TELECOMMUNICATIONS RESOURCE REQUIREMENTS

UNIVERSITY BUILDING STANDARDS FOR VOICE/DATA/VIDEO COMMUNICATION

Guidelines

All wiring will be in accordance with the TIA/EIA 568 standard for telecommunications wiring.

All copper RJ45 jacks will be wired in accordance with TIA/EIA 568A wiring pattern.

The standard wiring plan for the University is to provide an acceptable outlet for any communications device (voice, data or video) which requires connection to other devices, networks, or information services serving general university needs.

All new and upgrade work at the University should meet these guidelines unless otherwise directed.

RELATED SECTIONS
A. Voice and Data Cabling Standards
B. Building Telecommunication Standards
C. Equipment Room Standards
D. Network Design Standards
E. Cable TV Standards
F. Wireless Access Standards
G. IP Based Video Surveillance Standards
H. Head End Room Standards

A. Voice and Data Cabling Standards

NOTE: All backbone fiber patch cords must be Corning products. All infrastructure products for retrofitting or new construction, (ex. wall outlets, raceway, category 6 patch cords, etc.) must be a product of Corning, Panduit & Ortroinics. All station to frame wiring must be Panduit Minicom. These requirements are a must to stay in accordance and maintain the University's current 25-year warranty on all products and materials.

General

All station wiring will be continuous wire from the MDF/IDF to the communication outlet; all MDF/IDF terminations shall be of 100% cross connected as per the TIA/EIA 568 specifications.

All CAT6 copper cable runs should conform to the following color codes based on IP data services as follows:

Red = Facilities IP Services

Blue = Voice/Data/AV IP Services

Yellow = Wireless IP Services

Green = Security/Access Control IP Services

To facilitate future cable installations, a new pull string shall be installed in conduits simultaneously with the pull-in of cable.

All MDF's/IDF's shall be provided with one or more grounded 19" by 84" EIA standard wiring rack(s) and category 6 patch panels / Rack mount fiber termination cabinets or splice housings in quantities necessary to terminate the required cables. Appropriate wire management hardware will be provided to support routing of patch cables in a neat and organized manner.

All MDF's/IDF's shall be provided with the appropriate length copper patch cables, fiber patch cables and GBIC/SFP modules.

Voice blocks will be mounted on blue backboards, data blocks will be mounted on yellow backboards-and-telephone-company-demark-blocks (RJ21)-will-be-mounted on green-backboards.

The electrical work shall include requirements for installation of a conduit (1" minimum diameter) from each communication outlet and "stubbed" up above ceiling level. A pull string and appropriate junction or "pull" boxes shall also be provided in each conduit run to facilitate future installation of cable(s). Cable trays shall be installed to route the station cable to the MDF/IDF.

All IDFs, MDFs and connecting blocks must be properly identified according to specifications provided by the Information Resource Manager.

All cable pairs in copper riser cables or the copper entrance cable must be terminated on Category 6, 110 style to RJ45 patch panels and identified according to TIA/EIA 568 specifications.

Fiber runs between MDF's and IDF's shall consist of a 48 fiber single mode cable terminated in SC connectors and placed in appropriate fiber patch panels unless otherwise specified.

All communication outlets not in use, either wired or empty, must have a blank plate covering the outlet.

All modular jack assemblies must be labeled and identified according to TIA/EIA 568 specifications.

All data wall plate jacks must conform to the following Bryant Labeling specifications:

Wall plate data jack example: 03C001D1

Where:

03 = Floor Level

C = Closet Geographic Location – C for Central, N for North, S for South

001 thru 999 = Physical jack location

D1 = Data drop 1

All wiring inside of rooms should be protected by conduit or other means such as wire mold.

Cable may be run exposed above ceilings, provided this cabling is supported independent of other utilities, such as conduits, pipes, ceiling support systems, cable trays, and not laid directly on the ceiling panels. Cable to be plenum rated.

All patch cables both copper and fiber are to be provided by the contractor at the time of completion. All copper patch cables are to be category 6 compliant and six inch in length. All MDF/IDF patch cords should be 3 meters sc-sc type.

