UNIVERSITY of HOUSTON

UNIVERSITY INFORMATION TECHNOLOGY

NETWORK INFRASTRUCTURE STANDARDS

Prepared by UIT Network Services

Version 1.26 — August 6, 2019

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1.0 Revision Notes

Revision history

1.26 August 6, 2019

- Added provision to 2.0.1 Introduction requiring inclusion of turnkey solution cost in submitted proposals
- Removed Nick Ackles and updated James Schexneider's managerial titles in 3.0 Contact Information
- Added definitions for Metro Fiber and Lateral Fiber to 5.0.1 Definitions
- Changed "IDFs" to "NFs" in 5.0.2.1 General
- Replaced image for Figure 2 at 5.0.2.7 Sample Rack Elevation
- Added option for UITNS exception for Metro fiber splices in 6.0.5 Optical Fiber Cable Installation
- Added paragraph to require vendor to remit fiber test results to UITNS in 6.0.5 Optical Fiber Cable Installation
- Moved the reference to J-type Polywater to the correct paragraph regarding lubrication in 6.0.5 Optical Fiber Cable Installation
- Specified the minimum length for fiber loops between buildings at 6.0.6 Outside Plant (Infrastructure Cables)
- Specified the format for remitting OTDR bi-directional test results and added a requirement to remit Fiber Power Meter test results in 8.0.8 Deliverables to UITNS
- Added paragraph at beginning of 11.0.1 General to state a preferred product for firestopping
- Replaced Manager of Media and Security Systems to UITNS Project Manager in 12.0.4.2 Installation Testing Requirements
- Replaced UIT with UITNS at 15.0.1 General

1.25 July 27, 2018

- Inserted captions and cross-references for all numbered tables
- Updated company name from "Dow Corning" to "Corning" throughout
- Replaced "Lync" with "Skype for Business" throughout and updated related hyperlinks
- Updated 3.0 Contact Information
- Removed reference to Cable Television (CATV) in 5.0.1 Definitions
- Increased size of BDFs and clarify that BDF and IDF specifications are for FINISHED sizes in 5.0.2.2 Room Sizing
- Expanded scope of 5.0.2.4 Electrical to include all network convenience outlets, and not just those in IDFs
- Updated distribution shelf model number in 6.0.5 Optical Fiber Cable Installation
- Clarified service loop description at beginning of 6.0.6 Outside Plant (Infrastructure Cables)

- Added specification for lightning arrestors on copper cabling in 9.0.1 Lightning Protection
- Changed submission requirement for OTDF/OLTS test results from printouts to electronic submittal in 10.0.2.1 Fiber Optic Cabling
- Made substantial revisions to requirements in 12.0.2 Cameras, Table 2
- Removed Scallop from list of suppliers in 12.0.2.5 Guidelines for Alternative Camera Selection Process, and in 12.0.2.7 Network Video Recorder (NVR) Requirements
- Changed “PoE” to “PoE(+)” in 12.0.2.6.1 IP Camera Power Source Preferences
- Corrected “distribution” to “access” and added KVM provision in 12.0.2.7.1 NVR Server Installation Requirements
- Made multiple changes and clarifications to 12.0.2.7.2 Camera-NVR Configuration Requirements
- Clarified requirement regarding redundant cabling and jacks for WAPs and moved the statement from the bottom to the top of 15.0.3.1 Installation of WAPs
- Added a reference to the 15.0.3.1 redundancy requirement in 7.0.2 General
- Added Uniprise models to Cable Fiber OSP in Appendix C
- Updated Uniprise models for Fiber Optic Enclosures in Appendix C
- Updated model list for Power Distribution Unit in Appendix C
- Added model specification for Rackmount Monitor Shelf in Appendix C
- Clarified that all fiber strands must be tested (not just those that are terminated), and permitted the contractor to choose one of two tests, rather than requiring both in 10.0.2.1 Fiber Optic Cabling
- Applied numerous updates to equipment listed in 12.0.2 Cameras

1.24 February 24, 2017

- Updated camera specifications in Table 2, 12.0.2 Cameras

1.23 August 2, 2016

- Replaced references to Meru with Aruba
- Replaced references to Cisco with HPE
- Removed specific AP model numbers

1.22 June 7, 2016

- Added Category 6A to 5.0.2.5 Termination Hardware
- Changed one instance of “6e” to “6E” for consistency
- Removed DN14-180 day/night color/B&W from acceptable models in the Panoramic IP section of Table 2

2.0 Introduction and Purpose

2.0.1 Introduction

The specifications in this document are the minimum standard for UH structured wiring systems. They are general requirements and specifications to allow for adjustment in today's ever growing and changing telecommunications industry. UIT Network Services (**UITNS**) may modify these specifications to accommodate specific space requirements or functional or special design needs.

Specifications for wiring and wiring support are constantly changing as industry and networking standards evolve. **To ensure that all current media types, media support systems and installation standards are followed, all contractors and outside Information Technology consultants must receive approval from UITNS before submitting a design and starting an installation.** The designated specifications for material, products, and space requirements for Network Facilities are, however, standards for choosing material and products to be installed.

Proposal submittals must include a turnkey solution for the installation of all network equipment (including switches, UPS, WAPs, and other such devices).

These specifications and standards are a general guide for contractors to follow when installing, testing, and documenting structured wiring systems. Final specifications for a specific project will be a collaborative effort between the installation contractor, architect/designer, the occupant, and UITNS. Specific, detailed specifications will be based on the individual purpose of the space, and will be a culmination of the collaborative effort of the involved parties, subject to final approval by UITNS.

2.0.2 PURPOSE

The purpose of this document is to create a starting point for collaboration between the interested parties to ensure that contractors create high quality bid documents that adhere to accepted industry standards and specifications.

The standards in this document are adapted from relevant industry standards and practices for cabling installations. They provide these benefits for the University:

- Support for best practices
- Provision of 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

University Information Technology Network Services (UITNS)

Attention: UITNS
4211 Elgin Suite 117
Houston, Texas 77204 -1010
713-743-1411

UIT, Project Manager — Network Standards Coordinator
Mark Aycock
GSB 110
832-842-4674
MLAycock@Central.UH.edu

UIT, Project Manager
Lisa Thomas
GSB 108
713-743-4566
lcthoma2@Central.UH.EDU

UIT, Telecommunications Manager
Omar Farooq
GSB 105
832-842-4628
OFarooq@Central.UH.EDU

UIT, Telecommunications Manager — Access Network, Media Security Systems
James Schexneider
GSB 107
832-842-4592
jschexne@Central.UH.EDU

4.0 Codes, Standards and Regulations

4.0.1 Overview

Federal, state, and local codes, rules, regulations, and ordinances will govern the work. If the contractor notes an item in the drawings or the specifications that presents a code violation, promptly call it to the attention of the University of Houston in writing. Send written notice to the Network Standards Coordinator. Where the requirements of these specifications are more stringent than applicable codes, rules, regulations, and ordinances, the specifications will apply.

The design, manufacture, test, and installation of cabling networks at the University of Houston will comply with manufacturer's requirements and will be 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 *(Texas Administrative Code, Title 1, Part 10)*
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-C.1 -- Commercial Building Telecommunications Cabling Standard, Part 1: General Requirements

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

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

ANSI/TIA/EIA-569-C -- 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 Multi-mode Fiber Cable Plant

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

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 Network Facilities

5.0.1 Definitions

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

Main Distribution Frame (MDF) is the main telecommunications service entrance into the building. It may or may not be where the BDF is located.

Building Distribution Frame (BDF) 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.

Intermediate Distribution Frame (IDF) provides for demarcation between the per-floor horizontal customer service cabling and the building's video, data, and voice backbone cabling. This room contains the electronic equipment that transitions between the 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.

Main Cross-Connect (MC) is 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) is 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) is a secured case, cabinet, or housing for telecommunications equipment, cable terminations, and cross-connect cabling.

Network Facilities (NF) is the term used to describe rules that apply to all three types of distribution facilities on campus (MDF/BDF/IDF).

Metro Fiber (MF) is the term used to describe high fiber count cables (144, 288, etc.) that traverse the campus, have midpoint splice cases, and act as the fiber backbone of the campus.

Lateral Fiber (LF) is the term used to describe a fiber optic cable of a smaller fiber count (12 – 48 is typical) that originates from a BDF and terminates into the Metro Fiber for its network connectivity.

5.0.2 REQUIREMENTS

5.0.2.1 GENERAL

All work associated with NFs will comply with the National Electrical Code, and with state and local building codes. Follow the guidelines developed by **ANSI/TIA/EIA** and **BICSI** in both design and construction.

UITNS must approve all variances.

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

To facilitate the proper installation, routing and placement of cables, NFs will be located to comply 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 NFs will be less than 90 meters.

