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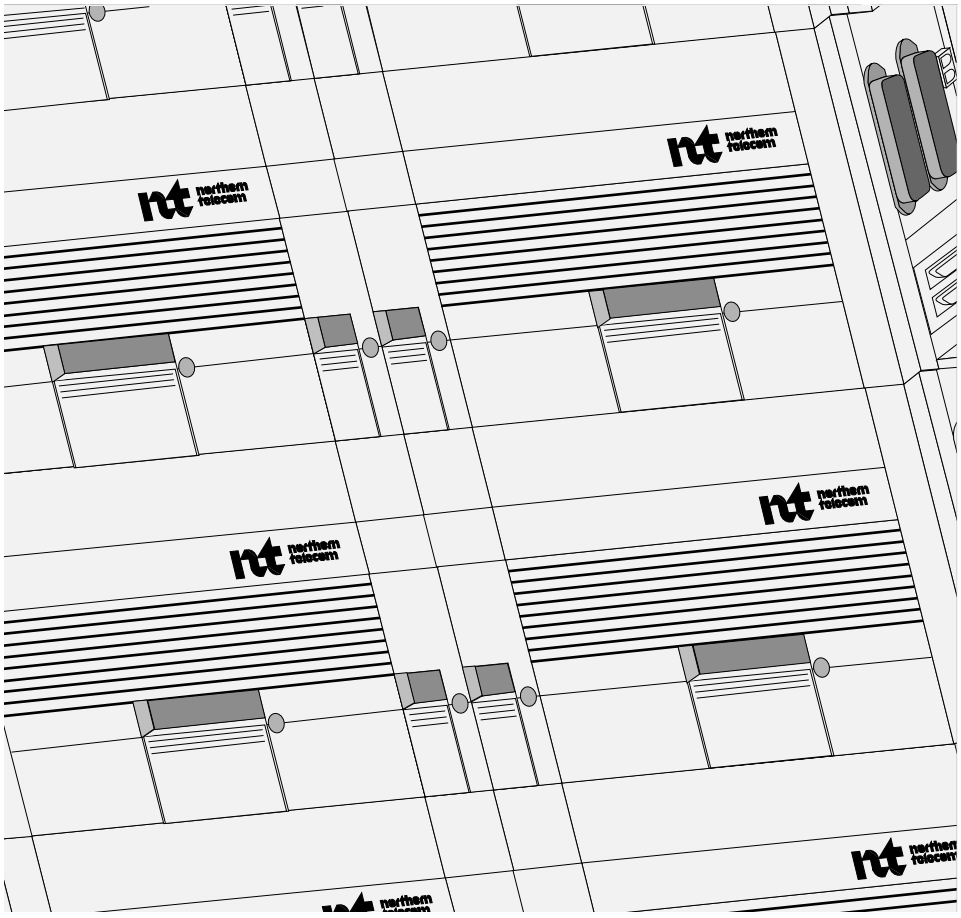
SONET Products

AccessNode

Site Installation Planning and Engineering Addendum 1 (MBP)

Issue 1.0 October 1999



NORTEL NETWORKS™

SONET Products

AccessNode

Addendum 1 (MBP)
Site Installation Planning and Engineering

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Standard AN10 release of the document.

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Standard AN08 release of the document.

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Reissue of AN07 standard.

April 1994

Standard AN07 release of the document.

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Standard FWP06 release of the document.

Contents

About this document

This document describes the site installation, planning, and engineering requirements for the following products:

- AccessNode equipment in modular business package (MBP) cabinets
- dc power equipment in a modular power package (MPP) cabinet

Users of this document should be experienced engineers familiar with system requirements for the installation of telecommunications equipment.

How to use this document

Refer to any of the topics in this document in any sequence according to your needs.

Safety guidelines and warnings

This document contains notices that are designed to alert you about the risk of personal injury, or of damage to equipment.

Samples of the formats for dangers and caution notices used in this document are as follows:

DANGER
Risk of personal injury
A danger notice warns you about a risk of personal injury.

CAUTION
Risk to service or equipment
A caution notice warns you about a risk of service interruption or of equipment damage.

To avoid personal injury, follow all danger warnings provided with this product, along with the safety procedures established by your company.

To avoid damage to equipment, or service interruptions, follow all caution warnings provided with this product, as well as the procedures established by your company.

Radio frequency emissions notice

The following regulatory notice applies to AccessNode equipment:

“This equipment has been tested and found to comply with the limits for a Class A digital device, pursuant to Part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a normal commercial environment. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instruction manual, may cause harmful interference to radio communications. Operation of this equipment in a residential area may cause harmful interference, in which case the users are required to correct the interference at their own expense.”

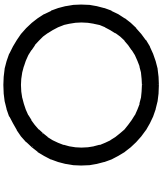
International electrical symbols on equipment

A number of International Electrotechnical Commission (IEC) symbols are used on AccessNode equipment. The labels and their meanings are as follows:

Power on

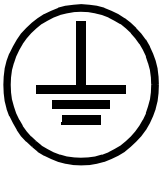
This symbol indicates that a main power on/off switch is in the on position.

Power off



This symbol indicates that a main power on/off switch is on the off position.

Protective grounding terminal



This symbol indicates the location of a terminal that must be connected to earth ground before you make any other connections to the equipment.

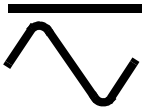
Alternating current

This symbol indicates the location of a terminal that supplies alternating current or to which a source of alternating current is applied.

Direct current

This symbol indicates the location of a terminal that supplies direct current or to which a source of direct current is applied.

Direct current and alternating current



This symbol indicates the location of a terminal that supplies direct current or alternating current, or to which a source of direct current or alternating current is applied.

Dangerous voltage

This symbol indicates the presence of a dangerous voltage inside an equipment enclosure. This voltage may be of sufficient magnitude to constitute a risk of injury due to electric shock for persons working on the equipment.

Abbreviations for the color of conductor insulation in cables

In this document, a uniform system of abbreviations is used to represent the colors of the conductor insulation used in equipment cables. These abbreviations take the form:

<pair_color> <group_marker_type> <group_marker_color>

Convention	Description		
<pair_color>	This is the background color of the conductor insulation which indicates the pair color.		
	BL	blue	(pair 1 of the binder group)
	O	orange	(pair 2 of the binder group)
	G	green	(pair 3 of the binder group)
	BR	brown	(pair 4 of the binder group)
	S	slate	(pair 5 of the binder group)
<group_marker_type>	This is the type of group marker used on the conductor insulation.		
	1	single dots spaced about 18 mm (3/4 in.) apart	
	2	two dots spaced about 3 mm (1/8 in.) apart with about 18 mm (3/4 in.) between each pair of dots	
	3	dashes about 3 mm (1/8 in.) long spaced about 18 mm (3/4 in.) apart	
	none	one colored stripe on conductor jacket	
<group_marker_color>	Is the color of the dot, dots or the stripe used as the group marker on the conductor insulation.		
	W	white	(binder group 1)
	R	red	(binder group 2)
	BK	black	(binder group 3)
	Y	yellow	(binder group 4)
	V	violet	(binder group 5)

For example, the abbreviation BL 2W (representing Pair 1 of the second 25-pair binder) means that the conductor has a blue insulation background color with two white dots spaced 18 mm (3/4 in.) apart. The abbreviation BL W (representing Pair 1 of the first 25-pair binder) means that the conductor has a blue insulation background with a single white stripe.

References in this document

The engineering design, installation planning, and the actual installation must be completed in accordance with referenced standards. Building locations for AccessNode equipment must meet the requirements of the following Bell Communications Research (Bellcore) and Nortel Networks standards.

Bellcore documents

- TR-EOP-000001, Section 4
- TR-TSY-000057, Issue 2, with Supplements 1 and 2 (TA-TSY-000057), Functional Criteria for Digital Loop Carrier Systems
- TR-EOP-000063, Network Equipment Building Systems (NEBS), Generic Equipment Requirements
- TA-TSY-000295, Isolated Ground Planes
- TA-NPL-000286, NEBS Generic Engineering Requirements, System Assembly and Cable Distribution
- TA-TSY-0000499 for Transport Systems Generic Requirements

Nortel Networks documents

- Northern Telecom Corporate Standard 4122.00, Grounding of Communication Systems
- *Site Installation Planning and Engineering*, 323-3001-200, in *Engineering, Configuration, and Ordering Guide*, Volume 1
- *Configuration and Equipment Description*, 323-3001-100, in *Description*, Volume 2A

In addition, this document references the following Nortel Networks Technical Publications (NTPs):

Engineering, Configuration, and Ordering Guide, Volume1

- *Mapper Layouts Planning Guide*, 323-3001-154

Description, Volume 2B

- *System Specifications*, 323-3001-180

Separately bound documents

- *Modular Business Package Description*, 323-3001-110
- *Modular Business Package Cabinet Installation Manual*, 323-3001-206
- *MBP VTBM Ring Installation Guide*
- *MBT VTBM Ring User Guide*

Installation planning overview

This chapter provides an outline of the factors that need to be considered when planning the installation of the AccessNode equipment contained in modular business package (MBP) cabinets, and dc power equipment contained in modular power package (MPP) cabinets.

Chapter contents

This chapter contains the following information:

Optical fiber cable safety notice

AccessNode equipment and associated optical test sets use laser sources that emit light energy into fiber cables. This energy lies within the infrared (invisible) regions of the electromagnetic spectrum.

Laser products are subject to federal and state or provincial regulations, and local practices. Regulation 21 CFR 1040 of the U.S. Bureau of Radiological Health requires manufacturers to certify each laser product as Class I, Class II, Class III, or Class IV, depending on the characteristics of the laser radiation that is emitted. In terms of health and safety, Class I products represent the least hazard (none at all), and Class IV products represent the greatest hazard.

Although Nortel Networks S/DMS optical products have a Class I certification, hazardous exposure to laser radiation could occur when fibers that interconnect system components are disconnected, broken, or are installed while equipment is under power. Certain procedures carried out during installation or testing require the handling of optical fibers without dust caps, and therefore increase the risk of exposure.

Exposure either to visible or invisible laser light could cause eye damage under certain conditions.

The caution label at the right appears on the optical interface card, near the optical connection. You must comply with this warning.

Caution

Avoid direct exposure to beam. Invisible light can blind. Keep all optical connectors capped.

DANGER
Risk of eye injury
At all times when handling optical fibers, follow the safety procedures recommend by your company.

Read and follow the precautions in the following paragraphs to reduce the risk of exposure to laser radiation.

Handling optical fibers

During the installation, service, repair, or removal of optical fiber cables or equipment, follow these rules:

- Avoid direct exposure to fiber ends or optical connections ends, where the laser signal is present.
- Wear safety glasses when handling optical fibers to avoid eye injury from flying glass fragments.
- Small bits of glass fiber are almost invisible on the fingers. Always wipe your hands on a tissue or on a clean absorbent cloth before making any contact with your eyes, or the area around your eyes.

DANGER
Risk of eye injury
If you suspect that you may have a glass chip in your eye, seek medical attention immediately.

- Handle optical fibers carefully, and always position them in a safe and secure location during the installation procedures.
- Do not handle broken or cut pieces of fiber with your bare fingers. Use tweezers or the sticky side of adhesive tape to pick up and discard loose fiber ends.
- Place all fiber cuttings or ends in a plastic bottle marked “Danger, Sharp Objects.”
- Protect optical fiber connectors with dust caps at all times.

Planning considerations

Consider the following factors (collectively) when planning the installation of AccessNode equipment (including add-on equipment).

Equipment packaging

See “Equipment packaging” on page 2-1 for an overview of the configurations in which equipment in MBP cabinets and MPP cabinets can be purchased. For a detailed description of the equipment packaging, see *Modular Business Package Description*, 323-3001-110.

Environmental requirements

See “Environmental requirements” on page 3-1 for environmental conditions that must be present at the installation site to allow equipment in MBP cabinets and MPP cabinets to operate within specifications.

Power and ground distribution

See “Power and grounding” on page 4-1 for the power and ground distribution guidelines applicable to MBP and MPP cabinets within shared power and ground environments of existing equipment systems.

Floor space requirements

See “Floor space requirements” on page 5-1 for the floor space planning requirements for modular business package (MBP) cabinet and modular power package (MPP) cabinets in equipment rooms at a remote site.

Site preparation requirements

See “Site preparation” on page 6-1 for an outline of the preparations that must be made at the installation prior to the arrival of the system to be installed.

Future expansion

See “Future expansion” on page 7-1 for guidelines that apply to provisioning additional equipment in an installed system.

Cabling requirements

See “External cabling requirements” on page 8-1 for a description of all external cabling, including power cabling, that is common to MBP and MPP cabinets.

Tools and test apparatus required

See “Documents, tools, materials and test apparatus requirements” on page 9-1 for a list of the tools required to perform installation tasks.

Optical link network (outside plant) planning

The installation of the optical link network (outside plant fiber cable) linking each AccessNode is the responsibility of the operating company. Detailed optical link planning and engineering are described in *Site Installation Planning and Engineering,* 323-3001-200, in *Engineering, Configuration, and Ordering Guide,* Volume 1.

Referenced standards

The engineering design, installation planning, and the actual installation must be completed in accordance with referenced standards. Building locations for AccessNode equipment must meet the requirements of Bell Communications Research (Bellcore) and Nortel Networks (NT) standards. Please refer to the lists of Bellcore documents and Nortel Networks documents in the “About this document” section of this publication.

Equipment packaging

This chapter describes the following:

- configuration of AccessNode equipment in the modular business package (MBP) cabinets
- configuration of AccessNode dc power equipment in the modular power package (MPP) cabinet

Chapter contents

This chapter contains the following information:

Reference the information in this chapter according to your requirements.

Types of cabinets

An AccessNode system is available in cabinets for installation in the equipment rooms of business buildings at a remote site. An equipment room is a common space used for telecommunications equipment such as private branch exchanges, mainframe computers, or video switches that are shared by the occupants of a building.

A system consists of from one to three cabinets as follows:

- modular power package (MPP) power cabinet
- modular business package (MBP) master cabinet
- modular business package (MBP) expansion cabinet

In a line-up of cabinets, the order of the cabinets, from left to right as viewed from the front of the line-up, is as follows: an MPP cabinet, a master MBP cabinet, and an expansion MBP cabinet as shown in Figure 2-1.

See Figure 2-1, Figure 2-2, and Figure 2-3 for illustrations of typical cabinet arrangements.

MPP power cabinet

An optional MPP cabinet converts a supply of alternating current to supplies of –48 Vdc for powering the equipment inside the master and expansion MBP cabinets. There are currently two models of power cabinet:

- standard MPP power cabinet
- STSBM power cabinet

MBP master cabinet

As a minimum, a system contains a master cabinet that contains an access bandwidth manager (ABM) shelf, a local craft access panel (LCAP), and one or more shelves of peripheral modules. There are currently three models of master cabinet:

- standard MBP master cabinet
- SONET transport signal bandwidth manager (STSBM) master cabinet
- virtual tributary bandwidth manager (VTBM) master cabinet

MBP expansion cabinet

An expansion cabinet is added to the MBP master cabinet system to house extra peripheral modules when needed. There are currently two models of expansion cabinet:

- standard MBP expansion cabinet
- STSBM/VTBM expansion cabinet

Figure 2-1
Standard MBP cabinet arrangement

PC-15637

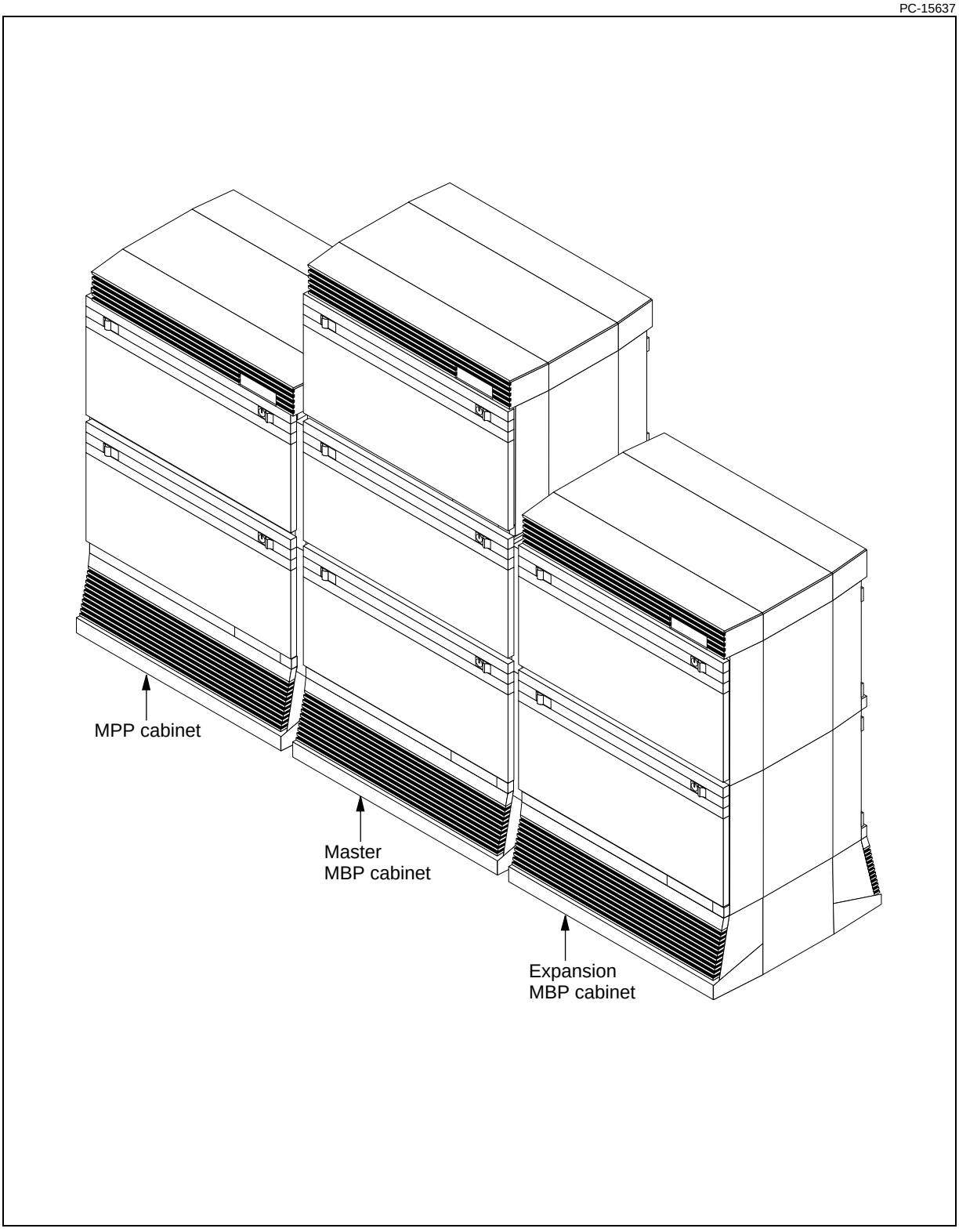


Figure 2-2
STSBM MBP cabinet arrangement

PC-15633

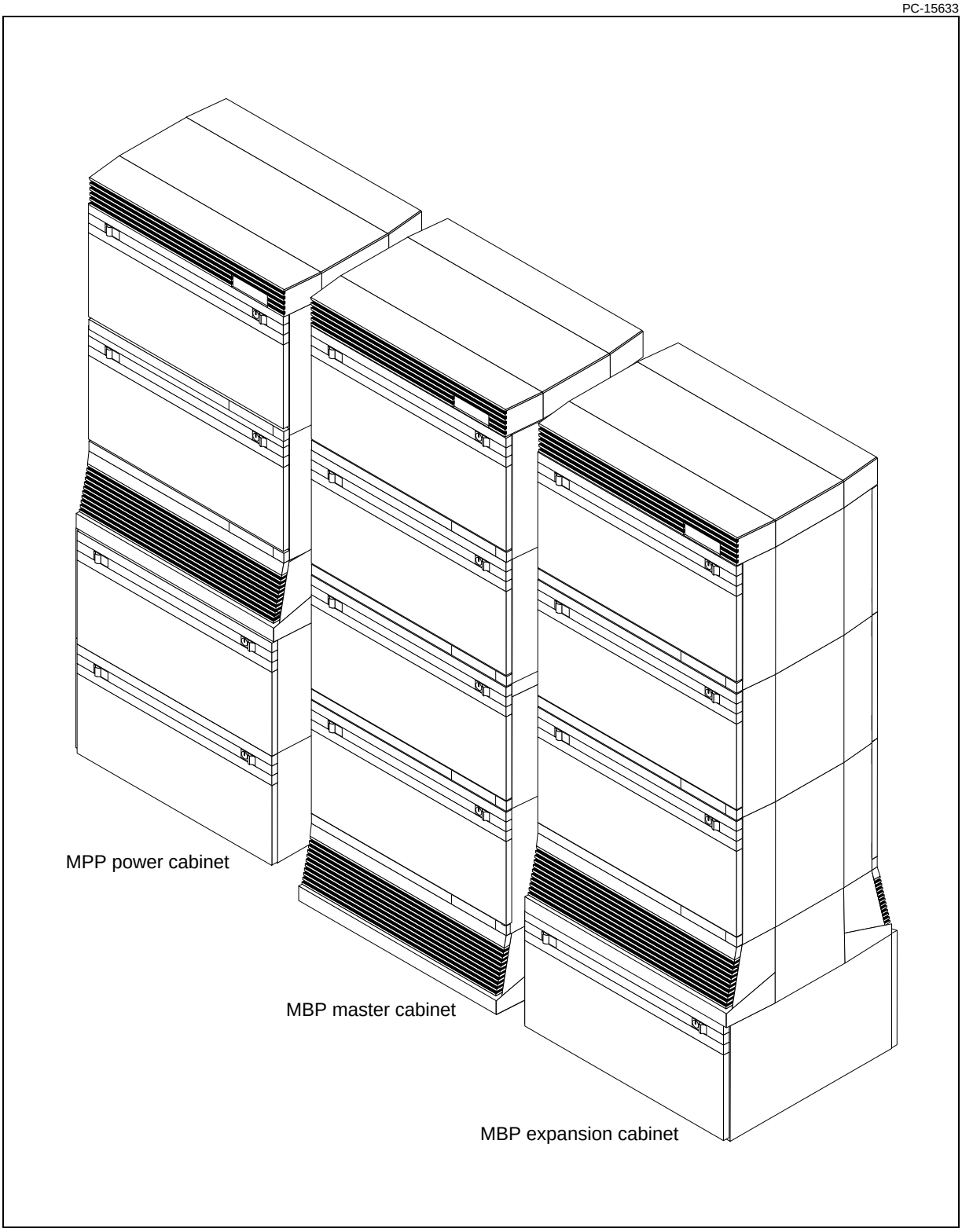
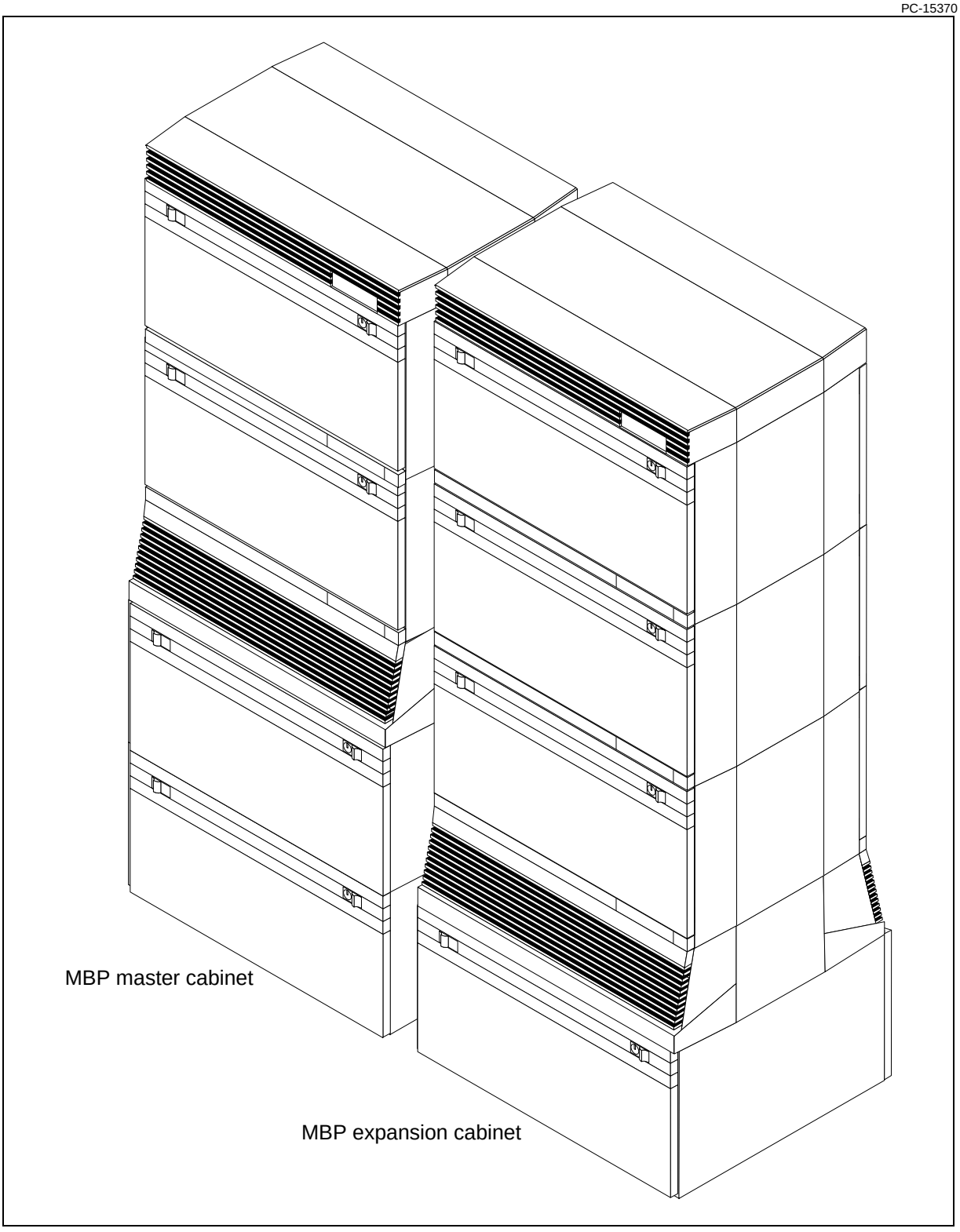


Figure 2-3
VTBM MBP cabinet arrangement

PC-15370



Installation in restricted areas and unrestricted areas

The Underwriter's Laboratory (UL) and the Canadian Standards Association (CSA) have approved modular business package (MBP) cabinets and modular power package (MPP) cabinets for use in equipment rooms in unrestricted and restricted areas.

