



University of Houston
Information Technology
Telecommunication Infrastructure
Standards

As prepared by IT Network Operations

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1.0 Revision Notes

Current revision is 1.19

Revision Date: November 2012

Updated the wording and naming conventions throughout the document. Added specifications for Security cameras, Television, and wireless.

2.0 Introduction and Purpose

2.0.1 Introduction

The specifications set forth in this document are designed to be the minimum standard of UH structured wiring systems. They are to be viewed as general requirements and specifications to allow for adjustment in today's ever growing and changing telecommunications industry. These specifications may be reviewed and modified by IT Network Operations (**ITNO**) to accommodate specific space requirements as well as any functional or special design needs.

Wiring specifications as well as those specifications designed to support wiring are constantly changing as per the dynamic changes of industry and networking standards evolve. **All contractors and outside Information Technology consultants will be required to receive approval from ITNO before submitting design and commencing an installation to ensure that all current media types, media support systems and installation standards are being followed.** The designated specifications for material and products, space requirements associated with the Telecommunication Facilities are, however, to be considered standards in choosing material and products to be installed.

Contractor shall be required to install, test and document all structured wiring systems specified in this document keeping in mind that these specifications and standards are not to be used for assimilating a final bid but as general guide. Final specifications will be a collaborative effort between the installation

contractor, architect/designer, the occupant, and ITNO. Specific detailed specifications will be defined for any given project based on the individual purpose of the space and will be a culmination of the collaborative effort of the involved parties with final approval received from ITNO.

2.0.2 Purpose

The purpose of this document is to create a starting point for collaboration between the interested parties to ensure that all industry specifications and standards and the creation of a specific bid document of high quality which will contain accepted industry standards and specifications.

The network cabling standards in this document are adapted from relevant industry standards and practices and are based on current practices for new cabling installations. These standards provide the following benefits for the University:

- Support for best practices.
- Provide multi-vendor equipment and services
- Improved management of building space resources
- Reduced costs for network wiring installation, support, and management
- Reduced training requirements for support personnel
- Consistency of wiring at different locations
- Improved reliability of network cabling infrastructure
- Improved trouble-shooting and fault isolation
- Improved ability to manage system moves, adds and changes

3.0 Contact Information

Information Technology Network Operations (ITNO)

Attention: Manager of ITNO
4211 Elgin
Houston, Texas 77204 -1010
(713)743-1411

4.0 Codes, Standards and Regulations

4.0.1 Overview

Federal, state, and local codes, rules, regulations, and ordinances will govern the work, and is part of the specifications outlined here on. If the contractor notes an item(s) in the drawings or the specifications, representing code violations, the contractor shall promptly call them to the attention of the University of Houston in writing. Written notice shall be sent to: ATTN: Manager of ITNO. Where the requirements of other sections of the specifications are more stringent than applicable codes, rules, regulations, and ordinances, the specifications located herein shall apply.

The design, manufacture, test, and installation of telecommunications cabling networks at the University of Houston shall be completed per manufacturer's requirements and in accordance with NFPA-70, state codes, local codes, requirements of authorities having jurisdiction, and include but are not limited to the following agencies, standards, and publications:

4.0.2 AGENCIES

ANSI American National Standards Institute

BICSI Building Industry Consulting Service International

EIA Electronic Industries Association

FCC Federal Communications Commission

FOTP Fiber Optic Testing Procedures

IEEE Institute of Electrical and Electronic Engineers, Inc

NBC National Building Code

NFPA National Fire Protection Agency

NEC National Electrical Code

TIA Telecommunications Industry Association

UL Underwriters Laboratories

TAC - State of Texas Department of Information Resources:

[http://info.sos.state.tx.us/pls/pub/readtac\\$ext.ViewTAC?tac_view=4&ti=1&pt=10&ch=208](http://info.sos.state.tx.us/pls/pub/readtac$ext.ViewTAC?tac_view=4&ti=1&pt=10&ch=208)

UH MAPP UH Manual of Administrative Policies and Procedures

4.0.3 APPLICABLE STANDARDS

ANSI/NECA/BICSI-568 – Standard for Installing Commercial Building Telecommunication Cabling.

ANSI/TIA/EIA-568-B.1 -- Commercial Building Telecommunications Cabling Standard, Part 1: General Requirements

ANSI/TIA/EIA-568-B.2 -- Commercial Building Telecommunications Cabling Standard, Part 2: Balanced Twisted Pair Cabling Components

ANSI/TIA/EIA-568-B.3 -- Optical Fiber Cabling Components Standard

ANSI/TIA/EIA-569-A -- Commercial Building Standard for Telecommunications Pathways and Spaces

ANSI/TIA/EIA-606(A) -- The Administration Standard for the Telecommunications Infrastructure of Commercial Buildings

ANSI/TIA/EIA-607(A) -- Commercial Building Grounding and Bonding Requirements for Telecommunications

ANSI/TIA/EIA-526-7 -- Measurement of Optical Power Loss of Installed Single-Mode Fiber Cable Plant

ANSI/TIA/EIA-526-14A -- Measurement of Optical Power Loss of Installed Multimode Fiber Cable Plant

ANSI/TIA/EIA-758(A) -- Customer-Owned Outside Plant Telecommunications Cabling Standard

Chapter 208 – State of Texas Communications Wiring Standards

UH MAPP 10.03.04 – UH Manual of Administrative Policies and Procedures

4.0.4 APPLICABLE PUBLICATIONS

BICSI -- Telecommunications Distribution Methods Manual

BICSI -- Cabling Installation Manual

BICSI -- LAN Design Manual

BICSI – Customer-Owned Outside Plant Design Manual

5.0 Telecommunication Facilities

5.0.1 Definition

Telecommunication facilities are spaces and secured rooms housing telecommunication and network equipment consisting but not limited to Data, Voice, Cable Television (CATV), Closed Circuit Television (CCTV) components and their associated wiring. Secured rooms have stringent requirements due to the expense and complexity of the equipment housed in them supporting the University's telecommunications and network infrastructure. The types of telecommunication facilities are as follows:

The Building Distribution Frame (BDF) is the main telecommunications service entrance into the building. It is the area where the demarcation between the inter-building and intra-building cabling systems is affected. This securable room is to be dedicated to this purpose with no other building services sharing the space.

Main Cross-Connect (MC): The cross-connect normally located in the BDF for cross-connection and interconnection of entrance cables, first-level backbone cables, and equipment cables.

Horizontal Cross-Connect (HC): A group of connectors (e.g. patch panel or punch-down block) that allows equipment and backbone cabling to be cross-connected with patch cords or jumpers.

Telecommunication Enclosure (TE): A secured case, cabinet or housing for telecommunications equipment, cable terminations, and cross-connect cabling.

Intermediate Distribution Frame (IDF): provides for demarcation between the per-floor horizontal customer service cabling and the buildings video, data and voice backbone cabling. Additionally this room contains the electronic equipment that transitions between the data, voice and video building backbone and the end user's telecommunications equipment. This securable room is to be dedicated to this purpose with no other building services sharing the space.

IDFs are allocated to each floor of a building and house the communications equipment and related wiring that serves that specific floor. Several IDFs may be located on a single floor in order to maintain the cable length limitations specified within particular standards.

5.0.2 Requirements

5.0.2.1 GENERAL

All work associated with IDFs shall comply with the National Electrical Code, state and local building codes. The guidelines developed by **ANSI/TIA/EIA** and **BICSI** shall be followed in both design and construction.

All variances must be approved by ITNO.

IT Telecom equipment will not be installed in the IDF/BDF until they are completely built, cleaned, and secured with IT approved key.

To facilitate the proper installation, routing and placement of cables in IDFs shall be located to assure compliance with TIA/EIA distance limitations, and stacked one above the other whenever possible. The total distance of the cable path between the telecommunication outlet and its termination in the IDF shall be less than 90 meters.

No plumbing, HVAC, or electrical conduit shall pass through or above the IDF, except for sprinkler systems. Sprinkler heads shall be caged and rated high temperature.

Under no circumstances shall electrical or any other utility panel be located in an IDF.

Doors and Locks for IDFs- A windowless, solid core door measuring 36" wide by 80" tall and swinging open out of the room is the minimum requirement. Locks shall be cored with a campus standard BEST system to accept the IDF standard keying of 3IL119 as provided by the University of Houston Lock Shop. Keys for IDFs will be available from ITNO Project Managers as needed. All doors must be equipped with online card reader system.

IDFs - Shall be secured to ensure all areas in which information technology resources are stored remain protected from environmental concerns hazards and theft. The security of the IDFs is to be coordinated with ITNO.

Floors – Floor loading must be at least 50 pounds per square foot (50 lb/ft²). Floors shall be vinyl composition tile or sealed concrete. Carpet is prohibited.

Conduits and Sleeves – Due to the need for facilitating frequent additions, moves and changes to the telecommunication systems, communications conduits are generously sized and labeled on both sides (to and from locations).

- Conduits entering the building are usually 4" with some type of sub-space partitioning.
- Conduits between building telecom rooms are also usually 4".
- Conduits outer diameter will be located within 4" of room walls.
- Conduits servicing end user spaces are usually 1". Exceptions are made for outlets for wall phones, payphones, etc... outlets where only one cable is needed. This conduit may be 3/4".
- The use of Flexible conduit is discouraged. If it is the only solution, increase its size by one trade size.
- Conduits between floors interconnecting telecom rooms are stubbed 2" into the rooms.
- The 1" conduits servicing end users information outlets are usually "stubbed" to above the ceiling, and thence to the nearest corridor/hallway telecommunications horizontal pathway leading to the IDFs.
- Minimum radii for conduit bends shall be as follows:
 1. Internal diameter of less than 2" – bending radii is 6 times the internal diameter.
 2. Internal diameter of 2" or more – bending radii is 10 times the internal diameter.
- All sleeves must be fire sealed. Initial sealing of the sleeve penetration is to be completed by the sleeve installer.
- All sleeves will be reamed and grommets placed prior to cable installation to prevent cable damage.

Building Riser - The building backbone riser system connects IDFs to each other, to the BDF Room and the IDF. UH specifies separate cable systems to provide data, video and voice needs. Riser (plenum) rated multi-pair twisted pair copper cables, coax, and single mode fiber cables along with their termination systems are specified.

Ceilings – There will be no suspended ceilings in the IDF. Suspended ceilings in existing IDFs shall be removed whenever large cable projects require the installation of new cable trays, or overhead conduits and sleeves are to be installed.

Cable Trays – Basket tray of 12" width shall be installed on three (3) walls at a height of 7' whenever possible with minimum clearance of 4" from ceiling. Basket tray spanning the width of the room shall be installed on top of the telecommunication racks. Radius drop-outs are to be used where the cable exits the tray to a lower elevation.

Walls – Interior walls in the room should be covered, floor to ceiling, with fire rated 3/4" plywood and painted with 2 coats of a neutral color fire retardant paint; the fire rated stamp must be visible. Fire Marshall's Office to inspect and approved before painting. Paint should be or equal to: Flame

Control Coatings, LLC. Flame Control NO. 20-20A. Fire Hazard Classification, ATSM E-84 (NFPA 255) Class "A"

Fire Wall Identification – Fire walls should be painted with a neutral color fire retardant paint; the fire rated stamp must be visible.

Lighting – Lighting should be maintained at 50 lumens, measured at 3 feet above floor level. Light switches shall be located immediately inside the door and must be a timer or motion type switch.

Cable Entrance - Riser or distribution cables entering/exiting the IDF shall be via four-inch (4") conduits, sleeved cores or cable tray. **An additional two conduits, sleeved cores or cable tray, over and above the current requirement shall be included in the design for future growth.**

5.0.2.2 ROOM SIZING

BDF –

Minimum size for all buildings – 9' x 12'

Minimum ceiling height is 9' 6"

BDF's cannot have any water pipes within the room's interior space, routing horizontally on the floor directly above the room, or within the floor slab

IDF –

Minimum size for all buildings 6' x 10'

Minimum ceiling height is 9' 6"

IDF's cannot have any water pipes within the room's interior space, routing horizontally on the floor directly above the room, or within the floor slab.

5.0.2.3 ENVIRONMENTAL CONTROL

HVAC should be designed to maintain a room temperature of 68 to 70 degrees with 30 – 55 percent humidity control with the full complement of equipment in the room. ITNO shall provide the HVAC contractor with equipment BTU information. In keeping with the University of Houston's

energy conservation program ambient control temperature within all IDFs will be reviewed and accepted by ITNO.