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

Under no circumstances will electrical or any other utility panels be located in an IDF.

Doors and Locks for NFs — A windowless, solid core door measuring 36” wide by 80” tall and swinging open out of the room is the minimum requirement. Locks are to 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 NFs will be available from UITNS as needed. Equip all doors with an online card reader system.

NFs — Secure NFs to ensure all areas in which information technology resources is stored remain protected from environmental concerns, hazards, and theft. Coordinate the security of the NFs with UITNS. All NFs must have full path access for UIT staff.

Floors — Floor loading must be at least 50 pounds per square foot (50 lb/ft^2). Floors will be vinyl composition tile or sealed concrete. Carpet is prohibited.

Conduits and Sleeves — To facilitate 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. 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 that interconnect telecom rooms are stubbed 2" into the rooms.
- The 1" conduits servicing end users’ information outlets are usually "stubbed" to above the ceiling, and from there to the nearest corridor/hallway telecommunications horizontal pathway leading to the IDFs.
- Minimum radii for conduit bends are:

    1. Internal diameter of less than 2" — bending radius is 6 times the internal diameter.
    2. Internal diameter of 2" or more — bending radius 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.
- To prevent cable damage, all sleeves will be reamed and grommets placed before cable installation.

Building Riser — The building backbone riser system connects IDFs to each other and to the BDF room. UH specifies separate cable systems to provide data, video, and voice needs. Riser (plenum) rated multi-pair twisted pair copper cables, 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.

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 should be covered, floor to ceiling, with fire rated ¾" plywood and painted with 2 coats of a neutral color fire retardant paint; the fire rated stamp must be visible. Have the Fire Marshall’s Office inspect and approve before painting. Paint should be (or be 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 500 lumens, measured at 3 feet above floor level. Use timer- or motion-type light switches, placed immediately inside the door. Use LED bright white lighting.

Cable Entrance — Riser or distribution cables entering/exiting the IDF shall be via four-inch (4") conduits, sleeved cores or cable tray. **Include two additional conduits, sleeved cores, or cable trays above the current requirement to allow for future growth.**

5.0.2.2 Room Sizing

BDF

Minimum *finished* size for all buildings — 10’ x 12’

Minimum ceiling height is 9' 6"

BDFs 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 *finished* size for all buildings 8’ x 10’

Minimum ceiling height is 9' 6"

IDFs 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 ducted in and designed to maintain a room temperature of 68 to 70 degrees with 30 to 55 percent humidity control with the full complement of equipment in the room. UITNS 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 UITNS.

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 on every wall 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.

UITNS must approve final design and layout of number, type, and location of outlets.

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 must accept 2-hole lug connectors. 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. UITNS will determine appropriate UPS devices.

5.0.2.5 Termination Hardware

UITNS must approve the design layout for the placement of racks, rack hardware, and wall fields within the IDFs.

Equipment Racks — Heavy duty, aluminum, 7' floor mount racks with cable management channels on both sides and mounting rails for 19" equipment are required on equipment racks. All racks are to be properly anchored, with space allocated between racks for installation of vertical cable managers. Racks are to be mounted side by side as shown in Figure 1 and Figure 2.

Patch Panels — Approved patch panel types are listed in Appendix C. All jacks will be Category 6E and Category 6A. 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 — other than Category 6A
- **Blue** General purpose, office, and lab connection — Category 6A
- **Yellow** Wireless access point connection
- **Purple** Security camera, security device, lighting controller, or Code Blue phone
- **Green** EMECS system connection
- **White** AV

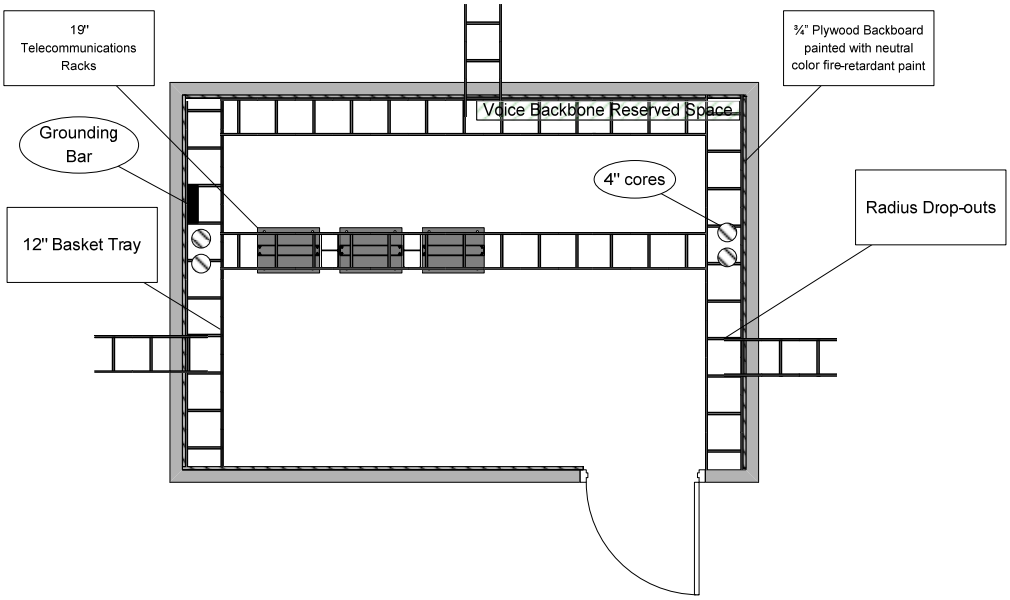
Rack Mounted Hardware — For BDFs, a minimum of eight Units (8U) are reserved at the top of each rack for fiber enclosures. For IDFs, a minimum of six Units (6U) are reserved at the top of each rack for fiber enclosures.

Wall Mounted Hardware — NFs — 25-pair or 50-pair 110 system kits shall be fastened to the plywood backboard and D-rings or jumper troughs used for wire management.

Wire Managers — Vertical wire managers will run the entire length of a rack, mounted on both sides of each rack. Vertical wire managers shall be 10” wide. 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.

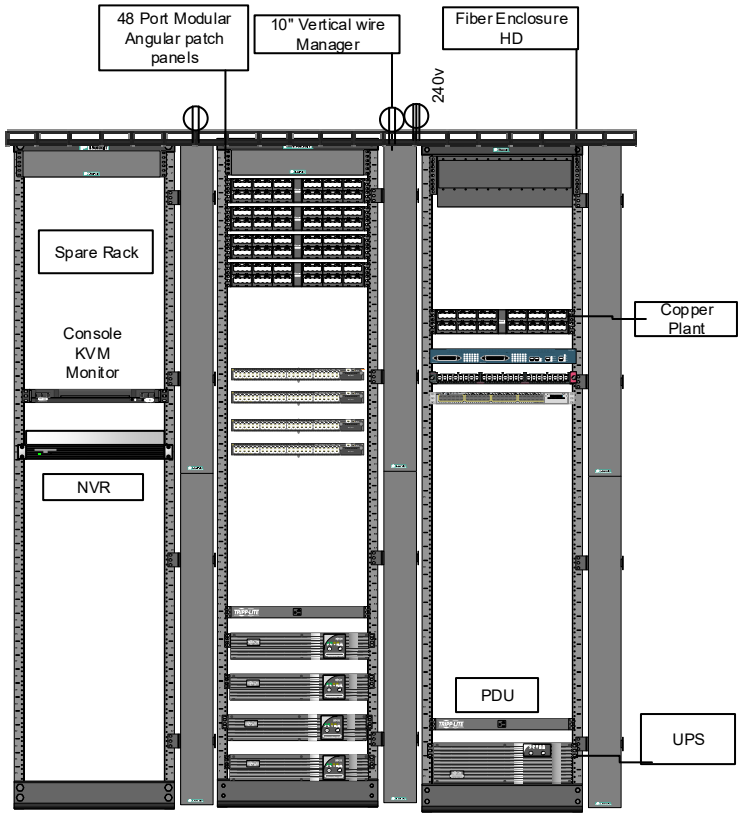
5.0.2.6 Sample IDF Layout

FIGURE 1



5.0.2.7 Sample Rack Elevation

FIGURE 2



5.0.2.8 Additional Requirements

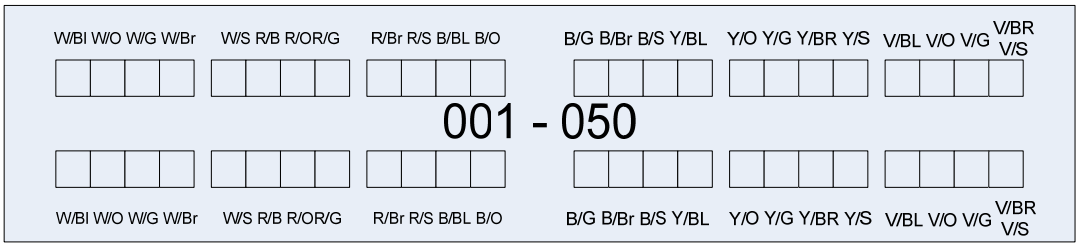
Riser and distribution cables leaving the MDF to BDF and IDF spaces shall be via four-inch (4") conduit, sleeved cores with basket cable tray for horizontal runs. At least two additional conduits, sleeved core or cable tray with sufficient available space must be included in the design to provide for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

The BDF 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 BDF and each IDF. UITNS must approve the final strand count.

