

## DIVISION 27 COMMUNICATIONS

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**DIVISION 27 COMMUNICATIONS**

**SECTION 27 00 00 GENERAL COMMUNICATIONS REQUIREMENTS**

**PART 1 – GENERAL**

**PURPOSE**

The purpose of this document is to provide guidelines for designing the University’s telecommunications and computer networking support structure facilities for University buildings. Standardization shall assure proper space requirements and conduit for voice and data systems and shall facilitate future rearrangements or replacements. This document should be used as a guideline only, for specific design elements that may be applicable to a specific project, please contact the ECU Project Manager.

**1.1 GENERAL REQUIREMENTS**

- A. All electrical work done as part of the telecommunication systems shall adhere to requirements within Division 26 of the University’s Construction Standards and all applicable codes.
- B. The A/E is responsible for the verification of existing conditions to ensure that issues related to the support of cabling systems or penetrations through rated walls, floors are addressed in the scope of the project even if the project is not specifically changing those features and they were the result of another project. Additionally, cabling systems may not be abandoned in-place, they must be removed in their entirety.**
- C. All installations, new construction or renovations, shall comply with both the current State of North Carolina, Department of Administration, State Construction Office, Electrical Guidelines and the Telecommunication Wiring Guidelines. Renovations in existing buildings shall be expected to include in the scope of the project, addressing preexisting conditions such as but not limited to: penetrations through rated walls that are not properly sealed or cabling installations that are not in raceways or cable trays.
- D. Integral to the telecommunications infrastructure in buildings are the secure communications rooms, consisting of the Main Distribution Frame (MDF) and generally one or more Intermediate Distribution Frames (IDF). (Please refer to the MDF and IDF sections for location and sizing.) These rooms must be secure, environmentally conditioned and clean before Telecommunications can work in them, especially as fiber must be terminated in these rooms, which requires a very clean environment. Expensive and delicate networking devices that require environmental conditioning are also housed in these rooms. In this regard, the completion of the MDF and IDF shall be a project milestone which shall be completed, inspected, and accepted by the owner for occupancy in a time frame that shall be determined between the designer and ECU-ITCS during the review process. In particular, all penetrations shall be completed and sealed (e.g. capped) before Telecommunications work can proceed in these environments.
- E. In addition to telephone systems, there are numerous computer services and networks, which utilize the telecommunication support structures. They include: (a) The campus Internet service (b) The University local area network, which connects University buildings for video, voice and data services (c) public address systems (d) video distribution systems (e) energy management control systems (EMCS) and (f) emergency notification systems.

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- F. All these systems require intra-building cables and associated supporting structures such as conduits, wire-ways, communications rooms/closets, etc. As technology progresses, data and voice networks have become one and the same. It is wise to anticipate continued evolution by providing adequate conduit structures and floor space for housing equipment during the project programming and design phases.
- G. In all buildings at East Carolina University, the communications supporting structure is an absolute necessity for meeting and keeping pace with the occupants' communications needs. These systems are designated to support, route, and house the cables and wiring necessary to connect communications equipment to the control, cross-connecting/patch panels, and switching equipment located in MDF rooms and IDF rooms.
- H. The design and capacity of the communications support structure shall have built-in flexibility to anticipate growth needs; minimum 20% space usage changes and shall be planned for in the initial building programming and design phases.
- I. Some of the advantages of a properly designed and installed support system are as follows:
1. Concealment of wire and cable improves appearance and reduces the possibility of physical damage and/or disruption of service.
  2. Increased communications security lessens the possibility of service interruptions.
  3. Additions and rearrangements can be made to occupants' communications system with a minimum of inconvenience and expense.
  4. Safety to the building occupants is improved when hazards such as overflow moldings and extension cords are avoided.
- J. Information concerning minimum facility standards for voice and data systems follows. The items that shall be addressed and therefore planned in the initial programming and design of a new building or a major remodeled or renovated building are:
1. Document Submittals
  2. Optical Fiber Infrastructure Components
  3. Analog Copper Cabling Network Components
  4. Inter-Building Communication Infrastructure
  5. Service Entrance
  6. Main Distribution Frame (MDF) Room and Intermediate Distribution Frame (IDF) Room(s)
  7. Sheath Panel Grounding Room (if required)
  8. Vertical Riser System
  9. Conduit Systems
  10. Intra-Building Cabling Standards and Guidelines
  11. Emergency Communications
  12. Security Systems
  13. Special Areas
  14. Schedule of components
- K. Cabling and wiring installation vendor(s) will possess the following certifications, as appropriate for the work performed, and will maintain these certifications throughout the term of the contract. Failure to maintain these certifications will result in termination of the contract.
1. Siemon Certified Installer (CI) certification - <https://www.siemon.com/us/installation/>

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2. Corning LANscape® Network Preferred Installers (NPI) program -  
<https://www.corning.com/media/worldwide/coc/documents/NPI/EWP-236-EN.pdf>
  3. CommScope Uniprise PartnerPro certification. –  
<https://www.commscopetraining.com/courses/actnetconnect-uniprise/>
- L. Vendor must be willing and capable of additional certifications for other industry manufacturers to enable the extended system performance coverage of the 25-Year manufacturer’s warranty for moves, adds, and changes, in addition to providing services that do not jeopardize provisions of these same extended warranties. Cabling and wiring installation vendors shall ensure that at least 25% or a minimum of one (1) Vendor employee working on-site for ECU is trained and representing the Vendor in the following certification programs:
1. Siemon Certified Installer (CI) certification -  
<https://www.siemon.com/us/installation/>
  2. Corning LANscape® Network Preferred Installers (NPI) program -  
<https://www.corning.com/media/worldwide/coc/documents/NPI/EWP-236-EN.pdf>
  3. CommScope Uniprise PartnerPro certification. -  
<https://www.commscopetraining.com/courses/actnetconnect-uniprise/>
  4. Preferred: BICSI, Installer Level 1 or above is desirable, but not required  
<https://www.bicsi.org/programs.aspx?l=2586&r=2588&c=inST1>

## 1.2 SUBMITTALS

- A. Provide required submittals in accordance with submittal requirements outlined in Construction Standards Division 1 - General Requirements.
- B. Submit for approval a materials and equipment list identifying the make and model number of all products to be provided. Submit technical data sheets for all alternate products to be provided.
- C. Submit proposed Testing and Acceptance Plan for review and approval a minimum of 30 days prior to initiating testing and acceptance activities.
- D. Submit certificates of training or resumes that verify equivalent experience of personnel performing the fiber optic work in the section. Training shall include
  1. Fiber optic cable placement techniques
  2. Fiber optic cable handling procedures
  3. Fiber optic hardware types and applications
  4. Fiber optic splicing
  5. Installation of optical connectors
  6. Attenuation test procedures
- E. Submit manufacturer’s data or shop drawings of the following items giving full information as to the dimensions, weight, materials, operating instructions, spare parts list, and all other information pertinent to the adequacy of the items:
  1. Equipment
  2. Wiring specialties

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3. Devices
  4. Systems
  5. Control panels
  6. Cutover plan implementation
- F. All shop drawings, manufacturer's literature and samples shall be returned to the Project Manager Engineer at the completion of the work in accordance with Construction Standards Division 1 - General Requirements.
- G. Cable pulling methodology and electronic wiring scheme shall be reviewed at a pre-installation meeting in accordance with Construction Standards Division 1 - General Requirements.
- H. Wiring documentation shall include a spreadsheet (Microsoft Excel compatible format) submitted on electronic media and hard copy in the following format:

Building Name	Telecom Room Number	Rack #	Patch Panel	Port	Office Room #
Bate	1315	7	A	23	1201
Bate	1315	7	A	24	1201

As-built drawings in accordance with Construction Standards Division 1 - General Requirements shall include outlet ID numbers.

### 1.3 INSTALLATION

#### A. Installation Plan

1. There are several communication systems that must be integrated into the overall communication infrastructure. Accordingly, the designer shall coordinate and schedule a pre-installation meeting **prior** to any communication infrastructure installation to include all relevant parties.
2. The designer shall coordinate and schedule a communication infrastructure inspection prior to any cabling installation to include all relevant parties.
3. **There are several building systems that require data communications in order to be tested and certified. For this reason, it is **absolutely** necessary for the data network to be installed prior to any data communication needs.**
4. ECU shall take beneficial occupancy of the MDF/IDF's at a **minimum of two weeks** prior to any data communication needs.
5. The designer will ensure that the contractor will establish milestone dates for MDF/IDF room completion and owner equipment installation, which shall be 60 days prior to any data communication needs. These milestone dates shall be coordinated between contractor, project manager, and ECU-ITCS.
6. The designer shall coordinate and schedule a communication infrastructure

inspection post cabling installation.

7. The designer shall coordinate and schedule a pre-installation meeting for owner installed ECU-ITCS equipment to include all relevant parties.
8. Installation Phases:
  - a. Communication infrastructure pre-installation meeting
  - b. Prepare conduits, precast hand holes / man holes, MDF/IDF flooring, equipment racks and equipment rooms for fiber and copper cable pulls. Install inner duct liners, fiber optic and copper cable termination and racking hardware
  - c. Inspect communication infrastructure
  - d. Install and terminate fiber optic and copper cable in equipment rooms and racks. Test and accept in accordance with approved testing and acceptance plan
  - e. Inspect cabling installation
  - f. ECU-ITCS moves into MDF/IDF rooms after ECU acceptance
  - g. ECU-ITCS installs and tests owner equipment
  - h. Building system(s) testing may take place

#### B. Installation Requirements

1. A qualified and properly licensed Contractor shall perform installations.
2. The schedule and installation of all systems shall be provided in the project schedule.
3. Final equipment details and a complete list of termination identification shall be provided on shop drawings. After construction effort is complete, as-built drawings shall be provided.
4. Any panel and equipment rack wiring required, including temporary wiring, shall be the responsibility of the selected Contractor. All wiring shall be installed in accordance with NEC and NFPA regulations (as applicable) and local building codes and ordinances. Components mounted in equipment racks shall be arranged to provide a neat appearance and accessibility for servicing.
5. **All fiber optic and copper cable runs are to be installed continuous and un-spliced from device to equipment rack and from distribution point.**
6. All fiber optic and copper cable terminations are to be clearly labeled at both origination and destination as specified in the [Cable Pull Labeling Guidelines](#) section. Table designations shall be coordinated with the Project Manager during the pre-installation meeting. Refer to Construction Standards Division 1 - General Requirements for information on the pre-installation meeting.

#### C. Testing and Inspection

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1. Testing and inspection shall be performed, and all test equipment, tools, and personnel required to conduct system tests and inspections shall be provided.
2. All test procedures shall be prepared and submitted for review by ECU-ITCS and Project Manager. Test procedure approval shall be obtained at specified times prior to actual system tests.
3. The test procedure shall confirm that each standard statement has been met or exceeded. An actual demonstration of each system requirement shall be provided.
4. ECU-ITCS shall be present during overhead inspection(s), duct bank inspection(s), and the final closet inspection.

END OF SECTION 27 00 00

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**SECTION 27 05 26 GROUNDING AND BONDING FOR COMMUNICATIONS SYSTEMS**

**1.1 SHEATH GROUNDING / PANEL ROOM**

- A. If it is not practical to have the entrance conduit terminate in the MDF room within the first 50 feet on entering the building or because of other design difficulties, an enclosure, panel, or room shall be provided for the termination of the entrance conduit and housing telephone cables sheath bond to ground splice. A sheath bond to ground or grounding block shall be installed on all entrance cables equipped with metallic shields within the first 50 feet inside a building. Consult with ECU-ITCS via Project Manager before designing the building with this special room or enclosure.
  
- B. This grounding/bonding panel/room can be housed in an accessible location as follows:
  - 1. In a flush mounted panel with locking, hinged door with a minimum panel size of 48" wide by 72" high by 8" deep.
  - 2. In a walk-in room with a minimum size of 4' by 8'.
  
- C. The requirements for a room/ panel box location shall include the following:
  - 1. A clear work space sufficient for full door opening.
  - 2. A light intensity level of 50 foot-candles at 30" above floor level that would be provided indirectly from the hallway or room where the panel is to be located.
  - 3. A properly sized copper ground wire from the master ground bar in the MDF room to this panel.
  - 4. Entrance conduits that terminate in the room/panel and the same number of 4" metallic conduits connecting the panel to the MDF room. In addition to the 4" conduits, a minimum 1-inch metallic conduit shall be placed between the MDF room and the room/panel box for the grounding system wire.

