

Telecommunication Standards

Iowa State University

VOICE, DATA AND VIDEO (CATV) SYSTEMS

A. Design and Installation Conformity

1. A Building Industry Consulting Services International (BICSI®) Registered Communications Distribution Designer (RCDD®) shall provide the design considerations and services for all system segments (e.g., closets, pathways, raceways, voice/data/video cabling, etc.).
2. An RCDD® shall provide oversight for intermediate and final inspections for all system segments (e.g., closets, pathways, raceways, voice/data/video cabling, etc.). The RCDD® shall seal appropriate drawings and specifications.
3. Every aspect of the design and installation shall, where applicable, conform to the latest additions of the following codes, standards and recommendations unless otherwise specified elsewhere in this document:
 - TIA/EIA 568B.1 - Commercial Building Telecommunications Cabling Standard General Requirements.
 - TIA/EIA 568B.2 – Commercial Building Telecommunications Cabling Standard Part 2 Balanced Twisted Pair Cabling Components
 - TIA/EIA 568B.3 – Optical Fiber Cabling Components Standards
 - TIA/EIA 569A - Commercial Building Standard for Telecommunications Pathways and Spaces
 - TIA/EIA 570B - Residential Telecommunications Infrastructure Standard
 - TIA/EIA 606A – Administration Standard for Commercial Telecommunications Infrastructure
 - J-STD 607A – Commercial Building Grounding (Earthing) and Bonding Requirements for Telecommunications
 - TIA/EIA 758A – Customer-Owned Outside Plant Telecommunications Infrastructure Standard
 - TIA/EIA 862 – Building Automation Systems Cabling Standard for Commercial Buildings

- BICSI® TDMM© – Telecommunications Distribution Methods Manual Vol. I & II
 - Meet or exceed the current top level of the CommScope SYSTIMAX® Solutions™ installation standards and guidelines
 - Comply with local codes that regulate Construction (new and existing) and all Life Safety issues (e.g., smoke/fire detection, containment and suppression) as drafted/adopted by local authorities having jurisdiction.
4. Only CommScope SYSTIMAX® Solutions™ products shall be used in every instance possible (e.g., cables, cords, blocks, panels, outlets, connectors, boxes, faceplates, etc.).
 5. For copper voice solutions, only the CommScope SYSTIMAX® GigaSPEED™ XL cables and the associated CommScope SYSTIMAX® Solutions™ product line in its entirety (no substitutions permitted) shall be designed and installed in every instance. Voice drop cables shall be blue in color.
 6. For copper data solutions, only the CommScope SYSTIMAX® GigaSPEED™ X10D product line in its entirety (no substitutions permitted) shall be designed and installed in every instance. Data drop cables shall be yellow in color.
 7. For optical fiber data solutions, only the CommScope SYSTIMAX® Solutions™ product line in its entirety (no substitutions permitted) shall be designed and installed in every instance.
 8. Only CommScope SYSTIMAX® Solutions™ Certified installers shall install, terminate and test the cabling plant.
 9. For voice, data and video (CATV) systems the contractor shall provide (in addition to other items as specified) the following materials in each telecommunications closet where applicable:
 - Protectors
 - D-Rings
 - Cable trays
 - Conduits and other raceways
 - Overhead ladder racks
 - Patch Panels - Data
 - Cables – Voice, Data & Video (CATV)
 - Data patch cables
 - Optical fiber termination cabinets
 - Sleeves – Horizontal & Vertical
 - Plywood backboards

- Connecting hardware
 - Grounding hardware
 - Equipment racks
 - Voice cable 110 blocks
 - Voice and data riser cables
 - Fiber riser cables
10. Telecommunications system design shall be detailed on a dedicated set of construction documents uniquely identified for all projects that affect more than ten voice and/or data outlets. Drawings shall include all components of the Telecommunications system as detailed above as a minimum. On projects with ten or less outlet changes the telecommunications system modifications are to be incorporated into the electrical documents.
 11. Telecommunications CAD layering system shall be set up to allow direct importing of the outlet and raceway layers into the Owners record drawings. Coordinate requirements with the Universities Project Manager.
 12. Telecommunications documents shall detail all room numbers for incorporation into the outlet numbering system.
 13. System design shall include a meeting prior to final review with building occupants, **Information Technology Services-Network and Communications** staff, project consultant Project Manger and FP&M staff to review the overall design, outlet locations, and planned use of outlets.
 14. The video design standards only include CATV systems. Video systems standards pertaining to closed circuit security cameras and their associated components not part of this standard.