In the NFs the riser cable shall be terminated on the patch panel in accordance with the drawing in Figure 3. Wire management is to be provided using D-rings or jumper troughs. Voice jacks are to be black in color.

FIGURE 3



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.

5.0.2.9 Labeling

Properly label all Network Facilities that include equipment, racks, cabling, patch cables, terminating panels, or grounding bus bars. 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 UITNS or by personnel UITNS designates. UITNS 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. 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-C, IEEE and TIA-492AAAC-A specifications.

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

6.0.3 Minimum Requirements for OSP Fiber Optic Cable

Optical fiber cables shall be of loose buffer tube configuration.

Optical fiber cables shall be gel free.

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 adjacent layers. Colors shall not cause fibers to stick together.

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. The outer jacket shall be fungus resistant, UV inhibited, and water resistant, and shall have a non-wicking rip cord for easy removal. The outer jacket or sheath shall be free of holes, splits, and blisters. The 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 (Newtons) 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 UITNS management.

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

All cable shall be installed in a one inch ID 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.

When splicing into the Metro fiber ring, all fiber cable installations are to be 100 percent terminated except as directed by UITNS. Plastic dust caps will be installed on all unused fiber terminations.

Preliminary fiber test results (CD or thumb drive) are to be submitted to the UITNS Project Manager post-installation before being put into service so that any non-conformities or inconsistencies may be corrected to avoid disruptions to the active network.

Terminated fiber strands will be installed in rack-mounted optical fiber distribution shelves. A Corning 2U-CCH-02U or Uniprise #RFE-SLG-EMT/2U distribution shelf will be used in all IDFs. A Corning RFE-FXD-EMT-BK/4U or 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 during installation to assure that tension and torsion do not exceed manufacturer specifications.

A minimum of three (3) plus a sleeve with a diameter of an inch and a quarter (1¼") 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. J-Type Polywater is preferred.

Fiber patch cables secured by strap or other fasteners shall not be pulled so tightly that the outside cable sheathing is indented or crushed.

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 consisting of at least 50' 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. A copper tracer line should be run with all fiber that is in a non-metallic conduit. All manhole/pull boxes shall have GPS locations recorded and submitted to UITNS.

All inner-ducts shall be spliced according to the manufacturer's approved methods.

Single-mode fiber patch cables will be terminated with 'LC' 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 UITNS-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. UITNS must approve final strand counts. Single-mode fiber size will be 9/125 micron. All single-mode cables are not to exceed 0.4 dB/km attenuation at 1310nm wavelength.

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.

At a minimum, a 12-strand, single-mode fiber of size 9/125 micron shall be installed. UITNS must approve final strand counts.

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 “LC” connectors on one end and as required on the other end.

Bulkhead distribution cabinets and cable must be labeled in accordance with UITNS labeling conventions defined in Appendix A.

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 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 the UITNS Project Manager. UITNS 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. The cabling contractor’s Project Managers and technicians

should be Asbestos Administrative Awareness-certified, with 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 the UITNS Project Manager **before any work is done.** If an asbestos warning sign is evident, **do not enter room or area in question.**

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

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

7.0.2 General

All network wiring shall be designed or approved by UITNS.

All network wiring shall be run using suspension hooks, conduits, or approved cable tray. **Never attach cable to the ceiling grid support system.**

Pull string shall be installed with cable when it is pulled in conduit that does not contain inner ducts.

For cabling to Wireless Access Point locations, see the requirements in section 15.0.3.1 Installation of WAPs.

7.0.3 Backbone Cabling

UITNS must approve all optical fiber and copper backbone cable designs, materials, and sizes before installation.

At minimum, the building feeder must have 25 balanced twisted-pair (UTP) **Category 3** cable. It must be solid copper and 24 AWG.

At minimum, each IDF must have 25 balanced twisted-pair (UTP) **Category 3** cable. It must be solid copper and 24 AWG.

Note: Listed Type CMR, CMP, MPR and/or MPP (as required in the NEC 2012).

See Appendix A for approved labeling conventions for backbone cabling.

See Appendix B for approved backbone cabling manufacturers.

7.0.4 Horizontal Cabling

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

See 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) that meets **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-C.2 shall be installed.

See Appendix B for listing of approved horizontal cabling materials manufacturers.

7.0.5 Copper Patch Cables

All copper patch cables shall meet or exceed TIA/EIA-568C.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 or 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
- **White** AV

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.

Faceplates must match the color and material of the surrounding wall outlets, subject to approval by UITNS.

7.0.6.2 Telecommunication Outlet Recommended Location and Quantities

Faculty/Administrative Offices — One (1) telecommunication outlet consisting of one (1) data jack. Additional outlets will be added upon a customer needs analysis and installed as needed.

Clerical/Staff Offices — One (1) telecommunication outlet consisting of one (1) data jack. Additional outlets will be added upon a customer needs analysis and installed as needed.

Secretary/Administrative Assistant Offices — One (1) telecommunication outlet consisting of one (1) data jack. Additional outlets will be added upon a customer needs analysis and installed as needed.

Lab — One (1) telecommunication outlet per designated lab station consisting of one (1) data jack.

Conference Rooms — One (1) telecommunication outlet consisting of one (1) data jack. Additional outlets will be added upon a customer needs analysis and installed as needed.

Dormitories — One (1) telecommunication outlet consisting of one (1) data jack. Additional outlets will be added upon a customer needs analysis and installed as needed.

Lecture Halls — One (1) telecommunication outlet consisting of one (1) data jack. Additional outlets will be added upon a customer needs analysis and installed as needed.

Classrooms — One (1) telecommunication outlet consisting of one (1) data jack. Additional outlets will be added upon a customer needs analysis and installed as needed.

General Purpose Classrooms — One (1) telecommunication outlet consisting of one (1) data jack. Additional outlets will be added upon a customer needs analysis and installed as needed. **Note: After installation, a minimum of one data port will 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

FPC/Direct Contracted Vendors must submit shop drawings, product data (including cut sheets and catalog information), and samples required by the contract documents to the UITNS Project Manager by email. Submit shop drawings, product data, and samples promptly enough and in appropriate sequence to cause no delay in the work or in the activities of separate contractors.

Provide a complete location table and spreadsheet with location detail for each wall jack:

- jack numbers
- room number
- wall orientation (North, South, East, or West, or Power Pole if applicable)
- landmark orientation and distance

The contractor is 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.

By submitting shop drawings, product data, and samples, the contractor represents that he or she has carefully reviewed and verified the related materials, quantities, field measurements, and field construction criteria. 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.

UITNS 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 UITNS in writing of the deviation at time of submittal, and UITNS has given written approval of the specific deviation. The contractor is responsible for deviations from requirements of the contract documents not specifically noted by the contractor in writing, and specifically approved by UITNS in writing.

UITNS 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.

UITNS 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. UITNS 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. UITNS approval of a specific item does not indicate approval of an assembly of which the item is a component.

Do not perform work requiring submittal and review of shop drawings, product data, or samples, until UITNS has approved the submittal.

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

General — submit:

- Bill of materials, noting items with long lead time
- 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:

- 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 the appropriate NFs.**

Product data — provide catalog cut sheets and information for:

- 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:

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

8.0.2 Contractor Certification

BICSI and Panduit/Uniprise Certifications for On-site Personnel

The contractor shall be a licensed Panduit Certified Systems Integrator (PCSI) Design and Installation Company and/or a Uniprise Certified Installer (UCI). A copy of the PCSI certificate 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).

When a contractor has been recommended for selection, UITNS will only award final approval after the contractor has provided documentation that all on-site personnel have:

1) BICSI certification **AND** 2) Uniprise certification OR Panduit certification

These certifications must remain in effect for all on-site personnel throughout the bidding process, installation, testing, documentation, and acceptance.

BICSI RCDD® Credential

Before the project is awarded, the contractor must have at least one (1) Registered Communications Distribution Designer (RCDD) on staff, with either (A) Panduit-approved certification plus RCDD equivalent submitted and approved by Panduit, or (B) Uniprise-approved certification plus RCDD equivalent submitted and approved by Uniprise. The RCDD must approve the design, installation, and documentation of communications systems, and must make sure all Panduit Integrity System or Uniprise Warranty documentation and requirements are met and submitted to Panduit or Uniprise upon completion of the project.

