

SECTION 00 70 00

TECHNOLOGY GUIDELINES

PART 0 - PURPOSE

- A. Describe broad guidelines for design of schools.
- B. Establish materials qualities and applications.
- C. Describe materials and conditions, which do not easily fit into specific specification sections.
- D. See specific sections of Design of Construction Standards for additional requirements.

PART 1 - INTRODUCTION

- A. The purpose of this document is to provide additional instructions for the planning and design of a communications infrastructure. Refer to division 27 specifications for installation requirements of each communications system.
- B. A structured wiring solution is only as robust as its weakest component, therefore all wires and connections should be Category 6 rated on a component level. The links shall further pass a permanent link performance test as described in this document. Multi-mode fiber links within buildings shall be of OM3 armored designation or higher as indicated by the project documents.
- C. When planning and installing a structured cabling system for Denver Public Schools (DPS) the Contractor must pay particular attention to ensure all components used are of the same Category or optical OM level of performance. Splicing in copper horizontal links is expressly forbidden unless part of a planned zone cabling strategy.
- D. The DPS network infrastructure design shall in all cases be a star topology unless indicated otherwise by specific project documentation. By pre-wiring all possible locations in a new or existing building in a star topology, all administrative moves, changes and additions will be made at patch field contained in the Telecommunications Rooms.

PART 2 - REGULATORY REFERENCES

- A. The (DPS) Department of Technology Services (DoTS) cabling standards are based on the guidelines published by the Telecommunications Industries Association (TIA) as well as the more detailed requirements of the Building Industry Consultative Services International (BICSI).
- B. Contractor is responsible for knowledge and application of current versions of all applicable Standards and Codes. In cases where listed Standards and Codes have been updated, Contractor shall adhere to the most recent revisions, including all relevant changes or addenda at the time of installation. A list of Regulatory References current as of the time of this writing is shown below.

PART 3 - STRUCTURED CABLING SYSTEMS DEFINITIONS

- A. On new school build-outs and large additions, the contractor will provide DPS with a cut sheet in Excel format that displays all of cable numbers sequentially in the first column and the corresponding room number for each cable will be show in the second column.
- B. "Structured Wiring" is a philosophy of pre-installing necessary cabling to device locations to be available to be used as these devices come on line. Moves and changes are affected at structured patch fields with the permanently installed links being relatively unchanging. In most basic form, a structured wiring system consists of horizontal wiring and appropriate connecting hardware, with backbone cabling connecting the horizontal sub-system to the main and intermediate distribution areas.
- C. The following terms for various sub-systems are defined within the ANSI/TIA 568-C series of standards and shall be referred to throughout this document.
 - 1. The D-Marc is the point where the outside plant cables and associated hardware is brought into the building. The entrance facility may be used for public network services, private network customer services or both. The demarcation points between carrier and customer and over-voltage protection devices are located here. For new construction, the MDF will serve as the entrance facility. A total of four

4” conduits are needed for fiber, copper, and coax services coming into the facility. Two of these conduits need to be dedicated to one service provider, while the other two should be dedicated to a secondary service provider. Note that service providers will not share conduit, vault space, or other pathways inside or outside of the building.

2. All MDF closets will be required to have a separate Air Conditioning unit installed. (IDF Closets do not require this.) Placement of unit will be coordinated with DoTS Networking personnel.
3. The backbone cabling provides interconnections between MDF/IDFs/D-Marc, It consists of the backbone cables, main and intermediate cross-connects, mechanical terminations and patch cords or jumpers used for cross-connection. The backbone may connect Telecom Rooms within a building or between buildings.
4. The horizontal cabling consists of the physical media used to connect each outlet or device to MDF/IDFs. Various types of cable can be used for horizontal distribution. Each type has its own performance limitations, size, and ease-of-use.

