DMS-100 Family

Power Distribution and Grounding Systems

User Guide

2000Q1 Standard 04.01 February 2000

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DMS-100 Family

Power Distribution and Grounding Systems

User Guide

Publication number: 297-1001-156
Product release: 2000Q1
Document release: Standard 04.01
Date: February 2000

Publsihed in U.S.A.

Publication history

February 2000

Standard 04.01
This release of this guide

- adds grounding and bonding requirements for the XA-Core applicaiton in Section 9
- adds information about the cabinet PECs for XA-Core applications in Section 10
- adds grounding and bonding requirement for the DMS Wireless system in Section 11
- adds grounding and bonding of the Glenayre MVP 4240 used with existing DMS switch systems in Section 12

March 1998

Standard 03.07

The release of this issue reflects changes made during Nortel Standard English (NSE) Legacy Conversion.

May 1995

Standard 03.06
This guide modifies the following items:

- item 5.6.3, paragraph 7: This guide corrects the reference for Figure 5-6.
- item 8.2, first bullet item: This guide changes 25 A to 20 A.
- figure 8-1: This guide changes 25 A to 20 A.

- item 9.3.6, note under last paragraph: This guide changes TR-EOP-000295 to TR-NWT-000295.
- figures 9-23, 9-24, and 9-25: This guide changes IMAP arrow to MAP arrow.

May 1995

Standard 03.05

The release of this issue was canceled because of a system failure.

January 1994

Standard 03.04

This guide reflects minor changes in format only. This issue is limited to internal use by Northern Telecom.

July 1993

Standard 03.03

This guide reflects minor changes in format, design, and content.

June 1993

Standard 03.02

This guide updates information on DMS communication links (section 10 of this guide).

March 1993

Standard 03.01

This guide includes power and grounding information on the cabinetized DMS-100F. Section 10 of this issue contains new information..

February 1992

Standard 02.01

Release 02.01 composed in a new typographical style (restructure format). Revision and expansion of the technical content of this guide occurred for the following reasons:

- to comply with the generic design intent, terminology, and definitions of Northern Telecom Corporate Standards
- to provide information on ac-free DMS-100F
- to update information on MAP configurations

- to add information on center-aisle lighting
- to add information on collocating equipment with DMS-100F
- to update figures and tables

May 1989; Issue 01.08

The guide was updated for the following reasons:

- to make several corrections to definitions
- to correct definition of circular mils for feeder size calculations
- to add information on specified frame configurations
- to correct cable size requirements
- to add a chart that shows MAP grounding requirements

December 1988; Issue 01.07

The guide includes power and grounding information on DMS SuperNode, DMS-STP, and DMS ISDN applications.

December 1987; Issue 01.06

The guide describes the design of power distribution and grounding systems for the DMS-100 switch to include the following subject areas:

- dc power requirements
- dc power distribution specifications and specified frame configurations
- ac power requirements
- battery return systems
- grounding systems

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About this document

Checking the version and issue of this document

The numbers indicate the version and issue of the document, for example, 01.01.

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References in this document

There are no other references in this document.

- [R-1]: *Product Documentation Directory*, 297-8991-001
- [R-2]: *Canadian Electrical Code-1998*, CSA C22.1
- [R-3]: *Bell Communications Research Technical Reference, Isolated Ground Planes; Definition and Application to Telephone Central Offices*, NTR-NWT-000295

- [R-4]: *Rural Electrification Administration (REA) Telecommunications Engineering and Construction Manual*, Section 810: Electrical Protection of Electronic Analog and Digital Central Office Equipment
- [R-5]: *National Electrical Code-1999*, ANSI/NFPA No. 70
- [R-6]: *Electrical Protection for Telecommunications Central Offices and Similar Type Facilities*, ANSI T1.313-1991
- [R-7]: *DMS-200 TOPS MPX Power Distribution and Grounding Guide*, 297-2291-156
- [R-8]: *DMS-200 200 TOPS MPX Power Distribution and Grounding Guide*, 297-2281-156
- [R-9]: *Guideline on Electrical Power for ADP Installations*, Federal Information Processing Standard (FIPS) Pub 94:
- [R-10]: *Protection of Electronic Computer/Data Processing-1999*, ANSI/NFPA No. 75
- [R-11]: *Lightning Protection Code-1992*, ANSI/NFPA No. 78

What precautionary messages mean

The types of precautionary messages that Nortel Networks documents use include attention boxes and danger, warning, and caution messages.

An attention box identifies information necessary for:

- the correct performance of a procedure or task
- the correct understanding of information or data

Danger, warning, and caution messages indicate possible risks.

Examples of the precautionary messages follow.

ATTENTION
Information needed to perform a task

ATTENTION
Deprovision DS-3 ports that are not in use before the installation of a DS-1/VT Mapper. If you do not deprovision these ports even a correctly provisioned DS-1/VT Mapper will not carry DS-1 traffic.

1 Introduction

Users of this guide need to understand the following definitions, list of abbreviations and acronyms, and cross reference table.

Definitions

The following definitions conform to those of the National Electrical Code (NEC) and the Canadian Electrical Code (CEC), where applicable.

ac equipment grounding (ACEG) conductor (green wire)

A conductor used to protect personnel from injury. The ACEG conductor does not normally carry current. It is permanently bonded to the serving panel ground and to metal parts of electrical equipment that do not normally carry current. The ACEG conductor is an insulated conductor for the applications covered by this document.

ac service entrance ground

The ground reference point for all ac-powered equipment. It must also be connected to the building principal ground.

advanced mobile phone service (AMPS)

A cellular technology. The AMPS standard has been the foundation for the industry in the United States, although it has been slightly modified in recent years.

base station controller (BSC)

A component of a GSM or CDMA network, that is located with the mobile telephone exchange (MTX) and that controls one or more base transceiver stations (BTSs).

base transceiver station (BTS)

A GSM network component that serves one cell and is controlled by a Base Station Controller (BSC).

battery return (BR)

A .conductor that carries the -48 V return current. Although BR conductors are not grounding conductors, they are referenced to ground by the battery return reference (BRR) conductor of the serving dc power plant.

battery return reference (BRR)

A grounding conductor that connects the battery return to ground.

bonding

The permanent joining of non-current carrying metallic parts to form an electrically conductive path, which ensures electrical continuity and the capacity to safely conduct any current likely to be imposed upon the path.

bonding network (BN)

A set of interconnected conductive structures that provides an electromagnetic shield for electronic systems and personnel at frequencies from dc to low rf. The term electromagnetic shield denotes any structure used to divert, block, or impede the passage of electromagnetic energy. In general, a BN need not be connected to earth, but all BNs considered in this document require an earth connection.

building principal ground (BPG)

The main point within a building at which the ground reference potential is established. The BPG is directly referenced to earth by such means as water pipes and/or electrodes driven into the earth.

code-division multiple access (CDMA)

A method of allowing multiple users to access the same system by assigning them different codes which they can use to decode their desired narrowband information from the stream’s wideband composite signal.

centralized CPDC configuration

A cabinetized DMS configuration in which a single CPDC is used to power one or more DMS lineups. Power is externally distributed vertically into each cabinet. Each cabinet (except the CPDC) is equipped with EMI filters for power input and an EMI filter for a logic return cable. Each cabinet is treated as an enclosed EMI envelope.

common bonding network (CBN)

The principal means used for bonding and grounding inside a telecommunications building. The CBN is the set of metallic components that are intentionally or incidentally interconnected to form the principal bonding network in a building. These components include:

- structural steel or reinforcing rods
- metal plumbing

- ac power conduit
- ac equipment grounding conductors
- bonding conductors
- cable racks

The CBN is a mesh topology and connects to the building grounding electrode system.

DMS-100 Family

Designates the group of digital multiplexed switching systems that include the DMS-100, DMS-100/200, DMS-100 switching cluster, DMS-100 switching network, DMS-200, DMS-250, DMS-300, and DMS-500.

DMS single point ground (DMS SPG)

A single point where the following connect to ground:

- the framework bonding equalizer (FBE)
- the logic-return equalizer (LRE)
- the serving ac equipment grounds (ACEG)
- the integrated collector bar (ICB)
- the serving dc-power plant battery return reference (BRR)

The DMS SPG is usually one of the following types of busbars:

- building principal ground (BPG)
- floor ground bar (FGB)
- dedicated SPG bar
- a dedicated section of the serving dc-power plant battery return (BR) bar

In configurations that are not ISG, the framework ground bus (not the FBE and LRE) connects to the DMS SPG.

digital signal processor module (DSPM)

A digital peripheral module (PM) that performs low bit rate speech coding/decoding and provides Time Division Multiple Access (TDMA) frame synchronization.

essential ac load

A load supplied from a commercial ac source and switched over to a standby supply, such as an engine alternator, during a commercial power failure. An essential load experiences a power loss until the standby supply is operational and connected to the load.

floor ground bar (FGB)

A copper bar on each floor of a building provided for equipment grounding. The FGB connects to the VGR. The FGB extends the BPG to each floor level.

framework bonding bar (FBB)

A copper bar used for bonding a DMS-100 frame to the FBE. The metal framework of each DMS frame is bonded to an FBB horizontally mounted above the frame.

framework bonding equalizer (FBE) bar

A copper plate mounted on insulators and used in an ISG DMS to bond DMS frames to ground. The FBE is preferably located close to PDC-00 and the equipment frames, and has a single connection to the DMS SPG. One FBB in each lineup is connected to the FBE. No other conductors are connected to the FBE.

framework ground bus

A copper plate mounted on insulators and used in a non-ISG DMS system to provide ground reference to DMS frames. The framework ground bus is preferably located close to PDC-00 and the equipment frames, and has a single connection to the DMS SPG. It is the start and end point of a ground loop formed with conductors that interconnect the FBB of all the PDCs in the frame lineups. Nortel Networks recommends that no other conductors be connected to the framework ground bus.

Glenayre MVP 4240

A multi-application, multi-media enhanced services platform that provides voice mail services to Nortel Networks customers. The Modular Voice Platform (MVP) enables operating companies to resell voice mail to their customer in a competitive manner. The MVP 4240 is available from Glenayre.

ground

A metallic connection, whether intentional or accidental, between an electric circuit or equipment and the earth, or some conducting body that serves in place of the earth. Typically, a ground is a connection to earth obtained by a grounding electrode.

ground window (GW)

The interface or transition point between the isolated and integrated ground planes. The GW can be a dimensional area around a busbar or the busbar itself. After passing through the GW, there can be no additional (intentional or unintentional) paths to ground inside the isolated ground plane.

Note that the above definition of the ground window agrees with the ANSI standards [R-6]. Wrong use of this term for different functions and hardware of the grounding system occurs. This document limits the use of the term ground window to avoid problems in communications.

incidental ground

A grounding connection that is not intended, engineered, or planned.

integrated collector bar (ICB)

An insulated copper plate that bonds metal objects to the DMS SPG. The ICB bonds metal objects that do not already connect to the DMS SPG. The ICB bonds all of these objects that are outside the IBN but within 2 m (7 ft) of the IBN. These metal objects include any metal objects that are not insulated and can connect, on purpose or by accident, to the building CBN. The ICB connects all these objects that cannot be insulated from the CBN.

integrated CPDC configuration

A cabinetized DMS configuration in which each cabinet lineup contains a CPDC. Power distribution is horizontal with internal runs from cabinet to cabinet. The CPDC has EMI filters for power input and an EMI filter for a logic-return cable. All cabinets in the lineup are bolted together. This condition allows power and ground cables to traverse between cabinets horizontally. The integrated CPDC cabinet lineup is treated as an enclosed EMI envelope.

intelligent cellular peripheral (ICP)

A switch site peripheral that provides an interface between the cell site and the switch.

isolated bonding network (IBN)

A bonding network with a single point of connection to the CBN or another IBN.

isolated system grounding (ISG)

The DMS grounding arrangement in which the equipment logic returns are connected to an internal plane that is separate from the framework ground. The DMS-100F systems configured without ISG reference equipment logic returns internally to framework ground or battery return as required.

isolation

The arrangement of parts of equipment, a system, or a facility to prevent uncontrolled electrical contact within or between parts.

logic return bar (LRB)

An isolated copper busbar used in DMS ISG frame-based systems. An LRB is installed parallel to the FBB. The first LRB of a DMS lineup connects to the LRE. The other LRBs in the same lineup are daisy-chained to the LRB connected to the LRE. Each vertical logic return bar of an equipment row referenced to the LRE connects to an LRB. The DMS core must be treated the same as a separate equipment row. The LRB of the core should be above the IOE frame.

logic return equalizer (LRE) bar

An isolated copper plate with a single connection to the DMS SPG. Preferably, the LRE is located close to PDC-00 and the equipment frames. The first LRB of each lineup is connected to the LRE. No other connections are made to the LRE.

Meridian cabinet trunk module (MCTM)

The MCTM is a four-shelf, two module common peripheral control equipment (CPCE) cabinet. The MCTM connects to the ENET through DS30 or DS512 links. The MCTM houses two digital trunk controller (DTC) modules. Each DTC provides 20 DS-1 ports of up to 24 channels each or 20 E-1 ports of 30 channels each.

Meridian digital-signaling processor cabinet (MDSP)

A switch site cabinet that contains one to four Digital Signal Processor Module (DSPM) shelves.

no-break ac load

An ac load that cannot tolerate any interruption. For DMS-100F, an inverter normally feeds no-break ac loads. The -48V plant serving the switch powers this inverter. Inverters in the IBN do not have ac line bypass facilities.

non-essential ac load

An ac load that does not need to operate during a commercial power outage and that is not connected to the standby ac system.

protected ac load

An ac load that should operate during a prolonged loss of commercial power and that can tolerate only minimal interruption times. An interruption can vary from milliseconds up to approximately five seconds.

single point ground (SPG)

A single connection that references equipment or a system to ground. In an ideal IBN arrangement, dc current does not flow through the single point connection unless a fault condition is present.

time division multiple access (TDMA)

A technique originated in satellite communications to interweave multiple conversations into one transponder so as to appear to get simultaneous conversations. A variation on TASI (time assignment speech interpolation). A technique now used in cellular and other wireless communications.

vertical ground riser (VGR)

A continuous conductor extending ground potential through the height of a multifloor building. The conductor is 750 kcmil or is as large or larger than the largest conductor for power distribution in the building. The FGBs on different floors connect to the VGR.

vertical logic return bar

A copper bar mounted vertically inside several types of DMS frames and that references the logic return to the LRB.

Abbreviations and acronyms

The following list is a reference for a quick identification of abbreviations and acronyms that this document uses.

ABS:
alarm battery supply

ac:
alternating current

ACEG:
alternating current equipment ground

AMPS
advanced mobile phone service

APC:
application processor cabinet

AWG:
American Wire Gauge

AXU:
alarm cross-connect unit

BN:
bonding network

BPG:
building principal ground

BR:
battery return

BRR:
battery return reference

BSC
base station controller

BTS
base transceiver station

CBN:
common bonding network

CC:
central control

CCC:
central control complex

CCPE:
cabinetized controller for peripheral equipment

CDMA
code-division multiple access

CDNI:
cabinetized digital network interconnect

CEC:
Canadian Electrical Code

CEXT:
cabinetized extension cabinet

CIOE:
cabinetized input output equipment

CLCE:
cabinetized line concentrating equipment

CLMI:
cabinetized line module ISDN

CM:
circular mils

CMIS:
cabinetized miscellaneous equipment

CMS7:
cabinetized message switching 7 equipment

CMSS:
cabinetized maintenance spare storage

CO:
central office

CPDC:
cabinetized power distribution center

CRSC:
cabinetized remote switching center

CSA:
Canadian Standards Association

CSLC:
cabinetized speech link connector

CTME:
cabinetized trunk module equipment

dc:
direct current

DCE:
digital carrier equipment (frame)

DCM:
digital carrier module

DME:
data modem expansion (frame)

DMS:
Digital Multiplex System

DMS-100F:
DMS-100 Family

DMS SPG:
DMS single point ground

DNI:
digital network interconnecting (frame)

DPCC:
dual plane combined core cabinet

DPN:
data packet network

DSNE:
dual shelf network equipment (frame)

DSPM
digital signal processor module

DTE:
digital trunk equipment (frame)

EIA:
Electronic Industries Association

EMI:
electromagnetic interference

EMIF:
EMI filter

ENET:
enhanced network

ESD:
electrostatic discharge

E:
receive and transmit signaling

FA:
fuse alarm

FBB:
framework bonding bar

FBE:
framework bonding equalizer

FG:
framework ground

FGB:
floor ground bar

FSP:
frame supervisory panel

GND, GRD:
ground

GS:
general specification

GW:
ground window

IAC:
integrated access control (frame)

IBN:
isolated bonding network

ICB:
integrated collector bar

ICP
intelligent cellular peripheral

IGP:
isolated ground plane (BOC terminology)

IGZ:
isolated ground zone (RUS terminology)

IMAP:
integrated MAP

IOC:
input/output controller

ICB:
integrated collector bar

ISDN:
integrated system digital network

ISG:
isolated system grounding

kcmil:
1000 circular mils

LCE:
line concentrating equipment (frame)

LCM:
line concentrating module

LD:
line drawer

LGC:
line group controller

LGE:
line group equipment (frame)

LIM:
link interface module

LIU:
link interface unit

LM:
line module

LMC:
line module controller

LME:
line module equipment (frame)

LPP:
line peripheral processor

LR:
logic return

LRB:
logic return bar

LRE:
logic return equalizer

MAP:
maintenance and administration position

MCTM
Meridian cabinet trunk module

MEX:
memory extension (frame)

MGB:
main ground bus (BOC terminology)

MGB:
master ground bar (REA terminology)

MIS:
miscellaneous equipment (frame)

MOE:
modem equipment (frame)

MS7E:
message switching 7 equipment (frame)

MSDC:
message switch duplex cabinet

MSS:
maintenance spare storage (frame)

MSSC:
message switch simplex cabinet

MTC:
magnetic tape center (frame)

MTD:
magnetic tape drive

MTM:
maintenance trunk module

MVP
modular voice processing

NEC:
National Electrical Code

NETC:
network combined (frame)

NFPA:
National Fire Protection Association

NM:
network module

NTP:
Nortel Networks technical publication

OAU:
office alarm unit

OEM:
original-equipment manufacturer

PDC:
power distribution center

RCE:
remote concentrating equipment (frame)

RCME:
remote control and maintenance equipment (frame)

REA:
Rural Electrification Administration (see RUS)

RF:
radio frequency

RFFE
radio frequency front end

RLCM:
remote line concentrating module

RLM:
remote line module

RME:
remote maintenance equipment (frame)

RSC:
Remote Switching Center

RSC-S:
Remote Switching Center-SONET

RSE:
remote service equipment (frame)

RUS
Rural Utilities Service (formerly REA)

SCC:
single core cabinet

SONET:
Synchronous Optical Network

SP:
supervisory panel

SPG:
single point ground

SSC:
spare storage cabinet

ST7E:
signaling terminal 7 equipment (frame)

STP:
signal transfer point

TBB:
transmission bonding bar

TBR:
talk battery return

TDMA
time division multiple access

TOPS MP:
Traffic Operator Position System Multipurpose

TOPS MPX:
Traffic Operator Position System Multipurpose Extended

TM:
trunk module

TME:
trunk module equipment (frame)

TR:
Technical Reference (Bell Communications Research)

UL:
Underwriters Laboratories

UPS:
uninterruptible power supply

VDU:
video display unit

VGR:
vertical ground riser

Cross reference of terms

Table 1-1 is a quick cross-reference of terms that Nortel Networks, the BOCs, RUS, and other operating companies use.

Table 1-1 Cross reference of terms (Sheet 1 of 2)

Nortel Networks	BOC	RUS	OTHERS
battery return (BR)	-48V return	N/A	battery ground
			dc return
			positive discharge bus
			power return
building grounding system	CO GRD	central office protection grounding	COG
			CO ground
building principal ground (BPG)	OPGPB	master ground bar (MGB)	COG
	PGP bus		CO GRD bus
			facility ground
			OPGP
			principal ground point (PGP)
			reference point 0
			zero potential reference point
common bonding network (CBN)	integrated ground plane	integrated ground zone	integrated ground system
DMS SPG	main ground bus (MGB)	master ground bar (MGB)	main ground bar (MGB)
floor ground bar (FGB)	CO GRD	floor bar	COG
	CO ground bar		COGB
	CO ground bus		C.O. GRD
framework bonding bar (FBB)			

Table 1-1 Cross reference of terms (Sheet 2 of 2)

Nortel Networks	BOC	RUS	OTHERS
framework bonding equalizer (FBE) bar			FG
			framework ground
			framework ground bus
isolated bonding network (IBN)	isolated ground plane	isolated ground zone (IGZ)	isolated ground system (IGS)
logic return (LR)			logic ground
			signal ground
logic return bar (LRB)			logic ground
logic return equalizer (LRE)			logic ground
vertical ground riser (VGR)	vertical equalizer		C.O. ground riser
	vertical riser		equipment ground riser
			GRD riser
			riser
			VERT EQLR

2 Overview

The power distribution system supplies controlled and protected dc power and ac power to DMS-100 frames and equipment. The grounding system provides the following:

- hazard protection for personnel and DMS-100 equipment
- immunity, within accepted standards, from operational and transient phenomena.

2.1 DC power

The -48 V power plant supplies dc power to the Power Distribution Centers (PDC) of the DMS-100F equipment. The power plant supplies power through dual primary battery feeders (A feeders and B feeders). Each feeder consists of a -48 V conductor and an associated battery return (BR) conductor. The conductors of a feeder are of equal cross section and are routed close together.

Fuse panels in a PDC distribute power to frame supervisory panels (FSP) in DMS equipment frames through secondary battery feeders. Other dc voltages, such as +5 V and -5 V required by DMS equipment, are obtained from dc/dc converters located within equipment shelves and powered from -48 V.

2.2 AC power

The ac-free version of the DMS-100F is intended to maintain and increase the integrity of the IBN by making the need for bringing external ac power to the switch unnecessary. The DMS-internal inverters provide power to ac loads and convenience outlets. The center-aisle lighting provided with this version of the DMS-100F is installed outside of the switch IBN and supplied from general purpose ac distribution panels.

An earlier version of the DMS-100F uses integrated lighting that receives ac power from one of the following:

- a general purpose distribution panel
- an isolation transformer

- a stand-alone inverter
- a UPS

2.3 Grounding

The ISG version of the DMS-100F is a grounding arrangement. In this arrangement the equipment logic returns are connected to a plane that is separated internally from the framework ground. In DMS-100F systems configured without ISG, the equipment logic returns are connected internally to a framework ground or battery return as required.

Within the switch IBN, the functional blocks are configured as individual single-point grounded entities. These functional blocks can be shelves, frames, or groups of frames. Communication links between functional blocks and to the outside world generally use ac coupling techniques to ensure connectivity.

3 Installation environment

This section addresses the environmental requirements for installing DMS-100F equipment.

3.1 General

The installation environment should be acceptable for the placement of electronic equipment. The environment should comply with the codes and standards that apply and with the requirements given in this guide.

3.1.1 Electrical protection

The ANSI standards such as [R-6] provide guidelines in the following areas considered important for preparation of the installation environment for the DMS-100F:

- identification of the sources and severity of electrical exposures
- description of electrical protection techniques
- implementation of a facility grounding system
- application of electrical protection techniques to serving ac power and transmissions media entering the facility
- grounding and bonding self-supporting and roof-top tower structures
- installation objectives and considerations, such as materials, connectivity, and workmanship

3.2 Building grounding system

The whole building grounding system must comply with the following:

- NEC Article 250, Grounding (in the United States)
- CEC Section 10, grounding and bonding (in Canada)
- any local codes that apply

3.2.1 Grounding electrode system

The grounding electrode system must be accessible at the building principal ground (BPG). This point is where grounding conductors of building systems (ac, communication, and structure) are bonded together.

The grounding electrode system consists of a metal water pipe (if available in the building) supplemented by any combination of the following:

- grounding grids
- grounding rod arrays
- supplementary grounding fields
- structural steel grounding grids
- well casings
- other bonded underground metal objects

The installation of the grounding electrode system must agree with the rules given in all codes that apply. The following requirements also apply:

- The resistance to earth of the BPG should be as low as practicable and must never exceed the local electrical utility limits.
- If the resistance of the made electrode (s) is not equal to less than 25 W, NEC Article 250-84 requires the addition of another electrode.
- In Canada, CEC Section 10 does not set limits to the grounding system resistance other than to achieve the lowest possible value.
- The location of equipment connected to the FGB must be within a 60 m by 60 m (200 ft by 200 ft) square. This location must not be more than 43 m (142 ft) from the FGB (direct line, not cable run).

3.2.2 Single-floor buildings

In single-floor buildings, the BPG bar can serve as the floor ground bar (FGB). In this event the BPG is the only busbar in the building to which all building systems are referenced. In this event, grounding cables with the same functions should be connected to the BPG bar in groups as shown in Figure 3-1. Not all grounding cables are present in all installations.

In large single-floor buildings, an FGB can be installed and used to connect the different communication grounding conductors (see Figure 3-3).

3.2.3 Multifloor buildings

In central-office type multifloor buildings, the BPG bar serves as the starting point of the vertical ground riser (VGR). A VGR is a conductor that extends through the height of the building. An FGB connects to the VGR on each floor to provide a ground reference for equipment located on that floor. See Figure 3-2 and Figure 3-4 for details.

The size of the VGR conductor is as follows:

- 750 kcmil in central-office buildings
- equal to or larger than the largest conductor used for power distribution in the building

The location of equipment connected to the FGB must be within a 61m by 61 m (200 ft by 200 ft) square. This location must not be more than 43 m (142 ft) from the FGB (direct line, not cable run).

Larger buildings, or attached building complexes used as a unit, may require installation of a second VGR. The second VGR should be within 61 m (200 ft) of the first VGR (see Figure 3-4). A horizontal conductor must interconnect the two FGBs as follows:

- at the bottom floor (BPG location)
- at the top floor, and
- at every third floor in between

The cables that bond VGRs and the FGB to the VGR must be at least the size of the associated VGRs.

3.2.4 Other building structures

Steel frame buildings

In steel frame buildings, the flush plate of each column base should bond to a grounding ring as in Figure 3-5. This arrangement incorporates the building steel frame structure as part of the building grounding system.

The busbars of the building grounding system (BPG bar and FGBs) should bond to the building steel. See Figure 3-6 for details.

Reinforced concrete buildings

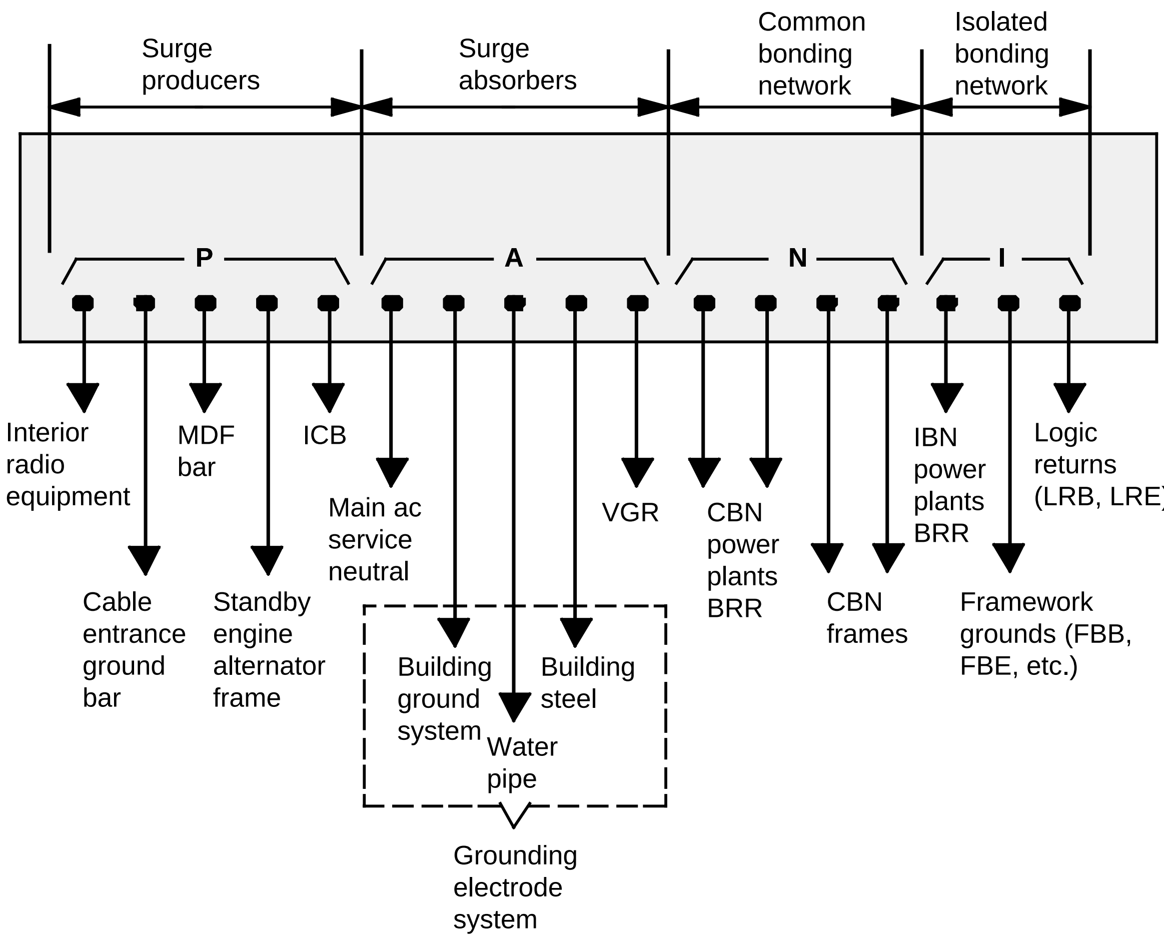
In new buildings, inspection and testing of electrical continuity and current-carrying capacity of the reinforcing steel is feasible. In these buildings, the flush plate of each column base should bond to a grounding ring as in Figure 3-5. This arrangement incorporates the building steel frame structure as part of the building grounding system.

In buildings where continuity and current-carrying capacity inspection or testing cannot be performed, the steel columns must not be used as part of the building grounding system.

If accessible at the base of the columns, the steel of the columns must be bonded to the grounding ring.

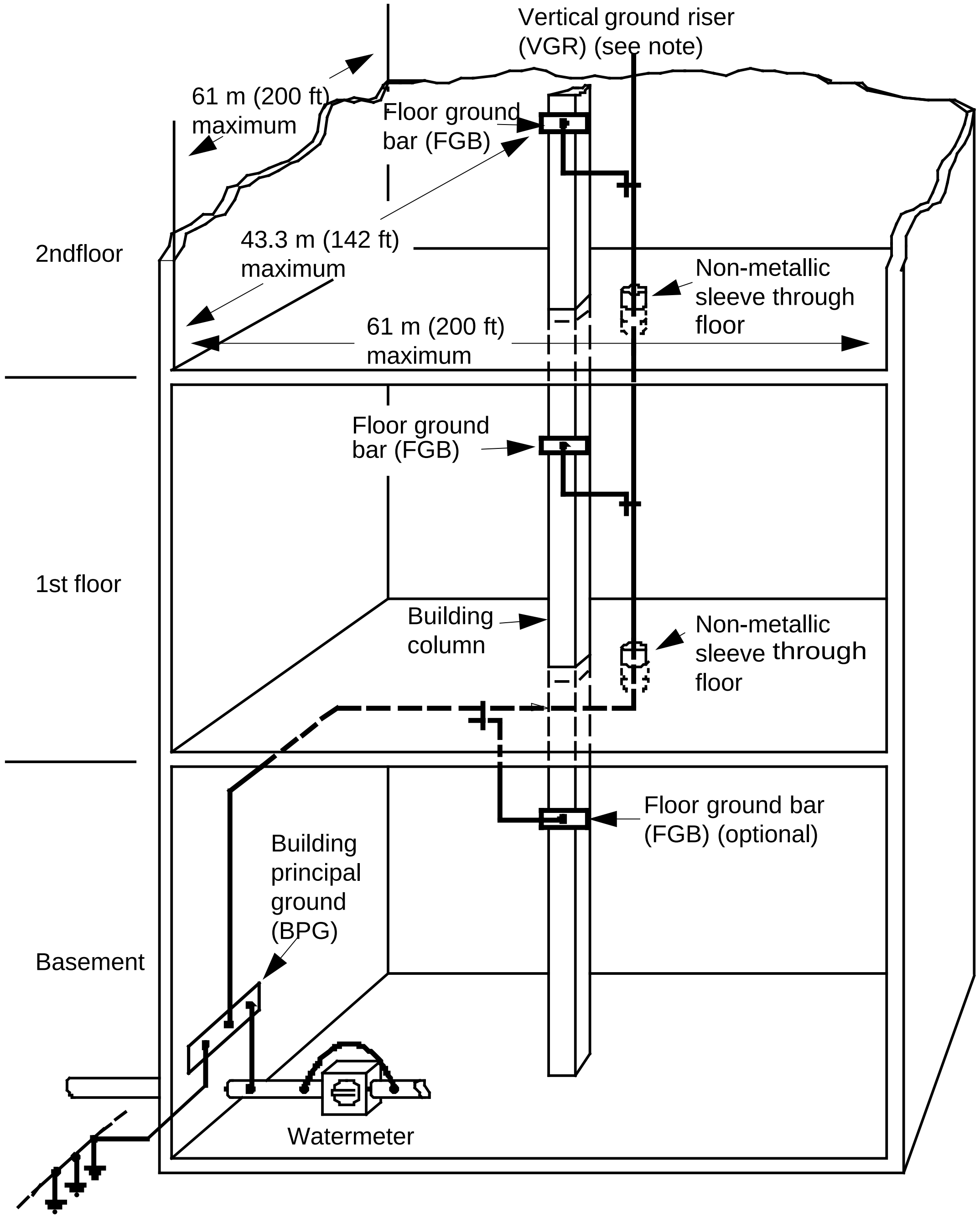
The busbars of the grounding system shall be insulated from the concrete columns as in Figure 3-7.

Figure 3-1 Building principal ground connection sequence



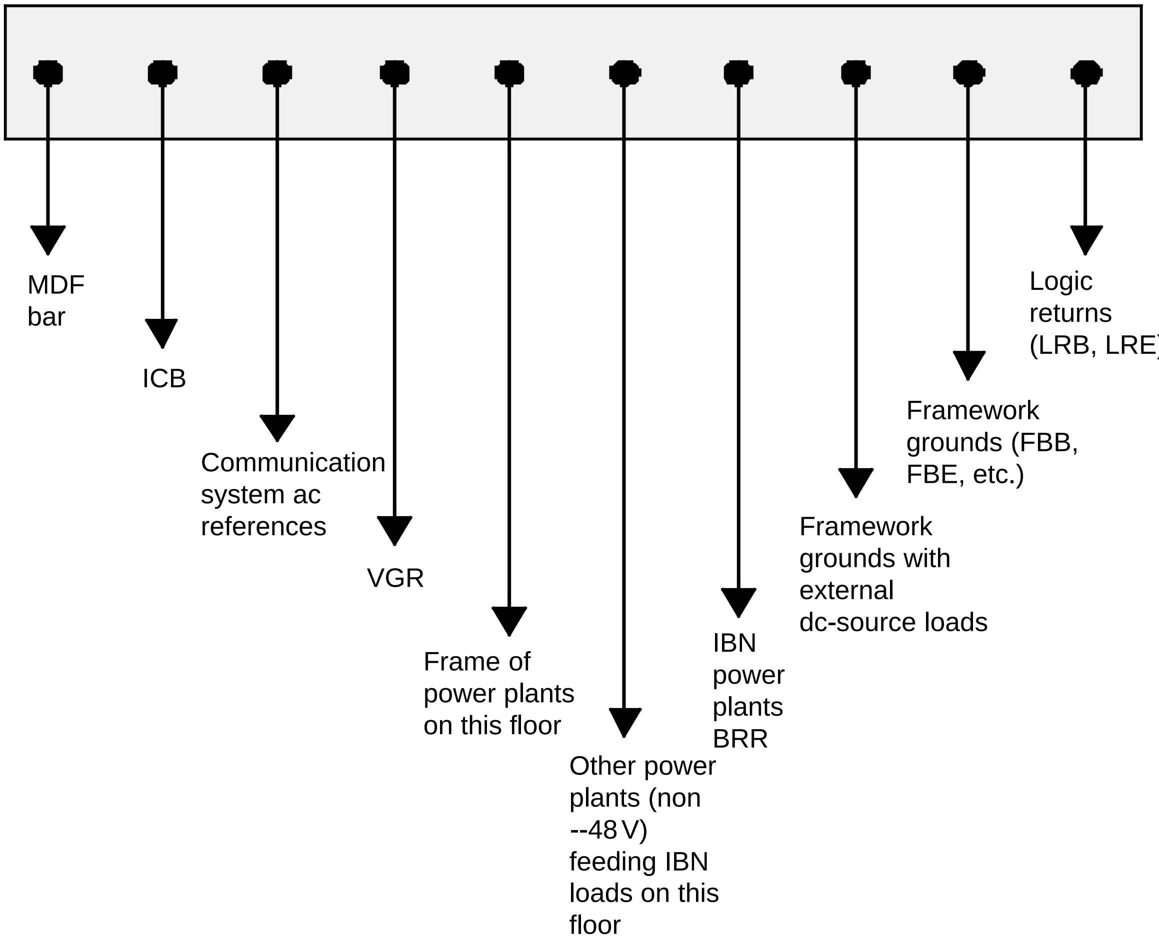
Note: Ignore the connections not available in a specified application, but maintain the sequence of the available connections.

Figure 3-2 Typical arrangement of the building grounding system



Note: The size of the VGR conductor must be 750 kcmil, or equal to or larger than the largest conductor used for power distribution in the building.

Figure 3-3 Example of FGB used as SPG



Note: Ignore the connections not available in a specified application, but maintain the sequence of the available connections.

Figure 3-4 Typical arrangement of the building grounding system for a large building

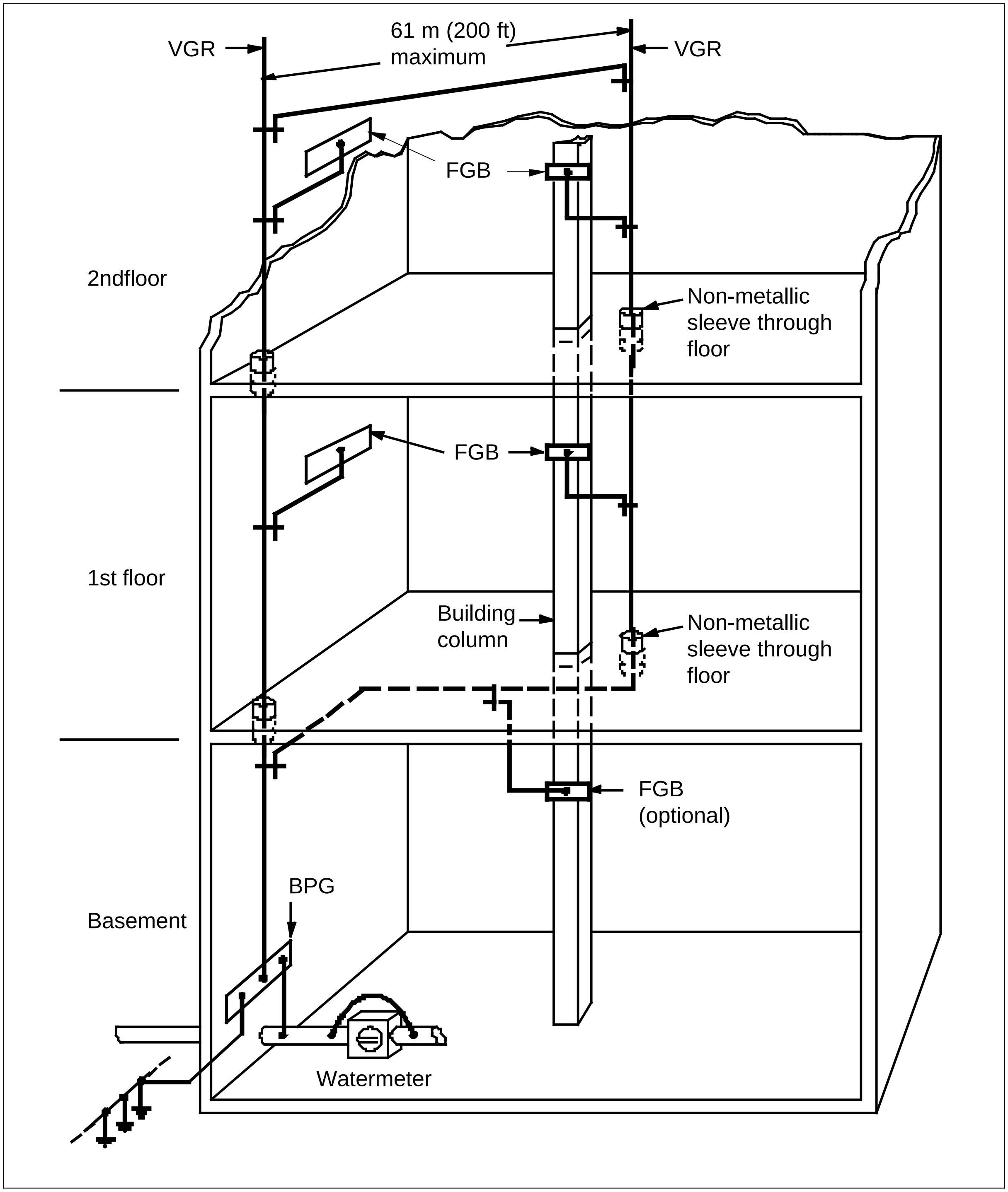


Figure 3-5 Typical grounding field in a new structural steel building

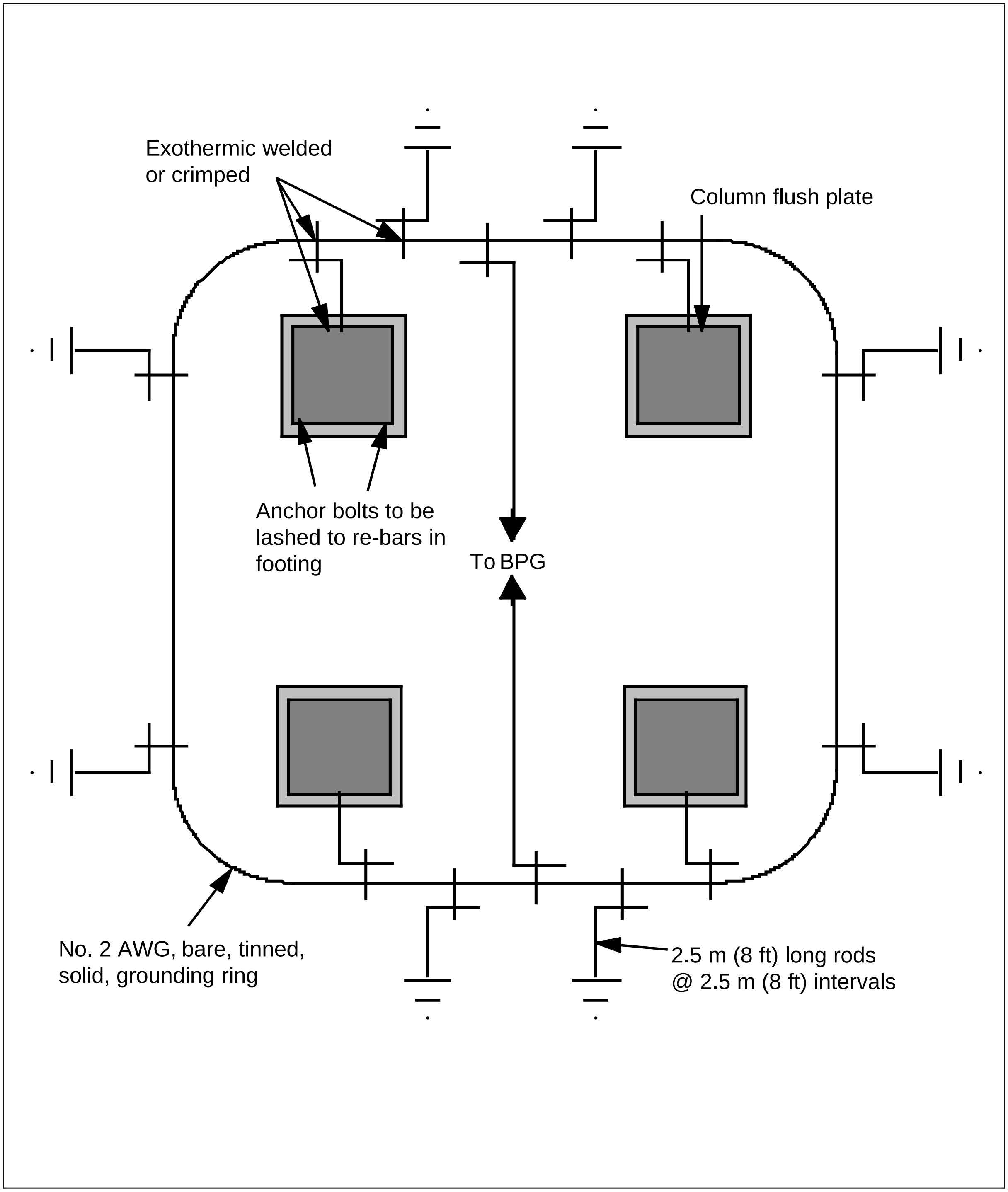


Figure 3-6 Typical method of bonding the FGB to the building steel column

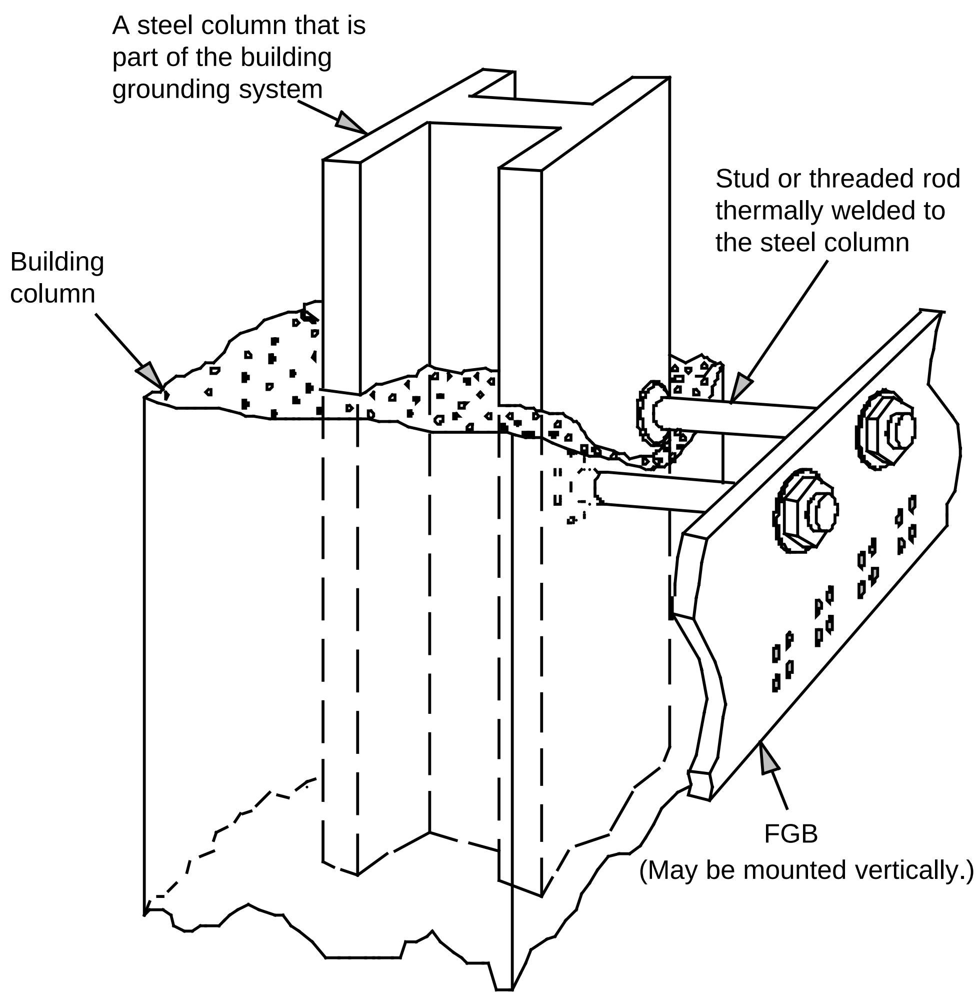
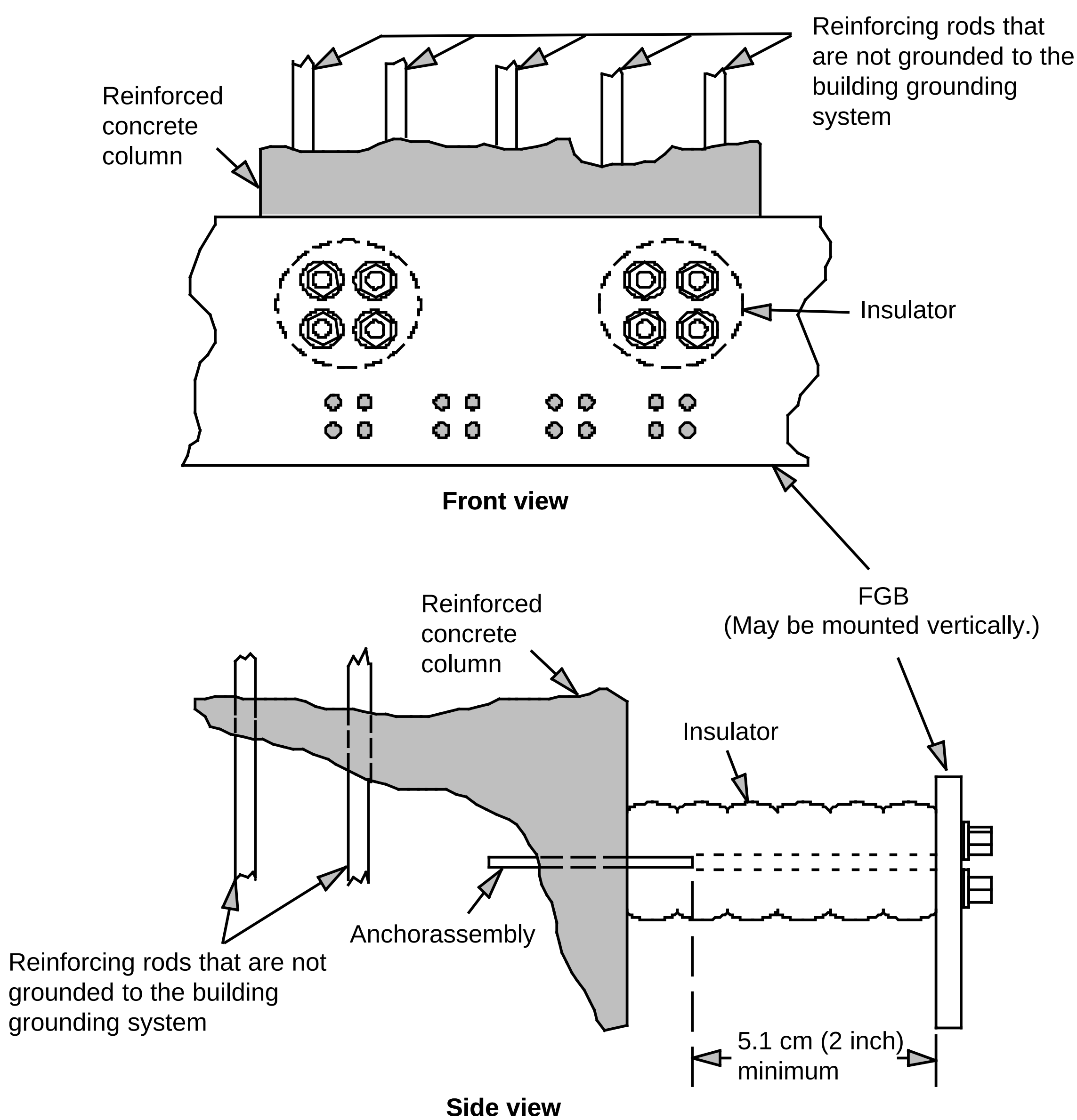


Figure 3-7 Typical method for isolating the FGB



3.2.5 Equipment rooms

The installation of a DMS-100F can occur in areas with conventional floors, raised floors, or dropped ceilings. All metal equipment, objects, or structures located in the equipment room that can become electrically energized should be grounded.

