



# Information Services Technology Standards

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# INFORMATION TECHNOLOGY STANDARDS

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## INFORMATION TECHNOLOGY STANDARDS

### FORWARD:

The contents of this document represent a compilation of industry and trade standards. Its' intended use is as a guide for technology network infrastructure, and equipment. Some of these standards are based on published, and for the most part, absolute standards involving safety and performance, specifically the National Electric Code (NEC), the ANSI publications listed at the end of this document, and standard promulgated by the Telecommunications Industry Association (TIA).

While every effort has been made to stay current with industry standards and publications, the approach is typically conservative in that the city's design philosophy is to recommend and execute proven solutions rather than "avant garde" technology if it requires a compromise in security, quality control or serviceability. We have found it better to over engineer a project toward security, safety, future functionality and performance rather than to embrace a new, but as yet, unproven technology or to plan for the moment without regard for the future.

We believe our design philosophy embraces the most efficient and cost effective methods applicable to meet the city's technology needs now and in the future. Our emphasis will always be tailored by our customer's needs and balanced by the reality of the city's business and financial constraints.



# INFORMATION TECHNOLOGY STANDARDS

## 1. INTRODUCTION

Included in the initial phase of any network project will be an evaluation of the facility from a connectivity viewpoint with recommendations concerning the location and types of Intra-building Conduits and Vaults, Computer Room Impact, Telecommunications Rooms (hubs) required and standards that will be adhered to in all aspects of construction that will involve technology. This is critical in new construction and/or remodel of an existing facility where building permits and/or inspections are required.

Standards recognized in telecommunications industry are published by ANSI, with TIA/EIA 568 and 559 being the primary reference volumes. Standards are intended to simplify the installation and management of cable infrastructure while at the same time, condensing the acceptable set of products to facilitate in installation and maintenance. References to the National Electric Code (NEC) are also included as they apply to grounding, bonding and protection issues dealing with life safety.

The following standards apply to all city facilities to one degree or another, i.e., scale and number of personnel will affect the level and magnitude of actual numbers/sizes.

## 2. FIBER METROPOLITAN AREA NETWORK

An integral part of the city's fiber strategy is to place pathway whenever street and/or sidewalk construction is planned along the established conduit routes. This pathway system will be installed for the use of the City's Information Services division. The conduits may be installed in the common communication trench. When installing conduit in the same trench as the traffic signal conduit, common vaults or handholds are preferred. At all times a minimum of 12" separation, unless encased in concrete, from power shall be maintained. This distance shall be increased as the 'power' load increases. In addition the following clearances should be maintained as a minimum.

- 50 inches below railroads
- 6 inches when crossing pipes (water, gas, etc)
- 12 inches when parallel with pipes (water, gas, etc)
- 30 inches below surface grade

At minimum along the route a single 4" PVC conduit shall be installed between vaults, handholds and splice points. A 2" PVC Schedule 40 conduit shall be installed between the Information Services vault and the traffic signal vault when they are not sharing a common vault. Schedule 40 PVC conduit is the preferred conduit; with Schedule 80 being installed under roadways, railways and driveways commonly used by heavy vehicles. Install conduit completely to the edge of the project. Terminate the conduit in a 25-TA vault. Where conduit passes or is adjacent (with 10 feet) of City owned conduit, connect to the existing conduit using 25-TA or Type 7 handhold. Where the conduit crosses any conduit owned by any public entity, notify the Information Services division. The IS division will negotiate with the public entity for intercept rights.

When the conduit includes the crossing of a bridge, install a handhold or vault at both ends of the bridge. In addition, the conduit should be supported every 6 to 8 feet with expansion joints every 100 feet.

All buried conduit must be must be equipped with a 300-lb. test calibrated pull tape (so



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overall length can be easily determined). The tape must include an interwoven location conductor. Where there is the possibility of future interruption or construction a warning tape shall be placed 12" above the conduit run.

Install 25-TA vaults at every arterial intersection when not connecting to existing traffic signal control vaults. Prior to connection to existing traffic signal control vaults permission shall be obtained from the traffic signal engineer. If the existing traffic signal control vault is smaller than a type 7 handhold, replace it with a 25-TA vault. Install a 25-TA vault where the conduit passes any property owned by the City or a public entity. Install the vault near the building entrance conduit. In addition install 25-TA vaults at spacing no greater than 2500 feet.

Install Type 7 handholds on a corner of every intersection where a 25-TA is not being installed. In addition install a Type 7 handhold at a maximum spacing of 500 feet. A 25-TA vault may be counted as a handhold for the maximum spacing rule.

Where possible locate the vaults or handholds to be adjacent to vaults and handholds owned by common carriers (Phone companies, cable companies, Electric Lightwave or other alternate signal carrier, etc).

### **3. INTRA-BUILDING CONDUITS, DUCTS, AND VAULTS**

An integral part of the city's short and long term strategies is the placement of adequate physical pathways to allow future growth. In the construction of new or renovation of existing areas new conduit will be installed for exclusive telecommunications use. This will include but is not limited to: voice, data, video, security, paging and intercom, HVAC control systems, or other listed limited energy devices. Pathway sizing must allow for one hundred percent expansion beyond current capacity.

Telecommunications ducts are approved for retrofitting of existing buildings in areas where obstacles of building type does not allow the installation of metallic conduit. Ducts are to be UL listed for the application and installed in accordance with NEC Article 250 in regards to grounding and bonding. Ducts installed in buildings located within secured perimeters of corrections facilities are to be constricted in a manner that provides for total closure of the duct. City approved locking or safety screws are required for cover attachment.

Vaults should also be included in any expansion efforts of any city owned facility. New building construction will require the installation of a vault to service the building and act as an intercept point for existing conduit(s) as well as provide a transition point for extensions of the conduit system. Handhold type vaults will only be used for pull through boxes or as an end point. In no case will a pull box be considered a splice point. In projects requiring vaults to be placed inside security perimeters, vaults will be specified with a locking mechanism requiring controlled key access. Vault sizing will be dependant on location. Approved/recommended vault sizes are included in the appendix to this document.



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### 4. COMPUTER CENTER IMPACT

The telecommunications infrastructure supporting most of the city's facilities are based on a hierarchical star that utilizes the city's telecommunication room at the core of the star. Primary data equipment is located in the telecommunication room while voice equipment is located in a second telecommunication room. An entrance room has been provided as the demarcation point for telecommunications service providers. All construction projects that require telecommunications services will affect the telecommunication room and TR. A preliminary assessment must be completed by Information Services to ascertain the impact and develop recommendations for meeting the telecommunications needs associated with any and all city expansion efforts. At a minimum, the assessment will include:

- a. PBX Capacity – Can the proposed addition be accommodated with the current PBX (or key system) configuration? Will additional telephone requirements dictate new station cards and will additional cards require physical expansion of the PBX cabinet(s)?
- b. Data Connectivity – How will the proposed addition impact existing equipment and will additional rack space be required?
- c. Bandwidth Impact – What changes are necessary in allocation of available bandwidth in either physical (media) or logical (port or address) assignment(s)?
- d. Conduit Sizing – All project need to include a "conduit allowance". This allows the city to continue to expand and allocates cost for additional conduit across all projects.

### 5. TELECOMMUNICATIONS ROOMS

Prior to, or as a part of building remodeling or network wiring, the city needs to design and construct Telecommunications Rooms. There should be a minimum of one Telecommunications Room per floor. This does not have to be a new room in most locations, rather a "redesign" of existing facility to include adequate termination facilities (voice and data), power, light, environmental conditioning, and security. Ideally, the closet should be sized to provide 100 square feet per 10,000 square feet of building. In reality, such space is not often available in remodels but must be planned for in the design phase of a new project. In new construction, the Telecommunications Room shall be located as close as practicable to the center of the area served and preferably in the core area. In no case will a Telecommunications Room be smaller than 50 square feet. Additional guidance is provided in ANSI/TIA/EIA-569 with particular reference to non-related systems:

"The Telecommunications Room shall be dedicated to the telecommunications function and related support facilities. The Telecommunications Room should not be shared with electrical installations other than those for telecommunications. Equipment not related to the support of the telecommunications room (e.g., piping, ductwork, pneumatic tubing, etc.) shall not be installed in, pass through, or enter the Telecommunications Room"



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- a. Telecommunications Room construction must adhere to local building codes with particular emphasis on the NEC in reference to grounding and bonding parameters. NEC Articles 250 and 800 cover the general requirements for grounding, bonding and protection of telecommunications circuits and equipment. In addition to the NEC recommendations, the requirements published in the **ANSI/TIA/EIA - 607, Standard for Grounding and Bonding of Commercial Buildings** will be incorporated in the construction specifications for Telecommunications Rooms. At a minimum, each Telecommunications Room will have a copper buss bar, bonded to the building's system ground that will act as a common grounding point for all equipment, racks and metallic cable sheaths incorporated in the room.
- b. Each Telecommunications Room shall have power as follows:
  - i. One, rack mounted duplex 110 volt, 20 amp dedicated circuit, generator backup.
  - ii. One, backboard mounted double duplex 110 volt 20 amp dedicated circuit, generator backup, where appropriate.
  - iii. One, 110 volt, 20 amp "utility" circuit.
- c. Overhead lighting should provide a minimum of fifty-foot candles of light measured three feet above the floor. Light fixtures should be mounted 8', 6" above finished floor.
- d. Floors shall be tiled or painted with light gray or white enamel to enhance the lighting characteristics and prevent dust/dirt problems.
- e. The door to the telecommunications room shall be a minimum of 36" wide and 84" high, without doorsill, and hinge outward (unless prohibited by code).
- f. Physical Security – The physical security of the Telecommunications Rooms is paramount and must be considered at all times. Access into these rooms must be controlled by a single point of entry that is secured with a cipher lock or proximity card reader meeting city standards, coded/keyed to the city's ER's.
- g. Each Telecommunications Room will have a backboard that is typically constructed of fireproof plywood, three-quarters of an inch thick and a minimum of four by eight feet. Finish will be two coats of light gray or white fire retardant material such as Benjamin Moore IronClad Retardo® or equivalent intumescant paint.
- h. Multiple Telecommunications Rooms on a floor shall be interconnected by a minimum of one conduit, three inches (3") or larger, or the equivalent pathway. Preferred method of intra closet installation shall be above grade with below grade, or in concrete slab, being an alternate placement method.
- i. Entrance conduits, sleeves or floor slots should be located as to facilitate pulling of cable.
- j. Fire protection of the Telecommunications Room shall be installed as per local codes. If sprinklers are required, the heads should be fitted with a protective cover to prevent accidental operation. High temperature heads shall be used.
- k. All outside plant copper cable needs to be terminated in accordance with the regulations listed in NEC Article 800 concerning primary protection. The city requires protection at **both ends** of runs that meet the criteria for protection. Outside plant cable is to be protected with primary and secondary (sneak current) protectors. Tails will be extended from the protection blocks to wall mounted 110 cross-connect field. Additional 110 blocks will be tailed to rack mounted patch panels to facilitate cross connection(s) using modular cords.
- l. Inter and intra-building fiber will also be terminated in rack mounted patch panels. Protective innerduct will run to the point of entry into the patch panel. All fiber innerduct will be orange in color and labeled "Fiber Optic Cable".



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- m. All station cables are to be terminated directly on patch panels employing modular RJ45 - 110 terminations installed in 19" equipment racks. This allows all outlets to be used for any application by cross connecting to the appropriate resource. In no case will patch panels be installed with more than forty-eight ports. Horizontal wire management shall be installed above and below each patch panel.
- n. Wherever practical, freestanding 19" racks will be installed in Telecommunications Rooms. In some locations, the space constraints will not allow the installation of a freestanding rack. In such cases, a wall mounted equipment cabinet will be specified. Racks must be bonded using a #6 (or larger as dictated by code) AWG cable to a common buss bar and to a known, building system ground source to insure same potential among all racks. In locations requiring more than one rack for patch panels and/or active electronics, a vertical wire management panel will be installed to accommodate cable transition between the racks. Additional rack detail is included as an appendix to this document.
- o. In addition to telecommunications racks, telecommunications cabinets may be employed in areas where a secure room does not exist. These cabinets will be secured to the structure and have locking doors. Conduits containing power and conduits containing backbone and station cable will be extended into the cabinet to secure the entrance and protect the housed equipment from unauthorized access. Potential locations for Telecommunications Rooms will be documented and included in all updates to construction drawings and specifications to insure proper HVAC is supplied to these rooms. A minimum of 150 CFM of airflow is required with 300 CFM necessary where PBX is housed. HVAC is to be supplied 24 hours per day, 365 days per year. The temperature and humidity shall be controlled to provide continuous operating ranges of 64° to 75° Fahrenheit with 30% to 55% relative humidity. Humidification and dehumidification equipment may be required depending upon local environmental conditions.
- p. Power conditioning is required in all areas where active electronics or file servers are housed. American Power Conversion is the city's standard for this type of equipment. Uninterruptible Power Supply (UPS) will be sized according to maximum current requirements for the Telecommunications Rooms will be specified. Intelligent UPS equipment that notifies file servers of power outage will be specified. In the event the telephone switch (PBX) is to be located in this room, insure that the UPS is properly sized to provide PBX and all ancillary equipment with sufficient backup. All UPS equipment will be equipped with remote monitoring interface allowing a Windows based application to monitor and control the operation of the UPS.
- q. Notwithstanding the above, all City of Renton telecommunication facilities will comply with TIA standard 942 Telecommunications Standard for Data Centers.

### 6. CABLE TERMINATION

ANSI/TIA/EIA – 568 mandates a four pair termination at each outlet, reference Sections 11 and 12. All jacks and patch panels will be specified at the then highest Category of performance commercially available that maintains a "downward compatibility", i.e., Category 6 RJ-45 connectors are downward compatible with Category 5. Testing and certification will be accomplished on all new installations.



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On occasion, exceptions may be granted for extenuating circumstances. The following disclaimer will be used in situations requiring “non-standard” cabling:

“All cable shall be the highest currently recognized Category. Testing and certification will be accomplished on all new installations. Exceptions will be granted for temporary services in modular or portable structures. As such, temporary services only will support an alternative option, which allows a single 4 pair run to support two (2) voice/switched, low speed data connections on a single run. It must be understood that if this option is implemented, the workstation cable will only support 1 LAN connection per work station and careful consideration must be given to locating LAN services such as printers, scanners, etc.”