B. Pathways and Spaces

1. Provide a riser sketch showing closets, connecting raceway, and all grounding required per EIA/TIA 607.
2. The design shall ensure adequate and safe support of all cable in each pathway.
3. Cable trays shall be provided above ceilings for orderly horizontal distribution of voice and data cabling. Cable trays shall consist of heavy-duty wire basket construction, 4-inch side rail, width as required. Acceptable manufacturers are GS Metals Flextray and CABLOFIL E-Z Tray.
4. Cable tray shall not be installed above hard ceiling such as sheetrock unless access is provided at intervals not exceeding 8 feet.

5. Cable trays in exposed areas shall be smooth solid bottom construction and installed at a minimum height of 8 feet above the floor. Tray shall be painted to match existing ceiling color.
6. Cable trays shall be used for all horizontal distribution and installed to meet ANSI/NFPA 70, Article 318.
7. All cable tray and conduit shall be installed level and parallel to building lines. Cable tray support system shall consist of trapeze style or tray manufacturer provided wall brackets. Center hung support systems are not allowed. Cable tray installed on walls shall utilize manufacturer provided wall supports that space the tray off the wall. Where cable trays penetrate floors provide covers to protect the cables to a height of 8 feet above the floor.
8. All cable tray and conduits shall be sized based on cable loading. Cable tray sizing shall account for other systems that may occupy the raceway system.
9. Cable tray to conduit connections shall be made to limit any bending stress on the cables. Provide appropriate cable protection consisting of bushings on the conduit, waterfalls in the tray, etc.
10. Breaks in cable tray are not allowed unless approved by Project Manager. Install offsets and other materials to negotiate pathway obstructions.
11. Cable tray and conduit fill shall not exceed 40% of cross sectional area at any location. This fill percentage shall factor in space considerations for future cabling requirements. Labs and other heavily wired locations require adequately sized feeder conduits servicing computer workstation clusters.
12. Cable tray system shall be allowed to support other non telecommunications (Telecommunications systems are defined as voice, data and video (CATV) system coax cabling) as follows:
 - a. Fire Alarm system cables will be allowed to be routed in the center of the cable tray for existing or new cable tray installations.
 - b. Building Automation system cables will be allowed to be attached to the outside of the cable tray or the tray support system for existing cable tray installations. For new cable tray installation cables will be allowed inside the cable tray only if a divider is present that segregates Building Automation cables from telecommunications cables.
 - c. Security, Access Control and CCTV system cables will be allowed to be attached to the outside of the cable tray or the tray support system for existing cable tray installations. For new cable tray installation cables will be allowed inside the cable tray only if a divider is present that segregates Security, Access Control and CCTV system cables from telecommunications cables.

- d. Leaky coax systems will be allowed to be attached to the underside of the cable tray or the tray support system for existing or new cable tray installations.
- e. Any and all other systems requesting access to the inside of the cable tray will require approval of **Information Technology Services-Network and Communications** Office.

Existing exposed solid bottom cable tray will require those systems not allowed inside the cable tray to provide a separate raceway system.

New cable tray systems shall be sized to accommodate all proposed cables with a 50% future growth. Where provided the divided section of the cable tray shall be designed to accommodate the Building Automation and Security, Access Control and CCTV system cables. Cable tray size shall not be determined until design of all systems proposing to utilize the tray has been determined.

All non telecommunications cables shall be properly supported and bundled. Cables placed in the tray system will not be allowed to be intermixed with Telecommunications system cables.

- 13. Conduit sleeves through floors for telecommunications systems are not to be shared with non telecommunications systems. **Conduit sleeves are to be provided that will allow for dedicated voice and data cable pathways.** Separate sleeves are to be provided for each non telecommunications system and identified by being painted a unique color.
- 14. Closet-connecting EMT sleeves shall be 4 in. in diameter and extend a minimum of 2 in. AFF and 2 in. below ceiling level on the lower floor.
- 15. All installed conduits are to be reamed and bushed at both ends and loaded with a minimum 200 lb. test pull line.
- 16. A maximum of two (2) 90° bends shall exist in any 1.5 inch conduit run without a pull box being placed in that run. No offsets allowed in conduits 2 inches and larger. Where offsets and bends are required provide an appropriate sized pullbox.
- 17. Conduit runs greater than 100 ft. shall require an intermediate junction box.
- 18. Bends are to be 6 times the I.D. for all conduits less than 2 in. in diameter and 10 times the I.D. for all conduits greater than 2 in. in diameter.
- 19. For voice and data telecommunications cabling, a minimum of 5 in. distance is required from any fluorescent lighting fixture or power line over 2kVA; and up to 24 in. from any power line over 5kVA. Both voice and data telecommunications cabling shall not be run adjacent or parallel to power cabling.