3.2.6 Raised floors

The raised floor installations must meet all local and national codes that apply. You can find potentially useful information on bonding and grounding in references [R-9] and [R-10].

The following rules apply:

- Check the raised floor support and pedestal construction for electrical continuity.
- If the electrical continuity is not confirmed, the support and pedestal system require a grid matrix. The maximum eight-ft grid matrix must consist of minimum No. 6 AWG. This grid makes sure that bonding occurs correctly.
- All the edges of the raised floor must bond to the building system.
- Installation of IBN equipment on the raised floor must use isolation details.

Installation of a raised floor as part of the CBN is recommended. The edges of the raised floor should be grounded to all other metal structures and metal objects that enter the raised floor area.

3.2.7 Air-handling spaces

Wiring placed in dropped ceilings and raised floors used as environmental air-handling space must meet the requirements for plenum cable. You can find the requirements for plenum cable in the following documents:

- NEC Article 300-22 for the United States
- CEC Sections 60-312 and 60-316 for Canada

Two-meter rule:

Maintain a 2-m (7-ft) separation between the DMS-100F and other metal equipment or structures that do not connect to the DMS SPG.

If the 2 m separation is not possible, observe one of the following guidelines:

- Bond the CBN equipment or structures to the DMS SPG directly or through a connection to the integrated collector bar (ICB).
- Install an insulating screen or barrier between the DMS-100F and the CBN objects.

3.2.8 Work areas

It is recommended that service personnel working on the DMS-100F wear grounded ESD wrist straps or stand on ESD-dissipating floor mats. If performance of service occurs at a work bench, a grounded ESD-dissipating mat should cover the bench top. AC circuits that serve the workbench should have a ground fault circuit interrupter (GFCI).

4 DC power distribution

This section describes requirements for the dc power distribution system.

4.1 System requirements

4.1.1 Voltage limits

The DMS-100 requires power from the dc power plant at a nominal voltage of -48 V. To make sure that the DMS-100 operates correctly, the voltage must remain within limits. The voltage range at the input terminals of a DMS power distribution center (PDC) must not exceed the limits of -43.75 V to -55.8 V. The voltage extremes may be encountered under battery equalization (-55.8 V) or battery discharge conditions following a loss of ac power to the dc power plant (-43.75 V).

4.1.2 Feeder voltage drop

Voltage drops across the primary and secondary distribution feeders are a function of both of the following:

- the current that flows through the feeders
- the resistance of the feeders

As a guideline, engineer the primary distribution feeders to make sure the maximum voltage drop is 1.0 V between the battery terminals and the PDC busbars under full-load conditions.

A maximum voltage drop of 0.25 V is acceptable between the battery terminals and the power plant discharge bus. This limitation results in a maximum voltage drop of 0.75 V between the power plant discharge bus and the PDC busbars.

The design of secondary distribution in the DMS-100 makes sure the maximum voltage drop between the PDC busbars and each frame load under full load conditions does not exceed 1.0 V.

Under battery discharge and maximum voltage drop conditions, the input voltage measured at a frame load must not be lower than -42.75 V. Under battery equalization and very small voltage drop conditions, the input voltage measured at a frame load must not exceed -55.8 V.

4.1.3 Noise limits

The maximum acceptable voiceband noise at the battery terminals of any dc power plant feeding DMS-100 equipment is 55 dBrnC. The higher frequency noise must not exceed 300 mV rms in any 3 kHz band between 10 kHz and 20 MHz.

4.1.4 Step voltage changes

The maximum acceptable step voltage change of the dc power plant is 5 V at a rate of change not greater than 1 V/ms. Faster rates of change are permitted if the product of step voltage size and rate of change does not exceed 5 V^2/ms. The step voltage change is measured at the load side of the A or B feeder circuit at the power board.

4.2 Primary distribution

The dc power plant provides -48 V, through dedicated primary distribution battery feeders to the DMS-100 PDC. Two separate battery feeders, designated A feeder and B feeder, are connected from the dc power plant to each PDC for power distribution to DMS loads. Each feeder consists of a -48 V conductor and the associated BR conductor. These conductors are of the same current-carrying capacity and are routed close to each other.

The full-load rating of each A feeder and B feeder is 400 A. The maximum dc distribution capability of each PDC is 800 A. As the load increases or decreases, the protection rating must be adjusted according to the following considerations:

- Under full-load conditions, one of the following must protect each of the feeders:
  - a 600 A fuse
  - a circuit breaker with suitable characteristics and a rating of 600 A
- When a feeder supplies load current of less than 400 A, the protection rating must be as close to, but not less than, 1.5 times the actual load current.
- The physical characteristics of the fuse holder can determine the rating of the fuse to be used.

Primary distribution feeders are designed on a job basis for a minimum current-carrying capacity equal to the full-load current. The design of these feeders also conforms to the voltage drop limits described in Section 4.1.

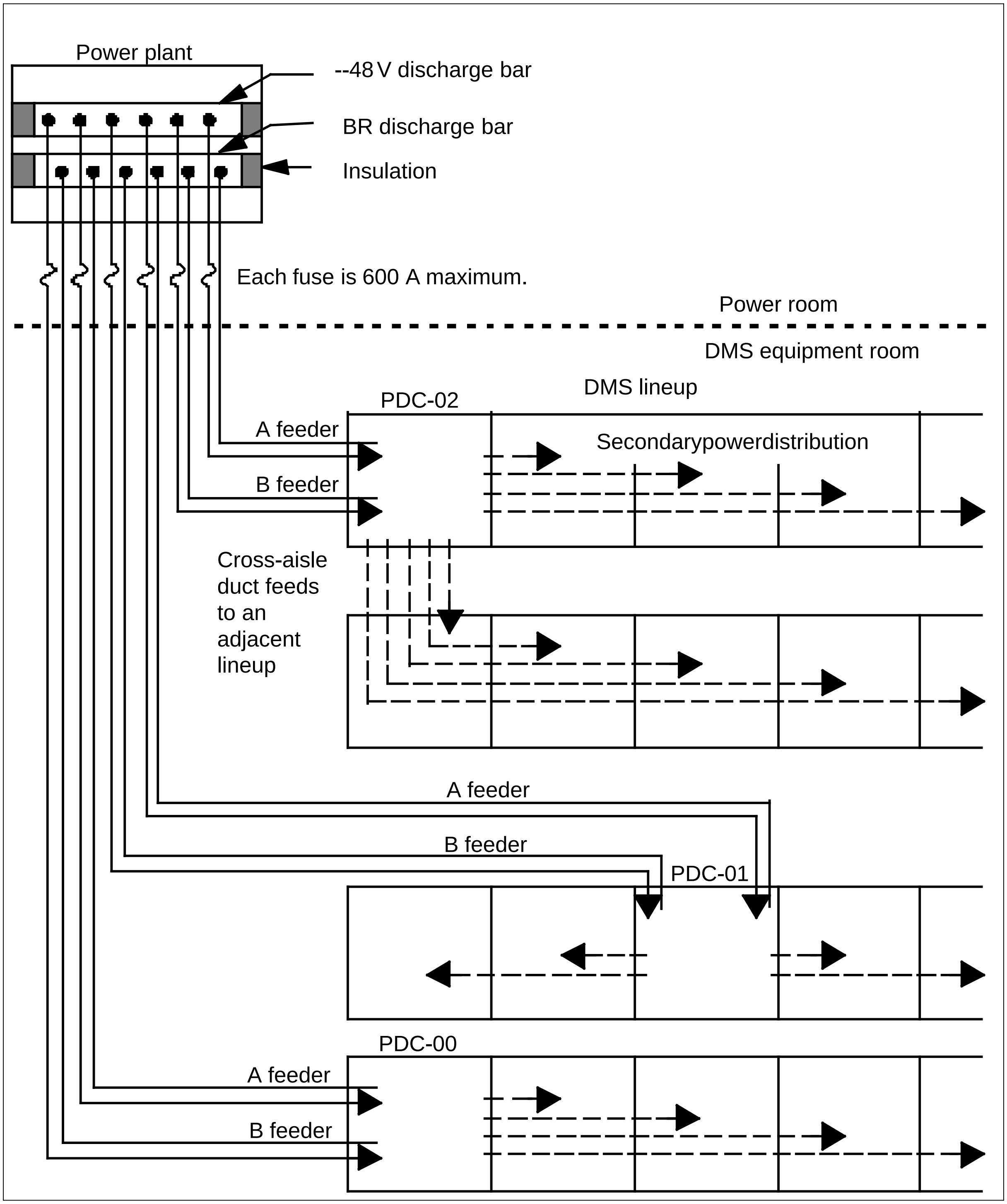
4.3 Secondary distribution

4.3.1 Power distribution center

Each PDC provides an interface between the A and B primary distribution feeders and up to 150 individual loads within the DMS-100 system. A typical PDC arrangement appears in Figure 4-1. Some of the features and limits of the PDC design are as follows:

- Each load uses an individual fuse at the PDC.
- The PDC can be in any position in an equipment lineup.
- The PDC can serve more than one lineup, provided that both of the following are met.
    - — the voltage drop limits of the feeders as described under Section 4.1
    - — the PDC distribution capability discussed under Section 4.2
- Cross-aisle battery and BR conductors are contained in one tray.
- Where more than one PDC is provided, the following rules apply.
    - — In non-ISG systems, the primary distribution BR conductors are interconnected with 750 kcmil cables at the PDC to equalize the potential differences between the BR conductors of the different PDCs.
    - — In ISG systems, the primary distribution conductors are not interconnected.

Figure 4-1 DC power distribution to DMS-100F lineups



4.3.2 Secondary feeder size calculation

Each battery feeder from the PDC to each DMS-100 load consists of a -48 V conductor routed close to a BR conductor of equal current-carrying capacity. The design of the feeder satisfies the voltage drop limit of 1.0 V at full load as specified in Section 4.1.2, "Feeder voltage drop".

Use the following formula to calculate the size of the feeder for a specified application:

- $CM = 11.1 \times I \times L$
- *Where:*

CM
is the area (in circular mils) of the conductor

11.1
is the resistivity in (ohms x CM) / ft of hard-drawn copper (ASTM Standard B173)

I
is the full-load current (in amps) carried by the feeder

L
is the conductor loop length in feet between the PDC and the individual load

Use the calculated value of CM to select one of the following conductor sizes so the voltage drop over the length L of the conductor is 1.0 V or less:

- If CM is less than or equal to 10 380, use No. 10 AWG copper.
- If CM is between 10 381 and 16 510, use No. 8 AWG copper.
- If CM is between 16 511 and 26 250, use No. 6 AWG copper.

The connection of secondary distribution -48 V conductors and BR conductors from the PDC to other frames varies with the types and quantities of the shelves used. Frames with duplicated loads have plane-0 connected to battery A bus and plane-1 connected to the B bus. Examples of frames with duplicated loads are Central Control, Network Module, and Memory Extension frames. Loads that are not duplicated are distributed as evenly as possible between the A and B buses. Feeder arrangements are determined during the job engineering process for each job application.

4.3.3 Fuse and breaker selection

Use only the type of cartridge fuses on a PDC fuse panel or on an FSP that Nortel Networks recommends to protect secondary distribution feeders. The fuse rating must be as follows.

- equal to or less than 30 A (the maximum for the fuse holder)
- in a special Data Packet Network (DPN) application, 35 A to 65 A with a different fuse holder
- as close to, but not less than, 1.5 times the maximum-load current
- correctly coordinated with any other over-current protective device connected to the feeder circuit

4.3.4 Configuration of the PDC: front view

The front view of a standard PDC configuration appears in Figure 4-2. A fully equipped PDC includes:

- a BR panel
- up to ten fuse panels for secondary dc power distribution to separate DMS-100 loads
- an FSP containing alarm circuitry
- a filter panel containing noise and transient suppression components
- a filler panel with a container for spare fuses

The lowest supporting screw hole for the panel in the mounting plate identifies the position of each panel in the PDC. The holes are numbered from 00 at the bottom of the frame to 77 at the top. The holes are located at 1-inch intervals on the vertical members of the frame.

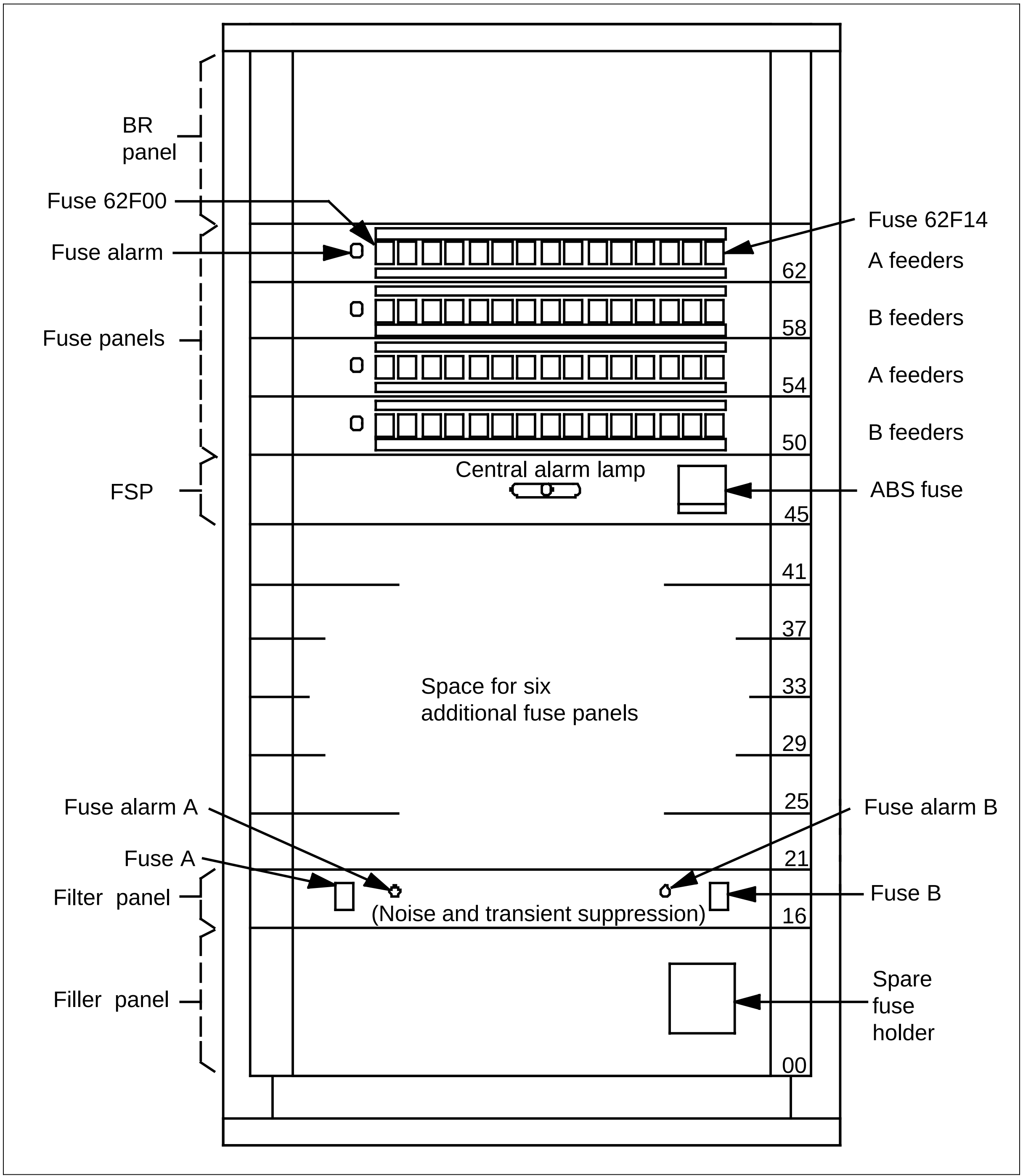
In a standard PDC, fuse panels mount in positions 62 to 50 and 41 to 21, as described below:

- In a minimum size PDC, two pairs of fuse panels occupy positions 62 to 50.
- As demand increases, fuse panels are added to positions 41 to 21, starting with positions 41 to 37. Unused positions are equipped with filler panels.
- The feeders (A and B) supply the fuse panels as follows:
  - — The A feeder supplies fuse panels in positions 62, 54, 41, 33, and 25.
  - — The B feeder supplies fuse panels in positions 58, 50, 37, 29, and 21.
- Fuses are assigned so that the loads on the buses are equalized as closely as possible.

Each fuse panel is equipped with 15 fuse blocks, numbered from 00 to 14. The fuses in these blocks range in value from 5 A to 30 A, as required. The base mounting position identifier of the panel and the fuse block number in the panel identify each fuse number. For example, a fuse identified as 62F00 refers to the panel at base mounting position 62 and the fuse contained in fuse block 00. Block 00 is the first fuse block from the left in the panel. Fuse block number 62F14 identifies the fifteenth (farthest to the right) fuse on the panel in position 62.

If a fuse opens, the fuse alarm lamp on that panel lights and a signal travels to the FSP in position 45. This signal activates the central alarm circuitry.

Figure 4-2 Typical PDC frame configuration (front view)



4.3.5 Configuration of the PDC: rear view

The -48 V conductors of primary distribution feeders A and B are connected in the sequence given to the A Bus and B Bus. These buses mount on the sides of the frame and extend from approximately position 68 to position 13. See

Figure 4-3. The two BR conductors connect to a common BR plate mounted at the top of the PDC. The BR plate is insulated from the PDC framework and connects to all secondary distribution BR conductors. The BR plate also has provisions for the 750 kcmil cable connection. The BR plate requires this connection when equalization of potential differences is specified (non-ISG configuration).

The -48 V and BR cables are normally routed through the top of the PDC frame and connected to the top ends of the battery busbars and the BR plate. If power feeders run in ducts under the floor or under a raised floor, the BR plate should be mounted at the bottom of the PDC. The BR plate changes places with the filler panel in this configuration. The battery and BR conductors follow a route through the bottom of the PDC and connect to the bottom of the battery busbars and the BR plate.

4.3.6 Frame supervisory panel

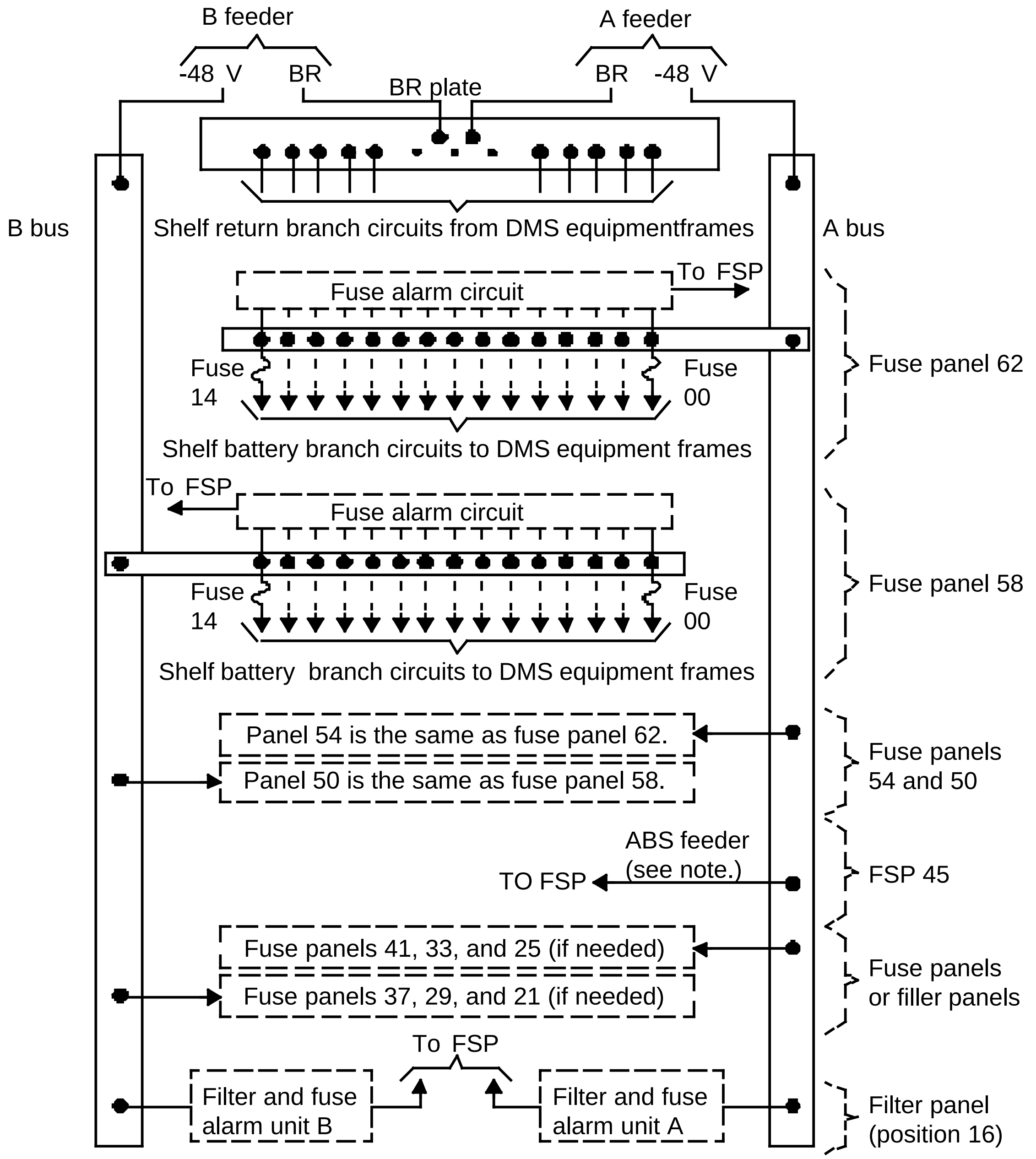
Each DMS-100 frame has a Frame Supervisory Panel (FSP). The FSP is the interface between the secondary distribution feeder circuits and Alarm Battery Supply (ABS) circuits from the PDC and the internal frame loads. The FSP subdivides the secondary distribution branch circuits into protected circuits to each shelf or circuits. Fuses or circuit breakers are used for circuit protection. The FSP also performs a power alarm and control function.

In a DMS-100F system equipped with the Enhanced Alarm System (EAS), the power feeder to the FSP in the PDC (position 45) originates from a 20 A fuse or circuit breaker at the power plant powering the PDC. In a DMS not equipped with EAS, this power feeder originates at the A Bus. This secondary distribution feeder provides an ABS for the alarm circuits and lamps of DMS frames fed from the PDC. A fuse within the FSP protects the ABS.

4.3.7 Filter panel

The PDC filter panel (position 16) contains two noise and transient suppression capacitors and associated fuses and alarm lamps. The negative side of capacitor C1 connects to the A Bus through filter unit Fuse A. Capacitor C2 connects to the B Bus through Fuse B. If Fuse A or Fuse B blows, a signal travels to the FSP to activate the central alarm circuitry.

Figure 4-3 Typical PDC frame configuration (rear view)



Note: For an OAU application with EAS, the -48 V feeders for the primary and secondary alarm MTMs originate directly from the power plant powering the PDC.

5 Grounding of dc power facilities

This section describes the grounding requirements for dc power facilities that supply DMS-100F equipment using the isolated bonding network (IBN) grounding topology.

CAUTION
DMS SPG
Only one DMS SPG can be the single point ground reference for a DMS switch, associated equipment, and the serving power plant.

5.1 Power plant located near the DMS-100F

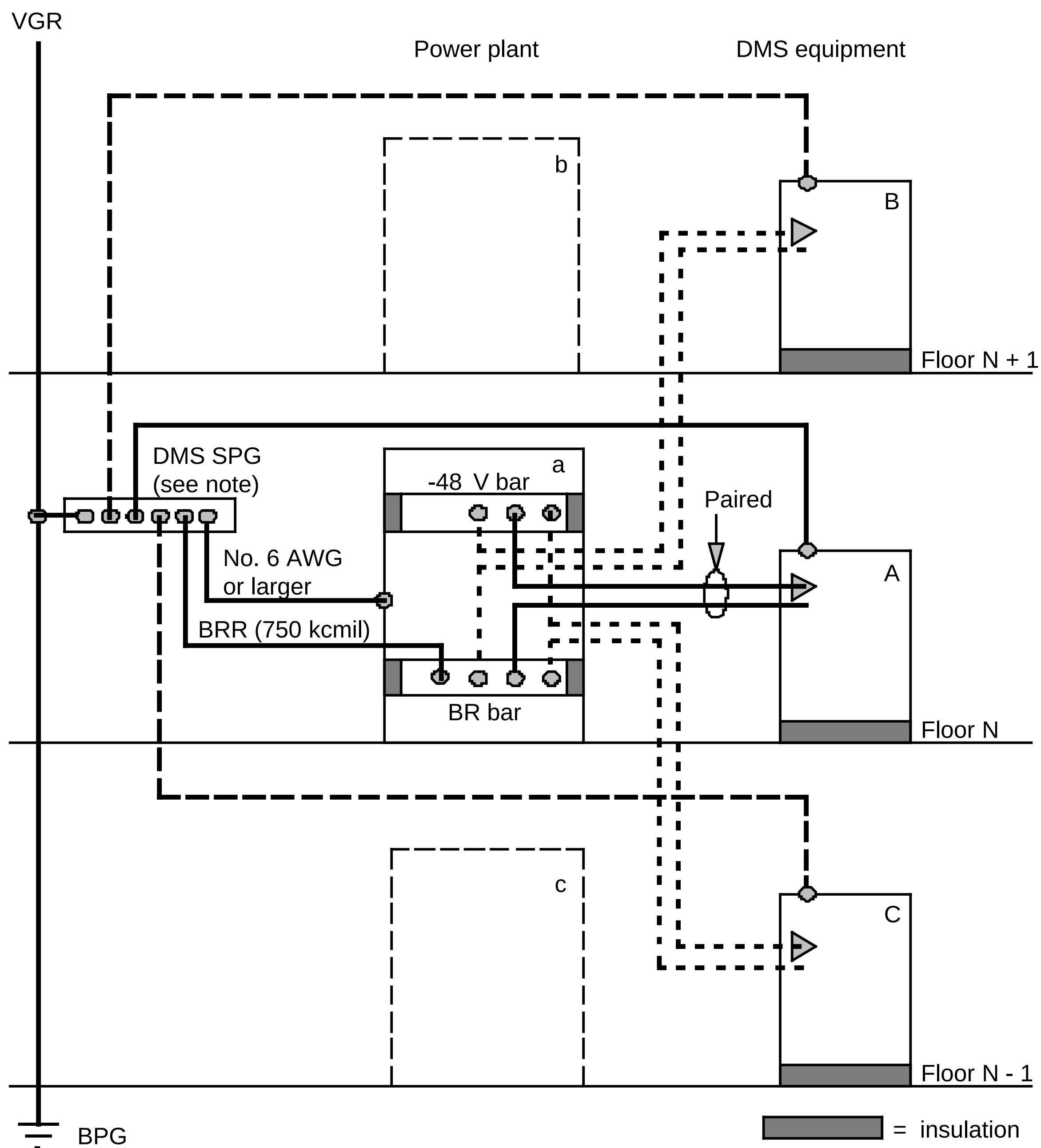
5.1.1 Feeding DMS-100F equipment

Figure 5-1 provides the recommended power plant configuration for feeding DMS equipment. The basic rules that apply to this configuration are as follows:

- All DMS-100F equipment must be within one floor of the DMS SPG.
- Location 'a' is the preferred power plant location, but locations 'b' and 'c' are acceptable.
- The power plant must have one of the following:
  - — a BR bar insulated from the framework and connected to the DMS SPG by a battery return reference (BRR) conductor
  - — a non-insulated BR bar and an additional insulated bar as shown in Figure 5-2

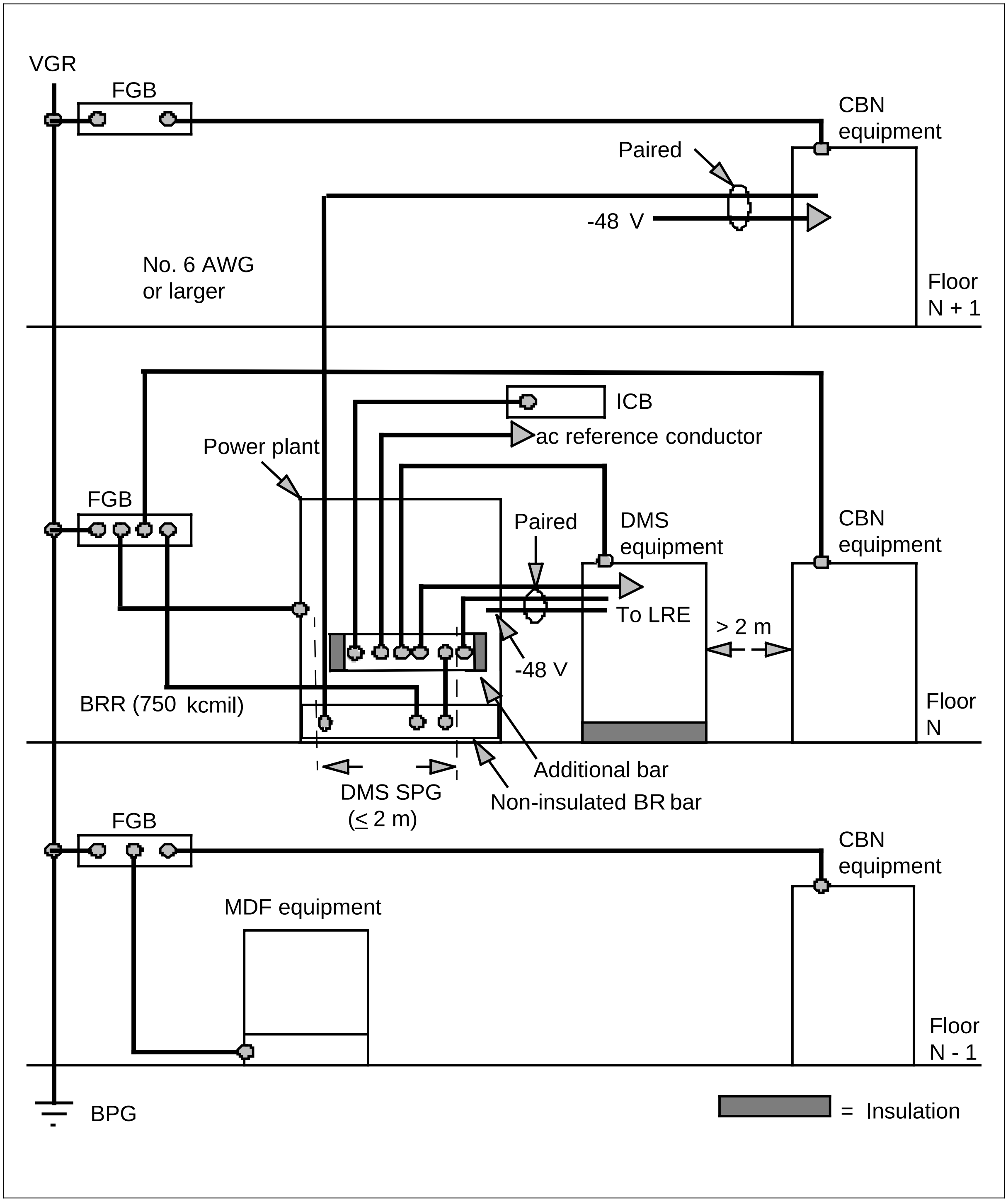
- The framework of the power plant must bond to the FGB of the floor where the power plant is located.
- Grounding conductors must not carry current under operating conditions.

Figure 5-1 Recommended power plant configuration



Note: The DMS SPG can be identical to the FGB, or the DMS SPG can be a separate bar. An example of a separate bar is the MGB located in the GW [R-5] that the BOCs use.

Figure 5-2 Near power plant with non-insulated BR bar feeding DMS-100F and CBN equipment



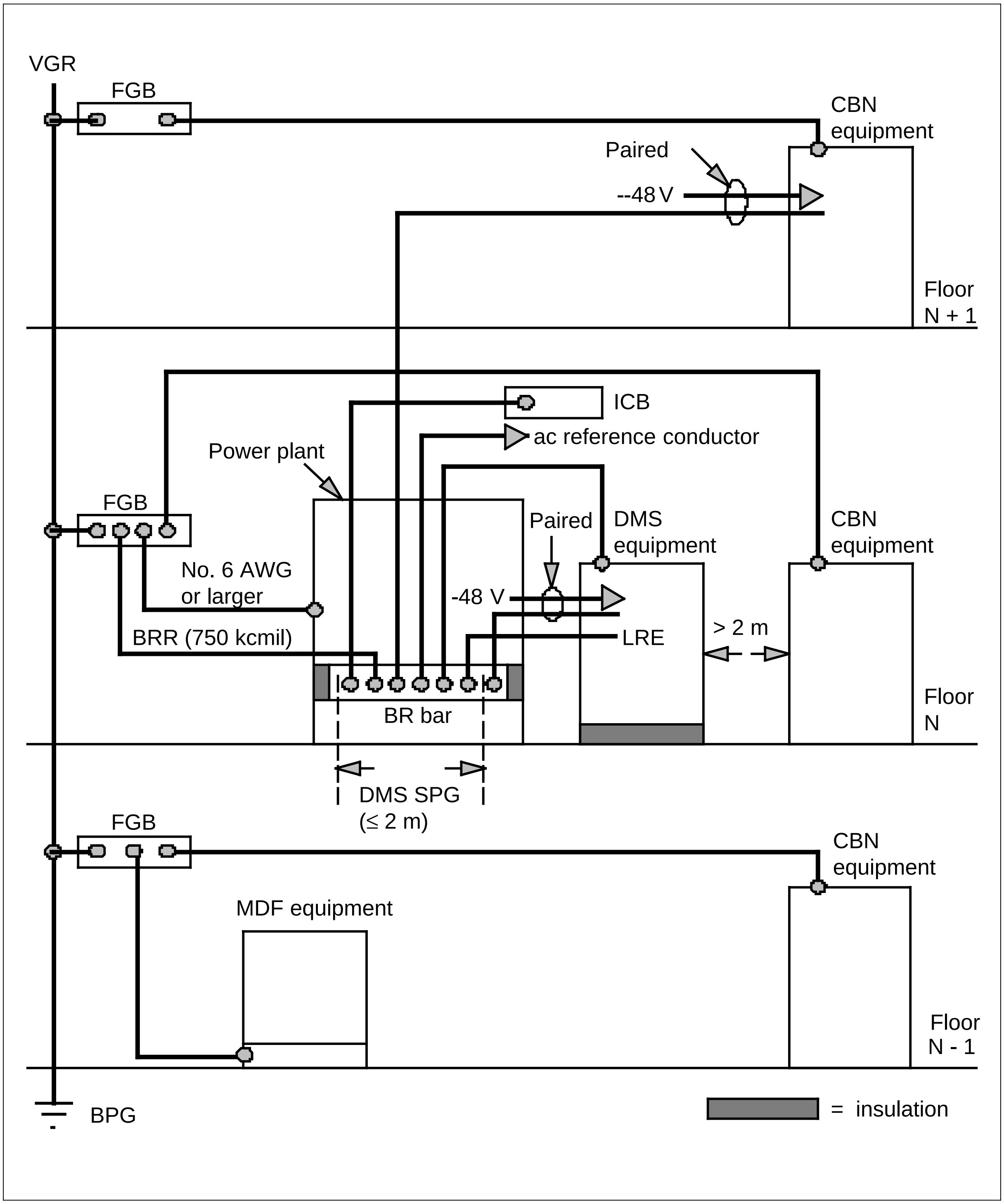
5.1.2 Feeding DMS-100F and CBN equipment

When a common power plant must feed both DMS-100F and CBN equipment, use the configuration in Figure 5-3. The following rules apply:

- All DMS-100F equipment must be within one floor of the DMS SPG.
- All CBN equipment must be within one floor of the power plant. Surge voltage can appear between the BR bar and the framework of the power plant. The equipment must be within one floor because this surge voltage increases with vertical distance.
- The BR bar of the power plant should be insulated from the framework and bonded to the FGB. A part of the insulated BR bar serves as the DMS SPG. If the BR bar of the power plant is not insulated from the framework, you can install an insulated busbar. In this configuration, use parts of the assembly as the DMS SPG. Figure 5-2, "Near power plant with non-insulated BR bar feeding DMS-100F and CBN equipment" shows the connections you must make for this arrangement.
- The framework of the power plant must be bonded to the FGB.

Existing communication equipment installed in the CBN is sometimes designed to connect the BR to the enclosure, frame, or chassis. This design can result in circulating currents and multigrounding of the power plant. Nortel Networks does not recommend the use of a common plant to feed such existing equipment and DMS-100F equipment. Nortel Networks recommends that you make provisions for insulating the BR from frame or cabinet.

Figure 5-3 Near power plant that feeds DMS-100F and CBN equipment



5.2 Power plant located far from the DMS-100F equipment

5.2.1 Feeding DMS-100F equipment

The power plant can be located several floors from the DMS-100F equipment as shown in Figure 5-4. Nortel Networks does not recommend this configuration. The following rules apply:

- All DMS-100F equipment must be within one floor of the DMS SPG (locations 'A', 'B', and 'C').
- The framework of the power plant must be bonded to the FGB of the floor where the power plant is located.
- The BR bar of the power plant must be insulated from the framework. A BRR conductor run to the DMS SPG must reference the BR bar to ground.

Note: Under surge conditions, current in the VGR creates a voltage drop. This voltage drop appears between the BR bar and the framework of the power plant. The power plant should be on a floor close to the DMS-100F equipment because the voltage drop increases with vertical distance.

5.2.2 Feeding DMS-100F and CBN equipment

Some existing installations use the power plant arrangement in Figure 5-5 to feed both DMS-100F and CBN equipment.

In this DMS-100F arrangement, the -48 V feeders to the CBN are routed within 1 m (3 ft) of the DMS SPG. This location is where the BR conductors connect to the DMS SPG bar. The location of all DMS-100F equipment must be within one floor of the DMS SPG. The CBN equipment is not subject to this restriction.

This arrangement results in circulating currents through the connection between the DMS SPG and VGR, and through the BRR conductor.

Nortel Networks does not recommend that you perpetuate the use of this arrangement in installations.

Figure 5-4 Far power plant that feeds DMS-100F equipment

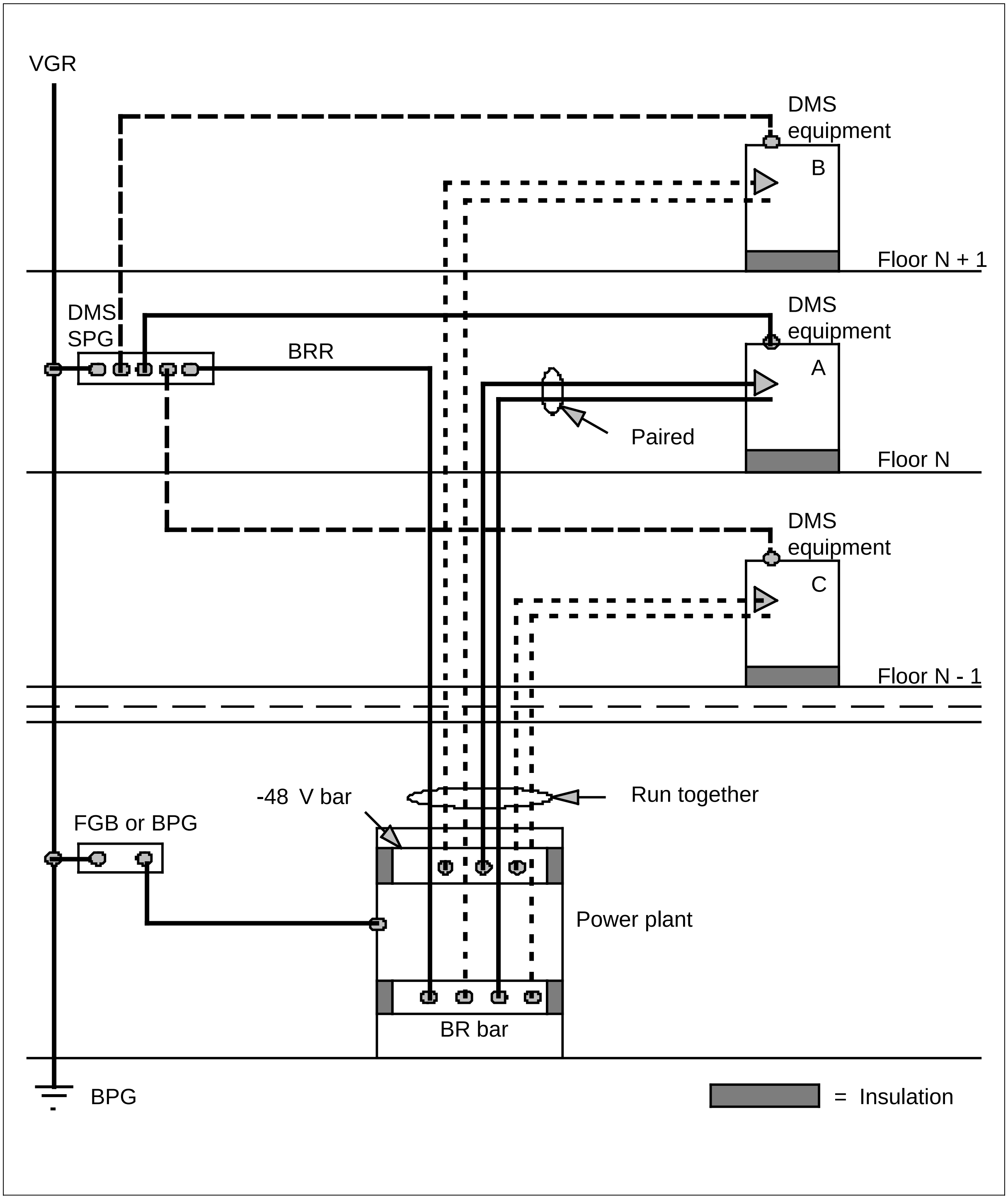
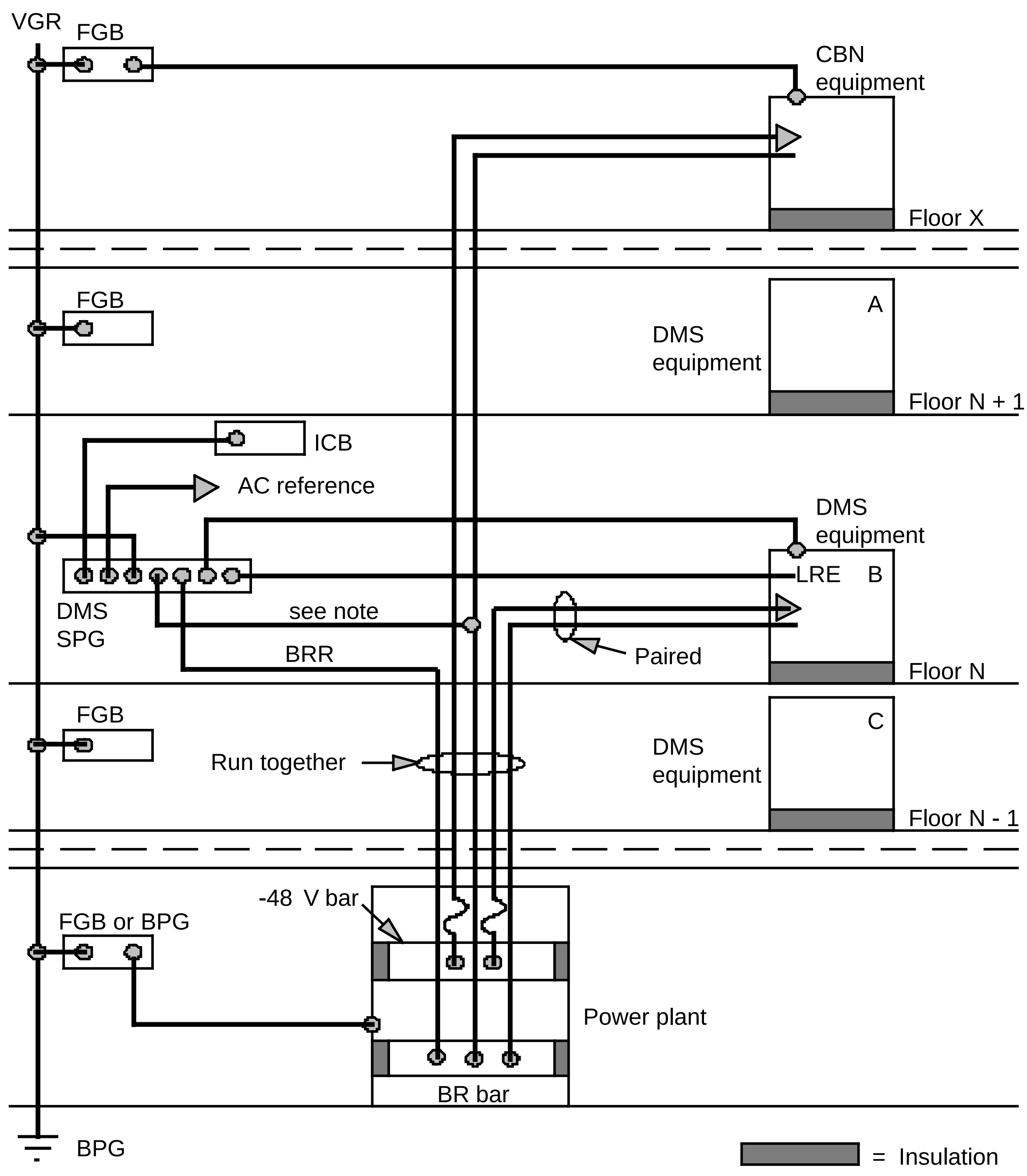


Figure 5-5 Far power plant that feeds DMS-100F and CBN equipment



Note: The length of this conductor must not exceed 1 m (3 ft).

5.3 Power plant ground reference

The BR conductor is referenced to ground only one time through the power plant's BR bar (see Figure 5-1 to 5-4).

All BR bars or terminations must be insulated from the frames. This requirement applies to the bars and terminations that are part of the powered IBN equipment or of associated power distribution bays.

The BR conductors of the feeders, that the BRR conductor already references to ground, must not connect to the DMS SPG. This requirement applies unless a part of the BR busbar in the power plant acts as the DMS SPG.

The primary power feeders must be routed close to the BRR conductor.

5.4 Batteries

The connection of the positive battery terminal to the BR bus of the power plant references the battery to ground. The battery must not have other connections to ground.

Ground conventional metal battery stands according to the practices of the operating company. You do not need to ground metal battery stands and battery cases that have nonconductive surfaces. Treatment with dielectric material can make surfaces nonconductive.

5.5 Internal dc/dc converters

The dc/dc converters internal to the DMS-100F communication system have isolation between input and output, and feed only system-internal loads.

The grounded output conductors connect to the nearest ground reference bus (normally the LRB of the frame or cabinet). For converters on printed circuit boards, this connection is at the associated backplane.

All converters are powered from the -48V power plant.

Internal dc/dc converters must not be used to supply power to equipment external to the DMS-100F system.

5.6 Grounding conductor requirements

5.6.1 Sizing and running

Grounding and bonding conductors must meet the following requirements.