Additional cable criteria:

- a. In no case will patch panels containing more than 48 ports be specified. Wire management will be installed at the rate of one horizontal wire management panel for each 24 ports.
- b. A Standard workstation cable configuration will incorporate four (4) RJ45 jacks per workstation. This will allow any combination of 4 devices per workstation. This allows greater flexibility in future location for printers and other LAN based equipment.
- c. Areas that require greater connectivity for current or projected needs will be analyzed on a “case-by-case” base and employ a configuration that suitable for the application.
- d. As applications become more bandwidth intensive, it is imperative to have installations performed according to the exacting standards of the established governing body, i.e., IEEE and TIA/EIA. An area that seems to be most overlooked is the number of termination points per cable. There will be no more than two termination points in each run, specifically, the wall plate in the work area and the patch panel in the Telecommunications Room.
- e. While not as critical as data cable, voice tie cables, if required to connect multiple Telecommunications Rooms, will be from a recognized manufacturer, Category 3, or higher, in performance/rating. Voice tie cables also be terminated in rack mounted, RJ45 patch panels to facilitate a quick and easy to manage cross connect system for voice to any outlet so required. Tie cables will be terminated on 110 blocks at Telecommunications Room housing the PBX or at such point as the cable is to be cross connected to the PBX supply field.

### 7. **BACKBONE FIBER OPTIC CABLE**

Due to the physical size of the some of the city facilities, multiple Telecommunications rooms are required. These rooms will be interconnected using fiber optic cable. This will allow connections between LAN users and with proper equipment and software provide common access within the facility and the various LAN applications that will be supported. Fiber will be sized in accordance with the application supported, specifically:



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- a. Primary Backbone - Fiber will be a minimum of 12 strands, 50/125 $\mu$ m Laser Optimized (10GB @ 300M) multi-mode. However, in large buildings, additional strands may be recommended in the anticipation of segmentation and/or switching in the network. In addition, composite fiber made up of a combination of single and multi mode may be installed to facilitate high speed inter connection between facilities. For those locations requiring greater than 500 meters total distance from an ER or TR, single mode will be installed between Telecommunications Rooms. All fiber will be installed in one of the above-mentioned inner ducts.
- b. Outlying Buildings – Fiber will be a minimum of 12 strands, 50/125 $\mu$ m Laser Optimized (10GB @ 300M) multi-mode for distances up to 500 meters. For those locations requiring greater than 500 meters total distance from an ER or TR, single mode fiber should be considered. In lieu of single mode fiber, the minimum installation requirements will include an open innerduct placed end-to-end to allow future placement of single mode fiber.
- c. Fiber will be installed in a “star” configuration, which provides patching at each Telecommunications Room. While this increases the number of patch points and potential for loss at connectors, the flexibility outweighs the risk. Typical loss with properly installed connectors will be 0.3dB or less.
- d. Backbone fiber will be terminated in rack mounted patch panels. Single mode fiber will use “SC-APC” connections. Multi-mode fiber will use “SC-UPC” connectors. All strands will be terminated at time of installation. “Dark Fiber” is not allowed.
- e. Tight buffer fiber rated for multiple applications, i.e., indoor, outdoor, duct and carrying a rating of OFNP is preferred for all installations. This allows installation of continuous lengths of fiber from patch panel to patch panel without the requirement of a break out kit.
- f. Single mode fiber service loops will be installed at each ER. For fiber runs longer than 2,500 feet; a 50 foot service loop will be installed in an intermediate vault for every 2,500 feet of installed fiber.

### 8. PATCH AND STATION CORDS

Patch cords and station cable will be supplied as part of the structured cable system. They will be specified in length, colors and quantities to provide 120% of projected “first day” use. Cabling color standards for the city are:

- 5e and below Data – Blue
- Category 6 Data – White
- Printer – Yellow
- Hub/Switch – White (straight-thru)
- Hub/Switch – Pink (cross-over)
- File Server – Violet
- Voice – Grey Flat Satin (straight-thru)
- Video Conferencing –
- Multi-mode Fiber – Orange
- Single mode Fiber – Yellow
- Radio – Red
- Security – Green
- Cameras - Black



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Cords will be equal in performance to the installed cable plant, specifically

- a. Copper patch cords will be equal to or higher in Category to the installed cable and be **stranded** unshielded twisted pair (UTP). Patch cords will be used between patch panels and active electronics. Lengths will be kept to a minimum while remaining with standard, manufactured lengths. In no case will patch cords be manufactured in-house.
- b. Copper station cords will be **stranded** unshielded twisted pair in lengths that allow proper routing and minimize coils or slack cable length. In no case will station cords be run across open spaces or taped to the floor. With the exception of voice only applications, flat "silver satin" will not be used for station cable.
- c. Fiber patch/jumpers will typically be 50/125 $\mu$ m Laser Optimized multi-mode for both the Telecommunications Room and station ends. The exception to this will be single mode jumpers, where applicable, to connect backbone active electronics supporting extended lengths or those jumpers connecting edge devices supplied by Telco's. In all cases, 50/125 $\mu$ m Laser Optimized multi-mode cords will facilitate the station side of fiber optic connectivity.

### 9. PLENUM REQUIREMENTS

The varied age of city facilities and types of construction employed requires close attention to the codes concerning plenum requirements. It is our belief that an "over engineered" system that errs in favor of compliance with all applicable codes is preferred to the potential savings in exclusive use of PVC cable. The absolute safety of building occupants is always a priority in design criteria. If there is any question as to plenum requirement, plenum will be specified.

### 10. LABELING

All unshielded twisted pair cables and the outlets in which they terminate shall be identified at both ends of the wiring run with nomenclature indicated below. Identification shall be made clear, machine produced, indelible marking. Such numbers are to be sequential and use the following criteria; bb.rm.rr.pp.nn,

- bb = Building number, alphanumeric up to three digits
  - rm = Room Number within the building, alphanumeric up to three digits
  - rr = Rack Number within the Room, numeric, 01 - 99
  - pp = Patch Panel number within the Rack, alphanumeric up to three digits
  - nn = port number within the patch panel, numeric, 01 – 48.
- a. Faceplate: Faceplate shall be marked with its Telecommunications Outlet number, i.e., "Label". This shall be accomplished by the use of a machine generated, clear, embossed label upon which is carried the Telecommunications Outlet number of that installed faceplate. Label is to be permanent. Self-adhesive label that can be easily "pealed off" are not acceptable. All labels are mounted behind a clear plastic protection window that is an integral part of the faceplate.



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- b. Cable – Each of the cable sheaths emanating from a Telecommunications Room to the Telecommunications Outlet shall be labeled at each, the Outlet and Closet side. Labeling of the cable shall be printed onto a cable sheath tag specifically designed for this purpose. The tag will be secured to the sheath no more than 4 inches from its termination point, using heat shrink labels.
- c. Patch Panels – Patch panels shall likewise carry sequential labels that correspond exactly to those on the Telecommunications Outlet. Those panels manufactured with a silkscreen label annotation for each port are acceptable as presented with a “patch panel” number applied in a conspicuous position on the left side of the panel.
- d. Floor Boxes – Floor boxes require engraved plastic labels. Stock shall be 1/16-inch thick melamine plastic laminate punched or drilled for mechanical fasteners. Label to be engraved in white letters on black background.
- e. Modular Furniture Outlets – Modular furniture that utilizes a standard faceplate shall be labeled as per “9.a Faceplates” above. All other modular furniture requires engraved plastic labels. Stock shall be 1/16-inch thick melamine plastic laminate punched or drilled for mechanical fasteners. Label to be engraved in white letters on black background.

### 11. DOCUMENTATION

Proper documentation for telecommunications infrastructure is required to facilitate new work as well as trouble shoot and maintain existing systems. For all new projects, the following are the minimum documentation requirements:

- a. Complete power and signal plans of the facility showing locations of Equipment Room and Telecommunications Room(s) and Telecommunications Outlets. All Telecommunications Outlet locations will be annotated with the above detailed label criteria. The Telecommunications Outlet label will be contained in a box immediately adjacent to the Telecommunications Outlet symbol as shown here:

A12.202.06.13.24



Building A12, Room 202, Rack 6, Patch Panel 13, Port 24

This document will be provided electronically in the then latest version of AutoCAD® as well as hard copy.

- b. Cable routing showing the approximate pathway(s) in the facility and the point of connection to the outside plant conduit system. This will include information on the number and sizes of each conduit. This document will be provided electronically in the then latest version of AutoCAD® as well as hard copy and may be combined with the above as a separate layer.
- c. Testing documentation will be included with all new projects. Hard copy output indicating successful testing of every location is not required, rather a CD containing the test data and the appropriate application to display such in a Windows based environment, i.e., Fluke, Scope, or Microtest viewer programs.



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### 12. COPPER STATION TERMINATIONS

Copper station terminations will be the highest Category currently recognized, RJ45 outlets with all pairs terminated in a single jack, as per ANSI/TIA/EIA - A. New construction or new installations will utilize the 568A pinout standard while existing installations are permitted to use 568B pinout only in those installations with an embedded base of 568B. The 568A pinout supports all known requirements for voice and data.

### 13. FIBER STATION TERMINATIONS

Fiber station terminations shall be Small Form Factor (SFF) designed to fit the same "footprint" as an RJ45 outlet. The outlet shall terminate two strands of fiber and be compliant with ANSI/TIA/EIA-604-x, where "x" is the addendum number associated with a particular type of SFF connector, Fiber Optic Connector Intermateability Standard. This document, together with its addenda, provides standards for the intermateability of fiber optic connectors. Each addendum to this document is a Fiber Optic Connector Intermateability Standard (FOCIS) for a particular type or design of fiber optic connector. The intermateability requirements in a FOCIS apply to mating optical components such as connector plugs, adaptors, and receptacles. The intermateability requirements in a FOCIS are to be for completed product. For example, for a connector plug the requirements are to be the requirements for the plug mounted with the fiber installed and ready for use.

### 14. FACEPLATE AND OUTLET COLOR SELECTION

Telecommunications Outlets and their respective jacks/inserts will be specified in a neutral color that will blend with the current and future paint and/or decorating schemes. There will be no differentiation between "voice" and "data" with diverse colors at the jack. The city will employ a universal premise distribution system that negates the need for such differences as the label identifies the jack with the same label criteria that carries through to the patching facility where each jack is connected to the appropriate resource. As such, the city will use Ivory, Almond, or similar colors consistently. Exceptions would be a specific color to match or complement modular furniture. It is in the best interest of all concerned parties to work with the interior design staff before finalizing this selection.

Telecommunications Outlets located within sensitive or secure areas (correctional facilities) will require special consideration. Configurations will require installation with approved safety screws. In certain locations, faceplates may be required to be constructed of unique or special materials. It is imperative that unique security or safety considerations be effectively communicated in the design phase of any project to provide accurate budget considerations and to allow sufficient lead-time if custom manufacturing is required.

### 15. CERTIFICATION

The installation will only be as good as the training and/or experience of the individuals responsible for such. Good design, planning and engineering will be in vain if the company selected to do the actual work is not well represented by individuals who have completed a recognized training program and successfully performed in similar installations. All Requests for Proposals or Quotes (RFP/RFQ) will include stringent qualifiers that clearly articulate the need for a certified system to be installed by licensed industry professionals who have completed appropriate training on the product set specified. Recommended verbage concerning technical qualifications is included as an attachment to this document.



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A new telecommunications infrastructure will carry a minimum guarantee of twenty years from the manufacturer. Additional coverage from the actual installer is a plus; however, the manufacturer will be key in providing warranty replacement and insuring that the system continues to meet performance criteria specified at time of installation. Reference to TIA/EIA-568 implies the then current version of the standard. Minimum criteria will include:

- a. **Extended Product Warranty** - The Extended Product Warranty shall ensure against product defects, that all approved cabling components exceed the specifications of TIA/EIA-568 and ISO/IEC IS 11801, exceed the attenuation and NEXT requirements of TIA/EIA-568 and ISO/IEC IS 11801 for cabling links/channels, that the installation will exceed the loss and bandwidth requirements of TIA/EIA-568 and ISO/IEC IS 11801 for fiber links/channels, for a twenty five (25) year period. The warranty shall apply to all passive Structured Cable System (SCS) components.
- b. **System Assurance** - The System Assurance shall cover the failure of the wiring system to support the application which it was designed to support, as well as additional application(s) introduced in the future by recognized standards or user forums that use the TIA/EIA 568 or ISO/IEC IS 11801 component and link/channel specifications for cabling, for a twenty five (25) year period.
- c. **Extended Product Warranty** - The Extended Product Warranty and the System Assurance shall cover the replacement or repair of defective product(s) and labor for the replacement or repair of such defective product(s).
- d. **System Certification** - Upon successful completion of the installation and subsequent inspection, the customer shall be provided with a numbered certificate, from the manufacturing company, registering the installation.

Several leading manufacturers offer single vendor solutions and extended warranty programs in addition to mandating the highest levels of training to receive their certification. AVAYA (formerly Lucent), AMP and Nordex, are the only manufacturers that provided all of the components of the system, i.e., cable, terminations, fiber, patch panels, etc. While this is an important feature, the overall cost of the installation must be balanced against the potentially higher "up front" cost of the installation.

As the installed base of personal computers continues to migrate toward faster speeds, Ethernet connectivity has moved away from 10Mbps to 100Mbps. The city's backbone, at time of this update is 1GB and will move to 10GB. 1GB is the city's desktop connectivity standard. This increase in speed mandates that cable systems be installed in accordance with very strict standards. Systems must be carefully designed and components selected with emphasis on system compatibility and documented sustainable performance. The long-term cost of acceptable performance of the system will be the deciding factor in selection of product.



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### 16. CANCELLIARY COMPONENTS and ACTIVE ELECTRONICS

- a. Telecommunications Room Active Electronics. Components supporting station cable (horizontal) will conform to all known standards and performance criteria relating to 100/1000BASE-T/IEEE 802.3x, which are the standards for operating Ethernet LANs on, twisted pair cable. The following will be considered minimum physical requirements for:
  - i. Manufactured by a first tier company with local presence and documented support and service abilities.
  - ii. Rack mountable.
  - iii. Redundant power supplies for equipment specified in critical applications.
  - iv. Able to support lobe lengths at 100 meters.
  - v. Backbone connection will support GBIC modules or small form factor pluggable (SFP) modules in fiber (single and multi-mode) using LC (fiber) interface as well as copper, RJ45 interface.
  - vi. Use RJ45, 8 pin connectors for all station transition points.
  - vii. Support browser enabled Simple Network Management Protocol (SNMP) elements to the network interface card (NIC) level.
  - viii. Modular in design allowing expansion while retaining initial investment. Emphasis should be placed on "stackable" components or "hot swappable" chassis configurations that allow expansion in increments of 12, 16, or 24 to the maximum configuration supported in a single collision domain.
  - ix. All options will be set externally or with soft commands.
- b. Network Interface Card (NIC) - Copper. The NIC requirements can be best met with a high performance card that is capable of supporting 10/100/1000 BASE-T (megabit, Baseband, Twisted pair) topology that employs an RJ45, eight pin modular connector. Card will be "auto-sensing" in its ability to detect network speed. Servers will be 1000 cards.
- c. Network Interface Card – Fiber. Applications requiring fiber to the desktop of servers equipped with fiber NIC capabilities will be equipped with a Small Form Factor interface that allows a duplex fiber jumper to be used.
- d. Network Management. While not a "hardware component", network management needs to be included in all planning discussions for networks in city facilities. All active electronics will be supported from and by a single, centralized network management location. Network management will be based on SNMP and/or RMON to include enterprise capabilities that allow management of equipment from different manufacturers from a single platform. Management system will have the ability to map and control to the port level of any hub with statistics on traffic as well as IP address and protocol last transmitted at a port level. Management software will be remotely accessible using a Web based browser.
- e. Personal Micro Computers. The environment at the city is a combination of dissimilar machines. While the infrastructure recommendations will take various protocols into consideration, the hardware discussions in this section will be limited to Intel based machines. See Information Services for current standards.



