DIVISION 27 - COMMUNICATION

1 GROUNDING AND BONDING FOR COMMUNICATION SYSTEMS

1.1 General

1.1.1 Grounding And Bonding Description - Connecting the communications system and permanently joining all the metal conducting portions of the communications pathway to earth in such a manner as to prevent potential electrical loops and transients that can cause damage to telecommunications equipment, networks and personnel. The intent is to effectively and safely neutralize the potential differences between two metallic items within the Telecom Rooms.

1.1.2 Definitions And Acronyms

1.1.2.1 BICSI: A professional association supporting the information technology systems (ITS) industry.

1.1.2.2 RCDD: Registered Communications Distribution Designer

1.1.2.3 TMGB: Telecommunications Main Grounding Busbar

1.1.2.4 TGB: Telecommunications Grounding Busbar

1.1.2.5 TBC: Telecommunications Bonding Conductor.

1.1.2.6 NRTL: National Recognized Testing Laboratory.

1.1.3 Informational Submittals - Plans showing as-built locations of grounding features specified in "Field Quality Control" Article, including the following

1.1.3.1 Grounding arrangements and connections for separately derived systems.

1.1.3.2 Grounding for sensitive electronic equipment.

1.1.4 Quality Assurance

1.1.4.1 Testing must be done to verify that the Telecommunications system is properly grounded and bonded to protect all equipment and personnel.

1.1.4.2 Testing Agency Qualifications: Member Company of NRTL.

1.1.4.2.1 Testing Agency's Field Supervisor: Currently certified by a current member company of NRTL to supervise on-site testing.

1.1.4.3 Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

1.1.4.3.1 Comply with UL 467 for grounding and bonding materials and equipment.

1.2 Products

1.2.1 General

1.2.1.1 All bonding and grounding components shall be listed for the purpose intended and approved by a National Recognized Testing Laboratory (NRTL).

1.2.1.2 All bonding and grounding components shall comply with EIA/TIA standard 607-C.

1.2.2 Insulated Conductors - No. 6 AWG green THHN insulated stranded conductors rated for 600 V unless otherwise required by applicable Code or authorities having jurisdiction.

1.2.3 Connectors

1.2.3.1 Listed and labeled by an NRTL acceptable to authorities having jurisdiction for applications in which used and for specific types, sizes, and combinations of conductors and other items connected.

1.2.3.2 Bolted Connectors for Conductors and Pipes: Copper or copper alloy, pressure type with at least two bolts.

1.2.3.2.1 Pipe Connectors: Clamp type, sized for pipe.

1.2.3.2.2 These connectors are to be used for bonding only.

1.2.3.3 Welded Connectors: Exothermic-welding kits of types recommended by kit manufacturer for materials being joined and installation conditions.

1.2.3.4 Bus-bar Connectors: Mechanical type, cast silicon bronze, solderless compression-type wire terminals, and long-barrel, two-bolt connection to ground bus bar.

1.2.4 Grounding Busbars

1.2.4.1 Grounding Busbars shall be electro tin plated copper ¼" thick and shall be U.L. listed and manufactured for this purpose. Busbars shall be installed on insulators and stainless-steel standoff brackets.

1.2.4.2 Busbars shall be as follows

1.2.4.2.1 Telecommunications Main Grounding Busbar (TMGB): Shall be a minimum of 4" high x 24" long. The TMGB shall be equipped with a minimum of 28 pairs of pre-drilled 5/16" diameter holes and 5 pairs of 7/16" diameter holes. The 5/16" hole spacing shall be 5/8" on center and the 7/16" hole spacing shall be 1" on center. The busbar shall meet EIA/TIA 607 standard.

1.2.4.2.2 Telecommunications Grounding Busbar (TGB): Shall be a minimum of 2" high x 12" long. The TMGB shall be equipped with a minimum of 6 pairs of pre-drilled 5/16" diameter holes and 3 pairs of 7/16" diameter holes. The 5/16" hole spacing shall be 5/8" on center and the 7/16" hole spacing shall be 1" on center. The busbar shall meet EIA/TIA 607 standard.

1.3 Execution

1.3.1 Hardware

1.3.1.1 No building steel or pipes are to be used for grounding purposes.

1.3.1.2 Conductors - No. 6 AWG green insulated stranded conductors will be installed and routed according to Division 27 Section 7.7, 7.8 and 7.9.

1.3.1.3 Grounding Bus - Provide in telecommunication rooms, in rooms housing service equipment, and elsewhere as indicated.

1.3.1.3.1 Provide bus on insulated spacers 2” minimum from wall, 6” above finished floor unless otherwise indicated.

1.3.1.3.2 Where needed on both sides of doorways, route grounding conductor up to top of door frame, across top of doorway, and down to specified height above floor; connect to horizontal bus.

1.3.1.4 Conductor Terminations and Connections

1.3.1.4.1 Pipe and Equipment Grounding Conductor Terminations - Bolted connectors.

1.3.1.4.2 Underground Connections - Welded connectors

1.3.1.4.3 Connections to Structural Steel - For Telecommunications it is not allowed.

1.3.1.4.4 The Telecommunications Grounding system shall remain separate and shall connect to the electrical grounding system at the main building ground.

1.3.2 Grounding Underground Distribution System Components

1.3.2.1 Grounding Manholes and Handholes - Provide a driven ground rod through manhole or handhole floor, close to wall, and set rod depth so 4” will extend above finished floor. If necessary, provide ground rod before manhole is placed and provide No. 1/0 AWG bare, tinned- copper conductor from ground rod into manhole through a waterproof sleeve in manhole wall. Protect ground rods passing through concrete floor with a double wrapping of pressure-sensitive insulating tape or heat-shrunk insulating sleeve from 2” above to 6” below concrete. Seal floor opening with waterproof, non-shrink grout.

1.3.2.2 Grounding Connections to Manhole Components - Bond exposed-metal parts such as inserts, cable racks, pulling irons, ladders, and cable shields within each manhole or handhole, to ground rod or grounding conductor. Make connections with No. 6 AWG minimum, stranded, copper bonding conductor. Train conductors level or plumb around corners and fasten to manhole walls. Connect to cable armor and cable shields according to written instructions by manufacturer of splicing and termination kits.

1.3.3 Equipment Grounding

1.3.3.1 Signal and Communication Equipment: In addition to grounding and bonding required by NFPA 70, provide an additional grounding system complying with requirements in TIA/ATIS J-STD-607-A.

1.3.3.1.1 For telephone, voice, data, and other communication equipment, provide No. 6 AWG minimum green insulated grounding conductor from main building grounding electrode system to each service location, terminal cabinet, wiring closet, and central equipment location.

1.3.3.1.2 Service and Central Equipment Locations and Wiring Closets: Terminate grounding conductor on a grounding busbar. For the Service Entrance Telecommunications Room (TR) provide a TMGB (section 2.4.B.1) and for all other Telecommunications Rooms provide a TGB (section 2.4.B.2).

1.3.3.1.3 In the Entrance TR all of the following must be bonded with a No. 6 AWG Bonding Conductor back to the TMGB

1.3.3.1.3.1 The vault splice closure for the entrance telephone cable

1.3.3.1.3.2 The telephone building protectors

1.3.3.1.3.3 All metallic conduits

1.3.3.1.3.4 All data relay racks

1.3.3.1.4 In all TRs the following must be bonded with a BC back to the TGB

1.3.3.1.4.1 All metallic conduits

1.3.3.1.4.2 All data relay racks

1.3.4 Installation

1.3.4.1 Busbar

1.3.4.1.1 Every TR shall be equipped with its own Busbar. No TR will share a grounding busbar with any other room.

1.3.4.1.2 Regardless of the current use or lack of use of a TR, all TRs shall have a busbar installed and grounded in that room.

1.3.4.1.3 Install the busbar horizontally where shown on Drawings. Mount busbars at 18" above finished floor.

1.3.4.2 Grounding Conductors

1.3.4.2.1 This is the conductor that connects Busbar to grounding electrode or Busbar to Busbar.

1.3.4.2.2 This conductor shall have NO splice points.

1.3.4.2.3 Route along shortest and straightest paths possible unless otherwise indicated or required by Code. Avoid obstructing access or placing conductors where they may be subjected to strain, impact, or damage. When routing on TR backboards (walls) the grounding conductors shall adhere to the same routing requirements as all other conductors within the TR.

1.3.4.3 Bonding Conductors

1.3.4.3.1 This is the conductor that connects the Busbar in each TR to the telecom equipment (racks, ladder tray, voice building protectors, etc.) in that TR.

1.3.4.3.2 No bonding conductor shall leave the TR that it is servicing.

1.3.4.4 Grounding to Steel Building Structure: The Telecommunications grounding system shall NOT be grounded using steel building structure.

1.3.5 Labeling

1.3.5.1 Comply with requirements in Section 260553 "Identification for Electrical Systems" for instruction signs.

1.3.5.2 Provide labels at the telecommunications bonding conductor and grounding equalizer and at the grounding electrode conductor where exposed.

1.3.6 Testing

1.3.6.1 Testing must be done to verify that the Telecommunications system is properly grounded and bonded to protect all equipment and personnel.

1.3.6.2 Testing Agency - Engage a qualified testing agency to perform tests and inspections.

1.3.6.3 Testing and Inspection

1.3.6.3.1 Inspect physical and mechanical conditions. Verify tightness of accessible, bolted, electrical connections with a calibrated torque wrench according to manufacturer's written instructions.

1.3.6.3.2 Testing methods

1.3.6.3.2.1 True Root Mean Square (rms) Alternating Current Measurements - Measure the ac current on any bonding conductor for Telecommunications and that reading should be 0 amperes (A) but must be less than 1A.

1.3.6.3.2.2 Two-Point Bonding Measurement - Test the bonding connectors of the system using an AC earth ground resistance tester. This test is performed by connecting the meter leads between the nearest available grounding electrode and the busbar in the Telecom Room. The recommended maximum value for the bonding resistance between these two points is 0.1 ohms (100 milliohms)

1.3.6.4 Grounding system will be considered defective if it does not pass tests and inspections.

1.3.6.5 Prepare test and inspection reports.

2 PATHWAYS FOR COMMUNICATION SYSTEMS

2.1 General

2.1.1 Communications pathways consist of structures that conceal, protect, support, and provide access between telecommunication spaces (Work area outlets, ETR, and TR).

2.1.2 Definitions and Acronyms

2.1.2.1 BICSI: A professional association supporting the information technology systems (ITS) industry. www.BICSI.org

2.1.2.2 Entrance Telecommunications Room (ETR): A space in which the joining of inter and/or Intra building telecommunications backbone facilities takes place. It is the TR where exterior cabling enters the building.

2.1.2.3 IDC: Insulation displacement connector.

2.1.2.4 RCDD: Registered Communications Distribution Designer.

2.1.2.5 Telecommunications Room (TR): A space for housing telecommunications equipment, cable terminations, and cross-connect cabling. A space that joins the backbone and horizontal cabling for a building.

2.1.2.6 EMT: Electrical Metallic Tubing.

2.1.2.7 GRC: Galvanized rigid steel conduit.

2.1.2.8 IMC: Intermediate metal conduit.

2.1.3 Action Submittals

2.1.3.1 Product Data: For surface pathways, wireways and fittings, floor boxes, hinged-cover enclosures, and cabinets.

2.1.3.2 Shop Drawings: For custom enclosures and cabinets. Include plans, elevations, sections, and attachment details.

2.1.4 Informational Submittals

2.1.4.1 Coordination Drawings: Pathway routing plans, drawn to scale, on which the following items are shown and coordinated with each other, using input from installers of items involved.

2.1.4.1.1 Structural members in paths of pathway groups with common supports.

2.1.4.1.2 HVAC and plumbing items and architectural features in paths of conduit groups with common supports.

2.2 Products

2.2.1 Metal Conduits and Fittings

2.2.1.1 Subject to compliance with requirements.

2.2.1.2 General Requirements for Metal Conduits and Fittings

2.2.1.2.1 Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

2.2.1.2.2 Comply with TIA-569-B.

2.2.1.3 GRC: Comply with ANSI C80.1 and UL 6.

2.2.1.4 IMC: Comply with ANSI C80.6 and UL 1242.

2.2.1.5 EMT: Comply with ANSI C80.3 and UL 797.

2.2.1.6 Fittings for Metal Conduit: Comply with NEMA FB 1 and UL 514B.

2.2.1.6.1 Conduit Fittings for Hazardous (Classified) Locations: Comply with UL 886 and NFPA 70.

2.2.1.6.2 Fittings for EMT

2.2.1.6.2.1 Material: Steel or Die Cast.

2.2.1.6.2.2 Type: Setscrew or Compression.

2.2.1.6.3 Expansion Fittings: PVC or steel to match conduit type, complying with UL-467, rated for environmental conditions were installed, and including flexible external bonding jumper.

2.2.1.7 Joint Compound for IMC or GRC: Approved, as defined in NFPA 70, by authorities having jurisdiction for use in conduit assemblies, and compounded for use to lubricate and protect threaded conduit joints from corrosion and to enhance their conductivity.

2.2.2 Non-Metallic Conduits and Fittings

2.2.2.1 Subject to compliance with requirements.

2.2.2.2 General Requirements for Nonmetallic Conduits and Fittings:

2.2.2.2.1 Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

2.2.2.2.2 Comply with TIA-569-B.

2.2.2.3 RNC: Type EPC-40-PVC, complying with NEMA TC 2 and UL 651 unless otherwise indicated.

2.2.2.4 Rigid HDPE: Comply with UL 651A.

2.2.2.5 Continuous HDPE: Comply with UL 651B.

2.2.2.6 RTRC: Comply with UL 1684A and NEMA TC 14.

2.2.2.7 Fittings for RNC: Comply with NEMA TC 3; match to conduit or tubing type and material.

2.2.2.8 Solvent cements and adhesive primers shall have a VOC content of 510 and 550 g/L or less, respectively, when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

2.2.2.9 Solvent cements and adhesive primers shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."

2.2.3 Ladder Tray

2.2.3.1 Tray is to be constructed of aluminum, at least 12” wide and at least 2” high.

2.2.3.2 Tray must be installed with the proper mounting hardware to securely fasten the tray to the walls and the top of the Floor-Mounted Racks.

2.2.3.3 Must be equipped with the proper grounding lugs to assure proper grounding and bonding of the tray.

2.2.3.4 The ladder tray should be selected to support the amount of cable at a 50 percent fill ratio per ANSI/TIA/EIA 569-A.

2.2.4 Surface Pathways

2.2.4.1 Surface Nonmetallic Pathways: Two- or three-piece construction, complying with UL 5A, and manufactured of rigid PVC with texture and color selected by Architect from manufacturer's standard or custom colors. Product shall comply with UL-94 V-0 requirements for self-extinguishing characteristics.

2.2.4.1.1 Panduit T45

2.2.4.1.2 Panduit T70

2.2.4.1.3 Panduit TG70

2.2.4.2 Tele-Power Poles

2.2.4.2.1 Material: Galvanized steel with ivory baked-enamel finish, or Aluminum with clear anodized finish.

2.2.4.2.2 Fittings and Accessories: Dividers, end caps, covers, cutouts, wiring harnesses, devices, mounting materials, and other fittings shall match and mate with tele-power pole as required for complete system.

2.2.5 Boxes, Enclosures and Cabinets

2.2.5.1 Outlet Boxes

2.2.5.1.1 Outlet Box Dimensions: 4” square by 2-1/8” deep (Double gang deep).

2.2.5.1.2 Exterior Cast-Metal Outlet Boxes: Comply with NEMA FB 1, ferrous alloy or aluminum, Type FD, cover with gasket.

2.2.5.1.2.1 Size to accommodate application.

2.2.5.1.2.2 Box extensions may be used to accommodate new building finishes shall be of same material as recessed box (i.e.. Sheetrock ring).

2.2.5.2 Floor Boxes

2.2.5.2.1 Material: Cast metal or sheet metal.

2.2.5.2.2 Type: Fully adjustable or Semi-adjustable.

2.2.5.2.3 Shape: Rectangular.

2.2.5.2.4 Listing and Labeling: Metal floor boxes shall be listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

2.2.5.3 Small Sheet Metal Pull Boxes: NEMA OS 1.

2.2.5.4 Cast-Metal Access, Pull, and Junction Boxes: Comply with NEMA FB 1 and UL 1773, cast aluminum, galvanized, or cast iron with gasketed cover.

2.2.5.5 Nonmetallic Outlet and Device Boxes: Comply with NEMA OS 2 and UL 514C.

2.2.5.6 Hinged-Cover Enclosures: Comply with UL 50 and NEMA 250, Type 1, 3R, 4, and 12 with continuous-hinge cover with flush latch unless otherwise indicated.

2.2.5.7 Metal Enclosures: Steel, finished inside and out with manufacturer's standard enamel.

2.2.5.8 Nonmetallic Enclosures Material: Plastic or Fiberglass.

2.2.6 Handholes And Manholes for Exterior Underground Cabling

2.2.6.1 General Requirements for Handholes and Manholes

2.2.6.1.1 Handholes and Manholes for use in underground systems shall be designed and identified as defined in NFPA 70, for intended location and application.

2.2.6.1.2 Comply with TIA-569-B.

2.2.6.2 Polymer-Concrete Handholes and Boxes with Polymer-Concrete Cover: Molded of sand and aggregate, bound together with polymer resin, and reinforced with steel, fiberglass, or a combination of the two.

2.2.6.2.1 Standard: Comply with SCTE 77.

2.2.6.2.2 Configuration: Designed for flush burial with open, closed, and integral closed bottom unless otherwise indicated.

2.2.6.2.3 Cover: Weatherproof, secured by tamper-resistant locking devices and having structural load rating consistent with handhole location.

2.2.6.2.4 Cover Finish: Nonskid finish shall have a minimum coefficient of friction of 0.50.

2.2.6.2.5 Cover Legend: Molded lettering, "COMMUNICATIONS".

2.2.6.2.6 Conduit Entrance Provisions: Conduit-terminating fittings shall mate with entering ducts for secure, fixed installation in enclosure wall.

2.2.6.2.7 Handholes 24” Wide by 36” Long and Larger: Size must be job appropriate. Have inserts for cable racks and pulling-in irons installed before concrete is poured.

2.2.6.3 Fiberglass Handholes and Boxes: Molded of fiberglass-reinforced polyester resin, with frame and covers of polymer concrete, reinforced concrete cast iron, hot-dip galvanized-steel diamond plate, and fiberglass.

2.2.6.3.1 Standard: Comply with SCTE 77.

2.2.6.3.2 Color of Frame and Cover: Gray

2.2.6.3.3 Configuration: Designed for flush burial with open, closed, and integral closed bottom unless otherwise indicated.

2.2.6.3.4 Cover: Weatherproof, secured by tamper-resistant locking devices and having structural load rating consistent with enclosure and handhole location.