- Grounding and bonding conductors must be insulated stranded copper wire unless specified exemptions are in effect. These conductors must be as short as practicable.
- All installer-made grounding and bonding connections must use conductors of size No. 6 AWG or larger.
- All conductors, connectors, and terminating hardware must be approved for the application by a qualified testing laboratory (for example UL or CSA).
- Grounding conductors should be sized to conduct fault currents of at least ten times the rated current of the associated protective device. Base this measurement on the time required to operate the device (fuse or breaker) safely. Assume normal system voltage and maximum resistance of the fault path.
- Grounding conductors should not be run in enclosed metal raceways. When you cannot avoid the use of a metal raceway, bond the grounding conductor to the raceway at each end of the raceway. The metal raceway must be electrically continuous from end to end.
- You can install conductors in or under cable racks or trays. Fasten conductors with materials other than metal, or metal clamps that do not encircle the cable.
- Enclose conductors connecting equipment located on different floors in protective nonmetal sleeves where allowed by applicable codes.
- Unless both ends of a cable are visible from each end, both ends must be visibly labeled.
- Avoid bends in conductors. When you cannot avoid a bend, the bend must have the largest possible angle and bending radius. An angle must not be smaller than 90 degrees. For easy installation, the recommended bending radius is 30 cm (12 inches) for all cable sizes.
- Make the connection of the grounding and bonding conductors so that conductor bends are in the direction of the anticipated current flow. This usuallymeans that the conductors are bent toward the grounding electrode system.

5.6.2 Labeling and color coding

All conductors of the power and grounding system must be appropriately labeled at the time of installation.

5.6.3 Terminations and connections

Cable lugs for installer-connected grounding cables must be standard two-hole double-crimped compression, long barrel lugs, or exothermic-weld copper lugs.

Use single-hole lugs where the use of two-hole lugs is not possible (for example, feed-through capacitors).

Only use solder where absolutely necessary and only when it is not the only means of connection.

All contact surfaces must be as follows:

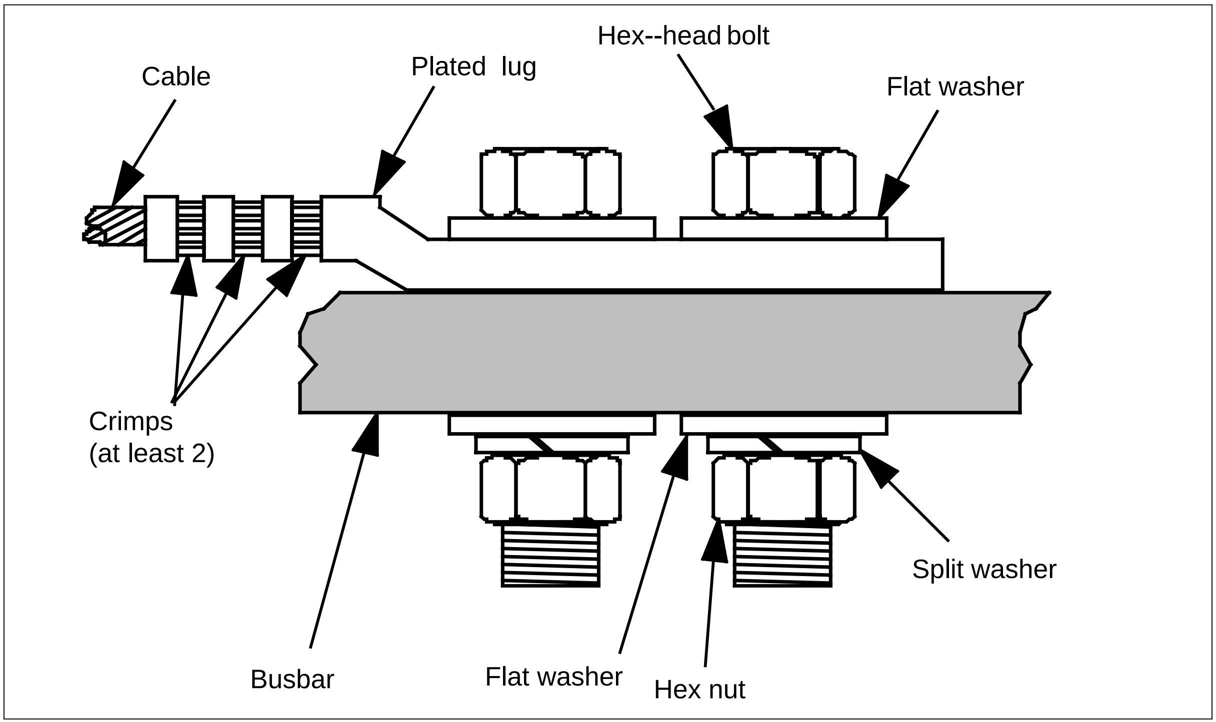
- flat (to maximize cross-sectional area of contact)
- clean (to ensure metal-to-metal contact)
- under pressure (to maintain contact force)
- gas tight (to inhibit corrosion and surface wear)

Clean plated-metal contact surfaces with a cloth. This action removes grease and other material. Do not abrade the plated surfaces.

Abrade bare metal contact surfaces until clean bright metal is visible. Coat the surfaces with a thin layer of an anti-oxidant compound (for example, NO-OX-ID) before you join the contact surfaces.

Figure 5-6 shows the correct termination of a two-hole lug. You also can use an equivalent manner acceptable to the operating company. The positions of the bolt head and the nut can be reversed. Retain the position of the flat and split washers in relation to the bolt head and nut.

Figure 5-6 Terminating 2-hole lug to busbar



Do not paint the bonding and grounding lug for each frame or cabinet. This lug must provide a contact surface as described in this section.

The bare copper framework bonding bar must connect to bare metal contact surfaces of the frame or cabinet. Abrade the surfaces until clean bright metal is visible. Coat the surfaces with a thin layer of an anti-oxidant compound (for example, NO-OX-ID) before you join the two contact surfaces. If one of the contact surfaces is plated, clean the plated surface with a cloth. Do not abrade a plated surface.

When you must make grounding connections to painted surfaces in the field, for example to existing equipment, remove the paint carefully to protect personnel and equipment.

All bolted connections must conform to the torque requirements listed in Table 5-1 unless an applicable Nortel Networks document specifies different requirements.

Table 5-1 Torque requirements for bolted bonds

bolt size	Threads/inch	Torque (in-lbs.)	Tension (lbs.)	Bond area (square inches)
#8	32	18	625	0.416
	36	20	685	0.456
#10	24	23	705	0.470
	32	32	940	0.626
1/4"	20	80	1840	1.225
	28	100	100	1.470
5/16"	18	140	2540	1.690
	20	150	2620	1.750
3/8"	16	250	3740	2.430
	24	275	3950	2.640
7/16"	14	400	5110	3.400
	20	425	5120	3.420
1/2"	13	550	6110	4.070
	20	575	6140	4.090
5/8"	11	920	7350	4.900
3/4"	10	1400	9300	6.200
7/8"	9	1950	11100	7.400
1"	8	2580	12900	8.600

6 AC power distribution

The customer supplies all general purpose ac distribution centers equipped with circuit breakers used for feeding lighting fixtures.

The customer must install all ac equipment and associated distribution in accordance with the NEC or CEC. This equipment and installations must also comply with other applicable codes and regulations.

6.1 AC-free switch

To maintain the soundness of the IBN, internal inverters are used to power all ac-powered loads in the switch and all convenience outlets incorporated into the DMS-100F equipment.

If external ac power distribution circuits are brought into the switch IBN, the circuits must be referenced to the DMS SPG in accordance with the requirements of Chapter 7, "Grounding of ac power facilities".

6.1.1 Service-affecting ac loads

These subsystems of the DMS-100F switch are critical to the operation of the switch. The following examples are service-affecting loads:

- system clocks
- disk drives and tape drives
- modems
- cooling units

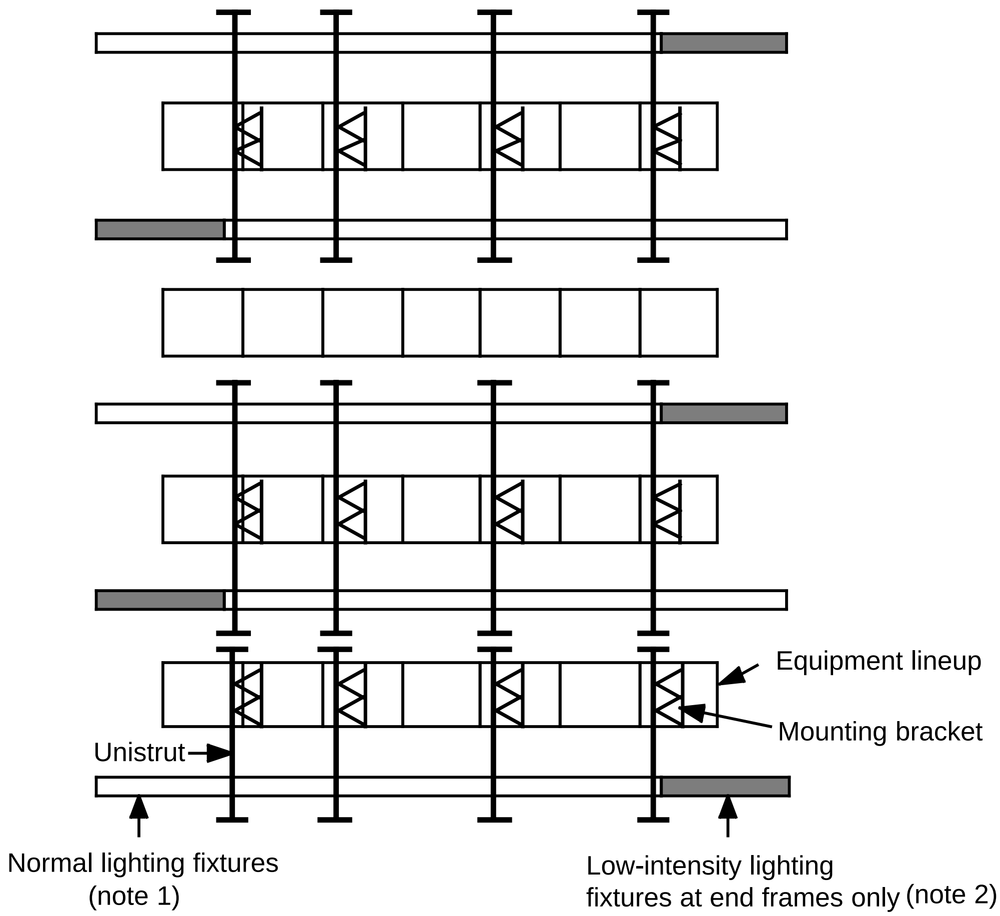
6.1.2 Lighting

Center-aisle lighting with fixtures suspended from the ceiling and powered from general purpose ac is recommended. The supply voltage is normally 120 V, 60 Hz. Lamps with a supply voltage of 277 V, 60 Hz are also available.

Low-voltage switches control the lighting fixtures. These switches are optionally located in the end guards of the frames, on the wall, or in both locations.

Another version of center-aisle lighting uses lighting fixtures supported from the DMS-100F frames in the lineups. Refer to Figure 6-1. The supply voltages and control switches are similar to the voltages and switches described for the ceiling-suspended version.

Figure 6-1 Earlier center-aisle lighting arrangement



Note 1: Bay-mounted switches at each end of a lineup control normal (not essential) lighting.
Note 2: Wall switches at each entrance to the DMS-100 area control essential low-intensity frame lights at the end of each maintenance aisle.

6.2 Other DMS versions

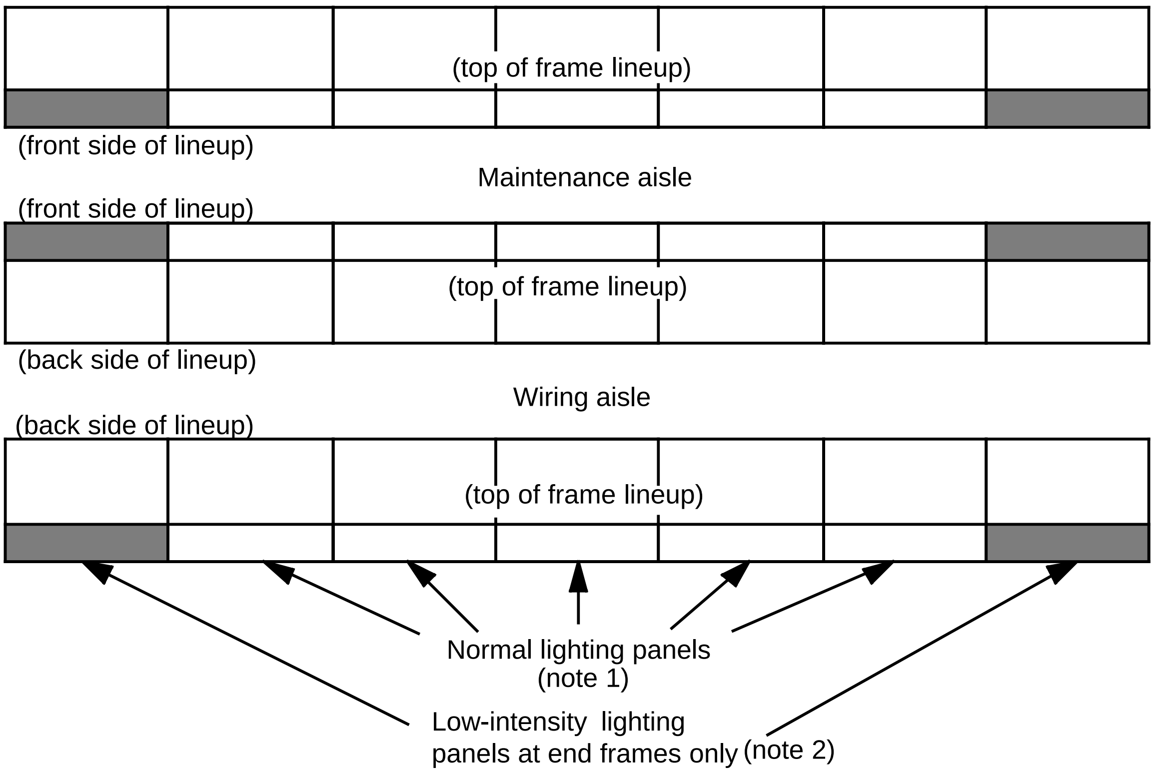
The DMS-100F switches that are not set up for ac-free operation have some or all of the following ac loads:

- Frame-integrated lighting with the lighting fixtures covered in sheet metal modules at the top of each frame (refer to Figure 6-2, "Frame-integrated lighting arrangement.").

> **CAUTION**
> **Improper use of outlets can generate noise**
> Do not use the orange or brown convenience outlets to power motorized power tools. The operation of motorized power tools from these outlets can generate electrical noise.

- Convenience outlets are normally on the end guards located at both ends of each DMS-100F lineup. A 120 V, 60 Hz supply feeds these outlets. This supply is acceptable for powering required loads.
- Service-affecting ac loads as previously described for ac-free switches. Internal inverters or an acceptable internal ac supply must power these no-break loads.

Figure 6-2 Frame-integrated lighting arrangement



Note 1: Bay-mounted switches at each end of a lineup controls normal (nor essential) lighting.
Note 2: Wall switches at each entrance to the DMS-100 area controls essential low-intensity frame lights at the end of each maintenance aisle.

6.2.1 Lighting

The following categories apply to the lighting systems in all versions of the DMS-100F switches:

Essential: Low-intensity lighting fixtures provide a minimum of light when the commercial ac supply fails. These fixtures are at or near the end frames of equipment lineups. The shaded areas in Figure 6-1 and 6-2 indicate these fixtures.

Low-intensity lighting constitutes essential load and must be fed from appropriate 120 V, 60 Hz supplies. Wall-mounted switches at each entrance to the DMS-100F area control the lighting fixtures.

Nonessential: Normal intensity light fixtures are on all frames between the end frames of a lineup. These fixtures appear not shaded in Figure 6-1 and 6-2.

Emergency: This contingency lighting is not part of the DMS-100 ac power distribution system. Do not connect this lighting to the DMS-100 ac power distribution system. A local dc source normally powers emergency lighting. The -48 V power plant is an example of a local dc source.

6.3 AC supplies for DMS-100F equipment

The DMS-100F installations that do not feed all internal loads from internal inverters require external ac power suitable to the loads. The customer must provide suitable ac supplies. The type of load determines if the system can use one or more of the following ac supplies:

- commercial ac
  - ac panel dedicated to DMS, or
  - branch circuits (when the system requires very little ac power)
- special ac
  - standby engine alternator
  - stand-alone inverter
  - isolation transformer
  - UPS

Additional information on ac distribution appears in Chapter 7, "Grounding of ac power facilities."

7 Grounding of ac power facilities

The ac-free version of the DMS-100F is intended to maintain and enhance the integrity of the IBN. The ac-free version of the DMS-100F precludes the need to route external ac power to the switch. This version provides internal inverters to feed all ac-powered loads in the switch and the convenienceoutlets. Refer to Section 6.1, "AC-free switch."

The guidelines in this section apply to all installations of the DMS-100F switch that use external ac supplies.

7.1 Commercial ac power

7.1.1 AC service entrance and distribution

The ac service entrance and distribution must meet the requirements of either the NEC [R-5], or the CEC [R-2].

The main ac service neutral must be bonded to the BPG bar. The main ac service neutral must be bonded to the ACEG bar inside the switchgear. This neutral is known as the main bonding jumper. The sizes of the main bonding jumper must comply with

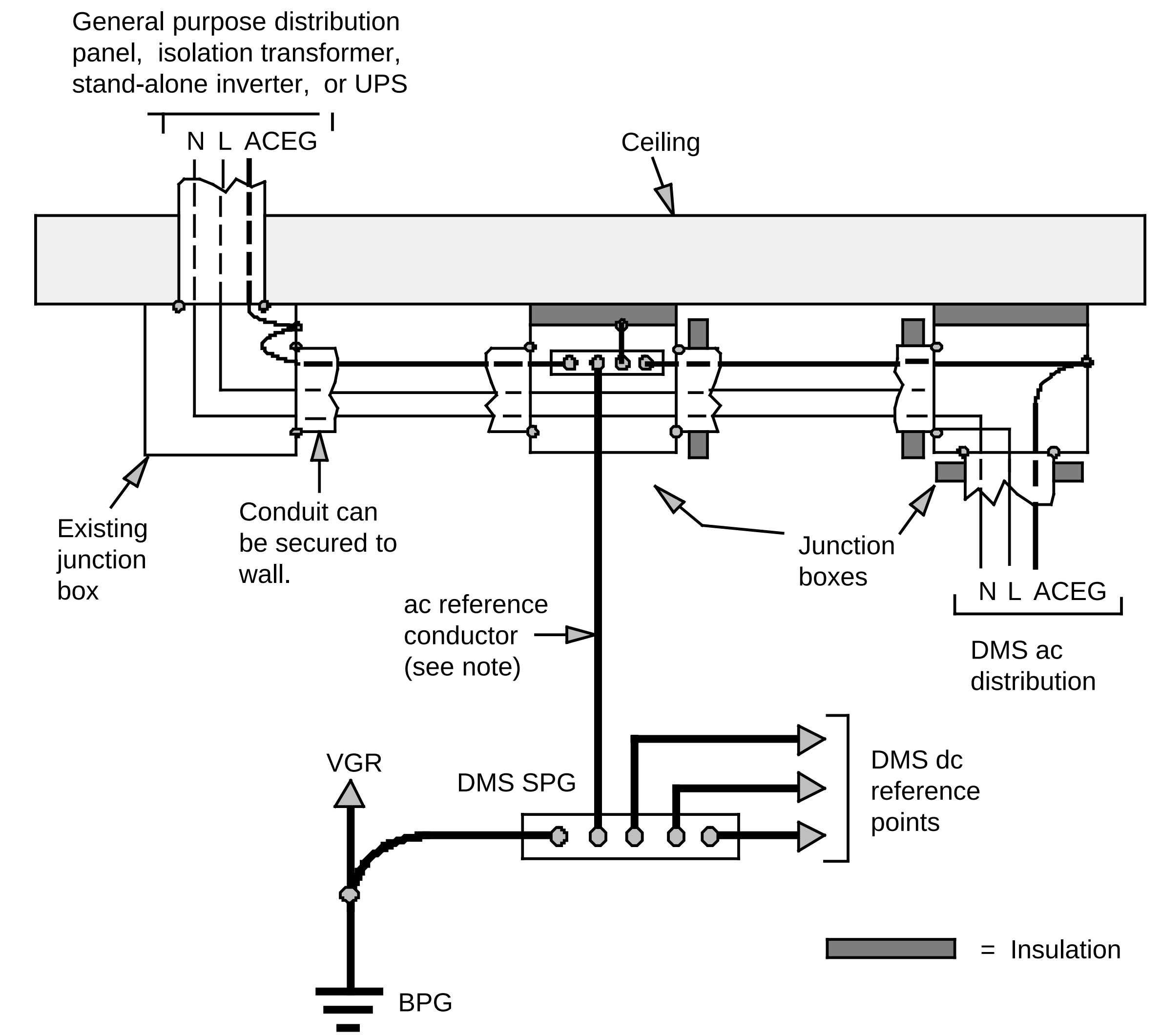
- NEC Article 250-79 in the USA, or
- CEC Rule 10-204 in Canada.

7.1.2 AC distribution panel

7.1.2.1 General purpose ac distribution panel

General purpose distribution panels provide ac power for building and utility equipment normally not related to communication. General purpose distribution panels can provide branch circuits to communication equipment as shown in Figure 7-1).

Figure 7-1 Recommended method of referencing ac branch circuits



Note: This conductor can be No. 6 AWG or larger. The length of this conductor cannot exceed 1 m or 3 ft. The conductor can only exceed this length if Nortel Networks and the operating company agree on a greater length.

Install at least one ACEG conductor in each race way or conduit, even if applicable codes do not specify it.

Two-meter rule:

General purpose panels and equipment powered from them must be at least 2 m (7 ft) away from any DMS-100F equipment.

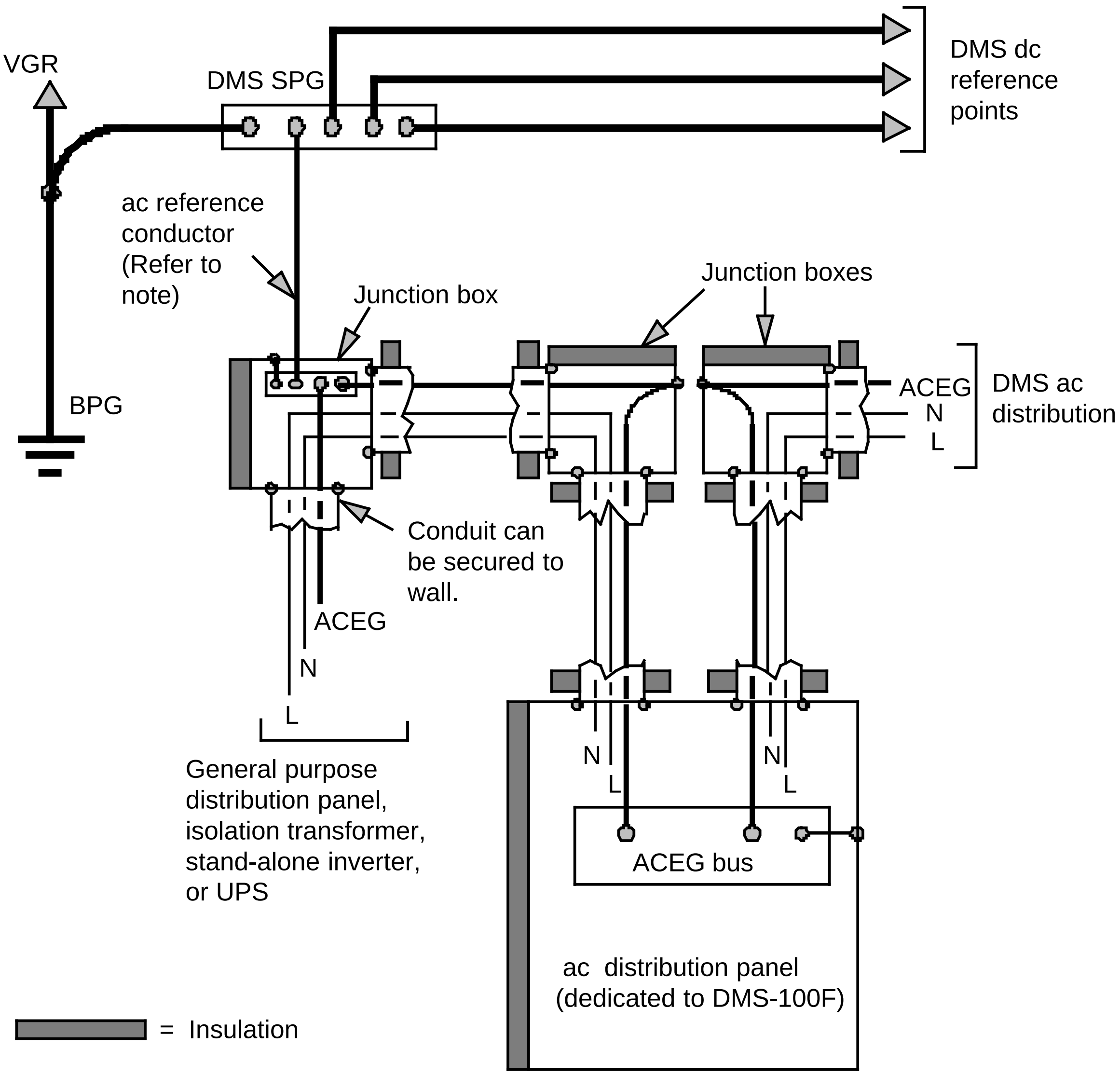
When the available distance is less than 2 m, the panel or the feeder must be bonded to the building grounding system as specified in this document.

7.1.2.2 AC distribution panel dedicated to DMS-100F equipment

AC panels that provide power only for DMS-100F communication equipment must be bonded to the DMS SPG. Figure 7-2 and Figure 7-3 show the bonding arrangement.

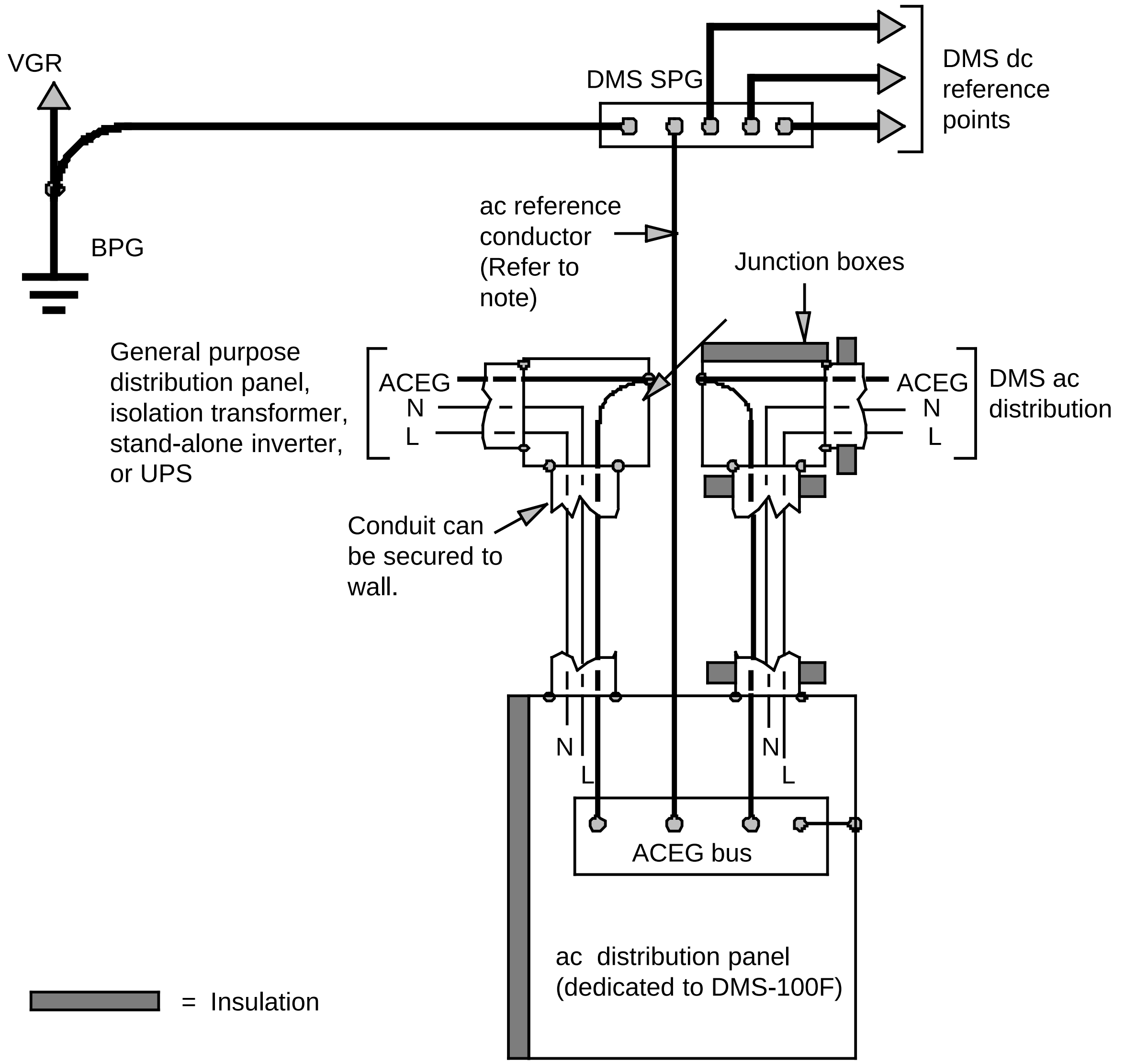
The panels must be clearly marked to prevent the use of the panels for general purposes.

Figure 7-2 Recommended method of ac referencing



Note: This conductor must be No. 6 AWG or larger. The length of this conductor must not exceed 1 m or 3 ft. The conductor can only exceed this length if Nortel Networks and the operating company agree on a greater length.

Figure 7-3 Alternate method of ac referencing



Note: This conductor can be No. 6 AWG or larger. The length of this conductor cannot exceed 1 m or 3 ft. The conductor can only exceed this length if Nortel Networks and the operating company agree on a greater length.

7.1.2.3 Branch circuit that feeds IBN equipment

IBN communication equipment can require only a small amount of ac power. In this condition, a dedicated ac panel is not always necessary. A single branch circuit or a small number of branch circuits typically run from a general purpose ac panel to the communication system. You must bond these branch circuits to the DMS SPG as described in Figure 7-1.

7.2 Special ac power

7.2.1 Standby engine-alternator

An automatic or manual transfer switch must be used to control standby ac supplies like engine-alternators. The following recommendations apply:

- You should connect the neutral conductor of the standby engine-alternator permanently to the neutral of the commercial ac supply.
- You should bond the grounding conductor of the standby engine-alternator according to either NEC Article 250-5 or 250-6.

The neutral conductor of the standby engine-alternator should not be bonded to the frame. Refer to the exception that follows.

When portable engine-alternators are connected to the building, the following rules apply:

- You must permanently bond the metal sleeve of the connecting receptacle to the grounding conductor of the transfer switch.
- You should connect the grounding conductor to the metal sleeve of the power plug of the alternator.

Examples of exceptions that can apply:

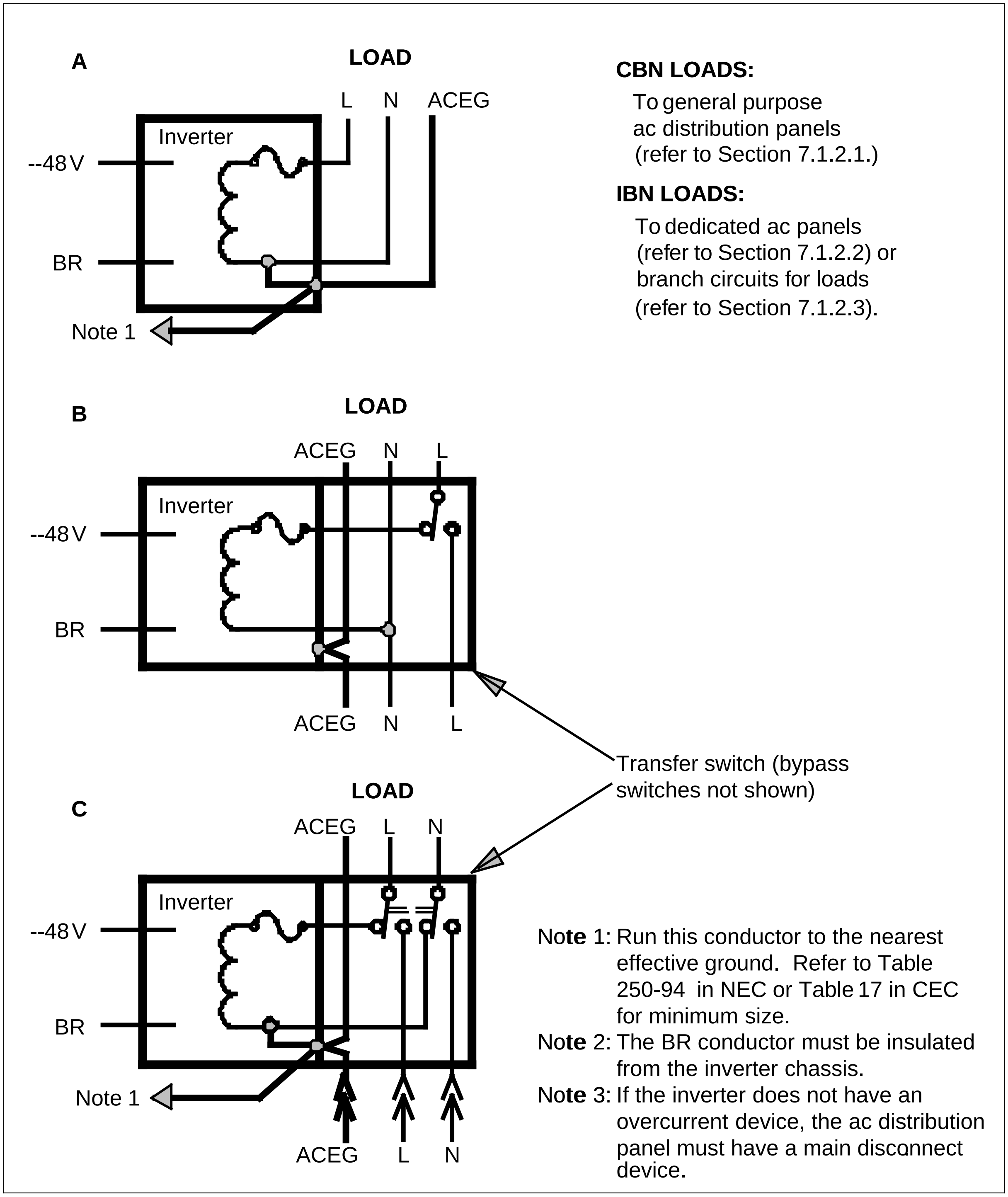
- Services greater than 1000 A require a ground fault protection (GFP) system, according to NEC Item 230-95 and CEC Section 14-102.
- The GFP system can require neutral switching within the transfer switch.

7.2.2 Stand-alone inverter

Stand-alone inverters are installed as part of the CBN to supply power to IBN loads, CBN loads, or both types of loads. Some installations include switches to transfer to commercial ac.

Inverters in the A or C configuration, shown in Figure 7-4, when used to power DMS-100F equipment, cannot be more than one floor away from that equipment.

Figure 7-4 Installation of a stand-alone inverter



You must insulate the BR conductor from the inverter chassis.

The connections that appear in Table 7-1 are recommended for stand-alone inverters.

Table 7-1 Recommended connections for stand-alone inverters

If		**Then**		
Transfer switch	**Neutral**	**Bond inverter in accordance with**	**Feed CBN equipment in accordance with**	**Feed DMS-100F equipment in accordance with**
No	Unswitched	Figure 7-4, Part A	DMS requirements for general purpose ac distribution panels [see Section 7.1.2.1, "General purpose ac distribution panel.")]	Either DMS requirements for ac panels dedicated to DMS equipment [refer Section 7.1.2.2, "AC distribution panel dedicated to DMS-100F equipment.")] or requirements for branch circuits that feed DMS equipment [refer to Section 7.1.2.3, "Branch circuit that feeds IBN equipment."]
Yes	Unswitched	Figure 7-4, Part B		
Yes	Switched	Figure 7-4, Part C		

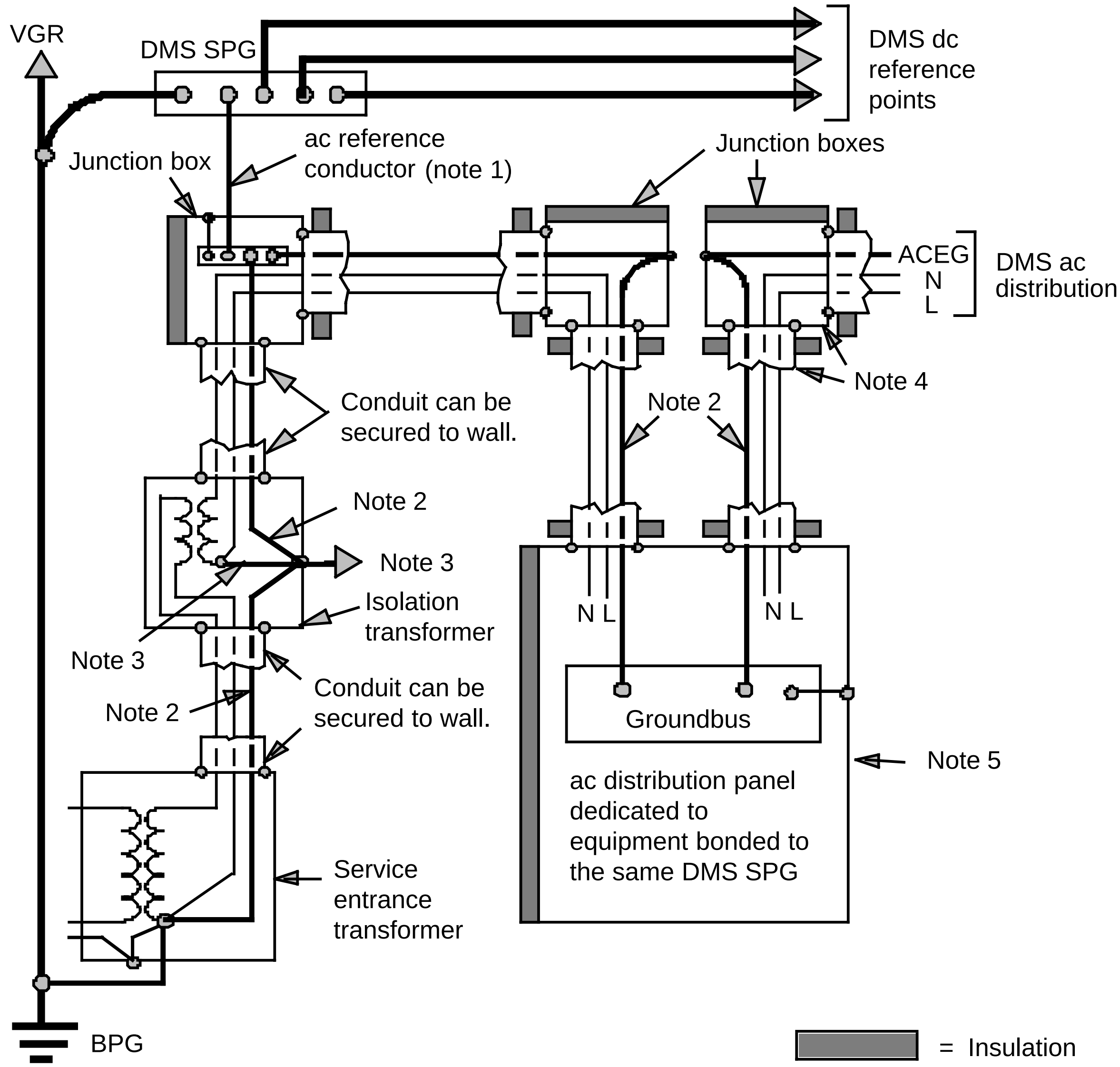
7.2.3 Isolation transformer

The ac source can be commercial ac, standby engine-alternator, stand-alone inverter, or UPS. When the ac source is several floors from the powered DMS-100F, insert an isolation transformer in the the ac feed to provide attenuation of common mode noise and reduction of induced surge voltages.

The isolation transformer should be close to the DMS-100F or at least within one floor of the DMS SPG. You should bond the transformer to the closest effective ground established in agreement with the customer. Bonding must comply with NEC Article 250-26 or CEC Section 10-206. Refer to Figure 7-5. The FGB or BPG, whichever is closest, can be an effective ground, subject to customer acceptance and compliance with the applicable codes.

Experience that supports the benefits of the isolation transformer in central office applications is not available.

Figure 7-5 Installation of an isolation transformer



Note 1: This conductor must be No. 6 AWG or larger. The length of this conductor must not exceed 1 m or 3 ft. The conductor can only exceed this length if the customer authorizes a greater length.
Note 2: Refer to Table 250-95 in NEC or Table 16 in CEC, to determine minimum wire size.
Note 3: Run this conductor to the nearest effective ground established in concurrence with the customer. Refer to Table 250-94 in NEC, or Table 17 in CEC for minimum size.
Note 4: You must isolate junction boxes, ac panel, and conduit beyond the referenced junction box from the building structure and incidental grounds.
Note 5: You must equip the ac distribution panel with a main disconnect device.

7.2.4 Uninterruptible power supply (UPS)

Install UPSs as part of the CBN according to NEC or CEC requirements.

The output stage of the UPS is an inverter. The rules to bond the output for feeding CBN and DMS-100F equipment loads are the same as the rules given in this document for a stand-alone inverter.

Any UPS used to power DMS-100F equipment should be no further than one floor away from the equipment.

7.2.5 Special ac distribution panel

These rules apply to ac panels fed from an isolation transformer, UPS, or stand-alone inverter that powers DMS-100F equipment.

- The panels and associated feeders and receptacles must be clearly marked to make sure the panels, feeders, and receptacles are used only for the specified purpose.
- Observe the protection coordination with the serving ac power source.
- A fault in a branch circuit must not cause the ac power source to transfer to standby ac power source.
- You must use instantaneous trip circuit breakers or fuses in the dedicated distribution panel.
- Branch circuit breaker ratings must coordinate with the distribution wiring and the load.
- Circuit breakers with ratings greater than 15 A are normally not required.
- The distribution panels must comply with one of the following:
  - — the installation requirements for ac panels dedicated to DMS-100 equipment. Refer to Figure 7-1 and Figure 7-2.
  - — the installation requirements for branch circuits that feed DMS-100F equipment. Refer to Figure 7-1.

7.3 AC outlets

7.3.1 General building outlets

Do not use general building outlets to feed loads located in the DMS IBN.

> **Two-meter rule:**
>
> General building outlets and associated conduits must be located at least 2 m, (7 ft) from any DMS-100F equipment.
>
> If outlets and conduits are located less than 2 m from equipment, bond the metallic conduit and/or the ACEG conductor to the DMS SPG. This bonding can be direct or indirect (using the ICB). This bonding is not necessary if the associated ac distribution panel is on the same floor as the DMS SPG and is bonded to the SPG.

7.3.2 Convenience outlets on communication equipment

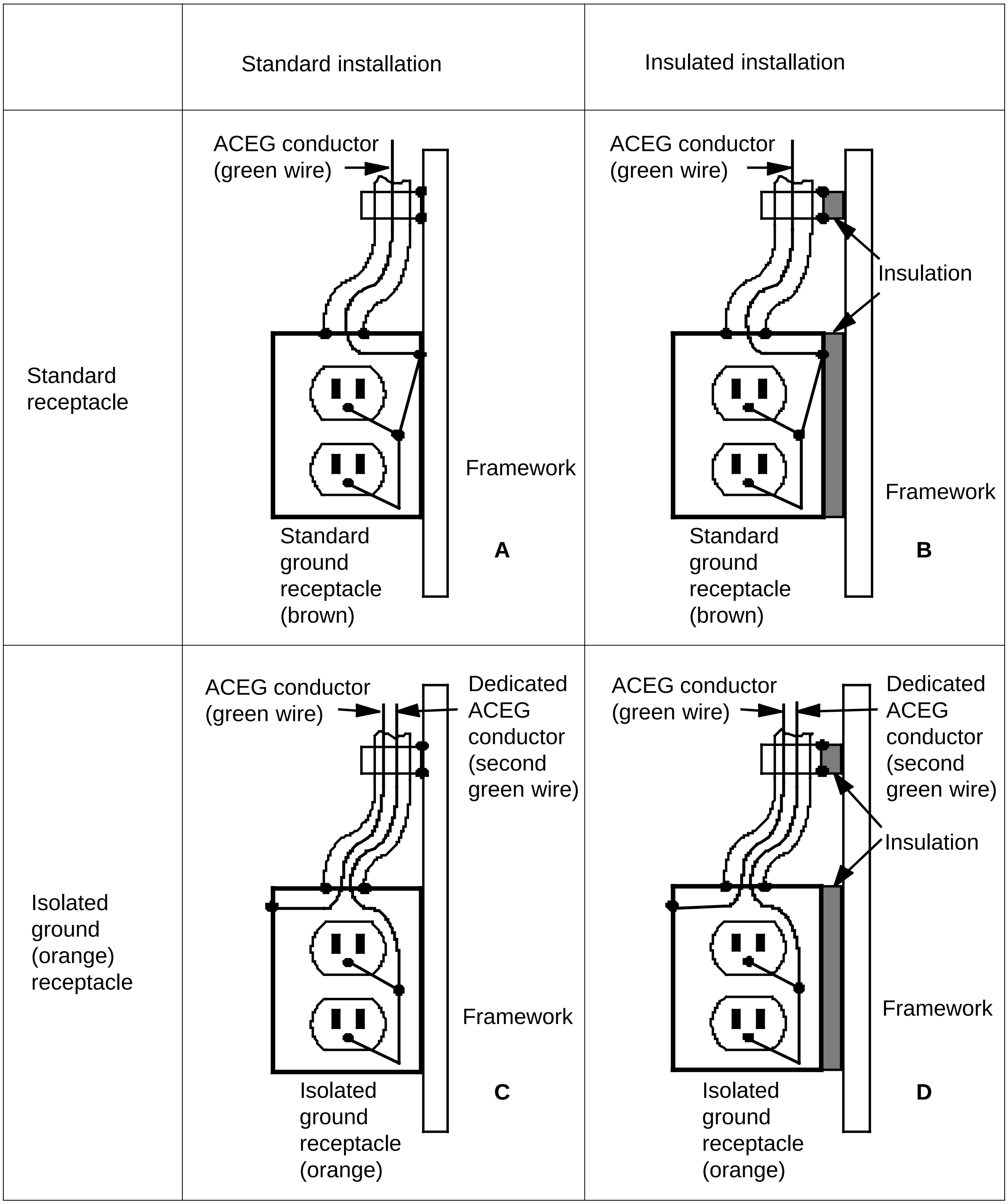
All ac panels that feed convenience outlets internal to the DMS-100F equipment or are located within 2 m of the equipment, must be bonded to the DMS SPG.

The type of receptacle, mounting details, and installation must comply with the practices of the customer. For example, Bell Operating Companies specify that a standard receptacle is to be mounted directly to the framework. Refer to Figure 7-6, Part A.

Use the standard receptacle insulated from the framework, unless customer requirements are different. Refer to Figure 7-6, Part B.

When using an isolated ground (orange) receptacle, bond both the ACEG conductor (green wire) and the dedicated ACEG conductor (second green wire) to the DMS SPG. Refer to Section 7.3.4 for grounding conductors.

Figure 7-6 Termination of grounding conductors in DMS equipment receptacles



7.3.3 Communication cables, feeders, and raceways

Insulate all ac feeders installed in metal conduit or raceways that serve DMS-100F equipment from contact with incidental grounds past the point of reference of the ACEG to the DMS SPG.

Insulate the ac grounding conductors from the frames of the DMS-100F to maintain the star IBN configuration. Grounding conductors include conduit, junction boxes, raceways. Insulate the conductors unless customer practices require other actions.

Install cables and raceways as follows:

- Do not run communication cables and ac power feeders (120 V and 277 V) in a common cable trough. You can run the cables and feeders in a common trough if metal barriers separate the communication cables and ac power feeders.
- Communication cables and dc power cables can run in the same cable trough, provided they are physically separated.
- Run bonding cables along the bottom of the cable trough. Bonding cables include BRR and cables that interconnect DMS SPG, FBE, and LRE buses. Fasten bonding cables to the bottom of the cable trough. Refer to the information for grounding and bonding conductors below.
- Continuous metal raceways are recommended.

7.3.4 Grounding and bonding conductors

Make sure grounding and bonding conductors meet the following requirements:

- Grounding and bonding conductors must be insulated stranded copper wire unless specified exemptions apply. Keep these conductors as short as practicable.
- All conductors, connectors, and terminating hardware must be certified for the purpose by a nationally recognized test lab (NRTL). The installation of all conductors, connectors, and terminating hardware must comply with NEC or CEC requirements.
- Size grounding (electrode) conductors according to the requirements in NEC Table 250-94 or CEC Table 17.
- Size and install a single grounding conductor to provide an effective grounding path in accordance with the requirements of NEC Article 250-51 and CEC Section 10-500
- Run at least one ACEG conductor (green wire) in each raceway, together with the line and neutral conductors. Run the conductor even when the different codes do not mandate this procedure.

- Bond the ACEG conductor (green wire) to each junction box in the wiring run.
- Connect the dedicated ACEG conductor (second green wire) of an isolated ground (orange) outlet to one of the following:
  - — the ACEG bar of the serving ac panel (Figure 7-1 and 7-2)
  - — the ACEG bar of the junction box connected to the ac reference conductor (Figure 7-3)

8 Equipment powering

This section addresses the power distribution for DMS equipment.