Subcontractor Certification

Do not subcontract installation of voice/data/video cabling, termination, or testing without the written consent of University of Houston and review and confirmation from Panduit or Uniprise to University of Houston that the proposed subcontractor personnel have current and valid certification as Panduit PCSI or Uniprise UCI, respectively.

Contractor Experience and References

The contractor must have at least five (5) years of satisfactory work experience on systems of this type and size.

Upon request by UITNS, furnish a list of references with specific information regarding type of project and the contractor's involvement in providing equipment and systems.

Materials, Subcontractor Rights and Obligations, and Quality Assurance Inspections

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 UITNS.

Quality Assurance inspections will be coordinated with UITNS Project Managers.

8.0.3 Warranty

Unless otherwise specified, unconditionally guarantee in writing the materials, equipment, and workmanship for a period of at least fifteen (15) years from date of acceptance by UITNS or twenty (20) years from date of manufacture.

8.0.4 Delivery, Storage, and Handling

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

When University of Houston deems it necessary to place site restrictions, use of the site shall be at UITNS direction.

Access to buildings wherein the work is performed shall be as directed by UITNS.

The selected contractor will temporarily 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 UITNS to minimize conflict and prevent disturbance of the University of Houston operations.

Do not interfere with ordinary use of streets, aisles, passages, exits, and operations of the University of Houston, including those of UITNS.

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

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

8.0.7 Continuity of Services

Do not interfere with or interrupt existing building services unless prior 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 to UITNS

At conclusion of the project — submit project record drawings and include:

- Approved shop drawings
- Plan drawings indicating locations and identification of work area outlets, nodes, IDFs, and backbone (riser) cable runs
- Termination detail sheets for IDFs
- 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 CDs (electronic submissions must be sent to the UITNS Project Manager)
- OTDR bi-directional test results: printouts and digital media (CDs or thumb drives)
- Fiber Power Meter test results: printouts and digital media (CDs or thumb drives)

9.0 Protection, Grounding and Bonding

9.0.1 Lightning Protection

NFPA 70 (NEC) articles 250 "Grounding and Bonding" and 800 "Communications Circuits" cover general requirements for grounding, bonding, and protecting electrical and communication circuits. NFPA 780 "Lightning Protection" addresses zone protection.

Install building entrance protection for copper cabling. 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.

Lightning arrestors on copper cabling that exits a building and feeds outdoor APS, cameras, or other network equipment will be rated for 1 Gbps.

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 that is connected to building ground system or IDF grounding bar using #6 AWG green insulated copper grounding conductor.

9.0.3 Bonding

Use low-impedance bonding 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, including during 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

All individual fiber strands, whether terminated or unterminated, shall be tested bi-directionally using optical time domain reflectometer (OTDR) or 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 1310 nm and 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 number of bad pairs shown in Table 1, or if outer sheath damage is cause of bad pairs, remove and replace the entire cable.

TABLE 1

MAXIMUM PERMISSIBLE BAD PAIRS IN CAT 3 CABLING

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 cable.

11.0 FIRESTOPPING

11.0.1 GENERAL

EZ-Path® fire rated pathways are the preferred method of fire stopping for all network cable penetrations. The individual product used shall meet the requirements of the particular installation. Traditional fire stopping products may be used as needed.

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. Firestopping materials shall adhere to substrates and maintain fire and smoke seal under normal expected movements of substrates, conduits, and cables. Use only approved filler material.

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.

11.0.2 APPLICABLE STANDARDS

The agencies in this section and their codes, standards, and regulations 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.

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)

2012 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

2015 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 for each type of communications.

The time delay ratings for selected systems must match or exceed those of the associated fire-rated floors, walls, or other partitions of building construction.

Coordinate with trades constructing floors, walls, or other partitions of building construction to specify the 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.

Install all firestops 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:

- Existing raceways, cable trays, and cabling whether they are contained in the preceding structures or penetrate any existing building construction shall be firestopped to the extent necessary to fill cavities that exist between existing building construction and

existing communications penetrations or 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 the 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 Camera Contractor Certification

Contractor shall have the following certification:

- All on-site personnel shall have appropriate Pelco certification for installation, programming, and troubleshooting.
- Appropriate certifications shall be included in all responses to RFOs, RFPs and standard contract project solicitations.
- Documentation for all on-site personnel shall be provided before final UITNS approval will be given.

12.0.2 Cameras

TABLE 2

ACCEPTABLE SECURITY CAMERA MODELS

Part	Manufacturer/Product Lines	Application — Model Choice
Facial ID	Pelco SARIX Enhanced IME+ Next Generation series with SureVision 3.0	Ingress doors, gates, and traffic areas with lane control. The specific model will support at least 100 ppf (pixels per foot) at the point of interest. May also be used in areas with marginal lighting conditions.

Part	Manufacturer/Product Lines	Application — Model Choice
Activity Detection	Pelco Sarix Enhanced IME series with SureVision 3.0	Detection and overviews that provide at least 20 ppf at the far end of the view. To be deployed in the following areas: • Hallways • Lobbies • Elevator landings • Stair landings • Exterior card readers • Plazas • Parking lots MODEL SELECTION: Specific model selection is based on business use requirements as determined by the business owner. Use these criteria to select the model: • Pixels per foot (ppf) • Lighting conditions • Environmental variables • Analytics requirements • Impact on network traffic *** Consult Campus Safety for final approval of model selection.
Alternative (indoor only) for • Low Light Facial ID • Activity Detection	IXE series with SureVision 3.0	Indoor applications facial ID / Activity Detection
Alternative Form Factor (indoor/outdoor) for • Facial ID • Activity Detection	IBE series with SureVision 3.0	Facial ID or Activity Detection indoor, outdoor

Part	Manufacturer/Product Lines	Application — Model Choice
Panoramic IP	Pelco Optera 180 Series	• Building perimeters • Parking lots • Large indoor arenas • Irregular hallways • Athletic facilities
PTZ	Pelco Spectra IP (20x or 30x zoom)	Live Event Monitoring (indoor/outdoor)
Specialty Camera License Plate Readers	AXIS Q1765-LE 2 MP with built-in IR arrays	• License Plate Readers • Confined areas with lane control under varying lighting conditions ***Consult with the Campus Safety Systems Manager for final design approval.
Video Server	Pelco DSSRV2	Pelco DSSRV2 — Digital Sentry NVR Firmware must be of the latest version at the time of system installation. ***Consult with the Campus Safety Systems Manager for final design approval

12.0.2.1 Camera Model Specifications and Use Requirements

For UH Department of Public Safety Use Requirements, camera deployments are defined in document G403006 SURVEILLANCE CAMERAS. Refer to the FP&C Master Specification for current camera business owner specifications.

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. Three 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 guidelines in Table 3 should apply.

TABLE 3

RESOLUTION REQUIREMENTS FOR SECURITY CAMERAS

Activity Detection (General Surveillance — the ability to recognize an event within the field of view)	20 ppf
License Plate Reading	60 ppf
Facial Identification	100 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.

$$Lens\ Focal\ Length = \frac{Imager\ Size\ \times Distance\ from\ the\ Subject\ in\ Feet \times PPF}{Total\ Horizontal\ Resolution\ in\ Pixels}$$

TABLE 4

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

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.

TABLE 5

UNIVERSITY OF HOUSTON STANDARDS

Purpose	Speed
Facial identification	10 fps with a shutter speed of 1/1000 sec
Cash register, teller stations	10 fps with a shutter speed of 1/1000 sec
License Plates	10 fps with a shutter speed of 1/1000 sec
School or office hallways	5 fps
Parking lots, traffic cameras, overview scenes	5 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 Pelco or Axis. All cameras being considered must be thoroughly tested within the UH infrastructure and must meet minimum criteria for UIT acceptance. The

only exception to this are approved manufacturer's latest models that are intended to replace existing legacy devices.

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 Pelco DSSRV)
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 UIT.

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 according to NEC recommendations.
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 and NVRs/DVRs.

12.0.2.6.3 Camera and IDF Cable Labeling

1. All cameras will be labeled with these elements, separated by hyphens:

   - IDF number
   - Patch panel id
   - Number of the nearest room/door

   EXAMPLE: 109-B19-113

2. All patch panel inserts will be labeled with the number of the nearest room/door

(New installation contractor must supply patch panel ID, switch ID, and switch port correlation table.)