Outside Plant Fiber Optic Cable Specifications

Multimode Fibers

All multi-mode fibers will be 62.5/125micron fiber. All cables will be of loose tube construction with the following fiber specifications: 100 KPSI proof tested; Core diameter 62.5um +/- 3um; Cladding diameter 125um +/- 2um; Core Non-Circularity less than or equal to 6%; Cladding Non -Circularity less than or equal to 2%; Numerical Aperture of 0.275 +/- 0.015; Coating Concentricity Greater than or equal to 0.7; Primary coating shall be 250 +/- 15 micron dual layered UV cured acryl ate applied by the fiber manufacturer which may be mechanically or chemically stripped without damaging the fiber; Multi Mode attenuation less than or equal to 3.5 db/km @ 850nm and 1.5 db/km @ 1300nm; minimum bandwidth of 160 MHz @ 850nm and 500 MHz @ 1300nm (this specification shall be a maximum attenuation for each fiber over the entire operating temperature range of the cable).

Single mode Fibers

All Single Mode fibers will be 8.3/125 micron fibers. All cables will be of loose tube construction with the following fiber specifications: 100 KPSI proof tested; Core diameter 8.3um; Numerical Aperture of 0.13; Cladding diameter 125um +/- 2um; Core to cladding offset of less than or equal to 0.8um; Cladding Non-Circularity of less than or equal to 1.0%; Coating Concentricity Greater than or equal to 0.7; Primary coating shall be 250 micron dual layered UV cured acryl ate applied by the fiber manufacturer which may be mechanically or chemically stripped without damaging the fiber; The cabled fiber cutoff wavelength shall be less than or equal to 1250nm; Attenuation Uniformity - no point of discontinuity greater than 0.1db at either 1310nm or 1550nm; Single Mode attenuation less than or equal to 1.0 db/km @ 1310nm and .75 db/km @ 1550nm (this specification shall be a maximum attenuation for each fiber over the entire operating temperature range of the cable).

General Cable Specifications

Optical fibers shall be placed inside a loose buffer tube containing up to 18 fibers. The fibers shall not adhere to the inside of the buffer tube. All optical fibers and buffer tubes shall be color coded per EIA/TIA-598. In buffer tubes containing multiple fibers, the colors shall be stable during temperature cycling and not subject to fading or smearing onto each other or into the gel filling material. Colors shall not cause fibers to stick together. Fillers may be included in the cable core to lend symmetry to the cable cross-section where needed. The cable shall contain a central strength member composed of an all dielectric epoxy/glass composite. Each buffer tube and the cable core interstices shall be filled with a non-hygroscopic, non-nutritive to fungus, electrically non-conductive, homogenous gel. The gel shall be free from dirt and foreign matter. The gel shall be readily removable with conventional non-toxic solvents. Binders shall be applied with sufficient tension to secure the buffer tubes to the central member without crushing the buffer tubes. The binders shall be non-hygroscopic, non-wicking (or rendered so by the

flooding compound), and dielectric with low shrinkage. Tensile strength shall be provided by high tensile strength armed yarns and/or fiberglass. The high tensile strength armed yarns/fiberglass shall be helically stranded evenly around the cable core. All dielectric cables (with no armoring) shall be sheathed with medium density polyethylene. The minimum nominal jacket thickness shall be 1.0 mm. Jacketing material shall be applied directly over the tensile strength members and flooding compound All fibers must be useable and meet minimum specifications, no spare fibers shall be included. 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.". The cable shall exhibit no flow (drip or leak) at 80 degrees C. The weight of any compound that drips from the sample shall be less than 0.05 grams (0.002 ounce). A representative sample of cable shall be tested in accordance with FOTP-81, "Compound Flow (Drip) Test for Filled Fiber Optic Cable.". The test sample shall be prepared in accordance with method A. All optical fibers shall be 100% attenuation tested.

The attenuation of each fiber shall be provided with each cable reel. Cables shall have crush resistance of 220 N/cm, Flex resistance of 25 cycles, and impact resistance of 25 impacts. All cables will have tensile strength of greater than or equal to 2700N short term and 600N long term. 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. All fibers in the cable must be useable fibers and meet required specifications. The cable provided will be new, unused, and of current design and manufacture. Outer jacket shall be fungus resistant, UV inhibited, Water resistant, and shall have a non wicking rip cord for easy removal. The outer jacket or sheath shall be free of holes splits or blisters. Outer cable jacket will be marked with "(Manufacturer’s Name) Optical Cable", Sequential foot or meter markings, and year of manufacture. The height of the markings shall be approximately 2.5mm. The cable jacket shall contain no metal elements and shall be of a consistent thickness. The outer jacket color shall be black.