8.1 Frame loads

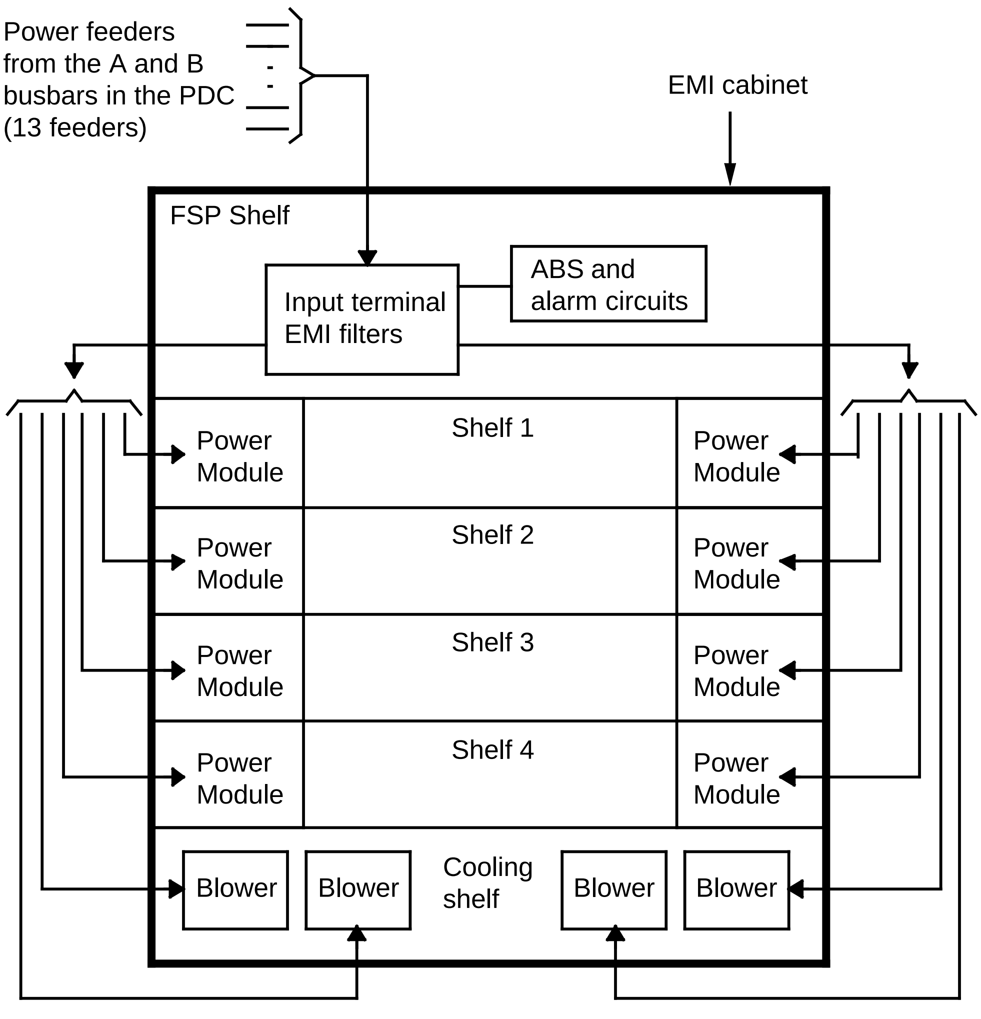
The paragraphs and figures that follow describe secondary distribution of dc power from the PDC to each of the DMS frames. All figures are based on the latest equipment and frame arrangements. The text provides an explanation of differences between these and earlier equipment and arrangements that continue to be in service.

8.2 SuperNode cabinet

The SuperNode (DPCC: NT9X01BA or NT9X01JA) cabinet, which appears in Figure 8-1, contains the following:

- combinations of the computing module, Enhanced Network, Message Switch, and/or System Load Unit (SLU)
- the -48 V cabling procedures for a fully equipped configuration

Figure 8-1 SuperNode cabinet power distribution



Note 1: The A Bus of the PDC frame powers plane 0 of the SuperNode frame.
Note 2: The B Bus of the PDC frame powers plane 1 of the SuperNode frame.
Note 3: The power module circuits are fused in the PDC at 20 A.
Note 4: The blower circuits are fused in the PDC at 5 A. The A Bus of the PDC feeds two of the blower circuits. The B Bus feeds the other two blower circuits.

Power distribution for the SuperNode cabinet is as follows.

- The SuperNode cabinet requires 13 power feeders from the PDC:
  - Eight feeders for power modules, each feeder fused at 20 A in the PDC. Feeders serving components in plane zero are obtained from the A Bus of the PDC. Feeders for the components of plane one are obtained from the B Bus.
  - The blowers require four power feeders, with each feeder fused at 5 A in the PDC. Two feeders are from the A Bus and two feeders are from the B Bus.
  - The ABS uses one feeder. This feeder normally originates from a single A Bus feeder fused at 10 A in the PDC.
- Each power module consists of two power converters. These converters are: NT9X30AA (+5 V, 86 A) and either NT9X31AA (-5.2 V, 20 A) for the computing module and network, or NT9X47AA (+12 V, 10 A) for the SLU.
- The -48 V supply directly powers each blower in the cooling shelf.

Other SuperNode cabinets, for example the CMDC, MSDC, LIM, and ENET, are powered according to the above description.

8.2.1 Central control complex and memory extension frame

Power is distributed from a separate 20 A fuse in the PDC to each shelf (see Figure 8-2) of the following:

- a central control complex (CCC) frame
- a memory extension (MEX) frame

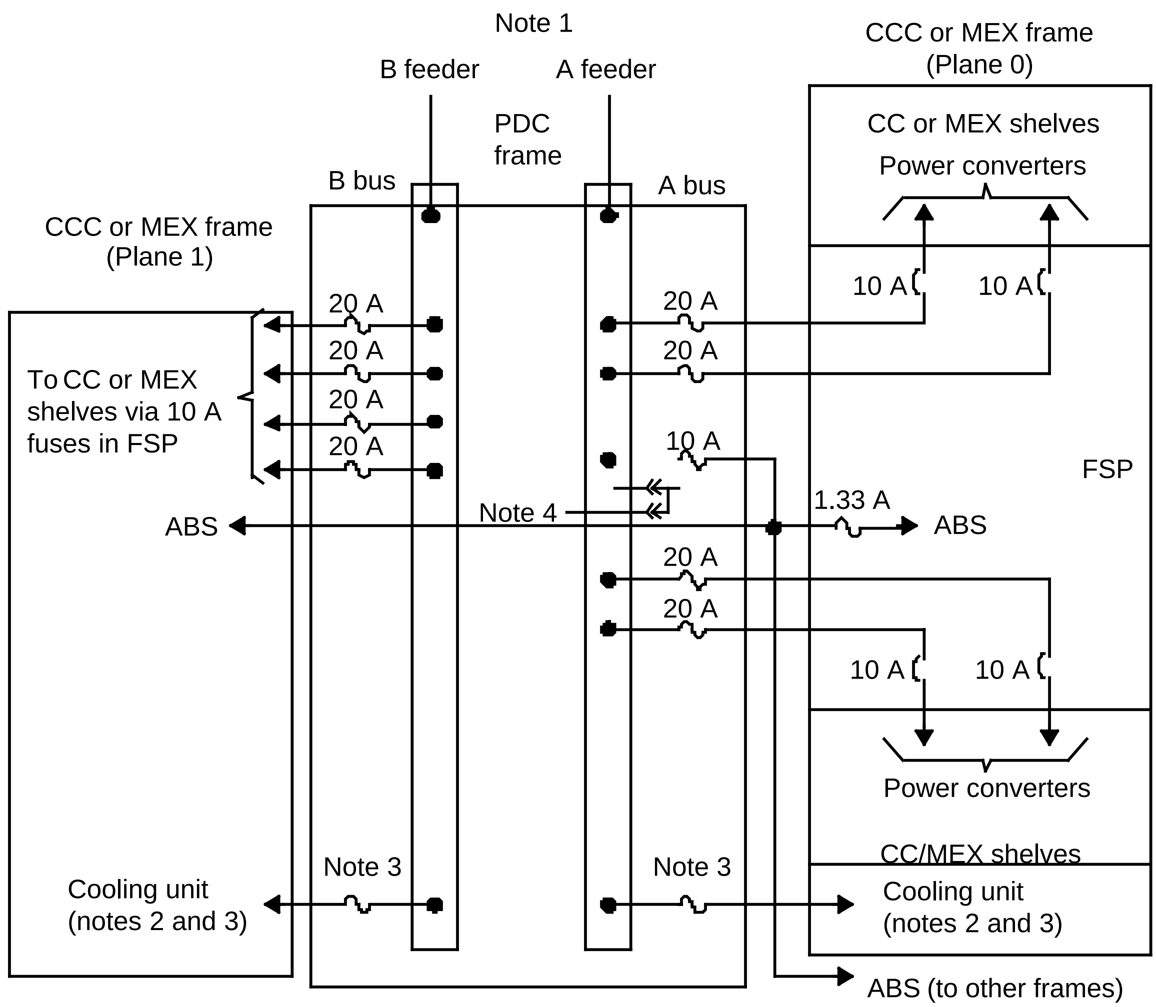
In the bottom shelf of each frame there is a cooling unit. The cooling unit for present vintage systems (NT3X90AC) contains five fans, each of which requires -48 V dc power. Two 5 A fuses at the PDC provide power for the NT3X90AC type cooling unit.

The cooling unit in earlier vintage systems, (NT0X30) contains five fans, each of which requires 120 V, 60 Hz no-break ac power. Separate dc-ac inverters generate the no-break ac supply. Two inverters feed a maximum of four cooling units. Each inverter is fed from a 20 A fuse at the PDC. To increase reliability, the inverters alternately connect to the A Bus and the B Bus of the PDC.

A 10 A fuse at the FSP of the PDC protects the ABS. In a DMS equipped with an Enhanced Alarm System (EAS), the ABS power feeder originates from a 20 A fuse or a circuit breaker at the power plant powering the PDC.

In a DMS not equipped with EAS, this feeder originates at the A Bus of the PDC.

Figure 8-2 CCC and MEX frame power distribution



Note 1: Each feeder (-48 V) has a corresponding return of the same gauge. The return connects to the battery return bus of the PDC.

Note 2: The CCC frame requires a cooling unit at all times. The MEX frame requires a cooling unit only when four memory shelves are provisioned.

Note 3: The current NT3X90AC type cooling unit requires two 5 A fuses at the PDC. Each NT3X90AA and NT3X90AB type cooling unit requires a 5 A fuse at the PDC. Earlier NT0X30 type cooling units with separate NT0X87 type inverters require a 20 A fuse at the PDC for each inverter.

Note 4: In a DMS with EAS, the ABS power feeder originates from a 20 A fuse or circuit breaker at the power plant feeding the PDC. In a DMS without EAS, this feeder originates at the A Bus of the PDC. A10 A fuse at the PDC protects the ABS.

8.2.2 Network module frame

The following two types of Network Module (NM) frames are described in this section:

- type NT5X13 (NETC)
- type NT0X48 (NET)

8.2.2.1 Network type NT5X13

The NT5X13 type frame is a standard frame equipped with network modules and a cooling unit. The NMs in shelf positions 51 and 65 are designated as Plane 0. Plane 1 consists of the NMs in shelf positions 18 and 45. The power distribution to the NM planes is as follows (refer to Figure 8-3).

- One battery feeder fused in the PDC at 20 A powers each NM plane. The A Bus feeds Plane 0 and the B Bus feeds Plane 1.
- The 20 A feeder divides at the frame FSP into two 10 A feeders, one for each shelf position.

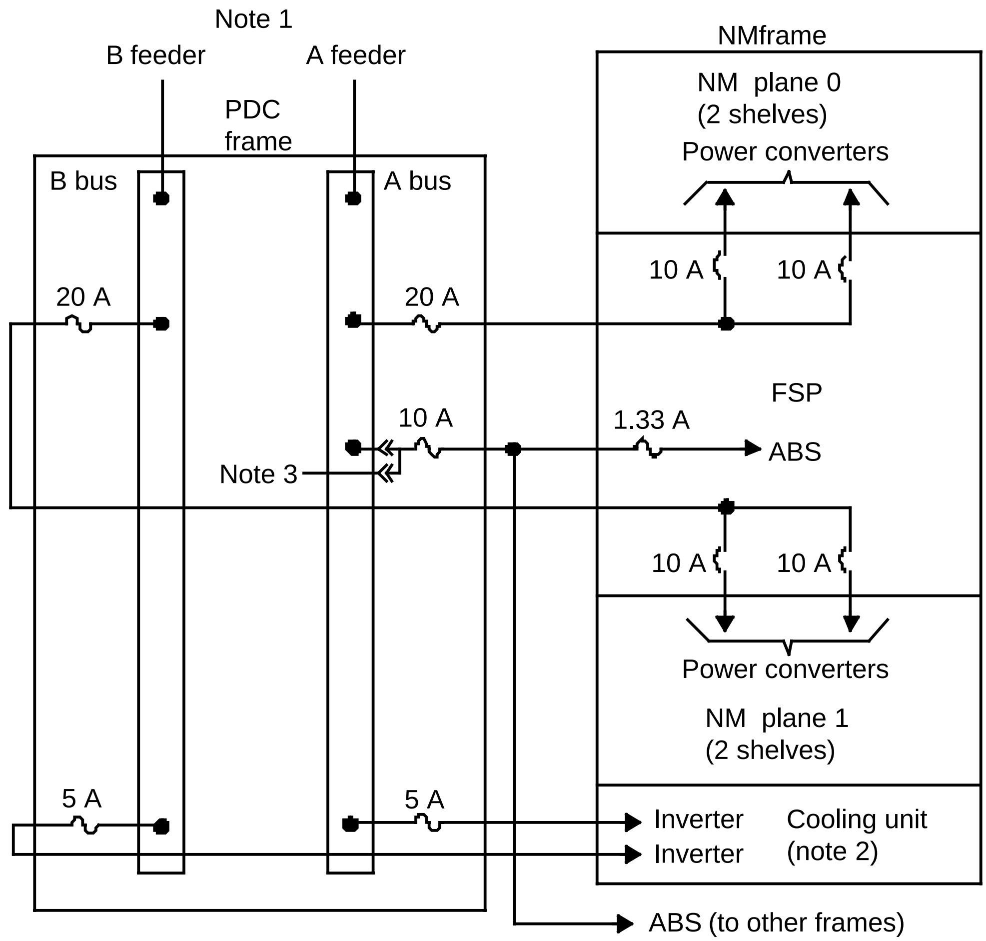
In the bottom shelf of each NM frame is an NT3X90 cooling unit. The cooling units in the NM frames have the same configuration as in the CC or MEX frames. The NT3X90AC cooling units use 48 V powered fans. Each unit is fed from dual 5 A fuses (A and B feeders) at the PDC.

Earlier installations use the NT3X90AA and NT3X90AB type cooling units. The cooling unit in the first NM frame comes equipped with two dc-ac inverters. The A Bus of the PDC feeds one inverter through a 5 A fuse. The B Bus of the PDC feeds the other inverter through a 5 A fuse. The cooling units for the remaining NMs have one dc-ac inverter. A PDC bus protected by a 5 A fuse powers this dc-ac inverter. The configuration of the power distribution to the inverters means that the A Bus of the PDC feeds alternate inverters. The B Bus of the PDC feeds the remainder of the inverters.

A 10 A fuse at the FSP of the PDC protects the ABS. In a DMS with EAS, the ABS power feeder originates from a 20 A fuse or a circuit breaker at the power plant feeding the PDC.

In a DMS without EAS, this feeder originates at the A Bus of the PDC.

Figure 8-3 NT5X13 NM frame power distribution



Note 1: Each feeder (-48 V) has a corresponding return of the same gauge. The return connects to the battery return bar of the PDC.

Note 2: The NT3X90AC type cooling unit has two fans. Each receives power (-48 V) through a 5 A fuse at the PDC. The NT3X90AA and NT3X90AB type cooling units have the following self-contained inverters:

a. The first NM frame contains two inverters.

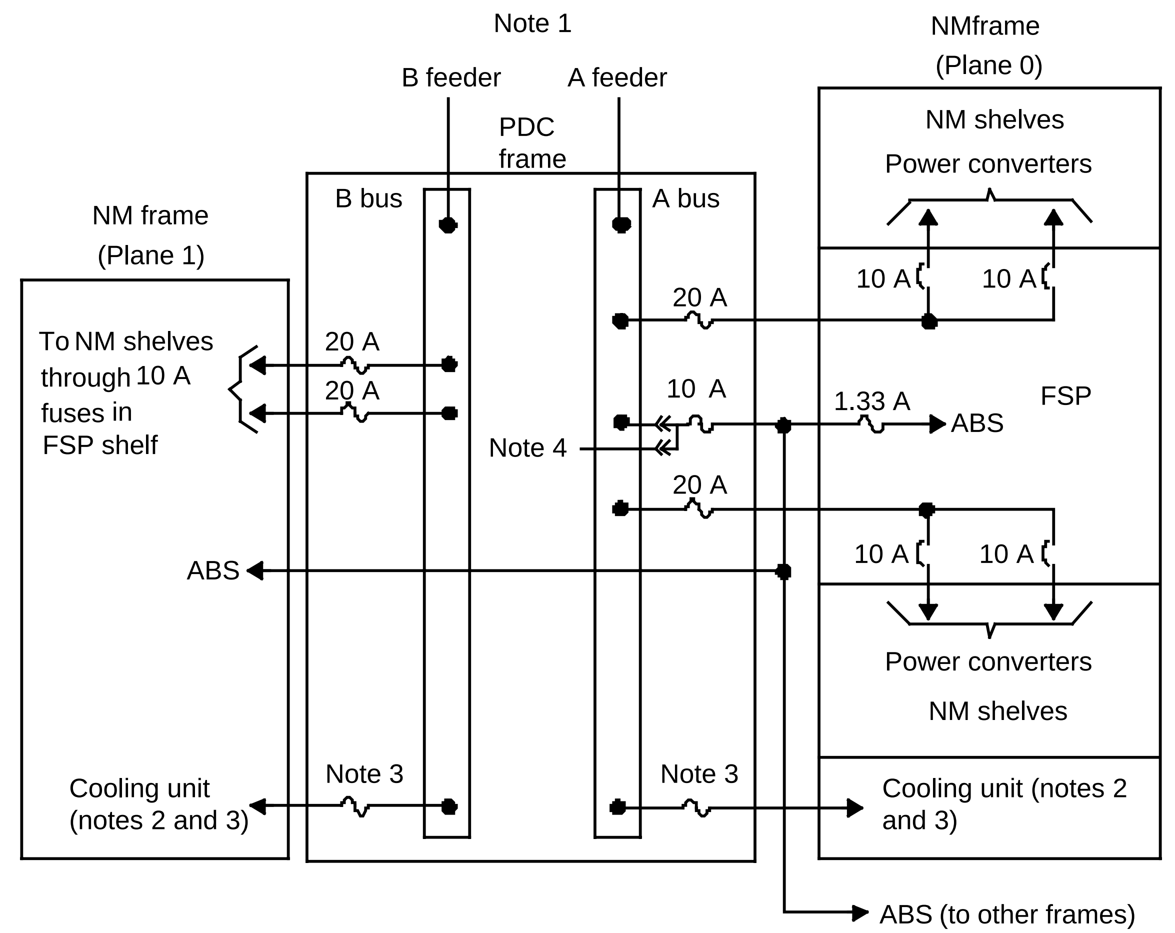
b. Each remaining NM frame contains one inverter.

Note 3: In a DMS with EAS, the ABS power feeder originates from a 20 A fuse or circuit breaker at the power plant feeding the PDC. In a DMS without EAS, this feeder originates at the A Bus of the PDC. A 10 A fuse at the PDC protects the ABS.

8.2.2.2 Network type NT0X48

A single network module (NM) is present in an NT0X48 type NM frame, as in Figure 8-4.

Figure 8-4 NT0X48 NM frame power distribution



Note 1: Each feeder (-48 V) has a corresponding return of the same gauge. The return connects to the battery return bar of the PDC.

Note 2: Each NM frame has a cooling unit.

Note 3: The current NT3X90AC type cooling unit requires two 5 A fuses at the PDC. Each NT3X90AA and NT3X90AB type unit requires a 5 A fuse at the PDC. Earlier NT0X30 type cooling units with separate NT0X87 type inverters require a 20 A fuse at the PDC for each inverter. The NT0X87 type inverters are not always in use on NM frames because every four cooling units require two NT0X87 inverters.

Note 4: In a DMS with EAS, the ABS power feeder originates from a 20 A fuse or circuit breaker at the power plant feeding the PDC. In a DMS without EAS, this feeder originates at the A Bus of the PDC. A 10 A fuse within the PDC protects the ABS.

The configuration and powering of these NMs is as follows:

- Two NMs are used in parallel for reliability purposes.
- One of the parallel pair of NMs has the designation plane 0, the other has the designation plane 1.

- Two battery feeders power each NM as follows:
  - — Each of the feeders fuses separately at 20 A in the PDC.
  - — NMs in plane zero are fed from the A Bus of the PDC.
  - — NMs in plane one are fed from the B Bus of the PDC.
- Each of the 20 A feeders divides into two 10 A feeders at the frame FSP.
- One of the 10 A feeders at the frame FSP powers each NM.
- A cooling unit is present in the bottom shelf of each NM frame as illustrated in Figure 8-4. The NT3X90 and NT0X30 type cooling units in an NM frame have the same configuration as the cooling units in the CC or MEX frame. This configuration enhances reliability.
- A 10 A fuse at the FSP of the PDC protects the ABS. In a DMS with EAS, the ABS power feeder originates from a 20 A fuse or a circuit breaker at the power plant feeding the PDC.
- In a DMS not equipped with EAS, this feeder originates at the A Bus of the PDC.

8.3 Trunk module equipment frame

The trunk module equipment (TME) frame can contain one of the following:

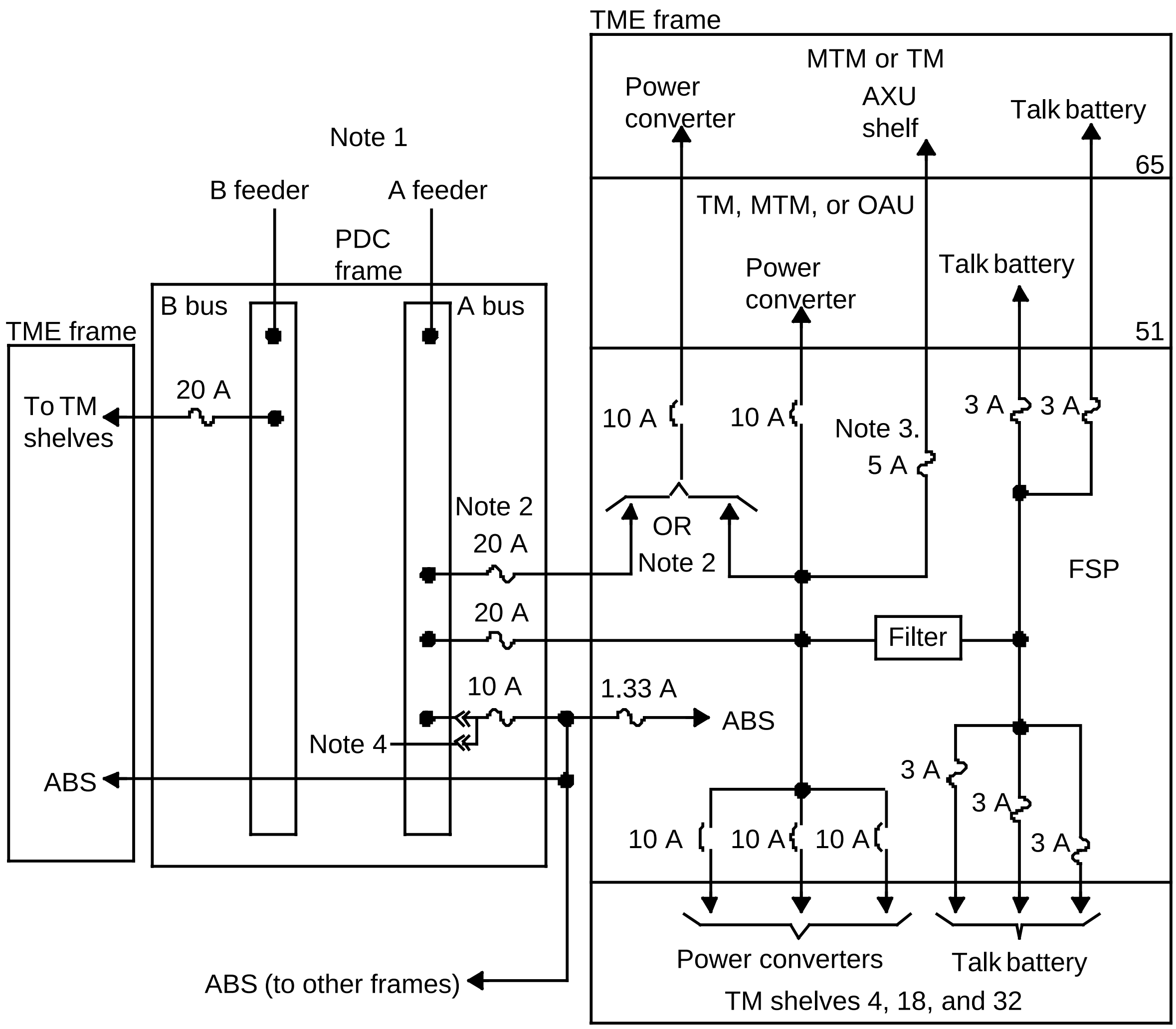
- only trunk module (TM) shelves
- a group of TM and digital carrier module (DCM), maintenance trunk module (MTM), or office alarm unit (OAU) shelves

Refer to Figure 8-5 for an example of the design of a TME. To avoid possible overload of the power supply, use the following combinations:

- five TM shelves in positions 65, 51, 32, 18, and 04 (use position 04 last)
- four TM shelves and one MTM shelf
- three TM or MTM shelves, another MTM shelf in position 51, and one alarm cross-connect unit (AXU) shelf in position 65
- two TM or MTM shelves and one DCM shelf with another MTM shelf in position 51, and one AXU shelf in position 65

Power-feed arrangements for these shelf combinations are designed during job engineering, in conjunction with GS0X82. Depending on the type of interface, consider the important factors presented later in this section about power-feed arrangements.

Figure 8-5 TME frame power distribution



Note 1: Each feeder (-48 V) has a corresponding return of the same gauge. The return connects to the battery return bar of the PDC.

Note 2: For an OAU application, the 10 A circuit breaker assigned to the the top shelf is fed through a separate 20 A fuse in the PDC. For an OAU application with EAS has -48 V feeders and returns for the primary and secondary alarm MTMs. These alarms and feeders originate directly from the power plant powering the PDC. The MTM in the top shelf is a secondary alarm. The MTM in position 51 is a primary alarm.

Note 3: For an OAU application, the 5 A breaker is present for the AXU shelf associated with the MTM in shelf position 51. In a DMS with EAS, the ABS power feeder originates from a 20 A fuse or circuit breaker at the power plant feeding the PDC.
In a DMS without EAS, this feeder originates at the A Bus of the PDC. A 10 A fuse within the PDC protects the ABS.

8.3.1 Analog trunk interface

The information that follows applies to analog trunks:

- TME frames are fed through 20 A fuses at the PDC.
- Power feeds are distributed equally across the A Bus and the B Bus to balance the load.
- The 20 A feed divides into four 10 A feeds at the FSP of the TME frame.
- Each TME shelf receives power from one of the 10 A feeders at the FSP of the TME. Earlier installations use 5 A fuses.
- When necessary, an additional 5 A feed for an AXU shelf and associated MTM is present.
- When the MTM in the TME is not associated with an AXU, an additional 20 A feed is present for the TME. This feed powers the MTM through the 10 A fuse in the FSP assigned to the top shelf.
- When TM and DCM shelves are mixed:
  - — the same feeder powers all TM shelves
  - — the A and B buses alternately feed the DCM shelves

8.3.2 Maintenance trunk module and office alarm unit

The AXU shelf and the associated primary alarm MTM can be in the TME frame at positions 65 and 51. The secondary alarm MTM must be in position 65 on another TME frame. The secondary alarm receives power from a different feed than the primary alarm MTM. The AXU, or OAU, is fed from a 5 A fuse at the FSP. When the MTM is not used for alarms, the location of the MTM in the TME frame is not restricted.

In a DMS-100F system with EAS, the 20 A power feeders associated with the primary alarm MTM (OAU) and with the secondary alarm MTM originate directly from the power plant powering the PDCs.

When a TME requires two power feeders, one of the following provides power:

- two feeders from the PDC
- one feeder from the PDC and another feeder from the power plant

8.3.3 E&M trunk interface

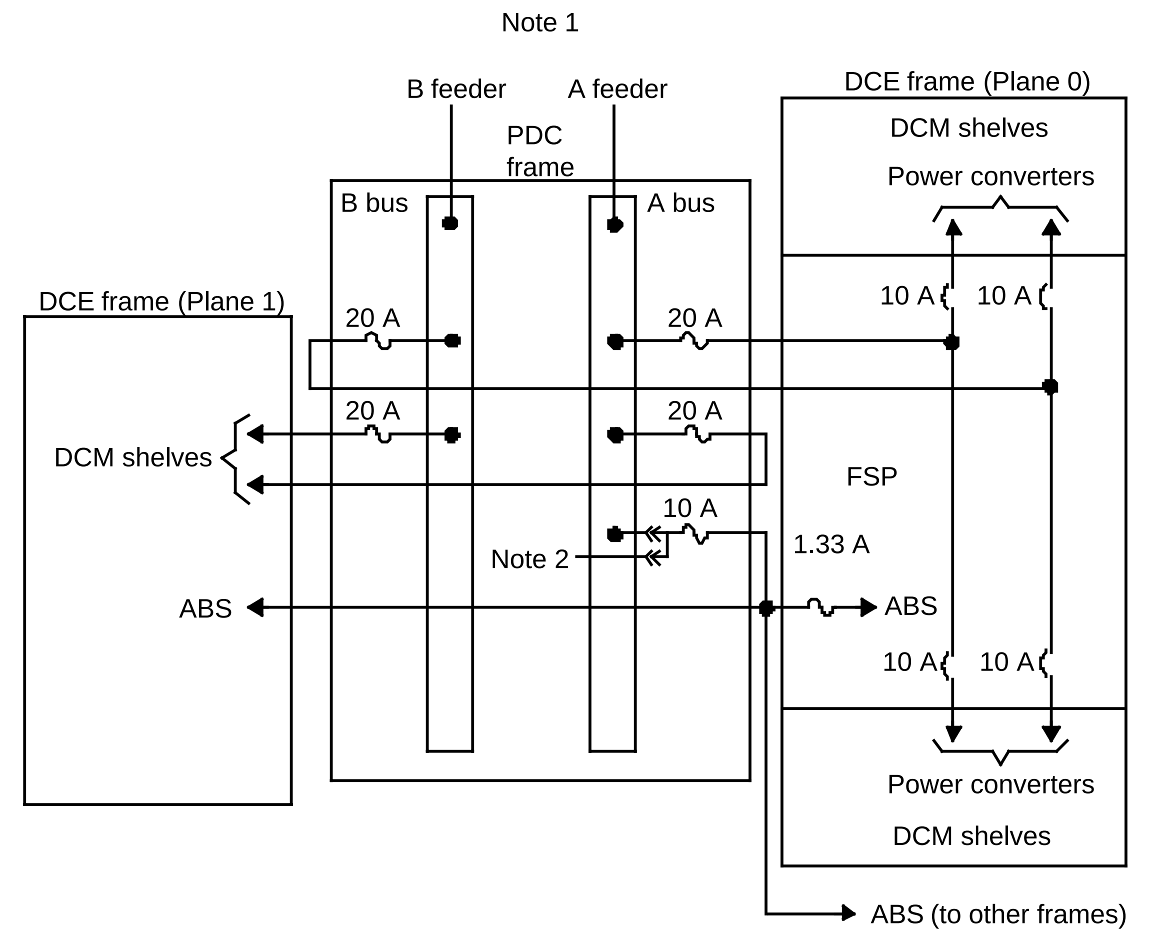
For E circuits, the battery return of the PDC is a separate logic return. The PDC battery feed provides a talk battery supply through a filter at the FSP. Distribution of the talk battery supply to each shelf is done through a 3 A fuse at the FSP.

8.4 Digital carrier equipment frame

When all shelves in a frame contain digital carrier modules (DCM), the frame is a digital carrier equipment (DCE) frame. Refer to Figure 8-6. Consider these factors when you arrange the power feed for a DCE:

- The DCE receives power from a 20 A fuse from the A Bus and a 20 A fuse from the B bus, both located in the PDC.
- The 20 A fused supplies are subdivided into 10 A fused supplies at the frame FSP of the DCE.
- The DCM shelves alternately receive power from the A Bus and B Bus through 10 A fuses. Earlier installations use 5 A fuses for the DCM shelf feeds.
- The DCE has a maximum of four DCM shelves.
- DCM loads are balanced between the A and B buses. This balance is as even as possible.
- A 10 A fuse at the FSP of the PDC protects the ABS. In a DMS with EAS, the ABS power feeder originates from a 20 A fuse or a circuit breaker at the power plant feeding the PDC.
- In a DMS without EAS, this feeder originates at the A bus of the PDC.

Figure 8-6 DCE frame power distribution



Note 1: Each feeder (-48 V) has a corresponding return of the same gauge. The return connects to the battery return bar of the PDC.

Note 2: In a DMS with EAS, the ABS power feeder originates from a 20 A fuse or circuit breaker at the power plant feeding the PDC. In a DMS without EAS, this feeder originates at the A Bus of the PDC. A 10 A fuse at the PDC protects the ABS.

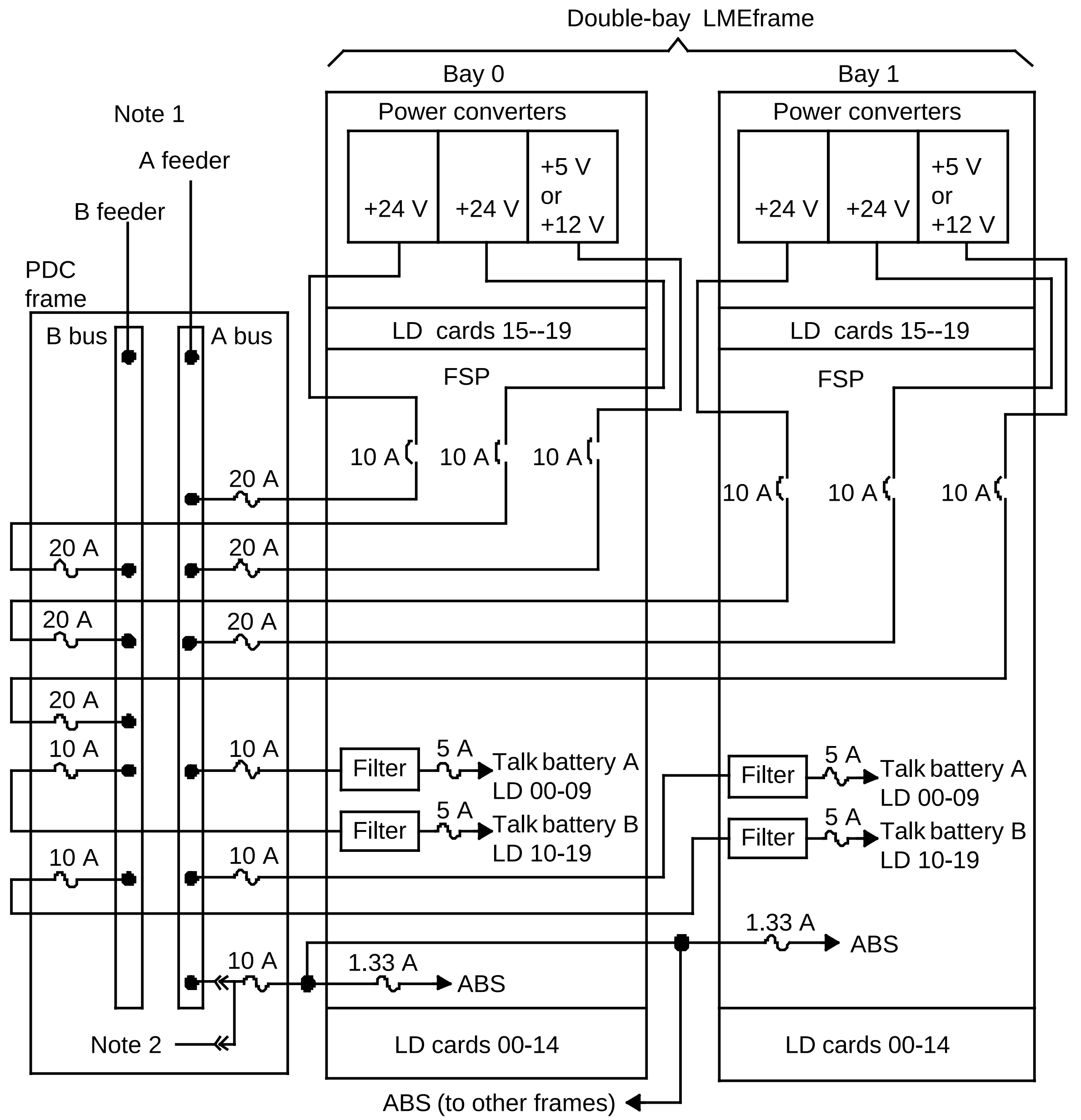
8.5 Line module equipment frame

The line module equipment (LME) frame is a double-bay frame. Each bay contains one line module (LM) with 640 lines and its ssociated line module controller (LMC). Refer to Figure 8-7. When one LMC fails, the other LMC in the LME controls both LMs. Each LMC contains two -48 V power converters that provide +24 V and one converter that provides +5 V and +12

V for the LM and associated equipment. Factors to consider in the design of power feeds to LMs are:

- The A bus and B bus of the PDC alternately feed LM loads. This arrangement balances the load and provides reliability in the event of a power failure on the A or B bus.
- One of the +24 V converters in each bay receive power from a 20 A fuse of the A bus. A 20 A fuse of the B bus powers the other.
- The +5 V and +12 V converter in the LCM Bay 0 receive power from a 20 A fuse of the A bus. The equivalent converter in Bay 1 receives power from a 20 A fuse of the B bus.
- Talk battery filters in the bay FSPs are fed from 10 A fuses as follows:
  - The filter assigned to line drawers (LD) 00 to 09 is fed from the A bus.
  - The filter assigned to LDs 10 to 19 is fed from the B bus.
- A 10 A fuse at the FSP of the PDC protects the ABS. In a DMS with EAS, the ABS power feeder originates from a 20 A fuse or a circuit breaker at the power plant feeding the PDC.
- In a DMS without EAS, this feeder originates at the A Bus of the PDC.

Figure 8-7 LME frame power distribution



Note 1: Each feeder (-48 V) has a corresponding return of the same gauge. The return connects to the battery return bar of the PDC.

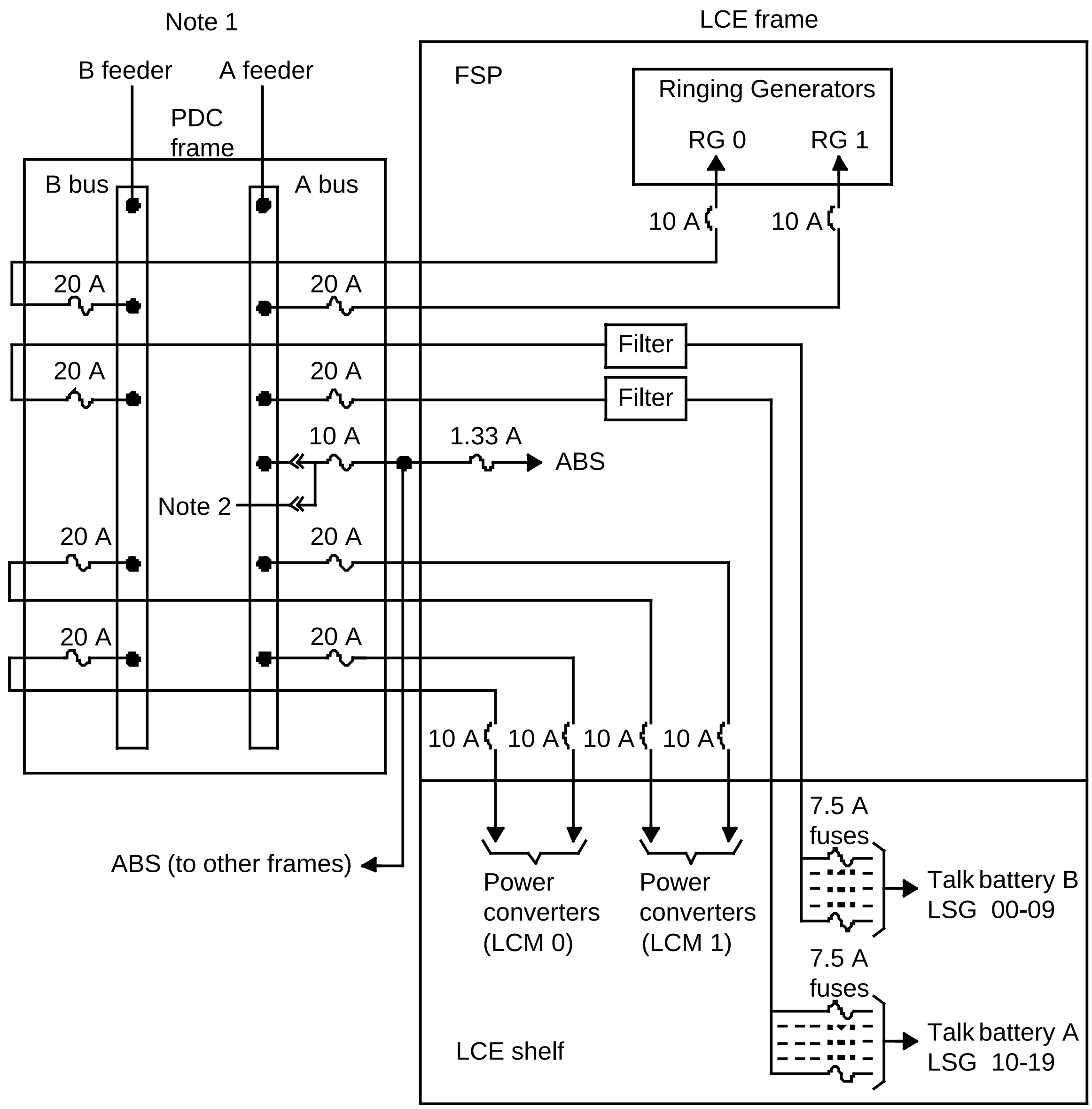
Note 2: In a DMS with EAS, the ABS power feeder originates from a 20 A fuse or circuit breaker at the power plant feeding the PDC. In a DMS without EAS, this feeder originates at the A Bus of the PDC. A 10 A fuse at the PDC protects the ABS.

8.6 Line concentrating equipment frame

Each line concentrating equipment (LCE) frame contains two line concentrating modules (LCMs), as in Figure 8-8. Consider these factors when you design the power feed arrangements for the LCMs:

- Two power feeds come from the PDC. A 20 A fused feed comes from the A bus. Another 20 A fused feed comes from the B bus.
- Each feed connects to a 10 A circuit breaker at the LCE. The feeds distribute power to the LCMs.
- The FSP of the LCE powers the following equipment:
  - The A bus feeds ringing generator RG 0. The B bus feeds generator RG 1. A 20 A fuse at the PDC and a 10 A circuit breaker at the FSP protects each feed.
  - A 20 A fuse at the PDC protects each talk battery supply. A 7.5 A fuse at the FSP of the line drawer protects the talk battery circuit for each line drawer. The A bus feeds one of the talk battery supplies. The B bus feeds the other talk battery supplies.
- A 10 A fuse at the FSP of the PDC protects the ABS. In a DMS with EAS, the ABS power feeder originates from a 20 A fuse or a circuit breaker at the power plant feeding the PDC.
- In a DMS without EAS, this feeder originates at the A bus of the PDC.

Figure 8-8 LCE frame power distribution



Note 1: Each feeder (-48 V) has a corresponding return of the same gauge. The return connects to the battery return bar of the PDC.

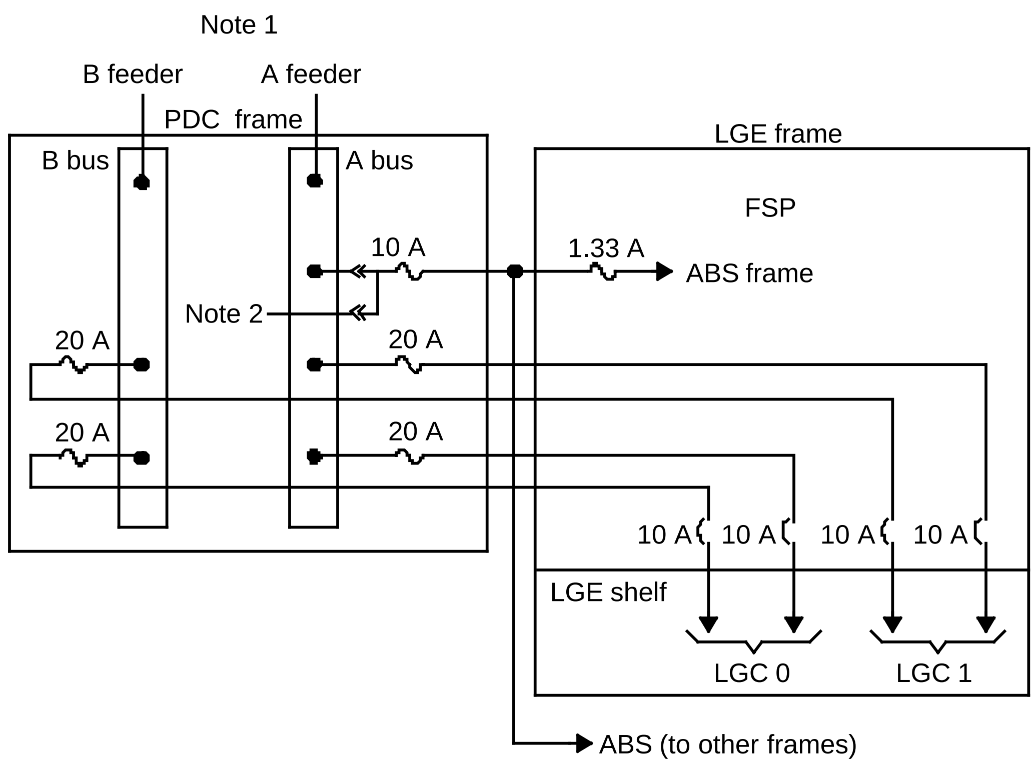
Note 2: In a DMS with EAS, the ABS power feeder originates from a 20 A fuse or circuit breaker at the power plant feeding the PDC.
In a DMS without EAS, this feeder originates at the A Bus of the PDC. A 10 A fuse at the PDC protects the ABS.

8.7 Line group equipment frame

The line group equipment (LGE) frame contains two line group controllers (LGCs) as shown in Figure 8-9. Consider these factors when you design the power feed arrangements for the LGEs:

- The A bus powers one LGC. The B bus powers the other LGC.
- Each of the secondary feeds originate from a 20 A fuse in the PDC. A 10A circuit breaker in the FSP before distribution to an LGC protects the secondary feeds.
- For ISG, the LGE and associated LCMs require power from the same PDC.
- A 10 A fuse at the FSP of the PDC protects the ABS. In a DMS with EAS, the ABS power feeder originates from a 20 A fuse or a circuit breaker at the power plant feeding the PDC.
- In a DMS without EAS, this feeder originates at the A bus of the PDC.

Figure 8-9 LGE frame power distribution



Note 1: Each feeder (-48 V) has a corresponding return of the same gauge. The return connects to the battery return bar of the PDC.

Note 2: In a DMS with EAS, the ABS power feeder originates from a 20 A fuse or circuit breaker at the power plant feeding the PDC.

In a DMS without EAS, this feeder originates at the A bus of the PDC. A 10 A fuse at the PDC protects the ABS.

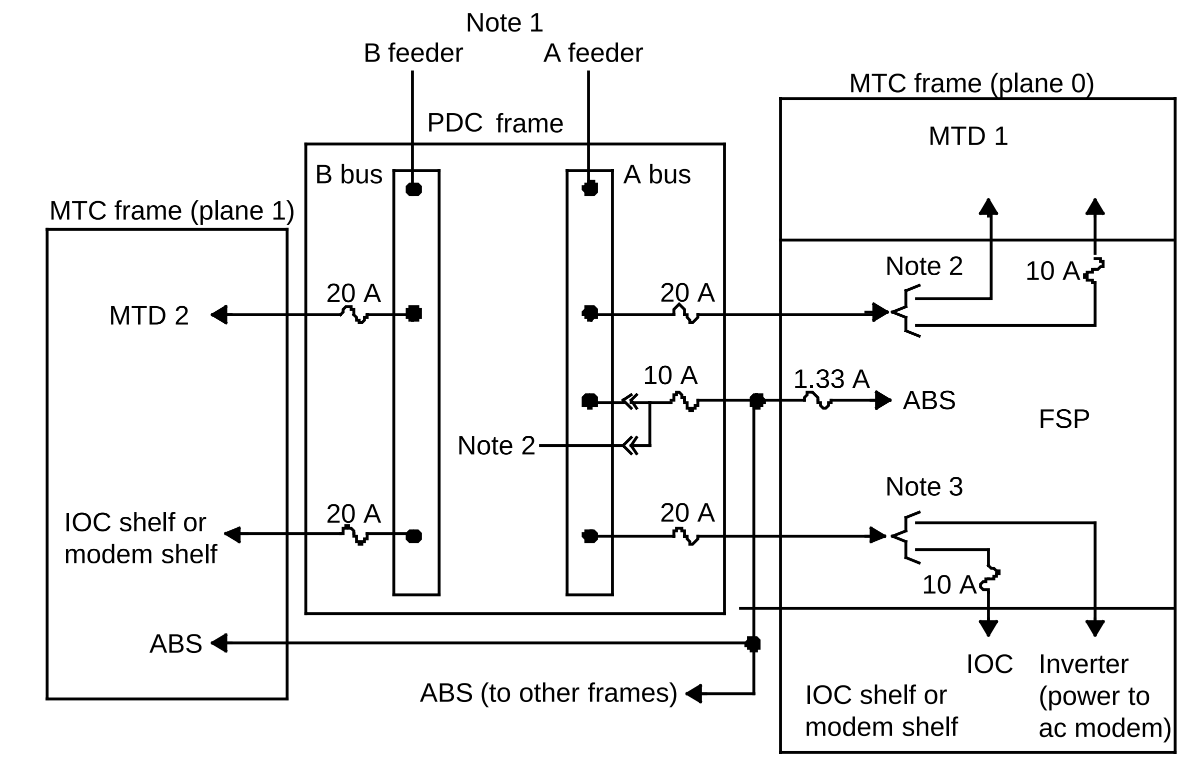
8.8 Magnetic tape center frame

The magnetic tape center (MTC) frame contains a magnetic tape drive (MTD) and an input/output controller (IOC) or modem shelf. The power-feed arrangement of these units are in Figure 8-10.