## INFORMATION TECHNOLOGY STANDARDS

### 17. OUTSIDE PLANT CONDUIT AND VAULT DETAIL <sup>1</sup>

- a. Outside Plant Conduit – All conduits installed “outside” are considered subsurface pathways. Approved conduit types are:
  - i. EB-20 for encasement in concrete;
  - ii. EB-35 for encasement in concrete;
  - iii. DB-60 for direct burial or encasement in concrete;
  - iv. DB-100 for direct burial or encasement in concrete;
  - v. DB-120 for direct burial or encasement in concrete;
  - vi. Rigid Nonmetallic Conduit Schedule 40 for direct burial or encasement in concrete;
  - vii. Rigid Nonmetallic Conduit Schedule 80 for direct burial or encasement in concrete;
  - viii. Multiple Plastic Duct (MPD) for direct burial or installation in conduit;
  - ix. Rigid Metallic Conduit For direct burial or encasement in concrete;
  - x. Intermediate Metallic Conduit for direct burial or encasement in concrete;
  - xi. Fiberglass Duct For direct burial or encasement in concrete;
  - xii. Innerduct Polyethylene (PE) for direct burial or installation in conduit;
  - xiii. Innerduct Polyvinyl Chloride (PVC) for direct burial or installation in conduit.
- b. Installation shall conform to the following:
  - i. Encased buried (EB-20) and direct-buried (DB-60) conduit shall meet NEMA standard TC-6.
  - ii. Encased buried (EB-35) and direct-buried (DB-120) conduit shall meet NEMA standard TC-8.
  - iii. Schedule 40 and Schedule 80 Rigid Nonmetallic conduit shall meet NEMA standard TC-2.
  - iv. Nonmetallic conduits shall be encased in concrete of minimum 17225 kPa (2500 lb/in<sup>2</sup>) compressive strength where vehicular traffic (i.e., automotive, railway) is above the pathway, or where a bend or sweep is placed.
- c. All bends will be sweeps with a minimum radius of six times the internal diameter (ID) for conduits up to 2 inch and ten times the ID for all conduits larger than 2 inch.
- d. The following is a list of construction elements that need to be considered in the design and installation of subsurface pathways.
  - i. Excavation;
  - ii. Clearances and separations from other utilities;
  - iii. Depth of burial;
  - iv. Buried street crossings;
  - v. Casing;
  - vi. Trenching;
  - vii. Boring (pipe pushing);
  - viii. Plowing;
  - ix. Backfill; and,
  - x. Restore landscape.

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<sup>1</sup> ANSI/TIA/EIA-758-1 Customer-Owned Outside Plant Telecommunications Cabling Standard (April 1999)



## INFORMATION TECHNOLOGY STANDARDS

- e. Vaults shall meet the following criteria.
  - i. Corrosion resistance of metal components. ASTM B 117 salt spray test for (30) days;
  - ii. Chemical resistance of nonmetallic components (gasoline, kerosene, acid/base etc.) ASTM D543;
  - iii. UV degradation of nonmetallic components. ASTM G 53 for (90 days - UVB-313 lamps);
  - iv. Resistance to flame or fire RUS Specification PE-35 or ASTM D 635
- f. Loading requirements:
  - i. Light duty (pedestrian traffic only), designed for protected areas only. (Test load 1361 kg [3000 lb] over 254 mm by 254 mm [10 in by 10 in] area with 13 mm [0.5 in] maximum deflection);
  - ii. H-5, designed for sidewalk applications and for occasional non-deliberate traffic (test load 5118 kg (11284 lb) over 254 mm by 254 mm [10 in by 10 in] area with 13 mm [0.5 in] maximum deflection);
  - iii. H-10, designed for driveways, parking lots and off road application subject to occasional non-deliberate heavy vehicles (test load 22 568 lb. over 254 mm by 254 mm [10 in by 10 in] area with 13 mm [0.5 in] maximum deflection); and,
  - iv. H-20, designed for deliberate heavy vehicular traffic.

### 18. **OUTSIDE PLANT CONDUIT SYSTEM AND VAULT INSTANTION GUIDELINES**

In most installations, the conduit duct bank is designed to include electrical, security, pneumatic control systems, video distribution, and telecommunications. The duct bank typically runs parallel to or at right angles from the major structures. Duct banks are typically encased for their entire runs in concrete. As such, it is imperative to allocate pathway for the immediate needs, but to include a one hundred percent growth factor for future systems that will be required over the life span of the institution.

- a. Vault Placement and Security – Vaults are in almost all cases, shared among low voltage applications, i.e., telecommunications, alarm, security, video, HVAC control systems, etc. Sizing and placement of the vaults needs to consider the likelihood of re-entry and the physical security required for protection against unauthorized access. An approved locking method must be installed on the access cover for all city vaults. Locking mechanism shall consist of a stainless steel slam lock with a keyway that is protected by a threaded aluminum plug that provides a weather and debris resistant seal. Threaded plug shall be a McGard Intimidator<sup>®</sup> type accessible for removal using a unique master key.
- b. Drainage - Installation of vaults should be such that water drainage will continue after the installation. In some instances the soil grading will be sufficient, while in other instances gravel may have to be placed at specified depths. The vault may be located below grade, in which case locator stakes or location devices should be employed. The location of the vault should be away from traffic conditions that could cause injury to personnel, yet it should be easily accessible for maintenance.
- c. Vault Racking and Interior Space Allocations – Approved vaults range in size from 4' x 4' x 6' up to 8' x 8'.x 12'. Conduits enter and exit these vaults in a variety of sizes and configurations. Allocation of space needs to be coordinated with all systems that will transverse the vault. For telecommunications systems, the following guidelines apply:



## INFORMATION TECHNOLOGY STANDARDS

- i. Fiber optic cable will be completely encased in innerduct. Innerduct will be labeled as it passes through the vault. In the event a splice is performed in a vault smaller than 4' x 6' x 6', appropriate slack coils will be provided to allow the splice case to be removed from the vault. When splicing is required in vaults 4' x 6' x 6' or larger, the splice case will be affixed to the side of the vault using the uni-strut rack fasteners cast into the wall of the vault. Splice cases will be labeled at each entry point with nomenclature that includes the cable origination point, strand count, and destination. Fiber splice cases will be labeled as "F-*nnn*", where *nnn* = the vault number as shown on the conduit and vault site plan.
- ii. Copper tie and supply cables will pass through vaults and be likewise labeled. In the event a splice is performed in a vault smaller than 4' x 6' x 6', appropriate slack coils will be provided to allow the splice case to be removed from the vault. When splicing is required in vaults 4' x 6' x 6' or larger, the splice case will be affixed to the side of the vault using the uni-strut rack fasteners cast into the wall of the vault. Splice cases will be labeled at each entry point with nomenclature that includes the cable origination point, pair count, and destination. Copper splice cases will be labeled as "C-*nnn*", where *nnn* = the vault number as shown on the conduit and vault site plan.
- d. Conduit Allocation and Fill Procedures. All conduits will be numbered and documented on site plan as-built drawings.
- e. All conduits that are not in use will be plugged with a watertight duct plug designed specifically for such purpose. Separate conduits will be allocated for fiber and high pair count copper cables. In the case of four-inch conduits allocated for fiber, five (5) one-inch innerducts will be installed as a part of the initial activation. One, or more, of the innerducts will be used for the initial fiber allocation with the remaining being allocated as spares. Innerduct will be labeled at each end and where is passed through a vault as "*ccc - iii*", where *ccc* = the conduit number from the site as-built drawings and *iii* = the innerduct number, 1 – 5, within the conduit.

### 19. INSIDE CONDUIT AND PATHWAY REQUIREMENTS

- a. Conduit – The following types of conduit are approved for interior uses in city facilities:
  - i. Rigid galvanized conduit, zinc coated and manufactured in accordance with UL-6, ANSI and Federal Specification WW-C-540 standards
  - ii. Intermediate Metal Conduit (IMC), zinc coated galvanized steel to comply with UL-1242, Type J and ANSI Standards
  - iii. Electrical Metallic Tubing (EMT), zinc coated steel to comply with UL-797 and ANSI Standards
  - iv. Liquid tight flexible metal conduit, zinc steel core with smooth gray abrasion resistant, liquid tight, polyvinyl chloride covering (with integral ground wire wound in steel core), to comply with UL360 and ANSI Standards. Anaconda Sealtite type U.A or similar.
  - v. Flexible metal conduit, to comply with UL360, ANSI Standards and Federal Specification WW-6-566



## INFORMATION TECHNOLOGY STANDARDS

- b. Wireways – The following are approved:
  - i. Non-exposed, all steel in construction with screw covers. All surfaces will be coated with a rust preventing coating with final finish being gray.
  - ii. Surface raceway, may be steel or UL listed non-metallic product. Where power and signal (low voltage) cables share a common pathway, an approved divider must be present. All fittings and transitions pieces are to be of the same manufacturer, however, power and low voltage receptacles may be from a different manufacturer so long as the product is designed to be an integral part of the completed system. Color is to be ivory, almond or off-white. In addition, where a metallic system is specified, the following requirements apply:
    - 1. Material is to be grounded to known source of building ground
    - 2. All cut edges that will be exposed to cable will be finished with a grommet or dielectric bushing material to protect cable from chaffing.
    - 3. All visible cuts will be painted to match overall color of product.
- c. Pathway – will conform to the requirements of ANSI/TIA/EIA 569-A, specifically:<sup>2</sup>
  - i. The scope of this Standard is limited to the telecommunications aspect of commercial building design and construction, encompassing telecommunications considerations both within and between buildings. Telecommunications aspects are generally the pathways into which telecommunications media are placed and the rooms and areas associated with the building used to terminate media and install telecommunications equipment.
  - ii. Both architectural and telecommunications terminology are used in this Standard (ANSI/TIA/EIA 569-A), which may cause some difficulty to readers experienced in one area but perhaps not in the other. The reader can reduce confusion by remembering that this Standard does not standardize the media or equipment; it only standardizes the pathways and spaces within and between buildings into which telecommunications media and equipment are placed.
  - iii. Although the scope is limited only to the telecommunications aspect of building design, this Standard significantly influences the design of other building services, such as electrical power and HVAC. This Standard also impacts space allocation within the building.
  - iv. This Standard does not cover safety aspects of building design; the reader is directed to National Fire Prevention Association/National Electric Code and building code references. Other codes and standards may also apply to the installation of telecommunications pathways and spaces.

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<sup>2</sup> ANSI/TIA/EIA-569-A-4Commercial Building Standard for Telecommunications Pathways and Spaces (April 2000)



## INFORMATION TECHNOLOGY STANDARDS

- d. Both single and multi-tenant buildings are recognized by this Standard. Occupancy usually occurs after the base building has been constructed and provisioned, based on the requirements of this Standard; however, the distinct needs of individual tenants in a multi-tenant building may need to be accommodated by additional telecommunications pathway and space facilities beyond those provided in the base building design. It is expected that, at occupancy time, each individual tenant will design the telecommunications cabling in conformance to ANSI/TIA/EIA-568-A. As a result, the build out design may also include pathways and spaces to support a two-level backbone cabling hierarchy for each tenant.
- e. Boxes and "in wall" conduit. Telecommunications Outlets (TO) are typically secured to a metal box affixed to the wall studs. All boxes servicing Telecommunications Outlets must be 4" x 4" and a minimum of 2, 1/2" deep including the mud ring. This may be accomplished with the use of a 2, 1/8" box and the appropriate single gang mud ring. The conduit serving these boxes should be 1" and in no case, smaller than 3/4 ". This conduit must be installed in a manner that minimized bends. Total bend radii must not exceed 270 degrees unless a pull point is furnished.

### 20. **ADDITIONAL WORKSTATION POWER CRITERIA**

city of Renton Information Services has levied the following requirements for workstation locations:

- a. All workstation locations will be serviced by dedicated receptacles. A 110-volt, 20-amp dedicated shall be allocated for every four workstations.
- b. All workstation receptacles and telecommunications outlets are to be located in such a manner as to allow them to be accessible after the workstation furniture has been placed without moving said furniture or any related modular panels.



## INFORMATION TECHNOLOGY STANDARDS

### 21. COMPUTER STANDARDS

All computers purchased by the city of Renton must be purchased through Information Services. All desktop computers must meet or exceed the following minimum requirements unless otherwise directed by the IS Manager:

- a. Manufacturer: Dell Computer Corporation
- b. Processor: Intel Pentium 4 – 3.2GHz
- c. RAM: 512MB
- d. Hard Drive: 40GB SATA at 7200RPM, 8MB Cache
- e. Optical drive: DVD Rom/CD-RW Drive
- f. Floppy Drive: No floppy drive
- g. NIC: 10/100/1000 Network Connection
- h. Support: 3-Year Next Business Day Parts and Labor On-site Response

All monitors must meet or exceed the following minimum requirements unless otherwise directed by the IS Manager:

- a. Manufacturer: Dell Computer Corporation
- b. Type: 17" Flat Panel LCD

All laptop computers must meet or exceed the following minimum requirements unless otherwise directed by the IS Manager:

- a. Manufacturer: Dell Computer Corporation or Panasonic Corporation
- b. Display: 14" LCD
- c. Processor: Intel Pentium M Processor
- d. RAM: 512 MB
- e. Hard Drive: 40 GB ATA-100 at 5400RPM, 2 MB Cache
- f. Optical Drive: DVD-Rom/CD-RW Drive
- g. NIC: 10/100/1000 and Cisco Compatible 802.11g or a spare Mini-PCI Slot with integrated antenna loop.
- h. Support: 3-Year Limited Parts and Labor Warranty.



