



# **Low-Voltage Wiring Standards**

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Networking Services

Brian Helman, Director

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## **Preface:**

Salem State University places a strong commitment to the communications infrastructure that services the Administration, Faculty and Student body. As such, this infrastructure is governed by a defined set of standards as presented in this document. This document is more than a guide. ***The standards set forth in this document are to be adhered to unless otherwise agreed upon, in writing, by the Director of ITS/Networking Services or the CIO.*** With respect to Means & Methods, the Assistant VP, Campus Planning & Facilities Management may also authorize exceptions. In the event of a conflict, the specifications contained within the Salem State University Low-Voltage Wiring Standards will take precedence. It is the responsibility of the Bidding Contractor to understand the specifications and standards contained in this document and adhere to them. ***Bid Specifications in conflict with this document may only take priority with written approval by the Director of ITS/Networking Services or the CIO.***

## **Version Control:**

Every effort is made to distribute the most recent version of this document. While this document has been carefully compiled and edited, occasionally clarifications and additions are issued. The most recent version of this document is available <http://www.salemstate.edu/18860.php>. Archival versions are available from Networking Services upon request. The Standards document that is current at the time a contract is signed will be the official Standards document for the life of that project, unless otherwise agreed upon in writing. A 12-month Document Change Log is included at the end of this document.

## **Installer Credentials:**

Cabling contractors must be an approved vendor of the University, either by State ITT/ITC contract, MHEC contract, University contract or competitive bid. All cabling products used must meet IEEE specifications. Installation must follow BiCSi guidelines and adhere to OSHA regulations. Installer must have a project manager who is BiCSi RCDD certified overseeing any project greater than \$5000. All cabling must be tested and a certification report submitted to ITS/Networking Services. This testing may not take place without proper termination of cabling in place. ***No project is considered completed until this report has been presented and accepted.*** Minimum cable certification requirements and sample reports are contained in Appendix H.

## **Means & Methods:**

Installer will adhere to standards defined in the latest published edition of the BiCSi Telecommunications Distribution Methods Manual for work environment, cable pulling – including handling and securing, termination and testing. Appendix G contains a boilerplate of procedures to be observed by the installer. A complete list must be obtained from the Facilities Department at (978) 542-HELP.

## **Deliverables:**

Upon completion of work, the installer will present a full certification report detailing that all cabling falls within accepted industry standards. This report must be submitted in an electronic format. The installer will also submit a jack cut sheet in the format specified in Appendix C of this document. All station-lines run, whether coax or copper, must be documented in the cut sheet. ***The cut sheets must also be submitted as an Excel spreadsheet, in an .xls or .xlsx file. All deliverables are due 7 calendar days prior to expected Certificate of Occupancy date.***

**Warranty:**

Warranties and guarantees will be provided at time of quote. No work performed will be guaranteed for less than 5 years to be free of defect from installation error. Warranties will be in affect based on manufacturer's stated schedule.

**Workmanship and quality:**

Salem State University expects installations to be performed in a professional, clean and neat manner. Wiring will be terminated per standards, but will also be dressed in, in a professional and presentable fashion. All cable slack and service loops will be similarly dressed in and secured. It is expected that all terminations will be completed to industry standards, regardless of a "Pass" in testing. That is to say, Salem State will not accept minimal quality work. Samples of cable terminations; dressing; fiber polishing are presented in Appendix G.

**Definitions:**

Station Wiring: All wiring installed between an IDF and a Location.

Location: A cluster of jacks containing any or all of the following *low/no voltage* wiring – Unshielded Twisted Pair (UTP), Coax, Fiber and Audio Wire – for use in Data, Voice, Video and Audio applications. "Location" is also referred to as "the Desktop."

Drop: A single *low/no voltage* line within a Location.

Network port: A drop used for Network Access.

Voice port: A drop used for Voice Access.

Video port: A drop used for Video Access.

IDF: Intermediate Distribution Facility. The IDF is the central termination point for all station wiring. It contains the network equipment necessary to provide connectivity between desktop computers and the University Network. It may contain "hub" connectivity for Video. The IDF will contain "pass thru" patch panels for Voice.

MDF: The Main Distribution Facility. MDF's contain core or intermediate network equipment, connectivity to the University Data, Telephone and Video "networks", as well as Data, Telephone and Video connectivity to the IDF's. The MDF may also contain telephone equipment. An MDF may also act as an IDF.

CDF: The Core Distribution Facility. CDF's house the "collapse point" for infrastructure on each campus. A CDF may also act as an MDF and IDF.

Rack Unit, "R.U.", "U": The standard measurement on a communications rack, amounting to 1  $\frac{3}{4}$ " (44.45mm). For the purposes of this document, "Rack Unit", "R.U" and "U" are synonymous.

"Fiber can", "can", "Fiber enclosure", "enclosure" and LIU are used interchangeably throughout this document.

**Cable Type:**

The University does not designate station wiring as Voice or Data at the faceplate. This wiring is ubiquitous to allow flexibility in usage. As such, all horizontal (station) cabling will *EXCEED* Category 6 Standards (Category "6+") or better unless otherwise specified, in writing. For acceptable cable colors, please refer to Appendix H.

Fiber Optic Cable is used for connectivity between MDF's as well as MDF to IDF (data only). In the event that an IDF is within 90 Meters from its MDF, some UTP may, as defined by Project, be run between these facilities. Both multimode and singlemode fiber is used from MDF to IDF and MDF to MDF. Existing multimode fiber between MDF/IDF and MDF/MDF has been 62.5μ. However, at this time, the University is in a period of transition with respect to its fiber infrastructure. This transition necessitates the installation of both 62.5μ and 50μ multimode fiber between MDF/IDF. MDF/MDF will remain 62.5μ. Factory-terminated LC pigtailed with fusion splices are to be used for all new fiber installations, whether single or multimode. Quantities are defined by Networking Services, based on need. Fiber adapters in LIUs will be limited to 12 strands (6 pairs) per adapter. If a new LIU enclosure is required, it will be sized to accommodate a minimum 50% growth. Because of their difficulty to work with, 1U LIU's are to be avoided.

Voice-Grade Copper is run between MDF and IDF's to service voice needs on the riser. Either Voice-Grade Copper or Fiber is used between MDF's for voice, depending on the need and density of telephones serviced by the facilities.

For video, unless otherwise specified, standard RG-6 (less than 150') or RG-11 (greater than 150') terminated with F-connections are to be used. MDF to IDF coax is standard ½" coax. Two ½" cables are run between the MDF each IDF as well as between MDF's (intra-campus only). Standard termination applies. Terminations MUST be secure and not easily removed by pulling.

Audio Cabling will be specified based on specific application.

For station-wiring, all wiring (data/voice/video, copper/fiber/coax) will be "home runs" from the IDF to the wall plate. Use of mechanical connectors (e.g "barrel connectors") is not permitted nor are splice-points. This also applies to vertical risers from MDF to IDF with the exception of riser voice trunks, where splice-points are acceptable. For external wiring, mechanical/fusion splices may be used SPARINGLY as necessary or where required by code (indoor/outdoor transition, lightning projection, etc).

All cables must be tested and certification reports submitted. Refer to Appendix I for requirements and sample reports.

ALL WIRING MUST MEET IEEE SPECIFICATIONS AND BUILDING CODES FOR INTENDED USE AND INSTALLATION CONDITIONS.

ALL CABLING INSTALLATIONS WILL PROVIDE A MINIMUM 1.5 METER DIAMETER (APPROXIMATELY 16 LINEAR FEET) SERVICE LOOP AT THE IDF/MDF. THIS CABLING WILL BE NEATLY COILED ON A WALL FIELD OR CABLE TRAY.

**Flush Mounting:**

Flush Mounting is the preferred method of mounting jacks at any given location.

### **Surface Mounting:**

Surface Mounting is only acceptable under two conditions – Flush mounting is not possible due to construction of the wall or flush mounting is not practical because of the application. An example of the former is cinderblock or poured-concrete construction. For the latter, high-density areas such as computer labs.

### **Jacks/faceplates/raceway:**

*Residence Halls* – Wherever possible recessed faceplates from Semtron with Ortronics TracJack Clarity jacks are to be used. This applies to both new installations and repair/replacement. Because of the unique installation requirements for the Semtron faceplates, wherever its usage is not practical, the Ortronics Series II System is to be used.

**Other University Spaces** – The University standard for Jacks and Faceplates is the Ortronics TracJack System. New installations will use Ortronics TracJack. Where repairs to legacy faceplates/jacks are required, these legacy systems are to be replaced by the TracJack system. If an environment requires the use of more durable systems, the Semtron should be used. When providing jacks to modular furniture, it is preferred that the jacks be placed above desktop height whenever practical and allowed. If it is necessary to install jacks under the work-surface, on the kick plate of modular furniture, it is preferred that the faceplates be flush-mounted. In this instance, it may be necessary to use Leviton 49910-Sx2 faceplates (for Steelcase furniture).

All cabling will be terminated under IEEE and BiCSi guidelines.

Under no circumstances will single-track raceway be used. The University has standardized on Panduit multi-track raceway. All raceway will be mechanically secured to the walls. Gluing is not acceptable.

### **Drop quantity:**

*New locations:* The number of drops at a location is defined by a complicated set of rules and needs. Exact numbers will be obtained through a location-specific identification.

The following can be used as **general guidelines:**

- Common Areas: 2 – 4 UTP lines per location
- Single Person Offices: 3 – 4 UTP lines + 1 coax (usually only 1 location)
- Office Cubicles: 3 – 4 UTP lines per location
- Multi-Person Offices: 3 – 4 UTP lines per location; Add 1 coax to 1 location only
- Classrooms: 2-3 UTP in ceiling for wireless arrays; 3 UTP + 1 coax in front and back
- Meeting Rooms: 2-3 UTP in ceiling for wireless; 3 UTP each location; 1 coax in front
- Labs: 2-3 UTP in ceiling for wireless; sufficient wiring at each desk/table for computers; 3 UTP + 1 coax in front of room
- Clerical Spaces (Copy/Storage Rooms): 4 UTP (usually 1 location)
- Wall Phones/Emergency Phones: 1 UTP
- Smart Classrooms: Wired as regular classrooms + 4 UTP/1 Coax in podium

NOTE: locations should only exist within a reasonable proximity to electric outlets. Also, "Power Users" should have 1 or 2 extra UTP lines run to their work areas.

*Existing Locations:* –No area should be wired for *exactly* what is needed in order to accommodate future growth. E.g. if 1 drop is needed, 2 or 3 should be run.

*Wireless Arrays:* -- The current wireless technology for the University is Aruba wireless Access Points. Depending on the model required, these arrays require 1-3 data connections. Exact drop quantity should be obtained by Networking Services.