In an unrestricted area, the equipment room remains unlocked and is accessible to all personnel. In a restricted area, the equipment room is kept locked and only authorized personnel have keys to open the room. Protection against shock hazards has to be greater in an unrestricted area than in a restricted area.

Unrestricted areas

In an unrestricted area, the MPP cabinet must be physically attached to the master MBP cabinet by means of a cable duct called an expansion kit, and all power cables that run between the cabinets must pass through this expansion kit.

Restricted areas

In a restricted area, the MPP cabinet can be attached to the master cabinet or installed up to 7.6 m (25 ft) away. When the cabinet is attached to the master cabinet, power cables pass through the expansion kit. When the MPP cabinet is remote from the master cabinet, power cables that run between the MPP cabinet and the master MBP cabinet can pass under the floor (in raised floor applications) or overhead in a cable rack (in concrete floor applications).

In raised floor applications, local electrical codes may require that the power cables under the floor be contained in conduit. The undersides of MBP and MPP cabinets are equipped with knockouts for the use of conduits.

Powering

AccessNode equipment in MBP cabinets requires four supply and return feeds, each of which is rated at a nominal –48 Vdc 30 A. These feeds can be provided from an optional MPP cabinet, or from an external power source owned by the customer. Requirements for these feeds are detailed in "- 48 V dc power cabling" on page 8-6.

The optional MPP cabinet requires two 45 A, 208/240 Vac feeds from a commercial power source. For the requirements for these feeds, see "Commercial ac power cabling" on page 8-5.

In standard MPP applications, battery backup is the responsibility of the customer. For information about the requirements for battery backup supplies, see "Battery backup" on page 4-7. The STSBM MPP cabinet provides space for back-up batteries. The VTBM cabinet configuration has the battery back-up provision integrated into the master and expansion cabinets.

Common features of MBP and MPP cabinets

Modular business package (MBP) cabinets and modular power package (MPP) cabinets share the common features described in the following paragraphs.

Types of covers

MBP cabinets and MPP cabinets can be purchased with three types of covers: key lockable covers that can be locked with a common key, tool-lockable covers that can be opened and closed with an NSQ2000L tool or an ATT216 tool, and safety locking covers that can be opened and closed without tools.

The access bandwidth manager (ABM) shelf located inside the master MBP cabinet is equipped with a cover that can be installed or removed with a screwdriver that has a flat blade 1/4 in. wide.

Anchoring and seismic kits

MBP and MPP cabinets are suitable for installation on concrete floors and on raised floors.

Concrete floors

A standard anchor kit is available for use on concrete floors which is used to secure the cabinets in installations that are not subject to seismic requirements.

A seismic kit is available for installing cabinets on concrete floors in Zone 4 seismic areas. This kit consists of special concrete anchors, anchor plates, bracing rods and tie plates. An expansion kit is also available which contains extensions for the bracing rods the seismic kits. This expansion kit can be used to ensure that the installation still meets the Zone 4 seismic requirements when the system is expanded by adding one or more field expansion modules (FEMs).

> ***Note:*** Seismic kits are only available for cabinets that are up to three SEM (or 1 DEM and 1 SEM) modules high. They are not available for cabinets that are four modules high. A single equipment module is considered to be one module in height and a dual equipment module is considered to be two modules in height.

Raised floors

MBP and MPP cabinets can be installed on raised floors in non-seismic applications. If a customer requires the installation of special hardware to secure the cabinets in non-seismic installations, such hardware must be site-engineered, with assistance from Nortel Networks. This special anchoring hardware is not supplied because of numerous variations in the construction of raised floors.

A Zone 4 seismic kit for use on raised floors is not available at this time.

Expandability

Existing MBP cabinets and the MPP cabinets are readily expanded. The system can be expanded from a multiplexer (MUX) configuration to a configuration that supports up to 672 subscriber voice lines in the following ways:

- by adding field expansion modules (FEMs) to an existing MBP cabinet
- by adding an expansion cabinet that contains copper-distribution shelves (CDS)

The voice lines can be added in increments of 96 lines.

OC-3 optical interface units can be added to provide OC-3 tributaries to the system for optical transport of 3 STS-1s or 1 STS-3C to a remote location.

A FEM or an expansion cabinet that contains a DSX-1 cross-connect shelf and a T1 repeater self can also be added to any existing configuration.

A second rectifier shelf and additional rectifier units can also be inserted into an MPP cabinet to support the additional power requirements of expanded systems.

MBP cabinet configurations

As a minimum, a system contains a master MBP cabinet. Depending on the number of equipment shelves in the system, an expansion cabinet can be added to the system. The AccessNode MBP system currently is available in three configurations:

- standard (multiplexer or DS0 services)
- SONET transport signal bandwidth manager (STSBM)
- virtual tributary bandwidth manager (VTBM)

AccessNode equipment in MBP cabinets can be purchased in a multiplexer configuration, or in configurations that support from 1 to 672 DS0 subscriber voice lines. These configurations can also be equipped with a DSX-1 cross-connect shelf and a T1 repeater shelf.

The multiplexer, standard and STSBM cabinet configurations can be combined with an MPP cabinet that provides battery back-up (STSBM MPP only), rectifiers and dc distribution equipment (see “MPP cabinet configurations” on page 2-23). The VTBM cabinet configurations do not require the MPP. VTBM configurations contain the battery, rectifier and dc distribution equipment.

The following paragraphs describe in more detail the configurations in which the equipment can be ordered from the factory.

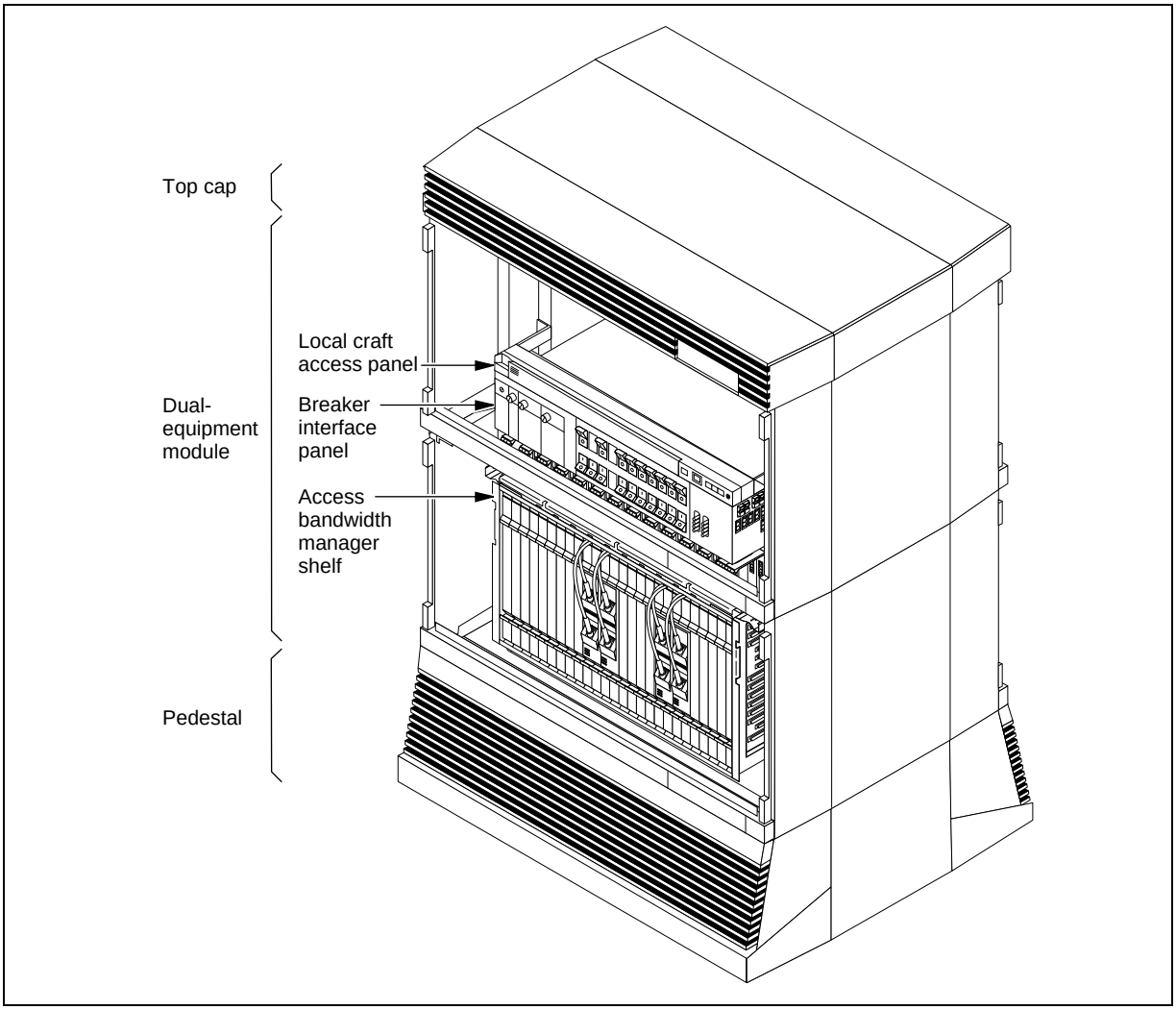
Multiplexer configurations

When used as a multiplexer (MUX), the AccessNode equipment is packaged in a master MBP cabinet, as shown in Figure 2-4. This cabinet contains the following items:

- a top cap kit and a grille kit
- a dual equipment module (DEM) that contains a local craft access panel (LCAP), a breaker interface panel (BIP), and an access bandwidth manager (ABM) shelf
- a pedestal that contains a power distribution unit, a blower unit, and an air filter assembly

Figure 2-4
Multiplexer configuration in a master MBP cabinet

PC-15320



Standard cabinet configurations

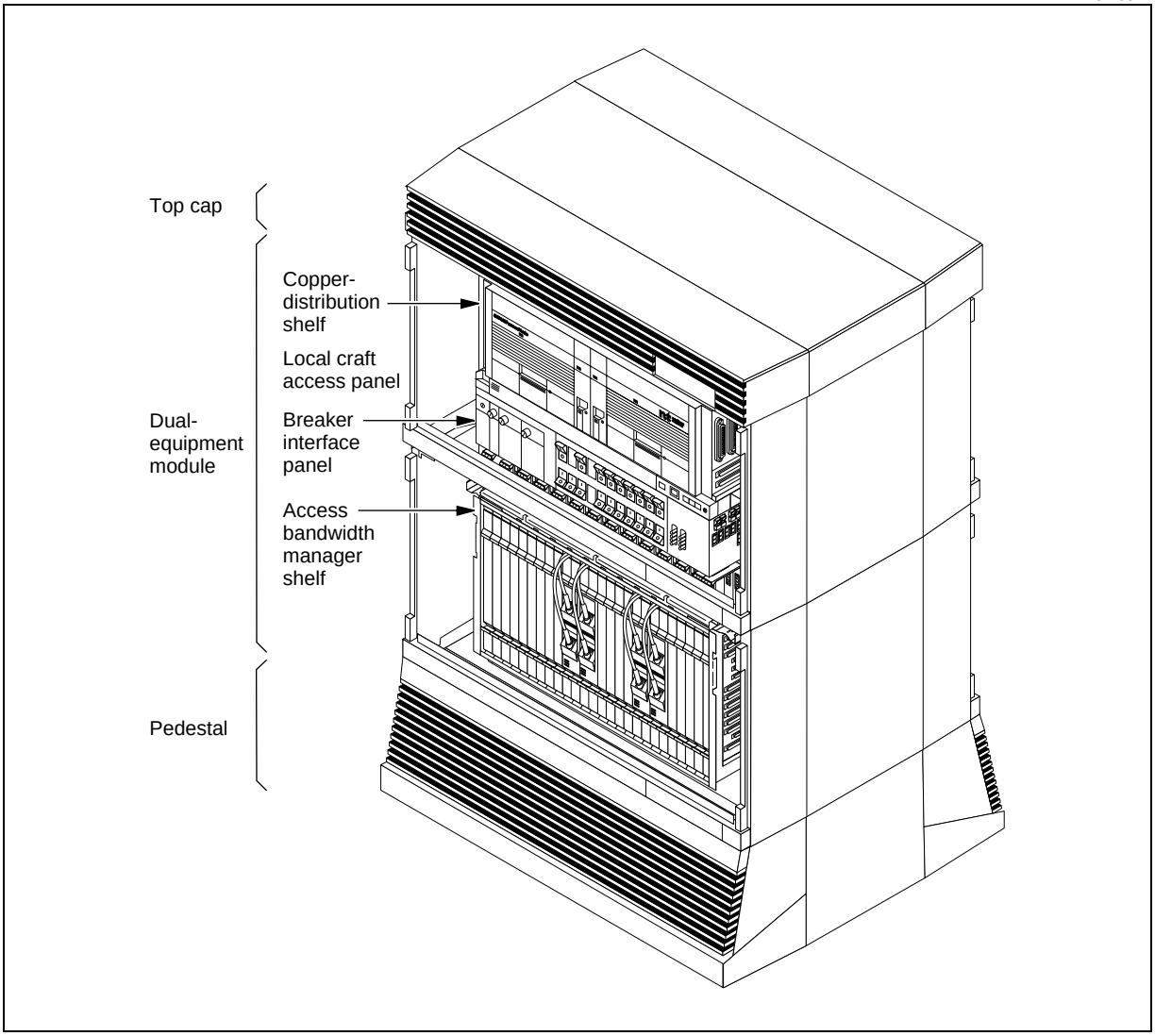
The 96-line configuration is contained in a single master MBP cabinet and is similar to the multiplexer configuration, except for the following:

- cabling changes
- the addition of a plenum duct
- the addition of one copper-distribution (CDS) shelf

The CDS shelf installs in the dual equipment module (DEM) above the LCAP, as shown in Figure 2-5.

Figure 2-5
96-line configuration in a standard MBP cabinet

PC-15321



Standard 192-line to 672-line configurations

The modular construction of MBP cabinets allows considerable flexibility in constructing configurations that support from 192 to 672 subscriber voice lines. These configurations are constructed at the factory by adding single equipment modules (SEMs) to the system. Each SEM can contain one CDS shelf (adds 96 subscriber voice lines) or two CDS shelves (add 192 subscriber voice lines).

Up to two SEMs can be included in a master cabinet. With the two SEMs, the master cabinet can contain up to five CDS shelves and support up to 480 subscriber voice lines, as follows:

- two CDS shelves in each of the two SEMs
- one CDS shelf in the DEM

Figure 2-6 on page 2-12 shows a single-cabinet configuration with 480 subscriber voice lines.

A third SEM containing up to two CDS shelves can be included in the system to bring the number of CDS shelves to seven, and allow the system to support up to 672 subscriber voice lines. This SEM is contained in an expansion cabinet that attaches to the master MBP cabinet. Figure 2-7 on page 2-13 shows a typical 672-line configuration in two MBP cabinets that has five CDS shelves in the master cabinet, and two CDS shelves in the expansion cabinet.

Other arrangements of the SEMs are possible. It is not necessary for the master cabinet to contain two SEMs. In one of many possible alternate arrangements, the master cabinet contains only one SEM, which gives the master cabinet a capacity of 288 subscriber voice lines. The CDS shelves that provide the system with its full 672-line capacity are contained in two SEMs, installed in an adjacent expansion cabinet. See Figure 2-8 on page 2-14.

In constructing alternate arrangements, two main rules apply:

- No cabinet can be more than four modules (4 SEM or 2 DEM) high. A SEM is considered to be one module high, and a DEM is considered to be two modules high.
- Cabinets for installation on concrete floors in Zone 4 seismic areas can only be three modules high, because the Zone 4 seismic kit is not approved for use on cabinets that are four modules high.

Figure 2-6
480-line configuration in a standard MBP cabinet

PC-15322

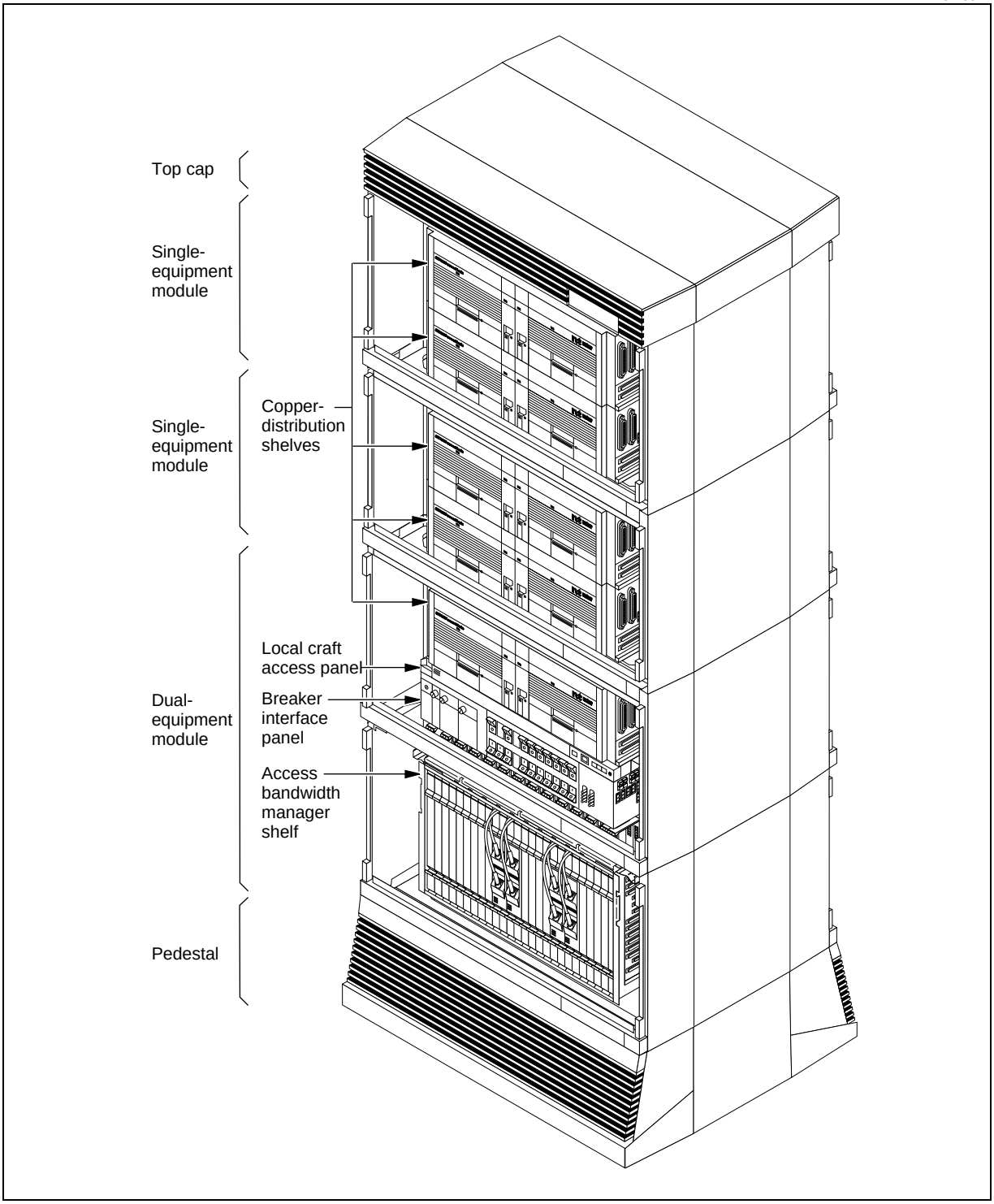


Figure 2-7
Typical 672-line configuration in two standard MBP cabinets

PC-15324

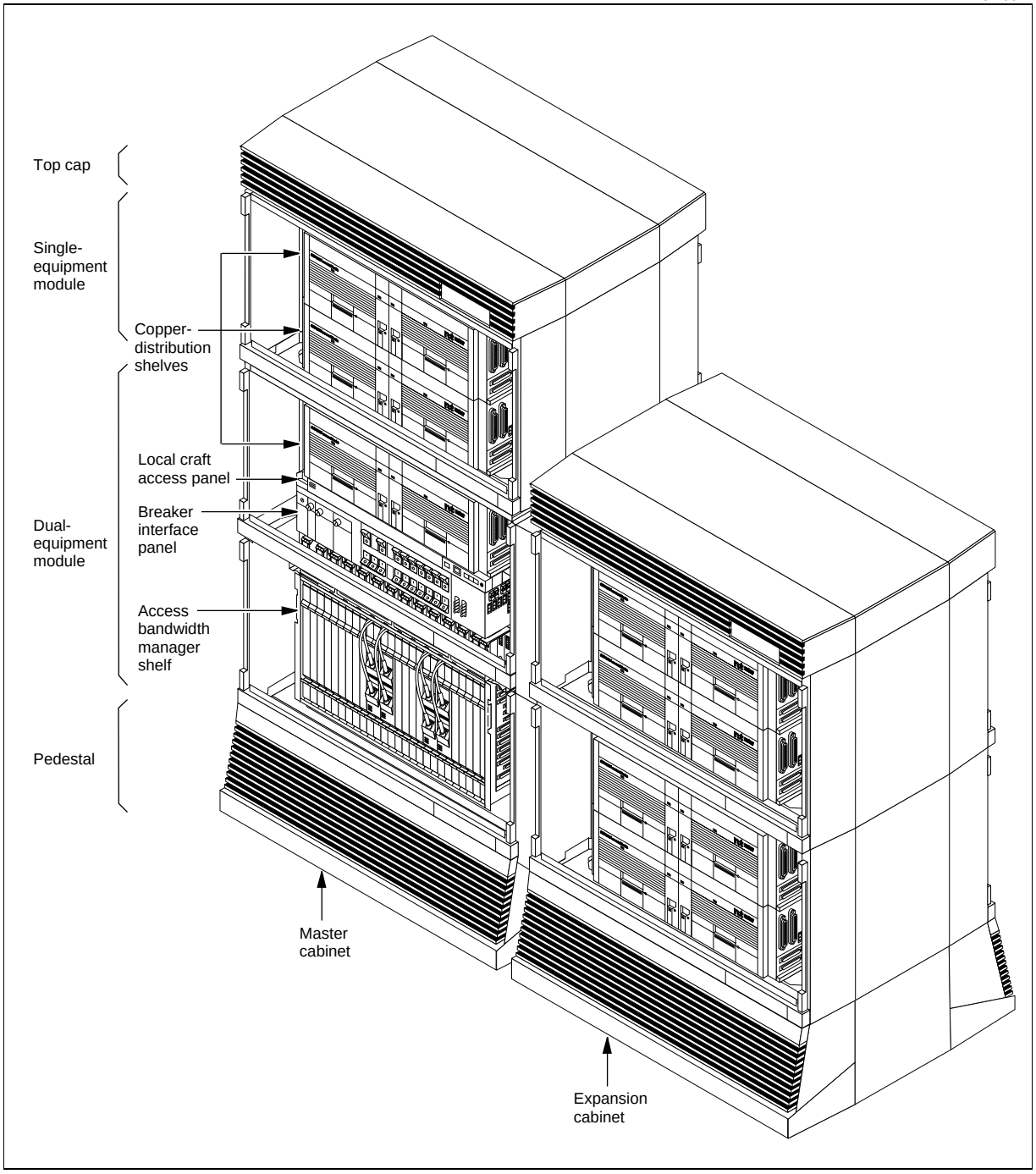
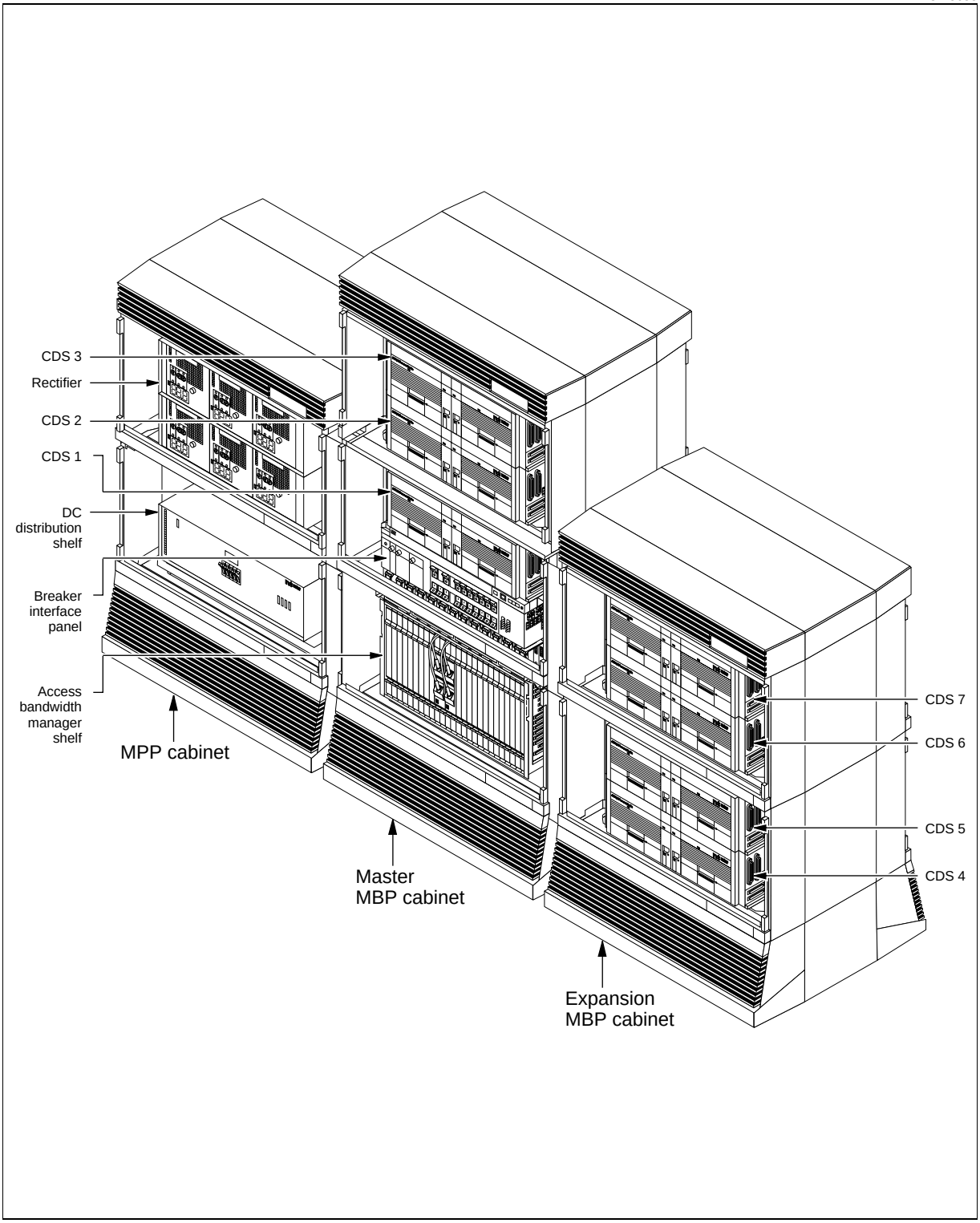


Figure 2-8
Alternate 672-line configuration in two standard MBP cabinets with MPP

PC-15638



DSX-1 shelf and a T1 repeater shelf

A DSX-1 cross-connect shelf and a T1 repeater shelf can be installed in a SEM and included in the system. The DSX-1 cross-connect shelf is used for connecting external DS1 cables to the system, and the T1 repeaters are used to compensate for signal losses on the external DS1 cables.

