Standards and Guidelines for Telecommunications Wiring Design and Installation
Montana State University-Bozeman

This document defines the standards used for voice and data wiring in buildings used by MSU departments. All telecommunications wiring will be performed by the Information Technology Center (ITC) or by contractors meeting ITC’s Campus Wiring Standards requirements. Throughout the document the word *shall* is mandatory. Where the word *preferred* is used we would like it done this way and it would be expected in new building construction. The terms cabling and wiring are used interchangeably. For more details about the industry telecommunication standards, which MSU complies with, see the TIA/EIA Commercial Building Telecommunications Cabling Standards as follows:

- Commercial Building Telecommunications Cabling 568-B.1-5;
- Commercial Building Standard for Telecommunications Pathways and Spaces 569-B;
- Commercial Building Grounding (Earthing) and Bonding Requirements for Telecommunications TIA-607-B;
- Customer-owned Outside Plant Telecommunications Infrastructure Standard TIA-758-A.

All communication wiring contractors must be TE Connectivity (Tyco Electronics) authorized AMP NETCONNECT Design and Installation (AMP ND&I) contractors, and must register their Amp wiring installation for the AMP NETCONNECT 25 Year Performance Warranty. (For a listing of ND&I Contractors, visit http://www.te.com/en/industries/enterprise-networks-north-america/partners/us-ndis.html.)

The telecommunications network systems contain cable, connectors, electronic equipment, and routing for MSU provided voice and data services and equipment throughout campus buildings. Voice/data cables are routed together from a telecommunications room (TR) to each individual telecommunications workstation outlet, within 76 meters and preferably with on the same floor.

New workstation outlets are typically either a single-gang box or mud ring with two (2) Amp Netconnect Category 6, four-pair, Unshielded Twisted Pair (UTP) cables, or a double-gang box or mud ring with four (4) Amp Netconnect Category 6 four-pair, Unshielded Twisted Pair (UTP) cables. Each cable can be used for either voice or data. All outlets are terminated and tested to Category 6 standards.

Some existing buildings have older standard cable and equipment, Category 5 or Category 5E. These will be replaced by the latest campus standard (currently Category 6) of cable and equipment when remodels, renovations, or new construction are done. For this reason, some Telecommunications Rooms will have a combination of cable and equipment types for some period of time.

MSU has selected Corning for its fiber optic cable, patch panel and connector standards, and Amp Netconnect (Tyco) for its copper telecommunication outlet and station cable product standard. The Amp Netconnect 25-Year Warranty shall be acquired by, or on behalf of ITC, to cover labor and materials on all new construction projects. ITC’s certifications and enrollment in the Tyco Electronics ND&I Program cover work done by the ITC Communication Wiring group.

MSU has selected Cisco for its data electronic equipment; Aruba Networks for its wireless network equipment; and Avaya for its telephone electronic equipment.
Under normal circumstances, the Information Technology Center (ITC) Communication Wiring group designs, installs, tests, certifies, and maintains outside plant and inside building cabling, communication outlet equipment, and telecommunication room racks, patch panels, and wire management components. They also ensure that all NEC and Building Code requirements are met with regard to wall and ceiling penetration sealing and fire-stopping.

ITC’s Infrastructure Systems and Operations (ISO) Networking group specifies the network equipment and fiber optic termination arrangement for each telecommunications room. ITC terminates and tests the fiber optic cable. ISO configures and installs the network switches and installs the necessary fiber patch cables and other accessory equipment to activate the network connections. ITC’s Telephone Services group defines and installs all telephone station equipment. Facilities Services electricians or contracted electricians install conduit, raceway, cable trays, j-hooks, electrical and raceway boxes, racks, seismic bracing and any other rough-in work required.

1.0 Telecommunications Rooms

1.1 Telecommunications Rooms, also known as MDF, IDF, or BDFs (Main, Intermediate, or Building Distribution Facilities), are preferably on each floor in a central and accessible area, and are common access points for backbone and horizontal building cable pathways. Telecommunications Rooms shall contain telecommunications and network equipment, cable terminations, and associated cross-connect or patch cabling. The primary (lowest) TR (on the lowest floor of the building) shall also contain the cable entrance facilities for voice and data. Telecommunications rooms shall be dedicated to the telecommunication function and related support facilities. They should not be shared with electrical installations other than those required for provisioning telecommunication services. Equipment not related to the support of the telecommunications rooms (e.g., piping, ductwork, pneumatic tubing) should not be installed in, pass through, or enter the telecommunications room. Telecommunications rooms shall be located as close as practicable to the center of the area served, and preferably in the core area.