## INFORMATION TECHNOLOGY STANDARDS

### APPENDICES: AUTHORIZED CABLE INFRASTRUCTURE MANUFACTURERS & PRODUCT SETS

<u>Manufacturer</u>	<u>Product Set Supplied/Authorized</u>
AMP	Complete structured cable systems, copper and fiber cable, patch panels, jacks and patch and station cables.
APC	Uninterruptible Power Supply, transfer switches and distribution.
AVAYA (Lucent)	Complete structured cable systems, copper and fiber cable, patch panels, jacks and patch and station cables.
BEJED	Fiber optic patch panels, splice trays and fiber jumpers
Belden	Copper cable only. Bonded pair is not recommended.
BerkTek	Copper cable only.
Best	Uninterruptible Power Supply, transfer switches and distribution.
B-Line	Ladder tray (communications grade)
Chatsworth (CPI)	Racks, shelving and cabinets. Ladder tray.
CommScope	Copper and fiber optic cable.
Isobar	Power distribution and surge suppression.
O.C.C.	Fiber optic cable.
Ortronics	Patch panels, jacks, and patch and station cables.
Panduit	Surface mounted, non-metallic raceway products. Patch panels, jacks, and patch and station cables.
Siecor	Fiber optic cable, fiber connectors, fiber patch panels.
Siemon	Patch panels, jacks, and patch and station cables.
Wiremold	Surface mounted metallic raceway products, power distribution.



## INFORMATION TECHNOLOGY STANDARDS

### RECOMMENDED CERTIFICATION VERBIAGE FOR RFP/RFQ

#### TECHNICAL QUALIFICATIONS

All technicians engaged in the completion of this project must be either:  
Licensed as a Journeyman Limited Energy Technician by the State of Washington or;  
Enrolled in an approved apprentice program and working under the direct supervision of a licensed Journeyman

Submit with your response a list of all technicians including their license number, date first licensed and date of hire by your firm.

A minimum of three references demonstrating the Contractor's past installation experience in Manufacturer's Certified systems in similar facilities with a minimum of 250 nodes shall be submitted. The Contractor must be able to supply a warranty certification from the manufacturer at completion of the job.

All Telecommunication Closet and Telecommunications Outlet equipment shall be installed and tested on-site by a technician(s) who, by virtue of an acceptable training course or documented experience, is qualified to perform these procedures. Acceptable training may include successful completion of the manufacturer's training course, documented on-the-job experience or successful completion of applicable technical courses in a recognized trade school.  
At least 35% of the technicians must have successfully completed the manufacturer's warranty certification class.

Verification of the above requirements must be submitted in writing.



## INFORMATION TECHNOLOGY STANDARDS

### STANDARDS SUMMARY

The standards selected will be the basis for recommendations that will encompass the entire organization. Those standards discussed above will allow an organization to:

- a. Publish standards for all support equipment and wiring with enforcement being at the city level.
- b. Establish communications within each facility for common use of equipment and sharing of data.
- c. Provide an open system based on ***industry recognized and supported standards*** that can be easily linked to establish communications between facilities.
- d. Establish the basis and provide a platform for organization wide E-Mail and Electronic File Transfer (EFT).
- e. Establish a means for communications with other facilities and institutions in the local area as well as state and national organizations.
- f. Position for enhanced connectivity to take advantage of Internet connectivity options for delivery of services such as streaming video and web cams.
- g. Develop a common, single cable standard that supports connectivity of any device, i.e., phone, computer, printer, fax, modem, etc.
- h. Provide a structured cable system that will carry, as a minimum, a twenty-year warranty to minimize exposure and provide consistent performance.
- i. Address bandwidth requirements to provide current, projected and future connectivity requirements in a proactive manner.



## INFORMATION TECHNOLOGY STANDARDS

### REFERENCES

Normative references - The following standards contain provisions, which, through reference in this text, constitute provisions of this Standard. At the time of publication, the editions indicated were valid. All standards are subject to revision, and parties to agreements based on this Standard are encouraged to investigate the possibility of applying the most recent editions of the standards indicated below. ANSI and TIA maintain registers of currently valid national standards published by them

ANSI/TIA/EIA-568-B.1-3 Commercial Building Telecommunications Cabling Standard (May 2001)

ANSI/EIA/TIA-569-A.4 Commercial Building Standards for Telecommunications Pathways and Spaces (April 2000)

ANSI/TIA/EIA-604 Fiber Optic Connector Intermateability Standard (September 2000), with Addendums

ANSI/TIA/EIA-606 The Administration Standard for the Telecommunications Infrastructure of Commercial Building (February 1993)

ANSI/TIA/EIA-607 Commercial Building Grounding and Bonding Requirements for Telecommunications (August 1994)

ANSI/TIA/EIA-758-1 Customer-Owned Outside Plant Telecommunications Cabling Standard (April 1999)

National Electric Code, 2002, NFPA - 70

TIA/EIA TSB-67 Transmission Performance Specifications for Field Testing of Unshielded Twisted-Pair Cabling Systems - (October 1995)

TIA/EIA TSB-72 Centralized Optical Fiber Cabling Guidelines - t (October 1995)

TIA/EIA TSB-75 Additional Horizontal Cabling Practices for Open Offices - (August 1996)

ISO/IEC IS 11801 Information Technology – Generic Cabling for Customer Premises, July 1995

TIA-942 Telecommunications Infrastructure Standard for Data Centers



# INFORMATION TECHNOLOGY STANDARDS

## GLOSSARY OF TERMS

**ACE** - aboveground cable enclosure

**Aerial Cable** - Telecommunications cable installed on supporting structures such as poles, bridge hangers, building extension supports, etc. These cables are typically non-filled cables intended exclusively for aerial placement via a separate metallic "strand" cable, or with support strand embedded in the same outer sheath (figure 8 cable).

**Aerial Distribution Method** - The method of running cable between buildings in campus systems by going through the air; that is, building to pole, pole to pole, and/or building to

**AIA** - American Institute of Architects

**Air Handling Plenum** - A designated area, closed or open, used for environmental air circulation (return air).

**ALPETH** - Aluminum-polyethylene, the primary sheath for aerial cable.

**ALVYN** --Aluminum-polyvinyl-chloride, the preferred sheath for riser backbone cable where a flame-retardant sheath is required to meet National Electrical Code (NEC) standards.

**American National Standards Institute (ANSI)** - Organization responsible for the definition and maintenance of standards. ANSI is the principal group in the United States for defining relative standards. ANSI represents the United States in the International Standards Organization (ISO).

**Amplifier** - An electronic component used to increase the strength of a transmitted analog signal. Performance is measured in decibels (dB).

**Application Layer** - Layer 7 of the open system interconnect (OSI) model for data communications. It defines protocols for users or application programs. APPN Advanced peer-to-peer networking is a network architecture that allows mainframes, minicomputers and PCs to communicate as peers across LANs and WANs

**Approved Ground** - Only as specified in NEC (National Electrical Code Handbook). Refer to articles 250-24, 250-50, 250-71, 250-80, 250-81, and 800-33 - 800-40 for compliant approved grounding methods and procedures. Refer to EIA/TIA 607 for standard telecommunications grounding.

**Aramid Yarn** - Strength elements that provide tensile strength and provide support and additional protection of the fiber bundles.

**Architecture** - The manner in which a system (infrastructure, hardware and software) is designed. Architecture usually describes how the system is constructed, how the components fit together, and the protocols and interfaces used to integrate these components. It also defines the functions and description of data formats and procedures used for communication between nodes and workstations.



## INFORMATION TECHNOLOGY STANDARDS

**Armor** - Additional protective element beneath outer jacket to provide protection against severe outdoor environments. Usually made of plastic-coated steel, it may be corrugated for flexibility.

**Array Connector** - A connector that aligns and protects fibers from a ribbon fiber optic cable. A fanout array design can be used to connect ribbon fiber optic cables to non-ribbon cables.

**Asynchronous Transmission** - A data transmission technique controlled by start and stop bits at each end of a character and characterized by an undetermined time interval between characters.

**Attachments** - A general term to include straps, bolts, clamps or brackets used to support cable in an aerial distribution scheme.

**Attachment Unit Interface (AUI)** - Branch cable interface located between a media attachment unit and a data station.

**Attenuation** - The decrease in magnitude of power of a signal in transmission between points. For example, in fiber, expresses the total loss of an optical fiber consisting of the ratio of light output to light input. Attenuation is measured in decibels (fiber or copper) per kilometer (dB/km) at a specific wavelength or frequency. The lower the number, the better. Typical multimode wavelengths are 850 - 1300 nanometers (nm) and single mode are at 1300 - 1550 nm. Copper is now characterized up to 350 MHz plus.

**AWG** - American Wire Gauge

**BDF** - Building distribution frame. Primary location for administration of "backbone" cable for a particular building. May reside in same location as B.E.T. (BET) and/or MDF. While BDF implies that there is one distributing frame for a building, there may be IC/TC (IDF) locations that serve as cross-connect locations beyond the BDF. Usually located at, or near, telco entrance facilities (basement, mechanical cores, utility tunnels, etc.) may also be MPOE (minimum point of entry) (telco) location. Terminology varies - see ANSI/EIA/TIA 568A or latest revision, and EIA/TIA 569.

**BET** - Building entrance terminal, also known as entrance facility. Usually the nearest location within a structure that permits termination and protection of telco entrance cable(s). May also serve as MDF and/or BDF. In some situations, the BET is co-located with, or serves as, PABX or key equipment room, MDF and/or BDF and may contain all associated power, battery and other communications equipment. See EIA/TIA 568A, 569. Terminology varies.

**Backboard** - A rigid support for mounting telecommunications terminating hardware, blocks, cross-connect components and wiring. May also be used to attach and support entrance and distribution cables, splice cases, etc. Typically 3/4 " plywood anchored/fastened to existing wall. It is required that the plywood be fire-retardant, or be coated with a fire-retardant substance.

**Backbone Cable** - Typically considered to be horizontal or vertical distribution cable. Connects entrance facility to various floors or telecommunications closets. Some versions are shielded. Should be placed near central axis of building for protection and minimized risk of lightning strikes.

**Balun** - Balanced/unbalanced device used when interconnecting balanced circuits with unbalanced circuits, such as coaxial cables to balanced unshielded or shielded twisted pair (UTP-STP).



## INFORMATION TECHNOLOGY STANDARDS

**Bandwidth** - The range of frequencies that can be used for transmitting information on a channel, equal to the difference in Hertz (Hz) between the highest and the lowest frequencies available on that channel. Bandwidth indicates the available frequency of a channel. Thus, the larger the bandwidth, the greater the amount of information that can pass through the circuit.

**Baseband Network** - A network in which the entire bandwidth of the transmission medium is used for the signal. Unlike broadband, no characteristic modulation techniques are used.

**Baseboard Raceway** - A distribution method in which metal or wood channels, containing cables, run along the baseboards of a building. The front panel of the baseboard channel is removable, and information outlets may be placed at any point along the channel.

**Basic Rate Interface (BRI)** - ISDN standard interface to serve sources or destinations of relatively small capacity, such as terminals. Two "B" channels (64 kbps) and one "D" channel (16 kbps).

**Bend Loss** - A form of increased attenuation caused by (a) having an optical fiber curved around a restrictive radius of curvature or (b) micro bends caused by minute distortions in the fiber imposed by externally induced perturbations.

**Bend Radius** - Measure for copper cable or optical fiber bends. Refer to manufacturer's recommendations for specific minimum bend radius. Typically 4X, 6X or 10X the outside diameter dependent on specific performance characteristic limitations.

**BICSI** - Building Industry Consulting Services International

**Binder (cable)** - A tape, film or thread used for holding assembled cable conductors in place.

**Bonding** - A low-resistance path obtained by joining all current-carrying metallic elements to assure electrical continuity, and having the capacity to safely conduct any current introduced into the path.

**Breakout Cables** - Multi-fiber compositions where each fiber is further protected by an additional jacket and optional strength elements.

**Bridge** - Linking together two or more networks by a device. A bridge is capable of providing logical routing of frames between rings based on routing information contained in the frames.

**Bridging Connection** - A parallel connection through which some of the signal energy in a circuit may be withdrawn, usually with imperceptible effect on the normal operation of the circuit.

**Broadband** - Denotes transmission facilities capable of handling frequencies required for high-grade communications. Broadband infers the use of carrier signals as opposed to direct modulation. Characteristically used for simultaneous multi-channel transmission.

**Buffer Tubes** - Extruded cylindrical tubes covering optical fiber(s) used for protection and isolation.

**Building Core** - That portion of any building devoted to stairwells, elevators, rest rooms, utility, mechanical, electrical, HVAC and telecommunications cabling/equipment.



## INFORMATION TECHNOLOGY STANDARDS

**Building Entrance Area** - The area inside a building where cables enter and may be connected to riser/backbone cables and where electrical protection is provided. The network interface, as well as protectors and other distribution components for campus backbone subsystems, may also be located here. See BDF, BET.

**Building Footing** - The concrete base under the foundation of a building, in which copper wire may be laid to form an electrical ground.

**Bundle** - Many individual fibers contained within a single jacket or buffer tube. Also, a group of buffered fibers distinguished in some fashion from another group in the same cable core.

**Buried Cable** - A gel-filled, mechanically protected cable that is direct buried in a trench in such a fashion that it cannot be removed without excavation (FED-std-1037A). As a general reference to types, characteristics and makeup, refer to AT&T Outside Plant Systems, Issue 3 or later. Not to be confused with underground cable (in ducts).

**Buried Distribution Method** - The method of running cable underground between buildings in campus systems by burying the cable in a trench.

**Bus Topology** - A local area network (LAN) topology in which endpoints connect to a single cable or fiber, or set of wires or fibers, at any point.

**Cabinet** - An enclosure that may house connection devices, terminated cables, splices, apparatus, wiring and equipment. Typically affords security and/or protection from prevailing conditions such as weather, vandalism or accidental damage.

**Cable Attenuation** - The measure of the loss in electrical strength encountered by signals sent through cable.

**Cable Bend Radius** - Cable bend radius during installation infers that the cable is experiencing a tensile load. Free bend infers a small allowable bend radius since it is at a condition of no load.

**Cable Listings** - National Electrical Code (NEC)

### Article 800:

MPP Multipurpose Plenum - MPR Multipurpose Riser - CMP Plenum Rated Communications Cable - CMR Riser Rated Communications Cable - CM General Purpose Not Used In Plenums Or Risers - CMX Residential And Restricted Commercial Use

### Article 700:

OFC Optical Fiber, Conductive - OFCP Optical Fiber, Conductive, Plenum - OFCR Optical Fiber, Conductive, Riser - OFN Optical Fiber, Non-Conductive - OFNP Optical Fiber, Non-Conductive, Plenum - OFNR Optical Fiber, Non-Conductive, Riser

Refer to appropriate articles of the NEC handbook for details on ratings and specific approved applications.



