

TELECOMMUNICATIONS ENTRANCE FACILITY

Heating, ventilation and air conditioning (HVAC)

Access provider and service provider equipment is often designed to operate in extreme environmental conditions such as temperature. As a guideline for cooling a typical access provider or service provider space, provide 9 m³ (300 ft³) of 12 °C (55 °F) conditioned air per 20 A dedicated receptacle. Actual air handling requirements may exceed these guidelines and should be calculated based on potential heating and cooling demand associated with equipment which may be present in the telecommunications entrance room, including, but not limited to:

- a) servers;
- b) backbone data switches;
- c) PBXs and key systems;
- d) coaxial amplifiers;
- e) video distribution equipment; and,
- f) uninterruptible power supplies.

Continuous operation

HVAC shall be provided on a 24 hours-per-day, 365 days-per-year basis. One means of providing around-the-clock HVAC is use of a stand-alone unit.

Operational parameters

Access provider and service provider space temperature and humidity shall be controlled to provide continuous operating ranges of 65 °F to 75 °F with 30% to 55% relative humidity. Humidification and dehumidification equipment may be required depending upon local environmental conditions.

The ambient temperature and humidity shall be measured at a distance of five (5) feet above the floor level, after the equipment is in operation, at any point along an equipment aisle centerline.

Other mechanical fixtures

Mechanical (e.g., piping, ductwork, pneumatic tubing) fixtures not related to the support of the access provider space and service provider space should not be installed in, pass through, or enter the access provider space or service provider space.

Conduit entrance design guidelines

Conduit entrances consist of several 103 (4) trade size conduits and, optionally, several 53 (2) trade size conduits. In general, 53 (2) trade size conduits should be considered for use with small diameter (e.g., 13 mm (0.5 in)) cables such as optical fiber and CATV cable, while 103 (4) trade size conduit should be considered for use with larger diameter, multi-pair copper cables. An innerduct that is rated in accordance with AHJ shall also be placed within 103 (4) trade size conduit to facilitate smaller diameter cables such as optical fiber and coaxial cable.

As a minimum, two 103 (4) trade size, with at least one spare 103 (4) trade size, conduits shall be placed for each entrance point. In addition three 53 (2) trade size conduits should be considered for placement at each entrance point.

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Pull box

A pull box shall be installed inside the building at the entrance point for cable pulling and splicing when:

- a) the building conduit is extended from the entrance conduit; or
- b) warranted by excessive conduit length; or
- c) the quantity of bends exceeds the equivalent of two 90-degree bends.

Electrical Power

General

Access provider and service provider power requirements shall be specified by the respective provider. As a minimum guideline, provide at least one dedicated 20 A, 120 Vac nominal, non-switched duplex electrical receptacle for equipment to be placed in each access provider space and service provider space. Operators of access provider spaces and service provider spaces shall be allowed access to convenience duplex receptacle(s).

Bonding and grounding

Access shall be made available to the telecommunications bonding and grounding infrastructure specified by TIA/EIA Joint Standard 607-A.

The telecommunications entrance facility (TEF) is the entrance point (room or space within the building) where:

- the telecommunications facilities enter,
- the joining of inter- and intrabuilding backbone facilities takes place, and
- the grounding (earthing) of these facilities is accomplished.

The TEF may also include antenna cable entrances, and electronic equipment serving telecommunications functions. The TEF is the desirable location for the telecommunications main grounding busbar (TMGB). The TMGB may also serve as the telecommunications grounding busbar (TGB) for equipment in the TEF. The TMGB should be placed to provide for the shortest and straightest routing of the primary protector grounding conductor. The TMGB is the common point in the TEF for all telecommunications grounding connections in that room or space. The TMGB shall be placed as close as practicable to the panel board for telecommunications equipment and shall be installed to maintain clearances required by applicable electrical codes. When a panel board for telecommunications equipment is not installed in the TEF, the TMGB should be located near the backbone cabling and associated terminations. In addition, the TMGB should be located so that the bonding conductor for telecommunications is as short and straight as possible.