5.0.2.4 ELECTRICAL

For an IDF, all convenience electrical outlets shall be installed to a side wall in order that power cables can be run along the telecommunication racks. This will minimize the possibility of tripping hazards. There should be, at a minimum, one *duplex convenience* outlet every six feet along the walls immediately to the left and right of the door for general purpose use. These should be installed at industry standard height. All outlets will be backed up via the building wide UPS or on emergency generator if there is no building UPS.

At a minimum, one 240 volt 30 AMP dedicated circuit with a NEMA L6-30R receptacle will be installed at a height of 7 feet. Conduit and outlets shall be connected to the outside of the basket tray facing the rear of the equipment racks. At a minimum, there must be four 120 volt 20 AMP NEMA 5-20R dedicated outlets with each pair on a dedicated circuit with emergency generator back-up. These outlets must be located at a height of 7 feet. Conduit and outlets shall be connected to the outside of the basket tray facing the rear of the equipment racks. **Final design and layout approval on number, type, and location of outlets shall be provided by ITNO.**

All telecommunication circuits are to be clearly labeled on circuit breaker panels and the circuit id number to be on the face plate of the outlet in the IDFs.

A grounding bar measuring 12" long by 2" wide by ¼" thick with pre-drilled ¼" holes shall be installed. The ground bar shall be connected to the main building ground using #2 or greater AWG copper wire.

All cable trays and racks are to be grounded to the main building ground using #2 or greater AWG copper wire. Rack-mounted electrical outlets must be grounded to the rack ground in addition to any other NEC, State, or local building code grounding requirements.

A rack mounted UPS of appropriate size will be installed in every BDF/IDF. ITNO will determine appropriate UPS devices.

5.0.2.5 TERMINATION HARDWARE

The design layout for the placement of racks, rack hardware, and wall fields within the IDFs shall be approved by ITNO.

Equipment Racks - Heavy duty aluminum 7' floor mount racks with cable management channels on both sides and mounting rails for 19" equipment are required. All racks are to be properly anchored with space allocated between racks for installation of vertical cable managers.

Patch Panels – The approved types are listed in Appendix C. All jacks will be Category 6. Different colors are assigned to the various types of network connections. The exposed front of the jack must be the correct color. The jack colors are assigned as follows:

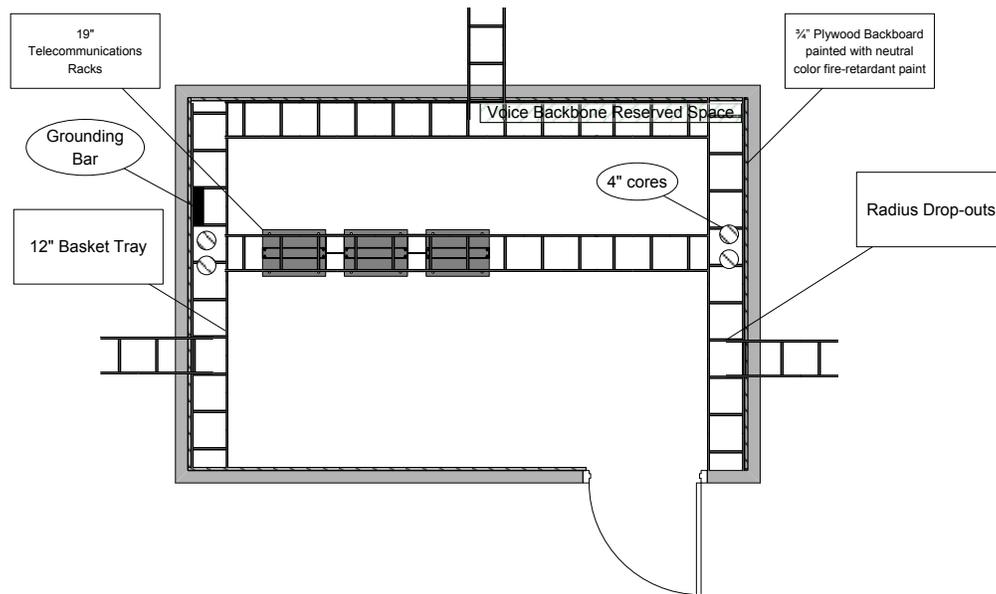
- Red General purpose, Office, and lab connection
- Yellow Wireless access point connection
- Purple Security camera, Security device, Lighting controller or Code Blue phone
- Green..... EMECS system connection

Rack Mounted Hardware - For BDFs a minimum of eight Units (8U's) are reserved at the top of each rack for fiber enclosures. For IDFs a minimum of six Units (6U's) are reserved at the top of each rack for fiber enclosures.

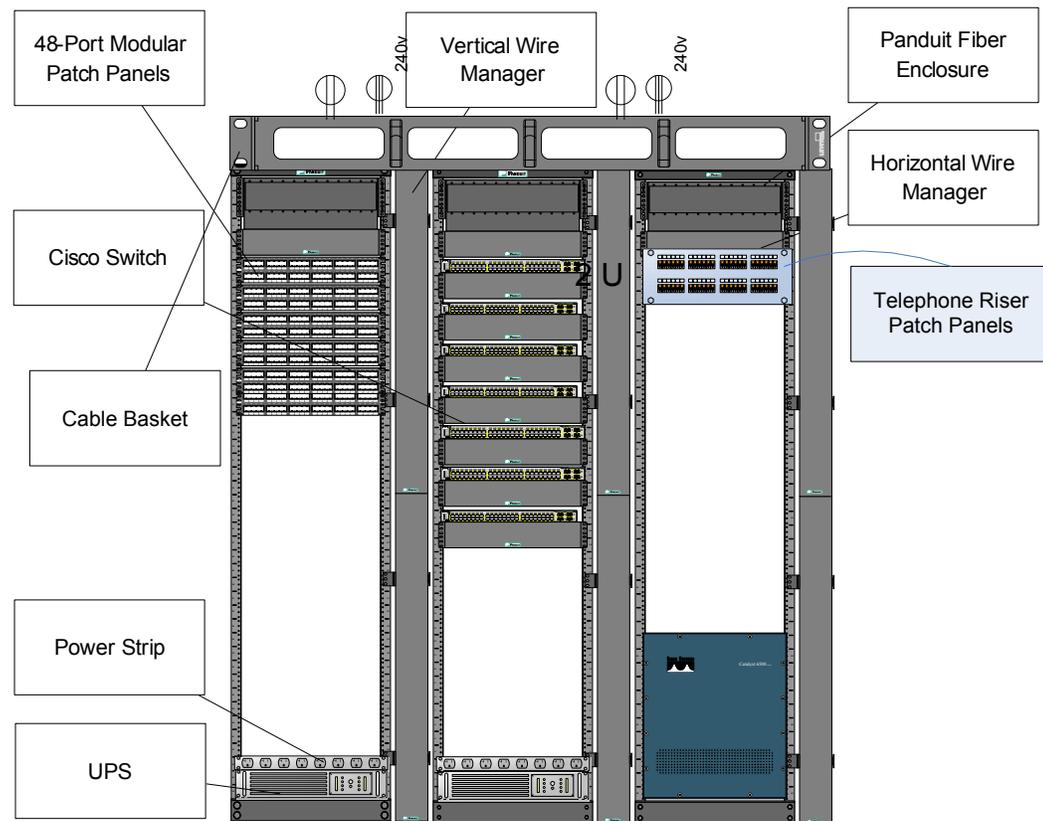
Wall Mounted Hardware – in the Entrance Facility - 25 pair or 50 pair 110 system kits shall be fastened to the plywood backboard and D-rings or jumper troughs utilized for wire management.

Wire Managers - Vertical wire managers will run the entire length of a rack and shall be mounted on both sides of each rack. Vertical wire managers shall be 10" in width. Horizontal wire managers will be mounted below the spaces left for the fiber enclosure to contain patch cabling which must run from one side of the rack to the opposite side.

5.0.2.6 Sample IDF Layout



5.0.2.7 Sample Rack Elevation



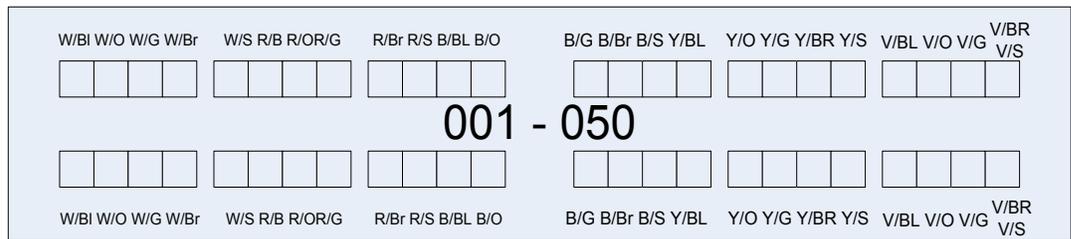
5.2.0.8 ADDITIONAL REQUIREMENTS

Riser and distribution cables leaving the Equipment Rooms to building and IDF spaces shall be via four-inch (4") conduit, sleeved cores with basket cable tray for horizontal runs. At least two additional conduits, sleeved core or cable tray with sufficient available space must be included in the design to provide for future growth. Conduit numbers and size to be determined by building square footage. All conduits will be sealed with appropriate fire stopping materials.

The Entrance Facility located usually in a mechanical closet must have sufficient conduit runs to all IDFs. Two additional cores/conduits must be provided for future growth.

At a minimum, a 12-strand, single-mode fiber of size 9/125 micron shall be installed between the Equipment Rooms to each IDF. The final strand count to be approved by ITNO.

In the IDFs the riser cable shall be terminated on the Patch Panel in accordance with the drawing below. Wire management to be provided using D-rings or jumper troughs. The voice jacks shall be black in color.



Building entrance protection for copper cabling shall be installed. This must consist of a building entrance terminal utilizing a two (2) foot fuse link between the outside cable plant splice and the protector module with IDC type input and output terminals, 25-pair capacity and female mounting base, equipped with 230 volt solid state protector modules. Sufficient protector modules will be provided to completely populate all building entrance terminals.

5.2.0.9 LABELING

All Telecommunication Facilities to include equipment, racks, cabling, patch cables, terminating panels, and grounding bus bars shall be properly labeled. Refer to Appendix A for labeling conventions.

6.0 Optical Fiber

6.0.1 General

All new cable plants to be connected to or disconnected from the UH campus telephone network, local area network, wide area network, video network, cable television network (existing buildings), and fiber optic network will be performed by or personnel designated by the ITNO. ITNO will no longer install multi-mode fiber optic cabling for network use. Multi-mode OSP cable will be provided only for the fire alarm system on Central campus only. Energy Research Park will use single mode fiber cabling for the fire alarm.

6.0.2 Minimum Fiber Qualities

Each optical fiber shall consist of a doped silica core surrounded by a concentric silica cladding. The fiber shall be a matched clad design.

The multi-mode fiber strands utilized in the cable specified shall conform to ANSI/TIA/EIA-568-B, IEEE and TIA-492AAAC-A specifications.

The single-mode fiber strands utilized in the cable specified shall conform to ANSI/TIA/EIA-568-B and IEEE specifications.

6.0.3 Minimum Requirements for OSP Fiber Optic Cable

Optical fiber cables shall be of loose buffer tube configuration.

The fibers shall not adhere to the inside of the buffer tube.

All optical fibers and buffer tubes shall be color coded per EIA/TIA-598. In buffer tubes containing multiple fibers, the colors shall be stable during temperature cycling and not subject to fading or smearing onto each other or into the gel filling material. Colors shall not cause fibers to stick together.

Each buffer tube and the cable core interstices shall be filled with a non-hygroscopic, non-nutritive to fungus, electrically non-conductive, homogenous gel. The gel shall be free from dirt and foreign matter. The gel shall be readily removable with conventional non-toxic solvents.

All fibers in the cable must be useable fibers and meet required specifications. The cable provided will be new, unused, and of current design and manufacture. Outer jacket shall be fungus resistant, UV inhibited, Water resistant, and shall have a non wicking rip cord for easy

removal. The outer jacket or sheath shall be free of holes, splits or blisters. Outer cable jacket will be marked with "(Manufacturer's Name) Optical Cable", Sequential foot or meter markings, and year of manufacture. The height of the markings shall be approximately 2.5mm. The cable jacket shall contain no metal elements and shall be of a consistent thickness.

