slotted Wall Channel, 6 ft section (black)
WMP1E or WMP1EY	Slotted Duct Horizontal Cable Management System, Two Rack Space, Front/Back (black)
WMPF1E or WMPF1EY	Slotted Duct Horizontal Cable Management System, Two Rack Space, Front Only (black)
WMPSE or WMPSEY	Slotted Duct Horizontal Cable Management System, One Rack Space, Front/Back (black)
WMPFSE or WMPFSEY	Slotted Duct Horizontal Cable Management System, One Rack Space, Front Only (black)
WMPV22E	NetRunner Vertical Cable Management, front/back, 22 RU (black)
WMPVHC45E	NetRunner Vertical Cable Management - High Capacity, front/back, 45 RU (black)
WMPV45E	NetRunner Vertical Cable Management, front/back, 45 RU (black)
WMPVCBE	NetRunner Center Mount Bracket Kit
Panduit - Wall Rack Units	
WBH2 or WBH2Y	Hinged Wall Bracket, 19", 2 Rack Space (black)
WBH4 or WBH4Y	Hinged Wall Bracket, 19", 4 Rack Space (black)
Panduit - Jack/Cable Labels	
S100X125YAJ	Cable Labels, Self-Laminating Self Adhesive (2500/pkg)
C138X019FJJ	Modular Jack Labels, Self Adhesive Laser printed white (1000/pkg)
PST-FO	Self-Laminating Fiber Optic Cable Marker Tags
Panduit - LD Raceway & Fittings	
LD3IW8-A	Pan-Way Type LD Surface Raceway, 3 Cable Capacity, 8 ft section (IW)
LD5IW8-A	Pan-Way Type LD Surface Raceway, 5 Cable Capacity, 8 ft section (IW)
LD10IW8-A	Pan-Way Type LD Surface Raceway, 10 Cable Capacity, 8 ft section (IW)
CFX3IW-X	Pan-Way Type LD Surface Raceway Fitting, Coupler Fitting, 3 cable capacity (IW)
CFX5IW-X	Pan-Way Type LD Surface Raceway Fitting, Coupler Fitting, 5 cable capacity (IW)
CFX10IW-X	Pan-Way Type LD Surface Raceway Fitting, Coupler Fitting, 10 cable capacity (IW)
ICFC3IW-X	Pan-Way Type LD Surface Raceway Fitting, Inside Corner Fitting, 3 cable capacity (IW)

Part Number	Description
ICFC5IW-X	Pan-Way Type LD Surface Raceway Fitting, Inside Corner Fitting, 5 cable capacity (IW)
ICFC10IW-X	Pan-Way Type LD Surface Raceway Fitting, Inside Corner Fitting, 10 cable capacity (IW)
OCFX3IW-X	Pan-Way Type LD Surface Raceway Fitting, Outside Corner Fitting, 3 cable capacity (IW)
OCFX5IW-X	Pan-Way Type LD Surface Raceway Fitting, Outside Corner Fitting, 5 cable capacity (IW)
OCFX10IW-X	Pan-Way Type LD Surface Raceway Fitting, Outside Corner Fitting, 10 cable capacity (IW)
RAFC3IW-X	Pan-Way Type LD Surface Raceway Fitting, Right Angle Fitting, 3 cable capacity (IW)
RAFC5IW-X	Pan-Way Type LD Surface Raceway Fitting, Right Angle Fitting, 5 cable capacity (IW)
RAFC10IW-X	Pan-Way Type LD Surface Raceway Fitting, Right Angle Fitting, 10 cable capacity (IW)
ECFX3IW-X	Pan-Way Type LD Surface Raceway Fitting, End Cap Fitting, 3 cable capacity (IW)
ECFX5IW-X	Pan-Way Type LD Surface Raceway Fitting, End Cap Fitting, 5 cable capacity (IW)
ECFX10IW-X	Pan-Way Type LD Surface Raceway Fitting, End Cap Fitting, 10 cable capacity (IW)
TFC3IW-X	Pan-Way Type LD Surface Raceway Fitting, Tee Fitting, 3 cable capacity (IW)
TFC5IW-X	Pan-Way Type LD Surface Raceway Fitting, Tee Fitting, 5 cable capacity (IW)
TFC10IW-X	Pan-Way Type LD Surface Raceway Fitting, Tee Fitting, 10 cable capacity (IW)
DCF3IW-X	Pan-Way Type LD Surface Raceway Fitting, Drop Ceiling/Entrance End, 3 cable capacity (IW)
DCF5IW-X	Pan-Way Type LD Surface Raceway Fitting, Drop Ceiling/Entrance End, 5 cable capacity (IW)
DCF10IW-X	Pan-Way Type LD Surface Raceway Fit, Drop Ceiling/Entrance End, 10 cable capacity (IW)
RF5X3IW-E	Pan-Way Type LD Surface Raceway Fitting, Reducer Fitting 5<->3 (IW)
RF10X5IW-X	Pan-Way Type LD Surface Raceway Fitting, Reducer Fitting 10<->5 (IW)
RF10X3IW-X	Pan-Way Type LD Surface Raceway Fitting, Reducer Fitting 10<->3 (IW)
Panduit – Fiber Optic Adapter Modules	
CMDBUSCZBU	**Single Mode (OS2) (9 micron)** Blue **SC** Duplex Adapter Module with Zirconia Ceramic Split Sleeve
CMDEISCEI	**Multi-Mode (OM1) (62.5 micron)** Electric Ivory **SC** Duplex Adapter Module with Phosphor Bronze Split Sleeve
CMSTZBU	**Single Mode (OS2) (9 micron)** Blue **ST** Single Adapter Module with Zirconia Ceramic Split Sleeve
CMSTEI	**Multi-Mode (OM1) (62.5 micron)** Electric Ivory **ST** Single Adapter Module with Phosphor Bronze Split Sleeve
Panduit - Miscellaneous Items	
BS100445	4" Flat Braided Bonding Straps, One Hole
BS100645	6" Flat Braided Bonding Straps, One Hole
BS100845	8" Flat Braided Bonding Straps, One Hole
HLS-15R0	Velcro, 15' roll (black)
GB2B0304TPI-1	Telecommunications Grounding Busbar, 1/4" X 2" X 10"
GB2B0306TPI-1	Telecommunications Grounding Busbar, 1/4" X 2" X 12"
Siemon	
M2-5T-128LR-TP	66-50 style Punch Down block, pre-wired to RJ-45, T568A pin-out (white)
M1-50	66-Punch Down Block (white)
S-89B	66-Block Wall Mount Bracket (white)
YT4-4U1	Modular 4-Way Splitter
Specseal	
SSB24	Fire Stop Pillow, 2"x4"x9"
Unique Fire Stop Products	
SP-1	1" Smooth Penetrator
SP-2	2" Smooth Penetrator
SP-4	4" Smooth Penetrator