Fiber cabling should be clearly labeled at both ends to establish its destination.

Testing and Certification

Copper Twisted Pair Cable

Each station cable will be tested for continuity from the closet to the workstation. This test shall verify continuity, determine the proper polarity and verify proper location of each pair of the 4 pair cable.

In addition to a continuity test each station will be tested with a 100Mb tester to verify each station location to be category 6 compliant. The tester shall provide a hard copy printout of each cable tested.

Each pair will be checked for noise level and signal loss. The total loss for a cable shall not exceed -5db. This test shall be performed on the four common bands (1-4). Band 1 Low 10 KHz-150Khz; Band 2 ALL 10 KHz-100Mhz; Band 3 High 10 MHz-100Mhz; Band 4 Impulse noise.

Each cable will be scanned for length bi-directionally with an automated test unit; if the distance readings are different the cable must be tested for faulty punch downs.

Each cable tested is to be recorded in a log with the cable number, date, and the initials of the technician who tested the cable. A printout of the test results for each cable shall be placed in the log. Any cables failing the above tests shall be replaced. A copy of the logs, a termination sequence chart, and all test results shall be provided to the Information Resource Manager prior to acceptance of the job as satisfactory and complete.

Fiber Optic Cable

Testing and certification will be performed by the installing contractor to verify the correctness of termination and overall transmission loss using an approved fiber optic transmission loss test instrument.

A certification report shall be provided listing the calculated and measured loss at both 850 and 1300 nanometers for multimode fibers and 1310 nanometers for single mode fibers. The certification report shall also include the installed lengths for all fibers within the cables that have been provided. All cabling will be tested bi-directionally with an optical power meter with printouts of the results for each fiber provided as part of the certification documents. All fibers will also be tested bi-directionally with an OTDR and printouts of the traces for each fiber will be provided as part of the certification documents. The University desires to achieve the following minimum results.

All Multi Mode cables not to exceed 1 db plus .0013 db per foot end to end attenuation at 850nm.

All Single Mode cables not to exceed 1 db plus .0008 db per foot end to end attenuation at 1310nm.

Approval of the test results will be made by the Information Services manager before the project is accepted by the University as satisfactory and completed.

Fiber Distribution Closet Example

Fiber Passive Rack in lager IDF Closets with the following components:

- 4 U Corning CCH-04U fiber patch panel containing 96 sm fiber strands. 96 total strands.

Fiber Passive Rack in smaller IDF Closets with the following components:

- 1 U Corning CCH-01U fiber patch panel containing 24 sm fiber strands. 24 total strands.

Cable Management & Punch Downs Example

- 6, 48 port 2 U each Panduit patch pan

- 7, 2 U each Panduit horizontal managers.

B. Building Communication Facilities

General

Guidelines concerning the number of communications outlets by room type are outlined below. Specific requirements for each room and each project shall be coordinated with the using agency at the onset of design for the project, The architect/engineer is cautioned that the Building Program also includes requirements, but may not be all inclusive regarding communication facilities. Therefore, the project architect/engineer must work very closely with appropriate Using Agency and Voice/Data/Communications personnel during initial planning to assure total coordination and minimize the need for revisions or changes at the second or design development document submittal stage. Sections 4 and 5 also contain data of concern to the project architect/engineer.

Location Terminations

Faculty/Administrative 0ffices

Each office shall have one communication outlet per 80 square feet. (Two CAT6 per outlet.)

Clerical/Staff Offices

One communication outlet per designated occupant plus one spare cabled outlet for every two (2) occupants or fraction thereof or one communication outlet per 80 square feet whichever is greater. (Two CAT6 per outlet.)

Secretary/Administrative Assistant Offices

One communication outlet per designated occupant plus two outlets per office area or 2 extra outlets per five people or one communication outlet per 80 square feet whichever is greater. (Two CAT6 per outlet.)

Dormitories

One data communication outlet and one F type coaxial outlet for each planned occupant per dormitory room. If the unit is single room, multiple occupancy units, the above specifications will apply to the room. All dormitory building facilities will also be provided with direct fiber optic connection to the campus backbone. This connection will consist of 48 single mode fibers or to be determined per building design and service needs. Each dormitory facility will also include a Main Data Closet to house the active (SWITCH) equipment and the terminated fibers to the campus backbone

Trunk and Access Requirements

Copper (Twisted Pair / Coaxial) cables from the communication outlets described in the previous section should be connected to an accessible MDF/IDF close to the center of the terminations on each floor rather than at the single (or major) communications room for the building. The fiber cables from the communication outlets described in the previous section should be routed through an accessible MDF/IDF close to the center of the terminations on each floor and either home run or fusion splice onto high count riser cables that lead to the MDF where all data communications electronics will be located.