### **Jack Labeling:**

All Jack labels will be placed under clear plastic inserts. Labels are not to be placed on the surface of the faceplate unless an insert does not exist. In this instance, a single layer of clear tape is to be placed over the label. Further, a label is to be placed on the inside of the faceplate, also with a layer of clear tape over it.

Jacks are labeled using the following format:

<IDF Designation>

<Rack Number><Patch Panel Designation>-<Port Number>

E.g. If the faceplate contains jacks connected to ports 35 and 36 on Panel C (Rack 2) in the Library Level 0 IDF (ID0) the label would be (single or dual jack)

LIBID0

2C-35

**[jacks]**

2C-36

Faceplates with 3 or 4 jacks:

LIBID0

2C-35 2C-36

**[jacks]**

2C-37 2C-38

Faceplates with 5 or 6 jacks:

LIBID0

2C-35 2C-36

**[jacks]**

2C-37 2C-38

2C-39 2C-40

A chart listing “<IDF Designation>” names can be found in Appendix C. When adding jacks to existing areas where labels follow an older standard, this new standard is to be used on the new installations. Do not follow the older labeling scheme that may already be present in that area. The racks, panels and ports remain consistent (see IDF Configuration section).

**More information on labeling of faceplates is available in Appendix A.**

### **Data Center/Frame Room Configurations:**

Fiber terminations: Both Multimode and Single mode fiber will be run between Data Center/Frame Rooms and internal MDF/IDF's. With respect to Multimode, both 50µ and 62.5µ will be run. Inter-building Multimode fiber will be 62.5µ. Both diameters of Multimode fiber may be terminated in the same fiber can, provided they are separate within the can (62.5µ on the far left; 50µ on the far right of the LIU) and clearly labeled with the location name of the other end of the fiber, per Appendix C. Multi and single-mode fiber are to be terminated in separate cans. Factory-terminated LC pigtails with fusion splices are to be used for all new fiber installations. Fiber adapters in LIUs will be limited to 12 strands (6 pairs) per adapter. If a new LIU enclosure is required, it will be sized to accommodate a minimum 50% growth. 1U LIU's are to be avoided.

Coax: If coax trunk lines are being fed in to the Data Center, they will be terminated using the proper tap for the cable size per the Cable Company's current standards. This should be verified at time of installation. The placement within the Data Center is not specifically defined, but there is an area set aside for coax.

Voice Copper: Where practical, voice applications outside of the Data Center ride over fiber. However, instances arise where copper connections will be home-run from the remote building to the Data Center. In these instances, the copper will be terminated on Green Hamaco 66-block wall boards in the Data Center and 110/RJ-45 panels in the remote Building MDF. If the telcom switch needs to be expanded, Purple Hamaco 66-block wall boards will be installed with telco cables run between board and Telephone Switch.

ALL CABLE TYPES WILL BE TRANSITIONED FROM OUTSIDE TO INSIDE cable within the appropriate distances (in most cases 50') of where they become accessible. All copper will be transitioned to lightning protection ON BOTH SIDES of any run that leaves a building, whether that run is exposed outside of the Data Center/Frame Room, in any manner, or not.

See Appendix E – Racks and Cable Trays, for more information.

### **MDF Configuration:**

An MDF will contain at least one (1) 19" Communication's rack. Depending on the type of equipment being placed in the MDF, this rack may be either an open box rack or a standard relay rack (see Appendix E for rack descriptions). In general, one (1) communications rack is sufficient for an MDF. If the MDF also acts as an IDF, additional racks will be required as defined by "IDF Configuration" below.

UPS's will need to be sized based on initial load and projected growth. However, in general 2KVA of backup power is required for every 300 watts of load. If the room is on a generator, this sizing can be halved. All UPS's require a Network Management Card. The UPS will back a standard 125v NEMA 5-20R 20A duplex or NEMA L5-20R twistloc outlet to every communications rack in the room. Rack-mounted UPS's will require an open-box communications rack. The preferred standard for UPS's is a single, larger UPS supporting multiple closets. If this is not attainable, fewer/larger UPS's supporting multiple closets is preferred.

Both Multimode and Singlemode fiber will be run between MDF and IDF's. With respect to Multimode, both 50µ and 62.5µ will be run. Inter-building Multimode fiber will be



62.5μ. Both diameters of Multimode fiber may be terminated in the same fiber can, provided they are separate within the can (62.5μ on the far left; 50μ on the far right of the LIU) and clearly labeled with the location name of the other end of the fiber, per Appendix C. Multi and single-mode fiber are to be terminated in separate cans. Factory-terminated LC pigtails with fusion splices are to be used for all new fiber installations. Fiber adapters in LIUs will be limited to 12 strands (6 pairs) per adapter. If a new LIU enclosure is required, it will be sized to accommodate a minimum 50% growth. All fiber terminations (CDF to CDF, CDF to MDF, MDF to MDF and MDF to IDF) will use Ultra Physical Contact (UPC) connectors. However between CDF/CDF, CDF/MDF and MDF/MDF, one (1) fiber pair of singlemode fiber will be terminated using Angled Physical Contact (APC) connectors. The separation between UPC and APC strands will be defined per Project and specified by Salem State Networking Services.

Voice trunks (copper) will be terminated on communications racks using 110/RJ-45 panels, unless otherwise specified by Telecommunications or Networking Services. Blocks coming from the Telecom Switch Room will be Green. Blocks going to the IDF will be Blue. If color panels are not available, icons are acceptable. Whether initially using them or not, all panels must support snap-on icons. Standard bundled voice-grade copper will be used for these trunks. Voice riser-trunk panels will be installed below Outside Plant Copper Trunk panels. Panels should be distributed across racks in a balanced fashion.

Specific lighting need not be specified beyond whatever is suitable for the room size. However, the lighting should produce a minimal amount of heat. It is also highly desirable that lights be placed both in front and behind communications racks rather than directly above.

Cable management in an MDF will follow the same specifications/requirements as IDF's.

*Environmentals:* The MDF must be a secure room and humidity levels must remain above 40% and non-condensing. At a minimum, active venting is required for all MDF's. If temperatures remain between 55-78 degrees Fahrenheit, no cooling is necessary. If a room cannot maintain a temperature above 55 degrees Fahrenheit, heating and humidification may be required.

*Room Size:* Appendix F contains drawings showing preferred layouts, room dimensions and spacing for MDF and/or IDF's. It also lists room requirements.

See Appendix F – Racks and Cable Trays, for more information

### **IDF Configuration:**

In an IDF, one (1) communications rack will be required for every 14 cumulative "u's" of patch panels (combination of Data, Trunk/Riser Voice and/or Video) and fiber cans. For each fiber can and each voice-trunk panel installed, a 2 u cable manager will be installed. For every 24-ports of data network equipment, a 1 u cable manager will be used. In addition, 6" wide x 13" deep vertical cable management will be installed at the ends/between all racks. If space does not permit the use of 6" wide cable management, 3.75" may be used on the ends only.

The Standard horizontal cable manager is TrippLite SRCABLEDUCT2UHD . The standard vertical cable manager is the Ortronics OR-DVMS706 (6") or OR-DVMS704 (3.75").

Refer to Appendix F for minimum room dimensions, rack placement and clearances.

All station wiring is to be terminated in a patch panel (See **Cable Type** for requirements). Voice trunk and riser panels may be Category 3. All new patch panels are to be Ortronics. Under no circumstances are 110/66 wall-blocks to be used in IDF's for voice. A patch panel will be placed at the top of each communications rack, or if a fiber can is also housed in the rack, under it for Voice Trunk ports only. If the IDF contains more than one (1) rack, the quantity of Voice Trunk ports will be divided equally to each rack. The Voice Trunk panels will be color Blue to differentiate them from the station wiring panels. Station wiring panels will be black. Alternatively, blue or black "icons" may be used on the patch panels to differentiate between Trunk and Station ports. All panels, whether Category 3 or 6, must support the use of icons. As with MDF's, multimode and single mode fiber will be terminated in separate cans. 50µ and 62.5µ fiber may be terminated in the same can, provided they are separated and clearly labeled. 62.5µ fiber will be terminated on the far left of the LIU, 50µ on the far right. If space does not permit this, cabler is not to make assumptions on placement; placement must be clarified with Salem State.

All Video cabling (RG-6 for distances less than 150', RG-11 for distances greater than 150') will be terminated at a wall field, where University Cable TV distribution is located. One pair of RG-11 cables will be run between an MDF and any IDF serviced by it.

*Rack/Patch Panel Labels:*

Starting at the top of rack 1 (defined in next paragraph) and moving down the rack each panel will be labeled sequentially starting with "A" (ie Rack 1 Panel A). Moving down Rack 1, the next panel will be "B", and so-forth. Moving to the rack to the right, the patch panel at the top of the second rack is Rack 2 Panel A and so forth. A label may be placed at the top of each rack designating the Rack number and a separate label placed on each patch panel designating the panel letter. **Only copper panels (voice trunk and station cabling) are to be labeled with letters. LIU's will be labeled to identify location of far end of fiber.**

Rack 1 is the "left-most" rack. Using the common left-to-right Western reading format, the "left-most" rack is the rack that is logically the starting point within the room. More information is available in Appendix A.

If the patch panel comes with factory numbering, it will not be altered/overlaid. If the patch panel does not come factory numbered, each patch panel will be numbered independent of others (ie the first port on each panel will start at "1").

*Environmentals:* The IDF must be a secure room and humidity levels must remain above 40% and non-condensing. At a minimum, active venting is required for all IDF's. If temperatures remain between 55-78 degrees Fahrenheit, no cooling is necessary. If a room cannot maintain a temperature above 55 degrees Fahrenheit, heating and humidification may be required.

One duplex 20A 110 outlet per communications rack is required. A minimum of a 1.5KVA SNMP-Manageable UPS will be placed in each IDF. UPS's will need to be sized, but in general 1.5KVA of battery backup is needed for every 300 watts of power consumption. All UPS's require a Network Management Card. Rack-mounted UPS's will require an open-box communications rack. The preferred standard for UPS's is a single,

larger UPS, placed in the MDF, supporting multiple closets. If this is not attainable, fewer/larger UPS's supporting multiple closets is preferred.

*Room Size:* Appendix F contains drawings showing preferred layouts, room dimensions and spacing for MDF and/or IDF's. It also lists room requirements.