Fire protection

Fire protection of the access provider and service provider spaces, if required, shall be provided as per applicable code. If sprinklers are required within either the access provider or service provider spaces, or both, the heads shall be provided with wire cages to prevent accidental operation. Drainage troughs shall be placed under the sprinkler pipes to prevent leakage onto the equipment within the room. For some applications, consideration should be given to the installation of alternative “dry” fire-suppression systems.

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Water infiltration

Where possible, the access provider and service provider spaces should not be located below water level unless preventive measures against water infiltration are employed. The space shall be free of water or drain pipes not directly required in support of the equipment within the space. A floor drain shall be provided within the space where risk of water ingress exists.

ALL TELECOMMUNICATIONS ROOMS

General

The telecommunications room shall be dedicated to the telecommunications function and related support facilities. The telecommunications room is a common access point for backbone and building pathways. The telecommunications enclosure shall be able to contain telecommunications equipment, cable terminations, and associated cross-connect cabling.

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) shall not be installed in, pass through, or enter the telecommunications room. Telecommunications room design, including location should be developed in accordance with the security plan of the building.

Quantity

There shall be a minimum of one telecommunications room per floor. Additional rooms (one for each area up to 10,000 ft² should be provided when:

- a) the floor area to be served exceeds 10,000 ft²; or
- b) the horizontal distribution distance to the work area exceeds 295 ft.

Location

The telecommunications room shall be located as close as practicable to the center of the area served and preferably in the core area.

When selecting the telecommunications room site, avoid locations that are restricted by building components that limit expansion such as elevators, core, outside walls, or other fixed building walls. Accessibility for the delivery of large equipment to the equipment room should be provided.

The room shall be located away from sources of electromagnetic interference. Special attention shall be given to electrical power supply transformers, motors and generators, x-ray equipment, radio or radar transmitters, and induction sealing devices.

Access

The telecommunications room shall be in an accessible area on each floor, e.g, a common hallway. Access to telecommunications room shall be controlled against unauthorized access. Doors providing access to other areas of the building through the room should be avoided in order to limit access to the equipment room to authorized personnel only.

Pathways

Pathways shall not pass through telecommunications room. Cables that enter and exit the telecommunications room shall be protected from sheath abrasion and conductor deformation by means of grommets, bushings, and suitable cable management hardware.

Multiple telecommunications rooms on a floor shall be interconnected by a minimum of one conduit 78 (3) trade size), or equivalent pathway.

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To facilitate cable pulling, sleeves and slots should be located adjacent to the door. Sleeves or slots shall not be left open except during cable installation and shall be properly fire stopped per applicable codes.