Cable tray (preferred and greater than 6 inch cross section) or a 4" conduit is an appropriate facility (raceway) if the actual needs are not known.

C. Equipment Room Standards

Communications Equipment Room

Space for connection of the building circuits to the outside plant should be provided as a separate room and not shared with other utility services, particularly the electrical service. When possible, it will not be adjacent to the electrical distribution room.

Minimum room size is 100 square feet for MDF and 60 square feet for each IDF, A size may or may not be included in the Project Building Program. The project Architect/Engineer must, during the initial (Schematic-Preliminary) Planning stage,

engage coordinated efforts of the Information Resource Manager's Office, Facilities Management and the Using Agency to assure appropriate size and arrangement of the communications equipment room(s).

Telephone

At least 1 Telephone per MDF / IDF.

Lighting

All communications equipment rooms (MDF & IDF) shall have a light intensity of 50-70 foot candles at 30 inches above the floor.

Dust Elimination

The walls, floors, and ceiling of all communications equipment rooms (MDF & IDF) shall be painted or otherwise treated to eliminate dust. If the walls are painted, a light colored, latex type paint should be used.

Backboard

All MDF & IDF's shall have plywood backboards 8'x4'x3/4" mounted on the back and side walls. The plywood backboard shall be affixed in such a manner that it will adequately support the weight of the cable, terminals, and other equipment that will be attached to it. The plywood backboard shall be treated with a fire retardant material.

Vertical Risers

Communications equipment rooms (IDF & MDF) contain the vertical cable riser space. The communications equipment rooms shall then provide vertical riser sleeves and bushings through the floor and/or ceiling to other vertically stacked communication equipment rooms. All sleeves shall be a minimum of 4 inches in diameter or sized to support the actual cabling requirements whichever is greater. Every communications equipment room should be equipped with a minimum of 4 riser sleeves; 3 for voice/data and 1 for video or any additional sleeves as required by actual cable needs.

The communication equipment rooms shall be centrally located to optimize the length of the cable run to the outlets. The length of a cable run shall not exceed 300 feet. In multi-level buildings, the communications equipment rooms should be located over the vertical cable riser space,

Room Temperature And Humidity

The ambient temperature shall be maintained between 70 and 75 degrees Fahrenheit and the relative humidity shall be maintained between 20 and 50 percent, unless otherwise specified. Temperature, and humidity requirements are on a 24-hour, 7 day-a-week basis regardless of the heat generated by normally operating communication equipment.

Special ventilation may be required for a battery back-up system in some buildings.

Electrical Facility Requirements

The space should interconnect with a telecommunications grounding and bonding infrastructure designed and installed in accordance with the applicable codes and the latest version of ANSI/TIA/EIA-607, Commercial Building Grounding and Bonding Requirements for Telecommunications. A telecommunications bonding backbone (TBB) should interconnect the telecommunications bonding and grounding infrastructure, through the grounding busbar to the building service ground.
The standard MDF/IDF design calls for, at least six 12OV, 20 AMP dedicated circuits with duplex outlets whose feeds are isolated from any motors, air conditioning or lighting circuits must be provided irrespective of room size. A separate small sub-panel with integrated surge suppression would provide the proper isolation in the MDF. At least three 12OV, 20 AMP circuits with duplex outlets must be provided in the IDF's. Depending upon individual equipment specifications, 220V, 30AMP circuits may also be required. **Consultation with Information Services is necessary in order to determine exact requirements.**

Lock

Access to all rooms or closets containing voice or data equipment will be through one uniform master key system. The standard key for all communications closets shall be a unique key under the Best lock grand master key system. No key will be issued without the signed approval of the Information Services Department Head.

Security

All IDFs/MDFs must have restricted key access. ALL users must be approved by the Information Services Department Head.

Outside Plant

All new building construction planning must include a connection into existing tunnels or manholes and should connect via five (5) 4" conduits. These conduits would be for the data, voice and video facilities only.

Whenever possible, all abandoned cable should be removed from tunnels, manholes, and conduit. If it is not feasible to remove said cable, it should be clearly tagged as abandoned and should be reported to the Information Resource Manager.