Consider these factors when you design the power feed arrangements for an MTC frame:

- The MTD receives power from a 20 A fuse on the PDC.
- The same bus powers the MTD and associated IOC.
- The IOC or modem shelf receives power from a 20 A fuse on the PDC.
- The 20 A feed to an IOC is protected by a 10 A fuse in the FSP before the feed goes to the IOC.
- If the configuration uses a modem shelf instead of an IOC, power from the 20 A fuse feeds directly to an inverter. Then the inverter powers the modem.
- A 10 A fuse at the FSP of the PDC protects the ABS. In a DMS with EAS, the ABS power feeder originates from a 20 A fuse or a circuit breaker at the power plant feeding the PDC.
- In a DMS without EAS, this feeder originates at the A bus of the PDC.

Figure 8-10 MTC frame power distribution



Note 1: Each feeder (-48 V) has a corresponding return of the same gauge. The return connects to the battery return bus of the PDC.

Note 2: When the MTD is a Hewlett-Packard unit, the MTD receives power directly from the 20 A fuse in the PDC. When the MTD is a Cook Electric unit, the unit receives power through a 10 A fuse in the FSP.

Note 3: When an IOC shelf is used, power from the 20 A fuse (PDC) is fed through a 10 A fuse (FSP) to the IOC. If a modem shelf is used instead of an IOC, power comes from the 20 A fuse. The fuse feeds directly to an inverter which then powers the modem.

Note 4: In a DMS with EAS, the ABS power feeder originates from a 20 A fuse or circuit breaker at the power plant feeding the PDC.
In a DMS without EAS, this feeder originates at the A bus of the PDC. The ABS is protected by a 10 A fuse at the PDC.

8.9 Remote line facility

Some line modules can be remote from the DMS. Examples of remotes are the remote line module (RLM), remote line concentrating module (RLCM), and remote switching center (RSC). These remotes are subject to the same power distribution rules as the DMS. The exceptions are that large remotes can have their own PDC, or share a PDC with collocated remotes. To share a PDC, the remotes must be in the same IBN.

8.10 Miscellaneous equipment frame

The miscellaneous equipment (MIS) frame can have the configuration of a standard MIS, a dedicated MIS, or a MOE. You also can use the MIS with the IMAP (or MAP). The MIS frame contains the following items:

- a metallic test access circuit
- a recorded announcement machine
- modems
- OEM equipment
- inverters

Power-feeding procedures for MIS frames vary in the job engineering process. These procedures vary because of the wide differences in shelf complements and office configurations.

8.11 Clustering

To ensure optimal logic referencing of functional circuits of some hardware, cluster hardware modules as follows:

- power the modules from the same PDC
- bond the vertical logic return bars to the BR plate of the common PDC with a No. 6 AWG.

The equipment entities that follow require clustering:

- LCE frame with associated LGE, LTE, DTE, RCE, RME, RCME, SME, ILGE, ILTE, IDTE, and SMS frames
- ILCE frame with associated ILGE, ILTE, IDTE, IAE, and STE frames
- ISLM frame with associated IAE, and STE frames
- MS6E frame with associated DME frames
- MS7E frame with associated ST7E frames

Exception: For DMS-200 and DMS-300 applications, the DTE/IDTE logic return bus must be

- bonded to the lineup logic return cable that connects to the LRE splice plate, or
- connected to the LRB busbar assembly.

For all other applications, connect the DTE/IDTE logic return bus to the battery return plate of the PDC that supplies power to the DTE/IDTE.

8.11.1 Integrated maintenance and administration position

The integrated maintenance and administration position (IMAP) is a version of the the MAP. The configuration of the IMAP is for installation in a CBN not in a DMS IBN.

The IMAP can use any suitable source of ac power. The exception is that the inverters that are part of the DMS switch must not power the IMAP and associated equipment.

Use a UPS or an inverter to make sure that the IMAP is available under bad conditions. If the inverter incorporates facilities for transfer to commercial ac, the transfer time generally should not exceed 15 ms. Equipment like a smart modem constitutes a protected load and requires the proper power supply.

Instead of customer-provided power, a 500 W inverter is available for installation in a MIS frame used with the IMAP. In all US installations, all fixed wiring must comply with NEC requirements for power distribution from the ac power source to IMAP outlets. Cord and plug distribution is acceptable in Canadian installations according to CEC requirements. Distribution facilities, must not carry power from different sources at the same time. Distribution facilities include conduit and PAC poles. Examples of different sources are commercial ac and protected ac.

Receptacles can be floor outlets, wall outlets, or PAC pole outlets. Use of isolated ground (orange) outlets in non-BOC installations is acceptable. These outlets must comply with NEC Article 250-74 or CEC Section 10-906. Receptacles that provide protected ac must have the correct markings.

The use of extension cords to connect OEM equipment to the IMAP receptacles is not recommended.

8.11.2 Maintenance and administration position

The basic IMAP equipment subsystems can be configured as part of an IBN, becoming a MAP configuration.

The IMAP can use any suitable source of ac power. The exception is that the inverters that are part of the DMS switch must not power the IMAP and associated equipment.

Install all ac power facilities that the MAP requires according to the distribution and grounding rules established for the IBN.

The earlier version of the MAP was always installed as part of the DMS IBN. The DMS inverters power this version.

9 Equipment grounding and bonding

This sections presents the requirements for gounding and bonding equipment in the DMS system.

9.1 DC grounding

The basic DMS grounding design encompasses many installation environments and conditions with minimum modification between any two environments.

The DMS-100 configuration is modular, with the module size selected to suit each functional area of the system. For example, while the core can include several frames, consider the core (front end) as a single module. In trunk circuits, a single shelf is a module.

Each module within the DMS-100 adopts the SPG concept and is a separate entity that requires a separate SPG.

9.1.1 Intra-module bonding

Signal transmission is dc-coupled between electronic circuits within a module. For this reason, a low-impedance logic return path is necessary within each module. The use of printed circuits on circuit packs and a common backplane achieves this path at each shelf assembly. All backplane logic returns within each module are interconnected by one or more copper busbars and straps. Connection of the copper busbars to a ground reference constitutes the single point ground (SPG). The SPG has the following requirements:

- The connection is at one point, either outside each module or in each module.
- All shelf backplanes and interconnecting busbars are electrically isolated from the module framework.
- The input of all dc-dc converters isisolated from the output to prevent contamination of the logic return network with current from the 48 V battery.
- The battery return is isolated from the module framework.

9.1.2 Inter-module bonding

When signal transmission between modules is ac-coupled, inter-module communication links are separate from the logic return network within the modules. The module SPG, in conjunction with the ac-coupled signal transmission, eliminates any ground loops between electronic circuitry in the modules.

9.2 Isolation of framework

This section presents the frame isolation requirements.

9.2.1 ISG installation

Isolate all frames in ISG installations from any ground other than the DMS SPG. All frames require isolation pads under the frames. The framework bonding network requires isolation from the logic return network. Both networks connect to the DMS SPG. This design makes sure that contamination of the framework bonding network or the logic return network does not occur by the following:

- all other building grounds
- grounding conductors
- return conductors

Battery return also requires isolation from the framework bonding network.

9.2.2 Non-ISG installation

In non-ISG installations, isolation pads under all frames are recommended. Isolation pads are mandatory for the following conditions:

- for all frames in any Central Control Complex (CCC) module lineup
- for all frames when the point of connection to the Building Grounding System is on another floor
- for all frames when the dc power plant is shared with other systems that specify isolation
- to comply with specified customer grounding standards
- to keep a minimum space of 5 cm (2 in.) between equipment that is isolated or between equipment that is not isolated, except where correct insulation is present

9.2.3 Personnel hazard protection

> **CAUTION**
> **Two-meter rule:**
> Maintain a 2 m (7 ft) separation (or equivalent isolating means) between DMS equipment and all other equipment that is NOT connected to the DMS SPG.

A 2 m (7 ft) separation should be maintained between DMS equipment and all other equipment that does not connect to the DMS SPG. Typically, equipment that does not connect to the DMS SPG has foreign ground connections. Examples of such equipment include the following:

- air-conditioning ducts
- cable racks
- conduit
- ceiling supports
- non-DMS equipment
- all other metalwork in the DMS area

If you cannot meet the 2 m (7 ft) separation, provide insulating screens. These screens do not allow personnel to touch the DMS equipment and other equipment at the same time. If possible, install the isolating screens so that personnel cannot circumvent the hazard protection of the screens.

9.2.4 Integrated collector bar (ICB)

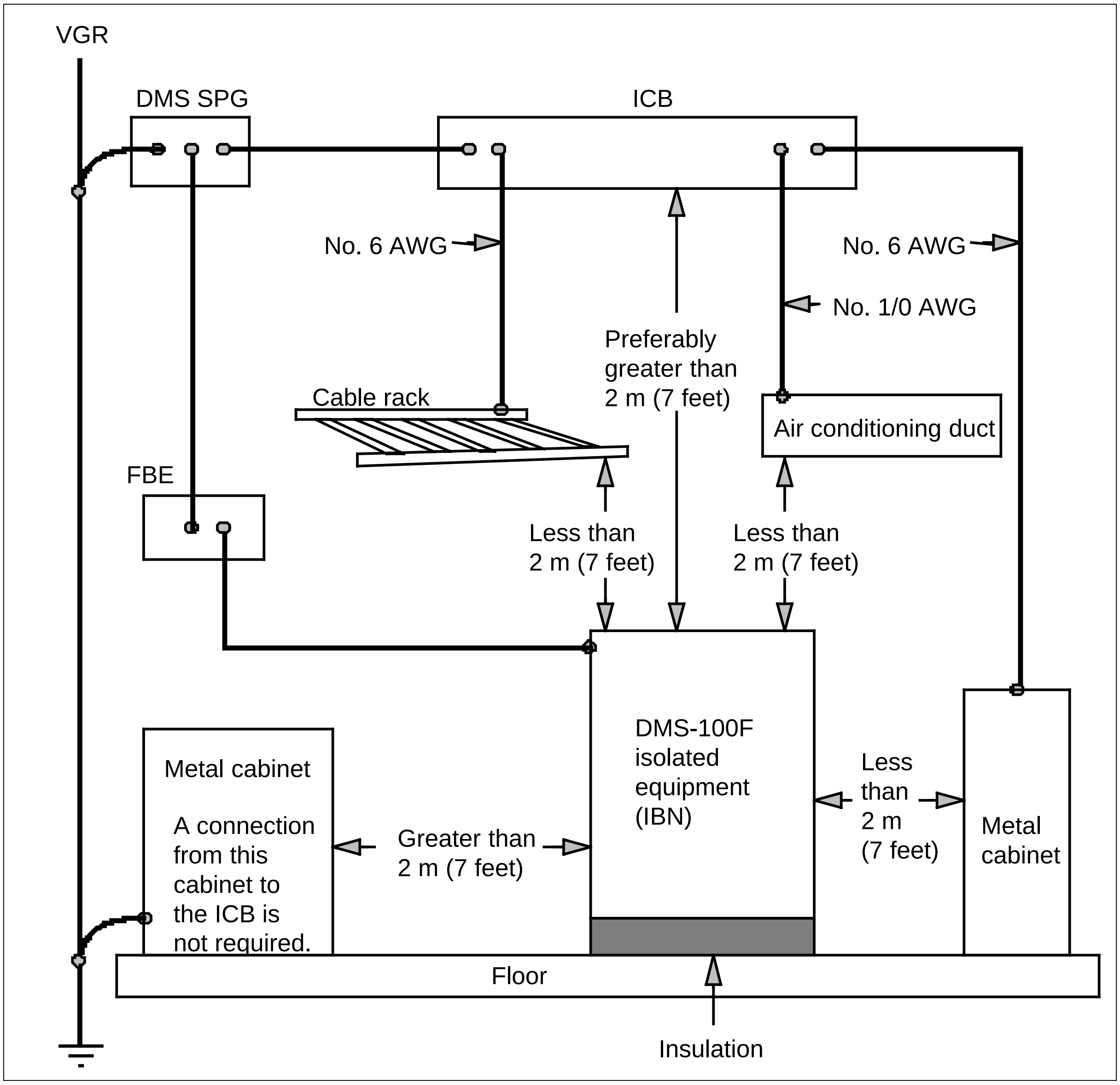
The ICB is an optional copper plate mounted on insulators. The ICB facilitates the bonding to ground of metal objects outside the IBN but within 2 m (7 ft) of the IBN. The ICB connects to the DMS SPG and is not nearer to the DMS-100F than the nearest metal object that must be grounded. Metal objects that are not bonded to the DMS SPG must be grounded using the ICB for the following conditions:

- when the 2 m (7 ft) separation cannot be maintained
- when an insulating means cannot be used
- when the CBN can be contacted deliberately or accidentally

The connection from a metallic object to the ICB should use a minimum cable size of No. 6 AWG. The cable size between the ICB and DMS SPG should be determined in the same way as are the sizes of cables used to connect the FBE and LRE to the DMS SPG.

Refer to Figure 9-1 for a standard ICB bonding configuration.

Figure 9-1 Standard ICB bonding configuration



9.3 Framework bonding and logic return networks

Non-DMS equipment must not use the framework bonding network and the logic return network internal to the DMS-100F system. The only exception to this rule is if Nortel Networks approves. Non-isolated system grounding (non-ISG) framework ground and logic return arrangements installed in accordance with earlier standards, or customized with the approval of Nortel Networks, have demonstrated adequate field performance. Upgrades, such as those to isolated system grounding (ISG), are intended to enhance that performance.

9.3.1 Grounding topology of DMS-100F frames

You can divide all frames in DMS-100F switches into eight groups with each group using the same grounding topology. These groups, designated by frame indexes A through H, are described next.

9.3.1.1 Frame index A

The following frames belong to this group (see Figure 9-2):

MIS
NT0X02AA

MIS
NT0X02AB (See note 1)

RME RSE
NT0X02AB (See note 2)

DNI
NT0X18AA

DNI
NT0X18CB

PDC
NT0X42AA

PDC
NT0X42BA

FIE
NT0X46AE

SLC
NT0X56AA

MSS
NT0X85AA

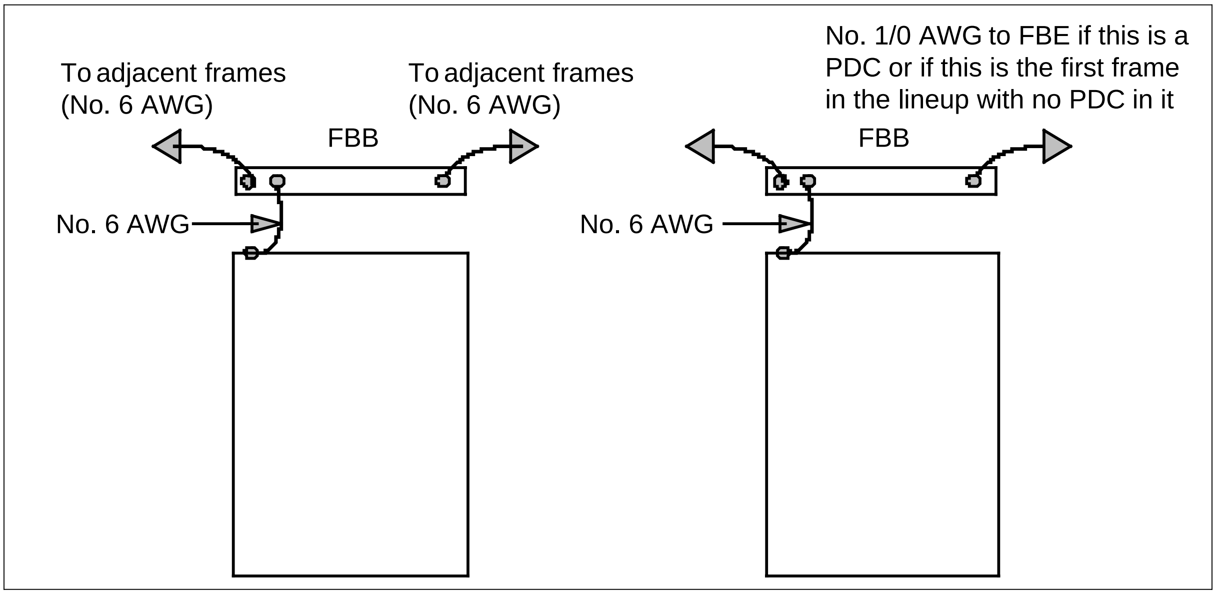
KSE
NT5X56AA

SSC
NT9X01FA

Note 1: For MIS frames equipped with modems, modem shelves, or inverters, see Frame index D.

Note 2: For RME and RSE frames equipped with modems, modem shelves, or inverters, see Frame index F.

Figure 9-2 Frame index A



9.3.1.2 Frame index B

The following frames belong to this group (see Figure 9-3):

NETC
NT5X13AA

NETC
NT0X48AB

DTE
NT6X01AA (note 1)

IDTE
NT6X01BA (note 1)

DCE
NT0X46AA

DCE
NT0X46BA

NET
NT0X48AC (note 2)

NET
NT0X48AG (note 2)

NET
NT0X48AC (note 2)

NET
NT0X48AG (note 2)

NET
NT0X48AH (note 2)

NET
NT0X48AJ (note 2)

N6E
NT5X08AA

N6E
NT5X08AB

TAE
NT5X12AA

TAE
NT5X12AB

MS6E
NT6X06AA

MS6E
NT6X06AB

MS6E
NT6X06AC

SCSE
NT6X15AA

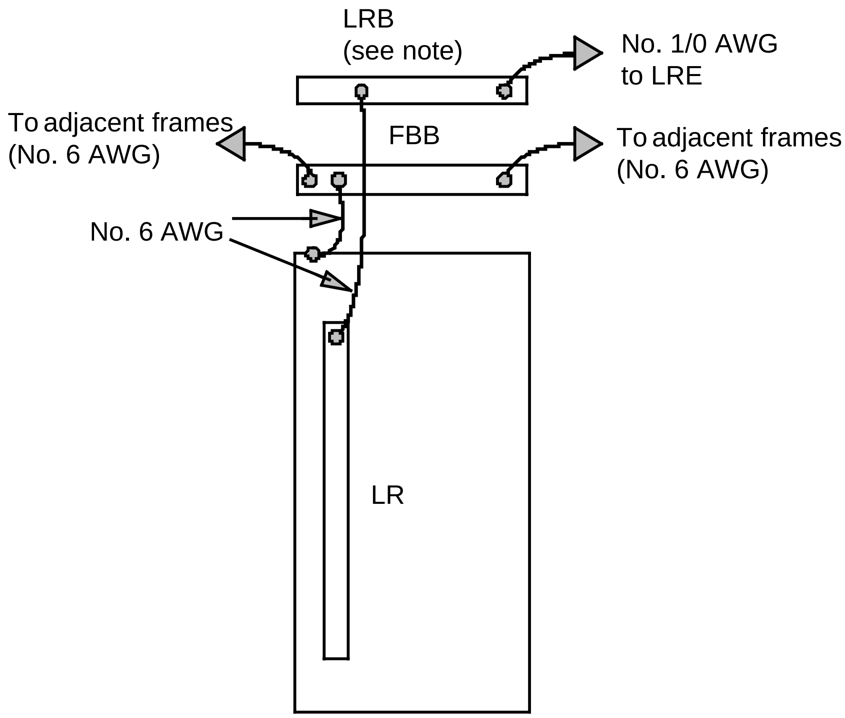
SCSE
NT6X15AB

DSNE
NT6X10AA

Note 1: For DMS-200 and DMS-300 applications only, the DTE/IDTE vertical logic return bar must connect according to this index. For all other applications, connect the DTE/IDTE vertical logic return bar to the BR plate of the PDC that supplies their power.

Note 2: These frames have two vertical logic return bars for each frame connected together with No. 6 AWG cable.

Figure 9-3 Frame index B



Note: Normally, one LRB for each lineup is present. You can add additional LRBs can to a lineup when necessary.

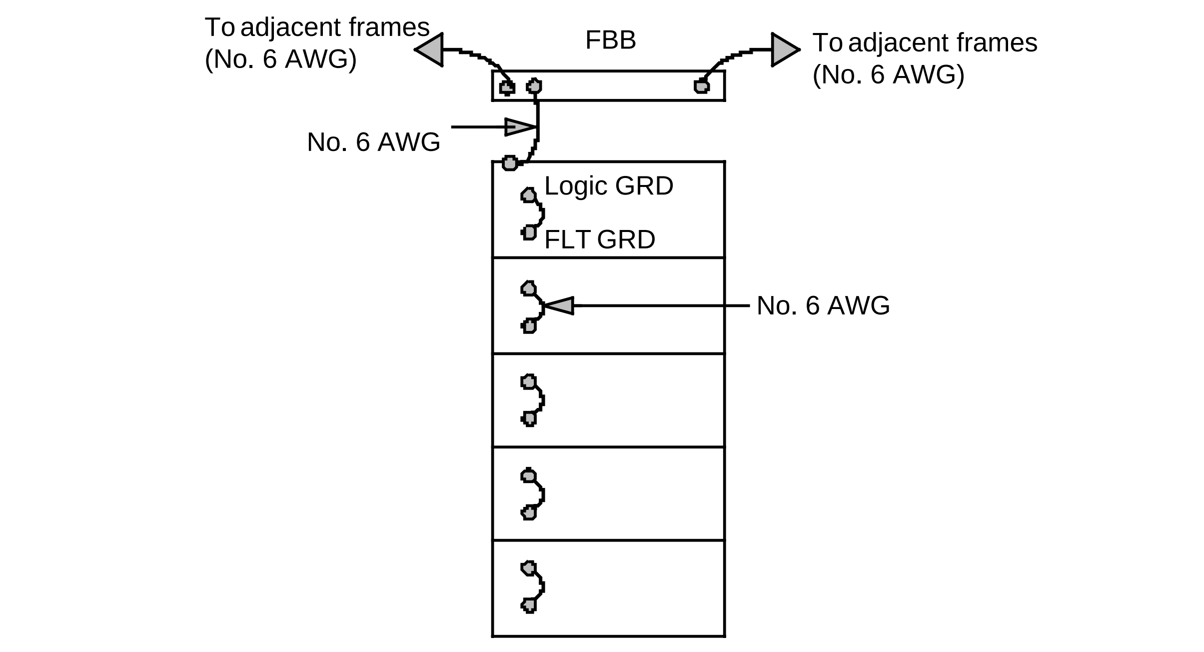
9.3.1.3 Frame index C

The following frames belong to this group (see Figure 9-4):

TME
NT0X46AA

ITME
NT0X46AB

Figure 9-4 Frame index C



9.3.1.4 Frame index D

The following frames belong to this group (see Figure 9-5):

MEX
NT0X41AB (note 1)

CCC
NT0X41AC (note 1)

CCC
NT0X41AJ (note 1)

MEX
NT0X41AK (note 1)

IOE
NT0X43AA (note 1)

MTC
NT0X43AB

MTC
NT0X43AC

IOE
NT0X43AD

CCC
NT3X45AA

MEX
NT3X45AB

CCC
NT3X45CA

MEX
NT3X45CB

CCC
NT3X45DA

MEX
NT3X45DB

CCC
NT3X45DW

CCC
NT3X45EA

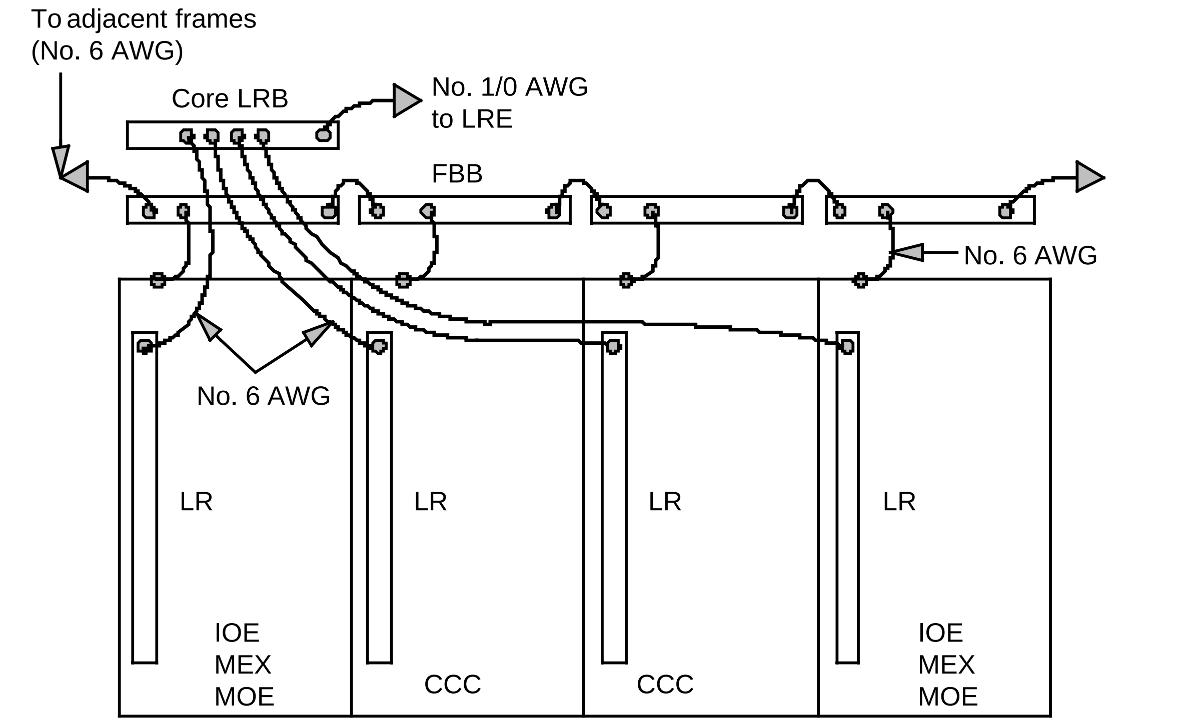
CCC
NT3X45EW

MOE
NT3X45BA (note 2)

Note 1: These frames have two vertical logic return bars for each frame that connect together with No. 6 AWG cable.

Note 2: The modem equipment frame (MOE or a dedicated MIS) must be within a 50 ft cabling distance of the IOE frame. The No. 6 AWG logic return cable from the MOE (or dedicated MIS) logic return bar (LRB) to the core LRB must not be longer than 50 ft.

Figure 9-5 Frame index D



Note: All frames of frame index D must connect to the core LRB. Other frames cannot connect to the core LRB.

9.3.1.5 Frame index E

The following frames belong to this group (see Figure 9-6):

LCE
NT6X03AA

LCE
NT6X03AC

LCE
NT6X03RA

LCE
NT6X03RB

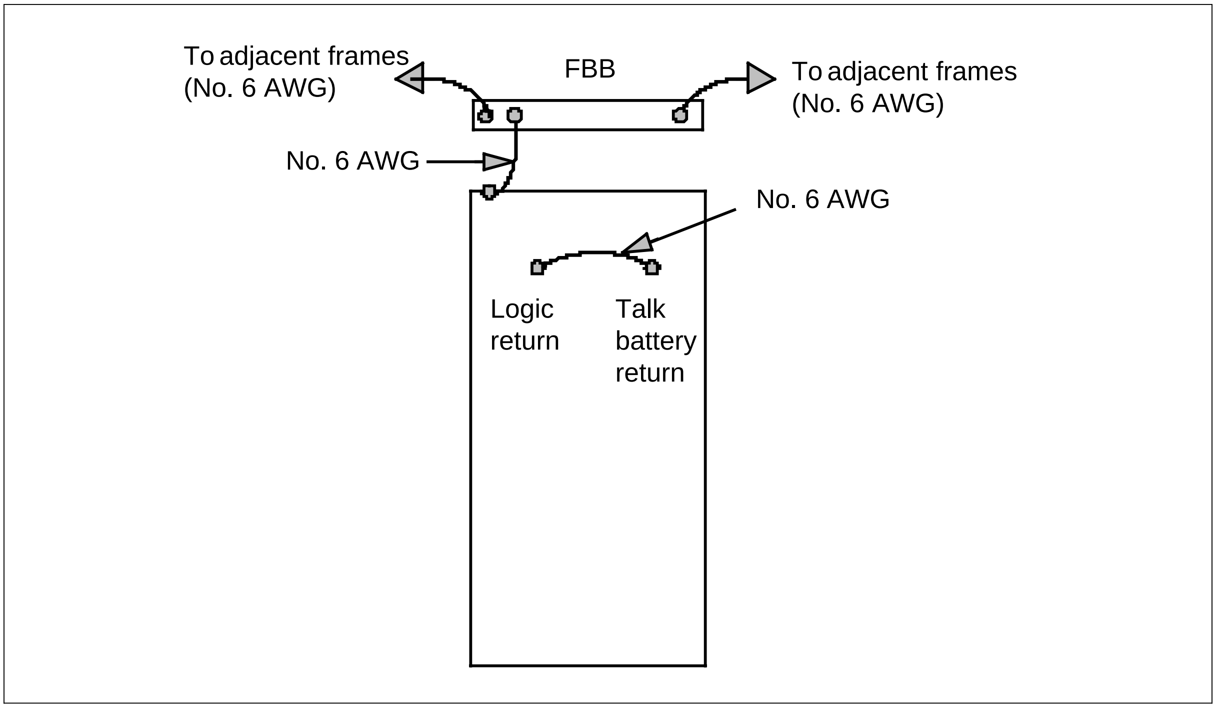
RLCM
NT6X14AA

ISLE
NT8X70AA

LCEI
NTBX30AB

LCEI
NTBX60AA

Figure 9-6 Frame index E



9.3.1.6 Frame index F

The following frames belong to this group (see Figure 9-7):

RME, RSE
NT0X02AB (note 1)

LGE, LTE, DTE, SME, SMS
NT6X01AA (note 2)

ILGE, ILTE, IDTE
NT6X01BA (note 2)

CPEI
NT6X01AB

IAE
NTBX40AA

ST6E, ST7E, STE
NT6X09AA

RCE
NT6X10AC

DME
NT6X29AA

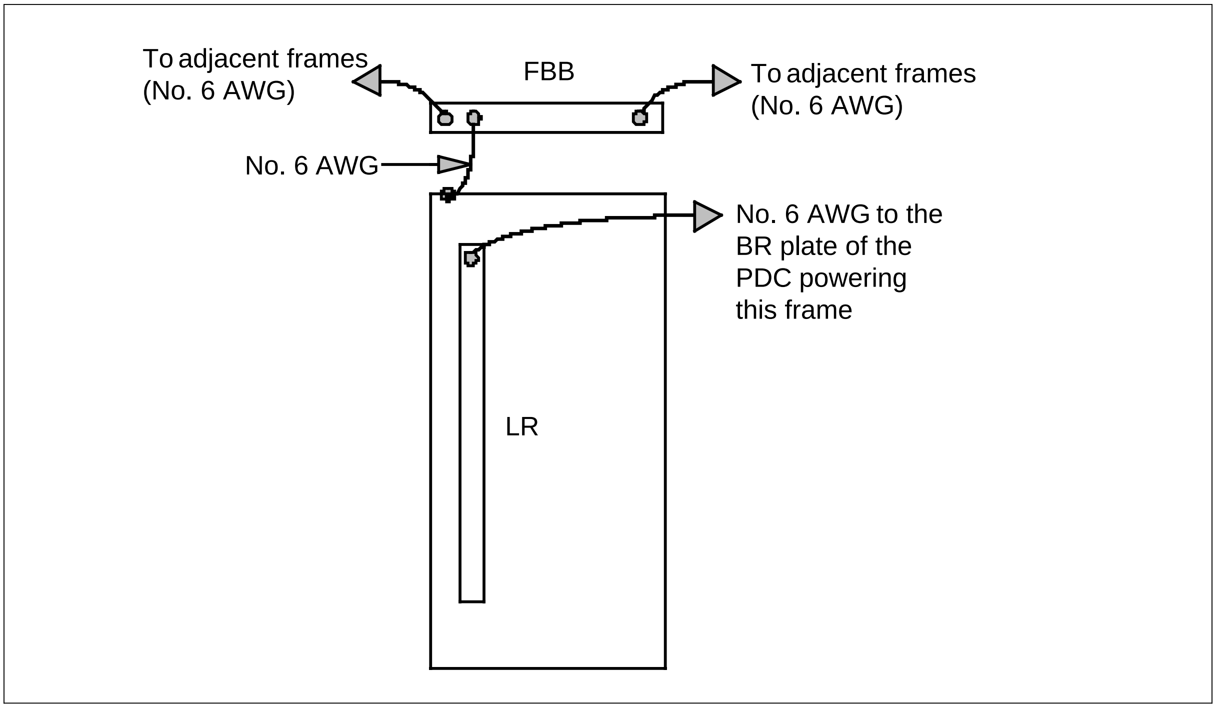
MS7E
NT6X31AA

DLE
NT7X50AA

Note 1: When RME or RSE frames contain modems, modem shelves, or inverters, they come with a vertical logic return bar. The vertical logic return bar connects to the BR plate of the RME/RSE.

Note 2: For DMS-100 and DMS-100/200 applications only, connect the DTE/IDTE vertical logic return bar according to this index. For all other applications, connect the DTE/IDTE vertical logic return bar to the LRB of the lineup.

Figure 9-7 Frame index F



9.3.1.7 Frame index G

The following frames belong to this group (see Figure 9-8):

LME
NT0X45AA

LME
NT0X45AB

LME
NT0X45AC

LME
NT0X45AD

LME
NT0X45AE

RLM
NT0X45BA

RLM
NT0X45BB

RLM
NT0X45BC

RLM
NT0X45BD

RLM
NT0X45BE

RLM
NT0X45BF

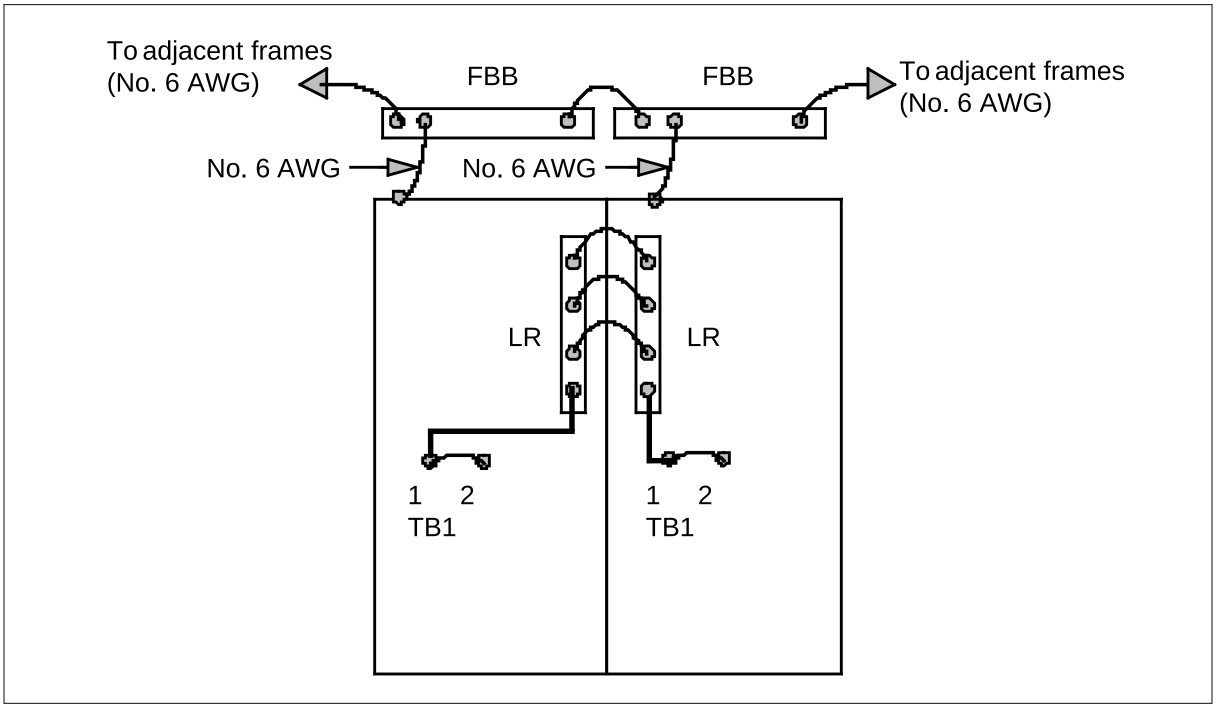
RLM
NT0X45BG

RLM
NT0X45BH

RLM
NT0X45BJ

RLM
NT0X45BK

Figure 9-8 Frame index G



9.3.1.8 Frame index H

The following cabinets belong to this group (see Figure 9-9):

DPCC
NT9X01BA - Core cabinets (see note)

CMDC
NT9X01AA- Core cabinets (see note)

MSSC
NT9X01CA- Core cabinets (see note)

MSDC
NT9X01GA- Core cabinets (see note)

DPCC
NT9X01JA- Core cabinets (see note)

MSDC
NT9X01LA- Core cabinets (see note)

ENET
NT9X05AB

LIM
NT9X70AA

DPCC
NT9X01JB- Core cabinets (see note)

SCC
NT9X01MB- Core cabinets (see note)

APC
NT9X80BA

EMC
NTEX01AA

SCE
NTNX93AA

NPP
NT9X80AA

DPCX
NTLX01AA- Core cabinets (see note)

SNXA
NTLX01AB- Core cabinets (see note)

EXTX
NTLX01AC

DPCC
NT9X01BC- Core cabinets (see note)

DPCC
NT9X01JD- Core cabinets (see note)

DPCC
NT9X01JF- Core cabinets (see note)

SCC
NT9X01MC- Core cabinets (see note)

SCC
NT9X01MD- Core cabinets (see note)

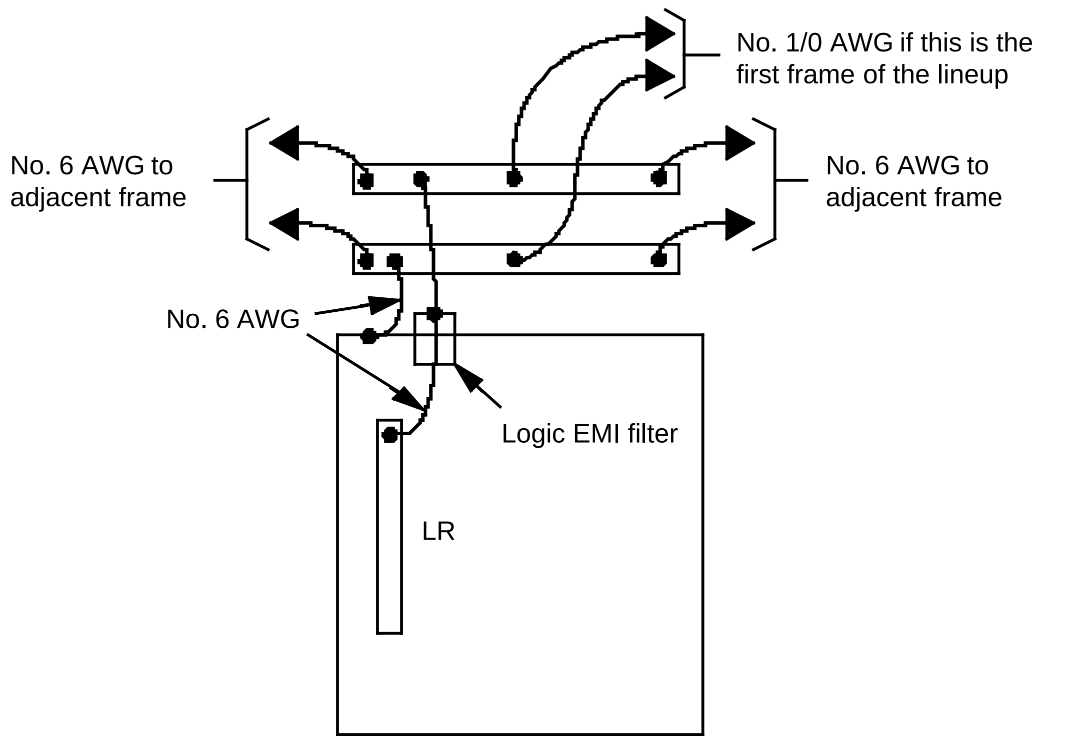
DPCC
NT9X01BB- Core cabinets (see note)

DPCC
NT9X01JC- Core cabinets (see note)

DPCC
NT9X01JE- Core cabinets (see note)

Note: The LRB of a core cabinet must connect to the core LRB. Normally the connection is over the IOE with a No. 1/0 AWG cable.

Figure 9-9 Frame index H



Note: These cabinets have two vertical logic return bars for each cabinet. These returns internally connect together with No. 6 AWG cable. Earlier cabinets have two logic EMI filters for each cabinet.

9.3.2 Modem equipment (MOE) frame

The modem equipment (MOE) frame is in host offices with ISG for the mounting of modem equipment. The modem shelves receive power from inverters mounted in the same frame. The modem shelves and associated inverters are isolated from the framework. A vertical logic return bar serves as the ground reference for the modems and inverters. The vertical logic return bar connects through a minimum No. 6 AWG conductor to the core LRB.

Isolate all customer-provided modem shelves from the frame and connect the modem shelves to the logic return bar.

You can mount modem equipment on an input/output equipment (IOE) frame in existing offices. All new host offices require an MOE frame. An existing host office upgraded to ISG must locate all modem equipment in either an MOE or an IOE frame.

Nortel Networks recommends that modem type equipment that requires connectivity to an IOE port be in the MOE or dedicated MIS. You must condition modem type equipment for ac coupling and dc isolation to maintain

LR isolation from the FG. One conditioning method is to use a current loop adapter at the modem and another current loop adapter at the IOE frame port.

9.3.3 Miscellaneous equipment (MIS) frame

The MIS contains equipment that does not require an external logic system reference, for example the LRB. The MIS does not require an equipment-specific isolation kit unless the frame is changed to a dedicated MIS or MOE frame.

9.3.4 Internal inverter

Inverters mounted as an integral part of the DMS IBN system that feed only system-internal load have neutral conductor and the chassis bonded to an approved grounding conductor of that system. Examples of approved grounding conductors are a framework bonding bar (FBB) and LRB. Do not provide facilities for transfer to commercial ac power.

9.3.5 Spare storage cabinets

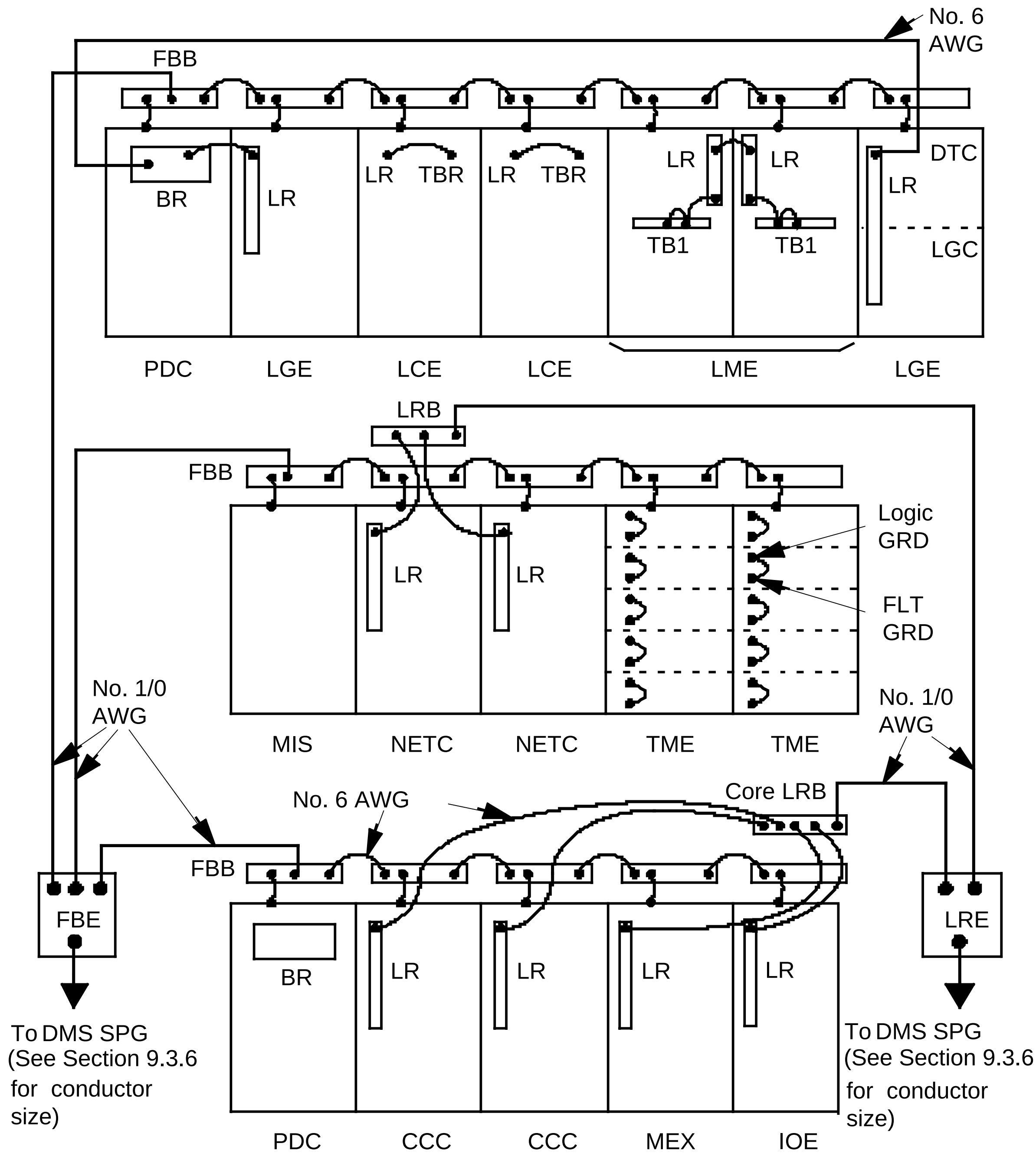
You can store spare circuit packs for the DMS switch in Nortel Networks cabinets or in OEM cabinets. Nortel Networks cabinets include the MSS, CMSS, and SCC. As an alternative, the operating company can provide OEM cabinets. Storage cabinets can be in a DMS lineup, or as stand-alone units in an IBN or CBN. Storage cabinets are bonded as follows.

- When in a DMS lineup, the storage cabinet is isolated from building grounds. The cabinet is bonded to the FBB of an adjacent cabinet (or frame) in the lineup.
- When a stand-alone unit in an IBN, the storage cabinet is isolated from building grounds. The cabinet is bonded to the FBE as a separate lineup.
- When a stand-alone unit in a CBN, isolation from building grounds is not required. The storage cabinet is bonded to the FGB. The storage cabinet can be within 2 m (7 ft) of the DMS and not be bonded to the FGB or the DMS SPG. In this event, bond the cabinet to the ICB.