12.0.2.7 Network Video Recorder (NVR) Requirements

1. H.264 compliance
2. Ability to support motion recording in Pelco cameras
3. Ability to support Pelco and Axis cameras
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
10. Archives with a lifespan of 15 days

12.0.2.7.1 NVR Server Installation Requirements

1. Install all NVRs in BDFs.
2. Connect all NVR servers to an access switch.
3. Connect all NVR servers to a gigabit port.
4. Supply a monitor, keyboard, and mouse for each NVR stack being installed; if more than two, a TrippLite KVM Rack Console unit is required.

12.0.2.7.2 Camera-NVR Configuration Requirements

1. UH-UIT and UHDPS must approve all designs.
2. Calculate an aggregate of storage consumption for the total number of cameras per given model at identical frame rates and maximum resolution. In general areas, this is typically 5 frames per second. In high-traffic cases such as building entrances and License Plate Readers, the rate increases to 10 FPS. The compression choice for IP cameras will be H.264 with maximum resolutions and at least 75% recording quality. The target storage capacity is 15 days. If motion recording is used, the percentage of anticipated traffic must be factored in. The aggregate of all these model aggregates will determine the storage requirements for a given NVR for 15 days of archive.
3. For large camera deployments (in excess of 20 cameras), multiple NVRs must be considered to mitigate server failures and to preserve processing power. While the Pelco DS-SRV2 is capable of larger throughputs, motion recording analytics and encoding functionality reduces server resource availability. Designs should utilize no more than 70% of the system's available processing throughput and storage capacity.
4. All Pelco camera firmware must be updated to be no older than 2 iterations at the time of installation.
5. Do not alter the default admin credentials until final testing and acceptance by UIT and Campus Safety are completed.

6. Provide maps with camera location, general lens direction, and the last octet of the IP address of each camera clearly marked.
7. Label all cameras as described in section 12.0.2.6.3 Camera and IDF Cable Labeling.
8. Provide an Excel spreadsheet of the camera number, its IP address, the switch IP address, the panel port number, and switch port number.
9. NVRs must be labeled with the host name as specified in number 10.b, and with the host IP address. This should be on the inside of the front cover panel.
10. NVR configuration requirements:

    a. Do not change the admin login credentials until final testing and acceptance by UIT and Campus Safety are completed.
    b. Host name = building number-building name-NVR series number as a single word. Example: 405 ERP NVR 1
    c. DNS Server addresses = 172.21.12.1 and 172.21.12.17

11. Enable time sync to ns1.uh.edu

CAMERA — Pelco Fixed		
Firmware	Must be the latest version at time of installation	
Frame rate per second	Activity Detection — 5	Facial ID — 10
Shutter speed (max exposure time)	10 ms	
Maximum gain	30%	
WDR setting	50% when backlit	
NVR recording quality	80%	
NVR recording resolution	Full	
Aspect ratio	4:3 for non-panoramic	
Motion record attributes (MR)		
MR sensitivity	default	
MR motion area	default	
MR reference count	120	
MR consecutive frames for record	3	

MR consecutive frames to stop record	50	
Scheduled recording	Motion 24/7 max resolution	
Motion record source	In camera	
Onscreen labeling	Room name and/or number or object viewed (must match cam schedule and schematics)	
Network cable and device labeling	Refer to Network Cable Infrastructure Standards http://www.uh.edu/infotech/services/computing/networks/network-infra-standards/index.php	
Login Credentials	Default (do not change)	
CAMERA — Pelco Optera		
Aspect Ratio	Panoramic default	
All other parameters	Same as Pelco fixed	
CAMERA — Axis LPR		
Shutter Speed	1/1000	
VIDEO SERVER — DSSRV2		
NTP server address	ns1.uh.edu America/Chicago	
DNS	Primary 172.21.12.17 Secondary 172.21.12.1	
Login Credentials	Default	
Remote Desktop	Enabled	

12.0.2.7.3 Back-up Power Supply

In the absence of a building generator/UPS, rack-mountable UPS's must be supplied to support NVR installations.

12.0.3 Emergency Phones

12.0.3.1 Contractor Certification

- Contractor shall be a certified Code Blue Phone Reseller and Installer, and:

- At least one (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.

12.0.3.2 EQUIPMENT LIST

TABLE 6

ACCEPTABLE EQUIPMENT FOR EMERGENCY PHONES

Part	Manufacturer	Description/Part Number	Type
Emergency Phones	Code Blue	CB1e — Tall Pedestal CB1wb — W/L Tall Pedestal CB2e — Wall mountable	VoIP Cellular

12.0.4 Security Alarms

TABLE 7

ACCEPTABLE EQUIPMENT FOR SECURITY ALARMS

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

12.0.4.1 Contractor Certification

- Contractor shall be a certified DSC alarm systems installers
    - At minimum (1) on-site personnel shall have appropriate DSC certification for installation, programming and troubleshooting.
    - Certification documents must be included in all responses to RFP/RFO.

12.0.4.2 Installation Testing Requirements

- Test all zones and associated devices with UHDPS as part of a system's signoff.

- Forward all IP configurations, device serial numbers, and deployment documentation copies to the Manager of Public Safety Systems and the UITNS Project Manager. Installation forms are available through the UH Department of Public Safety.

12.0.4.3 Labeling Requirements

- All zone labels will include the building name, building number, and room number.
- Panic alarm types will be distinguished as either Hold-up (for Point of Sale locations) or Panic (for all other locations)

13.0 Audio Visual

13.0.1 Digital Signage

The University of Houston's official digital signage solution is Four Winds. Standards documentation is being updated. Until that is available, contact UIT for details, clarification, or questions.

13.0.2 Microsoft Skype for Business Video Conferencing rooms

MS Skype for Business is the official University of Houston conferencing service and platform. For a sample design of a Skype for Business conference room please visit: http://www.uh.edu/infotech/services/skype/conference-room/index.php

13.0.3 Television Services

The University of Houston no longer supports growth of the coaxial network for new construction projects. Television services are delivered over the IP data network utilizing Philo.

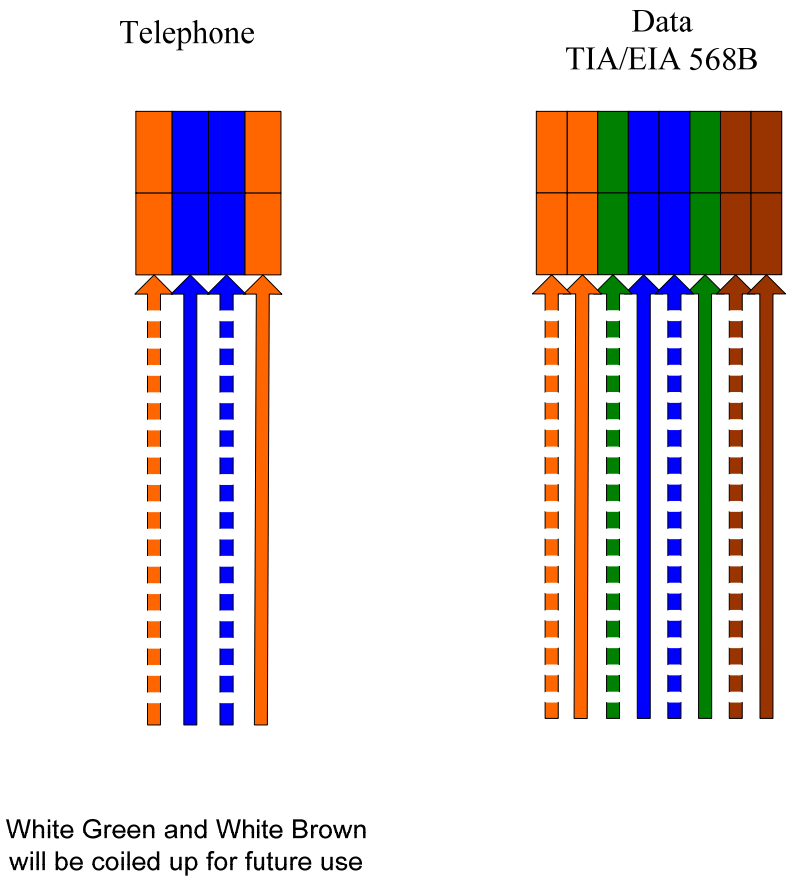
14.0 Legacy Issues

The examples in this section illustrate replacement of legacy jacks with the new material designated in these Cabling Standards and provide wiring allocations to meet the new cabling standards.