No cable should be installed in any facilities (raceways) other than those intended for that use. Gas pipe and water pipes must not be used for conduit under any circumstances.

All buildings shall be wired with a 75 OHMS RG6 U coaxial cable.

D. Network Design Standards

General

User connections will consist of switched full duplex 10/100/1000 Gigabit Ethernet. The main switch for the building shall be equipped with an Gigabit switch capable of performing LES/BUS/LANE functions should it's connection from the campus backbone become inoperative and should connect to the campus backbone via redundant load sharing Gigabit single mode links.

Network Switching Equipment

Each network switch will have as a minimum the following functions.

Backplane support for switched 10/100/100 Gigabit Ethernet.

Backplane support for Gigabit switching.

Uplink capability from the switched Ethernets to the Gigabit switch fabric.

Full SNMP Management of all chassis/bridging functions.

Support the LANE, PNNI, and MPOA standards that are current at the time of acquisition.

Support upgrades to Layer 3 switching as the standards become established.

Full RMON support for all RMON groups standardized at the time of acquisition.

Per port RMON / RMON II support for all switched Ethernet ports as well as port replication.

Support for out of band / side band network management via isolated 100 MB Ethernet.

Network Equipment Examples

- 1U each Cisco Catalyst 3750-X series stackable switches. Specifications Of: 1.73 x 17.5 x 16.1 in., weight 15.5 lbs 1150W and 690 Btus per hour.

Wiring Closet Power Supplies

Each wiring closet will be provided with one or more rack mounted uninterruptible power supplies of sufficient capacity to power all active data equipment within the closet

Each UPS will be fully SMNP manageable or shall be capable of being managed through the switching equipment.

Battery Backup Equipment Examples

- Appropriately sized APC UPS unit providing at least 30 minutes of up-time with a network management card.

E. Cable TV Standards

All buildings video topology shall be star-wired to a closed-circuit television (CCTV) stainless steel communications wall plate with F81 barrel splice termination.

The signal strength at the F81 wall plate outlet shall be measured at no more than l0 dB.

All connectors shall be one-piece crimp-on.

All connections between the CCTV backbone network and the building communications closet shall be made with jacketed 1/2" coaxial cable.

All new building construction planning must include a connection to the campus fiber optic backbone which terminates in the Unistructure building. This backbone connection must consist of a 36 strand composite fiber optic cable.

Local and long haul single mode fiber optical cable runs used in the Cable TV network will be fusion spliced not mechanically spliced for minimal reflection and optimal performance of the video signal.

F. Wireless Standards.

Wireless Network

All new and retro-fitted facilities are required to have wireless communications.

The recommended Access Point is a Cisco Model AIR-CAP3502I-A-K9 or a Cisco Model AIR-CAP3502E-A-K9. The AIR-CAP3502I-A-K9 is the preferred Access Point. The model AIR-CAP3502I-A-K9 is equipped with an internal antenna. The model AIR-CAP3502E-A-K9 requires an external antenna.

The recommended external antennas to be used are the Cisco models AIR-ANT2430V-R and AIR-ANT5140V-R. These are ceiling mount antennas. If a ceiling mount antenna does not fit the project then the Cisco Model AIR-ANT5135DB-R and Cisco Model AIR-ANT2422DB-R Dipole antennas may be used.

Each Access Point will require a 1Gig POE Ethernet connection that is able to provide 20W of power to the Access Point.

The number of Access Points that should be installed differs based on the project.

If the project is a new Townhouse each Townhouse should have an Access Point installed on the second floor as close to the middle of the building as possible.

If the project is a Residence Hall one Access Point should be installed for every 8 occupants.

If the project is a classroom one Access Point should be installed for every 15 seats.

G. IP Based Video Surveillance Standards

IMPORTANT VIDEO SURVEILLANCE CONSIDERATIONS

Video monitoring is used at Bryant University buildings and facilities exclusively for safety and security purposes. The use of video monitoring shall be conducted in a professional, ethical, and legal manner. Video surveillance is limited to areas in which individuals have no reasonable expectation of privacy. Public areas, parking lots, hallways, classrooms, building entrances and exits, loading docks, storage rooms, electronics rooms, and repair shops are among areas where individuals should have no reasonable expectation of privacy.