See Appendix F – Racks and Cable Trays, for more information

### ***Special Considerations***

#### **Residence Halls:**

It has been our experience that the data jacks used in the offices, classrooms, labs and common areas throughout the University are not suited to the energetic behavior of resident students in their rooms. After extensive research, we found the Semtron recessed faceplates and Ortronics TracJack Clarity jacks to be the most durable. Wherever possible, the Semtron plates are to be used. When an existing faceplate needs to be replaced, a Semtron should be used, if possible. When it is impractical to use the Semtron faceplate, Ortronics TracJack faceplates and jacks are to be used. To be consistent, Semtron faceplates (with TracJack Clarity jacks) should be used throughout residence halls, not just in living spaces. **Networking Services should be consulted to verify the current product to be used for faceplates as more durable products are continually being researched.**

Wiring Quantities: 2 UTP (voice and data) "per pillow" + 1 coax per room. It has been our experience that rooms get over booked. Rooms should have 1 location per designed capacity + 1 extra location (e.g. a double room should have 3 locations). Common Areas should have 3 UTP per location. At least one location per Common Area will have 1 coax. When wiring for a flat-panel TV, the Semtron recessed faceplates are preferred. Because of the torque that RG-11's place on the back of faceplates, a short "pigtail" transition from RG-11 to RG-6 OR a 45° connector on the RG-11 should be used.

#### **Semtron part numbers (for use with Ortronics TracJack Clarity jacks):**

- Single port: 1-0RE-TJ
- Dual port: 1-0RE-2TJ
- 3-port: 1-000RE-TJ
- 4-port: 1-0000RE-TJ

#### **ePhones & CCTV:**

At present, there is no standard in place defining what the cable bundle to an ePhone should be. At a minimum, an ePhone requires a standard telephone line. If a strobe/emergency light will be installed, power will need to be supplied. Similarly, wherever a CCTV camera will be present, coax, power and pan/tilt/zoom (PTZ) control lines (UTP) will be needed.

#### **Minimum ePhone & CCTV Cable specifications:**

##### **ePhone**

Category 3 or better UTP or STP

Light Red icon on patch panel (if legacy patch panels are in place that do not support icons a pink patch cable or other pink identifier may be used)

### CCTV Camera

2 Strands Multimode (62.5μ) fiber (less than 2000 meters) *or* Singlemode fiber (more than 2000 meters)

### Siren

2 Strands Multimode (62.5μ) fiber (less than 2000 meters) *or* Singlemode fiber (more than 2000 meters). If a CCTV Camera is present, the siren may use the same fiber installed for that application. In this instance, a CM2 copper/fiber transceiver at the camera location will be used to manage both requirements.

### Power for CCTV and/or Strobe/Marker Light

18/2 UTP (less than 100')

16/2 UTP (less than 150')

\*When using coax, 100% copper center conductor and a copper braid coverage of 96% or better.

### LCD Electronic Messaging System (Digital Signage)

In 2006 the University designed and implemented an Electronic Messaging System utilizing existing plasma TV's, later expanding to LCD and now LED units. For the purposes of this document, the following components/cabling standards/installation requirements apply:

It is beyond the scope of this document to specify the Screen hardware, however Networking Services should be consulted before any unit is purchased to ensure its compatibility and suitability. In general, the following specifications should be met:

- Standard Mounting Pattern
- HDMI Interface, with video support for 1280x768
- Serial Control Port

The mounting of the LED will, in most cases, be performed by the cable-installer. It is expected that the mount will be properly secured per the weight-based guidelines of the manufacturer using appropriate fasteners and adhering to the policies of the University's Facilities department.

Once a location has been identified for the location of the LED, a suitable mount will need to be selected. It is preferred that the mount be installed prior to running any cabling. This may not be consistently practical, but the goal is to place the data jack behind the LED such that it is minimally/not noticeable. If the wiring location is placed prior to installation of mount, the mount should take aesthetics (hiding the cables) into consideration.

For each LED, the data-run will consist of three (3) Category 6\* cables and one (1) low-skew cable. The low-skew cable will be terminated in the lower-right position on the faceplate onto a green jack. The remaining 3 cables may use any other appropriately-colored jack that matches the faceplate, but all 3 will be the same color. In the event that a green jack is not available, a green icon is acceptable. Wherever possible, the Semtron recessed faceplate should be used in the installation of wall-mounted screens.

\*Specific manufactured cables must EXCEED Category 6 specifications (e.g Cat "6+"). See **Cable Types** for more information.

## **Wireless Arrays**

The University has standardized on Aruba wireless Access Points for wireless networking connectivity. For best coverage, these units need to be mounted parallel to the floor/ceiling. Wall mounting will require L-brackets. All deviations from this must be approved through Networking Services. Networking Services will provide locations for all wireless array installations or relocations

When mounting a wireless array to an acoustical ceiling tile (ACT), the mounting bracket is to be centered on the tile and not attached to the ceiling grid. To add support to the tile, a 24" length of metal stud is to be placed above the tile such that it sits in the ceiling grid. The stud segment will have a hole punched in it to allow the necessary cabling to pass through. Cut ends of the stud will be covered with tape to eliminate sharp edges. The stud will also be chained in the same fashion that a light fixture would be secured in a suspended ceiling.

The responsibility of the low-voltage contractor with regard to hanging the actual electronics (provided by the University) will be project-dependent. In some cases, the contractor will only install the mount and SSU personnel will install the actual arrays.

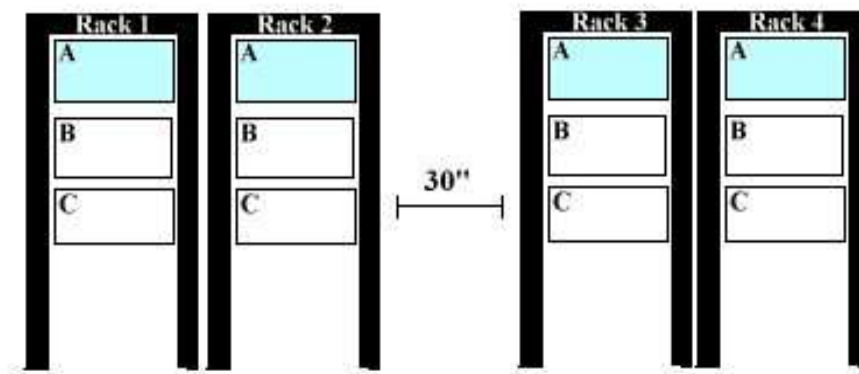
## Appendix A

### Jack Labels



NOTE: When installing a coax port on a recessed (Semtron) faceplate with 3 jacks, use a 4-position plate with a blank. Do NOT install coax on the bottom of a 3-position recessed plate.

### Rack/Patch Panel Labels



## Appendix B

### Fiber LIU Labeling

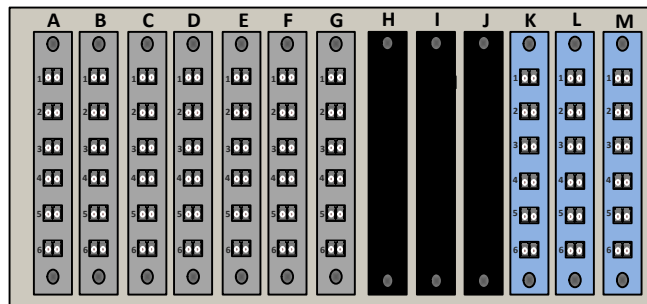
Salem State currently utilizes multimode (62.5 $\mu$  and 50 $\mu$ ) and singlemode fiber with either ST or LC connectors. The labeling standards documented below are independent of the fiber type (single or multimode). ST connectors are being phased out. When re-terminating, unless otherwise specified LC connectors/packs should be used. All new installations will use LC connectors.

NOTE: ST and LC packs may be mixed in the same LIU. While exceptions are made based on requirements and space, fiber modes should not be mixed in the same LIU. At no time shall they be mixed on the same pack. 62.5 $\mu$  and 50 $\mu$  multimode may be mixed in the same LIU, but never in the same pack.

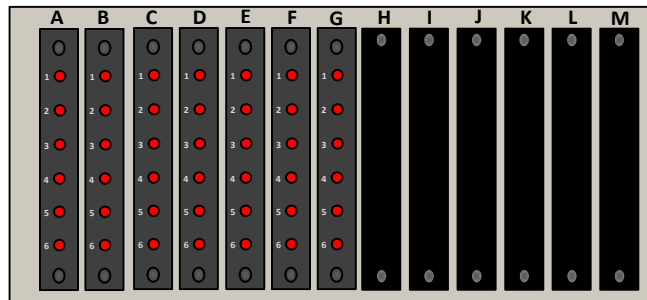
ST LIU/Pack labeling

Factory labeling of slots in LIU's take many forms:

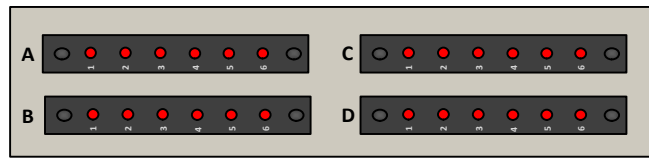
#### 1) 4u vertical pack LIU with 62.5 $\mu$ (A-G) & 50 $\mu$ (K-M) multimode, LC terminations



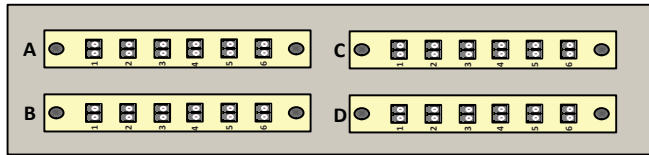
#### 2) 4u vertical pack LIU with 62.5 $\mu$ (A-G) multimode, ST terminations



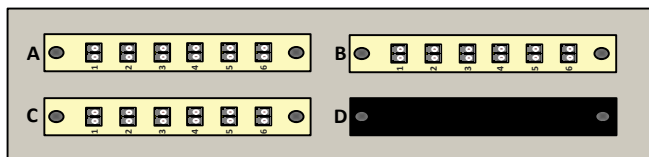
**3) 2u horizontal pack LIU with 62.5μ multimode, ST terminations**



**4) 2u horizontal pack LIU with singlemode, LC terminations**



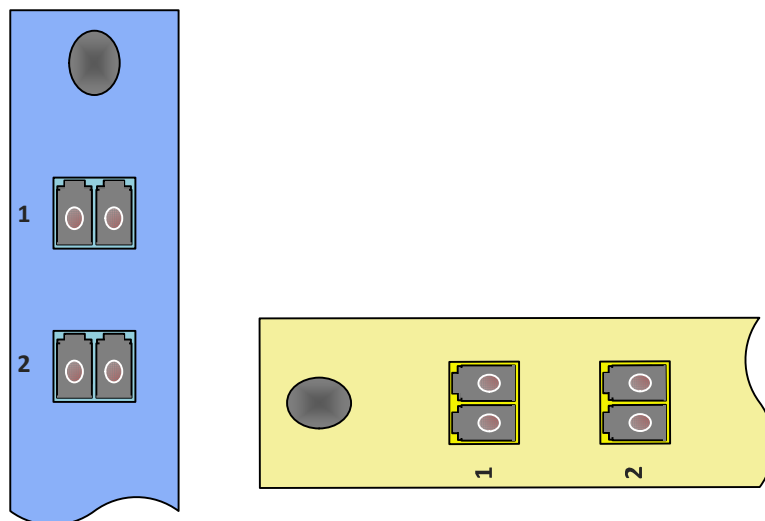
**5) 2u horizontal pack LIU with singlemode, LC terminations (A-C)**