END OF SECTION 27 05 26

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**SECTION 27 05 28 PATHWAYS FOR COMMUNICATION SYSTEMS**

**1.1 INTER-BUILDING COMMUNICATIONS INFRASTRUCTURE**

- A. This purpose of this section is to specify the performance requirements for providing and installing the inter-building cabling infrastructure that shall be distributed throughout the ECU campus. This inter-building cabling infrastructure shall provide for an integrated telecommunications network that is flexible, expandable and protect against failures and network outages.
- B. Spread of Fire or Products of Combustion
  - 1. **The Designer shall ensure that fire stops are provided in openings around conduit or cabling, or cabling penetrations through fire rated partitions, floors, and ceilings.**

**1.2 VERTICAL RISER SYSTEM**

- A. The vertical riser system capacity shall be determined by the design of the communication infrastructure design. This shall include the main communications infrastructure and any additional communications systems (i.e. one card, cameras, HVAC, Smart Classrooms, etc.).
- B. The vertical riser system shall be designed to accommodate all communication wiring systems and an additional 25% growth.
- C. The following requirements are the **minimum** for the vertical risersystem.
  - 1. In multi-level structures, the MDF room and the IDF room shall be designed in a stacked configuration, i.e., one room above the other.
  - 2. A minimum of four 4" inch sleeved holes shall be provided between the rooms. If the MDF room shall be offset from the IDF stack due to building design limitations, a minimum of four 4" conduits shall be provided for the riser system. Designer shall consult with project manager and ECU-ITCS concerning additional vertical riser capacity requirements for additional communication infrastructure systems (i.e. one card, cameras, HVAC, Smart Classrooms, etc.)
  - 3. A minimum of one 1" metallic sleeve shall be provided for the vertical riser ground system. If the MDF room shall be offset from the IDF stack due to building design limitations, a minimum of one 1" conduit shall be provided for the vertical riser ground system.
    - a. A continuous length of properly sized insulated copper ground wire shall run through all IDF rooms on each floor starting from the master ground bar in the MDF room. The properly sized vertical ground wire shall be terminated on a ground bus bar in each IDF room. If there are multiple IDF rooms on a floor, a properly sized copper ground wire shall be run from the ground bus bar to a ground bus bar located in each IDF room. A minimum of one separate 1" metallic conduit shall be provided for pulling the ground wire to each closet.
    - b. All conduits provided for the ground wire system shall be metallic.
  - 4. Conduits in the room shall extend below the ceiling and above the floor 6" with a 2"

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clearance from the finished wall.

5. Fire stop material shall be installed in all sleeves.
  6. The Designer shall use approved fire stopping methods and materials to maintain the existing fire resistance rating, per UL standards.
- D. Special or proprietary networks for the exclusive use of one University department shall not be permitted to occupy the University underground conduit system. If there is a strong reason to make an exception to this rule, it shall be brought to the attention of ECU-ITCS via the Project Manager.
- E. The inter-building cabling infrastructure includes a fiber optic network that may consist of single mode fiber, or 62.5 multi-mode fiber, as well as multi-pair copper telephone cable where applicable. Network hubs and fiber optic distribution points shall be provided and strategically located in MDF rooms. Fiber optic cables shall be installed between hubs and fiber distribution points to create a physical ring and star combination topology.
- F. Hubs and fiber optic distribution points shall have pass through, patch and cross connect capability to support all logical and physical data network topologies. This flexible optical configuration shall support hubs with automatic service protection switching such as self-healing rings, primary and secondary path switching, etc. Additionally, the network shall permit network maintenance personnel to manually reconfigure the network to bypass cable cuts or prolonged outages as well as accommodate new construction and building renovations without interrupting service.

G. Duct Bank

For general requirements refer to ECU Electrical Standard Division 26.

H. Conduit

1. A minimum of two 4-inch schedule 40 PVC conduits with four inner duct liners per 4-inch conduit shall be provided to each building.
2. A minimum of four 4-inch conduits (2 with inner duct liners) shall be provided between adjoining hand holes / man holes at road crossings.
3. Conduit shall be installed such that the top side of the highest conduit is a minimum of 33 inches below finished grade.
4. Conduit shall be provided and installed from building penetration to MDF room.

I. Inner Duct

1. Inner duct liners shall be ribbed or corrugated high density polyethylene have a poly pull rope installed in each liner and shall be orange in color.
2. Inner duct liners shall be installed in all new and existing conduits between facilities and between floors inside buildings to provide a safe path for pulling fiber optic cables. Inner duct shall also be used to subdivide conduits to make space available for additional cables.
3. Four 1-inch diameter inner ducts shall be installed in each 4-inch conduit, unless noted otherwise.

J. Outside Plant Fiber Cabling

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1. In addition to the standards in the [Optical Fiber Infrastructure Components](#) section. The following standards apply to inter-building fiber cabling.
  - a. The fiber count shall be determined by the size of the building. ECU-ITCS **must** be consulted to determine the exact fiber count requirements.
  - b. The core of the fibers used in the outside cable plant shall contain a filling compound to prevent the ingress of water.
    - 1) The filling compound shall be neutral in color, nontoxic, dermatologically safe, and contain an antioxidant.
  - c. Tensile Strength: These cables shall have a minimum tensile load rating of 600 pounds.
    - 1) The sheath strength elements shall be non-metallic glass filaments
  - d. The cable jacket material shall be high density black polyethylene. Outer jacket shall be continuous, free from holes, splits, and inclusions.
  - e. The fibers shall be color-coded so that each fiber can be individually identified. The colors shall be blue, orange, green, slate, white, red, black, yellow, and violet. Dashed versions of these same colors shall be used for cables with higher fiber counts.

K. Outside Plant Analog Copper Cabling

1. In addition to the standards in the [Analog Copper Cabling Network Components](#) section. The following standards apply to inter-building analog copper cabling.
  - a. Feeder cable sizing. All feeder cables shall be 50 pair UTP voice grade cables as specified in the [Schedule of Components](#) section.
  - b. Feeder cable shall originate from the nearest copper node as determined by ECU-ITCS.
  - c. Feeder cable shall be terminated in the MDF room or the Sheath Panel / Grounding room on a Krone punch down block w/ lightning protection attached to the plywood backboard.

L. Handholes / Manholes

1. Handholes / Manholes shall be provided at building entrances, both sides of road or parking lot crossings, at tie-ins to existing conduits, and where multiple cable runs intersect.
  - a. Handholes
    - 1) Shall be utilized for outside cable installation where applicable (low traffic areas). Locations must be approved by ECU.
    - 2) Shall not be utilized in roadways.
    - 3) Precast hand hole covers shall be heavy duty traffic rated
    - 4) Standard handholes shall be 24"x36"x36" with mouse holes and heavy-duty cover labeled "Fiber Optics".
    - 5) If a depth of more than 36" is required a larger size shall be utilized.
    - 6) Hand holes shall be pre-cast polymer concrete type by Quazite or

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equal.

- 7) If during a redesign a hand hole ends up in a roadway it must be upgraded to a manhole.

b. Manholes

- 1) Shall be utilized for outside cable installation where applicable (high traffic areas, roadways, etc.). Locations must be approved by ECU.
  - 2) Manhole covers shall be heavy duty traffic rated
  - 3) Manhole size shall be determined by the design.
2. The Designer shall provide hand holes / man holes of additional depths as required ensuring minimum conduit depth is maintained throughout.
  3. Precast hand holes / man holes shall be installed with a maximum of 500' spacing to maintain proper cable pulling tension.

M. Road, Sidewalk, and Parking Lot Crossings

1. Outside cable runs requiring crossing of roadways, sidewalks and parking lots shall be installed in 4-inch galvanized rigid steel conduit.
2. Boring/drilling or cut patch may be required. Exact method shall be approved by ECU-ITCS and Project Manager.

END OF SECTION 27 05 28

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**SECTION 27 05 33 CONDUITS AND BACKBOXES FOR COMMUNICATIONS**

**1.1 CONDUIT SYSTEMS**

- A. The conduit system capacity shall be determined by the design of the communication infrastructure design. This shall include the main communications infrastructure and any additional communications systems (i.e. one card, cameras, HVAC, Smart Classrooms, etc.). The designer shall consult with the project manager and ECU-ITCS concerning these systems.
- B. The conduit systems shall be designed to accommodate all communication wiring systems and an additional 25% growth.
- C. The following requirements are the **minimum** for the conduitsystems.
- D. The University recognizes two types of conduit systems. One type is called the Zoned Home Run System. The other is the Wire way or Cable Rack System. The Zoned Home Run System consists of a system of IDF rooms located to serve a floor area where the maximum allowable cable length is 90 meters (295 feet). All data conduit is "home-run" to the appropriate IDF room. Depending on the size of the building and floorgeography, the Zoned Home Run System shall generally require more IDF rooms than the Wire way System.

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**SECTION 27 05 36 CABLE TRAYS FOR COMMUNICATIONS SYSTEMS**

**1.1 GENERAL**

A. The Wire way System uses cable racks or enclosed wire way in conjunction with conduit. The wire way or cable rack shall be installed in the ceiling space above the major hallways in a configuration that provides the occupants with the most efficient and productive use of communications services. The wire way or cable- rack supports all communications cabling, whether data, voice, or video. Radiating conduits are provided from the wire way or cable rack to station/terminals. The wire way or cable is installed to the MDF room and/or IDF room. As with the Zoned Home Run System, the total measured linear feet of cable shall be limited to 90 meters (295 feet).

1. The wire way shall be industry standard, heavy wall steel with a hinged cover. Wire ways are generally provided in 6", 8", and 10" square sizes. The following table gives dimensions of wire way by amount of floor space to be served. Open wire ways or cable racks can also be specified and can be 12 to 24 inches wide of aluminum or steel construction with 3" to 9" rung spacing.

Amount of floor space to be serviced in square feet	Wire way dimension	Cable tray dimension
up to 5,000	6" x 6"	12"
5,001 to 20,000	8" x 8"	18"
20,001 to 35,000 *	10" x 10"	18"
* Maximum allowable space to be serviced by one IDF room using the wire way or cable rack system.		

- a. The wire way shall be mounted above the main corridor in the ceiling.
- b. It is **imperative** that the wire way be installed within 4 to 8 inches above the ceiling tile, have no less than a 24" horizontal clearance along one side and 6" above the tray. This ensures that the wire way is accessible for cable installation.
- c. No foreign conduit, pipes, or HVAC duct shall rest on or extend through the wire way.
- d. Supporting hangers shall be attached along the wire ways sides and not within the wire way bed.
- e. The wire way shall "tee off" if required and be run into the MDF room or an IDF room.
- f. If the MDF or IDF wall is a firewall, the wire way or cable rack shall be terminated at the wall and 4" conduits provided into the room. Under no circumstances shall the number of 4" conduits penetrating the fire wall be less than two for the 6" x 6" wire way and 12" cable rack and three for the larger wire ways and cable racks.
- g. Rooms directly adjacent to the IDF or MDF room can be directly served by conduit, bypassing the wire way.

- h. Conduit shall be provided as a continuous run perpendicular from wire way to station outlet. All cable shall be enclosed in conduit, raceway, or wire way for protection.
  - i. Because the wire way requires ceiling spaces that are accessible, wire ways shall not be placed above permanent type ceilings or above offices.
- B. The conduit may consist of two (2) types: rigid metallic and electrical metallic tubing. PVC is allowed only in wet and/or corrosive environments.
1. Rigid Metallic Conduit
    - a. It shall be industry standard, heavy wall steel conduit and shall have galvanized finish throughout.
    - b. It shall not be less than 1" tradesize.
    - c. Rigid metallic conduit installation shall be made in accordance with industry standards for installation.
      - 1) Running threads, split couplings and thread-less couplings shall not be accepted.
      - 2) Metallic bushings shall be installed at all terminations in wire way, freestanding conduits, and within boxes, enclosures and cabinets.
      - 3) During installation, cap all runs left unfinished or unattended overnight. Cap all terminations of finished runs with manufactured fittings until wire and cable are pulled in.
      - 4) No more than two 90 degree sweep bends or the equivalent shall be permitted between junction boxes, pull boxes, cabinets, or cable access points. The sweep bend radius shall not be less than 12".
  2. Electrical Metallic Tubing (EMT)
    - a. All EMT conduits shall be cold rolled steel tubing with a zinc coating on the outside and protected on the inside with a zinc enamel or equivalent corrosion-resistant coating.
    - b. EMT may be installed in dry construction in sheltered spaces, in partitions other than concrete, and in solid plaster work. EMT shall not be installed where:
      - 1) it will be exposed to view below 8' above finished floor
      - 2) it may be subject to severe physical damage,
      - 3) it may be subject to severe corrosive influence,
      - 4) trade size is larger than 2", or
      - 5) tubing, elbows, couplings, and fittings shall be in concrete or in direct contact with the earth.
    - c. EMT couplings shall be all steel, hexagonal, compression type with all joints made tight.
    - d. Follow installation practices as specified for rigid conduit.
  3. All empty conduit runs shall have a nylon type pulling tape, string, or wire installed from outlet to apparatus closets. This tape shall be continuous through all junction boxes. The pulling strength shall not be less than 200 pounds on either type of pulling facilities provided.
  4. The following table gives the nominal conduit dimensions and the maximum number of cables that may be placed in them. A pull box or one trade size larger conduit shall be specified if (a) the length is over 200 feet, (b) there are more than two 90-degree bends, or (c) there is a reverse bend in the run. If the type of communication or data system is unknown, the conduit size to be specified shall be 1".