20. In no circumstance shall cable be fastened to the exterior of other piping systems (i.e. water, fire sprinkler, electrical conduit, etc.).
21. Contractor shall be required to restore all walls and floor slabs to their original fire ratings using appropriate fire stopping materials after penetrating walls or slabs with any type of horizontal or vertical raceway.
22. Wiremold™ metallic raceway may be used only with prior approval from Project Manager. The installation of Wiremold™ metallic raceway shall be limited to renovation projects, and then, only as a last resort. Minimum size shall be the Wiremold™ 2100 series system. Reuse of the Wiremold™ 500 or 700 series system is not allowed.
23. Drop cable raceway shall be embedded in the wall, wherever possible.
24. Raceways between ceilings and floor or ceilings and furniture are not allowed.
25. Each outlet shall have a dedicated raceway system back to the cable tray or MDF/IDF/TC as specified. Daisy chaining of outlets is not allowed.
26. Cable paths to modular furniture workstations must be enclosed and secure.
27. Each telephone/data/coax/fiber outlet shall consist of a double gang outlet box with a reducer plate and a one each 1 inch or two each ¾ inch conduits (to be determined on a project by project basis). Conduit shall be extended to the cable tray or MDF/IDF/TC as specified. All conduits shall be equipped with a pull line.
28. Poke through outlets shall be avoided.
29. Cable fill calculations for all raceways (wire basket tray, solid bottom cable tray and any conduit containing cables for more than one outlet) shall be completed and provided to Project Manager.
30. Outlet installations shall conform to the installation details numbered R1 to R8 on the Telecommunications ISP Installation Standards drawing “TELECOM 01”.
31. Underground raceway to the outlet is not allowed. At locations with slab on grade construction all outlet raceways shall route up to the cable tray or other raceway systems. At locations where no walls are available the raceway may be imbedded in the concrete floor (with a minimum of 2 inches of concrete below the conduit) only between the equipment and nearest wall.

C. Cabling and Connecting Hardware

1. Engineer shall provide a riser diagram in the project bid documents showing connecting raceway, telecommunications cabling risers and innerducts between all floors and closets.

2. Contractor shall provide all cable and connecting hardware for a complete system. Project bid shall be based upon current available materials with a unit price for each item to allow a change order to be issued if material requirements change. Contractor shall not order the materials until just before they are needed on the job site and shall be responsible for notifying the project manager for approval prior to ordering the material. Material order shall not be released until Project Manager has approved them.
3. All TC equipment racks shall be Amco Engineering P/N S22145. – 22” x 22” x 87” H., no exceptions. Two each vertical cable management spacers shall be provided between each rack in multi rack installations. Spacers shall be Chatsworth Products Inc, no exception, MCS-EFX Series vertical cable management in a 6”, 10” or 12” width. (Confirm size to be provided with Project Manager) Part numbers are as follows: 6" Part number: 40095-703, 10" Part number: 40096-703, or 12" Part number: 40097-703. Provide uni-strut bar bolted across the top at the front of each data rack for additional structural support to prevent the racks from twisting Paint the uni-strut black to match the data racks. The center rack of three rack assemblies shall contain a 4 rack space Panduit patch cord organizers, part number: NCMHAEF-4 and a CommScope SYSTIMAX® jumper storage shelf part number LSJIU-072-5.
4. Each rack shall be securely bolted to the floor or overhead cable tray in accordance with the manufacturer’s recommendation.
5. Voice drop cables shall be unshielded CommScope SYSTIMAX® GigaSPEED™ XL 2081 cables consisting of 8 conductors (4 pairs) per cable. Data drop cables shall be unshielded CommScope SYSTIMAX® GigaSPEED™ X10D 2091 cables consisting of 8 conductors (4 pairs) per cable. Voice drop cables shall be blue in color. Data drop cables shall be yellow in color. All drop cables shall be NEC-rated as CMP, plenum rated cables and contain 24 AWG conductors. Voice and data drop cables shall be isolated from each other through out the raceway system except for the final raceway to outlet location. This includes any conduit sleeves through walls and floors, i.e. dedicated sleeves shall be provided for each type of cable and intermixing of the cables is not allowed.
6. Voice riser cables shall be unshielded CommScope SYSTIMAX® 2010 LAN™ cables consisting of a minimum of 200 conductors (100 pairs) per TC. The riser cables shall be NEC-rated as CMP, plenum rated and contain 24 AWG conductors.
7. All copper data riser cables shall be unshielded CommScope 2061-025 LAN™ (Power Sum) cables consisting of 50 conductors (25 pairs) per TC. The copper data riser cables shall be NEC-rated as CMP, plenum rated and contain 24 AWG conductors.