When the system is shipped from the factory with a DSX-1 cross-connect shelf, the SEM that contains them is installed at the top of the expansion MBP cabinet.

Up to fourteen repeaters can be provisioned in the repeater shelf to support a maximum of 14 DS1s.

The T1 repeater shelf and the LEDs in the DSX-1 shelf can be powered in one of three ways:

- from the dc distribution harnesses that are connected to the breaker interface panel (BIP) in the master MBP cabinet
- from an MPP cabinet
- from an external power source that is supplied by the customer

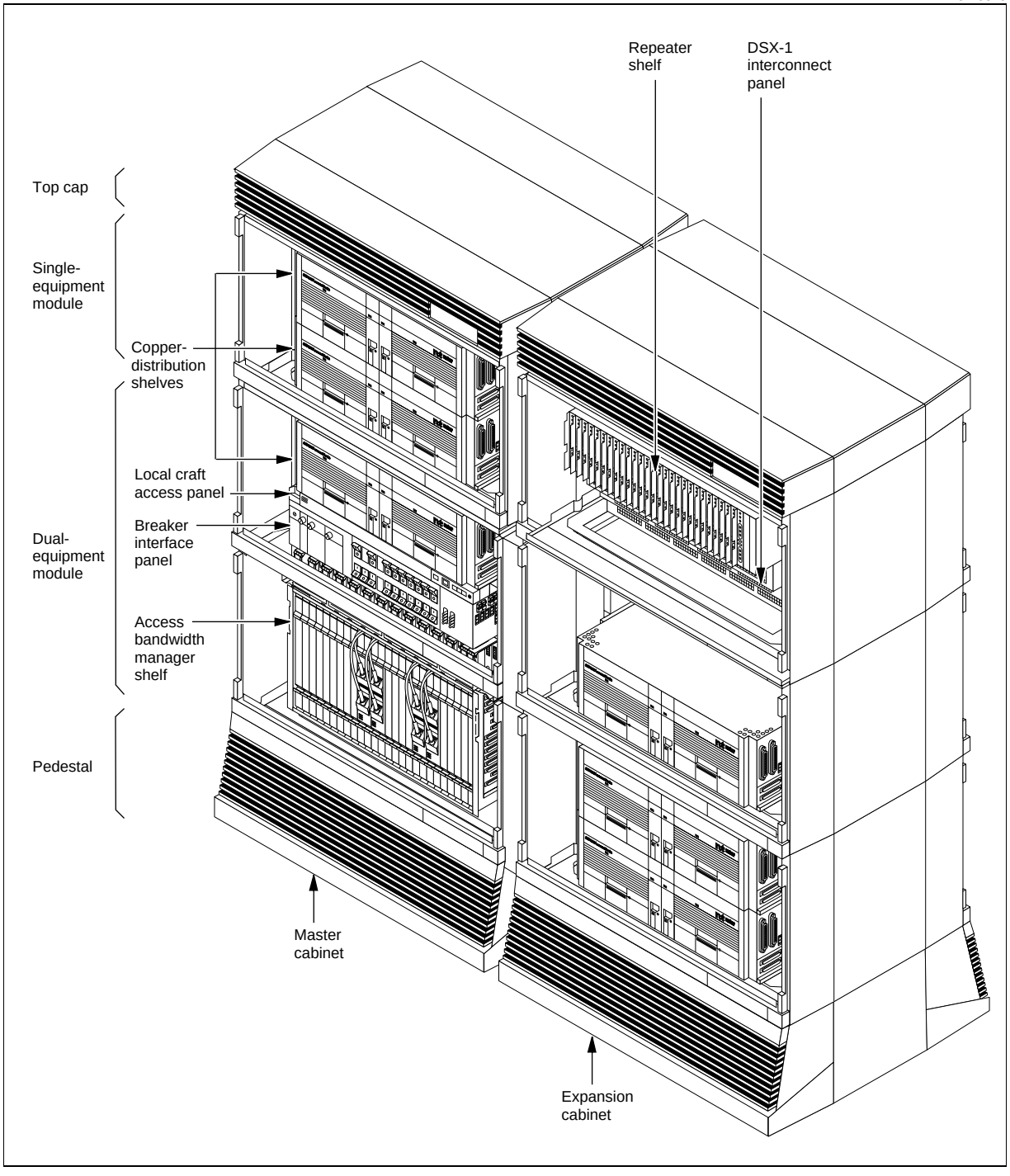
In systems containing from one to six CDS shelves, the repeaters and LEDs are powered from the dc distribution harnesses connected to the BIP. In systems containing seven CDS shelves, the power for the repeaters and LEDs must be provided by an external source.

This external power source can be obtained by connecting a power cable to terminal blocks in the MPP cabinet. These terminal blocks contain feeds to an auxiliary power connector on the rear of the dc distribution shelf that can be used for powering the DSX-1 shelf and the T1 repeater shelf. In systems that are not equipped with an MPP cabinet, the external power source must be provided by the customer.

Figure 2-9 shows a typical two cabinet configuration that contains a DSX-1 cross-connect shelf and a T1 repeater shelf.

Figure 2-9
Typical two-cabinet standard configuration that contains a DSX-1 shelf and a T1 repeater shelf

PC-15325



Fiber patch panel

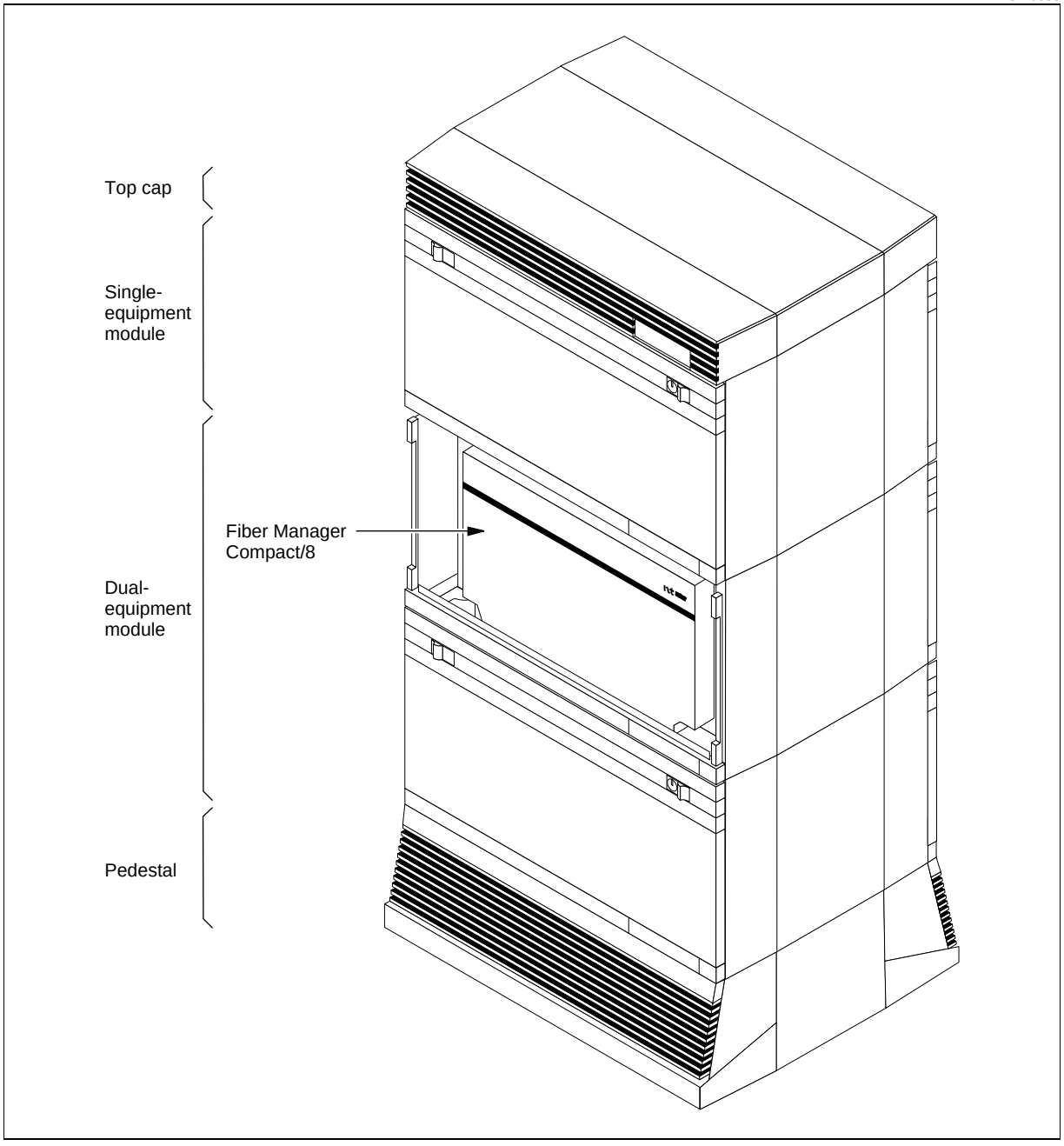
The standard MBP master cabinets can be purchased with an optional FiberManager Compact/8 fiber patch panel. This panel stores up to eight fiber splices and extra fiber for the fiber leads that connect to the ABM shelf. When equipped, this panel mounts inside the rear of the DEM in the master MBP cabinet, as shown in Figure 2-10.

The number of OC-3 tributaries in the system is restricted by the capacity of the FiberManager Compact/8 fiber patch panel. Internally spliced primary and secondary optics must be configured first and then any additional fiber capacity can be filled with OC-3 tributaries. OC-3 tributaries require two fibers, one transmit fiber and one receive fiber, per unit.

> ***Note:*** OC-3 tributary functionality requires OC-12 primary and secondary optics and NT4K52FB processor cards in the common-equipment shelf.

Figure 2-10
Rear view of master MBP cabinet showing the FiberManager Compact/8 fiber patch panel

PC-10833



STSBM cabinet configurations

Sonet transport signal bandwidth manager (STSBM) fiber ring MBP configurations consist of an NT4K06EA/EC 192-line STSBM master cabinet and an NT4K06BB expansion cabinet that can be equipped with up to five CDS shelves for an additional 480 lines.

> ***Note:*** This expansion cabinet is used in both the STSBM and the VTBM configurations.

The STSBM master cabinet consists of the following:

- a pedestal containing a blower module
- a DEM containing
  - — AccessNode common-equipment
  - — AccessNode supporting equipment
  - — space for an additional CDS shelf
- a DEM containing
  - — TransportNode common-equipment
  - — TransportNode supporting equipment
  - — one CDS shelf

The STSBM expansion cabinet consists of the following:

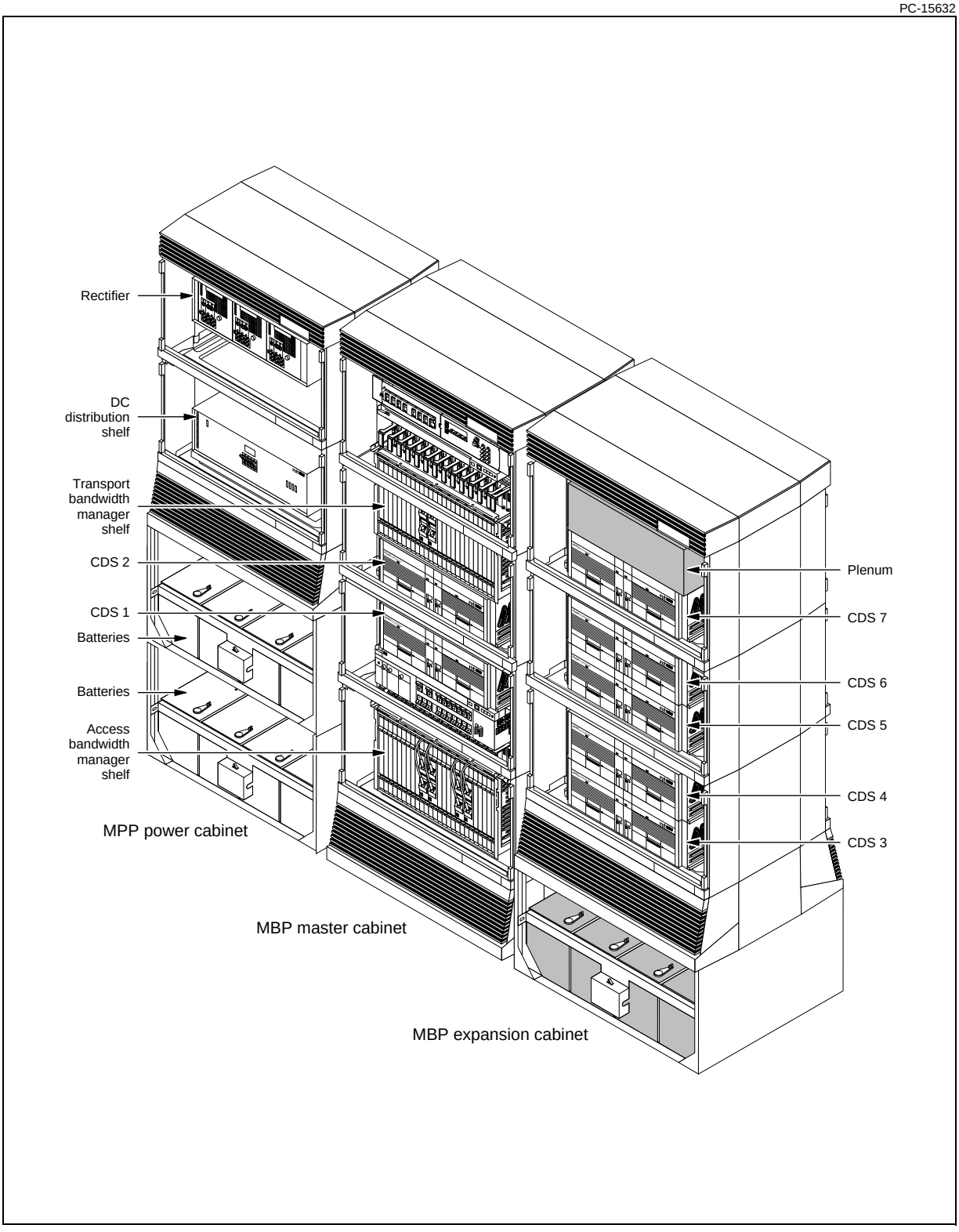
- a battery equipment module (BEM) containing space for back-up batteries
- a pedestal containing a blower module
- three SEMs containing up to five CDS shelves

The STSBM cabinet configuration can be combined with an MPP cabinet that provides battery back-up, rectifiers and dc distribution equipment (see “MPP cabinet configurations” on page 2-23.

Figure 2-11 shows a two-cabinet STSBM configuration with 672 subscriber voice lines and an MPP.

Figure 2-11
STSBM two-cabinet 672-line configuration with MPP

PC-15632



VTBM cabinet configurations

Virtual tributary bandwidth manager (VTBM) fiber ring MBP configurations consist of an NT4K06ED 192-line STSBM master cabinet and a co-located NT4K06BB expansion cabinet that can be equipped with up to five CDS shelves for an additional 480 lines.

> ***Note:*** This expansion cabinet is used in both the STSBM and the VTBM configurations.

The VTBM master cabinet consists of the following:

- a battery equipment module (BEM) containing back-up batteries
- a BEM containing rectifiers and dc distribution equipment
- a pedestal containing a blower module
- a DEM containing AccessNode common-equipment and two CDS shelves

The VTBM expansion cabinet consists of the following:

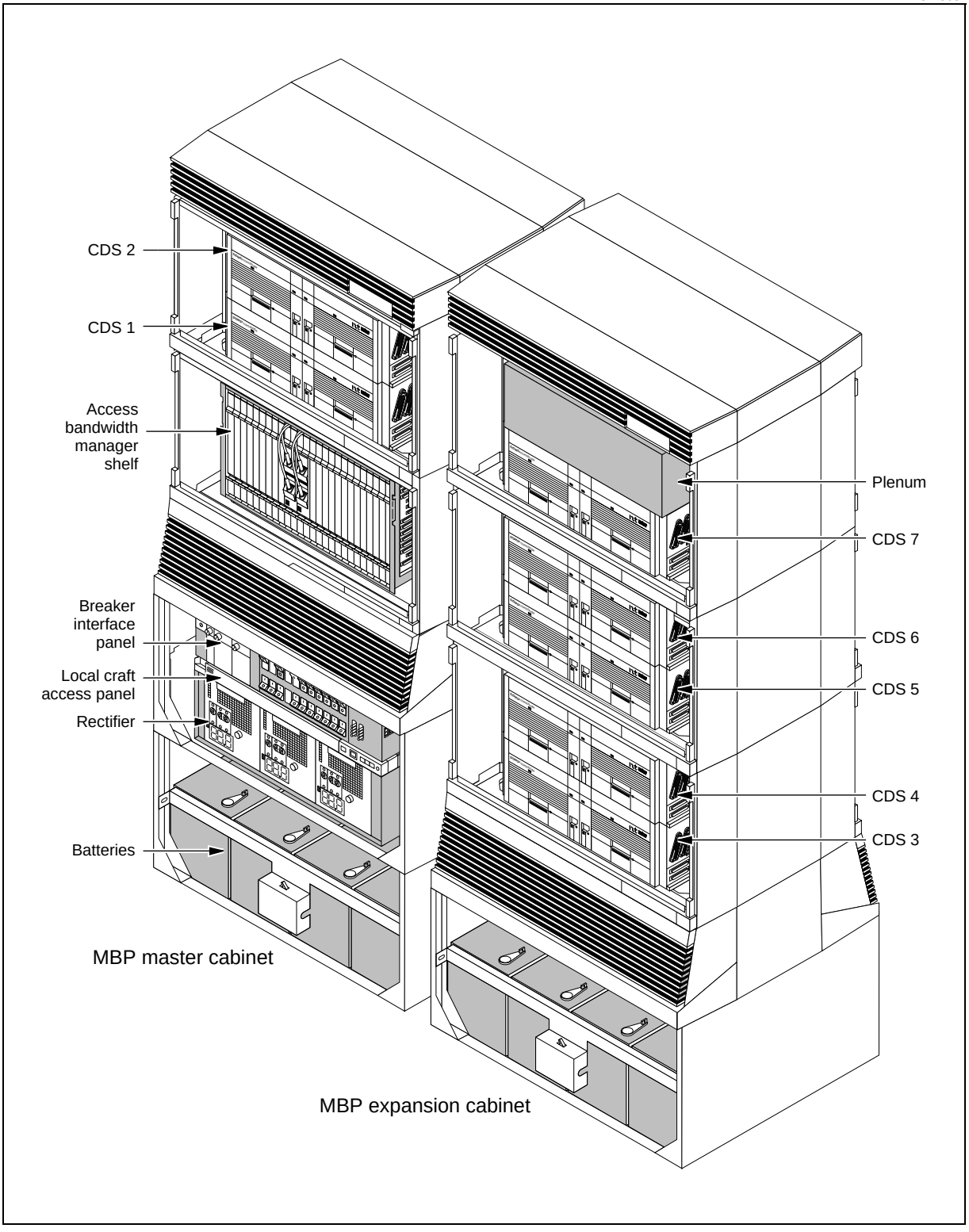
- a battery equipment module (BEM) containing back-up batteries
- a pedestal containing a blower module
- three SEMs containing up to five CDS shelves

The VTBM configuration does not require an MPP cabinet.

Figure 2-12 shows a two-cabinet VTBM configuration with 672 subscriber voice lines.

Figure 2-12
VTBM two-cabinet 672-line configuration

PC-15634



MPP cabinet configurations

The modular power package (MPP) is available in two configurations. The standard configuration and the SONET transport signal bandwidth manager (STSBM) configuration. The VTBM configuration does not require an MPP cabinet.

The optional MPP cabinet requires two 35 A, 208/240 Vac feeds from a commercial power source. For the requirements for these feeds, see "Commercial ac power cabling" on page 8-5.

Standard MPP configuration

The standard MPP cabinet shown in Figure 2-13 contains the following items:

- a top cap kit and a grille kit
- a dual equipment module that contains a dc distribution shelf, and up to two rectifier shelves that can contain a total of up to four MPR25A rectifiers

  Note: The upper rectifier shelf (rectifier shelf 1), equipped with three rectifiers, is standard equipment in the MPP. The lower rectifier shelf (rectifier shelf 2), equipped with one rectifier only, is optional and must be ordered separately. Rectifier positions 2 and 3 (the middle and the left-most positions respectively) in the lower rectifier shelf (rectifier shelf 2) cannot be equipped with rectifiers. Blank cover plates must be installed to cover these positions.

- a pedestal that contains a power distribution unit, a blower assembly and a filter to provide clean cooling air for the two rectifier shelves. In standard MPP configurations, battery backup is the responsibility of the customer. For information about the requirements for battery backup supplies, see "Battery backup" on page 4-7.

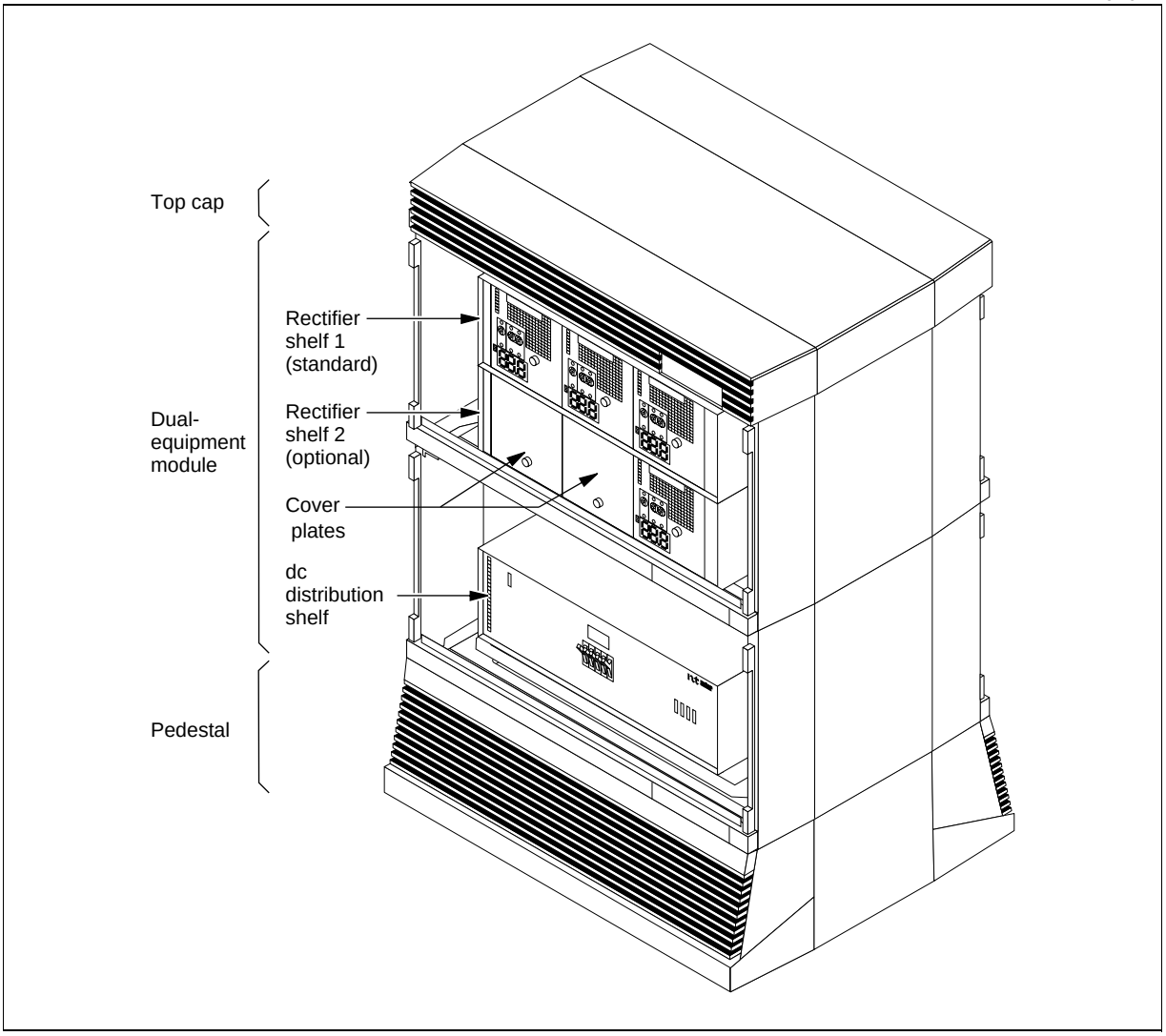
The dc distribution shelf is equipped with 12 Anderson Power pole connectors as follows:

- six pairs of connectors rated at 120 A for connecting strings of backup storage batteries
- six pairs of connectors for connecting the load to the MPP –48 Vdc power source. Four of these pairs of connectors are used for supplying power to the master MBP cabinet. One pair can be used for powering the blower unit in the MPP cabinet, and one pair for supplying –48 Vdc power to external customer equipment.

These 12 pairs of connectors are prewired to a pair of terminal blocks located at the rear of the MPP cabinet. All external connections for dc power are wired to these terminal blocks at the installation site.