1.2 The maximum horizontal distribution cable distance in new construction or a complete building remodel shall be 76 meters (250ft). If the length of any cable run to a workstation outlet exceeds the 76-meter limitation or if the floor has in excess of 10,000 square feet, additional telecommunication rooms must be configured.

1.3 Telecommunications rooms shall be 10' by 11’ in size if the serving area is 10,000 square feet; 10’ by 9’ if the serving area is 8,000 square feet; 10’ by 7’ if the serving area is 5,000 square feet. In locations where space or outlet numbers are limited, other options such as a single rack, wall mounted racks or enclosed lockable cabinet(s) may be considered. Adequate clearance and access (minimum 36 inches, front and rear) shall be provided to all racks and cabinets, and include any swing radius of cabinet doors or rack frame. It is preferred there be one telecommunications room on each floor, stacked above each other, to facilitate vertical distribution of riser cables.

1.4 Multiple telecommunications rooms in a building will be connected with multi-mode and/or single-mode fiber optics cable, plus 6 (six) Category 6 copper cables. The type of cable will be determined at the planning stage, taking into consideration the amount of network traffic.
between closets, the distance between the telecommunications rooms and the difficulty of running other cables at a future date.

1.5 A minimum of one dedicated 20 amp circuit and 20 amp duplex receptacle shall be installed to power the active electronics located in each telecommunications room. In room where there are two active electronics racks, it is preferred there be two dedicated 20 amp circuits. The receptacle(s) shall be located on the side of, on top of, or at the bottom of the vertical wire manager for the active electronics racks, as determined by the ITC representative for the project. Where racks are placed proximate and perpendicular to a wall, the outlet may also be mounted on the wall adjacent to the nearest rack or wire manager. A Line-Interactive Uninterruptible Power Supply (UPS) shall be provisioned in every Telecommunications Room, to provide reasonable back-up power to the active electronics if electrical service fails. All racks and cable tray shall be grounded. Grounding systems are integral to the provisioning and protection of telecommunications systems and cabling. In addition to helping protect personnel and equipment from hazardous voltages, a proper grounding system may reduce electromagnetic interference (EMI) to and from the telecommunications cabling system. Grounding and bonding shall meet the requirements and practices of application authorities or codes; and shall conform to ANSI/TIA/EIA-607 requirements.

1.6 Below are environmental and other factors that shall be addressed in the design of the telecommunications room.

1.6.1 Electromagnetic Interference – telecommunications rooms shall be located away from sources of electromagnetic interference such as electrical power supply transformers, motors and generators, x-ray equipment, radio or radar transmitter, and induction sealing devices.

1.6.2 Plywood Backboard – a telecommunications room requires a 4’ x 8’, ¾” plywood board securely mounted on at least one wall. The plywood will be fire-rated (fire-retardant) and painted. This item requires discussion and coordination with ITC prior to installation.

1.6.3 Ceiling – Ceiling height will be a minimum clear height of 8 feet without obstructions; however most installations shall be 10 feet to accommodate overhead pathways. For purposes of access and flexibility, it is preferred that dropped ceilings are not provisioned in the telecommunications rooms.

1.6.4 Treatment – Floors shall be sealed, and drywall surfaces painted, to eliminate dust. Painted surfaces shall be light in color to enhance room lighting. Floors shall have anti-static properties where feasible.

1.6.5 Lighting – Lighting shall be a minimum of 500 lx (50 foot-candles) measured 3 feet above the finished floor, illuminating both front and rear of all cabinets and racks. The lighting shall be controlled by one or more switches located near the entrance doors to the room. Lighting fixtures shall not be powered from the same electrical circuit as the telecommunications and network equipment in the telecommunications room.

1.6.6 Door – The door shall be a minimum of 36 inches wide and 80 inches high, without doorsill, hinged to open outward (codes permitting). The door latch shall be a permanent locking type, to maintain limited access.

1.6.7 Floor loading – Telecommunications rooms shall be located on floor areas designed with a minimum floor loading of 50 lbs/ft².

