

Portland State University
OIT—Networking & Telecommunications Services

TELECOMMUNICATIONS CABLING/WIRING
INSTALLATION & RELATED FACILITIES STANDARDS
2009-2011

Introduction

The Office of Information Technology/ Networking and Telecommunications Services (OIT-NTS) is responsible for providing voice and data services for Portland State University. Every effort is being made to keep the rates of the services as low as possible while still providing service and maintenance in a timely manner. OIT-NTS is constantly evaluating emerging technologies and equipment so that we can continue to offer the most reliable, up to date, and cost-effective services.

It is essential to design the telecommunications systems to meet present and future voice and data communication needs. Horizontal and vertical wiring and the pathways and communication rooms should be considered an integral part of the building infrastructure and therefore capable of future growth as new technology and customer needs change.

Telecommunications systems include vertical and horizontal copper and fiber optic wiring as well as the associated termination hardware on both ends. The system includes pathways and conduit; equipment racks; frames; wire management systems; communication rooms; and the electrical, mechanical, and environmental equipment required to support them. These specifications are intended to allow OIT-NTS to meet the telecommunications requirements of the University over the lifetime of the buildings. It is essential that OIT-NTS shall be consulted prior to and throughout the planning and design process to ensure that present and future voice and data service requirements can be met.

The standards herein apply to the technologies in use at the time of the latest update to this document. The implementation of newer technologies shall require adherence to the standards written at the time of that implementation.

General Standards

Construction specifications are a main ingredient of an Information Technology system. Information Technology systems shall adhere to these specifications in order to be functional in a wide variety of communications applications. This document does not allow or condone the avoidance of following any of the Laws, Standards, or Procedures of any of, but not limited to, the following:

- National Electrical Code (NEC)
- Uniform Building Code (UBC)
- Uniform Fire Code (UFC)
- State of Oregon Low Voltage Laws
- Building Industry Consulting Services International (BICSI)
- ANSI/TIA/EIA Standards

Related Documents

Materials and equipment shall be manufactured, installed and tested as specified in the latest editions of applicable publications, standards rulings and determinations of:

- ANSI – American National Standards Institute
- TIA/EIA – Telecommunications Industry Association/Electronic Industry Alliance
- FCC – Federal Communications Commission
- BICSI – Telecommunications Distribution Method Manual
- NEC – National Electrical Code
- NFPA-70 – National Fire Protection Association
- ANSI/TIA/EIA-568 Commercial Building Telecommunications Cabling Standard
- TIA/EIA-568-B-2.1, Transmission performance specification for 4 pair 100 Ohm Category 6 cabling.
- ANSI/TIA/EIA-569A Commercial Building Standard for Telecommunications Pathway and Spaces
- ANSI/TIA/EIA-606 Commercial Building Standards for the Telecommunications Infrastructure and Spaces
- ANSI/TIA/EIA- 607 Commercial Building Grounding and Bonding Requirements for Telecommunications
- ANSI/TIA/EIA-TSB-67 Telecommunications System Bulletin Technical Systems Bulletin, Transmission Performance Specifications for Field Testing of Unshielded Twisted Pair Cabling Systems

General Wiring Installation Standards

Based on the standards, practices and procedures contained in the references listed above, the wiring of new buildings and major remodels of existing buildings shall use outlets, jacks, terminal blocks and horizontal wiring that are Category 6 compliant.

For all PSU voice and data communications installations, PSU uses an open architecture design. Communications outlets at workstation and other jack locations shall minimally consist of three gang wall plates equipped with three 8-pin modular (RJ-45) jacks. ***The preferred standard for communications outlets in new construction is four gang wall plates equipped with four 8-pin modular (RJ-45) jacks.*** PSU has standardized on the AMP/TYCO SL type workstation components. These components may be substituted with equivalent product only with the prior approval of OIT/NTS. Horizontal station wire shall extend from communications outlets to associated terminal closets and shall be terminated on Intermediate Distribution Frames (IDF's) using CommScope UNP610 Category 6 modular patch panels. All terminated station wiring shall be properly labeled at the outlet faceplate and the IDF.

