MARICOPA COUNTY COMMUNITY COLLEGES DISTRICT

INFRASTRUCTURE TECHNOLOGY

CABLING STANDARDS

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FINAL

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DISTRICT STANDARDS

Purpose

These specifications are provided as standards for the cabling infrastructure for Information Technology Services and are organized according to the *Construction Specifications Institute (CSI) MasterFormat model.*

They are to include all new installations, re-models, renovations, and expansions. All work is to be signed off by the Customer Representative before final acceptance of the project.

All labor, materials, equipment, and related services for communications projects throughout the Maricopa Community College District are included in this document. The work to be performed includes Communications Room hardware; Pathways; Cabling/Terminations of copper and fiber; and Testing, Identifying, and Administration of the project.

DIVISION 7 -- THERMAL AND MOISTURE PROTECTION

SECTION 078400 Firestopping

PART 1 GENERAL

1.1 SUMMARY

A. It is the responsibility of the Electrical Contractor to seal all penetrations of a firewall, all floor corings and any other joint, gap, or openings where flame spread may occur.

B. It is the responsibility of the Cabling Contractor to seal all conduits, whether or not cable is installed in the conduit. All cable tray penetrations are also to be properly sealed.

PART 2 PRODUCTS

2.1 MATERIALS

- Sealants
- Mortar
- Putty
- Compounds
- Intumescent Pillows

PART 3 EXECUTION

3.1 PREPARATION OF SURFACES

A. Verify that all sleeves have been properly installed and are secured in place and supports are installed on both sides of the penetrated structure.

B. Prepare all surfaces before installing firestop material according to manufacturer's instructions.

C. All cable tray penetrations are to be completely sealed with intumescent pillow-style fire protection.

D. Replace and inspect any intumescent pillow-style firestop material after all cable has been pulled.

E. The firestop material must be rated at or above the rating of the surrounding wall or ceiling assembly. This includes both the T and F ratings.

F. All firestopping must adhere to NFPA, ANSI/NFPA-70 NEC, Article 300-21, EIA/TIA-569 and Chapter 11 of the BICSI TDMM Manual 10th Edition specifications.

DIVISION 27 -- COMMUNICATIONS

Section 270526 Grounding And Bonding For Communications Systems

PART 1 GENERAL

1.1 SUMMARY

This section details the procedures for the complete installation of the Common Bonding Network of the infrastructure system. This includes all cable tray sections, ladder rack, equipment racks, and any shielded cable entering the building.

PART 2 PRODUCTS
NOT USED

PART 3 EXECUTION

3.1 INSTALLATION PROCEDURES

A. All MCs/TCs will be provided a ground wire from the electrical contractor. This ground wire shall meet all requirements of ANSI/TIA/EIA-607 Commercial Building and Bonding Requirements. It shall also follow all NEC Article 800 and Article 250 along with Chapter 10 of the Tenth Edition of the BICSI TDMM Manual.

B. A Telephone Main Grounding Bar (TMGB) is to be installed in the Main Closet where the Outside Plant Cable enters the building. All TCs are to receive a Telephone Grounding Bar (TGB) for all grounding/bonding requirements for the building.

C. Lightning protection is to be grounded to the nearest TMGB or TGB, but not greater than 50 feet within the room.

D. The sheath of all inter-building cable shall be grounded to the Lightning Protection Block or to the nearest ground as close as practicable to the building point of entrance (NEC 800.93) and shall be as short as practicable.

E. All outside plant coaxial backbone cabling shall have its outer conductive shield grounded to the building premises as close as possible to the point of entrance to the building (NEC 820.93).

F. The ground is to be no longer than 6m (20 ft.) and shall have a grounding conductor no smaller than 14 AWG (NEC 820.100).

G. All sections of ladder rack are to be firmly bonded to each other using #6 conductor green-jacketed wire bolted at both sides through the aluminum frame. An alternative is to utilize bonding clamps designed for this purpose.

H. All ladder racks are to be bonded to the equipment racks utilizing the same methods as in 3.1.G.

I. Equipment racks are to be bonded to the grounding busbar (TMGB or TGB) utilizing #6 conductor green jacketed conductor.

J. All cable tray sections are to be bonded to each other for a continuous bonding system utilizing #6 conductor green jacketed conductor.

K. The cable tray assembly shall be grounded to the nearest electrical ground or TGB according to Section 270526.

Section 270528 Pathways For Communications Systems

PART 1 GENERAL

1.1 SUMMARY

A. All inside plant systems shall conform to all NEC and NFPA building codes. These systems include not only the voice and data cabling but also HVAC controls, security camera cabling, wireless access points, Audio/Video cabling, cable trays and conduit paths. Since this is the complete distribution of these technologies, the design should incorporate the vision of future growth and changes in current technologies. Flexibility should be of prime importance.

B. The vertical or riser systems are the means of inter-connecting the telecommunications closets, located on different floors or on the same floor.

PART 2 PRODUCTS
NOT USED

PART 3 EXECUTION

3.1 VERTICAL SYSTEMS (RISER)

A. A minimum of four 4" conduits or sleeves shall be installed between each closet. This will provide for ease of installation of the various services and allow for continued growth.

B. The total number of conduits/sleeves will depend on the location of the computer room, the number of floors in the building and the number of satellite closets on each floor. The maximum fill ratio shall not exceed 40%.

C. The engineer shall provide for a single line diagram of the conduit system for approval by the ITS Department.

3.2 CONDUIT/SLEEVES

A. All conduit and sleeves shall be EMT (Electrical Metallic Tubing) or rigid metallic conduit. EMT is the preferred choice because of its flexibility and lower cost.

B. The sleeves shall penetrate the floor no more than 3 inches AFF and protrude no less than 8 feet AFF if coming in from above. This will allow for the ease of installation of fiber innerduct and multi-pair copper cabling and allow for enough protection from the surrounding area.

C. If conduit is to be run to a satellite closet, there shall be no breaks in the conduit. All fittings are to be of the compression-type. A pull box shall be installed in the event that there are more than 180 degrees in bends, or if the conduit run is longer than 100 feet.

D. Label all pull box covers with permanent markers denoting "to/from" ends of conduits.

E. All conduits, including outlet box conduits shall be free of all burrs and be equipped with bushings at both ends.

F. No voice/data conduit shall be less than 1".

G. All Multi-Media outlets shall be minimum 1 1/2" that terminate in the floor for instructor stations. This conduit will be run from the plenum to a quadplex wall outlet and then to the floor assembly.

H. Wall outlets, such as classroom phones that only require one drop for a wall mounted phone can be ¾".

I. All voice/data conduits shall terminate on the same floor as they originated.

J. All voice/data conduits exiting the MC or TC should be routed overhead. Under slab is allowed only with prior approval from the IT department.

K. No PVC conduit is allowed except for PVC conduit in poured concrete.

L. Flex conduit is to be utilized only as a last resort and must be approved in advance by the ITS Department.

3.3 SURFACE-MOUNTED RACEWAY

A. Surface mounted raceway shall be two-channel metallic or plastic raceway. If using a metallic barrier between the two channels, this barrier must be bonded to ground.. The voice/data shall be in the upper channel with the electrical to be on the bottom.