6.0.4 Fiber Physical Performance

The fiber optic cable shall withstand water penetration when tested with a one meter static head or equivalent continuous pressure applied at one end of a one meter length of filled cable for one hour. No water shall leak through the open cable end. Testing shall be done in accordance with FOTP-82, "Fluid Penetration Test for Filled Fiber Optic Cable."

All cables will have tensile strength of greater than or equal to 2700N (Newton's) short term and 600N long term without exhibiting an average increase in attenuation greater 0.20 dB (multi-mode) and 0.10 dB (single mode). Minimum bend radius for all cables will be less than or equal to 20 times the outside diameter under installation tensile load and 10 times the outside diameter under long term tensile load.

6.0.5 Optical Fiber Cable Installation

Aerial installation of fiber optic cable is prohibited unless written approval is received from ITNO Management.

6.0.5.1 GENERAL

Cable runs will be installed in one continuous length from bulkhead connector to bulkhead connector, including service loops, repairs, and without splices unless required by standard.

All cable shall be installed in one inch inner duct when transitioning into conduit. A pull string shall be run in addition to the cable in order to provide access for future growth.

All fiber cable installations are to be 100 percent terminated. Plastic dust caps will be installed on all unused fiber terminations.

Terminated fiber strands will be installed in rack-mounted optical fiber distribution shelves. A Uniprise #RFE-SLG-EMT/2U distribution shelf will be used in all IDFs. A Uniprise #RFE-FXD-EMT-BK/4U distribution shelf will be used in all BDFs.

Cable installation shall not exceed manufacturer specifications for tensile load; bend radius, and vertical rise. All pulled cables shall be monitored for tension and torsion during installation and shall not exceed manufacturer specifications.

A minimum of three (3) with a diameter of an inch and a quarter ($1\frac{1}{4}$) corrugated inner-ducts will be placed inside each conduit of four (4) inch diameter. All optical fiber cable installations shall be placed in inner-duct up to the point the cable enters a terminating enclosure.

Lubricants may be used to facilitate pulling of cables but the lubricant must not be harmful to the cable, the raceway or personnel.

Fiber patch cables secured by strap or other fasteners shall not be pulled so tight that the outside cable sheathing is indented or crushed. J-Type Polywater is preferred.

6.0.6 OUTSIDE PLANT (INFRASTRUCTURE CABLES)

When installing fiber optic cable in manholes between buildings, there shall be a **minimum of two (2) complete loops in each manhole**. It shall be pulled in an inner-duct inside the manhole to prevent damage to the cable. No splicing is allowed in fiber cables between buildings.

All inner-ducts shall be spliced according to manufacturers approved methods.

Single mode fiber patch cables will be terminated with 'ST' connectors on one end and as required on the other end.

At a minimum, a 48-strand, single mode fiber of size 9/125 micron shall be installed to a ITNO designated Core location. A minimum number of single mode fiber shall be installed to a secondary building. This number is determined by the number of IDFs/BDF in the given building plus one spare multiplied by two. Final strand counts to be approved by ITNO. Single-mode fiber size will be 9/125 micron. All Single-mode cables are not to exceed 1 dB plus .0008 dB per foot end to end attenuation at 1310nm.

The AVERAGE/MAXIMUM fiber splice loss for single-mode fusion splices will be 0.05/0.3 dB and 0.10/0.3 dB for mechanical splices.

Sump pumps may be installed in manholes where flooding is a consistent problem.

6.0.7 INSIDE PLANT (RISER CABLES)

Fiber optic cable shall be tight-buffer tube construction, all dielectric, with no metallic components of any kind.

At a minimum, a 12-strand, single-mode fiber of size 9/125 micron shall be installed. Final strand counts to be approved by ITNO.

Each buffer tube within a cable must be color coded with none of the same colors appearing in one cable. Each fiber within a buffer tube must be color coded with none of the same colors appearing in the same buffer tube.

The outer cable sheath construction will be of NEC Rated OFNP (PLENUM) Jacket – Flame retardant material.

Individual mated connector pair loss will be less than or equal to 0.20 dB.

All fiber strands are to be terminated in accordance with industry standard color codes.

Single-mode fiber patch cables will be terminated with “ST” connectors on one end and as required on the other end.

Bulkhead distribution cabinets and cable must be labeled in accordance with ITNO labeling conventions. Reference: Appendix A for labeling conventions.

A minimum of ten meters (33 feet) of extra cable shall be coiled and fastened to the IDF plywood backboard as a service loop at each end of the cable.

7.0 Inside Plant

7.0.1 Asbestos Clearance

Certain UH buildings constructed prior to 1970 may contain asbestos found in the original construction materials used. The majority of materials detected with asbestos are blown-in ceiling insulation, floor tiles, walls, pipe insulation and other construction materials. **Before beginning any cabling job, and especially prior to disturbing areas or making surface penetrations, an asbestos check and clearance must be granted for the location and scope of work to be performed.** Consult with ITNO Project manager. ITNO personnel are trained in Asbestos Awareness procedures.

All cabling contractors will ensure that personnel they place on UH premises will have asbestos awareness training and certification. Cabling Contractor's project managers and Technicians should be Asbestos Administrative Awareness certified possessing current credentials. Documentation will be provided to UH upon request.

The following procedures will be followed without exception by all personnel doing cable installation on behalf of the University of Houston:

Step 1: If an Asbestos concern develops, immediately notify your supervisor and contact ITNO Project Manager **before any work is done.** If an asbestos warning sign is evident – **Do not enter room or area in question.** Proceed to step 2.

Step 2: ITNO Project Manager will contact and coordinate with Plant Operations and IT Management to verify the asbestos status of suspected room or area.

Step 3: ITNO personnel and contractors will be notified by IT Management when it is possible to resume the original work suspended.

7.0.2 General

All telecommunication wiring shall be designed or approved by ITNO.

All telecommunication wiring shall be run using suspension hooks, conduits or approved cable tray. **At no time is cable to be attached to the ceiling grid support system.**

Pull string shall be installed in all conduit which do not contain inner ducts simultaneously with the pulling in of cable.

7.0.3 Backbone Cabling

All optical fiber and copper backbone cable designs, materials and sizes shall be approved by ITNO prior to installation.

Solid copper, 24 AWG, 100 balanced twisted-pair (UTP) **Category 3** cables with four individually twisted-pairs, which meet or exceed the mechanical and transmission performance specifications in ANSI/TIA/EIA-568-B.2 up to 16 MHz shall be installed.

Note: Listed Type CMR, CMP, MPR and/or MPP (as required in the NEC 2002).

Reference Appendix A for approved labeling conventions for backbone cabling.

Reference Appendix B for listing of approved backbone cabling manufacturers.

7.0.4 Horizontal Cabling

All voice and data cabling shall be continuous (no splicing) from the nearest IDFs to the telecommunications outlet.

Reference Appendix A for approved labeling conventions for horizontal cabling.

Horizontal cabling will be 100 percent terminated in the IDF to an approved 19 inch rack mountable, 48-port 8-pin modular to insulation displacement connector (IDC) meeting **Category 6 performance standards**, and pinned to T568B standards. IDC color codes shall mimic telecommunication outlet jack color standards.

Solid copper, 24 AWG, 100 balanced twisted-pair (UTP) **Category 6** cables with four individually twisted-pairs, which meet or exceed the mechanical and transmission performance specifications in ANSI/TIA/EIA-568-B.2 shall be installed.

See appendix A for listing of approved horizontal cabling materials manufacturers.

7.0.5 Copper Patch Cables

All copper patch cables shall meet or exceed TIA/EIA-568B.2-1 Category 6 and ISO 11801 Class E standards. Patch cables shall be constructed of 24 AWG solid copper cables and have a nominal diameter of .31 inches and be constructed of RJ-45 style plugs that meet PCC part 68 Subpart F requirements as well as exceed IEC 6060J-7 specifications. Patch cables must provide strain relief. Copper patch cables will be labeled with the switch and port number on the patch panel end and the patch panel and port number on the switch end. The approved types are listed in Appendix C. Each connection must use an appropriate color cable on each end of a given network jack.

The cable colors are assigned as follows:

- **Blue**..... General purpose, Office, and lab connection
- **Yellow**.... Wireless access point connection
- **Purple** Security camera, Security device, or Code Blue phone
- **Green**..... EMECS system connection

7.0.6 Telecommunication Outlets

Single-gang mounting plate with four (4) openings which might contain one or more the following devices:

- Telecommunications Outlet – 8 – pin modular, Category 6, un-keyed, **red**, pinned to T568B standards and be fully terminated.
- Wireless Outlet – 8 – pin modular, Category 6, un-keyed, **yellow**, pinned to T568B standards and be fully terminated. This will be terminated at the remote end on an appropriate Panduit/Uniprise jack mounted in a surface mount box.
- Security Camera/Intrusion Alarm Outlet – 8 – pin modular, Category 6 un-keyed **purple**, pinned to T568B standards and be fully terminated.
- EMECS Systems – 8 – pin modular, Category 6, un-keyed, **green**, pinned to T568B standards and be fully terminated.
- Blank Inserts – to be inserted in unused openings.

7.0.6.1 Installation

Telecommunication outlets shall be installed at industry standards heights (12 inches from center) unless otherwise noted.

A telecommunication outlet providing data services shall be located within 3m (10 feet) of its intended usage area.

A telecommunication outlet providing *voice services only* intended for wall phone use shall be installed in accordance with the standards of the Americans with Disability Act (ADA) requirements.

7.0.7 Telecommunication Outlet Recommended Location and Quantities

Faculty/Administrative Offices - One (1) telecommunication outlet consisting of two (2) data jacks. Additional outlets will be added upon a customer needs analysis and additional outlets installed as needed.

Clerical/Staff Offices - One (1) telecommunication outlet consisting of two (2) data jacks. Additional outlets will be added upon a customer needs analysis and additional outlets installed as needed.

Secretary/Administrative Assistant Offices – One (1) telecommunication outlet consisting of two (2) data jacks. Additional outlets will be added upon a customer needs analysis and additional outlets installed as needed.

Lab - One (1) telecommunication outlet per designated lab station consisting of two (2) data jacks.

Conference Rooms - One (1) telecommunication outlet consisting of two (2) data jacks. Additional outlets will be added upon a customer needs analysis and additional outlets installed as needed.

Dormitories – One (1) telecommunication outlet consisting of two (2) data jacks. Additional outlets will be added upon a customer needs analysis and additional outlets installed as needed.

Lecture Halls – One (1) telecommunication outlet consisting of two (2) data jacks. Additional outlets will be added upon a customer needs analysis and additional outlets installed as needed.

Classrooms – One (1) telecommunication outlet consisting of two (2) data jacks. Additional outlets will be added upon a customer needs analysis and additional outlets installed as needed.

General Purpose Classrooms – One (1) telecommunication outlet consisting of two (2) data jacks. Additional outlets will be added upon a customer needs analysis and additional outlets installed as needed. **Note: Post install a minimum of one data port shall remain active at all times.**

The quantities for each location are based on historical industry usage data for the different application and locations.

8.0 Documentation and Submittals

8.0.1 General

Submit to ITNO shop drawings, product data (including cut sheets and catalog information), and samples required by the contract documents. Submit shop drawings, product data, and samples with such promptness and in such sequence as to cause no delay in the work or in the activities of separate contractors.

The Contractor shall provide a complete location table and spreadsheet indicating each wall jack location including the following information: jack numbers, room number, and wall orientation per jack number (North, South, East, or West, or Power Pole if applicable), landmark orientation and distance. The contractor shall be responsible for appending new installations to this documentation so that a complete, consolidated inventory of all installations and work completed by the contractor is maintained at all times.

By submitting shop drawings, product data, and samples, the contractor represents that he or she has carefully reviewed and verified materials, quantities, field measurements, and field construction criteria related thereto. It also represents that the contractor has checked, coordinated, and verified that information contained within shop drawings, product data, and samples conform to the requirements of the work and of the contract documents.

