Telecommunications

STANDARD FOR BUILDING AND CAMPUS DISTRIBUTION SYSTEMS

State of New Mexico
Department of Information Technology
Infrastructure Voice Radio Division

Revision 03 August 2017

Color Coding with Colors as Follows:
Wiring Contractor
Building Contractor/Architect
Electrical Contractor/Electrical Engineer
NOTE: Color-coding is for ease of use;
However it does not represent limits of responsibility

INDEX

1.0 INTRODUCTION

1.1 BACKGROUND

This document establishes criteria intended to standardize voice, data, and low voltage infrastructure systems inside and outside buildings used by state agencies. By setting specific guidelines and standards, state agencies can expect optimum performance from the telecommunications systems they purchase. The intent of this standard is to define requirements and procedures based on the current industry standards. The State of New Mexico will be updating this standard as technologies emerge (fiber, wireless, and copper). This document is intended for use as a technical reference for RFP's and planning building and campus wiring. It is required for use by all State of New Mexico Executive Entities who are required to follow the State Statute 15.5.6 (see definition section 8). This document can be used by non-executive entities.

1.2 PLANNING

1. All planning for buildings (new, retrofit, remodel, or lease) must include outside and inside facilities for telephone, data, video, and all low voltage systems (security/alarm services, sound, etc.). It is recommended that State of New Mexico Infrastructure Voice and Radio (IVR) at (505-841-4265 or 505-841-4269) is consulted early in the process so that all requirements are met including those required by the Americans with Disabilities Act.
2. Specifically, planning must consider:
    - The quality and competence level of the distribution system and associated external equipment necessary to meet immediate and long-term requirements. Some basic planning in the early stages of a project will avoid expensive material and labor costs.
    - The Infrastructure Voice Radio Division has established a policy of installing distribution systems and the associated connecting hardware meeting the following criteria:
        - Fiber to the desktop (multi-mode/single-mode).
        - For 10 gigabit applications Category 6a or fiber is recommended.
        - Presently, Category 7 is not an EIA/TIA standard but is an ISO standard and must have an exception for approval.
        - Minimum of Category 6 for new installations.
        - Category 5e is NOT to be used for new or existing voice and data installations except by approval only.
        - Video, alarm, security, and other low voltage systems should be installed with minimum requirements to assure correct operation of such devices.
        - Other media may be used as required by special request and approved by the Infrastructure Voice Radio Division within the Department of Information Technology (DOIT).
    - Main Communications Equipment Rooms and Telecommunication Rooms for equipment, protection, termination (punch-down) blocks, patch panels, grounding,

servers, satellite equipment racks, environmental conditioning, lighting, room access, etc., as needed.

- Pathways for inter and intra-building cabling. (E.g. conduits, raceways, structural design.)
- Entrance facilities shall be in accordance with the NEC and local codes for the any application requiring aerial, direct burial or conduit feeds to the building. This includes codes covering grounding, bonding, protection, and demarcation point. These must be documented on the architectural drawings.
- Special power requirements for the desktop and or the Main Communications Equipment Room may be considered.
- Environmental concerns must be considered (heating, cooling, and lighting).
- Other considerations as floor loading, door opening and working space - required by the NEC code if by an electrical panel.

1.3 SCOPE

Unless otherwise specified in the Request For Proposal (RFP), Request For Quote (RFQ), Contract Vendor Request (CVR), or Work Order, the responding contractor/contractors must provide all materials (cable, jacks, terminal strips, backboards, raceway, buss bars, grounding material, entrance conduits, pull boxes, etc.) and labor required to install and test a complete telephone, data, video or alarm system. The contractor must deliver a complete turnkey system ready to perform its function as specified by the Infrastructure Voice Radio Division. The Telco up to a point of demarcation shall perform any work needed for the local Telco. After the demarcation point the contractor will be responsible for the installation and labor of the required service.

1.4 ENFORCEMENT

DOIT is responsible for enforcement under statute for all telephone services and equipment. This applies to any and all related telephone infrastructure and or shared infrastructure that will carry telephone traffic. The Agency or state entity is responsible for enforcement of this wiring standard for all non-telephone data infrastructure and for approved exceptions.

1.5 COORDINATION

Before the start of any State wiring project the contractor must coordinate all work with the Infrastructure Voice Radio Division DOIT Engineer, the agency project manager, and the General Contractor. All three entities must agree on the plan of procedure and any changes in the process shall be made in writing to the Infrastructure Voice Radio Division. The wiring of the building is to be started before the ceiling tile is installed, and after the following are completed:

- The pathway installation to the workstation area.
- The ceiling grid is installed.
- The Main Communications Equipment Room and/or Telecommunications Room are completed.

The wiring contractor must coordinate all activities with the General Contractor and Infrastructure Voice Radio Division or agency project leader. The wiring is to be completed prior to the completion date of the building. The General Contractor, in turn, must coordinate with the

local telephone company for details relating to the building's entrance cabling and conduits. Agencies will initiate all telephone, voice, and shared (i.e. voice and data) project coordination through the DOIT automated work order system. The Infrastructure Voice Radio Division and Agency may, by mutual agreement, modify, waive, or adjust any specifications in this document, so long as such modifications, waiver, or adjustment does not conflict with local and national codes and industry standards.

1.6 REQUESTS FOR VARIANCES

Deviations from the standards presented in this document must be submitted via the automated work order system titled as a "Request for Variance".

1.7 EXISTING INSTALLATIONS

1. This standard does not mandate the retrofitting of existing installations.
2. Existing installations will be deemed compliant (i.e., grandfathered) with respect to technical compliance with this standard.
3. This section cannot excuse non-compliance with pertinent federal, state, and local codes and regulations.
4. Any adds, deletes, changes, or improvement to an existing system may require an upgrade to the existing system and supporting infrastructure to current standards (e.g. upgraded voice and data systems).
5. Agencies should carefully consider any adds, changes, or deletions to existing installations and should coordinate their ideas with the DOIT Infrastructure Voice Radio Division Engineers prior to beginning any work.

2.0 BUILDING SPECIFICATIONS

2.1 MAIN COMMUNICATIONS EQUIPMENT ROOM (MCER)

Any room serving as the main location for data, telephone, and low voltage systems that house main wiring cross connects shall be deemed the Main Communications Equipment Room. Generally the Main Communications Equipment Room will be the entrance point for facilities that enters the building. The local Telco, Alarm Company, video services, data POP, and other communication services may appear within the Main Communications Equipment Room. Entrance facilities may be extended to the Main Communications Equipment Room if required to keep the wiring plant within specification. The Main Communications Equipment Room may also serve as a Telecommunication Room (See Illustrations A & B). The Main Communications Equipment Room generally serves an entire building, other Telecommunications Rooms, external buildings or campus. The MCER specifications for satellite or outlying locations may be adjusted to incorporate Telecommunications Room specifications (per section 2.3 of this document) by mutual agreement between the DOIT Communications engineer and the agency.

2.2 LOCATION AND DESIGN

1. There must be one Main Communications Equipment Room (MCER) in each building located in proximity to but not co-located or adjacent with an electrical room for power and grounding requirements.
2. Sized at a minimum of 150 square feet (10' x 15') Note: Contact project engineer (DoIT) for any exceptions.
3. Ceilings should be of a solid design, (no false ceilings except where HVAC concerns are necessary) at least 8 feet, 6 inches high, painted with low gloss paint non-reflective.
4. [1]The walls must go to the roof deck for security. Sleeves **must** be installed for cable access to the Main Communications Equipment Room with appropriate fire stopping.
5. Lighting must be equivalent to 50 foot-candles as measured 3 feet from the finished floor.
6. If the Main Communications Equipment Room is to be used as a Telecommunications Room, locate as near as possible to the center of the building and adjacent or co-locate to the computer room.
7. Fire suppression should be a part of the design and is dependent of cost, equipment, and local codes. The following are recommended:
    - An approved water free fire suppression system is recommended as the first choice.
    - If water is used a dry pipe system using misters is recommended to reduce equipment damage in the Main Communications Equipment Room.
    - A wire cage or recessed heads should be installed to prevent accidental breakage of sprinkler heads or misters if a dry pipe system is not used. A drainage trough should also be installed under sprinkler pipes to prevent them from leaking onto telecommunications equipment.
    - Portable fire extinguishers (carbon dioxide or non-aqueous) **must** be mounted as close to the entrance away from the door.
    - The contractor must always adhere to local fire codes.

8. Do not locate the Main Communications Equipment Room in any place that may be subjected to:
    - Water infiltration
    - Steam infiltration
    - Humidity from nearby water or steam
    - Heat (i.e., direct sunlight)
    - Any other corrosive atmosphere
    - Overhead water supply systems/plumbing
    - Electro magnetic interference (EMI)
9. Locations which are unsatisfactory for Main Communications Equipment Rooms include space in or adjacent to:
    - Boiler rooms
    - Washrooms
    - Janitor's closets
    - Any place that contains steam pipes, drains, or clean-outs
    - High voltage transformers/ high voltage lines
10. *The Main Communications Equipment Room also must be equipped with adequate environmental control (HVAC). Environmental control needs to allow for a temperature range of 64 to 75 degrees Fahrenheit, 30 to 55% relative humidity with a minimum of one air exchange per hour. A thermostat MUST be provided in the Main Communications Equipment Room regulating this room only. NOTE: Environmental controls MUST be operational at all times (24x7). Deviations to this specification must be coordinated through the Infrastructure Voice Radio Division.
11. The walls in the Main Communications Equipment Room must extend to the roof or next floor. It must be sealed all the way around with conduits feeding into the room for security.
12. A lock must be provided to allow only limited access. A cipher lock is recommended with logging capability.