2.2.6.3.5 Cover Finish: Nonskid finish shall have a minimum coefficient of friction of 0.50.

2.2.6.3.6 Cover Legend: Molded lettering, "COMMUNICATIONS".

2.2.6.3.7 Conduit Entrance Provisions: Conduit-terminating fittings shall mate with entering ducts for secure, fixed installation in enclosure wall.

2.2.6.3.8 Handholes 24” Wide by 36” Long and Larger: Size must be job appropriate. Have inserts for cable racks and pulling-in irons installed before concrete is poured.

2.2.6.4 Concrete Manholes shall be vaults made of steel reinforced, pre-cast concrete with non-skid, steel lids labeled for application as required. Manholes shall be equipped with all necessary plugged holes for duct entry(s), pulling eyes for pulling in cables, racks for supporting cables and splices, ground wire for bonding cable shields and splice closures, sump and ladder. Manholes shall be capable of withstanding heavy vehicular loading, as a minimum, manholes shall meet REA/RUS standards.

2.2.7 Specialty Pathway

2.2.7.1 Hubbell NAV Wall Box – This is the box that is mounted behind the TVs.

2.2.7.2 Floor Poke – Hubbell E-series

2.3 Execution

2.3.1 Pathway Application

2.3.1.1 Outdoors: Apply pathway products as specified below unless otherwise indicated

2.3.1.1.1 Exposed Conduit: GRC or Type EPC-80-PVC.

2.3.1.1.2 Concealed Conduit, Aboveground: GRC, IMC, EMT, RNC, Type EPC-40-PVC.

2.3.1.1.3 Underground Conduit: RNC, Type EPC-40-PVC, Type EPC-80-PVC, direct buried and concrete encased.

2.3.1.1.3.1 Comply with manufacturer's written instructions for solvent welding PVC conduit and fittings.

2.3.1.1.4 Boxes and Enclosures, Aboveground: NEMA 250

2.3.1.1.4.1 Type 3 for general outdoor use

2.3.1.1.4.2 Type 4 for areas that will be subjected to high pressure water situations (e.g. Tiger Stadium).

2.3.1.2 Indoors: Apply pathway products as specified below unless otherwise indicated.

2.3.1.2.1 Exposed and Subject to Severe Physical Damage: GRC or IMC Pathway locations include, but not limited to the following

2.3.1.2.1.1 Loading Dock

2.3.1.2.1.2 Corridors used for Traffic of mechanized cars, forklifts and pallet-handling.

2.3.1.2.1.3 Mechanical Rooms

2.3.1.2.1.4 Gymnasiums

2.3.1.2.2 Concealed in Ceilings and Interior Walls and Partitions: EMT.

2.3.1.2.3 Damp or Wet Locations: GRC or IMC.

2.3.1.2.4 Pathways for Cable in Spaces Used for Environmental Air: Plenum-type communications-cable pathway or EMT.

2.3.1.2.5 Pathways for Risers in Vertical Shafts: Riser-type communications-cable pathway or EMT.

2.3.1.2.6 Pathways for Concealed General-Purpose Distribution of Cable: EMT.

2.3.1.2.7 Boxes and Enclosures: NEMA 250

2.3.1.2.7.1 Type 1 for general indoor use.

2.3.1.2.7.2 Type 4 for institutional and commercial kitchens and damp or wet locations.

2.3.1.3 Pathway Fittings: Compatible with pathways and suitable for use and location.

2.3.1.3.1 Rigid and Intermediate Steel Conduit: Use threaded rigid steel conduit fittings unless otherwise indicated. Comply with NEMA FB 2.10.

2.3.1.3.2 EMT: Use setscrew or compression, steel or cast-metal fittings.

2.3.1.3.3 Comply with NEMA FB 2.10.

2.3.1.4 Surface pathways are discouraged but, if necessary, only install where indicated on Drawings.

2.3.1.5 Complete pathway installation before starting cable installation.

2.3.2 Installation of Inside Pathway

2.3.2.1 Minimum Pathway Size: 1" conduit from outlet box to above accessible ceiling space. If no accessible ceiling space is available, then conduit shall be home run to nearest TR.

2.3.2.2 Minimum Pathway Size and Quantity between Entrance TR and each TR: Minimum of two (2) – 4" conduits.

2.3.2.2.1 Pathway Conduits must not exceed 40% fill ratio. If it is determined that additional conduit space is needed, then additional 4" conduits should be added.

2.3.2.3 Install no more than the equivalent of two 90˚(90-degree) bends in any pathway run. If more than 180˚bends are necessary in a pathway, then a pull point will be necessary.

2.3.2.3.1 Separate lengths with pull or junction boxes or terminations at distribution frames or cabinets where necessary to comply with these requirements.

2.3.2.4 Support pathway within 12" of all pull points and any changes in direction.

2.3.2.5 Utilize long radius bends for all pathways.

2.3.2.6 Conceal conduit and EMT within finished walls, ceilings, and floors unless otherwise indicated. Install conduits parallel or perpendicular to building lines.

2.3.2.7 Stub-ups to Above Recessed Ceilings:

2.3.2.7.1 Use EMT for pathways.

2.3.2.7.2 Use a conduit bushing or insulated fitting to terminate stub-ups not terminated in hubs or in an enclosure.

2.3.2.8 Pathway above Ceiling

2.3.2.8.1 Accessible Ceiling: Above ceiling where conduit is not available, cabling should be supported in open top hangers (j-hooks) at random intervals between 4' and 5'.

2.3.2.8.2 Inaccessible Ceiling: Passing communication cables through inaccessible ceiling space is discouraged. Every attempt should be made to create access to all space that communication cables are passed through. In hard ceiling areas, hatches that are large enough so that a technician can work in that area above the ceiling is recommended.

2.3.2.9 Install pathways square to the enclosure and terminate at enclosures with locknuts.

2.3.2.10 Do not rely on locknuts to penetrate nonconductive coatings on enclosures. Remove coatings in the locknut area prior to assembling conduit to enclosure to assure a continuous ground path.

2.3.2.11 Install pull string in empty pathways. Use polypropylene or monofilament plastic line with not less than 200-lb tensile strength. Leave at least 24" of slack at each end of pull string.

2.3.2.12 Surface Pathways

2.3.2.12.1 Surface pathways are discouraged but, if necessary, only install where indicated on Drawings.

2.3.2.12.2 Install surface pathway with a minimum 2" radius control at bend points.

2.3.2.12.3 Secure surface pathway with screws or other anchor-type devices at intervals not exceeding 24" and with no less than three (3) supports per straight pathway section.

2.3.2.12.4 Support surface pathway according to manufacturer's written instructions or above instructions, whichever is more stringent. Tape and glue are not acceptable support methods.

2.3.2.13 Mount outlet boxes at heights indicated on Drawings. If mounting heights of boxes are not individually indicated, give priority to ADA requirements.

2.3.2.14 Horizontally separate boxes mounted on opposite sides of walls so they are not in the same vertical channel.

2.3.2.15 Fasten junction and pull boxes to or support from building structure. Do not support boxes by conduits.

2.3.2.16 Floor boxes are to be level and flush with finished floor surface.

2.3.3 Sleeve and Sleeve-Seal Installation for Communications Penetrations

2.3.3.1 Install sleeves and sleeve seals for all telecommunication penetrations of all floor and wall assemblies.

2.3.4 Firestopping

2.3.4.1 Install firestopping at penetrations of fire-rated floor and wall assemblies

2.3.5 Installation of Outside / Underground Pathways

2.3.5.1 Underground Conduit

2.3.5.1.1 Minimum Pathway Size and Quantity from servicing manhole to Entrance TR: Minimum of four (4) –4" conduits.

2.3.5.1.1.1 Pathway Conduits must not exceed 40% fill ratio. If it is determined that additional conduit space is needed, then additional 4" conduits should be added.

2.3.5.1.2 Install no more than the equivalent of two 90˚(90-degree) bends in any pathway run. If more than 180˚bends are necessary in a pathway, then a pull point will be necessary.

2.3.5.1.2.1 Separate lengths with access points using underground vaults or terminations at distribution frames or cabinets where necessary to comply with these requirements.

2.3.5.1.3 Excavate trench bottom to provide firm and uniform support for conduit.

2.3.5.1.4 After installing conduit, backfill and compact. Start at tie-in point, and work toward end of conduit run, leaving conduit at end of run free to move with expansion and contraction as temperature changes during this process. Firmly hand tamp backfill around conduit to provide maximum supporting strength. After placing controlled backfill to within 12" of finished grade, make final conduit connection at end of run and complete backfilling with normal compaction.

2.3.5.1.5 Install manufactured duct elbows for stub-ups at equipment and at building entrances through floor unless otherwise indicated. Encase elbows for stub-up ducts throughout length of elbow.

2.3.5.1.5.1 Install manufactured rigid steel conduit elbows for stub-ups at building entrance TR through floor. Couple steel conduits to PVC ducts with adapters designed for this purpose and encase coupling with 3" of concrete for a minimum of 12" on each side of the coupling.

2.3.5.1.5.2 Arrange stub-ups in Entrance TR so curved portions of bends are not visible above finished slab.

2.3.5.1.6 Cap underground pathways designated as spare above grade alongside pathways in use. No underground pathway designed as spare will be left capped undergrade.

2.3.5.2 Installation of Underground Handholes and Manholes

2.3.5.2.1 Install Manholes and handholes level and plumb. Orientation and depth must be coordinated with connecting conduits to minimize bends and deflections required for proper entrances.

2.3.5.2.2 Unless otherwise indicated, support units on a level bed of crushed stone or gravel, graded from ½" to No. 4 and compacted to same density as adjacent undisturbed earth.

2.3.5.2.3 Elevation: In paved areas, set so cover surface will be flush with finished grade. In grassy areas, set cover flush with grade or slightly higher than grade. No cover is to be buried below grade.

2.3.5.2.4 Install removable hardware, including pulling eyes, cable stanchions, and insulators, as required for installation and support of cables and conductors.

2.3.5.2.5 If not, factory built with conduit windows, field cut openings for conduits according to enclosure manufacturer's written instructions. Cut wall of enclosure with a tool designed for material to be cut. Size holes for terminating fittings to be used, and seal around penetrations after fittings are installed.

3 COMMUNICATIONS EQUIPMENT ROOM

3.1 General

3.1.1 Telecommunication Spaces Description - The telecommunication spaces include the Entrance Telecommunication Room (ETR) and the Telecommunication Room (TR). The telecommunications space is an enclosed architectural space for housing communications cabling, cable terminations, and cross-connect hardware and telecommunications electronics. This section will cover all the requirements for physically constructing the room and locating it within the building that it services. In addition, it will cover how to configure the room's layout to accommodate the services that these spaces will provide.

3.1.2 Definitions And Acronyms

3.1.2.1 BICSI: A professional association supporting the information technology systems (ITS) industry.

3.1.2.2 Cross-Connect field: A facility enabling the termination of cable elements and their interconnection or cross-connection.

3.1.2.3 IDC: Insulation displacement connector.

3.1.2.4 POTS: Plain Old Telephone Service. Used to describe traditional analog voice service.

3.1.2.5 Work Area Outlet: A connecting device on which horizontal cable terminates opposite of the Telecommunications Room (TR or ETR).

3.1.2.6 RCDD: Registered Communications Distribution Designer

3.1.2.7 Entrance Telecommunications Room (ETR): An enclosed architectural space for housing telecommunications equipment, cable terminations, and cross-connect cabling. This room is where outside communication services enter the building.

3.1.2.8 ITS: Information Technology Services

3.1.2.9 UNI: University Networking and Infrastructure

3.1.3 Administrative Requirements

3.1.3.1 Coordination Of Work

3.1.3.1.1 The use of space within the ETR and TR is dictated by LSU's policy statement PS114 and simply put dictates that "nothing other than ITS equipment, cables and cross-connects shall be allowed in ETRs or TRs." The policy statement states that LSU's ITS must comply with the "Security of LSU's Computing Resources" and that it is "necessary to minimize the possibility of unauthorized access to protected information and the University's information technology infrastructure."

3.1.3.1.2 Although a general diagram of the layout of the ETR & TR is given in Division 27, Sections 8.1 and 8.2, the sub-contractor for the telecommunications work shall coordinate with LSU Information Technology Services the configuration and layout of the ETR and TR prior to any equipment, cables, terminations or cross-connections being installed.

3.2 Products

3.2.1 Backboards/ Wall Lining

3.2.1.1 Plywood, 4' x 8' x ¾" A/C grade with A side out. The plywood shall be fire-rated and the label that proves the rating shall be exposed and visible after the board is installed. If the plywood is required to be painted, it shall be finished in a light color to increase illumination (this paint does not need to be fire retardant). Comply with requirements in Division 09 Finishes Section 6 Painting and Coating for painting backboards. DO NOT paint over manufacturer's label that proves the backboard is fire-rated.

3.2.2 Equipment Rack / Frame

3.2.2.1 2-Post Rack

3.2.2.2 4-Post Frame

3.2.2.3 Racks and frames are to be constructed of aluminum and black in color.

3.2.2.4 7' high, 19" wide, 29” deep rack space (for 4 post frame).

3.2.2.5 Panel mounting holes are to be #12-24 tapped on EIA-310-D universal spacing on both front and rear of rack/frame. Square mounting holes are not allowed.

3.2.2.6 Rack mounting units are to be marked and numbered on the channels.

3.2.2.7 The rack/frame must be self-supporting with base suitable to floor mount.

3.2.2.8 Must be equipped with the proper grounding lugs to ensure proper grounding and bonding of the rack.

3.2.2.9 Chatsworth, 4-post, Black, frame (or approved equal); Part Number 50120-703

3.2.2.10 Chatsworth, 2-post, Black, Rack (or approved equal); Part Number 55053-703

3.2.3 Vertical Cable Management for Equipment Rack / Frame

3.2.3.1 Metal or plastic, with integral wire retaining fingers.

3.2.3.2 Vertical cable management panels shall have front and rear channels, with covers.

3.2.3.3 Management shall be black in color.

3.2.3.4 Panduit, vertical management, black; 1. Part Number PR2VDxx

3.2.4 Ladder Tray

3.2.4.1 Tray is to be constructed of aluminum, at least 12” wide and black in color

3.2.4.2 Tray must be installed with the proper mounting hardware to securely fasten the tray to the walls and the top of the Floor-Mounted Racks.

3.2.4.3 Must be equipped with the proper grounding lugs to assure proper grounding and bonding of the tray.

3.2.4.4 The ladder tray should be selected to support the amount of cable at a 50 percent fill ratio per ANSI/TIA/EIA 569-A.

3.2.4.5 All the proper accessories to install a complete system will be provided by the contractor.

3.2.4.6 Water fall brackets shall be utilized to transition cable from the ladder tray.

3.2.5 Labeling

3.2.5.1 Comply with TIA/EIA-606-A and UL 969 for a system of labeling materials, including label stocks, laminating adhesives, and inks used by label printers. Labels shall be made using a mechanical label maker. Permanent marker, ink pen, and/or pencil labels shall not be accepted. All labels shall be permanent; no hanging/paper tags.

3.3 Execution

3.3.1 General Communications Equipment Room Requirements

3.3.1.1 Layout: Room configuration will be laid out in accordance with Division 27, Section 7.1 through 7.5. If any changes are needed to the basic flow and layout of the rooms, then the contractor’s RCDD shall coordinate those changes through LSU’s ITS department.

3.3.1.2 Telecommunications rooms shall contain communications equipment only.

3.3.1.3 ITS recommends that no Telecommunications Room shall be used as a pass through for any other building services such as water, gas, exhaust vents, etc., but if it is necessary to do so, then there SHALL BE NO maintenance valves in the TR. If unions are needed in piping, then those unions shall be situated such that none are positioned above any IT electronics devices.

3.3.1.4 Size: Telecommunication Rooms (TR) shall be sized according to the usable floor space that will be served from that room. These are minimum sizes for TRs and the use of the TR should be considered when determining size. All TRs shall have a minimum ceiling height of 8 ½’ above finished floor. Entrance TRs service usable floor space in addition to servicing other TRs and housing special equipment to terminate entrance cables; therefore, the size of the room should be increased by 2ft in both directions (i.e. increase 10ft x 8ft to 12ft x 10ft).

3.3.1.4.1 TR Dimensions

3.3.1.4.1.1 Servicing area less than or equal to 5,000sf: 10’ x 8’

3.3.1.4.1.2 Servicing area 5,000sf to 8,000sf : 10’ x 9’

3.3.1.4.1.3 Servicing area 8,000sf to 10,000sf: 10’ x 10’

3.3.1.4.1.4 Servicing area greater than 10,000sf: then consider a second TR or get approval and dimensions from LSU’s Information Technology Services-University Networking and Infrastructure.

3.3.1.5 Positioning: Each floor shall contain a telecommunications room. Telecommunications rooms shall be stacked vertically wherever possible. In general, telecommunications rooms should be placed centrally in the building. Central location of telecommunications rooms reduces the length of cable to each workstation. If there will be more than one telecommunications room per floor, then they shall be equally distributed away from possible sources of electromagnetic interference such as electric motors or transmitters.

3.3.1.6 Distances: Telecommunications Rooms (TR’s) shall be located such that the length of the cable installed from the TR to all station terminations served by that room is less than two-hundred ninety-five feet (295'). If that distance will be exceeded, then a second TR must be located on the same floor. The distance between TR and TR shall not exceed three hundred-fifty feet (350').

3.3.1.7 Electrical Service: Telecommunications rooms shall contain one double duplex 120V 20A non-switched receptacle for each 6 feet of wall space. Each receptacle shall be wired to an individual 20A breaker and the breaker panel shall be clearly marked with the word “COMMUNICATIONS”, the telecommunications room number and the receptacle number. Receptacles should be evenly placed around the telecommunications room, 18" AFF (above finished floor), in accordance with NEC specifications and/or local fire codes. Regardless of TR size a room shall have no less than 2 separate double duplex 120V 20A non-switched receptacle. The Entrance Telecommunications Room shall also contain one 208V 20A non-switched receptacle with a L620 type receptacle, located on wall behind the floor mounted equipment rack. This circuit shall be connected to emergency generator for the building. In ETR and TRs, install at least one double duplex 120V 20A non- switched circuit located behind the floor mounted equipment rack and connect to emergency generator for the building. Coordinate location of power raceways and receptacles with locations of communications equipment requiring electrical power to operate.

3.3.1.8 HVAC: Telecommunications rooms will house active electronic components. These rooms must maintain certain environmental conditions. Equip all telecommunications rooms to provide an appropriate atmosphere for these components on a year-round basis. Maintain positive pressure within these spaces with a minimum of one air change per hour. Connect emergency power to HVAC systems that serves the Telecommunications Room.

3.3.1.9 Lighting: All telecommunications rooms must be 500 lux (50-foot candles) at a distance of three feet (3') above the finished floor. This lighting must be achieved using long lasting fluorescent lamps. Ceiling lights must be fused on a separate breaker and be provided with a switch located immediately inside the access door to each room.