NOTE the positions of packs B and C in this LIU compared to units #3 and #4

**Pack orientation**

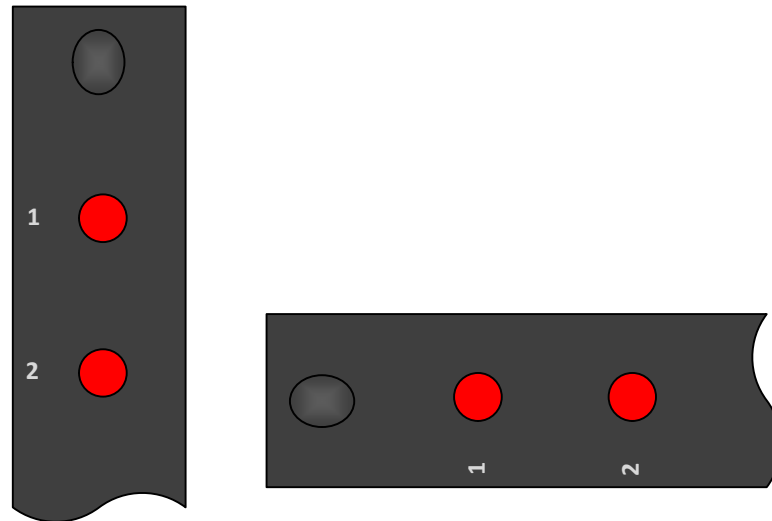
LC Connectors





For vertical pack, fiber strand 1 is in the upper left. For horizontal pack, fiber strand 1 is in the lower.

#### ST Connectors



For vertical pack, fiber strand 1 is on top. For horizontal pack, fiber strand 1 is on the left.

For all pack types, only factory labeling is used on packs. However, for internal use, ST strands are labeled as 1, 2, 3 etc, but LC strands are labeled as 1a, 1b, 2a, 2b ... That is to say, since LC fiber is terminated in pairs, PAIR 1 is considered 1a, 1b; PAIR 2 is considered 2a, 2b; etc.

More information on terminating and polishing fiber connectors is available in Appendix G.

## Appendix C

### MDF/IDF Names

Old Label	Old Description	New Label	New Description
acbmndf	Academic Building MDF	ACBMDF	Academic Building MDF
adnxmdf	Admin Annex MDF	ADNXMDF	Admin Annex MDF (HR Trailer)
adbmdf	Administration Building MDF	ADBMDF	Administration Building MDF
adbidf	Administration Building IDF	ADBIDF	Administration Building IDF
adhmdf	Admissions House MDF	LORING35MDF	35 Loring Ave MDF
ah108a	Alumni House MDF 108a	AHMDF	Alumni House MDF 108a
ahidf	Alumni House IDF	AHIDF	Alumni House IDF
audframeroom	Auditorium Frame Room	AUDMDF	Auditorium Frame Room
batesa	Bates A	BATESA	Bates A
batesb	Bates B	BATESB	Bates B
batesc	Bates C	BATESC	Bates C
batesd	Bates D	BATESD	Bates D
batese	Bates E	BATESE	Bates E
batesf	Bates F	BATESF	Bates F
batescommons	Bates Commons	BATESCOMMONS	Bates Commons
bhmdf	Bowditch Hall MDF	BHMDF	Bowditch Hall MDF
bhid3	Bowditch Hall 3 <sup>rd</sup> Floor IDF	BHID3	Bowditch Hall 3 <sup>rd</sup> Floor IDF
bhid6	Bowditch Hall 6 <sup>th</sup> Floor IDF	BHID6	Bowditch Hall 6 <sup>th</sup> Floor IDF
b1mdf	Building 1 MDF (Data Center)	B1MDF	Building 1 MDF (Old Data Center)
b1126	Building 1 126	B1ID1A	Building 1 126
b1170	Building 1 170	B1ID1B	Building 1 170
b1256	Building 1 256	B1ID2	Building 1 256
b1lib	Building 1 Library	B1LIB	Building 1 Library
baseball	Baseball Field	BASEBALLMDF	Baseball Field
catcove	Cat Cove	CATCOVEMDF	Cat Cove
ccrh117b	CCRH MDF 117b	ATLANTICMDF	Atlantic MDF 117b
ccrh225a	CCRH 225a	ATLANTICID2A	Atlantic 225a
ccrh234a	CCRH 234a	ATLANTICID2B	Atlantic 234a
ccrh317	CCRH 317	ATLANTICID3	Atlantic 317
ccrh407b	CCRH 407b	ATLANTIC4A	Atlantic 407b
ccrh414	CCRH 414	ATLANTIC4B	Atlantic 414
ciemdf	CIE MDF	CIEMDF	CIE MDF
dcidf	Dining Commons IDF	DCMDF	Dining Commons IDF
dove	Dove – 57 Loring Ave	LORING57MDF	57 Loring Ave
ecmdf	Ellison Campus Center MDF	ECCMDF	Ellison Campus Center MDF
ecentermdf	Enterprise Center MDF	ENTMDF	Enterprise Center MDF
ecenteridf	Enterprise Center IDF	ENTIDF	Enterprise Center IDF
hbmdf	Harrington Building MDF	HBMDF	Harrington Building MDF
hbidf	Harrington Building IDF	HBIDF	Harrington Building IDF

hmmddf	Horace Mann MDF	HMMDF	Horace Mann MDF
NA	NA	LAMDF	Lafayette Annex (287 Lafayette)
NA	NA	LA331MDF	331 Lafayette MDF
libid0	Library Level 0 IDF	LIBID0	Library Level 0 IDF
libmdf	Library Level 1 MDF	LIBMDF	Library Level 1 MDF
libid3	Library Level 3 IDF	LIBID3	Library Level 3 IDF
marsh105	Marsh105	MARSHMDF	Marsh 105
marsh168	Marsh168	MARSHID1	Marsh 168
marsh230	Marsh230	MARSHID2A	Marsh 230
marsh268	Marsh268	MARSHID2B	Marsh 268
marsh326	Marsh326	MARSHID3A	Marsh 326
marsh368	Marsh368	MARSHID3B	Marsh 368
marsh426	Marsh426	MARSHID4A	Marsh 426
marsh468	Marsh468	MARSHID4B	Marsh 468
marsh526	Marsh526	MARSHID5A	Marsh 526
marsh568	Marsh568	MARSHID5B	Marsh 568
mh209	Meier Hall MDF 209	MHMDF	Meier Hall MDF 213
mh215	Meier Hall 215	MHID2	Meier Hall 216
mhfanroom	Meier Hall Fan Room	MHID1	Meier Hall Fan Room
mh326	Meier Hall 326	MHID3	Meier Hall 326
okcmdf	Okeefe Center MDF	OKCMDF	Okeefe Center MDF
okcidf	Okeefe Center IDF	OKCID3	Okeefe Center IDF 3 <sup>rd</sup> floor
NA	NA	OKCID1	Okeefe Center IDF Fitness Center
okcfield	Okeefe Center Field	OCKFIELD	Okeefe Center Field
phmdf	Peabody Hall MDF	PHMDF	Peabody Hall MDF
phid3	Peabody Hall 3 <sup>rd</sup> Floor IDF	PHID3	Peabody Hall 3 <sup>rd</sup> Floor IDF
phid6	Peabody Hall 6 <sup>th</sup> Floor IDF	PHID6	Peabody Hall 6 <sup>th</sup> Floor IDF
publicsafety	Public Safety	POLICEMDF	Public Safety MDF
NA	NA	POLICEIDF	Public Safety IDF
stanleymdf	Stanley Building MDF	STANLEYMDF	Stanley Building MDF
NA	NA	STANLEYDC	Stanley Building Data Center
sbmdf	Sullivan Building MDF	SBMDF	Sullivan Building MDF
sbidf	Sullivan Building IDF Attic	SBIDF	Sullivan Building IDF Attic
tennis	Tennis Court	TENNISMDF	Tennis Court
NA	NA	VHMDF	Viking Hall MDF (West bar)
NA	NA	VHID2W	Viking Hall West bar 2 <sup>nd</sup> Floor IDF
NA	NA	VHID3W	Viking Hall West bar 3 <sup>rd</sup> Floor IDF
NA	NA	VHID4W	Viking Hall West bar 4 <sup>th</sup> Floor IDF
NA	NA	VHID1E	Viking Hall East bar 1 <sup>st</sup> Floor IDF
NA	NA	VHID2E	Viking Hall East bar 2 <sup>nd</sup> Floor IDF
NA	NA	VHID3E	Viking Hall East bar 3 <sup>rd</sup> Floor IDF
NA	NA	VHID4E	Viking Hall East bar 4 <sup>th</sup> Floor IDF

## **Appendix D**

### **Sample Cut Sheet:**

<b>Wiring Closet</b>	<b>RACK</b>	<b>PANEL</b>	<b>PORT</b>	<b>JACK Room Number</b>
MHMDf	1	B	1	112
MHMDf	1	B	2	112
MHMDf	2	B	3	151
MHMDf	2	C	1	151
MHMDf	3	B	1	151
MHMDf	3	C	1	152
MHID3	1	B	1	200
MHID3	1	B	2	200
MHID3	1	B	3	203
MHID3	2	B	1	204
MHID3	2	C	1	204
MHID3	2	C	2	206

## **Appendix E**

### **Racks & Cable Trays**

#### **Standard Single Relay Rack:**

Single Relay Racks are the standard “flat” racks used for patch panels and equipment that requires only a two-point mount. The University no longer standardizes on a specific manufacturer, however the following criteria must be met:

- 19”
- 84”/45-Rack Units
- Threaded mounts (no clips)
- Minimum 700lbs capacity
- Rack Units must be stamped into finish of rack and visible
- Black finish
- When adding a rack to an existing IDF, the new rack must match existing racks as closely as possible.

This rack type is used in both MDF’s and IDF’s. All racks in a closet must be the same design. If adding a rack to an existing closet, new rack must match existing racks as closely as possible.

#### **Open Box Rack:**

An Open Box Rack is similar to the traditional Rack Enclosure, used for equipment that requires a four-point mount. However, the Open Box Rack does not have front, back, side or top panels. It does, however, have power distribution. At this time, the standard is not defined. However, 7’ x 36” racks are recommended.

This rack type is used in MDF’s only.

#### **Rack Enclosure:**

The traditional box enclosure with sides, top, door and back.

At this time, the standard is not defined. However, 7’ x 40” racks are recommended.

This rack type is used in MDF’s and where ever a lockable rack is needed.