Terminal closet material standards include the following: 7' x 19" Chatsworth racking system including wire management and tray, AMP/TYCO Category 6 patch panels & Corning fiber optic connectivity housings and panels. AMP/TYCO patch panel may be substituted with equivalent product only with prior approval of OIT/NTS.

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The riser system shall consist of multi-mode & single-mode fiber and Category 3 copper riser cable. The recommended fiber cable is multi-mode, graded-index optical fiber with a nominal 62.5/125 micron core/cladding diameter and single-mode fiber. The copper riser shall be solid copper, 24 AWG, twisted-pair Category 3 backbone cable. The cable jacket shall comply with Article 800 NEC for use as plenum or non-plenum wire, and all cabling and wiring installation shall comply with appropriate code for plenum or non-plenum requirements.

Certification

A BICSI-certified Registered Communications Distribution Designer (RCDD) shall design, engineer and sign off on all projects and he or she shall provide oversight during the project.

All technicians performing horizontal and riser cabling or wiring work must be certified or otherwise qualified in the installation of Category 6 wire, jacks, patch panels and terminal blocks. While contractors may choose to use less qualified personnel or workers who are not Category 6 certified for “wire pulling or rough in” work, all wire termination work must be performed by technicians who are certified Category 6 installers and testers. Contractors may be asked to provide documentation or similar evidence that technicians are qualified Category 6 installers and are current with ANSI/EIA/TIA standards. Failure to provide such evidence or documentation could result in the disqualification of the contractor and termination of the work order, service order, or installation agreement or contract.

The above standards describe the general cabling and wiring guidelines to be adhered to by all contractors performing telecommunications cabling and wiring work at PSU. Any exceptions to these standards will be duly noted in the specific Scope of Work for each project. Any deviation from these standards that is not specifically allowed by OIT—Networking & Telecommunications Services (NTS) or otherwise delineated in the Scope of Work could be grounds for disqualification of Contractor and termination of the installation agreement/contract.

Quality Control & Assurance Requirements

Testing and Documentation

Contractor shall test all cabling and wiring installed with an approved Category 6 tester performing a link test to at least 250 MHz following TSB-95 to support a minimum of 1000Mbps Ethernet. Contractors shall test all installed fiber strands for cable integrity using a bi-directional Power Meter with a controlled light source at a wavelength of 850nm & 1300nm for multimode and 1310nm & 1550nm for single mode. Contractor shall record all test results. Any installations that fail the testing shall be corrected and retested. All recorded results and related testing documentation, including those showing test failures, shall be provided to NTS on disk. NTS reserves the right to randomly test the Category 6 throughput at various installation locations to ensure the accuracy and completeness of contractor testing. Should any of these tests fail, NTS may withhold all, or some portion, of the payment due Contractor for wiring installation work.

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Housekeeping and General Clean-up

Contractor shall ensure that all work areas are left in a clean, safe condition at the end of each workday or shift as well as at the end or completion of the entire project. Contractor is responsible only for that work they perform and resulting cleanliness or safety issues. Prior existing conditions are the responsibility of PSU.

Qualifications, Professionalism and Behavior of Contractor Employees

All technicians and other contractor employees performing work on PSU premises shall be highly qualified, skilled professionals who behave in a professional and courteous manner at all times. Contractor employees must have the ability to plan and organize their work efficiently and communicate effectively with NTS staff and other customer contacts in the field.

NTS places a strong emphasis on good customer service and fully expects all of its contractors and vendors to endorse this service ethic when deploying technicians and other employees on the PSU campus. All contractor technicians and employees shall wear appropriate work attire on the job and shall present themselves in a professional manner in terms of attire and overall appearance. At least one technician or employee per work group shall wear attire that includes the contractor or vendor logo, business name, etc.