Part Number	Description
	Miscellaneous
	Cable Ties, 8", Natural (100/pkg)
	Cable Ties, 14", Natural (100/pkg)
	Cable Ties, 24", Natural (10/pkg)
	Cable Ties, 36", Natural (10/pkg)
	Cable Ties with screw mount, 7", Natural (100/pkg)
	Cat 5E Patch Cable with booted ends (assorted colors) 3'
	Cat 5E Patch Cable with booted ends (assorted colors) 5'
	Cat 5E Patch Cable with booted ends (assorted colors) 7'
	Cat 5E Patch Cable with booted ends (assorted colors) 10'
	Cat 5E Patch Cable with booted ends (assorted colors) 14'
	Cat 5E Patch Cable with booted ends (assorted colors) 25'
	Cat 5E Patch Cable with booted ends (assorted colors) 40'
	Cat 5E Patch Cable with booted ends (assorted colors) 100'
	Cat 5E Patch Cable with non-booted ends (assorted colors) 3'
	Cat 5E Patch Cable with non-booted ends (assorted colors) 5'
	Cat 5E Patch Cable with non-booted ends (assorted colors) 7'
	Cat 5E Patch Cable with non-booted ends (assorted colors) 10'
	Cat 5E Patch Cable with non-booted ends (assorted colors) 14'
	Cat 5E Patch Cable with non-booted ends (assorted colors) 25'
	Cat 5E Patch Cable with non-booted ends (assorted colors) 40'
	Cat 5E Patch Cable with non-booted ends (assorted colors) 100'
	Cat 6 Patch Cable with booted ends (assorted colors) 3'
	Cat 6 Patch Cable with booted ends (assorted colors) 5'
	Cat 6 Patch Cable with booted ends (assorted colors) 7'
	Cat 6 Patch Cable with booted ends (assorted colors) 10'
	Cat 6 Patch Cable with booted ends (assorted colors) 14'
	Cat 6 Patch Cable with booted ends (assorted colors) 25'
	Cat 6 Patch Cable with booted ends (assorted colors) 40'
	Cat 6 Patch Cable with booted ends (assorted colors) 100'
	Cat 6 Patch Cable with non-booted ends (assorted colors) 3'
	Cat 6 Patch Cable with non-booted ends (assorted colors) 5'
	Cat 6 Patch Cable with non-booted ends (assorted colors) 7'
	Cat 6 Patch Cable with non-booted ends (assorted colors) 10'
	Cat 6 Patch Cable with non-booted ends (assorted colors) 14'
	Cat 6 Patch Cable with non-booted ends (assorted colors) 25'
	Cat 6 Patch Cable with non-booted ends (assorted colors) 40'
	Cat 6 Patch Cable with non-booted ends (assorted colors) 100'

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