B. A 2" trade size conduit and box shall be provided for every twelve feet of surface raceway and be located at the end of the raceway.

3.4 CABLE TRAY

A. Cable tray shall be a flexible tray system. and shall be UL-approved.

B. The minimum size shall be 4" x 12" for overhead systems which will allow for the installation of not only the voice/data copper cabling but will also allow for fiber innerduct and A/V cabling to be installed in the same tray.

C. Under floor cable tray systems are to be firmly affixed to the flooring utilizing a unistrut-style cross member or to the flooring supports utilizing manufacturers recommended hardware.

C. In low-profile raised flooring installations, a 1½" x 2" tray shall be utilized to keep the cable from lying directly on the slab.

D. Cable tray is to be installed as level as possible and should be run down hallways, public areas, or any other easily accessible area. Locating cable tray over classrooms and offices should be avoided as much as possible. These routes must be approved in advance by the ITS department.

E. All cable trays are to be firmly affixed to the upper deck or to an adjacent wall according to the manufacturer's instructions.

F. Cable tray is not to be center-hung.

3.5 ACCESSIBILITY

A. All cable tray and conduit ends should be easily accessible.

B. Extend conduit at least 12 inches past and completely over any intervening hard or inaccessible ceiling.

C. Cable trays should be only used above accessible or open ceiling areas.

D. Where cable tray runs are interrupted by hard ceilings or inaccessible areas, provide four 4" EMT conduits which extend beyond the cable tray on both ends by a minimum of six inches.

3.6 CONDUIT AVAILABILITY

The voice/data cable installers will be responsible for checking and confirming that all conduits are clean, dry, and acceptable before the pulling of any cable.

Section 270543 Underground Ducts And Raceways For Communications Systems

PART 1 GENERAL

1.1 SUMMARY

A. This section defines the pathways for the communication's infrastructure.

B The Electrical Contractor is responsible for the installation of the maintenance holes, hand holes and the duct bank system.

C. The Cabling Contractor is responsible for the sleeving of the conduits with the innerduct.

PART 2 PRODUCTS
NOT USED

PART 3 EXECUTION

3.1 BUILDING ENTRANCE REQUIREMENTS

A. All entrance conduits shall be either EMT or Schedule 40 PVC conduits. DB-120 is not permitted because of its thin wall construction.

B. Each Access Provider shall have their own path to the building entrance, whether a full 4"conduit or their own innerduct as required by the Service Provider.

3.2 UNDERGROUND CONDUITS

A. All conduits entering the building must be sloped to drain into the maintenance hole/hand hole and not into the building. This slope must be at least 1% at all points.

B. Conduits should enter the Maintenance Hole (MH) at the lower level of the vault and reserve the upper layers for expansion.

C. As a minimum, three 4" conduits shall be installed to each building. This will provide for one conduit for copper, one for fiber optic cabling and one for spare.

D. One 4" conduit will be sleeved with three 1¼" OR two 1½" and one 1" innerducts and will be the responsibility of the cabling contractor.

E. Electrical conduits shall be spaced no less than 12 inches from voice and data conduits, with either one sack slurry or sand fill. The top of the conduit shall be a minimum of 24 inches below grade.

F. Mark trenches with a metallic locater tape approximately 18 inches below grade.

G. Multiple voice/data conduits should be separated from each other using a spacing device such as Carlon spacers or equivalent

H. The minimum bend radius of any voice/data conduit 2½" or greater, shall be no less than ten times the diameter of the conduit. 4" conduits should have a minimum of a 36" long sweep.

I. No conduit from maintenance hole/hand hole to the building entrance facility shall have more than two 90 degree bends or any combination of bends/sweeps totaling more than 180 degrees.

J. Sweeps in PVC conduit 2½" or larger shall be metal or concrete-encased PVC.

3.3 PULL ROPES

A. All conduits or innerducts provided for the Access Providers shall have a MARKED, in feet or meters, pull rope with a minimum test rating of 200 pounds. No pull strings allowed.

B. All other ducts or innerducts shall have a pull rope with a minimum test rating of 200 pounds but are not required to be marked.

C. Clean and swab all underground conduits to remove dirt, debris, and moisture before installing final pull rope.

3.4 SEALING

Any empty conduit or innerduct that enters the building must be properly sealed in order to prevent rodents, water or noxious fumes from entering the building. These can be sealed with either expanding foam or Jackmoon plugs.

3.5 ABOVE GROUND CONDUITS/TRANSITIONS

A. Any PVC conduit exiting the ground, external to the building, where the trench was not filled with slurry, must exit using a metallic EMT long radius sweep and riser.

B. All metallic underground conduits shall be wrapped with a minimum of one half-lapped layer of 10 mil corrosion protection tape such as 3M Temflex 100 tape or equivalent. The corrosion protection tape shall be applied to underground conduit to a point at least 12 inches above grade.

C. Apply corrosion protection tape whenever metallic conduit is in contact with concrete or passes through it.

D. Metallic conduit shall not be installed in slabs.

3.6 MAINTENANCE HOLES AND HAND HOLES

A SIZING

1. Maintenance holes are to be sized according to the various services that they will house, including A/V taps, fiber optic cable splicing, and copper splicing.

2. The minimum size for a maintenance hole shall be 6’ x 6’ x 7’ deep.
3. All maintenance holes shall be pre-cast modular concrete units with a minimum 3500 psi rating.
4. Hand holes are to be 3’ x 3’ x 3’ as a minimum. These are not to be used for any type of equipment or splice but are to be utilized strictly as a pulling point for cable.

B. If the total of bends/sweeps exceeds 180 degrees or if the distance between pull points exceeds the recommended distance of 600 feet, a new pull point is necessary.

C. Each maintenance hole shall be racked with Unistrut on all four walls. This will provide for the necessary infrastructure in order to properly attach the copper and fiber to the maintenance hole.

D. Include all necessary non-corrosive hardware including rings, ladder, and all miscellaneous pieces. In no instance, will the cable be allowed to cross the middle of the maintenance hole but must be attached to the perimeter.

E. All cores shall be sealed on the outside of the conduit entering the maintenance hole/handhole with expanding foam.

F All maintenance hole/handhole access is to be elevated slightly above surrounding final grade to ensure proper drainage away from openings

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G. INTERNAL DRAINAGE

1. Maintenance holes/handholes are to have pea gravel as needed to assure that any water that enters to properly drain out into the pea gravel.
2. Solid bottom maintenance holes or vaults shall have a minimum 36” diameter by 4’ dry well filled with pea gravel beneath with a 12” diameter sump hole at the lowest area of the vault.
3. Hand holes are to have a minimum 8” diameter by 48” deep pea gravel sump allowing for proper drainage of hand hole.

H. MAINTENANCE HOLE COVERS

1. All covers are to be a minimum of 30” diameter by 6” overall depth (top and rim) cast iron cover/frame with extension rings as necessary.
2. Cover shall not be water tight to allow trapped gases to be released.
3. All covers, frames, and extension rings shall be traffic rated.

I. COVER MARKINGS

Each maintenance hole or hand hole cover shall be permanently marked denoting the type of service provided (e.g. “Telecom”, “Data”, or “Electric”).