NOTES:

1 This is mandatory to meet HIPAA and IRS requirements.

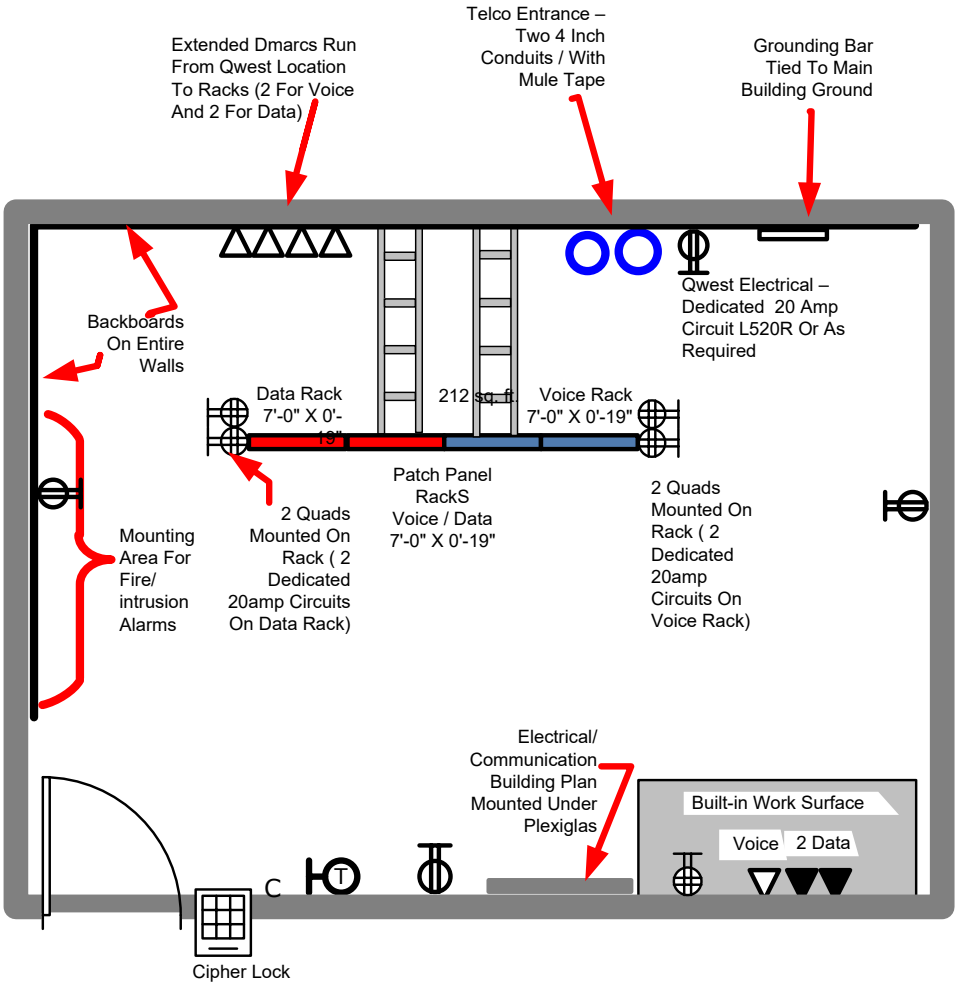
MCER Room Contents

The Main Communications Equipment Room must be equipped with the following:

1. A minimum of three dedicated non-switched 3-wire 120V AC quad electrical outlets and one dedicated L520R outlet all of which are on separate 20 ampere circuits and are supplied according to the following:

    - Dedicated electrical outlets or plates must be orange and labeled with the panel and circuit breaker numbers.
    - This is an important item and location of these outlets must be coordinated with the Infrastructure Voice Radio Division.
    - Separate ground minimum of #6 solid copper green wires with a grounding buss bar (with a minimum of 12 lug taps) run back to the main building ground. NOTE: If length is excessive (over 20 feet) the current NEC code must be followed. A "DO NOT REMOVE" label must be put on the ground wire at the power panel end to avoid damage to equipment and safety. Isolated grounds are NOT permitted.
    - Air conditioning units should be a non-condensing refrigerated air type. Swamp coolers are not acceptable.
    - Reference Equipment Rack in Illustration A for location of power.
    - **Must** be equipped with a ground buss bar that is tied back to the building ground using a minimum of #6 copper green wire. The grounding conductor **must** be attached to an approved electrode per NEC 2003 or **must** meet current standards, as referenced in TIA 607.
    - All dedicated A/C outlets must only be used to power communications equipment.
    - Any additional dedicated circuits maybe required dependant on equipment requirements.

2. Additionally, one utility/common use 120-volt AC outlet should be provided on each wall of the room. This outlet should be labeled as a utility outlet.
3. Two adjacent walls must be covered completely with ¾ inch A-C plywood (finished on one side) 8 feet high. This must be painted with two coats of a fire resistant, low gloss, light colored paint. (Note: fire rated plywood may be substituted)
4. There **must** be at least one 19" communications/equipment rack located in the Main Communications Equipment Room. (See Equipment Rack section 2.5 for details)
5. Main Communications Equipment Rooms must not contain dust-creating devices such as high volume printers or photocopy machines.
6. Main Communications Equipment Rooms must **not** be used as storage areas.
7. Provisions must be made for a telephone in the Main Communications Equipment Room.
8. Floors **must** be concrete, linoleum, or vinyl tile. Carpet should never be used.



Note:

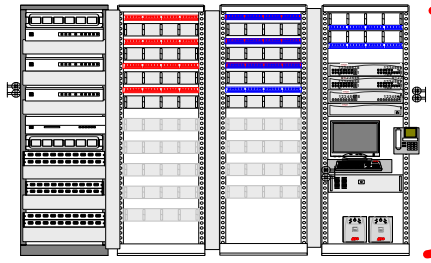
1) An Architectural Drawing Of The MCER Must Be Attached To The Construction Drawings On-site During Construction.

2) Do not run any water, or sprinkler lines through or on top of telecomm equipment room

3) Do not place any electrical transformers, or equipment generating EMI on any adjacent walls to the main equipment room.

4) Walls to the ceilings or deck

5) Any other requirements



Voice / Data Rack Elevation Detail (for reference only - equipment will vary)

Illustration A – Typical Main Communications Equipment Room

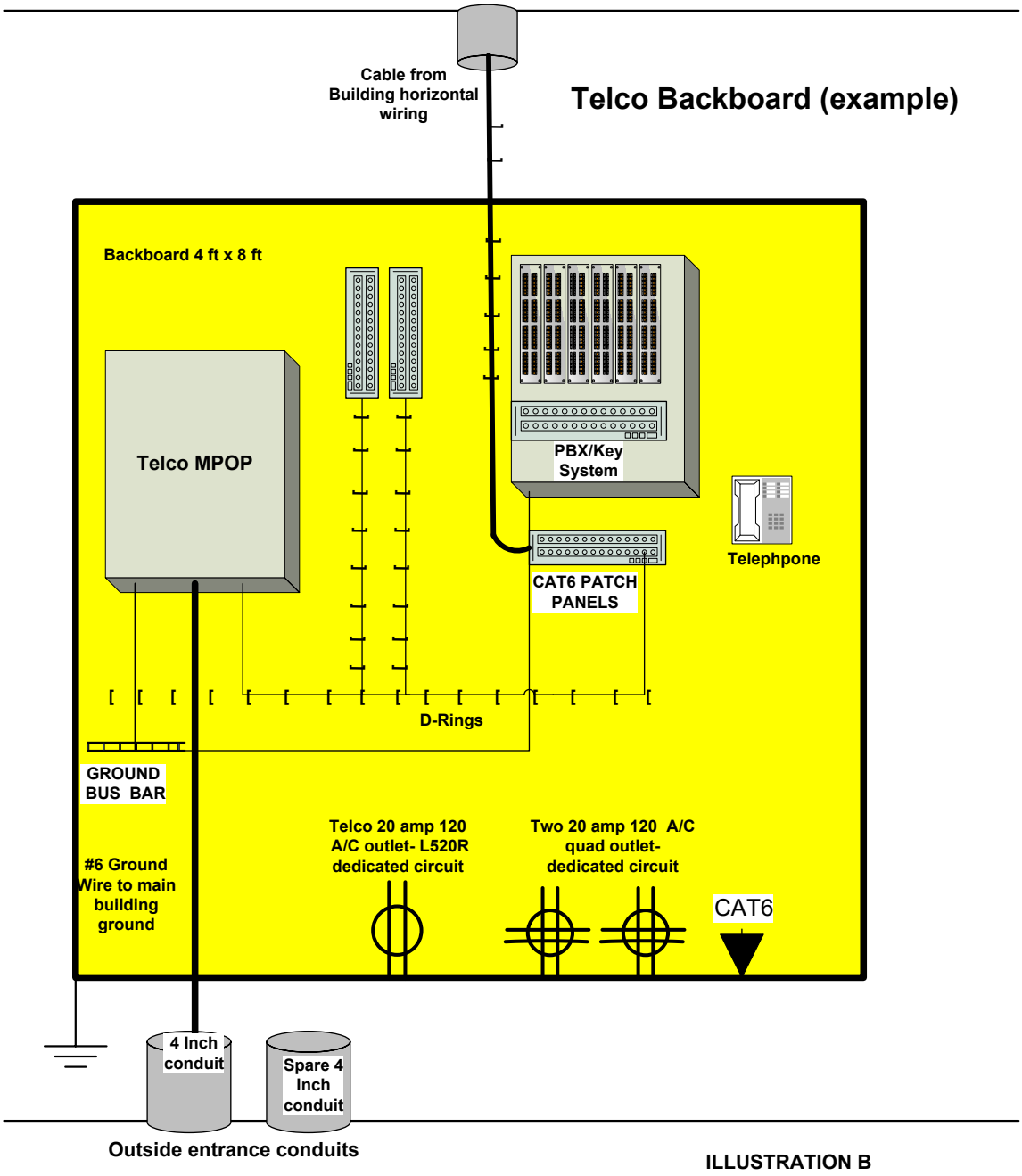


ILLUSTRATION B

2.3 TELECOMMUNICATION ROOM (TR)

Areas designated for use as a cross connect point between the backbone (riser) cable and the horizontal distribution cabling (wiring to the station outlets) shall be deemed a Telecommunication Room.

Room Design

The Telecommunication Room should be designed as follows:

1. There must be at least one Telecommunication Room or Main Communications Equipment Room (use as a horizontal distribution cross-connect) per floor. Multiple Telecommunication Rooms are required if:
    - The floor area to be served exceeds 10,000 square feet
    - The horizontal distance to any work area from the Telecommunications Room exceeds 295 feet (does not include patch cables).
2. The Telecommunication Rooms should be located as close as possible to the center of the area being served or within 295 feet, which ever is closer.
3. The size of the Telecommunication Room should be determined by the following chart:

SERVING AREA	ROOM DIMENSIONS
5,000 square feet or less	10 feet x 7 feet
5,000 to 8,000 square feet	10 feet x 9 feet
8,000 to 10,000 square, feet	10 feet x 11 feet

4. If the area to be served is less than 5,000 square feet and the Telecommunications Room is not being used as a Main Communications Equipment Room, then a walk in room sized at 4.5 feet x 4.5 feet may be used.
5. Locate light fixtures a minimum of 8 feet, 6 inches above the finished floor.
6. Telecommunication Rooms should have fully outward opening, lockable doors which are at least 36-inches wide and 80-inches tall.
7. Depending on the scope of the job communication/equipment racks may be required in the Telecommunications Rooms.
8. Telecommunication Rooms must be equipped with adequate environmental control (HVAC). Environmental control needs to allow for a temperature range of 50 to 95 degrees Fahrenheit with a minimum of one air exchange per hour if just used for cross connects. If equipment is located in the Telephone Room then the temperature must range from 64 to 75 degrees Fahrenheit. These controls must be operational at all times (24x7). Swamp coolers are not acceptable.
9. Lighting must be equivalent to 50 foot-candles as measured 3 feet from the finished floor.
10. The room must have walls that extend to the roof or next floor. It must be sealed all the way around with conduits feeding into the room for security. Solid ceilings are acceptable.
11. Telecommunication Room floors are to have a minimum loading of 50 LB/per square feet.
12. Provisions should be made for a telephone in each Telecommunications Room.