9.3.6 ISG installation

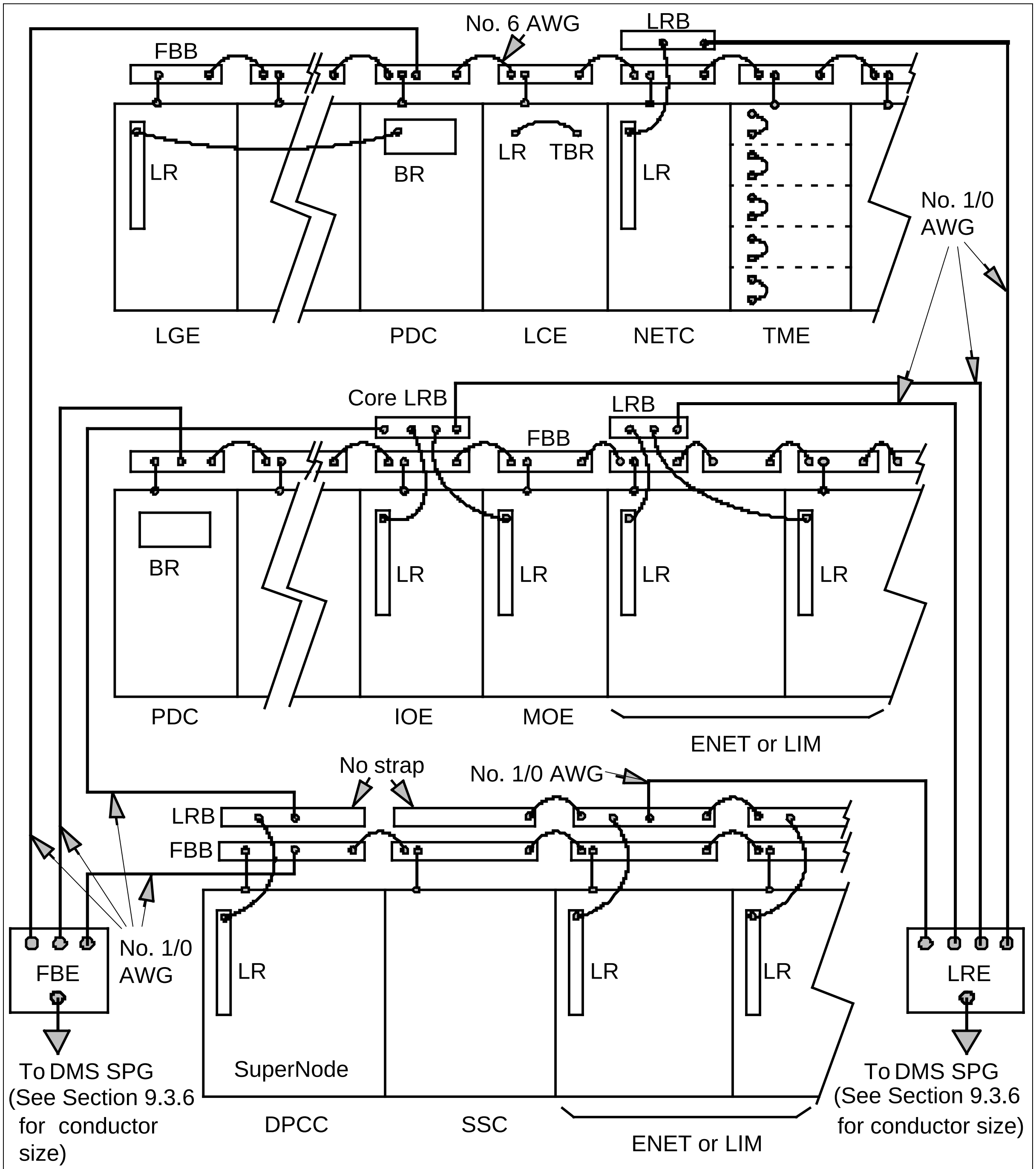
The framework bonding and logic return network designs for systems with ISG appear in Figure 9-10 and Figure 9-11. The ISG design isolates the framework ground network from the logic return and the battery return networks. The DMS SPG is the only point of connection between framework ground, logic return and battery return. For core frames like IOE, MIS, MOE with modems, and CCC or DPCC, all vertical logic bars require connection to the same core LRB. All vertical logic bars require connection if they are located in a separate lineup or in the same lineup. The core LRB is preferably located over the IOE frame. No other frames or cabinets are allowed to be connected to the core LRB.

Figure 9-10 Standard ISG DMS-100F framework bonding and logic return networks



Note: When a PDC is present in the lineup, the framework ground cable connection between the FBE and the lineup must go to the FBB above that PDC.

Figure 9-11 Standard ISG DMS-100F with SuperNode, ENET, and LIM cabinets



Note: When a PDC is present in the lineup, the framework ground cable connection between the FBE and the lineup must go to the FBB above that PDC.

The FBB of each PDC connects to the FBE with a No. 1/0 AWG cable. If a lineup does not have a PDC, the No. 1/0 AWG cable connects to the first frame in the lineup. The addition of a PDC to an lineup without a PDC, requires the removal of the FBE cable from the first frame. The cable must be bonded to the PDC. When two PDCs are in a lineup, each one must connect to the FBE.

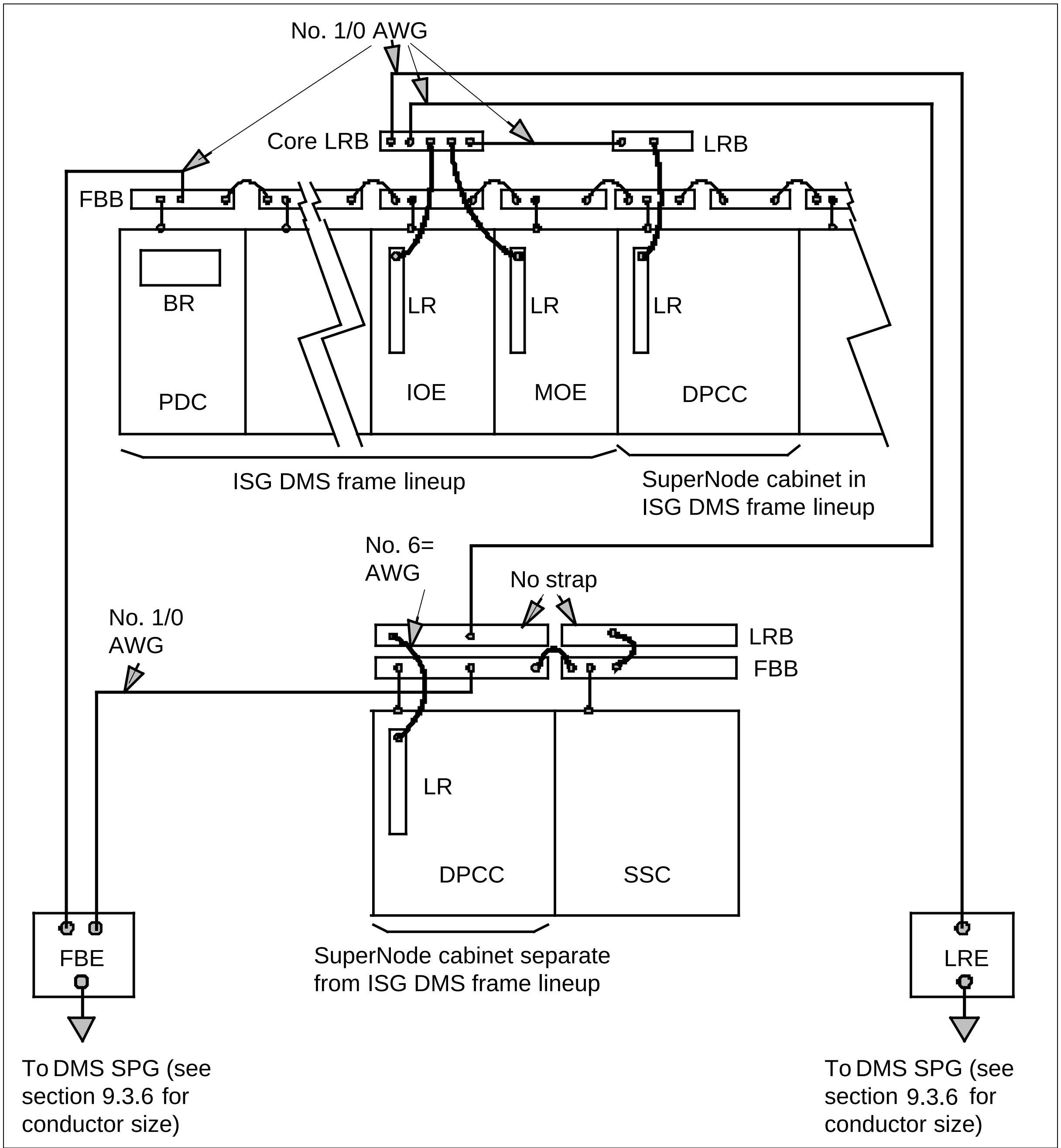
The bonding network that connects the logic return from any single frame through an LRB to the logic return equalizer (LRE) bar must not have a resistance greater than 15 milliohms.

In DMS-200 and DMS-300 applications, the logic return of the digital trunk equipment (DTE/IDTE) frame is bonded to the LRB of the lineup. The LRB of the lineup connects to the LRE. For all other DMS-100 and DMS-100/200 applications, the DTE/IDTE frame logic return connects to the battery return plate of the PDC that supplies power to the DTE/IDTE.

Frame groups, for example LGE/LCE, require power clustering (see Section 8.11, "Clustering"). The frame vertical logic return bar for the LGE equipment is bonded by a No. 6 AWG cable to the battery return plate of the PDC that supplies power to the LGE.

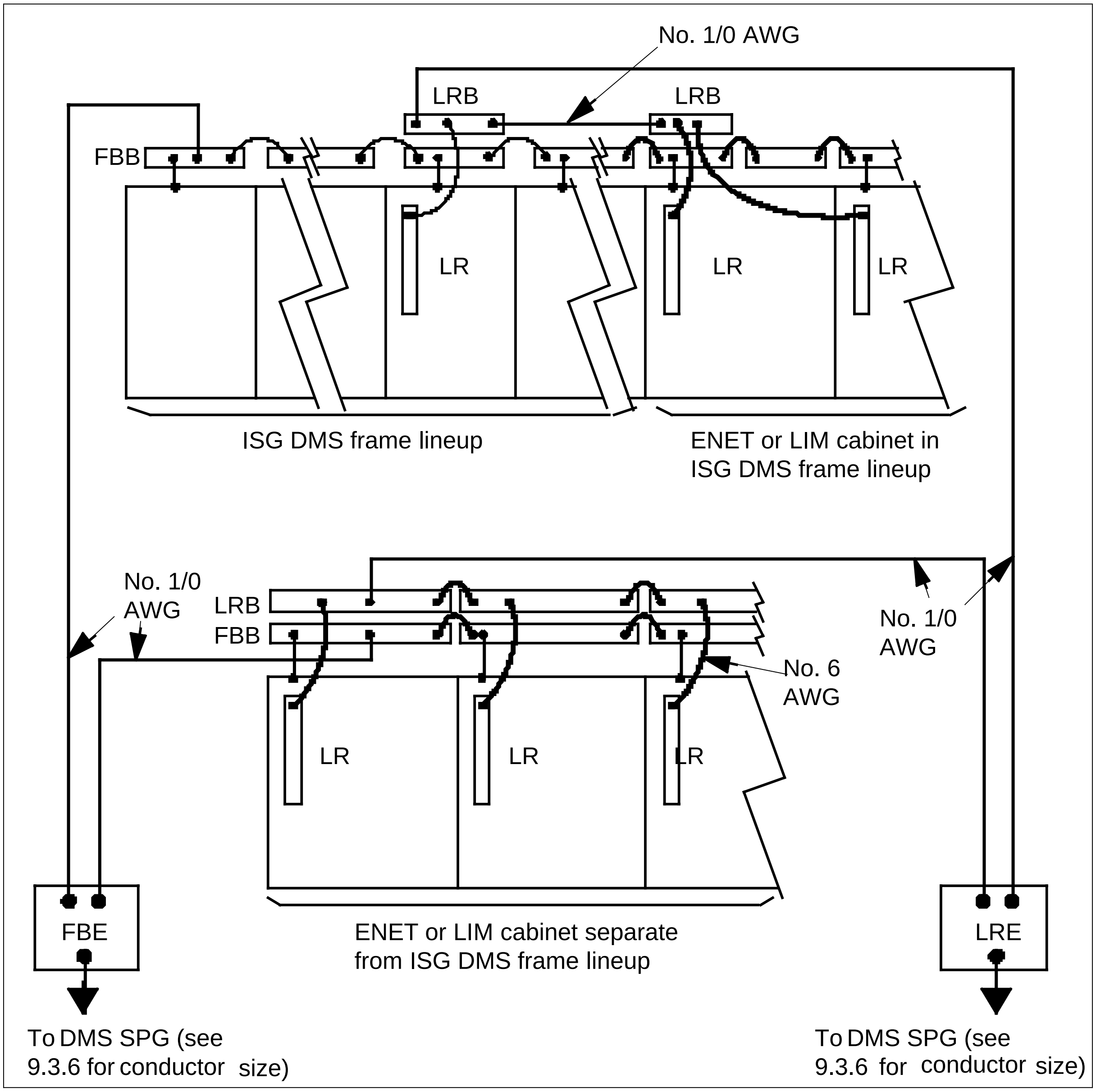
The addition of SuperNode cabinets with DMS-100 style cable troughs to an existing ISG DMS lineup requires the installation of an LRB above the cabinet. The LRB above the cabinet must connect to the core LRB with a No. 1/0 AWG cable (refer to Figure 9-12).

Figure 9-12 Addition of SuperNode cabinets to an ISG DMS-100F lineup



The addition of ENET or LIM cabinets with DMS-100 style cable troughs to an exiting ISG DMS lineup requires the installation of an LRB above the cabinet. The LRB above the cabinet must connect to the LRB of the lineup with a No. 1/0 AWG cable (refer to Figure 9-13).

Figure 9-13 Addition of ENET or LIM cabinets to an ISG DMS-100F lineup



The following determines the size of the cables that connect the FBE and LRE to a DMS SPG:

- use No. 2/0 AWG cable when the conductive length is less than or equal to 50 ft
- use 350 kcmil cable when the conductive length is greater than 50 ft, but is less than or equal to 150 ft
- use 750 kcmil cable for a conductive length greater than 150 ft

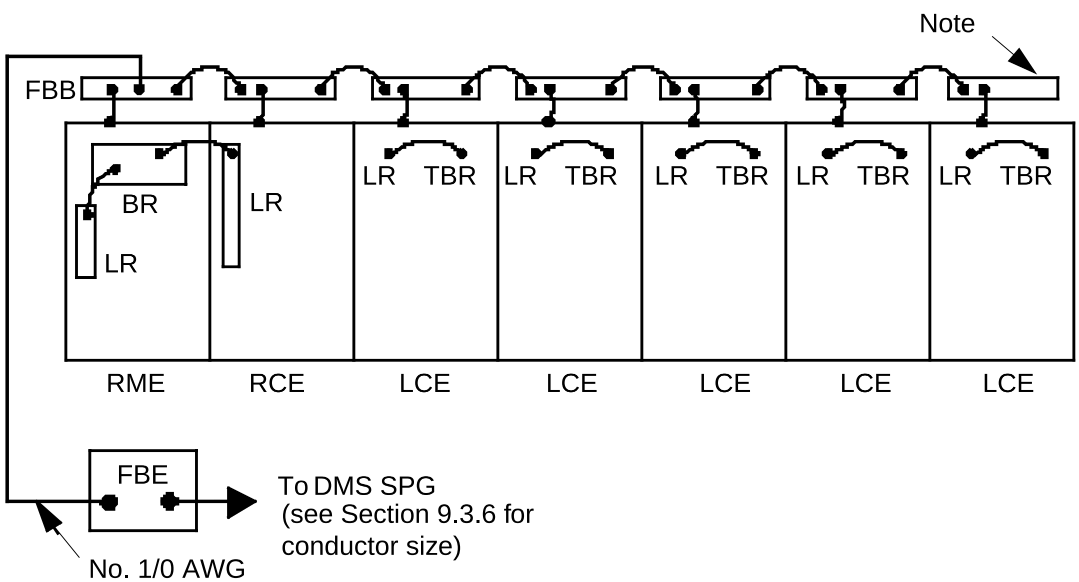
You do not need to modify earlier installations to comply with the cable sizes specified here.

> ***Note:*** Installations that require compliance with TR-NWT-000295 (such as an RBOC) can require these cables to be 750 kcmil, regardless of the distance, when they are crossing from one floor to another (refer to [R-3]).

9.3.7 ISG remote line facility

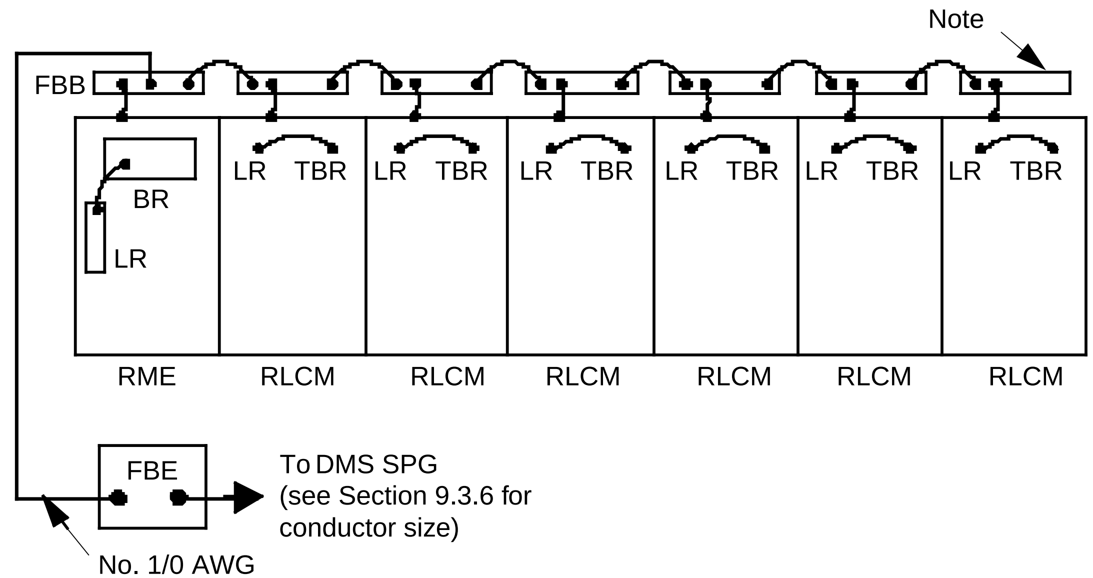
Remote line modules are subject to the same grounding rules that are specified for the DMS. The exception to this rule is that an LRE is not installed for remotes. Examples of remote line modules are RSC, RLCM, and RLM. The logic returns are referenced to battery return using No. 6 AWG cable. Typical framework bonding and logic return network for ISG remotes appear in Figure 9-14, Figure 9-15, and Figure 9-16.

Figure 9-14 Standard framework bonding and logic return network for ISG RSC



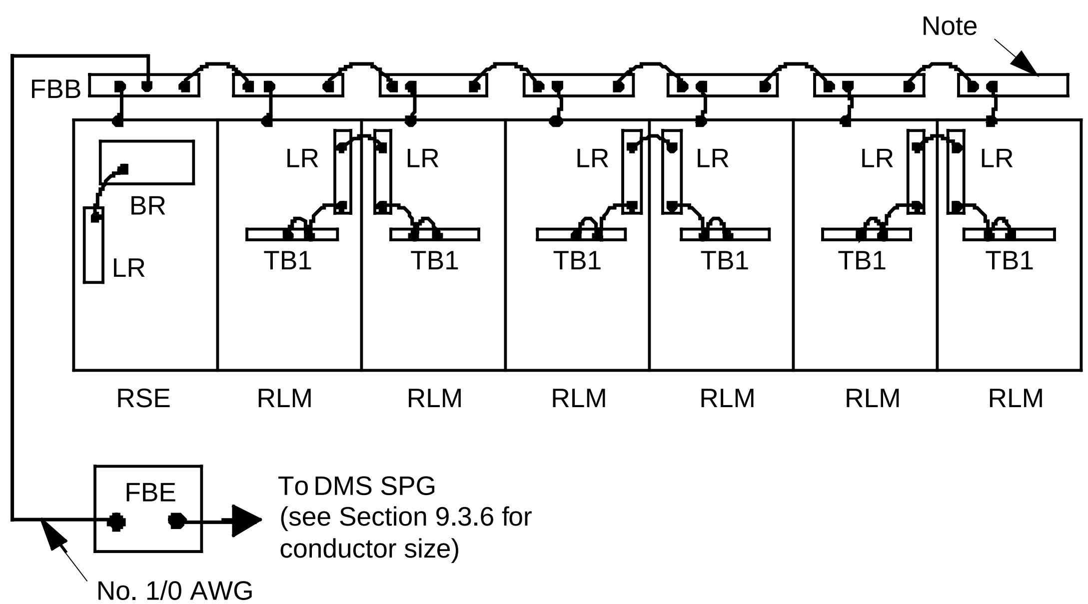
Note: In some installations, the FBBs are replaced by a collector cable.

Figure 9-15 Standard framework bonding and logic return network for ISG RLCM



Note: In some installations, the FBBs are replaced by a collector cable.

Figure 9-16 Standard framework bonding and logic return network for ISG RLM



Note: In some installations, the FBBs are replaced by a collector cable.

9.3.8 ISG ISDN installation

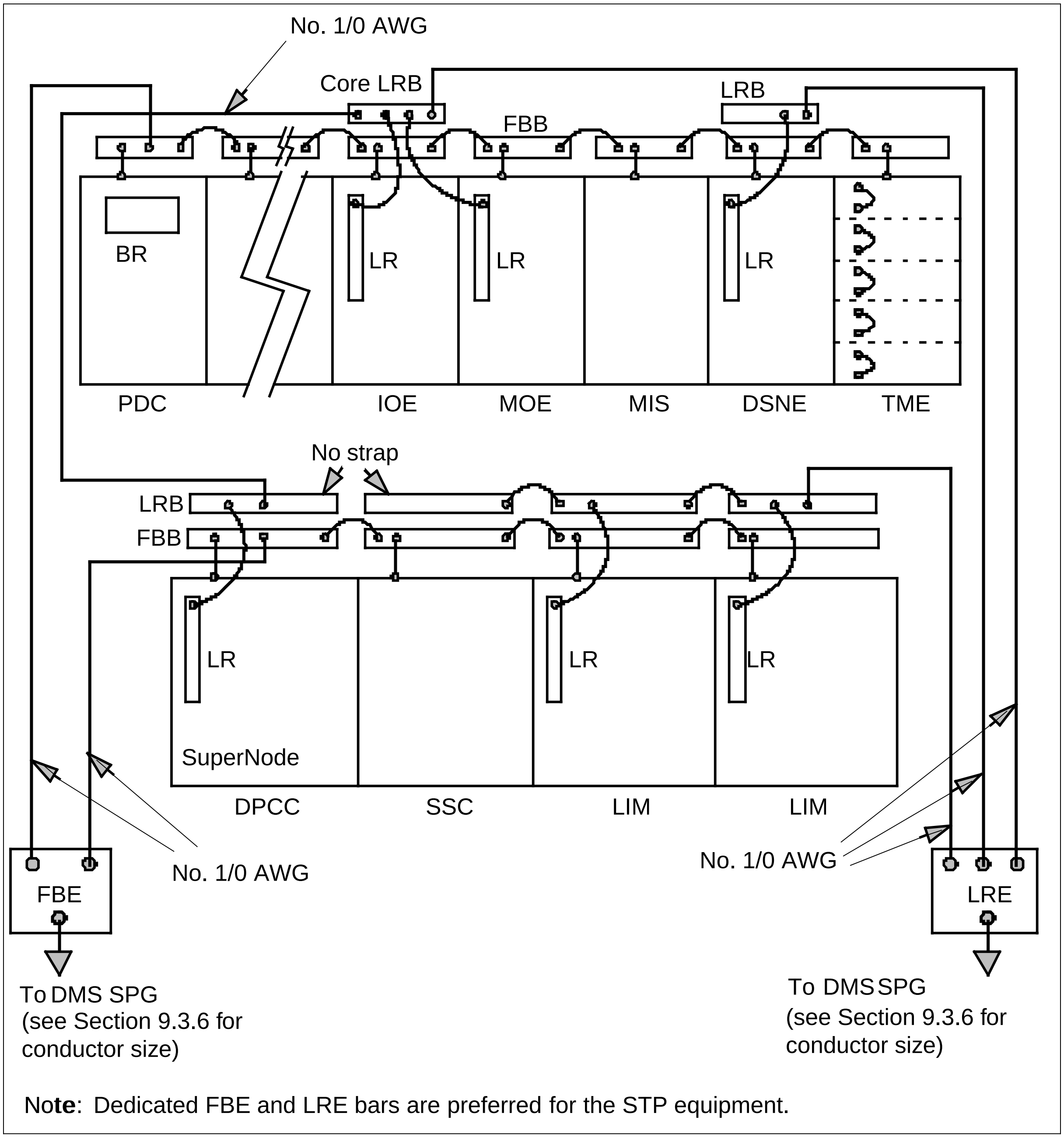
A typical integrated services digital network (ISDN) installation is a DMS-100F to which data packet network (DPN) frames are added. The grounding rules for the ISDN DMS are the same as described in this practice. Set up the DPN as a separate entity, with FBE and LRE connections to the DMS SPG. Cable sizes for these DPN connections to the SPG are determined in the same way as the cable sizes used for DMS connections to the SPG.

9.3.9 ISG STP installation

Signal transfer point (STP) facilities are subject to the grounding rules specified for the DMS-100F, with the following exceptions (see Figure 9-17):

- To maintain the modularity of STP as a separate switch, and to facilitate troubleshooting, dedicated FBE and LRE bars are preferred. If requested by the customer, the STP and the colocated DMS-100 switch are allowed to share a set of FBE and LRE bars.
- The DPCC, IOE, and MOE frames represent the core, which is a treated as a separate equipment row with regard to the logic return network.
- The logic return network of the DSNE frame is bonded to the LRE through its own LRB.
- The LIM cabinet LRBs are interconnected and bonded to the LRE with a No. 1/0 AWG cable.
- The battery return plate of the PDC is referenced to the DMS SPG through the power plant. No equalizer cables are connected to the battery return plate.
- You must reference any external ac power distribution circuits brought into the STP to the DMS SPG according to the applicable requirements of Chapter 7.
- If the DPCC cabinet is in the same lineup as the LIM cabinets
  - — connect the DPCC LRB to the core LRB
  - — connect the LIM LRBs together and to the LRE

Figure 9-17 Standard ISG STP grounding configuration



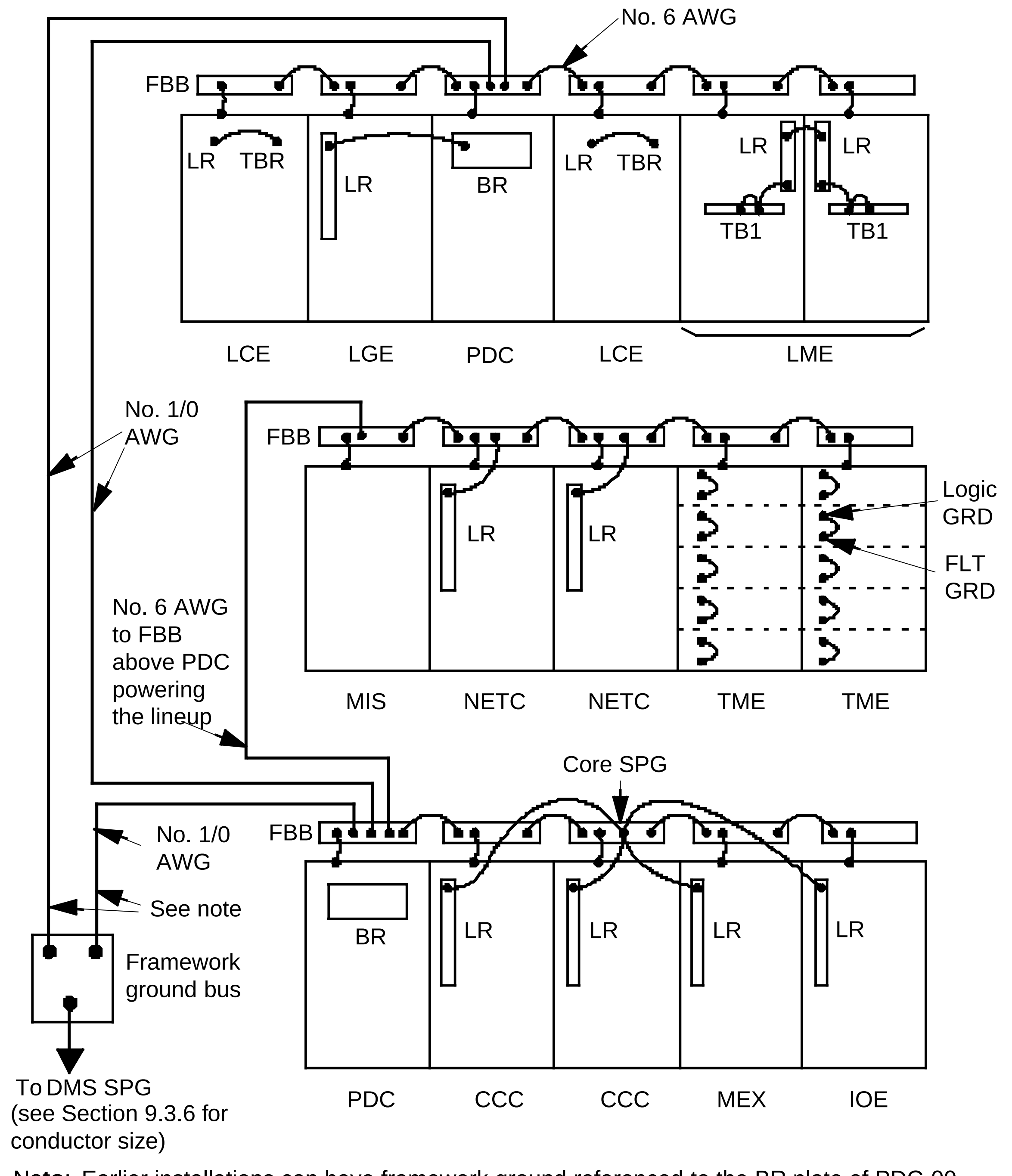
9.3.10 Non-ISG installation

The framework bonding bar (FBB) provides a point for referencing each module to ground (some modules use talk battery return). The FBB can be bonded with two or more straps from the vertical logic bar in a module. In this event, the straps connect to a single point on the FBB. An example of this is a CCC frame. Existing MEX frames customized to connect the logic returns to the FBB directly above each frame are adequately bonded to ground.

A typical non-ISG DMS-100 lineup appears in Figure 9-18. A typical non-ISG lineup for the DMS with SuperNode, ENET, and LIM cabinets appears in Figure 9-19. The framework ground and logic return network for non-ISG consists of the following components:

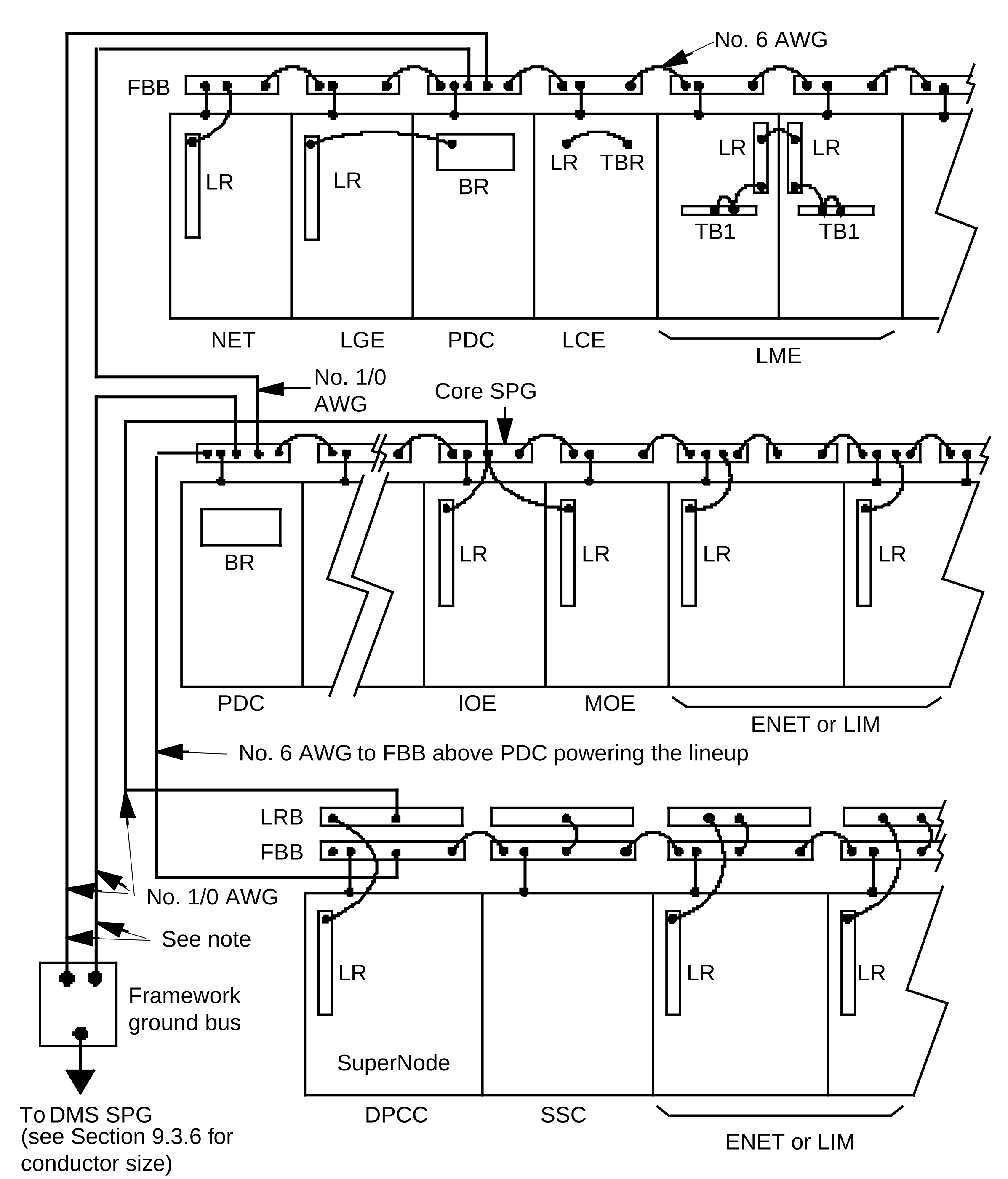
- a horizontal copper busbar, called the FBB, which is above each equipment frame in an lineup
- a No. 6 AWG cable that connects each frame to its associated FBB
- a No. 6 AWG cables that interconnects the FBBs of near frames in a lineup
- a No. 6 AWG cable that connects the FBB of the end frame in a lineup that does not contain a PDC, to the end frame in an adjacent lineup that does contain the PDC that powers the lineup.
- a copper plate or busbar, called the framework ground bus. This bus interfaces the framework ground network with the building grounding system through the DMS SPG. The framework ground bus is located close to the PDC nearest the interface of the building grounding system. The PDC-00 is normally the nearest frame to the interface.
- a No.1/0 AWG cable that interconnects the framework ground bus and the FBB above each PDC in a ring configuration

Figure 9-18 Standard non-ISG DMS-100F framework bonding and logic return network



Note: Earlier installations can have framework ground referenced to the BR plate of PDC-00.

Figure 9-19 Standard non-ISG DMS-100F with SuperNode, ENET, and LIM cabinets



Note: Earlier installations have framework ground referenced to the BR plate of PDC-00.

In some earlier DMS-100 systems, the battery return (BR) plate in PDC-00 serves as the focal point for referencing the dedicated power plant to ground. This design requires the following:

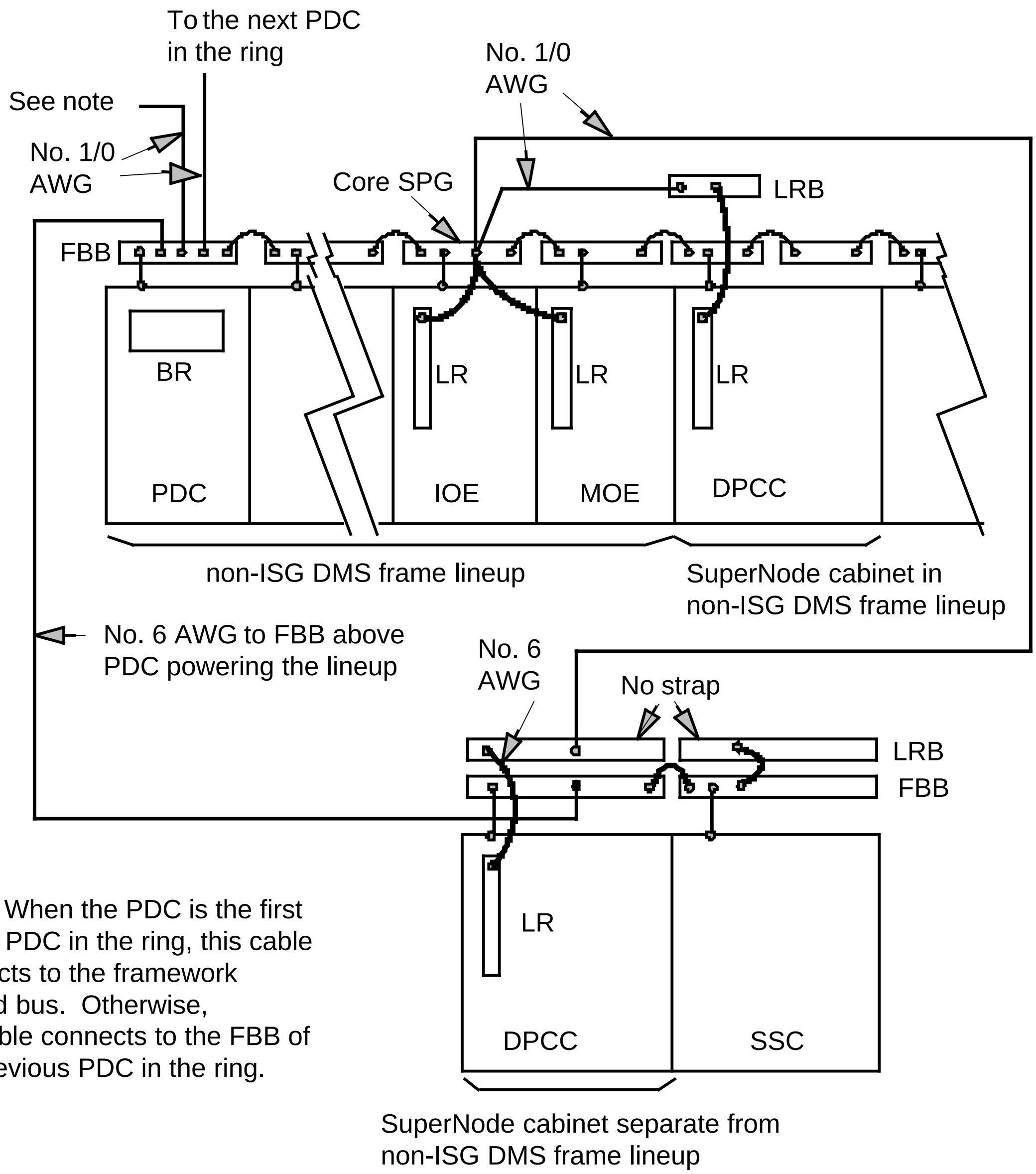
- a 750 kcmil cable between the DMS SPG and PDC-00 battery return bus
- 750 kcmil equalizer cables between all BR plates in the PDCs
- separate connection of the dc power plant BR bar to the DMS SPG is not present
- power plant feeders provide power to isolated loads only
- battery return separated from foreign grounds

Non-ISG grounding configurations are bonded to the building grounding system through the DMS SPG. The following determines the size of the cable used for the bond between the framework ground bus and the DMS SPG:

- use No. 1/0 AWG cable when the conductive length is less than or equal to 100 ft
- use 750 kcmil cable when the conductive length is greater than 100 ft

The addition of SuperNode cabinets with DMS-100 style cable troughs to an existing non-ISG DMS lineup requires the installation of an LRB above the DPCC cabinet. Connect this LRB to the core SPG with a No. 1/0 AWG cable (refer to Figure 9-20).

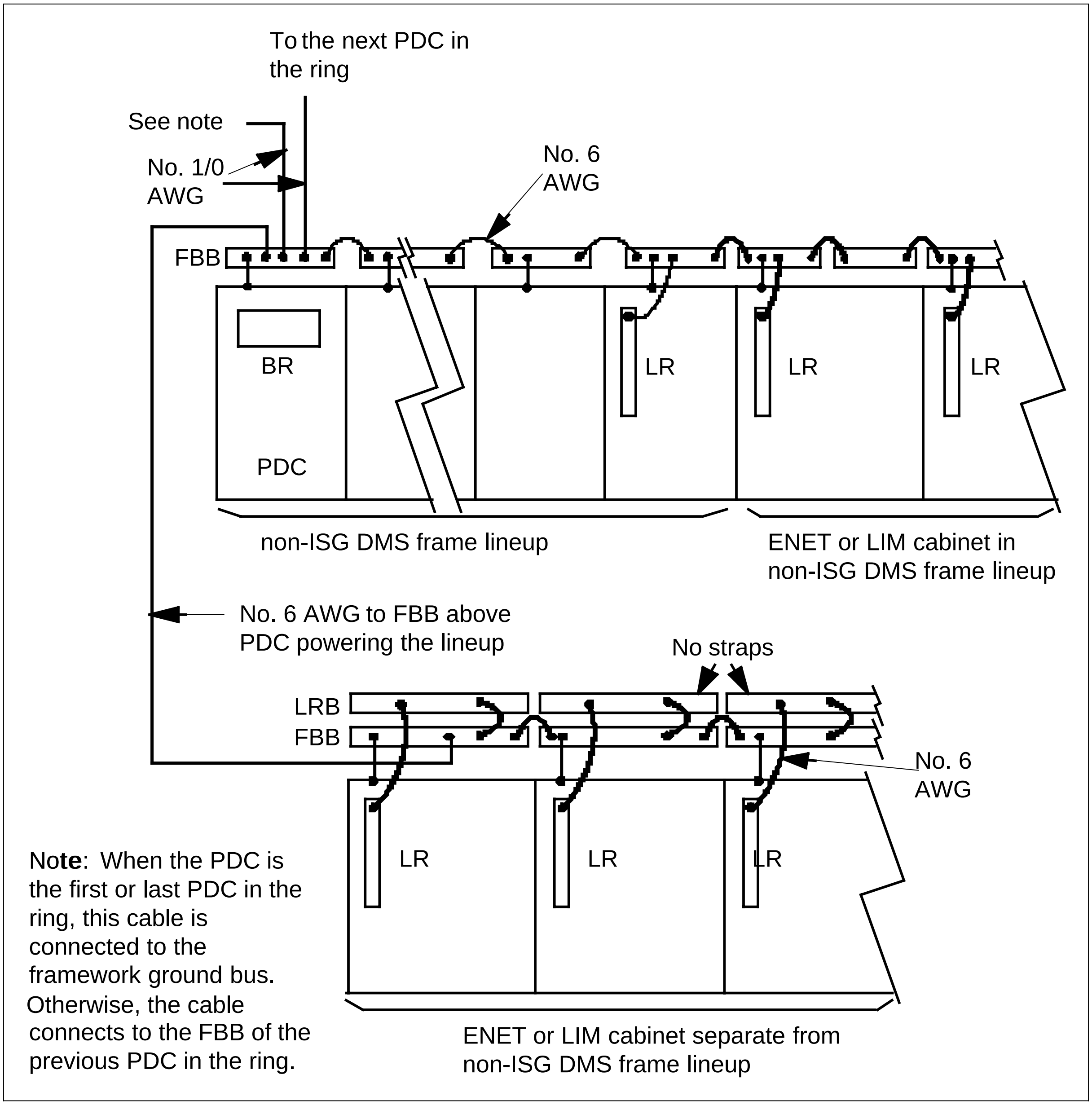
Figure 9-20 Addition of SuperNode cabinets to a non-ISG DMS-100F lineup



Note: When the PDC is the first or last PDC in the ring, this cable connects to the framework ground bus. Otherwise, the cable connects to the FBB of the previous PDC in the ring.

The addition of an ENET or LIM cabinet with a DMS-100 style cable trough to an existing non-ISG DMS lineup requires a No. 6 AWG cable to connect the logic return of the cabinet to the FBB above the cabinet (refer to Figure 9-21).

Figure 9-21 Addition of ENET or LIM cabinets to a non-ISG DMS-100F lineup



The addition of ISDN and STP facilities to non-ISG sites must be done in accordance with Section 9.3.8 and Section 9.3.9.

9.4 IMAP and MAP equipment

An integrated maintenance and administration position (IMAP) is installed in the common bonding network (CBN). Use the IMAP installation for new maintenance and administration positions. If installed in an isolated bonding network (IBN), a maintenance and administration position is known as a MAP. Earlier MAP installations were only installed as part of the DMS IBN.

Power for IMAP and MAP equipment is not obtained from the DMS. Communication links between IMAP and MAP equipment and the DMS are current loops or other isolated communication links. An example of this type of link is modem-to-modem. The DMS inverters provided power for earlier MAP equipment. Communication links between earlier MAP equipment and the DMS in ISG systems were current loops or other isolated communication links. Earlier non-ISG MAP systems used direct metal (EIA RS-232) or current loop communication links.

The IMAP and MAP furniture that contains substantially exposed metal must be grounded. Trim metal is not considered substantially exposed metal.

The IMAP sites subject to high lightning activity must have all metal parts of the ac distribution system bonded together. Bond these parts at one visible and accessible point within the IMAP. This common bonding point can be a copper busbar, a copper conductor, metal conduit, or another appropriate grounding component.

Bonding requirements for IMAP, MAP, and earlier MAP installations are listed in Table 9-1.

Table 9-1 IMAP, MAP, and earlier MAP grounding requirements (Sheet 1 of 2)

	Maintenance and administration position installed as		**Earlier MAP installations**	
Item	**IMAP (ISG or non-ISG)**	**MAP (ISG or non-ISG)**	**ISG**	**Non- ISG**
PAC poles	Isolated from DMS, bonded to ac distribution (Notes 1 and 2)	Isolated from foreign grounds, bonded to serving SPG of IBN (Note 2)	Isolated from foreign grounds, bonded to DMS (Notes 2 and 3)	Isolated from foreign grounds, bonded to DMS (Notes 2 and 3)
Furniture	Isolated from DMS, bonded to FGB (Notes 4 and 5)	Isolated from foreign grounds, bonded to serving SPG of IBN (Note 5)	Isolated from foreign grounds, bonded to DMS SPG (Note 5)	Isolated from foreign grounds, bonded to DMS SPG (Note 5)
EIA RS-232	No	No	No	Yes (Note 6)

Note 1: Isolated from DMS, referenced to non-DMS essential or protected ACEG conductor through the green wire of the PAC pole. Isolation from foreign grounds is not required.

Note 2: Tthe PAC pole should not be fed from two ac sources of different power quality.

Note 3: Isolated from foreign grounds like walls, ceiling, non-DMS metal objects. The ac equipment grounding (ACEG) conductor (green wire) references this item to DMS inverters.

Note 4: Can be bonded to the DMS SPG when DMS SPG is on the same floor as the IMAP. You should apply the 2-meter (7-foot) rule if the IMAP equipment is within 2 m (7 ft) of the DMS.

Note 5: Can be bonded to the ICB rather than the DMS SPG, as required.

Note 6: DMS inverters are required when EIA RS-232 communications are used.

Note 7: When current loops or modem-to-modem communications are used, the following can provide power for the MAP:

- DMS inverters
- protected ac power, if the feeder of the protected ac is referenced to the DMS SPG

Note 8: Powered from DMS-100 embedded inverters located in a MIS frame with the chassis referenced to framework ground.

Note 9: The CBN power source must meet facility power and grounding requirements.

Note 10: An inverter chassis ground lug can additionally connect to a grounding electrode conductor (NEC Article 250-26 or CEC Section 10-206) or to the nearest effective grounding structure as the customer requires. (See Figure 9-26.)

Note 11: The serving ac power distribution must meet IBN grounding requirements.

Table 9-1 IMAP, MAP, and earlier MAP grounding requirements (Sheet 2 of 2)

	Maintenance and administration position installed as		Earlier MAP installations	
Item	**IMAP (ISG or non-ISG)**	**MAP (ISG or non-ISG)**	**ISG**	**Non- ISG**
Current loop or modem-to-modem	Yes	Yes	Yes	Yes (option) (Note 7)
Powered from DMS-100F	No	No	Yes (Note 8)	Yes (Note 8)
Powered from the CBN	Yes (Notes 9 and 10)	Yes (Notes 9 and 11)	No	No (Note 7)

Note 1: Isolated from DMS, referenced to non-DMS essential or protected ACEG conductor through the green wire of the PAC pole. Isolation from foreign grounds is not required.

Note 2: Tthe PAC pole should not be fed from two ac sources of different power quality.

Note 3: Isolated from foreign grounds like walls, ceiling, non-DMS metal objects. The ac equipment grounding (ACEG) conductor (green wire) references this item to DMS inverters.

Note 4: Can be bonded to the DMS SPG when DMS SPG is on the same floor as the IMAP. You should apply the 2-meter (7-foot) rule if the IMAP equipment is within 2 m (7 ft) of the DMS.

Note 5: Can be bonded to the ICB rather than the DMS SPG, as required.

Note 6: DMS inverters are required when EIA RS-232 communications are used.

Note 7: When current loops or modem-to-modem communications are used, the following can provide power for the MAP:

- DMS inverters
- protected ac power, if the feeder of the protected ac is referenced to the DMS SPG

Note 8: Powered from DMS-100 embedded inverters located in a MIS frame with the chassis referenced to framework ground.

