Consider supplementing ANSI/TIA/EIA-606-A cable labels with sequence numbers or other identifiers to simplify troubleshooting. For example, the 24-port patch panel with 24 category 6 cables from the MDA to HDA1 could include the label above, but could also include the label 'MDA to HDA1 Cat 6 UTP 1 – 24'.

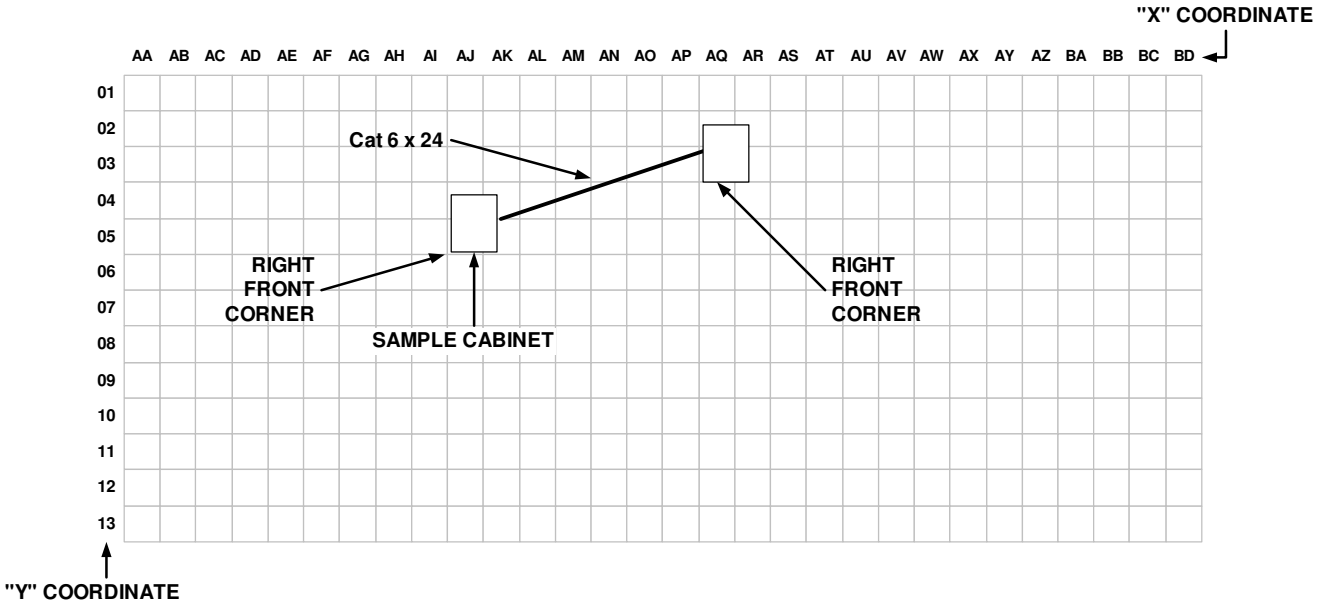


Figure 14: Sample 8-position modular patch panel labeling – Part I

For example, figure 15 shows a label for a 24-position modular patch panel with 24 category 6 cables interconnecting cabinet AJ05 to AQ03 as shown in figure 14.

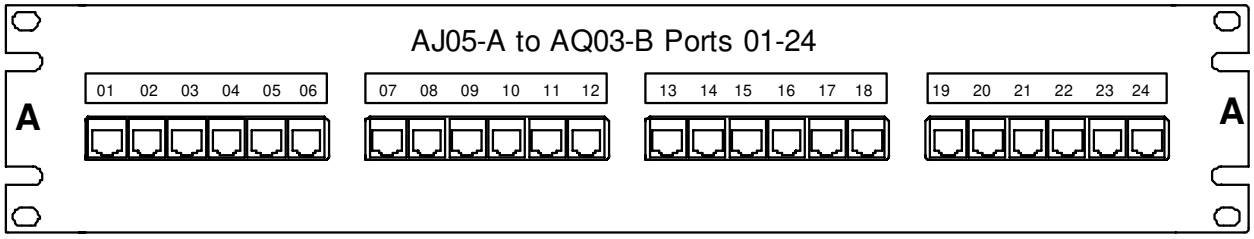


Figure 15: Sample 8-position modular patch panel labeling – Part II

B.5 Cable and patch cord identifier

Cables and patch cords should be labeled on both ends with the name of the connection at both ends of the cable.