#### **Cable Trays**

Cable trays will be installed above communication racks, parallel to the face of the racks. Ceiling heights should accommodate trays for applicable usage and codes. Tray installations will be designed based on local need, however generally speaking they will be no less than 12” wide. Ladder tray is acceptable in most cases, however specific applications may call for mesh-basket or solid/enclosed trays.

Trays will also be installed along the ingress/egress path inside an IDF/MDF/CDF to support cables not wholly contained in that space. If necessary and agreed upon, D-rings and/or J-Hooks may also be used.

## Appendix F

### MDF/IDF Room Size Requirements:

The following guidelines should be followed when configuring an MDF or IDF

- A margin of 6" must be maintained between the swing of the door and the front of a communication rack
- A margin of 2" must be maintained between the swing of the door and the side of a communication rack
- Ceiling heights are a minimum of 8'. Since fire codes usually require a minimum distance of 18" from a sprinkler head and to accommodate cable trays, a 9 ½' or higher ceiling is preferred. A finished ceiling is not required in a wiring closet. However, if the decking material is prone to flaking, a ceiling is preferred.
- Port counts are determined by the TOTAL number of Voice Trunk Ports (building feeds and riser), Station Ports (Cat 6\*), fiber ports and Video ports (Coax) in a closet.

Specific cabling must exceed Category 6 specifications (e.g "Cat 6+"). See *Cable Types* for more information.

The table below is an APPROXIMATION of space required for data closets. These measurements are based on open, unobstructed floor space. Obstructions may include support columns, floor-corings, security enclosures on walls, electrical conduits, wall-mounted panels, electrical sub-panels non-standard racks, etc. If such obstructions/additions are present, additional space will be needed. ONLY DEVICES RELATED TO IT SERVICES ARE TO BE INSTALLED IN MDF/IDFs.

<i>Total Ports</i>	<i>Racks Needed</i>	<i>Min Room Size</i>
<337	1	4'10" x 6'9"
337-768	2	7' x 6'9"
769-1200	3	9'3" x 6'9"
1201-1632	4	7' x 10'
1633-2064	5	9'3" x 10'
2065-2496	6	9'3" x 10'
2497-2928	7	11'6" x 10'

**Electric note:** THESE ARE GENERAL GUIDELINES and should be verified with ITS/Networking prior to commitment and installation. All receptacles shown in diagrams are Quad outlets. If using option (2), only duplex outlets are required. Outlets labeled "A" are required, whether using option (1) or (2). ***Overhead lighting is required such that both the front and back of the racks are lighted sufficiently to allow reading of labels without supplemental lighting.***

**<sup>1</sup>Central UPS:** If wired to a central UPS, outlets are to be placed above the Relay Racks, but not attached to the racks. At least 1 building-electric (A) Quad will also be placed in room. One UPS-quad outlet is required for every 2 racks, or fraction (ie 3 racks requires two quad outlets) **OR** if twistloc (e.g L5-20R) outlets are required, there should be one (1) receptacle per rack. Each UPS-Quad or twistloc outlet is to be on a separate circuit.

**<sup>2</sup>Local UPS's:** If not on a central UPS, outlets are to be placed at standard (16") height at locations marked. At least two Duplex outlets (A and B) are required, and on separate circuits. For closets with more than 2 racks, each rack will require a separate duplex outlet. No more than 2 Duplex outlets are to be on the same circuit.

Unless otherwise specified, outlets are NEMA 5-20R. Power Distribution Units currently in use require L5-20R receptacles. If local Uninterruptable Power Supplies (UPS) are to be used to support more than 2 racks, 1 or more L5-30P receptacles may be needed. Because of an increased dependence on the network for security devices new, renovated and upgraded data closets should be placed on emergency generator power.

## Room and Equipment Measurements


### Rack-to-Front/Back Walls

Measurements based on standard 19" Relay Rack; Measurements taken from FRONT of vertical support, where equipment would be screwed to rack.

- A MINIMUM of 43" is required from the FRONT of a rack to the FRONT wall (or FRONT of opposite rack, if using two rows of racks).
- A MINIMUM of 38" is required from the FRONT of a rack to the BACK wall.

### Rack-to-Side Wall

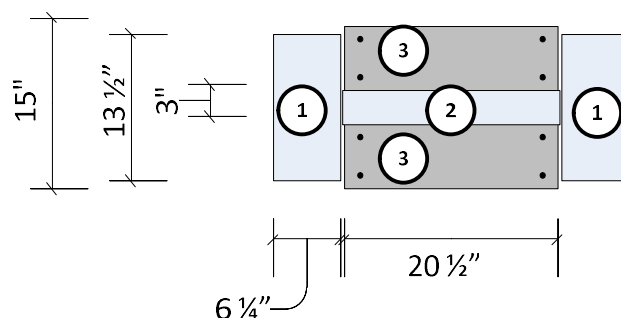
- If vertical cable management is installed A MINIMUM of 24" is required from the end of the last communication rack in a row to the side wall;
- If vertical management is not yet installed, the MINIMUM distance from the end of the last rack to the side wall is 30".

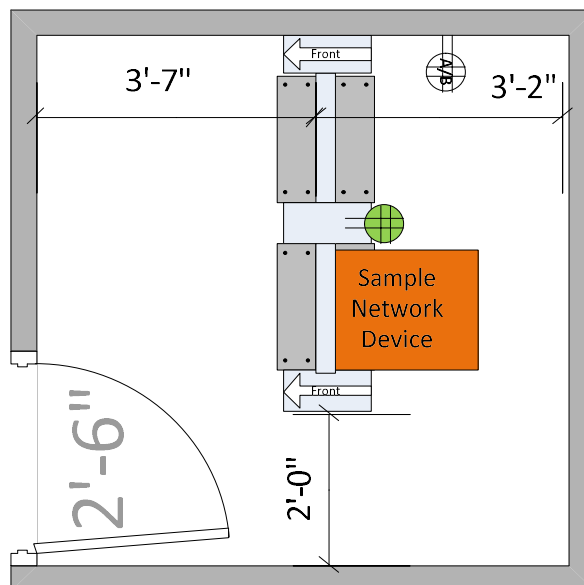
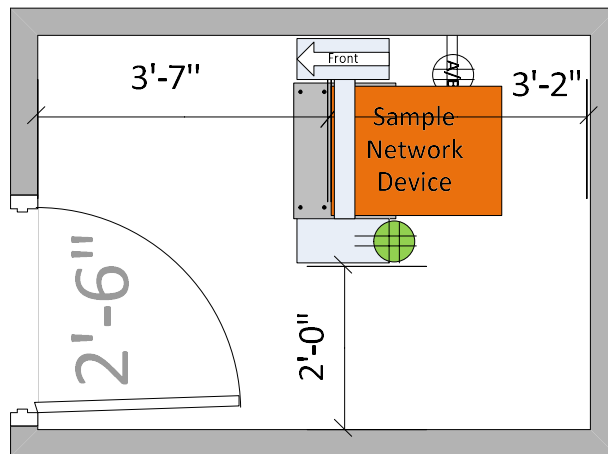
<sup>1</sup> - Central UPS outlets (standard NEMA 5-20R). If twistloc (e.g L5-20R) outlets are required, there should be one (1) receptacle per rack, centered above rack.

<sup>2</sup> - Local UPS outlets

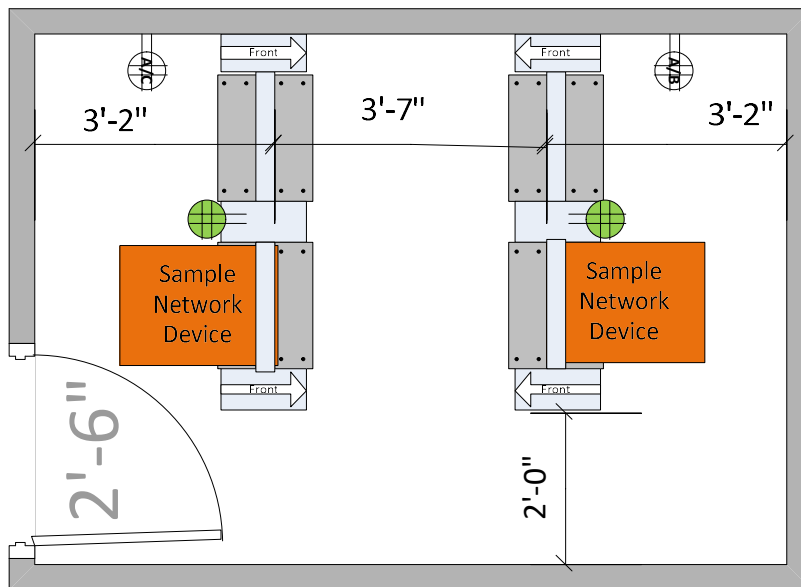
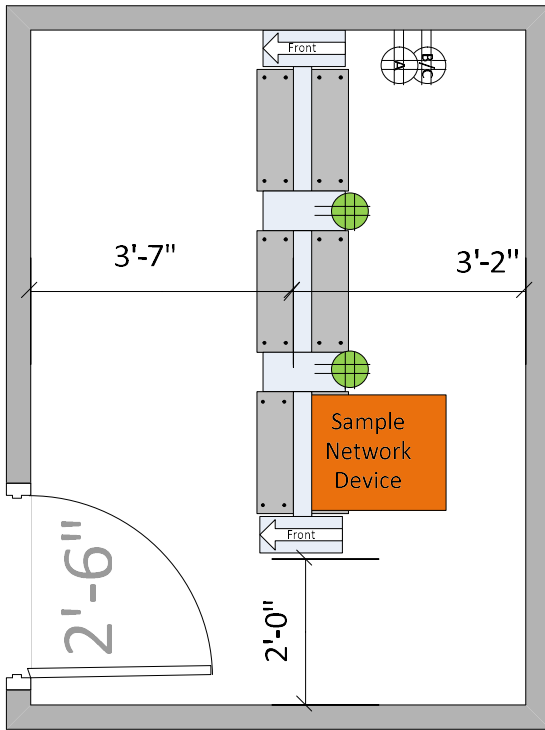
Rack Measurements (looking down on rack)