1.6.8 Seismic considerations – All racks shall be bolted to the floor, and braced horizontally to 2 perpendicular walls, by strut members or cable trays.

1.6.9 HVAC shall be included in the design of the telecommunications room to maintain a
consistent maximum room temperature of approximately 72 degrees F. It shall be operational 24 hours per day and 365 days per year.

1.6.10 Contaminants – The telecommunications room shall be protected from contaminants and pollutants that could affect operation and material integrity of the installed cable and equipment. Positive interior air pressure should be maintained by the air-handling system, to prevent the influx of exterior dust, debris, or other contaminants.

1.6.11 Vibration – Potential vibration sources, which can lead to service failures over time, should be avoided, or considered and mitigated, in the design of the telecommunications room.

1.6.12 Security – The telecommunications room will have only 1 access door into the space and a lock shall be installed, keyed to MSU’s Mechanical Room designation. No pass-through access to other spaces is permissible.

1.6.13 Fire Protection – Fire protection of the telecommunications room shall be provided per applicable code. If sprinklers are required, the heads shall be provided with wire cages to prevent accidental operation. Drainage troughs shall be placed under the sprinkler pipes to prevent leakage onto the equipment within the room.

1.7 See TIA/EIA Standard 569-B Commercial Building Telecommunications Pathways & Spaces for more details in planning and installing telecommunications rooms.

Contractor's needing access in MSU established Telecommunications Rooms must contact ITC 24 hours in advance.

2.0 Telecommunications Room Termination Equipment

2.1 Termination floor-standing racks, wall racks and cabinets shall be industry standard 19" equipment (relay) racks. The preferred equipment configuration is at least two Chatsworth floor racks (one for active electronics and one for cable terminations) with double sided Chatsworth vertical wire management units mounted between racks, with wire managers on both sides of all cable termination racks. Floor racks shall be bolted to the floor, to each other and braced to the ceiling or walls to meet seismic standards. Racks and cable trays shall be grounded as per TIA/EIA Standard 607-A Commercial Building Grounding & Bonding. Part numbers for Chatsworth racks are as follows:

- Chatsworth Universal Rack 46353-5-03
- Chatsworth Wire Management Unit 11729-5-03
- Great Lakes Wall Mount Cabinet GL36WM
- Chatsworth Wall Mount Rack 11960-512

If ITC has been determined to use a wall-mounted rack or cabinet, select the appropriate size and style of rack/cabinet to meet the needs of the cable terminations, electronics, and the available space. If the telecommunications room is not in a secure area, lockable cabinets shall be used. Conduits holding cables must meet and secure at the cabinet, and a dedicated electrical outlet will be mounted inside the cabinet so no access can be gained to the equipment or cabling except through the cabinet door. For small installations, use a Wall Mounted Cabinet with 19" swing rack inside and deep enough for electronic equipment. When there is adequate space, use 1 or more floor standing lockable cabinets, if a dedicated telecommunications room is not possible.
2.2 AMP Netconnect patch panels shall be installed on the racks to terminate the Unshielded Twisted Pair (UTP) horizontal wiring. Amp Category 6 high density patch panels are unloaded kits, black in color as follows:

- TE High Density 48 Port Patch Panel Kit 1375015-2
- TE High Density 24 Port Patch Panel Kit 1375014-2

Layout of jacks in the rack patch panel shall have station cables grouped by room number, terminated adjacent to each other, where possible. Wireless access point cables should all be grouped on a separate (dedicated) patch panel.

2.3 Amp Telephone patch panels are installed in the rack to terminate the riser and distribution telephone cable in the rear, and to have telephone patch cables plugged in the front:

- TE 24 Port 557403-1
- TE 48 Port 557411-1

2.4 Siemon Rear Wire Minders shall be installed on the back of the rack, and Amp 2U Wire Managers shall be installed in the front to aide in dressing the cables. All patch panels shall have horizontal wire managers both above and below the patch panel. Part numbers for these products are as follows:

- Siemon Rear Wire Minders WM-BK
- TE Wire Manager 558331-1

3.0 Telecommunications Workstation Outlet Termination Equipment

3.1 At each communication outlet location AMP Netconnect components shall be installed in a single or double gang electrical or surface box. All conduit and surface raceway boxes at each workstation outlet shall be “deep” models. If installation is in a single gang or surface-raceway box, an AMP Single Gang Faceplate is needed. If installation is in a double gang box, an AMP Double Gang Faceplate is needed. Part numbers for the AMP products are as follows:

- TE Single Gang 4 port Faceplate 558088-1
- TE Double Gang 4 port Faceplate 83935-1

3.2 TE keystone jack inserts shall be used in the workstation outlet. AMP Category 6 modular inserts shall be used for all cables. If no jack insert is required, an AMP SL Series blank insert shall be installed. Part numbers for the inserts are as follows:

- TE Category 6 Modular Insert 1375055-1
- TE SL Series Blank Insert 1116412-1

3.3 Jack cable sets (2 cables) shall be oriented left and right in a faceplate, to match the orientation on the patch panel in the TR. Typically, the left cable is used for the telephone connection, and the right cable is used for the network connection. Because both cables are Category 6, they can
be used for voice or data service as required.

4.0 Telecommunications Horizontal Cabling and Support Structure

4.1 The horizontal cabling is the portion of the telecommunications cabling system that extends from the telecommunications room to the work area telecommunications outlet. The horizontal cabling shall be installed in a home run, star topology. It is preferred that a telecommunications room should be located on the same floor as the work areas served. The maximum horizontal distance shall be 76 meters (250 feet). For ease of cable installation and future expansion in hallway or major distribution routes, cable trays are the preferred method for distributing the horizontal wiring from the telecommunications room to the communication outlets. When conduit runs are required a minimum 1” conduit shall be run to each jack; daisy-chaining jacks is not acceptable. J-hooks, spaced every 4 feet, may be used for distribution of small cable bundles above suspended ceiling spaces, from major distribution routes to room outlet locations. Cable trays shall be designed to accommodate a maximum calculated fill ratio of 50% to a maximum of 6 inches inside depth, to allow for future cable installations. Cable tray products shall be B-Line or Flex Tray brand. No cable may be attached to conduit, pipes, any other utility structure, or laid on top of ceiling tile.

4.2 J-hooks shall be attached to building members with fasteners appropriate for the material. Wood screws or lag bolts shall be used for wood, screws with plastic or lead anchors shall be used for plaster and concrete, self-taping screws shall be used for sheet metal. Attachment to drywall alone should be avoided.

4.3 Unistrut or equivalent may be used where necessary to provide attachment points for conduit or cable tray. All Thread Rod shall be secured to threaded anchors.

4.4 Occasionally large hooks that will carry the weight of many cables may be used, and securely attached with lag bolts, metal concrete anchors, or metal anchors with epoxy.

4.5 Hooks shall be mounted no more than four (4) feet apart. Closer spacing may be necessary in areas where cables are routed around corners or are in close proximity to other mechanical or electrical systems.

4.6 Where raceway, cable tray and conduit are used it shall be sized according to the list below. The minimum size for raceway and conduit is 1 inch diameter or equivalent. Use Flextray or B-Line cable tray products. No more than two 90 degree bends are allowed between horizontal cable pull points, although no 90 degree bends is preferred. Use sweeping bend products when 90’s are required. The number of cables that can be installed in a conduit is limited by the allowed maximum pulling tension of the cables. A maximum fill of 40% is preferred to allow for future additions of cable.

4.7 Surface Raceway, Cable Tray and EMT Conduit

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<th>EMT Conduit Sizing Chart</th>
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<td>FT4X4X10</td>
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No section of interior conduit shall be longer than 100 feet between pull points. No section of conduit shall contain more than two 90-degree bends, or equivalent between pull points. For conduits with an internal diameter of 2 inches or less, the inside radius of a bend in conduit shall be at least 6 times the internal diameter. For conduits with an internal diameter of more than 2 inches, the inside radius of a bend in conduit shall be at least 10 times the internal diameter. Conduit sizing is directly related to the planned diameter of the cable bundle, including known future installations, and the maximum pull tension that can be applied to the cable without degradation of the cable transmission properties. Conduits shall be reamed to eliminate burrs and sharp edges. Pull string or rope shall be placed in installed conduits.

Flexible conduit (metal or plastic) is not permitted.

Surface raceway systems shall not force cable into a bend radius less than 1.21 inches under condition of maximum fill.