TR Room Contents

The Telecommunication Room must be equipped with the following:

1. Minimums of two dedicated 3-wire 120V AC duplex electrical outlets, which are on separate circuits and are 20 ampere rated. More may be required if equipment needs dictate.
2. Fire suppression equipment may be installed if required by the fire marshal or contractor.
3. Line one or two adjacent walls with ¾ inch A-C plywood 8 feet high. This must be painted with a fire resistant, low gloss, light colored paint. (Note: fire rated plywood may be substituted)
4. Additionally, one utility/common use 120-volt AC outlet should be provided on each wall of the room, labeled as such.

2.4 CONDUITS AND PATHWAYS

General Pathway Requirements

1. All pathways must be installed to meet national and local building codes. NEC Article 392.
2. Cable trays/baskets are preferred for all main pathways and should be located adjacent to or over the common building hallways leading to the MCER and TR locations.
3. J-Hooks are permissible but are subject to the following conditions:
    a. They are to be spaced no further apart than 5' apart.
    b. Must contain no more than 50 cables. Else cables trays or home run conduits must be used.
    c. J-hooks that cannot be attached to the building structural steel must be solidly secured using all threads.

Cable Tray Requirements

1. Cable trays should be used throughout the building for main pathways to the MCER and TR locations.
2. The cable trays should be located adjacent to or over the common building hallways leading to the MCER and TR locations.
3. Access to the cable trays is necessary for future cable installations.
4. Conduits used in conjunction with cable trays should terminate within 1 foot of the cable tray run.
5. The inside of cable trays must be free of burrs, sharp edges or projections that can damage cable insulation.

Conduit Requirements

1. All conduit runs are to have no more than two 90-degree bends and no bend must ever exceed 90 degrees.
2. All conduits must be provided with an adequate pull string (rated at 200 lb.).
3. The minimum conduit size is 1-inch (3/4 inch and smaller conduit is **not** acceptable)
4. Multiple outlets off one conduit run are acceptable if ample sizing of the conduit is used. No more than 3 outlets per one conduit run for sizing purposes.

5. Box size and depth of outlet box should accommodate bend radius of all components installed in box.
6. Splicing of wire in a conduit run is not allowed. Splicing of communications wiring is not allowed at any time.
7. All exposed ends of conduits should be reamed and bushed.
8. Communications wiring shall never be placed in the same conduit with electrical power wiring.

Entrance Conduits

Entrance conduits must be provided as follows:

1. A minimum of two 4-inch conduits must be home run from the Main Communications Equipment Room (or Telecommunication Room if designated as an entrance facility) to the Telco point of presence. This is to provide Telco (or serving LEC) a pathway for a serving cable, so they must be contacted to determine where to place the conduit. The conduits should extend into the room a minimum of 2 inches. If the conduits are to be used for pulling large cables the conduits should extend 4 inches or more to give pulling strength for the cable puller.
2. All conduits shall be provided with a non-corrosive pull- rope/pull-tape (a measured mule tape is preferred) rated at 200 pounds pulling strength All non-Telco conduits that leave the building are to be stubbed out and blocked-plugged just outside the building. If the contractor has a way of leaving a marker for the conduits provisions should be made at this time upon covering up the conduits.
3. The size and content of the building determines the amount of entrance facility conduits.
4. The two 4 inch conduits must be contiguous and must be coordinated with the Department of Information Technology and the agency.
5. The path of the two 4 inch conduits must be indicated on the architectural plans.

Riser Conduits

Conduits between Main Communications Equipment Room and Telecommunication Rooms must be provided as follows:

1. At least three 4-inch conduits are to be provided between floors (add) – with a minimum of 2 inches penetration into room. (Usually between Telecommunication Rooms).
2. At least one 4-inch conduit is to be provided between Telecommunication Rooms on the same floor- minimum of 2 inches penetration into room.
3. Conduits should be brought up at the location where the backboard is installed in the room.

Horizontal Station Serving Conduits

Conduits used to serve the workstation must be provided as follows:

1. Conduits terminating in either the Telecommunications Room or Main Communications Equipment Room are to protrude 4 inches up from the finished floor or 4 inches down from the finished ceiling, depending upon the design.

2. Conduits feeding outlet boxes must be a minimum of 1-inch diameter. If multiple outlets have to be fed from one conduit, add one grade size for each box, (e.g., two boxes =1 1/4 inch, three = 1 1/2 inch, etc.). More than three outlet boxes on a single conduit are not permitted.
3. All telecommunications outlets installed in a dry wall, plaster, or concrete block wall must be at least 4 inch square by 2 1/8 inch deep (quad). The outlet boxes must be equipped with a single gang or double gang with mud ring, and metal cover plates. (Note: In order to meet A.D.A. specifications, the distance from the bottom of the outlet and the finished floor must be at least 15 inches. If this is a wall height phone location ADA requires 48 inches above finished floor.

Campus Conduits

In a campus environment a minimum of one 4 inch conduit must connect each building to the building with the local Telco demarcation point. The Infrastructure Voice and Radio Division must be consulted in any campus project during the design phase.

Other Configurations

Any other pathway or raceway (access floors, under floor ducting, etc.) not covered in this section requires the approval of a Communications Engineer from the Infrastructure Voice Radio Division. The engineer must be contacted early in the design stage.

2.5 Communication/Equipment Racks

Depending on the scope and size of the job, racks will be either floor or wall mounted type.

Floor Mounted Racks

- Floor mounted racks must be 7 feet high and 19 inches wide for the purpose of mounting communications equipment and patch panels.
- A ladder rack **must** be attached from the rack to the backboard.
- Dedicated power **must** be mounted on the racks away from the low voltage cabling.
- Power with surge protection **must** be provided for each equipment rack.
- Two shelves should be provided on each equipment rack for non-racked equipment.
- A number 6 AWG copper conductor (NEC article 100) **must** be used to connect separate pieces of ladder style cable raceway and racks to form a continuous ground that connects to the telecommunications grounding bus bar.
- There **must** be a minimum of 3 feet of clear working space in front and behind of any floor standing racks. Care **must** be taken when electrical panels are co-located in the same Telecommunication Room. Adequate working space requirements **must** be met by both the electrical and communication requirements.
- Floor mounted racks **must** be fully secured to the floor using bolts.
- Floor mounted racks of different heights can be used depending upon the application.

Wall mounted racks

- Wall mounted racks must be 2 to 4 feet high and 19 inches wide for the purpose of mounting communications equipment and patch panels.
- Wall mounted racks must be mounted to the ¾" plywood.
- There **must** be a minimum of 3 feet of clear working space in front and of any wall-mounted rack.
- Power with surge protection **must** be provided for all equipment.
- Wall mounted racks **must** also be properly grounded to the ground bus bar.

Wire Management

- Wire Management must be used for all communication/equipment racks.
- Horizontal wire management **must** be no less than 3" wide.
- Vertical wire management **must** be no less than 4" wide.
- There **must** be one U space between either side of all patch panels and the wire management and equipment. (This is for practical access)