## INFORMATION TECHNOLOGY STANDARDS

**Cable Plant** - The cable plant consists of all the optical elements, for example, fiber, connectors, splices, etc. between a transmitter and a receiver.

**CAD** - Computer-Aided Drafting

**Campus** - The buildings and contiguous property of a complex, such as a university, college, industrial park, military establishment, municipality or health care facility, to name a few.

**Campus Backbone Cable** - The communications cable that is part of the system and runs between buildings. Typical methods of installing campus backbone cable: in-conduit (underground conduit), direct buried (in trenches), aerial (on poles), and in-tunnel (in steam tunnels).

**Campus Cable Entrance** - The point at which campus backbone system cabling (aerial, direct-buried, or underground) enters a building.

**Capacitance** - The property in a system of conductors and dielectrics that permits the storage of electrical charges whenever a difference in potential exists between the conductors. Capacitance is undesirable in copper cable because it interferes with signals by opposing the desired flow of current.

Carrier Sense Multiple Access/Collision Detection (CSMA/CD) - Network access method in which nodes contend for the right to send data. If two or more nodes attempt to transmit at the same time, they abort their transmission until a random time period of microseconds has transpired and then attempt to resend.

**Category 1-6 Cabling** - (Structured Wiring)

- Cat 1 POTS Voice And Low-Speed Data
- Cat 2 ISDN, Low-Speed Data, 4 Mbps Token Ring
- Cat 3 Cables/connecting hardware with transmission characteristics up to 16 MHz
- Cat 4 Cables/connecting hardware with transmission characteristics up to 20 MHz
- Cat 5 Cables/connecting hardware with transmission characteristics up to 100 MHz
- Cat 5e Cables/connecting hardware with transmission characteristics up to 155 MHz
- Cat 6 Cables/connecting hardware with transmission characteristics up to 250MHz

**CATV (Community Antenna Television/Cable Television)** - A method of delivering high-quality television reception by transmitting signals from a central antenna throughout the community, via fiber and coaxial cable. CATV is a broadband transmission facility which generally uses a 75 ohm coaxial distribution drop cable to carry numerous frequency-divided TV channels simultaneously.

**CCTV** - Closed-circuit television

**Ceiling Distribution Systems** - Distribution systems that use the space between a suspended or false ceiling and the structural floor of the story above for placing the cable. Methods include zone, poke-through, conduit, raceway and cable trays.



## INFORMATION TECHNOLOGY STANDARDS

**Cellular Floor Method** - A floor distribution method in which cables pass through floor cells, constructed of steel in concrete, that provides a ready-made raceway for distributing power and communications cables (separately).

**Centralized Cabling** - A cabling topology used with centralized electronics connecting the horizontal cabling with intra-building backbone cabling in the telecommunications closet.

**Central Member** - The center component of a cable. It serves as an anti-buckling element to resist temperature-induced stresses. Sometimes serves as a strength element. The central member material is steel, fiberglass, or glass-reinforced plastic.

**Central Office** - Facility where common carriers originate subscriber's circuits and where the switching equipment that interconnects those circuits is located.

**Cladding** - The low refractive index material that surrounds the core of an optical fiber, usually silica.

**Cleave** - The process of separating an optical fiber by a controlled fracture of the glass, for the purpose of obtaining a fiber end, which is flat, smooth, and perpendicular to the fiber axis.

**Client** - A node that requests network services from a server.

**Client-Server Computing** - A technique by which processing can be distributed between nodes requesting information (clients) and those maintaining data (servers).

**Closet** - Typically a location for hardware, conduit, power panels and electronics. See Telecommunications Closet (TC).

**Coating** - A protective layer of material over the cladding of an optical fiber.

**Coaxial Cable** - A cable with one transmission conductor (inner conductor) and an outer conductor/braid/shield insulated from one another by dielectric foam.

**Collapsed Backbone** - A local area network configuration wherein bridging and routing functions are located at the main cross-connect and accessed via concentrators at the horizontal cross-connects.

**Color-Coded Cable** - Cable having color-coded insulation on the conductor to aid identification.

**Communication Power Pole** - A raceway placed between the ceiling and floor used in conjunction with a ceiling distribution system for the purpose of distributing communication and power service to a work area. Also called utility column, ceiling drop pole or power pole.

**Communications System** - A collection of individual communications networks, transmission systems, relay stations, tributary stations, and terminal equipment capable of interconnection and inter-operation to form an integral whole. These individual components must serve a common purpose, be technically compatible, employ common procedures, respond to some form of control and, in general, operate in unison.

**Composite Cable** - A cable construction technique that combines multiple cables or media in a single over jacket.



## INFORMATION TECHNOLOGY STANDARDS

**Conductor** - A medium such as copper wire that can carry electrical current.

**Conduit** - A pipe, usually metal, that runs underground, from floor to floor, or along a floor or ceiling to protect cables. In the riser backbone subsystem when riser telecommunications closets are not aligned, conduit is used to protect cable and to provide the means for pulling cable from floor to floor. In the horizontal subsystem, conduit may be used between a telecommunications closet and an information outlet in an office or other room. Conduit is also used for campus distribution, where it is run between buildings and intermediate manholes and is made of PVC occasionally encased in concrete. Multiduct conduit may also be used.

**Conduit Sizing** - All INC (intra and inter-building network cabling) conduits should be sized at a minimum of 4 inches. When placing new conduits, size installation to include one spare 4" conduit for future. All INC cores and sleeves should meet same criteria (min. 4 in.).

**Connecting Hardware** - A device used to terminate cable with connectors and adapters that provide an administration point for cross connecting between cabling segments or interconnecting to electronic equipment.

**Connector** - A device to connect and disconnect copper wires or fibers in cable to equipment or to other wires or fibers. Copper wire and fiber optic connectors most often join transmission media to equipment or cross-connects.

**Cord** - A flexible insulated cable (stranded vs. solid conductors).

**Core** - (a) The central transmission area of a fiber. The core always has a refractive index higher than that of the cladding or (b) section of building dedicated to utilities, HVAC, mechanical, electrical, etc. See building core.

**CPE** - Customer remises (or provided) equipment. Equipment residing on customer sites such as, PABX systems, key systems, data devices, etc. This term is frequently interchanged with "station equipment" in protection practices.

**Cross-Connect** - System component where communication circuits are administered (that is, added or rearranged using jumper wire or patch cords). In 110 connector systems, jumper wire or patch cords are used to make circuit connections. In fiber optic connector systems, fiber optic patch cords are used. The cross-connect is located in an equipment room or telecommunications closet.

**Cross-Connect Field** - Copper wire or fiber terminations grouped to provide cross-connect capability. The groups are identified by color-coded sections of backboards mounted on the wall in equipment room or telecommunications closets, or by designation strips or labels placed on the wiring block or unit. The color-coding identifies the type of circuit that terminates at the field. See EIA/TIA 606.

**Crosstalk** - Undesired signals in one circuit as a result of inductive coupling from another circuit. See Near End Crosstalk (NEXT).

**Daisy Chain** - A cabling practice no longer recommended, where devices were connected from one to another in a chain configuration.



## INFORMATION TECHNOLOGY STANDARDS

**Data Circuit-Terminating Equipment (DCTE)** - General terminology for data communications equipment. A device that terminates a data communications session and provides encoding or conversion if necessary (for example, modems or printers).

**Data Communications Equipment (DCE)** - A device that establishes, maintains, and terminates a data communications session and provides encoding or conversion if necessary.

**Data Link Layer** - Layer 2 of the open system interconnect (OSI) model; it defines protocols governing data packetizing and transmission into and out of each node.

**Data Terminating Equipment (DTE)** - General terminology for data equipment such as terminals and host computers. DTE can also stand for data terminal equipment. See DCTE.

**Decibel (dB)** - The standard unit for expressing transmission gain or loss and relative power ratios. The decibel is one-tenth the size of a Bel, which is too large a unit for convenient use. Both units are expressed in terms of logarithm to the base 10 of a power ratio used primarily for attenuation and crosstalk measurements in telecommunications.

**Decibel/kilometer (dB/km)** - A unit of measurement for fiber optic attenuation.

**DEMARC** - Demarcation point is the point of interface that readily identifies division of loop or circuit responsibility. Other terms frequently applied (properly or improperly): SNI (subscriber network interface), MPOE (minimum point of entry), EF (entrance facility) and others.

**Dielectric** - A non-conducting or insulating material that prevents passage of electric current and resists inductive coupling.

**Dielectric Breakdown** - Any change in the properties of a dielectric that causes it to become conductive. Normally a catastrophic failure of insulation because of excessive voltage.

**Dielectric Cable** - A non-conducting cable, such as a fiber cable, without metallic members.

**Distributed Architecture** - A network that uses a shared communications medium (such as star, bus or ring LAN) and uses shared access methods.

**Distribution Block/Frame** - Centralized connection equipment where telephone or data terminal cabling is terminated and cross-connections are made.

**Distribution Field** - The cross-connect or interconnect field used to further distribute the cabling from one point in the network to another. Distribution fields are color coded by function (EIA/TIA 569).

**Distribution Network** - Part of the local exchange network, comprising small cables between subscribers' distribution points (DPs) and cabinets, remote line units (RLUs) or other flexibility points.

**Distribution Panel** - Wall or rack mounted panel that permits accessible physical "patching", or cross connecting of voice/data circuits and/or devices.

**Drain Wire** - An un-insulated wire in contact with a shield throughout its length. Used for terminating the shield, typically at the equipment end only.



## INFORMATION TECHNOLOGY STANDARDS

**Drop Cable** - In a CATV system, the transmission cable from the -optic connections (MIC A and MIC B) that allow it to be connected to the dual FDDI ring.

**Dual-Fiber Cable** - A type of fiber cable that has two single-fiber cables enclosed in a jacket of extruded polyvinyl chloride (PVC), with a ripcord for pulling back the jacket to access the fibers.

**Dual Homing** - The optional connection of dual-attached stations (DASs) to concentrators to increase reliability of the **Ducts** - Various pathways or conduits ranging from PVC to metallic to clay/tile. Example: the main feeder channels in which communication cable is routed between buildings in a campus environment.

**Duplex** - (a) In data communications, a circuit used to transmit/receive signals simultaneously in both directions, or (b) in general, two receptacles or jacks in a common housing which accepts two plugs.

**Electromagnetic** - Referring to the combined electric and magnetic fields caused by electron motion through conductors.

**Electromagnetic Interference (EMI)** - The interference in signal transmission or reception caused by the radiation of electrical and magnetic fields. See RFI, Radio Frequency Interference.

**Electronic Industries Alliance (EIA)** - Governing agency for established standards and published test procedures.

**Emergency Power** - An alternate electrical supply source, separate and distinct from the primary electrical utility (generators, batteries, rectifiers, etc.). Typically referred to as "back up", "hot standby", standby, emergency generators, etc.

**Entrance Facility** - Typically denotes any or all of the following: telecommunications space, equipment, support hardware, cables, connectors, blocks, protectors, sleeves, splices, or other items specific to the DEMARC or MPOE where telco responsibility ends and the customer's begins. Also known as: telecommunications service entrance.

**Equipment Closet** - A termination point for customer premise cabling designed to offer access to common equipment. Closets generally serve a specific area. See Telecommunications Closet (TC).

**Telecommunication Room (TR)** - Area dedicated to housing equipment associated with telecommunications systems such as PABX, data, power, key and or peripheral components. (Also PABX Room, MDF.)

**Equipment Subsystem** - The part of a premises distribution system that includes the cable and distribution components in an equipment room and that interconnects system-common equipment, other associated equipment, and cross-connects.

**Feeder Cable** - (a) In telecommunications, main distribution cable or trunk cable, or (b) in CATV, the transmission cable from the head end (signal pickup) to the trunk amplifier.

**FEP** - Fluorinated ethylene-propylene. A thermo-plastic material with superior electrical insulating properties and chemical and heat resistance, also known as: TEFLON (DuPont).

**Ferrule** - A mechanical fixture, typically a rigid tube, used to protect and align a fiber in a connector. Generally associated with fiber optic connectors.



## INFORMATION TECHNOLOGY STANDARDS

**Fiber** - Thin filament of glass. An optical wave guide consisting of a core and a cladding that is capable of carrying information in the form of light.

**Fiber Distributed Data Interface (FDDI)** - An American National Standards Institute (ANSI) standard for a fiber-based physical and data line protocol that operates at a 100-Mbps data transfer rate.

**Fiber Optic Cable** - A transmission medium consisting of a core of glass or plastic surrounded by a protective cladding, strengthening material, and outer jacket. Signals are transmitted as light pulses, introduced into the fiber by a light transmitter (either a laser or light-emitting diode {LED}). Some of the advantages offered by fiber optic cable are low data loss, high-speed transmission, greater bandwidth, small physical size, lightweight, and freedom from electromagnetic interference or electrical ground problems. Common types are single, dual, multi-fiber and ribbon.

**Fiber Optic Connectors** - Connectors designed to connect and disconnect either single or multiple optical fibers repeatedly. Fiber optic connectors are used to connect fiber cable to equipment and interconnect cables.

**Fiber Optic Cross-Connection** - Fiber optic apparatus for terminating cable in couplings. Designed for high-density cross-connection fields, the apparatus can terminate up to 72 fibers on each shelf, with up to nine shelves in a bay frame. Single shelves can also be wall mounted. Cross connections are handled with fiber optic patch cords.

**Fiber Optic Interconnect** - An interconnection unit used for circuit administration and built from modular cabinets. It provides interconnection for individual optical fibers but, unlike the fiber optic cross-connect panel, it does not use patch cords. The fiber optic interconnect provides some capability for routing and rerouting circuits, but is usually used where circuit rearrangements are infrequent.

**Fiber Optics** - The technique of conveying light or images through glass or plastic fibers. Coherent fiber optics should actually be called aligned fiber optics because the fibers are all the same length and are held in a constant spatial relationship.

**File Server** - A mass storage device that allows files to be accessed by several computers.

**Fire-Rated Poke-Through** - A cable distribution device, which is fitted through a predrilled core hole and allows cables to be fed from the floor below. A compartment at or above the floor surface is used to provide voice, data, power and video connections while maintaining the fire integrity of the floor.

**Fire Resistance Rating** - (Expressed in hours, or fractions of hours) Rating of designs or assemblies that show an acceptable resistance to fire (full scale); and, descriptions of materials or assemblies that withstand the passage of flame and heat transmission when exposed to fire under specified test and performance criteria. Reference to NFPA/NEC articles for specific rating.

**Fire Wall** - A wall that helps prevent fire spreading from one contained area to another and that runs from structural floor to structural ceiling.

**Firebreak** - A material, device or assembly of parts installed in a cable system to prevent the spread of fire along a cable system (not to be confused with fire barrier penetration). See Fire Shield.