Consider color-coding patch cables by application and type. A sample cable and patch cord administration schema follows:

p_{1n} / p_{2n}

Where:

p_{1n} = The near end rack or cabinet, patch panel sequence, and port designator assigned to that cable.

p_{2n} = The far end rack or cabinet, patch panel sequence, and port designator assigned to that cable.

For example, the cable connected to first position of the patch panel shown in figure 15 may contain the following label:

AJ05-A01 / AQ03-B01

and the same cable at cabinet AQ03 would contain the following label:

AQ03-B01 / AJ05-A01

ANNEX C (INFORMATIVE) ACCESS PROVIDER INFORMATION

This annex is informative only and is not part of this Standard.

C.1 Access provider coordination

C.1.1 General

Data center designers should coordinate with local access providers to determine the access providers' requirements and to ensure that the data center requirements are provided to the access providers.

C.1.2 Information to provide to access providers

Access providers will typically require the following information for planning entrance rooms for a data center:

- address of the building;
- general information concerning other uses of the building, including other tenants;
- plans of telecommunications entrance conduits from the property line to the entrance room, including location of maintenance holes, hand holes, and pull boxes;
- assignment of conduits and innerducts to the access provider;
- floor plans for the entrance facilities;
- assigned location of the access providers protectors, racks, and cabinets;
- routing of cables within entrance room (under access floor, overhead cable ladders, other);
- expected quantity and type of circuits to be provisioned by the access provider;
- date that the access provider will be able to install entrance cables and equipment in the entrance room;
- requested location and interface for demarcation of each type of circuit to be provided by the access provider;
- requested service date;
- name, telephone number, and email address of primary customer contact and local site contact.

C.1.3 Information that the access providers should provide

The access provider should provide the following information:

- space and mounting requirements for protectors on copper-pair cables;
- quantity and dimensions of access provider racks and cabinets;

- power requirements for equipment, including receptacle types;
- service clearances;
- installation and service schedule.

C.2 Access provider demarcation in the entrance room

C.2.1 Organization

The entrance room will have up to four separate areas for access provider demarcation:

- demarcation for low-speed copper-pair circuits, including DS-0, ISDN BRI, and telephone lines;
- demarcation for high-speed DS-1 (T-1 or fractional T-1, ISDN PRI) or CEPT-1 (E-1) copper-pair circuits;
- demarcation for circuits delivered on coaxial cable including DS-3 (T-3) and CEPT-3 (E-3);
- demarcation for optical fiber circuits (for example, SONET OC-x, SDH STM-x, FDDI, Fast Ethernet, Gigabit Ethernet, 10 Gigabit Ethernet).

Ideally, all access providers provide demarcation for their circuits in the same location rather than in their own racks. This simplifies cross-connects and management of circuits. The centralized location for demarcation to all access providers is often called meet-me areas or meet-me racks. There should be separate meet-me or demarcation areas or racks for each type of circuit; low speed, E-1/T-1, E-3/T-3, and optical fiber. Cabling from the computer room to the entrance room should terminate in the demarcation areas.

If an access provider prefers to demarcate their services in their racks, the customer can install tie-cables from that access provider's demarcation point to the desired meet-me/demarcation area.

C.2.2 Demarcation of low-speed circuits

Access providers should be asked to provide demarcation of low-speed circuits on IDC connecting hardware. While service providers may prefer a specific type of IDC connecting hardware (e.g. 66 block), they may be willing to hand off circuits on another type of IDC connecting hardware upon request.