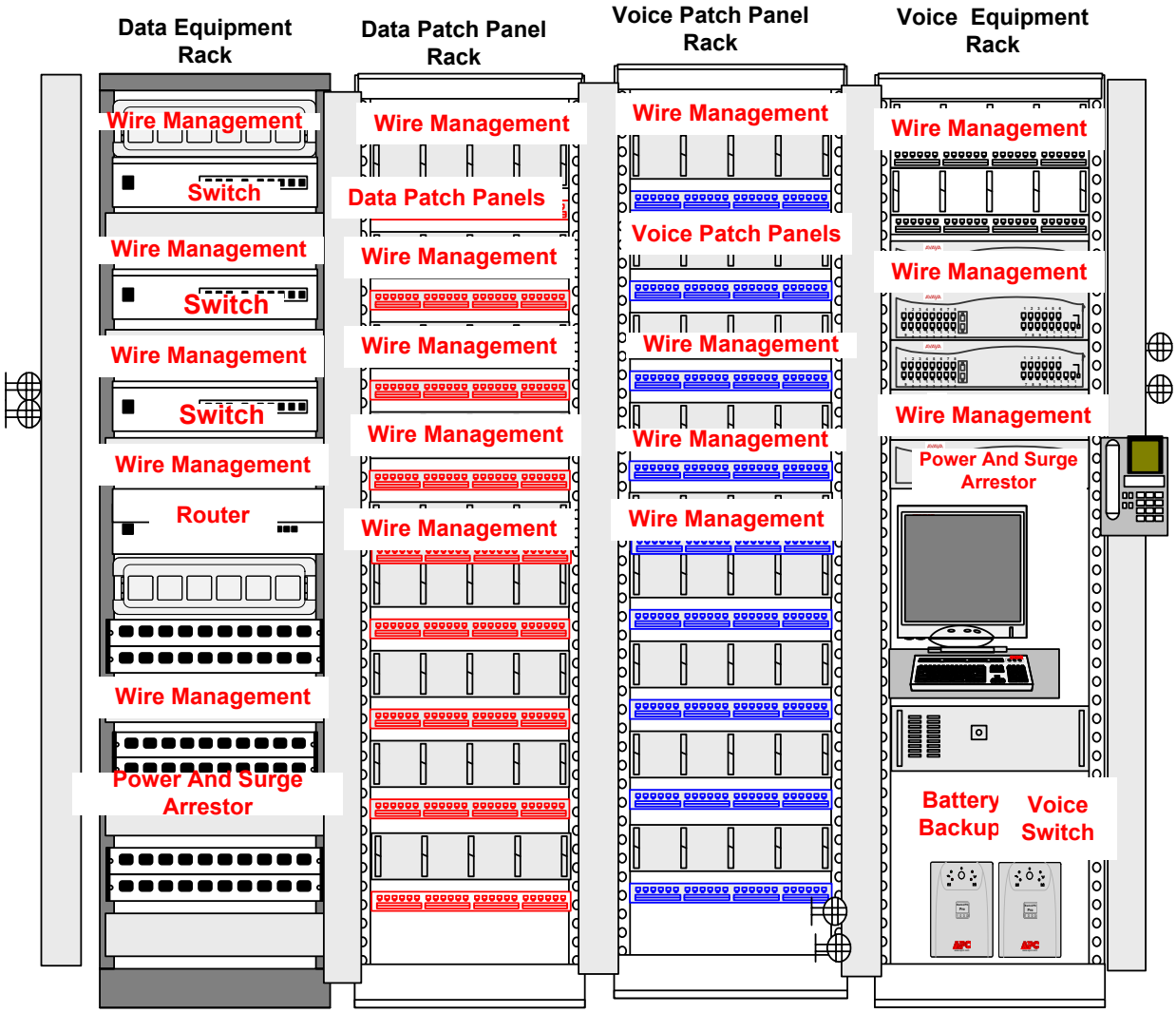


ILLUSTRATION – Typical Communication/Equipment Racks

Illustration of typical Communication/Equipment Racks

3.0 SPECIFICATIONS FOR INTERNAL WIRING

3.1 General Wiring requirements

1. The State's standard for cabling and wiring applications is a Category 6 four pair jacketed cable (commonly called UTP – Unshielded Twisted Pair). STP or shielded twisted pair may be used in environments that require noise immunity but must be approved and tested by a certified communications wiring contractor.
2. The State's standard for horizontal optical fiber to the desktop is 50/125 or 62.5/125-micron multi-mode fiber. It is recommended to use the 50/125-micron multi-mode fiber since it provides longer distances.
3. All inside fiber must be tight buffered.
4. In plenum situations, where conduit is not available, the cable/wire shall be constructed with insulation and jacket material (i.e., Teflon), which satisfies the NEC. Under no circumstances must non-plenum wire be installed in a plenum air return. Some situations allow non-plenum cable because the air plenum is not a return and ducted. If the air space changes to an air plenum action must be taken to ensure public safety according to applicable code.
5. All installed cable shall be Underwriter's Laboratories listed (or recognized) and shall display manufacturer's markings showing the type of installation for which it is approved (reference the NEC, Article 800).
6. All patch cords must be of the same category rating/fiber rating as the wire and jack. If the patch cord is made of copper wire it must be stranded copper wire and not solid. All patch cords and drop cables for data should be factory made and tested - no hand made jumpers should be made except for cross over cables.
7. PDS cabling and wiring shall be placed directly (laid openly or direct buried) or within conduit, depending upon the application and building design considerations.
8. Direct wiring from the Telecommunications Room to the premise equipment is **NOT** allowed
9. The appropriate jacks and cross-connections must be provided with labeling on patch panels and outlet plates.

3.2 Specifications for Internal Use Wire

Horizontal Wiring

1. Building inside horizontal wiring shall consist of two runs, one for voice and one for data, which will connect employee workstation terminals (outlets), with their serving Telecommunication Room or cable termination point.
2. Wiring runs shall be installed in such a way that electrical interference generating devices are avoided (florescent lighting fixtures, electric motors, X-ray machines, etc. To avoid electromagnetic interference, all horizontal cabling shall have clearances of at least:
    - 4 feet from large motors or transformers
    - 1 foot from conduit and cables used for electrical power distribution
    - 1 foot from florescent lighting

3. Wiring runs should be placed behind the backboards in both the Main Communications Equipment Room and Telecommunications Rooms. The cables will be brought through the backboard directly behind the connecting blocks. This will allow cross-connections to be made in an orderly manner by not having to cross over exposed cables running vertically on the backboard.
4. The two runs shall consist of 4 twisted pairs (8 conductors).
    - One minimum Category 6 rated UTP for voice communications.
    - One minimum Category 6 rated UTP or fiber cable for data communications.
5. If a higher grade of wire is installed the minimum test must be at that level.
6. The installation of fiber as a horizontal medium (fiber to the desktop) is a design consideration for future applications.
7. Transition from copper to fiber will require equipment that is compatible at the workstation as well as in the Main Communications Equipment Room.
8. The maximum lengths of horizontal distribution cables are:
    - From the termination in the Telecommunications Room to the outlet - 295 feet (average runs are to be - 150 feet).
    - Combinations of patch cords and cross-connect jumpers in the Telecommunications Room - 20 feet
    - Connections from the outlet to the user station - 10 feet
    - Total maximum length including patch cables and cable slack must not exceed 325 feet.
9. Horizontal wiring must be installed in a star topology (homeruns from each outlet to the Telecommunications Room). No splices may be made. If a transition box is installed only one transition may be installed.
10. Cable slack shall be as follows:
    - Over all in the Telecommunications Room - 10 feet
    - 12 inches at the outlet
    - The same slack will apply to fiber, coax, UTP or any other type of wiring installed
11. Cables should cross perpendicular to florescent lighting and electrical power cables and conduits.
12. The minimum bend radius' for horizontal cables are:
    - No less than six times the cable diameter for
        - UTP
        - STP
        - Coaxial cable
    - No less than ten times the cable diameter for optical fiber
13. All wiring that is not contained in a closed pathway (conduit, cable tray, etc.) must be supported by J-supports above the ceiling:
    - Located on 48 inches to 60 inches centers
    - May hold up to fifty .25 inches diameter cables.
    - Cable loads must be calculated when large horizontal pathways are used.
    - Under no circumstances can horizontal pathways be cable tied, cinched to existing false ceilings or laid upon the ceiling tile.
    - All cables must be bundled and or supported by Approved Reusable Hook and Loop Cable Ties. Nylon tie wraps are NOT acceptable.

- Directional changes must be made immediately after supporting points (i.e.: J-Hooks).

14. All cable runs must follow a logical and orderly path.

Backbone (Riser) Cables

1. Design backbone cables to provide for all anticipated low Voltage DC wiring needs. This can include:
    - Telephone and data wiring systems
    - Paging and public address systems
    - Environmental and intrusion alarms
    - Fire and security systems
    - Video systems- CATV/MATV
    - Other special purpose requirements
    - Foreseeable growth needs must be included.
2. Riser cables will be placed behind the backboards the backboard directly behind the connecting blocks or patch panels. This will allow cross-connections to be made in an orderly manner by not having to cross over exposed cables running vertically on the backboard.
3. All riser cables must be terminated and labeled at both ends.
4. Fiber will be installed and terminated - tested in both directions for dB loss and noted on NEMA termination box.
5. Risers may consist of either solid category 6 rated wire or optical fiber or both. Determination/exceptions will be made by the DOIT Infrastructure Voice Radio Division Engineer.

Unshielded Twisted Pair

Voice and data cable - Unshielded Twisted Pair (EIA/TIA Category 6): (See Illustration D).

- Category 6 apply to connecting hardware appropriate for use with UTP cables specified in EIA 568-C.
- These values are consistent with specification EIA/TIA-568-C connecting hardware requirements.

Fiber Optic Cable

The following are specifications defined by EIA/TIA 568C:

1. Fiber Optic cable - 8.3 micron core, single mode:
    - Attenuation per kilometer @ 1310 nanometers = .7 dB maximum.
    - Attenuation per kilometer @ 1550 nanometers = .45 dB maximum.
2. Fiber Optic cable – 50 micron core Multimode:
    - Attenuation per kilometer @ 850 nanometers = 4 dB maximum.
    - Attenuation per kilometer @ 1300 nanometers = 1.2 as maximum.
    - Bandwidth Range = 500 to 700 MHz per kilometer @ 850 nm.
    - Bandwidth Range = 500 to 1100 MHz per kilometer @ 1300 nm.
3. Fiber Optic cable - 62.5 micron core, Multimode:
    - Attenuation per kilometer @ 850 nanometers = 4 dB maximum.

- Attenuation per kilometer @ 1300 nanometers = 2.7 dB maximum.
- Bandwidth Range = 160 to 300 MHz per kilometer @ 850 nm.
- Bandwidth Range = 300 to 700 MHz per kilometer @ 1300 nm.

4. Fiber Optic Testing - (See Illustration C)

Special Cable Requirements

Agencies requiring special wire types (coaxial, under carpet, STP, fiber, etc.) other than the recommended State standard should coordinate with the DOIT Infrastructure Voice Radio Division Engineer.

Fiber Optic Testing

The three basic segments, their cable characteristics, and testing recommendations are shown in the chart below.

INTERBUILDING BACKBONE

CHARACTERISTICS	TESTING RECOMMENDATIONS

Segments typically have the fewest cables: however, the cables usually have the highest fiber counts and the longest routes of any of the segments. They are generally not easily accessible (i.e., buried or installed in conduit or duct runs).	Extensive testing is recommended because these cables are the primary backbones for most data, voice, and video telecommunications systems. Recommended testing includes:
	• End-to-end attenuation testing for all connectorized fibers at both 850 nm and 1300 nm wavelengths to:
	  • Ensure predicted system performance.
	  • Document the system.
	  • Perform routine maintenance checks as required.
	• OTDR signature trace documentation for as-built records and benchmark performance records. Comparing follow-up routine maintenance checks to the initial records can quickly reveal potential problems. If a cable breaks, an OTDR signature trace can quickly pinpoint the exact fault location, minimizing system downtime.

INTRABUILDING BACKBONE

CHARACTERISTICS	TESTING RECOMMENDATIONS

Segments consist of medium-fiber-count cables connecting intermediate cross-connects (IC's) to Telecommunications Rooms. Distances range from 100 to 1,000 feet or more. Cables are routed through riser shafts, conduits, or cable trays, and are fairly easy to install, access,	Testing recommended for these segments is not as extensive as for the inter-building backbone. Recommended testing includes:
	• End-to-end attenuation testing for all connectorized fibers at both 850 nm and 1300 nm wavelengths to:
	  • Ensure predicted system performance.
	  • Document the system.
	  • Perform routine maintenance checks as required.
	• OTDR inspection of intra-building runs after installation is recommended to check for faults and overall length.
	Signature trace documentation is not required, due to cable length and accessibility, but could be beneficial during system troubleshooting.

and reconfigure.	