ITNO approval of shop drawings, product data, and samples submitted by the contractor shall not relieve the contractor of responsibility for deviations from requirements of the contract documents, unless the contractor has specifically informed ITNO in writing of such deviation at time of submittal, and ITNO has given written approval of the specific deviation. The contractor shall continue to be responsible for deviations from requirements

of the contract documents not specifically noted by the contractor in writing, and specifically approved by ITNO in writing.

ITNO approval of shop drawings, product data, and samples shall not relieve the contractor of responsibility for errors or omissions in such shop drawings, product data, and samples.

ITNO review and approval, or other appropriate action upon shop drawings, product data, and samples, is for the limited purpose of checking for conformance with information given and design concept expressed in the contract documents. ITNO review of such submittals is not conducted for the purpose of determining accuracy and completeness of other details such as dimensions and quantities, or for substantiating instructions for installation or performance of equipment or systems, all of which remain the responsibility of the contractor. The review shall not constitute approval of safety precautions or of construction means, methods, techniques, sequences, or procedures. ITNO approval of a specific item shall not indicate approval of an assembly of which the item is a component.

Perform no portion of the work requiring submittal and review of shop drawings, product data, or samples, until ITNO has approved the respective submittal.

Submit shop drawings, product data, and samples as a complete set within thirty (30) days of award of contract.

General: Submit the following:

- Bill of materials, noting long lead time items
- Optical loss budget calculations for each optical fiber run
- Project schedule including all major work components that materially affect any other work on the project

Shop drawings: Submit the following:

- Backbone (riser) diagrams
- System block diagram, indicating interconnection between system components and subsystems
- Interface requirements, including connector types and pin-outs, to external systems and systems or components not supplied by the contractor
- Fabrication drawings for custom-built equipment
- One set shall be laminated and placed in appropriate IDFs.

Product Data -- Provide catalog cut sheets and information for the following:

- Wire, cable, and optical fiber
- Outlets, jacks, faceplates, and connectors

- All metallic and nonmetallic raceways, including surface raceways, outlet boxes, and fittings
- Terminal blocks and patch panels
- Enclosures, racks, and equipment housings
- Over-voltage protectors
- Splice housings

Samples-- Submit the following:

- All Material submittals will be, when requested, provided from Appendix C.

Submit project record drawings at conclusion of the project and include:

- Approved shop drawings
- Plan drawings indicating locations and identification of work area outlets, nodes, IDFs, and backbone (riser) cable runs
- IDFs termination detail sheets.
- Cross-connect schedules including entrance point, main cross-connects, intermediate cross-connects, and horizontal cross-connects.
- Labeling and administration documentation.
- Warranty documents for equipment.
- Copper certification test result printouts and diskettes.
- Optical fiber power meter/light source test results.

8.0.2 Contractor Certification

The contractor shall be a licensed Panduit Certified Integrator (PCI) Design and Installation Company and a Uniprise Certified Installer (UCI). A copy of the PCI Company and UCI certificate or verification by Panduit and/or Uniprise records must accompany contractor bid, no expired certificates and certificates issued under Panduit or Uniprise past certification programs will be accepted as proof of certification.

The contractor must be a member of Building Industry Consulting Service International (BICSI).

100 percent of on-site personnel shall have either a Uniprise or Panduit Certification in effect through, the bidding process, installation, testing, documentation, and acceptance. Documentation of all on-site personnel shall be provided post recommendation of selected contractor before final ITNO approval will be given

100 percent of on-site installation personnel shall have BICSI certification in effect through the bidding process, installation, testing, documentation and

acceptance. Documentation of all on-site personnel shall be provided post recommendation of selected contractor before final ITNO approval will be given

The contractor must have a minimum of one (1) Registered Communications Distribution Design (RCDD) on staff, with Panduit approved Certification plus RCDD equivalent submitted and approved by Panduit prior to project award, or a Uniprise approved Certification plus RCDD equivalent submitted and approved by Uniprise prior to project award. The RCDD shall provide approval on the design, installation, and documentation of communications system along with making sure all Panduit Integrity System or Uniprise Warranty documentation and requirements are met and submitted to Panduit or Uniprise upon completion of the project. Documentation of all on-site personnel shall be provided post recommendation before final ITNO approval will be given

The contractor shall not subcontract installation of voice/data/video cabling, termination or testing without the written consent of University of Houston and with Panduit's or Uniprise review and confirmation to University of Houston of proposed subcontractor's current and valid Panduit PCI Uniprise UCI certified status.

The contractor shall have worked satisfactorily for a minimum of five (5) years on systems of this type and size.

Upon request by ITNO, furnish a list of references with specific information regarding type of project and involvement in providing of equipment and systems.

Material shall be new, and conform to grade, quality, and standards specified. Materials of the same type shall be a product of the same manufacturer throughout.

Subcontractors shall assume all rights and obligations toward the contractor that the contractor assumes toward the University of Houston and ITNO.

Quality Assurance inspections will be coordinated with ITNO Project managers.

8.0.3 WARRANTY

Unless otherwise specified, unconditionally guarantee in writing the materials, equipment, and workmanship for a period of not less than fifteen (15) years from date of acceptance by ITNO or 20 years for Uniprise.

8.0.4 DELIVERY, STORAGE, AND HANDLING

Protect equipment during transit, storage, and handling to prevent damage, theft, soiling, and misalignment. Coordinate with ITNO for temporary secure storage of equipment and materials during project timeframes. Do not store equipment where conditions fall outside manufacturer's recommendations for environmental conditions. Do not install damaged equipment; remove from site and replace damaged equipment with new equipment.

8.0.5 SEQUENCE AND SCHEDULING

Submit schedule for installation of equipment and cabling. Indicate delivery, installation, and testing for conformance to specific job completion dates. As a minimum, dates are to be provided for bid award, installation start date, completion of station cabling, completion of riser cabling, completion of testing and labeling, cutover, completion of the final punch list, start of demolition, owner acceptance, and demolition completion.

8.0.6 USE OF THE SITE

Use of the site shall be at ITNO direction in matters which the University of Houston deems it necessary to place restriction.

Access to building wherein the work is performed shall be as directed by ITNO.

The selected contractor temporarily will occupy the premises during the entire period of construction for conducting his or her normal business operations. Selected contractor will cooperate with the University of Houston and ITNO to minimize conflict and to facilitate non-disturbance of the University of Houston operations.

Proceed with the work without interfering with ordinary use of streets, aisles, passages, exits, and operations of the University of Houston to include ITNO operations.

All contractors will adhere to the University of Houston's Contractor Badge Program and will wear assigned contractor's badge on person in a clearly visible location following the Contractor Badge Program standards as administered and provided by Facilities Planning & Construction.

All contractors shall, when pulling cables in any University of Houston building or related off-site areas provide proper safeguards at the reel location. This can be done with personnel or appropriate safety barricades.

8.0.7 CONTINUITY OF SERVICES

Take no action that will interfere with, or interrupt, existing building services unless previous arrangements have been made with the University's representative(s). The work shall be arranged to minimize down time.

Should services be inadvertently interrupted, immediately furnish labor, including overtime, material, and equipment necessary for prompt restoration of interrupted service.

8.0.8 DELIVERABLES

Submit project record drawings at conclusion of the project to include:

- Approved shop drawings
- Plan drawings indicating locations and identification of work area outlets, nodes, IDFs, and backbone (riser) cable runs
- IDFs termination detail sheets.
- Cross-connect schedules including entrance point, main cross-connects, intermediate cross-connects, and horizontal cross-connects.
- Labeling and administration documentation.
- Warranty documents for equipment.
- Copper certification test result printouts and diskettes.
- Optical fiber power meter/light source test results.

9.0 Protection, Grounding and Bonding

9.0.1 Lightning Protection

NEC article 250 "Grounding" and 800 "Communication Circuits" cover general requirements for grounding, bonding, and protecting electrical and communication circuits. NFPA 70 "Lightning Protection" addresses zone protection.

Building entrance protection for copper cabling shall be installed. This shall consist of a building entrance terminal utilizing a two (2) foot fuse link between the outside cable plant splice and the protector module with IDC type input and output terminals, 100-pair capacity and female mounting base, equipped with 230 volt solid state protector modules. Provide sufficient protector modules to completely populate all building entrance terminals.

9.0.2 Grounding

Grounding shall conform to ANSI/TIA/EIA 607(A) - Commercial Building Grounding and Bonding Requirements for Telecommunications, National Electrical Code®, ANSI/NECA/BICSI-568 and manufacturer's grounding requirements as minimum.

Bond and ground equipment racks, housings, messenger cables, raceways, and rack-mounted conduit.

Connect cabinets, racks, and frames to single-point ground which is connected to building ground system or to IDFs grounding bar via #6 AWG green insulated copper grounding conductor.

9.0.3 Bonding

Bonding shall be of low impedance to assure electrical continuity between bonded elements.

All conduits terminating to cable trays, wire ways and racks shall be mechanically fastened. When connected to a cable tray or rack it must be connected with ground bushings, wire bonded to the tray or rack, and grounded to the main building grounding system or IDF grounding bar using #6 AWG copper.

10.0 Inspection and Testing

10.0.1 Inspection of Work

The installation company shall have an RCDD on staff and full-time during all phases of the installation to include testing and documentation. RCDD documentation shall be included in all responses to RFP/FRO.

10.0.2 Testing

10.0.2.1 FIBER OPTIC CABLING

Individual fiber strands shall be tested bi-directionally using optical time domain reflectometer (OTDR) and optical loss test sets (OLTS). An initial acceptance test is to be conducted on the reel with a second test completed after installation.

OTDR tests for multi-mode fiber shall be conducted bi-directionally at 850 and 1300 nm and tests for single-mode fiber shall be conducted bi-directionally at 1550 nm. Installation reports shall include the installed lengths for all fibers.

Cables will be rejected for broken strands or OTDR/OLTS tests that reveal a single fiber strand or an entire cable is out of manufacturer specifications. A rejected cable shall be replaced at contractor expense. The OTDR and OLTS printouts must be delivered to the University within 10 business days of cable installation.

10.0.2.2 CATEGORY 3 UTP CABLING

Testing shall conform to ANSI/TIA/EIA-568-B.1 standard. Testing shall be accomplished using level IIe or higher field testers. Test each pair and shield of each cable for opens, shorts, grounds, and pair reversal. Correct any reversed or grounded pairs. Examine open and shorted pairs to determine if problem is caused by improper termination. If termination is proper, tag bad pairs at both ends and note on termination sheets.

If copper cables contain more than the following quantity of bad pairs, or if outer sheath damage is cause of bad pairs, remove and replace the entire cable:

CABLE SIZE	MAXIMUM BAD PAIRS
<100	1
101 to 300	1 – 3
301 to 600	3 – 6
>601	6

These figures apply only to voice riser cables.

10.0.2.3 CATEGORY 6 UTP CABLING

Testing shall conform to ANSI/TIA/EIA-568-B.1 standard. Testing shall be accomplished using level IIe or higher field testers.

If horizontal cable contains bad conductors or damaged outer jacketing, remove and replace cables.

11.0 Firestopping

11.0.1 General

Products may be in the form of caulk, putty, strip, sheet, or devices that shall be specifically designed to fill holes, spaces, and voids (hereinafter referenced as cavities) at communications penetrations. Fire stopping materials shall also provide adhesion to substrates and maintain fire and smoke seal under normal expected movements of substrates, conduits, and cables. Under no circumstances will non-approved filler material be allowed.

New and existing raceways, cable trays, and cables for power, data, and telecommunication systems penetrating non-rated and fire-rated floors, walls, and other partitions of building construction shall be firestopped where they penetrate new or existing building construction.

Firestopping shall be accomplished by using a combination of materials and devices, including penetrating raceway, cable tray, or cables, required to make up complete firestop.

Verify that cabling and other penetrating elements and supporting devices have been completely installed and temporary lines and cables have been removed.

The following agencies and their codes, standards, and regulations shall govern all firestopping work performed at the University of Houston. These codes, standards, and regulations have been approved by the UH Fire Marshall's Office.

11.0.2 APPLICABLE STANDARDS

ASTM E814, Standard Method of Fire Tests of Through-Penetration Fire Stops.

UL 1479, Fire Tests of Through-Penetration Firestops

UL Fire Resistance Directory: Through Penetration Firestop Devices (XHCR) and Through Penetration Firestop Systems (XNEZ).

ASTM E 119, Fire Tests of Building Construction and Materials (for fire-rated architectural barriers)

2002 NFPA National Electrical Code, Section 800-52, Paragraph 2(B), Spread of Fire and Products of Combustion

NFPA 101 Life Safety Code: Mandated by the State of Texas.