PART 4 - COMMUNICATIONS SERVICES

A. Entrance Facility and WAN Services:

1. The main MDF supports the incoming feeds from various service providers into the buildings.
 - a. It also contains the VOIP telephone system, the master data networking equipment, paging equipment, and video amplifiers, as well as being the serving terminal for all intermediate TRs.
2. The feed from Century Link is terminated in this room by Century Link.
The feed from Comcast is terminated in this room by Comcast.
3. From the D-Marc feed to the main MDF the Contractor will install one 25 pair plenum cable and two Category 6 plenum cables.
4. The Contractor shall install labels for all terminating hardware within entrance facilities.

B. Commissioning of Communications:

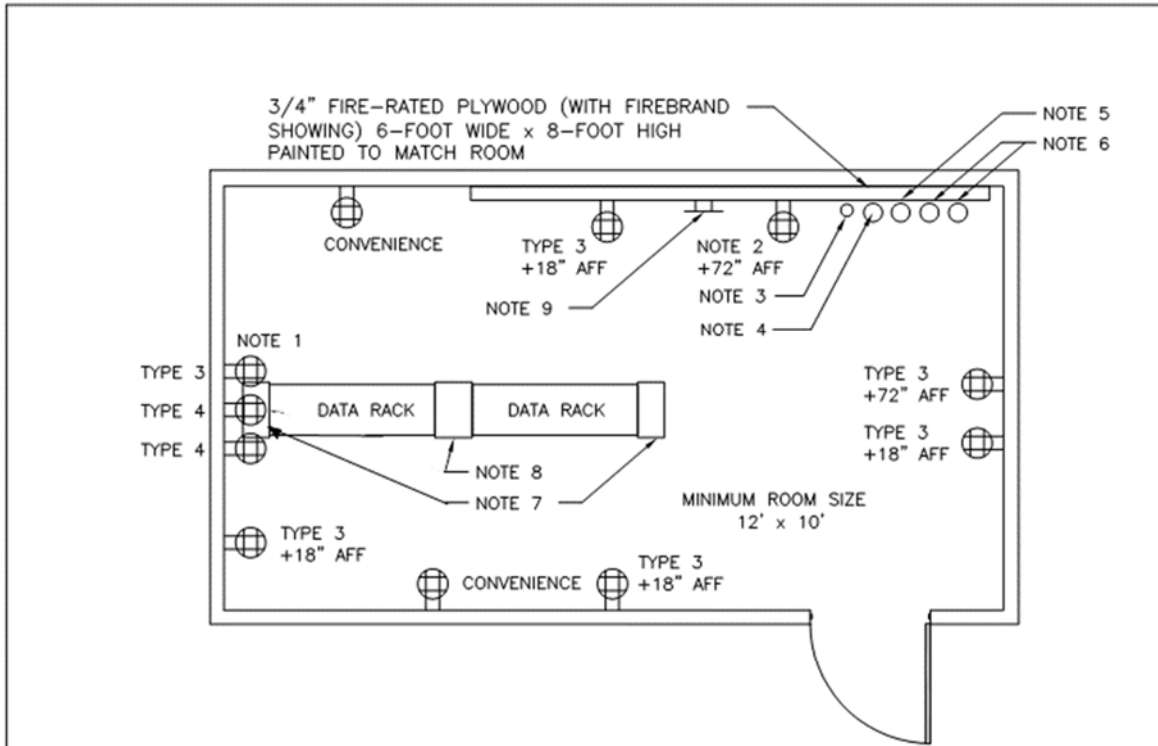
1. Denver Public Schools and/or its designees shall periodically inspect the work of the Contractor. When requested the Contractor shall, at no additional charge, supply an installation technician to accompany the individual(s) performing the inspection tasks. The Contractor shall be responsible for uncovering concealed areas in order for the work to be inspected.
2. Denver Public Schools requires a thirty (30) day acceptance period after the completion of any project, or a portion thereof if turned over to DPS prior to the completion of the total project. Final project completion is the conclusion of all specified work, including all labeling, testing, documentation, site cleanup, and quality inspection.
3. DPS and/or its designees shall utilize this acceptance period to perform workmanship evaluations and random testing. A representative of the Contractor shall be available to work with DPS and/or its designees during this acceptance period.
4. The Contractor shall be required to make any repairs or modifications deemed necessary by Denver Public Schools and/or designees immediately, without exception or recourse.
5. The required warranties shall begin at the conclusion of the acceptance period.