Section 270553 Identification for Communications Systems

PART 1 GENERAL

1.1 SUMMARY

This section denotes the labeling schedule to be used for all documentation purposes. The Customer Representative is to define the labeling scheme to be used before the start of the project. The labeling requirements may differ from college to college but should follow the EIA/TIA 606 Standard.

PART 2 PRODUCTS
NOT USED

PART 3 EXECUTION

3.1 LABELS

A. All labeling standards shall comply with EIA/TIA 606 Class 3 specifications.

B. All labels are to be machine produced and permanently affixed to the cable or equipment such that the markings are clearly legible with a minimum of 8 point font.

3.2 HORIZONTAL VOICE/DATA CABLING

A. The MC of the building should be designated with the descriptor “01” for jack/cable numbering. Each TC shall have its own unique descriptor number.

B. The jack faceplate label should have the building descriptor, the MC/TC where the cable terminates and the jack number (e.g. “SC-02-142”).

C. The cable label should have the building descriptor, the MC/TC designator where the cable terminates, the jack number, and the position of the cable in the faceplate (e.g. “SC-02-142-b”)

D. Horizontal cables are to be labeled the same at both ends:

1. At the patch panel, the label is to be placed approximately 4" from the end of the cable.
2. At the jack, the label is to be placed approximately 2" from the end of the cable.

E. Multi-pair copper cable is to be labeled on the 110 block as to the location of pairs on the 110 block and the termination point at the far end (e.g. "Pairs 1-50 at SC-02" , "Pairs 101-200 at Lib-01", etc.).

3.3 COAX CABLES

A. Backbone Coax cable is to be marked with the distant end termination, either the MC/TC or the Room number if the head end is not located inside the MC/TC (e.g. "To SC-02" or "Room SC115").

B. Each coax splitter shall be labeled as to its approximate location (e.g. "Hall-142" or "Floor 165").

C. Coax drops are to be labeled with the distant end descriptor according to the different scenarios:

1. If the coax drop terminates at the jack outlet, the number of the jack outlet shall be the descriptor (e.g. "SC-01-123")
2. If the coax cable terminates at a splitter, then the splitter descriptor shall be used e.g. ("Hall-142")
3. If the coax cable terminates at the head end, then the head end descriptor shall be used e.g. ("SC-02, Port 3")

3.4 FIBER CABLES

A. Fiber optic cable sheath is to have the strand count and the distant end of the cable clearly labeled before entering the LIU to which it is terminated (e.g. "12 strand from SC -02")

B. Fiber optic LIUs are to be labeled for each fiber optic cable,--the number of strands, the type of fiber, either MM or SM, and the descriptor of the other end (e.g. "1-12 MM SC-02", 13-24 SM SC-02")

C. Fiber optic cable innerduct is to be clearly marked in the MC/TC as to the presence of the cable in the innerduct. Labels such as "Caution-Fiber Optic Cable" or similar are to be firmly affixed to the innerduct using means such as tie wraps.

D. Empty innerducts are not to be labeled except for the descriptor of the far end (e.g. “SC-03”). This will show that the innerduct has no fiber inside and is available for use.

Section 270600 SCHEDULES FOR COMMUNICATIONS

PART 1 GENERAL

1.1 SUMMARY

A. Customer representative shall provide to cabling contractor complete electronic backgrounds in .dwg AutoCad format for all affected buildings/areas.

B. These submittals will then be populated with jack numbers corresponding to the actual location of these jacks within the building. This information will be on its own layer and color.

C. The MC/TC numbers, either the room number or the closet identifier, shall be clearly denoted on the drawings as to the MC/TC identifier (e.g. “TC-02”).

D. Coax splitter locations are to be denoted on the drawings the same as the splitter’s identifier.

E. One hard copy of cable plant records is to be given to appropriate Customer Representative at completion of job.

F. These records are to include:

1. Location’s Room number
2. Coax Splitters and their locations
3. Fiber counts to each location and type of fiber
4. Patch Panels port count in each location
5. Test Results for copper station cable
6. Continuity of all multi-pair cables
7. Fiber Test Results
8. One CD with AutoCad drawings complete with above

PART 2 PRODUCTS
NOT USED

PART 3 EXECUTION
NOT USED

Section 271100 Communications Room Fittings

PART 1 GENERAL

1.1 SUMMARY

This section defines the cabling infrastructure for outside plant and inside plant cabling systems terminations. It also defines all necessary racking, termination blocks, patch panels and cable management.

PART 2 PRODUCTS
NOT USED

PART 3 EXECUTION

3.1 BUILDING CLOSETS DESCRIPTIONS

A. The main telecommunications room (MC) serves as the demarcation point for the building. It is utilized as the transition point from outside plant cable, copper or fiber, to inside plant cable. This room can also serve as the telecommunications room (TC)

B. In a multi-floor building, the MC can serve as the telecommunications closet if it is located directly below the other TCs.

C. Connecting conduits or raceway systems shall be installed either to serve the telecommunications closet or the area directly around the MC if the MC is utilized as the TC.

D. A satellite closet is a small closet with limited cabling and no networking equipment.

E. A telecommunications enclosure is a stand-alone cabinet with its own electrical, and HVAC controls.

3.2 MAIN TELECOMMUNICATIONS ROOM (MC- MAIN CLOSET)

A. ENTRANCE. The building entrance room (ER) or the MC shall be located near bathrooms, corridors, electrical rooms, etc. This will minimize the possibility of needing to relocate the room if the floor is remodeled. The center of the building is preferable, for three reasons:

1. Interior walls are cooler than exterior walls so the rooms require less air conditioning during the summer.

2. By centralizing the MC, the room can also be utilized as the TC for that floor.
3. Length of pulls minimized by a central location.

B. ACCESS. The MC should be off of a corridor or through an electrical/mechanical room. Access through restrooms, classrooms, or offices is STRICTLY prohibited and design considerations must be taken into account to eliminate the possibility of this occurring in re-modeling scenarios.

C. SERVICES. All services such as HVAC, water lines, or major electrical lines should not be located directly above the MC.

D. SIZING. The MC should be sized according to the amount of cabling and equipment that is to be located there and whether or not the MC will also be utilized as the telecommunications closet or the TC. As a minimum, the MC shall be 100 square feet, 10' x 10'. TCs shall be a minimum of 80 square feet 10' x 8'. (See Appendix B for Layouts)

E. CONDUITS. All conduits entering the Main Telecommunications closet shall be located within six inches of the wall and extend no more than 3 inches above the finished floor (AFF) or extend downward from the plenum at no less than eight feet AFF.

F. ELECTRICAL

1. The electrical requirements will vary greatly, depending on whether or not the MC is also a TC. If there is no equipment located in the MC, standard electrical outlets can be utilized. Sufficient numbers of outlets shall be installed in order to provide for future expansion, both for 120 v. and 208 v. circuits.
2. If electronic equipment is to be installed in this closet, isolated grounds must be installed. At a minimum, three 120 volt duplex receptacles and one 208 volt receptacle must be installed.

G. STRUCTURAL. The vertical clearance of the rooms should be a minimum of eight feet six inches in order to provide for fire sprinklers, lighting, ladder rack, etc. (See Appendix B for suitable layouts).