Video surveillance will not be used in areas where individuals do have a reasonable expectation of privacy. They are restrooms, shower rooms, locker rooms, and individual

offices. Information obtained through video monitoring will be exclusively for security and safety purposes and will only be released when authorized by the Executive Director. The improper use, misuse, or abuse of the surveillance system, its equipment, recorded images, data, or other information may be cause for disciplinary action.

IP based video surveillance systems should include:

- Choice of open-platform video recording hardware and software.
- Comprehensive set of security features, including multiple user access levels, HTTPS encryption, IEEE 802.1X and IP address filtering.
- Camera support of QoS features sets Ipv6 and Ipv4 addresses.
- Fixed and PTZ camera support for 802.3af PoE standard-compliant product.
- Cabling to include the installations of CAT6.
- Flexible and seamless support for a variety of standard and multi-megapixel image resolutions beyond NTSC, PAL and SECAM.
- Transmission of commands for PTZ cameras via the same cable.
- On-camera automated alerting via email or file transfer in response to video motion detection or dry-contact alarms.
- Support for different streaming media and compression formats to relieve transmission bandwidth and data storage requirements.
- Support for new embedded intelligent video motion detection with shape recognition/counting applied to objects, people, and vehicles.
- Integration of video surveillance with other systems and functions such as access control, alarm systems, building management, traffic management, etc.
- Future-proof installations with field-upgradeable products due to the ability to upgrade camera firmware over the network.
- Remote accessibility: Including access live and recorded video at any time and any location.
- All outdoor cameras require powered environmentally protective control enclosures
- Fixed and PTZ indoor cameras require protective housing.
- All IP cameras require integration with Best Access Control System video management software.

IP Camera Standard Equipment

For IP Cameras with Pan Tilt Zoom, the Axis 214 PTZ should be used. For stationary IP Cameras, the Axis 216MFD should be used.

In the event that the distance is too far for the use of copper, an analog camera will be used connecting to an IP converter in the closet wiring closet. In these situations, the Pelco SD435-PG-E1 Spectra IV camera will be used and will connect to an Axis 241Q IP converter.

H. HEAD END ROOM GUIDELINES

- 80-100 square feet on average for 5-rack head end.
- Allow three (3) feet of clear working space behind, three (3) feet of clear working space in front, three (3) feet of clear working space on one end of row of racks.
- Distribution racks and cabinets should be placed with proper consideration to clearances around the equipment, taking into account sources of EMI (electro magnetic interference), technician workspace, and sufficient walkways to avoid accidental disruption of service.
- The space should be dedicated to technology equipment only with lockable separation from adjourning spaces.

HVAC

- The space should be maintained between 64 °F and 75 °F at all times. The humidity range should be kept between 30% to 55% relative humidity.
- The space should be cooled from an independent air conditioning system separate from the rest of the building HVAC system and be able to run 24 hours a day, 7 days a week.
- If the rooms are considered unoccupied, outside air (OSA) can be at the minimum, depending on local codes.
- Generally, no heating is required.
- Maintain positive air pressure to avoid ingress of dust and debris.
- The HVAC system should have an emergency power system backup.

Electrical

- The electrical requirements for equipment should be coordinated with an electrical engineer. Voice/data/AV jacks are typically co-located with electrical outlets.
- Additional convenience outlets should be located a minimum of 10 inches AFF (above finished floor) at 6-foot intervals around the perimeter of each room.
- Emergency lighting and power is recommended.
- Equipment power should be on different circuits than lighting fixtures.
- Lighting in the space should provide a minimum of 500 lux (50 foot-candles) measured 3 feet AFF. Fixtures should be a minimum of 8.5 feet AFF.
- The space should interconnect with a telecommunications grounding and bonding infrastructure designed and installed in accordance with the applicable codes and the latest version of ANSI/TIA/EIA-607, Commercial Building Grounding and Bonding Requirements for Telecommunications. A telecommunications bonding backbone (TBB) should interconnect the telecommunications bonding and grounding infrastructure, through the grounding busbar to the building service ground.

Plumbing/Fire Protection

- Wet pipes or steam should not be routed through the space.
- Dry pipe sprinkler systems are preferred to wet.
- If wet overhead pipes such as drain lines, fire sprinkler lines, and domestic water lines are unavoidable, provide secondary drains below.
- Provide smoke detectors connected to the fire alarm system.
- As a first preference, possibly use a chemical fire suppression system such as Ansul 2000 system over a dry pipe sprinkler system.