8. In the TC, all data cable shall be terminated in modular CommScope SYSTIMAX® Gigaspeed X10D M3000 Modular Patch Panel, M3000-24 (part # 760065391) with a front water fall cord organizer and cover (part # 760035501) on the front of the M3000 panel loaded with up to 24 each Black MGS500 jacks. The Modular Patch Panels shall be installed with a 1 unit space between each assembly. The space shall be covered with a black blank filler plate as manufactured by Chatsworth Products Inc, no exception, # 30026701.
9. In the TC, all voice cable shall be punched down on CommScope SYSTIMAX® 110 style blocks in the TC as specified. Horizontal station cables shall be use the CommScope SYSTIMAX® 100C-4, four pair connector block. All entrance and riser cables shall use the CommScope SYSTIMAX® 100C-5, five pair connector block. Provide CommScope SYSTIMAX® 188B1 jumper trough between station and entrance/riser blocks.
10. All labeling of all cables and cable terminations shall be machine labeled by a label maker or in another manner only if pre-approved by the Project Manager. Specific labeling requirements will be per section "I" of this standard.
11. A star topology only shall be used to interconnect closets and from each closet out to each work area outlet. All backbone cable runs from a TC to another TC must be home run without splices. All cable runs from the TC to the outlet must be home run without splices.
12. The combined length of the Basic Link and the GigaSPEED™ X10D data patch cables and cables used to connect equipment in the work area and telecommunications closet shall not exceed 100 m (328 ft.) in length (Basic Channel).
13. No GigaSPEED™ X10D data cables shall exceed 90 m (295 ft.) in length (Basic Link) from the horizontal cross-connect to the outlet/connector.
14. The use of j-hooks shall not be allowed for voice, data or video (CATV) cables.
15. In no circumstance shall cable be laid directly on a suspended ceiling or tied to suspended ceiling support hangers.
16. Location and number of telephone/data/coaxial outlets will vary and must be determined during the building program design period by consultation with building occupants. Nominal density for planning purposes may be considered one (1) voice and one (1) data outlet and per 100 sq. ft. of occupied floor space. A standard office installation shall consist of one (1) voice and one (1) data outlet. Coaxial outlet density shall be established by the Project Manager on a building by building basis.

17. All work area outlet faceplates shall be quadplex CommScope SYSTIMAX® M14L Type, having four (4) outlet openings. Blank covers shall be placed over any unused openings. Voice outlets shall be ivory, data outlets shall orange, coax outlets shall be black. Icon inserts shall be “GS” for all voice and data outlets.
18. Each work area outlet shall consist of at least one (1) voice 8 pin CommScope SYSTIMAX® MGS400 GigaSPEED™ modular jack and one (1) data 8 pin CommScope SYSTIMAX® MGS500 GigaSPEED™ X10D modular jack, with data or voice jacks, LC optical fiber and/or F-style coaxial jack possibly specified in addition. Locations where only a voice or data are required will have only one jack installed in the faceplate.
19. In the work area, contractor shall terminate all four pairs (8 conductors) of each voice and data drop cable at the outlet using an 8 position T568B Standard pin out.
20. All .625 coaxial cable shall comply with the following:
 - Center construction of copper-clad aluminum per ASTM B-556 Class 10A
 - Dielectric of foamed polyethylene per ASTM D-1248
 - Outer conductor of a seamless full wall high purity electrical grade aluminum tube per ASTM B-221
 - Jacket construction of abrasion resistant, low coefficient of friction, medium density black polyethylene per ASTM D-1248
 - Sequential footage marking on outer jacket
 - Cold flowing, polyisobutylene for self healing
 - Acceptable manufacturer is Commscope CATV rated .625 or Project Manager approved equivalent
 - Installation restricted to underground conduits only.
22. All RG-6 and RG-11 coaxial cable shall comply with the following:
 - RG-6 cable shall have a center construction of 18 AWG copper covered steel, .040” O.D. (nominal).
 - RG-11 cable shall have a center construction of 14 AWG copper covered steel, .064” O.D. (nominal)
 - RG-11 cable shall be utilized as the trunk cable to a splitter. The RG-6 cable shall be the branch conductor to the outlet
 - Dielectric of foamed polyethylene with an inner shield of aluminum polypropylene-aluminum laminated tape with overlap bonded to dielectric
 - Third shield of non bonded aluminum foil tape
 - Outer shield of 42% 34 AWG bare aluminum braid wire
 - Outer Jacket shall be plenum rated.
 - Impedance of 75 ohms

- Velocity of propagation of 85%
- Maximum attenuation (per 100 feet)
- | RG-6 | RG-11 |
|--------------------|--------------------|
| At 55-Mhz: 1.60 DB | At 55-Mhz: 0.96 DB |
| At 1-Ghz: 5.65 DB | At 1-Ghz: 3.65 DB |
- Acceptable manufacturer is Commscope Model # RG-6 and RG-11 or Project Manager approved equivalent.
- Installation restricted to inside plant risers and outlets.

23. All .625 Connectors shall comply with the following:

- Cable fittings and connectors shall have a characteristic impedance of 75 ohms (30-dB return loss).
- All connectors shall be cable termination (TRM) series.
- Connectors shall be compatible with cable provided.
- Acceptable manufacturers are Pyramid Industries, Inc. (PI Series) or Gilbert Engineering (GRS Series) no exceptions.