H. WALLS. All walls shall extend from the finished floor to the upper deck or roof above. It is necessary to extend beyond the ceiling in order to provide additional security measures. At a minimum, two walls shall be covered with ¾" x 4' x 8' tall plywood, free of all voids, mounted six inches AFF. The plywood must be coated with a minimum of two coats fire-retardant paint, painted to match the walls. (See Appendix B for layout.)

I. FLOORING. The floors shall be finished with a low-static, no static material such as VCT or bare concrete, sealed with a high quality concrete sealant. IN NO CIRCUMSTANCES WILL CARPETING BE ALLOWED IN THE MC OR TC.

J. CEILING. The ceiling shall be a suspended gypsum board ceiling constructed such that no ingress or egress can occur. False ceilings are strictly prohibited. Conduit must be provided to extend beyond the walls so that additional cable may be added at a later date.

K. LIGHTING. Incandescent lighting is highly recommended over fluorescent lighting in this area. Fluorescent lighting can create unacceptable levels of EMI which can be induced into nearby cabling. Care must be taken if fluorescent lighting is used to maintain a minimum of 12 inches between the light fixtures and any cable tray or ladder rack. A minimum of 50 foot candles at a height of three feet AFF must be maintained. All lighting should be on a motion sensor or timer switches.

L. HVAC. If the MC houses electronic equipment, air conditioning must be maintained on a 24 x 7 x 365 basis. This may require a split system A/C unit such as a Hitachi or Samsung wall unit, with a minimum capacity of 1½ tons of cooling. The building's zone system may serve this room if it is available on a continuous basis or may serve the room on a primary basis with the split system providing for off hours cooling.

M. LAYOUT OF ROOM. The layout of the room will depend on the services provided. See the Appendix for suitable layouts for Main and Telecommunications Closets, along with shallow room build outs.

3.3 TELECOMMUNICATIONS CLOSETS

A. The difference between the telecommunications closet (TC) and the main closet (MC) is the type of facilities that each serves. The TC does not house the outside plant cabling and equipment.

B. There shall be at least one telecommunications closet per floor or one per building.

C. Telecommunications closets located on different floors shall be stacked vertically.

D. SIZING The size of the telecommunications closet depends on the area served and the services provided. The following are the minimum recommended sizes for various service areas:

- 5,000-8,000 square feet 10' x 8'.
- 8,000-10,000 square feet 10' x 10'
- 10,000 square feet or greater a second TC is to be installed

E. LOCATION The location of the telecommunications closet shall be as close to the center of the building as possible. This will minimize the horizontal cable lengths. If any cable length exceeds 295 linear feet, a second location shall be installed. As a general rule of thumb, a 250 foot radius from the TC should be used. This will take into account conduit design and vertical distances. Take into consideration the ACTUAL path that the cable will need to traverse including vertical distances. If conduit runs exceed 295 linear feet, due to building configurations, then a second TC on that floor MUST be installed.

F. SPECIFICATIONS The specifications for lighting, HVAC, grounding, structural requirements and layout should follow the same requirements as for the MC.

3.4 TELECOMMUNICATIONS ENCLOSURES /SATELLITE CLOSETS

A. For small buildings, less than 5,000 square feet, an exception to the previous chart MAY be allowed by written approval of the Customer Representative. If this building has a low density of computers, a shallow room such as a 4' x 8' closet or a Telecommunications Enclosure may be substituted ONLY by the prior approval of the IT Department of the Customer Representative. See Appendix B for this configuration.

B. SPECIFICATIONS. These closets/enclosures should not require any additional HVAC since most will not house any amount of electrical equipment. Isolated electrical outlets and a switched lighting source should be all that is required. All equipment and cabling will be rack mounted so plywood backboards are also not required.

Section 271113 Communications Entrance Protection

PART 1 GENERAL

1.1 SUMMARY

A. This section describes the necessary copper protection from lightning strikes. This is necessary whenever copper cabling, either coax or twisted

pair runs outside of a building. This protection is not only for personnel safety but also protects sensitive electronic equipment from transient voltage caused by a nearby strike.

B. A complete building lightning protection is beyond the scope of this document.

PART 2 PRODUCTS
NOT USED

PART 3 EXECUTION

3.1 LIGHTNING PROTECTION

A. All copper cable, either multi-pair or coaxial cable is to be terminated on lightning protection within 50 feet of the entrance into the building according to ANSI/NFPA 70, EIA/TIA 571.

B. All pairs of inter-building twisted pair copper cable are to be protected on both ends to lightning protection blocks such as Systi-Max 188 ENA xxx or Circa 19” rack-mount 1880ENA/NSC-200.

C. Lightning Protection Blocks are to be grounded to the nearest Telephone Main Grounding Bar (TMGB) or Telephone Grounding Bar (TGB)

D. Lightning protection modules are to be solid state ATT 3X1S or Circa C4B1S or Circa C3B1S.

3.2 COAX CABLES

Coax cables are to be terminated on a video distribution head-end, installed with a lightning protection fuse, grounded to the nearest acceptable ground as outlined in Section 270526.

Section 271116 Communications Racks, Frames, Enclosures

PART 1 GENERAL
NOT USED

PART 2 PRODUCTS
NOT USED

PART 3 EXECUTION

3.1 EQUIPMENT RACKS

A. Communications Racks are to be black or brushed aluminum, 7’ high x 19” wide.

B. Racks are to be securely fastened to the underlying deck or raised flooring using lag bolts, all-thread, or any other acceptable fastening method as approved by Customer.

C. Racks are to be secured on the top by either 12” or 18” ladder rack, which in turn is firmly attached to the surrounding areas using appropriate mounting hardware.

D. Equipment Racks are to be installed parallel to the longest walls of the MC or TC and no closer than 30” to the wall, allowing for sufficient clearance for MACs.

E. Equipment racks are to have EIA-310-D 5/8” 5/8” ½” hole patterns.

3.2 ENCLOSURES

Enclosures should only be utilized in small buildings where there is a harsh environment, such as a Performing Arts building where sets are designed and sawdust is prevalent. These enclosures are to be sealed as much as possible and if electronics are present, environmentals must be considered. Liebert’s Foundation Series would be one acceptable solution.

Section 271119 Communications Termination Blocks and Patch Panels

PART 1 GENERAL
NOT USED

PART 2 PRODUCTS
NOT USED

PART 3 EXECUTION

3.1 COPPER TERMINATION BLOCKS

A. All copper termination blocks are to be 110-style, 100 pair or 300 pair with legs.

B. The nearest column to the Lightning Protection Blocks shall be used for cross-connect to either horizontal station cable or to intra-building multi-pair cable.

C. A horizontal cross-connect field shall be installed between any multi-pair blocks to horizontal station cable block.

D. Termination of multi-pair cable to multi-pair cable may be terminated on the same 110-style block with no cross-connect necessary.

3.2 COPPER PATCH PANELS

A. Patch Panels are to be 19" with black finish utilizing EIA-310-D 5/8" 5/8" ½" hole patterns.

B. Patch Panels are to be mounted on equipment racks or to wall-mounted swing-out brackets.

C. Patch Panels are to be no more than 48 ports allowing for cable management between multiple panels.

D. Angled patch panels are acceptable but should not exceed 48 ports. Horizontal cable management is not necessary if this style is utilized.