C. Communication Closets MDF/IDF Build Out:

1. MDF Build out
 - a. Room size 10' x 12'.
 - b. Wrap room with 4' x 8' x ¾" fire rated plywood installation coordinated with DOTs PM.
 - c. Floor will be a clear seal on concrete. No flooring is to be installed in any closet.
 - d. Adequate lighting in front of rack and in the back of the racks.
 - e. Typical electrical layout refer to attachment 8, 10,& 11.

- f. All doors providing access to closet needs to open outward into a common corridor.
- g. Door must be keyed to a XGM1 barrel.
- h. MDF will require a separate AC unit placement of this unit will be coordinated with DOTs PM.

Typical MDF Layout



NOTES:

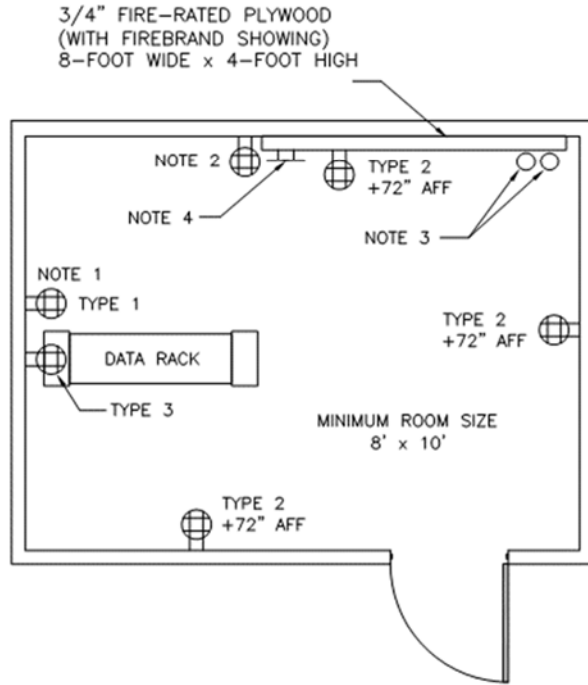
1. DEDICATED RECEPTACLES FOR REDUNDANT PROCESSORS. MOUNT 18" AFF. REFERENCE DRAWINGS 27000-7 & -8 FOR RECEPTACLE TYPES.
2. DEDICATED TYPE 3 RECEPTACLE. MOUNT 72" AFF. REF. DRAWING 27000-7.
3. 4" CONDUIT TO REMOTE IDF TELECOM CLOSETS FOR FIBER OPTIC CABLE.
4. 4" CONDUIT TO REMOTE IDF TELECOM CLOSETS.
5. 4" CONDUIT TO CENTURY LINK FIBER.
6. (2) 4" CONDUIT TO PHONE COMPANY FEED (CENTURY LINK) COPPER FEED.
7. 8" VERTICAL WIRE MANAGER ON THE ENDS OF THE ROW OF RACKS.
8. 12" VERTICAL WIRE MANAGER BETWEEN EACH OF RACKS.
9. BUS BAR ON STANDOFFS EQUIPPED WITH A #6 AWG SOLID GROUND WIRE CONNECTED TO SERVICE ENTRANCE GROUND AND ROUTED TO EACH TELECOM ROOM.

* DOTS WILL LOCATE ALL EQUIPMENT INSTALLED WITH CONTRACTOR.

						DENVER PUBLIC SCHOOLS DEPARTMENT OF FACILITIES MANAGEMENT	
NO.	REVISIONS	DWN.	APP.	APP.	DATE		
DESIGNED	-					SCALE: NONE	
DRAWN	-					NO.	REV.
CHECKED	-					27000-5	1
APPROVED							
APPROVED							
DATE	4/12/2016						
SPECIFICATION SECTION 27000 TELECOMMUNICATIONS SYSTEMS						TYPICAL LARGE MAIN TELECOM MDF ROOM	

2. IDF Build out:
 - a. Room size 10' x 10'
 - b. 1 – 4' x 8' ¾" fire rated plywood installation coordinated with DOTs PM.
 - c. Floor will be a clear seal on concrete. No flooring is to be installed in any closet.
 - d. Adequate lighting in front of rack and in the back of the racks.
 - e. Typical electrical layout refer to attachment 10
 - f. All doors providing access to closet needs to open outward into a common corridor.
 - g. Door must be keyed to a XGM1 barrel.