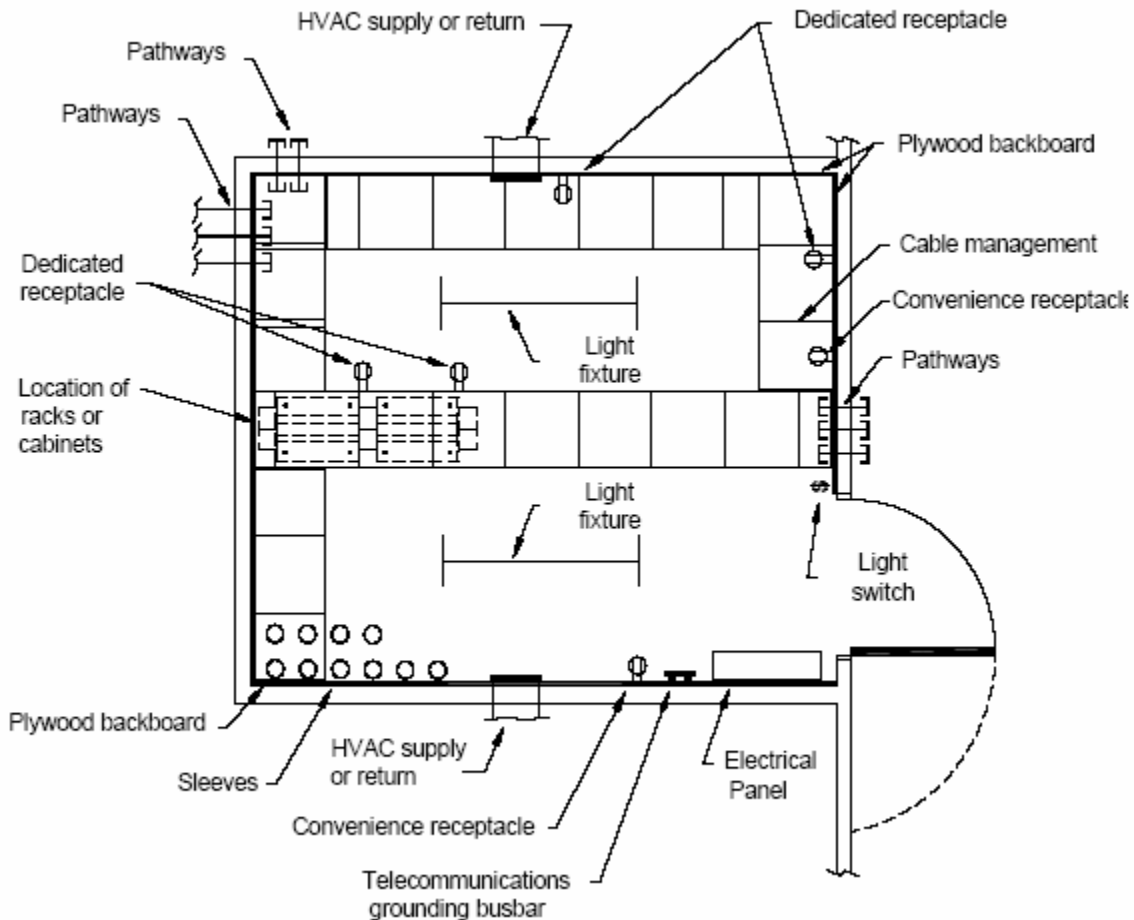
Size and spacing

The telecommunications room shall be sized to meet the known requirements of specific equipment; this information can be obtained from the equipment provider(s). Sizing shall include projected future as well as present requirements. Where a room or space is intended to be used for more than equipment (e.g., equipment and entrance facility), it shall be increased in size accordingly and meet the requirements specified.

Based on one work area per 10 m² (100 ft²), the telecommunications room should be sized per the table below which provides minimum acceptable room dimensions based on areas served up to and not exceeding 1000 m² (10,000 ft²).

Serving area m² (ft²)	Room size mm (ft)
1000 (10 000)	3000 x 3400 (10 x 11)
800 (8000)	3000 x 2800 (10 x 9)
500 (5000)	3000 x 2200 (10 x 7)

Typical Telecommunications Room Layout



Guidelines for voice and data

When designing the equipment room floor space, allowance shall be made for non-uniform occupancy throughout the building. The practice is to provide 0.75 ft.² of equipment room space for every 100 ft of work area space. The equipment room shall be designed to a minimum of 50 ft².

NOTE – If it is expected that the density of work areas will be higher, then the size should be increased accordingly.

Special considerations for small spaces

Spaces smaller than 5000 ft² may be served by small rooms or telecommunications enclosures.

For smaller buildings, less than 1000 ft² telecommunications enclosures may be considered. Walk-in rooms should be a minimum of 4.5 ft wide by 4.5 ft deep to serve a floor area of up to 5000 ft².

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Guidelines for special-use buildings

In special-use buildings (e.g., hotel, hospital, laboratory), equipment room floor space shall be based on the known number of work areas as shown below (not on usable floor area).

Equipment room floor space – special-use buildings

Work areas	Area	m²	(ft²)
Up to 100		14	(150)
101 to 400		37	(400)
401 to 800		74	(800)
801 to 1200		111	(1200)

Quantity

When the area served exceeds 2000 m² (20 000 ft²) consideration should be given to providing more than one central telecommunications room.