E. All copper Patch Panels are to have the pin-out structure according to EIA/TIA 568 A standards.

F. Patch Panels are to be of the same category rating as the horizontal cabling to be terminated. Multi-pair cabling is to be a minimum of Category 5.

3.3 FIBER OPTIC PATCH PANELS (LIUs)

A. Fiber Optic patch panels (LIUs) are to be rack mounted at the top of the rack. All connectors are to be located within the LIU so that no patching of fiber is outside of the LIU.

B. Fiber optic bulkheads are to contain either Small Form Factor LC connectors (preferred) or SC connectors. This is to be determined by the Customer Representative.

C. All LIUs are to be of the lockable type.

D. LIUs are to have a splice shelf for cable storage.

E. LIUs are to allow for both top and bottom cable entry.

Section 271123 Communications Cable Management and Ladder Rack

PART 1 GENERAL
NOT USED

PART 2 PRODUCTS
NOT USED

PART 3 EXECUTION

3.1 HORIZONTAL WIRE MANAGEMENT

A. Horizontal wire management is to be either finger mold style with cover (preferred style) or ring run style.

B. As a minimum, horizontal management is to be placed near the top of the equipment rack and between every 48 ports of patch panels when non-angled patch panels are utilized. In all cases, one horizontal wire manager is to be placed between the last patch panel and the networking equipment.

3.2 VERTICAL WIRE MANAGEMENT

A. Vertical wire management is to be either finger mold style with cover (preferred style) or the open ring style.

B. As a minimum, vertical wire management is to be placed on one side of the equipment rack, left or right, both front and back of the rack. Both sides, front and back is the preferred method.

C. Innerduct is to run through the vertical wire management if fiber optic cable is present.

3.3 LADDER RACKING

A. Ladder Rack is to be of the tubular style either 12” or 18”. 18” ladder rack is necessary in the MC or the Data Center where a high density of fiber optic and copper cabling exist. 12” is suitable for most ICs.

B. Ladder Rack is to be firmly affixed to the surrounding area.

3.4 TIE STRAPS

A. Horizontal station cables are to be bundled with hook and loop style tie straps (such as Velcro® tie straps) within the MCs and TCs.

B. Tie straps shall be only as tight as needed for proper cable management but not so tight as to cause deformation of the cable jacket which can cause degradation of the signal.

C. No tie wraps are to be used in the MC or TCs.

Section 271313 Communications Copper Backbone Cabling

PART 1 GENERAL
NOT USED

PART 2 PRODUCTS
NOT USED

3.1 OUTSIDE PLANT CABLING

A. All outside plant copper backbone cabling is to terminate on 110-style lightning protection blocks as described in Section 271113 on page 3.

B. All inter-building multi-pair copper cabling is to be run through its own 4" conduit. If coax cable is run, it is permissible to run the two in the same conduit.

3.2 INSIDE PLANT CABLING

A. All inside plant copper backbone cabling shall terminate on either lightning protection blocks if terminated to inter-building cable or on 110-style patch panels.

B. Multi-pair copper cabling shall be a minimum of Category 5 cable. The recommended cable shall be Category 5, plenum, 24 AWG with a nominal impedance of 100 ohms.

C. All riser cable is to be a minimum of CMR rated. This cable must meet all ANSI/NFPA-70 Article 800 specifications.

D. All abandoned riser cable (vertical cable) shall be removed according to NEC 800.154(B)(1).

Section 271323 Communications Optical Fiber Backbone Cabling

PART 1 GENERAL

1.1 SUMMARY

A. It is recommended that both single mode and multi-mode fiber optic cable is pulled between buildings if distances allow. This is determined by the needs of the Customer but a ratio of 1 MM to 1 SM is now the de facto standard.

B. As a guideline the maximum supportable distances can be used according to ANSI/TIA/EIA-568-B.1-3.

- 100Base-FX 2000 meter (650 ft.) @ 1300 nm
- 1000Base-SX 550 meter (1800 ft.) @ 850 nm
- 1000Base LX 550 meter (1800 ft.) @ 1300 nm
- 1000Base LX 5000 meter (16350 ft.) @ 1310 nm Single mode
- 10GBase-LX4 10000 meter (32700 ft.) @ 1310 nm Single mode

PART 2 PRODUCTS
NOT USED

PART 3 EXECUTION

3.1 FIBER COUNT

A. All inter-building fiber optic cabling shall be MM PVC 50/125 µm gel-filled loose-tube cable and/or SM PVC 8 µm gel-filled cable.

B. All intra-building cable shall be orange, plenum-sheathed 50/125 µm tight buffered LOMM cable or 8µm yellow single mode cable plenum-sheathed tight buffered.

C. Air-blown fiber systems may be looked at as an option to the conventional fiber optic installation method if it is cost effective to do so, primarily in new inter-building construction.

3.2 INNERDUCT

A. All fiber optic cabling is to be run through PVC innerduct between buildings and plenum innerduct intra-building. PVC innerduct is to be terminated before entering any plenum area.

B. All fiber optic innerduct is to be securely fastened to equipment racks, plywood backboard, and ladder racks.

3.3 FIBER TERMINATIONS

A. All fiber optic cabling is to be terminated in LIUs or fiber enclosures. All terminations are to be enclosed within the LIU such that no fiber termination is exposed outside of the LIU.

B. All terminations are to be LC or SC connectors which meet or exceed TIA 455 and ISO/IEC 874-1 performance specifications.

C. All fiber strands shall be terminated at both ends. This will allow for a complete system that can be tested and certified.

D. Fiber optic strands are to be terminated in the LIU according to fiber optic color code standards. (See Appendix C)

Section 271333 Communications Coaxial Backbone Cabling

PART 1 GENERAL

1.1 SUMMARY

This section describes the coaxial backbone cable distribution system. A complete and concise distribution plan should be written prior to the installation of the backbone cable. This distribution system is more complex than the horizontal twisted pair cabling infrastructure and requires a thorough analysis of the requirements of the broadband applications.

PART 2 PRODUCTS
NOT USED

PART 3 EXECUTION

3.1 BACKBONE COAX CABLE

A. Outside plant coaxial cable shall be either a .500 or .750 inch diameter cable with a nominal impedance of 75 ohms. The size will need to be determined by the broadband designer/installer and be sized according to the bandwidth requirements necessary for the applications.

B. Outside plant coaxial cable may be pulled through the same conduit as the multi-pair copper cable if pulled at the same time.

3.2 DISTRIBUTION HARDWARE

A. All distribution blocks, splitters, amplifiers, and any other miscellaneous connectors shall be gold-anodized.

B. All distribution blocks, splitters, amplifiers, and any other miscellaneous connectors shall be firmly affixed to the plywood backboard.

Section 271513 Communications Copper Horizontal Cabling

PART 1 GENERAL

A. All voice/data cables shall be 4–pair, UTP, 22-24 gauge plenum-sheathed cable. The outer jacket of the horizontal cable shall have the following jacket colors:

- Category 3—White or grey
- Category 5/5e—Blue
- Category 6--Yellow

This will provide for easy identification of rated-cabling.