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<b>Sizes and Capacities of Conduits</b>						
<b>Conduit size in inches</b>	<b>4 Pair</b>	<b>6 Pair</b>	<b>25 Pair</b>	<b>50 Pair</b>	<b>75 Pair</b>	<b>100 Pair</b>
1"	4	3	2	1	0	0
1 ¼"	6	5	2	1	1	1
1 ½"	6	5	3	2	1	1
2"	20	10	5	4	3	2
2 ½"	30	20	8	6	3	3
3"	40	30	10	7	6	4

**Outside diameter equivalences:**

6 pr. ca. = 1 coax RG 58, 59, or 6 fiber optical cable

25 pr. ca. = 1 IBM Type 1 cable

50 pr. ca. = 1 Thick wire Backbone or .500 coax cable

100 pr. ca. = 1.750 broadband cable

**C. Outlet Boxes, Junction Boxes, and Pull Boxes**

1. Except as noted, all boxes shall be manufactured from galvanized industry standard gauge sheet steel.
2. Flush mount outlet boxes shall have a minimum size of 4-11/16" square with a minimum depth of 2-1/8", with vertical mounted single gang plaster rings, and standard mounting height shall be 18" centered above the finished floor or 6" centered above a backsplash in a countertop area.
3. For classrooms, lecture halls, auditoriums, or designated multi-media rooms, the double gang electrical box shall be equipped with a double gang plaster ring with 1" radial conduit.
4. Each outlet box shall have a conduit and each conduit shall have no more than two 90-degree bends between the outlet and the designated communications room or cable tray. If more than two 90-degree bends are required, a pull box shall be installed and the locations of pull boxes shall be shown on the drawings.
5. The use of LB, LL, and LR fittings shall not be used without approval by ECU- ITCS via Project Manager.
6. Outlets shall not be looped in the same run of conduit.
7. Flush wall mount telephone outlets shall be 4-11/16" square with a minimum depth of 2-1/8", a mounting height of 48" to the center above the finished floor, and conduit entry from the



top.

8. Interior surface mounted devices and raceways (exposed to view) to be metal “wire mold” type and shall be painted to match wall surface.
  9. Pull boxes shall be located in lieu of a bend. ECU-ITCS shall be contacted where it is necessary to do so. Pull boxes shall be placed in a readily accessible location. A minimum of two outlets shall be provided on opposite walls for each office of less than 175 gross square feet. For every 100 gross square feet over 175 gross square feet, an additional pair of outlets shall be provided. This is considered the minimum standard.
  10. Special rooms or research laboratories may require more outlets or a special wire way to house data/voice cables within the room. Assigned occupants of the special rooms or laboratories shall be consulted in this situation.
  11. Additional outlets shall be provided at 50’ intervals along corridor walls above the lay in ceiling for wireless access points. They can also be attached to the cable tray when necessary. The designer should consult with ECU-ITCS via the Project Manager for a determination of the number and most suitable locations. See the [Special Areas](#) section for further details.
- D. A drawing of all communications conduit, raceways, and outlets shall be a part of the contract drawings and updated to as-built conditions.

## 1.2 SPECIAL AREAS

Special function rooms shall require additional attention to conduit needs. Classrooms, lecture halls, and auditoriums require additional outlets due to other requirements. Laboratories, computer rooms, and computer classrooms/laboratories need flexible communications support structures.

### A. Laboratories and Computer Classrooms/Laboratories

1. The designers shall consult the building occupants via the Project Manager during programming for special communications support requirements for laboratories. Typically, building users would desire communications conduit systems mounted at working height encompassing the laboratory with removable panels for easy cable rearrangements and additions.

### B. Security Systems

1. The designer shall contact the Project Manager regarding current University policy for Security Systems.
2. Two CAT 6 cables in a 1” conduit shall be provided to each camera location.

### C. Classrooms, Lecture Halls, and Auditoriums

1. The designer shall address potential for lectern locations, media equipment, etc. with the Project Manager.

### D. Residence Halls

1. Entrance Phone: One telephone cable in conduit shall be run from the nearest available MDF or IDF room to the primary entrance(s) for entrance phone. This conduit shall be a minimum 1”. Designer shall consult with ITCS via Project Manager to determine the specific mounting location and rough-in requirements.

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2. Each bedroom shall be wired for 3 data drops and 1 RG6 in a single gang box.

3. ECU-ITCS must be consulted for wireless network design.

E. Exam Rooms

1. Each exam room shall be wired for 2 datadrops.

F. Devices that require network connectivity

1. Two CAT 6 cables in a 1" conduit shall be provided for any device that requires network connectivity such as HVAC, generators, fire alarms, burglar alarms, one card, electrical monitoring devices, and etc.

G. Wireless drops

1. These are the **minimum** requirements for the wireless network. The Designer must consult with ECU-ITCS via Project Manager to determine additional locations that require cable drops to support wireless infrastructure.

2. At a minimum one outlet with two CAT 6 cables shall be provided and terminated in a one gang box every 50' down cable tray corridor in or above the ceiling.

3. In classrooms/auditorium style rooms a minimum of two outlets with two CAT 6 cables each shall be provided in or above the ceiling.

4. In the case of a drop ceiling outlets shall either be mounted to the cable tray or 6" above the drop ceiling. These locations shall be **marked** with a label on the ceiling grid.

5. In the case of a hard ceiling a recessed/flush mount wireless enclosure shall be used. Outlet/cable shall be terminated inside the enclosure. Wireless enclosure/model shall be determined by the type of wireless unit that is used. Designer shall consult ECU-ITCS via the project manager to determine the correct enclosure to use.

6. In the case of outdoor locations, a weatherproof NEMA enclosure shall be used. Outlet/cable shall be terminated inside the enclosure. Wireless enclosure/model shall be determined by the type of wireless unit that is used. Designer shall consult ECU-ITCS via the project manager to determine the correct enclosure to use.

END OF SECTION 27 05 36

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**DIVISION 27 COMMUNICATIONS**

**SECTION 27 05 53 IDENTIFICATION FOR COMMUNICATIONS SYSTEMS**

**1.1 Cable Pull Labeling Guidelines**

- A. Cable Identification: All cable shall be labeled on both ends with an alpha/numeric identification code using the following format: (Rm# 1-A) indicates data one (Rm#1-B) indicates data two, (Rm# 1-C) indicates data three (Rm#1-D) indicates data four, (RM#-V-1) indicates video one, (RM#-F- 1) indicates fiber one, etc. If more than one Outlet is used in the same room, for example (RM# -2-A), then this will be indicated by a permanent label on the communications outlet. All above ceiling outlets should be identified by a label on the ceiling grid.
- B. Any exceptions to this labeling scheme, for example unique media types, shall be coordinated with ECU-ITCS via Project Manager.
- C. All outlet labeling shall be permanent, non-erasable, stick-on, labeling using a professional labeling machine.
- D. The voice and data drawing, as built, should include cable tray routes and the CAT 6 cable labeling to be mounted in each associated comm. Room.
- E. Cables shall be labeled and terminated in consecutive numerical room number order from low to high on the patch panel.
- F. Cable shall be labeled from left to right as you enter the room from the main corridor.
- G. All of the fire alarms, single phone lines, emergency phones, cameras, elevator phones and wireless outlets shall be terminated on the last patch panel.
- H. All of the wireless outlets should be labeled on the jack above the ceiling and on the ceiling grid. An orange color indicator shall be placed on the ceiling grid to help locate the wireless unit and label.
- I. All patch panels and corresponding jacks shall be labeled with the room number from low to high. Multiple jacks within same room labeled left to right  
  
Example: room 101 PP- 101-1A/B
- J. If there is more than one jack in the room  
  
Example:: room 101 PP- 101-1A/B, #2 101-2A/B, #3 101-3A/B
- K. All the outside fiber and copper plant shall be labeled to and from each building on the terminated end of the cable.
- L. The riser fiber shall be labeled from the IDF to the MDF
- M. Each riser fiber shall terminate in the MDF from the IDF.
- N. The following is an example of a quad wall plate with two labels and corresponding patch panel.

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- O. In the following example the office room number is 2S78, the telecom closet room number is 1315, and the cables are punched down in Rack 7 on patch panel A.
- P. Figure 1 is an example of a quad wall plate. Notice the labeling “1315-R7-A-23,24 and 1315-R7-A-25,26” in figure 1 is typed, leaving the label clear and easy to read. In this example, 1315-R7-A-23 corresponds with port A on the wall plate, 1315-R7-A-24 corresponds with port B, 1315-R7-A-25 corresponds with port C, and 1315-R7-A-26 corresponds with port D.
- Q. Figure 2 is an example of the corresponding patch panel. The patch panel labeling is also typed and corresponds to the room number clearly.

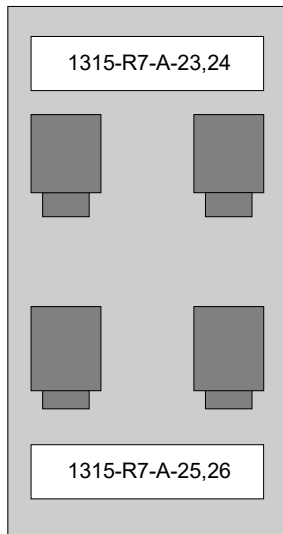


Fig. 1

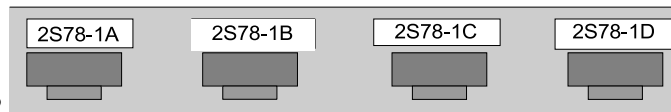


Fig. 2

- R. The following is an example of a dual wall plate with two labels and the corresponding patch panel.
- S. In the following example the office room number is 2S78, the telecom closet room number is 1315, and the cables are punched down in Rack 7 on patch panel A.
- T. Figure 3 is an example of a dual wall plate with two labels. Each label is used to identify each port.

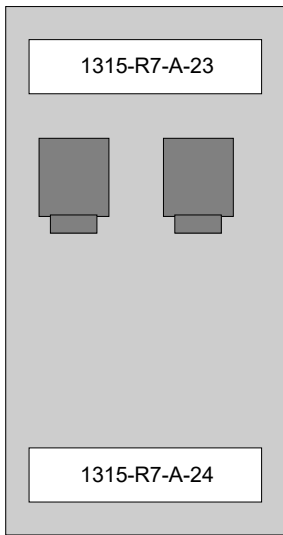


Fig. 3

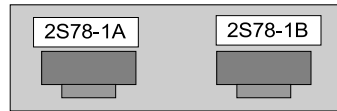


Fig. 4

- U. The following is an example of a dual wall plate with a single label and the corresponding patch panel.
- V. In the following example the office room number is 2S78, the telecom closet room number is 1315, and the cables are punched down in Rack 7 on patch panel A.
- W. Figure 5 is an example of a dual plate with one label. Each port must be labeled individually, 1315-R7-A-23 being the top port and 1315-R7-A-24 the bottom port.

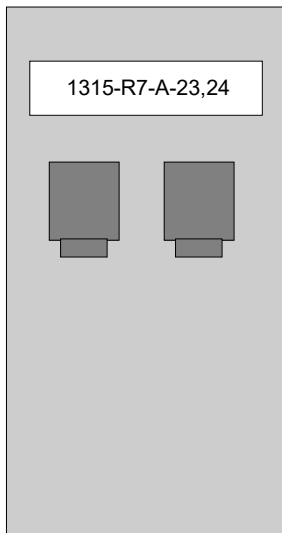


Fig. 5

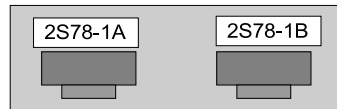


Fig. 6

- X. **Note: If a situation where a clear and simple labeling scheme is not possible ECU-ITCS must be contacted via the Project Manager.**

END OF SECTION 27 05 53

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**DIVISION 27 COMMUNICATIONS**

**SECTION 27 06 10 SCHEDULES FOR STRUCTURED CABLING AND ENCLOSURES**

**1.1 SCHEDULE OF COMPONENTS**

A. In order to provide consistent support to ECU’s communications infrastructure it is necessary that some components be manufacturer and part number specific. These components are specified to maintain compatibility with existing installed systems and components. Substitutions will only be accepted with prior approval from ECU- ITCS.