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Interior provisioning

Environmental

HVAC

HVAC shall be included in the design of the telecommunications room to maintain a temperature the same as the adjacent office area.

HVAC Operational parameters

A positive pressure shall be maintained with a minimum of one air change per hour, or as required by applicable code. When active devices (heat producing equipment) are present, a sufficient number of air changes should be provided to dissipate the heat.

The temperature and humidity shall be controlled to provide continuous operating ranges of 18 °C (64 °F) to 24 °C (75 °F) with 30% to 55% relative humidity. Humidification and dehumidification equipment may be required depending upon local environmental conditions. The ambient temperature and humidity shall be measured at a distance of 1.5 m (5 ft) above the floor level, after the equipment is in operation, at any point along an equipment aisle center line.

HVAC Standby operation

If a standby power source is available in the building, the HVAC system serving the telecommunications room should be connected to the standby supply.

HVAC Contaminants

The telecommunications room shall be protected from contaminants and pollutants that could affect operation and material integrity of the installed equipment. When contaminants are present in concentrations greater than indicated in the table below, vapor barriers or absolute filters shall be provided.

Contamination Limits

Contaminant	Concentration
Chlorine	0.01 ppm
Dust	100µg/m ³ /24 h
Hydrocarbons	4µg/m ³ /24 h
Hydrogen Sulfide	0.05 ppm
Nitrogen Oxides	0.1 ppm
Sulfur Dioxide	0.3 ppm

HVAC Vibration

Mechanical vibration coupled to equipment or the cabling infrastructure can lead to service failures over time. A common example of this type of failure would be loosened connections. Potential vibration problems should be considered in the design of the telecommunications room, since vibration within the building will exist and will be conveyed to the

telecommunications room via the building structure. In these cases, the project structural engineer should be consulted to design safeguards against excessive telecommunications room vibration.

HVAC Vibration and noise

Audible noise created by the equipment within the telecommunications room should not adversely affect the productivity or satisfaction of nearby workers.

Guidelines for other equipment

Environmental control equipment, such as power distribution or conditioner systems, and UPS up to 100 kVA shall be permitted to be installed in the equipment room. UPS larger than 100 kVA should be located in a separate room. Equipment not related to the support of the equipment room (e.g., piping, ductwork, pneumatic tubing) shall not be installed in, pass through, or enter the telecommunications room.

Electrical Power

A minimum of two dedicated 120 V nominal, non-switched, ac duplex electrical receptacles, each on a separate branch circuit, shall be provided for equipment power. These receptacles should be rated at 20 A and be connected to a 20 A branch circuit. In addition, identified and marked convenience duplex outlets shall be placed at 6 foot intervals around the perimeter walls, at a height of 6 inches above the floor. Specific outlets for equipment and convenience along with their locations shall be coordinated with the telecommunications system designers.

NOTE – In many cases, it is desirable that a dedicated power panel be installed to serve the telecommunications room.

Standby power

If standby power is available, automatic switchover of power should be provided.

Separation between telecommunications and power cables

Co-installation of telecommunications cable and power cable is governed by applicable electrical code for safety. For minimum separation requirements of electrically conductive telecommunications cable from typical branch circuits (120/240 V, 20 A), Article 800.52 of ANSI/NFPA 70 shall be applied, for example:

- a) separation from power conductors;
- b) separation and barriers within raceways; and
- c) separation within outlet boxes or compartments.

Reducing noise coupling

In order to further reduce noise coupling in electrically conductive telecommunications cables from sources such as electrical power wiring, radio frequency (RF) sources, large motors and generators, induction heaters, and arc welders, the following additional precautions should be considered:

- a) Increased physical separation;
- b) Electrical branch circuit line, neutral, and grounding conductors should be maintained close together (e.g., twisted, sheathed, taped, or bundled together) for minimizing inductive coupling into telecommunications cabling;
- c) Use of surge protectors in branch circuits that can further limit the propagation of electrical surges. Follow guidelines in section 9.11.2 of ANSI/IEEE 1100;

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- d) Use of fully enclosed, grounded metallic raceway or grounded conduit or use of cable installed close to a grounded metallic surface that will also limit inductive noise coupling. Refer to section 9 of ANSI/IEEE 1100.