3.3.1.10 Wall And Floor Preparation

3.3.1.10.1 All telecommunications room (TR) walls must be completely covered with plywood. The plywood will cover the wall from the finished floor to a minimum height of eight feet (8') or to the ceiling.

3.3.1.10.2 If it is required to paint the plywood, plywood must be painted with a light color to increase illumination. The contractor must make sure that the rating labels / stamps are visible for the Fire Marshall’s inspection.

3.3.1.10.3 Due to dusting characteristics of concrete, all such interior floor surfaces shall be painted or tiled and finished in a light color to increase illumination. Telecommunications rooms will not be carpeted.

3.3.1.11 Room Access: Door access to the Telecommunication rooms shall be accessible via main hallways and common areas. No TR shall be located such that a technician has to gain access through a secured area or potentially secured area. All Telecommunication rooms shall be keyed with the LSU Facility Services "Best GM201" key. The doors of the TR must swing outward.

3.3.2 Installation

3.3.2.1 Comply with NECA 1.

3.3.2.2 Comply with BICSI TDMM for layout and installation of communications equipment rooms.

3.3.2.3 Coordinate layout of all Telecommunication Rooms with the LSU Information Technology Services /University Networking and Infrastructure personnel.

3.3.2.4 Coordinate location of power raceways and receptacles with locations of communications equipment requiring electrical power to operate.

3.3.2.5 The Entrance Telecommunications Room must be equipped with two (2) 19" aluminum relay racks which are anchored to the floor and are supported from the wall with a 12" ladder tray. The tray will be used to support the racks and also to transition communication cables to the rack. No cables will free span from the wall to the rack. This room must be equipped with a Telecommunications Main Grounding Busbar (TMGB) that will be bonded to main building electrical ground, the building protectors for the telephone entrance cable, and the relay racks. All bonding in this room must be accomplished using a #6 AWG stranded copper conductor with a green jacket. The CATV area must contain enough hinged wall brackets for the amount of panels needed. The entrance TR will be laid out in the manner listed in Division 27, Section 7.1.

3.3.2.6 The Telecommunication Rooms (TR) must be equipped with one (1) 19" aluminum relay rack which is anchored to the ground and supported from the wall with a 12" ladder tray. The tray will be used to support the racks and also to transition the cables to the rack. No cables will free span from the wall to the rack. This room must contain a Telecommunications Grounding Busbar (TGB) which is bonded to the nearest TR or Entrance TR and to the relay rack. All walls must be lined with ¾" AC grade plywood which is fire retardant or painted with two coats of fire-retardant paint. All bonding in this room must be accomplished using a #6 AWG stranded copper conductor with a green jacket. The CATV area must contain enough hinged wall brackets for the amount of panels needed. The TR will be laid out in the manner listed in 8.2.

3.3.3 Identification LSU deploys its own labeling scheme. All cabling and terminations shall be labeled as follows.

3.3.3.1 General infrastructure labeling

3.3.3.1.1 Permanently label all terminal strips, junction boxes, pull points and conduit runs as per telephone industry standards and these specifications.

3.3.3.1.2 Room Numbers: Only final room numbers specifically provided and/or approved by the LSU Office of Campus Planning shall be used for labeling; labels utilizing room numbers provided solely by the architect shall not be used.

3.3.3.1.3 Equipment racks: Label equipment racks, naming the leftmost unit "Rack 1," and incrementally increasing the number by 1 as you move to the right.

3.3.3.1.4 Patch Panels: Label the patch panels - by row of 24 - in each rack, naming the uppermost unit "1," and incrementally increasing the number by 1 as you move to the bottom. Note: Do not number the individual patch panels; Do number the individual rows

3.3.3.2 Equipment room terminations: All Cables and All termination fields shall be labeled.

3.3.3.2.1 Data outlets: Each data jack shall be labeled. Labels shall be affixed to the patch panel at a point adjacent to the jack being labeled and include the official far end room number – no hyphens - followed by a colon, followed by the number of the faceplate which contains the far-end jack. Example: 1103B:2

3.3.3.2.2 Feeder cables: All cables that feed other communications closets shall be labeled/tagged as to the location of other end of that particular cable. The patch panels or punch downs where that cable is terminated shall also be labeled in the same manner (label cable and termination field).

3.3.3.3 Documentation (Data Cable Labels Only)

3.3.3.3.1 The contractor shall provide the LSU Information Technology Services-networking and Infrastructure with both a printed and a software media copy of a Microsoft Excel, Corel, Quattro-Pro, or Lotus 1-2-3 spreadsheet which documents the installation of data cable labels. The spreadsheet shall contain, at a minimum, information on the labeling on each end of every data cable termination installed in every equipment closet. The format shall be such that each entry for a closet termination shall have in the adjacent column and on the same row, an entry for the work station end of the cable. Label documentation shall be formatted as follows.

3.3.3.3.1.1 For the closet end, the column entries shall contain the Official 3 or 4 character LSU Building Abbreviation followed by a hyphen, followed by the Official closet room number - without any hyphens – followed by the Rack Number and a hyphen, the Patch Panel Row Number and a hyphen, and the Patch Panel Row Position Number. For example, for a jack located in CEBA equipment closet E3106-C-1, Rack 1, Patch Panel Row 2, Patch Panel Row Position Number 23, the column entry would read “CEBA-E3106C1-1-2-23”.

3.3.3.3.1.2 The documentation for the work station end of that cable would be placed on the same row in the next column and would be an exact copy of the label installed in the equipment room rack for that cable. An example, from Section 3.5.B.1 (above) would be “1103B:2”.

3.3.3.3.2 Comply with requirements in Section 099123 "Interior Painting" for painting backboards. For fire-resistant plywood, do not paint over manufacturer's label.

3.3.3.3.3 Labels shall be preprinted or computer-printed type.

4 COMMUNICATIONS BACKBONE CABLING

4.1 General

4.1.1 Backbone Cabling Description: The backbone cabling system shall provide IT services to the building and shall provide interconnections between telecommunications rooms, telecommunications terminal spaces, and any cross-connect facilities in the telecommunications cabling system infrastructure within the building. This system consists of servicing cables, main and intermediate cross-connects, and mechanical terminations.

4.1.2 Definitions and Acronyms

4.1.2.1 BICSI: A professional association supporting the information technology systems (ITS) industry. www.BICSI.org

4.1.2.2 Cross-Connect: A facility enabling the termination of cable elements and their interconnection or cross-connection.

4.1.2.3 EMI: Electromagnetic interference.

4.1.2.4 Entrance Telecommunications Room (ETR): A space in which the joining of inter and/or intra-building telecommunications backbone facilities takes place. It is the TR where exterior cabling enters the building.

4.1.2.5 IDC: Insulation displacement connector.

4.1.2.6 RCDD: Registered Communications Distribution Designer.

4.1.2.7 Telecommunications Room (TR): A space for housing telecommunications equipment, cable terminations, and cross-connect cabling. A space that joins the backbone and horizontal cabling for a building.

4.1.2.8 ITS: Information Technology Services

4.1.2.9 UNI: University Network and Infrastructure

4.1.3 Administrative Requirements

4.1.3.1 Coordination Of Work

4.1.3.1.1 Coordinate layout and installation of communications backbone cabling with LSU's Information Technology Service (ITS)/University Networking and Infrastructure (UNI) personnel prior to installation.

4.1.3.1.2 All splices into active service cables shall be coordinated with LSU's ITS/UNI personnel. The project is responsible for the cost of these splices, but it may be determined that LSU will have its own in-house contractor perform the work.

4.1.3.2 Quality Assurance

4.1.3.2.1 All communications work shall be performed by qualified communications personnel regularly employed in this field. The communications subcontractor shall have a BICSI certified Registered Communications Distribution Designed (RCDD) on staff and available on site to discuss any issues as they arise. All qualifications shall be made available for verification by LSU and/or the Architect.

4.1.3.3 Submittals

4.1.3.3.1 All test results for installed cables shall be provided to LSU's ITS department as proof that all cables pass test qualifications. These test results can be delivered as a hard copy or electronic copy before acceptance of the system can be given. If electronic copies of the results are given, the results shall be delivered as a .pdf file.

4.2 Products

4.2.1 Cables

4.2.1.1 Singlemode Fiber Optical Backbone Cable

4.2.1.1.1 Cable Strand Specifications

4.2.1.1.1.1 Nonconductive, tight buffer

4.2.1.1.1.2 Maximum Attenuation: 0.5 dB/km at 1350 nm.

4.2.1.1.1.3 Minimum Modal Bandwidth: 160 MHz-km at 850 nm; 500 MHz-km at 1300 nm.

4.2.1.1.1.4 Fiber Type: Single mode, glass core, glass cladding.

4.2.1.1.1.5 Core Diameter: 8.0 to 9.0 microns.

4.2.1.1.1.6 Core/Clad Concentricity Error: < or = 0.8 micron.

4.2.1.1.1.7 Cladding Diameter: 125 microns +/- 1 micron.

4.2.1.1.1.8 Cladding Non-circularity: < or = 1%.

4.2.1.1.1.9 Strand Color Code: Per industry practice.

4.2.1.1.2 Outside Singlemode Fiber Optical Backbone Cable

4.2.1.1.2.1 Cable shall have an overall PVC jacket/sheath. The jacket/sheath shall be abrasion resistant, impervious to light or water.

4.2.1.1.2.2 The cable may contain but it is not required to have a metal shield. If the cable has a metal shield, it shall encase the cable and the shield shall be continuous throughout the length of the cable.

4.2.1.1.2.3 The cable shall contain a petroleum gel or dry water blocking material that is used to fill all voids and indices to prevent the intrusion of moisture.

4.2.1.1.2.4 Jacket Color: Black

4.2.1.1.2.5 Cable shall be imprinted with fiber count, fiber type, and aggregate length at regular intervals.

4.2.1.1.2.6 Fiber count shall be determined by LSU's ITS/UNI personnel.

4.2.1.1.2.7 Jacket shall be rated for the environment in which it is installed.

4.2.1.1.2.8 Use the following products or approved equal: Corning

4.2.1.1.3 Inside Singlemode Fiber Optical Backbone Cable

4.2.1.1.3.1 Nonconductive, tight buffer, optical fiber cable

4.2.1.1.3.2 Comply with ICEA S-83-596 for mechanical properties.

4.2.1.1.3.3 Comply with TIA/EIA-568-C for performance specifications.

4.2.1.1.3.4 Jacket Color: Yellow

4.2.1.1.3.5 Cable shall be imprinted with fiber count, fiber type, and aggregate length at regular intervals.

4.2.1.1.3.6 Jacket shall be rated for the environment in which it is installed. (I.e. plenum, riser, etc.)

4.2.1.1.3.7 Fiber count shall be determined by LSU's ITS/UNI personnel.

4.2.1.1.3.8 Use the following products or approved equal: Corning

4.2.1.2 CATV Backbone Cable

4.2.1.2.1 All CATV backbone cabling will be the responsibility of Cox Communications for design and installation. The project shall provide Cox Communications with adequate pathway.

4.2.2 Connecting Hardware

4.2.2.1 Optical Fiber Cable Hardware

4.2.2.1.1 Optical Fiber Housings

4.2.2.1.1.1 Fiber Cross-Connect Housings shall be manufactured to fit in both a 19" relay rack.

4.2.2.1.1.2 The Housings shall be sized to accommodate the appropriate number of fiber connections and utilize the least amount of rack space. When possible it is advised that multiple cables be terminated in a single housing to save rack space.

4.2.2.1.1.3 Choice of which housing will be determined by LSU's ITS/UNI personnel.

4.2.2.1.1.4 Use the following products or approved equal

4.2.2.1.1.5 Corning

4.2.2.1.1.6 EDGE-0XU (Where X represents the number of rack units needed to accommodate the housing.) Note: This product is used for high density TRs.

4.2.2.1.1.7 CCH-0XU (Where X represents the number of rack units needed to accommodate the housing.)

4.2.2.1.2 Fiber Housing Cassettes

4.2.2.1.2.1 Fiber cassettes for the Fiber Cross-Connect Housings serve duty as both the fiber splice housing and fiber Housing bulkhead panel.

4.2.2.1.2.2 Each cassette is preloaded with LC fiber pigtails and splice tubes required for the number of fiber ports available per the cassette purchased

4.2.2.1.2.3 Use the following products or approved equal

4.2.2.1.2.4 Corning (for EDGE Housing)

4.2.2.1.2.5 EDGE-CS12-AE-P00RE (Will accommodate 12 strands.)

4.2.2.1.2.6 Corning (for CCH Housing)

4.2.2.1.2.7 CCH-CS24-AE-P00RE (Will accommodate 24 strands)

4.2.2.1.2.8 CCH-CS12-A9-P00RE (Will accommodate 12 strands)

4.2.2.2 Splicing Hardware

4.2.2.2.1 Fiber Optic Cabling

4.2.2.2.1.1 Splice Cases

4.2.2.2.1.2 All splice cases shall be specified for the particular environment in which they will be placed and shall be sized to accommodate the entire strand count of the largest cable entering the splice. All splice cases shall be re-enterable and shall contain all necessary equipment to be installed properly and fully splice the largest cable entering the splice case.

4.2.2.2.1.3 If the entrance fiber cable (outside rated fiber cable) is the type that has a metal protective armor, that cable is required to be grounded per Section 260526 "Grounding and Bonding for Communication Systems"

4.2.2.2.1.4 Fiber Splice Unit

4.2.2.2.1.5 All fiber splices shall be preformed using fusion splice technology. Cable should be spliced in Fiber Splice Case or fiber housing cassette only.

4.2.2.2.1.6 Use the following products or approved equal: a) Preform (Model will be determined by LSU ITS/UNI personnel based on strand count)

4.2.3 Identification Products

4.2.3.1 Shall comply with TIA/EIA-606-A and UL 969 for a system of labeling materials, including label stocks, laminating adhesives, and inks used by label printers.

4.2.3.2 No handwritten labels will be accepted.

4.3 Execution

4.3.1 Entrance Backbone Cabling

4.3.1.1 General

4.3.1.1.1 All Entrance Telecommunication Rooms (ETRs) will have one (1) singlemode fiber cable home run back to the University's nearest appropriate service point. A typical installation will call for a minimum of one (1) 12 strand single mode fiber cable. The project may need to have higher strand and pair counts, in these cases the count will be determined by the project engineer in coordination with LSU's Information Technology representative.

4.3.1.1.2 In the entrance telecommunications room, allow for a 10-foot- long service loop after the cable has been terminated.

4.3.1.2 Entrance Fiber Backbone Cabling

4.3.1.2.1 If the outside rated fiber cable is a gel type cable then the cable must be terminated with a gel block to prevent the gel from exiting the terminated end of the cable or the outside cable must be transitioned (spliced) into inside rated cable.

4.3.1.2.2 If the cable has a metal strength member then that metal strength member must be grounded to the Telecommunications Main Grounding Busbar (TMGB) per Section 260526 "Grounding and Bonding for Communications Systems."

4.3.1.2.3 The entrance fiber cable will be terminated/spliced in a rack mount fiber housing using the proper cassette with LC type connectors.

4.3.2 Interior Backbone Cabling

4.3.2.1 General

4.3.2.1.1 All Telecommunication Rooms will have one (1) single mode fiber cable home run back to the Entrance Telecommunications Room. A typical installation will call for one (1) 12 strand single mode fiber cable.

4.3.2.1.2 All cables installed underground or under slab shall be NEC rated for wet locations. Use water blocked type cable construction in conduit for the entire length of the run.

4.3.2.1.3 Comply with TIA/EIA-568-B.1.

4.3.2.1.4 Comply with BICSI TDMM, Ch. 5 "Backbone Distribution Systems."

4.3.2.1.5 All cables shall be routed neatly in the room and follow the rules of routing cabling in the ETR and TRs set forth within the construction specs for setting up a TR(Section 271100: "Communication Equipment Rooms.").

4.3.2.1.6 Do not install bruised, kinked, scored, deformed, or abraded cable. Remove and discard cable if damaged during installation and replace it with new cable.

4.3.2.1.7 In each of the telecommunication's room, allow for a 10-foot- long service loop after the cable has been terminated.

4.3.2.1.8 When pulling cable always comply with the manufacturers recommended methods of pulling and cable tension.

4.3.2.2 Interior Fiber Backbone Cabling

4.3.2.2.1 All fiber optic cables shall be terminated in the approved rack mounted housings.

4.3.2.2.2 The fiber cables shall be terminated in cassette type hardware that utilizes LC type connectors.

4.3.2.2.3 It is a requirement that the project terminate all strands of the fiber cable, unless specifically called out for in the construction documents.

4.3.3 Terminations

4.3.3.1 Entrance Telecommunications Room

4.3.3.1.1 The Fiber Termination Cassettes will be arranged in the Housing such that the service fiber cable to the building will be positioned to the far left in the fiber housing.

4.3.3.1.2 Immediately following the building service cable, the interior riser backbone cables will be arranged in sequential order based on the room number of the building TRs.

4.3.3.1.3 Immediately following the interior riser backbone cables, the Horizontal fiber cables will be arranged in sequential order based on the room number of where they serve.

4.3.3.1.4 With the exception of the horizontal fiber cables, there shall only be one cable terminated in a cassette. Note: one cable may require multiple cassettes.

4.3.3.2 Telecommunications Room

4.3.3.2.1 The interior riser backbone cable that services this TR from the ETR will be arranged such that the service fiber cable will be positioned to the far left in the fiber housing.

4.3.3.2.2 Note: No “horizontal” fiber shall be terminated in this TR’s fiber housing. All Horizontal fiber cabling shall be terminated in the ETR.

4.3.3.3 Field Quality Control

4.3.3.3.1 Testing Agency: Engage a qualified testing agency to perform tests and inspections.

4.3.3.3.2 End-to-end cabling will be considered defective if it does not pass tests and inspections.

4.3.3.3.3 Where cabling is considered defective, that cabling is to be repaired or removed and replaced.

4.3.3.4 Visual Inspection

4.3.3.4.1 Visually inspect the optical fiber jacket materials for NRTL certification markings to make sure that the cables are rated for the environment in which they are installed.

4.3.3.4.2 Inspect cabling terminations in communications equipment rooms for compliance with color-coding for pin assignments, and inspect cabling connections for compliance with TIA/EIA-568-C.

4.3.3.4.3 Visually inspect cable placement, cable termination, equipment and patch cords, and labeling of all components.

4.3.3.5 Testing

4.3.3.5.1 Optical Fiber Cable Tests

4.3.3.5.1.1 All single mode fiber cables shall be tested at both 1310 nm and 1550 nm after installation. Printed test results for each fiber strand are required. All tests are to be performed in accordance with ANSI/TIA/EIA-526-7, Method A.1, Two Reference Jumpers required. Fibers will be considered acceptable if the OTDR trace for that fiber shows an end to end loss of less than the following equation: xxdB + yy(0.2)dB + zz(0.5)dB (Where xx is the maximum advertised attenuation by the manufacturer of the cable for the length of the fiber installed, yy is the number of splices, and zz is the number of connector pairs).