Figure 2-13
Standard MPP cabinet configuration

PC-15242

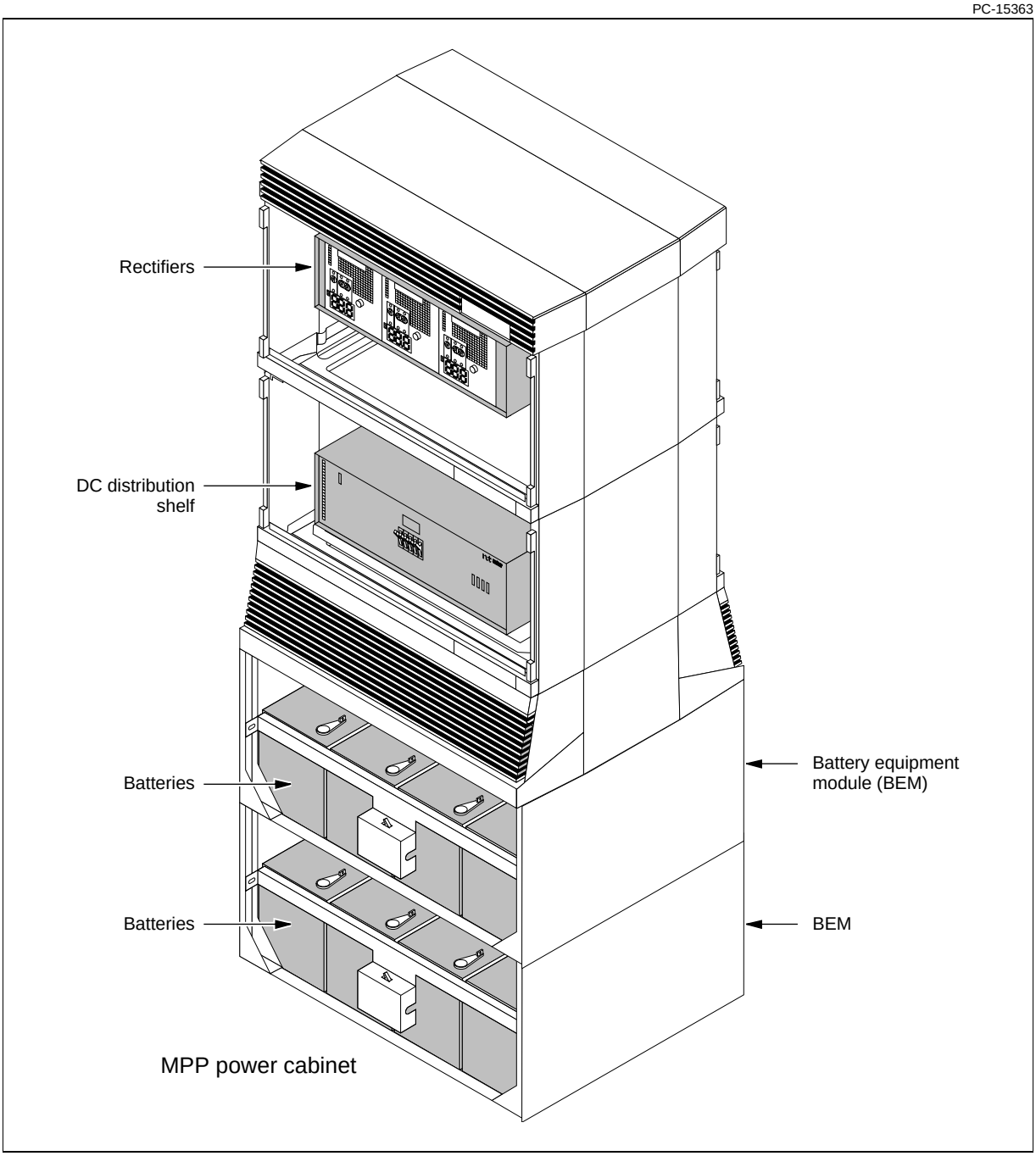


STSBM MPP configuration

The STSBM modular power package is shown in Figure 2-14. It is similar to the standard MPP and has a battery equipment module (BEM) for additional mounting space for battery back-up capability.

Figure 2-14
STSBM MPP cabinet configuration

PC-15363



System expansion

An existing system can be expanded in a number of ways:

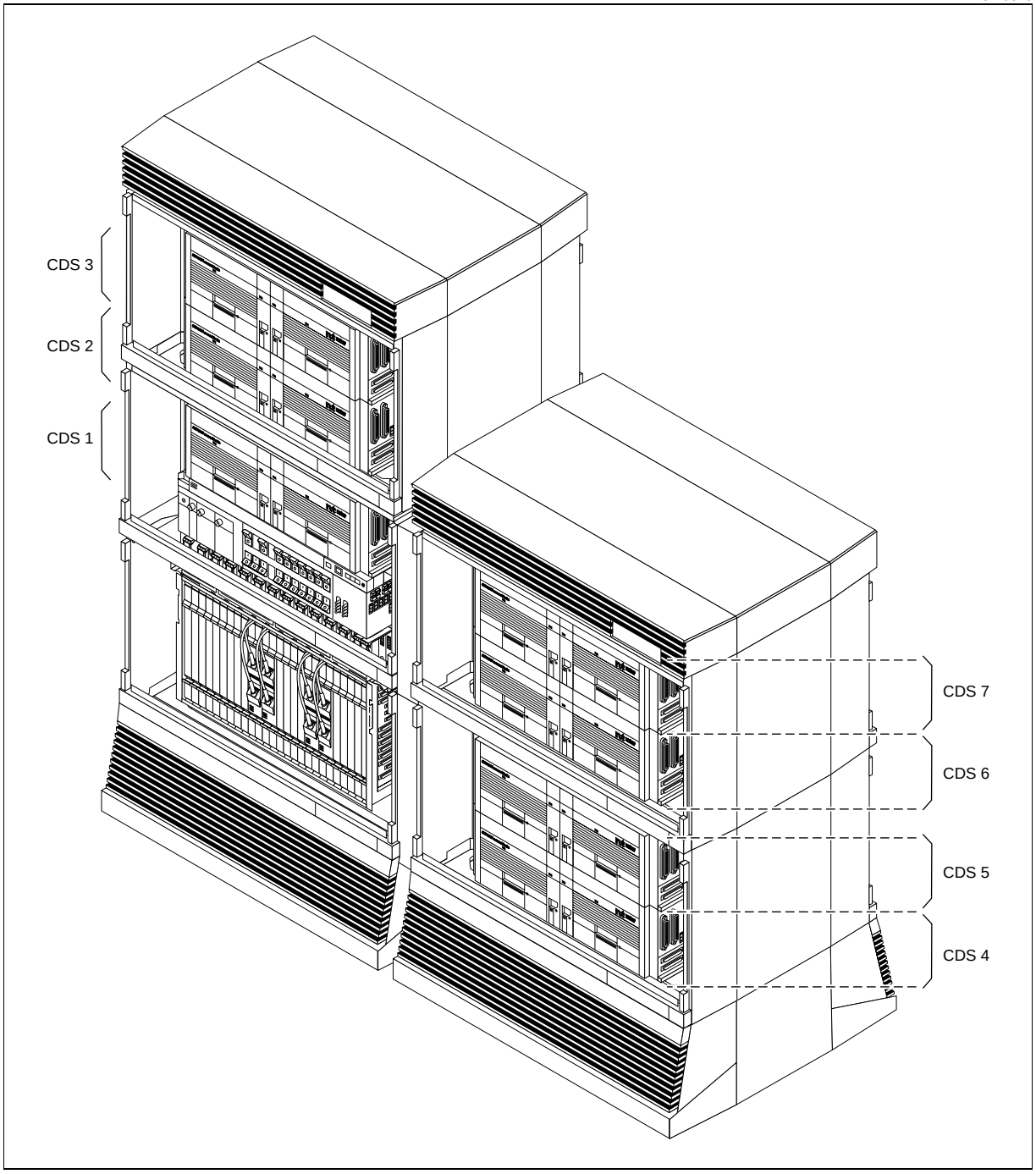
- by adding an MBP expansion cabinet, with the desired configuration of shelves
- by adding field expansion modules (FEM). A FEM is a single-equipment module equipped with side panels, rear covers, internal ground cables, and with one or two copper-distribution shelves, or with a DSX-1 cross-connect shelf and a T1 repeater shelf.
- by adding a copper-distribution shelf into an empty shelf space in an existing SEM
- by adding a FiberManager Compact/8 fiber patch panel to the rear of the master MBP cabinet
- by adding OC-3 tributary optical interface units
- by adding rectifiers and a rectifier shelf to support additional CDS shelves

Numbering of copper-distribution shelves

In MBP cabinets, copper distribution shelf (CDS) 1 is the lowermost CDS in the master cabinet (above the ABM shelf), as shown in Figure 2-15. Shelf number 2 is the CDS immediately above shelf 1, and so on up to the top of the master cabinet. Shelf numbering continues at the lowermost CDS in the expansion cabinet, and on up to shelf 7—the uppermost CDS in the expansion cabinet.

Figure 2-15
Numbering of copper-distribution shelves for a typical system in MPP cabinets

PC-15326



Environmental requirements

This chapter outlines the characteristics of the environment that must be present at the installation site if AccessNode equipment is to operate within design specifications.

> ***Note:*** For complete AccessNode system specifications, see *System Specifications,* 323-3001-180, in *Description,* Volume 2B.

Chapter contents

This chapter contains the following information:

Temperature

The modular business package (MBP) meets or exceeds the requirements and objectives specified in Bell Communications Research (Bellcore) technical references TR-TSY-000057 (DLC) and TR-NWT-000063 (NEBS):

- operating temperature: 0°C (32°F) to +50°C (122°F)
- short-term temperature: –40°C (–40°F) to +50°C (122°F)

  Note: Short-term operating temperature is for no more than 72 consecutive hours and no more than 15 days total each year.

These values exclude OPC (NT7E24) tape and hard drive limits which are listed in *System Specifications,* 323-3001-180, in *Description,* Volume 2B.

Altitude

operating	up to 4000 m (13,000 ft) above mean sea level
shipping or storage	up to 15,000 m (50,000 ft) above mean sea level

Relative humidity

The following relative humidity range applies to FCOT and RFT terminals:

operating	5% to 95% (not to exceed 3.6 kPa water vapor pressure over the normal operating temperature)
shipping or storage	5% to 95% (not to exceed 5.3 kPa water vapor pressure for temperatures above +35°C)

The following relative humidity range applies to the OPC:

operating	20% to 90% (not to exceed 3.6 kPa water vapor pressure over the normal operating temperature of the OPC)
shipping or storage	10% to 90% (not to exceed 5.3 kPa water vapor pressure for temperatures above +35°C for the OPC)

Atmospheric dust

AccessNode MBP and MPP cabinets have been designed with an air filter in the inlet of the bay that meets the ASHRAE 80% dust arrestance requirements.

Electrostatic discharge (ESD)

AccessNode MBP and MPP cabinets and equipment comply with section 4.5.2 of Bellcore technical reference TR-EOP-000063.

Emissions and susceptibility

AccessNode equipment shelves and all intershelf cables are shielded, and cable interface signals on all other non-shielded cables are filtered. Electromagnetic interference (EMI) shielding and filtering is in compliance with FCC, Part 15, Subpart B, for Class A computing devices.

These same design features also ensure that the EMI susceptibility, specifically radio frequency interference (RFI) immunity, is in accordance with Bell Canada DS-8465.

Mechanical shock

Vibration in the cabinet equipment area must be limited to a frequency range of 0.5 to 200 Hz and a G-force magnitude of 0.1 G, according to Bellcore technical reference TR-EOP-000063.

Earthquake resistance

Seismic kits are available for MBP and MPP cabinets. These kits contain earthquake mounting hardware to ensure normal operation when subjected to the Zone 4 earthquake loading, in accordance with Bellcore technical reference TR-EOP-000063, Section 4.5. These kits are available for cabinets that are from 1 to 3 modules in height. A single equipment module is considered to be one module in height and a dual equipment module is considered to be two modules in height.

Power and grounding

This chapter contains power and grounding guidelines for MBP and MPP cabinets installed in power and ground environments that are shared with existing equipment and systems.

Chapter contents

This chapter contains the following information:

Powering arrangements

AccessNode equipment in MBP cabinets can be powered from:

- a customer-supplied external –48 V dc power plant
- commercial ac power to a modular power package (MPP) cabinet
- commercial ac power to a VTBM master cabinet

Powering from a customer-supplied external dc power plant

External dc power plants are the responsibility of the customer. The cabling required for feeding the AccessNode equipment are the responsibility of the customer. Conductor gauge and length must conform to local electrical codes.

dc powering

Four supply and return circuits must be grouped together for a continuous connection between the external – 48 V dc source and the MBP cabinet.

Battery back-up

In standard MPP cabinets, six customer-supplied battery strings, rated at up 120 A can be connected to the MBP master cabinet terminal blocks. External customer-supplied cables connect the battery strings to these terminal blocks.

> ***Note:*** In STSBM MPP cabinets and VTBM master cabinets, battery back-up is contained in the cabinets. For more information about battery backup, see “Battery backup” on page 4-7.

Table 4-1 lists the customer-supplied dc powering requirements of the AccessNode equipment installed in MBP cabinets.

Table 4-1
Powering requirements for a customer-supplied dc source

Requirement	Specification
Battery feeds	four separately-fused 30 A feeds from a source of nominal – 48 V dc
Operating range	– 2.5 to – 56.0 V dc, as measured at the terminal block at the rear of the master MBP cabinet
Battery feed cabling	6 AWG, maximum length of 10.7 m (35 ft) from dc source to the MBP master cabinet

Grounding

Return cables are referenced to ground through the cabinet ground return bars, which are referenced to a floor ground bar (FGB) in common bonding network (CBN) grounding environments or to a single-point building ground in integrated bonding network (IBN) grounding environments. For information about ground referencing, see “Grounding schemes” on page 4-14.

Powering from an MPP or VTBM master cabinet

Providing ac power is the responsibility of the customer. The cabling required for feeding the AccessNode equipment is the responsibility of the customer. Conductor gauge and length must conform to local electrical codes.

ac powering

A system powered from an MPP cabinet operates from one, separately-fused, commercial ac source for each rectifier shelf contained in the MPP cabinet, as shown in Figure 4-1. The cabinet can contain up to two rectifier shelves. Nortel Networks recommends that the installation site be engineered for two 208/240 V ac, 40 A feeds to allow for expansion.

The ac distribution panel and cabling must be installed by a licensed electrician in accordance with the national and local electrical codes, the power distribution schemes are shown in Figure 4-2 to Figure 4-5 on page 4-10 through page 4-13.

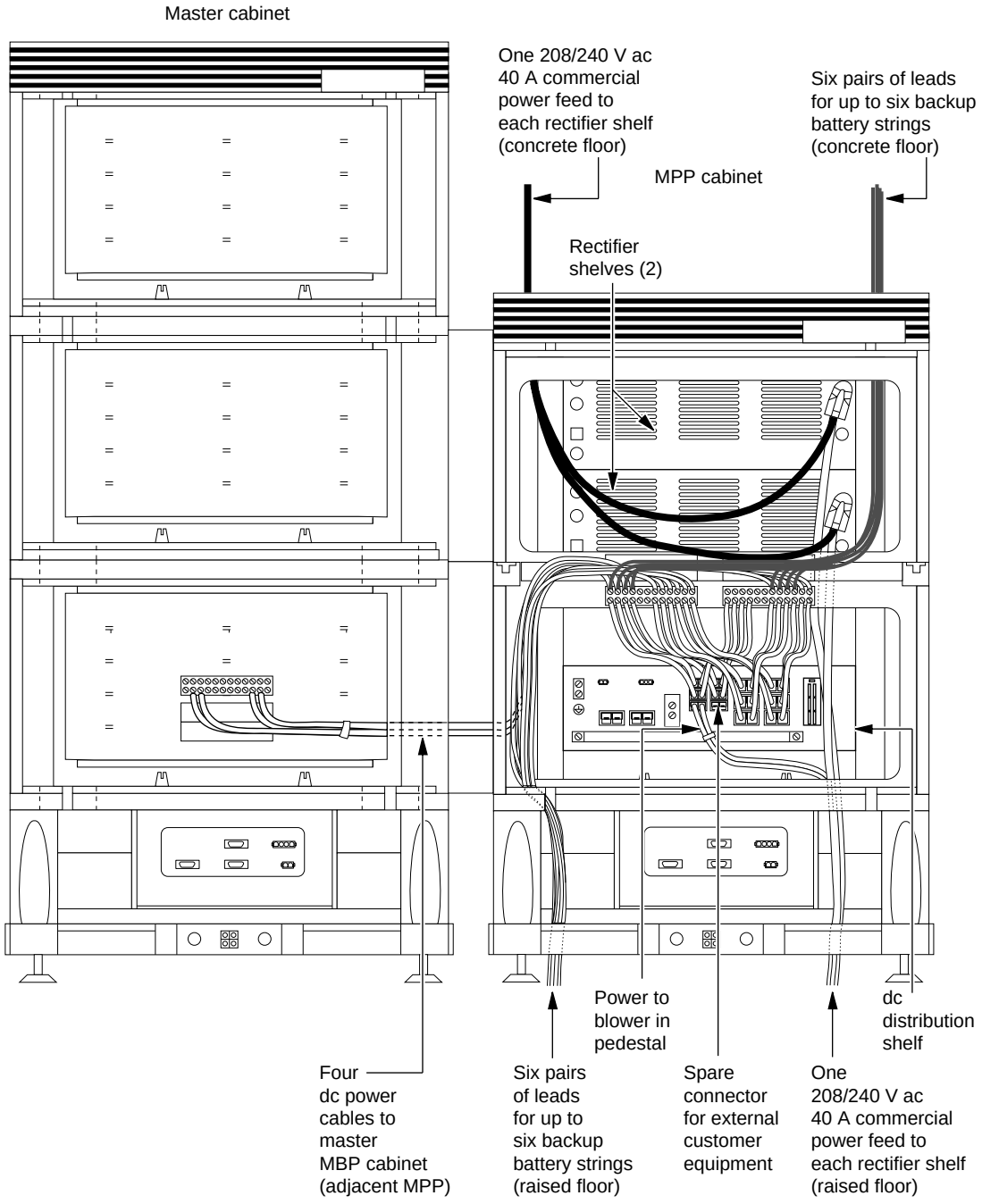
Table 4-2 lists the powering requirements for a customer-supplied ac source.

Table 4-2
Powering requirements for a customer-supplied ac source

Requirement	Specification
AC feeds	One 208/240 V ac feed rated at 40 A is required for each rectifier shelf contained in the MPP cabinet Note: The maximum number of rectifier shelves is two.
AC input cabling	6 AWG, maximum length of 10.7 m (35 ft) from dc source to the MBP master cabinet The MPP cabinet can be connected to an ac panel by armored cable or appropriate-sized conductors in metal conduit. The preferred method is to use metal-clad flexible armored cable. Conductor sizing and the routing of conduit must conform to applicable electrical codes. In the United States: Table 250-94, of the National Electrical Code (NEC) In Canada: Table 17, of the Canadian Electrical Code (CEC)
AC panel	Use of a dedicated ac panel for feeding communication equipment and utility receptacles is recommended in common bonding network (CBN) grounding environments and is required in isolated bonding network (IBN) grounding environments.

Figure 4-1
MBP cabinets powered from an MPP cabinet, with or without battery backup

PC-11007



Note: This figure is intended to show the cables required. Actual routing of the cables between cabinets depends on the location of the MPP and the type of floor.

Battery back-up

In standard MPP cabinets, an internal dc distribution shelf is equipped with six pairs of Anderson Pole connectors each of which is rated at up 120 A for up to six customer-supplied battery strings. These connectors are prewired at the factory to MBP master cabinet terminal blocks. External customer-supplied cables connect the battery strings to these terminal blocks.

In STSBM MPP cabinets and VTBM master cabinets, battery back-up is contained in the cabinets. For more information about battery backup, see “Battery backup” on page 4-7.

Grounding

See Figure 4-2 for a schematic diagram of the wiring required in common bonding network (CBN) grounding environments and Figure 4-3 for the wiring required in isolated bonding network (IBN) grounding environments.

Supplying Nortel Networks with a power and grounding layout

When engineering a specific equipment configuration, you should prepare a power and grounding layout which includes the locations of the following items:

- the proposed location of the MBP cabinets
- in systems powered by an external customer-supplied dc power plant the location of:
  - — the batteries and the rectifier system
  - — the battery distribution fuse bay (BDFB)
- in systems powered by an MPP cabinet, the proposed location of the MPP cabinet
- the length and routes for dc and ac power cables
- a grounding plan which should include the locations of the following:
  - — the floor ground bars (FGBs)
  - — the vertical ground risers (VGRs), if used in your building
  - — the building principal ground (BPG), or the single point ground (SPG) if applicable

DC power

The following paragraphs describe the dc power requirements for AccessNode equipment in MBP cabinets.

dc power consumption

Table 4-3 lists the approximate power drain of AccessNode shelves and common equipment.

Table 4-3
Shelf and common equipment power drain

Item	Description	Power drain
ABM shelf common equipment	includes OC-3/OC12, protected optics, and protected common control	188 watts
	Timing and cross-connect card (TXC)	26 watts
	ABM shelf options:	
	• Operations controller (OPC)	52 watts
	• DS1/VT mapper (with 14 DS1s)	13 watts
	• DS3/STS mapper (with 3 DS1s)	16 watts
TBM shelf common equipment	includes OC-3/OC12, protected optics, and protected common control	123 watts
	TBM shelf options:	
	• Operations controller (OPC)	52 watts
	• DS1/VT mapper (with 14 DS1s)	13 watts
	• DS3/STS mapper (with 3 DS1s)	16 watts
Copper-distribution shelf	Common equipment and power	45 watts
Fans (3)	Cooling unit (one used per bay)	93 watts
Fans (8)	Cooling unit (one used per bay)	65 watts

Table 4-4 lists the approximate power drain of AccessNode line cards.

Table 4-4
Line card power drain

Line card	Item	Power drain
2-wire Omega sink	FXS, POTS, UVG at 6 CCS	0.58 watts
	FXS, POTS, UVG at 18 CCS	0.77 watts
	Coin at 6 CCS	0.71 watts
	Coin at 18 CCS	0.90 watts
	ETO/TO at 36 CCS	0.87 watts
2 -wire Omega source	DPO at 6 CCS	1.14 watts
	DPO at 18 CCS	2.04 watts
4-wire Omega	DDS, DS0DP at 36 CCS	1.99 watts
	FXO at from 0 to 36 CCS	1.93 watts
6 and 8-wire Omega	E&M, PLR, and TDM at from 0 to 36 CCS	2.52 watts

Key:

CCS	Call hundred seconds
DDS	Digital data services
DS0DP	DS0 dataport service
E&M	Ear and mouth
PLR	Pulse link repeater
FXO	Foreign exchange office
POTS	Plain ordinary telephone service
TDM	Tandem service
UVG	Universal voice grade service

Battery backup

The MPP cabinet is equipped with terminal blocks for connecting up to six strings of backup batteries. External cables connect the battery strings to these terminal blocks. When rated at 200 Ah per string, the six strings will provide 1200 Ah backup power (120 A for eight hours) for a fully-equipped installation.

In standard MBP applications, battery backup equipment is the responsibility of the customer. The installation and connection of all battery backup to the standard MPP shall comply with all national, state, and local codes governing equipment of this type. The conductors between the MPP and the battery backup system shall be treated as “TAP” conductors, tapped from the common dc bus located in the dc distribution panel of the MPP. The available current from this bus shall be calculated as follows:

- 25 A per rectifier (maximum 4)
- 30 A per battery string (maximum 6)

The conductors must be terminated with 30 A over-current protectors that are provided as part of the battery source. The conductors must be no longer than the maximum 7.62 m (25 ft) of 4 AWG wire rated for 90º C. The conductors must be protected from physical damage or enclosed in a raceway where not more than three feeders per raceway are installed (reference NEC 240-3 (d) for relevant wire application information).

AC power

The following paragraphs describe the ac power requirements for AccessNode equipment in MBP cabinets.

Power distribution panel

Use of a dedicated ac panel for feeding communication equipment and utility receptacles is recommended in common bonding network (CBN) grounding environments and is required in isolated bonding network (IBN) grounding environments. The sizes of ac and entrance distribution feeder cables must conform with the information contained in national electrical codes as follows:

In the United States	Table 250-94, of the National Electrical Code (NEC)
In Canada	Table 17, of the Canadian Electrical Code (CEC)

Unless otherwise specified by the operating company or by local electrical codes, the preferred wiring is metal-clad flexible armored cable.

The ac distribution panel and cabling must be installed by a licensed electrician in accordance with the national and local electrical codes. The power distribution scheme is shown in Figure 4-2 to Figure 4-5 on page 4-10 through page 4-13.

208/240 V ac power for an MPP cabinet

A system powered from an MPP (or the VTBM master) cabinet operates from a commercial source of three-phase/single-phase 208/240 Vac. One 208/240 V ac feed rated at 40 A from an ac panel is required for each rectifier shelf provisioned in an MPP cabinet. Up to two rectifier shelves can be provisioned. The MPP cabinet can be connected to the dedicated ac panel by armored cable or appropriate-sized conductors in metal conduit. The preferred method is to use armored cable.

> ***Note:*** Each feeder line must be protected by one 40 A fuse. For example, place 40 A fuses on both L1 and L2 for single-phase circuits and on L1, L2, and L3 for three-phase circuits.

Conductor sizing and the routing of conduit must conform to applicable electrical codes listed in “Power distribution panel” on page 4-8.

See Figure 4-2 for a schematic diagram of the wiring required in common bonding network (CBN) grounding environments and Figure 4-3 for the wiring required in isolated bonding network (IBN) grounding environments.

120 V ac utility receptacles

Utility receptacles can be one of the two following types:

- standard receptacle for 3 conductors (line L, neutral N, and ac equipment ground ACEG).
  - — Use armored cable with 3 conductors: L, N, and G.
- isolated ground (orange) receptacle for 4 conductors (L, N, ACEG, and dedicated ACEG).
  - — Use armored cable with four conductors: L, N, ACEG, and dedicated AGEC.

Unless otherwise specified by the operating company or by local electrical codes, the preferred method is to use standard 3-conductor receptacles.