<b>General Infrastructure Components</b>				
<b>Item</b>	<b>Description</b>	<b>Manufacturer</b>	<b>Part Number</b>	<b>Equals Accepted</b>
CAT 6 Cable	PVC cable	Commscope	75N4 Yellow	Belden or Bertek
CAT 6 Cable	Plenum cable	Commscope	7504 Yellow	Belden or Bertek
CAT 6 Outlet	Duplex Modules	Siemon	CT-C6-C6-02	No
CAT 6 Outlet	Single Gang Faceplates	Siemon	CT4- FP- 02	No
CAT 6 Outlet	Quad Gang	Siemon	CT8- FP- 02	No
CAT 6 Patch Panel	24 Port Patch Panel	Siemon	HD6-24 568A Wiring	No
CAT 6 Patch Panel	48 Port Patch Panel	Siemon	HD6-48 568A Wiring	No
CAT 6A Cable (SD)	PVC, Small Diameter, Yellow jacket, 1000 ft	CommScope	760240218	No
CAT 6A Cable (SD)	Plenum, Small Diameter, Yellow jacket, 1000 ft	CommScope	760238632	No
CAT 6A UTP Outlet	CAT 6A, RJ45, White, Tool-Less, T568A/B	ZMAX	Z6A-02	No
CAT 6A Jack Adapter	Dual Bezel for CAT6A UTP jacks	ZMAX	CTE-MXA-02-02	No
CAT 6A Patch Panel	48 port, 1U, Black, Flat	ZMAX	Z6-PNL-U48K	No
Wire Management	Horizontal Wire Management	Panduit	WMP1E	No
Wire Management	10in Vertical Wire Management	Panduit	PR2VD10	No
Wire Management	6in Vertical Wire Management	Panduit	PR2VD6	No

General Infrastructure Components				
Item	Description	Manufacturer	Part Number	Equals Accepted
CAT 6 Cable	PVC cable	Commscope	75N4 Yellow	Belden or Bertek
CAT 6 Cable	Plenum cable	Commscope	7504 Yellow	Belden or Bertek
CAT 6 Outlet	Duplex Modules	Siemon	CT-C6-C6-02	No
CAT 6 Outlet	Single Gang Faceplates	Siemon	CT4- FP- 02	No
CAT 6 Outlet	Quad Gang	Siemon	CT8- FP- 02	No
CAT 6 Patch Panel	24 Port Patch Panel	Siemon	HD6-24 568A Wiring	No
CAT 6 Patch Panel	48 Port Patch Panel	Siemon	HD6-48 568A Wiring	No
CAT 6A Cable (SD)	PVC, Small Diameter, Yellow jacket, 1000 ft	CommScope	760240218	No
CAT 6A Cable (SD)	Plenum, Small Diameter, Yellow jacket, 1000 ft	CommScope	760238632	No
CAT 6A UTP Outlet	CAT 6A, RJ45, White, Tool-Less, T568A/B	ZMAX	Z6A-02	No
CAT 6A Jack Adapter	Dual Bezel for CAT6A UTP jacks	ZMAX	CTE-MXA-02-02	No
CAT 6A Patch Panel	48 port, 1U, Black, Flat	ZMAX	Z6-PNL-U48K	No
Wire Management	Horizontal Wire Management	Panduit	WMP1E	No
Wire Management	10in Vertical Wire Management	Panduit	PR2VD10	No
Wire Management	6in Vertical Wire Management	Panduit	PR2VD6	No

General Infrastructure Components				
Item	Description	Manufacturer	Part Number	Equals Accepted
Relay Rack	CPI Vertical Relay Racks	CPI	55053-503	No
Building entrance terminal	25 Pair 10 Pair Protection Magazine	ADC	6659-1-025-32/25	No
Building entrance terminal	50 Pair 10 Pair Protection Magazine	ADC	6637-1-320-18/25	No
Copper OSP Feeder Cable	50 Pair	General	PE-89	Superior, Essex, or AT&T
Copper Riser Cable	25 Pair	General	CAT 3 PVC Inside 25/24 LV3 non-plenum	Superior, Essex, or AT&T
Corning Fiber/Glass	Corning Fiber/Glass	Corning	n/a	No
Fiber housing	12 Port Housing	Corning	CCH-01U	No
Fiber housing	24 Port Housing	Corning	CCH-02U	No
Fiber housing	72 Port Housing	Corning	CCH-03U	No
Fiber housing	144 Port Housing	Corning	CCH-04U	No
Fiber splice housing	Splice Housing	Corning	CSH-03U	No
Fiber splice housing	Splice	Corning	CSH-04U	No
Fiber splice tray	Splice Tray	Corning	M67-078	No
Fiber Heat Shrink	Heat Shrink Protectors	Corning	P322467 Qty50	No
Fiber Module	Duplex SC SM Cassette	Corning	CCH-CS12-59-P00RE	No
Fiber Module	Duplex SC MM Module w/Pigtails	Corning	CCH-CS12-91-P00KE	No
Emergency Phone (Analog)	Phone	Talk-A-Phone	ETP-500E	No
Emergency Phone (VoIP)	Phone	Talk-A-Phone	VOIP-600	No
Emergency Phone	Strobe Unit (120v)	Talk-A-Phone	ETP-EL	No
Emergency Phone	J-Bolts	Talk-A-Phone	MT Bolt Kit	No
Emergency Phone	Tower	Talk-A-Phone	ETP-MT OP4	No
Emergency Phone	Camera Arm/Plate	Talk-A-Phone	ETP-MT-OP-NA Arm kit / ECU	No



General Infrastructure Components				
Item	Description	Manufacturer	Part Number	Equals Accepted
Emergency Phone	Camera Arm Dual	Talk-A-Phone	OP-4D-EXT	No
Emergency Phone	Lightening ground protection device			Yes
Pull Tape	Pull tape	NEPTO	WL1250	Yes

END OF SECTION 27 06 10

**DIVISION 27 COMMUNICATIONS**

**SECTION 27 11 13 COMMUNICATIONS ENTRANCE PROTECTION**

**1.1 SERVICE ENTRANCE**

- A. The master plan developed to provide long-range guidance for the University specifies that all entrance cable serving a building shall be installed in conduit. During the initial process of design and development, the Designer shall contact ECU-ITCS via the Project Manager to define the route and suitability of the building entrance location. At that time, the proper hand hole or manhole to route the building entrance conduit for termination shall be identified as well as a redundant path at the building level.
- B. A minimum of two 4-inch schedule 40 PVC conduits with four 1" inner duct liners per conduit shall be installed to each building.
- C. These conduits shall terminate in the Main Distribution Frame (MDF) room to be specified later in this document.
- D. Where the entrance conduits penetrate the foundations, footings or outside walls, rigid conduit shall be used. Where conduit is exposed rigid steel or aluminum shall be used. For concealed locations PVC may also be used. Fiber ducts shall not be accepted.
  - 1. At the point of entrance and to the specified hand hole or manhole serving the building, a minimum of 30" ground cover shall be maintained and the pipe **sloped away** from the building.
    - a. Ground cover is defined as the measurement from the top of the topmost conduit to the final ground grade.
    - b. If it is impossible to maintain a slope on the entrance conduit away from the building, it is suggested that an additional hand hole or manhole be placed just outside the building in which the building's entrance duct bank is terminated before it continues to the building's MDF room.
    - c. All conduits terminated in this hand hole or manhole shall be plugged to prevent water from entering the conduits heading to the building.
  - 2. The conduit entrance shall not contain more than two 90-degree bends from the MDF room to the hand hole/manhole.
  - 3. The minimum bend radius allowed in any conduit shall be 6 feet.
  - 4. Entrance conduits shall be separated from power conduits housing a maximum voltage of 12.5KV by 3".
  - 5. All service entrance conduits shall be concrete encased up to building entry point.
  - 6. It is necessary that the entrance conduit be terminated in the "end wall" of the hand hole or manhole and not the longer "sidewall."
  - 7. Where concrete encasement is not feasible, the rigid galvanized steel conduit shall have two (2) coats of bit mastic applied to the full length when exposed to the ground.
  - 8. The entrance conduit shall be plugged in the MDF room to prevent water and gas from entering the building.
- E. Where inner duct is not provided, provide sequentially marked (English or metric) pull tape in the entrance conduit (each pipe) with a pulling strength of not less than 1200 lbs. as specified in the [Schedule of Components](#) section.

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**1.2 MAIN DISTRIBUTION FRAME / INTERMEDIATE DISTRIBUTION FRAME**

- A. A Main Distribution Frame (MDF) room shall be provided for each major renovation, remodeled building, or new building. Designer shall consult with ECU-ITCS via Project Manager to determine size requirement of MDF.
- B. The MDF room shall be the room where the building entrance conduit terminates and where the entrance cables (internet, Video, and EMCS) shall be terminated, as well as optical fiber interfaces, telephone equipment, and lightning protectors.
- C. The MDF room shall be established within the first 50 feet from where the entrance conduit first enters the building; otherwise, alternate facilities shall be provided (see the [Sheath Grounding / Panel Room](#) section).
- D. The MDF room is where ECU provides its demarcation point for the building. The building project shall provide the intra-building network starting in the MDF room.
- E. Consult with ECU-ITCS via the Project Manager to include necessary infrastructure to connect the building to existing communication systems.
- F. Typically, the MDF room is the largest communications room in the building and also serves as the communications closet for that floor. The distance in conduit from the closet/MDF room to the station/terminal outlet is restricted to a limit of 90 meters (295 feet) cable length.
- G. A typical MDF room is capable of serving a structure up to 20,000 square feet. However, if the room is centrally located within the building structure, this service area can be increased to 35,000 square feet. This ensures that all voice and data networking criteria are supported.
- H. In multi-level structures, the MDF room and IDF room(s) shall be designed in a "stacked" arrangement, connected via floor sleeves. The conduit system shall be designed to ensure that the MDF room and IDF rooms serve the floor level they are on and that the maximum "home-run" cable length, including cable trays and radial conduit to the faceplate, do not exceed 90 meters (295 feet) as mentioned previously.
- I. If the floor where the MDF room is located is over 20,000 square feet or the conduit length shall exceed 90 meters (295 feet), one or more IDF rooms shall be provided on that floor.
- J. The MDF room shall have, at a minimum, three 4" metallic conduits, an 8" x 8" wire way, or a 12" wide cable rack connecting it to each IDF room on that level.
- K. A 1-inch metallic conduit shall also be provided for the ground system.
- L. Approximate space requirements for MDF rooms are listed below, along with general notes to be taken into account during planning. Actual size and configuration shall be reviewed with ECU-ITCS via the Project Manager.

**MDF Room Sizing**

Total Building Size in Gross Sq. Ft	Recommended Minimum MDF Room Size	*Cooling Capacity
up to 20,000	12' x 16'	designer based
20,001 to 50,000	12' x 20'	designer based
50,001 to 75,000	12' x 24'	designer based
75,001 and above	14' x 24'	designer based
*Cooling capacity shall be determined by the design. ITCS must be consulted for final design requirements.		

- M. IDF rooms in multi-level buildings shall be "stacked" one above the other, starting above the MDF room. The IDF room stacks are typically centrally located in the building superstructure. A single IDF room may service a floor area up to 20,000 square feet. Wire way and conduit connections shall be designed to ensure that the cable length shall not exceed 90 meters (295 feet).

  - A. In multi-level structures, closets shall be designed so they are placed one above the other with vertical sleeved holes between.

- N. Approximate space requirements for IDF rooms are listed below, along with general notes to be taken into account during planning. Actual size and configuration shall be reviewed with ECU-ITCS via the Project Manager.

Total Building Size in Gross Sq. Ft	Recommended Minimum IDF Room Size	Cooling Capacity
up to 20,000	12' x 14'	designer based
*Cooling capacity shall be determined by the designer. ITCS must be consulted for final design requirements.		