HORIZONTAL CABLING

CHARACTERISTICS	TESTING RECOMMENDATIONS
Consists of high numbers of low-fiber-count cables that run from the telecom. Telecommunication Room to work area telecom. Outlets. Runs are usually less than 300 feet and follow routes through a variety of hardware and distribution systems, including: cable trays, conduit, plenum areas, raised floors, cellular duct, & furniture systems	Minimal testing is recommended because runs are short and accessible. However, the time required for testing is high due to the number of runs. Recommended testing includes: • End-to-end attenuation testing at either 850 nm or 1300 nm to ensure predicted system performances. Testing at one wavelength is sufficient for short runs because test results are similar at both wavelengths. • OTDR inspection and traces are not necessary unless the end-to-end readings are high.

Illustration C

Recommended Segment Testing

Test	Premises Segment (see Note 5)			Equipment Needed
	Inter-building Backbone	Intra-building Backbone	Horizontal Cabling	
End-to-end Attenuation (see Note 1)	850 & 1300 nm	850 & 1300 nm	850 or 1300 nm	Power meter, light source
Connector Loss (See Note 3)	850 or 1300 nm	850 or 1300 nm	Not required	OTDR
Splice: Loss (See Note 3)	850 or 1300 nm	850 or 1300 nm	Not applicable	OTDR of fusion splicer reading
OTDR Documentation (See Note 3)	850 or 1300 nm signature trace	850 or 1300 nm inspection	Not required	OTDR
Bandwidth (See Note 3)	(See Note 4)	(See Note 4)	(See Note 4)	Bandwidth Test Set

Illustration C (cont.)

Testing and Documentation - Fiber

- Every fiber shall be tested and documented.
- Every fiber shall be tested with a light source tester; OTDR testing may be required at the UTA representative's discretion. Testing with either a light source meter or an OTDR shall be done in both directions.
- Locations of any mechanical or fusion splice should be noted in the OTDR information.
- Light meter tests will be Dual wavelength (850nm, 1300nm) Multi-mode.
- Light meter tests will be Dual wavelength (1310nm, 1550nm) Single mode.
- All tests should be received in a hard copy with a diskette copy of the file.
- All information should be delivered to the Infrastructure Voice Radio Division Engineer, project manager, and building owner in an accurate and timely manner.
- A general rule of thumb for acceptable losses is 0.5db for a multimode termination, 0.3db for a single mode termination and 0.1db for each splice.

Fiber System Loss Budget Calculation

- Acceptable Fiber Attenuations:

Wave Length 850nm	3.50db/km
Wave Length 1300nm	1.00db/km
Wave Length 1310nm	0.40db/km
Wave Length 1550nm	0.30db/km

- Acceptable Connector Attenuation: 0.75db/connector link
- Acceptable Splice Attenuation: 0.10db/splice
- Formula for calculation:
  (Cable Footage * Fiber Attenuation / 3281 ft) + (# of connector pairs * 0.75db) + (# of splices * 0.10db)
  - Cable Footage is the actual length of the fiber run in feet.
  - Fiber Attenuation / 3281 ft is the Acceptable Fiber Attenuation reference for the wavelength being tested divided by 3281 to convert the measurement from kilometers to feet.
  - # of connector pairs indicates the number of patch panel connection points. This will be 2 unless the strand of fiber contains multiple hops.
  - # of splices indicate the number of splices of any type, if any, in the fiber path
- Example Calculation:
  - The job calls for a fiber optic run of 3000 ft.
  - We wish to test it at the 850nm wavelength.
  - This is a single hop test, so there are only 2 connection points, one at either end of the run.
  - There are no splices in the fiber run.
  - The acceptable db loss for this test would be 4.70db.
  - The calculation would be:

    = (3000ft * 3.5db / 3281ft) + (2 [connector pair at either end] * 0.75db) + (0 [no splices] * 0.10db)
    = (3.20db) + (1.50db) + (0db)
    = 4.70db

- If the fiber optic cable installation in this instance is over 4.70db loss when testing at 850nm wavelength, the cable installation does not meet TIA/EIA minimum standards. Whatever is required to bring the test results up to TIA/EIA minimum standards is at the contractor's expense.

Fiber Testing Notes:

1. If any fibers are to be left not terminated, use an OTDR to test end-to-end attenuation.
2. It is common industry practice to ensure the proper bandwidth fiber is purchased, rather than performing actual field bandwidth testing. If documentation on an existing system is not available, field bandwidth testing can be performed on links longer than 1 km (0.62 mi.).
3. These recommendations are based on terminated multimode fiber. For single-mode systems, substitute 1310 nm and 1550 nm for 850 nm and 1300 nm.
4. The maximum allowable attenuation for a horizontal 62.5/125 micron multimode link is 2.0 db (This value is based on the loss of two connector pairs, one pair at the outlet and one pair at the Telecommunication Room, plus 300 feet of optical fiber cable. Attenuation need only be measured at one wavelength and in only one direction.)

3.3 SPECIFICATIONS FOR INTERNAL USE HARDWARE

Terminations (patch panels and blocks)

Copper Terminations

1. Distribution cross connects terminals for Category 6-voice wiring shall consist of 210 type blocks or Category 6 rated patch panels.
2. The terminal blocks shall be designated with the proper category number and mounted vertically (unless specified otherwise by the DOIT Infrastructure Voice Radio Division DOIT Infrastructure Voice Radio Division Engineer)
   - There must be sufficient space between the terminal blocks for ease of placing cross connections.
   - The terminal blocks shall be of high dielectric, low moisture absorption, flame retardant material.
   - A clear space of 6 inches above and below the top and bottom of the connecting 210 blocks for cable handling.
3. Category 6 data service shall require all connecting hardware be specifically rated and marked Category 6.
   - Terminals will be a patch panel type block mounted either in a rack or attached to the backboard.
   - It is recommended that patch panels have no more than two rows of jacks (Standard is 12, 24, or 48), and have wire management hardware above and below each panel.
   - All wire and connecting hardware shall be rated Category 6 on all pairs.
   - No more than one-half inch twist unraveling will be permitted for connecting to terminal blocks or jacks.

Fiber Terminations

1. All fiber ends must be terminated with LC, SC duplex or other TIA/EIA approved connectors mounted in a proper fiber patch panel in the Main Communications Equipment Room /Telecommunications Room. Proper fan-out kits must be used when directly connected to equipment.
2. All terminations at the work station must be terminated using the appropriate fiber connectors:
   - Must provide easy connectivity
   - May be co-located with copper terminal jacks.
   - Should provide slack storage and preserve minimum bend radius.
     - Ensure a minimum 30mm bend radius.
     - Store 1m of 2-fiber cable or buffered fibers.
3. All patch cords for work stations and equipment connections must be the appropriate fiber connectors.
4. Other connectors may be used at the agency discretion.

Terminals (Jacks and plugs)

1. Both voice and data wiring (Category 6) must meet the following requirements:
   - Terminate on a flush mount, female modular connector.
   - Equipped with one 8-position (for voice) modular jack wired as T568A type connection, and labeled with a jack number, an ICON, and a category rating.
   - Equipped with one 8-position (for data) modular jack wired as T568A type connection, and labeled with a jack number, an ICON, and a category rating.
   - With insulation displacement contact (IDC) connections and covered with a faceplate.
   - The faceplate should be expandable to hold up to 4 modular jacks, however the DOIT Infrastructure Voice Radio Division Engineer may require up to 6 jacks assuming that the conduit feeding the outlet has been properly sized.
   - All wiring should adhere to the T568A pin out standard for premise wiring as stated by the latest revision of ANSI/EIA/TIA 568-C Wiring Standard (unless a specific exception is made by the DOIT Infrastructure Voice Radio Division Engineer).
   - To meet Category 6 standards, data wiring must be homerun from the RJ45/RJ48 jack to a patch panel containing RJ45/RJ48 jacks with all pairs meeting the Category 6 specifications (T568-A type jack).
   - Data cables will be wired straight through from jack to jack (see Illustration D).
   - For Category 6 data service, patch panels are preferred.
   - Patch panels used in the Telecommunication/Main Communications Equipment Room can be:
     - Wall mounted with a minimum of 3 feet clearance in front of it for access.
     - Mounted with a free standing rack with 3 feet clearance both front and back.
   - Normally voice and data signals are transmitted over separate cables, but if riser cables are to carry both voice and data signals, then the cable must meet the higher quality standard.

2. Exceptions to normal terminations are as follows
   - Under no circumstances is the contractor to install a proprietary non TIA/EIA standard wiring plant
   - In some instances user agencies may want to incorporate terminals, which combine 210 type modular jacks with RJ45 or RJ48 connectors in order to avoid the requirement for patch panels.
   - In some instances equipment may be located in places other than the Telecommunication or Main Communications Equipment Room. Additional wiring will be necessary in these latter situations.
   - Specific location of the 210 blocks shall be per the agency's floor and backboard plans.
   - If the file server is not to be located in the Telecommunication/Main Communications Equipment Room, the DOIT Infrastructure Voice Radio Division Engineer must plan for additional cabling to the file server location plus suitable termination devices. File server units will be located in the Telecommunication/Main Communications Equipment Room whenever possible. Contractors should determine all equipment locations and connectivity requirements prior to bidding projects.

Jack Configurations and Color Coding

- The State's standard for voice and telephone installations is 8 conductor jacks wired to the ANSI/EIA/TIA 568-C standard, using the T568A pin-out scheme and color-coding. (See Illustration D).
- The State's standard for color-coding and wiring administration is specified by the EIA/TIA-606 standard.
- The State does recommend wall plates that use modular snap-in jacks that can hold up to four modular jacks. This allows for easy installation of additional jacks if necessary.
- Color icons must be used – red for data, and blue for voice at the jack locations.