NFPA 1 Uniform Fire Code: Referenced in 101 and has been adopted by the University of Houston as our Fire Prevention Code (MAPP 06.02.02).

ANSI/NECA/BICSI-568, Standard for Installing Commercial Building Telecommunications Cabling, Section 5, Clause 5.1 through 5.2.3, Firestopping

2000 edition of the BICSI Telecommunications Distribution Methods Manual, Chapter 15, Firestopping

Factory Mutual Approval Guide

ULC List of Equipment and Materials, VOL. II

11.0.3 Installation

Select appropriate type or types of through penetration firestop devices or systems appropriate for each type of communications.

Selected systems shall not be less than the hourly time delay ratings indicated for each respective fire-rated floor, wall, or other partition of building construction.

Perform all necessary coordination with trades constructing floors, walls, or other partitions of building construction with respect to size and shape of each opening to be constructed and device or system approved for use in each instance.

Coordinate each firestop selection with adjacent Work for dimensional or other interference and for feasibility. In areas accessible to public and other "finished" areas, firestop systems Work shall be selected, installed, and finished to the quality of adjacent surfaces of building construction being penetrated.

Use materials that have no irritating or objectionable odors when firestopping is required in existing buildings and areas that are occupied.

Provide damming materials, plates, wires, restricting collars, and devices necessary for proper installation of firestopping. Remove combustible installation aids after firestopping material has cured.

All firestops shall be installed in accordance with the manufacturer's instructions in order to maintain the specific rating assigned by the independent testing laboratory.

Additional requirements for existing penetrations are as follows:

- Existing raceways, cable trays, and cabling whether contained in the preceding structures or penetrate any existing building construction shall be firestopped to the extent necessary to fill cavities that may exist between existing building construction and existing communications penetrations or existing conduit sleeve, and between existing conduits and existing conduit sleeve.
- Assemblies consisting of individual steel hat type restricting collars filled with intumescent type materials that completely surround communications penetration shall be used for nonmetallic raceways and cabling.

If required by inspecting authorities:

- Expose and remove firestopping to the extent directed by inspecting authority to permit his or her inspection.
- Reinstall new fire stopping and restore work where removed for inspection

12.0 Security Systems

12.0.1 Contractor Certification

- Contractor shall have the following certification:
 - 100 percent of on-site personnel shall have appropriate Pelco Certification for installation, programming, and troubleshooting.
 - At minimum (1) on-site personnel shall have appropriate Strand Video System training for installation, programming and troubleshooting.
 - Appropriate Certifications shall be included in all responses to FRP/RFO documents.
 - Documentation of all on-site personnel shall be provided post recommendation before final ITNO approval will be given

12.0.2 Cameras

Part	Manufacturer / Product Lines	Application - Model Choice
IP Security Camera	Pelco / SUREVISION Sarix IX Series Sarix IM-E Series Environmental Sarix IM-V Vandal Resistant Sarix IM Mini Domes INDOOR FIXED DOME Sarix ID Indoor Domes Sarix IM Vandal Resistant Sarix IM Mini Domes Camclosure IP Fixed IP Dome OUTDOOR FIXED DOME Sarix IE Environmental Sarix IM Environmental Mini Dome	APPLICATIONS: Activity Detection; License Plate Reading; Recognition; Identification. Model appropriateness depends on the camera's ability to provide adequate Pixels per Foot (PPF) MODEL SELECTION: Specific models are based on business use requirements as determined by the business owner – The University of Houston Department of Public Safety. The University of Houston Information Technology Operations Group will select the appropriate model to meet these requirements.

	<p>PTZ DOME Spectra HD Spectra IV H.264 Spectra IV IP Spectra Mini IP</p>	<p>The model selection process is based on the following criteria:</p> <ul style="list-style-type: none"> • PPF – Pixels per foot • Lighting conditions • Environmental Variables • Analytics requirements • Network Impact
		<p>MULTIPIXEL AVAILABLE CAMERA RATINGS:</p> <p>0.5 MP 1.3 MP 2.1 MP 3.0 MP</p>
<p>Panoramic IP</p>	<p>Scallop</p>	<p>D7 180</p> <p>***Consult with the UH IT Network Operations Video Analyst and the UH DPS Manager of Public Safety Systems for final design approval.– day time color best suited for indoor with consistent ambient lighting. Suited for Activity Detection in wide open spaces. (does not support motion recording)</p> <p>M6-200 – day/night black and white with exceptional detail in low lighting conditions. Suited for Activity Detection in wide open spaces. (does not support motion recording)</p> <p>***Consult with the UH IT Network Operations Video Analyst and the UH DPS</p>

		Manager of Public Safety Systems for final design approval
Specialty Camera (Infrared IP Camera)	Pelco	License Plate Readers; Confined areas under very low light. ***Consult with the UH IT Network Operations Video Analyst and the UH DPS Manager of Public Safety Systems for final design approval
Analog Camera	Pelco	***Consult with the UH IT Network Operations Video Analyst and the UH DPS Manager of Public Safety Systems for final design approval
DVR	Pelco	***Consult with the UH IT Network Operations Video Analyst and the UH DPS Manager of Public Safety Systems for final design approval.
NVR	Strand Pelco	NVR P-8 NVR E-24 NVR E-32 Pelco Digital Sentry NVR ***Consult with the UH IT Network Operations Video Analyst and the UH DPS Manager of Public Safety Systems for final design approval

12.0.2.1 Camera Model Specifications and Use Requirements

UH Department of Public Safety Use Requirements for camera deployments are defined in document G403006 SURVEILLANCE CAMERAS (Refer to Master Specification Section 28 23 00 for current camera specification) as follows:

1. Cameras at entrances and exits to the building shall show the faces of those exiting the building at 120 pixels per foot (ppf). Cameras in public hallways shall show an individual's movement within the building.
2. Classrooms: Generally there will be no cameras in classrooms.
3. Research space: Cameras shall show persons exiting the research facility at 120 ppf. Cameras in the hallways shall show the movement of persons within the research facility. Cameras shall only be employed within the research spaces themselves only when there is a need to monitor the health and safety of the researchers.
4. Administrative space: Cameras shall be installed in the hallways and shall show movement of persons in the building.
5. Residential spaces: Cameras shall be located to show activity in the common areas, including lounges, laundry, computer labs, etc. No cameras shall be located within in the bedroom units.
6. Point-of-Sale and cashier areas: Cameras shall be located to show patrons' faces at 120 ppf at the Point-of-Sale. Consult Owner Representative regarding use of security camera domes.
7. Surface parking lots and campus roadways: Cameras shall be located to show the description of the vehicles (color and make during daylight hours). Cameras shall show license plates of the vehicles at 60 ppf at parking lot entrances and exits.
8. Parking structures: Overview cameras shall show flow of traffic and vehicle descriptions. Cameras shall detect activity at parking gates and on parking levels. Cameras shall show license plates at 60 ppf at parking gates.

***Additionally, there is a requirement for a 30-day archive lifespan.

12.0.2.2 Deployment Applications and Pixels per Foot

The number of pixels per foot in a video frame helps determine the suitability of given camera model and its focal length for a specific situation. As a metric, pixels per foot serves as a minimum threshold for producing image resolutions capable of meeting a specific business need. Four general categories or levels of surveillance comprise the whole of security camera applications at the University of Houston. The ideal number of pixels per foot for each level of surveillance is affected by lighting conditions and the camera's LUX rating.

Generally, the following guidelines should apply:

Activity Detection (General Surveillance - the ability to recognize an event within the field of view)	20 ppf day 40 ppf night (*street lights etc)
License Plate Reading	60 ppf day 80 ppf night
Recognition (Forensic Detail)	80 ppf day 100 ppf night
Identification (High Detail)	120 ppf +

12.0.2.3 PPF Camera Model and Focal Length Determination

A camera's ability to produce the minimum number of ideal pixels per foot is determined by its imager size (typically 4.8 mm); the distance of the camera from the area of interest; the total horizontal resolution the camera produces; and the camera's focal length.

$$*** \text{ Lens Focal Length} = \frac{\text{Imager Size} \times \text{Distance from the subject in feet} \times \text{PPF}}{\text{Total Horizontal Resolution in Pixels}}$$

Pixel Rating Horizontal Resolution Chart

Megapixel Rating	Horizontal Resolution
0.5	800
1.3	1280
2.0	1632
3.0	2048
4.0	2272
5.0	2592

*slight variations based on camera manufacturer and image collector size

** Megapixel rating is the horizontal sensor count multiplied by the vertical sensor count and then divided by 1 million.

12.0.2.4 Deployment Applications and Frame Rates

As image quality and frame rate increase, so do bandwidth and storage requirements. The frame rate selected must meet the business requirements, but it does not need to be higher than what is required.

Industry Guidelines (source: IP Video Market)

Cash register, teller stations	12 to 15 fps
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License Plates	10 – 15 fps
School or office hallways	5 fps
Parking lots, traffic cameras, overview scenes	1 to 3 fps
Sports Stadiums on non-event days	1 fps

12.0.2.5 Guidelines for Alternative Camera Selection Process

Alternatives to University of Houston Information Technology approved security camera models will be considered on a per project basis if there is a clear though currently undefined business need that is not supported by either Pelco or Scallop. All cameras being considered must be thoroughly tested within the UH infrastructure and must meet minimum criteria for UIT acceptance.

Acceptance of an alternative camera manufacturer's products will be determined by the following:

1. Functional and feature compatibility with the adopted Network Video Recorder (Currently Strand P6 or P8)
2. The company's reputation for quality and customer support
3. Turn around times for parts replacements
4. The camera's LUX rating
5. The camera's ability to support motion recording
6. The camera's storage and bandwidth requirements
7. The camera's ability to meet the business requirement.
8. Price point and cost of ownership

Recommendations for cameras that are not project dependent will be reviewed on a low priority basis.

No test cameras will be deployed unless approved for testing by UH IT.

12.0.2.6 Camera Installation Requirements

12.0.2.6.1 IP Camera Power Source Preferences

1. PoE switch ports
2. Power Injectors
3. AC adaptors

12.0.2.6.2 External Camera Lightning Protection

1. External cases will be grounded
2. Cameras will be mounted to their cases using nylon washers
3. All cables must incorporate surge protection such as DTK-MRJPOE for PoE cables or applicable alternatives designed to protect network switches, NVRs/DVRs.

12.0.2.6.3 Camera and IDF Cable Labeling

12.0.2.7 Network Video Recorder Requirements

1. H.264 compliance
2. Ability to support motion recording in Pelco cameras (Strand will meet this requirement in June, 2012)
3. Ability to support Scallop cameras (Strand will meet this requirement by March 2012)
4. Access to multiple NVRs through a single interface
5. Tiered access rights
6. Access priority rights
7. Ability to support matrix views
8. Gigabit uplinks
9. Ability to export snapshots and video clips

12.0.2.7.1 Server Network Requirements

1. All NVR servers must be connected to a distribution switch
2. All NVR servers will be connected to a gigabit port.

12.0.3 Emergency Phones

12.0.3.1 Contractor Certification

- Contractor shall be a certified Code Blue Phone Reseller and Installer and have the following certification:

- At minimum (1) on-site personnel shall have appropriate Code Blue Phone certification for installation, programming and troubleshooting.
- Certification documents must be included in all responses for RFP/RFO.