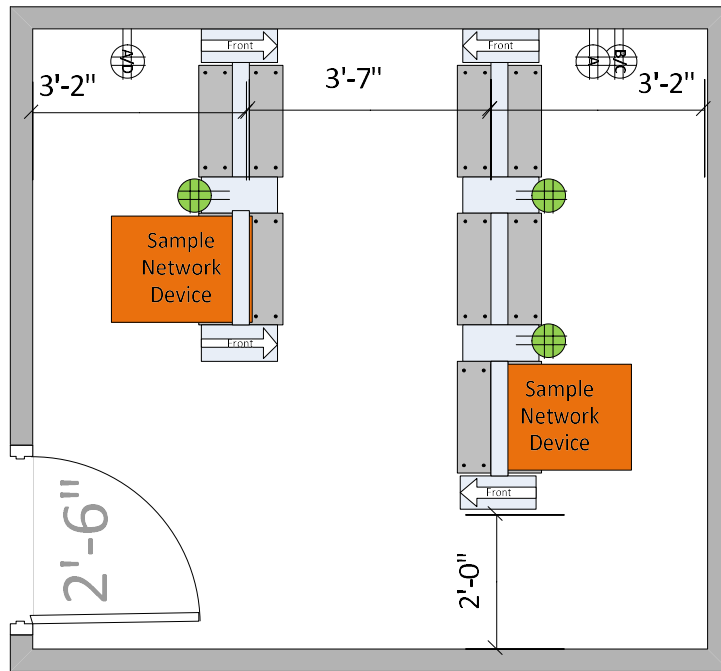
- ① Vertical cable managers (on sides of rack)
- ② Top horizontal support of rack
- ③ Floor brackets

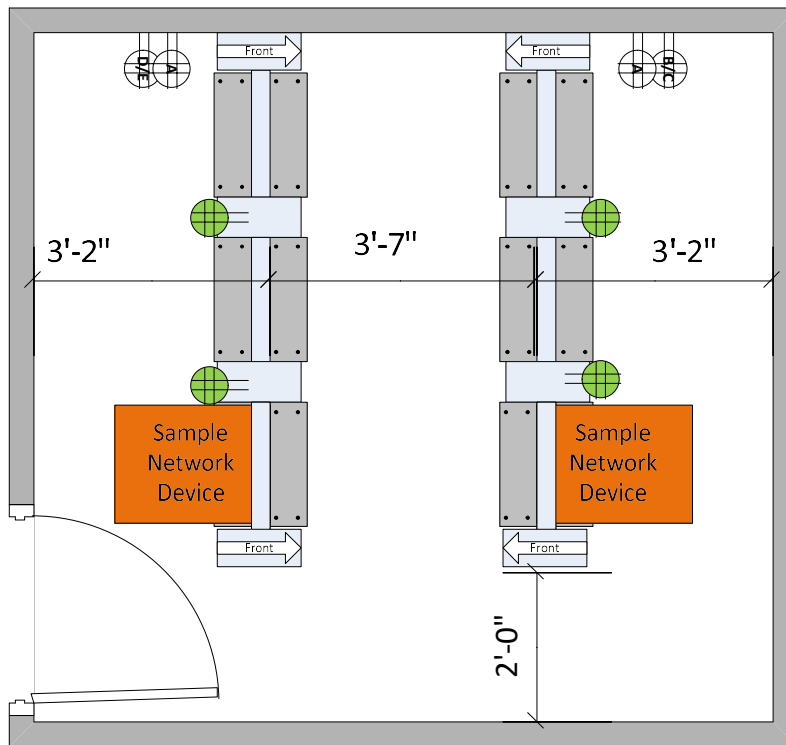


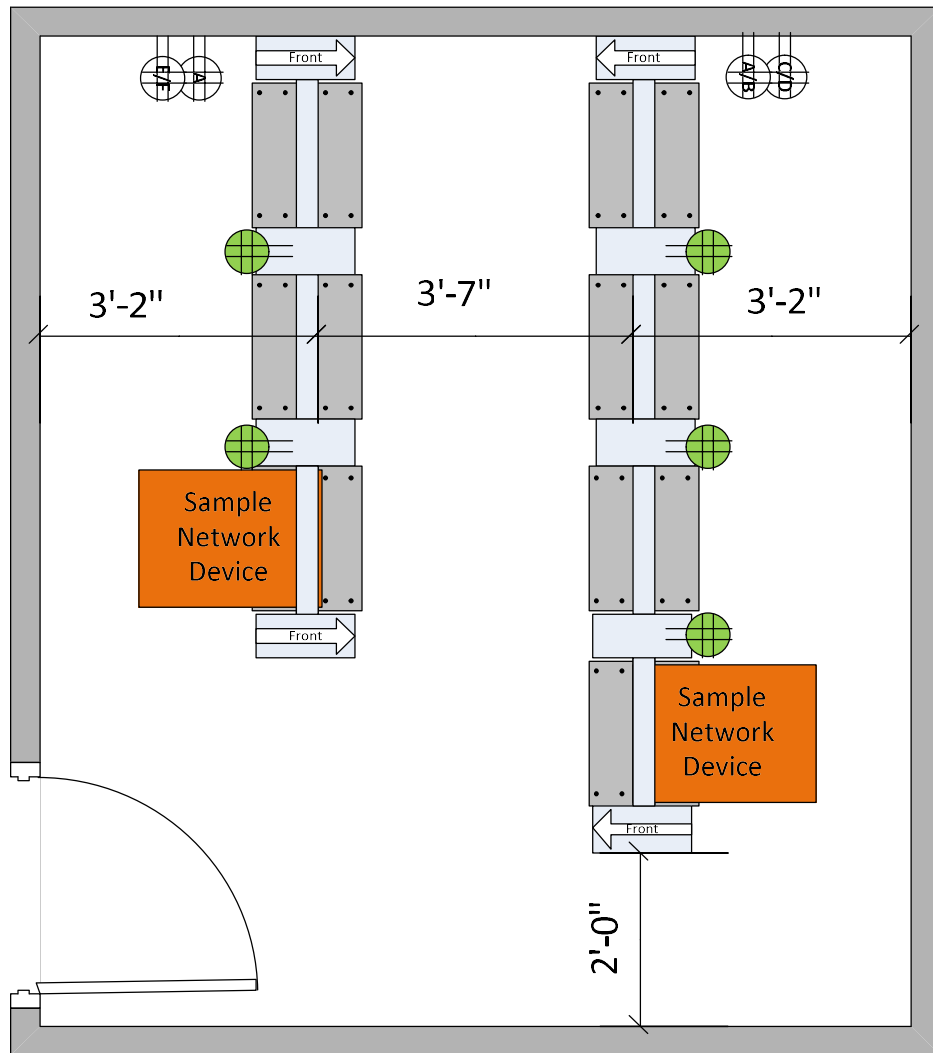












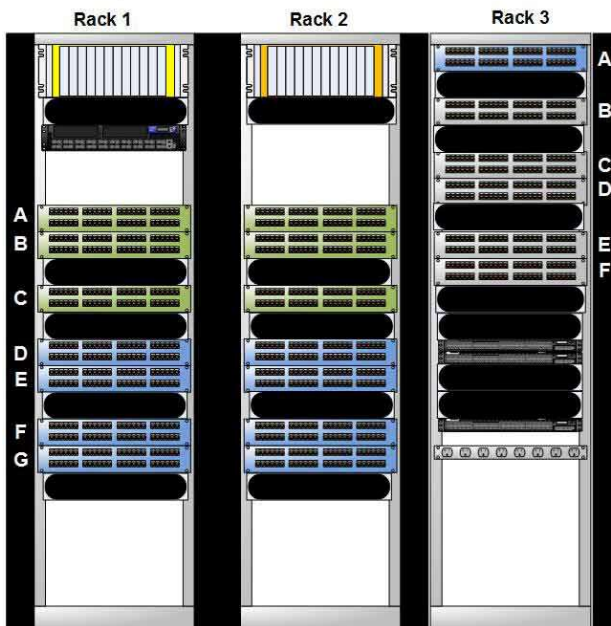
### **IDF/MDF/CDF Room Signage**

For security purposes, Communications Closets (IDF/MDF/CDF) should not be labeled as such. Only a room number should be placed at the door.

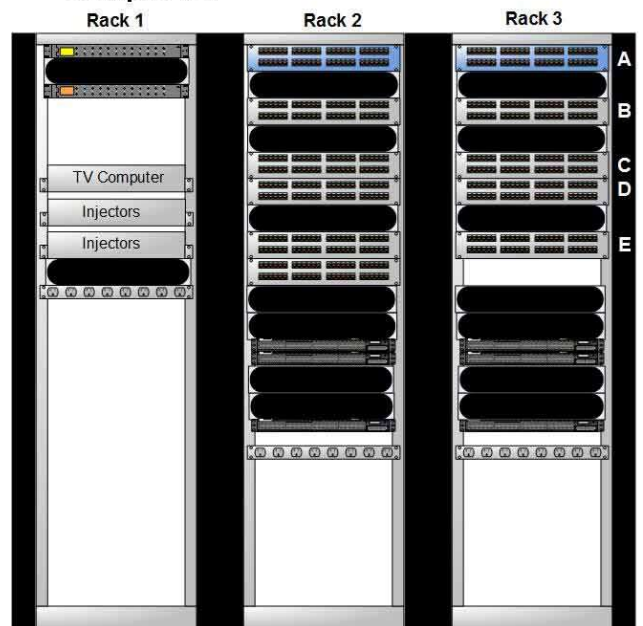
## Sample equipment, panel, shelf, LIU placement guide (within racks)

This section is meant as a guide for the placement of equipment, shelves, low-voltage wiring, etc within racks.

**Sample MDF**



**Sample IDF**



### LEGEND

	Single Mode Fiber Panel		PDU
	Multi Mode Fiber Panel		Network Switch (devices)
	SM Fiber Panel		Network Switch (backbone)
	MM Fiber Panel		Cable Manager
	Voice Panel (to Switch)		Shelf
	Voice Panel (IDF distribution)		Coax Panel (no longer used for new installations)
	Data Panel (Station wiring)		

**Data closets (IDF's, MDF's, Telecom Frame Rooms, etc) are secure facilities. They are not to be used for storage of non-IT equipment. Services unrelated to security and IT are not to be installed in data closets. Third party equipment relating to security is to be coordinated with Networking Services BEFORE mounting/installing/configuring in a data closet.**

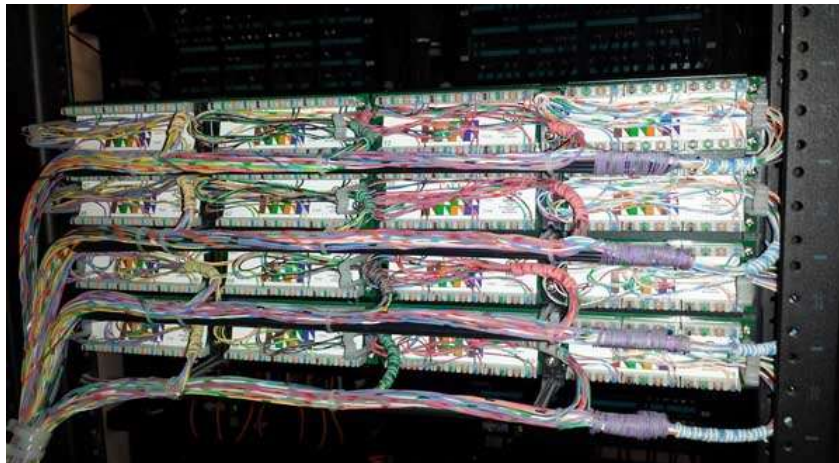
## **Appendix G**

### **Means & Methods Boilerplate:**

The following is meant as a minimal set of guidelines for any installation/renovation of data, video or voice cabling at Salem State University. As of 27 February 2004, these were the most up to date specifications. A more complete and up to date guide may be obtained through the Facilities Department by calling (978) 542-HELP.