Warranty

Contractor must guarantee installation work, must warranty the fiber materials, if provided by the Contractor, and is required to describe the nature of Contractor's guarantee in the Bid Response or Quote submitted for this solicitation. The warranty shall cover manufacturing defects in material, if provided by the Contractor, and workmanship under normal and proper use, application assurance, and the installation of all materials.

The minimum warranty period for the installation of horizontal station wiring work shall be 5 years if PSU provides the materials and a minimum of ten years for labor and material if the Contractor provides the materials. Fiber installation warranty shall be a minimum of 5 years if PSU provides the fiber materials and 10 years for labor and materials if Contractor provides the materials.

Protection of Existing Equipment

All existing and active networking and telecommunications hardware installed in PSU campus buildings shall be protected prior to the start of any construction. ***It shall be Contractor's responsibility to effectively protect the owner's network and telecommunications facilities, equipment, and materials from dust, dirt and any other damage during construction.*** Contractor shall take no action that will interfere with, or interrupt, existing building network and telecommunications services unless previous arrangements have been made with NTS or the appropriate building owner's representative. If any shutdown of network or telecommunications services or systems is required for Contractor to perform work, Owner's personnel will perform shutdown of affected systems. Contractor must provide Owner with a minimum of three (3) days' advance notice for such system shutdowns. ***Should Contractor cause network or telecommunications services or systems to be interrupted in any way, Contractor shall be solely responsible for all costs associated with satisfactorily restoring or replacing services or systems***

to include all labor and materials required to restore or replace services or systems. All service or system restoration or replacement by Contractor must be approved by NTS.

Communications Facilities Requirements

Main Switchroom for Telephone System and Data Networking Equipment

The main telephone equipment switchroom typically houses the telephone switch (PBX) cabinets; equipment racks for data networking equipment; UPS equipment; the wall field for cross-connecting the equipment cables, riser cables, intracampus BET cables, and ILEC/CLEC entrance cables; a work station; and storage space for maintenance spares, tools and test equipment.

At PSU, there are typically two types of switchrooms: 1) the main switchroom which houses the central PBX cabinetry that serves the entire campus; and 2) satellite switchrooms for remote PBX cabinets that are connected via leased or PSU owned outside plant facilities back to the main campus switchroom. Since the main switchroom for the campus is in place and rather permanent in nature, this facilities requirement addresses *satellite switchrooms which typically are required for new off campus buildings or similar major facilities construction projects* where it's more efficient and effective to install remote PBX cabinets versus extending additional cable plant facilities to serve extensions directly off the main PBX.

The minimum size requirement for a satellite switchroom is 10' x 15'. Minimum clear height in the room shall be 8 feet without obstructions. The access door to the room shall be at least 36 inches wide and 80 inches high, with doorsill, and shall be fitted with a lock. A minimum of two walls should be covered with rigidly fixed (3/4 trade size) A-C plywood preferably void free, 8ft. high, capable of supporting attached equipment. Plywood should be either fire rated or covered with two coats of fire retardant paint.

A separate power supply circuit serving the switchroom shall be provided and terminated in its own electrical panel. Power supply (including lights) in the switchroom shall be on emergency power. Power shall be sufficient to support the equipment load and supporting facilities for the switchroom. A 1-1/2 trade-size conduit shall be provided from the switchroom to the building grounding electrode.

The preferred location for the switchroom is the first floor (or ground floor) or a basement or sub-basement. It is desirable to locate the switchroom close to the main backbone network and building outside telephone company cable entrance site for ease of connectivity to these network and distribution facilities.