Part	Manufacturer	Description/Part Number
Emergency Phones	Code Blue	CB1e – Tall Pedestal CB1wb – W/L Tall Pedestal CB2e – Wall mountable

12.0.4 Intrusion Detection

Part	Manufacturer	Description/Part Number
T-Link TL250	DSC	T-Link Starter Kit
LCD Keypad	DSC	PK 5500
Zone Expander Card	DSC	PC 5108
Accessory Kit	DSC	ACCK-1
Power Adapter / ACCK 1	DSC	PTD164DU-CC
Wireless Receiver	DSC	RF 5132-433
Panic Buttons Wireless	DSC	WS 4938 – One Button
Panic Buttons Hardwire	DSC	HUB-25A
Motion Detectors	DSC	EC – 300D
Wireless Receiver Card	DSC	PC 5320 Multiple Rcv Card
Door Contact	DSC	SM35W Surface Mount
Door Contact	DSC	DC 1641 W Flush Mount
Door Contact	DSC	OCD59A Overhead Door
Cable	Lake	P224C 22 AWG 2pr Plenum
Cable	Lake	P224C-09 22 AWG 4Pr Plenum

13.0 General Purpose Classroom Audio Visual Systems

13.0.1 Media Base Package 1

Required Equipment	Manufacturer	Model	Qty
Podium			None
Microphones			None
Data Projector	Sanyo	PCL-WXU300	1
Security Hardware Ceiling mount	BMX		1
DVD Player Code Free			1
Audio- Amp/Mixer/Speakers	TOA	8 in Ceiling Flush Mount 35 Watt	2
System Controls Wall Mount	Extron	104 IP	1
Wall Plate 2 RJ45/VGA+ Audio/ 1Composite/1HDMI			1
Screen Manual		TBD	1
Rapid Run PC/Video And/or Digital Runners as applicable	Quicktron		As needed
Misc hardware			As Needed

13.0.2 Media Base Package 2

Required Equipment	Manufacturer	Model	Qty
Podium			1
Microphones Wireless	Shure	TBD	1
Data Projector	Sanyo	PCL-WXU300	1
Security Hardware Ceiling mount	BMX		1
DVD Player Code Free			1
Audio- Amp/Mixer/Speakers	Crown	8 in Ceiling Flush Mount 180MA	2
System Controls Wall Mount	Extron	104 IP	1
Wall Plate 2 RJ45/VGA+ Audio/ 1Composite/1HDMI			1
Screen Manual		TBD	1
Document Camera	Elmo	TBD	1
Small Form Factor PC	Dell	TBD	1
19" Flat Screen Monitor	Dell	TBD	1
Rapid Run PC/Video And/or Digital Runners as applicable	Quicktron		As needed
Misc hardware			As Needed

13.0.3 Media Base Package 3 with MediaSite Recording

Required Equipment	Manufacturer	Model	Qty
Podium			1
Microphones Wireless	Shure	TBD	1
Data Projector	Sanyo	PCL-WXU300	1
Security Hardware Ceiling mount	BMX		1
DVD Player Code Free			1
Audio- Amp/Mixer/Speakers	Crown	8 in Ceiling Flush Mount 108MA	2
System Controls Wall Mount	Extron	104 IP	1
Wall Plate 2 RJ45/VGA+ Audio/ 1Composite/1HDMI			1
Screen Electric		TBD	1
Document Camera	Elmo	TBD	1
Small Form Factor PC	Dell	TBD	1
19" Flat Screen Monitor	Dell	TBD	1
MediaSite Recording System package	Sonic Factory	MSL-CSR-500 MSL-SSS-S09	1 1
HD PTZ Camera	Sony	EVID70	1
Rapid Run PC/Video And/or Digital Runners as applicable	Quicktron		As needed
Misc hardware			As Needed

13.0.4 Media Base Package with Video Conferencing

Required Equipment	Manufacturer	Model	Qty
Podium			1
Microphones Wireless	Shure	TBD	1
Data Projector	Sanyo	PCL-WXU300	1
Security Hardware Ceiling mount	BMX		1
DVD Player Code Free			1
Audio- Amp/Mixer/Speakers	Crown	8 in Ceiling Flush Mount 108MA	2
System Controls Wall Mount	Extron	104 IP	1
Wall Plate 2 RJ45/VGA+ Audio/ 1Composite/1HDMI			1
Screen Electric		TBD	1
Document Camera	Elmo	TBD	1
Small Form Factor PC	Dell	TBD	1
19" Flat Screen Monitor	Dell	TBD	1
Video Conference Package	Polycom	TBD	1
HD PTZ Camera	Sony	EVID70	1
Rapid Run PC/Video And/or Digital Runners as applicable	Quicktron		As needed
Misc hardware			As Needed

13.0.5 Media base Package 5 with MediaSite and Video Conferencing

Required Equipment	Manufacturer	Model	Qty
Podium			1
Microphones Wireless	Shure	TBD	1
Data Projector	Sanyo	PCL-WXU300	1
Security Hardware Ceiling mount	BMX		1
DVD Player Code Free			1
Audio- Amp/Mixer/Speakers	Crown	8 in Ceiling Flush Mount 108MA	2
System Controls Wall Mount	Extron	104 IP	1
Wall Plate 2 RJ45/VGA+ Audio/ 1Composite/1HDMI			1
Screen Electric		TBD	1
Document Camera	Elmo	TBD	1
Small Form Factor PC	Dell	TBD	1
19" Flat Screen Monitor	Dell	TBD	1
Video Conference Package	Polycom/LifeSize/ Tandberg	TBD	1 1
MediaSite Recording System package	Sonic Factory	MSL-CSR-500 MSL-SSS-S09	1 1
HD PTZ Camera	Sony	EVID70	1
Rapid Run PC/Video And/or Digital Runners as applicable	Quicktron		As needed
Misc hardware			As Needed

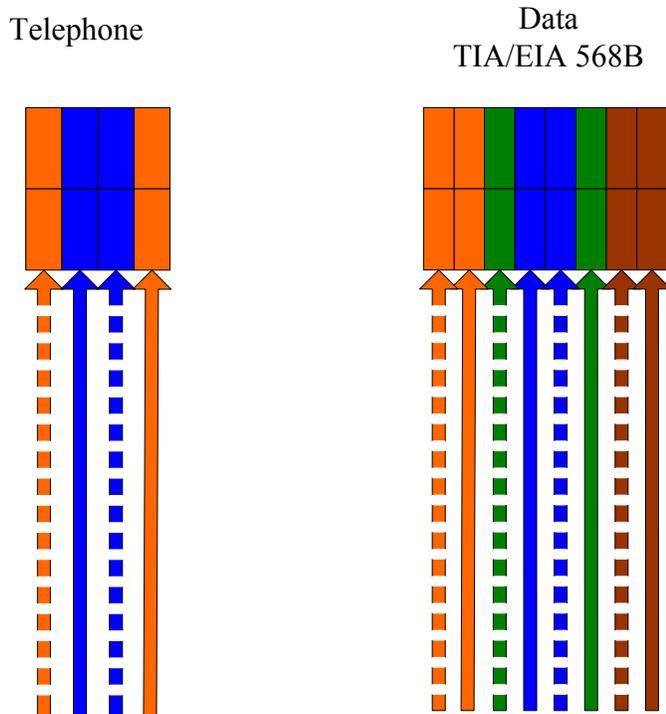
14.0 Legacy Issues

General

The following examples will allow replacement of legacy jacks with the new material designated in these Cabling Standards and will provide wiring allocations to meet the new cabling standards

14.0.1 RLH Replacement

Replacement of the Leviton Jacks will be with the appropriate Panduit/Uniprise Jacks and be punched down as follows:



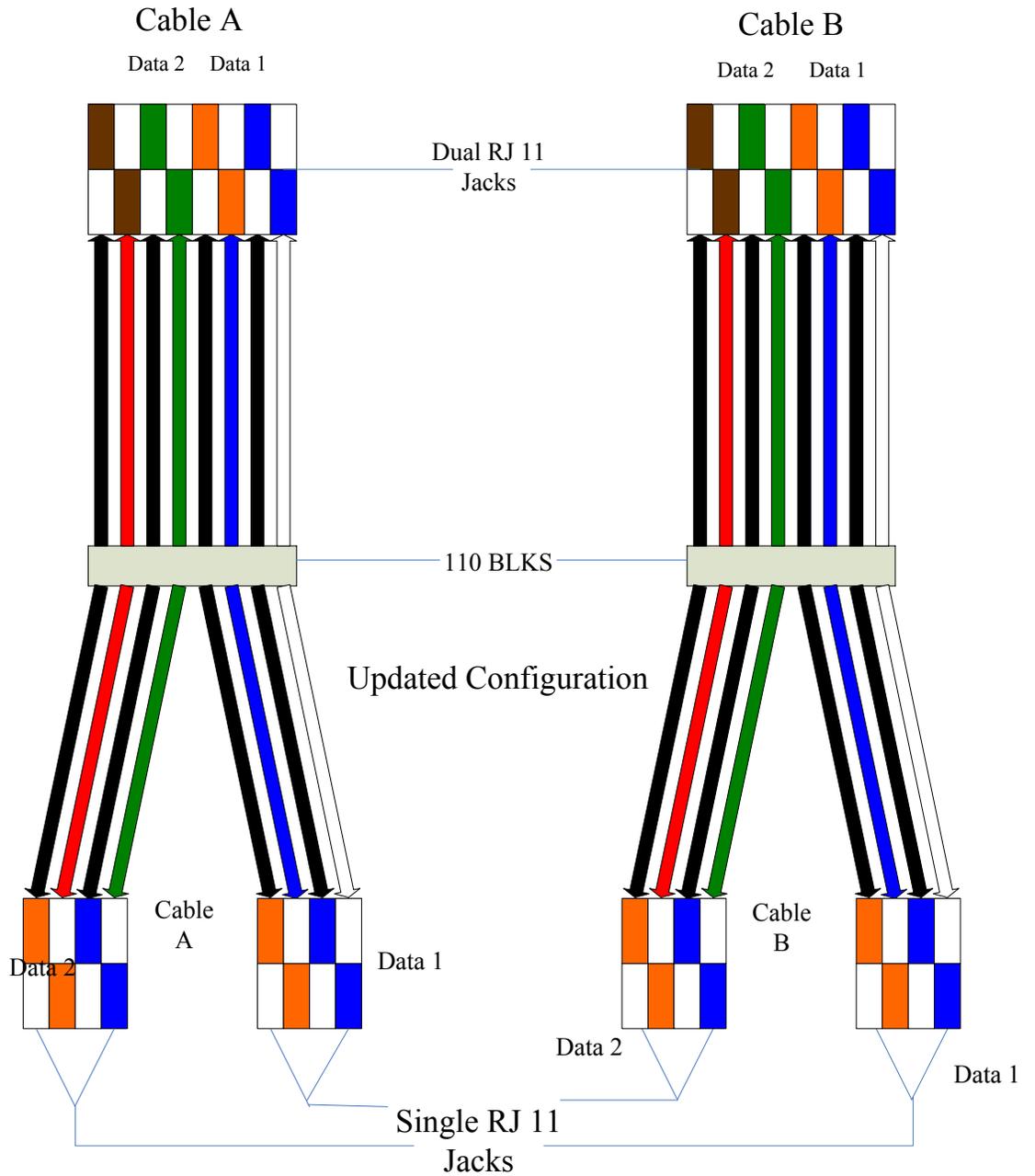
White Green and White Brown
will be coiled up for future use

14.0.1 Category 3 Replacement

Replacement of the Leviton Jacks will be with the appropriate Panduit/Uniprise Jacks and be punched down as follows

Legacy Jack Conversion

Legacy Configuration



15.0 Wireless Design and Installation Standards

15.0.1 General

The wireless standards below are for indoor design only. Outdoor specifications are not included and shall be consulted with UIT prior designing for outdoor spaces.

The approved Vendor for Wireless Access Points (WAP) is Meru. The approved WAP models are 320i (preferred) and 1020 (for alternative design to be approved by UIT). The

15.0.2 Wireless Design

Our design criteria for coverage is not less than minus 63 dbm at 5 Ghz. High density areas, such as classrooms, auditoriums, meeting rooms, study areas, multipurpose areas and housing facilities, should be designed for capacity.

Guidelines for designing for capacity are:

- Rooms with 100 or less seats require 1 WAP per 25 seats
- Rooms with more than a 100 seats require 1 WAP per 50 seats

Vendor shall provide UIT with proposed planning electronic maps which shall include WAP locations and DB levels to obtain UIT's approval prior to installations. Vendor shall use Meru standards and design software as Ekahau wireless software. WAP location and DB level maps are included in Appendix D and E.

15.0.3 Wireless Installation

15.0.3.1 Installation of WAPs

WAP will be mounted in a visible and accessible location, preferably below the ceiling or on the walls. For maintenance purposes, WAP must to be mounted in a space no higher than 10-feet high avoiding areas such as air conditioning units, vents, sprinkler systems, or anything interfering with the performance of WAP.

Wireless jacks should be labeled on the ceiling grid with the IDF # and the jack # following the labeling convention specified in Appendix A. WAP must be labeled with the MAC address in a visible area on the WAP.