- All wiring/cabling will be installed as per BiCSi specifications and will be properly supported from the building's structural elements, independent of any drop ceilings or other suspended building systems.
- All ceiling tiles, removed or pushed away, will be properly reinserted by the close of business each day. It is the responsibility of the contractor to provide all ceiling tile replacements necessary. The contractor is also responsible for the repair of any property damage that may occur by them, their vendors or their subcontractors. ALL damage is to be reported as soon as possible to Facilities to help facilitate timely repairs. Facilities can provide specifications for our institutional standards as required.
- All trash generated by the contractor must be removed from the University by the vendor at the close of each business day and the work area will be broom swept before the contractor leaves each day. Construction materials are not to be placed in University trash receptacles or dumpsters. Should a dumpster be required by the contractor, the Office of Facilities Management will assist in identifying a location.
- All exposed conduit/raceways will be installed in a neat and workmanlike manner. All conduit/raceway will be mechanically fastened to the support structure.
- All wall penetrations will be appropriately filled with material appropriate for the purpose. All firewall penetrations are to be specifically noted and reported to the Facilities Office for inspection. In the event that an existing penetration that was not previously filled is reused, the contractor must seal that penetration.

**The following photos are meant as a guide to represent what is expected in the quality of cable terminations and fiber polishing. Salem State expects the quality of all work to meet or exceed these samples.**

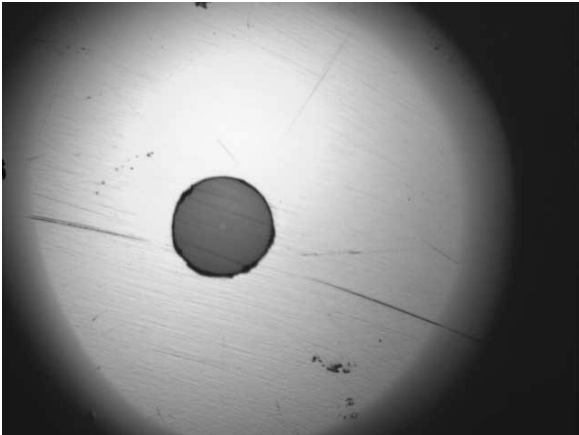
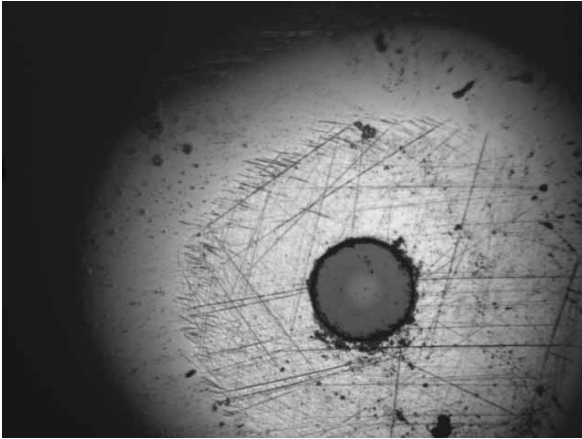




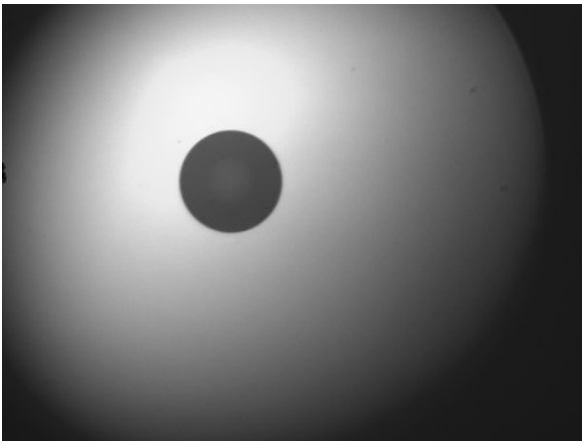
**Note that strain-relief is to be used for all copper cabling. Cables will be dressed in to the strain-relief with either Velcro or zip ties. Further, all cable bundles will be dressed in at no greater than 36" segments where visible and no more than 60" segments where not in cable tray.**



**The following are examples of incomplete polishing of fiber connectors. These connectors will pass testing, but are not acceptable (magnification 200X using JDSU P5000i microscope):**



**The following is a completely polished fiber connector:**



**Networking Services requires that all fiber strands that are field-terminated use Epoxy/Polish terminations rather than Unicam.**



## **Appendix H**

### **Reserved Cable and Icon Colors**

Unless otherwise specified or agreed upon in writing, the following colors will be used for copper wiring:

#### **Station Wiring (in-wall):**

Category 6 family: Black<sup>2</sup>, Purple  
Category 5e: Blue<sup>2</sup> or White<sup>2</sup>  
Wireless: Orange, Black<sup>2</sup>  
Low-skew: Grey, Maroon

#### **Patch cables:**

Category 6 family: Black<sup>2</sup>  
Category 5e: Blue<sup>2</sup>, White<sup>2</sup>  
Wireless: Orange  
Crossover: Red

Security devices (ePhones, CCTV, etc) do not require a different color cable (horizontal wiring or patch). However, they are to be marked using light red icons at each Patch Panel port.

#### **RESERVED ICON COLORS**

Light Blue (Ortronics OR-40326500) –	Telephone (non-security)
Light Red (Ortronics OR-40322500) –	Security (ephones, cameras, etc)
Light Orange (Ortronics OR-40323500) –	Wireless Arrays
Purple (Ortronics OR-40327500) –	A/V devices
Light Green (Ortronics OR-40325500) –	Low Skew
White (Ortronics OR-40309200) --	Facilities (Energy Management, etc)

#### **RESERVED CABLE COLORS (in wall)**

Black	Category 6 family horizontal wiring AND patch cables
White	Category 5e horizontal wiring AND patch cables
Blue	Category 5e horizontal wiring AND patch cables
Grey	Low-skew
Maroon	Low-skew
Orange	Wireless Access Point/Array
Purple	Facilities' Functions/Building Controls
Red	Crossover patch cables

#### **Color Consistency**

Patch cables are to be a consistent color within a closet for a given application (ie Category 5e cables may be Blue or White, but only one of those colors is to be used in any single IDF). Similarly, horizontal station cabling for each wiring closet will be the same color for each Category-grade of copper. Do NOT confuse colors used for cabling with colors used for icons. Due to legacy installations, they are not always the same.

---

<sup>2</sup> Wireless feeds will be Orange, whether Cat 5e or Cat 6. If orange is not available, Black Cat 6 may be used

**CONTRACTORS ARE RESPONSIBLE FOR PROVIDING ENOUGH ICONS OF EACH COLOR BASED ON CABLE TYPES INSTALLED.**

## **Appendix I**

### **Cable Certification Requirements & Sample Cable Test Reports**

The following are the minimum testing requirements to be submitted for Coax (video), UTP (xBaseT/Data), Telco trunk and Fiber Optic (Single and Multimode). Note, a value of "Pass/Fail" is only acceptable for non-quantifiable values (e.g presence of mechanical connectors) and for an overall rating of the cable. Actual values are otherwise expected.

#### **Coax (75Ω)**

Length  
Continuity  
Short identification  
Splitter/mechanical connector identification  
Overall Pass/Fail

#### **UTP (Category 5e @ 100MHz, Category 6 family @ 250MHz)**

Length  
Crossed-wire identification  
Crossed pair identification  
Continuity/Split-wire identification  
Insertion loss fault  
Bandwidth fault  
Delay skew  
dB loss  
Mechanical connector/splice identification  
Overall Pass/Fail

#### **Telco trunk**

Open-loop conductor identification  
Low-loop current  
High-loop current  
Short identification  
Crossed-pair identification  
dB loss  
split connections

#### **Fiber Optic cable (Multimode @ 850/1300nm, Singlemode @ 1310/1550nm)**

OTDR trace, identifying:  
Wavelengths  
Cable length  
Power loss (dB)  
Faults (breaks, splits, cracks, faulty connectors)  
Presence of mechanical/fusion splices  
Overall Pass/Fail

The following are sample Certification Reports. Not all cable types are represented in these samples. The samples are meant as a guideline. Graphs are required for all fiber documentation. They are preferred, but not required, for Category 6 family of cabling. Graphs are not necessary for copper cables of quality less than Category 5e. While the samples below come from Fluke, Salem State University does not endorse or require the use of any particular cable reporting tool.



## Cable ID: 3A-K017

## Test Summary: PASS

Date / Time: 03/02/2007 11:52:11am  
 Headroom: 10.7 dB (NEXT 12-36)  
 Test Limit: TIA Cat 6 Channel  
 Cable Type: Cat 6 UTP

Operator: Helmut  
 Software Version: 1.3100  
 Limits Version: 1.0200  
 NVP: 69.0%

Model: DTX-1800  
 Main S/N: 8582197  
 Remote S/N: 8649008  
 Main Adapter: DTX-CHA001  
 Remote Adapter: DTX-CHA001

### Wire Map (T568B)

PASS



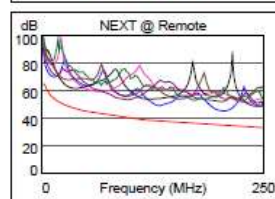
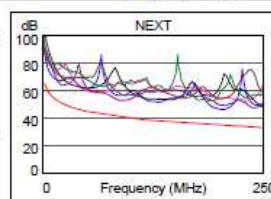
16 ft



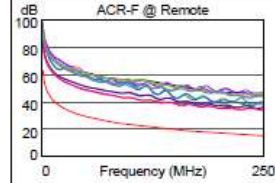
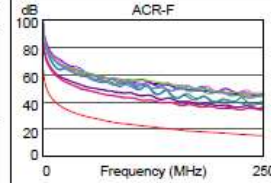
Length (ft), Limit 328	[Pair 12]	16
Prop. Delay (ns), Limit 555		23
Delay Skew (ns), Limit 50		0
Resistance (ohms)	[Pair 12]	1.0
Insertion Loss Margin (dB)	[Pair 45]	33.9
Frequency (MHz)	[Pair 45]	250.0
Limit (dB)	[Pair 45]	35.9