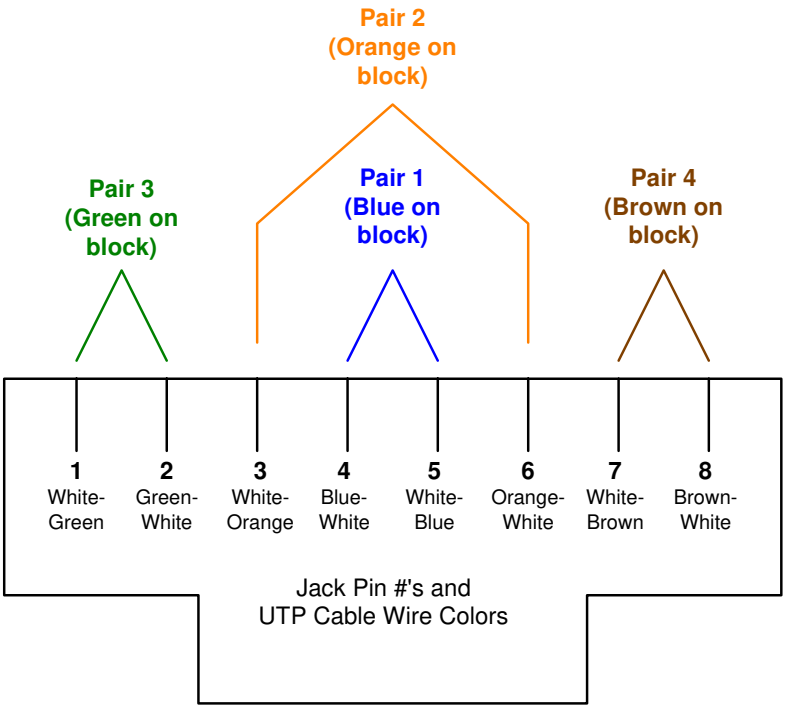
Cabling from the low-speed circuit demarcation area to the main distribution area should be terminated on IDC connecting hardware near the access provider IDC connecting hardware.

Circuits from access providers are terminated either in one or two pairs on the access provider IDC connecting hardware. Different circuits have different termination sequences, as illustrated in figure 16 and figure 17.

Each 4-pair cable should be terminated in an eight-position modular jack at the work area. The 100 ohm UTP and ScTP telecommunications outlet/connector should meet the modular interface requirements specified in IEC 60603-7. In addition, the telecommunications outlet/connector for 100 ohm UTP and ScTP cable should meet the requirements of ANSI/TIA/EIA-568-B.2 and the terminal marking and mounting requirements specified in ANSI/TIA-570-B.

Pin/pair assignments should be as shown in figure 16 or, optionally, per figure 17 if necessary to accommodate certain 8-pin cabling systems. The colors shown are associated with the horizontal

distribution cable. These illustrations depict the front view of the telecommunications outlet/connector and provide the list of the pair position for various circuit types.



(View from Front of Jack or Back of Plug)

1) **Phone Lines**:1-pair cross-connect to Pair 1**(Blue**)

2) **ISDN BRI U-Interface (U.S.)**: 1-pair cross-connect to Pair 1 (**Blue)**

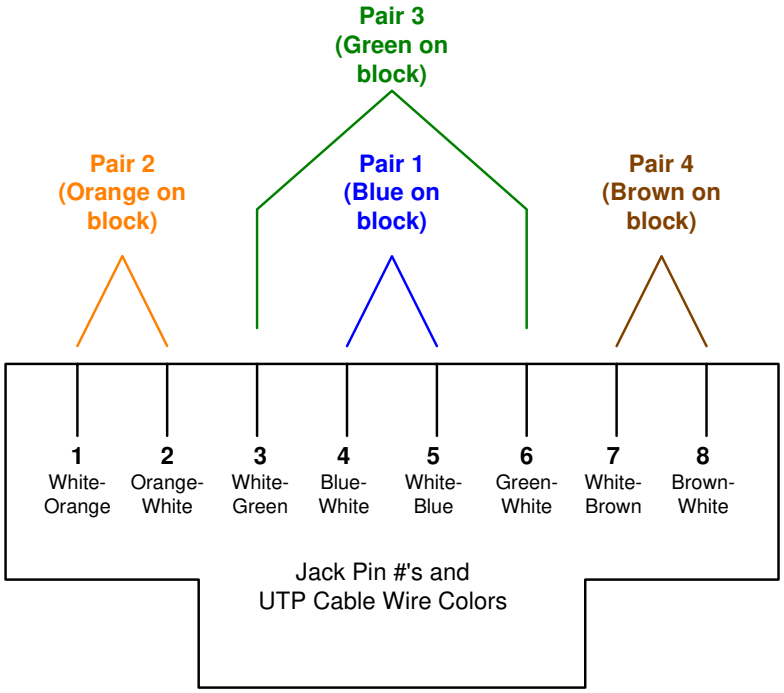
3) **ISDN BRI S/T-Intf (Intl)**: 2-pair cross-connect to Pairs 1 & 2 (**Blue** & **Orange**)