When selecting the room site, avoid locations that are restricted by building components that limit expansion such as elevators, core, outside walls or other fixed building walls. Ease of accessibility to the space is important for the delivery of large equipment. The switchroom shall be located away from sources of electromagnetic interference at a distance that will reduce the interference to 3.0 V/m throughout the electromagnetic frequency spectrum. Special attention shall be given to electrical power supply transformers; motors and generators; x-ray equipment; radio, cell phone or radar transmitters; and induction sealing devices. The switchroom shall be located with ready access to the main HVAC delivery system to ensure sufficient airflow and cooling.

HVAC shall be provided on a 24 hours-a-day, 365 days-per-year basis. The temperature and humidity shall be controlled to provide continuous operating ranges of 64° F to 72° F with 30% to 55% relative humidity. The ambient temperature and humidity shall be measured at a distance of 5 feet above the floor level, after the equipment is in operation, at any point along the equipment aisle. A positive pressure differential with respect to surrounding area should be provided.

The switchroom shall be provided with the proper fire suppression system. Appropriate portable fire extinguishers shall be provided and maintained within the switchroom. They should be located as close as practicable to the switchroom entry or exit. Additionally, some form of temperature alarm system should be installed to provide an early warning to a remote monitoring site of temperatures exceeding 75° F.

The interior finishes of the switchroom shall be light in color to enhance room lighting. The floors, walls and ceiling shall be sealed to reduce dust. Flooring materials having antistatic properties shall be used. Lighting shall be a minimum of 540 lx (50 candles) measured 3 feet above the finished floor in the middle of equipment aisles between cabinets. One or more switches located near the entrance door to the room shall control the lighting. ***Lighting fixtures shall not be powered from the same electrical distribution panel as the telecommunications equipment in the room.*** Emergency lighting and signs should be properly placed in the room where absence of light would hamper emergency exit.

Terminal Closets for Telephone System and Data Networking Equipment

There shall be at least one terminal closet per floor. Additional closets should be provided when the floor area exceeds 10,000 sq. ft. or the horizontal distribution distance to the workstation exceeds 90 meter (300 ft). There are typically two size scenarios for terminal closets: 1) the ideal situation where there is ample space to provide a minimum closet size of 10 ft. by 8 ft. with a single door at least 30 inches wide and 80 inches tall, opening out; and 2) the limited space scenario where the closet size should be a minimum of 7 ft. wide and 30 inches deep, both of which are inside dimensions, provided the closet is accessed via double doors which swing out away from the closet. ***In either scenario, the closet should be at least 8 feet high.***

Each closet shall have sufficient power and lighting. PSU's minimum power requirements are two dedicated 20 amp duplex power outlet per closet. Power supply (including lights) in the closet shall be on emergency power. Additionally, ***each closet shall have adequate airflow to ensure that operating temperatures do not drop below 50° F or exceed 80° F.***

Closets shall be "centrally located" on each floor, or located so that horizontal station wires runs to user work stations and phones do not exceed 200 feet. The preferred standard for station wire is 150 feet.

Each closet shall have sufficient sleeves, slots, conduits, or similar floor penetrations necessary to allow for ease of installation of telecommunications cabling and wiring. Such penetrations shall be properly firestopped per the applicable building codes. A minimum of two walls should be covered with rigidly fixed (3/4 trade size) A-C plywood preferably void free, 8ft. high, capable of supporting attached equipment. Plywood should be either fire rated or covered with two coats of fire retardant paint.

Horizontal Pathways

Horizontal pathways and spaces consist of structure that conceal, protect and support horizontal cables between the workstation outlet and the telecommunications terminal closet. When designing a building, the layout and capacity of the horizontal distribution systems must be thoroughly documented in the floor plans and other building specifications.

Every ceiling distribution system must provide proper support for cables from the telecommunications terminal closet to the work areas it serves. **Ceiling panels, support channels (T-bars), and vertical supports are NOT proper supports.** Ceiling conduits, raceways, cable trays, and cabling must be suspended from or attached to the structural ceiling or walls with hardware or other installation aids specifically designed to support their weight. The pathways must have adequate support to withstand pulling the cables and be installed with at least 3 inches of clear vertical space above the ceiling tiles and support channels (T-bar) to ensure accessibility.