Receptacles in a CBN

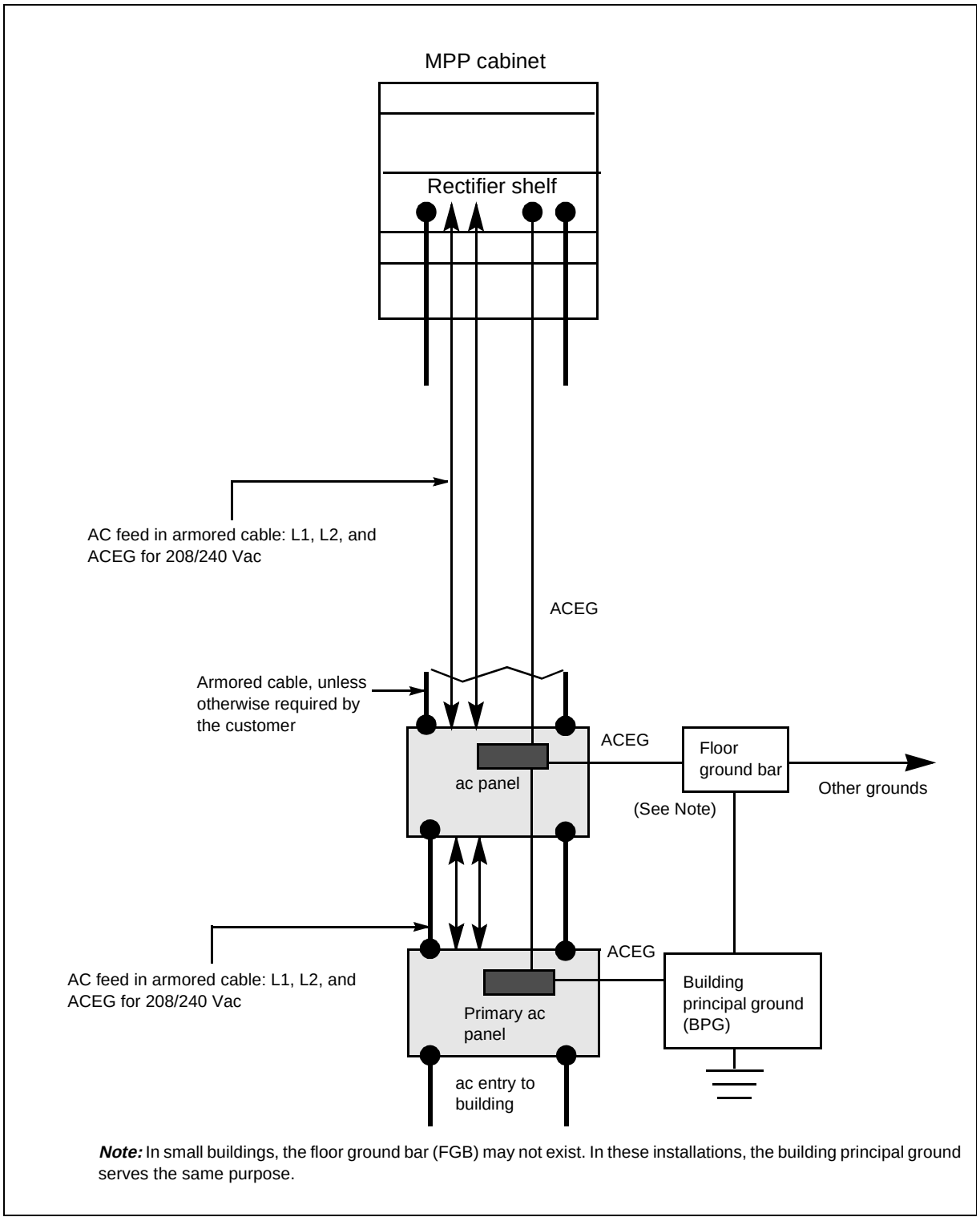
In a CBN, utility receptacles should be powered from an ac panel that has its ACEG bonded to the same floor ground bar (FGB) as the AccessNode. For an illustration of the grounding scheme for ac utility receptacles in a CBN, see Figure 4-4 on page 4-12.

Receptacles in an IBN

In an IBN, utility receptacles should be powered from an ac panel that has its ACEG bonded to the SPG. For an illustration of the grounding scheme for ac utility receptacles in an IBN, see Figure 4-5 on page 4-13.

An AccessNode system in MBP cabinets does not require a source of 120 V ac commercial power to operate. However, we recommend installing two 120 V ac receptacles in the equipment room to power portable terminals and printers connected temporarily to AccessNode equipment, and to permit the use of other customer-supplied equipment.

Figure 4-2
208/240 V ac power distribution in a CBN



Note: In small buildings, the floor ground bar (FGB) may not exist. In these installations, the building principal ground serves the same purpose.

Figure 4-3
208/240 V ac power distribution in an IBN

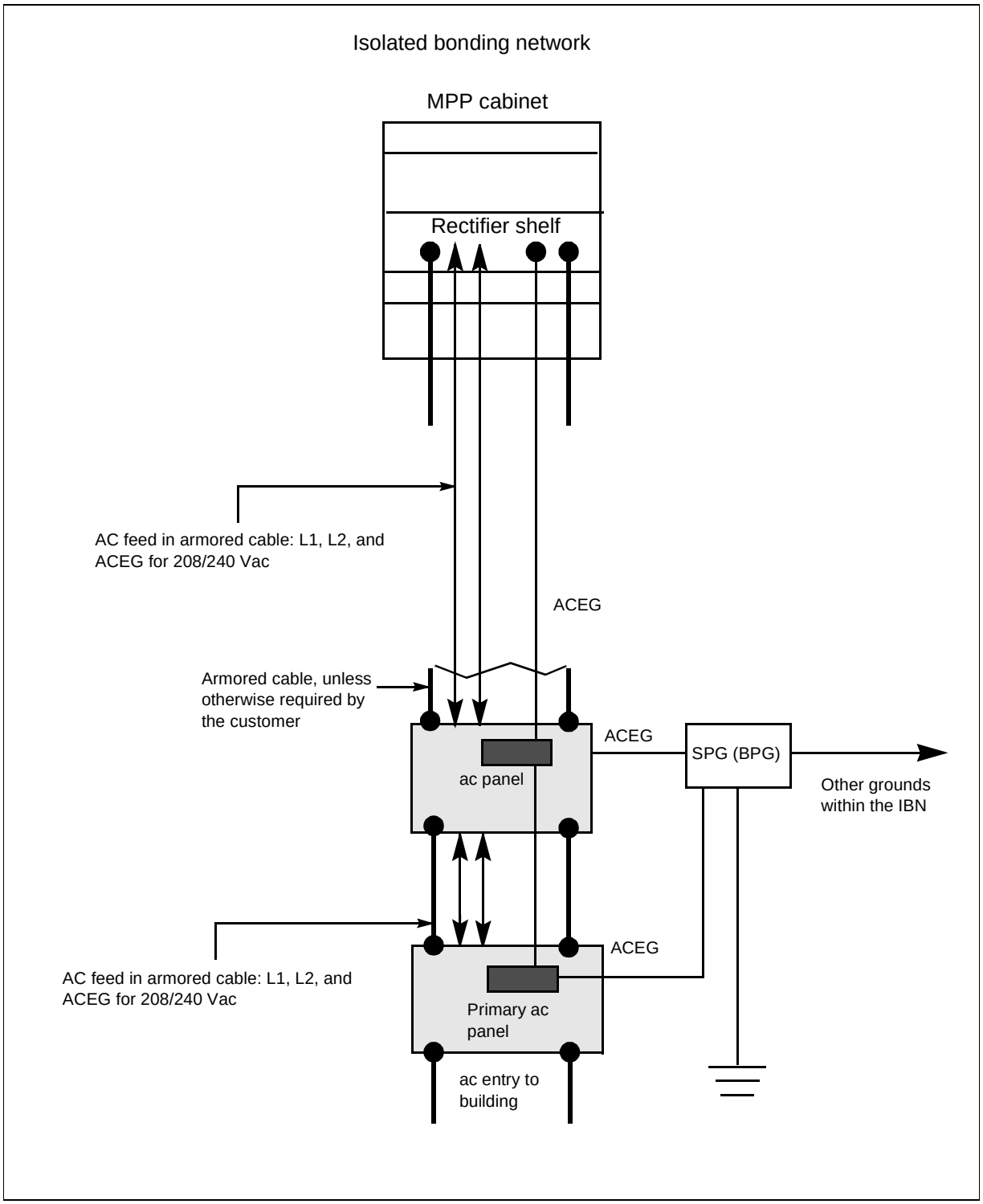
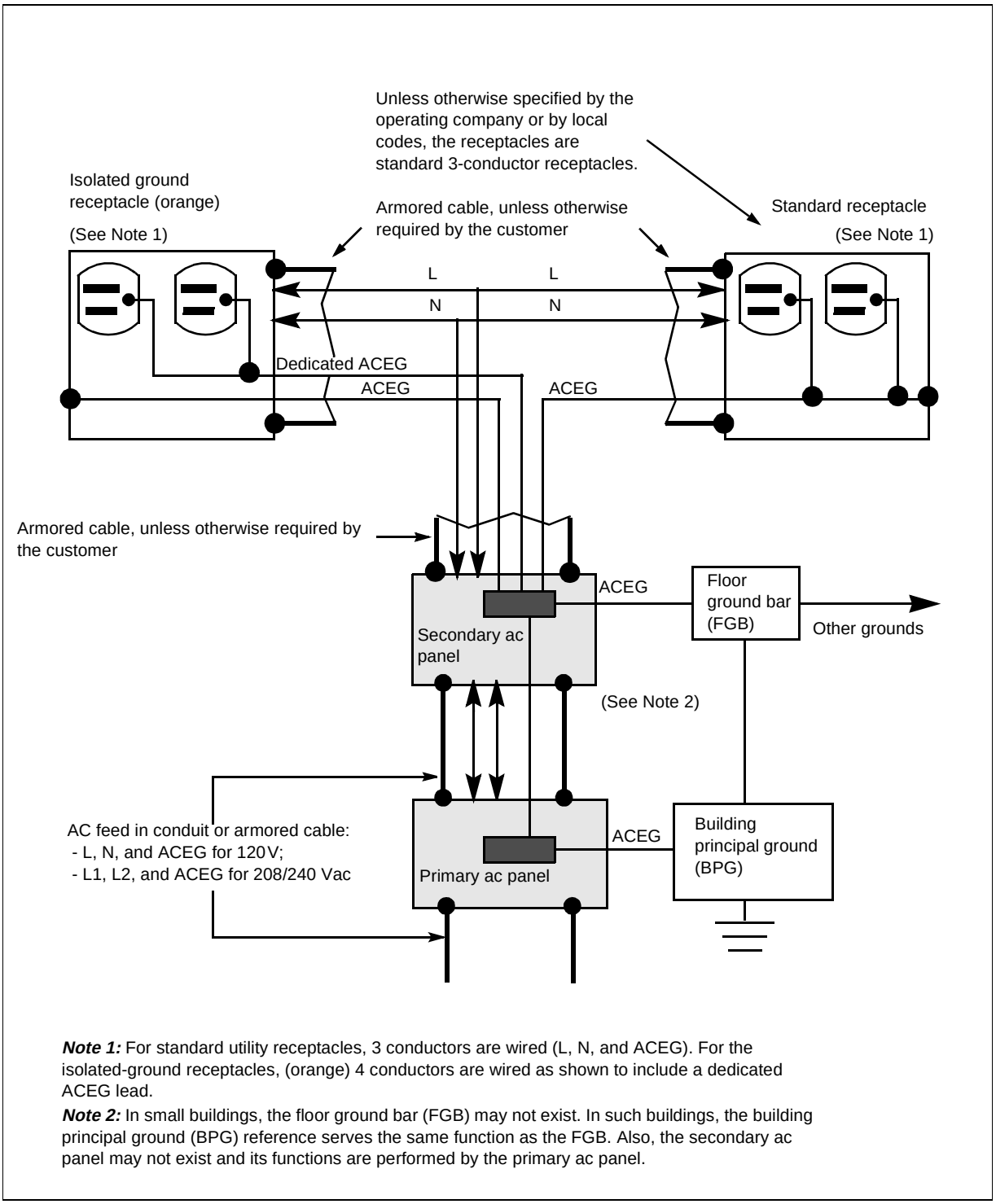


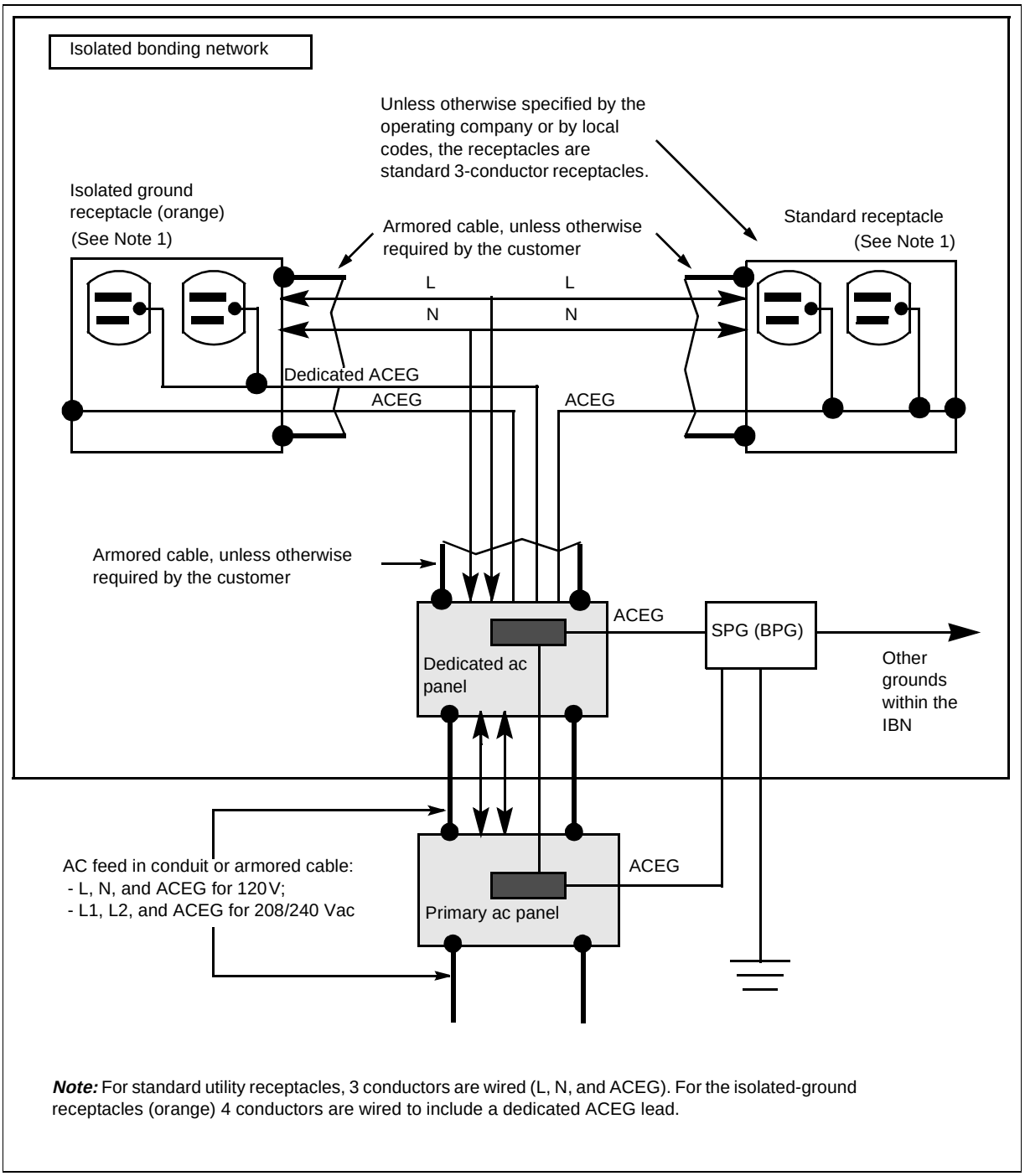
Figure 4-4
Power (ac) distribution and utility receptacle ground wiring scheme in a CBN



Note 1: For standard utility receptacles, 3 conductors are wired (L, N, and ACEG). For the isolated-ground receptacles, (orange) 4 conductors are wired as shown to include a dedicated ACEG lead.

Note 2: In small buildings, the floor ground bar (FGB) may not exist. In such buildings, the building principal ground (BPG) reference serves the same function as the FGB. Also, the secondary ac panel may not exist and its functions are performed by the primary ac panel.

Figure 4-5
Power (ac) distribution and utility receptacle ground wiring scheme in an IBN



Note: For standard utility receptacles, 3 conductors are wired (L, N, and ACEG). For the isolated-ground receptacles (orange) 4 conductors are wired to include a dedicated ACEG lead.

Grounding schemes

With the use of line interface cards and external copper-access lines, large transient currents caused by certain events, such as lightning storms, and ac or dc power line faults, can be expected to flow through the shared system grounds. The resulting disturbances can affect the AccessNode and any other interconnected systems. Therefore, it is important that the shared grounding scheme, involving supply leads, ac grounding, logic ground, and frame ground, be installed correctly.

> ***Note 1:*** On all subscriber lines that exit a building at a remote side, first-order protection is required, as provided by gas discharge tube or carbon block protection.
>
> ***Note 2:*** Installation according to the Northern Telecom Corporate Standard 4122.00, "Grounding of Communication Systems," is mandatory.

AccessNode equipment can be installed in a common bonding network (CBN) or in an isolated bonding (IBN) network. A CBN is the most common grounding network used with transmission equipment.

When the system is to be installed at a site with existing equipment, use the grounding scheme that suits the existing grounding network at the site; that is, use a CBN scheme in an existing CBN and an IBN scheme in an existing IBN. When the system is being installed by itself at a new site, a CBN is preferred because cables containing ground will interface with another transmission system, which is usually in a CBN.

For a schematic diagram of AccessNode equipment in a CBN, see Figure 4-6 on page 4-17, and for AccessNode equipment in an IBN, see Figure 4-8 on page 4-19.

Supply and return cables

The supply and return cables, which are red and white for North American installations, must be the same gauge, and grouped together for a continuous pair connection between the –48 V source and the AccessNode equipment. In the MPP cabinet (or in the BDFB), the "return" conductors connect to an insulated battery-return (BR) bus.

Utility 120 V ac receptacles

Standard utility receptacles with three conductors are used, wired as L, N, and ACEG. The ACEG leads and the metal conduit or insulated metal-clad cable must be wired as shown in Figure 4-4 on page 4-12 in a CBN and as shown in Figure 4-5 on page 4-13 in an IBN.

Grounding and battery isolation

AccessNode equipment can be installed in office configurations that comply with the following IBN standards:

- Nortel CS 4122 (Corporate Grounding Standard)
- Bellcore GR-1089-CORE

IBN configurations

IBN configurations completely separate the –48 V battery and battery return (BR) from frame ground and logic ground. IBN configurations achieve the separation by the following methods:

- isolating framework from unintentional contact with ground
- isolating communication links to other equipment and systems

In addition, the dc power system is configured so that the following conditions are met:

- The BR has only one point of ground reference.
- The point of ground reference is no more than one floor away from the equipment and systems that it powers.

CBN configurations

In CBN configurations, the BR may contact the frame ground at several points in the network, allowing battery return current to flow over frame ground conductors. Separation between battery returns and equipment grounds is not well controlled.

In all cases follow operating company guidelines and Nortel Networks documentation to maintain the integrity of isolation.

Internal grounding and battery isolation

Although local power supplies for AccessNode equipment are referenced to frame ground, minimal or no current flows into frame ground. For all loads except supply monitoring circuits, AccessNode uses converter transformers and optical coupling devices to isolate the incoming power (–48 V and BR) from the converter outputs or frame ground. You may observe minimal current flow (less than 3 ma) for supply monitor circuits. These circuits check for power and ground connections in the system.

In the common equipment shelves for both access bandwidth manger (ABM) and transport bandwidth manager (TBM) shelves, the –48 V and BR inputs feed dc isolated point-of-use power supply (PUPS) modules. PUPS generates local power for each circuit pack. Copper distribution shelves (CDS) receive power from a copper distribution shelf power converter (CDSP), which is an isolated converter.

Note 1: DS2 and other coaxial cable shielding terminate on the common system/shelf ground.

Note 2: RS-232C grounding pins connect to the common system/shelf ground.

Frame ground

Each cabinet has a frame ground connection which attaches to the FGB in a CBN as shown in Figure 4-6 or Figure 4-7, or to the SPG in an IBN as shown in Figure 4-8 or Figure 4-9. The cable used to perform this connection has a minimum gauge of 6 AWG.

If the FGB or SPG is more than 16 m (53 ft) away, if a lineup of cabinets are involved, or if a frame ground collector is used, a 2 AWG conductor must be used to connect to the FGB or SPG.

The general requirements for frame grounding are as follows:

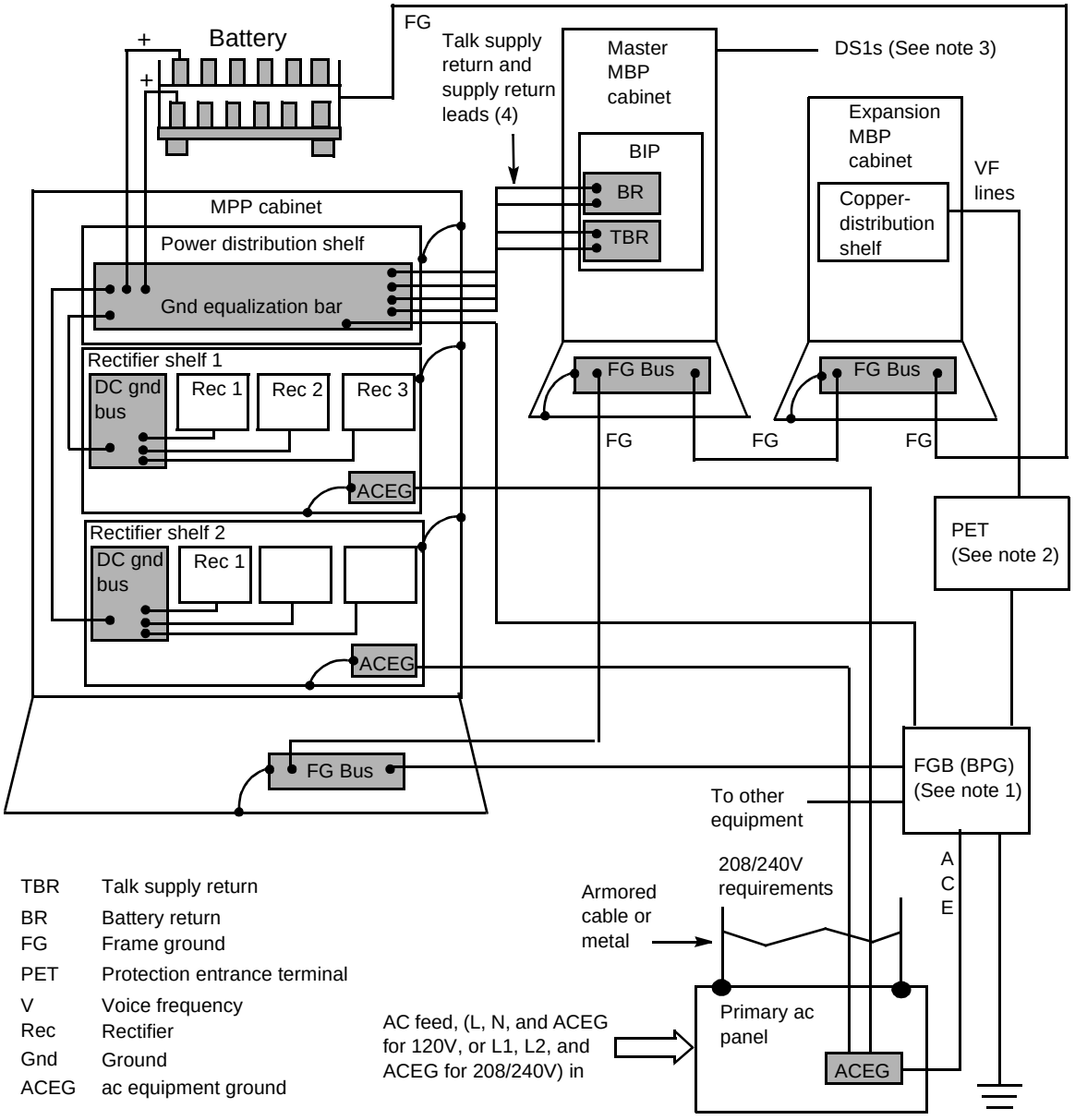
- The conductor size and insulation rating must accommodate the maximum expected dc or ac fault current, or transient current.
- The resistance of the frame ground conductor must be less than 20 m¾.
- No dc current more than 10 mA for each frame is diverted to frame ground, except for transient fault currents when a fuse blows.

Cable racks

All cable racks associated with equipment in a CBN or an IBN must be bonded to the equipment framework and there must be continuous conductance between lineups, except if crossing from a CBN to an IBN. In which case, bridges between two isolated lineups must be bonded to the framework of one lineup and isolated from the other. In an IBN, these cable racks must be isolated from any other grounding connections.

Other cable racks that are not part of the equipment in the IBN system must be separated by a distance of at least 2 m (6 ft), otherwise they must be bonded to the SPG.