4) **56k/64k Leased Line**: 2-pair cross-connect to Pairs 3 & 4 (**Green** & **Brown**)

5) **E1/T1**: 2-pair cross-connect to Pairs 1 & 3 (**Blue** & **Green**)

6) **10Base-T/100Base-T**: 2-pair cross-connect to Pairs 2 & 3 (**Orange** & **Green**)

Figure 16: Cross-connection circuits to IDC connecting hardware cabled to modular jacks in the T568A 8-pin sequence



(View from Front of Jack or Back of Plug)

1) **Phone Lines**:1-pair cross-connect to Pair 1**(Blue**)

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3) **ISDN BRI S/T-Intf (Intl)**: 2-pair cross-connect to Pairs 1 & 3 (**Blue** & **Green**)

4) **56k/64k Leased Line**: 2-pair cross-connect to Pairs 2 & 4 (**Orange** & **Brown**)

5) **E1/T1**: 2-pair cross-connect to Pairs 1 & 2 (**Blue** & **Orange**)

6) **10Base-T/100Base-T**: 2-pair cross-connect to Pairs 2 & 3 (**Orange** & **Green**)

Figure 17: Cross-connection circuits to IDC connecting hardware cabled to modular jacks in the T568B 8-pin sequence

The conversion from access provider 1-pair and 2-pair cabling to 4-pair cabling used by the data center structured cabling system can occur either in the low-speed circuit demarcation area or in the main distribution area.

The access provider and customer IDC connecting hardware can be mounted on a plywood backboard, frame, rack, or cabinet. Dual-sided frames should be used for mounting large numbers of IDC connecting hardware (3000+ pairs).

C.2.3 Demarcation of T-1 circuits

Access providers should be asked to hand-off T-1 circuits on RJ48X jacks (individual 8-position modular jacks with loop back), preferably on a DSX-1 patch panel mounted on a customer-owned rack installed in the DS-1 demarcation area. Patch panels from multiple access providers and the customer may occupy the same rack.

For example, in the United States and Canada, access providers typically use DSX-1 patch panels that fit 585 mm (23 in) racks. Thus, the DS-1 demarcation area should use one or more 585 mm (23 in) racks for access provider DS-1 patch panels. These same racks or adjacent 480 mm (19 in) racks can accommodate patch panels for cabling to the main distribution area. Outside the United States and Canada, access providers typically use DSX-1 panels that fit in 480 mm (19 in) racks.

The DSX-1 patch panels may require power for indicator lights. Thus, racks supporting access provider DSX-1 patch panels should, at minimum have one 20A 120V circuit and a multi-outlet power strip.

Allocate rack space for access provider and customer patch panels including growth. Access providers may require rack space for rectifiers to power DSX-1 patch panels.

Access providers can alternatively hand off DS-1 circuits on IDC connecting hardware. These IDC connecting hardware can be placed on the same frame, backboard, rack, or cabinet as the IDC connecting hardware for low-speed circuits.

A single 4-pair cable can accommodate one T1 transmit and receive pair. When multiple T1 signals are placed over multi-pair unshielded twisted-pair cable, the transmitted signals should be placed in one cable and the receive signals placed in a separate cable.

If the data center support staff has the test equipment and knowledge to troubleshoot T-1 circuits, the DS-1 demarcation area can use DSX-1 panels to terminate T-1 cabling to the main distribution area. These DSX-1 panels should have either modular jacks or IDC terminations at the rear.

The IDC connecting hardware, modular jack patch panels, or DSX-1 panels for cabling to the main distribution area can be on the same or separate racks, frames, or cabinets as the ones used for access provider DSX-1 patch panels. If they are separate, they should be adjacent to the racks assigned to the access providers.