Typical IDF Layout

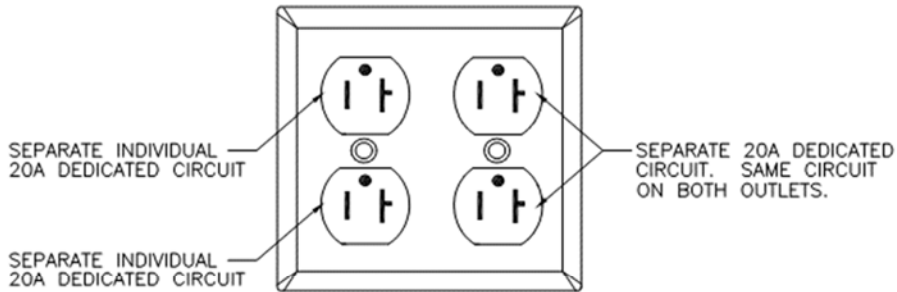


NOTES:

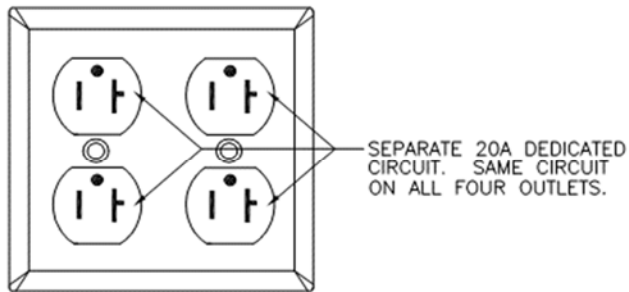
1. DEDICATED RECEPTACLES FOR REDUNDANT PROCESSORS. MOUNT 18" AFF. REFERENCE DRAWINGS 27000-7 & -8 FOR OUTLET TYPES.
2. DEDICATED TYPE 2 RECEPTACLE. MOUNT 72" AFF. REF. DRAWING 27000-7.
3. (2) 4" CONDUIT TO MDF.
4. 2" x 6" GROUND BUS BAR ON STANDOFFS EQUIPPED WITH A #6 AWG SOLID GROUND WIRE CONNECTED TO SERVICE ENTRANCE GROUND AND ROUTED TO EACH TELECOM ROOM. GROUND BUS BAR TO BE LOCATED IN UPPER LEFT CORNER NEXT TO RECEPTACLE.

					DENVER PUBLIC SCHOOLS DEPARTMENT OF FACILITIES MANAGEMENT	
NO.	REVISIONS	DWN.	APP.	APP.	DATE	
DESIGNED	—					SCALE: NONE
DRAWN	—					
CHECKED	—					NO. 27000-6
APPROVED	_____					
APPROVED	_____					REV. 1
DATE	4/12/2016					
SPECIFICATION SECTION 27000 TELECOMMUNICATIONS SYSTEMS			TYPICAL SMALL REMOTE TELECOM IDF ROOM			