Fire protection

Fire protection of the telecommunications room, if required, shall be provided as per applicable code. If sprinklers are required, the heads shall be provided with wire cages to prevent accidental operation. Drainage troughs shall be placed under the sprinkler pipes to prevent leakage onto the equipment within the room. For some applications, consideration should be given to the installation of alternative "dry" fire-suppression systems.

Cable Termination

Cable trays and cable runways within the ceiling shall protrude into the room 1-3 inches, without a bend, and above the 8 foot level. These pathway entry requirements prevent partial bend transitions through the wall and ensure that the cable is at a height that may be fed to termination fields without interfering with equipment racks or back panels.

Plywood backboards

A minimum of one wall should be covered with ¾ inch A-C plywood, preferably void free, 8 feet high, and securely fastened to the wall. Plywood shall be fire-rated (fire retardant) to meet applicable codes. To reduce warping, fire-rated (fire retardant) plywood shall be kiln-dried to a maximum moisture content of 15%.

Dust

Dust in the telecommunications room should be less than 100 micrograms per cubic meter per 24-hour period.

Ceiling height

The minimum clear height in the room shall be 8 feet without obstructions. The height between the finished floor and the lowest point of the ceiling should be a minimum of 10 feet to accommodate tall frames and overhead pathways.

Suspended ceiling

For maximum flexibility, false ceilings shall not be provided. In such cases where fireproofing may be sprayed onto the exposed ceiling, the fireproofing shall be treated to mitigate airborne dust.

Treatment

Floors, walls, and ceiling shall be treated to eliminate dust. Finishes shall be light in color to enhance room lighting. Floors shall have anti-static properties.

Lighting

Lighting shall be a minimum of 500 lx (50 foot-candles) measured 3 feet above the finished floor, in the middle of all aisles between cabinets and racks. Lighting design should seek to minimize shadows within the room. The lighting shall be controlled by one or more switches located near the entrance door(s) to the room. There should be no fluorescent lighting (Or maintain the 6-inch distance per code to prevent EMI from the ballast. Emergency lighting and

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signs shall be properly placed per AHJ such that an absence of primary lighting will not hamper emergency exit.

NOTE – Lighting fixtures should not be powered from the same electrical distribution panel as the telecommunications.

Floor loading

Telecommunications rooms shall be located on floor areas designed with a minimum floor loading of 2.4 kPa (50 lbf/ft²). It shall be verified that concentrations of proposed equipment do not exceed the floor loading limit. If unusually heavy equipment is anticipated, these specifications may have to be increased.

Signage

Signage shall be developed within the security plan of the building.

Door

Doors shall be a minimum of 36 inches wide and 80 inches high, without doorsill, hinged to open outward (code permitting) or slide side-to-side, or be removable. The door shall be fitted with a UTEP TELM Key lock.

Sufficient working space shall be provided and maintained for a technician to gain ready and safe access to the telecommunications enclosure. All ADA requirements must be met.

Conduit

Use of conduit

The use of conduit as a horizontal raceway system for telecommunications cabling is considered when: it is required by code, outlet locations are permanent, device densities are low, special mechanical protection is required, or flexibility is not required. In-floor conduit systems are especially inflexible as they are usually buried in concrete. If flexible metal conduit is used, the length should be less than 20 feet for each run and the conduit selected should minimize cable abrasion during the pulling in operation. Innerduct (also known as subduct) is typically a nonmetallic pathway within a pathway, and may be used in accordance with appropriate codes for installation of cable to facilitate subsequent placement of additional cable in a single pathway.

Conduit Design guidelines

Conduit Length

No section of conduit shall be longer than 100 feet between pull points.

Conduit runs to outlets

Any single conduit run extending from a telecommunications room shall not serve more than three outlet boxes.