4.3.3.5.1.2 In addition, no splice may show a loss of greater than 0.2 dB and no connector pairs may show a loss of greater than 0.5 dB.

4.3.3.5.1.3 The contractor shall test each fiber strand utilizing an OTDR and preform a bi-directional test at the wavelengths specified above.

4.3.3.5.1.4 Overall, the OTDR test results shall be made up of the wavelength of the conducted test, the link length, attenuation, cable identification, and the locations of the near end, the far end and each splice point or points of discontinuity. Electronic copies (.pdf) or hard-copy results for each fiber strand shall be submitted as part of “As- Built” documentation.

4.3.3.6 Identification Standards

4.3.3.6.1 During construction all Backbone Cables (service and riser) shall be labeled/tagged as to the location of other end of that particular cable. The label shall be wrapped or flagged on the jacket of the cable at its first visible location as close to its termination as possible.

4.3.3.6.2 No handwritten labels will be acceptable. Labels shall be preprinted or computer printed type.

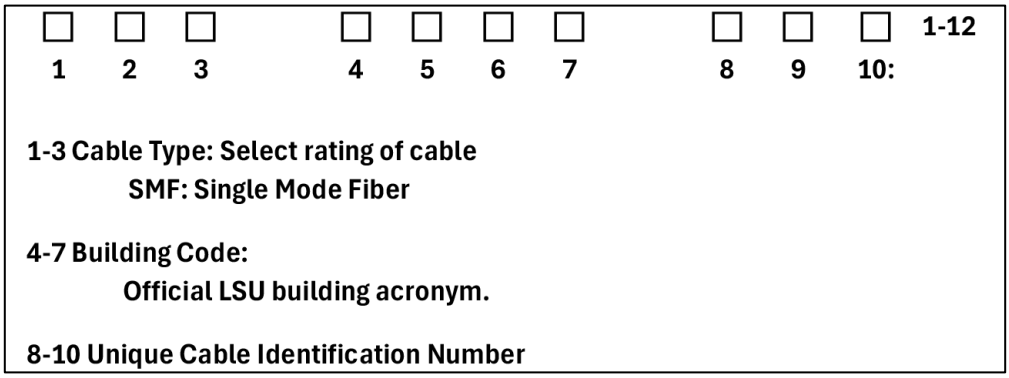
4.3.3.6.3 Fiber Optic Housing Labels

4.3.3.6.3.1 LSU deploys its own labeling scheme to track fiber optic cables and strands.

4.3.3.6.3.2 These unique identifiers will be adhered to the front door of the Fiber Housing that the cable is terminated in.

4.3.3.6.3.3 On the outside of the door of the fiber connector housing the contractor shall place the label with the Unique Identifier of the cable directly above / in front of the location where the cable is physically located in the housing. Directly below the label with the unique identifier of the cable will be a label that indicates the location of the other end of that cable.

4.3.3.6.3.4 How to develop the Unique Identifier for the horizontal fiber cables



4.3.3.6.3.5 Each horizontal fiber cable is given a unique number that is used to track that cable. The number will start with the number 1 and increase by 1 for the next cable. The only requirement for the numbering scheme is that the number be in increasing sequential order in the TR fiber optic connector housing.

4.3.3.6.3.6 Example: 1, 2, 3…101, 102, …

4.3.3.6.3.7 Example of Unique Identifier: SMF-FSB-3:1-12

4.3.3.6.3.8 The location label will look like this: LOC: BLDG Room# xxx

5 MULTIMEDIA AV CLASSROOMS

5.1 Introduction

5.1.1 Classroom Information Technology, a division of Louisiana State University - Information Technology Services (LSU ITS), provides consultation, design, installation, and maintenance services for the University's general purpose multimedia classrooms. These are the general audio-visual technical guidelines for designing, constructing, and renovating instructional spaces at LSU. These are minimal standards and are not all inclusive. There will be unique situations that will require modifications. This manual offers current standards for the design of instructional spaces at LSU. Periodic reviews of classroom facilities are done to identify deficiencies and develop plans for any needed upgrades or improvements. This is a “living document” that will be under constant review and adjusted as audio visual technology advances.

5.2 Types of Learning Spaces

5.2.1 Seminar TEC – 1-19 seats

5.2.2 Classroom TEC - 20 to 59 Seats

5.2.3 Lecture Room TEC - 60 to 149 Seats

5.2.4 Auditorium TEC - 150+ Seats

5.2.5 Tier 2 Hybrid Classrooms – A Tier 2 hybrid classroom can encompass any classroom and includes technology to allow onsite and remote instruction. A Tier 2 room includes a camera, microphone, speakers, and appropriate AV switching technologies. A consultation is highly recommended to determine whether the classroom will be used as a hybrid room.

5.2.6 Computer Labs Classrooms – Classrooms with desktop computers installed at student seating locations.

5.3 General requirements for all classrooms that

5.3.1 These standards apply to new construction and renovation of existing facilities unless otherwise noted.

5.3.2 Network Six (6) Cat6 drops for networking: 3 drops to the lectern; one is for classroom PC and two are for monitoring/control of MM equipment (projector, controller, etc.) and one in ceiling for wireless access point. Additionally, there are 2 Cat6 cables from the lectern to projector location for video signals and control, terminated with RJ 45M on both ends. Contact LSU/ITS for specifics. Network ready devices include all AV equipment in the classroom, plus the 802.11x Access Point and a lectern PC.

5.3.3 Conduit: See Division 27, Section 8.2 for diagram

5.3.3.1 2.00” conduit shall be installed from lectern to projector (see Division 27, Section 8.5).

5.3.3.2 1.50” conduit shall be installed from the lectern or equipment rack location in each learning space to all locations where equipment will be installed that must be connected to the lectern or rack (screens, speakers, instructor area equipment/inputs, lighting control system, cameras, ceiling mics, wireless mic antenna, assistive listening transmitter, etc.).

5.3.4 No section of conduit shall be longer than 30m (100ft) or contain more than two 90-degree bends between pull points or pull boxes.

5.3.5 Fill capacity for conduit shall not be more than 50%.

5.3.6 AV cables cannot be in the same conduit as power.

5.4 Electrical

5.4.1 One isolated 115v/20-amp circuit shall be provided for the lectern, and one isolated 115v/20-amp circuit shall be provided for the projector (see Division 27, Section 8.5) each in its own conduit. No AV cables shall be mixed with electrical/power cables in the same conduit or raceway.

5.4.2 All low-voltage connections shall be separated from the electrical circuits to the room through separate conduit or separate channel within a raceway or cable tray. These services include control and signal cables for audio, video, data, and voice feeds.

5.4.3 Cables and conductors of Class 2 and Class 3 circuits shall not be placed in any cable, cable tray, compartment, enclosure, outlet box, device box, raceway, or similar fitting with conductors of electric light, power, Class 1, nonpower-limited fire alarm circuits, and medium power network-powered broadband communications cables.

5.4.4 Audio, video, voice and data telecommunications cabling shall not be run parallel to power cabling – even along short distances – unless one or both cable types are shielded and grounded. For low voltage communication cables, a minimum 5" distance is required from any fluorescent lighting fixture or power line over 2 kVA and a minimum of 24" from any power line over 5 kVA.

5.5 Physical security

5.5.1 Data projectors shall be attached to security type mounts as theft deterrent. A two-tray system is preferred. Projectors should not be able to be removed without a key or security screw removal.

5.5.2 However, the mount should be able to be adjusted by pivot in az. and el. for proper alignment of image.

5.5.3 Document cameras shall be attached to security type mounts as theft deterrent. A two-tray system is preferred.

5.5.4 Lectern PCs shall be contained in PC cage mount accessible only by key.

5.5.5 Key locked access drawer shall be designed into Lectern for storage of mics, remote advancers, etc. Key access shall be attained by checkout from Classroom Information Technology in Himes Hall.

5.5.6 Flat panel displays shall be secured to the lectern with Kensington type combination lock.

5.6 Telecommunications.

5.6.1 Each room shall have a ring-down telephone installed onto wall phone block for Technical Support.

5.6.2 Telephone block/jack shall be installed near the lectern location.

5.7 ADA Compliance

5.7.1 Every consideration should be taken to accommodate requirements set forth by the ADA, including but not limited to appropriate lighting and space for an interpreter, wheelchair access, and any other accommodations.

5.7.2 The ADA Code of Federal regulations may be found at http://www.usdoj.gov/crt/ada/adastd94.pdf (PDF document).

5.7.3 Infrastructure for assistive listening devices should also be considered.

5.8 Lighting (see Division 27, Section 8.4)

5.8.1 Less than 5 Vertical Foot-candles shall be on screen.

5.8.2 Apply window treatments if necessary to control ambient light.

5.8.3 Room lights shall be conveniently controlled from the teaching area, along with any lights that are capable of being dimmed during projection.

5.8.4 There are four lighting zones in most classrooms

5.8.4.1 Zone 1 - Main classroom lighting (student seating area)

5.8.4.1.1 This zone services students and allows them to read and take notes in class.

5.8.4.2 Zone 2 – Projection area

5.8.4.2.1 While light bleed isn't the problem it once was, it is still important that light not shine directly on a screen during projection. Because of this, we recommend that lights which shine directly on the screen be controlled separately. They can be turned off during presentations but turned on when maximum whiteboarding needs to be illuminated.

5.8.4.3 Zone 3 – Instructor Workstation

5.8.4.3.1 The light direction above the instructor workstation should be switched separately whenever possible to allow the instructor to see their materials while conducting a class with the rest of the lights off for projection.

5.8.4.3.2 Touch screen lighting control panel (in new construction) should be mounted on wall near lectern for presentation zone controls.

5.8.4.4 Zone 4 - Emergency Lights

5.8.4.4.1 Due to fire and safety codes, many classrooms must have an emergency light that stays on at all times, even when the lights are shut off. Because this can cause interference with the clarity of the projected image on screen, every effort must be made to isolate light radiation to the back of the room away from the projection screen.

5.9 A/V Technology

5.9.1 Design and Technology Employed

5.9.1.1 The design and the technology remain relatively consistent; the actual equipment manufacturer model numbers may vary as new technology becomes available. Please reference See Division 27, Section 8.6 for current model numbers of equipment as of 2023.

5.9.2 Screen: Draper or DaLite Manufacturing (see Division 27, Section 8.3)

5.9.2.1 Screen shall be 16:10 or 16:9 (depending on application).

5.9.2.2 Screen shall be sized vertically (furthest viewer divided by 5).

5.9.2.3 Electric screen shall be recessed mounted when appropriate.

5.9.2.4 The bottom of screen shall be dropped no lower than 60” (where conditions allow).

5.9.2.5 Screen shall be matte white with gain of about 1.0 (30 Lamberts per square foot of screen area).

5.9.2.6 An unobstructed view shall be provided of the entire image on all screens from all seats within the viewing angles.

5.9.2.7 The viewing angle shall be a maximum 45-degree horizontal angle from the perpendicular to the center of screens and a maximum 35-degree vertical angle from the perpendicular to the top of each screen.

5.9.2.8 Screens should be oriented towards the “center of gravity” of the seating area so students in all seats can easily see projected images and the whiteboards.

5.9.2.9 Minimum distance between screen and closest seat is 9 feet.

5.9.3 Audio Systems: Please contact LSU ITS for specific model numbers as model numbers change.

5.9.3.1 Speech reinforcement sound amplification shall be present and distributed through a minimum of four ceiling 2 X 2 ceiling drop-in speakers where applicable or pendant where applicable. Depending on room size, more speakers may be needed.

5.9.3.2 Program sound amplification shall be present when a data/video projector is designed into the room.

5.9.3.3 Special Performing Arts rooms: faculty should be consulted about their specific needs.

5.9.3.4 Wireless microphones, if needed, should be frequency agile and the transmit frequencies shall be set upon collaboration with LSU ITS to eliminate interference.

5.9.4 Lectern

5.9.4.1 There shall be laptop connectivity support via cable pass through or chassis bulkhead plates to include HDMI and USB – a minimum of 3 feet cable reach from cubby/plate.

5.9.4.2 A power conditioner shall be provided with an 8-outlet minimum.

5.9.4.3 The lectern shall be Mulnix, KSI, Marshall or equivalent Instructor’s Lectern and be ADA compliant.

5.9.4.4 Custom Designed Lectern

5.9.4.5 NOTE: Most “off-the-shelf” lectern furniture does not meet our goals. The University has worked closely with A/V vendors and A/V Furniture Manufacturers to develop custom designs that do meet these goals and seek to standardize workstation and user interface design for each classroom. This standardization simplifies ease of use and minimizes instructor training. Refinements to the University’s custom-designed instructor workstations are made periodically. Architects and Consultants should obtain electronic copies of drawings for the appropriate current design(s) from LSU ITS (see Division 27, Section 8.1)

5.9.4.6 Equipment Standards for control and signal distribution in standard MMC.

5.9.4.6.1 Note: Tier 2 standard classrooms will have additional requirements (Tracking camera, ceiling mics, matrix switcher, additional networking, etc.). Contact ITS for updated information.

5.9.5 Control Interface: Crestron equipment is required in classrooms. Please contact ITS for specific model numbers given that equipment changes over time.

5.9.5.1 The touch control interface manufactured by Crestron shall be configurable and centrally controllable.

5.9.5.2 The Touchscreen control interface shall be mounted in custom lectern cutout or modify existing cutout to allow for Crestron TLP mounting.

5.9.5.3 The interface shall have controls for AV equipment and other selected programmable devices.

5.9.5.4 The touch panel on the instructor lectern shall be easy-to-read, simple menu choices which mirror the LSU chosen standard design. Contact LSU ITS for details.

5.9.5.5 All source codes, compiled codes, and access passwords shall be provided to the University at acceptance and become University property.

5.9.5.6 AV vendor shall provide updates to existing code during the life of the AV vendor equipment service warranty.

5.9.6 Scaler Switcher: Crestron standard required. Please contact ITS for specific model numbers given that equipment changes over time.

5.9.6.1 Switcher shall be remote controllable via RS 232 or LAN connection and have a minimum of three simultaneous video outputs

5.9.6.2 Integrated DTP inputs and output support transmission of video, control, and analog audio up to 330 feet (100 meters) over a shielded CAT 6 cable

5.9.6.3 Include a twisted pair output that can send video and embedded audio, plus bidirectional RS-232 and IR signals to an HDBaseT-enabled display.

5.9.6.4 Two mic or line level audio sources can be independently mixed with program audio and embedded onto the HDMI output. Selectable 48-volt phantom power allows the use of condenser microphones.

5.9.6.5 Embedded HDMI two-channel PCM audio can be extracted to the analog outputs, or multi-channel bitstream formats can be passed to the HDMI outputs.

5.9.6.6 Selectable output rates from 640x480 to 1920x1200, including 1080p/60 and 2K

5.9.7 Processor: Crestron standard for General Purpose MMC, alternatives NOT supported by LSU/ITS.

5.9.7.1 Please contact ITS for specific model numbers given that equipment changes over time.

5.9.7.2 Three AV LAN ports allow AV devices to be isolated from the corporate network

5.9.7.3 AV LAN ports provide PoE+ to external devices

5.9.7.4 Two bidirectional RS-232 serial ports with software handshaking.

5.9.7.5 One bidirectional RS-232/RS-422/RS-485 serial port

5.9.7.6 Two IR/Serial ports for one-way control of external devices

5.9.7.7 Ethernet monitoring and control on each Ethernet port

5.9.7.8 Central Deployment - Use the primary control processor to deploy all system files, configurations, and programs.

5.9.8 Computer: Please contact ITS for specific model numbers given that equipment changes over time.

5.9.8.1 There shall be at least one computer installed in the classroom with the following specifications

5.9.8.1.1 Ultrasharp LCD display (monitor) with DisplayPort\HDMI input

5.9.8.1.2 DVD ROM drive

5.9.8.1.3 Minimum two HDMI/DP output ports

5.9.8.1.4 Minimum USB 2.0, 6 port standard o Minimum One active USB 2.0 powered extension

5.9.8.1.5 One micro or standard sized keyboard

5.9.8.1.6 One optical scroll wheel mouse

5.9.8.1.7 A current version of Windows operating system

5.9.8.1.8 Front USB connections

5.9.9 Document Camera

5.9.9.1 There shall be at least one Document Camera installed with the following specifications

5.9.9.1.1 Progressive scan camera

5.9.9.1.2 Digital SXGA, WXGA, 720P, 1080P, HDMI and USB simultaneous outputs

5.9.9.1.3 75Hz and 60Hz output modes

5.9.9.1.4 RS232 (preferable) IR and USB inputs for control and connection to other devices

5.9.9.1.5 Automatic and manual focus o Brightness controls

5.9.9.1.6 Lamps for overhead lighting

5.9.9.1.7 USB connectivity for live document camera preview and control on local PC

5.9.9.1.8 HDMI and USB simultaneous outputs

5.9.10 Video/Data Projector (WUXGA preferred)

5.9.10.1 NOTE: To keep pace with current technology, the Classroom Information Technology team should work directly with audio-visual consultants/vendors to specify projectors that meet current criteria established by LSU. Cost should not be the only consideration when selecting projection options.

5.9.10.2 The criteria for projector selection shall include the minimum criteria

5.9.10.2.1 Seminar TEC – 1-19 seats - 6000 Lumen (laser preferred)

5.9.10.2.2 Classroom TEC - 20 to 59 Seats – 6000 Lumen (laser preferred)

5.9.10.2.3 Lecture Room TEC - 60 to 149 Seats - 6000 Lumens (laser preferred)

5.9.10.2.4 Auditorium 150+ seats – 6000+ Lumens (laser preferred)

5.9.10.2.5 Low noise output - 38 dB (High Brightness Mode) 30 dB (Low Brightness Mode)

5.9.10.2.6 Compatibility with classroom computers, laptops, and other audio-visual components

5.9.10.2.7 Uniformly bright, clear images with good resolution and excellent color rendition

5.9.10.2.8 Reliability including proven track record for good customer service and next day advanced replacement warranty

5.9.10.2.9 Low-profile size to avoid blocking views of screens and whiteboards

5.9.10.2.10 Availability of specialized projectors and/or lenses for unique classroom spaces

5.9.10.2.11 Accessibility of filter change without removing projector

5.9.10.2.12 Lens shift preferred with standard Throw Ratio Range: 1.35–2.2:1

5.9.10.2.13 Closed Captioning capability (preferred)

5.9.10.2.14 Laser lit light source 20,000 hours full brightness 30,000 hours low

5.9.10.2.15 RS232 or HDBT control (HDBT preferred)

5.9.10.2.16 Input requirements - HDMI, HDBT, Composite Video

5.9.10.2.17 Projectors shall be mounted with security mount (BMS Mfg.).

5.9.10.2.18 NOTE: Projector mounts should not cover the lamp or filter change housing area so that lamp and filter changes can be made without removing the projector from the ceiling mount.

5.9.10.2.19 Projector location: The center of the lens shall be exact height of the top of white projection area of the screen and perpendicular to the center of the screen. Zero keystoning preferred.