14.0.1 RLH Replacement

Replace Leviton jacks with the appropriate Panduit/Uniprise jacks, punched down as shown in Figure 4:

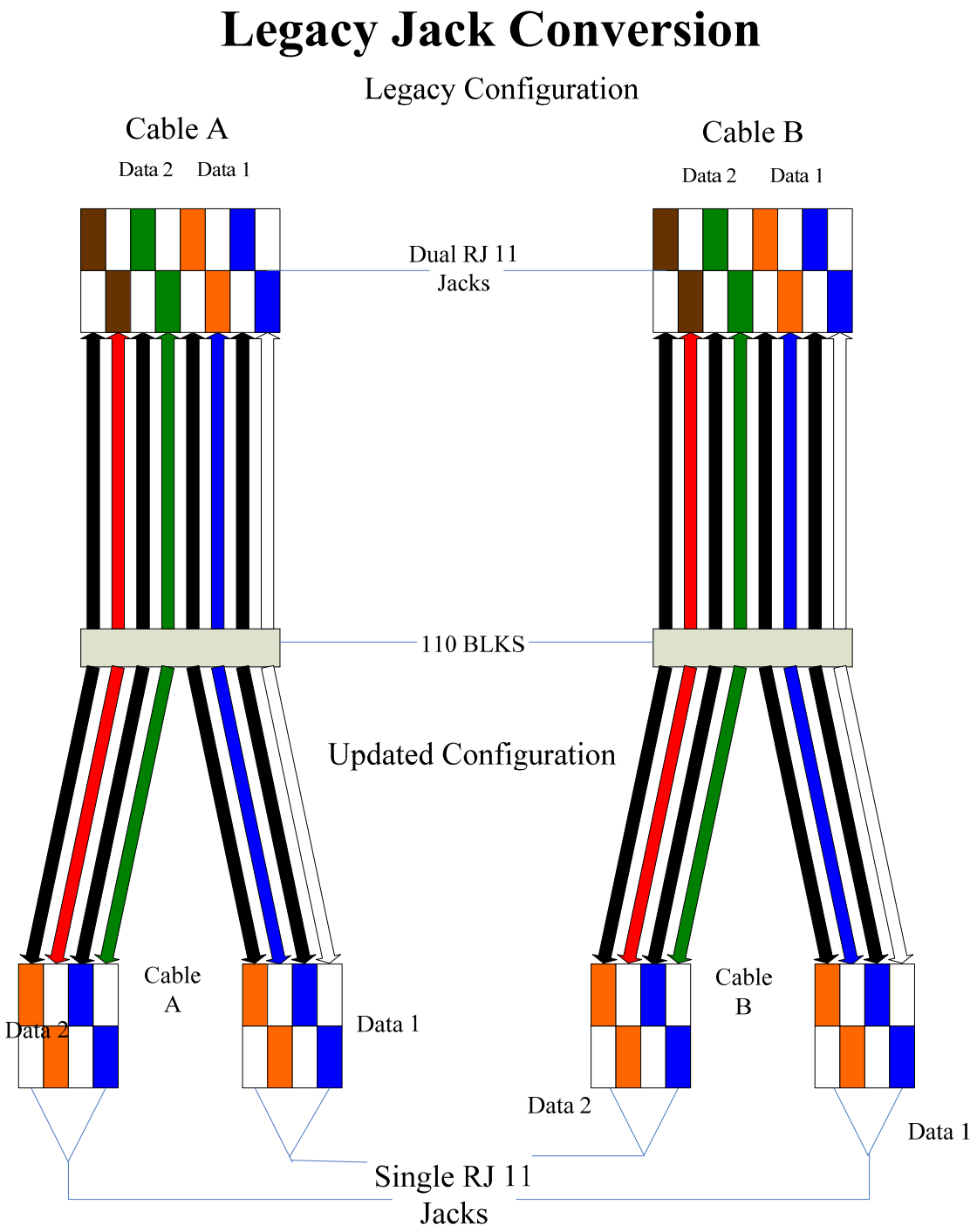
FIGURE 4



14.0.2 Category 3 Replacement

Replace Leviton jacks will be with the appropriate Panduit/Uniprise Jacks, punched down as show in Figure 5:

FIGURE 5



15.0 Wireless Design and Installation Standards

15.0.1 General

The wireless standards in this section are for indoor design only. Outdoor specifications are not included. Consult with UITNS before designing for outdoor spaces.

The approved Vendor for Wireless Access Points (WAP) is Aruba. The approved WAP model is the latest Wi-Fi technology in the market approved by the UH Wi-Fi team.

15.0.2 Wireless Design

Our design criteria for coverage is an SNR of 20 dBm minimum and a signal no less than minus 63 dBm at 5 GHz measured at the extents of the target coverage areas. 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:

- Open concept rooms (classrooms, auditoriums) require one (1) WAP per 50 seats
- WAPs should be located as to evenly divide the target coverage area.
- Elevator cars require one (1) WAP each. Two (2) Category 6E cables will need to be added to the elevator umbilical.

Provide proposed planning electronic maps that include WAP locations and dB levels to obtain UIT's approval before installation. Shall use Aruba standards and design software such as Ekahau wireless software. WAP location and dB level maps are included in Appendix D and Appendix E.

15.0.3 Wireless Installation

15.0.3.1 Installation of WAPs

For all WAP installations, run two Category 6E cables and install two jacks at each location to accommodate future needs.

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

Label wireless jacks on the ceiling grid with the IDF number and the jack number, following the labeling convention in Appendix A. Label each WAP with the MAC address, IDF number and jack number in a visible area on the WAP. Labels must be readable from the ground with no magnification.

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

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 HPE switch for wireless devices.

Refer to cabling specifications outlined in section 5.0 Network Facilities for additional cabling standards in IDF rooms.

15.0.3.3 Post Installation

After installation, provide the final WAP location map (PDF) and spreadsheet (MS Excel) with WAP location information that includes the MAC address, room number, IDF number, and switch port number. A sample spreadsheet is available in Appendix F.

16.0 IP Addresses

The program Project Manager must complete and submit the UITNS IP address form as early as possible.

17.0 Telephone Services

Telephone services will be Voice over IP. The vendor is MS Skype for Business. The phone will share a data jack with a computer.

Skype for Business offers voice and video calls, online meetings, and instant messaging (IM) in one easy-to-use program, making it simple to switch between different communication and collaboration tools. For a detail list of features and capabilities please visit: www.uh.edu/skype.

For a list of supported Skype for Business phones/handsets, please go to http://www.uh.edu/infotech/services/skype/phones/index.php.

APPENDIX A

UH CABLE LABELING STANDARDS AND CONVENTIONS

Labels will be used on all fiber optic and copper cabling, including 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 a life span equal to or greater than that of the product to which they are applied. All labels shall be machine printed unless otherwise approved by UITNS in writing.

FIBER OPTIC CABLE

OSP CABLE

Label Outside Plant (OSP) cable at each end, specifying the far-end building name, building number, single-mode or multi-mode, and the strand count. Label the cable at entrance and exit points of the tunnel system or if it enters a conduit. Place the label between 12 inches and 36 inches from the conduit, or at the closest point that it is clearly visible. Label the cable along its length at 100-foot intervals or the closet point that maintains clear visibility. On labels in the tunnel system, specify the building name and number for both ends of the cable and specify the strand count. Label termination panels at both ends with the far end building name, building number, single-mode or multi-mode, and the strand count. On termination panels, use both machine printed labels and manufacturer's color coding on ferrules to denote single-mode fiber or multi-mode fiber. Use yellow ferrules for single-mode. Each separate 6- or 12-strand panel insert shall have a factory panel label, and each strand's terminations shall have a factory label or installer applied, machine printed label with the strand number for that cable. If there is a factory supplied label for the door or cover, use it to indicate cable numbers and strand number.

RISER CABLE

Label each riser cable originating in a fiber Entrance Facility and its interconnecting equipment or IDF on both ends of the cable with the far-end Entrance Facility, equipment, or IDF number and strand count, and specify single-mode or multi-mode. On some occasions, a small building or facility may be fed from a primary building and treated as equipment to the primary building. In those instances, label the riser cable (may require an OSP rated cable) the same as the feeder cable in the above paragraph. Label termination panels using factory supplied labels or approved machine printed labels and specify far-end Entrance Facility, 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 with the panel number. Label each strand with either a factory label or installer applied, machine printed label.

HORIZONTAL CABLE (STATION)

In most cases fiber cable to the desktop 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 must match the number on the patch panel and faceplate. On the faceplate, 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 that are yellow 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

Label outside Plant (OSP) cable on each end with the far-end building name, building number, and the pair count. Apply a label at a point within 12 to 36 inches of the point where a cable leaves the tunnel and enters a conduit, or at the nearest location to maintain visibility. Include the name and number of the building the cable is entering, along with the pair count. Label the cable along its length in the tunnel at 100-foot intervals and at every turn in a location that maintains clear visibility. Each 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, far-end building name and number, and pair count. The cable number will be supplied by UITNS.

Riser Cable

Riser cables shall be labeled on each end with the far-end Entrance Facility, equipment, or IDF number and the pair count. Termination panels shall specify the far-end Entrance Facility, equipment, or IDF number. At the point where individual pairs are terminated, label as every fifth (5^{th}) pair point.