Figure 4-6
Grounding of MBP cabinets powered from an MPP cabinet in a CBN

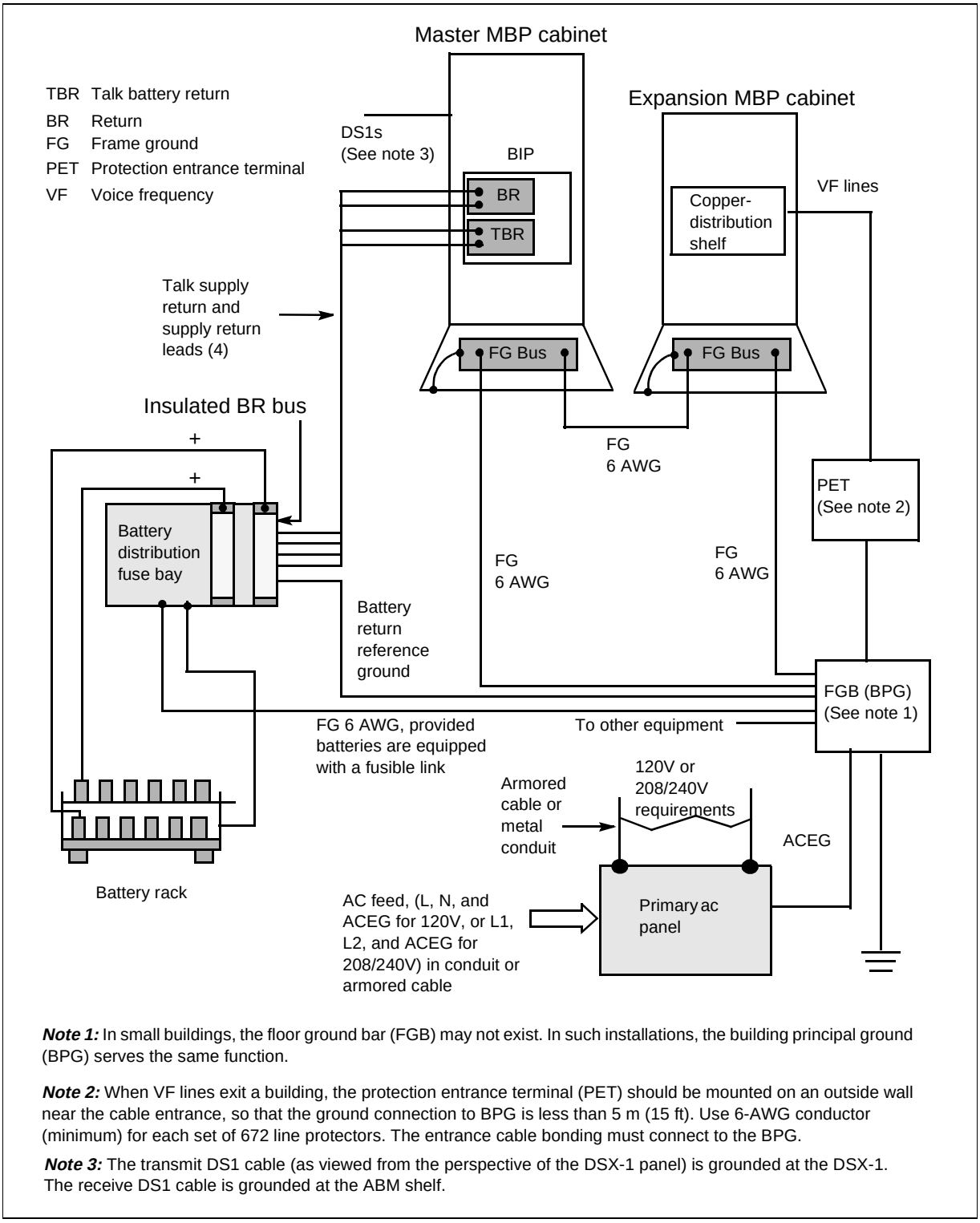


Note 1: In small buildings, the floor ground bar (FGB) may not exist. In such buildings, the building principal ground (BPG) serves the same function.

Note 2: When VF lines exit a building, the protection entrance terminal (PET) should be mounted on an outside wall near the cable entrance, so that the ground connection to BPG is less than 5 m (15 ft). Use 6-AWG conductor (minimum) for each set of 672 line protectors. The entrance cable bonding must also connect to the BPG.

Note 3: The transmit DS1 cable (as viewed from the perspective of the DSX-1 panel) is grounded at the DSX-1. The receive DS1 cable is grounded at the ABM shelf.

Figure 4-7
Grounding of MBP cabinets powered from a customer-supplied power source in a CBN

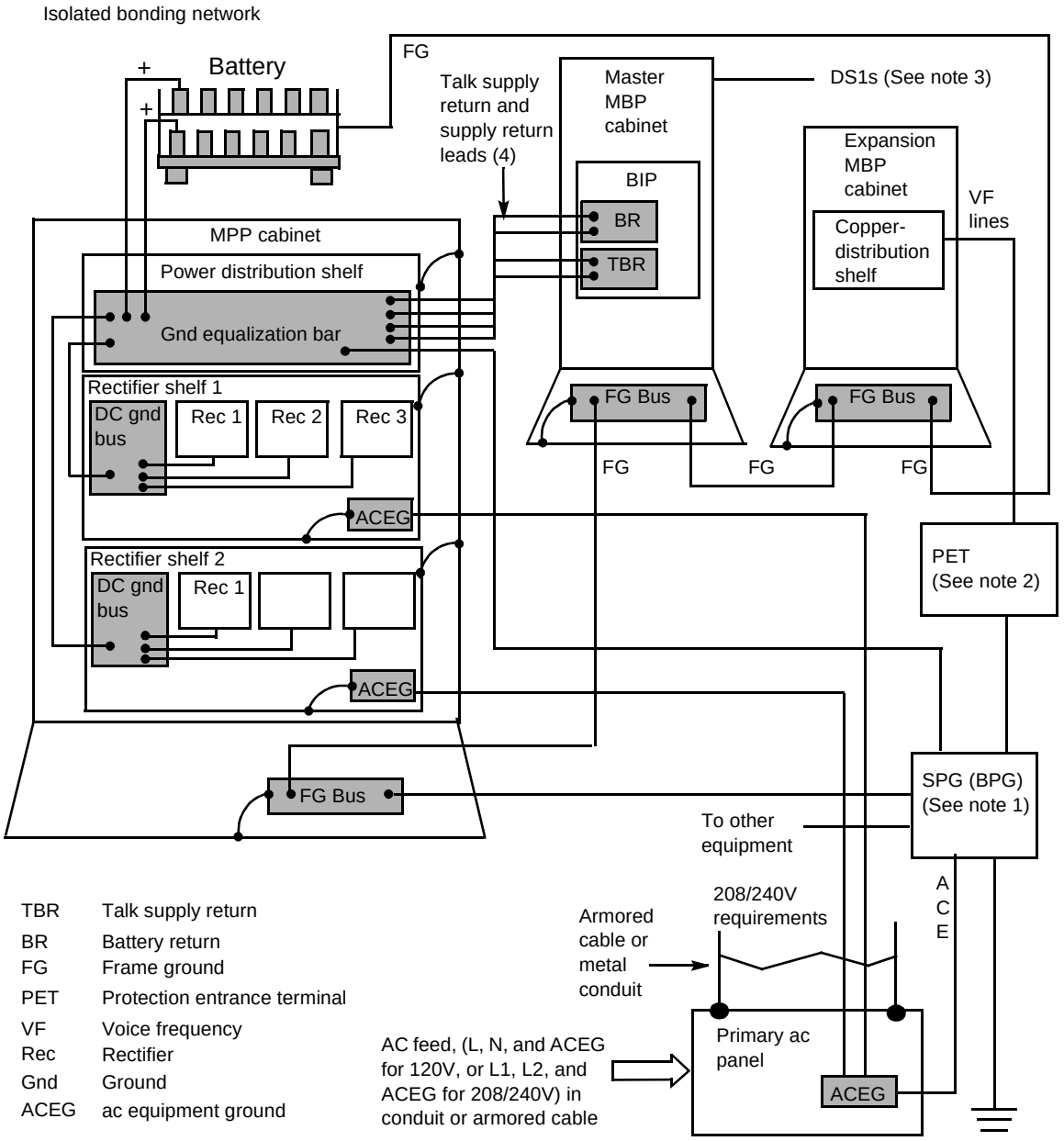


Note 1: In small buildings, the floor ground bar (FGB) may not exist. In such installations, the building principal ground (BPG) serves the same function.

Note 2: When VF lines exit a building, the protection entrance terminal (PET) should be mounted on an outside wall near the cable entrance, so that the ground connection to BPG is less than 5 m (15 ft). Use 6-AWG conductor (minimum) for each set of 672 line protectors. The entrance cable bonding must connect to the BPG.

Note 3: The transmit DS1 cable (as viewed from the perspective of the DSX-1 panel) is grounded at the DSX-1. The receive DS1 cable is grounded at the ABM shelf.

Figure 4-8
Grounding of MBP cabinets powered from an MPP cabinet in an IBN

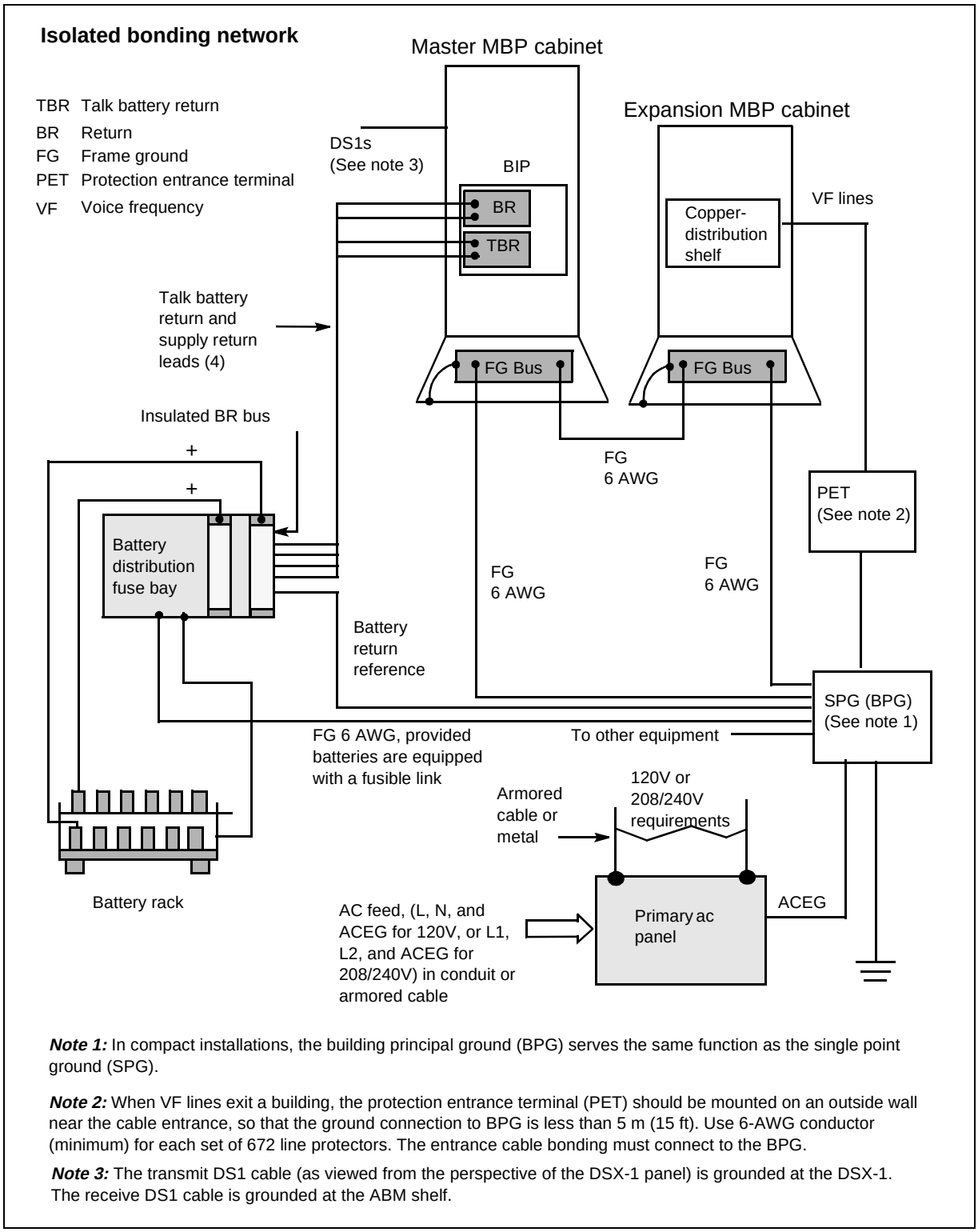


Note 1: In compact installations, such as customer-supplied equipment, the building principal ground (BPG) serves the same function as the single-point ground (SPG).

Note 2: When VF lines exit a building, the protection entrance terminal (PET) should be mounted on an outside wall near the cable entrance, so that the ground connection to BPG is less than 5 m (15 ft). Use 6-AWG conductor (minimum) for each set of 672 line protectors. The entrance cable bonding must connect to the BPG.

Note 3: DS1 cable shields are grounded at the transmit end only.

Figure 4-9
Grounding of MBP cabinets powered from a customer-supplied dc power source in an IBN



Note 1: In compact installations, the building principal ground (BPG) serves the same function as the single point ground (SPG).

Note 2: When VF lines exit a building, the protection entrance terminal (PET) should be mounted on an outside wall near the cable entrance, so that the ground connection to BPG is less than 5 m (15 ft). Use 6-AWG conductor (minimum) for each set of 672 line protectors. The entrance cable bonding must connect to the BPG.

Note 3: The transmit DS1 cable (as viewed from the perspective of the DSX-1 panel) is grounded at the DSX-1. The receive DS1 cable is grounded at the ABM shelf.

Floor space requirements

This chapter describes floor space planning requirements for modular business package (MBP) cabinet and modular power package (MPP) cabinets in equipment rooms at a remote site.

Chapter contents

This chapter contains the following information:

Floor space planning requirements for MBP cabinets in equipment rooms are described in the following paragraphs.

Equipment room size requirements

The recommended formula for calculating the equipment room size according to EIA and Canadian Standards Association (CSA)is as follows:

Size = {[Usable floor area (ft^2)] divided by [100 times number of workstations]} times 1.33

> ***Note:*** A workstation space where an occupant interacts with telecommunication equipment is 100 ft^2.

Floor loading requirements for equipment rooms

The floor loading requirement for the equipment room is defined in NEBS TR-EOP-000063, and includes the aisles and open areas associated with each system, based on an area of 1.0 m^2 (11.5 ft^2).

The floor loading should be sufficient to bear both distributed and concentrated loading in accordance with EIA and CSA, as follows:

Duty	Distributed loading	Concentrated loading
Light	732.3 kg/m^2 (150 lbs/$ft^{2)}$	0.19 kg/cm^2 (2.7 lbs/$in.^{2)}$
Medium	1220.5 kg/m^2 (250 lbs/$ft^{2)}$	0.31 kg/cm^2 (4.4 lbs/$in.^{2)}$
Heavy	1708.7 kg/m^2 (350 lbs/ft^2)	0.39 kg/cm^2 (5.6 lbs/$in.^{2)}$

Cabinet weights

Table 5-1 lists the approximate shipping weights for sample configurations of standard MBP and MPP cabinets.
Table 5-2 lists the approximate shipping weights for sample configurations of SONET transport signal bandwidth manager (STSBM) MBP and MPP cabinets.
Table 5-3 lists the approximate shipping weights for sample configurations of virtual tributary bandwidth manager (VTBM) MBP master and expansion cabinets.
Table 5-4 lists the approximate weights of the assemblies in a cabinet.

Because the number of possible configurations is large, it is impractical to include weights for all of them in the cabinet weight tables. If the weight of a cabinet configuration cannot be found in Table 5-1, Table 5-2, or Table 5-3, calculate it using Table 5-4 on page 5-5.

The following items are shipped separately from the cabinet assemblies and are not included in the cabinet weights listed in the tables.

- provisionable access bandwidth manager (ABM) shelf common-equipment cards
- provisionable transport bandwidth manager (TBM) shelf common-equipment cards
- copper-distribution shelf (CDS) line cards
- seismic kits
- rectifiers
- batteries
- repeaters

Table 5-1
Approximate shipping weights for sample standard system configurations

Item and description	Approximate shipping weight	
Mux configuration in standard MBP cabinet	167 kg	368 lb
Standard MBP configurations		
96-line standard MBP master cabinet	181 kg	400 lb
288-line standard MBP master cabinet	247 kg	544 lb
384-line standard MBP master cabinet	297 kg	656 lb
480-line standard MBP master cabinet	312 kg	688 lb
192-line standard MBP expansion cabinet	110 kg	243 lb
288-line standard MBP expansion cabinet	211 kg	465 lb
384-line standard MBP expansion cabinet	175 kg	385 lb
480-line standard MBP expansion cabinet	225 kg	495 lb
576-line configuration in two cabinets as follows:		
• standard 288-line master cabinet containing three copper-distribution shelves and a Fiber Manager Compact/8 fiber patch panel	256 kg	565 lb
• standard 288-line expansion cabinet containing three copper-distribution shelves, a DSX-1 panel, and a repeater shelf	211 kg	465 lb
672-line configuration in two cabinets as follows:		
• standard master cabinet containing three copper-distribution shelves	247 kg	544 lb
• standard expansion cabinet containing four copper-distribution shelves	175 kg	385 lb
Standard MPP cabinet with two rectifier shelves	199 kg	438 lb

Table 5-2
Approximate shipping weights for sample STSBM system configurations

Item and description	Approximate shipping weight	
STSBM MBP configurations		
192-line STSBM MBP master cabinet	308 kg	678 lb
192-line STSBM/VTBM MBP expansion cabinet	240 kg	528 lb
288-line STSBM/VTBM MBP expansion cabinet	266 kg	585 lb
384-line STSBM/VTBM MBP expansion cabinet	283 kg	622 lb
480-line STSBM/VTBM MBP expansion cabinet	300 kg	660 lb
STSBM MPP cabinet with one rectifier shelf	251 kg	552 lb

Table 5-3
Approximate shipping weights for sample VTBM system configurations

Item and description	Approximate shipping weight	
VTBM MBP configurations		
192-line VTBM MBP master cabinet	297 kg	653 lb
192-line STSBM/VTBM MBP expansion cabinet	240 kg	528 lb
288-line STSBM/VTBM MBP expansion cabinet	266 kg	585 lb
384-line STSBM/VTBM MBP expansion cabinet	283 kg	622 lb
480-line STSBM/VTBM MBP expansion cabinet	300 kg	660 lb

Table 5-4
Approximate weights of assemblies for calculating shipping weights

Item and description	Weight	
Packaging for shipping a cabinet (consists of the pallet, the carton, bubble pack, anchor brackets, and strapping)	27.3 kg	(60 lb)
Top cap assembly	6.4 kg	(14 lb)
Dual-equipment module (no equipment shelves, cables, or side panels, but with separator and equipment covers)	68.1 kg	(149 lb)
Single-equipment module (no equipment shelves, cables or side panels, but with equipment covers)	33.6 kg	(74 lb)
Battery-equipment module (no equipment shelves, cables or side panels, but with equipment covers)	37.3 kg	(82 lb)
Pedestal assembly with blower unit	39.5 kg	(87 lb)
Pedestal assembly without blower unit	31.8 kg	(70 lb)
Side panel for SEM or DEM shelf	1.0 kg	(2.2 lb)
Fiber Manager Compact/8 fiber patch panel	9.5 kg	(21 lb)
Access bandwidth manager shelf (without provisionable cards)	16.3 kg	(36 lb)
Copper-distribution shelf (without line cards or power converters)	14.5 kg	(32 lb)
Breaker interface panel	10.5 kg	(23 lb)
Local craft access panel	2.7 kg	(6 lb)
T1 repeater shelf (empty)	5 kg	(11 lb)
Repeater card	0.2 kg	(0.5 lb)
DSX-1 shelf	9.5 kg	(21 lb)
Line card for copper-distribution shelf	0.9 kg	(0.2 lb)
Power converter pack for copper-distribution shelf	1.6 kg	(3.5 lb)
Card for ABM shelf	0.9 kg	(2.1 lb)
NT6C14JA dc distribution shelf	24.5 kg	(54 lb)
NT4K35AA dc distribution unit	1.8 kg	(4 lb)
NT4K36AA LVD unit	3.6 kg	(8.0 lb)
Battery string	181.8 kg	(400 lb)
Seismic kit	9.1 kg	20 lb)
Empty rectifier shelf	10.5 kg	(23 lb)
Rectifier	6.7 kg	(14 lb)

Cabinet dimensions

The cabinet dimensions are shown in Table 5-5.

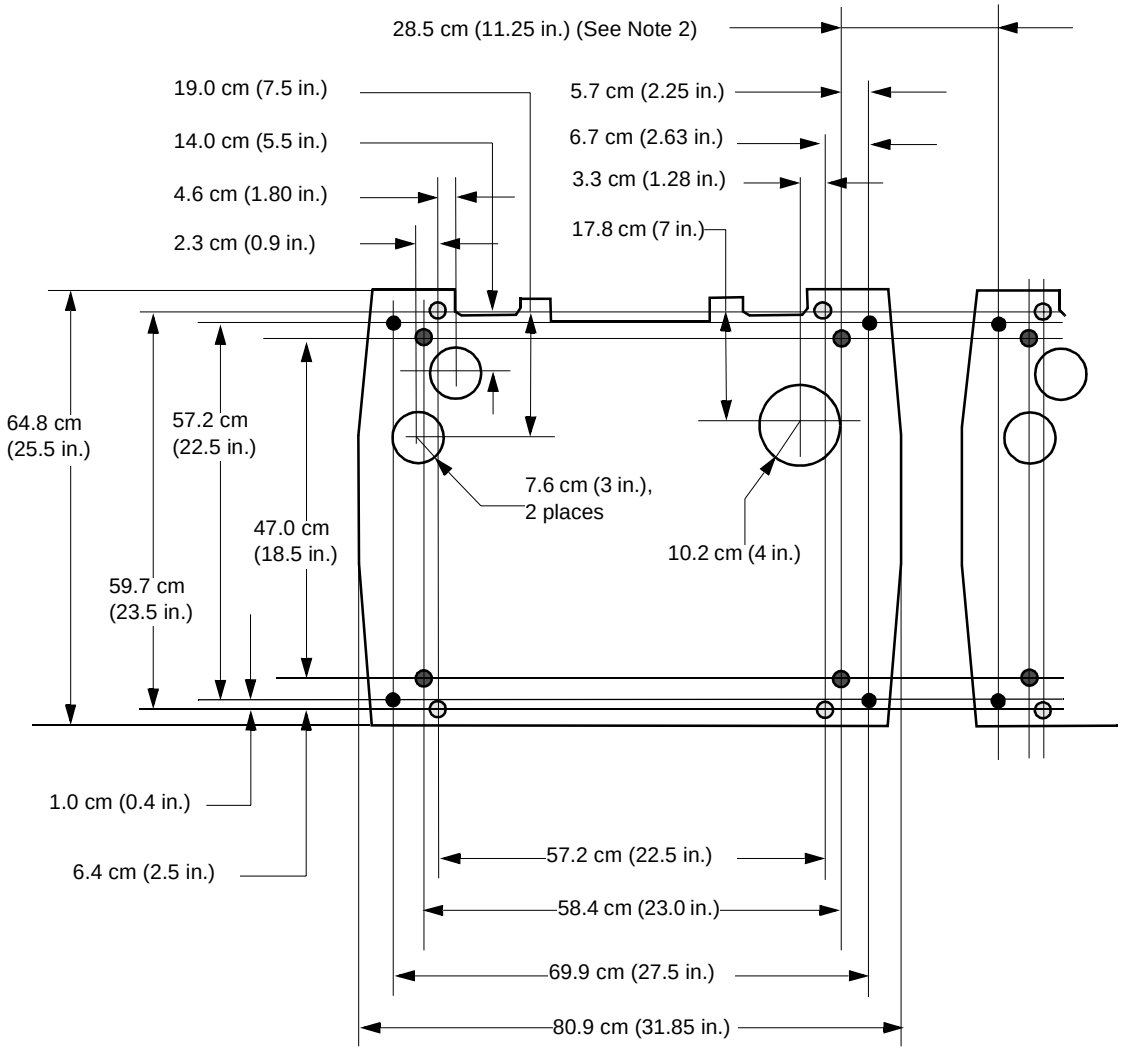
Table 5-5
MBP cabinet dimensions

Dimension	Value	
width		80.9 cm (31.85 in.)
depth		64.8 cm (25.5 in.)
height	The height of a cabinet varies from: 77.5 cm (30.5 in.) to 207 cm (81.5 in.) according to the number of single-equipment modules and dual-equipment modules in the cabinet.	
	Heights of individual modules are as follows:	
	• top cap	8.9 cm (3.5 in.)
	• single equipment module	42.5 cm (16.75 in.)
	• dual equipment module	84.7 cm (33.5 in.)
	• base equipment module	42.5 cm (16.75 in.)
	• battery equipment module	42.5 cm (16.75 in.)
	• pedestal	25.4 cm (10.0 in.)
	• allowance for casters or levelling feet	8.9 cm (3.5 in.)
	• allowance shipping pallet and packaging material	20.3 cm (8.0 in.)
clearance between mounting rails		54.6 cm (21.5 in.)
horizontal mounting centers		56.6 cm (22.3 in.)

Cabinet footprint

The footprint for MBP and MPP cabinets is shown in Figure 5-1.

Figure 5-1
Cabinet footprint



Legend

- Levelling feet or casters
- Primary anchor plate location (seismic anchor kits only)
- Pedestal anchor location (standard anchor kit only)
- Pedestal conduit openings (MPP cabinet, raised floors only)

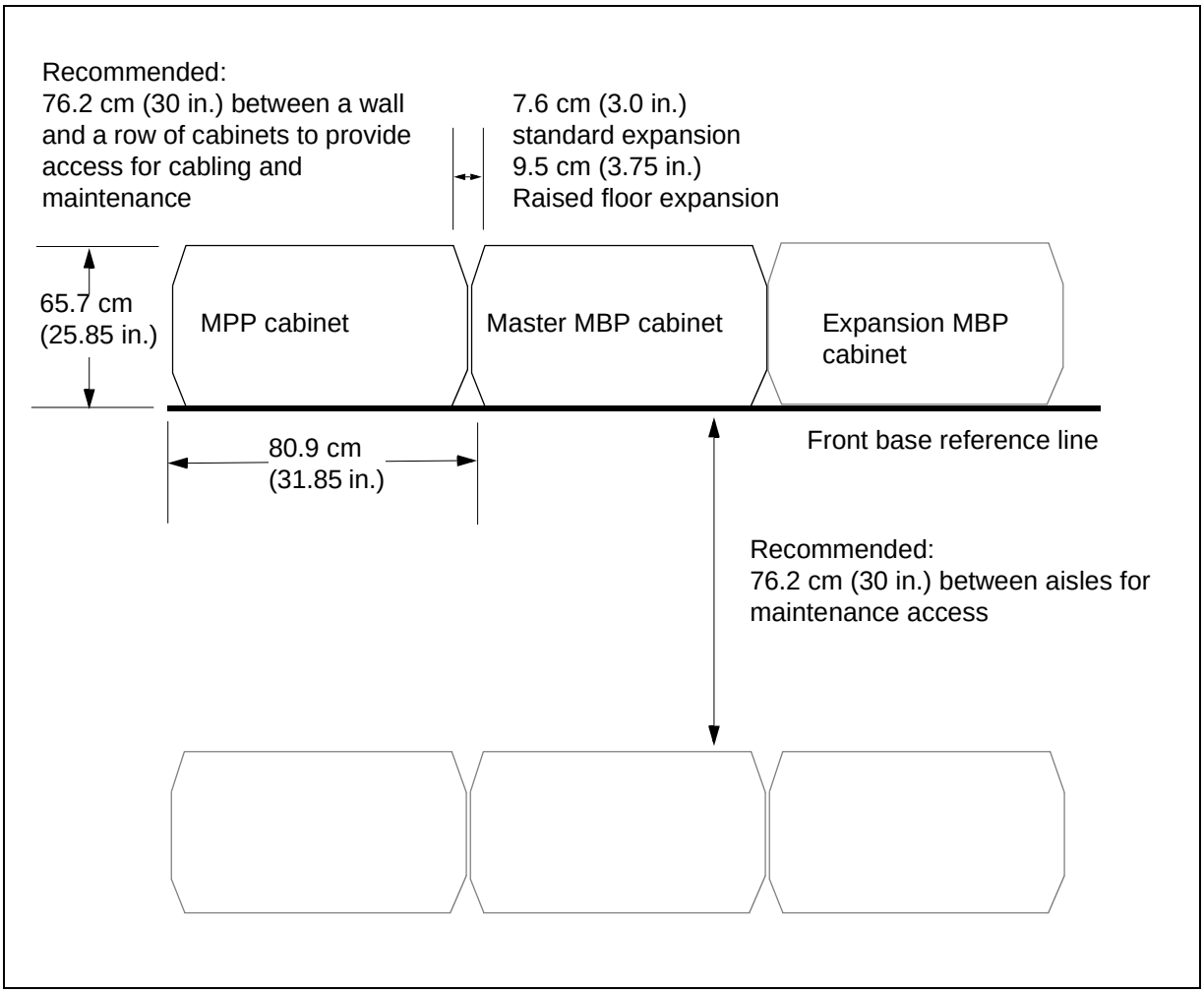
Note 1: This illustration is not to scale. For laying out and marking the floor, Nortel Networks recommends that you use cabinet mounting template, NT4K0601.