5.10 New Construction

5.10.1 Room Layout (See Division 27, Section 8.3)

5.10.1.1 Minimum Ceiling Height = Screen Size (vertically) + 5’

5.10.1.2 Prefer Square Room

5.10.1.3 For fixed tables, include power and conduit for data. If non-fixed, put power in floor boxes in strategic locations around room.

5.10.1.4 Table rows should be separated enough to allow students to enter row easily when others are seated.

5.10.1.5 Leave 9 feet between front of room and first student seat.

5.10.1.6 Instructor location should be to the left or right of screen. Preferably on the opposite side of room entry location.

5.11 Acoustical (including room properties and the effects of HVAC and mechanical systems)

5.11.1.1 Intelligibility: STI > .9

5.11.1.2 Hard surfaces up front and soft in the back

5.11.1.3 Overall Noise Level <= 35dBA SPL

5.11.1.4 Sound Level 70dB +-3dB over entire seating area, THD >0.5%

5.11.1.5 HVAC designed for NC30 or below

5.11.1.6 No AC vents by screen, no noise generation to interfere with the teacher or back rows where students sit, and classrooms placed away from noise generating locations (i.e., mechanical rooms, bathrooms, elevator shafts, etc.).

5.11.1.7 For entrances in the back of the room, any door should have a window for viewing whether class is in session.

5.11.1.8 Acoustic Ceiling Tiles and Carpeting (Tiles) for flooring – static resistant, lifetime warranty for wear/ravel/stain.

5.11.1.9 The front wall may reflect sound to the rear of the room. If a reverberation problem occurs, apply a small amount of acoustical material to the walls in the rear of the room to deaden the effect. Walls in the classroom should have a minimum sound transmission class (STC) of 50.

5.11.1.10 The rear wall of any large classroom (over 75) should have an acoustically absorbent finish. Side walls in large lecture halls should not be parallel, and they should have a rough or textured surface. Noise levels should not exceed NC 25-30.

5.12 Design and Consultation Process

5.12.1 Design guidance is of little value if it is not read, understood, and followed. We welcome suggestions to improve it, and we actively solicit opinions from faculty, staff, and students.

6 HORIZONTAL CABLING

6.1 General

6.1.1 Horizontal Cabling Description

6.1.1.1 Physical cabling and terminating hardware that provides the means of transporting data and voice signal between the Work Area Outlets and its horizontal cross-connect location in the Telecommunications Room (TR). This section will cover all the types of cables used and the connectors associated with each type of cable. It will also cover the standard methods and configurations for the Horizontal Cabling.

6.1.2 Definitions and Acronyms

6.1.2.1 BICSI: A professional association supporting the information technology systems (ITS) industry.

6.1.2.2 Cross-Connect field: A connection scheme between cabling runs used to attach connecting hardware on each end.

6.1.2.3 EMI: Electromagnetic Interference.

6.1.2.4 ETR: Entrance Telecommunications Room.

6.1.2.5 IDC: Insulation Displacement Connector.

6.1.2.6 LAN: Local Area Network.

6.1.2.7 Permanent Link: Horizontal cabling that has been installed and terminated properly on both ends of the cable, one end terminated in the TR and the other end terminated in a work area outlet.

6.1.2.8 POTS: Plain Old Telephone Service. Used to describe traditional analog voice service.

6.1.2.9 RCDD: Registered Communications Distribution Designer.

6.1.2.10 TR: Telecommunications Room

6.1.2.11 Work Area Outlet: A connecting device on which horizontal cable terminates opposite of the Telecommunications Room (TR or ETR).

6.1.2.12 Wet Location: Slab-on-grade construction where pathways are installed underground or in concrete slabs in direct contact with soil is considered a wet location.

6.1.2.13 ITS: Information Technology Services

6.1.2.14 UNI: University Network and Infrastructure

6.1.3 Administrative Requirements

6.1.3.1 Coordination of Work

6.1.3.1.1 Coordinate all routing, installation practices and issues of horizontal cabling with LSU's Information Technology Services personnel prior to installation.

6.1.3.1.2 Certain final connections and tie connections will be made directly by LSU's ITS/UNI personnel. Coordinate with LSU's ITS/UNI in a timely manner prior to the necessary work.

6.1.3.2 Quality Assurance

6.1.3.2.1 All communications work shall be performed by qualified communications personnel regularly employed in this field. The communications subcontractor shall have a BICSI certified Registered Communications Distribution Designed (RCDD) on staff. All qualifications shall be available for verification by LSU and/or the Architect.

6.1.3.2.2 A registered Panduit Certified Installer (PCI) contractor shall perform all communications work. The contractor shall have completed standards based product and installation training. A copy of the PCI Contractor Agreement shall be submitted in the proposal. All qualifications shall be available for verification by LSU and/or the Architect at time bid.

6.1.3.3 Submittals

6.1.3.3.1 All test results for installed cables shall be provided to LSU's ITS/UNI department as proof that all cables pass test qualifications. These test results can be delivered as a hard copy or electronic copy before acceptance of the system can be given. If electronic copies of the results are given, the results shall be delivered as a PDF file.

6.1.3.3.2 At the completion of all horizontal cable testing, a spreadsheet shall be provided to the LSU ITS department. The document shall be in Microsoft Excel format. The following data populated.

6.1.3.3.2.1 Building code

6.1.3.3.2.2 TR/ ETR #

6.1.3.3.2.3 Rack #

6.1.3.3.2.4 Patch panel row # (first installed patch panel is "1")

6.1.3.3.2.5 Patch panel jack position # (1-24)

6.1.3.3.2.6 End room # of circuit

6.1.3.3.2.7 Box # in room (left to right, clockwise around room)

6.1.3.3.2.8 Test result (good/bad) of each circuit

Bldg	Closet #	Rack	PP Row	PP Port	End Rm #	Box #	Tested
CSC	201D	1	1	1	100	1	Y
CSC	201D	1	1	2	100	1	Y
CSC	201D	1	1	3	101	1	Y
CSC	201D	1	1	4	101	1	Y
CSC	201D	1	1	5	102A	1	Y
CSC	201D	1	1	6	102A	1	Y
CSC	201D	1	1	7	102B	1	Y
CSC	201D	1	1	8	102B	1	Y
CSC	201D	1	1	9	102C	1	Y
CSC	201D	1	1	10	102C	1	Y

6.2 Product

6.2.1 Communications Cables

6.2.1.1 Balanced Twisted Pair Cables: 100-ohm, four-pair Balanced Twisted Pair, covered with a plenum rated thermoplastic jacket.

6.2.1.1.1 Comply with ICEA S-90-661 for mechanical properties.

6.2.1.1.2 Comply with TIA/ EIA-568-C for performance specifications.

6.2.1.1.3 Comply with TIA/EIA-568-C Category 6a for data station cables.

6.2.1.1.4 Jacket Color: White

6.2.1.1.5 Use the following products or LSU ITS approved equivalent

6.2.1.1.5.1 Balanced Twisted Pair Category 6a Cables. For data station cable use General Cable Part Number 7141840; Panduit Part Number PUP6AS04IG-G

6.2.1.1.5.2 Balanced Twisted Pair Category 6a Cables. For Wet Locations use General Cable Part Number 7141007; Mohawk Part Number 59202

6.2.1.2 Fiber Optic Cables – Single Mode Fiber

6.2.1.2.1 Horizontal Fiber Optic Cable Construction

6.2.1.2.1.1 Nonconductive, tight buffer, optical fiber cable.

6.2.1.2.1.2 Comply with ICEA S-83-596 for mechanical properties.

6.2.1.2.1.3 Comply with TIA/ EIA-568-C for performance specifications.

6.2.1.2.1.4 Jacket Color: Yellow

6.2.1.2.1.5 Cable shall be imprinted with fiber count, fiber type, and aggregate length at regular intervals.

6.2.1.2.1.6 Strand color code: per industry practice.

6.2.1.2.1.7 Jacket shall be plenum rated.

6.2.1.2.1.8 Strand count 6.

6.2.1.2.2 Use the following products or LSU ITS approved equal:

6.2.1.2.2.1 Corning single mode fiber; Part number 006E88-31131-29

6.2.1.3 Coaxial Cable

6.2.1.3.1 RG-6

6.2.1.3.1.1 Characteristic Impedance: 75-ohm +/- 3 ohm.

6.2.1.3.1.2 Structural Return Loss: 15 dB @ 1000-3000 MHz; 20 dB @ 5 – 1000 MHz.

6.2.1.3.1.3 Center Conductor: No. 18 AWG, solid, copper-clad steel.

6.2.1.3.1.4 Dielectric Material: foam- FEP insulation.

6.2.1.3.1.5 Quad shielded: Inner shield with 100 percent aluminum/ poly-foil shield and 60 percent aluminum braid; Outer shield with 100 percent aluminum/ poly-foil shield and 40 percent aluminum braid.

6.2.1.3.2 A. CATV Plenum Rated: Type CMP

6.2.1.3.2.1 Jacket color: White

6.2.1.3.2.2 Use the following product or LSU ITS approved equal: General Cable Part number C3525.41.86

6.2.2 Communications Hardware

6.2.2.1 Balanced Twisted Pair Cable Connectors

6.2.2.1.1 Assemblies shall be RJ-45 modular jacks and color-coded for specific use. The same modular jack will be installed at the workstation and in the modular patch panel. Modular jacks shall be Category 6a compliant (as described in the ANSI/TIA/EIA-568-C) 8-conductor, 8-position, un- keyed, and utilize IDC termination contacts. The jack shall be terminated according to the T568B wiring standard. The jack shall be of the appropriate category compliance to match the cable to which it will be terminated.

6.2.2.1.2 Jack Color

6.2.2.1.2.1 Data Jack Cat 6a (at the station outlet and in the TR): White.

6.2.2.1.2.2 Building Automation Systems (BAS) (at the device outlet and in the TR): Blue.

6.2.2.1.3 Use the following products or LSU ITS approved equivalent.

6.2.2.1.3.1 RJ-45 Category 6a Jacks, Panduit: Mini-com CAT6a RJ45 Data Jacks-White; Part # CJ6X88TGWH

6.2.2.1.4 The modular patch panels shall be manufactured to house the same category compliant RJ-45 modular jack that will be installed at the work area outlet. Modular patch panels shall be of the same manufacturer as the modular jack and shall be sized to accommodate the appropriate number of jacks provided plus an additional 10%. The panel shall fit in a 19” rack, accommodate exactly 24 jacks per row, and be colored black. Use the following products or approved equivalent.

6.2.2.1.4.1 Panduit: Mini-Com 24 Port 19” – Black; Part # CPP24WBLY

6.2.2.2 Fiber Optic Cable Connectors

6.2.2.2.1 All fiber cable strands shall be terminated using LC type connectors. The connector shall match the rating of the fiber that it is terminating.

6.2.2.2.2 Work Area Outlet

6.2.2.2.2.1 A work area outlet fiber termination will consist of two parts: the connector for the termination of the fiber strand and the coupler insert for the work area outlet faceplate.

6.2.2.2.2.2 Fiber connector to terminate fiber strands.

6.2.2.2.2.3 Use of a crimp type connector will be allowed at the work area outlet only. Use the following: Corning UniCam LC Single Mode; Part # 95-200-99

6.2.2.2.2.4 Fiber coupler insert for the work area outlet faceplate. Use the following: Panduit LC/ LC coupler insert Single Mode; Part#CMDSLCZBU

6.2.2.2.3 Fiber Optic Connector Housings

6.2.2.2.3.1 Fiber cross-connect housing (fiber patch panel)

6.2.2.2.3.2 Fiber cross-connect housings shall be manufactured to fit a 19" relay rack.

6.2.2.2.3.3 The housings shall be sized to accommodate the appropriate number of fiber connections and utilize the least amount of rack space. When possible it is advised that multiple cables be terminated in a single housing to save rack space.

6.2.2.2.3.4 Use the following products or approved equal: Corning CCH-0XU (where X represents the # of rack units needed to accommodate the housing).

6.2.2.2.4 Telecommunication Rooms

6.2.2.2.4.1 The termination of the fiber will happen in a fiber "Housing" mounted in the relay rack.

6.2.2.2.4.2 The horizontal fiber cable will be terminated in a Fiber Optic Housing Cassette.

6.2.2.2.4.3 The fiber optic connectors are LC type connectors and are included in the purchase of a "Fiber Optic Housing Cassette".

6.2.2.2.4.4 Fiber housing cassettes for the fiber cross-connect housings serve as both the fiber splice housing and fiber housing bulkhead panel. Each cassette is preloaded with LC fiber pigtails, LC/LC couplers and splice tubes required for the number of fiber ports available per the cassette purchased. Use the following products or approved equal: Corning (for CCH housing) CCH-CS12-A9-P00RE (will accommodate 12 strands) Up to 3 horizontal fiber cables can be accommodated in a single cassette.

6.2.2.3 Coaxial Cable Connectors

6.2.2.3.1 For both Work Area Outlet and TR locations

6.2.2.3.1.1 F type connectors.

6.2.2.3.1.2 Accepts RG-6 Coaxial cable.

6.2.2.3.1.3 Use the following products or approved equivalent

6.2.2.3.1.4 Panduit: mini-com jack insert- International White; Part # CMFIW

6.2.2.3.2 Coaxial Modular Patch Panel

6.2.2.3.2.1 The modular panel for the coax cable shall be the same patch panel as used for the data ports, but it will be mounted on the TR backboard using wall mount brackets.

6.2.2.3.2.2 The modular patch panels shall be manufactured to house the same f- type modular jack that will be installed at the work area outlet. Modular patch panels shall be of the same manufacturer as the modular jack and shall be sized to accommodate the appropriate number of jacks provided plus an additional 10%.

6.2.2.3.2.3 Use the following products of approved equivalent for the patch panel:

6.2.2.3.2.4 Panduit: Mini-Com 24 Port wall mount – Black; Part # CPP24WBLY

6.2.2.3.2.5 Use the following products or approved equivalent for the wall bracket: AllenTel wall mount bracket for 19” patch panel – Black; Part#AT55HM-1

6.2.2.4 WAP and Camera Hardware

6.2.2.4.1 Accessible Ceiling, use the following part or equal

6.2.2.4.1.1 Surface Mount outlet box; Part #CBX1WH-A

6.2.2.5 Work Area Outlet Faceplates

6.2.2.5.1 Outlet faceplates shall be single gang and manufactured to accept the same modular jack that will be installed in the modular patch panel. Unless otherwise noted on drawings, all faceplates shall have 4-ports minimums. Plates shall be thermos-plastic or non- conductive flexible nylon or Lexan. Use Type 302 stainless steel on concrete, masonry construction, or any other location as mandated by code. Faceplates shall be equipped with blank inserts of same color in unused ports.

6.2.2.5.2 The color of the faceplate shall be determined by the Architect or interior designer of the project.

6.2.2.5.3 Both the faceplate and the blank inserts shall be the same color.

6.2.2.5.4 Wall mounted work area outlet faceplate. Use the following products or approved equivalent

6.2.2.5.4.1 Panduit (4 PORT), Standard outlet; Mini-com faceplate, 4 module; Part #CFP4xx

6.2.2.5.4.2 Panduit (4 PORT), Residential Housing outlet; Mini-com faceplate, 4 port angled modules; Part #CFPS4xx

6.2.2.5.4.3 Reserved space/ blank for faceplate; Mini-com blank module; Part # CMBxx-X; xx = in the above part numbers represent the color of the faceplate and insert. The 2 shall match. IW (International White/ Off White), EI (Electric Ivory), WH (White), IG (International Grey), or BL (Black).

6.2.2.6 Work Area Outlet - Floor Mounted Faceplate

6.2.2.6.1 Provide a single gang, 4-port duplex frame. Frames shall be manufactured to accept the same modular jacks as the standard work area outlet faceplates. Provide blank inserts for all unused ports; Manufacturer: Hubbell Inc. E-series; Part # S1PTBRS With sub plate part # S1SP (with 106 Frame) or sub plate part # S1SP4X4PA

6.2.2.7 Labeling

6.2.2.7.1 Comply with TIA/ EIA-606-A and UL 969 for labeling materials, including label stocks, laminating adhesives, and inks used by label printers.

6.2.2.7.2 No handwritten labels will be accepted

6.3 Execution

6.3.1 General Cable Installation

6.3.1.1 Comply with TIA/ EIA-568-C.

6.3.1.2 Comply with BICSI TDMM, Ch. 5 “Horizontal Distribution Systems.”

6.3.1.3 NO cable ties are allowed in LSU's cable plant. All cables shall be neatly arranged and tied with hook and loops straps. Wiring is neatly arranged and can be easily modified.

6.3.1.4 Horizontal cabling shall contain no consolidation points, splice points, or transition points between the nearest Telecommunications Room and the Work Area Outlet. (Exception: Horizontal fiber optic cable shall be pulled through the nearest TR to the building Entrance Telecommunications Room.)

6.3.1.5 The proper cable for the environment is to be installed. (Wet locations shall have the appropriate cable.)

6.3.1.6 The maximum allowable horizontal cable length is 295 feet.

6.3.1.7 All horizontal cable shall be plenum rated cable.

6.3.1.8 Install lacing bars and distribution spools to restrain cables, to prevent straining connections, and to prevent bending cables to smaller radii than the minimum recommended by the manufacturer.

6.3.1.9 Cable shall not be run through structural members or in contact with pipes, ducts, or other potentially damaging items.

6.3.1.10 Inside routing shall be installed parallel and perpendicular to existing structural lines and members.

6.3.1.11 Do not install bruised, kinked, scored, deformed, or abraded cable. Remove and discard cable if damaged during installation and replace it with new cable.

6.3.1.12 Telecommunications horizontal cable shall be installed in conduit where routed in walls, floors, and inaccessible ceilings.

6.3.1.13 If cable has to cross fluorescent lighting and/or power cables, the cables must cross perpendicular to both.

6.3.1.14 For cable not installed horizontally in conduit, support exposed cable in accessible ceiling space at most every five feet using industry standard J- hooks. Mount as high as possible next to floor/ roof deck. Do not support cabling from conduit, joists, or ductwork directly. Use only the J-hooks.

6.3.1.15 Separation from EMI Sources must comply with BICSI TDMM and TIA-569-B for separating unshielded copper voice and data communication cable from potential EMI sources, including electrical power lines and equipment

6.3.1.15.1 Separation between conduit and cables used for electrical power: a minimum of 12".

6.3.1.15.2 Separation between light fixtures: a minimum of 18".

6.3.1.15.3 Separation between Communications Cables and Electrical Motors and Transformers, 5 kVA or HP and larger: a minimum of 48".