24. All F-Connectors (RG-6 and RG-11 Coaxial) shall comply with the following:

- RG-6 and RG-11 coax cable shall be terminated at the directional tap, splitter or outlet location in a male “F” connector.
- The male “F” connector shall be matched to the RG-6 and RG-11 cable specified, be a single piece connector, and incorporate a 1/2” crimp ring which uses hex crimps.

25. All splitters required shall be rated at 1 Ghz. Splitter mounting shall be accessible above suspended ceiling or attached to the outside of the cable tray.

26. Each coax outlet shall consist of the CommScope SYSTIMAX® M81C-B video connector.

27. Coax cable F connector terminations shall only be installed at the splitter or outlet. All cable connectors at the MDF/IDF/TC shall be installed by campus CATV provider.

D. Interior Cable Field Testing

1. Contractor shall perform validation testing on all of the following cable types: optical fiber, coaxial, voice, and data.
2. For optical fiber, approved OTDR and Power Meter cable testers shall be used. The contractor shall submit a cable certification report for each cable with test results for the following categories:

| | Max. Attenuation (dB/km) | Min. BW (Mhz-km) |
|-----------------------|-----------------------------|---------------------|
| • | | |
| 62.5/125 µm Multimode | | |
| @850 nm | 3.75 db/km | 160 |
| @1300 nm | 1.50 dB/km | 500 |
| Single-mode | | |
| @1310 nm | 0.50 dB/km | N/A |
| @1550 nm | 0.50 dB/km | N/A |

- Bi-directional OTDR
- Length

3. Contractor shall perform validation testing on all coaxial cables. An approved cable tester shall validate each drop cable run from every closet to work area coaxial termination in every room and on the coaxial trunk.
4. For all .625 coaxial trunk cable the contractor shall submit a cable certification report for each cable with test results for the following categories:
 - Shorts
 - Opens
 - Impedance discontinuities
 - Location of impedance discontinuities
5. For all RG-6 and RG-11 coaxial drop cables, the contractor shall use an ohm meter for testing and shall submit a cable certification report for each cable with test results for the following categories:
 - Shorts
 - Opens
6. Contractor shall perform validation testing on all terminated 25 pair CommScope SYSTIMAX® 2010-100 LAN™ voice riser cables.

7. For all 25 pair voice riser cables, an approved cable tester shall be used. The contractor shall submit a cable certification report for each cable with test results for the following categories:
 - Wiremap
 - Length

8. Contractor shall perform validation testing on all terminated 25 pair CommScope 2061-025 LAN™ (Power Sum) data riser cables.

9. For all 25 pair copper data riser cables greater than 90 m in length, an approved cable tester shall be used. The contractor shall submit a cable certification report for each cable with test results for the following categories:
 - Wiremap
 - Length

10. For all 25 pair copper data riser cables less than or equal to 90 m in length, an approved cable tester that can measure Cat 5e characteristics shall validate, at 100 MHz, all 6 unique 4 pair groups within each 25 pair cable. Contractor to provide and install test equipment cords (2 m max. on each end of the link) and conduct “link” performance verification tests on each installed link in accordance with the contract. All cables shall meet or exceed the requirements for backbone, unshielded twisted pair cabling as specified in TIA/EIA 568A-A5. The contractor shall submit a cable certification report for each cable with test results for the following categories:
 - NEXT 32.3 dB minimum
 - Attenuation 21.6 dB maximum
 - PS-NEXT 27.1 dB minimum
 - ELFEXT 20.0 dB minimum
 - PS-ELFEXT 17.0 dB minimum
 - Return Loss 10.7 dB minimum
 - Delay Skew 43.0 ns maximum
 - Wiremap
 - Overall Pass/Fail

11. Contractor shall perform validation testing on all terminated CommScope SYSTIMAX® GigaSPEED™ XL voice and GigaSPEED™ X10D data drop cables. An approved cable tester shall validate each cable run from every closet to every voice and data jack in every room.