**Fireproof** - A property in material such as masonry, block, brick, concrete or gypsum board that does not support combustion even under accelerated conditions.

**Firestop Zoning** - A unique group of architectural structure or assemblies that prevents the passage of fire or toxicity from one contained area to another, thus reducing the possible spread of combustion through the fire barrier.



## INFORMATION TECHNOLOGY STANDARDS

**Firestop, Firestopping** - (a) A material, device, or assembly of parts installed after penetration of a fire-rated wall, ceiling or floor area to prevent passage of flame, smoke or gases through the rated barrier. Refer to NFPA specifications for the intended application(s). - (b) The use of special devices and materials to prevent the outbreak of fire within telecommunications utility spaces and to block the spread of fire, smoke, toxic gases and fluids through openings, cable apertures and along cable pathways. The techniques used are often mandated by local building codes.

Note: Classifications are available under the rating criteria of ASTM E814.

### **Rating/Achievement:**

**F** - Withstands the fire test for the rating period without: Permitting flames to pass through the fire stop flame occurring on any element of the unexposed side of the fire stop (auto-ignition) developing any opening in the fire stop that permits a projection of water beyond the unexposed side during the hose strength test.

**T** - Meets the criteria of an "F" rating and prevents the transmission of heat during the rating period so that the temperature rise is not more than 325 degrees Fahrenheit on any exposed surface, thermocouple or penetrating item.

**Floor Box** - A cast iron, stamped steel or nonmetallic box placed in the concrete floor (prior to pouring the concrete slab) of a building, which is fed via conduit and used to house voice, data, power or video connections.

**Frame** - A metallic structure for supporting connectors, protectors, patch panels, blocks, etc.

**Frequency** - The number of cycles completed by a signal in one second (1 sec); expressed in Hertz (Hz). Example: 100 MHz.

**Frequency Response** - The characteristic of a device denoting the range of frequencies over which it may be used effectively.

**Furniture System** - Furniture walls combined with furniture units such as desks, work surfaces and file cabinets (modular furniture).

**Furniture Wall** - Hollow metal partitions with vertical and horizontal slots through which cable can be run. These walls can be covered with fabric, wood, veneer or other material and are usually from 48 to 72 inches high. See above.

**Fusion** - A process for splicing optical fibers. See also mechanical splicing. Refer to technical specifications to determine which is most effective for intended applications.

**Gas Tube** - A surge-limiting device similar in operation to a carbon block except that it has specially configured electronics with a more precise narrow gap (also available with a wide gap) and a sealed gas composition. The gas tube results in a more accurate and precise operating voltage range and extended service life under conditions of repeated operation.

**Gas Tube Protector** - An over voltage protector featuring metallic electrodes which discharge in a gas atmosphere within a ceramic, glass or synthesized envelope.

**Gauge** - A measure of a conducting wire's physical size, usually referred to as AWG. See also American Wire Gauge (AWG).

**Gigahertz (GHz)** - A unit of frequency equal to 1 billion Hertz.

**GND or GRD** - Abbreviation for ground.



## INFORMATION TECHNOLOGY STANDARDS

**Graded Index Fiber** - A fiber design in which the refractive index of the core is lower toward the outside of the fiber core and increases toward the center of the core. The refractive index bends the rays inward and allows them to travel faster in the lower index of refraction region. This type of fiber provides high-bandwidth capabilities.

**Ground** - An electrical connection to the earth, generally through a bonding conductor or ground grid. Also a common return to a point of zero potential, such as the main grounding busbar. See EIA/TIA 607.

**Grounding** - A conducting connection, whether intentional or accidental, between an electrical circuit or equipment and the earth, or to some conducting body that serves in place of the earth.

**Grounding Conductor** - The conductor used to connect electrical equipment to a grounding electrode. Also, bonding conductor.

**Grounding Electrode** - A conductor or group of conductors (usually a rod, or grid) in direct contact with the earth, providing a connection to the earth.

**Ground Loop** - A completed circuit between conductors created by random contact. An undesirable circuit condition in which interference is created by ground currents when grounds are connected at more than one point.

**Ground Potential** - The potential of the earth. A circuit, terminal, or chassis is said to be at ground potential when it is used as a reference point for other potentials in the system.

**Half Duplex Transmission** - Data transmission over a circuit capable of transmitting in either direction, but not simultaneously.

**Home-Run Method** - A distribution method in which individual cables are run directly from the telecommunications closet to each information outlet in a star configuration.

**Horizontal Length (HL)** - The cable distance from the work area outlet (WAO) to the specific field of the cross-connect (maximum 295 ft.) in the telecommunications closet (TC).

**Horizontal Cabling** - The portion of the cabling system extending from the work area outlet to the TC. The cross-connect facilities in the telecommunications closet are considered part of the horizontal cabling.

**Hub** - A concentrator or repeater in a star topology at which node connections originate. Hubs can be either active or passive.

**Hybrid Cable** - A cable containing two or more different types of cable, such as copper and fiber optic.

**IC** - Intermediate cross-connect (EIA/TIA 568A/569). Formerly IDF.

**ICEA** - Insulated Cable Engineers Association

**Impedance** - The total opposition that a circuit offers to the flow of current at a particular frequency. It is a combination of resistance (R) and reactance (X) and is measured in ohms.

**INC** - Intra-building network cable. Also, inter-building network cable. Cabling that comprises infrastructure beyond the telco MPOE. See Backbone Cable. MPOE.

**Inductance** - The electrical property of a circuit that induces change in existing current.



## INFORMATION TECHNOLOGY STANDARDS

**Information Outlet (IO) also known as: Work Area Outlet (WAO)** - A connecting device designed for a fixed location (usually a wall or floor in an office) on which horizontal cable pairs terminate and which receives an inserted plug. It is the point where the horizontal system meets the work area. Although such devices are also referred to as phone jacks, the term information outlet or WAO encompasses the integration of voice, data and other communication services that can be supported via a premises distribution system.

**Infrastructure** - See INC, backbone cable, riser. Encompasses all wire, cable, equipment, power, hardware, devices and associated components or labor to maintain operating systems beyond the telco MPOE (minimum point of entry).

**Innerduct** - Flexible conduit originally produced for protection of optical fiber cables. See manufacturer's standards for sizing and placement.

**Insertion Loss** - A measure of the attenuation of a device determining the output of a system before and after the signal is inserted into the system.

**Institute of Electrical and Electronics Engineers Inc. (IEEE)** - The standards group that develops standards for Token Ring, fiber distributed data interface (FDDI), 10BASE-T/FL, etc.

**Insulation** - A material having high resistance to the flow of electric current. Thin conducting wires are covered with color-coded insulation for protection and ease of identification.

**Insulation Displacement** - The type of wire terminals that require no insulation removal; when the conductor is correctly attached. The insulation is displaced (pierced) to form a connection.

**Integrated Services Digital Network (ISDN)** - Integrated voice and data network based on digital communications technology and standards interfaces.

**Integrated System** - A telecommunications system that moves analog and digital traffic over the same network, including voice, data and video.

**Intelligent Hub** - A hub that performs bridging and routing functions in a collapsed backbone environment.

**Intelligent Terminal** - An input/output device, remote from its main computer, which contains an integral microprocessor capable of performing some amount of information storage or processing.

**Interactive** - Interactive, also referred to as on-line or real-time processing, occurs when the user is directly connected to the host and receives immediate response to requests or inquiries.

**Intercloset Cables (more accurately, Backbone Cables)** - Cables that connect telecommunications closets.

**Interconnect** - A circuit administration point, other than a cross-connect or information outlet, that provides capability for routing and rerouting circuits. It may not use patch cords. Typically it is a jack-and-plug device used in smaller distribution arrangements or to connect circuits in large cables to those in smaller cables.

**Interface** - The location where two systems or a major and a minor system meet and interact with each other.

**Interference** - Disturbance of an electrical, electromagnetic or RFI nature that introduces undesirable responses into other electronic equipment.

**Intermediate Cross-connect (IC)** - In telecommunications, it is the space between MC and TC, if required.



## INFORMATION TECHNOLOGY STANDARDS

**International Standards Organization (ISO)** - The organization responsible for the open systems interconnect (OSI) standards among others.

**International Telegraph and Telephone Consultative Committee (CCITT) also known as: ITU-International Telecommunication Union(s)** - A standards organization that, among numerous other activities, specializes in the electrical and functional characteristics of switching equipment. The CCITT sets standards to ensure compatibility between data communications equipment (DCE) and data terminating equipment (DTE).

**IPCEA** - Insulated Power Cable Engineers Association

**Isolated Ground** - A separate ground, which is insulated from the equipment or building ground. Not recommended. See EIA/TIA 607.

**Isolation** - The ability of a circuit or component to reject interference.

**Jack** - A receptacle used with a plug to make electrical contact between communications circuits. Jacks and their associated plugs are used in a variety of connecting hardware applications including adapters, information outlets and equipment connections.

**Jacket** - The flexible covering of a cable, used to bind and protect the color-coded conductors inside.

**Jumper** - Optical fiber cable that has connectors installed on both ends.

**Jumper Wire** - Typically, a short length of copper used to route a circuit by linking two cross-connect termination points.

**Junction Box** - A connection point in a duct system that allows access to cables running in the ducts.

**Keying** -

**KPSI** - Tensile strength in thousands of pounds per square inch.

**KVA** - kilovolt amperes

**Laser** - (light amplification by stimulated emission of radiation) In telecommunications, a device that produces light at a narrow range of frequencies, to generate signals used in fiber optic communications systems.

**LED** - See Light Emitting Diode.

**Line Voltage** - The value of the potential existing on a supply or power line.

**Link** - The communications circuit or transmission path connecting two points.

**Link Budget** - Optical loss budget that determines the maximum distance allowable between stations. Loss and dispersion factors are included.

**Local Area Network (LAN)** - A data communications network consisting of host computers or other equipment interconnected to terminal devices, such as personal computers, often via twisted pair or fiber cables. LANs allow users to share information and computer resources. Typically, a LAN is limited to a single organization, city or geographic site.

**Loop** - The cable pair that connects the customer to the switching center (ex: central office, main PABX). This path is called a loop because it is generally two wires out to the customer which are electrically tied together through the terminal set (device, instrument) when the device goes off-hook, creating a continuous path, or "loop."



## INFORMATION TECHNOLOGY STANDARDS

**Loose Tube Cable** - Type of cable design whereby coated fibers are encased in buffer tubes offering excellent fiber protection and segregation.

**Loss** - The portion of energy applied to a system that is dissipated and performs no useful work, or contributes to system impairments.

**Low Frequency** - A band of frequencies extending from 30 to 300 KHz in the radio spectrum, designated by the Federal Communications Commission.

**Main Terminal** - See MPOE, equipment room, BDF.

**Mbps** - Megabits per second. One million units (bits) of information per second. As in binary language 0 or 1.

**MC** - Main cross-connect. Formerly MDF. See EIA/TIA 569.

**MDF** - Main distribution (distributing) frame, no longer used. Replaced by MC (main cross-connect). Location within the building that serves as the main cross-connect point between telco entrance cables, backbone or distribution cables (intra - and inter - building cables). May also serve as, or be co-located with main telecommunications equipment room, housing PABX, key, data, power or other associated equipment. May also serve as B.D.F. within the building. See MPOE, BDF, BET, entrance facility, network interface, etc.

**Mechanical Splicing** - Joining two fibers together by permanent or temporary mechanical means (vs. fusion splicing or connectors) to enable a continuous signal.

**Media Access Control (MAC)** - Refers to both the media access portion of the interface standard and the hardware and firmware which implements this portion of the standard.

**Mega** - Prefix = million.

**Megabit (Mb)** - One million binary bits.

**Megabyte (MB)** - One million binary bytes.

**Megahertz (MHz) One Million Hertz (Cycles)**. - A bandwidth-length product rating: Bandwidth is found by multiplying length by bandwidth-length equation.

**Metropolitan Area Network (MAN)** - An extended LAN operating within a metropolitan area and providing integrated services for real-time data, voice and image transmission.

**MHz** - Megahertz. Analog Frequency Spectrum Unit, one million cycles per second.

**Micro** - Prefix meaning one-millionth.

**Micron** - A micrometer; One-millionth of a meter.

**Mode** - A variable wave traveling in an optical fiber.

**Modular Jack** - A female telecommunications interface connector. Modular jacks are typically mounted in fixed locations and may have 4, 6 or 8 contact positions. Not all positions need be equipped with contacts. See also Telecommunications Outlets.

**Modular Plug** - A male telecommunications interface connector. Modular plugs may have 4, 6 or 8 contact positions. Not all positions may be equipped with contacts.

**Molding Raceway Method** - A cable distribution method in which hollow moldings support cables. Small sleeves of pipe can be placed in the wall behind the molding to allow cable to pass through the wall.



## INFORMATION TECHNOLOGY STANDARDS

**MPOE** - Minimum point of entry. Frequently, this location is coincident with the BET, BDF and/or in close proximity to, or co-located with, the main telecommunications equipment room or MDF (aka network interface, BDF, BET, MDF, equipment room). See MC, MDF.

**Multifiber Cable** - An optical cable containing two or more fibers, each providing a separate information channel.

**Multimode Fiber** - An optical wave guide in which light travels in multiple modes. Typical core/ cladding size (measured in micrometers) is 50/125.

**Multimode Fibers** - Optical fibers that have a large core (25 to 300 um) and that permit nonaxial rays or modes to propagate through the core. 62.5/125 mc is the common standard core for premises distribution systems.

**Multiuser Outlet** - A telecommunications outlet used to serve more than one work area, typically in open-system furniture applications.

**Nanometer** - A unit of measurement equal to one billionth of a meter.

**National Electrical Code (NEC)** - A nationally recognized safety standard for the design, construction and maintenance of electrical circuits. The NEC, sponsored by the National Fire Protection Association (NFPA), generally covers electrical wiring within buildings.

**NEMA 6P** - National Electrical Manufacturers Association - Waterproof rating.

**Network** - An interconnection of computer systems, terminals or data/voice communications facilities.

**Network Architecture** - A formalized definition of the structure and protocols of a computer network.

**Network Communication Cable (NCC)** - Network communication cable, often called NCC, is generally used in the riser backbone subsystems. The cable consists of 24-AWG, annealed-copper conductors insulated with color-coded polyvinyl chloride (PVC) in twisted pairs, encased in an outer PVC jacket whose frictional properties permit it to be pulled in conduit. This type of cabling used to be referred to as direct inside wire (DIW). Not rated Category 5.

**Network Connectivity** - The topological description of a network, which specifies the interconnection of the transmission nodes in terms of circuit termination locations and quantities.

**NEXT** - near end cross talk

**Noise** - In a cable or circuit, any extraneous signal which tends to interfere with the signal normally present in or passing through the system. See NEXT.