6.3.1.15.4 Separation between Communications Cables and Fluorescent Fixtures: a minimum of 5".

6.3.2 Terminations

6.3.2.1 Balanced Twisted Pair Cable

6.3.2.1.1 Terminate all Balanced Twisted Pair cable using modular type female RJ45 connectors at both ends of the cable.

6.3.2.1.2 Terminate all cable conductors; no cable shall contain non- terminated pairs.

6.3.2.1.3 No cable shall have pairs that are split between 2 connectors.

6.3.2.1.4 When terminating cable, comply with TIA/ EIA-568-C.

6.3.2.1.5 The jack shall be terminated according to the T568B wiring standard.

6.3.2.2 Coaxial Cable

6.3.2.2.1 Terminate all coaxial cable using F type connectors.

6.3.2.2.2 The connector shall have a modular insert design to fit into the same faceplate as the balanced twisted pair cables.

6.3.2.3 Fiber Optic Cable

6.3.2.3.1 All fiber optic cables shall be terminated using type LC connector specified.

6.3.2.3.2 Use LC UniCam connectors at the outlet and LC pigtails in the TRs (pigtails are part of the Cassettes).

6.3.3 Telecommunications Work Area Outlet Configuration

6.3.3.1 Work Area Outlet (Typical for an office space)

6.3.3.1.1 TIA/EIA-568-C.1 requires that a minimum of two work area outlet/connectors be installed for each work area.

6.3.3.1.2 All work area outlets must be accessible after final furniture is placed in space.

6.3.3.1.3 Standard work area outlet for an office space shall consist of TWO (2) Category 6a compliant data ports. Division 27, Section 7.6.

6.3.3.1.4 If there is a need for Coax for CATV, then the outlet shall consist of the appropriate cabling to provide this service. ONE (1) RG- 6 Coax cable port for CATV.

6.3.3.1.5 Ports will be positioned in the outlet per Division 27, Section 7.6 for all cables.

6.3.3.2 Fiber Optic Work Area Outlet

6.3.3.2.1 When fiber optics are required at a work area, it must be installed in a separate outlet box from other horizontal cabling.

6.3.3.2.2 A 6-strand single mode fiber cable) will be pulled from the nearest TR to the servicing outlet location.

6.3.3.2.3 All strands of the fiber cable shall be terminated. No strand shall be left un-terminated.

6.3.3.2.4 The fiber optic connector shall be LC type connector.

6.3.3.2.5 This outlet will be required to have a 4-port faceplate and be configured per Division 27, Section 7.6.

6.3.3.3 Wireless Access Points and Camera

6.3.3.3.1 Above Accessible Ceiling

6.3.3.3.1.1 For WAP and Camera outlets above accessible ceilings, the outlet shall be attached / supported above the ceiling grid. The outlet shall be a surface mount type that can be either attached to the vertical ceiling hangers or attached to wall at the correct location.

6.3.3.3.1.2 Location of outlet box must be clearly marked with intended use type, jack id.

6.3.3.3.1.3 Location shall be marked on metal grid using ½" wide label. Printing must be black on white label.

6.3.3.3.2 On Inaccessible Ceiling

6.3.3.3.2.1 For WAP and Camera outlets on inaccessible ceilings the installation will require coordination with LSU ITS/UNI personnel.

6.3.3.3.3 Mounted on the exterior surface of the building.

6.3.3.3.3.1 For all penetrations and how the devices look on the exterior of the building, defer to the architect and LSU's Facility Development team.

6.3.3.3.3.2 If the penetration through the exterior surface of the building enters the building above an accessible ceiling space, then install a surface mount outlet within 12" of the penetration. Once the cable is installed through the penetration, then that penetration shall be fire stopped and sealed in compliance with the building Fire Stop system.

6.3.3.3.3.3 If the penetration through the exterior surface of the building enters the building above an inaccessible ceiling space, coordinate the installation with LSU ITS/ UNI personnel.

6.3.4 Telecommunications Room Configuration

6.3.4.1 In the TR, group connecting hardware for cables into separate logical fields. Data and fiber cabling will be terminated on the relay rack. Coax cabling will be terminated on wall backboards.

6.3.4.2 Data Cabling

6.3.4.2.1 Includes network connections, wireless access point connections, camera connections, and Building Automation System (BAS) connections.

6.3.4.2.2 Mount all horizontal data cabling in patch panels in relay racks.

6.3.4.2.3 Configuration of the data cabling in the patch panels will be determined by the use of the cable. Start patch panels on relay rack row 39 in Entrance Telecommunications Rooms and row 42 in Telecommunications Rooms. Install a maximum of 16 patch panel rows.

6.3.4.2.3.1 The data connections will fill in the patch panels at the top of the field and will be arranged in the patch panels from left to right and top to bottom.

6.3.4.2.3.2 Immediately after the complete population of the data network connections there shall be empty patch panel spaces available for a 10% growth.

6.3.4.2.3.3 Immediately following the growth section of the patch panels and on a new row, the wireless access point connections will be arranged in the patch panels from left to right and top to bottom.

6.3.4.2.3.4 Immediately following the wireless access point connections rows and on a new patch panel row, the camera connections will be arranged in the patch panel from left to right and top to bottom.

6.3.4.2.3.5 Once ALL the data jack fields are installed, the BLUE BAS connections will be installed on the very BOTTOM row of the patch panels and all the way to the RIGHT.

6.3.4.2.4 Coax Cabling

6.3.4.2.4.1 Mount all horizontal coax cabling in 19” patch panels on the telecommunications room backboards.

6.3.4.2.4.2 The 19” patch panel will be the same patch panels used for the data network connections in the relay racks.

6.3.4.2.4.3 Use brackets to attach the patch panels to the back board at location in the TR as described in Division 27, Sections 7.1, 7.2 and 7.3.

6.3.4.2.5 Fiber Optic Cabling

6.3.4.2.5.1 Mount all horizontal fiber optic cabling in a fiber optic connector housing in the relay rack, starting on row 45.

6.3.4.2.5.2 All horizontal fiber optic cable connections will be terminated in a Fiber Optic Cassettes that are separate from that of service/ backbone fiber optic cables. Only 3 cables will be allowed to be terminated in a single cassette.

6.3.4.2.5.3 The location of the Horizontal fiber cassette will be located as far to the right of the housing as possible. (More details on the set up of the Fiber Optic Housing will be covered in Division 27, Section 4)

6.3.4.2.5.4 All fiber optic cables shall be terminated using the factory-manufactured pigtails that are included in the cassettes specified.

6.3.4.2.5.5 All pigtails shall be fusion spliced into fiber optic cable.

6.3.5 Identification and Labeling

6.3.5.1 No paper labels or tags will be acceptable.

6.3.5.2 No hand-written labels or tags will be acceptable.

6.3.5.3 Work Area Outlets

6.3.5.3.1 Each Work Area Outlet shall have its own unique identifier. The outlet's unique identifier shall be placed at the top of each faceplate and shall consist of the official room number of the wiring closet serving the outlet, followed by a colon, followed by a space, then the faceplate number. (e.g. Faceplate 1 served from Closet 1023 would have the following label: 1023: 1).

6.3.5.3.2 Faceplate numbers shall be assigned sequentially in a room, starting at the first outlet to the left of the leftmost entrance with a "1," and increasing the count incrementally by 1 in a clockwise direction around the room.

6.3.5.4 Work Area Outlet Ports

6.3.5.4.1 All data jacks in an individual work area outlet shall be labeled. Each data jack on the faceplate shall be labeled with the rack number, patch panel row number, and the patch panel row position number from which it is served, separated by hyphens. For example, if the far-end of a jack in the faceplate is located in Rack 1, Patch Panel Row 2, Patch Panel Row Position Number 23, the work area outlet jack would be labeled 1-2-23.

6.3.5.5 Wireless access points and camera locations:

6.3.5.5.1 Cables installed for wireless access points and cameras shall be flagged with the room number of the TR as well as the Rack/ Patch Panel Row/ Panel Port location as described above.

6.3.5.6 Equipment Room Terminations

6.3.5.6.1 Racks: rack shall be labeled. Each rack shall be labeled sequentially from left to right beginning with the number 1.

6.3.5.6.2 Data Outlets: each jack shall be labeled. Labels shall be affixed to the patch panel at a point adjacent to the jack being labeled. Labels shall include the official far end room number followed by a colon, followed by the number of the faceplate, which contends the far end jack. Example 1103B:2.

6.3.5.7 Coax Cable Labels

6.3.5.7.1 The contractor will not be required to do any labeling at the work area outlet for the Coax cable.

6.3.5.7.2 The contractor will be required to label above each port on the coax cable patch panel in the TR.

6.3.5.7.3 Coax shall be arranged in the patch panel in ascending sequential order by room number.

6.3.5.7.4 The label is required to have the room number and outlet number for the location of the outlet side of the coax cable.

6.3.5.7.5 The location label will look like: "XXXX YYY"

6.3.5.7.5.1 XXXX: the room # of the work area outlet.

6.3.5.7.5.2 YYY: the work area outlet #.

6.3.5.7.5.3 E.g. 123:2

6.3.5.8 Fiber Optic Cable Labels

6.3.5.8.1 Each horizontal cable will be given a unique identifier and labeled per its unique identifier and its location.

6.3.5.8.2 Work Area Outlet

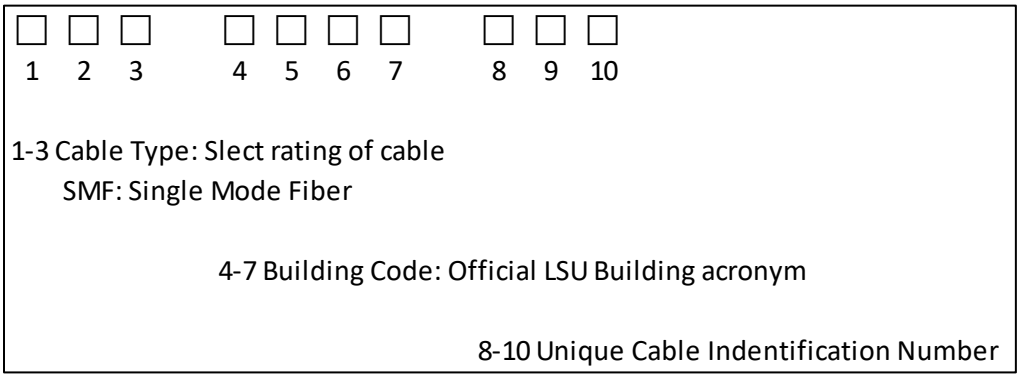
6.3.5.8.2.1 At the work area outlet the outlet will be labeled with the room number of the servicing TR and the outlet box number in the room. Similar to that of the data cabling.

6.3.5.8.2.2 Above the LC couple ports and centered on the faceplate the contractor shall adhere the “unique identifier” for that horizontal fiber cable.

6.3.5.8.3 Fiber Connector Housing in the TR

6.3.5.8.3.1 On the outside of the door the fiber connector housing the contractor shall place the label with the unique identifier on the cable directly above/ in front of the location of where the cable is physically located in the housing. Directly below the label with the unique identifier of the cable will be a label that indicates the location of the work area outlet of that horizontal fiber cable.

6.3.5.8.3.2 How to develop the unique identifier for the horizontal fiber cables



6.3.5.8.3.3 Each horizontal fiber cable is given a unique number that is used to track that cable. The number will start with the number 1 and increase by 1 for the next cable. The only requirement for the numbering scheme is that the number be in increasing sequential order in the TR fiber optic connector housing. (e.g. 1, 2, 3…101, 102; e.g. Unique Identifier: SMF-FSB-3:1-4).

6.3.5.8.3.4 The Fiber Work Area Outlet location label will look like this: “LCO: XXXX YYY” where XXXX = Official LSU building acronym and YYY=The room # of the work area outlet (e.g. LOC: FSB 123)

6.3.6 Field Quality Control & Testing

6.3.6.1 All questions and/ or disagreements with regards to the cabling practices for the project will be discussed and a resolution will be agreed upon by LSU’s ITS department and the contractor’s RCDD for the project. End-to-end horizontal cabling will be considered defective if it does not pass physical inspections and performance tests.

6.3.6.2 If a cable fails to pass physical inspections and performance tests, the contractor will perform corrections to the cable. Corrections can be made to the existing cabling that are pre-approved by LSU ITS or the cabling must be replaced by the contractor at the contractor’s expense.

6.3.6.3 Physical inspection of cable assemblies

6.3.6.3.1 The contractor (or qualified independent testing agent) will perform the following physical tests and inspections prior to LSU’s ITS.

6.3.6.3.1.1 Visually inspect all horizontal cables for compliance with installation requirements for the entire route of every cable installed.

6.3.6.3.1.2 Visually inspect all horizontal cable jacket materials to verify that all cables installed are PLENUM rated.

6.3.6.3.1.3 Visually confirm that all the cables are of the proper type (Category 6a, Singlemode, etc.) and that the jackets are the proper color.

6.3.6.3.1.4 Inspect cabling terminations in communications equipment rooms and at telecommunication outlets for compliance with termination requirements. Verify that the terminations are made properly, that the jacks are the correct color, and that the ports are labeled properly.

6.3.6.4 Performance Testing

6.3.6.4.1 Balanced twisted pair performance tests

6.3.6.4.1.1 All horizontal distribution runs shall work together to create a permanent link solution for wire and jack combination. A permanent link solution is a pairing of wire and jack tested together to produce optimum efficiency and throughput. The permanent link solution will be tested as a complete assembly from the work area outlet to the patch panel interface.

6.3.6.4.2 Test for each outlet. Perform the following tests according to TIA/ EIA-568-C.

6.3.6.4.2.1 All Category 6A distribution cables will be tested in accordance with procedures laid out in TIA/EIA- 568-C for the basic link. Written test results for each cable shall include all four of the primary field test parameter results. Any cable that fails testing shall be reported along with the procedures used to rectify the failure (i.e., replaced cable, replaced jack, etc.). Contractor tests shall utilize a Category 6A Level II compliant cable tester. Electronic results for each balanced twisted pair Category 6A four-pair cable will be submitted as part of the contractor's "As-Built" project performance acceptance records. In addition to the above information, the documentation will also include a pass/ fail indication for the specified cable, the test date, the serial number and software version of the scanner, and a copy of the calibration certificate for the scanner. Necessary applications for reading the results will be provided by the requirements refer to ANSI/ TIA/ EIA-569-B.

6.3.6.4.2.2 Document data for each measurement. Data for submittals shall be printed in a summary report.

6.3.6.4.2.3 Prepare test and inspection reports.

6.3.6.4.3 Coax Cable performance testing

6.3.6.4.3.1 The horizontal coax cable assembly consists of the coupler modules at the work area outlet, the coax cable with the f-type connectors properly terminated on each end of the cable, and the coupler module in the TR.

6.3.6.4.3.2 The horizontal coax cabling will be physically inspected and a continuity test will be made to determine that the f-type connectors have been properly terminated.

6.3.6.4.3.3 If the cable fails to meet the above requirements, the contractor will perform corrections to the cable or it shall be replaced by the contractor at the contractor's expense.

6.3.6.4.4 Fiber Optic performance testing

6.3.6.4.4.1 All singlemode fiber cables shall be tested at both 1310 nm and 1550 nm after installation. All tests are to be performed in accordance with ANSI/ TIA/ EIA-526-7.

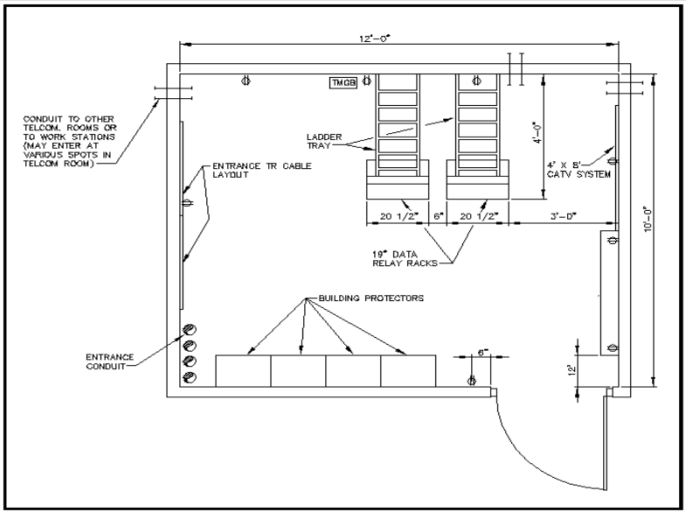
6.3.6.4.4.2 No splice may show a loss of greater than 0.2 dB and no connector pairs may show a loss of greater than 0.5 dB. Fibers will be considered acceptable if the OTDR trace for that fiber shows an end to end loss of less than xxdB + yy(0.2) dB + zz(0.5) dB (where yy is the number of splices, zz is the number of connector pairs and xx is calculated using the following formula: xx = distance X fiber attenuation/ unit distance @ lambda of the manufacturers specifications of fiber cable used). The vendor shall test each fiber strand utilizing an OTDR tester at the wavelengths specified above. Overall, the OTDR test results shall be made up of the wavelength of the conducted test, the link length, the link attenuation, cable identification, and the locations of the near end, the far end and each splice point or points of discontinuity. Hard-copy results for each fiber strand shall be submitted as part of “As-Built” documentation.

6.3.6.4.4.3 If the cable fails to meet the above requirements, the contractor will perform corrections to the cable, or it shall be replaced by the contractor at the contractor’s expense.

6.3.6.4.4.4 Printed test results for each fiber strand are required.
Communications equipment room fittings

7 NETWORK & TELEPHONY REFERENCES

7.1 Entrance Telecommunication Room



7.1.1 Equipment racks shall be constructed of aluminum, shall be 19” wide and floor mountable.

7.1.2 All racks shall be anchored using drop anchor bolts.

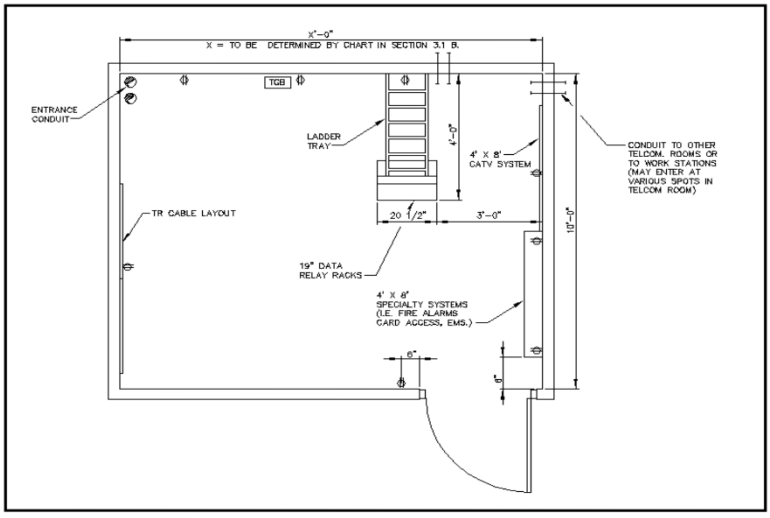
7.1.3 Minium floor space required shall be 12 sq ft, 3’ front by 4’ deep per rack.