Note 2: The spacing between cabinets is governed by the expansion kit used. The hole spacing shown here is for the NT8D49AA concrete floor expansion kit. For the NT8D49BA expansion kit, this spacing is 26.7 cm (10.5 in.).

Floor space requirements for cabinets

The floor space requirements for cabinet lineups are shown in Figure 5-2.

Figure 5-2
Floor space requirements for MBP cabinets



Effects of cable length limits on equipment location

The following cable length limits can affect the location of cabinets, relative to the location of the interfacing equipment.

Power	Power cables that connect the BIP to the MPP cabinet or to the battery distribution frame are 6 AWG. To avoid excessive voltage drop, the maximum length of the cables supplied by Nortel Networks for this purpose 10.7 m (35 ft). Longer runs are possible with larger gauge wire supplied by the customer.
DS1	Allow a maximum cable length of 200 m (655 ft) to interface the DSX-1 cross-connect for systems without repeaters.

Note: Complete details of cable requirements are described in a separate chapter starting on page 8-1.

Overhead cable rack hardware requirements

Modular business package (MBP) cabinets can be used on installations with overhead cable racks. The overhead cable rack is the responsibility of the operating company.

Site preparation

This chapter outlines preparations that must be made at the site prior to the arrival of the system to be installed.

Chapter contents

This chapter contains the following information:

Site preparation and planning requirements for MBP cabinets in equipment rooms are described in the following paragraphs.

Cautions

Observe the following cautions:

CAUTION
Avoid structural stress when maneuvering uncrated cabinets

When handling and moving uncrated cabinets, exercise care to avoid strain, excessive shock, or vibrations, which might damage the equipment or the cabinet. Keep the cabinets on their pallets until they reach the equipment room.

DANGER
Risk of injury when maneuvering cabinets

Uncrated cabinets weigh from 170 kg (380 lb) to 280 kg (630 lb) kg. Use at least three people to maneuver a cabinet.

Receiving and moving the equipment

All areas and passageways must be accessible to allow unhindered transport of crated cabinets from the receiving area to the area of installation.

Any uneven floors must be prepared in advance to ensure smooth movement when transporting crated or uncrated cabinets.

Equipment must be kept vertical, and moved by the bottom skid. Cabinets must never be placed on their sides.

The dimensions of door openings and entrance ways must be verified against the information in “Cabinet dimensions” on page 5-6 to allow the cabinets to pass through.

Installation space considerations

Cabinets should be installed with a minimum of 76.2 cm (30.0 in.) between the front and rear of the cabinet and adjacent walls or equipment to allow a safe working area for installation.

Lighting

In-house lighting or portable lighting must be available to provide sufficient lighting for safe working conditions.

Future expansion

This chapter contains guidelines for provisioning additional equipment in an installed system.

Chapter contents

This chapter contains the following information:

System expansion

The AccessNode system packaged in modular business package (MBP) and modular power package (MPP) cabinets can be expanded in the following ways:

- by adding an expansion cabinet to an existing system contained in a master cabinet
- by adding additional field expansion modules to accommodate copper-distribution shelves or other external equipment
- by adding copper-distribution shelves to increase the DS0 services capacity up to a maximum of 672 lines per system
- by adding additional DS1, DS3 or OC-3 tributary equipment to the common-equipment shelf
- by adding additional powering equipment to an MPP or a VTBM master cabinet (for example, adding a rectifier or rectifier shelf)

Adding an expansion cabinet

An expansion cabinet may be added to an existing system. The following considerations must be addressed:

- floor space requirements (see “Floor space requirements for cabinets” on page 5-8)
- floor loading (see “Floor loading requirements for equipment rooms” on page 5-2)
- space for additional VF cross-connect facilities

Expansion from 96 lines to 672 lines

The line capacity of a system can be increased from 96 lines to 672 lines by:

- adding NT4K06CA field expansion modules (FEMs) containing copper-distribution shelves
  - — The FEMs can be purchased with one copper-distribution shelf to expand an existing system by 96 lines, or with two copper-distribution shelves to expand a system by 192 lines. FEMs can be added to the master cabinet or the expansion until the cabinet is four modules high.

  Note: A field expansion module is considered to be one module in height, a single-equipment module is considered to be one module in height, and a dual-equipment module is considered to be two modules in height.

- adding a factory-wired NT4K06BA or NT4K06BB expansion cabinet adjacent to the master cabinet to contain the additional copper-distribution shelves
  - — Expansion cabinets can be installed adjacent to the master cabinet. Standard NT4K06BA expansion cabinets attach to standard master cabinets and the NT4K06BB VTBM expansion cabinet can attach to the SONET transport signal bandwidth manager (STSBM) or the VTBM master cabinet.

Expansion for OC-3 tributaries

OC-3 optical interface units can be added to provide OC-3 tributaries to the system for optical transport of 3 DS1s or STS-1s to a remote location.

Note: OC-3 tributary functionality requires OC-12 primary and secondary optics and NT4K52FB processor cards in the common-equipment shelf.

Addition of a DSX-1 shelf and a T1 repeater shelf

A DSX-1 shelf and a Rockwell T1 repeater shelf mounted in a field expansion module (FEM) can be added to an installed system.

The FEM containing the DSX-1 shelf and the T1 repeater shelf can be added to an NT4K06BA expansion cabinet, provided the expansion cabinet contains fewer than three single-equipment modules (SEMs) before adding the FEM Up to 14 repeaters (a repeater contains transmit and receive circuits) can be provisioned in the repeater shelf to support a maximum of 14 DS1s.

The T1 repeater shelf and the LEDs in the DSX-1 shelf can be powered in one of three ways:

- from the dc distribution harnesses that are connected to the breaker interface panel (BIP) in the master MBP cabinet
- from an MPP cabinet
- from an external customer-supplied power source

In systems containing from one to six copper-distribution shelves, the repeaters and LEDs are powered from the dc distribution harnesses connected to the BIP. In systems containing seven copper-distribution shelves, the power for the repeaters and LEDs must be provided by an external source.

The external power source can be obtained by connecting a power cable to terminal blocks in the MPP cabinet. These terminal blocks contain feeds to an auxiliary power connector on the rear of the dc distribution shelf that can be used for powering the DSX-1 shelf and the T1 repeater shelf. In systems that are not equipped with an MPP cabinet, the external power source must be provided by the customer.

Addition of a fiber patch panel

A FiberManager Compact/8 fiber patch panel can be purchased and added to the system at the rear of the DEM in the master cabinet as shown in Figure 2-10 on page 2-18.

The number of OC-3 tributaries in the system is restricted by the capacity of the FiberManager Compact/8 fiber patch panel. Internally spliced primary and secondary optics must be configured first and then any additional fiber capacity can be filled with OC-3 tributaries. OC-3 tributaries require two fibers, one transmit fiber and one receive fiber, per unit.

> ***Note:*** OC-3 tributary functionality requires OC-12 primary and secondary optics and NT4K52FB processor cards in the common-equipment shelf.

Addition of rectifiers to an MBP or MPP cabinet

Additional rectifiers or an additional rectifier shelf can be added to MBP/MPP cabinets for the following reasons:

- to support additional copper-distribution shelves
- to support optional transport equipment
- to upgrade reserve power requirements for the backup batteries

Each rectifier shelf holds 3 rectifiers. Each rectifier is rated at 25 Amp output.

NT4K06ED and NT4K07BB

These MBP/MPPs contain a single rectifier shelf with a maximum of 3 rectifiers. Most 672 line systems require 2 rectifiers. For Transport shelves or power reserves, a third rectifier may be required.

NT4K07AA

This MPP cabinet contains a maximum of two rectifier shelves with up to four rectifiers. The NT4K07AA cabinet is factory equipped with one rectifier shelf that contains up to three rectifiers. For systems that require more than three rectifiers, a second rectifier shelf is ordered and installed in the NT4K07AA cabinet below the first shelf. The second shelf contains a maximum of one rectifier installed in the right-most position. The remaining two positions in the second shelf (middle and left-most) must be covered by blank cover plates. The four rectifier set satisfies the maximum allowed safety rating for battery backup feeders.

General

The sparing scheme for all MBP/MPP rectifiers is an “n+1” scheme in which the minimum number of rectifiers is two rectifiers: one for the load plus one spare.

Most 672-line MBP systems plus one repeater shelf can be supported by 3 rectifiers (one rectifier shelf) and satisfy the N+1 redundancy rule.

Table 7-1 shows the scheme for provisioning rectifiers according to equipment contained in the NT4K06ED MBP cabinet. Table 7-1 also contains the recommendations for provisioning battery backup power.

Table 7-1
Provisioning and power scheme for the NT4K06ED MBP cabinet

System configuration	Number of rectifier shelves	Number of rectifier modules	Number of battery strings required	Recommended Ah rating for battery backup power (See Note)
Multiplexer (0 lines)	1	2	1	125 Ah
96 to 192 lines	1	2	1	125 Ah
288 lines to 672lines	1	3	2	250 Ah
Note: These figures represent the recommended total Ah rating for battery backup power. This calculation is based on Johnson Control TEL12-125 batteries providing 125 Ah per string for eight-hour backup operation at 25^{o}C with no low-temperature overrating.				

Table 7-2 shows the scheme for provisioning rectifiers according to equipment contained in the NT4K07AA and NT4K07BB MPP cabinets. Table 7-2 also contains the recommendations for provisioning battery backup power.

Table 7-2
Provisioning and power scheme for the NT4K07AA and NT4K07BB MPP cabinets

System configuration	Number of rectifier shelves	Number of rectifier modules	Number of battery strings	Ah rating for battery backup power (See Note)
NT4K07AA	1 or 2	1-4	none	none
NT4K07BB	1	1-3	1-2	100 or 200 Ah
Note: These figures represent the recommended total Ah rating for battery backup power. This calculation is based on Johnson Control TEL12-100 batteries.				

External cabling requirements

This chapter describes the cabling requirements for AccessNode equipment in modular business package (MBP) cabinets and for dc power equipment in a modular power package (MPP) cabinet.

Chapter contents

This chapter contains the following information:

Definition of external cables

The following pages describe the external cables that require connection at installation. External cabling is defined as:

- between any building or office ground connection point and any MBP or MPP cabinet
- between the ac panel and the MPP or virtual tributary bandwidth manager (VTBM) MBP master cabinet
- between any termination point that is located outside of the MPP or MBP cabinets and the cabinets (including fiber management facilities)
- between any MBP and a remotely located MPP (up to 10.7 m (35 ft))

Intra-cabinet cables, that is cables that connect a co-located MPP to an MBP master cabinet and cables that connect an MBP master to the MBP expansion cabinets, are not considered external cables for the purpose of site planning and engineering. Therefore, they are not included in this section.

General equipment cabling rules

For site planning and engineering, heed the following general equipment and cabling rules:

Note: All signal carrying cables are also subject to the grounding requirements described in "Power and grounding" on page 4-1.

- Equipment cabinets that require significant interconnecting cables should be clustered together in the same lineup, or at least within the same area.
  - — The maximum distance between MPP and MBP master cabinet is 10.7 m (35 ft). MBP master cabinets and MPB expansion cabinets must always be located adjacent to each other and connected with an expansion kit.
- External signal cables must be routed in grounded cable troughs or cable racks.
- RS-232 connections must be connected through an external modem for any of the following conditions:
  - — the terminal is more than 12.6 m (50 ft) from the cabinet or the terminal is located in a different grounding network or in a grounding network of a different type
- VF cable connections that exit the building in which the AccessNode is installed must be protected by gas discharge protectors at a protector frame. These protectors must be connected to the building principal ground (BPG), preferably within 5 m (15 ft) of the BPG.
- Shielded cables must interconnect equipment that is bonded to the same ground point.

- Interconnection between clusters of equipment frames, or frames not within the same bonding network, must be as follows:
  - — routed through grounded ducts if in a CBN or between two CBNs or routed through the SPG if entering or exiting an IBN, so that cable shields or other ground leads can be referenced to the SPG.
- AC equipment ground (ACEG) must be isolated from the equipment frame ground in IBN grounding networks.

External cabling requirements

Considerations for external cabling for site planning and engineering the MBP system is described in the following paragraphs. Considerations for each type of cabinet are detailed.

Ground cabling applies to all cabinets. See "Grounding schemes" on page 4-14 for detailed cabinet ground cabling requirements.

Standard MBP master cabinets

External cabling to consider for site planning and engineering the standard MBP master cabinet is as follows:

For cabling information about	See section	
dc input power feeds	- 48 V dc power cabling	on page 8-6
external battery back-up	Battery cables	on page 8-7
alarms	Alarm cable from an MPP to an MBP	on page 8-8
DS1	DS1 signal cable	on page 8-9
DS3	DS3 signal cable	on page 8-11
fiber optics	Optical patch cords	on page 8-12
orderwire	Orderwire extension cable	on page 8-16
external modem	RS232 DTE Modem cable	on page 8-17
test access	Test access path cable (TAP)	on page 8-18
user interface	User interface cable for the LCAP	on page 8-19
VF	VF copper cable	on page 8-20

STSBM master cabinets

External cabling to consider for site planning and engineering the SONET transport signal bandwidth manager (STSBM) MBP master cabinet is as follows:

For cabling information about	See section	
dc input power feeds	- 48 V dc power cabling	on page 8-6
alarms	Alarm cable from an MPP to an MBP	on page 8-8
DS1	DS1 signal cable	on page 8-9
DS3	DS3 signal cable	on page 8-11
fiber optics	Optical patch cords	on page 8-12
orderwire	Orderwire extension cable	on page 8-16
external modem	RS232 DTE Modem cable	on page 8-17
test access	Test access path cable (TAP)	on page 8-18
user interface	User interface cable for the LCAP	on page 8-19
VF	VF copper cable	on page 8-20

VTBM master cabinets

External cabling to consider for site planning and engineering the VTBM MBP master cabinet is as follows:

For cabling information about	See section	
ac input power	Commercial ac power cabling	on page 8-5
DS1	DS1 signal cable	on page 8-9
DS3	DS3 signal cable	on page 8-11
fiber optics	Optical patch cords	on page 8-12
orderwire	Orderwire extension cable	on page 8-16
external modem	RS232 DTE Modem cable	on page 8-17
test access	Test access path cable (TAP)	on page 8-18
user interface	User interface cable for the LCAP	on page 8-19
VF	VF copper cable	on page 8-20

Standard and STSBM expansion cabinets

External cabling to consider for site planning and engineering the standard and STSBM MBP expansion cabinets is as follows:

For cabling information about	See section	
VF	VF copper cable	on page 8-20
DSX-1 cross-connect	Repeater shelf	on page 8-21

VTBM expansion cabinets

External cabling to consider for site planning and engineering the MBP expansion cabinets is as follows:

For cabling information about	See section	
VF	VF copper cable	on page 8-20

MPP cabinets

External cabling to consider for site planning and engineering the standard and STSBM MPP cabinets is as follows:

For cabling information about	See section	
ac input power	Commercial ac power cabling	on page 8-5
external battery back-up	Battery cables	on page 8-7
dc output power feeds to the MBP master cabinet	- 48 V dc power cabling	on page 8-6
alarms	Alarm cable from an MPP to an MBP	on page 8-8

Power cables

Cabling for commercial ac power and – 48 V dc power is described in the following paragraphs. Descriptions of individual cables in the following paragraphs only include cables that are connected as part of system installation or system expansion.

Commercial ac power cabling

The commercial ac power source terminates in an ac distribution panel (supplied by the customer). This power source and the panel must conform to the national and local electrical codes, and the recommended office ground

scheme described in "AC power" on page 4-8. The location of the distribution panel determines the length of conduit and wiring to feed rectifier and battery power plants, and any ac utility receptacles, if required.

The sizes of ac and entrance distribution feed cables must conform with the information contained in national electrical codes as follows:

In the United States	Table 250-94, of the National Electrical Code (NEC)
In Canada	Table 17, of the Canadian Electrical Code (CEC)

The entrance cabling for commercial ac power must be installed by the local power utility. The subsequent ac power panel wiring must be completed by a qualified electrician.

208/240 V ac power for an MPP cabinet

A system powered from an MPP cabinet operates from a commercial source of three-phase/single-phase 208/240 V ac. One 208/240 V ac feed rated at 40 A from an ac panel is required for each rectifier shelf provisioned in an MPP cabinet. The MPP cabinet can be connected to the dedicated ac panel by armored cable, or by conductors enclosed in metal conduit. The ac distribution panel, the receptacles, and 208/240 V ac wiring are the responsibility of the customer.

> ***Note:*** Each feeder line must be protected by one 40 A fuse. For example, place 40 A fuses on both L1 and L2 for single-phase circuits and on L1, L2, and L3 for three-phase circuits.

See Figure 4-2 on page 4-10 and Figure 4-3 on page 4-11 for schematic diagrams of the wiring required.

120 V ac utility receptacles

An AccessNode system in standard MBP cabinets does not require a source of 120 V ac commercial power to operate. However, we recommend installing two 120 V ac receptacles in the equipment room to power portable terminals and printers connected temporarily to the AccessNode, and to permit the use of other customer-supplied equipment. The cabling between the ac distribution panel and the 120 V ac utility receptacles are the responsibility of the customer.

– 48 V dc power cabling

Direct current – 48 V dc power for AccessNode equipment in standard and STSBM MBP master cabinets can be provided from an external customer-supplied dc power plant or from dc power equipment contained in the MPP cabinet.

To supply power to the MBP, four 2-conductor main power cables are required. Each cable is comprised of one 6 AWG red jacketed conductor for the – 48 V dc supply, and one 6 AWG white jacketed conductor for return. One cable is required for each of the four battery and return feeds to master MBP cabinet.

Nortel Networks manufactures an NT4K81AA dc power cable to supply this power from an attached MBP cabinet. Power cables from a customer-supplied external source of power, or from a remote MPP cabinet are the responsibility of the customer. The wire sizing and run lengths for customer-supplied cables must conform to local electrical codes. Unless specified otherwise in the electrical codes the cable conductor size is 6 AWG with a maximum cable run length of 10.7 m (35 ft).

Battery cables

For standard MBP systems, with or without MPP cabinets, the battery back-up equipment and cables are the responsibility of the customer. STSBM and VTBM cabinet systems provide internal space for battery back-up and all wiring and cabling is internal to the cabinets.

Terminal blocks at the rear of the MPP cabinet are equipped with No. 10 screw terminals that are designed to accept ring lugs for supply and return leads from up to six battery strings in an external battery rack (12 leads total).

The installation and connection of all battery back-up to the standard MPP shall comply with all national, state, and local codes governing equipment of this type. The conductors between the MPP and the battery back-up system shall be treated as “TAP” conductors, tapped from the common dc bus. The available current from this bus shall be calculated as follows:

- 25 A per rectifier (maximum 4)
- 30 A per battery string (maximum 6)

The conductors must be terminated with 30 A over-current protectors that are provided as part of the battery source. The conductors must be not longer than the maximum 7.62 m (25 ft) in length of 4 AWG wire rated for 90 degrees C. The conductors must be protected from physical damage or enclosed in a raceway where not more that three feeders per raceway are installed (reference NEC 240-3 (d) for relevant wire application information).

External signal cable descriptions

The following sections describe the external signal cabling for the AccessNode modular business package (MBP) systems.

Blower power from the dc distribution shelf to the PDU of an MPP

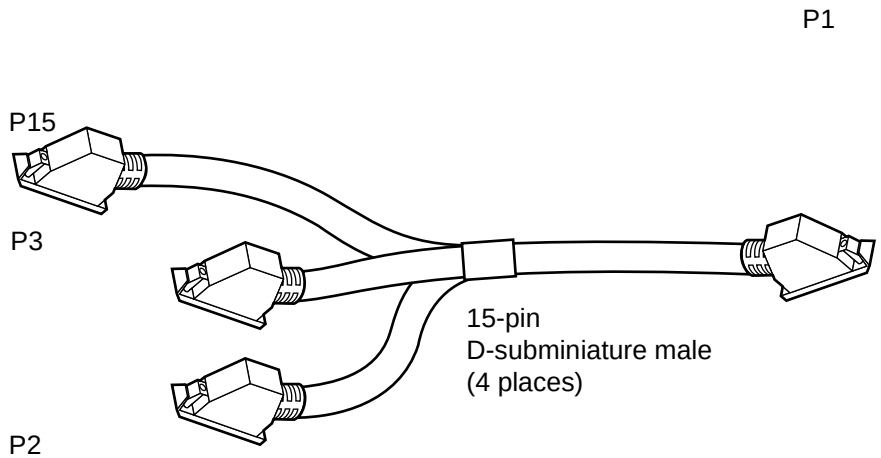
The dc distribution shelf to PDU power cable (NT4K82GA) is used to supply power to a blower unit installed in the pedestal of an MPP cabinet. This blower unit and cabling is installed in the MPP cabinet when the cabinet is equipped with a second rectifier shelf as part of a system expansion.

Alarm cable from an MPP to an MBP

The NT4K83CA, CB alarm cable connects between the PDU of an MBP cabinet and the PDU and dc distribution shelf of an MPP cabinet. Its purpose is to carry alarms for conditions such as a high cabinet temperature or an open cabinet door from the MPP cabinet to the MBP cabinet. If the system is equipped with an expansion MBP cabinet, the cable attaches to the PDU of the expansion cabinet. If an expansion cabinet is not used, the cable attaches to the PDU of the master MBP cabinet.

PC-11005

NT4K83CA or CB



24 conductors, 24 AWG, solid wire with 15-pin D-subminiature connectors.

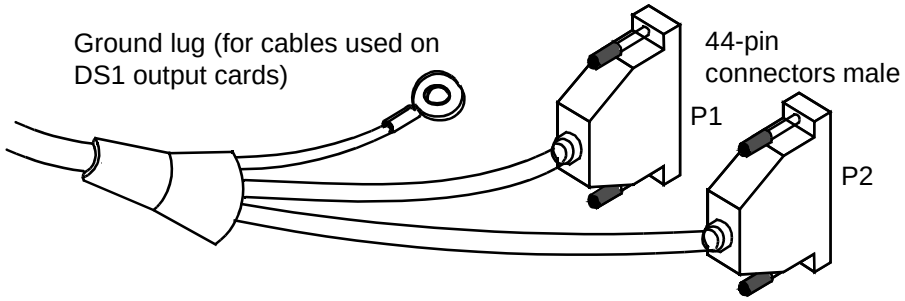
1.6 m	(5.5 ft)	NT4K83CA
10.6 m	(35.0 ft)	NT4K83CB

DS1 signal cable

The DS1 cable connects the 1.544 Mb/s signals of two DS1 input cards or two DS1 output cards on the access bandwidth manager (ABM) shelf, to an external office DS-1 cross-connect panel or to a DSX-1 shelf installed in an MBP cabinet.

Note: For information on planning your DS1/DS3 mapper layout, see *Mapper Layouts Planning Guide*, 323-3001-154, in the *Engineering, Configuration, and Ordering Guide*, Volume 1.