- O. For floors over 20,000 square feet, additional IDF room(s) may be necessary. A minimum of three 4" metallic conduits, an 8" x 8" wire way or a 12" wide cable rack shall be provided as a pathway to the main IDF room or the other sub-IDF room on the same level. The main IDF room is defined as the IDF room having riser conduit connecting it to other IDF rooms on other floors and/or the MDF room. A properly sized ground wire shall be provided to each additional closet(s), originating from the ground bus bar in the main IDF room. A minimum 1-inch metallic conduit shall be provided for the ground wire if three 4" conduits are to be provided for the main IDF to sub-IDF connections.
- P. Cooling
  - 1. MDF/IDF rooms shall be treated with conditioned air and equipped with a dedicated (mini-split) self-contained HVAC unit w/ thermostat that can be controlled separately from the main building system. HVAC system shall be fed from room's electrical panel on a standby power circuit. Normal operating temperature for the room shall be between 74 degrees and 78 degrees. The designer shall verify heat load (plus anticipated 25 % growth) requirements with ECU-ITCS via the Project Manager. Additionally, the HVAC system shall not be located above any equipment racks or any other electronic equipment. ECU-ITCS must be consulted for proper location of HVAC system. MDF rooms to have 2 units; one primary; one backup.
  - 2. Coordinate location of evaporators & condensers with facilities services via the project manager.
  - 3. Building HVAC system thermostat shall be provided in each room for monitory of alarms by BAS, not controlling.
- Q. Doors
  - 1. For the MDF A single 3'0" solid door shall be provided. The preferred swing of the door is to the outside. If the MDF room has an external wall, one exterior entrance shall also be provided. All interior entrances shall open into corridors.
  - 2. For IDF rooms a single 3'0" solid door shall be provided and mounted to swing outside the closet. This space shall be located off a corridor or an area not associated with business offices.

- 3. Door seals. In order to protect sensitive network electronics, it is important that moisture and dust be kept out of MDF/IDFs. The bottom of interior doors should be equipped with solid door sweeps, brush door sweeps, or thresholds equipped with vinyl inserts as applicable to prevent water and dust from entering room underneath door. Exterior doors should be equipped with a rubber gasket or perimeter seal on top and side of door to provide a seal from external rain, humidity, and dust.
- R. Room Access
  - 1. Normal MDF/IDF will be keyed configurations.
  - 2. Designer shall consult with project manager on any special access requirements.
- S. A finished ceiling shall be omitted. HVAC duct(s) are necessary for conditioned air but mainline HVAC ducts, plumbing lines (water, sewer, chilled or steam) and building electrical switches and panels may not be installed through and in this room.
- T. Linear wall space shall be lined with 3/4" plywood. These 4' x 8' x 3/4" plywood panels shall be fire retardant plywood installed **horizontally** at a minimum of 24" above finished floor. Anchors for plywood shall be sufficient to support all background equipment apparatus weighing up to 15 pounds per square foot of plywood space. Any electrical outlets installed on the wall shall be installed **below** the plywood panels and **never** on the panels.
- U. The floor surface shall be VCT with rubber base. Floor loading shall be rated in excess of 150 pounds per square foot.

END OF SECTION 27 11 13

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**DIVISION 27 COMMUNICATIONS**

**SECTION 27 11 16 COMMUNICATIONS CABINETS, RACKS, FRAMES, AND ENCLOSURES**

**1.1 EQUIPMENT RACKS**

- A. All equipment racks shall be 84-inch high TIA/EIA standard 19-inch equipment racks unless limited space is encountered. If limited space is encountered wall mounted racks with hinged doors may be used only with approval from ECU-ITCS.
- B. Required number of 84-inch high TIA/EIA standard 19-inch equipment racks shall be provided for each equipment room as required to mount termination frames and to terminate fiber optic and copper cables.
- C. The number of racks shall be determined by the number of fiber termination frames, the number of copper terminations, and the number of equipment racks required.
- D. 19-inch free-standing flange racks shall be 7 ft. tall, of aluminum construction with clearance of 36" on all sides unless multiple racks are mounted side by side with cable management adjacent.
- E. Vertical cable management is required between racks.
  - a. Vertical cable management size shall be determined by the number of patch panels required. Designer shall consult ECU-ITCS.
- F. Horizontal cable management is required above and below patch panels.
- G. Depending on the location of the fiber entrance, the fiber termination frame(s) shall either be mounted in the right most or left most rack.
- H. Network equipment racks shall be centered between patch panel racks.
- I. UPS equipment shall be mounted in the bottom of network equipment racks.
- J. Typical Rack layouts
  - 1. If design requires 1 rack
    - a. The fiber termination frame shall be mounted in the top of the rack.
    - b. The copper patch panels shall be mounted below the fiber termination frame.
    - c. Network equipment shall be installed below the patch panels.
  - 2. If design requires 2 racks
    - a. Depending on the location of the fiber entrance, the fiber termination frame(s) shall either be mounted in the right most or left most rack.
    - b. The copper patch panels shall be mounted below the fiber termination frame(s).
    - c. Network equipment shall be installed in the adjacent rack.
  - 3. If design requires 3 racks
    - a. Depending on the location of the fiber entrance, the fiber termination frame(s) shall either be mounted in the right most or left most rack.
    - b. The network equipment rack shall be the center rack.
    - c. The copper patch panels shall be evenly distributed between the two adjacent racks.
  - 4. If design requires 4 or more racks
    - a. Depending on the location of the fiber entrance, the fiber termination frame(s) shall either be mounted in the right most or left most rack.
    - b. The fiber termination frames shall have dedicated racks

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- c. The remaining racks shall be distributed in sets of 3. I.e. Network racks shall be centered between two adjacent copper patch panel racks with the patch panels being evenly distributed between the two racks.

Rack layout examples:





K. Lighting

1. Fluorescent light fixtures shall be required to provide 75 foot-candles measured 30" from the floor. The wall switch shall be located near the door. Power to the fixtures shall be from emergency power where available. If emergency power isn't available, provide wall mounted battery type emergency lights.

END OF SECTION 27 11 16



**DIVISION 27 COMMUNICATIONS**

**SECTION 27 11 23 COMMUNICATIONS CABLE MANAGEMENT AND LADDER RACKS**

- A. A cable ladder rack shall be mounted above the plywood lined walls where cable enters the MDF room and over the top of the communications rack. The ladder rack shall be attached at the walls for stability spanning the length of the room. The rack shall have rung spaces 3 to 9 inches apart.
- B. MDF/IDF Room Turnover Deadline
  - 1. The MDF/IDF shall be fully functional **two (2) weeks prior to** any data communication needs so that owner can take beneficial occupancy of these rooms. The MDF shall have all copper cables and fiber optic cabling terminated and tested, electrical power sources functional, be properly cleaned, HVAC functional, and be secured as specified in the ECU construction standards. After turnover this room may only be accessed by ECU personnel. Please refer to the [Installation Phases](#) section for additional information.

END OF SECTION 27 11 23

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**DIVISION 27 COMMUNICATIONS**

**SECTION 27 11 26 COMMUNICATIONS RACK MOUNTED POWER PROTECTION AND POWER STRIPS**

**1.1 POWER**

- A. An electrical three phase panel board shall be provided in the MDF/IDF rooms to serve as the load center for the room. A feeder circuit shall serve the power panel with isolated ground from the building main service entrance equipment enclosure or emergency source. Emergency power is **required** unless it is not available.
- B. The power panel shall be protected by a transient voltage surge suppressor. In new construction, surge protection shall be integral to the panel. In renovations, transient voltage surge suppressor shall be hardwired directly from a breaker in the panel. A properly sized ground wire shall connect the transient voltage surge suppressor to the master ground bar in the room.
- C. All receptacles in MDF/IDF rooms shall be isolated grounding type. All receptacle outlets shall be duplex 3-wire and installed at either the top of the communications equipment rack or to the rear of the equipment racks based on ECU-ITCS needs. Designer shall contact ECU-ITCS via project manager concerning locations and possible deviations from this standard. Refer to the following link for power outlet and plug types: <http://www.tripplite.com/support/outlet-plug-types>

MDF Room Size	120 VAC 20 AMP Duplex Outlets (5-20R)	208 VAC 30 AMP (L6-30R)	208 VAC 20 AMP (L6-20R)	Panel Board 120/208V MLO, 100A 12 Space Minimum
12' x 16'	5	2	2	Yes
12' x 20'	6	2	2	Yes
12' x 24'	7	2	2	Yes
14' x 24'	7	2	2	Yes
<b>*Receptacle quantities are the minimum. ECU-ITCS must be consulted for final design requirements.</b>				

IDF Room Size	120 VAC 20 AMP Duplex Outlets (5-20R)	208 VAC 30 AMP (L6-30R)	208 VAC 20 AMP (L6-20R)	Panel Board 120/208V MLO, 100A 12 Space Minimum
12' x 14'	4	2	2	Yes
<b>*Receptacle quantities are the minimum. ECU-ITCS must be consulted for final design requirements.</b>				

Example top of rack outlets



- D. There shall be at least one 120VAC, 2-pole, 3-wire grounding NEMA 5-20R duplex receptacle outlet and one 208 VAC 30 AMP (L6-30R) installed in the MDF/IDF rooms served from a separate panel source than the one located within the room.
- E. To assure an effective single point systems ground, a master ground bar shall be mounted in the MDF room. From the master ground bar, individual properly sized insulated ground wires shall be routed within a 3/4" (minimum) metallic conduit to **EACH** of the following ground sources:
  - 1. The building main electrical service entrance equipment disconnect enclosure,
  - 2. The building structural steel,
  - 3. The building ground electrode if available, and
  - 4. The metallic water pipe system serving the building which shall be in continuous contact with earth ground for at least 10 feet. Bypass bonding conductors shall be installed around water meters and/or insulating joints. This connection is typically made to the water line within 5 feet of building entry point.
- F. The master ground bar shall serve as the only source of ground for the entire communications system, i.e., vertical riser, IDF rooms, electronic equipment, etc. The ground resistance objective shall be 5 ohms or less when measured at the master ground bar. The resistance between equipment ground (at device outlet) and the master ground bar shall be 3 ohms or less. Provide documentation system meets this requirement. The master ground bar shall be mounted to the bottom of the plywood panel.
- G. All conduit bushings shall be grounding type and shall be bonded to master ground bar. All metal panels, racks, equipment, etc. shall be bonded to master ground bar.
- H. Fire protection for all telecom rooms shall be determined by ECU Facilities and ECU- ITCS based on the building design.
- I. Wire ways entering these rooms shall penetrate the room walls above the plywood panels and extend only one to three inches inside. Conduits entering these spaces from telephone outlets shall penetrate the room walls above the plywood panels and extend one to three inches into the room to facilitate the installation of bushings.

END OF SECTION 27 11 26

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**DIVISION 27 COMMUNICATIONS**

**SECTION 27 13 13 COMMUNICATIONS COPPER BACKBONE CABLING**

**1.1 ANALOG COPPER CABLING NETWORK COMPONENTS**

- A. The analog copper cabling network consists of three (3) distinct elements: feeder, entrance, and distribution/riser cable facilities.
- B. Feeder cable is multi-paired, shielded cable routed between the Switch room and pre-determined geographical serving areas of campus that is supported by the underground conduit. Older feeder cables may be direct buried. The geographical areas may consist of multiple buildings, vacant land, or both. The feeder cable is presently or eventually shall be terminated in serving area interfaces.
- C. The term "entrance" is used to describe the cable that is spliced into the feeder cable and routed into a building to provide telephony services to that building. Typically, this entrance cable is terminated in the building's MDF room.
- D. Distribution/riser cable originates from the serving area interface and serves buildings via their entrance cables.
- E. Feeder, entrance, and distribution/riser copper cables shall be of waterproof construction consisting of a single sheath, metallic shield(s), plastic insulated conductors, and moisture-proofing compound.
- F. All feeder and entrance cables shall be 24 AWG; however, special inter-building cabling applications (non-feeder) may require 22 AWG.
- G. Cables shall meet REA specifications PE-89 and/or have the Bell standard designation AFMW, that is, of ASP (aluminum steel polyethylene) construction. Bell standard designation for a 22 AWG cable is AFAW.
  - 1. Note: Cables meeting the Bell standard of ASP construction are suitable for use in power stations within high ground fault-potential areas.
- H. The copper conductors shall be color coded to telephone industry standards. Unlike horizontal inside cables, outside cables do not have band-markings. Outside cables use solid-color identification where pair identification is dependent on the integrity of the twist of individual pairs. It is very important that an end portion of the sheath is removed, and the pair bundles are securely taped before the rest of the cable sheath is removed for splicing.