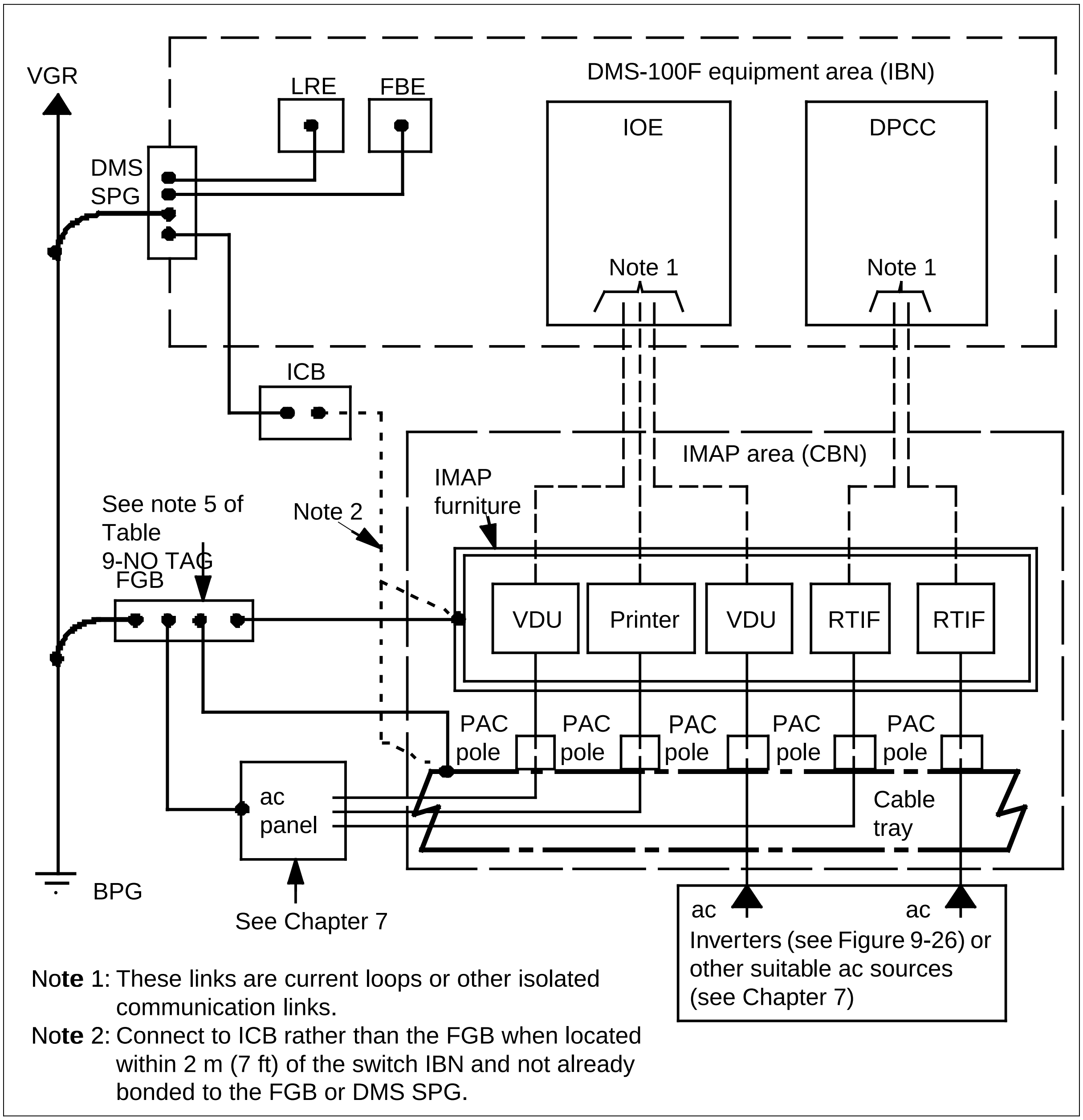
Note 9: The CBN power source must meet facility power and grounding requirements.

Note 10: An inverter chassis ground lug can additionally connect to a grounding electrode conductor (NEC Article 250-26 or CEC Section 10-206) or to the nearest effective grounding structure as the customer requires. (See Figure 9-26.)

Note 11: The serving ac power distribution must meet IBN grounding requirements.

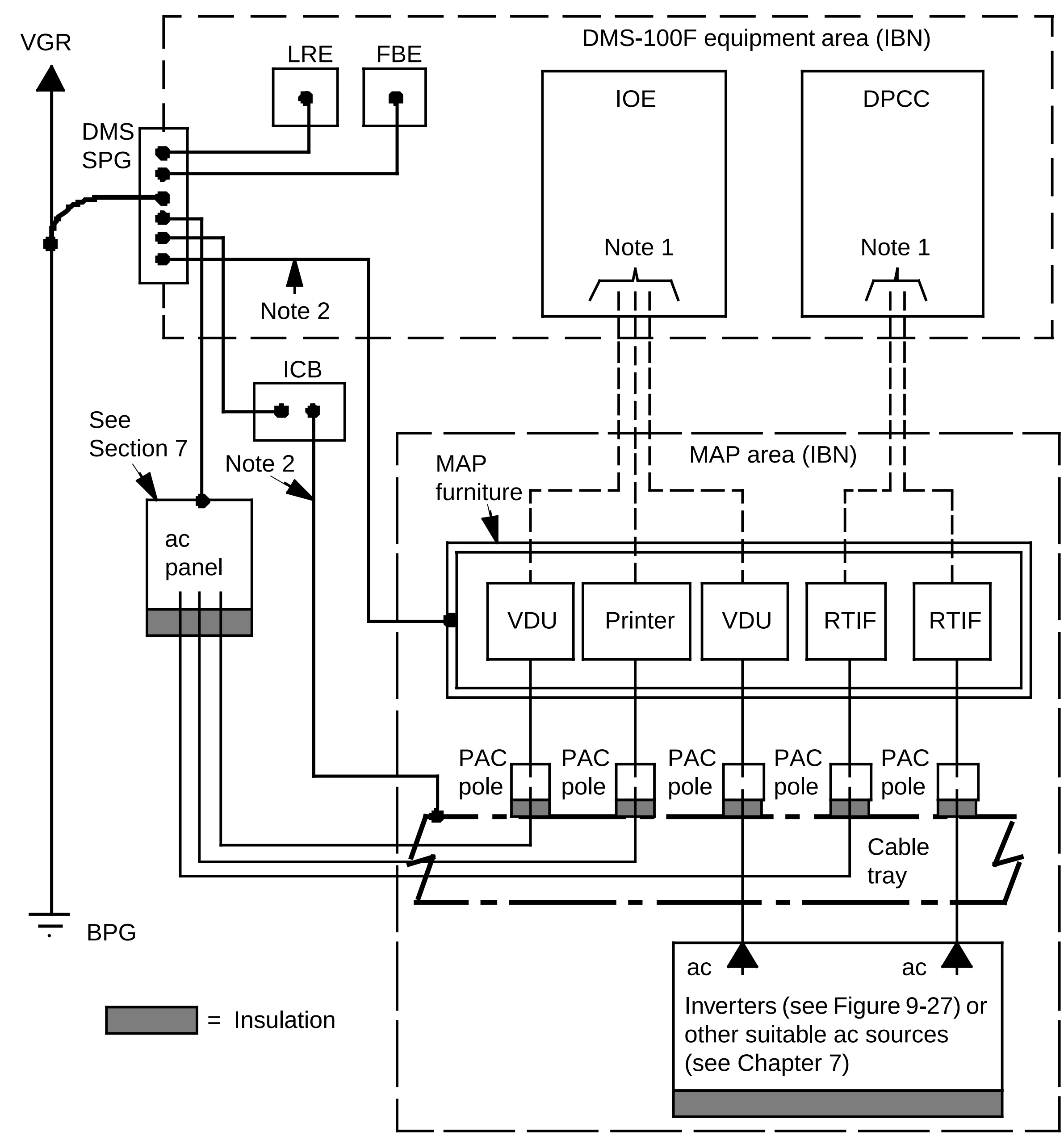
Grounding configurations for IMAP appear in Figure 9-22.

Figure 9-22 Standard IMAP power and grounding



The MAP configuration appears in Figure 9-23.

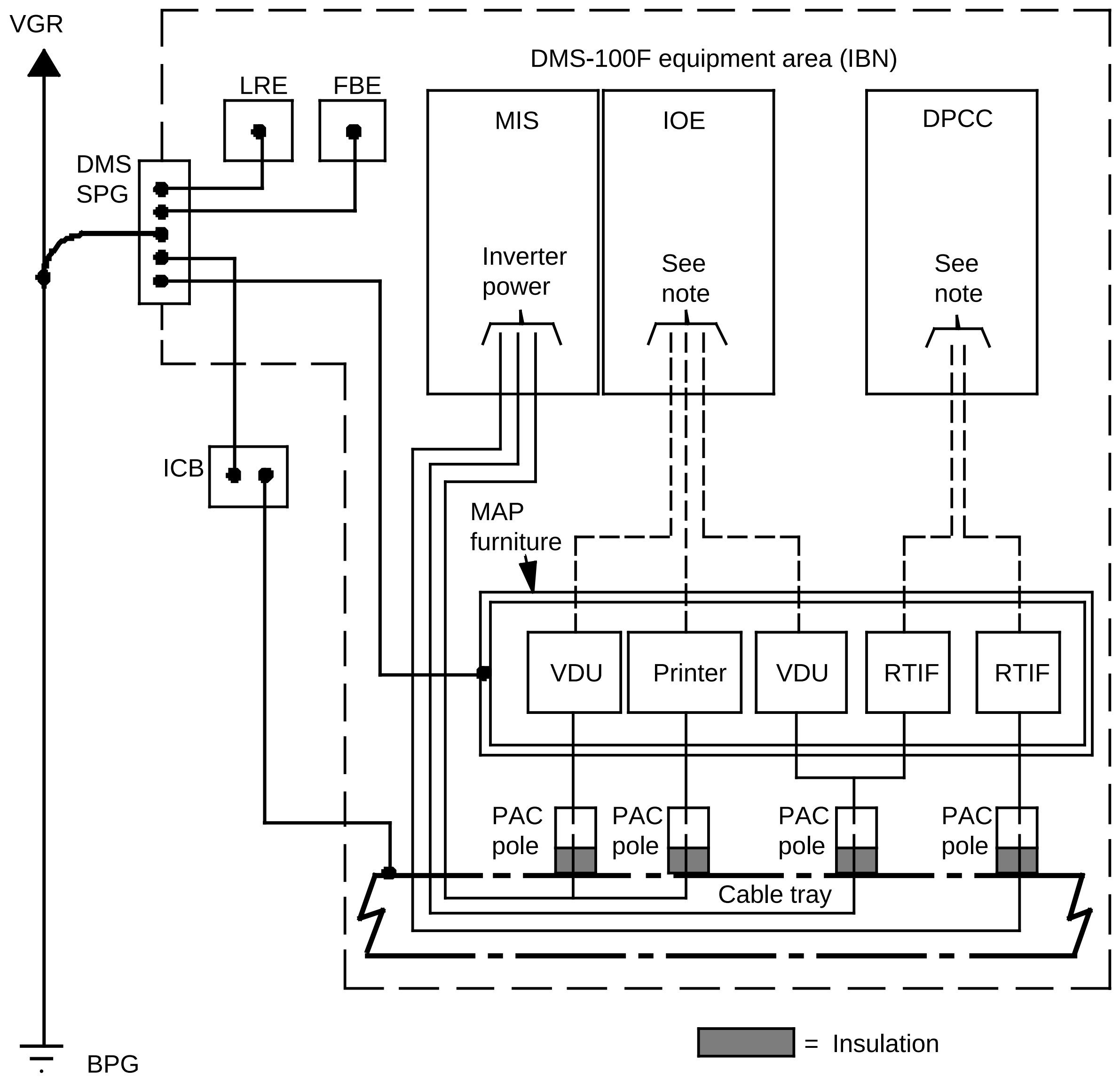
Figure 9-23 Standard MAP power and grounding



Note 1: These links are current loops or other isolated communication links.
Note 2: Can be bonded to another SPG (not shown) which serves the MAP area IBN.

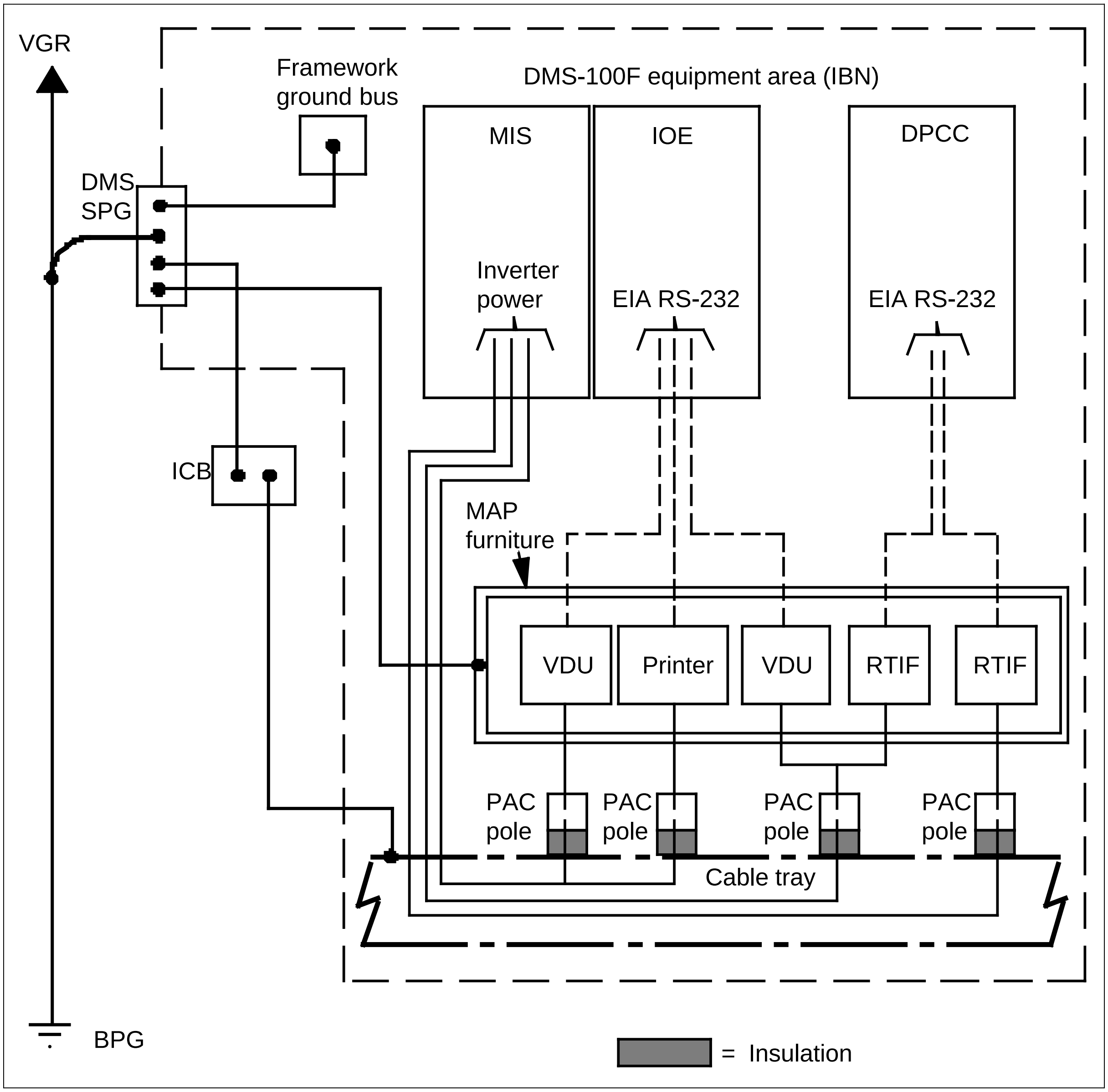
Earlier MAP configurations appear in Figure 9-24 and Figure 9-25.

Figure 9-24 Standard earlier MAP power and grounding for ISG DMS



Note: These links are current loops or other isolated communication links.

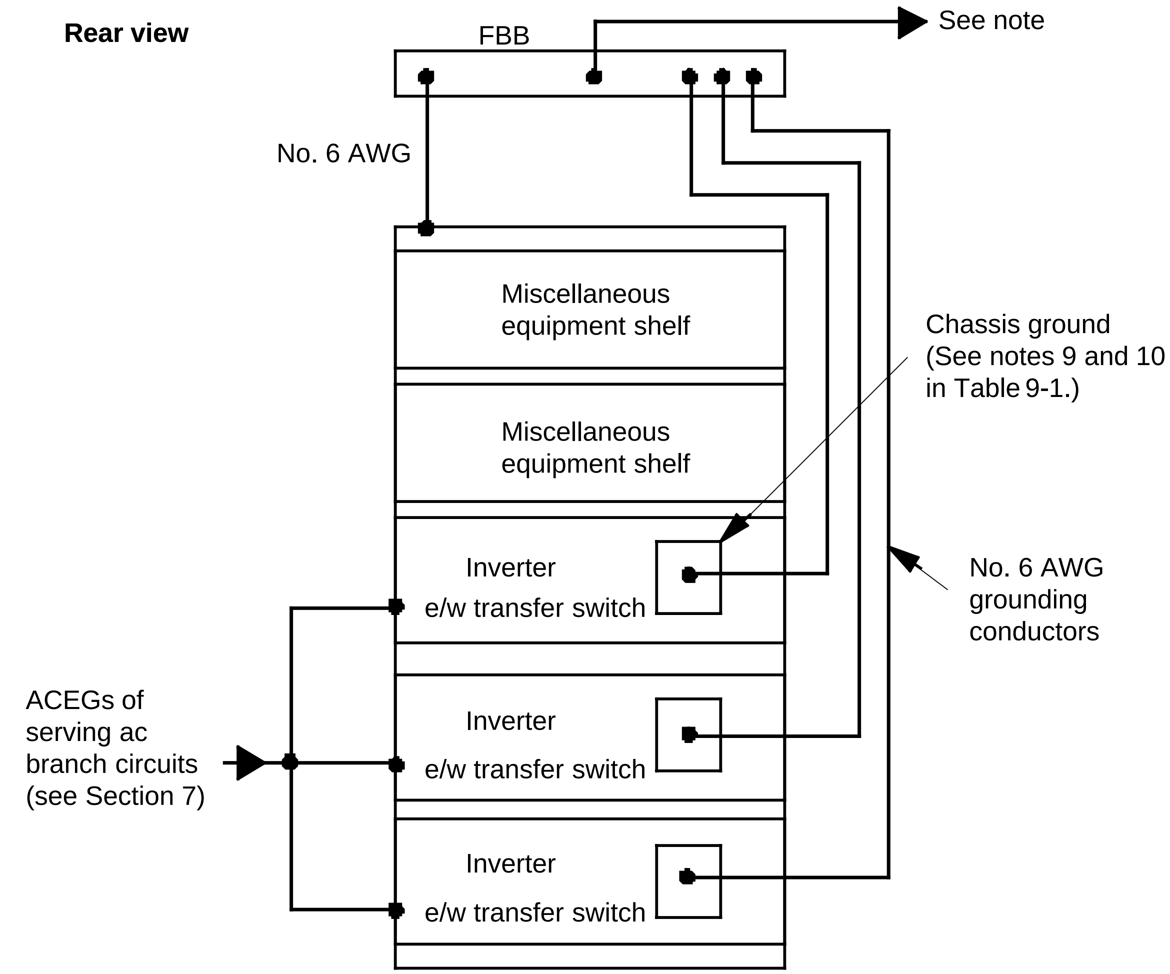
Figure 9-25 Standard earlier MAP power and grounding for non-ISG DMS



9.4.1 MIS frame used with IMAP

An MIS frame can mount DMS-approved inverters and ac-powered equipment that supports IMAP functions. A vertical logic return bar or FSP is not present. The MIS frame has an FBB for grounding purposes, and can have end-guards (no ac outlets or lights) and end frame dress panels. The MIS frame should be in the IMAP area.

Figure 9-26 Standard MIS frame used with IMAP

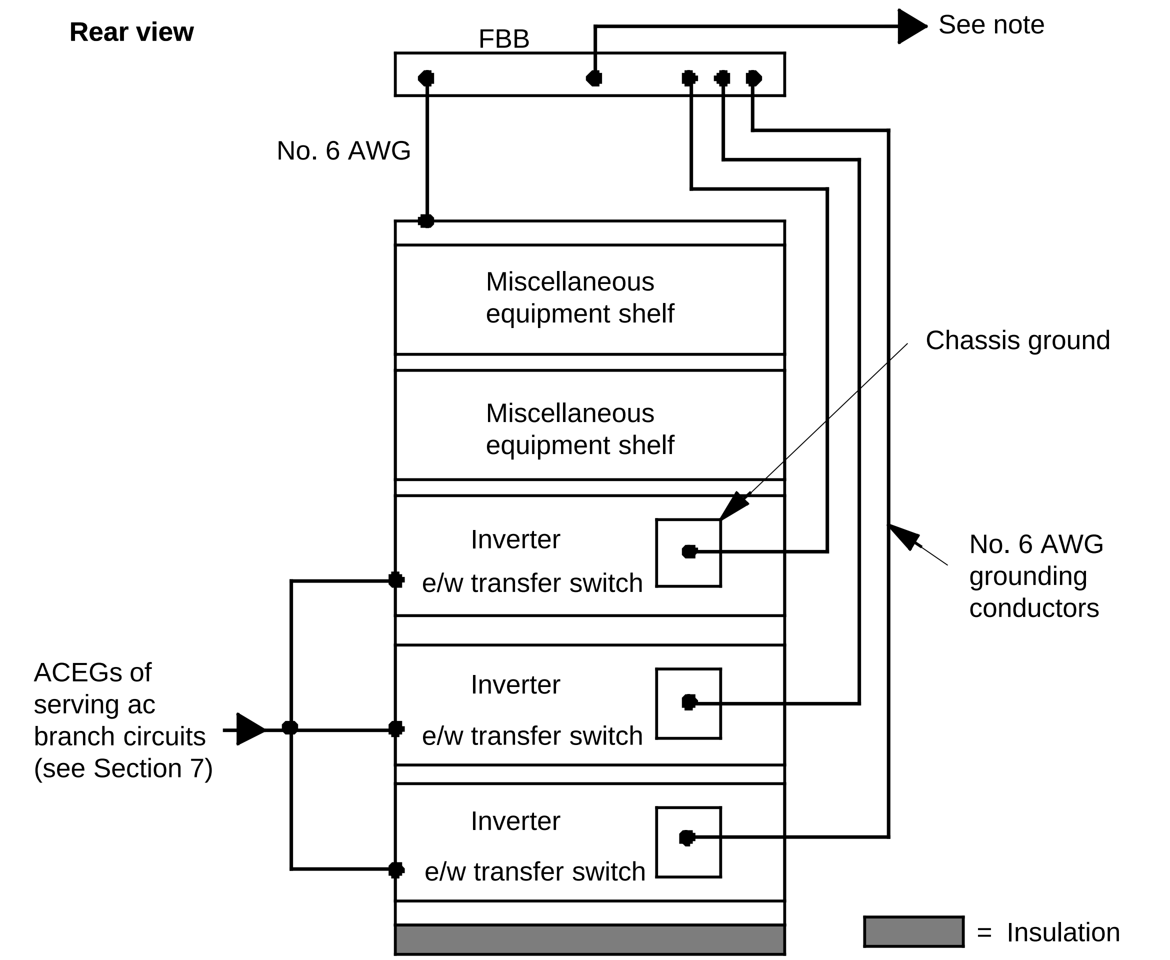


Note: Bond to a ground bar that connects to the ground reference point of the serving dc power plant. This is usually the FGB or the DMS SPG. The size of the bonding conductor must be a minimum No. 6 AWG or equal to the size of the inverter input conductors, whichever is the larger conductor.

9.4.2 MIS frame used with MAP

An MIS frame can contain DMS-approved inverters and ac-powered equipment that supports MAP functions. A vertical logic return bar or FSP is not present. The MIS frame has an FBB for grounding purposes, and can have end guards (no ac outlets or lights) and end frame dress panels. The MIS frame must be installed in the DMS IBN area.

Figure 9-27 Standard MIS frame used with MAP



Note: Bond to the DMS SPG. The size of the bonding conductor must be a minimum No. 6 AWG or equal to the size of the inverter input conductors, whichever is the larger conductor.

9.5 Collocated transmission equipment

For the installations described here, all transmission and miscellaneous equipment used with DMS systems are subject to the same grounding rules as the DMS. Nortel Networks recommends the following guidelines for isolated bonding network (IBN) transmission equipment that does not require connection of the battery return (BR) to the framework ground:

- transmission equipment should not be more than one floor away from the DMS equipment
- transmission equipment can be within DMS lineups. The equipment framework must be on isolating pads if
  - — the equipment is in the central control complex (CCC) frame lineup, or
  - — all the DMS frames are isolated from the floor
- follow framework ground and personnel safety rules for DMS. The nearest DMS PDC can provide the power. The DMS PDC must provide power according to DMS power feeder rules if the equipment is within the DMS-100 lineup.
- if the manufacturer permits, transmission equipment framework not in a DMS lineup can sit directly on the floor. The equipment framework must be bonded with a minimum No. 6 AWG conductor to the DMS SPG. A supplementary fuse panel on the power plant must provide power to the transmission equipment.
- ac-powered test sets should use only receptacles in DMS lineups
- all communication links for the DMS must be ac-coupled or routed by way of a transmission bonding bar (TBB)

The following guidelines are recommended for IBN transmission equipment that requires connection of the BR to the framework ground.

- transmission equipment should not be more than one floor away from the DMS SPG. The DMS SPG must be the BR bus of the power plant.
- transmission equipment must not be within DMS lineups or connect directly to the DMS framework ground
- transmission equipment framework must be on isolating pads to eliminate contact with the floor or any other ground
- transmission equipment framework must connect to the DMS SPG with a No. 6 AWG conductor or larger cable
- a supplementary fuse panel on the main power plant must provide the power for the transmission equipment
- ac-powered test sets must use only receptacles in DMS lineups
- all communication links for the DMS must be ac-coupled or routed by way of a transmission bonding bar (TBB)

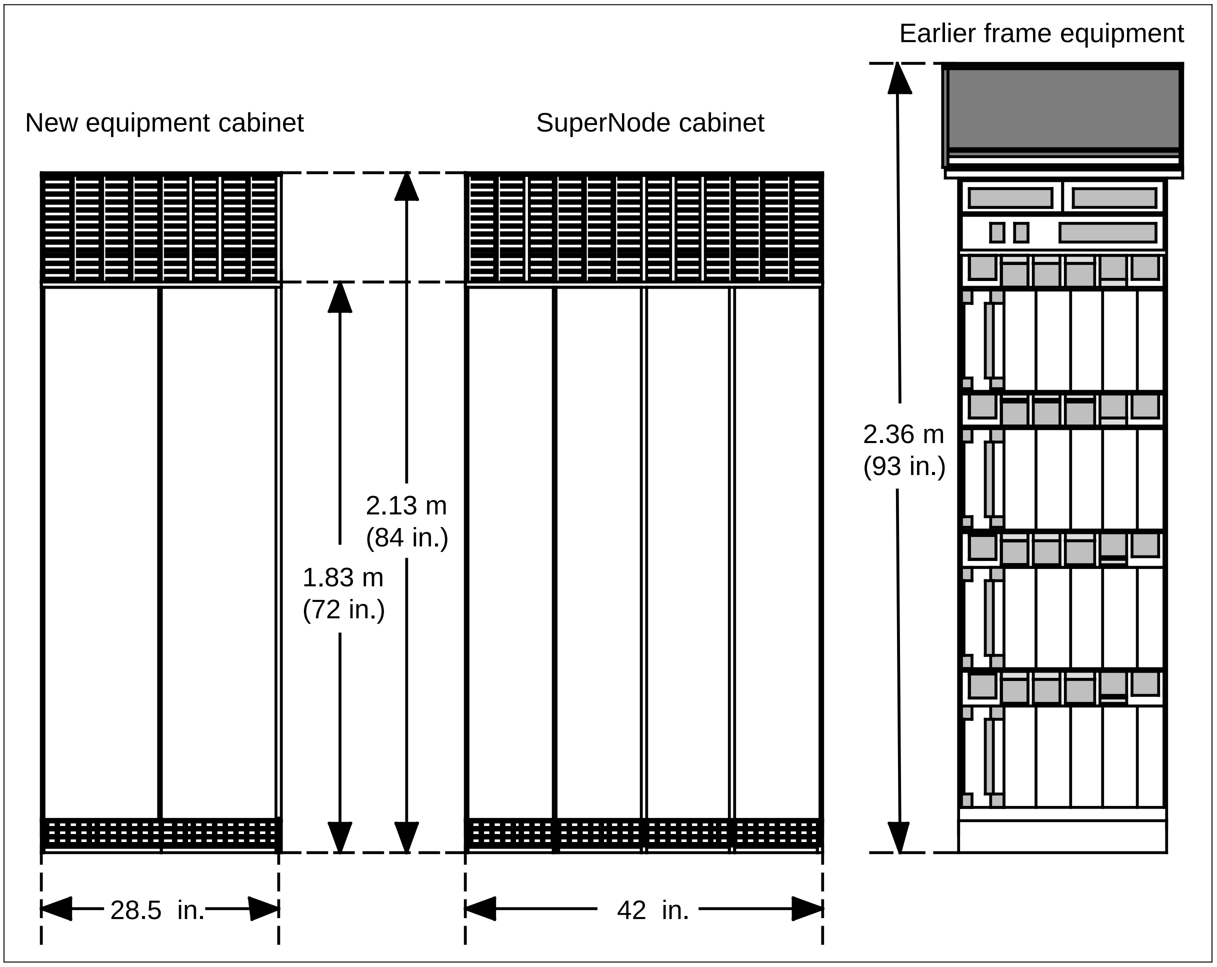
9.6 TOPS MP and TOPS MPX equipment

TOPS MP and TOPS MPX equipment grounding is not covered in this document. Nortel Networks publications [R-7 and R-8] provide detailed information on TOPS MP and TOPS MPX equipment grounding.

10 Cabinetized DMS-100F

The cabinetized DMS-100F provides a new packaging design for the DMS SuperNode and other DMS-100 frames. The new cabinets match the height, depth and general appearance of the SuperNode cabinet. The new cabinets differ in height and appearance from earlier equipment frames as shown in Figure 10-1.

Figure 10-1 Cabinetized DMS



The naming standard for cabinets is easy. A "C" appears in front of the earlier frame designation. For example, the name of the cabinetized version of the LCE is CLCE. Table 10-1 lists cabinets currently in use in DMS-100F.

Table 10-1 Cabinets in use in the cabinetized DMS-100F

Name	Nomenclature	Comments
APC	Application processor cabinet	SuperNode cabinet
CCPE	Cabinetized control peripheral equipment	ISDN CCPE and non-ISDN CCPE
CDNI	Cabinetized digital network interconnect	Cabinet is not powered
CDSN	Cabinetized dual shelf network	
CEXT	Cabinetized extension cabinet	
CIOE	Cabinetized input output equipment	
CLCE	Cabinetized line concentrating equipment	
CLMI	Cabinetized line module ISDN	
CMIS	Cabinetized miscellaneous equipment	
CMS7	Cabinetized message switching 7 equipment	
CMSS	Cabinetized maintenance spare storage	Cabinet is not powered
CPDC	Cabinetized power distribution center	
CRSC	Cabinetized remote switching center	
CSLC	Cabinetized speech link connector	Cabinet is not powered
CTME	Cabinetized trunk module equipment	
DPCC	Dual plane combined core	SuperNode cabinet
ENET	Enhanced network cabinet	SuperNode cabinet
LPP	Link peripheral processor	SuperNode cabinet
SCC	Single core cabinet	SuperNode cabinet

The cabinetized DMS provides enhanced power distribution and grounding for assembly and site installation. The cabinetized DMS complies with national standards for EMI. Earthquake protection is standard with every cabinet.

10.1 Site considerations for cabinetized DMS

The cabinetized DMS-100F is typically installed in an ac-free configuration with an IBN grounding topology. The cabinetized DMS-100F normally uses an IMAP, but can use a MAP for maintenance and administration. Refer to Section 9.4, "IMAP and MAP equipment" for requirements on IMAP and MAP.

The cabinetized DMS-100F uses a -48 V power source. Equipment that uses a voltage other than -48 V is not normally required. Power plant considerations for the cabinetized DMS-100F are the same as the considerations for the frame-based DMS switch. The considerations comply with Section 4 of this guide.

Internal inverters power every ac-powered load in the switch and every convenience outlet in the DMS-100F equipment. Internal inverters are intended to maintain the integrity of the IBN (refer to Chapter 6, "AC power distribution").

If the switch IBN receives external ac power distribution feeders, reference the feeders to the DMS SPG according to the requirements of Chapter 7, "Grounding of ac power facilities".

10.1.1 Communication links

When possible, use dc-isolated communication links between the DMS switch and other systems. Use these dc-isolated links to maintain the integrity of the IBN.

- Unbalanced links, like EIA RS-232 must be dc-isolated using means such as
  - back-to-back modems
  - isolation transformers
  - optical isolators
  - current loop adapters
  - fiber adapters

  These means must make sure that frame or chassis ground pins (that the EIA designates as “protective ground") and cable shields do not interconnect through the link.

- Balanced links, like DS-1, shielded EIA RS-422, and shielded twisted pairs that enter DMS cabinets, bond the cable shields to ground through connections to the cabinets. To prevent connections to grounding systems other than DMS IBN, these cable shields must not be bonded to ground at the other end of the cable.

- Coaxial cable links, like DS-3, are permitted if the outer conductors are bonded to the DMS SPG. The conductors can be bonded directly or through a transmission bonding bar (TBB).

10.1.2 Lighting and end-guard outlets

Lighting equipment is separate from the cabinetized DMS switch and is not an integral part of the switch. The end guards of lineups can contain low-voltage controlled light switches for lighting external to the DMS switch. Refer to Section 6.1.2, "Lighting". The following guidelines apply to a center-aisle lighting system:

- Isolate the lighting system from the DMS cabinets.
- When the lights are within 2 m (7 ft) of the DMS cabinets, bond the lights directly to the DMS SPG or reference the lights to the DMS SPG through an ICB.
- The electrical interface and components between the DMS cabinets use safety extra-low voltage (SELV) Class-2 circuits, for example, 24 V ac.

An inverter placed in the base of a CPDC can provide power for end-guard outlets. Internal ac power can provide only one branch circuit for each CPDC. The branch circuit powers a pair of duplex receptacles (one on each end of a lineup).

10.1.3 Enhanced alarm system

The enhanced alarm system (EAS) is used with the cabinetized DMS. The EAS provides the following features:

- independent alarm battery and return feeders that originate at the power plant. The system routes these components to one of the following:
  - — directly to OAU and MTM equipment
  - — through EMI filters in the CPDC of an integrated lineup
- audible and visual alarm indication in 2 s of a loss of power to one or more CPDCs
- dedicated contacts that external alarm scanners use for loss of power to the DMS (critical power plant) alarm
- a dead system alarm indication
- internal detection of a loss of power to one or more CPDCs

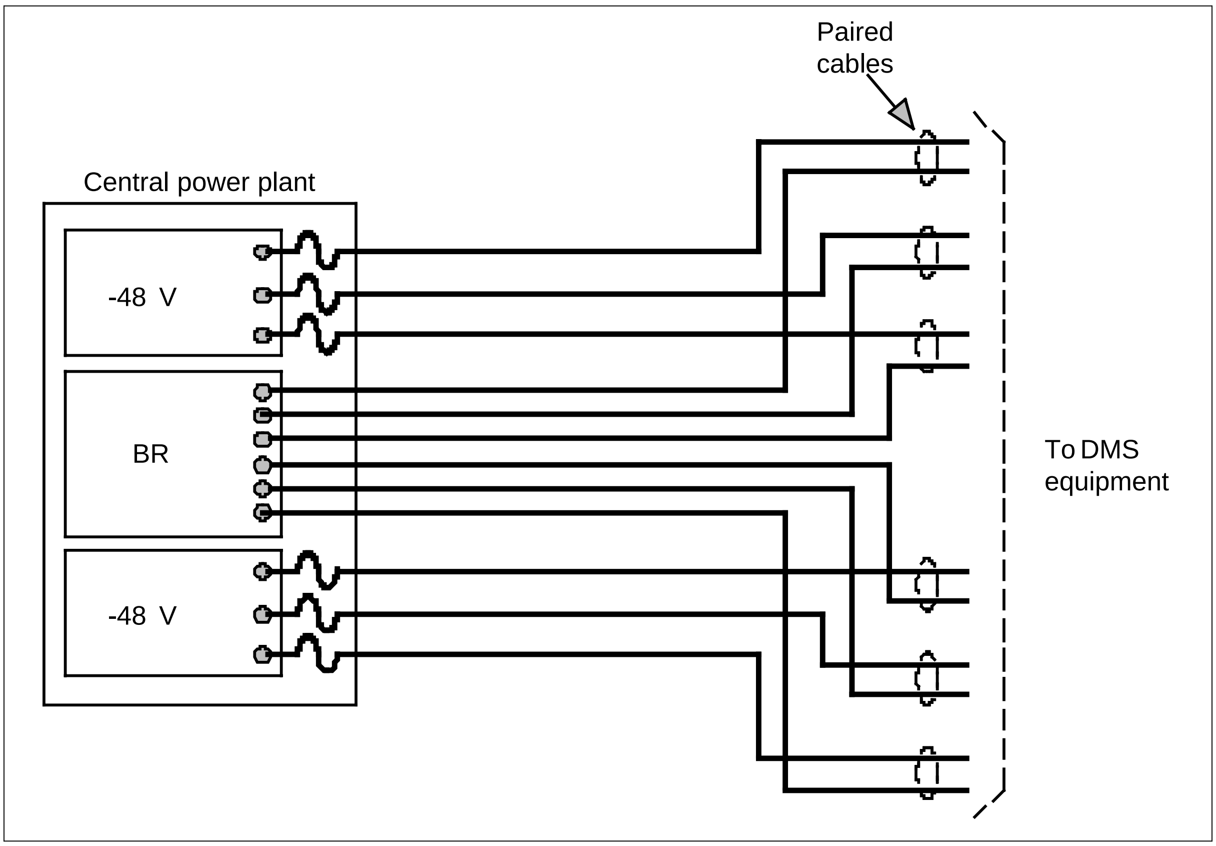
- low voltage detection to indicate when feeder voltage levels are below the minimum system requirements
- a frame fail and end of aisle lamp indication during the loss of a power feed to a CPDC

10.1.4 Equipment powering

A central power plant normally provides primary power to DMS equipment. The power plant can be dedicated to the DMS switch, or shared with other office equipment. Refer to Chapters 4 and 5.

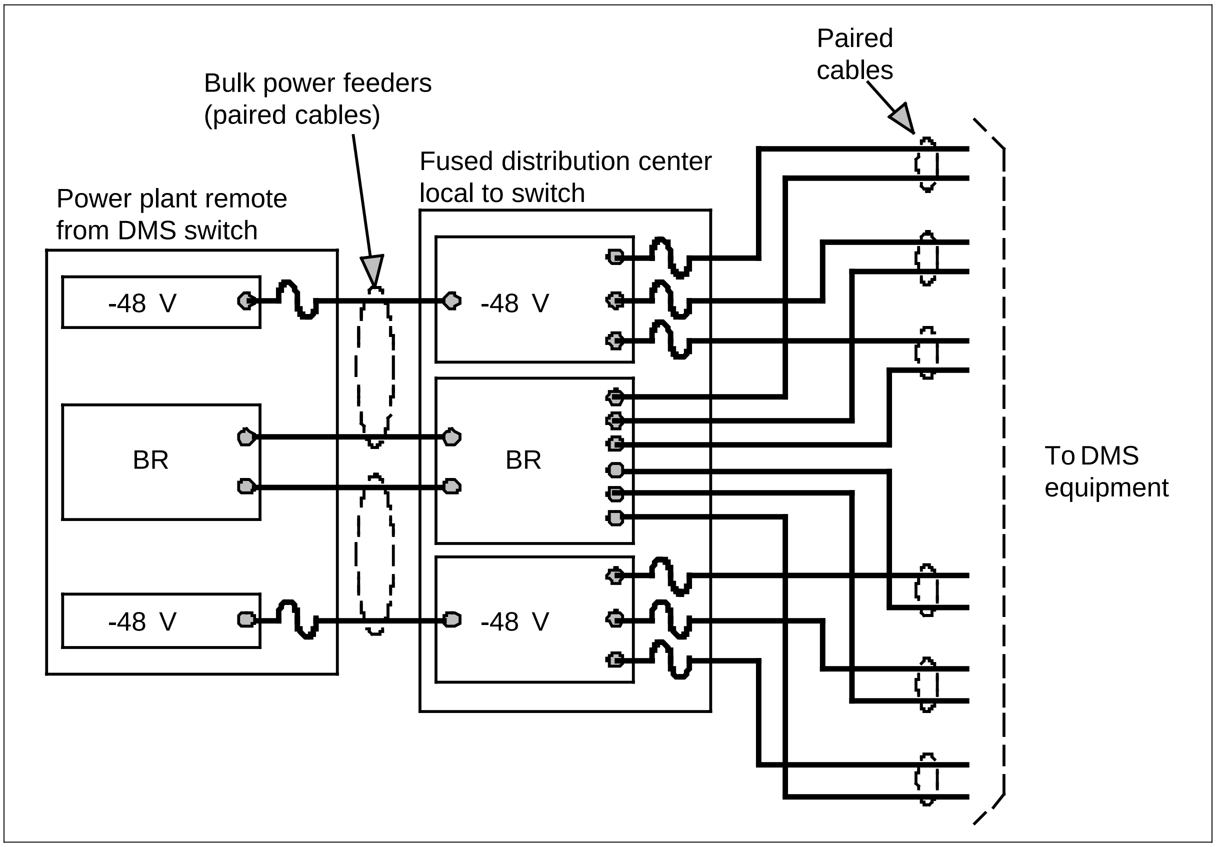
Each primary feeder to DMS equipment consists of a -48 V conductor and an associated BR conductor. These conductors are the same size (same cross-sectional area) and are routed next to each other as paired cables. The power plant can supply primary power feeders directly to the DMS switch. Refer to Figure 10-2.

Figure 10-2 Central power plant



Multiple power feeders to the DMS switch are not always available directly from the power plant. If the power feeders are not directly available, use a fused local power distribution center. Refer to Figure 10-3. The fused local power distribution center allows for the use of bulk power feeders from the power plant.

Figure 10-3 Fused local distribution center



Two DMS cabinet configurations are available. The two configurations are

- the integrated CPDC configuration
- the central CPDC configuration

The two configurations can use distributed power plants. These configurations are described next.

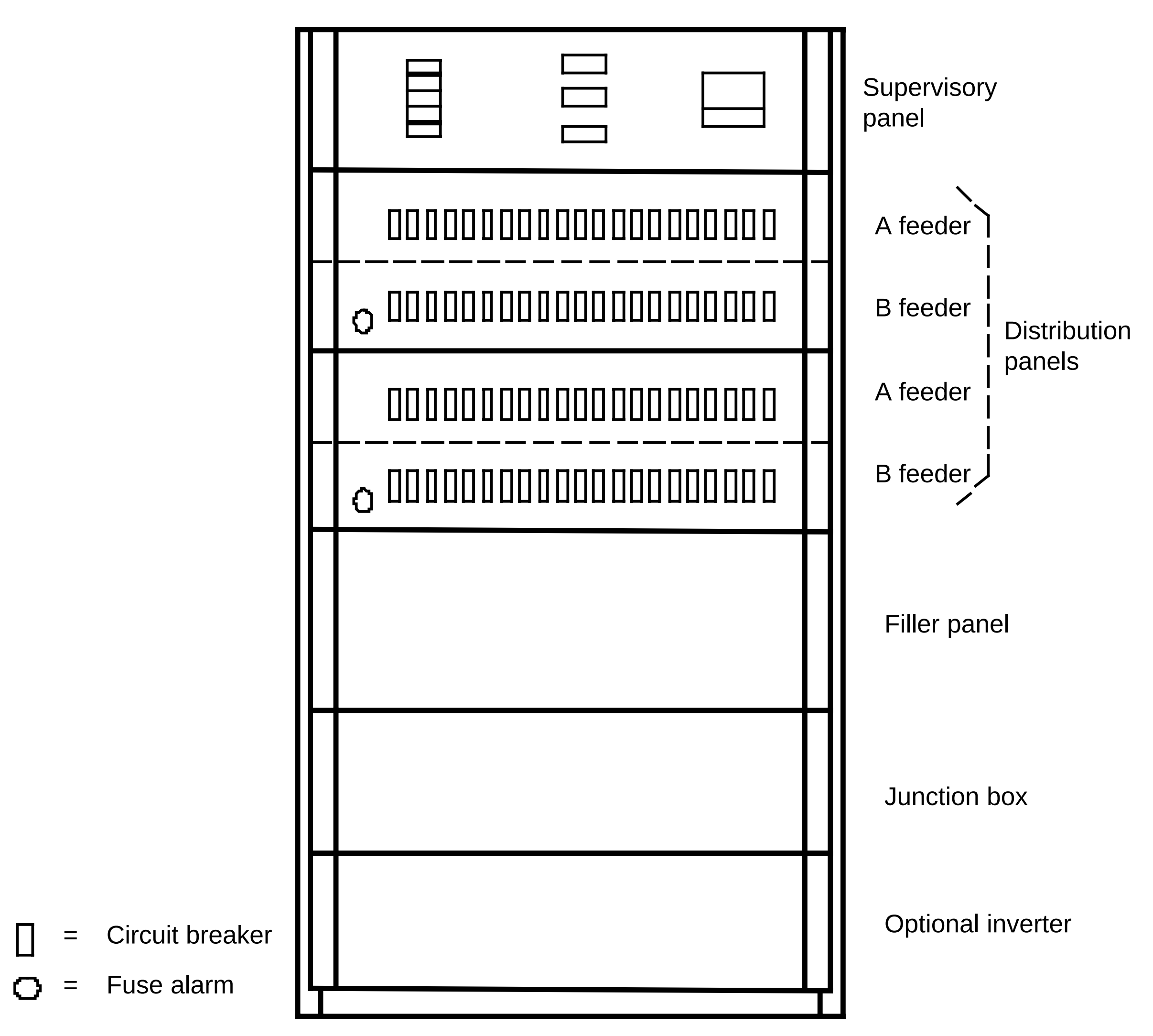
10.2 Integrated CPDC configuration

Each DMS cabinet lineup in an integrated CPDC configuration contains a CPDC. Internal cable runs distribute power horizontally through internal cable runs.

A fully equipped integrated CPDC (refer to Figure 10-4) includes the following equipment:

- 4.6 m (15 ft), No. 4/0 AWG cables for input power
- EMIFs for all input power and logic return
- an A and B bus distribution facility and an associated BR bar
- supervisory panel that contains alarm and control circuitry
- two distribution panels with overcurrent protection and noise and transient-suppression capacitors on both A and B buses. Each panel has 21 circuit breakers for secondary feeders from the A bus. Each panel also has 21 circuit breakers for feeders from the B bus. Each panel can contain one of the following circuit breaker mixes:
  - — only 30 A breakers
  - — 30 A and 10 A breakers
  - — 30 A and 5 A breakers
- an optional inverter

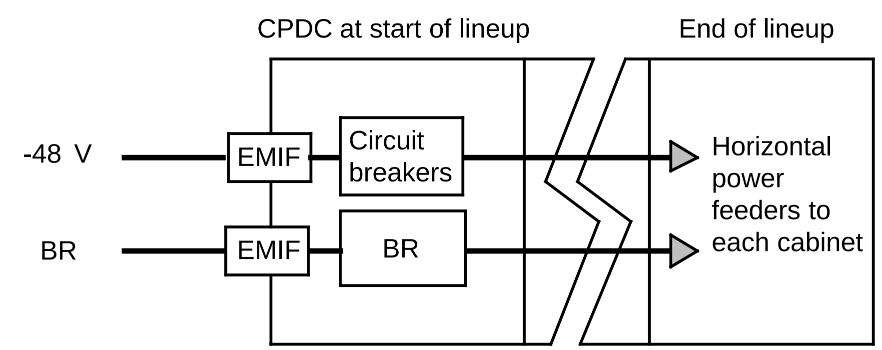
Figure 10-4 CPDC NTRX31AA



A No. 10 AWG power cable can connect the CPDC and any cabinet for secondary power distribution. The maximum cable length (one way) between the CPDC and a cabinet is 10.6 m (35 ft).

The integrated CPDC contains EMIFs for power input and logic return conductors. The cabinets in the lineup are bolted together. Power and grounding cables can cross from cabinet to cabinet horizontally. Each integrated CPDC lineup is treated as an enclosed EMI-compliant envelope (refer to Figure 10-5).

Figure 10-5 Integrated CDPC configuration



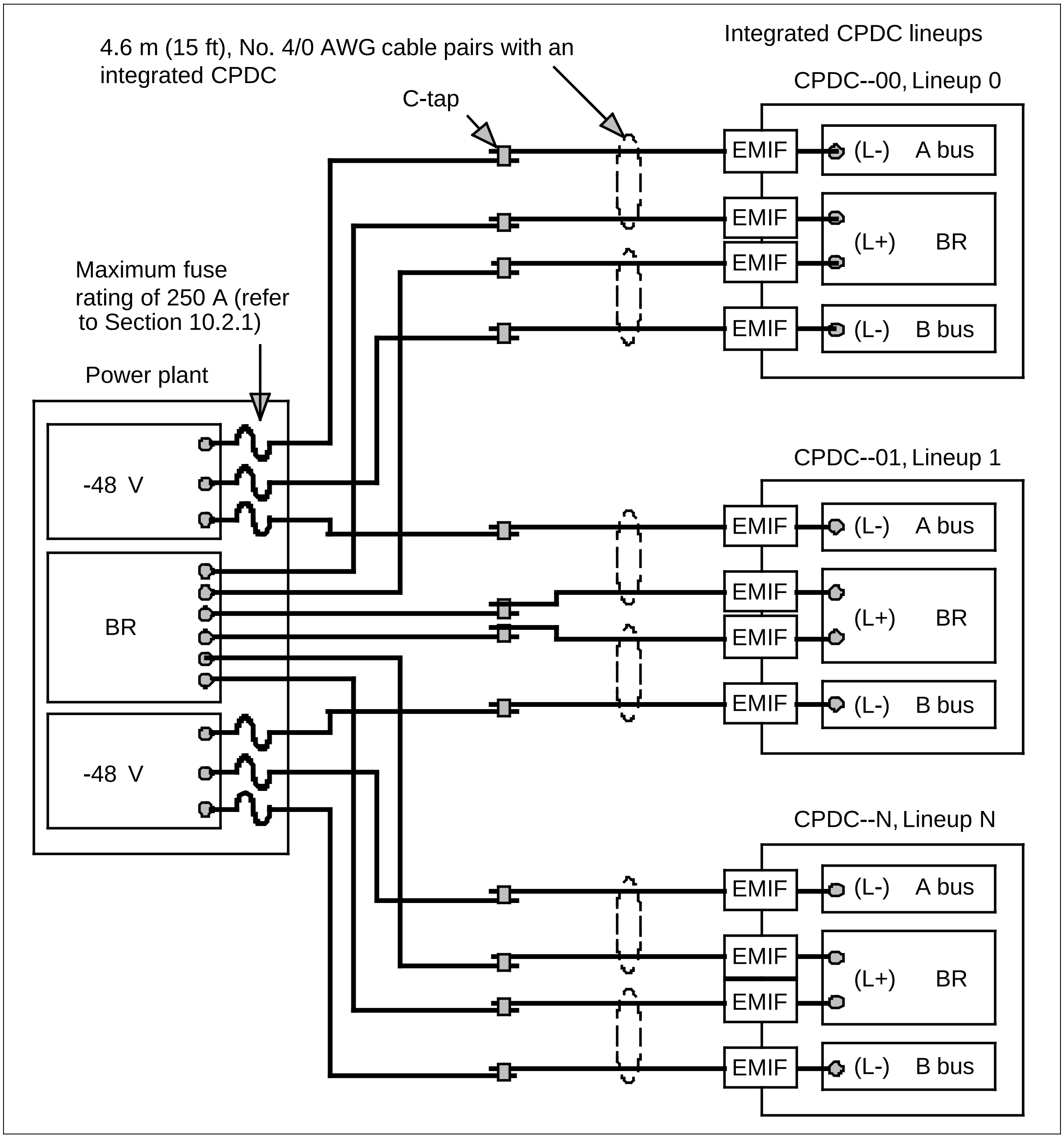
10.2.1 Input power protection for integrated CPDC configuration

The A and B input power feeders to an integrated CPDC must be sized for voltage drop and for current-carrying capacity. The integrated CPDC has a maximum dc-current distribution rating of 400 A. The maximum full-load current rating of each A and B feeder is 200 A. A fuse or circuit breaker with suitable characteristics and rating protects each feeder. The following considerations define a suitable rating:

- Under full-load conditions, the protection rating for each feeder from the power plant to the CPDC is 250 A.
- When the load current is less than 200 A, the protection rating for each feeder must be as close as possible to 1.5 times the load current on the feeder.
- The physical characteristics of a fuse holder can determine the rating. The fuse rating cannot exceed 250 A.