4.8 When cables are installed in an un-insulated drywall wall, no box is required; instead a device mounting bracket can be mounted securely in the wall.

4.9 When a conduit and surface raceway box is used as both a jack and pull box, the minimum box depth shall be 3-1/8".

4.10 Cable in exposed finished areas (e.g., open ceilings) shall be installed in EMT conduit, or an appropriate raceway. The preference is not to use raceway which combines electrical and communications wiring; however, power poles may be used for this when necessary.

5.0 Telecommunications Cable

5.1.1 Unshielded Twisted Pair (UTP) Category 6 cable shall be used for horizontal wiring of campus buildings. Cable shall be Amp Incorporated (Tyco Electronics) Category 6, four pair UTP. Plenum rated cable will be used throughout a building if cable routing is in return air spaces. The following are the part numbers for Category 6 cable (spools in a box):
TE Non-plenum Category 6 cable – gray – TE620R-GYRB
TE Plenum Category 6 cable – gray – TE620P-GYRB

5.2 A minimum of two UTP Category 6 cables shall be run to each station location. Each pair of station cables is considered a “jack” location. For station locations with more than two cables, additional cables shall be in pairs, with each pair being terminated and labeled as an individual “jack”, even if all are in one faceplate. Wall phone locations may have only 1 cable. At the telephone location, a wall-phone outlet is installed; Part No. IC630DB6.

5.3 Patch cables shall be of the same performance category, or higher, as the horizontal cables to which they connect, and manufactured by Amp Netconnect. Patch cables used are to be factory terminated cables. Patch cables should be 14 feet or shorter at the workstation outlet location (the preferred length is 10 feet). A 3’ to 14’ patch cable shall be used in the telecommunications room from the AMP patch panel to the network switches (the preferred length is one that is just the right length from the network switches to the patch panel port after dressing in wire managers). In no case shall the total distance from workstation outlet to the patch panel exceed 76 meters. Bootless patch cables are preferred. The part numbers are listed below:

- TE Category 6 Patch Cord – Bootless – 1 foot – black TCPC-6RUvB-BK-01F
- TE Category 6 Patch Cord – Bootless – 3 feet – black TCPC-6RUvB-BK-03F
- TE Category 6 Patch Cord – Bootless – 5 feet – black TCPC-6RUvB-BK-05F
- TE Category 6 Patch Cord – Bootless – 7 feet – black TCPC-6RUvB-BK-07F
- TE Category 6 Patch Cord – Bootless – 10 feet – black TCPC-6RUvB-BK-10F
- TE Category 6 Patch Cord – Bootless – 14 feet – black TCPC-6RUvB-BK-14F

6.0 Installation Guidelines for Telecommunications Cable

6.1 The minimum horizontal cable bend radius, under no-load conditions, shall be four times the diameter of the Category 6 cable. The minimum inside bend radius, under no load conditions, for 4-pair UTP patch cable shall be .25 inches.

6.2 The maximum tensile loading shall not exceed 25 pounds on the Category 6 cable.

6.3 Cable ties shall not be installed as to place a strain or compression on the cable jacket.

6.4 Cables that serve several adjacent rooms shall be grouped together into bundles. A single large cable bundle is preferable to several small bundles. It is preferred that the cables be grouped in a way that reduces the quantity of bundles.

6.5 Cables in service areas such as attics, crawl spaces, mechanical chases, and above lay-in ceilings shall be held in place with metal J-hooks or cable tray. The J-hooks shall keep cables neatly bundled and shall be located so as to reduce interference with future maintenance and construction projects. Cables shall be mounted at least 1’ above drop tile ceilings, shall never lie on the ceiling, and shall always be supported every 4 feet.
6.6 In areas where the installation of hooks is impossible, a discussion with an ITC Communication Wiring representative should be initiated. The cables may be bundled with plastic tie-wraps spaced no more than four feet apart, so long as the tie-wraps are tight enough to neatly bundle the cables together, but loose enough to permit the pulling of individual cables within the bundle.

6.7 Electrical or other tape, used for bundling cables during installation, shall be removed once the cables are in place, to allow the slack in individual cables to be more easily removed. Duct tape should not be used for this purpose.

6.8 It is preferred that pull string be left in conduits, cable trays and cable hooks, after initial cable installation, to allow for future cabling needs. Pull string shall be left in places that will be difficult to access in the future.