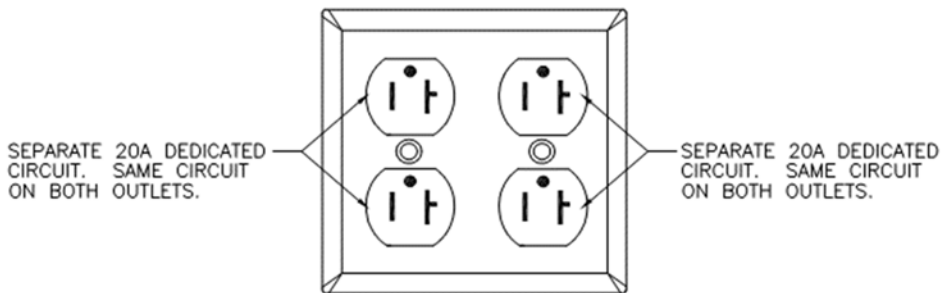
IDF/MDF Outlet Configurations



TYPE 1 OUTLET
TYPICAL INSTALLATION HEIGHT = 18" AFF



TYPE 2 OUTLET
TYPICAL INSTALLATION HEIGHT = 72" AFF
CENTERED ON PLYWOOD BACKBOARD

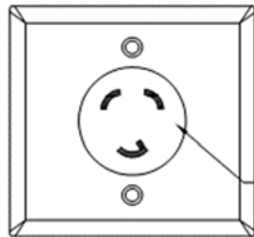


TYPE 3 OUTLET
TYPICAL INSTALLATION HEIGHT = 18" AFF

						DENVER PUBLIC SCHOOLS DEPARTMENT OF FACILITIES MANAGEMENT	
NO.	REVISIONS	DWN.	APP.	APP.	DATE		
DESIGNED	-					SCALE: NONE	
DRAWN	-					NO.	REV.
CHECKED	-					27000-7	1
APPROVED							
APPROVED							
DATE	4/12/2016						
SPECIFICATION SECTION 27000 TELECOMMUNICATIONS SYSTEMS				TYPICAL FOURPLEX RECEPTACLE TYPES			

Typical 220V

Dedicated Receptacle



DEDICATED 208V, 20A CIRCUIT FOR
A NORTH AMERICAN (LOCKING)
(2550W POWER SUPPLY) NEMA L6-20 PLUG (240V)

TYPE 4 OUTLET

TYPICAL INSTALLATION HEIGHT = 18" AFF

NOTES:

1. TYPE 4 OUTLET IS REQUIRED FOR CISCO 6509 & 6513.
2. (2) TYPE 4 OUTLETS ARE REQUIRED PER LOCATION FOR REDUNDANT PROCESSORS.

						DENVER PUBLIC SCHOOLS DEPARTMENT OF FACILITIES MANAGEMENT	
NO.	REVISIONS	DWN.	APP.	APP.	DATE		
DESIGNED	-					SCALE: NONE	
DRAWN	-	SPECIFICATION SECTION 27000 TELECOMMUNICATIONS SYSTEMS				TYPICAL 220V DEDICATED RECEPTACLE	
CHECKED	-						
APPROVED	-					27000-8	1
APPROVED	-						
DATE	4/12/2016						

PART 5 - TYPICAL IDF/MDF EQUIPMENT

- A. Typical:
 - 1. Equipment Racks and Frames
 - 2. Cabling (horizontal and backbone)
 - 3. Patch panels
 - 4. Network switches, routers, etc.
 - 5. PBX/VOIP
- B. Other:
 - 1. Security panels and equipment
 - 2. Public address/Intercom
 - 3. CATV/MATV
 - 4. Distributed Antennae System (DAS)
 - 5. Low Voltage/Specialty
- C. Electrical Considerations:
- D. Load:
 - 1. For initial planning purposes, assume 3KVA per rack plus an additional? KVA for wall mounted equipment. Final loads shall be defined by the Technology Consultant.
- E. Electrical Panels:
 - 1. Do not locate electrical panel(s) within the room unless the panel(s) is dedicated to serving only the technology equipment in the IDF/MDF.
If an electrical panel is to be provided:
 - a. Assume (for initial planning purposes) a 120/208 3-phase panels sized at no less than 150A.
 - b. Locate the panel on the short wall opposite the end of the row of racks. If this is not possible, than locate the panel on the long wall in a location that is not immediately in front of or behind the racks.
 - c. The panel shall not be used to power the lights or convenience receptacles within the IDF/MDF
- F. Power Receptacles:
 - 1. Provide convenience receptacles for each wall as required by code.
 - 2. Wall receptacles shall be flush mounted with the backboard (i.e. surface mounted receptacles and raceway interfere with the mounting of ladder racking and restricts the surface area available for wall-mounted equipment.
 - 3. Provide receptacles for the equipment racks mounted on the wall where the racks originate (minimum of one per rack).
 - 4. For initial planning purposes, assume that both 20A and 30A receptacles will be required.
 - 5. Electrical Drawings should indicate that the Contractor is to refer to the Technology Drawings for receptacle mounting requirements, types, quantities, and locations.
- G. Lighting:
 - 1. Provide a minimum of 50 foot-candles measured at 3-feet above the floor.
 - 2. Provide pendant type fixtures, located in two rows above and parallel to the equipment racks (one row in front of the racks and one row behind).