Conduits should be incrementally increased in size from the furthest outlet box toward the telecommunications room.

Telecommunications room termination

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Conduits protruding through the floor in the telecommunications room shall be terminated 1-3 inches above the floor surface. This protrusion aids in preventing poured concrete from entering the conduit during construction and protects cabling and firestop materials from water and other liquid spills.

Conduits within the ceiling shall protrude into the room from 1-3-inches, without a bend, and above the 8 foot level. These pathway entry requirements prevent partial bend transitions through the wall and ensure that the cable is at a height that may be fed to connecting hardware without interfering with equipment racks or back panels.

Conduit Bends

No section of conduit shall contain more than two 90-degree bends, or equivalent, between pull points (e.g., outlet boxes, telecommunications rooms, pull boxes). If there is a reverse (U-shaped) bend in the section, a pull box shall be installed.

For conduits with an internal diameter of two (2) inches or less, the inside radius of a bend in conduit shall be at least 6 times the internal diameter. For conduits with an internal diameter of more than 2 inches, the inside radius of a bend in conduit shall be at least 10 times the internal diameter. Bends in the conduit shall not contain any kinks or other discontinuities that may have a detrimental effect on the cable sheath during cable pulling operations.

Conduit Sizing

Conduits used for horizontal cables should be sized the chart below.

Conduit trade size	Maximum number of cables based upon allowable fill							
	Cable outside diameter, mm (in)							
	3.3 (.13)	4.6 (.18)	5.6 (.22)	6.1 (.24)	7.4 (.29)	7.9 (.31)	9.4 (.37)	13.5 (.53)
16 (½)	1	1	0	0	0	0	0	0
21 (¾)	6	5	4	3	2	2	1	0
27 (1)	8	8	7	6	3	3	2	1
35 (1¼)	16	14	12	10	6	4	3	1
41 (1 ½)	20	18	16	15	7	6	4	2
53 (2)	30	26	22	20	14	12	7	4
63 (2 ½)	45	40	36	30	17	14	12	6
78 (3)	70	60	50	40	20	20	17	7
91 (3 ½)	–	–	–	–	–	–	22	12
103 (4)	–	–	–	–	–	–	30	14

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Conduit to wall-mounted public telephone locations

A minimum 21 (¾) trade size conduit should be provided from the telecommunications room to serve each wall-mounted public telephone. In discussion with the telephone provider, and where it is desirable to conceal the outlet box directly behind the surface-mounted telephone, the center of the outlet box shall be placed 48 inches above the floor.

Conduit to Elevator telecommunications

A 21 (¾) trade size conduit shall be provided from the telecommunications room to a suitable device box. This location shall apply to passenger, freight, and window-washing elevators and be coordinated with the elevator contractor.

Pull boxes

Use of pull boxes

- a) Pull boxes shall be used for the following purposes:
 - 1) Fishing the conduit run.
 - 2) Installing a pull string or cable.
 - 3) Pulling the cable to the box and then looping the cable to be pulled into the next length of conduit. This is usually done with smaller diameter cables and not with cables of 2-½ inches diameter or greater.
- c) Conduit fittings shall not be used in place of pull boxes.

Pull Box Design guidelines

Pull boxes shall be readily accessible. Pull boxes shall not be placed in a fixed false ceiling space unless immediately above a suitably marked access panel. A pull box shall be placed in a conduit run where;

- a) The length is over 100 feet;
- b) there are more than two 90° bends, or equivalent or,
- c) if there is a reverse (U-shaped) bend in the run.

Pull boxes should be placed in a straight section of conduit and not used in lieu of a bend.