6.9 Cables that are part of a bundle shall be of uniform length. Uniform cable length is achieved by pulling on individual cables in a bundle after the bundle has been placed in the hooks or raceway and before the cables are terminated.

6.10 Cable bundles shall hang with minimal tension between the hooks. Check cable bundles to verify that individual cables do not have excessive tension, or are supporting the weight of several other cables.

6.11 At vertical to horizontal transitions, cable bundles shall have a uniform loop containing one to three feet of recoverable slack. Additional hooks may be required to support this slack.

6.12 Long open vertical runs shall require intermediate support. These shall support the weight of the cable between horizontal transitions. One foot of slack shall be left at each strain-relief hook so as to insure proper loading of the hooks. Vertically mounted cable tray is preferred for long vertical runs.

6.13 Four inches of service slack shall be left at each outlet box.

6.14 Twenty-four inches of recoverable slack in each cable shall be neatly bundled and secured in the vertical wire management units located adjacent to the patch panel rack.

6.15 Slack or extra cable not mentioned in this section is unacceptable and shall be eliminated prior to termination.

6.16 Patch cables will be neatly dressed in wire managers from the patch panel insert to network switch and telephone patch panel. The upper one-half of a patch panel will have patch cables go directly up to the horizontal wire manager, then right or left to the vertical wire manager, then up or down to the network switch. The lower one-half of the patch panel will have patch cables go directly down to the horizontal wire manager, then right or left to the vertical wire manager, then up or down to the network switch.

7.0 Termination of Telecommunications Cables
7.1 All cables shall be terminated and tested during the installation process.

7.2 Twisted Pairs shall not be untwisted more than 0.5 inches, and preferred .025 inches, from the point of termination for Category 6 cable.

7.3 The cable jacket or outer sheath shall be left intact as close to the termination as possible.

7.4 Cables will be neatly dressed with tie wraps at the rear of the patch panel onto Siemon Rear wire managers, but not cinched so tightly as to indent the cable sheaths.

8.0 Testing of Telecommunications Category 6 cables

8.1 A Category 6 cable tester shall be used to test each cable to Category 6 standards, such as distance, attenuation; NEXT, crosstalk, opens, shorts, pair polarity and connector pin-out.

8.2 Test results will be saved on the tester and then downloaded to the campus network. Any cables not passing all tests shall be investigated, the cause(s) resolved, and the cable re-tested, until all tests are passed for warranty submission. Final test results must be provided to the ITC Communication Wiring group.

8.3 Data will be submitted to Tyco Electronics for the 25-Year Warranty program.

9.0 Telecommunications Labeling and Documentation

9.1 As-built drawings shall be provided and at minimum shall show cable routes, telecommunication room and outlet locations. Drawings will be given to Facilities Services for entry onto their CADD system.

9.2 Each outlet and patch panel pair of ports shall be clearly labeled in both the telecommunications room and the workstation location with the workstation room number. If there are multiple jacks in a room, the numbering shall include a hyphen suffix designation, such as 232-1, 232-2, and will begin at the closest jack to the left of the main doorway (standing in the doorway, looking in), and proceed clockwise around the room. Single jacks in a room shall be labeled with just the room number and will not have a hyphen suffix designation (e.g., 233, 234). If there are jacks located in the center of the room, after going around the exterior of the room, go up the middle from the main doorway. The label at the outlet will be placed on either the top of the faceplate (if difficult to see the front of the faceplate), or on the top label indentation on the front of the faceplate. Four-plex or greater density jack plates will be labeled as two (or more) jacks rather than one, such as 101-1, 101-2. Each jack consists of 2 cables.

10.0 Telecommunications Backbone and Riser cables

10.1 Copper Cables
At the design stage, plans will be made to route the appropriate telephone backbone cable(s) for the building feed(s).

10.1.1 Inter-Building Feed – Under most circumstances, the copper (telephone) backbone cable(s) will originate from 110-type terminal blocks in the Telecom Room in Room 18 of the Renne Library basement. If this feed is routed entirely in the campus tunnel system (i.e., no portion is in underground conduit), the cable specified is to be a CMR rated ARRM-type shielded riser cable, with a fire retardant PVC jacket. If this feed is routed, in whole or in part, in underground conduit, the use of an Alpeth shielded air core PIC-type cable is preferred, and shall be discussed with an ITC Communication Wiring representative before the specification is submitted. Due to the distance between the termination point and the tunnel entrance, per Article 800, section 48 of the National Electric Code, unlisted (unrated) cable (e.g. PIC-type) may not be used, unless routed in rigid metal conduit, or transitioned (spliced) to a CMR-type cable near the tunnel entrance.