12. For all 4 pair copper voice and data drop cables, an approved Level III cable tester that can measure Category 6 and GigaSPEED™ characteristics shall validate, at 250 MHz, each cable run from every closet to every voice and data jack in every

room. Contractor to provide and install all preconnectorized patch cords and conduct “channel” performance verification tests on each installed channel in accordance with the contract. All cables shall meet or exceed the requirements for horizontal, unshielded twisted pair cabling as specified in TIA/EIA 568B. The contractor shall submit a cable certification report for each cable at 250 MHz with test results for the following categories:

| | | | |
|---|-------------------|---------|---------|
| • | NEXT | 33.1 dB | minimum |
| • | Insertion Loss | 35.9 dB | maximum |
| • | PS-NEXT | 30.2 dB | minimum |
| • | ELFEXT | 15.3 dB | minimum |
| • | PS-ELFEXT | 12.3 dB | minimum |
| • | Return Loss | 8 dB | minimum |
| • | Delay Skew | 45.0 ns | maximum |
| • | Wiremap | | |
| • | Overall Pass/Fail | | |
| • | Length | 328 ft | maximum |
| • | Propagation Delay | 45.0 ns | minimum |

13. The only approved copper voice and data cable testers are the latest models manufactured by Fluke® or Microtest®. The most current software, firmware and appropriate launch cords shall be used to validate each drop cable run from every closet to jack in every room.
14. All cable certification reports shall bear the location/room number and cable identifier for each cable tested. Test results/reports in both a paper and electronic copies by closet and building shall be delivered to the Project Manager according to the submittal procedures.
15. It is understood that contractor shall correct any cabling conditions that will have an adverse affect on the system’s ability to meet the requirements as specified in the project design document.

E. Telecommunications Grounding, Bonding and Electrical Protection

1. All bonding and grounding shall be in accordance with Equipment Manufacturers, ANSI/NFPA Articles 250 and 800, and J-STD 607A. These provisions include, but are not limited to, the bonding and grounding of service entrances, cable trays, conduits, ladder racks, equipment and equipment racks.
2. At all telecommunications closets install a Telecommunications closet Grounding Busbar (TGB) convenient to equipment location.
3. Busbars shall be drilled with holes as per TIA/EIA standard hole pattern, for attachment of bolted compression fittings.

4. Make all bonding connections, with listed bolts, crimp pressure connectors, clamps, or lugs.
5. All telecommunications equipment, frames, cabinets and over voltage protectors shall be directly bonded with a green insulated #6 AWG (minimum) copper conductor to the nearest grounding busbar.
6. Electro tin plated copper grounding busbars of minimum specified sizes shall be placed in all service entrances and telecommunications closets (3.94 in. H X .24 in. W X Variable length - 12 in. minimum). Install a Telecommunications Grounding Busbar (TGB) in each TC. Install the Telecommunications Main Grounding Busbar (TMGB) at the MDF. Refer to ANSI/NFPA 70 Articles 800 and 250, and TIA/EIA 607).
7. The TMGB shall be connected to the building's electrical service ground. Consult with Universities Project Manger to identify connection location in building with multiple service point.
8. Each TGB shall be directly attached to the closest point of the building's structural steel and also bonded to the TMGB via the TBB. The TMGB is, in turn, connected to the building's structural steel and also to the building's electrical service ground via the grounding electrode conductor (Refer to Figs. 2.1-1 and 5.2-1 in TIA/EIA 607).
9. All TGBs shall be connected to the TMGB via a continuous insulated #6 AWG (minimum) copper conductor Telecommunications Bonding Backbone (TBB). Size shall be increased to a maximum of 3/0 if system design and local conditions demand.
10. Wherever two (2) or more vertical TBBs are used within a building, the TBBs shall be bonded together with a TBB interconnecting bonding conductor (TBBIBC).
11. Bonding conductors shall be routed with a minimum number of bends. All bends placed in the conductor shall be sweeping.
12. Limiting the distance between the telecommunications closets will include designing an optimal grounding arrangement, which minimizes intersystem grounding disturbances.
13. All metal-sheathed cable shall be properly grounded and protected upon entering building.
14. Project drawings shall include a grounding riser diagram.

F. Wireless Equipment and Transmission Statement

1. The aim of this document is to provide for the efficient and controlled use of the radio frequency (RF) spectrum resources on the campus. This scope includes technologies effecting both wireless systems and RF-sensitive equipment. Here, wireless systems are defined as any entity that is designed to transmit or receive an RF signal as its primary function. This group includes two-way radio systems, cable TV receivers, systems used for on site news gathering, point to point and point to multi-point voice and data microwave systems, and wireless microphones that are used throughout campus. These systems are all intimately involved with the transmission and reception of RF signals as their primary function. RF-sensitive equipment however, is by definition, any equipment whose operation is susceptible to RF interference. RF-sensitive equipment on campus is harder to identify. This equipment may be a simple personal computer, monitor, personal electronic device or complex instrumentation equipment used in laboratory and hospital environments.
2. Every aspect of the design and installation shall, where applicable, conform to the latest additions of the following codes, standards and recommendations unless otherwise specified elsewhere in this document:
 - Code of Federal Regulations (CFR) Title 47 Parts 20 – 39: Covers licensing, operation and regulation of telecommunications.
 - FCC Rule Part 15: Covers electromagnetic radiation compliance requirements for wire and radio communications equipment.
 - ANSI/NFPA 70 – National Electric Code®
 - All wireless systems brought onto campus shall meet all relevant FCC guidelines including, but not limited to, type acceptance, frequency emissions and power output.
 - No aspect of any new wireless technology implementation shall interfere with or degrade the performance of any of the university's existing wireless systems and/or RF-sensitive equipment.
 - Designer shall fully assess and understand the technological impact of the submitted design on existing systems. Designer shall submit assessment results, including any electronic RF field measurements, to the **Information Technology Services-Network and Communications Office** for review and approval.
 - All proposed modifications to existing wireless equipment and/or systems shall be submitted in writing to, and reviewed by, the **Information Technology Services-Network and Communications Office** prior to contract award. It is