The customer (data center owner) may decide to provide its own multiplexers (M13 or similar multiplexer) to demultiplex access provider T-3 circuits to individual T-1 circuits. T-1 circuits from a customer-provided multiplexer should not be terminated in the T-1 demarcation area.

C.2.4 Demarcation of E-3 & T-3 circuits

Access providers should be asked to hand-off E-3 or T-3 circuits on pairs of female BNC connectors, preferably on a DSX-3 patch panel on a customer-owned rack installed in the E-3/T-3

demarcation area. Patch panels from multiple access providers and the customer may occupy the same rack.

In the United States and Canada, access providers typically use DSX-3 patch panels that fit 585 mm (23 in) racks. Thus, the E-3/T-3 demarcation area should use one or more 585 mm (23 in) racks for access provider DSX-3 patch panels. These same racks or adjacent 480 mm (19 in) racks can accommodate patch panels for cabling to the main distribution area. Outside North America, access providers typically use DSX-3 panels that fit 480 mm (19 in) racks.

If the data center support staff has the test equipment and knowledge to troubleshoot E-3 or T-3 circuits, the E-3/T-3 demarcation area can use DSX-3 panels to terminate 734-type coaxial cabling to the main distribution area. These DSX-3 panels should have BNC connectors at the rear.

The DSX-3 patch panels may require power for indicator lights. Thus, racks supporting access provider DSX-3 patch panels should, at minimum have one 20A 120V circuit and a multi-outlet power strip.

Allocate rack space for access provider and customer patch panels including growth. Access providers may require rack space for rectifiers to power DSX-3 patch panels.

Cabling from the E-3/T-3 demarcation area to the main distribution area should be 734-type coaxial cable. Cables in the E-3/T-3 demarcation area can be terminated on a customer patch panel with 75-ohm BNC connectors, or directly on an access provider DSX-3 patch panel. Access provider DSX-3 patch panels typically have the BNC connectors on the rear of the panels. Thus, BNC patch panels for cabling to the main distribution area should be oriented with the front of the patch panels on the same side of the rack as the rear of the access provider DSX-3 panels.

All connectors and patch panels for E-3 and T-3 cabling should use 75-ohm BNC connectors.

C.2.5 Demarcation of optical fiber circuits

Access providers should be asked to hand-off optical fiber circuits on fiber patch panels installed on racks in the fiber demarcation area. Fiber patch panels from multiple access providers and the customer may occupy the same rack. If requested, access providers may be able to use the same connector to simplify patch cable requirements.

In the United States and Canada, access providers typically use fiber patch panels that fit 585 mm (23 in) racks, but may be able to provide patch panels that fit 480 mm (19 in) racks, if requested. In the United States, it is usually prudent to use 585 mm (23 in) racks for access provider fiber patch panels in the fiber demarcation area. These same racks or adjacent 480 mm (19 in) racks can accommodate patch panels for cabling to the main distribution area. Outside North America, access providers typically use fiber patch panels that fit 480 mm (19 in) racks.

The racks in the fiber demarcation area do not require power except possibly utility outlets for access provider and customer test equipment.

Cabling from the fiber demarcation area to the main cross-connect in the main distribution area should be single-mode optical fiber cable. If the access providers provide services terminated in multimode optical fiber cable, the cabling from the fiber demarcation area to the main cross-connect (MC) in the main distribution area can also include multimode optical fiber cable.

ANNEX D (INFORMATIVE) COORDINATION OF EQUIPMENT PLANS WITH OTHER ENGINEERS

This annex is informative only and is not part of this Standard.

D.1 General

Coordinate placement of equipment and lighting in the data centers so that lighting fixtures are placed in aisles between cabinets and racks instead of directly over equipment rows.

Coordinate placement of equipment and sprinklers in the data centers so that tall cabinets or overhead cable trays do not block water dispersal from the sprinklers – the minimum clearance by Code is 460 mm (18 in). Electrical engineers will need to know placement and power requirements for equipment cabinets and racks. Coordinate routing of power cabling and receptacles with routing of telecommunications cabling and placement of equipment.

Mechanical engineers will need to know cooling requirements for equipment cabinets and racks. Coordinate placement of cable trays and telecommunications cabling to ensure that adequate airflow is maintained to all parts of the computer room. Airflow from cooling equipment should be parallel to rows of cabinets and racks. Perforated tiles should be placed in “cold” aisles, not “hot” aisles.