10.1.2 Intra-Building Feed – Backbone telephone cable from the building Entrance Protector location to the telecommunications room(s), if they are in different locations, shall be CMR-rated ARRM-type shielded riser cable, and will be installed in conduit unless cable hooks or cable tray are used, and will be concealed from public spaces. The telephone riser cable will be terminated on Category 3 telephone patch panels, with 2-pair (4-conductor) 6-position jacks. For each set of 25-pair cable binder-groups and 24 patch-panel ports, the 25th cable pair (violet-slate) shall be terminated on the white-orange positions of the 24th patch-panel port. Thus, all 25 pairs of a telephone cable binder-group will be terminated on the patch panel, and the 24th port of each group will be a 4-conductor connection.

When workstation outlets are made active for telephone lines, a telephone patch cord (6-conductor flat silver-satin cross-over cable) will be installed between the telephone patch panel(s) and the appropriate Tyco Electronics station cable patch panel port. Determine the appropriate patch cord length and dress it in the cable manager. The following telephone patch panels are to be used:

| TE 24 Port | 557403-1 |

10.2 Fiber-Optic Cables

At the design stage, selection of the inter-building fiber-optic backbone cable(s) shall be made, and plans will be made to route backbone cable from the fiber optic building entrance termination location to the telecommunications room. Indoor fiber riser cable will be used and installed in conduit, cable tray, or in innerduct in cable hooks in concealed spaces.

A determination will be made as to whether multi-mode or single-mode fiber optic cable, or both, will be used. Fiber optic cable will be terminated and tested before the fiber is put into use. Fiber test results shall be provided to the ITC Communication Wiring group. Riser cable connections will be made to the fiber optic building entrance location equipment, and in the telecommunications room active rack.

For both fiber optic outdoor backbone and riser cabling, Corning brand cable is required.
Termination by fusion splice is the preferred method. ITC will specify specific connectors in a project wiring specifications document. Termination in the telecommunications rack shall be in a fiber panel.

11.0 Grounding and Bonding

11.1 The reference and specifications for this section is the TIA-607-B series of standards documents. A copy of these standards documents can be viewed on request to an ITC Communication Wiring representative. All Telecom Rooms shall be outfitted with a Telecommunications Grounding Busbar (TGB), bonded to both building steel and the Electrical Entrance Facility ground. Telecommunications Bonding Backbone conductors shall be sized according to the TIA-607-B specifications.

11.2 All racks and cable tray in each Telecom Room shall be grounded to the TCB with #6 AWG stranded conductors. All Building Entrance Protector housings shall be grounded to the TCB (or to a Main Telecommunications Grounding Busbar) with a minimum #6 AWG stranded conductor.

11.3 All shielded cables shall be bonded together (in a splice arrangement), bonded to the Building Entrance Protector housing, or bonded to the TGB, as the site situation dictates.

12.0 Telecommunications AutoCAD Drawing Legend

12.1 The following Legend and symbols will be used on all telecommunication drawings and plans: Facilities Services CADD Manager or contracted architect/engineers will provide CADD drawings showing outlet locations, major cable routing, and telecommunication rooms.

Legend

- A Single voice/data workstation jack with two 4-pair Cat 6 cables in a single gang electrical box.

- A2 Double voice/data workstation jack with four 4-pair Cat 6 cables mounted in a double gang electrical box.

- A Wall phone jack

- VD VD Cable bundle containing several voice and data cables.

- VD VD Open circle at end of cable bundle designation indicates a horizontal to vertical transition of the cable bundle where cables proceed downwards.
from the transition.

Black dot at end of cable bundle designation indicates a horizontal to vertical transition of the cable bundle where cables proceed upwards from the transition.

Arrow at end of cable bundle designation indicates that various cable pairs in the bundle are distributed to voice/data workstation outlets in the areas near the arrows.

Telecommunications room where all voice and data cables are terminated.

MSU-Bozeman Information Technology Center Communication Wiring Design Guidelines
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