**NRZ** - no return to zero

**Ohm** - The unit of measurement of the volume resistivity of a cubic meter of material, as determined by measuring the DC resistance between any two opposite faces of the cube. For soil measurements, the resulting reading in ohms is the earth's resistivity for that soil. When earth resistivity is expressed in ohm/centimeters, convert to ohms by dividing by 100.

**Ohm's Law** - Stated  $E = IR$ ,  $I = E/R$  or  $R = E/I$ , the current,  $I$  in a circuit, is directly proportional to the voltage  $E$ , and inversely proportional to the resistance,  $R$ .

**Open Architecture** - An architecture that is compatible with hardware and software multiple vendors. See OSI.



## INFORMATION TECHNOLOGY STANDARDS

**Open System Interconnect (OSI)** - A collection of international protocol standards for data networking. Multivendor/multiproduct applications.

**Optical Fiber** - A thin filament of glass. Optical waveguide consisting of cladding and a core capable of carrying information in the form of light.

**Optical Time Domain Reflectometer (OTDR)** - An instrument that characterizes cable loss by measuring the backscatter and reflection of injected light as a function of time. It is useful for estimating attenuation and for locating splices, connections, anomalies and breaks.

**Optical Waveguide Fiber** - A transparent filament of high refractive index core and low refractive index cladding that transmits light.

**OSP** - outside plant

**Outer Protection** - An outer layer of material, composed of armored wire or metallic tape, covering the sheath of the cable. Specified when additional mechanical protection is required due to external factors such as gophers, squirrels, rocks or other site-specific requirements. Also known as armored cable.

**Pair** - Two wires, grouped (usually twisted) together and marked with reciprocal color-coding.

**Patch Cord** - A short length of stranded copper wire or fiber optic cable with connectors on each end used to join communication circuits at a cross-connect.

**Patching** - Connecting circuits by means of cords with plugs inserted into appropriate jacks.

**Patch Panel** - A device, usually located in a telecommunications closet, in which temporary or semi-permanent connections can be made between incoming and outgoing lines. Used for modifying or reconfiguring a communications system or for connecting devices such as test instruments to specific lines.

**Pedestal** - An enclosure, usually mounted on the floor, which is used to house voice/data jacks or power outlets at the point of use. Also referred to as a monument, tombstone, above floor fitting or doghouse.

**Personal Computer (PC)** - A computer for personal, single-user use, as opposed to mainframes or mini-computers, which are shared by many users.

**Pigtail** - Optical fiber cable that has a connector installed on one end.

**Pin** - A conductor on a plug or connecting device/apparatus.

**Plenum** - A return air space inside buildings through which environmental air is handled.

**Plenum Cable** - Cable specifically designed for use in a plenum. Plenum Cable has insulated conductors often jacketed to give them low flame-spread and low smoke-producing properties.

**Plug** - A device used for connecting conductors to a jack. It is typically used on one or both ends of equipment cords or on wiring for interconnects or cross-connects.



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**PMD** - Physical medium dependent. Determines the specifications for transmitters and receivers, cables, connectors and bypass switches.

**Poke-Through Method** - A ceiling distribution system method that involves drilling a hole through the floor from the ceiling space below and poking cables through to terminals. Not Recommended.

**Polyvinyl Chloride (PVC)** - A multipurpose thermoplastic used for wire and cable insulation and jackets.

**Ports** - Terminations in equipment systems at which various types of communication devices, switching equipment, and other devices are connected to the transmission network.

**POTS** - Plain Old Telephone Service

**Power/Communication Pole** - A raceway placed between the ceiling and floor used in conjunction with a ceiling distribution system for the purpose of distributing communication and power service to a work area. Also called Utility Column or Ceiling Drop Pole.

**Premises Distribution System (PDS)** - The transmission network inside a building or group of buildings that connect various types of voice and data communication devices, switching equipment, and information management systems together, as well as to outside communications networks. It includes the cabling and connecting hardware components and facilities between the point where building wiring connects to the outside network lines, back to the voice and data terminals in the office or other work locations. The system consists of all the transmission media and electronics, administration points, connectors, adapters, jacks, plugs, and support hardware between the building's side of the network interface and the terminal equipment required to make the system operational.

**Premise Wiring/Structured Wiring (Premise Cabling/Structured Cabling)** - The entire wiring system on the user's premises used for transmission of voice, data and video.

**Prewiring** - Wiring installed before walls and ceilings are enclosed or finished, and in anticipation of future use or need. It is more cost effective to prewire all potential locations at the time of a major installation, rather than return on a repeated basis to keep adding locations one (or more) at a time.

**Primary Rate Interface (PRI)** - ISDN standard interface comprising 23 "B"+1 "D" channel for North America, and 30 "B"+1 "D" Channel for Europe. See Basic Rate Interface (BRI) and Integrated Services Digital Network (ISDN).

**Private Branch Exchange (PBX) or Private Automatic Branch Exchange (PABX)** - A private telephone switching system, usually located on a customer's premises connecting a common group of lines from one or more central offices to provide service to a number of individual phones. Now used interchangeably with PABX (private automatic branch exchange).

**Protector** - Device used to limit damaging foreign voltages and currents on metallic telecommunications conductors and equipment.

**Protector (Unit)** - A device to protect against overvoltage, overcurrent or both. The unit may contain carbon electrodes, gas tubes, solid-state components, heat coils, fuses or a combination thereof. Units may be integrated or have plug-in/screw-in elements depending on the application and design. Used with, or in,



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protector blocks, protected terminals, connecting blocks and central office connectors as well as PABX and other devices/systems.

**Protector Module** - A device that limits voltage between telecommunications conductors and ground. The protector is equipped with 3 mil carbon electrodes or equivalent gas tubes. Typical line protectors limit voltage to 350V DC. See Protector (Cable).

**Public Switched Network** - Any common carrier network that provides circuit switching between public users, such as the public interactive telephone network.

**Pulling Tension** - The amount of pull, measured in pounds or foot-pounds, placed on a cable during installation.

**Punch Down** - See Cut Down.

**PVC** - Polyvinyl chloride, widely used in cable sheaths/jackets and conduits.

**QA/QC** - Quality assurance/quality control. Should be clearly defined in contract terms and conditions.

**Raceway** - Examples of raceways include, but are not limited to:

1. Conduit (rigid or flexible, metallic or nonmetallic) EMT, a thin wall electrical metallic tubing
2. Sleeves, slots, cores or auxiliary channels (gutters)
3. Baseboard (concealed) systems
4. Under floor systems. Cellular floor systems
5. Cable trays, troughs, ladder racking
6. Busways, surface raceways, lighting fixture raceways and latch duct, nonmetallic or metallic. There are other raceways/ pathways that may need to be considered.

\*Note: Flexible metallic (flex) conduit should never be a consideration, recommendation or option for communications.

**Rack** - A vertical or horizontal open support, usually made of aluminum or steel, which is attached to a floor, ceiling or wall. Cables are laid in and fastened to the rack and connected to the equipment(s).

**Raised Floor Method** - A floor distribution method in which square, steel or wood-laminated plates resting on aluminum locking pedestals are attached to the building floor. Also called access floor, since each plate can be removed for easy access to cables below.

**RCDD** - Registered Communications Distribution Designer. This is a certification program for telecommunications industry personnel planning to consult or design. It is regulated by BICSI and requires documented experience, knowledge and testing to obtain status.



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**Requirements Survey** - The systematic study of a building or campus of buildings to determine the needs for voice and data telecommunications equipment and distribution media. This is normally done prior to designing the system for the site.

**Resistance** - The property of a conductor that determines the current produced by a given potential difference. It impedes the flow of current and results in the dissipation of power as heat. Resistance is measured in ohms.

**Response Time** - The time it takes a system to react to a given input. The response includes the transmission time, the processing time, the time for searching records and the transmission time back to the originator.

**Return Loss** - Noise or interference caused by impedance discontinuities along the transmission line at various frequencies. Return loss is expressed in decibels.

**RFI** - (a.) request for information. (b) radio frequency interference. A disturbance in the reception of signal transmission due to conflicting undesired signals, either through induction, radiation or, less frequently, unbalanced line conditions or poor circuit design. See EMI.

**RFP** - request for proposal

**RFQ** - request for quotation

**Ribbon Fiber Cable** - A cable that contains one to 12 ribbons, with each ribbon having 12 fibers for a cable size range of 12 to 144 fibers. Ribbon fiber cables are designed for use in large distribution systems where small cable size and high pulling strength are important.

**Riser** - The conduit or path between floors of a building into which telephone and other utility cables are placed to bring service from one floor to another.

**Riser Backbone System** - The part of a premises distribution system that includes a main cable route and structure for supporting the cable from an equipment room (often in the building basement) to the upper floors, or along the same floor, where it is terminated on a cross-connect in a riser telecommunications closet, at the network interface, or at distribution components of the campus backbone subsystem.

**Riser Telecommunications Closet** - The closet where riser backbone cable is terminated and cross connected to either horizontal cable or to other riser backbone cable. The riser telecommunications closet houses cross-connect facilities, and may contain auxiliary power supplies for terminal equipment located at the user work area.

**Satellite Cabinet** - Surface-mounted or flush-type wall cabinets for housing circuit administration hardware. Satellite cabinets, like satellite telecommunications closets, supplement riser telecommunications closets by providing additional facilities for connecting horizontal cables from information outlets in user work areas. Sometimes referred to as a satellite location. No longer recommended terminology. See TC.



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**Satellite Telecommunications Closet** - A walk-in or shallow wall closet that supplements a riser telecommunications closet by providing additional facilities for connecting riser backbone to horizontal cables from information outlets. Also referred to as a satellite location. No longer recommended terminology. See TC.

**Schedule 40** - PVC (polyvinyl chloride) conduit typically used for underground entrance facilities. Refer to local governing codes and conditions.

**Service Clearance** - The space encompassing the equipment, or unit, which is required to permit proper working room for operating, inspecting and servicing equipment. This space should adequately allow:

- Doors to be fully opened.
- Component drawers to be pulled out, or racks opened.
- Allows safe work operations, i.e., a minimum of 36".

**Sheath** - A common term for the jacketing of twisted pairs in multi-pair cable.

**Sheave** - The grooved wheel or pulley used to assist in pulling cable through a bend in the routing; especially used in underground installations between manholes.

**Shield** - The metallic layer that surrounds insulated conductors in shielded cable. The shield may be the metallic sheath of the cable or the metallic layer inside a sheath.

**Shielding** - A metallic layer used to reduce EMI, RFI, noise, emissions or absorption. Also, the reduction of undesirable effects on circuits caused by electrostatic fields (FED-STD-1037A).

**Single Mode Fiber** - A fiber wave guide in which only one mode will propagate. The fiber has a very small core diameter of approximately 8 um. It permits signal transmission at extremely high bandwidths and is generally used with laser diodes.

**Slab on Grade** - A concrete floor place directly on the soil without a basement or crawl space.

**SLC** - subscriber loop carrier or subscriber line concentrator

**Sleeve** - A metallic section of conduit that typically extends above the floor line (after coring) at least one (1) inch, and extends into the space below as required by local fire codes.

**Slot** - An opening, usually rectangular (typically, 6" x 9"), through floors, ceilings or walls that accommodate placement of cable and wiring.

**Sneak Current** - A foreign current flowing to ground through terminal wiring and equipment that is driven by a voltage that is too low to cause a protector to operate.

**Sneak Current Protection** - The use of devices to protect against sneak currents either by interrupting the current (fuses) or grounding the conductor (heat coils).

**Splice** - The physical joining of two or more copper conductors or optical fibers to form a continuous circuit/conductor.

**Splice Closure** - A container used to organize and protect splice trays. Typically used in outside plant environments.

**Splice Tray** - A container used to secure, organize and protect spliced fibers.



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**Standard Protection** - Also, primary protection. the minimum basic protection required on all exposed facilities to comply with NEC requirements.

**Standing Wave Ratio (SWR)** - A ratio of the maximum amplitude to the minimum amplitude of a standing wave stated in current or voltage amplitudes.

**Star Topology** - A network interconnection scheme in which one central location has links to all other nodes, which have no direct connections to each other. See examples in workbook.

**Station Field** - The field used in telecommunications closets or equipment rooms to connect horizontal cabling to stations via work area outlets. Station fields are blue.

**Stranded Cable** - A strong woven-steel cable used to support cable in aerial distribution systems. The cable is lashed to the stranded cable during installation.

**Strength Member** - That part of a fiber optic cable composed of Aramid yarn, steel strands or Fiberglas filaments that increase the tensile strength of the cable.

**Stub Cable** - A short cable (usually 25 ft. or less) that extends from a cable terminal, protector or block and is used to splice incoming cable connections to such devices.

**Support Hardware** - The racks, clamps, cabinets, brackets, trays and other equipment that provides the physical means to attach the transmission media and connecting hardware to walls and ceilings, or in outside plant, ducts, manholes, vaults, poles, pull boxes, etc.

**Surge** - A temporary and relatively large increase in the voltage or current in an electric circuit or cable. Also called transient.

**Surge Suppression** - The process by which transient voltage (surges) are prevented from reaching sensitive electronic equipment.

**Surface Raceway** - A cable distribution method in which channels containing cables are run along or within the baseboards of a building.

**Suspended Ceilings** - A ceiling construction method where wires and T-bar suspend ceiling tiles. Cable is run in the area above the tiles. Also known as: false ceilings.

**T1** - A digital transmission link with 1.544 Mbps bandwidth. T1 operates on two twisted pairs and can handle 24 voice channels, each digitized at 64 Kbps. More voice channels are available with advanced digital encoding techniques.

**T1 Carrier** - The digital transmission system that transmits data at 1.544 Mbps. See T1.

**Telecommunications** - The transmission and reception of electrical or optical signals by copper wire, optical fiber or electromagnetic means. Encompasses all forms of transmitted intelligence, wire or wireless.

**Telecommunications Closet (TC)** - A space (formerly known as floor closet, IDF, satellite closet or other terms), in a building that is set aside to provide a safe, secure and environmentally suitable area for the installation of cables, wires, telecommunications equipment and/or termination and administration systems.

**Telecommunications Service Entrance** - The point where regulated telecommunications cables enter the building or property. See Entrance Facility.



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**Terminal** - A device that provides a user interface to the host.

**Terminal Block** - An assembly, pre-manufactured to accept 22-26 AWG conductors, allowing termination and cross-connect administration, test points and/or fusing and protection where required.

**TIA** - Telecommunications Industry Association.

**Tight-Buffered Cable** - Type of cable construction whereby each glass fiber is tightly buffered by a protective thermoplastic coating to a diameter of 900 micrometers. Increased buffering provides ease of handling and connectorization.