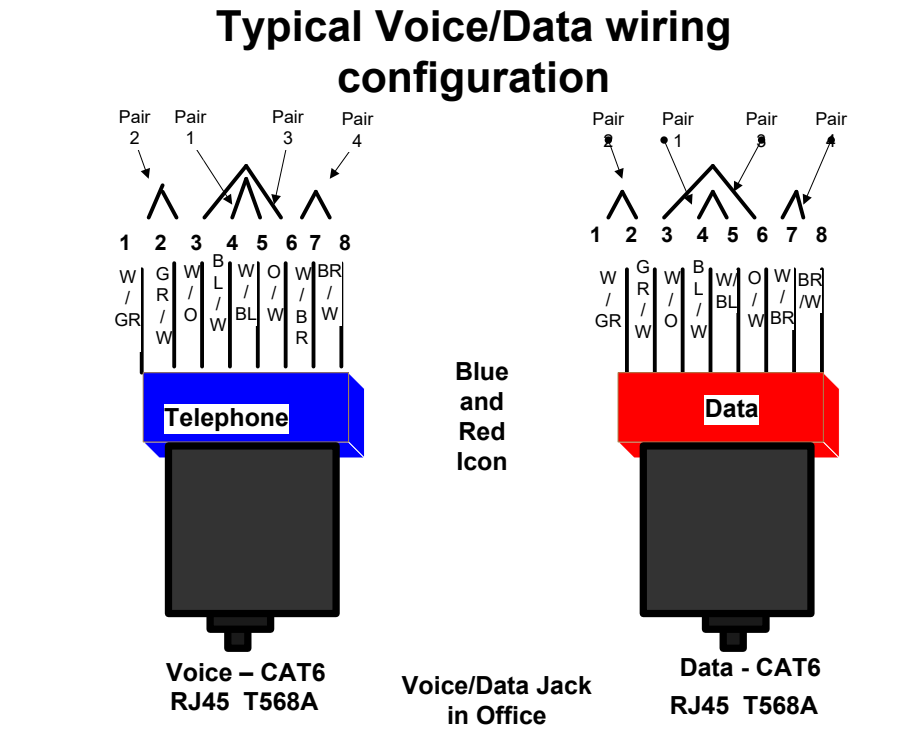
3.4 LABELING

Various components of the PDS must be clearly, legibly, and indelible marked or labeled. We prefer that hand marking not be used. If it is, extra care must be taken to assure legibility.

1. Each telephone jack and data jack and/or faceplate will be marked with the proper category designation and labeled according to EIA/TIA 606A.
2. All outlet jacks will contain a color indicator and coded as follows:
   - Category 6 voice must have a blue icon.
   - Category 6 data must have a red icon.
3. Cables will be marked at each end or breakout point with the cable identity matching the "as built" drawings. Cable markings may consist of tags firmly attached to the physical cable, hand or stenciled markings on the cable sheath, or markings on the termination blocks to which the pairs from the cable attach.
4. Blocks will be marked to show every pair termination and feeder location if pertinent. Markings will normally be placed on the inside of the hinged block covers.
5. Backboards will be divided into sections according to use and marked according to the following:

- Category 6-voice wiring is to be terminated on 210 type blocks or patch panels located in a distinct area of the backboard and clearly marked as “telephone”.
- Data wiring is to be terminated on patch panels located in a distinct area of the backboard and clearly marked as “data”.
- Equipment intended for Category 6 data use shall meet specifications per Illustration D.
- The wiring on both types will be clearly marked to correspond with jack and faceplate numbers.
- Typically, subsections would include PBX wiring, key system wiring, paging system wiring, building wiring, line status indicator wiring, and so forth.

6. Backboard subsections will be color-coded according to function per the following scheme:
   - GREEN = Network connections. Network connections or auxiliary terminations (Ex. cabling from the network interface to the trunk cross connects).
   - PURPLE = Trunk and line connections from system common equipment (Ex. cable connections from a PBX)
   - WHITE = First level backbone and campus cable connections (Ex. the cabling that runs between Main Communications Equipment Rooms and Telecommunication Rooms and the inter-building facilities.)
   - YELLOW = Auxiliary equipment connections (Ex. cabling from a host computer or console device).
   - BLUE = Horizontal wiring to work stations (Ex. the wiring from an IO, typically located in an office, to a cross connect in the Main Communications Equipment Room, a Telecommunication Room, or satellite location).
   - RED = Trunk and line connections from key telephone systems equipment.
   - GRAY = Second level backbone cable connections (Ex. the wiring that runs between cross connects, especially between a backbone and a satellite Room or between satellite locations.)
   - ORANGE = Demarcation point. Central office terminations.
   - BROWN = Inter-building backbone.



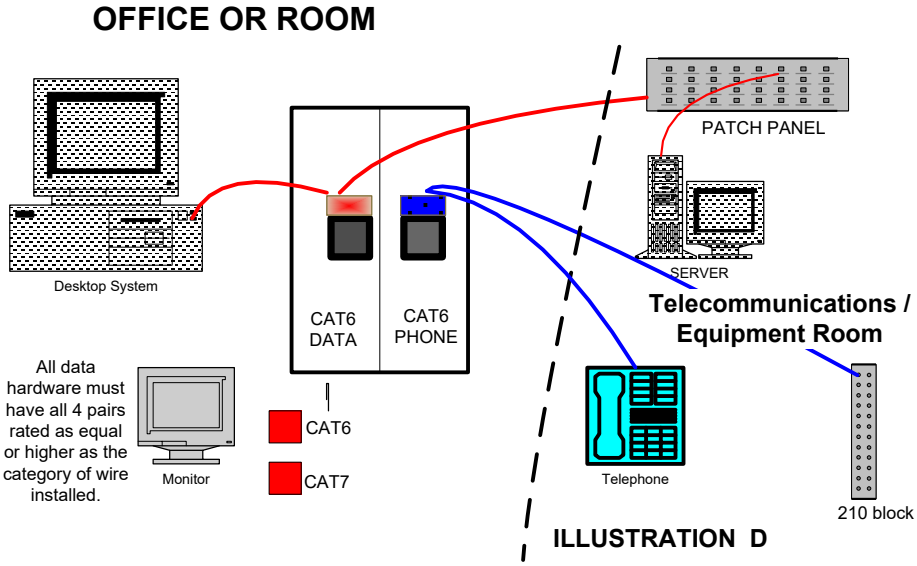
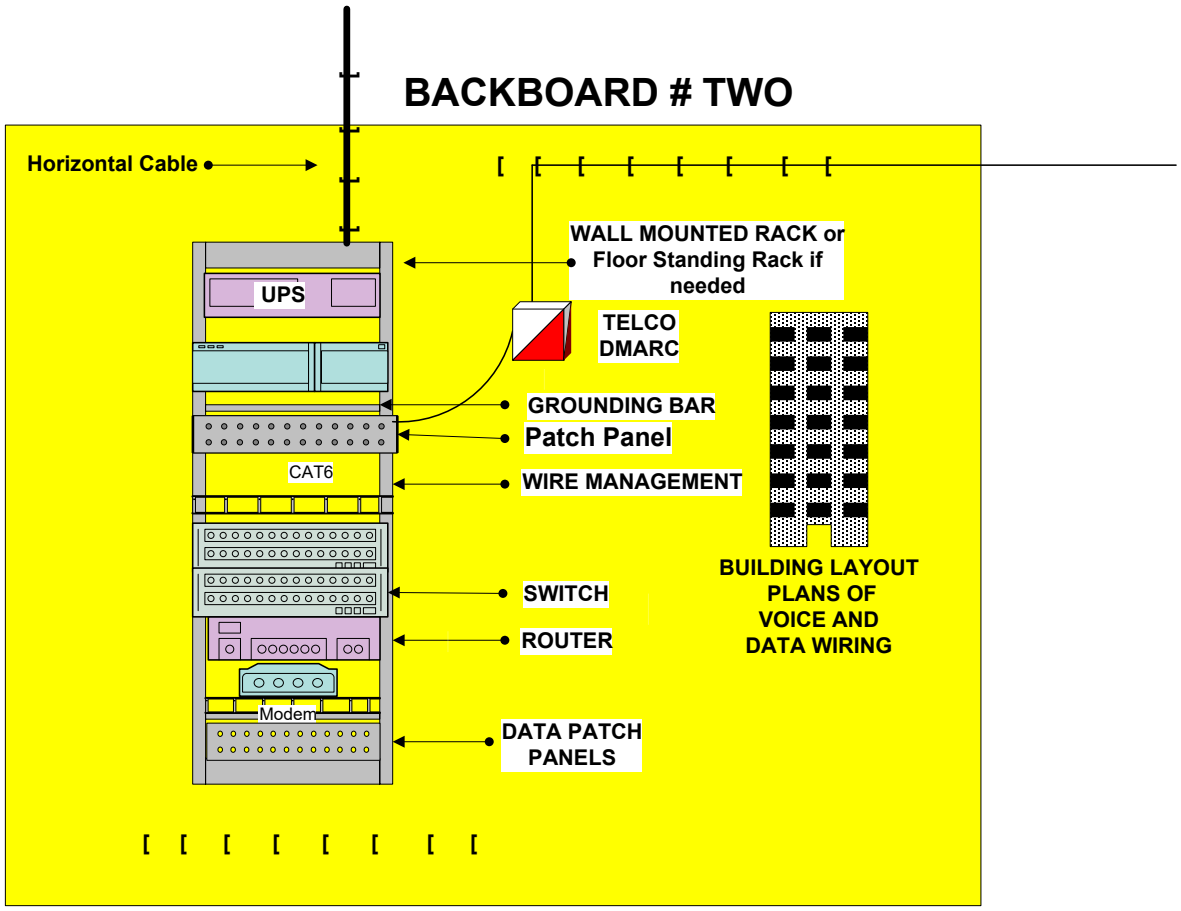
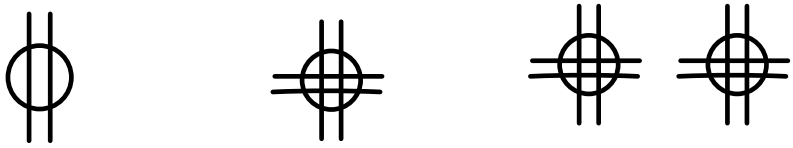


Illustration D





20 amp 120 A/C outlet- L520R dedicated circuit

20 amp 120 A/C quad outlet- dedicated circuit

Two 20 amp 120 A/C quad outlet- dedicated circuit

ILLUSTRATION E

4.0 SPECIFICATIONS FOR EXTERNAL WIRING

4.1 GENERAL WIRING REQUIREMENTS

1) The State prefers buried facilities to aerial facilities whenever possible. Buried cable must be placed in conduit. Cable buried not in conduit (i.e., direct buried) must be coordinated with the DOIT Infrastructure Voice Radio Division Engineer.
2) Documentation for all cable facilities must be provided as follows:
   - Cable design and makeup.
   - Site map of cable layout
   - Length, type, gauge of cable, and number of pairs
   - Physical layout of the cable infrastructure should be documented with an electronic copy of Auto Cad.
   - Location of pull points, power poles, and points of inter-connection

Protection

1. Cables which enter/exit any building shall be provided with over-current and over-voltage protection.
2. Such protection devices shall be located "as close as practicable to the point at which the cable enters the building" (NEC, Section 800-50).
3. Cables between buildings shall be protected at both ends.
4. No protection is required on cables installed completely within the confines of a building. See the NEC, Article 800. Such installations are intended to protect both personnel and equipment from hazardous voltages/currents.
5. Protectors must meet the following specifications:
   - Impulse Breakdown (@ 100V/usec) 1000V Maximum
   - DC Breakdown Voltages 200V Minimum
   - Surge Life (10 x 1000 usec, 10A Crest) 500 Surges
   - Current (1 amp RMS, 1 sec, 60 HZ) 10 Surges
   - High Current Capability (60 HZ, 480V AC) 30 Amp, 15 Minutes
   - Insulation Resistance (@ 50V DC) 100 Meg Ohm Minimum
   - Capacitance 30.0 Pico Farad

(Reliable Electric Co. models 3AB and 3AR, or equivalents, meet these specifications)

6. Carbon protection is outdated and not allowed for new construction.

Grounding and Bonding (EIA/TIA 607)

1. Shield bonding and grounding shall be in compliance with accepted industry standards.
2. The contractor must provide access to the building-grounding electrode/system as described in the NEC handbook. Grounding will be a minimum of #6 AWG copper cable, with a copper ground bar for multiple ground bonds.
3. All telecommunications rooms must adhere to the grounding guidelines set forth in TIA/EIA-607 (Commercial Building, Grounding, and Bonding Requirements for Telecommunications).
4. All Telecommunications Racks must be grounded and bonded to the main building ground (TIA/EIA-607).
5. The Telecommunications Ground Busbar shall:

- Be a predrilled copper busbar provided with standard NEMA bolt hole sizing and spacing for the type of connectors to be used.
- A minimum of 12 bolt holes is required.
- Have minimum dimensions of six mm thick X 50 mm (approximately ¼ inch x 2 inches) wide and variable in length to meet the application requirement with consideration of future growth.