understood that no equipment shall be ordered or installed by the contractor until permission to proceed has been granted by the **Information Technology Services-Network and Communications Office**.

- All proposed new installation wireless equipment and/or systems shall be submitted in writing to, and reviewed by, the **Information Technology Services-Network and Communications Office** prior to contract award. It is understood that no equipment shall be ordered or installed by the contractor until permission to proceed has been granted by the **Information Technology Services-Network and Communications Office**.
- Every wireless work area receptacle shall provide outlets for both voice and data.
- An approved AC power outlet shall also be provided in proximity to each wireless receptacle where required.
- All wireless network antennas shall be located no more than 90 m from the serving MDF/IDF.

G. Removal of abandoned systems

1. Per National Electrical Code all abandoned telecommunications cables shall be entirely removed where ever possible. Systems included but not limited to all voice and data cables, coax cables, riser cables, outside plant cables, multimode and single mode cables, etc.
2. Scope of abandoned raceway system removal shall be coordinated with project manager.
3. Abandoned MDF's, IDF's and TC's shall have all equipment removed along with all plywood backboards.

H. System Commissioning/Cutover Activities

1. All room numbers shall be confirmed to be correct a minimum of thirty working days prior to any system commissioning or cutover activities. Any revisions to labeling caused by room number changes shall be corrected prior to proceeding.
2. Telecommunications Closet, MDF or IDF construction activities shall be completed prior to the installation of any University furnished and installed electronics and/or any system commissioning or cutover activities. This includes but is not limited to room related construction completed, HVAC systems to be operational, electrical systems and grounding completed, room locks in place and on permanent keys or access control, labeling completed, contractor tools removed and room is clean.

3. Startup activities associated with Elevators, Metasys, Access Control and Fire Alarm systems requiring voice and/or data services may be provided with temporary connections from telecommunications closet or other acceptable method. Permanent cables may be used if available.
4. Thirty working days prior to any final system commissioning, cutover activities or move in of occupants (which ever occurs first) the Contractor shall provide to Project Manager, **Information Technology Services-Network and Communications** Office and Design Professional one copy each of the red-marked as-built construction telecommunications documents. The documents shall include all outlet installed or affected by the project detailing the current locations and outlet number. Preferred format is 11 by 17 inch size. (All system wiring does not have to be complete for this step to be completed.)

I. Telecommunications Identification and Labeling

1. In addition to requirements in this Article, comply with applicable requirements in Section 26 05 00 H "Identification" in FDM Part 2/[Div 26 Electrical.pdf](#).
2. General Label Requirements:
 - Mechanically print and install all labels per drawing details.
 - Format: Select font size to be readable and to fit all information required without overlap of text. Font: Helvetica, Bold.
 - Use all capital letters. Use a one-line format.
 - Clean all surfaces prior to attachment of any label. Follow manufacturer's recommendations for cleaning and affixing labels.
3. Horizontal Cable Labels:
 - Label each cable at its origin and destination ends. A distinctive number shall be provided for each cable originating from a single communication closet. Cable numbering shall be based on station outlet locations and shall follow a logical pattern.
4. Station Outlet Faceplate Labeling shall be per the number indicated on the drawings and as follows:
 - Label Location: On the top of the faceplate in the outlet location window.
 - The manufacturer's paper label strip fits behind the clear plastic window.

- Label Information: Outlet location number. The information shall match the outlet location number shown on the floor plan drawings. Outlet numbers are unique to building.
- Method: Manufacturer's white paper inserts. Utilize commercial software to print the information on an adhesive label and affix the label to the paper insert or type the information on the strip. Labels shall not be affixed to the clear plastic window.
- Example: B112101AA, B112101AB, etc. The B11 is the building identification number as provided by Owner, 2101 is the full room number and shall be minimum of 4 characters (if building room is not at least 4 digits in length add leading "0's", i.e. 0014 to bring up to four characters), and "AA, AB, etc" would be the respective jack number in the room.

5. Patch Panel Labels:

- Label Locations: Centered over each patch panel jack location.
- Label Information: Floor plan termination number. Numbers are unique to building and floor. Refer to detail drawings.
- Example: 2101AA, 2101AB, etc.