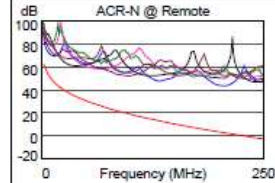
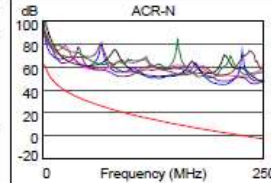
	Worst Case Margin	Worst Case Value
<b>PASS</b>	MAIN	SR
Worst Pair	12-36	12-36
NEXT (dB)	11.7	10.7
Freq. (MHz)	202.5	202.5
Limit (dB)	34.7	34.6
Worst Pair	36	36
PS NEXT (dB)	12.7	12.7
Freq. (MHz)	202.5	202.5
Limit (dB)	31.8	31.7



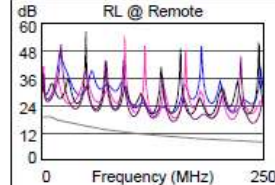
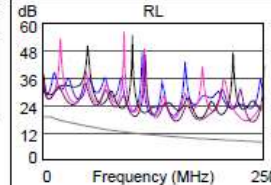
	Worst Case Margin	Worst Case Value
<b>PASS</b>	MAIN	SR
Worst Pair	36-78	78-36
ACR-F (dB)	17.9	18.6
Freq. (MHz)	155.0	247.0
Limit (dB)	19.5	15.4
Worst Pair	36	36
PS ACR-F (dB)	18.0	18.4
Freq. (MHz)	223.0	247.5
Limit (dB)	13.3	12.6



	Worst Case Margin	Worst Case Value
<b>N/A</b>	MAIN	SR
Worst Pair	12-36	12-36
ACR-N (dB)	20.9	41.9
Freq. (MHz)	8.5	202.5
Limit (dB)	51.9	2.9
Worst Pair	36	36
PS ACR-N (dB)	22.1	42.9
Freq. (MHz)	9.3	202.5
Limit (dB)	48.5	0.0



	Worst Case Margin	Worst Case Value
<b>N/A</b>	MAIN	SR
Worst Pair	78	78
RL (dB)	6.9	8.6
Freq. (MHz)	149.5	238.0
Limit (dB)	10.3	8.2



### Compliant Network Standards:

10BASE-T	100BASE-TX	100BASE-T4
100BASE-T	ATM-25	ATM-51
ATM-155	100VG-AnyLan	TR-4
TR-10 Active	TR-10 Passive	



**Cable ID: FIBER 11**

**Test Summary: PASS**

Date / Time: 04/16/2007 07:41:57am  
Test Limit: General Fiber  
Cable Type: Multimode 62.5

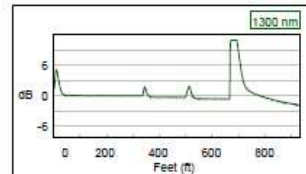
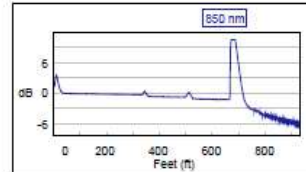
Operator: JOHN ADAMS  
Software Version: 1.4516  
Limits Version: 1.2000  
End1: EQUIPMENT ROOM  
End2: FLOOR 9 TR

Model: DTX-1800  
Main S/N: 9348009  
Main Adapter: DTX-OTDR-QMOD

**OTDR End1 PASS**

Date / Time: 04/16/2007 07:41:56am  
Cable Type: Multimode 62.5  
Tester: DTX-1800 (9348009 v1.4516)  
Module: DTX-OTDR-QMOD (8000011 v1.4516)  
Overall Length: 666.7 ft **PASS**  
Overall Loss  
850 nm: 1.24 dB **PASS**  
1300 nm: 0.70 dB **PASS**  
ORL: N/A

Location (ft)	850 nm (n=1.4960)		1300 nm (n=1.4910)	
	Loss (dB)	Status	Loss (dB)	Status
0.0	N/A	N/A	N/A	N/A
336.6	0.32	PASS	0.26	PASS
501.0	0.32	PASS	0.17	PASS
666.7	N/A	N/A	N/A	N/A





## Cable ID: SM Length/Loss

## Test Summary: PASS

Date / Time: 04/04/2003 02:28:55pm  
Headroom: 0.57 dB (Loss)  
Test Limit: TIA-568B Fiber Backbone  
Cable Type: AFL Singlemode, SMF

Operator: TOM  
Software Version: V1.3.138  
End1: MAIN END1  
End2: MAIN END2

Model: OptiFiber

### Loss End2-1 PASS

Date / Time: 04/04/2003 02:28:40pm  
Cable Type: AFL Singlemode, SMF  
Tester: OptiFiber (HM22 V1.3.138)  
Module: OFTM-5632 (9999904 V1.3.138)

Propagation Delay (ns)	1374.8	
Length (ft)	922.5	PASS
Limit 16405		
	1310 nm	1550 nm
Result	PASS	PASS
Loss (dB)	0.55	0.36
Loss Limit (dB)	2.24	2.24
Loss Margin (dB)	1.69	1.88
Reference (dBm)	-10.74	-10.87

n = 1.4860  
Number of Adapters: 2  
Number of Splices: 2  
Reference Date: 04/03/2003 04:33:08pm  
Method A.1

### Loss End1-2 PASS

Date / Time: 04/04/2003 02:28:55pm  
Cable Type: AFL Singlemode, SMF  
Tester: OptiFiber (8129031 V1.3.138)  
Module: OFTM-5632 (9999908 V1.3.138)

Propagation Delay (ns)	1374.8	
Length (ft)	922.5	PASS
Limit 16405		
	1310 nm	1550 nm
Result	PASS	PASS
Loss (dB)	1.67	1.26
Loss Limit (dB)	2.24	2.24
Loss Margin (dB)	0.57	0.98
Reference (dBm)	-10.80	-10.62

n = 1.4860  
Number of Adapters: 2  
Number of Splices: 2  
Reference Date: 04/03/2003 04:33:08pm  
Method A.1

#### Compliant Network Standards:

FDDI	1000BASE-LX	10GBASE-LX4
10GBASE-L	10GBASE-E	ATM 52 Fiber Optic
ATM 155 Fiber Optic	ATM 622 Fiber Optic	Fibre Channel 266
Fibre Channel 100-SM-LC-L	Fibre Channel 200-SM-LC-L	Fibre Channel 400-SM-LC-L
Fibre Channel 1200-SM-LC-L		

Fibre Channel 1200-SM-LC-L: This channel is certified for 1200 Megabytes per second Fibre Channel application over singlemode fiber with long wavelength 1310 nm laser source.



### Cable ID: SM OTDR

Date / Time: 04/14/2003 04:55:18pm  
Test Limit: General Fiber  
Cable Type: Generic, SMF

Software Version: V1.3.143  
End1: DATA CENTER  
End2: CLOSET

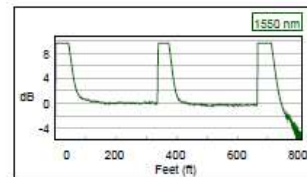
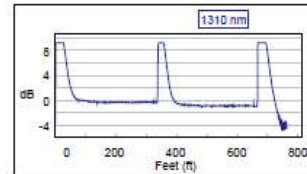
### Test Summary: PASS

Model: OptiFiber  
Main S/N: HM21  
Main Adapter: OFTM-5632

### OTDR End1 PASS

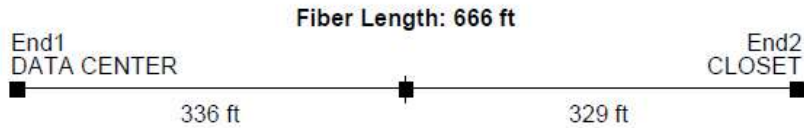
Date / Time: 04/14/2003 04:54:06pm  
Cable Type: Generic, SMF  
Tester: OptiFiber (HM21 V1.3.143)  
Module: OFTM-5632 (9999909 V1.3.143)  
Operator: PV PERSON  
Comment: 100M SPOOL  
Overall Length: 666.8 ft  
Overall Loss  
1310 nm: 0.92 dB **PASS**  
1550 nm: 0.33 dB **PASS**  
ORL: N/A

Location (ft)	1310 nm (n=1.4650)		1550 nm (n=1.4670)	
	Loss (dB)	Status	Loss (dB)	Status
93.1	0.25	PASS	N/A	N/A
336.5	0.58	PASS	0.31	PASS
666.0	0.00	PASS	N/A	N/A
668.8	N/A	N/A	N/A	N/A



### ChannelMap

Date / Time: 04/14/2003 04:51:59pm  
Tester: OptiFiber (HM21 V1.3.143)  
Module: OFTM-5632 (9999909 V1.3.143)  
Operator: PV PERSON



## **Appendix J**

### **Design & Bid Document Inclusion Checklist**

The following items should be included in Bid Specifications for Construction and Renovation Projects. All items below are relevant to new construction. With respect to renovated spaces, ITS/Networking should be consulted prior to issuing bid documents to verify applicable items.

This appendix is meant as a template to remind those creating bid documents of the items that should be included in those documents. By including those items, it is implied that those items will comply with the standards defined in this document with respect to material, quality, quantity and installation.

#### **MDF/IDF**

- ☐ Racks
- ☐ Rack placement
- ☐ Pathways in to MDF/IDF, Cable Tray, Capacity
- ☐ Room Size
- ☐ Cable Management – vertical and horizontal
- ☐ Electric – PDU's, UPS's (local or central), outlets (quantity, location, type), Room Lighting
- ☐ HVAC – Cooling, Venting
- ☐ Fiber Optic LIU's – existing (need to be converted to LC?), placement
- ☐ Layout of room
- ☐ Rack Elevation design
- ☐ Panels – Coax, Voice, Data; icons
- ☐ Non-IT equipment in IDF/MDF\* – card access panels; AV equipment; Alarm panels
- ☐ Card Access to room
- ☐ Patch Cables
- ☐ Labeling of panels, LIU's, racks

#### **Work/Living Spaces**

- ☐ Jacks
- ☐ Faceplates
- ☐ Cable types and colors
- ☐ Placement of jacks in modular work spaces (location and type, to be coordinated with furniture manufacturer)
- ☐ Installation of wireless antennas/access points/arrays
- ☐ Labeling of jacks

#### **Interconnect/Backhaul feeds**

- ☐ Existing capacity
- ☐ New copper, fiber (epoxy/polish), wireless connectivity – fiber types/connectors, pair counts
- ☐ Conduits, pathways

#### **Global**

- ☐ Required documentation – test results (fiber, copper, coax); cut sheets. Test results and cut sheets must be submitted 1 week prior to facilities opening.

**\*MUST be coordinated with Networking Services BEFORE bid.**



## **12-Month Change Log**

This log documents changes to this document over the previous 12 months.

### **2021.07.08**

- Reserved purple cable for Facilities' applications (e.g Energy Management)

### **2021.08.23**

- Added definition for white icons (Facilities)
- ADNXMDF definition retained in IDF names, but changed to strike-thru. Several buildings will be removed from list in the next year. At that time the matrix will need to be rebuilt.
- Reindexed

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