4.2 BURIED FACILITIES

Cable within Conduits (Standards based on EIA/TIA-569)

1. Conduits shall be installed a minimum depth of 24 inches and backfilled with Select Fill material. They must be sized to the following:
   - Schedule 40 or better is standard for all outside conduit runs
   - Schedule 80 is a minimum requirement under most roadways.
   - Under State or Federal Roads a Galvanized Iron Pipe (GIP) is required.
2. Fill compaction must meet local codes.
3. Conduits that penetrate through exterior walls must slope downward toward the outside of the building.
4. Conduits terminating inside of a building shall be installed so that the conduit extends 4 inches beyond the surface from which it emanates. Conduits shall be plugged with inserts to insure that foreign matter does not enter the building.
5. Encase conduits in concrete (2,500 PSI) where:
   - Minimum depth cannot be met
   - Conduits pass under roads, driveways, or railways
   - Bend points are subject to movement
6. The ends of metallic conduit shall be reamed, bushed, and grounded according to the National Electric Code.
7. All conduits shall be provided with a non-corrosive pull- rope/pull-tape (a measured mule tape is preferred) rated at 200 pounds pulling strength.
8. Communications cable placed in conduit outside buildings shall be direct buried quality; interior grade cable shall not be used.
9. No single conduit run can exceed 600 feet without a pull box.
10. The total number of bends in a conduit section run shall not exceed two 90-degree bends or equivalent of sweeps and radius bends. Each bend shall have a minimum radius
    - Six times the internal diameter of conduits 2 inches or smaller
    - Ten times the internal diameter of conduits larger than 2 inches
    - At points of where the conduit is to be swept this point should be built up to prevent separation of the conduit upon pulling the rope/cable. Build-ups can be concrete or other rigid device to secure the sweeps.

Direct Buried Cable (Requires Coordination with DOIT Infrastructure Voice Radio Division Engineer)

1. Cables which enter/exit any building shall be provided with liquid proof splice cases or closures at every point where the manufacture's liquid proof protective sheath has been penetrated.
2. Cable shall be installed a minimum depth of 24 inches and backfilled with Select Fill material.
3. In joint trenching, the minimum space requirements between telecommunications cabling and other facilities are:
    - From power:
        - 3 inches of concrete
        - 4 inches of masonry
        - 12 inches of well tamped earth
    - From pipes (gas, oil, water, etc.):
        - 6 inches when crossing
        - 12 inches when parallel
    - From railroad crossings:
        - 5 feet below top of rail
        - 12 feet from nearest rail, if terminating on a pole
        - 7 feet from nearest rail, if terminating on a pole at a siding
4. Place an orange warning tape 18 inches above the cable.

Note: Local compaction regulations must be met on all buried facilities along with OSHA regulations for shoring of the trench when being dug.

Hand-holes and Manholes

1. Underground cabling shall consist of continuous cable runs wherever possible.
2. Where splices and/or cross-connects are necessary, access shall be provided. Such access shall permit space for an average sized individual to accomplish the tasks, which might be reasonably required (make cross-connects, repair splices, etc.) without physical contortions being necessary.
3. Manholes shall be placed where specified and constructed as follows:
    - Typically no cable run should exceed 600 feet without an access/pull point.
    - A minimum concrete strength of 3,500 PSI
    - Shall have interior hardware made of galvanized steel that includes:
        - Pulling eyes (with a minimum of 7/8 inch diameter)
        - Struts for wall racks
    - Shall have a sump hole of at least 8 inches in diameter and bonding inserts
    - Re-enterable splice cases may be required as designed by the DOIT Infrastructure Voice Radio Division Engineer.
4. Pull points must be designed to use a quasi type hand-hole no smaller than 30 inches by 48 inches by 20 inches deep. Hand-hole construction rating must be determined by the application.

4.3 AERIAL FACILITIES

1. The pole-to-building span shall be no greater than 100 feet with minimum clearances of:
   - 40 inches below power at the pole
   - 12 inches below power at midspan
   - 4 inches horizontally at building attachment
   - 18 feet vertically above street or driveway
   - 9.5 feet vertically above pedestrian traffic
   - 8 feet above rooftops
   - 27 feet vertically above railroad tracks
   - 6 feet horizontally from roof conductors (antennas, mastheads, etc.)
   - Non joint used poles must never exceed sag (seasonal temperature changes affect sag) of more than 10 feet at midspan.
2. The cable entry shall extend through the exterior wall using a:
   - Cable mast
   - Sleeve through wall opening sloping downward toward outside of building

Note: All of the above specifications are subject to State and local codes.

5.0 FIRE-STOPPING

1. All penetrations into firewalls or core holes between floors must be properly fire-stopped in accordance with the guidelines in BICSI TDM 95 Chapter 20. Fig. 11 and must also conform to any related NEC requirements for Fire-stopping.
2. Penetrations into the surface of any Firewall or presumed Firewall should be only slightly larger than the cable or cables that will need to pass through it. This will make Fire-stopping easier and allow the wall to maintain a better over all structural integrity.
3. Proper Fire-stopping should be performed on any hole and/or penetration of a firewall or solid wall. This may include the Contractor installing Mineral Wool in the space between the sheet rock walls and then installing a sheet rock patch on both sides before installing the Fire-Stopping Material.
4. Fire-stop any transitions between floor using or not using conduit and sleeve. When using Fire-stopping Putty in a conduit or sleeves between floors a section of Fire-resistant Mineral Wool must be inserted to create the proper base for the putty. Making a form out of cardboard is *not acceptable*. Fire-stopping pillows are also acceptable to seal an opening that may need to be reentered at a later time.
5. All locations must prominently display the documentation of the appropriate fire-stopping system used.
6. All fire-stopping applications must comply with local codes.

Properly Fire-stopped using SpecSeal™ Intumescent Pillows

6.0 GENERAL SPECIFICATIONS

Workmanship

A professional, industry standard level of workmanship shall apply. In particular, care must be taken to insure no damage occurs to cable, wire, equipment, and other devices being installed or removed, or to co-locate or nearby cable, wire, equipment, and other devices. Care must also be taken to insure no damage occurs to structures or furnishings. If holes must be drilled, trenches dug, and the like, it is the contractor's responsibility to obtain necessary permissions/permits and to return the area to its original appearance/configuration as much as is practical.

Site Inspections

Site visits are recommended prior to responding to CVR's or Request for Quotes'. If any unknown costs occur during the actual installation, the vender will be held financially responsible. The state will **NOT** pay for cost over runs. If a change is needed, a change order request will come from the Infrastructure Voice Radio Division to the contractor or from the contractor to the Infrastructure Voice Radio Division. No other adds, moves, or changes shall occur other than stated by the contract.

Cleanup

The contractor is responsible for maintaining a safe and neat work area. Wire and cable scraps, food and drink containers, smoking materials, and other trash shall not be permitted to accumulate.

Security

The physical security of all contractors' property and State property in the contractor's custody shall be the contractor's responsibility.

Power Poles

Where electrical power and communications wiring are to share power poles; one channel shall be dedicated to the voice and data wiring. In no case will power and communications be run in the same power pole channel. Power poles should be sized to meet current and future needs.

Office Power Requirements

A single 20 amp circuit shall serve no more than three PCs and peripherals. **Special Cable**

A vendor must specify and quote plenum rated cable when appropriate.

Removals

For any job tasking, which requires the removal of existing cabling and wiring the following will apply:

- Workmanship will meet the same standard as for installations.
- Old cable and wire will be removed from conduit, power poles, ceilings, walls, etc.
- Disposition of old cable and wire will be in accordance with instructions from the DOIT Infrastructure Voice Radio Division Engineer.

7.0 PROJECT COMPLETION - HANDOVER:

The wiring contractor shall demonstrate and document the quality, completeness and operational functionality of the building wiring system prior to its acceptance by the DOIT Infrastructure Voice Radio Division Engineer and the agency project manager. This demonstration and documentation shall include the following:

Verification of the system

This verification shall consist of actual testing by the contractor that all telephone and data jacks function properly, are wired correctly, have continuity, and are mechanically and electrically sound. All voice and data wire runs and all fiber runs MUST be tested with an approved cable tester (e.g. Scope, Fluke, Microtest, etc.). The testing parameters for category 6 MUST be in compliance with ANSI/TIA/EIA 568-C.2 and ANSI/TIA/EIA 568-C.2-1-2002 standard, respectively. The results will be supplied to the DOIT Infrastructure Voice Radio Division Engineer and Agency Project Manager in an electronic format. The DOIT Infrastructure Voice Radio Division Engineer may make exceptions for special wiring and small wiring projects. The system must function according to the concept of Operational Functionality. That is, the PDS must support telecommunications devices designed to be operated over the type cable/wire. The system must be covered by a manufacturers warranty for system components and a vendors warranty for installation.

Regulations and Codes

1. All cable and wire installed by the contractor shall comply with all National, State, and local regulations and codes governing such installations.
2. The contractor shall insure that the entire installation, including all equipment, devices, and material, are in compliance with the FCC Registration Program for connection to the public switched network (Part 68, Chapter 1, Title 47, of the Code of Federal Regulations), as applicable, as well as with all local regulations and codes as pertain to communications systems.
3. The contractor shall have at least one RCDD (Registered Communications Distribution Designer) on staff or retainer for the project. The contractor will also have an ES7/8 journeyman on staff or retainer. A general electrician license covers these specialties.