B. The total length of the cable from jack outlet to 110 block shall not exceed 295 feet.

PART 2 PRODUCTS
NOT USED

PART 3 EXECUTION

3.1 SUSPENSION

A. Where cable tray is not provided, J-hooks must be provided every 5 feet for support of cable. J-Hooks are to be used only in accessible, open areas. Securing to ceiling grid, sprinkler heads or delivery system, or electrical conduit is strictly prohibited.

B. No bundle of four-pair cables shall be so large as to distort the physical properties of any of the individual cables such that performance is degraded.

C. All cables are to have the proper bend radius of no less than 4 times the outer diameter of the cable.

D. As a minimum, six feet of service loop is to be provided at the workstation end. This loop shall be in the shape of a figure 8 and be stored in the plenum area.

E. All cable shall maintain the following clearances:

- 12 inches from any fluorescent light fixture
- 12 inches from unshielded power lines
- 36 inches from any electrical motor.

3.2 TERMINATIONS

A. All cables shall be terminated on 110-style patch panels in the MC/TC and 110-style 568A jacks on the workstation end.

B. Voice/Data cables are to be terminated consecutively on the patch panel. All cables from one outlet shall be terminated on the same patch panel.

3.3 MISCELLANEOUS ITEMS

A. All abandoned horizontal cable shall be removed according to NEC Article 800.154(A).

B. All cables are to be home runs from the UWO (Universal Workstation Outlet) to the MC or TC. An exception to this would be if a consolidation point (CP) is used.

C. At least a 50 foot distance between a consolidation point and the telecommunications outlet connector should be maintained to help improve NEXT and PSNEXT.

D. No more than six horizontal cables are to be run to a single duplex outlet. Where coax cable is to be installed, no more than four voice/data cables are to be run.

E. There are to be no more than nine voice/data cables in a 1" conduit and no more than fourteen cables in a 1¼” conduit in order to maintain a 40% fill ratio.

Section 271523 Communications Fiber Optic Horizontal Cabling

At this time, no fiber to the desktop is proposed. This section will be addressed when it is cost-effective to do so.

Section 271533 Communications Coaxial Horizontal Cabling

PART 1 GENERAL
NOT USED

PART 2 PRODUCTS
NOT USED

PART 3 EXECUTION

3.1 MISCELLANEOUS ITEMS

A. All horizontal coaxial cabling is to be plenum rated, 75 ohm, RG-6 cable.

B. Coaxial terminations are to be of the compression-type which replaces the hex-style crimp connector.

C. No more than two coax splitters per run will be allowed without in-line amplification.

D. Coax cable is to be securely attached to the surrounding area.

Section 271543 Communications Faceplates

PART 1 GENERAL

1.1 SUMMARY

There are several faceplate designs possible depending on the type of room, the technologies required for the space and density requirements. The following configurations are the most common. All designs should be approved by the Customer Representative before the start of the project.

PART 2 PRODUCTS
NOT USED

PART 3 EXECUTION

3.1 FACEPLATE CONFIGURATIONS

A. Communications faceplates are to be single duplex, the, color to match as closely as possible the surrounding electrical outlet faceplates.

B Wall phone faceplates are to be a single outlet, RJ-45, with mounting stand-offs for the installation of the phone.

C There are several faceplate combinations that may be used. Some of the options are:

- 6 Category 6 voice/data jacks (high density computer areas)
- 3 Category 6 voice/data jacks (normal new installation, with PBX)
- 3 Category 6 voice/data jacks and one coax jack
- 2 Category 5e and 2 Category 6 voice/data jacks(normal re-model outlet)
- 2 Category 5e and 2 Category 6 voice/data jacks and one coax jack
- 2 Category 6 cables (normal new installation if using VoIP)
- Other outlet designs are also possible.

D. Multi-media outlets will vary according to individual scenarios. Contact customer representative for proper terminations.

3.2 FACEPLATE DESIGN

A. All faceplates shall have a labeling area which can be covered with a clear plastic guard that is an integral part of the jack.

B All voice/data cables shall terminate on 8 pin, 8 conductor IDC-style jacks with all pairs terminated. Splitting of pairs is strictly prohibited.

C. All voice/data jacks are to be wired according to EIA/TIA 568A pin out specifications

D. All coax terminations are to be on “F”-type, compression connectors. Twist-on and “hex” type connectors are not to be used.

E. All fiber connectors are to consist of dual SC, LC or other Small Form Factor connectors.

F. Icons are to be color-coded the same as the cable sheath to which the jack is terminated. This will distinguish the category rating of the cable behind the jack once the faceplate is installed.

G. Coax icons are to be purple in color .

H. Fiber optic icons are to be orange.

3.3 OUTLET BOXES

A. All workstation/desktop outlet boxes are to be quadplex metal 4" square electrical junction boxes that are firmly affixed to the surrounding area.

B. A single duplex reducer shall be installed on all voice/data j-boxes.

C. In high technology centers or computer commons, where several data jacks may be installed, additional conduits will be necessary. A maximum of 6 data drops per location will be strictly adhered to.

D. In the event that a new outlet needs to be installed after the walls have been erected, a metal cut-in box shall be installed with the same dimensions as above. "Mudrings" or Caddy MP-2s are not acceptable.

E. All wall box outlets (e.g. classroom phones, hall phones) shall be a single duplex electrical box with a 3/4" conduit

APPENDICES

Appendix A Applicable Documents

The cabling specifications in this document are derived in part from the following recommendations made in industry standard documents. The list of documents below is the references used.

A.) EIA/TIA 568-B.2-1 Performance Specifications for 4-Pair 100-ohm Category 6 Cabling

B.) EIA/TIA 568-B.1-3 Supportable Distances and Channel Attenuation for Optical Fiber applications by Fiber Type

C.) ANSI/TIA/EIA-568-A Commercial Building Standard for Telecommunications Cabling

D.) ANSI/TIA/EIA-569-A Commercial Building Standard for Telecommunications Pathway and Spaces

E.) ANSI/TIA/EIA-606 Administration Standard for the Telecommunications Infrastructure of Commercial Buildings

F.) ANSI/TIA/EIA-607 Commercial Building Grounding and Bonding Requirements for Telecommunications

G.) BICSI TDMM Manual (Telecommunications Distribution Methods Manual) 10th edition 2003

H.) National Fire Protection Agency (NFPA)-70, National Electrical Code, 2005 edition