Conduit

Conduit types include electrical metallic tubing, rigid metal conduit, and rigid PVC. Conduits shall be of the type permitted under the appropriate electrical codes. **Metal flex conduit is not recommended due to cable abrasion problems and is not covered in this standard.** Fish tape or pull cord/string shall be installed in all conduits.

Any single conduit run extending from a telecommunications terminal closet shall not serve more than three communications outlets. Conduit shall be sized per Table 1.1, below, and be incrementally increased in size from the furthest outlet toward the telecommunications closet. No section of conduit shall be longer than 30 m (100 ft) or contain more than two 90° bends between pull boxes. A third bend may be acceptable in a pull section without derating the conduit’s capacity if the run is not longer than 10 m (33 ft) or the conduit size is increased to the next trade size.

TABLE 1.1

CONDUIT			NUMBER OF CABLES								
INTERNAL DIAMETER	TRADE SIZE		3.3	4.6	5.6	6.1	7.4	7.9	9.4	13.5	15.8
Mm (in)			(.13)	(.18)	(.22)	(.24)	(.29)	(.31)	(.37)	(.53)	(.62)
15.8	0.62	½	1	1	0	0	0	0	0	0	0
20.9	0.82	¾	6	5	4	3	2	2	1	0	0
26.6	1.05	1	8	8	7	6	3	3	2	1	0
35.1	1.38	1 ¼	16	14	12	10	6	4	3	1	1
40.9	1.61	1 ½	20	18	16	15	7	6	4	2	1
52.5	2.07	2	30	26	22	20	14	12	7	4	3
62.7	2.47	2 ½	45	40	36	30	17	14	12	6	3
77.9	3.07	3	70	60	50	40	20	20	17	7	6

Pull Boxes

Pull boxes shall be used for the following purposes:

- a) Fishing the conduit run.
- b) Pulling the cable to the box and then looping the cable to be pulled into the next length of conduit.

Pull boxes shall be placed in an exposed manner and location, and readily accessible. Pull boxes shall not be placed in a fixed, false ceiling space unless immediately above a suitably marked, hinged panel.

A pull box shall be placed in a conduit run where:

- 1) the length is over 30 mm (100 ft);
- 2) there are more than two 90° bends; or,
- 3) if there is a reverse bend in the run.

Boxes shall be placed in a straight section of conduit and not used in lieu of a bend. The corresponding conduit ends should be aligned with each other.

Surface Raceway

Surface raceway, consisting of base, cover, couplings, elbows, and similar fittings, mounts directly on wall surfaces at appropriate work levels to provide a continuous perimeter pathway. Telecommunications outlets are located in cover fittings along the raceway. The electrical contractor shall provide faceplates for the surface raceway.

The practical capacity for telecommunications wiring in perimeter raceways ranges from 30% to 60% fill depending on cable-bend radius. The pathway size shall be calculated as follows: the summation of the cross-sectional area of all cables divided by the percent (expressed as a decimal fraction) of fill.

Grounding and Bonding

Grounding shall meet the requirements of the NEC and additionally grounding bonding shall conform to ANSI/TIA/EIA-607. When applicable, horizontal cabling and connecting hardware must be grounded and bonded in compliance with ANSI/NFPA 70 requirements and practices. When grounding telecommunications cabling, ensure that the installation conforms with proper practices and codes (ANSI/TIA/EIA-607, ANSI/NFPA 70, and local building codes).

An approved ground is available at the telecommunications terminal closet for:

- Cross-connect frames.
- Patch panel racks.
- Active telecommunications equipment.
- Test apparatus used for maintenance and testing.

**Any questions about these standards should be directed to Dan Walsh, PSU
Telecommunications Technical Services Mgr. At 503/725-4434.**