7.1.4 The rack(s) will be supported from the top of the rack using a ladder type tray.

7.1.5 The tray will be used to support the rack and also to transition the cable from the rack to the wall.

7.1.6 No cables will free span from the wall to the rack.

7.2 Telecommunications Room



7.2.1 Equipment racks shall be constructed of aluminum, shall be 19” wide and floor mountable.

7.2.2 All racks shall be anchored using drop anchor bolts.

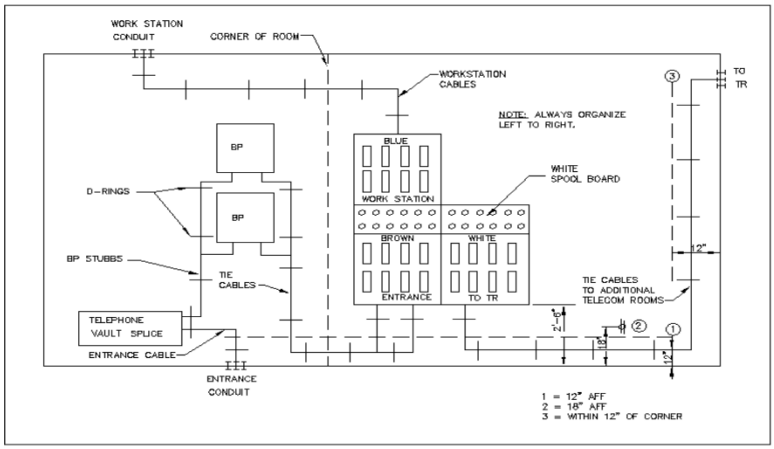
7.2.3 Minium floor space required shall be 12 sq ft, 3’ front by 4’ deep per rack.

7.2.4 The rack(s) will be supported from the top of the rack using a ladder type tray.

7.2.5 The tray will be used to support the rack and also to transition the cable from the rack to the wall.

7.2.6 No cables will free span from the wall to the rack.

7.3 Entrance Cable Layout



7.3.1 Keep all cables routed at floor below 12”

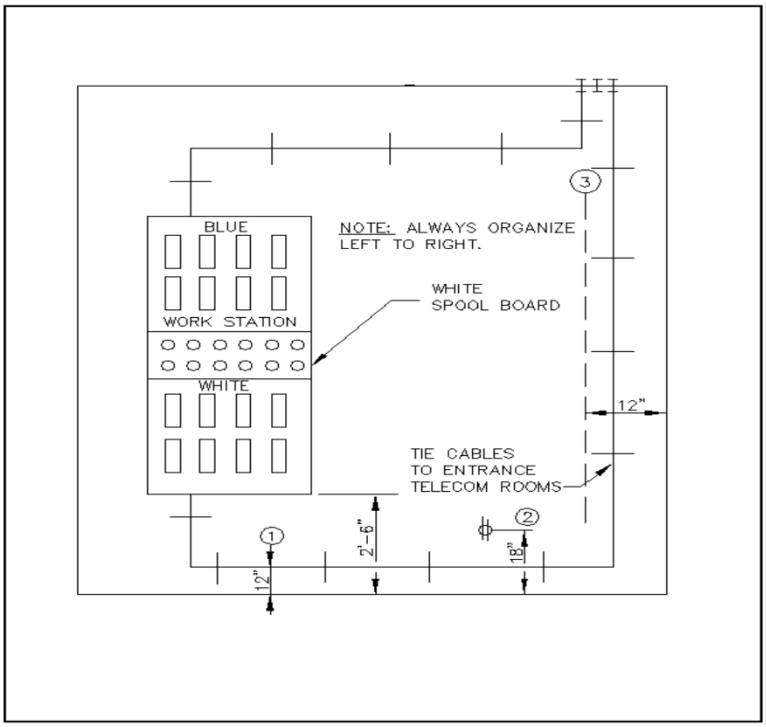
7.3.2 Install electrical receptacle at 18” above finished floor.

7.3.3 Do not cover the receptacle with any obstructions.

7.3.4 Receptacle must be in clear site.

7.3.5 Any cable that transverses the wall vertically must do so within 12” of the corner.

7.4 Telecommunications Room Cable Layout



7.4.1 Keep all cables routed at floor level below 12”.

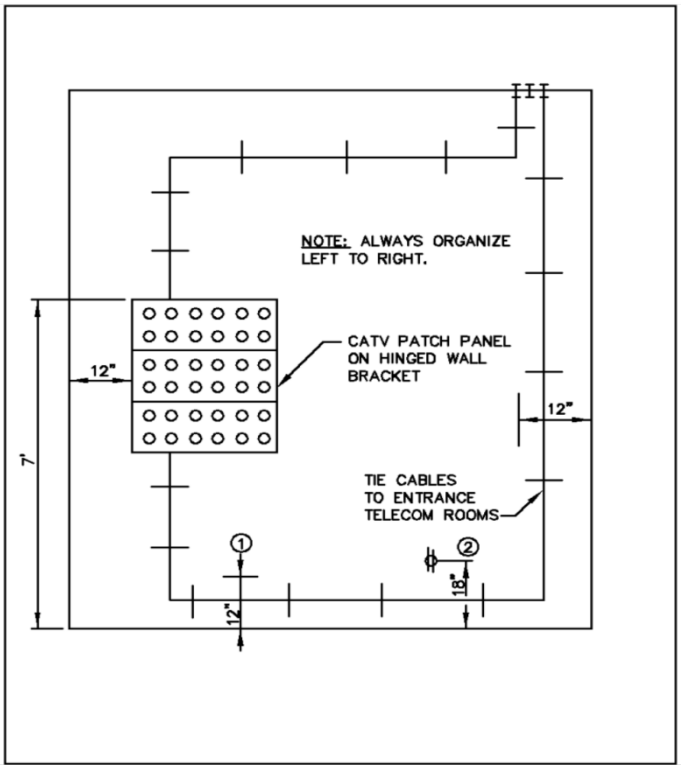
7.4.2 Install electrical receptacle at 18” above finished floor.

7.4.3 Do not cover the receptacle with any obstructions.

7.4.4 Receptacle must be in clear site.

7.4.5 Any cable that transverses the wall vertically must do so within 12” of the corner.

7.5 CATV Layout



7.5.1 Keep all cables routed at floor below 12”

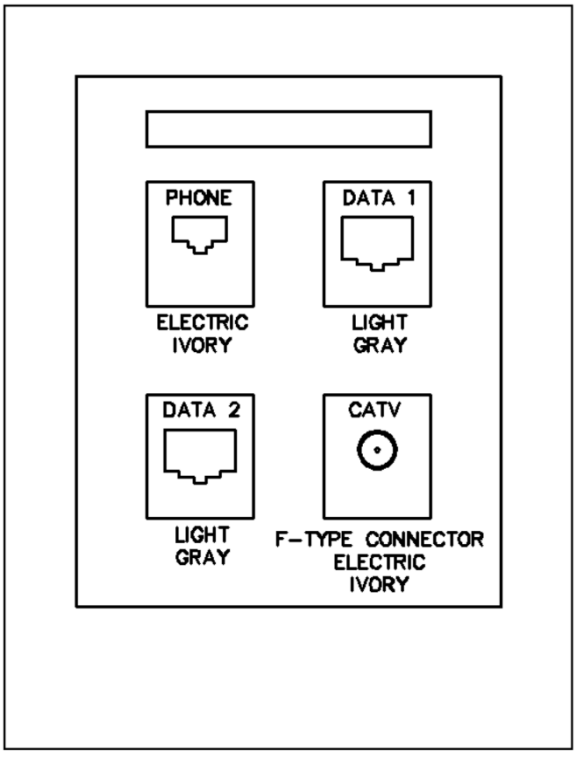
7.5.2 Install electrical receptacle at 18” above finished floor.

7.5.3 Do not cover the receptacle with any obstructions.

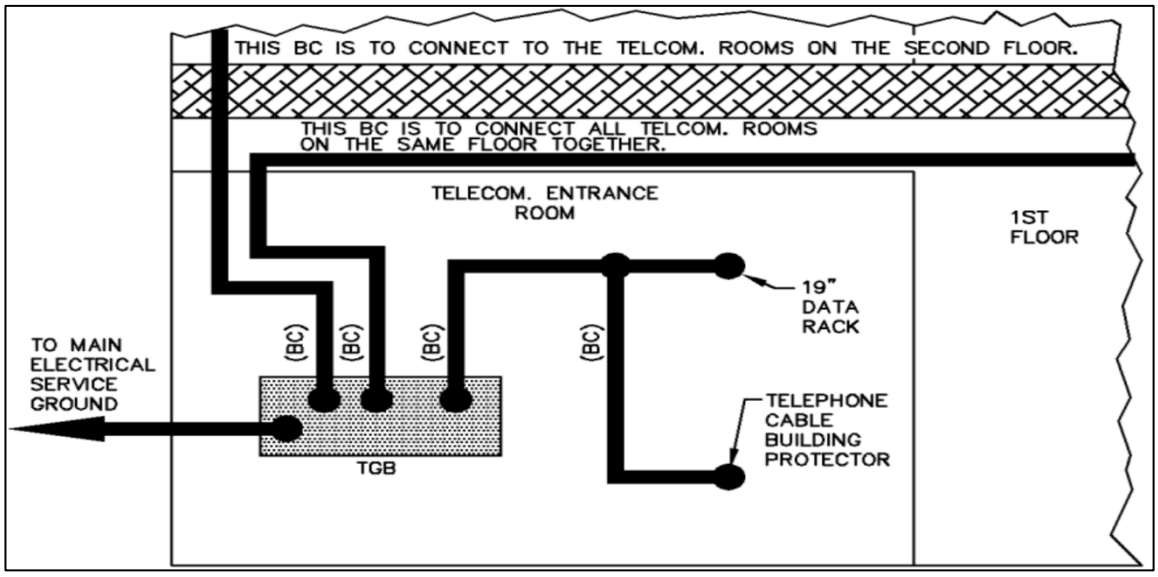
7.5.4 Receptacle must be in clear site.

7.5.5 Any cable that transverses the wall vertically must do so within 12” of the corner.

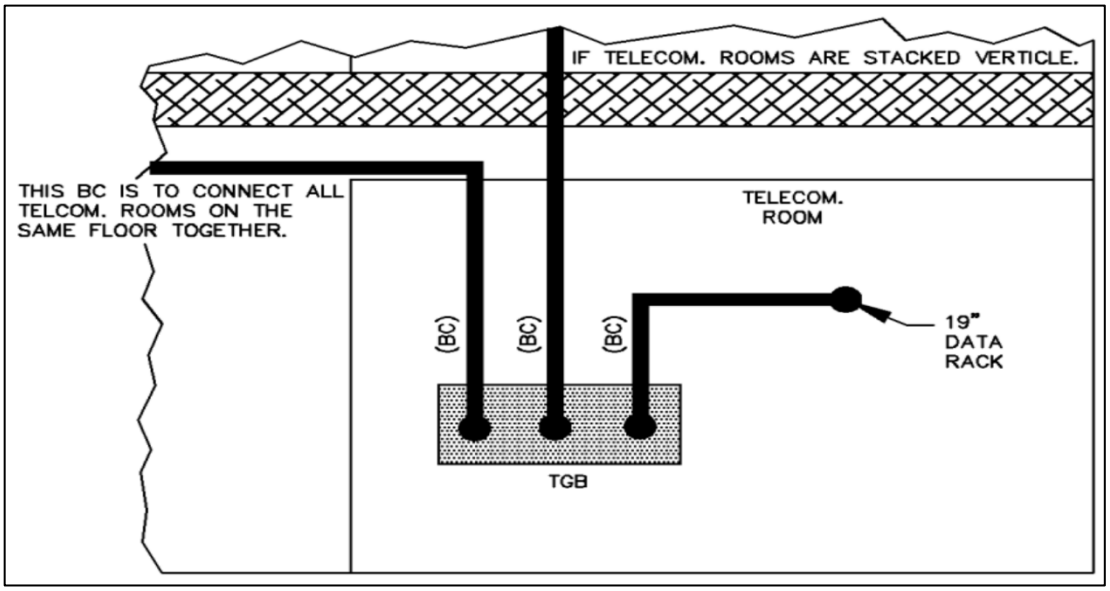
7.6 Work Station Outlet



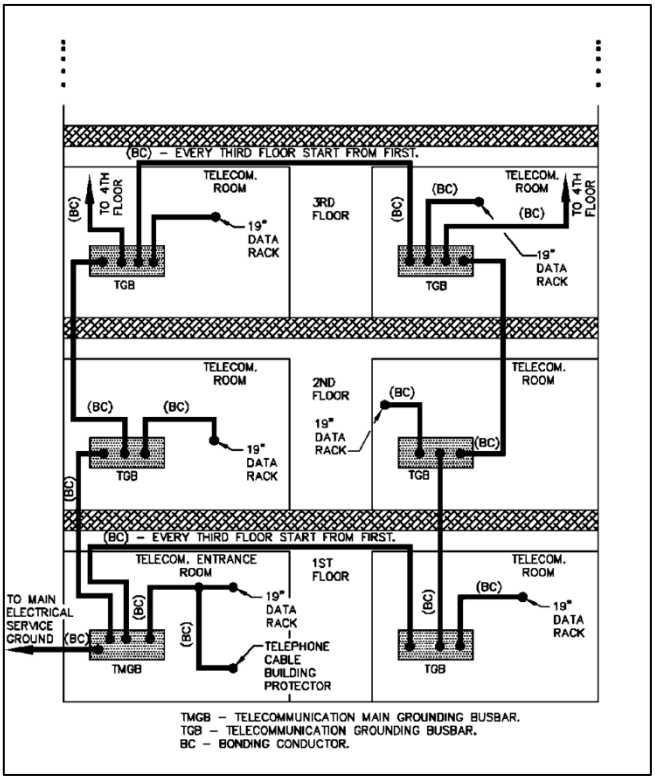
7.7 Cut Out of Telecommunications Entrance Room



7.8 Cut Out of General Telecommunications Room



7.9 Typical Grounding System



8 AUDIO VISUAL REFERENCES

8.1 Lecterns shall include

8.1.1 Exterior dimensions - 35" w x 30" d x 41" h

8.1.2 Split work surface - rear sloped portion for touch panel/interface cut out - balance of work surface is flat

8.1.3 Well for a 17" LCD monitor on presenter's left with integral cable management

8.1.4 Cutout for interface device on angled work surface for flush mounting

8.1.5 Cutout for Crestron Cable Cubby

8.1.6 High intensity dimmable gooseneck LED light on presenter's right

8.1.7 Space for a CPU tower to the left of the 12 space rack on an adjustable shelf

8.1.8 7 outlet power strip in lectern bottom

8.1.9 Keyboard/mouse shelf with heavy duty ball bearing slides

8.1.10 Flip- up down side shelf - 22"w x 24"d – on both sides- rated at 70 lbs, double bracket with positive spring locks with large finger pulls.

8.1.11 Twelve space rack rail in lower section to the right of the CPU section, with heavy duty side mounts including large mechanical fasteners at every space.

8.1.12 Hinged front locking access panel for the lower section with continuous security mounting bracket.

8.1.13 Standard lectern base with exclusive L-shaped structural support re-enforced with multiplied cleats at all joints - no power inlet.

8.1.14 Manufactured cable well for auxiliary cable and duplex outlet.

8.1.15 Blank rack plates as needed.

8.1.16 Middle Atlantic TD2-LK Rack mounted locking drawer.

8.1.17 Back doors for equipment access with C346A lock.

8.1.18 Constructed with black laminate.

8.1.19 All laminated edges with exclusive edge-wear treatment.

8.1.20 All laminate surfaces glued with PVA glue with applied continuous pressure at 1250 pounds per square inch.

8.1.21 The laminate should be mounted to a Medium Density Fiber board that has been rated for core screw holding of 290lbs. with internal bond of 117psi and modulus of rupture 4,400 psi.

8.1.22 Moisture content should be between 4-7%

8.1.23 All construction includes super structure wrap around continuous glue joinery with mechanical re-enforcement at load critical joints

8.1.24 Work surface constructed in modular sections for facilitating possible subsequent retrofitting of new or additional integration items

8.1.25 All work surface cut outs made with computer controlled machinery for accuracy of fit and excellence in finish

8.1.26 Verify all equipment for size prior to fabrication

8.1.27 Crestron Cable Management with a duplex outlet and pass-through AAP for Laptop HDMI

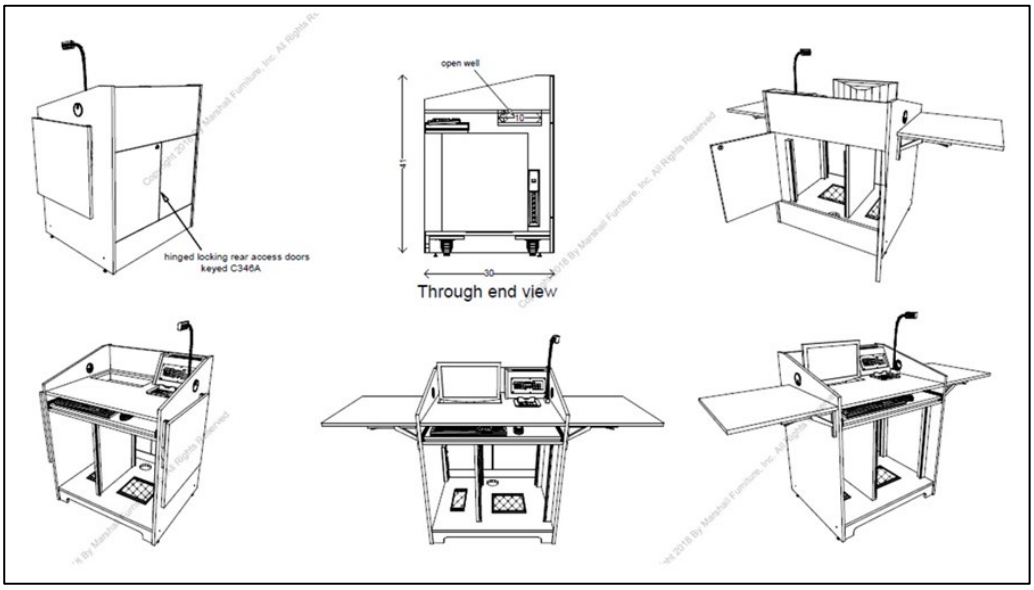
8.1.28 115 volt rack mounted power strip

