SECTION 27 00 00 - COMMUNICATIONS

PART 1 - GENERAL

1.1 REFERENCES

A. General provisions of Contract, including General and Supplementary Conditions and Division-1 Specification sections.

B. Architectural, Electrical, and Technology Drawings. Other systems drawings may apply. Division 26 Basic Electrical Materials and Methods sections apply to work of this section.

1.2 SUMMARY

A. This section describes the codes, standards, specifications, recommendations, and practices required for construction at The University of Colorado Denver | Anschutz Medical Campus for the Information Technology (IT) Services department. Section 27 00 00 applies to all telecommunications projects at The University.

B. The project general contractor (GC) is responsible for building telecommunications pathways and spaces as per the requirements described in this document. The project GC shall provide these specific items: spaces (telecommunications rooms, telecommunications entrance faculty, and equipment rooms), pathways (riser and horizontal distribution), grounding system, and fire suppression systems, as described below. The IT Services department is responsible, through its contractor, for providing cabling, data networking, and voice equipment.

Planning.

1. To facilitate provisioning of telecommunications services, the architect/engineer shall provide the University IT Services with floor plan drawings for new building construction and major renovation projects during design and at construction. CAD drawings of the Electrical/Communications plans shall be provided to IT Services upon release of construction document through the The University project manager.
2. The project's technology consultant shall meet with the building's projected occupants, IT Services Network Services, and IT Services Telecommunications, and other interested parties to determine the telecommunications requirements of the occupants. Compliance with overall campus telecommunications plans will also be validated during these meetings. The technology consultant shall submit all findings to IT Services for review and approval.
3. The preliminary plans, indicating service locations and space requirements, will be returned to project managers for inclusion in the final plans.

Consult with The University IT Services for the following.

1. Acceptability for specific substitutions of specified products.
2. Guidance in the application of a standard or specification in a non-listed or design situation.
3. Approval for deviation from standards and specifications or industry-standard methods and procedures if indicated by special circumstances.

E. Workmanship. All materials and equipment shall be installed in accordance with recommendations of the manufacturer as approved by the architect, to conform to initial design requirements or specification's and contract documents.

1.3 SUBMITTALS

A. Refer to Section 27 05 00 for requirements.

1.4 QUALITY ASSURANCE

A. Applicable Codes, Standards, and Specifications: The following list of codes, standards, specifications, recommendations, and methods and procedures (M&P) are applicable to the provisioning of telecommunications services for The University. They are incorporated by reference.

1. ANSI/EIA/TIA-526: Standard Test Procedures for Fiber Optic Systems.
2. ANSI/EIA/TIA-568-C.0: Generic Communications Cabling for Customer Premises.
3. ANSI/EIA/TIA-568-C.1: Commercial Building Communications Cabling Standards, Part 1: General Requirements.
4. ANSI/EIA/TIA-568-C.2: Balanced Twisted-Pair Communications Cabling and Components Standard.
5. ANSI/EIA/TIA-568-C.3: Optical Fiber Cabling Components Standard.
6. ANSI/EIA/TIA-569-A: Commercial Building Standard for Telecommunications Pathways and Spaces.
7. ANSI/EIA/TIA-606-A: Administrative Standard for Commercial Telecommunications.
8. ANSI/J-STD-607-A: Commercial Building Grounding and Bonding Requirements for Communications.
9. TIA-758-A: Customer-Owned Outside Plant Communications Cabling Standard.
10. ANSI/TIA-942: Telecommunications Infrastructure Standard for Data Centers.
11. ASTM: American Society for Testing and Materials
12. BICSI CO-OSP Design Manual (current edition): Customer-Owned Outside-Plant Design Manual.
13. BICSI Electronic Safety and Security (ESS) Design Reference Manual (current edition).
14. BICSI Network Design Reference Manual (current edition).
15. BICSI TDM Telecommunications Distribution Methods Manual (current edition).
16. BICSI Wireless Design Reference Manual (current).
17. EIA/TIA TSB67: Transmission Performance Specifications for Field Testing of Unshielded Twisted-Pair Cabling.
18. ICEA: Insulated Cable Engineers Association
19. IEEE-802.11 a, b, g, n: Wireless Local Area Networks
20. IEEE-802.3: 10Mb/s, 100Mb/s, 1Gb/s, and 10Gb/s Ethernet Standards as applicable based on media types (twisted pair copper, fiber optics, etc.)
21. IEEE-802.3ak: 10Gb/s Ethernet (evolving copper standard).
22. IEEE-802.3af: Power-over-Ethernet (PoE).
23. IEEE-1100-1999: Recommended Practice for Powering and Grounding Sensitive Electronic Equipment.
24. IEEE-141: Recommended Practice
25. IEEE-241: Recommended Practice for Electric Power Systems in Commercial Buildings.
26. ISO/IEC 11801: International Standard on Information Technology – Generic Cabling of Customer Premises.
27. NESC: National Electrical Safety Code
28. NEMA Stds Pub No. VE 1, Cable Tray Systems. Additionally, comply with current edition of NEC, as applicable to construction and installation of cable tray systems.
29. NEMA Std 250: Enclosures for Electrical Equipment (1000 Volts Maximum).
30. NFPA-70/NEC: National Electrical Code.
31. NFPA-72: National Fire Alarm and Signaling Code
32. UL Compliance: Provide products which are UL-listed and labeled.
33. USDA Bulletin 1751F-643: Underground Plant Design.