PART 6 - MECHANICAL CONSIDERATIONS

- A. Environmental Control:
 - 1. Provide independent (stand-alone) environmental control capable of maintaining temperature 24x7x365 at no more than 80 degrees F and humidity not exceeding 50%.
 - 2. For initial planning purposes, assume 3 tons of cooling per relay rack will be required and 5 tons of cooling will be required for server cabinets. Final loads shall be as defined by the Technology Consultant.
 - 3. Provide Monitoring of:
 - a. Room temperature and humidity.
 - b. Discharge temperature and humidity.
 - c. Fan motor status.
 - d. Overall unity status.
- B. Fire Protection:
 - 1. If a wet pipe system is used/required, provide wire cages around sprinkler heads.
 - 2. Provide each IDF/MDF with smoke and heat sensors connected to the building fire alarm panel.
- C. Ducts, Piping, and Plumbing:
 - 1. Mechanical ductwork, piping and/or plumbing shall not pass through an IDF/MDF (i.e. these systems should be routed around the IDF/MDF, not through it.)

PART 7 - ARCHITECTURAL CONSIDERATIONS

- A. Locations:
 - 1. Locate IDFs on 150 ft. radii (with slight overlap). In practice, this will result in one IDF per approximately 25k to 35k SF.
 - 2. EIA/TIA standards require a minimum of one IDF per floor. For facilities with multiple floors, IDFs should be stacked floor-to-floor, and identically sized.
 - 3. Do not co-locate IDFs/MDF with Electrical, Mechanical, or Janitorial rooms.
 - 4. Do not locate IDFs/MDFs directly below any area where water service may be provided (e.g. restrooms, kitchens, wet laboratories, etc.)
 - 5. Locate IDFs in central/core areas wherever possible.
 - 6. Locate IDFs in the middle of the areas that they are to serve, wherever possible (this helps reduce the overall quantity of IDFs required by maximizing the floor space served by the remaining IDFs).
 - 7. Entry should be direct form a hallway or a common room/area, not through another room (such as an Electrical Room, Mechanical Room, or Office).
 - 8. Close proximity to an Electrical Room is desirable, although ideally the wall of the IDF should not be the same wall as that of an Electrical Room.
 - 9. Reducing the quantity of IDFs necessitates larger (longer) remaining IDFs and longer cable runs (which can impact cost and future maintenance).
- B. Walls, Doors, and Ceilings:
 - 1. Provide one-hour fire rated partitions and opening per NFPA 75.
 - 2. Provide walls to structure. Assume equipment to be mounted on all walls.
 - 3. Provide 11-foot minimum overhead clearance from floor.
 - 4. Rooms should have no more than 4 wall surfaces.
 - 5. Avoid columns in rooms. If not possible, locate columns in corners only and add “length” to the room equal to the width of the column (e.g. a 2 foot column will necessitate adding 2-feet to the length of the room).

6. Door swings should swing out of the room – not into the room.
7. Doors should be located on the “short” wall if at all possible.
8. Door should be located on either end of a wall – not the middle of a wall.
9. Inform the technology consultant if doors are expected to exceed 7’ tall.
10. Ceiling space should be left open to structure – no suspended ceilings.
11. Unless the owner requires otherwise, wall finishes should be light color.

END OF SECTION 00 70 00