Telecommunication Outlets

Mark faceplates with an ultra-fine tip, black, permanent Sharpie®, then cover with a machine printed label, such as a P-touch® type label (this procedure ensures that identification remains if the machine printed label comes 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 NF, after the first panel has been filled (1-48) the other panels must be labeled in continuous sequencing (49-96, etc.). Other cable contractors may have installed cables at these facilities. Locate all of the other equipment or IDF locations at the site to determine the correct labeling sequence to be used for the new equipment or IDF. Examples of faceplate labels are included in this Appendix.

EXAMPLES

FIBER LABELING

There will be three areas labeled on each fiber panel:

1. Above the individual columns on label panel
2. Above the letters on each column

   First line: Destination building number — Destination NF room number
   Second line: Destination fiber distribution cabinet — fiber type

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

   Destination panel — Destination fiber port — Destination color

FIGURE 6

FIBER LABELING ILLUSTRATION

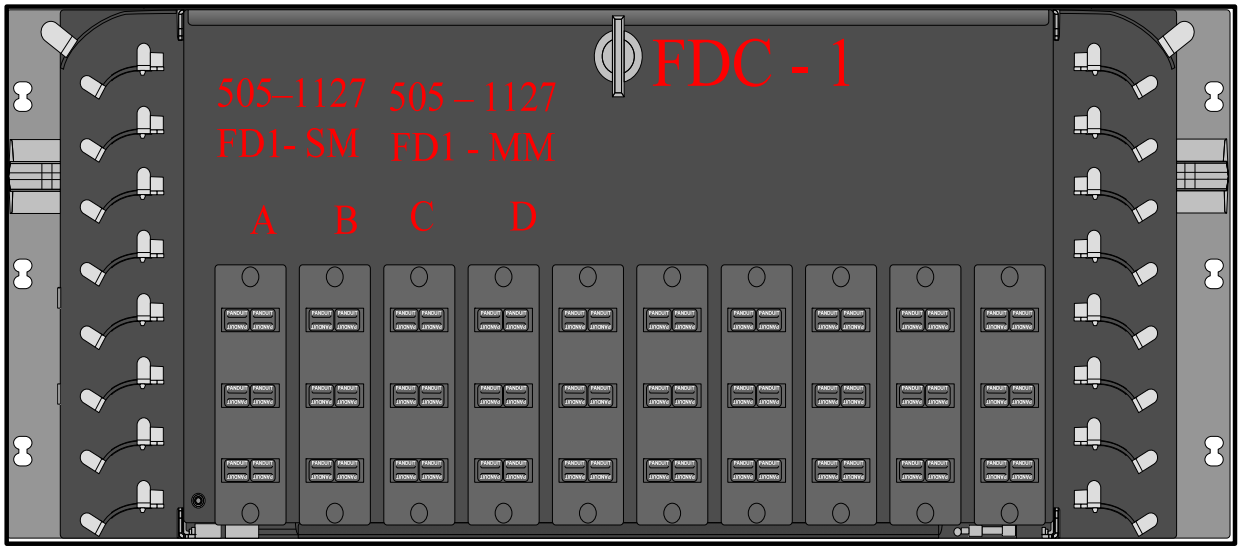


TABLE 8

TYPICAL FIBER COLORS AND PAIR DESIGNATION

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

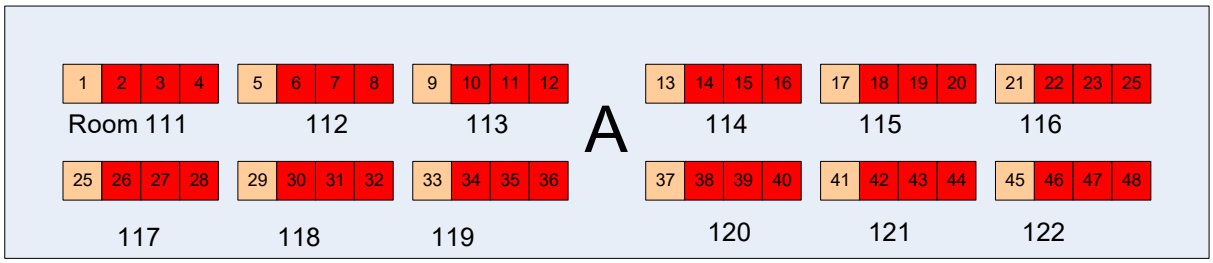
COPPER LABELING

Patch panel: each panel will have an alphanumeric designation.

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

FIGURE 7

COPPER LABELING ILLUSTRATION



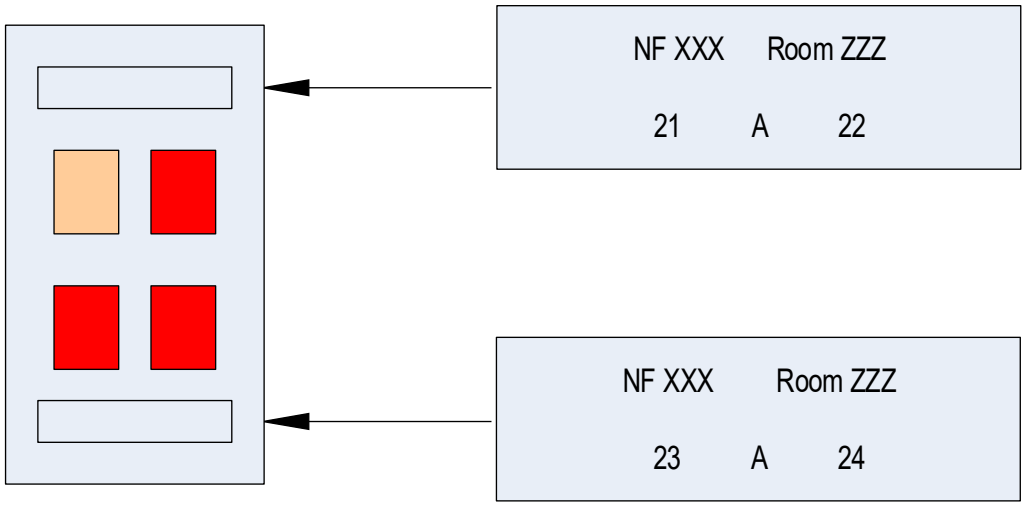
Faceplate at Each Office

First line: NF room number and the room number of the communication outlet

Second line: first jack number followed by the panel letter followed by the second jack number

FIGURE 8

OFFICE FACEPLATE LABELING ILLUSTRATION



Patch Cord Labeling

Panel number — jack number — Switch number — Port number

These need to be on each end of the cable.

EXAMPLE: A23-SW1- P11-17

Rack Labels

Label the top of each rack with the rack number.

EXAMPLE: Rack 1

APPENDIX B

APPROVED MANUFACTURERS

RACKS

- Chatsworth Products Inc.
- CommScope

PATCH PANELS

- Uniprise Angled Patch Panels
- Panduit Angled Patch Panels

CABLE COPPER

- UTP
- Uniprise

CABLE FIBER

- Corning — single and multi-mode
- Uniprise — single and multi-mode

CABLE MANAGEMENT

- Vertical — Chatsworth Products, Inc., Uniprise, CommScope
- Horizontal — Panduit, Uniprise, CommScope

TELECOMMUNICATION OUTLETS

- Uniprise
- Panduit

UNINTERRUPTIBLE POWER SUPPLY (UPS)

- Tripp Lite

BASKET CABLE TRAY

- Cabofil

CAMERAS, DVRS AND NVRS

- Pelco Cameras and NVRs
- Axis Cameras
- Scallop 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

CommScope

CABLE COPPER

Category 6 UTP

Uniprise 6504 Blue

CommScope

Category 3 UTP

Berk-Tek — 1103213

CABLE FIBER (DISTRIBUTION)

Multi-mode

Corning- 012KD8-31330-20

Uniprise — P-012-DS-6F-FSUOR

Single-mode

Corning- 012ED8-31331-20

Uniprise — P-012-DS-8W-FSUYL

CABLE FIBER OSP

CORNING

24F, single-mode- 024EUC-T4101D20

48F, single-mode- 048EUC-T4101D20

96F, single-mode- 096EUC-T4101D20

144F, single-mode- 144EUC-T4101D20

UNIPRISE

24F, single-mode- 024EUC-T4101D20
D-024-LA-8W-F12ns

48F, single-mode- 048EUC-T4101D20
D-048-LA-8W-F12NS

96F, single-mode- 096EUC-T4101D20
D-096-LA-8W-F12-NS

144F, single-mode- 144EUC-T4101D20
D-144-LA-8W-F12ns

FIBER OPTIC ENCLOSURES

CORNING

1U- CCH-01U

2U- CCH-02U

3U- CCH-03U

4U- CCH-04U

UNIPRISE

1U — SD-1U

2U — SD-2U

3U — SD-4U (holds 6 panels)