B. Requests for variations from code shall be submitted to the The University Code Official via the University project manager and must have IT Services approval. The University Code Official will either disapprove or approve the request. In general, requests for code variations shall not be looked upon favorably. Variations from standards may be authorized by the University IT Services on a case-by-case basis and must be requested in writing by the designer through the University project manager.

C. The University owns and maintains it telephone and communications distribution system. The Univesity IT Services will provide design parameters for the distribution systems and for systems in individual buildings, and IT Services shall be consulted during project design through the assigned the University project manager.

1.5 DEFINITIONS

A. Telecommunications. Any transmission, emission, or reception of signs, signals, writings, images, and sounds, or information of any nature by wire, radio, visual, or other electromagnetic systems. Includes, but is not limited to, voice communications networks, Local Area Networks (LAN), Wide Area Networks (WAN), and Local Exchange Carriers (LEC).

B. Telecommunications Room (TR). A floor serving facility for housing telecommunications equipment, cable terminations, cross-connections, and network electronics. The TR is the recognized transition point between the building backbone and the horizontal pathway facilities.

C. Equipment Room (ER). A campus serving space. An ER houses primary system electronics, power, and media distribution for a campus or groups of buildings. The Communications Center in Building 500 is an example of a campus serving ER. ERs require extensive planning due to their size, nature, scope, and complexity. ERs are not typically required for most projects.

D. Telecommunications Entrance Facility (TEF). Serves as the entry point into a building for the campus backbone media. TEFs interconnect the building backbone to campus backbone. The TEF is where conductive copper media receives it primary protection from sustained hazardous voltages. Therefore, significant wall space in the TEF may be required for primary protection of copper circuits. Also called the Service Entrance (SE).

E. Telecommunications Main Grounding Busbar (TMGB). The building’s main telecommunications grounding point. The TMGB is busbar placed in the TEF, ER, or a selected TR to provide interconnection to the building’s power ground via a bonding conductor for telecommunications.

F. Telecommunications Grounding Busbar (TGB). A common point of connection for telecommunications systems and equipment for bonding to ground. TGBs are required in all TRs and ERs.

G. Telecommunications Bonding Backbone (TBB). A conductor that electrically interconnects the TMGB to all TGBs.

H. Grounding Equalizer (GE). A conductor used to interconnect two or more vertical TBBs in multistory buildings. Previously called a Telecommunications Bonding Backbone Interconnecting Bonding Conductor (TBBIBC).

I. Network. Backbone media and electronics for transport of electronic information between campus entities.

J. Horizontal Distribution. The facility used for installation of media from the TR to the work area. Usually consists of cable tray and J-hooks to the work area faceplate.

K. Work Area (WA). A building space where the occupant generally interacts with the telecommunications equipment. WAs are typically defined as 100 ft2 of usable space.

L. L. Building backbone. The pathways between floors for distribution of media. Building backbone was previously called riser cabling.

M. Campus backbone. The pathways and media that provide connectivity between the Communication Center in Building 500 and all other buildings on the Anschutz Medical Campus (AMC). The campus backbone provides connectivity between buildings. The campus backbone represents the outside plant (OSP) infrastructure.

N. The University Information Technology (IT) Services. Department responsible for telecommunications on the University of Colorado at Denver and Health Sciences Center (the University) campuses.