Plan telecommunications cabling routes to maintain a minimum separation of unshielded twisted pair cabling from fluorescent lights by 125 mm (5 in).

ANNEX E (INFORMATIVE) DATA CENTER SPACE CONSIDERATIONS

This annex is informative only and is not part of this Standard.

E.1 General

The data center should have an adequately sized storage room so that boxed equipment, spare air filters, spare floor tiles, spare cables, spare equipment, spare media, and spare paper can be stored outside the computer room. The data center should also have a staging area for unpacking and possibly for testing new equipment before deploying them in the computer room. It is possible to dramatically reduce the amount of airborne dust particles in the data center by having a policy of un-packaging all equipment in the build/storage room.

The required square footage of space is intimately related to the layout of the space, including not only equipment racks and/or cabinets, but also cable management and other supporting systems such as electrical power, HVAC and fire suppression. These supporting systems have space requirements that depend upon the required level of redundancy.

If the new data center replaces one or more existing data centers, one way to estimate the size of the data center is to inventory the equipment to be moved into the new data center and create a floor plan of the new data center with this equipment and expected future equipment with desired equipment adjacencies and desired clearances. The layout should assume that the cabinets and racks are efficiently filled with equipment. The floor plan should also take into account any planned technology changes that might affect the size of the equipment to be located in the new data center. The new computer room floor plan will need to include electrical and HVAC support equipment.

Often an operations center and a printer room are spaces with data center adjacency requirements, and are best designed together with the data center. The printer room should be separated from the main computer room and have a separate HVAC system because the printers generate paper and toner dust, which are detrimental to computer equipment. NFPA 75 specifies separate rooms for storage of spare media and forms. Additionally, it is a good practice to have a separate tape room for tape drives, automated tape libraries, and tape libraries because of the toxicity of smoke from burning tape.

Consider separate spaces or rooms outside the computer room for electrical, HVAC, and fire suppression system equipment, although space is not used as efficiently, security is improved because vendors and staff that service this equipment don't need to enter the computer room. Also, separate spaces for support equipment may not be possible in large data centers that are wider than the throw distance of computer room air conditioners (CRAC), which is about 12 m (40 ft).

ANNEX F (INFORMATIVE) SITE SELECTION

This annex is informative only and is not part of this Standard.

F.1 General

Some of the considerations in this annex apply to higher tier data centers, considerations that are particularly important to a specific tier level are provided in the tiering chart in annex G.

The building should conform to all applicable national, state, and local codes.

The building and site should meet all current applicable local, state, and federal accessibility guidelines and standards.

The building should conform to the seismic standards applicable to the International Building Code Seismic Zone of the site.

The building should be free of asbestos, lead-containing paint, PCB's, and other environmental hazards.

Consideration should be given to zoning ordinances and environmental laws governing land use, fuel storage, sound generation, and hydrocarbon emissions that may restrict fuel storage and generator operation.

The difficulty in properly cooling equipment increases with altitude, thus data centers should be located below 3050 m (10,000 ft) elevation as recommended by ASHRAE.

F.2 Architectural site selection considerations

The need for redundant access to the building from separate roads should be considered.

Where practical, the building should be a single story dedicated data center building.

Buildings with large clear spans between columns that maximize usable space for equipment are preferred.

The building materials should be non-combustible. Exterior walls should be constructed of concrete or masonry to provide security, particularly in areas where brush fires may cause service outages or threaten the structure.

For one or two story buildings, the building construction should be International Building Code Type V-N, fully sprinklered with 18 m (60 ft) of clear side yards on all sides. For buildings with three or more stories, the building construction should be International Building Code Type I or II.

Where the building is not dedicated to the data center, other tenant spaces should be non-industrial, International Building Code type 'B' offices, and non-intrusive to the data center. Avoid buildings with restaurants and cafeterias to minimize fire risk.

If the data center is to be on an upper floor of a multi-tenant building, then there should be adequate shaft and conduit space for generator, security, telecommunications, and electrical conduits as well as supplemental HVAC, grounding conductors and cabling to antennas, as needed.