The corresponding conduit ends should be aligned with each other. Where a pull box is used with conduits of 35 (1-¼) trade size or larger, the pull box shall:

- a) for straight pull through, have a length of at least 8 times the trade-size diameter of the largest conduit;
- b) for angle and U pulls:
 - 1) have a distance between each conduit entry inside the box and the opposite wall of the box of at least 6 times the trade-size diameter of the largest conduit, this distance being increased by the sum of the trade-size diameters of the other conduits on the same wall of the box; and
 - 2) have a distance between the nearest edges of each conduit entry enclosing the same conductor of at least:
 - a. six times the trade-size diameter of the conduit; or
 - b. ten times the trade-size diameter of the larger conduit if they are of different sizes.
- c) for a conduit entering the wall of a pull box opposite to a removable cover, have a distance from the wall to the cover of not less than the trade-size diameter of the largest conduit plus 6 times the diameter of the largest conduit.

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If the pull box is comprised of metallic components, it shall be bonded to ground in accordance with prevailing codes.

Areas above ceilings

Considerations

- a) Inaccessible ceiling areas, such as lock-in type ceiling tiles, drywall or plaster, shall not be used as distribution pathways.
- b) Ceiling tiles shall be of the removable or lay-in type.
- c) Adequate and suitable space shall be available in the ceiling area for the contemplated layout.

Planning

The design shall provide a suitable means and method for supporting cables. Cable shall not be laid directly on the ceiling tile or rails.

Clearance

A minimum of 3 inches clear vertical space shall be available above the ceiling tiles for the horizontal cabling and pathway.

General horizontal design information and cable fill

Cable trays

Cable trays shall be designed to accommodate a maximum calculated fill ratio of 50% to a maximum of six (6) inches inside depth. For planning cable tray pathways, the maximum pathway fill should be 25%.

NOTE – A calculated fill ratio of 50% will physically fill the entire tray due to spaces between cables, and random placement.

Cable Runway

Cables installed on cable runway shall be stacked no higher than six (6) inches. Retaining posts may be installed on runway to contain cables.

Cable Support

The support span for cable support systems should be determined in accordance with the manufacturer's maximum recommended load capacity for a given span. These systems may be supported by three basic methods: cantilever brackets from a wall, trapeze or individual rod supports from the ceiling, or directly from the floor. Cable tray supports should be located where practicable so that connections between sections of the tray fall between the support point and one-quarter the distance of the span. A support should be placed within 24 inches on each side of any connection to a bend, tee, or cross.

NOTE – NEMA-VE2, *Metal Cable Tray Installation Guidelines* contains useful information regarding additional cable tray support and installation.

Cable Installation

The inside of the cable support system shall be free of burrs, sharp edges or projections that can damage cable insulation. Abrasive supports (e.g., threaded rod) installed within the cable fill area shall have that portion within the tray protected with a smooth, non-scratching covering so

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that cable can be pulled without physical damage. Openings in fire-rated walls, floors and ceilings shall be properly fire stopped. Cabletrays and cable runways shall not be used as walkways or ladders. Trays may be divided with a barrier to allow for physical separation between power and conductive telecommunications cables. Power and telecommunications cables shall be installed per electrical code. A minimum of 12 inches access headroom shall be provided and maintained above a cable tray system or cable runway. Care shall be taken to ensure that other building components (e.g., air conditioning ducts) do not restrict access.

Cable - Non-continuous support

Non-continuous supports shall be located at intervals not to exceed 5 feet. Non continuous supports shall be selected to accommodate the immediate and anticipated quantity, weight, and performance requirements of cables. Steel, masonry, independent rods, independent support wires or other structural parts of the building shall be used for cable support attachment points up to the total weight for which the fastener is approved. Rods or wires that are currently employed for other functions (e.g. suspended ceiling grid support) shall not be utilized as attachment points for non-continuous supports.

NOTE – A weight of 2.2 lb (or 0.7 kg/m with spacing of support wire/rod at 1.5 m (5 ft)) is equivalent to a bundle of sixteen 4-pair 24 AWG UTP cables, including fasteners.

Telecommunications outlet locations

Outlets General

Cabling system performance is sensitive to the arrangement of slack cable behind the telecommunications outlet/connector. Sufficient space shall be provided so that bend radius requirements are not violated in these termination spaces. The location, mounting, or strain relief of the telecommunications outlet/connector should allow pathway covers and trim to be TIA-569-B 36 removed without disturbing the cable termination. This may be done by appropriate furniture design, by use of external mounting enclosures, or in other ways. It is suggested that telecommunications outlets/connectors be mounted in such a way that they do not reduce the required pathway cabling capacity.