O. Technology Consultant. A firm or member of a firm that has considerable technology design experience and possesses working knowledge and subject matter expertise in telecommunications code (NEC and NESC), industry standards (see TIA/EIA commercial standards in references), and BICSI methods and procedures (Telecommunications Distribution Methods Manual, LAN Design Manual, and Customer-Owned Outside Plant Design Manual).

1. IT Services maintains a list of pre-screened technology consultants that can be obtained from the the University project manager via IT Services.
2. Technology consultants used for the University projects shall be selected from the pre-screened technology consultant list.
3. Technology consultants not listed on the pre-screened technology consultant list must meet with IT Services for certification and possible inclusion on the list. Firms vying for campus technology consultant designation must possess a registered communication distribution designer (RCDD) on staff. The RCDD must be thoroughly familiar with campus standards and methods and procedures and be dedicated to the assigned project. Contact the IT Services Director of Communications (303.724.0440) for possible interview times.

PART 2 - DESIGN REQUIREMENTS

2.1 SPECIFIC DESIGN SPECIFICATION AND CONSTRUCTION REQUIREMENTS

A. Telecommunications Entrance Facility (TEF) or Service Entrance (SE).

1. All buildings require a TEF. The TEF serves as the entry point into a building for the campus backbone media. TEFs interconnect the building backbone to the campus backbone. The TEF shall be solely dedicated to telecommunications services. Space shall not be shared with electrical installations other than those designed and intended for telecommunications. The TEF shall be vertically aligned or stacked with the TRs to facilitate interconnection with the floors above and below. The University IT Services must be consulted if the TEF does not align with the building's TRs.
2. TEFs may be co-located inside TRs or ERs, depending on the size of the building they support. Buildings larger than 100,000 ft2 may require a dedicated TEF. Buildings with 5 or more stories shall have a shared TR/TEF that is 10' x 16'. That is, TRs serving as the TEF shall be a minimum of 10' x 16'. These larger TEFs shall support 5 equipment racks, with one rack being dedicated to fiber optics cable management. TEF ceiling height shall be a minimum of 8' 6".
3. The TEF shall be dry and free from the danger of flooding. The TEF shall not be located where water ingress is possible or probable. No water or drain piping shall be routed through the TEF that is not associated with TEF equipment. Steam, heat, and any other source of environmental hazard shall be avoided.
4. TEF location should be carefully considered. Accessibility for the delivery of equipment as well as expansion should be provided for. TR location must also be designed for maximum cable lengths as specified in associated documents listed in References.
5. The TEF location should not be adjacent to any source of electromagnetic interference (EMI). The TEF shall be located away from sources of EMI at a distance which will reduce the interference to 3.0 V/m throughout the deployed frequency range. Interference may not exceed 3.0 V/m throughout the usable bandwidth of the communications cabling. Bandwidth for telecommunications is up to 350 MHz.