Solid color wires					
Insulation color code					
Number	Tip	Ring	Number	Tip	Ring
1	White	Blue	14	Black	Brown
2	White	Orange	15	Black	Slate
3	White	Green	16	Yellow	Blue
4	White	Brown	17	Yellow	Orange
5	White	Slate	18	Yellow	Green

6	Red	Blue	19	Yellow	Brown
7	Red	Orange	20	Yellow	Slate
8	Red	Green	21	Violet	Blue
9	Red	Brown	22	Violet	Orange
10	Red	Slate	23	Violet	Green
11	Black	Blue	24	Violet	Brown
12	Black	Orange	25	Violet	Slate
13	black	green			

Binder color code (Standard units)			
Binder number	Binder color	Binder number	Binder color
1	White-blue	13	Black-green
2	White-orange	14	Black-brown
3	White-green	15	Black-slate
4	White-brown	16	Yellow-blue
5	White-slate	17	Yellow-orange

6	Red-blue	18	Yellow-green
7	Red-orange	19	Yellow-brown
8	Red-green	20	Yellow-slate
9	Red-brown	21	Violet-blue
10	Red-slate	22	Violet-orange
11	Black-blue	23	Violet-green
12	Black-orange	24	Violet-brown

END OF SECTION 27 13 13

**DIVISION 27 COMMUNICATIONS**

**SECTION 27 13 23 COMMUNICATIONS OPTICAL FIBER BACKBONE CABLING**

**1.1 OPTICAL FIBER INFRASTRUCTURE COMPONENTS**

- A. This section describes the generic cable construction and performance requirements of the single mode and multimode optical fibers, the fiber optic distribution assemblies, and the fiber optic connectors covered in this document.
- B. The optical fibers defined by this standard shall be provided for use in a variety of communications applications. These applications include long and short haul communications, local and wide area networks, data links, video transmission, CATV, and premises distribution. These fibers shall be used in both inter-building and intra-building environments.
- C. **There shall be no fiber splicing allowed unless expressly permitted by ECU- ITCS.**
- D. All optical fiber shall be of the same manufacturer and have the same optical performance regardless of the application or cable construction. All fiber optic termination, splicing and mounting hardware provided shall be of the same manufacturer.
- E. The fiber cables defined by this standard shall be constructed to protect the fibers during installation and to prevent breakage once installed. This standard section applies to both single mode and multi-mode fiber optic cable.
- F. The fibers shall be located in the core of the cable to isolate them from crushing loads and impacting.
- G. Fiber Optic Cable Testing
  - 1. Factory Testing: Factory testing documentation (OTDR traces) shall be provided with the fiber optic cable. Factory OTDR readings shall be provided for each fiber in each spool. These readings shall be taken at 850nm and 1300nm for multi-mode fiber, and at 1310 nm and 1550nm for single mode fiber.
  - 2. After Installation Testing: After installation of the fiber, OTDR readings shall be taken to ensure no damage has occurred during installations. Readings shall be submitted to the Designer for comparison to factory readings.
  - 3. Terminated Fiber Connector Test: After completion of terminations, Connector insertion loss with an OTDR optical power meter and matching light source shall be tested. Document at 850nm and 1300nm for multi-mode fiber, and at 1310nm and 1550nm wavelengths for single mode fiber, in both directions through each connector pair.
  - 4. All testing results shall be submitted as part of Owner’s permanent O&M Manuals. All testing results shall be submitted to the Owner as a printed copy and electronic media copy as part of the Owner’s permanent O&M Manuals.
- H. Multi-Mode Fiber
  - 1. Core Diameter: The core diameter shall be 62.5 microns; the diameter tolerance shall be plus or minus 3 microns.
  - 2. Cladding Diameter: The cladding diameter shall be 125 microns; the diameter

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tolerance shall be plus or minus 2 microns.

3. Attenuation: The attenuation of the multi-mode fiber shall be between 2.5 and 3.75db/km at 850nm and between .5 and 1.5db/km at 1300nm.
4. Bandwidth: the bandwidth of multi- mode fiber shall be between 150 and 500 MHz-km.

I. Single Mode Fiber

1. Core Diameter: The core diameter shall be 8.3 microns; the diameter tolerance shall be plus or minus .5 microns.
2. Cladding Diameter: The cladding diameter shall be 125 microns; the diameter tolerance shall be plus or minus 2 microns.
3. Attenuation: The attenuation of the single mode fiber shall be between .35 and .6db/km at 1310nm and between .2 and .5db/km at 1550nm.
4. Mode Field Diameter: The mode field diameter shall be between 8 and 10 microns, with tolerance a plus or minus 10%.
5. Dispersion: The zero dispersion wavelengths shall be 1310nm plus or minus 10nm.

J. Fiber Optic Distribution Assemblies

1. Outside plant and building cable assemblies shall be mounted, terminated, spliced at endpoints, distributed, and cross-connected. Fiber counts, routing, origination and destination shall be specified.
  - a. Termination Frames: Termination frames shall be provided to facilitate the termination of all cable types covered in this standard. Termination frames shall be rack mountable in standard 19-inch vertical equipment racks. These frames shall be modular in construction utilizing connector/coupling panels. Combination of termination frames shall be provided with termination capacities of 24, 72 and 144 fibers and be suitable for both single mode and multi-mode fibers.
  - b. Splice Organizers: Splice organizers shall be utilized to facilitate end point splicing for all cable types covered in this standard. Splice organizers shall be rack mountable in standard 19-inch vertical equipment racks. The splice organizers shall accommodate both fusion and mechanical splices. These organizers shall provide sufficient storage and protection for the entire length of un-cabled fiber and end point splices. Splice organizers shall provide end point splice capacities of 24, 72 and 144 fibers and be suitable for both single mode and multi-mode fiber.
  - c. Miscellaneous Hardware: Specify all required miscellaneous hardware including but not limited to cable clamps, strain reliefs, blocking and grommet kits, closures, and fan outs for a complete operational fiber optic cable system.
  - d. End Point Splices: Mechanical fiber optic end point splices shall not be used. Fusion end point splicing shall be used on both single mode and multi-mode fiber.
    - 1) Insertion Loss: Fusion end point splice insertion loss shall not exceed .2dB single mode and .25dB multi-mode.

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- 2) Mounting: All end point splices and associated un-cabled fiber shall be securely mounted in end point splice organizers as described in this standard.

K. Fiber Optic Connectors

1. This section describes the performance requirements and characteristics for fiber optic connectors that shall be used on single mode and multi-mode fibers.
  - a. Connectors shall be SC connectors and shall be capable of being mated and unmated without special tools.
  - b. Strain Relief: Connector assembly shall include a rubber or plastic boot for strain relief.
  - c. Insertion Loss: Connector insertion loss shall not exceed .4dB for single mode and .5dB for multi-mode fibers.
  - d. Environmental Protection: connector assembly shall protect against dust, sand and dirt and permit cleaning when disconnected.
  - e. Repeatability: Connector attenuation shall not exceed .2dB of change for 1000 reconnections.
  - f. Strength: Cable pull out strength shall be greater than 25 pounds.

END OF SECTION 27 13 23

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**DIVISION 27 COMMUNICATIONS**

**SECTION 27 15 01.11 23 CONDUCTORS AND CABLES FOR ELECTRONIC SAFETY AND SECURITY**

**1.1 SECURITY SYSTEMS**

The designer shall contact the Project Manager regarding current University policy for Security Systems.

**1.2 INTRA-BUILDING CABLING STANDARDS**

- A. The purpose of this section is to provide standards for intra-building cabling.
- B. Spread of Fire or Products of Combustion
  - 1. The Designer shall ensure that fire stops are provided in openings around conduit or cabling, or cabling penetrations through fire rated partitions, floors, and ceilings.
  - 2. The Designer shall use approved fire stopping methods and materials to maintain the existing fire resistance rating, per UL standards.
- C. Intra-Building Fiber Riser Cabling
  - 1. In addition to the standards in the [Optical Fiber Infrastructure Components](#) section. The following standards apply to intra-building fiber cabling.
    - a. The fiber count shall be determined by the size of the building. ECU- ITCS **must** be consulted to determine the exact fiber count requirements.
    - b. The cables shall be suitable for installation in raceways under floor, in walls and ceilings, and vertical shafts of buildings. These raceways typically shall be conduits, ducts, cable trays, and an open space in a plenum environment.
    - c. Horizontal distribution and vertical riser cables shall have a minimum pulling tension rating of 150 pounds.
    - d. The strength elements shall be Aramid yarn.
    - e. The cable outer jacket material shall be flame-retardant polyvinyl chloride or a fluoropolymer. An additional protective buffer jacket made of polyvinyl chloride shall be provided to ease connectorization and add robustness. The outer jacket shall be continuous, free from holes, splits, and inclusions.
    - f. The fibers shall be color-coded so that each fiber can be individually identified. The colors shall be blue, orange, green, slate, white, red, black, yellow, and violet. Dashed versions of these same colors shall be used for cables with higher fiber counts.
    - g. Corning Products "Fiber optic" cabinets shall be used to terminate all multimode and single-mode fiber cable as specified in the [Schedule of Components](#) section.
    - h. Industry standard SC connectors shall be used to terminate the fiber cable.
    - i. In some cases, such as in the Primary room, dark fiber shall be spliced through and housed in splice trays.

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- j. All cabinets shall be rack mounted in a 19-inch vertical Relay rack.
- k. All fiber will be fusion spliced with the parts specified in the [Schedule of Components](#) section.

D. Horizontal Cabling

1. Horizontal cabling shall be installed throughout all spaces in ECU campus buildings. These cables will originate at a MDF/IDF room and terminate at telecom outlets.
2. A communications wiring plan which complies with this document shall be used in all new construction and major renovations.
3. Purchase, installation, termination, testing, and documentation of all specified communications cabling is required.
4. At completion of testing and prior to beneficial occupancy of the MDF and IDF, the Owner shall require a minimum 5% random testing with 100% compliance witnessed by ECU-ITCS and the Designer. Additional testing may be required if random testing determines cable specifications are not met.
5. Cable Specification: All communications cable must meet or exceed the following cable specifications. Acceptable cable manufacturers are listed in the [Schedule of Components](#) section; however, if substitutions are made vendor cable specifications must be provided which then must be approved by ECU-ITCS via Project Manager before the cable is installed.
  - a. Data Cable EIA/TIA 568 Standard
    - 1) UL Listed Category 6 UTP (unshielded twisted pair)
    - 2) 4 Pair 24 Gauge Solid Copper
    - 3) 100 Ohm Impedance
    - 4) Sheath color: yellow
  - b. Video Cable- Room to Station
    - 1) Comm/Scope Coax
    - 2) Part # F6SSV/2227K (cm/cmp)
    - 3) RG-6 18 Gauge solid copper
    - 4) 75 Ohm Impedance
  - c. Attenuation:

Maximum, dB per 1,000 ft.			
@ 1.0 MHz	6.3	@ 25.0 MHz	32
@ 4.0 MHz	13	@ 31.25 MHz	35.7
@ 8.0 MHz	17	@ 62.5 MHz	52
@ 10.0 MHz	20	@ 100 MHz	67
@ 16.0 MHz	25	@ 155 MHz	86
@ 20.0 MHz	28.2	@ 200 MHz	99

Near End Crosstalk (Next) dB per 1,000 ft., worst pair to pair			
@ 1.0 MHz	72.3	@ 25.0 MHz	51.3

@ 4.0 MHz	63.3	@ 31.25 MHz	49.9
@ 8.0 MHz	58.8	@ 62.5 MHz	45.4
@ 10.0 MHz	57.3	@ 100 MHz	42.3
@ 16.0 MHz	54.3	@ 155 MHz	39.5
@ 20.0 MHz	52.8	@ 200 MHz	37.8

PSNEXT per 1000 ft.:

@ 1.0 MHz	70.3	@ 25.0 MHz	49.3
@ 4.0 MHz	61.3	@ 31.25 MHz	47.9
@ 8.0 MHz	56.8	@ 62.5 MHz	43.4
@ 10.0 MHz	55.3	@ 100 MHz	40.3
@ 16.0 MHz	52.3	@ 155 MHz	37.5
@ 20.0 MHz	50.8	@ 200 MHz	35.8

ACR per 275 ft.:

@ 1.0 MHz	70.6	@ 25.0 MHz	42.6
@ 4.0 MHz	59.9	@ 31.25 MHz	40.1
@ 8.0 MHz	54	@ 62.5 MHz	31.1
@ 10.0 MHz	51.9	@ 100 MHz	23.9

@ 16.0 MHz	47.4	@ 155 MHz	15.9
@ 20.0 MHz	45	@ 200 MHz	10.5

Return Loss:

@ 1.0 MHz	26	@ 25.0 MHz	25.3
@ 4.0 MHz	26	@ 31.25 MHz	24.6
@ 8.0 MHz	26	@ 62.5 MHz	22.5
@ 10.0 MHz	26	@ 100 MHz	21
@ 16.0 MHz	26	@ 155 MHz	19.8
@ 20.0 MHz	26	@ 200 MHz	19

END OF SECTION 27 15 01.11 23

**DIVISION 27 COMMUNICATIONS**

**SECTION 27 15 13 COMMUNICATIONS COPPER HORIZONTAL CABLING**

**1.1 ANALOG RISER CABLING**

- A. In addition to the standards in the [Analog Copper Cabling Network Components](#) section. The following standards apply to analog riser cabling.
  - 1. Analog riser cable sizing. All analog riser cables shall be 25 pair UTP voice grade cables as specified in the [Schedule of Components](#) section.
  - 2. There shall be an analog riser cable ran from the MDF to each IDF.
  - 3. Analog riser cable shall be terminated in the MDF on a Krone punch down block attached to the plywood backboard and in each IDF on a Krone punch down block attached to the plywood backboard

END OF SECTION 27 15 13

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**DIVISION 27 COMMUNICATIONS**

**SECTION 27 15 23 COMMUNICATIONS OPTICAL FIBER CABLING**

**1.1 PATCH PANEL SPECIFICATION**

A. Patch Panel Specification

1. All patch panels shall be UL Listed as Category 6.
2. All Category 6 cable shall be terminated on UL Listed Category 6 complaint patch panels.
3. The EIA/TIA 568A punch down sequence shall be used on all Category 6 compliant patch panels.
4. 48 port patch panels shall be used except where space constraints dictate. A 24-port panel with one horizontal wire management panel shall be acceptable with approval from ECU-ITCS.
5. All patch panels shall be mounted to either floor mounted standard 19-inch racks or, if limited space is encountered, wall mounted racks with hinged doors shall be used upon approval from ECU-ITCS.
6. All wiring of patch panels shall begin from the top down in racks.