Appendix B Typical Telecommunications Room Diagrams

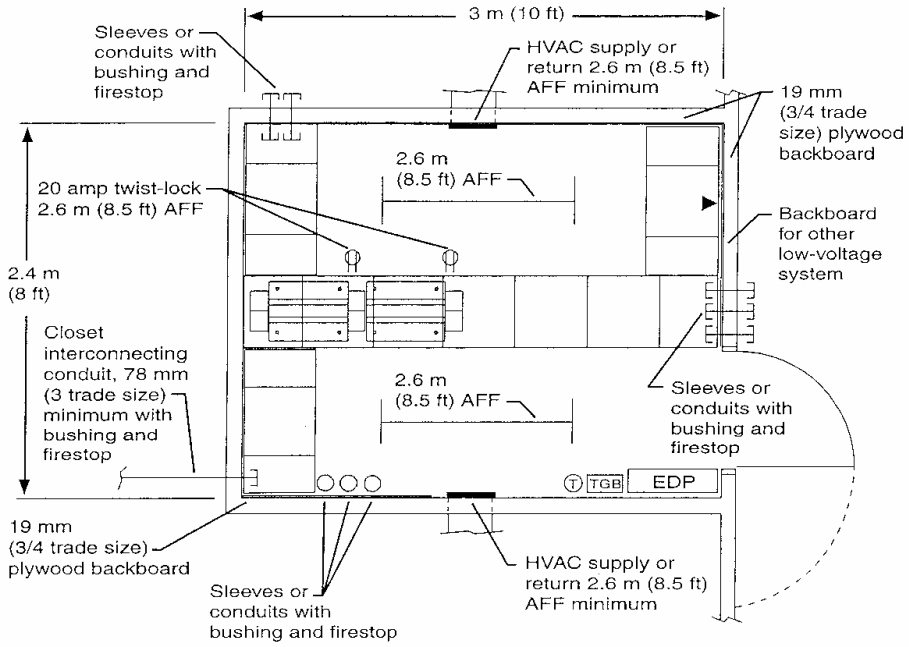
The following diagrams are taken from the 10th Edition, 2003 BICSI TDMM manual, used with permission. These figures are to be used as a general guideline since the newer Telecommunications Rooms will require more rack/patch panel space. This should be taken into consideration when actual design is finalized.

Chapter 7: Telecommunications Rooms and Enclosures

Typical Telecommunications Room (TR) Diagram

Figure 7.1 shows a typical layout for a full size TR, suitable for a maximum of 480 terminations. The drawing illustrates architectural, mechanical, electrical, and telecommunications requirements on a single plan view perspective for purposes of showing coordination issues. Actual design documents will typically separate requirements by discipline.

Figure 7.1
Typical telecommunications room layout

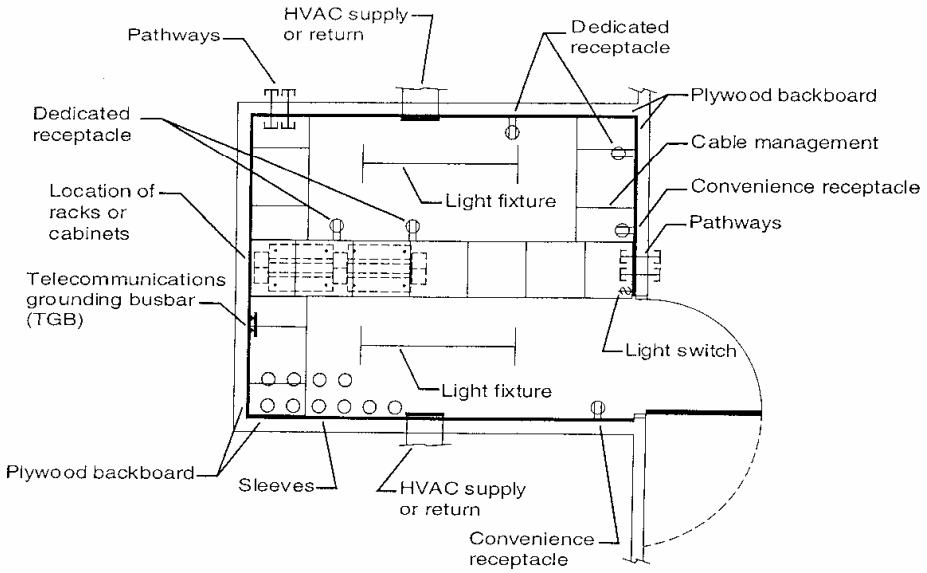


▼ = Telecommunications outlet/connector
Ⓣ = Thermostat
AFF = Above finished floor
EDP = Electrical distribution panel
HVAC = Heating, ventilating, and air conditioning
TGB = Telecommunications grounding busbar

Typical Telecommunications Room (TR) Diagram, continued

Figures 7.2 and 7.3 are examples of common telecommunications rooms.

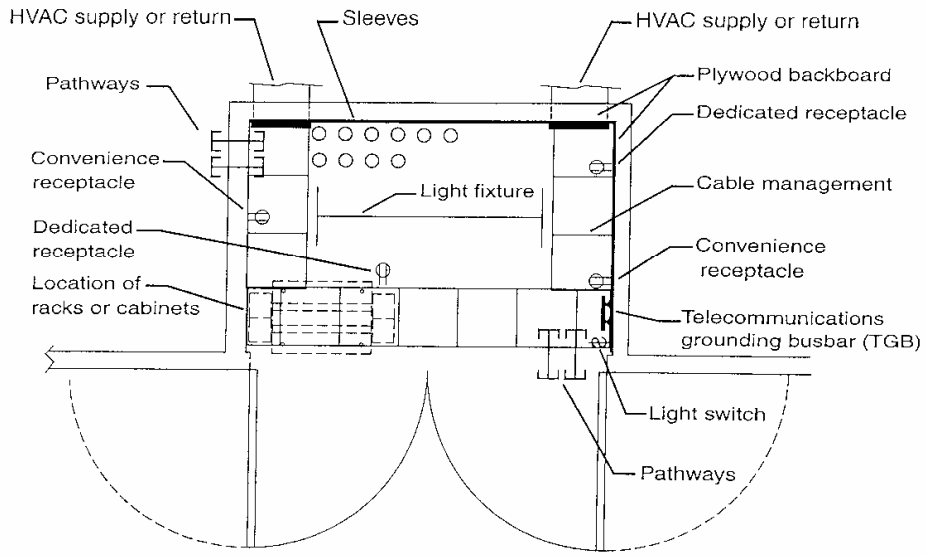
Figure 7.2
Common telecommunications room example 1



HVAC = Heating, ventilating, and air conditioning

Typical Telecommunications Room (TR) Diagram, continued

Figure 7.3
Common telecommunications room example 2



HVAC = Heating, ventilating, and air conditioning

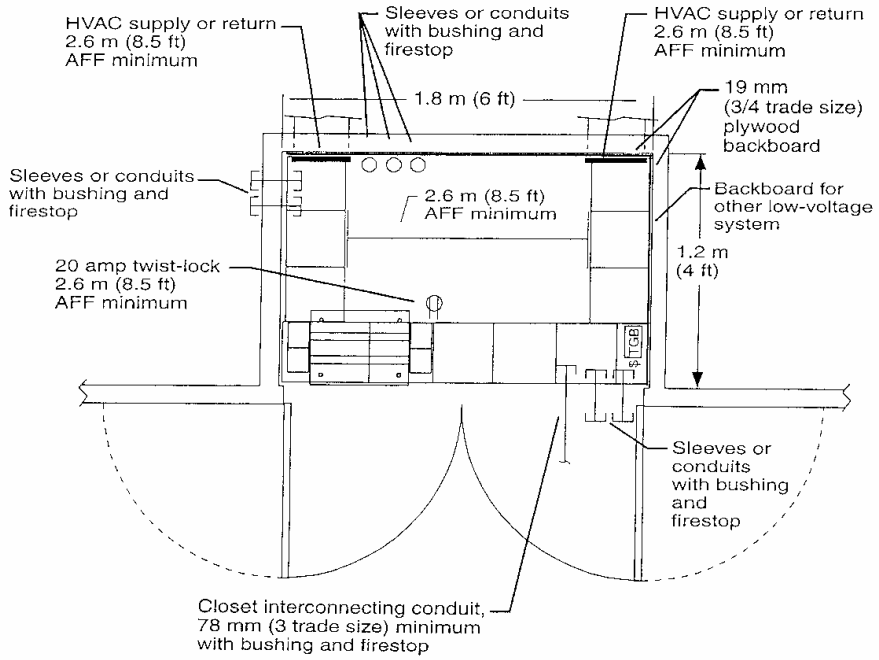
NOTES: If better cable reel access from the hallway is desirable, the three floor sleeves and the electrical panel (and TGB) could be interchanged.