6. Typical equipment requirements have a temperature range from 64°F to 75°F (18°C to 24°C) with a desired non-condensing, relative humidity range from 30% to 55%. Humidifiers are not typically required in TEFs. Consult IT Services for TEF cooling requirements.
7. The TEF is where conductive copper media receives it primary protection from sustained hazardous currents. Therefore, significant wall space in the TEF may be required for primary protection of copper circuits. All four TEF walls shall be covered by 3/4" non-combustible A/C plywood mounted 6” above the finished floor (AFF) to 8’6” AFF. (To see a sample of A/C fire rated plywood, contact Strait Lumber 11150 E. Colfax Avenue, Aurora CO or equivalent lumber supplier 303.366.3561; description: 4x8-23/32” AC Fire Retard Ply PLY34ACNC). The A-side (smooth side) of the sheet shall be outward facing. The A/C plywood shall be securely fastened to the wall.
8. TEF design must conform to vibration requirements specified in TIA/EIA−569.
9. The TEF lighting shall be a minimum of 500-lux (50 foot-candles) measured 1 meter from the finished floor and shall be mounted to meet the design configurations of the room. Emergency lighting is recommended.
10. The TEF door shall be a minimum of 36” wide and 80” high, without doorsill, hinged to open outward, unless restricted by building code, and fitted with a lock compliant with IT Services and Facilities assigned key codes.
11. Floors, walls, and ceiling shall be treated and sealed to eliminate dust. Finish shall be light in color to enhance room lighting. Antistatic flooring materials shall be used.
12. All TEF ceilings shall be a minimum of 8' 6" high, unobstructed; to provide space over the equipment frames for suspended cable trays or ladder racks. Suspended cable trays and ladder racks are typically installed at 7’ AFF. TEFs shall be free of false or suspended ceilings. Ceiling protrusions (i.e. fire suppression sprinkler heads) must be placed to assure a minimum of 8 feet of clearance from the finished floor.
13. A dedicated electrical panel shall be placed in each TEF to support telecommunications equipment. The panel shall be rated at 100 Amps or higher to facilitate future growth. The panel may not be shared, it is for the exclusive use of the TEF’s equipment. Emergency generator power is required for the TEF, if available in the project. Label the panel per campus standard.
14. A minimum of three (3) dedicated, unswitched 20A, 120-VAC duplex outlets, each on a separate circuit, shall be provided for equipment power at heights and locations specified by IT Services during the design phase. These three dedicated circuits shall be installed from above into the equipment racks as directed by IT Services. Additional convenience duplex outlets, on a separate dedicated unswitched circuit, should be provided at 6’ intervals around the room. Install the convenience receptacles 15” AFF or as directed by IT Services. Label all outlets to the campus standard. Emergency generator power is required for the TEF, if available in the project.
15. Sleeves or slots through walls and floors shall be fitted with approved re-enterable firestopping. Applicable codes, standards, and specifications shall be enforced.
16. Building backbone pathways connecting the TEF to TRs will require a minimum of four Trade Size 4” sleeves/conduits for interconnection, except where cable tray exists. A minimum of two (2) spare conduits must be installed when the TEF is not vertically aligned from floor-to-floor to allow for lower fill ratios.
17. Sprinkler heads shall be provided with wire cages to prevent accidental discharge. Preaction sprinklers are preferred over wet pipe or dry pipe systems. If wet pipe or dry pipe systems are employed, then drainage troughs shall be provided under the sprinkler heads and pipes to prevent leakage onto the TEF equipment. High temperature heads are preferred.

B. Telecommunications Room (TR).

1. A minimum of one TR shall be designated per floor and that TR shall be solely dedicated to telecommunications services. Space shall not be shared with electrical installations other than those designed and intended for telecommunications. TRs shall be vertically stacked to facilitate interconnection with the floors above and below.
2. The TR shall be dry and free from the danger of flooding. The TR shall not be located where water ingress is possible or probable. No water or drain piping shall be routed through the TR that is not associated with TR equipment. Steam, heat, and any other source of environmental hazard shall be avoided.