B. Cable Termination

1. All cable runs, regardless of media type, shall be able to reach the designated patch panel plus an additional 20 feet of slack.
2. Cable within a room shall be bundled and terminated via standard Category 6 compliant patch panels, as detailed above.
3. Terminate all video cables in patch panels in equipment racks.

C. All cable types shall be physically separated into individual groups.

D. All cable termination points shall be labeled to indicate floor, room, room outlet, and terminal drop number as specified in the [Cable Pull Labeling Guidelines](#) section.

E. Contact ECU-ITCS via the project manager concerning any special vendor equipment requirements.

F. Communication Outlets

1. The communications wiring plan includes communications outlets in all work areas in accordance with this standard.
2. Unless specified otherwise all outlets shall be wired to support two data communications connections, except in locations where only wall telephones are required.
3. All outlets shall be shown on the building electrical or communications floor plan.

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- 4. See figure 3 in [Cable Pull Labeling Guidelines](#) for a typical outlet installation. (Dependent on selection of outlet.)
- 5. The EIA/TIA 568A punch down sequence shall be used on all Category 6 compliant jacks.
- 6. All communications outlets shall use the acceptable vendor communications outlet part number as listed in the [Schedule of Components](#) section. However, deviations from the standard or optional communications outlet specifications shall be addressed on a case-by-case basis at the design phase.
- 7. Outlet Identification - All outlets shall be labeled using the cable identification method detailed in the [Cable Pull Labeling Guidelines](#) section.
- 8. All data outlets shall be UL Listed as Category 6.
- 9. Any additional service options or deviations from the communications outlet standard shall be coordinated with and approved by ECU- ITCS via Project Manager.

END OF SECTION 27 15 23

**DIVISION 27 COMMUNICATIONS**

**SECTION 27 41 00 AUDIO-VIDEO SYSTEMS**

**1.1 ELEVATOR TWO-WAY VISUAL COMMUNICATION SYSTEMS**

- A. All residence hall elevators shall be equipped with Video monitoring
- B. All emergency phones shall report directly to ECU Police
- C. Two-way elevator visual communications system shall be based on the RATH SmartView System. Equipment shall be able to be integrated into the current front end monitored by ECU Police.

END OF SECTION 27 41 00

**SECTION 27 41 16 INTEGRATED AUDIO-VIDEO SYSTEMS AND EQUIPMENT FOR CLASSROOMS**

**1.1 AUDIO-VIDEO SYSTEMS AND EQUIPMENT FOR CLASSROOMS**

The purpose of this document is to provide guidelines for designing the University's classrooms, seminar/conference rooms, and class labs systems support structure facilities for university buildings. Standardization shall assure proper space requirements and conduit for voice and data systems and shall facilitate future rearrangements or replacements. **This document should be used as a guideline only.** For specific design elements please contact ECU-ITCS Audio Visual Design and Engineering. This section is maintained by ECU-ITCS.

**1.2 Room Descriptions**

- A. Seminar/Conference Rooms up to 20 participants.
- B. Small Classroom 21 to 35 student desks and a teaching station.
- C. Medium Classroom 36 to 50 student desks and a teaching station.

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- D. Large Classroom 51 to 100 student desks and a teaching station.
- E. Lecture Hall 100 plus students may have auditorium style seating.
- F. Lab Classrooms may be one of the above with computer stations for each student.

**1.3 Infrastructure**

A. All AC power circuits providing power for AV equipment should be isolated ground 20 Amp branch circuits.

B. Low voltage signal cable localized in the room should be run in conduit to a large junction box then branched off to handy boxes within 3 feet of location to the demark locations.

C. Equipment Racks

- 1. Classroom equipment racks should be enclosed in the Lectern.
  - a. The lectern should be ECU's AV technical standard located on the left side of the screen (audience perspective) whenever possible. There must be at least 36 inches between the lectern and side walls and at least 50 inches from the back of the lectern to the wall.
  - b. The rack in the lectern should have adequate ventilation to maintain equipment specified operating range.
  - c. If the lectern will not accommodate all the equipment with a minimum of 3 empty rack spaces or maintain operating temperature within specifications, then an external rack should be added in the room or an AV closet.
- 2. Conference room equipment racks may be small rack cabinets that match the room furniture.
  - a. These racks should be in the room opposite the display wall.
  - b. The rack should have adequate ventilation to maintain equipment specified operating range.

D. AV Floor box

- 1. Any location requiring a floor box for power, data, and AV connections such as lectern or conference table locations should use the approved floor box from the [Schedule of Components](#) section.
  - a. AC power in one compartment of the floor box providing one dedicated 20 Amp isolated ground branch circuit with 2 duplex receptacles shall be provided.
- 2. Lectern locations
  - a. Classroom Lecterns
    - i. Should include a minimum of 4 data ports connected to the nearest network closet following all network standards.
    - ii. Should be placed to make sure floor box will be under the equipment section of the lectern providing 36 inches of clearance on side walls and 50 inches of clearance behind the lectern for accessibility.

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- b. Conference table
  - i. These locations should include a minimum of 4 data ports connected to the nearest network closet following all network standards.
  - ii. There should also be a minimum of 2- 1 ½ in conduits from the floor box to display or projector, screen, and loudspeaker locations or both stubbed up above the ceiling in the room to allow for signal and control wiring to these locations.

**1.4 Acoustic – Audio**

A. Ambient or background noise from HVAC or other mechanical systems must be no more than (Noise Criteria) NC-30 this provides a proper signal to noise ratio for the sound pressure levels in the program and speech reinforcement calculations.

- 1. Surfaces and Finishes
  - a. Walls Sound Transmission Class (STC).
    - i. General Classroom basic classroom walls must meet a minimum STC 50.
    - ii. Louder subject classrooms such as Music must meet a minimum STC 60.
- 2. Classroom surfaces and finishes should be configured to provide a maximum reverberation time of 0.7 seconds.
- 3. Impact Insulation Class (IIC)
  - a. The classroom floor and ceiling assemblies should be constructed to meet at least IIC-50.

B. Program Audio

- 1. Program audio is from program sources (computer, Laptop, MP3 player, etc....) supplied through two loudspeakers in the front of the room usually flanking the projector screen or ceiling speakers providing 50% overlap pattern based on the diameter of the coverage pattern at ear height.
- 2. The audio level target to the farthest listener is 85 dB SPL plus 10 dB headroom or 95 dB SPL without distortion.

C. Speech Reinforcement

- 1. Speech reinforcement audio is amplification of the instructor for larger rooms usually 50 or more student capacity it can be a separate system and should provide the same level to all listeners plus or minus 2dB across the band for speech.
- 2. Speech reinforcement is usually distributed through ceiling speakers with a 50% overlap pattern based on the diameter of the coverage pattern at ear height.
- 3. The audio level target for speech at each listener's ear is 70 dB SPL with 15 dB headroom or 85 dB SPL with no distortion.

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4. The loudspeakers and power amplifiers driving them must be impedance compatible to produce sufficient voltage at its rated power to assure the loudspeaker can develop targeted sound pressure levels.
5. Potential audio gain and needed audio gain (PAG-NAG) calculations must be provided to show an Equivalent Audio Distance (EAD) of 4 feet or less.

D. Microphones

1. Microphones must be carefully chosen for their intended purpose
2. Speech reinforcement microphones should be no more than 2.5 feet from the presenter's mouth.
3. Lapel and handheld microphones wired, or wireless are acceptable for reinforcement.
4. Ceiling microphones may be used for recording (Class Capture) and video conferencing.

**1.5 Displays**

A. Front projection screens

1. Should be 16:10 format.
2. Surface should be white matte finish with a gain of 1.0 +/- 0.2.
3. Screen sized for best fit considering the following:
  - a. Ceiling height.
  - b. The bottom of the screen must be at least 48 inches above the finished floor.
  - c. The screen size should meet the ANSI/INFOCOMM V202.01 standard for display image size for 2D content. To ensure visual acuity designers should ECU the minimum text font size for the intended farthest viewer for both basic and analytical decision making.
  - d. There should be no more than 30 degrees vertical viewing angle for the closest participant.
  - e. The most off axis participant should be no more than 45 degrees measured from the center of the screen.
4. All powered screens shall include low voltage control with provision to enable contact closure (Relay) control by AV control system.

B. Front Projection

1. Front projection native resolution should be 16X10 with native HD resolution.

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2. There should be no light fixtures in the projection path and no direct light from light fixtures on the screen.
3. The room Task level should be controllable to reduce task light levels for detailed video viewing.
4. The display should meet the ANSI/AVIXA V201.01 image system contrast standard.
5. Projector location must be calculated so the image from the projector will fill the screen with a default lens with zero keystone.

C. Rear projection

1. Rear projection is not normally used but where it is required the projected image should meet the same criteria for image quality as front projection.
2. Flat Screen Displays
  - a. Flat screen displays may be good choices for classrooms/conference rooms, these displays should follow the same general size rules.
    - i. Currently most of these monitors are 16:9.
  - b. When used in a room where participants are expected to be seated the bottom of the screen should be no less than 48 inches above the finished floor.
  - c. When used in a room or space that the participants will be standing the bottom of the screen should be around 72 inches above finished floor.
  - d. Display height should be at least 1/5 the distance to the farthest participant.
3. Flat screen displays must provide control ports.
  - a. Displays must be capable of control via the AV control system by RS-232, Ethernet, or Wired IR control. Any different control method must be approved by ECU AV project manager.
4. The intended use of the display must be considered to confirm proper input connections are included.
  - a. Computers may use USB-C, Display port, HDMI, DVI.
  - b. If the display is intended to display Cable TV content, it must have a tuner or an input for a cable box.
5. In small rooms the included or supplementary sound bars may be sufficient to supply 85 dB SPL for program audio.

D. Multiple Displays

1. When multiple displays are used in one room for participant viewing the system should use the highest common resolution.

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**1.6 The ECU installation standards** section contains examples of materials and manufactures used in ECU classrooms and conference rooms. Depending on room size and program, some models of equipment may need to change. The designer shall consult with ECU-ITCS via the project manager to determine any changes required.