Electrical outlets are shown for illustration only. Place convenience electrical outlets at 1.8 m (6 ft) intervals around perimeter walls.

Typical Telecommunications Room (TR) Diagram, continued

Figure 7.4 shows a typical layout for a small TR, suitable for a maximum of 240 terminations. The drawing illustrates architectural, mechanical, electrical, and telecommunications requirements on a single plan view perspective for purposes of showing coordination issues. Actual design documents will typically separate requirements by discipline.

Figure 7.4
Typical layout for a small telecommunications room

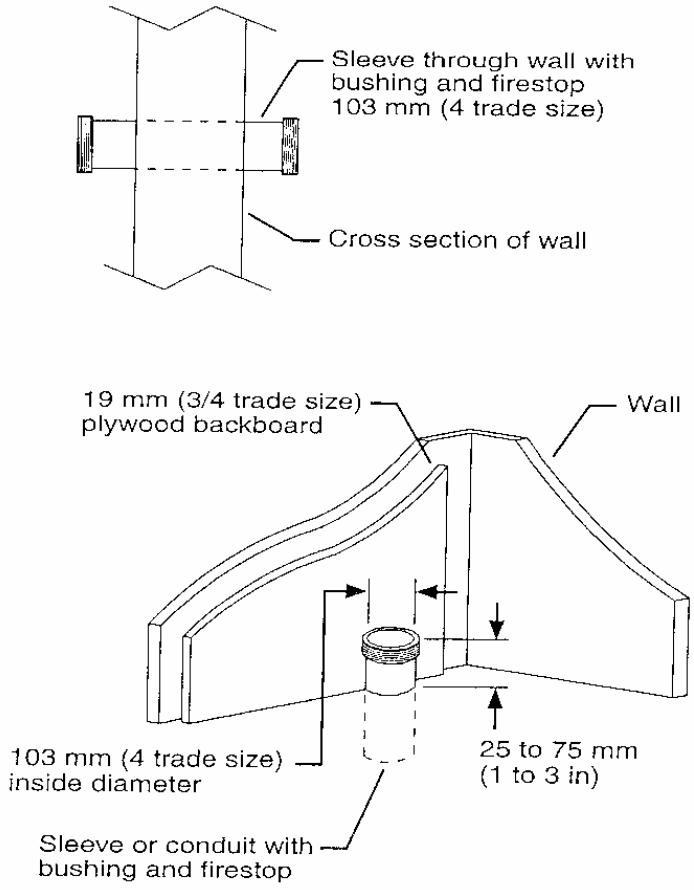


AFF = Above finished floor
HVAC = Heating, ventilating, and air-conditioning

Typical Telecommunications Room (TR) Diagram, continued

Figure 7.5 shows a typical sleeve/conduit through a TR floor.

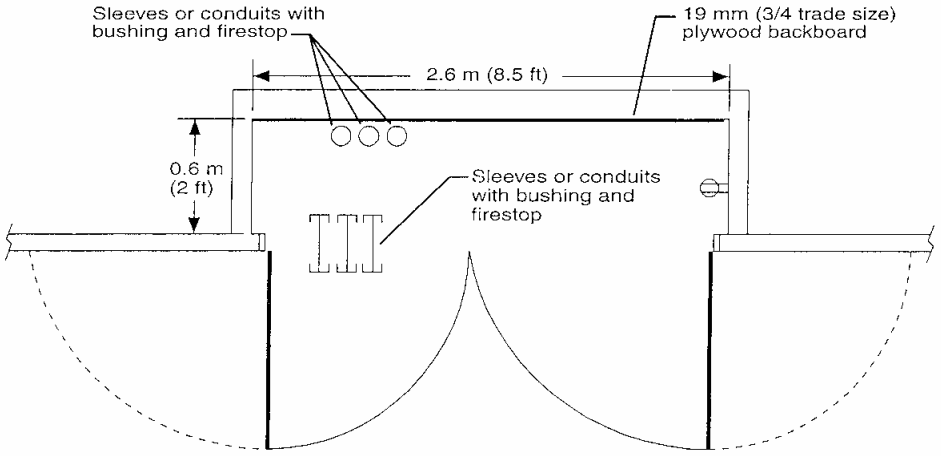
Figure 7.5
Typical sleeve/conduit



Typical Shallow Room Diagram

A shallow room is defined as an enclosed space for housing cable terminations, cross-connect cabling, and telecommunications equipment. Figure 7.6 shows a typical layout for a shallow room. The layout may be better suited for splicing than terminations. Sleeve placement must be considered when using a shallow room so that there is vertical alignment with TRs above and below when used in this manner.

Figure 7.6
Typical layout for a shallow room



Appendix C Fiber Optic Color Codes

The following table is the fiber strand color code sequencing to be used for all of the District's fiber optic LIU connections. If more than a 12-strand cable is installed, terminate the next 12 strands according to the color of the ribbon, following the same color code sequence as the following chart.

Strand	Color
1	Blue
2	Orange
3	Green
4	Brown
5	Slate
6	White
7	Red
8	Black
9	Yellow
10	Violet
11	Rose
12	Aqua

Appendix D List of Abbreviations

AFF	Above Finished Floor
ANSI	American National Standards Institute
A/V	Audio/Video
AWG	American Wire Gauge
CP	Consolidation Point
CSI	Construction Specifications Institute
CM	CoMmunication Cable
CMP	Communication Cable Plenum
CMR	Communication Cable Riser
EIA	Electronic Industries Association
EMI	Electro-Magnetic Interference
EMT	Electrical Metallic Tubing
ER	Entrance Room
HVAC	Heating, Ventilating, Air Conditioning
IC	Interconnect Closet
IDC	Insulation Displacement Connector
LC	Lampert Connector
LIU	Line Interface Unit
MAC	Moves, Adds, Changes
MC	Main Closet
MDF	Main Distribution Field (Frame)
MH	Maintenance Hole
MM	Multi-Mode
NEC	National Electrical Code
NFPA	National Fire Protection Agency
PVC	Poly-Vinyl Chloride
RFI	Radio Frequency Interference
SC	Subscription Channel Connector
SFF	Small Form Factor
SM	Single Mode
TC	Telecommunications Closet
TE	Telecommunications Enclosure
TGB	Telephone Grounding Bar
TMGB	Telephone Main Grounding Bar
TR	Telecommunications Room
UTP	Unshielded Twisted Pair
UWO	Universal Workstation Outlet
µm	Micron
VCT	Vinyl Composite Tile