3. The minimum TR size is 10’ x 12’. Ceiling height shall be a minimum of 8’ 6”. Variations in size shall be approved by IT Services on a case-by-case basis and will be dependent upon the floor size and applications to be served.
4. TRs shall be designed to meet floor loading (minimum floor loading of 50 lbf/ft2) as specified in the references section.
5. TR location should not be adjacent to any source of EMI. The TR shall be located away from sources of EMI at a distance which will reduce the interference to 3.0 V/m throughout the deployed frequency range. Interference may not exceed 3.0 V/m throughout the usable bandwidth of the communications cabling. Telecommunications bandwidth is up to 350 MHz.
6. TRs require a temperature range from 64°F to 75°F (18°C to 24°C). The desired non-condensing, relative humidity range is from 30% to 55%. Humidifiers are not typically required in TRs. Temperature sensors shall be configured for alarm reporting and HVAC support units shall be installed on emergency power. A minimum of one air change per hour is required. Each TR supports 4 racks of equipment, with each rack requiring 5,000 BTUs of cooling. Fan coil units are the required cooling source.
7. All four TR walls shall be covered by 3/4" non-combustible A/C plywood mounted 6” AFF to 8’6” AFF. (To see a sample of A/C fire rated plywood, contact Strait Lumber 11150 E. Colfax Avenue, Aurora CO 303.366.3561; description: 4x8-23/32” AC Fire Retard Ply PLY34ACNC). The A-side (smooth side) of the sheet shall be outward facing. The plywood shall be securely fastened to the wall.
8. TR design must conform to vibration requirements specified in TIA/EIA−569.
9. The lighting shall be a minimum of 500-lux (50 foot-candles) measured 1 meter from the finished floor and shall be mounted to meet the design configurations of the room. Emergency lighting is desired.
10. The TR door shall be a minimum of 36” wide and 80” high, without doorsill, hinged to open outward, unless restricted by building code, and fitted with a lock compliant with IT Services and Facilities assigned key codes.
11. Floors, walls, and ceiling shall be treated and sealed to eliminate dust. Finish shall be light in color to enhance room lighting. Antistatic flooring materials shall be used.
12. All TR ceilings shall be a minimum of 8' 6" high, unobstructed; to provide space over the equipment frames for suspended cable trays or ladder racks. Suspended cable trays and ladder racks are typically installed at 7’ AFF in TRs. TRs shall be free of false or suspended ceilings. Ceiling protrusions (i.e. fire suppression sprinkler heads) must be placed to assure a minimum of 8 feet of clearance from the finished floor.
13. A dedicated electrical panel shall be placed in each TR to support telecommunications equipment. The panel shall be rated at 100 Amps or higher to facilitate future growth. The panel may not be shared, it is for the exclusive use of the TR’s equipment. Emergency generator power is required for all TRs, if available in the project. Label the panel per campus standard.
14. A minimum of two dedicated, unswitched 20A, 120-VAC duplex outlets, each on a separate circuit, shall be provided for equipment power at heights and locations specified by IT Services. These two dedicated circuits shall be installed from above into the equipment racks as directed by IT Services. These two unswitched circuits shall be homed from the dedicated panel described above. Additional convenience duplex outlets, on a separate dedicated unswitched circuit, should be provided at 6’ intervals around the room. Install the convenience receptacles 15” AFF or as directed by IT Services. Label all outlets to the campus standard. Emergency generator power is required for each TR, if available in the project.
15. Sleeves or slots through walls and floors shall be fitted with approved re-enterable firestopping. Applicable codes, standards, and specifications shall be enforced.
16. Building backbone pathways connecting TR’s will require a minimum of four (4) Trade Size 4” sleeves/conduits for interconnection, except where cable tray exists. A minimum of two (2) spare conduits must be installed when TR’s are not vertically aligned from floor-to-floor to allow for lower fill ratios.
17. Sprinkler heads shall be provided with wire cages to prevent accidental operation. Preaction sprinklers are preferred over wet pipe or dry pipe systems. If wet pipe or dry pipe systems are employed, then drainage troughs shall be provided under the sprinkler heads and pipes to prevent leakage onto the TR equipment. High temperature heads are preferred.

C. Equipment Room (ER).

1. ERs are not required for most buildings; contact IT Services for need and placement.
2. Generally, each campus requires a minimum of one ER. Buildings may require an ER if they are located at some significant distance from the Communications Center in Building 500. The IT Services department will specify when an ER is required. ERs shall be exclusively dedicated to telecommunications services. ER space must not be shared with electrical services other than those designed and intended for telecommunications. The ER should be centrally located to minimize the size and length of backbone cabling as well as provide easements and pathways for backbone and carrier services required of the room. The room shall not be adjacent to any high -voltage electrical services or water mains. A location should also be selected to allow for movement of large or heavy equipment. Access to cable pathways are required. ER walls should extend to structure and provide a sealed environment for equipment.
3. The ER may also serve as the TEF facility for local exchange carriers (LEC) or competitive local exchange carrier (CLEC) where such a separate facility does not exist. Adjacency to existing carrier entrance facilities is required.
4. Sizing of ER will be calculated using area of service, types of service provided, and projections of growth. IT Services design engineers will provide space requirements based on these factors. The minimum size of an ER is 150 ft2. Working clearances of 3 feet must be provided for all scheduled and installed equipment.
5. ERs may require access (raised) flooring to allow for the cable routing from cable vaults to equipment frames and PBX equipment. Cable tray, or equivalent, must be provided for cable management under the raised floor. Finished floor height must be at least 12” from the sub-floor to accommodate the cable management systems. The plenum area may be used for air handling for equipment cooling. All metal parts of the raised floor must be bonded to ground. Floor panels must be covered with high-pressure laminate or a durable, vinyl tile resistant to static electricity.
6. Floor loading capacity shall be sufficient to bear both the distributed and concentrated load of the installed equipment. The ER distributed loading shall be at least 100 lbf/ft2 and the concentrated loading must be at least 2000 lbf. Distributed floor loading may range as high as 250 lbf/ft2.
7. ER design must conform to vibration requirements specified in TIA/EIA−569.
8. The ER shall be dry and free from the danger of flooding. The ER must not be located where water ingress is possible or probable. No water or drain piping shall be routed through the ER that is not associated with ER equipment. Steam, heat, and any other source of environmental hazard shall be avoided.
9. The floors, walls, and ceilings shall be treated and sealed to eliminate dust.
10. All four walls in the ER shall be covered by 3/4" non-combustible A/C plywood mounted 6” AFF to 8’6” AFF. (To see a sample of A/C fire rated plywood, contact Strait Lumber 11150 E. Colfax Avenue, Aurora CO 303.366.3561; description: 4x8-23/32” AC Fire Retard Ply PLY34ACNC). The A-side (smooth side) of the sheet shall be outward facing. The A/C plywood shall be securely fastened to the wall.
11. ER location should not be adjacent to any source of EMI. Interference may not exceed 3.0 V/m throughout the usable bandwidth of the communications cabling. Sources of EMI should be kept 3 meters from the ER. Bandwidth for telecommunications is currently 350 MHz.
12. ER doors shall be a minimum of 36” wide by 80” high. Due to the nature of the equipment located in the ER, ERs require at least one oversized door (72” by 90”) to allow large equipment to be moved in or out. Doors should open outward if permitted by building code or be removable. ER doors shall be secured with either electronic access or a lockset specified by the University Facilities.
13. ER ceilings shall be a minimum of 8' 6" high, unobstructed; to provide space over the equipment frames for suspended cable trays or racks. ERs shall be free of false or suspended ceilings. Ceiling protrusions (i.e. fire suppression) must be placed to assure a minimum of 8 feet of clearance from the finished floor.
14. ERs require lighting with a uniform intensity of 500 lux (50 foot candles) when measured 1 meter above the finished floor. Indirect lighting is not recommended. Connect lighting fixtures for ERs to separate electrical circuits from those that accommodate the equipment in the room. To avoid blocking or filtering the light, do not place lighting equipment above equipment cabinets,