If the WAP needs to be mounted in non-standard location (e.g. exposed or recessed ceilings) contact UIT for alternative mounting solutions.

In high density areas a secondary jack must be installed to allow for future WAP installations.

15.0.3.2 Cabling Installations in the IDF rooms

All jumpers for wireless devices in the IDF rooms should be yellow patch cables. On the patch panels all wireless station cables must be terminated with yellow modules.

All wireless jacks must be connected to a gigabit port with Power Over Ethernet (802.at) on a dedicated CISCO switch for wireless devices.

Refer to cabling specifications outlined in sections 5.0 for additional cabling standards in IDF rooms.

15.0.3.3 After Installation

After installation the vendor shall provide the final WAP location map (PDF) and spreadsheet (MS Excel) with WAP location information including the MAC address, room #, IDF #, and switch port #. A sample spreadsheet is available as appendix F.

16.0 Television Services

16.0.1

The University of Houston no longer supports growth of the coaxial network for new construction projects. Television services will be delivered over the IP data network utilizing a Haivision Stingray set top box (or approved equal).

17.0 IP addresses

ITNO IP address form needs to be completed by the program project manager and submitted to ITNO as soon as possible.

Appendix A

UH Labeling Standards and Conventions

Labels will be used on all fiber optic and copper cabling to include Outside Plant cable, risers, horizontal (station) and fiber and copper patch cables. The labeling scheme shall be TIA/EIA-606A compliant or better. Labeling shall also extend to racks, cabinets, and patch panels used for terminations. Label materials shall meet all applicable fire codes and be resistant to the environment and have life span equal to or greater than the product to which they are applied. All labels shall be machine printed unless otherwise approved by ITNO in writing.

Fiber Optic Cable

OSP Cable

Outside Plant (OSP) shall be labeled at each end of the fiber optic cable shall be specifying the far end building name, building number, single-mode or multi-mode, and the strand count. The cable shall be also be labeled at entrance and exit points of the tunnel system or if it enters a conduit. The label shall be placed between 12 inches and 36 inches from the conduit or at the closet point that it is clearly visible. The cable shall be labeled along its length at 200-foot intervals or the closet point that maintains clear visibility. The labels in the tunnel system shall specify the building name, and number of both ends of the cable and specify the strand count. Termination panels at both ends shall be labeled with the far end building name, building number, single-mode, and the strand count. Termination panels shall use both machine printed labels and manufactures color coding on ferrules to denote single-mode fiber or multimode fiber. Ferrule colors shall be yellow for single-mode. Each separate 6 or 12 strand panel insert shall have a factory panel label and each strands terminations shall have a factory label or installers machine printed label with the strand number for that cable. If there is a factory supplied label for the door or cover it shall be used to indicate cable numbers and strand number.

Riser Cable

Each riser cable originating in a fiber Entrance Facility and interconnecting an Equipment or IDF shall be labeled on both ends of the cable with the far end Entrance Facility or Equipment or IDF number, strand count, and specify single-mode. On some occasions a small building or facility may be fed from a primary building and treated as an Equipment Room to the primary building. In those instances the riser cable (may require an OSP rated cable) shall be labeled the same as the feeder cable in the above paragraph. Termination panels will be labeled using factory supplied labels or approved machine printed labels and specify far end Entrance Facility or Equipment or IDF number, single-mode or multi-mode, and the strand count. Each separate 6 or 12

strand panel insert must be factory labeled as to panel number. Each strand must be either factory numbered or installer applied machine printed label.

Horizontal Cable (station)

In most cases fiber cable to the desk top will be duplex multi-mode or single-mode cable. The cable shall be labeled on each end behind the faceplate or patch panel with the far end, Equipment or IDF room number and the cable number. The cable number shall match the number on the patch panel and faceplate. The faceplate shall specify the Equipment or IDF room number on the upper left corner of the plate and the cable number either directly below or next to the jack. If it is a fiber optic connection, the faceplate must specify the type of fiber, single-mode or multi-mode. The Equipment or IDF patch panel shall include the room number below the cable number.

Fiber Optic Patch Cables:

Fiber optic patch cables shall be duplex cables either yellow in color for single-mode or orange for multi-mode. The patch cord shall be labeled on each end specifying the source and destination of the cable.

Copper Cable

OSP or Feeder Cable:

Outside Plant (OSP) cable shall be labeled on each end with the far end building name, building number, and the pair count. A label shall be applied at a point with 12 to 36 inches or nearest location to maintain visibility of the point it leaves the tunnel and enters a conduit. The label shall contain the building name and number and pair count of the building it is entering. The cable shall also be labeled along its length in the tunnel at 200 foot intervals at a location that maintains clear visibility and at every turn. The label shall contain the building name and number at each end and the pair count. The protector blocks at each end shall be labeled with the cable number and far end building name and number and pair count. The cable number will be supplied by ITNO.

Riser Cable

Riser cables shall be labeled on each specifying the far end Entrance Facility or Equipment or IDF number and the pair count. Terminations panels shall specify the far end Entrance Facility or Equipment or IDF number. The point that individual pairs are terminated will be labeled as to actual pair at every 5th pair point.

Telecommunication Outlets

Faceplates shall be marked with an ultra fine tip black permanent sharpie and covered with a machine printed label, such as a P Touch type label, over the handwritten sharpie identification (this procedure must be done so that identification remains if the machine printed label falls off. Mark the new location with the Equipment or IDF number on the upper left corner of the face plate and the cable number immediately below (preferred) or next to the jack. In the telecomm room after the first panel has been filled (1-48) the other panel must be labeled in continuous sequencing (49-96) etc. Other cable contractors have installed cables at these campuses or buildings. Locate all of the other Equipment or IDF locations at this site to determine the correct labeling sequence to be used for the new Equipment or IDF. Samples of faceplate labels are included within this document.

Examples

Fiber labeling

There will be three areas labeled on each fiber panel

Above the individual columns on label panel

Above the letters on each column

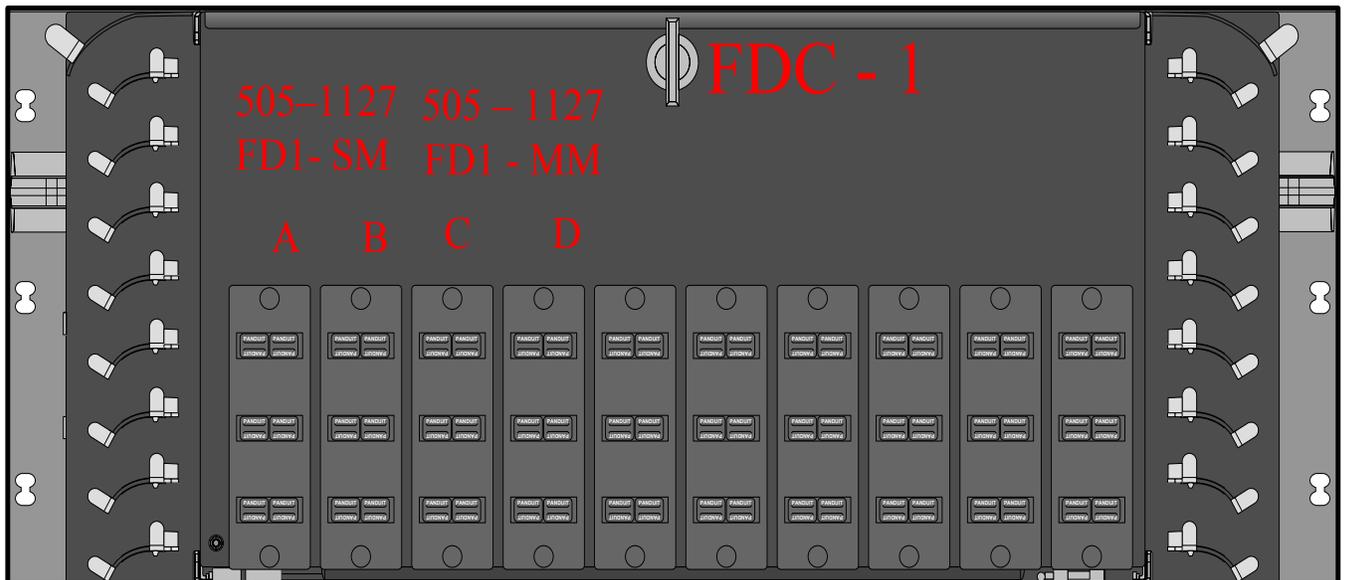
First line → Destination Building number – Destination ER/TR room number

Second line → Destination Fiber distribution cabinet – Fiber type

On each line in each column, individual labels for each fiber port

Destination panel - Destination fiber port - Destination color

Example:



Typical fiber colors and pair designation:

Blue: Bl Orange: O
Green: G Brown: Br
Slate: S White: W
Red: R Black: B
Yellow: Y Violet: V
Cyan: C Rose: Ro

Example:

505-1127
A
A1-Bl
A2-O
A3-G

Label the front of each Fiber optic distribution box with FD-sequence number

Example:

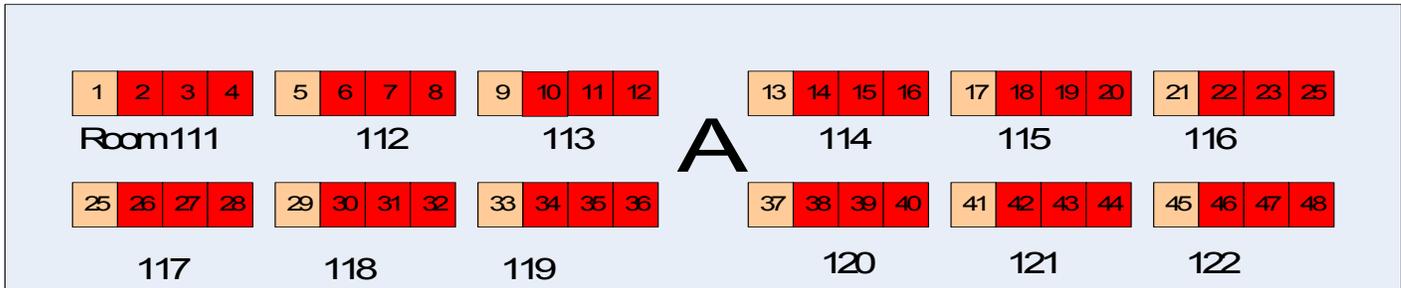
FD1

Copper labeling

Patch panel. Each panel will have an alphanumeric designation

Each jack number on the patch panel will be determined by room number along with the panel and port designation as shown below.

Example:

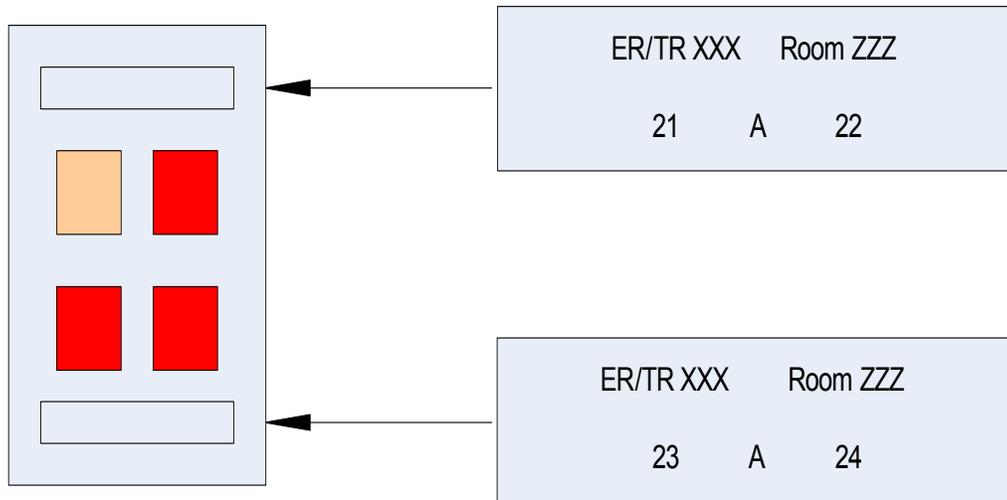


Faceplate at each office

ER/TR room # as well as the room number of the communication outlet on the first line of the supplied label

First Jack # followed by the panel letter followed by second jack #

Example:



Patch cord labeling

Panel number - jack number – Switch number – Port number

These need to be on each end of the cable.