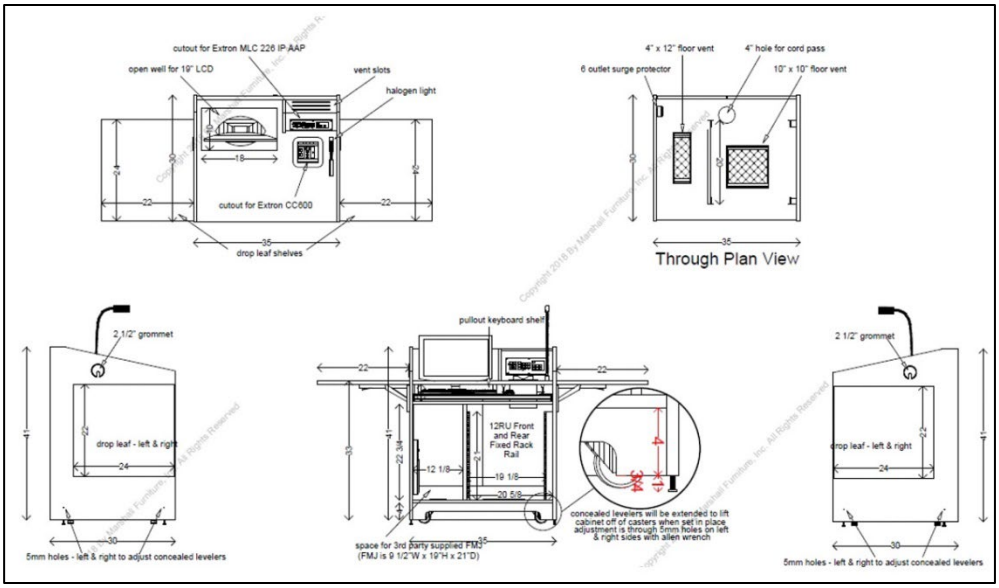
8.1.29 Middle Atlantic SSDR series security doors for equipment racks to cover switcher and power strip

8.1.30 Four lockable swivel carpet casters and concealed levelers to lift off casters when in place

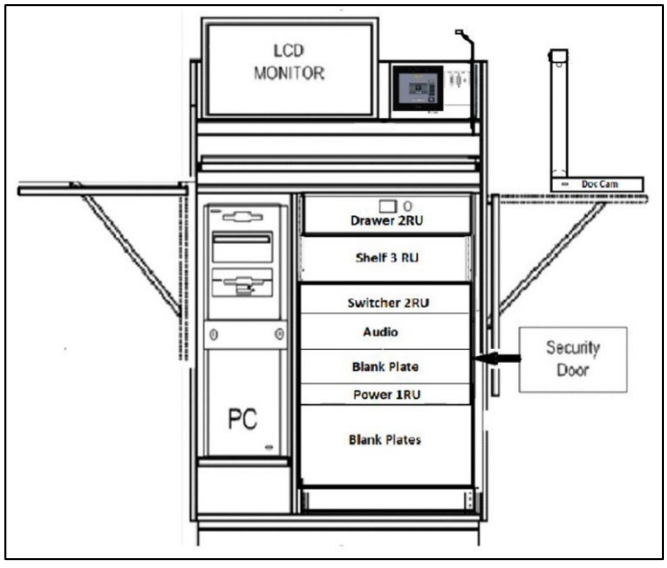
8.1.31 Warranty- 3 years parts and labor

8.1.32 Shown below: Model ELSU35S

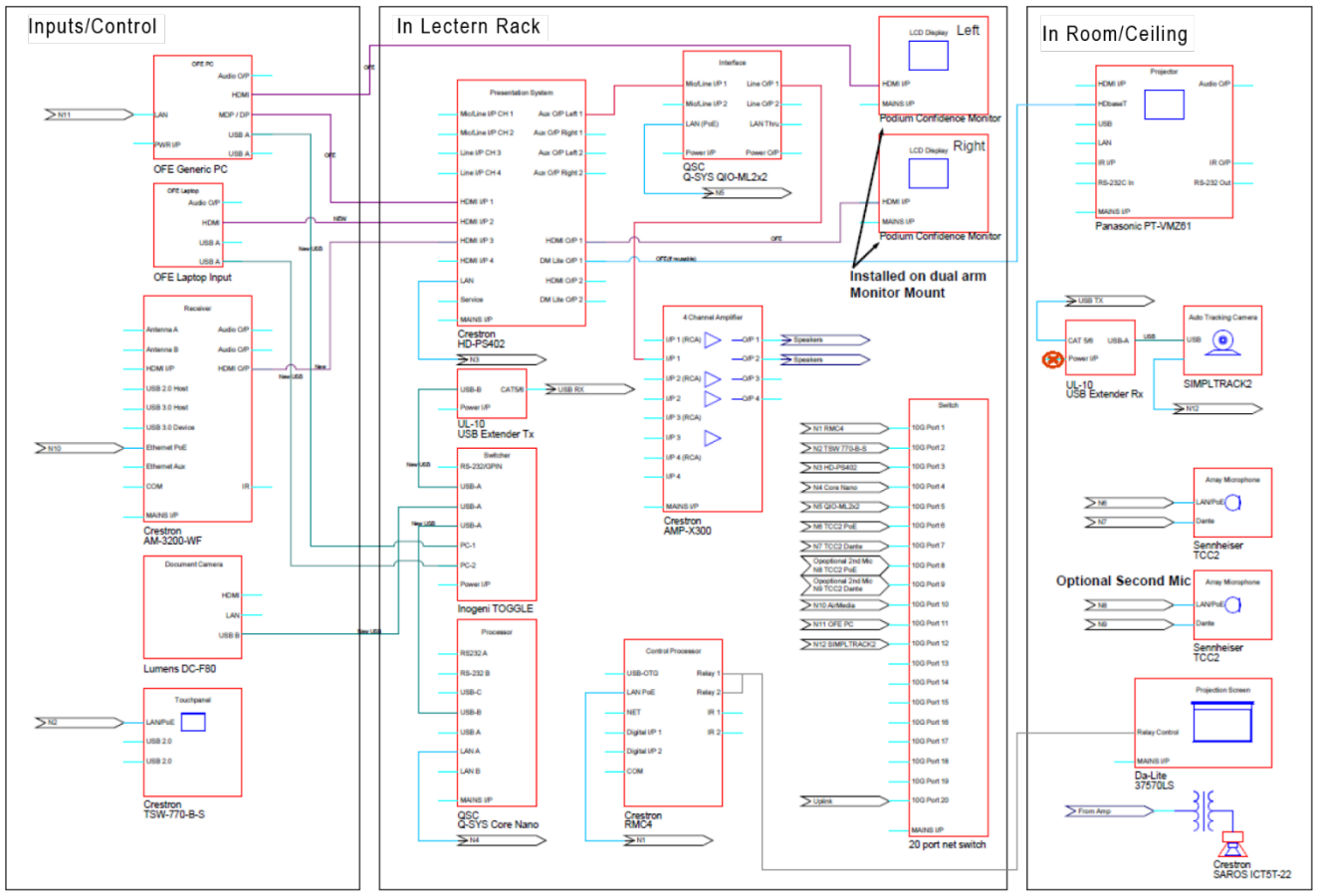




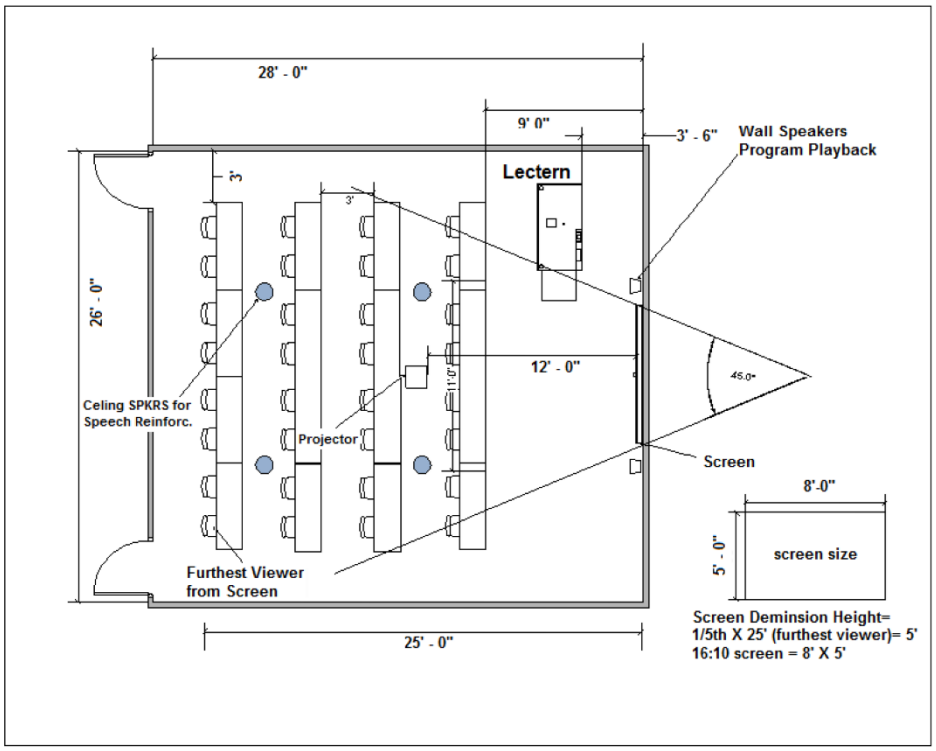
8.1.33 Lectern Rack Equipment Layout

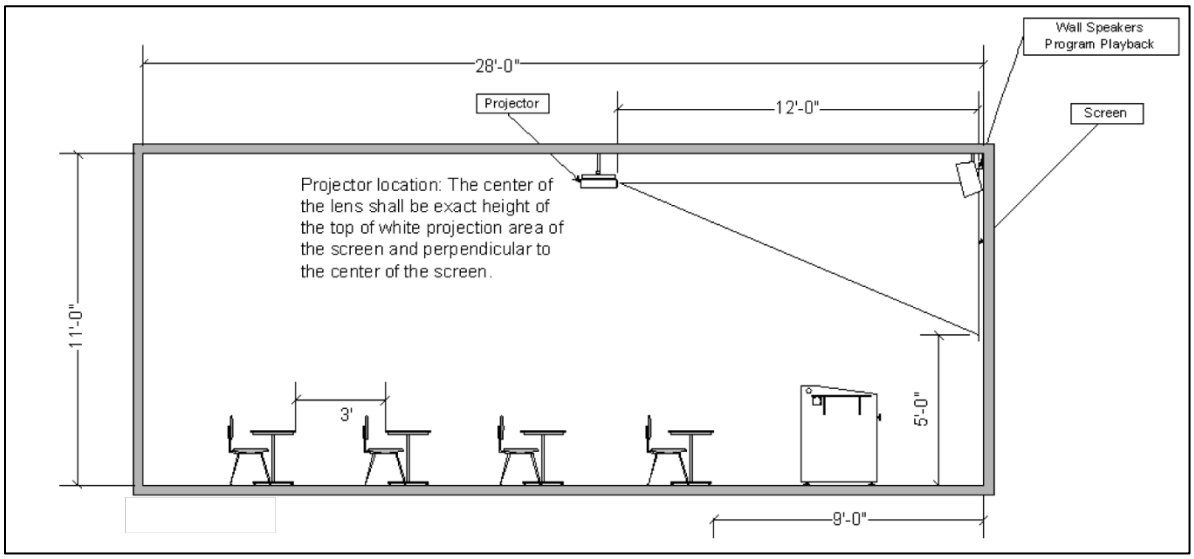


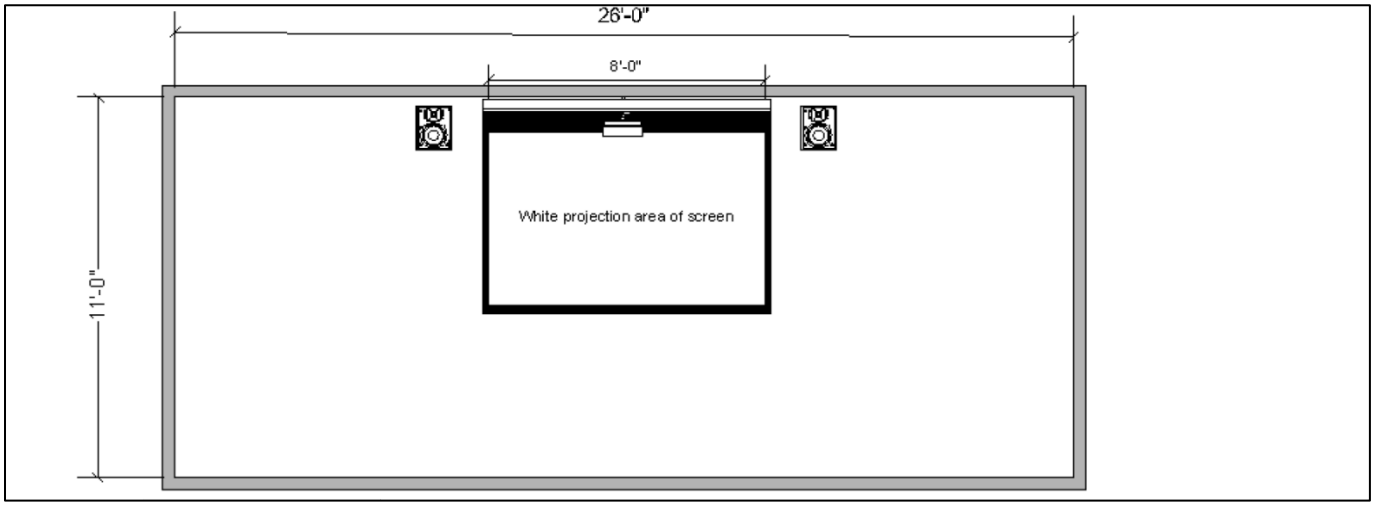
8.2 Generic Classroom Update



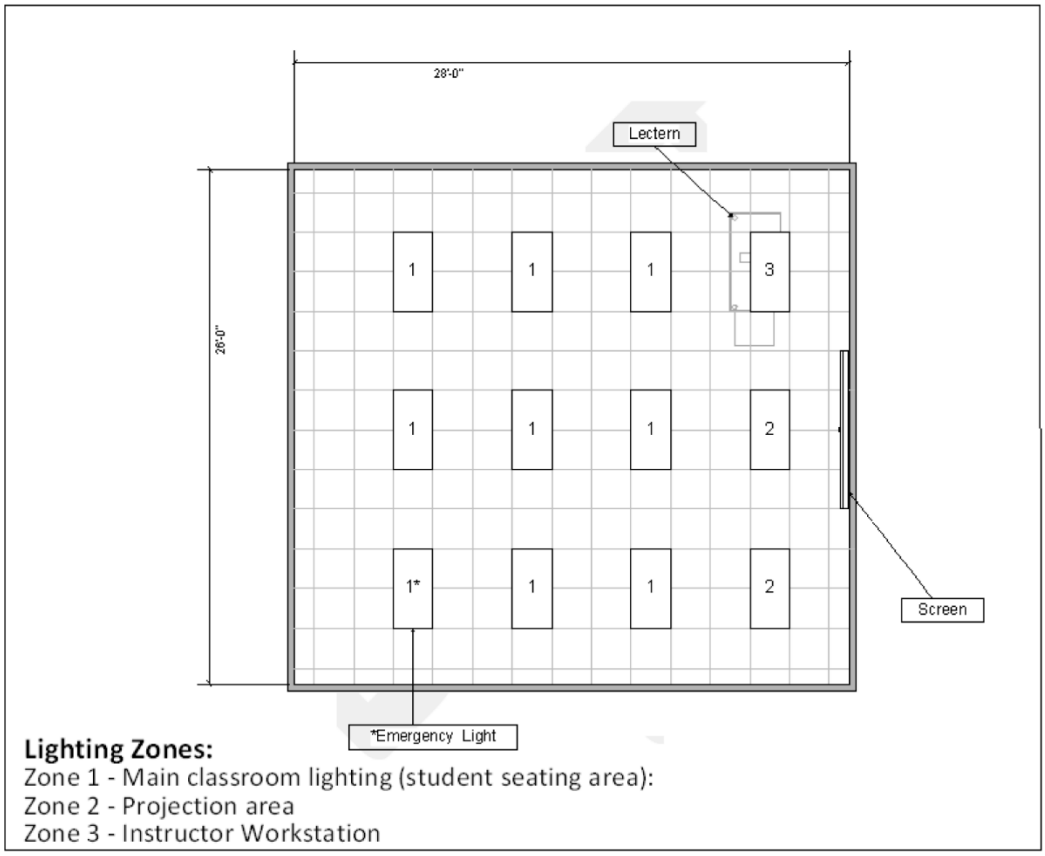
8.3 Typical Room Layout



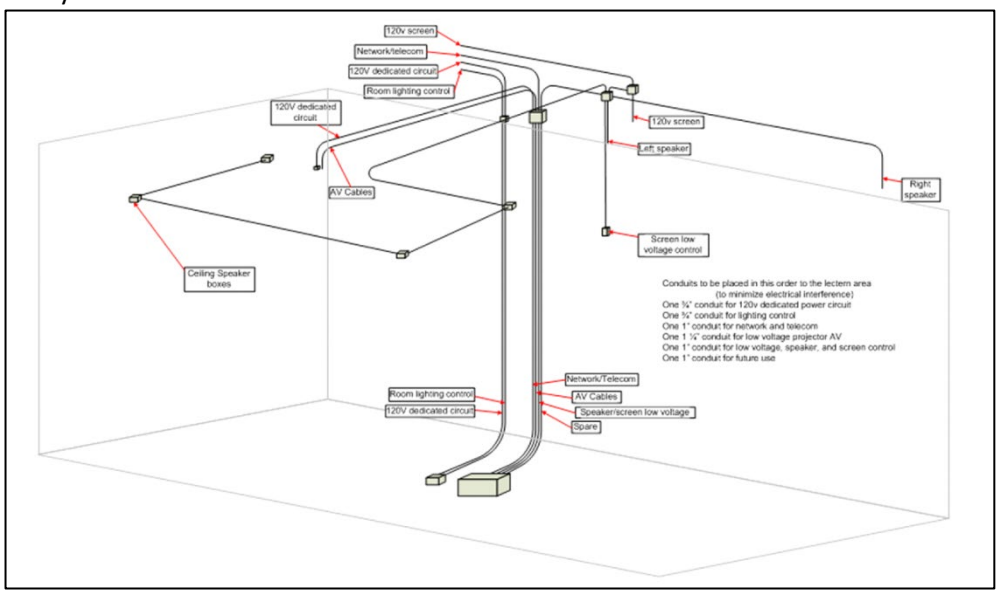




8.4 Lighting Zone Diagram



8.5 Conduit Layout



8.6 Current Equipment (as of 2023)

8.6.1 Crestron AMP-X300

8.6.2 Crestron SAROS ICT5T Ceiling Tile Speakers

8.6.3 Crestron SAROS SR8T-B-T Speakers

8.6.4 Crestron HD-PS402 switching

8.6.5 Crestron RMC4 processor

8.6.6 Crestron Air Media

8.6.7 Crestron TS-770-B-S touchscreen

8.6.8 QSC Core Nano DSP

8.6.9 Sennheiser Team Connect Ceiling 2

8.6.10 HuddleCam Simpletrack 2 Auto-Tracking Camera

8.6.11 Panasonic PT-VMZ61 Data Projector

8.6.12 Epson DC-21 Document Camera

8.6.13 Marshal Furniture Lecterns