termination frames, or other freestanding equipment. Use a light colored finish to enhance room lighting. Provide emergency lighting in ERs.

15. Specific circuits for equipment in ERs will be designated during the space planning process and shall be placed according to IT Services approved blueprints. In addition to those circuits, additional electrical outlets are required in all ERs. All such electrical outlets shall be grounded, non-switched, and separately fused. ERs require one 120-VAC, 20-amp duplex receptacle per every 6 linear feet of wall space. Emergency generator power is required for ERs.
16. ERs typically house the building's TMGB, which is connected to the building's electrical entrance facility by the bonding conductor for telecommunications. An ER shall be equipped with a copper TMGB that is a minimum of 24" long, 4" wide, and ¼" thick. The TMGB shall be bonded to building structural steel, the entrance facility, and electrical service grounds with a minimum 6 AWG stranded copper. The TMGB shall be drilled and tapped to accept standard NEMA compliant grounding hardware. Equipment grounds shall use a minimum 6 AWG stranded, insulated copper to the TMGB and be attached with standard NEMA compliant grounding hardware. All TGBs will be bonded to the TMGB with TBBs that are a minimum 6 AWG insulated, stranded copper; with consideration given to using a 3/0 AWG conductor. Refer to J-STD-607-A and NEC Article 250.
17. Temperature and moisture shall be controlled in all ERs. Typical equipment requirements are:
    a. Temperature range from 64° F to 75° F (18° C to 24° C);
    b. Relative humidity range from 30% to 55%; humidifiers are required in ERs;
    c. Heat dissipation of 5,000 BTUs per hour per cabinet.
        1) Temperature sensors shall be configured for alarm reporting and HVAC support units shall be installed on emergency power. Consult IT Services for ER cooling requirements.
18. When cable services for any ER exceeds 1800 pairs, provide a separate room (cable vault) for cable splices. This room should be sized according to the requirements of the facility and should be located adjacent to the ER with free pathways to terminating equipment and cross-connect fields.
19. FM−200 fire suppression agent, or equivalent, is the preferred fire suppression agent in ERs. The ER should be free of automatic fire sprinklers, unless specifically required by building code. In such instances, the sprinklers should be a preaction system, not a wet pipe or dry pipe system. Additionally, such sprinkler systems must have troughs to prevent accidental water damage to the equipment.
20. Fire stops (area around sleeves, drilled core floor openings, and cables) shall be sealed or plugged with an 8-to-1 ratio expandable urethane foam with a 1" thick topping of water plug cement or equivalent. All unused sleeves must be plugged and capped with approved firestop.

END OF SECTION 27 00 00