FAILURE TO ADHERE TO NATIONAL ELECTRICAL CODE AND OTHER REGULATIONS AND CODES WILL RESULT IN REPLACEMENT OF THE INADEQUATE ELEMENTS AT THE VENDOR'S EXPENSE, AND WITHIN THE EXISTING SCHEDULE.

Drawings

The contractor MUST provide one hard copy of the "as built" drawings to the using agency displayed in the MCER. An electronic copy must be supplied to the Infrastructure Voice Radio Division depicting the installed configuration and design of the cable or wiring system. These "as built" drawings shall be professional quality; 11 inches X 17 inches in size, and will be laminated and contain at a minimum the following information.

- Points of interconnection (i.e., all pull boxes, pedestals, manholes, and hand holes).
- Location of conduit and/or wiring/cabling runs (outside plant).
- Length of all backbone cables (campus, vertical, and horizontal).
- Cable counts.
- Location of power poles.
- General system drawing.
- Location of MPOP.
- Type of cable (Category 6, or fiber for both voice and data).

Inspection

The DOIT Infrastructure Voice Radio Division Engineer and Agency Project Manager will coordinate the control and quality of each wiring installation.

8.0 QUESTIONS AND SUGGESTIONS

We actively solicit suggestions for improving this standard and encourage questions concerning its content. Please direct questions and suggestions to:

Rick Faris, Communication Engineer, RCDD **505-841-4265**

9.0 Definitions and Terminology

"Backboard":

A backboard is a 4 x 8-foot sheet of ¾ inch A-C plywood, mounted on end, which is attached to a wall of the Main Communications Equipment Room and Telecommunications Room to serve as an attachment base for wire distribution hardware and related equipment. Backboards must be painted with a fire resistant, low gloss, light colored paint. (Note: fire rated plywood may be Substituted), (See Illustrations B and E)

"BICSI":

Building Industry Consulting Services International – An organization dedicated to maintaining wiring standards for the telecommunications industry.

"Building Inside Horizontal Cabling/Wiring":

See "Horizontal Distribution".

"Category Ratings":

Unshielded and shielded twisted pair cables-

- **Cat 1:** Currently unrecognized by TIA/EIA. Previously used for POTS telephone communications, ISDN and doorbell wiring.
- **Cat 2**: Currently unrecognized by TIA/EIA. Previously was frequently used on 4 Mbit/s token ring networks.
- **Cat 3**: . Currently defined in TIA/EIA-568-C, used for data networks using frequencies up to 16 MHz. Historically popular for 10 Mbit/s Ethernet networks
- **Cat 4**: Currently unrecognized by TIA/EIA. Provided performance of up to 20 MHz, and was frequently used on 16 Mbit/s token ring networks.
- **Cat 5**: Currently unrecognized by TIA/EIA. Provided performance of up to 100 MHz, and was frequently used on 100 Mbit/s ethernet networks. May be unsuitable for 1000BASE-T gigabit ethernet.
- **Cat 5e**: Currently defined in TIA/EIA-568-C. Provides performance of up to 100 MHz, and is frequently used for both 100 Mbit/s and gigabit ethernet networks.
- **Cat 6**: Currently defined in TIA/EIA-568-C. It provides performance of up to 250 MHz, more than double category 5 and 5e.
- **Cat 6a**: Specification for 10 Gbit/s applications.
- **Cat 7**: An informal name applied to ISO/IEC 11801 Class F cabling. This standard specifies four individually-shielded pairs (STP) inside an overall shield. Designed for transmission at frequencies up to 600 MHz.

* **Definitions for Categories from Wikipedia.**

“Campus”:

A group of adjacent buildings, usually administratively related, such as a college, prison, hospital, or government setting.

“Coaxial Cable”:

Coaxial cable is a type of distribution cable commonly used to carry high-speed data or radio frequency signals over moderate distances. It consists of an insulated conductor, of either single or stranded composition, surrounded by a wire braid or mesh sheath that performs a shielding function which in-turn is surrounded by an insulating jacket.

“Conditioned power”:

This is an umbrella phrase covering a number of methods for providing power to sensitive telecommunications or computer equipment. This depends upon the telecommunications or computer equipment involved. Conditioned power may be as little as surge protection alone, or it could extend to rectification of the line AC with a large battery bank capable of carrying the load for several hours. Typical “conditioned power” installations convert line AC to DC that maintains a battery bank from which the telecommunications or computer equipment is normally powered. Depending on the application, the batteries are sized to carry the full load from 15 minutes to several hours. The common term for this arrangement is Uninterruptible Power System (UPS). Installations where telecommunications or computer equipment is normally powered directly from line AC but with a battery backup arrangement is not “conditioned power”.

“Contract”:

An agreement for the procurement of items of tangible personal property or services.

“Contractor”:

A vendor selected via the RFP/CVR process; a successful offeror.

“CVR”:

Contract Vendor Request - A written request to an approved (contracted) vendor to provide, or quote to provide services and/or equipment. A CVR is only used where a contract for the services and/or equipment is already in place.

“Data Grade Twisted Pair”:

See “Twisted pair”.

“Department”:

The Department of Information Technology.

“DOIT Infrastructure Voice Radio Division Engineer”:

The State of New Mexico, Department of Information Technology, Infrastructure Voice Radio Division (DOIT/IVR), IVR Engineer that has been assigned responsibility for the project/job.

“EIA”:

Electronic Industries Association.

“Equipment”:

Premise Distribution Systems equipment and related hardware, accessories, and spare parts listed in the successful offer's Equipment and Services Schedule (ESS).

“FDDI”:

Fiber Distributed Data Interface.

“General Contractor”:

The vendor with whom the State, has contracted for construction work on a building or campus.

“Horizontal Distribution”:

This is that portion of The Premise Distribution system that serves a single floor. This consists of all of the wire and hardware Telecommunications Room to the serving customer outlet.

“Intermediate Distribution Frame (IDF)”:

Any of several types of wire or fiber optic cable connection points where the distribution system interfaces with switching or data systems, or where the distribution system changes purpose such as the point where the horizontal distribution system interfaces with riser cables, or where a premise's system interfaces with campus cable.

“Inside Plant”:

Communication-Electronic equipment, wiring, cabling and fibers that extend inward inside a building from the MPOP or entrance cable termination point.

“IVR”:

Infrastructure Voice Radio Division – the state’s engineering group responsible for the voice and data networks for the State of New Mexico and its agencies

“Jack”:

In this case, a data or telephone jack. This is the point of interconnection, typically in the wall like an electrical outlet, where a telephone or data terminal may be connected (typically this is a "plug-in" type connection).

“Minimum Point of Presence (MPOP)”:

The MPOP is the place where the public networks (e.g. U.S. West) wiring interfaces with the wiring of the building. It may also be called the entrance cable and conduit, along with its wiring distribution frame or block. (See Illustrations B and E)

“NEC”:

National Electric Code, current edition.

‘NEMA”:

National Electrical Manufacturers Association.

“Multimode Fiber”:

An optical waveguide in which light travels in multiple modes (paths).

“Operational Functionality”:

All installations must not only meet the specifications described herein, but must function properly.

“Outside Plant”:

All equipment, wiring, cabling and fibers buried, aerial, or otherwise, connecting one or more buildings. This includes that portion of the outside plant facilities which are physically inside a building but which extend outward from the MPOP or entrance cable termination point.

"PDS":

See Premises Distribution System.

"Plastic Insulated Conductor (PIC)":

Conductors covered with an extruded coating of plastic, either polyethylene or polypropylene.

"Plenum":

A compartment or chamber to which one or more air ducts are connected and which forms part of the building air distribution system. Special NEC requirements apply to cabling/wiring transiting plenums.

"Premises Distribution System":

All the telecommunications wiring and cabling within a building or group of adjacent buildings (campus).

"Riser Cable": (Backbone Cable)

Riser cable is the segment of building wiring that connects the horizontal distribution system on different floors of the building with one another. This connection is accomplished in the Telecommunication Room on each floor. Special NEC requirements apply. (See vertical distribution.)

"Run (cable run)":

A continuous length of cable linking two interconnection points or devices.

"Single-mode Fiber":

An optical waveguide in which light travels in only one mode (path).

"State":

The State of New Mexico.

State Statute 15-5-6:

All departments, institutions and agencies of the state government to the extent that it is practical and feasible shall participate in the central telephone system. No agreement for any leased or purchased telephone service or for purchase of any telephone equipment shall be entered into by any department, institution or agency of the state participating in the central telephone system, except those institutions enumerated in Article 12, Section 11 of the New Mexico constitution, except upon prior written approval of the secretary of general services or the director of the Infrastructure Voice Radio Division, acting as his designee. If, on the basis of a technical survey, it is found to be infeasible or impractical to include particular agencies, departments or institutions in the central telephone system, the director of the Infrastructure Voice Radio Division may exclude them. In the event of exclusion of any agency, department or institution, the director of the Infrastructure Voice Radio Division shall file a written statement, certifying the reasons therefore, with the state records center.

"TIA":

Telecommunications Industry Association.

“TSB-36”:

Technical Systems Bulletin number 36 of the EIA/TIA. Covers cable performance.

“TSB-40”:

Technical Systems Bulletin number 40 of the EIA/TIA. Covers connecting hardware performance.

“Twisted Pair”:

Twisted pair is just what the name implies. Typically, it consists of two unshielded but insulated conductors, twisted together to prevent inductive crosstalk. Twisted pair can carry telephone signals effectively and has been found to be a very cost effective way to carry moderate speed data communications over moderate distances within a building and even between buildings, which are close to one another. (See Category Ratings). Twisting wire minimizes radiated signal energy and reduces the effects of cross talk. Generally, dramatic decreases in radiation and cross talk can be achieved by increasing the number of twists per foot. Category 6 wires may be either solid or stranded.

“Turnkey”:

A term describing a job or project completed by the contractor to the extent that no further work is required for the result to be used as intended. For example, a turnkey building-wiring project would require that the client only plug a telephone or data set into a wall jack for the circuit to work (presuming the PABX or host computer programming is complete). In other words, the contractor must deliver a complete system ready to perform its function.

“Unshielded Twisted Pair”: (UTP)

See “Twisted pair”.

“Vertical Distribution”:

The vertical portion of a premises distribution system, such as the system providing connectivity between floors. (See Riser Cable).