4U — SD-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

Cable Management (Horizontal)

Panduit

1U — NCMHF1

2U — NCMHF2

CommScope

Copper Termination Facilities

Category 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

CATEGORY 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
    - Append the 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
    - ?? = Color Designation
    - Replace ?? in 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

Miscellaneous

Uninterruptible Power Supply (UPS)

- Tripp Lite
  - SMART1500LCD
  - SMART5000XFMRXL

Power Distribution Unit

- Tripp Lite
  - PDU1215
  - PDU1220

Rackmount Monitor Shelf

- Tripp Lite
  - B020-008-17 Console KVM Switch w/LCD

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

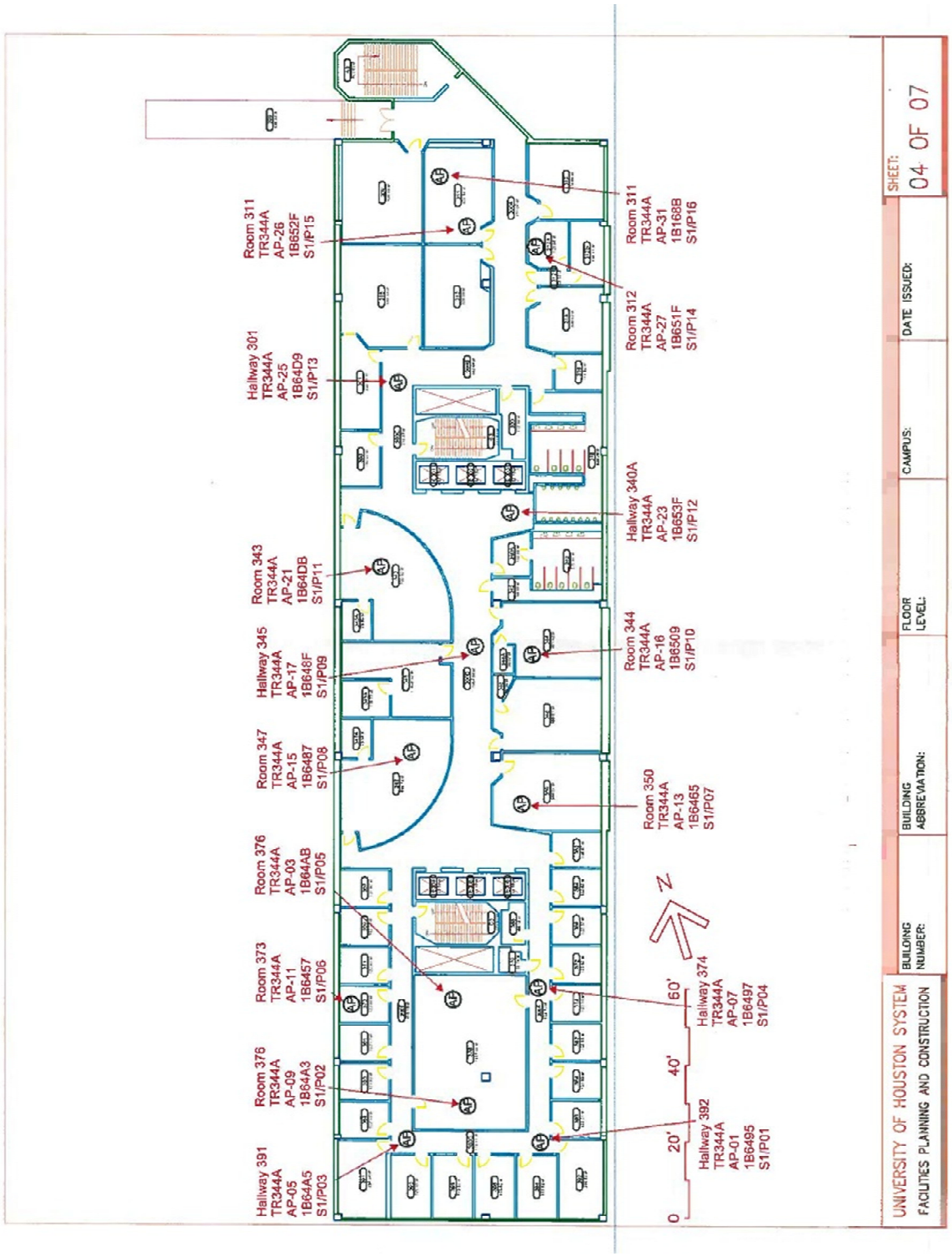
Suspension devices

- J-Hooks
  - Panduit — J — Pro

- Tomarco/Stiffy Comfort Cradles
  - 2” FIG205-122UH
  - 3.5” FIG205-8UH
  - 2” FIG201-2UH
  - 3.5 FIG201-3UG

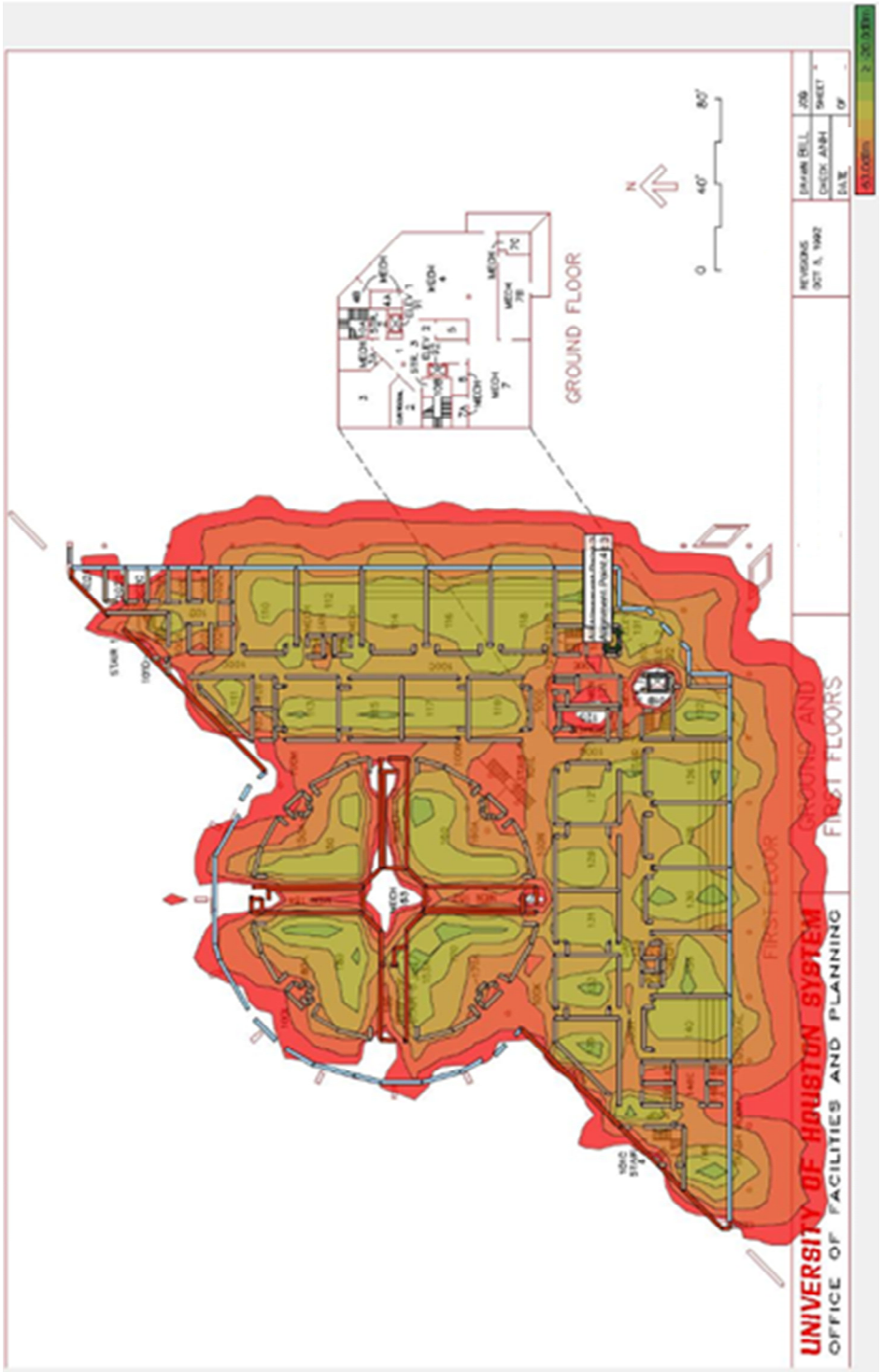
APPENDIX D

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