NOTE – The federal Americans with Disabilities Act (ADA) affects mounting locations in some instances.

Outlet density

A minimum of one location for a telecommunications outlet shall be installed per work area. For planning purposes, space allocated per work area averages 100 ft². For building areas where it is difficult to add telecommunications outlets at a later date (e.g., private office space), a minimum of two separate outlet locations should be provided in the initial design for that area; they shall be located to offer maximum flexibility for change within the work area (e.g., on opposing walls in private office space).

Outlet location considerations

Telecommunications outlet locations should be coordinated with the furniture layout. A power outlet should be installed near each telecommunications outlet box (e.g., within 3 feet). Telecommunications outlet locations are typically at the same height as the power outlet.

Control center, attendant, and reception areas

Control center, attendant, and reception areas have heavy demands for telecommunications equipment. Independent and direct pathways shall be provided from these areas to the serving telecommunications room or equipment room. Where conduit protrudes through the floor, it shall be terminated in a box. Where built-in, flush-mounted, or recessed installations are planned, they shall be designed with access to the pathway.

Outlet box

An outlet box shall be no smaller than 50 mm wide, 75 mm high, and 64 mm deep (2 in, 3 in, 2-½ in). This box will accommodate one or two 21 (¾) trade size conduits. Where a larger conduit is required, the box size shall be increased accordingly. A maximum 35 (1-¼) trade size conduit will require a 120 mm x 120 mm x 64 mm (4-11/16 in x 4-11/16 in x 2-½ in) outlet box. Where a 27 (1) trade size conduit is required, a 100 mm x 100 mm x 57 mm (4 in x 4 in x 2-¼ in) box should be used. Specialty boxes may be used in place of the above as appropriate. Supports for attaching the outlet box and a suitable cover plate shall be provided.

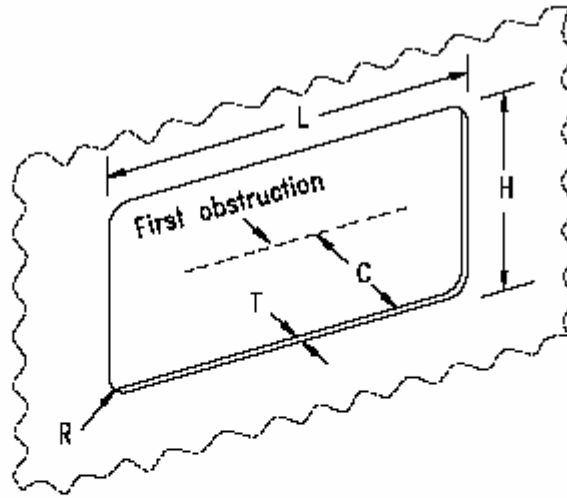
Low-voltage mounting bracket

A low-voltage mounting bracket is similar to a plaster ring and may be used in place of an outlet box where permitted by code.

Furniture

Furniture outlet openings provide for mounting faceplates. Two standard sizes of openings are specified:

- a) NEMA-equivalent opening. This size shall provide openings that are dimensionally equivalent to standard (NEMA OS 1, WD-6) openings. In addition, a minimum depth of 30.5 mm (1.2 in) should be provided.
- b) Alternative (furniture-size) opening. These openings should have dimensions as specified in the following chart.



	Dimension		Tolerance	
	mm	(in)	mm	(in)
L	68.8	(2.71)	1.02	(0.040)
H	35.1	(1.38)	0.90	(0.035)
T	1.4	(0.055)	0.64	(0.025)
R	4.06	(0.16) max.	-	-
C	30.5	(1.2) min.	-	-

If wiring must be routed through furniture then the wiring must be done at the exact same time the furniture is put in place. (Otherwise, the wall outlet cannot be reached.)