6. 110 Blocks Labels:

- Label Locations: Within the label holder which is mounted in the center of the 110 block. The paper label strip slides into the plastic label holder that snaps onto the 110 block.
- Block Label Information: Outlet number for horizontal cabling, entrance cable number or building number and riser copper cable count (as applicable) in 4- or 5-pair increments. See detail drawings for label numbers.
- Method: Green color-coded paper strips for outside plant entrance cable terminations, blue color-coded paper strips for voice cable terminations and yellow color-coded paper strips for data cable terminations. Mechanically produced. Use cardstock weight paper.
- Examples:
 - Riser Cable: B11, 750-755. Where B11 equals building number and 750-755 equals pair count.
 - Entrance Cable: C01, 001-300, where C01 equals cable number and 001-300 equals pair count.
 - Station Cable: B11 2101AA.

7. Inside Plant Copper Cables:

- Label Locations: At each termination and splice point.
- Cable Label Information: Building number and riser copper cable count.
- Method: Mechanically produced.
- Example: D11, 1-300.

8. Outside Plant Copper and Fiber Optic Cables:

- Label Location: On the jack or sheath of the cable at the ends and at every splice, case, and manhole. Place near the hardware on which the cable is terminated.
- Locate label in a visible and readable location.
- Label Information: The cable identifier is the cable number followed by the cable pair count (numeric characters), both the beginning and ending count. The cable identifier is unique to the campus. Refer to the schematic drawings.
- Provide polyethylene non-conductive cable tags with cable numbers as shown on the plans. Provide "Mini-Tags" model number SH as manufactured by Almetek Industries, Inc. Install tags at all splices (on each cable that enters the splice case), terminations, cable tray to conduit transitions, in manholes (at least once on each cable as it passes through the manhole), and at other locations as directed by the Owner. The mini-tag holder shall be of sufficient length that the complete number is held in one holder with all information on one line.
- Example: A03 001-0100, A03 0101-0200

9. Cables, General: Label each cable within 4 inches of each termination and tap, where it is accessible in a cabinet or junction or outlet box, and elsewhere as indicated.

10. Inside Plant Fiber Optic Cables:

- Label Location: On the jacket or sheath of the cable at both ends (before the fanout or breakout point) and at every splice. Place the label near the cable entrance into the termination hardware and exterior to the termination hardware. Label shall be located in a visible and readable location.
- Label Information: Building Number, MDF number, fiber count and type. See detail drawings.
- Method: Brady label, part number WML-1223-292, or equivalent.

- Example: B01, 1A, 1-12 mm, 0001-0012

11. Equipment Racks:

- Rack Label Location: On the cross bar at the top of the rack on both sides of the rack.
- Rack Label Information: See detail drawings.
- Method: Machine printed Brady labels, part number PSL-514-619, or equivalent.
- Example: R001

12. Fiber Termination Enclosure Frames:

- Label Location: On the outside of the enclosure surface in the top left corner of the panel front.
- Label Information: Building Number, Telecommunications Room designation and termination shelf number. See detail drawings.
- Method: Machine printed Brady labels, part number PSL-1833-619-BK, or equivalent.
- Example: B11-1A-TS01

13. Building Fiber Terminations Within the Fiber Termination Enclosure Frames:

- Label Location: On the inside front panel of the enclosure in the location identified by the manufacturer for the label. In most cases, the manufacturer's label will be used and relabeled. The connector layout within each enclosure may vary. In general, the columns of fiber connectors are grouped in units of twelve (12) connectors. Columns count from left to right. Termination positions within a column count from top to bottom. Refer fiber termination numbering conflicts to the Owner for a decision.
- Label Information: Total fiber terminations within enclosure, 1- 144 maximum.
- Labeled as follows: F1, F2, F3 through F144.
- Method: Machine printed Brady labels, part number CL-111-619, or equivalent.

14. MDF or IDF Label:

- Label Location: On wall opposite the door, 12 inches below cabling tray. See detail drawings.

- Label Information: MDF or IDF name. These are named as follows:
- Building Number – Floor Number IDF Number (i.e., A20-1A where A20 equals the building number, 1 equals the floor number, and A equals the telecom room number). See detail drawings.
- Method: Adhesive label, 3 inches high with safety orange background and black lettering.
- Manufacturer: 3M P/N: Scotchlite 5025 reflective lettering system.

15. Cable Administration Drawings: Show building floor plans with cable administration point labeling. Identify labeling convention and show labels for telecommunications closets, backbone pathways and cables, terminal hardware and positions, horizontal cables, work areas and workstation terminal positions, grounding buses and pathways, and equipment grounding conductors. Follow convention of TIA/EIA-606. Furnish electronic record of all drawings, in software and format selected by Owner.