NT4K85HA through HJ DS1 cables and NT4K85UA DS1 pigtail



NT-613 30 pair, twisted, 22 AWG solid wires with overall shielding. One end is split (15 pairs each) and connected to two 44-pin connectors (terminating 14 pairs each). For cables used on DS1 output connectors, a ground lug wire provides connection of the outer shield to the ABM shelf frame ground. The ground lug wire is not used for DS1 input connectors. The DS1 cable is available in the following lengths:

3 m	(10 ft)	NT4K85UA (used with internal DSX-1 shelf)
15 m	(50 ft)	NT4K85HH
30 m	(100 ft)	NT4K85HA
46 m	(150 ft)	NT4K85HB
61 m	(200 ft)	NT4K85HJ
76 m	(250 ft)	NT4K85HC
107 m	(350 ft)	NT4K85HD
137 m	(450 ft)	NT4K85HE
168 m	(550 ft)	NT4K85HF
198 m	(650 ft)	NT4K85HG

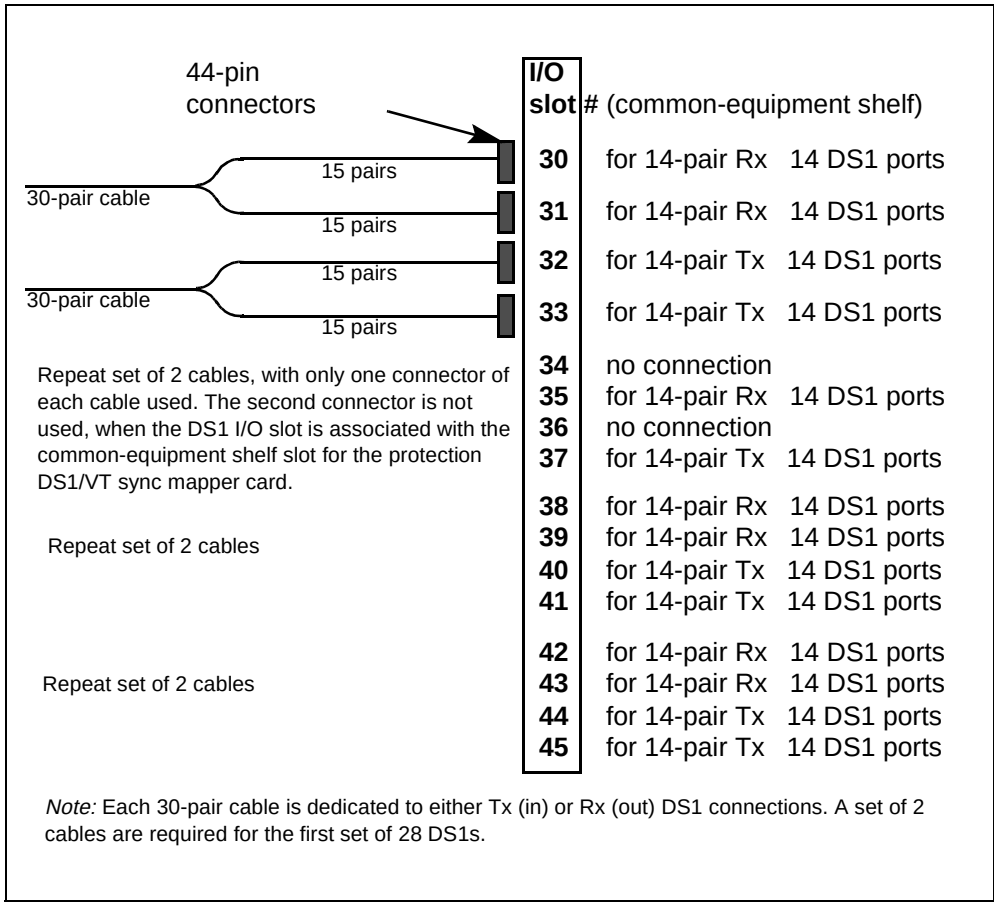
Each split-end cable is dedicated to either two DS1 Input cards (14 DS1s each), or two DS1 Output cards (14 DS1s each).

The length of NT-613 cable to an external DSX-1 cross-connect must not exceed 200 m (655 ft). If an internal DSX-1 is used, this cabling is factory-installed.

Figure 8-1 shows the connection of DS1s to the I/O area of the ABM shelf.

Figure 8-1
DS1 signal cable connections to the common-equipment shelf I/O cards

PC-10013



To minimize cable congestion, DS1 cables that are connected to the I/O cards in slots 30 to 42 of the I/O area of the ABM shelf are routed down the left side of the cabinet. Cables to the DS1 cards in slots 43 and up are routed down the right side.

On cables that connect to DS1 input cards, the ground lug at the I/O shelf end of the cable is not used. The unused ground lug is cut off, and the cut end is folded back on itself and protected against shorting with heat-shrinkable tubing. The ground lug at the DSX-1 panel end of the cable is connected to a ground point on the DSX-1 panel.

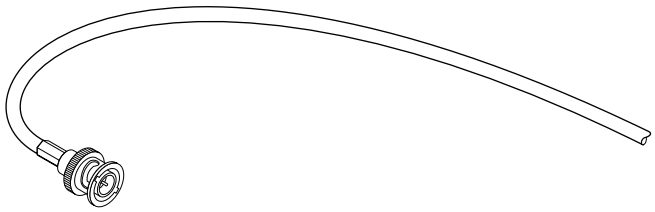
On cables that connect to DS1 output cards, the opposite is true. The ground lug at the DSX-1 panel is not used. The unused ground lug is cut off, and the cut end is folded back on itself and protected against shorting with heat-shrinkable tubing. The ground lug at the I/O shelf end of the cable is connected to a ground point on the ABM shelf.

DS3 signal cable

The DS3 cable connects the signals of DS3 Input or DS3 Output cards on the ABM shelf to an external office DSX-3 cross-connect panel. One DS3 input cable and one DS3 output cable is required for each I/O card. (There are cable connectors on each I/O card for DS3 input and DS3 output.)

FW10068

NT7E43AA through AH, and NT7E43AJ through AL



NT-734-E coaxial cables pre-connectorized at one end with a BNC connector. These cables are available in the following lengths:

5 m	(16.4 ft)	NT7E43AA
10 m	(32.8 ft)	NT7E43AB
20 m	(65.6 ft)	NT7E43AC
30 m	(98.4 ft)	NT7E43AD
40 m	(131.2 ft)	NT7E43AE
50 m	(164 ft)	NT7E43AF
60 m	(196.8 ft)	NT7E43AG
75 m	(246 ft)	NT7E43AH
80 m	(264 ft)	NT7E43AJ
100 m	(328 ft)	NT7E43AL
140 m	(459.2 ft)	NT7E43AK

It is recommended that you use a Schleuniger coaxial stripper tool Model HZ207A (Tool room number T00067) and BNC connector kit (Tool room number K000702) when installing BNC connectors in the field.

Note: For information on planning your DS1/DS3 mapper layout, see *Mapper Layouts Planning Guide*, 323-3001-154, in the *Engineering, Configuration, and Ordering Guide*, Volume 1.

Optical patch cords

Fiber patch cords, single-mode overall jacketed cable with or without miniature variable optical attenuators (mVOA), connect the OC-3 and OC-12 optical signals between the common-equipment shelf (ABM or TBM) and a fiber management facility such as a fiber patch panel or the Fiber Manager Compact/8 available from Nortel Networks.

Note 1: Optical patch cords and pigtails with miniature variable optical attenuators install at the receiver of the OC-3 or OC-12 optical interfaces.

Note 2: To each common-equipment shelf, four fiber cables are required for primary transport, and eight optional cables for secondary and tributary transport access.

Note 3: Optical patch cords are routed inside a horizontal channel of the common-equipment shelf to the right side of the cabinet. They are then encased in flexible split tubing for protection. Typically, 18 mm (0.75 in.) diameter split tubing accommodates 4 to 14 fiber patch cords. The length of split tubing corresponds to the length required for the fiber cabling.

Refer to the following tables for listings of the different optical fiber cables that are available for MBP applications.

- Table 8-1, “Optical patch cords”
- Table 8-2, “Optical patch cords with miniature variable optical attenuators”
- Table 8-3, “Optical pigtails”
- Table 8-4, “Optical pigtails with miniature variable optical attenuators”

Table 8-1 lists the optical patch cords that are used in MBP applications.

Table 8-1
Optical patch cords

PEC	Length in meters	Length in feet	Connector type
NT7E46AA	5	16.4	Biconic-biconic
NT7E46AB	10	32.8	
NT7E46AC	15	49.2	
NT7E46AD	20	65.6	
NT7E46AE	30	98.4	
NT7E46BF	3	9.84	FC-FC
NT7E46BA	5	16.4	
NT7E46BB	10	32.8	
NT7E46BC	15	49.2	
NT7E46BD	20	65.6	
NT7E46BE	30	98.4	
NT7E46CF	3	9.84	ST-ST
NT7E46CA	5	16.4	
NT7E46CB	10	32.8	
NT7E46CC	15	49.2	
NT7E46CD	20	65.6	
NT7E46CE	30	98.4	
NT7E46FA	5	16.4	SC-SC
NT7E46FB	10	32.8	
NT7E46FC	15	49.2	
NT7E46FD	20	65.6	
NT7E46FE	30	98.4	

Table 8-2 lists the optical patch cords with an attached mVOA that are used in MBP applications.

Table 8-2
Optical patch cords with miniature variable optical attenuators

PEC	Length in meters	Length in feet	Connector type
NT7E47AA	5	16.4	Biconic-biconic
NT7E47AB	10	32.8	
NT7E47AC	15	49.2	
NT7E47AD	20	65.6	
NT7E47AE	30	98.4	
NT7E47BA	5	16.4	FC-FC
NT7E47BB	10	32.8	
NT7E47BC	15	49.2	
NT7E47BD	20	65.6	
NT7E47BE	30	98.4	
NT7E47CA	5	16.4	ST-ST
NT7E47CB	10	32.8	
NT7E47CC	15	49.2	
NT7E47CD	20	65.6	
NT7E47CE	30	98.4	
NT7E47FA	5	16.4	SC-SC
NT7E47FB	10	32.8	
NT7E47FC	15	49.2	
NT7E47FD	20	65.6	
NT7E47FE	30	98.4	

Table 8-3 lists the optical pigtails that are used in MBP applications.

Table 8-3
Optical pigtails

PEC	Length in meters	Length in feet	Connector type
NT7E48AA	20	65.6	Biconic
NT7E46BA	20	65.6	FC
NT7E46CA	20	65.6	ST
NT7E46FA	20	65.6	SC

Table 8-4 lists the optical pigtails with an attached mVOA that are used in MBP applications.

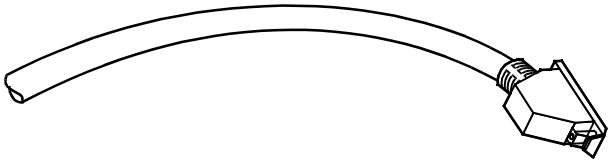
Table 8-4
Optical pigtails with miniature variable optical attenuators

PEC	Length in meters	Length in feet	Connector type
NT7E49AA	20	65.6	Biconic
NT7E49BA	20	65.6	FC
NT7E49CA	20	65.6	ST
NT7E49FA	20	65.6	SC

Orderwire extension cable

The orderwire cable connects orderwire circuits from a connector on the left side of the ABM shelf to the office orderwire network. Orderwire circuits allow maintenance technicians to communicate between sites.

NT4K85TA, TB, and TC



25-pin D-subminiature male

12-pair, twisted, 26 AWG solid wires connectorized at one end for connection to the ABM shelf, and the other end free for customer termination to the intended office equipment. This cable is available in the following lengths.

30 m	(100 ft)	NT4K85TA
61 m	(200 ft)	NT4K85TB
91 m	(298 ft)	NT4K85TC

RS232 DTE Modem cable

The RS232 DTE modem cable provides access for a remote data terminal equipment (DTE), such as a modem, a VT-100-type terminal, or a printer. To maintain ground isolation, the cable must be connected to an external modem (standard 25-pin connector), located within the same grounding network.

If you are connecting directly to the DTE without going through a modem, you must install an NT7E44MA null modem adaptor between the NT4K86RA, RB, or RC cable and the DTE. The DTE must also be battery powered or powered from an ac outlet that is bonded to the same ground point as the MBP equipment.

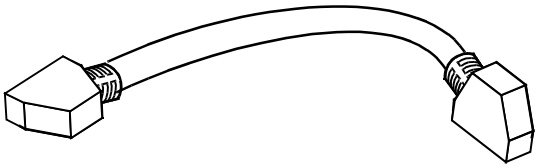
NT4K86RA, RB, RC

25-pin D-subminiature male 9-pin D-subminiature male

4-pair, twisted, 26 AWG solid wires with shielding, connectorized at both ends. One end connects to the 9-pin connector on the ABM shelf and the other end connects to the 25-pin connector on a remote modem. This cable is available in the following lengths:

1.5 m (5 ft)	NT4K86RA
4.5 m (15 ft)	NT4K86RB
15 m (50 ft)	NT4K86RC

NT7E44MA null modem adaptor for direct connection to a printer, or a VT-100-type terminal



25-pin D-subminiature female 25-pin D-subminiature male

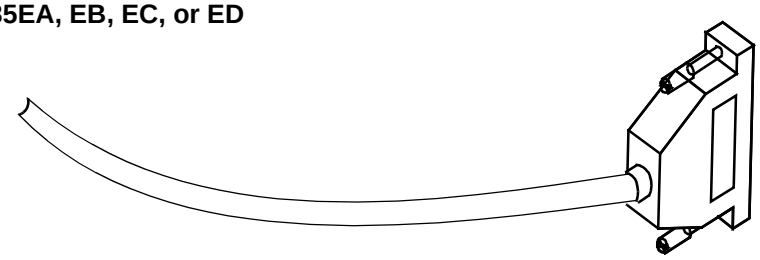
4-pair, 26 AWG solid wire connectorized at both ends. One end connects to the male connector on the NT4K86RA, RB, or RC cable and the other end connects directly to the terminal or printer.

Test access path cable (TAP)

The test access path cable provides access to the metallic test access unit (MTAU) when a universal application is interfacing an analog switch for the testing of subscriber loops at the remote site. This testing is done in conjunction with a TAP card at the central office, or with the metallic test access (MTA) in integrated S/DMS SuperNode offices.

The TAP cable (shown in the diagram below) connects from the I/O card area of the access common-equipment shelf to the office MDF, for cross-connection to the appropriate interface pairs.

NT4K85EA, EB, EC, or ED



44-pin
D-subminiature male

25-pair, twisted, 26 AWG solid wires connectorized one end for connection to the access bandwidth manager shelf TAP I/O card. This cable is available in the following lengths:

15 m	(50 ft)	NT4K85ED
30 m	(100 ft)	NT4K85EA
61 m	(200 ft)	NT4K85EB
91 m	(300 ft)	NT4K85EC

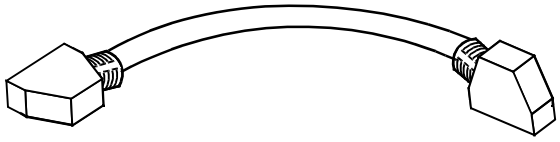
User interface cable for the LCAP

The user interface cable allows the temporary connection of a printer, a VT 100-type terminal, or a modem to the user interface Port 2 connector on the faceplate of the local craft access panel (LCAP).

If you are connecting the LCAP to a modem, you must connect an NT7E44MB null modem adaptor between the NT7E44FA, FB cable and the modem or printer.

Note: If you are not using a modem, the equipment to be connected must be bonded to the same ground point.

NT7E44FA and FB

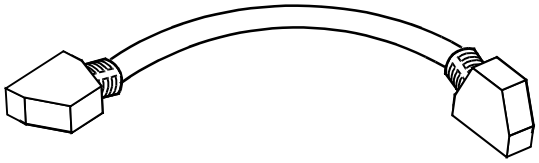


25-pin D-subminiature male 25-pin D-subminiature male

4-pair, twisted, 26 AWG solid wires with shielding, connectorized at both ends. One end connects to the 25-pin connector on the faceplate of the LCAP and the other end is for connection to a 25-pin connector of a VT-100 terminal. This cable is available in the following lengths:

5 m	(16.4 ft)	NT7E44FA
20 m	(65.6 ft)	NT7E44FB

NT7E44MB null modem adaptor for connection to a modem



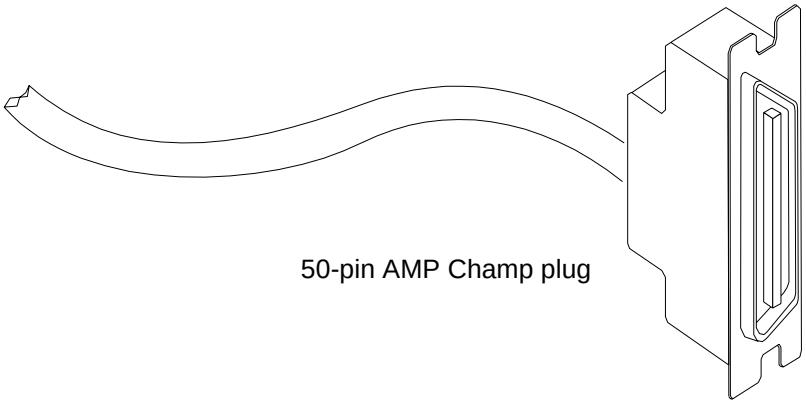
25-pin D-subminiature female 25-pin D-subminiature male

4-pair, 26 AWG solid wire connectorized at both ends. One end connects to the male connector on the NT7E44FA or FB cable and the other end connects directly to the modem.

VF copper cable

Four VF copper cables (supplied by Nortel Networks) are required for each copper-distribution shelf to provide access for 96 VF subscriber lines (POTS or special services, switched and non-switched).

NT4K85FA, FB, FC, FE, FF or FG



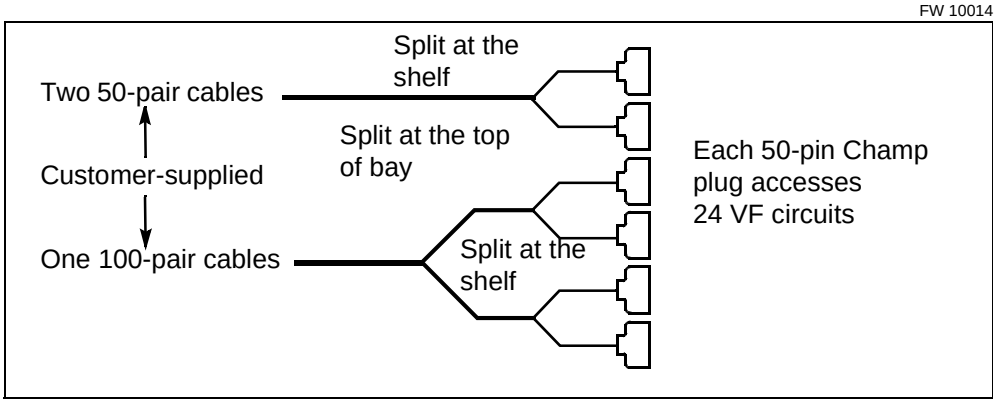
25-pair twisted 24 AWG solid wire connectorized at one end with an AMP Champ plug, available in the following lengths:

15 m	(50 ft)	NT4K85FE
30 m	(100 ft)	NT4K85FA
46 m	(150 ft)	NT4K85FF
61 m	(200 ft)	NT4K85FB
76 m	(250 ft)	NT4K85FG
91 m	(300 ft)	NT4K85FC

The four VF copper cables are routed to four 50-pin connectors on the copper-distribution shelf (two on the left and two on the right).

If customer-supplied 100-pair or 50-pair cables are used, the cables must be split as shown in the following illustration, to allow 50 pairs (1 to 50) routed to the left side of the copper-distribution shelf, and 50 pairs (51 to 96 plus 4 spares) routed to the right side, as shown in the following diagram. At each side of the copper-distribution shelf, the 50 pairs are split and connectorized into two 25-pair (50-pin) AMP-Champ connectors that feature a bail-lock latching mechanism.

FW 10014



For the full complement of seven copper-distribution shelves, a maximum of twenty-eight 25-pair pre-connectorized cables (fourteen 50-pair cables, or seven 100-pair cables) are required to connect all 672 VF lines.

Repeater shelf

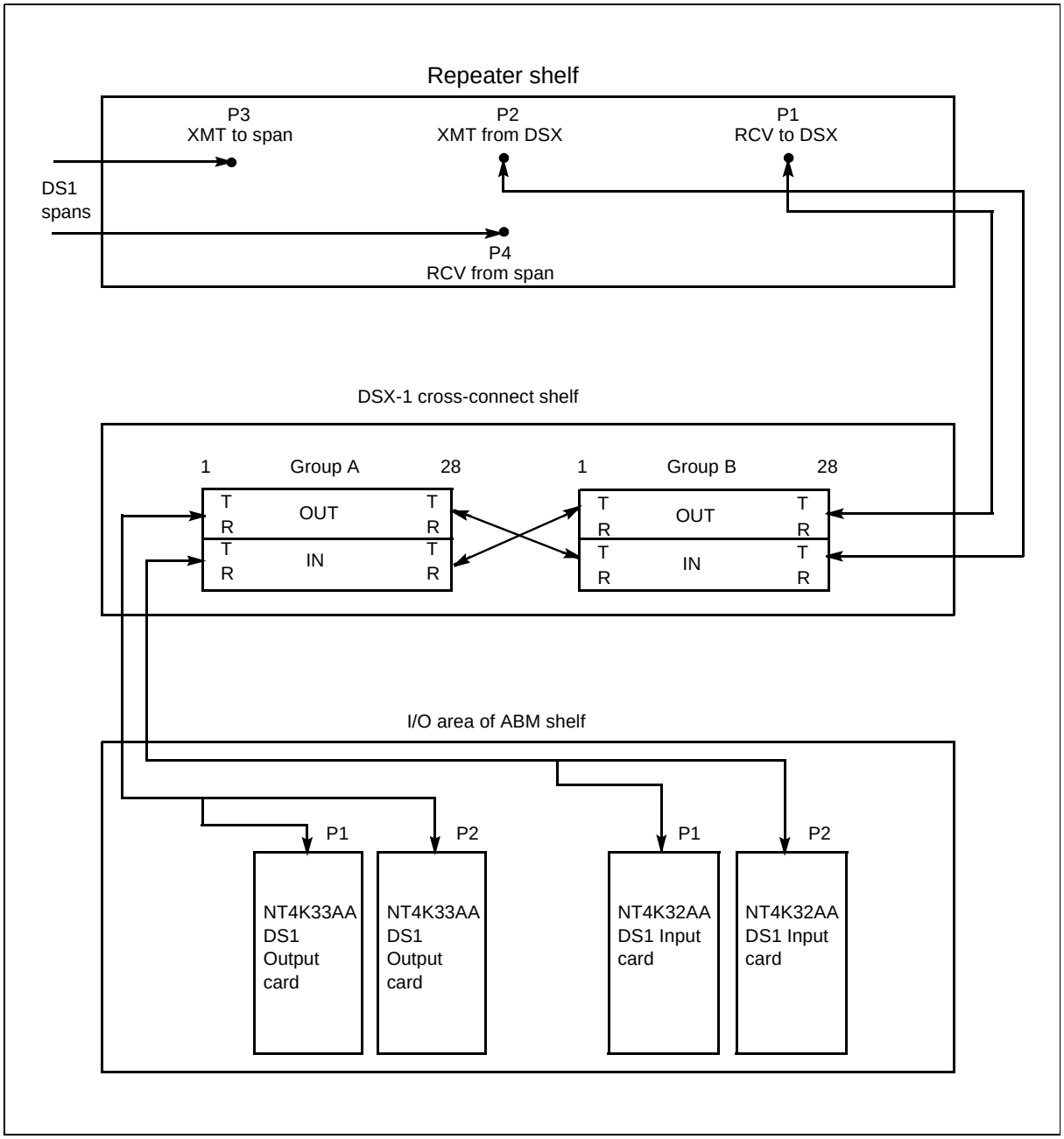
The repeater shelf with Rockwell repeaters connects the external copper DS1 span lines to the factory-wired DSX-1 cross-connect shelf. Cabling from the repeater shelf to the DS1 spans is supplied by the customer.

The DSX-1 cross-connect shelf connects to the DS1 input and output cards on the ABM shelf. Figure 8-2 shows the cabling between the ABM shelf, the DSX-1 cross-connect shelf, and the repeater shelf.

When a single equipment module (SEM) or a field expansion module (FEM) that is equipped with a T1 repeater shelf and a DSX-1 cross-connect shelf is shipped from the factory, the NT4K85UA cables are preconnected to the DSX-1 cross-connect shelf. At the installation site, the free ends of the DS1 cables are uncurled and attached to DS1 input or output cards on the ABM shelf. The repeater cables are pre-connected at the factory to the repeater shelf and the DSX-1 shelf. They will not need to be connected during installation.

Figure 8-2 shows the repeater shelf connections from the DS1 span to the DSX-1 shelf and on to the I/O cards in the common-equipment shelf.

Figure 8-2
Repeater and DSX-1 cabling in the master cabinet and the expansion cabinet



Documents, tools, materials and test apparatus requirements

This chapter lists the documents, tools, materials, and test apparatus required to install modular business package (MBP) and modular power package (MPP) cabinets.

Chapter contents

This chapter contains the following information for the tools, the materials, and the test apparatus required for planning and engineering the MBP site:

Documentation

In addition to the complete set of AccessNode documentation, reference the documents applicable to the MBP packaging option you are planning.

- *Modular Business Package Cabinet Installation Manual*, 323-3001-206
- *Modular Business Package VTBM Ring Installation Guide*
- *Modular Business Package VTBM Ring User Guide*

Tools and fixtures

- measuring tape, 15 m (50 ft)
- center punch, large for concrete floor
- claw hammer
- Roto-hammer drill, Hilti TE-52 or equivalent
- carbide-tipped concrete masonry drill bit 25 mm (1 in.)
- carbide-tipped concrete masonry drill bit 16 mm (5/8 in.)
- anchor setting tool, RT-134 for Ramset anchors or HST 3/4 for Hilti drop-in anchors
- vacuum cleaner

- carpenter’s square
- spirit level
- straight edge, 2 m (6 ft)
- lift truck or lift trolley for transporting cabinet pallets
- cable ripper for stripping armored cable
- cable cutter for 6 AWG cable
- crimping tool, Thomas and Betts TBM 2, or equivalent
- crimping tool, Thomas and Betts TBM 6, or equivalent
- NSQ2000L tool or ATT216 tool for unlocking tool-lockable equipment covers
- open end wrench set, 1/4 in. to 1/2 in.
- nut driver set 1/8 in. to 3/8 in.
- power knife
- rubber squeeze bulb
- screwdriver, flat-bladed, 1/2 in. wide blade
- screwdriver, Phillips No. 1
- socket wrench set 1/4 in. drive and 1/2 in. drive
- torque wrench 1-100 ft lb capacity
- torque wrench 1-100 in.lb capacity
- side cutters
- cable butting tool
- wire spudger
- wire strippers, 22–26 AWG wire
- wire-wrap gun with bits for 22–26 AWG wire

Materials

- plastic drilling template NT4K0601
- work gloves, safety glasses, safety boots, safety helmets
- method and materials for mounting local external fiber management facility
- method and materials for mounting local cross-connect and protector blocks
- felt marker pen
- masking tape
- sheets of cardboard or foam on which to rest equipment covers, side panels, and grilles while installation is being performed

- wooden block for driving anchors into the floor
- 6 AWG stranded green jacketed ground leads for grounding cabinets
- heat shrinkable tubing, black 9.3 mm (3/8 in.) R0113153 or equivalent, 1 m (3 ft)
- crimp type 2-hole ground lugs for cabinet ground cables
- cable ties

Test apparatus

- dc voltmeter
- battery rejuvenation device (battery charger)

Index

F

G

M

O

P

R

S

V

W

SONET Products

AccessNode

Addendum 1 (MBP)
Site Installation Planning and Engineering

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