**1. Cabling**

- A. **Speaker:** Speaker cables must be 14 to 16 awg plenum.
- B. **Audio:** Audio cables must be shielded, plenum and 20 to 22 awg.
- C. **Power:** Extended power cables must be 14 to 16 awg plenum.
- D. **Camera:** Must use RG-6 or HD-SDI for camera cables.
- E. **Control:** Control cables must be 18awg to 22 awg.
- F. **Crestron:** Crestron **DM** and Crestron **Cresnet** cable must be used. Any changes to this must have ECU AV engineering approval.
- G. **Power:** Extra lengths of power cable must be zip tied individually and mounted, preferably at the equipment that it belongs to or neatly at the power conditioner or power strip, so they are easily traced and serviced.
- H. **Securing:** All cables in rack must use Velcro to be secured, except for power, which may utilize zip ties to be bundled vertically. All tech flex must be secured with Velcro except at the ends which must use zip ties to secure the flip over.
- I. **All:** Proper **strain relief** of cables must be used for longevity and smooth operation.
- J. **All:** All **low voltage** and **field terminated** cables must use heat shrink. All field terminated power cables must have individual wires heat shrunk and then those heat shrunk over with no exposed copper.
- K. **All:** Cables must be dressed **neatly** and **serviceable** at the rack and ceiling
- L. **All:** All cables must be labeled by vendors to ECU standards.
- M. **All:** Keystone jacks must not be used in AV wiring without ECU engineering approval.
- N. **All:** **Bends** in cables must not be less than 90 degrees and gradual. Any exceptions must be approved by ECU AV engineering.
- O. **All:** Power must be separated from video and audio wherever possible.
- P. **Podium:** All **exposed cable** at the lectern and/or cart must have tech flex covering the entire length except for the laptop cables in the cubby.
- Q. **Podium: Internal cables** must be cut to length with minimal excess (excluding factory HDMI/ethernet cables and similar cables). These are cables that start and end in the rack.
- R. **Podium: Laptop cable** length must go to the floor if the cable cubby is in the center of the PLC-69 lectern. If cable cubby is on the far side of the podium, it must be long enough to get to the document camera area for laptop use. All other lectern style cable lengths must be approved by ECU AV engineering if questionable.
- S. **Podium:** Digital and analog cables must be placed in the appropriately sized holes and spaced with digital cables on one side and analog cables on opposite side.
- T. **Podium:** Lectern cables and power to floor box or wall plate must be in tech flex and bundled with Velcro.
- U. **Podium:** If the wire and/or cable goes to a floor box, it should go down through the bottom of the rack to the floor box under the lectern rack location.
- V. **Podium:** Lectern cables to wall plate must go through side grommet unless specified by ECU AV engineering. Vendors must not house extra cable in the floor box without ECU engineering approval. Please reach out to us regarding this item! There is not always an available/obvious grommet/entry.
- W. **Ceiling:** All cables **above ceiling** must be supported above/independent from ceiling grid, electrical conduit, HVAC, plumbing, etc.
- X. **Ceiling:** Must include 6-foot **service loop** above floor box or wall plate location and all other equipment locations in ceiling (e.g., Sensors, mics, etc.).

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- Y. **Ceiling:** All **cables in ceiling** must be independently supported utilizing j-hooks hung from hangers supplied by AV vendor. **J-hooks** must be installed every 4 to 5 feet. You may also use building I-Beams and joists. If these are not available, ECU engineering team will make the final decision on mounting. **No cables** must be resting on any other hardware of other's trade.
- Z. **Ceiling:** All cables in the ceiling must be plenum rated.

**2. Equipment**

- A. **Equipment mounted behind monitors:** Must be serviceable and accessible.
- B. Do not make **holes** in the wall to pass cable through without ECU approval.
- C. **Projector mounts:** Must be secured to the ceiling grid using CMS 440 kit screws. Projector mount must have 4 points of contact using 4 different (provided with CMS 440) aircraft cables secured to the deck and/or ceiling beams. Aircraft cables must be taut to alleviate the weight of projectors on the ceiling grid.
- D. **Speakers:** Must be tapped properly and independently supported and hung from hangers supplied by AV vendor. Speaker cables must be run into speaker correctly.
- E. **Program speakers** Must be tapped at 4/8 ohm. **Ceiling speakers** for speech reinforcement tapped appropriately for room configuration (typically 70V).
- F. **AirMedia, distribution amp, distribution amp power, and network streamer:** Must be mounted on Extron shelf. If a shelf is not provided, then ECU AV engineering will need to approve a mounting method.
- G. **RevoLabs:** Receiver stations must be mounted at the bottom of the rack near the access door, accessible and serviceable.
- H. **Power supplies:** Must not be mounted to equipment but should be visible and serviceable.
- I. **Vertically mounted equipment:** Must be secured with kit hardware or with Velcro and screwed into sticky blocks with zip ties or something strong enough to hold long-term. Please reach out to the ECU team if you have questions about what is acceptable. Please do not use adhesive backed Velcro in excess, this will hinder or make service difficult.
- J. **Any equipment secured with sticky Velcro:** Must not cover the stickers/manufacture information/model #/serial #.
- K. **Occupancy sensors** Must be placed near the lectern, outside of the light path of the projector and ceiling lights, and away from the entry to the hallway. Prior to system commissioning, occupancy sensor lights should not trigger while no movement exists in the room.
- L. **Mics:** Must be placed away from air returns and other noise causing devices.
- M. **Ceiling mounted devices:** Must be mounted in their own tile and distanced appropriately to their function from utilities in the ceiling. ECU engineering will provide mounting locations for these devices.
- N. **All room equipment:** Must be updated with the latest or to ECU preferred firmware revision, configured and tested before ECU QA test the room.
- O. Vendors must provide **stainless steel plates** per the State code with grommet if applicable to prevent cable degradation.
- P. **New ceiling mounted equipment:** Must be installed in a ceiling tile free of imperfections.
- Q. **Ceiling tiles:** Ceiling tiles have been moved must be put back in place before room turnover to ECU.
- R. **As-built:** Vendors should provide a ledger sized **as-built** for each room.
- S. **Adapter Ring:** (DL-AR) should be mounted as close to the head of the HDMI laptop cable as possible and secured tight as possible without straining the plastic to prevent it from sliding on the cable. Use included kit clamps.
- T. **DMPS and audio amp:** Must utilize offset lacing bars allowing more serviceability of the cables.

**1.7 The Wiring Schedule Standards** section contains examples of device inputs and outputs for digital media presentation switchers that match the ECU classrooms and conference rooms for consistent programming and troubleshooting. Depending on room size and program, some models of equipment may need device connections. The designer shall consult with ECU-ITCS via the project manager to determine any changes required.

Video Inputs		Cable Colors			
1	HDMI - Computer Primary			Video	Network
2	HDMI - Computer Secondary	Computer Primary		Blue	Blue
3	HDMI - Laptop	Computer Secondary		Green	
4	HDMI - Document Camera	Laptop		Black	
5		Doc Cam		Gray	Gray
		Local Monitor		Black	
<b>Video Inputs</b>		LAN			Purple
1	HDMI - Computer Primary	Content LAN			Red
2	HDMI - AirMedia	Touch Panel			Yellow
3	HDMI + VGA - Laptop	NVS			Green
4	HDMI - Document Camera	AV Bridge		Black	Black
5	HDMI - Computer Secondary	Recorder		White	White
		Codec		Orange	Orange
		DSP			Pink
<b>Video Outputs</b>					
1	HDMI - Local Monitor				
2	HDMI - Mediasite				
3	HDBaseT - Audience left display	1	AV Bridge		
4	HDBaseT - Audience right display	2	Blank		
		3	Equipment shelf		
		4	Blank		
		5	PC		
		6	PC		
		7	PC		
		8	Blank		
		9	Amp		
		10	Blank		
		11	Switcher / Processor		
		12	Switcher / Processor		
		13	Switcher / Processor		
		14	Blank		
		15	Power		
		16	Power		
<b>Audio Inputs</b>					
MIC 1	Lav Mic 1				
MIC 2	Ceiling Mic 1/Lav. Mic 2				
MIC 3	Ceiling Mic 2				
MIC 4	Ceiling Mic 3				
MIC 5	Ceiling Mic 4				
MIC 6	Ceiling Mic 5				
<b>Audio Outputs</b>					
PROG	Program - Stereo				
AUX 1	Speech - Mono				
AUX 2	Recorder / AV Bridge				
<b>Control</b>					

1	Occupancy Sensor				
<b>COM</b>					
A	Recorder				
B	PTZ Camera				
<b>Relays</b>					
1	Screen Down				
2	Screen Up				
3	Amp On/Amp Off				
4					

\* For devices with PoE injectors: PoE injector LAN port should use color coded network cable and PoE port should use black network cable that comes with the device

1.8 The [Schedule of Components](#) section contains examples of part numbers and Manufactures used in ECU classrooms and conference rooms. Depending on room size and program, some models of equipment may need to change such as screen sizes and projector lumens. The designer shall consult with ECU-ITCS via the project manager to determine any changes required.

<b>Audio Visual Components</b>				
<b>Item</b>	<b>Description</b>	<b>Manufacturer</b>	<b>Part Number</b>	<b>Equals Accepted</b>
HDbaseT Transmitter	HDbaseT Transmitter	Crestron/ Extron	Transmitter part number	Upon Approval
HDbaseT Receiver	HDbaseT Receiver	Crestron/ Extron	Receiver part number	Upon Approval
Cable video/audio/control	Cable video/audio/control	Upon Approval	TBD	Upon Approval
Media Presentation Switcher	Control and AV (Audio Visual) signal router	Extron / Crestron	TBD	No
Amp	power Amp	Crestron / Extron / QSC	TBD	No
Control panel	Control panel	Crestron / Extron	TBD	No
Document Camera	Digital Presenter	Wolfvision	TBD	
Projector	Laser Projector	Sony	TBD	Upon Approval
Screen	Front Projection Screen	Da-Lite non tab tension	TBD	No
Lectern	Lectern	AVinED	PL70-RR-LAM	Upon Approval
Speakers	Speakers	JBL / QSC	TBD	Upon Approval
AV Floor box	AV Floor box	Legrand 11 slot	TBD	<u>Upon Approval</u>

END OF SECTION 27 41 16

**DIVISION 27 COMMUNICATIONS**

**SECTION 27 51 29 EMERGENCY COMMUNICATIONS SYSTEMS**

**1.1 EMERGENCY COMMUNICATIONS**

A. Emergency Call STATIONS AND Blue Light Phones

1. The University Police Chief or appointed representative shall be consulted concerning location and number of units required for each construction project. The project shall include the purchase and installation of the required units.
2. Each Emergency Call Station and Blue Light Phone provides a voice channel and location identification to University Police when activated. A blue light mounted on the top of the remote emergency phone provides a visual location of the emergency phone to facilitate response by emergency personnel. When the phone is activated, the blue light flashes. The annunciation-and-reporting station is located on the dispatcher’s desk at the ECU Police Station for Main Campus and at Brody Public Safety for the Health Sciences Campus. These stations are the designated or code recognized “Remote Supervising Station”.
3. Emergency Call Stations or Blue Light phones are typically located exterior to buildings, either wall mounted at building entrances or pedestal mounted away from the building in the parking and pedestrian areas. The University uses both types/models, depending upon application. Designer shall consult with ECU-ITCS via Project Manager to determine the correct model to use.
4. Each Emergency Call Station or Blue Light phone shall be equipped with a lightning ground protection device at both ends.
5. Each installation requires clear, unobstructed access by the public, including sidewalks and mounting pads for Blue Light Phones.
6. There shall be no trip hazards in the vicinity of any Emergency Call Station or Blue Light Phone.
7. These areas shall be illuminated with a minimum of 2.5 maintained foot-candles.
8. Access to and operation of all emergency call stations and blue light phones shall comply with ADA requirements.
9. Power and data lines shall be installed in separate conduit systems.
10. Installations require a dedicated 120 VAC, 20A circuit connected to emergency power where available.
11. Each installation requires a single run of six strand multi-mode fiber. On the pole side the fiber shall be terminated with SC uncam connectors.

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- 12. Two (2) CAT 6 gel filled exterior cables shall be provided to each pole. These cables must be grounded at both ends.
- 13. All telecom cable for phones shall be in conduit from MDF or IDF room to emergency phone.
- 14. Exterior, below grade conduit shall be PVC 1" minimum diameter for both power and telecom cable.
  - a. Shall be installed a minimum of 24" below finished grade.
  - b. Shall not have more than two 90-degree bends to a specified outdoor telephone terminal, MDF room, hand hole or manhole.
  - c. Except as approved by Project Manager, exterior conduits shall be concealed and not surface mounted on side of buildings.
  - d. Interior conduit in concealed locations shall be 1" EMT minimum diameter, and" RGS in exposed locations.
  - e. Interior or wall mounted emergency phones can use interior telecom cable.

B. Emergency Elevator Communications System

- 1. One telephone cable in conduit shall be run from the nearest available MDF or IDF room into the elevator controller in the elevator machine room. This conduit shall be a minimum 1".
- 2. Refer to Construction Standards Section 14200 – Elevators/Wheelchair Lifts for additional information.

END OF SECTION 27 51 29

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**DIVISION 27 COMMUNICATIONS**

**SECTION 27 53 13 CLOCK SYSTEMS**

**1.1 LOCATIONS**

- A. The A/E shall consult with ITCS, Human Resources, and the University ADA compliance office when determining the number and locations for time clocks. Locations shall be such as to avoid door swings and must be ADA compliant.
- B. There should be one drop and one spare pulled to each clock location.
- C. Contractors shall install a single gang, flush mounted box for the data drops.

END OF SECTION 27 53 13

END OF DIVISION 27

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