**Transport Control Protocol/Internet Protocol (TCP/IP)** - A common network layer and transport layer data networking protocol.

**Trunk** - Typically, a communication link between two switching systems. The term switching includes equipment in a central office (of the telephone company) and PBXs. A tie trunk connects PBXs. Central office trunks connect a PBX to the switching system at the central office and/or link other central offices together.

**Turn-Key** - A contractual arrangement in which one party designs and installs a system and turns over, in its entirety, to another party who will operate the system, after acceptance.

**Twisted Pair** - Two or more insulated wires twisted together. The twists, or lays, are varied in length to reduce the potential for signal interference between pairs. In cables greater than 25 pair, the twisted pairs are grouped and bound together in a common binder group. Twisted pair is the most common type of transmission media. Formerly referred to as direct inside wire (DIW). See Unshielded Twisted Pair (UTP).

**UL Approved** - Tested and approved by the Underwriters Laboratories Inc.

**Under Carpet Wiring** - A cable distribution method that uses flat cables placed beneath carpeting to provide voice, data video and power services to open office workstations. Difficult to install, administer or troubleshoot.

**Under Floor Duct Method** - A floor distribution method using a series of metal distribution channels, often embedded in concrete, for placing cables. This method uses one or two levels, depending on the complexity of the system. Sometimes referred to as under floor raceways.

**Underground Cable** - Not "direct buried" but in support structures beneath the surface of the earth as in conduit, duct, duct banks or other approved structures that isolate the cable from direct contact with earth and/or foreign power/EMI/RFI influences. Considered exposed to elements such as lightning, commercial power "hits", etc. (FED-STD 1 037A).

**Underground Distribution Method** - The method of running cable underground between buildings in campus systems by going through buried conduits.

**Underwriters Laboratories (UL)** - A private testing laboratory concerned with electrical and fire hazards of equipment.



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**Uniform Service Order Code (USOC)** - Bell System term used on Universal System service orders and to denote varying pin configurations on registered jacks (RJ's).

**Unshielded Twisted Pair (UTP)** - Copper cable with no foil or metallic/braid shielding, capable of high-speed voice and data transmission. Techniques exist to address the signal impairments due to the transmission characteristics of copper media and to limit radiated emissions. See UTP-categories.

**VA** - Volt-ampere. A designation of power in terms of voltage and current.

**Video** - Pertaining to visual information in an integrated system.

**Wide Area Network (WAN)** - Any physical network technology that spans large geographic distances through telco facilities or IECs. WANs usually operate at slower speeds than local area networks (LANs).

**Wiring Closet** - See Telecommunications Closet.

**Work Area Cable (Line Cord)** - A cable assembly used to connect equipment to the telecommunications outlet in the work area. Max. 10 ft. (EIA/TIA).

**Work Area Outlet (WAO) also known as: Workstation** - In general, a workstation is any designated location where constructive activities occurs. In communications, a workstation is an input/output device at which a user can send data to or receive data from a device for the purpose of performing a job. Usually a personal computer or a terminal. WAOs are considered to include voice, data (LAN), video or other applications. See definition for Telecommunications. Reference EIA/TIA 568B.

**Zone Method** - A ceiling distribution method in which serving areas are divided into sections or zones. Cable is then run to the center of each zone to serve the information outlets nearby. Variations of Star.



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### CONDUIT/PHONE REQUIREMENTS QWEST TELEPHONE SERVICE REQUIREMENTS

This set of requirements, is intended for commercial and residential developments within the QWEST area. There may be some additions or possibly some exceptions to these guidelines, depending upon individual site requirements. Your local contact will provide those if they are applicable to your development.

1. All conduit(s) must have not more than three (3) 90-degree bends or a maximum of 270 degrees in bends. Conduit must have sweep bends at all locations, meeting or exceeding these specifications:  
  
24" minimum radius on 2" diameter conduit (for use only with IW)  
36" minimum radius on 3" diameter conduit (if non standard size is used)  
48" minimum radius on 4" diameter conduit
2. All buried conduit must be Schedule 40 PVC (carefully placed), or equivalent. It must be equipped with a 300-lb. test calibrated pull tape (so overall length can be easily determined). Duct must be at a 30" minimum depth and ends must be capped. Conduit within the building must be metallic in conformance with all applicable codes.
3. All buried conduit(s) in Public Right of Way (or future ROW) must be covered by CDF (depth of material is determined by local rules, as it varies between Municipalities). On private property campus environments, the owner shall place all conduits, vaults and ancillary hardware for those vaults per the specifications given by the appropriate QWEST representative.
4. Inside the buildings, the owner will provide ¾" (min.) fire-rated plywood backboard, with height and width determined by individual building requirements. The backboard must have 42" minimum clearance in front of each panel for access.
5. Pathways inside the building for distribution of said services may be up to the owner to design and provide, depending on the Letter of Intent option chosen and filed with the State. Letters of Intent will be signed and returned to the company prior to any design work on the project. Depending on the option that is chosen (by type of development) multiple equipment rooms may be required for service.
6. A number size (#6) solid copper ground wire must be installed to each backboard or outside terminal location and connected to a ground bar (provided by the owner) installed at the lower left corner of the backboard. The other end of the ground wire is to be connected (by the owner's electrician) to the Building Ground or the Power Company Multi-Grounded Neutral per the NEC. No other grounds are acceptable, including a ground rod. Ground wire placed to outside terminals will be connected by QWEST inside the terminal.
7. If the building is to be fed by aerial cable (must be approved by local municipalities and fit QWEST area design criteria), the owner must provide a rigid metallic mast from 4' above ground level to a height on the building or above the building. This mast must obtain and maintain appropriate ground clearance when the cable is placed, and a minimum of 12" from power at all times. The mast must be equipped with a weatherhead and a building clamp for the cable; attachment must be securely attached to building (not siding or fascia).



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8. All conduit (equipped with pull tape), plywood backboard(s), grounding requirement, building distribution sleeves, and a minimum of one 1 1/2" conduit from telephone terminal to individual retail or tenant spaces(s) must be in place and the QWEST Communications Engineer notified a minimum of 45 days prior to the in-service date of the building. This time frame assumes all up front design layout work, has already been completed. It typically takes a minimum of two weeks for initial site design and layout work (some times longer, based on the actual size of the project being designed).
9. Should these provisions not be ready, or if they are not placed as directed by the QWEST Communications Engineer, delays in provision of telephone service (including alarm and elevator phones) could result. QWEST will not place temporary service for alarms, elevator phones or regular service if the 45-day lead time is not provided for by the owner/builder. Larger developments, will require more up front lead time to provide initial services to the site for ultimate distribution.
10. It is the owner's and/or the builder's responsibility to contact QWEST as soon as possible in the planning stage of the project. We will determine the nearest point outside your property where facilities are available and the point of connection at your building/property line.
11. Special construction charges may be applicable for rearrangements to existing plant on site or adjacent to, directly/indirectly related to construction of the new development or remodeled site. An "Authorization to Bill" letter, must be signed and returned prior to any design or start of any construction.
12. Upon completion of the installation of QWEST facilities, the owner will provide an access key for long term access to any/all Telco equipment room(s) where QWEST facilities have been terminated.

If you have any questions regarding these requirements, your local QWEST contact for this project is:

Name: \_\_\_\_\_ Telephone number: \_\_\_\_\_ Fax: \_\_\_\_\_

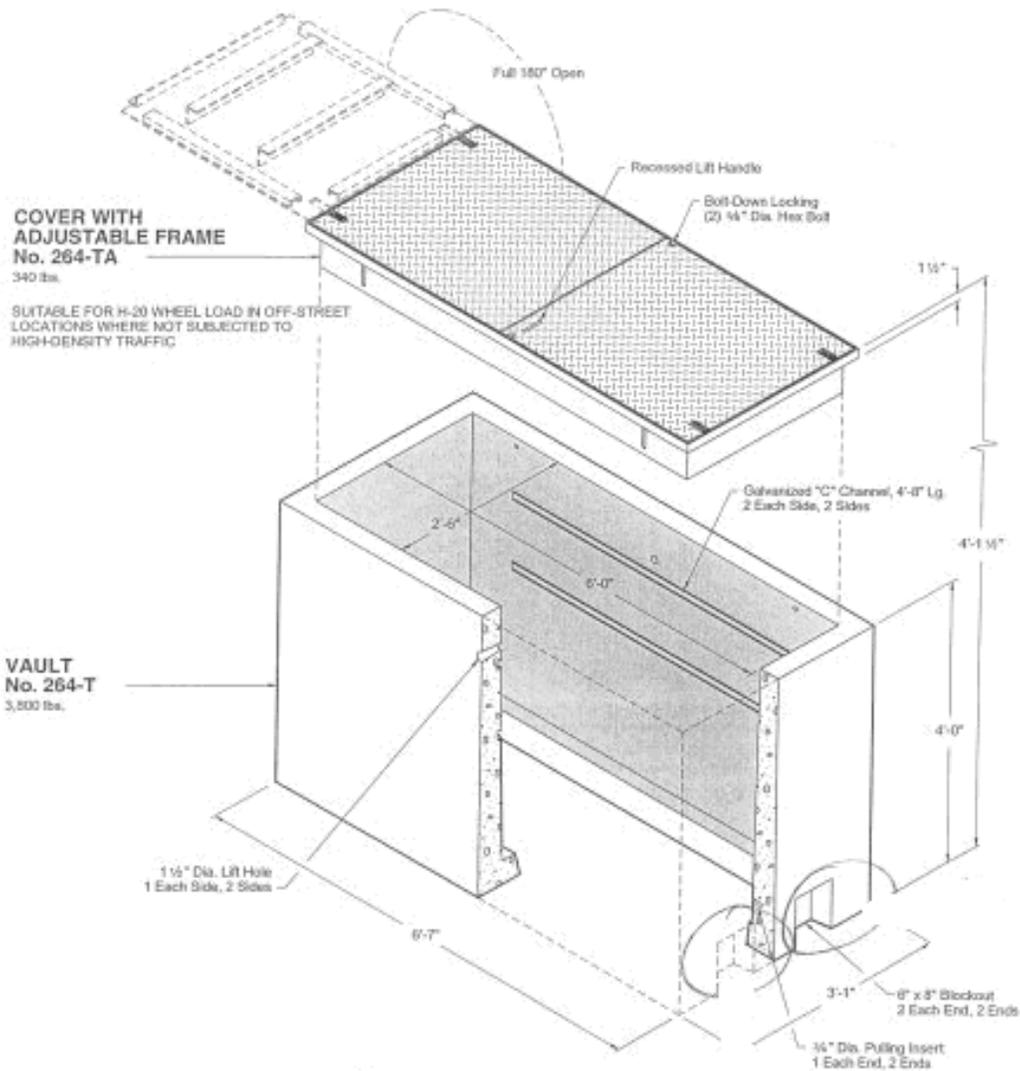
Title: \_\_\_\_\_

Mailing address: \_\_\_\_\_



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## 264-TA



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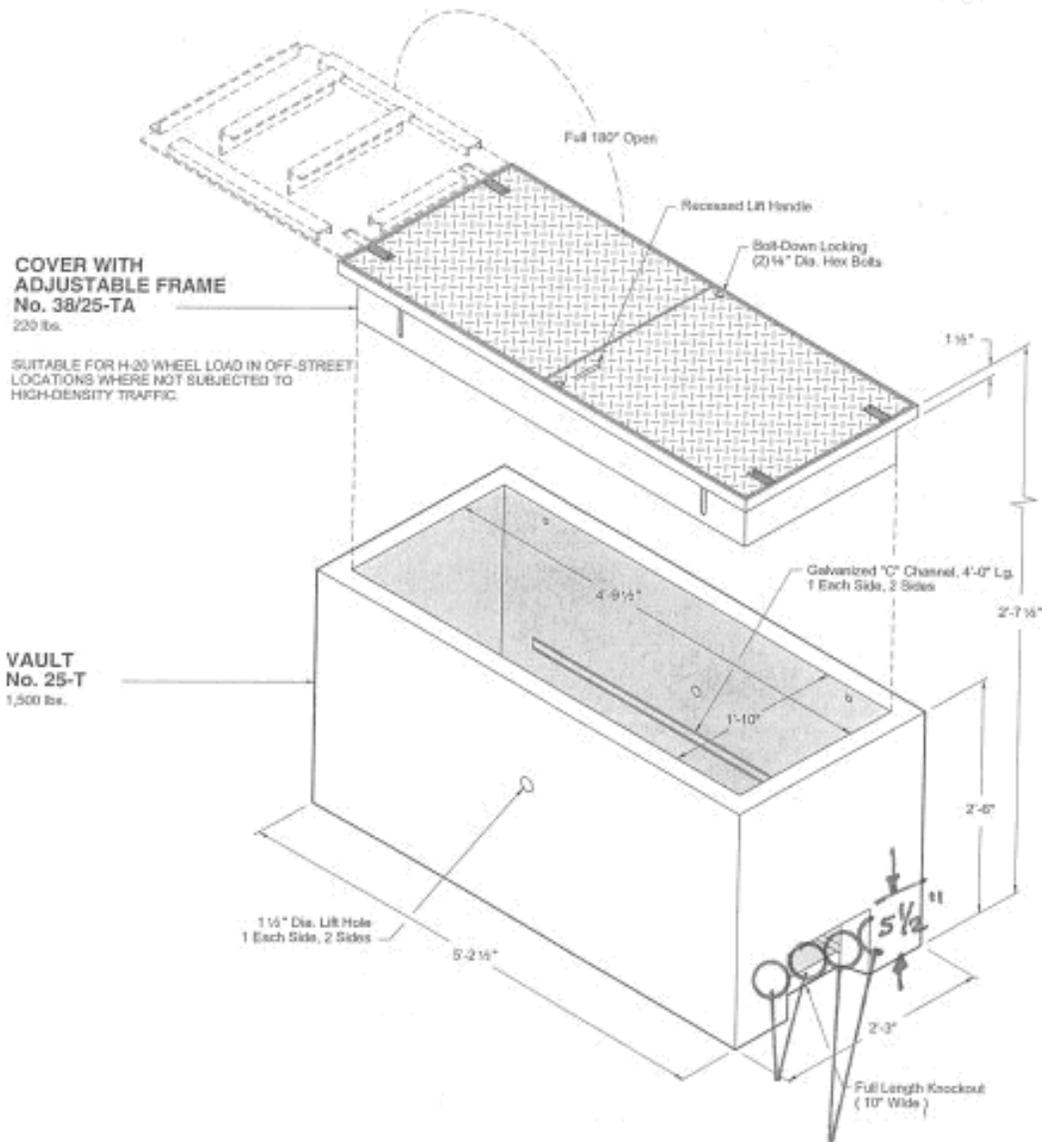
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# INFORMATION TECHNOLOGY STANDARDS

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