Example:

A23-SW1- P11

Rack labels

Label the top of each rack with the rack number.

Example:

Rack 1

Appendix B

Approved Manufacturers

Racks

Chatsworth Products Inc.

Patch Panels

Uniprise Angled Patch Panels

Panduit Angled Patch Panels

Cable Copper

UTP and Coaxial

Uniprise

Cable Fiber

Uniprise – single and multi mode

Cable Management

Vertical – Chatsworth Products, Inc, Uniprise

Horizontal – Panduit, Uniprise

Telecommunication Outlets

Uniprise

Panduit

Uninterruptible Power Supply (UPS)

Tripp Lite

Basket Cable Tray

Cabofil

Cameras, DVRS and NVRs

Pelco Cameras and DVRS

Arecont Cameras

Strand NVRs

Extreme I R Cameras

Alarm System Components

Digital Security Controls

Appendix C

Parts Listing

Racks

- Chatsworth Products Inc.
 - Rack – 55053-703
 - Vertical Cable Manager – 30162-703
 - Grounding Bar – 13622 – 012

Cable Copper

- Cat 6 UTP
 - Uniprise 6504 Blue
- Cat 3 UTP
 - Ber-Tek – 1103213
- Coaxial
 - Uniprise – 2275 V

Cable Fiber

- Multi mode
 - Uniprise – P-006-DS-6F-FSUOR
- Single mode
 - Uniprise – P-006-DS-8W-FSUYL

Fiber Optic Enclosures

- Uniprise
 - 1U – RFE-SLG-EMT/1U
 - 2U – RFE-SLG-EMT/2U
 - 3U – RFE-FXD-EMT-BK/4U
 - 4U – RFE-FXD-EMT-BK/4U

Cable Management

- Vertical – Chatsworth Products Inc.
 - 30162-703

➤ Uniprise

VCM-DS-84-6B	760072785	6 IN. WIDE 7FT DOUBLE SIDED BLACK W/ DOORS
VCM-DS-84-8B	760089359	8 IN. WIDE 7FT DOUBLE SIDED BLACK W/ DOORS
VCM-DS-84-10B	760089367	10 IN. WIDE 7FT DOUBLE SIDED BLACK W/ DOORS
VCM-DS-84-12B	760089375	12 IN. WIDE 7FT DOUBLE SIDED BLACK W/ DOORS

➤ Horizontal – Panduit

- 1U – NCMHF1
- 2U – NCMHF2

Copper Termination Facilities

➤ Cat 3 Riser Cables

- Main Cross Connect (MC)
 - 5 Pair – Panduit P110KB1005
 - 5 Pair – Uniprise #UNK-110-WB-5M-100PR
 - 4 Pair – Panduit P110KB1004
 - 4 Pair – Uniprise #UNK-110-WB-4M-100PR
- Entrance Facility (EF)*
 - 5 Pair – Panduit P110KB1005
 - 5 Pair – Uniprise #UNK-110-WB-5M-100PR
 - 4 Pair – Panduit P110KB1004
 - 4 Pair – Uniprise #UNK-110-WB-4M-100PR
- Equipment and IDF *
 - Angled Patch Panel – Panduit – UICMPPA48BL
 - Angled Patch Panel – Uniprise – M2000A-48

➤ Cat 6 Horizontal Cables **

- Main Cross Connect (MC)
 - Angled Patch Panel – Panduit – UICMPPA48BL
 - Angled Patch Panel – Uniprise – M2000A-48
- Entrance Facility (EF)*
 - Angled Patch Panel – Panduit – UICMPPA48BL
 - Angled Patch Panel – Uniprise – M2000A-48
- Equipment and IDF *
 - Angled Patch Panel – Panduit – UICMPPA48BL
 - Angled Patch Panel – Uniprise – M2000A-48

* Angled patch panels utilized for telephone riser cables will be terminated as stated in Section 4.0 BDF Additional Requirements.

** Angled Patch Panels shall be filled with appropriate number and color of Panduit or Uniprise Jacks (listed below) for termination purposes.

Copper Patch Cables

- Panduit
 - 3 FT. UTPSP3
 - 5 FT. UTPSP5
 - 7 FT. UTPSP7
 - 10FT. UTPSP10
 - 14 FT. UTPSP14
 - 20 FT. UTPSP20
 - Colors – Above part numbers are off white
 - Add following to part numbers for different colors
 - Black – BL
 - Blue - BU
 - Red – RD
 - Yellow – YL
 - Violet – VL
 - Orange – OR
- Uniprise
 - 3 FT. UNC6 –?? – 3F
 - 5 FT. UNC6 –?? – 5F
 - 7 FT. UNC6 –?? – 7F
 - 10FT. UNC6 –?? – 10F
 - 14 FT. UNC6 –?? – 15F
 - 20 FT. UNC6 –?? – 20F
 - Colors –?? = Color Designation
 - Add following to part numbers for different colors
 - Black – BK
 - Blue – BL
 - Red – RD
 - Yellow – YL
 - Violet – VL
 - Orange – OR

Telecommunication Outlets

- Panduit
 - Faceplate – CFPE4IW
 - Jacks
 - Red – C5688TPRD
 - Yellow – C5688TPYL
 - Blank – CMBIW – X
- Uniprise
 - Faceplate – UNF-MFM-4P-WH
 - Jacks UNJ600-??
 - Red – RD
 - Yellow – YL
 - Blank – UNDC-WH

Uninterruptible Power Supply (UPS)

- Tripp Lite
 - SMART1500RML2U
 - SMART5000XFMRXL

Power Distribution Unit

- Tripp Lite
 - PDU1220

Basket Cable Tray

- Cabofil
 - 12 X 2 – CF541300 EZ
 - 12 X 4 – CF1051300 EZ

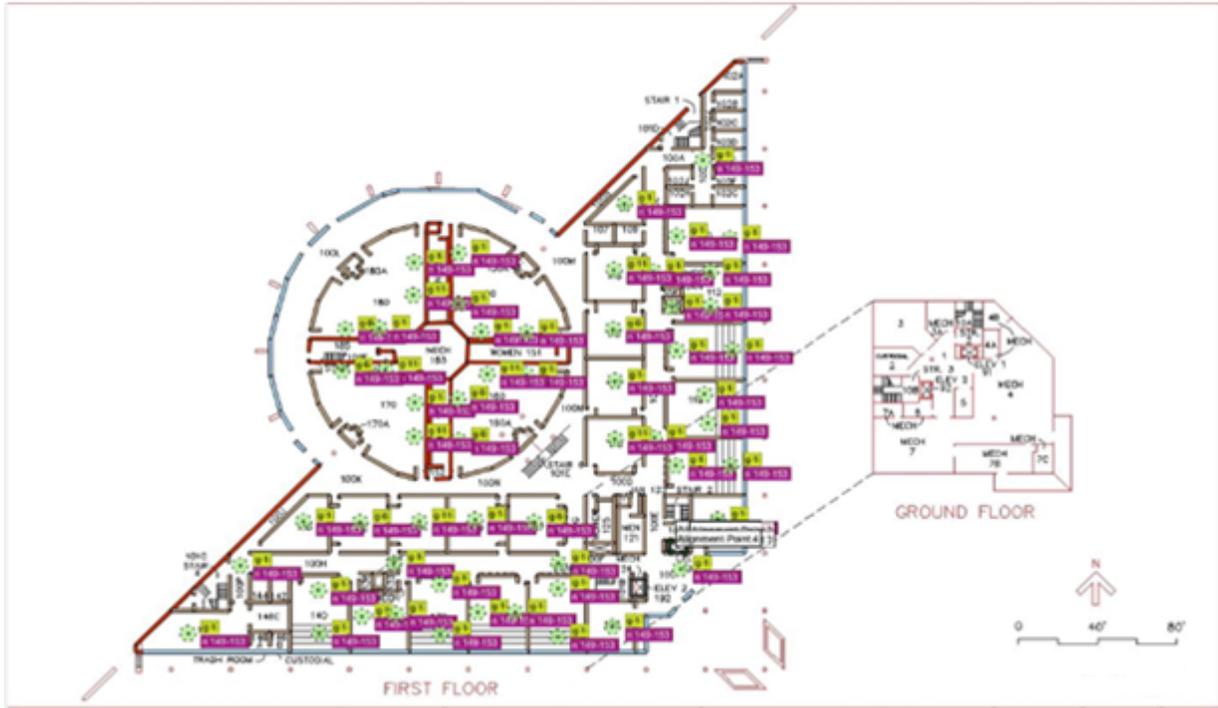
Gas Protected Termination Blocks

- Circa – Box
 - Terminal – 188OECA1-100G
 - Modules – 3BIE

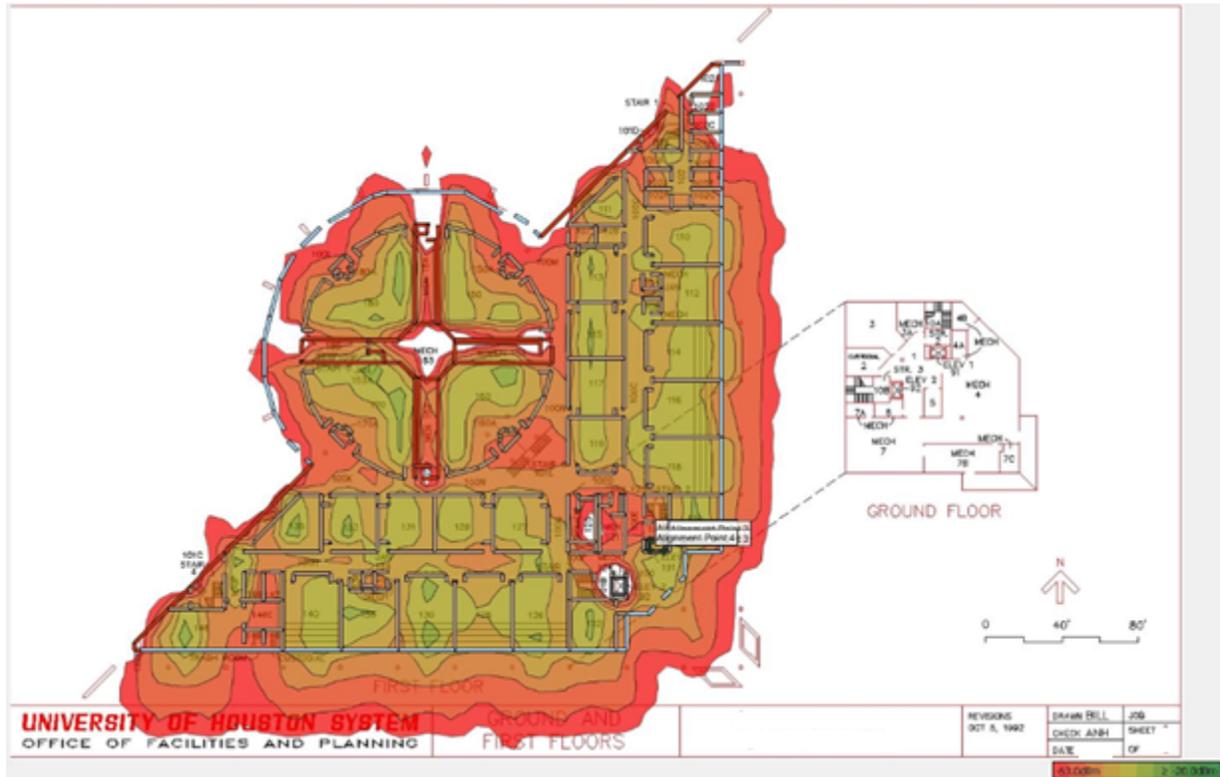
Miscellaneous -

- Suspension devices
 - J-Hooks
 - Panduit – J – Pro

Appendix D: Sample of WAP location Map



Appendix E: Sample of a WAP DB Level (Heat) Map



Appendix F: Sample of Excel File with WAP information

AP Name	AP Model	MAC Address	Room #	IDF #	Switch Port #
563-0100N-HW	AP320i	00:0c:e6:08:18:f4	100N	IDF 105	1/0/11
563-0107B-CT	AP320i	00:0c:e6:07:91:1f	107B	IDF 105	1/0/15
563-00102-HW	AP320i	00:0c:e6:07:8f:65	102	IDF 105	1/0/17