In the CPDC, separate primary input power feeders connect to -48 V A and a B buses and to a BR bar for secondary power distribution to other DMS cabinets. To the extent possible, the loads are equally distributed between the two buses. Circuit breakers protect secondary power. A supervisory panel in the CPDC monitors secondary power. Internal dc-dc converters provide other dc voltages (like + 5 V and -5 V) necessary to operate DMS equipment. Figure 10-6 shows the integrated CPDC configuration.

Figure 10-6 Integrated CDPC configuration



10.2.2 Cabinet locations for integrated CPDC configuration

An integrated CPDC lineup can contain any number of cabinets under the following conditions:

- The lineup does not require more than 80 breakers (40 breakers for A power feeders and 40 breakers for B power feeders) in the CPDC.
- The cabling length (one way) of the power feeders from the CPDC to a cabinet does not exceed 10.6 m (35 ft).
- The full load current of all cabinets that the CPDC powers does not exceed 200 A for each bus.
- When a column splits a lineup, two options are available:
  - — treat the split lineup as two lineups (each requires a CPDC)
  - — maintain the split lineup as one lineup through around-the-column duct between the split sections

To locate cabinets in an integrated CPDC lineup, the following rules apply:

- The CPDC is located at the start of the lineup. Refer to Figure 10-5.
- The dc-coupled communication links must not be present between cabinets in separate lineups.
- The CIOE and associated CMIS modems must be in the same lineup (powered from the same CPDC). The CIOE cabinets should appear in the same lineup as the DPCC cabinets.
- The LPP and associated CMIS modems must be in the same lineup (powered from the same CPDC).
- The CLCEs and CLMIs and the associated CCPE or CIPE controller must be in the same lineup (powered from the same CPDC).

10.2.3 Framework bonding and grounding for integrated CPDC configuration

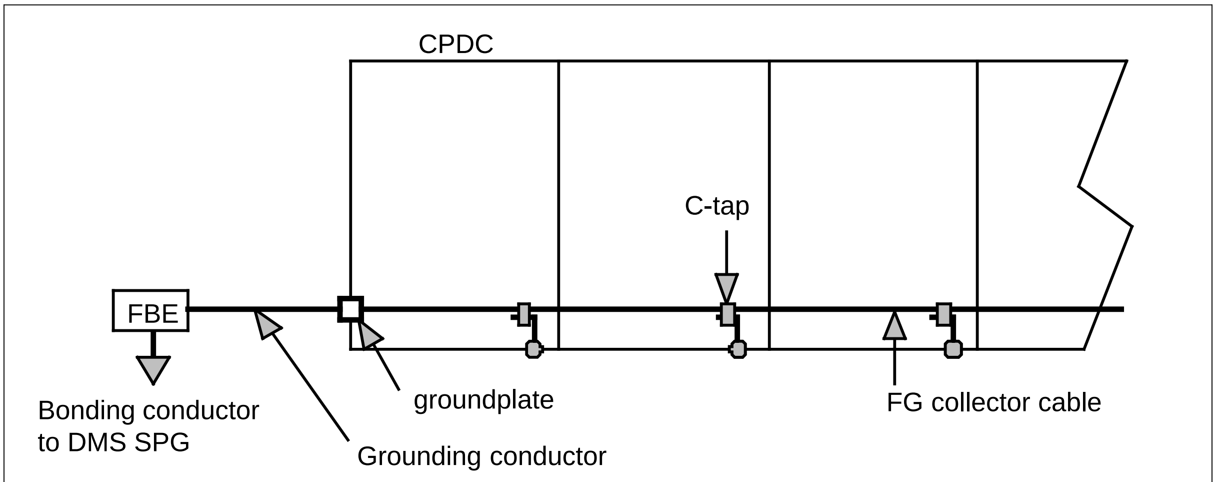
A framework bonding and grounding termination (FG) is available at the bottom of each cabinet.

The framework of each cabinet must be isolated from contact with incidental grounds. Use the following steps to isolate and bond the framework to the DMS SPG:

- Run an internal FG collector cable along the base of the cabinets in a lineup. This No. 1/0 AWG cable terminates at a ground plate in the bottom of the EMI bulkhead in the CPDC (refer to Figure 10-7).
- In each cabinet, except for the CPDC, run a No. 6 AWG cable from the FG of the cabinet and C-tapped to the FG collector cable.

- Bond the ground plate of the CPDC to the FBE with a No. 1/0 AWG cable.
- Bond the FBE to the SPG. Determine the size of the bonding conductor according to the distance between the FBE and SPG.
  - — Use a No. 2/0 AWG cable when the conductive length is less than or equal to 15 m (50 ft).
  - — Use a 350 kcmil cable when the conductive length is greater than 15 m (50 ft), and less than or equal to 45.7 m (150 ft).
  - — Use a 750 kcmil cable for a conductive length greater than 45.7 m (150 ft).

Figure 10-7 Framework bonding and grounding for integrated CPDC configuration



10.2.4 Logic return bonding for integrated CPDC configuration

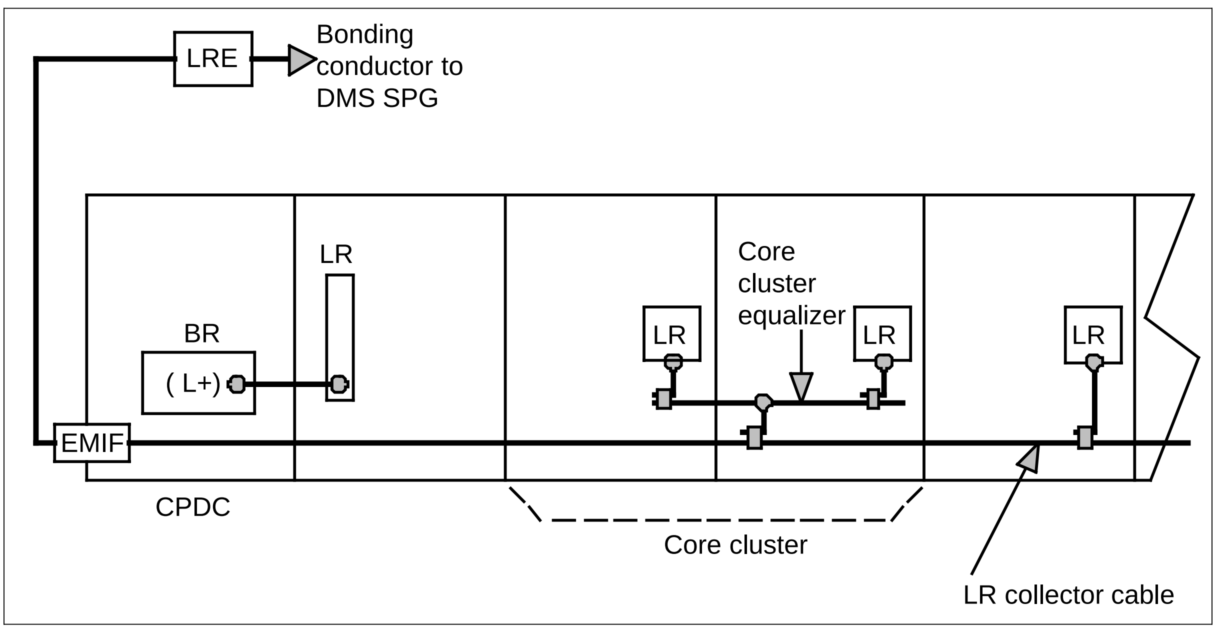
The LR of each cabinet is isolated from contact with incidental grounds. Use the following steps to isolate and bond the LR to the DMS SPG:

1. Run an internal LR collector cable along the base of the cabinets in a lineup. This No. 1/0 AWG collector cable ends at an EMIF on the bulkhead of the CPDC (refer to the Figure 10-8).
2. C-tap the LRs of cabinets in the lineup directly to the LR collector cable. Exception: Do not C-tap the core clusters and cabinets that have LRs that connect to BR.
3. Core cluster cabinets (DPCC or SCC, CIOE, and CMIS that contain modems that associate with CIOE cabinets) must be in the same lineup. You must C-tap the internal LRs of cabinets in a core cluster with a No. 6 AWG cable to another No. 6 AWG cable called is a core cluster equalizer. Run this cable internally along the base of the cabinets and C-tap this cable to the LR collector cable.

4. A cabinet that requires an LR reference to BR has a connection between the LR and the BR in the CPDC with a No. 6 AWG cable. Run this grounding cable internally along the base of the lineup.
5. The C-taps must have protective covers to insulate the taps.
6. Bond the logic return EMIF on the CPDC to the LRE with a No. 1/0 AWG cable.
7. Use a bonding conductor to connect the LRE to the SPG. The size of the conductor depends on the distance between the LRE and SPG.
   - Use No. 2/0 AWG cable when the conductive length is less than or equal to 15 m (50 ft).
   - Use a 350 kcmil cable is when the conductive length is greater than 15 m (50 ft) and less than or equal to 45.7 m (150 ft).
   - Use a 750 kcmil cable for a conductor length greater than 45.7 m (150 ft).

Figure 10-8 shows the logic return bonding for the integrated CPDC configuration.

Figure 10-8 Logic return bonding for integrated CPDC configuration



10.2.5 Adding a vertically powered cabinet to an integrated CPDC configuration

An integrated CPDC lineup requires that every internal power cable passes horizontally through a passage in the side walls. This procedure is necessary to maintain EMI compliance. You can use other cabinets with an integrated

CPDC lineup. If an added cabinet does not allow horizontal power distribution, the cabinet must be equipped with EMIFs. This arrangement is called vertical powering. The following installation considerations apply:

- Vertically powered cabinets must be at the end of an integrated lineup. A separation space should be available when you anticipate a future expansion of the lineup. Refer to Figure 10-9.
- Equip the CPDC of the lineup with an optional personality plate. This plate has 13 filtered outputs, which include an ABS feeder.
- Each CPDC can supply one vertically powered 42-inch wide (type C42) cabinet. The C42 needs up to 12 power feeders plus one ABS feeder. Depending on cabinet power requirements, use up to three 28-inch (C28) cabinets in place of the C42.
- Bond the FG termination of the cabinet to the FBE through an FBB. The FBB is above the cabinet. Refer to Figure 10-10.
- Connect the LR of the added cabinet to the LRE through an EMIF and an LRB. The LRB is above the cabinet. If the added cabinet is a DPCC, the associated CIOE must be as close as possible to the DPCC. The best location is at the end of the integrated CPDC lineup, next to the expansion space. The CIOE must have an EMIF to connect the internal core cluster equalizer to the LRB. The LRB is above the DPCC. Refer to Figure 10-10.

Figure 10-9 Adding a vertically powered cabinet to an integrated CPDC lineup

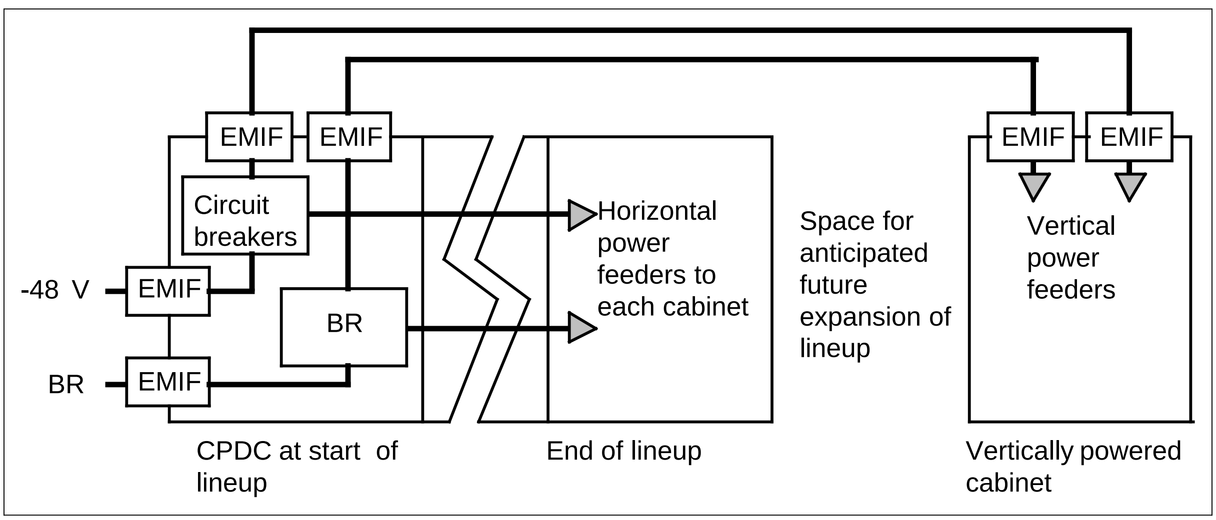
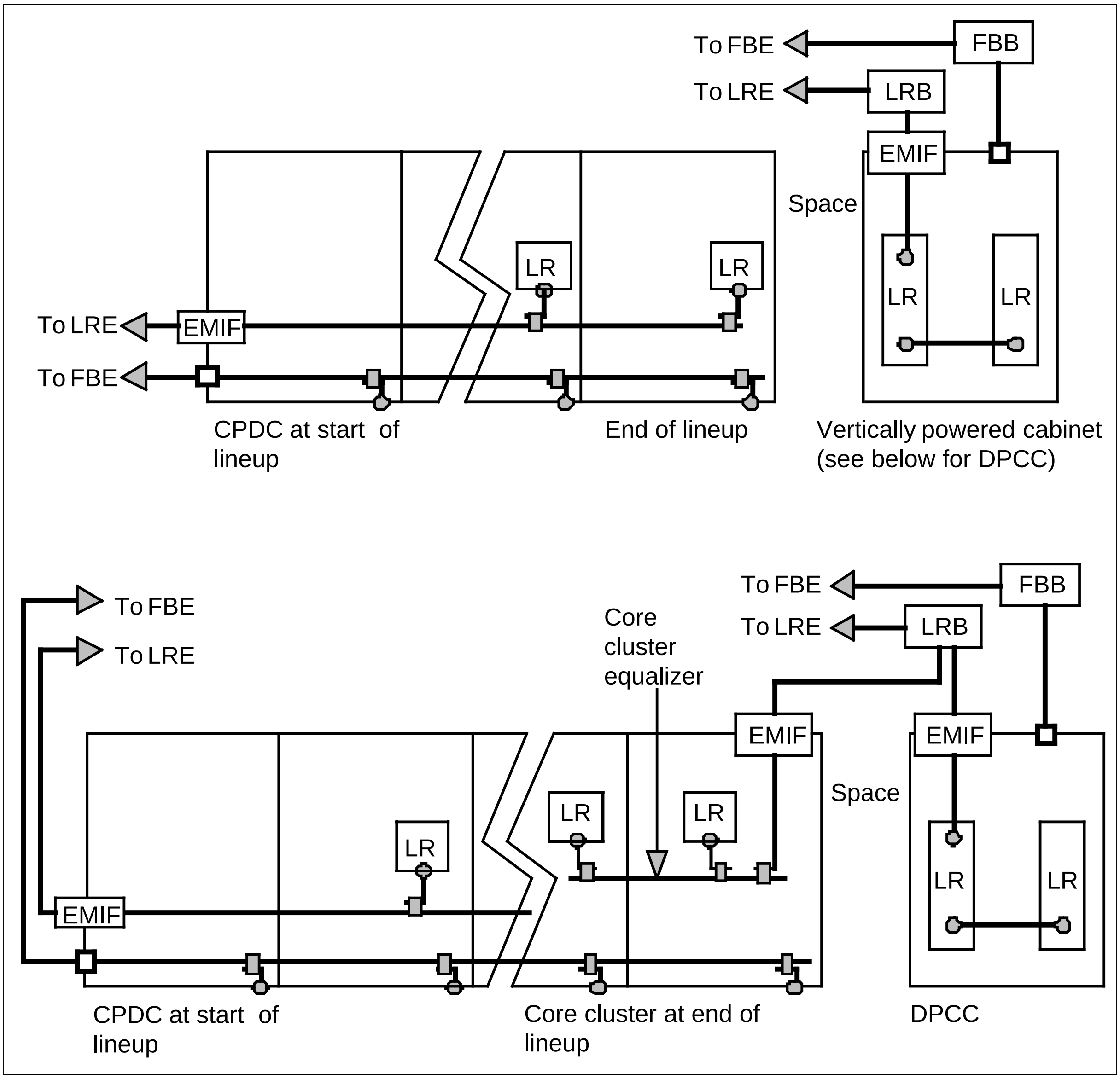


Figure 10-10 Bonding and grounding a vertically powered cabinet added to an integrated CPDC lineup



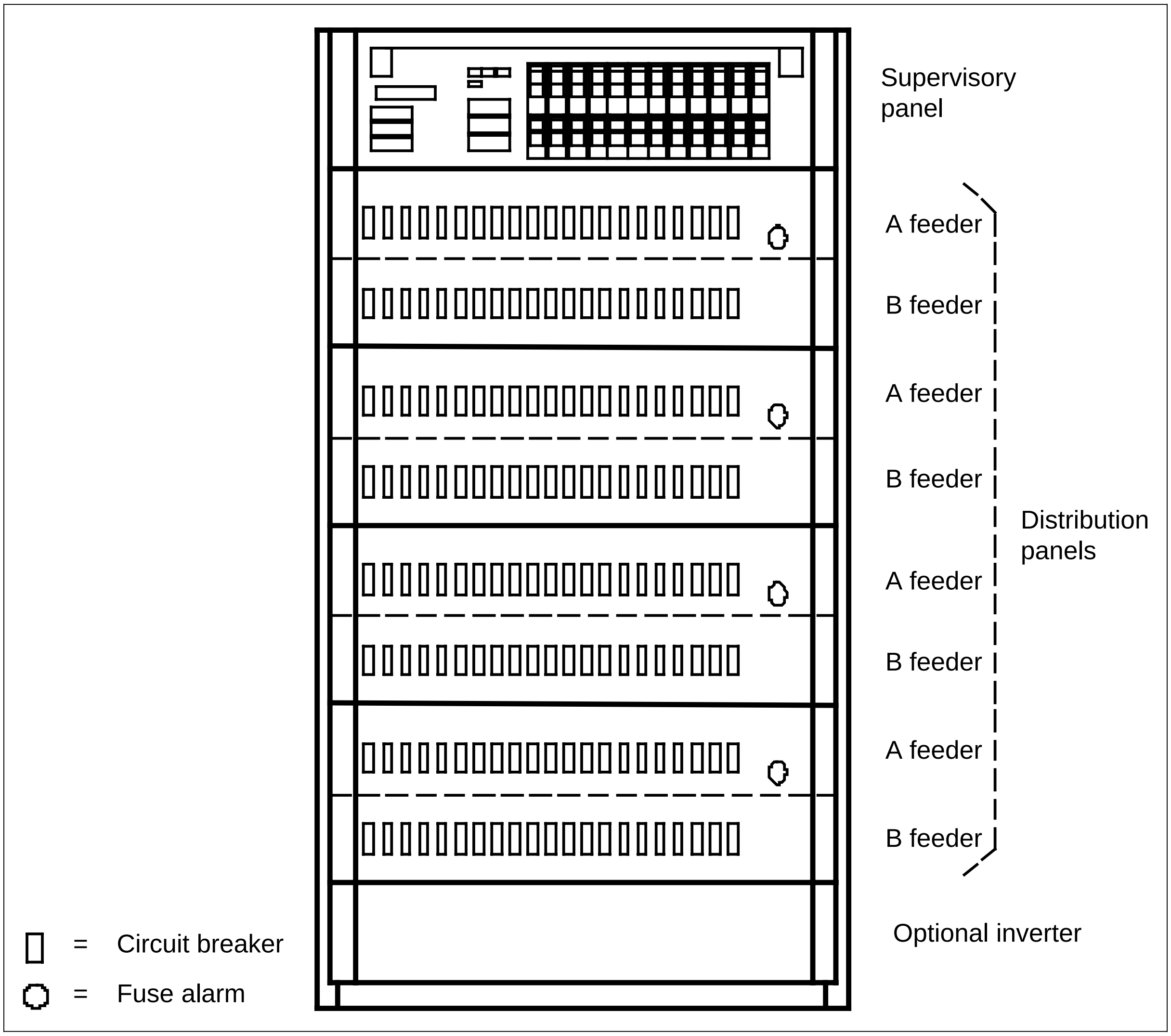
10.3 Centralized CPDC configuration

A centralized CPDC configuration is a configuration in which a single CPDC powers one or more DMS lineups. Run secondary power feeders outside the lineup and distribute the secondary power feeders vertically to each cabinet.

A fully equipped CPDC in a centralized configuration (refer to Figure 10-11) includes the following equipment:

- an A and B bus distribution facility and an associated BR bar
- supervisory panel that contains alarm and control circuitry
- four distribution panels with overcurrent protection and noise and transient-suppression capacitors on A and B buses. Each panel has 20 circuit breakers for secondary feeders from the A bus. Each panel has 20 circuit breakers for feeders from the B bus. Each panel can contain any of the following circuit breaker mixes:
  - — only 30 A breakers
  - — 30 A and 10 A breakers
- an optional inverter

Figure 10-11 CPDC NTRX31CA

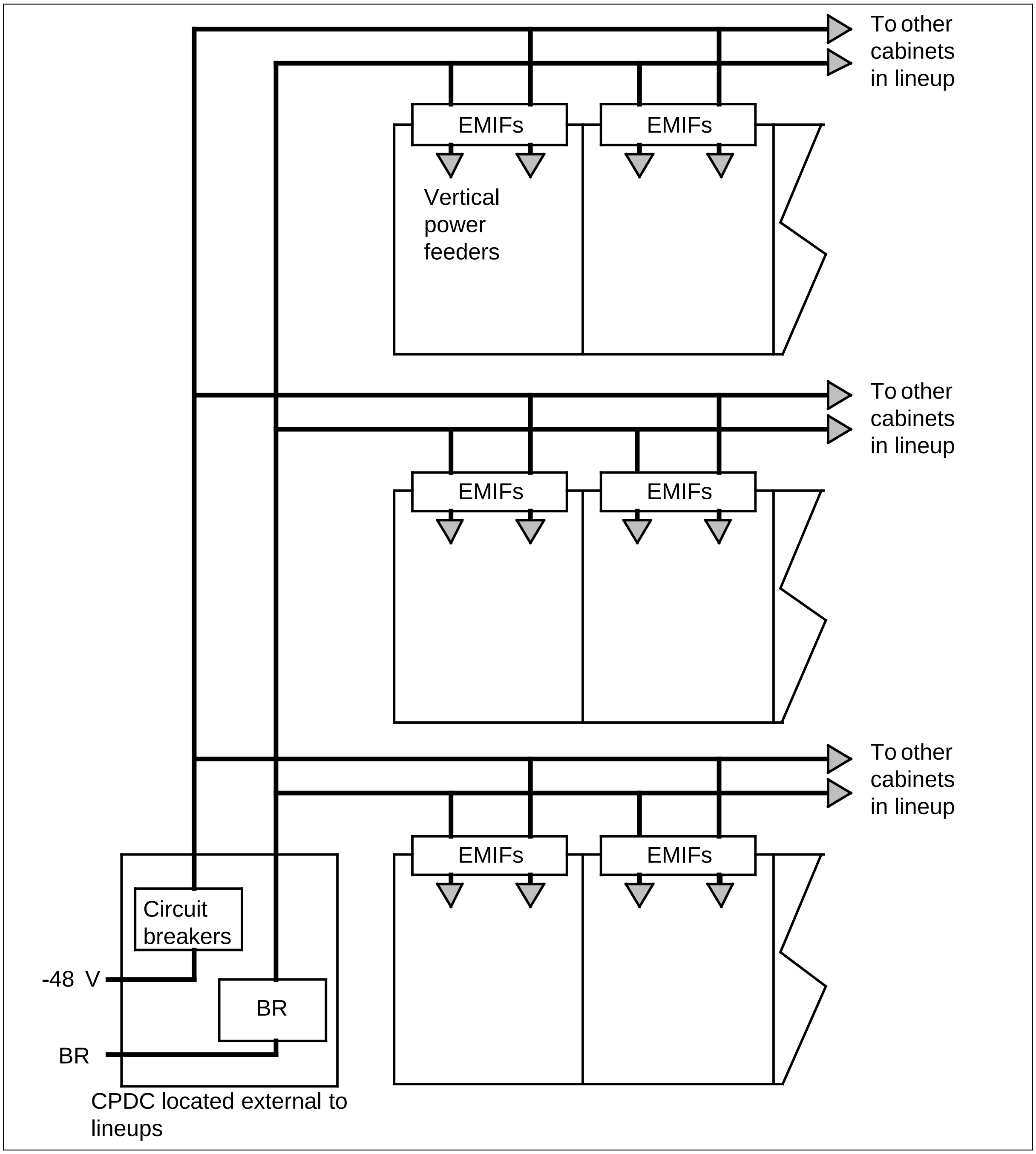


Secondary power distribution normally requires a No. 10 AWG power cable between the CPDC and any DMS cabinet. The maximum cable length (one way) between the CPDC and a cabinet is 10.6 m (35 ft). When the cable length exceeds this distance, power feeders can be No. 8 AWG or No. 6 AWG as required to meet voltage drop requirements.

The centralized CPDC differs from the integrated CPDC because it does not have EMIFs. Each cabinet (except the CPDC) has EMIFs for power input and logic return. Each cabinet is a separate EMI-compliant envelope. The 28-inch wide and 42-inch wide (C28 and C42) type cabinets have EMIFs when used in a centralized CPDC configuration. The 21-inch wide (C21) cabling cabinet does not require input power and does not use EMIFs.

The centralized configuration allows the location of the CPDC to be external (stand-alone CPDC) to the cabinet lineups or it can be in one of the lineups. In either case the CPDC remains outside the EMI-compliant cabinet envelopes (refer to Figure 10-12).

Figure 10-12 Centralized CDPC configuration



10.3.1 Input power protection for centralized CPDC configuration

Size each A and B input power feeder to a centralized CPDC configuration for voltage drop and current-carrying capacity. The CPDC has a maximum dc-current distribution rating of 800 A. Circuit breakers protect secondary power. A supervisory panel in the CPDC monitors secondary power. Other dc voltages (like + 5 V and -5 V) that DMS equipment requires come from internal dc-dc converters.

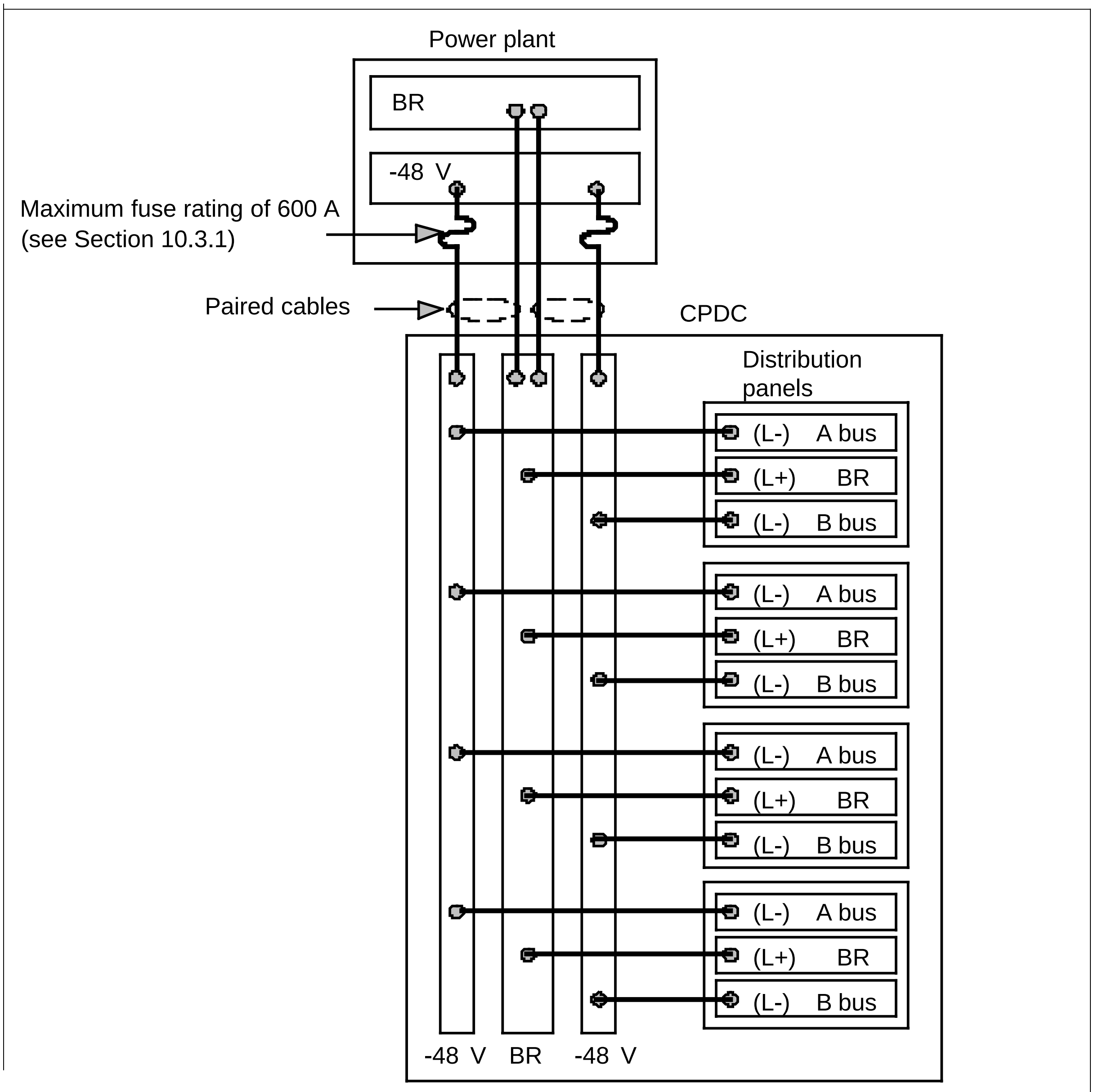
Dual-feed or multifeed primary power distribution can be used with the centralized CPDC configuration.

10.3.1.1 Dual-feed input

Dual-feed power connections can connect to the A and B input power buses. Refer to Figure 10-13. The following considerations determine the protection rating:

- Under full-load conditions, the protection rating for each feeder from the power plant to the CPDC is 600 A.
- When the load current is less than 400 A, the protection rating for each feeder must be 1.5 times the load current on the feeder.
- The characteristics of a fuse holder can determine the fuse rating. The fuse rating cannot exceed 600 A.

Figure 10-13 Dual-feed power protection for central CPDC configuration

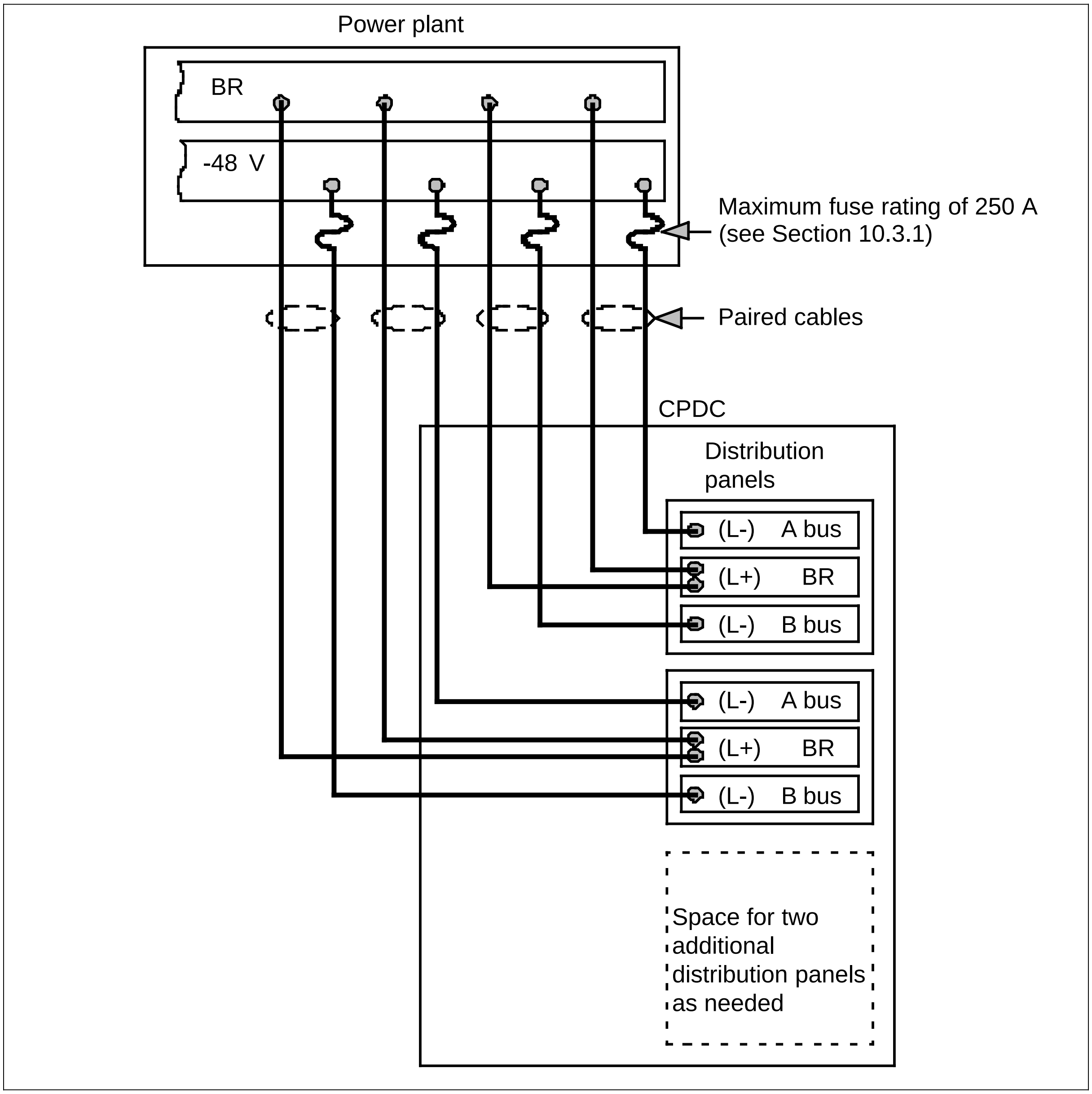


10.3.1.2 Multifeed input

Multifeed connections can be made directly to the secondary power distribution panels of the CPDC. Refer to Figure 10-14. The following considerations determine the protection rating:

- Under full-load conditions, the protection rating for each feeder from the power plant to the CPDC is 250 A.
- When the load current is less than 200 A, the protection rating for each feeder must be as close a possible to 1.5 times the actual load current on the feeder.
- The characteristics of a fuse holder can determine the rating. The fuse rating cannot exceed 250 A.

Figure 10-14 Multifeed power protection for central CPDC configuration



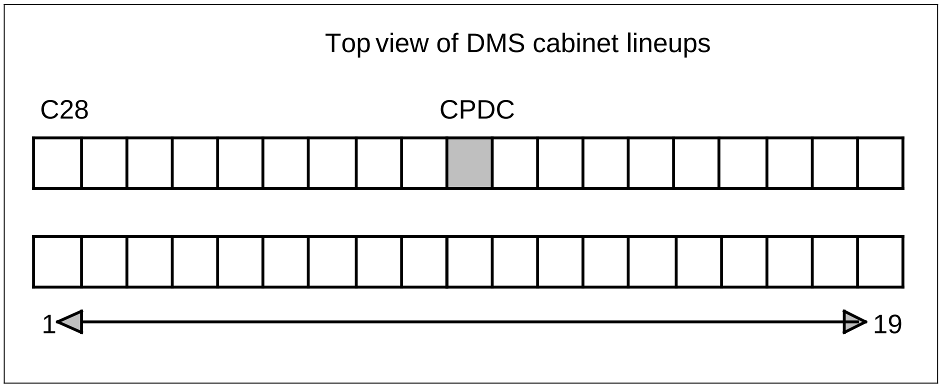
10.3.2 Cabinet locations for centralized CPDC configuration

A centralized CPDC configuration allows for unidirectional or bidirectional expansion of lineups. Unidirectional growth is the recommended option. A maximum of four lineups for each CPDC are allowed. The following configuration restrictions apply:

- In a lineup with 18 C28 cabinets, the CPDC can be in the center of the lineup. The CPDC lineup and an adjacent lineup of 19 C28 cabinets use the maximum power capability of the CPDC and No. 10 AWG power cables.

The maximum cable length (one way) between the CPDC and cabinet is 10.6 m (35 ft) for a No. 10 AWG cable. Refer to Figure 10-15.

Figure 10-15 C28 cabinets in a centralized CPDC configuration



> ***Note:*** Other common C28 cabinet configurations include three lineups of 12 cabinets with the CPDC in the center lineup. Another configuration is four lineups of nine cabinets with the CPDC in one of the center lineups.

- In a lineup that does not have C28 type cabinets, the bus rating of 400 A limits the number of C42 cabinets.
- The dc-coupled communication links between cabinets in separate lineups are not allowed.
- Provisioning should allow for two CSLC cabinets (one for plane 0 and one for plane 1) and two CDNI cabinets. Multiple CSLC and CDNI cabinets should not be in the same lineup because of the heavy cabling required. The two CSLC cabinets should be face-to-face in separate lineups. The CDNI cabinets should be face-to-face in separate lineups.
- The CIOE and associated CMIS modems must be in the same lineup. The CIOE cabinets should be in the same lineup as the DPCC or SCC.
- The LPP and associated CMIS modems must be in the same lineup (powered from the same CPDC).
- The CLCEs and CLMIs and associated CCPE or CIPE controllers must be powered from the same CPDC. This applies to all peripheral equipment that communicates with a controller with dc-coupled links like DS-30A.
- Breaks in a lineup caused by columns and future additions of cabinets are allowed because of vertical powering of separate cabinets.

- Cross-aisle cable troughs are metal. Each end of the trough is bonded to the associated cabinet.
- The CPDC can be in positions other than at the end of a lineup where no growth is anticipated. You can add more cabinets to the growth end of a lineup. You cannot add these cabinets between the CPDC and the end of the lineup where no growth is anticipated.

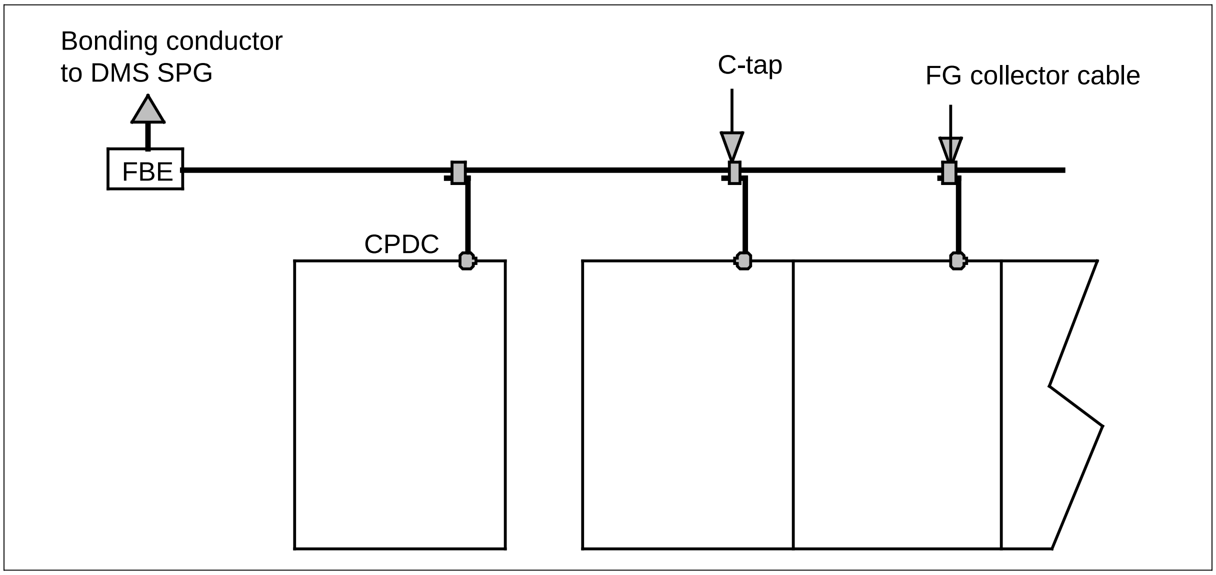
10.3.3 Framework bonding and grounding for centralized CPDC configuration

A framework bonding and grounding termination (FG) is available at the top and at the bottom of each cabinet.

Isolate the framework of each cabinet from the incidental grounds. Bond the framework to the DMS SPG. To isolate and bond the framework, perform the following steps:

1. Run a No. 1/0 AWG, FG collector cable outside the lineup and end it at the FBE. Refer to Figure 10-16.
2. Use a No. 1/0 AWG cable to bond the FG of the CPDC to the FG collector.
3. At each of the other cabinets, run a No. 6 AWG cable from the FG of the cabinet and C-tap the cable to the FG collector cable.
4. Connect the FBE to the SPG by a bonding conductor. The distance between the FBE and SPG determines the size of the bonding conductor:
   - Use aNo. 2/0 AWG cable when the conductive length is less than or equal to 15 m (50 ft).
   - Use a 350 kcmil cable when the conductive length is greater than 15 m (50 ft). The conductive length is less than or equal to 45.7 m (150 ft).
   - Use a 750 kcmil cable for a length greater than 45.7 m (150 ft).

Figure 10-16 Framework bonding and grounding for centralized CPDC configuration



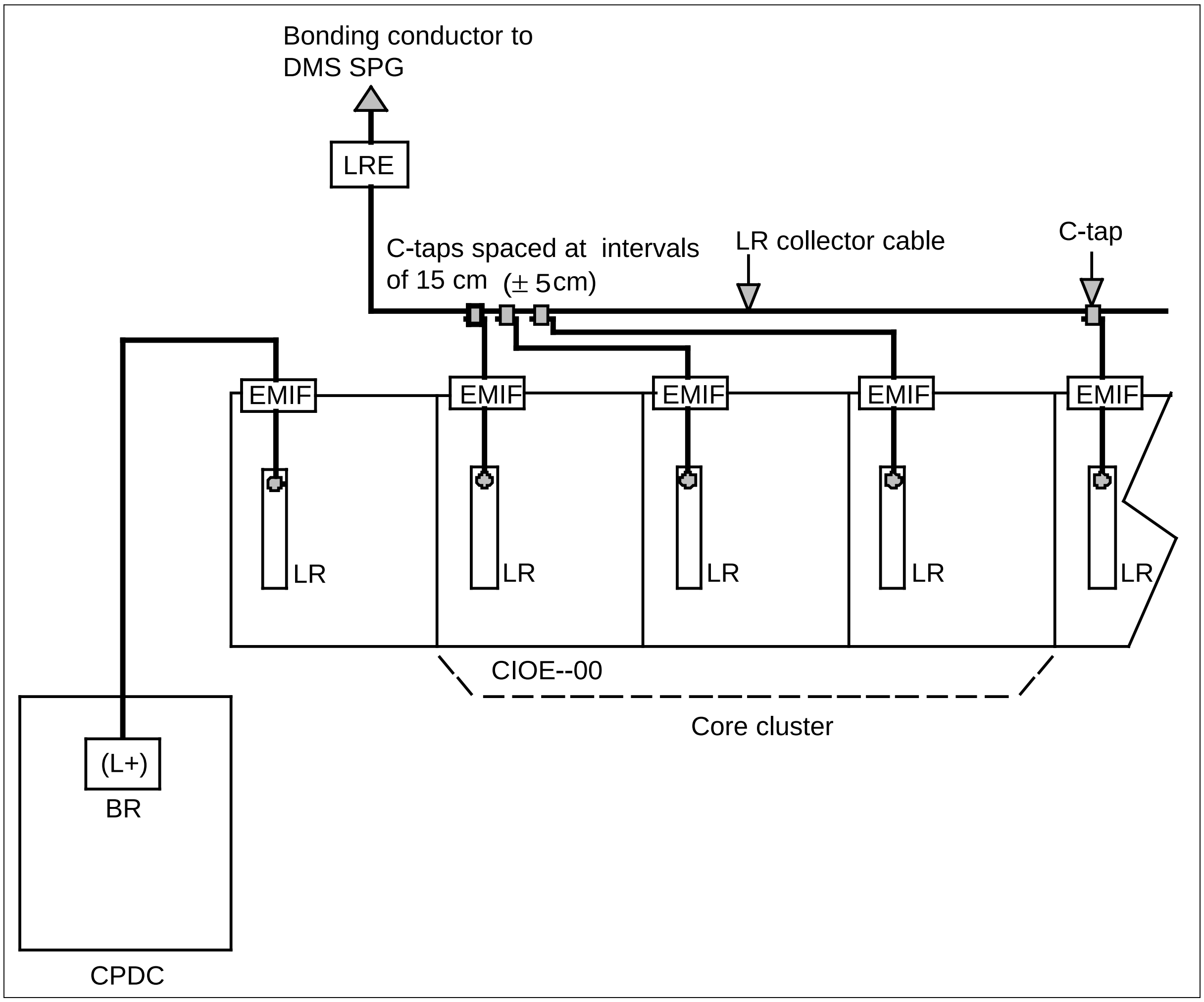
10.3.4 Logic return bonding for centralized CPDC configuration

Isolate the LR of each cabinet from incidental grounds. Bond to the DMS SPG. To isolate and bond the LR, perform the following steps:

- Run a No. 1/0 AWG, LR collector cable outside the cabinets. Terminate the LR collector at the LRE. Refer to Figure 10-17.
- Core cluster cabinets are DPCC or SCC, CIOE and CMIS that contain modems associated with CIOE cabinets. The core cluster cabinets must be in the same lineup. The LR of the core cabinets are referenced with No. 6 AWG cables that route through EMIFs to the LR collector. The C-taps are at intervals of 15 cm (± 5 cm) above CIOE 00. The C-taps of LPP and associated CMIS cabinets appear in intervals of 15 cm (± 5 cm) above the LPP cabinet.
- A cabinet that requires an LR reference to BR has the LR connected to BR in the CPDC with a No. 6 AWG cable. This grounding cable runs internally to and along the base of the lineup.

- The C-taps must have a protective cover to insulate the taps from incidental contact with other grounds. Framework ground is an example of other grounds.
- A bonding conductor connects the LRE to the SPG. The size of the bonding conductor depends on the distance between the LRE and SPG.
  - — Use No. 2/0 AWG cable when the conductive length is less than or equal to 15 m (50 ft).
  - — Use a 350 kcmil cable when the conductive length is greater than 15 m (50 ft). The conductive length is less than or equal to 45.7 m (150 ft).
  - — Use a 750 kcmil cable for a length greater than 45.7 m (150 ft).

Figure 10-17 Logic return bonding for centralized CPDC configuration



10.4 Remote Switching Center-SONET

The Remote Switching Center-SONET (RSC-S) is an enhanced version of the RSC. The RSC-S has a direct fiber interface to the host switch. The RSC-S provides features at the remote site similar to the features of the host site. An RSC-S lineup can contain any of the cabinets listed in Table 10-2.

Table 10-2 Cabinets used in an RSC-S

Name	Nomenclature	Comments
CCPE	Common control peripheral equipment	ISDN CCPE and non-ISDN CCPE
CEXT	Cabinetized extension cabinet	
CLCE	Cabinetized line concentrating equipment	
CLMI	Cabinetized line module interface	
CMIS	Cabinetized miscellaneous equipment	
CPDC	Cabinetized power distribution center	
CRSC	Cabinetized remote switching center	
CMSS	Cabinetized maintenance spare storage	Not a powered cabinet.

An RSC-S can contain both EMI-compliant and non EMI-compliant DMS equipment powered by integrated or centralized CPDCs, PDCs, RMEs, or by an approved power distribution center provided by the operating company.

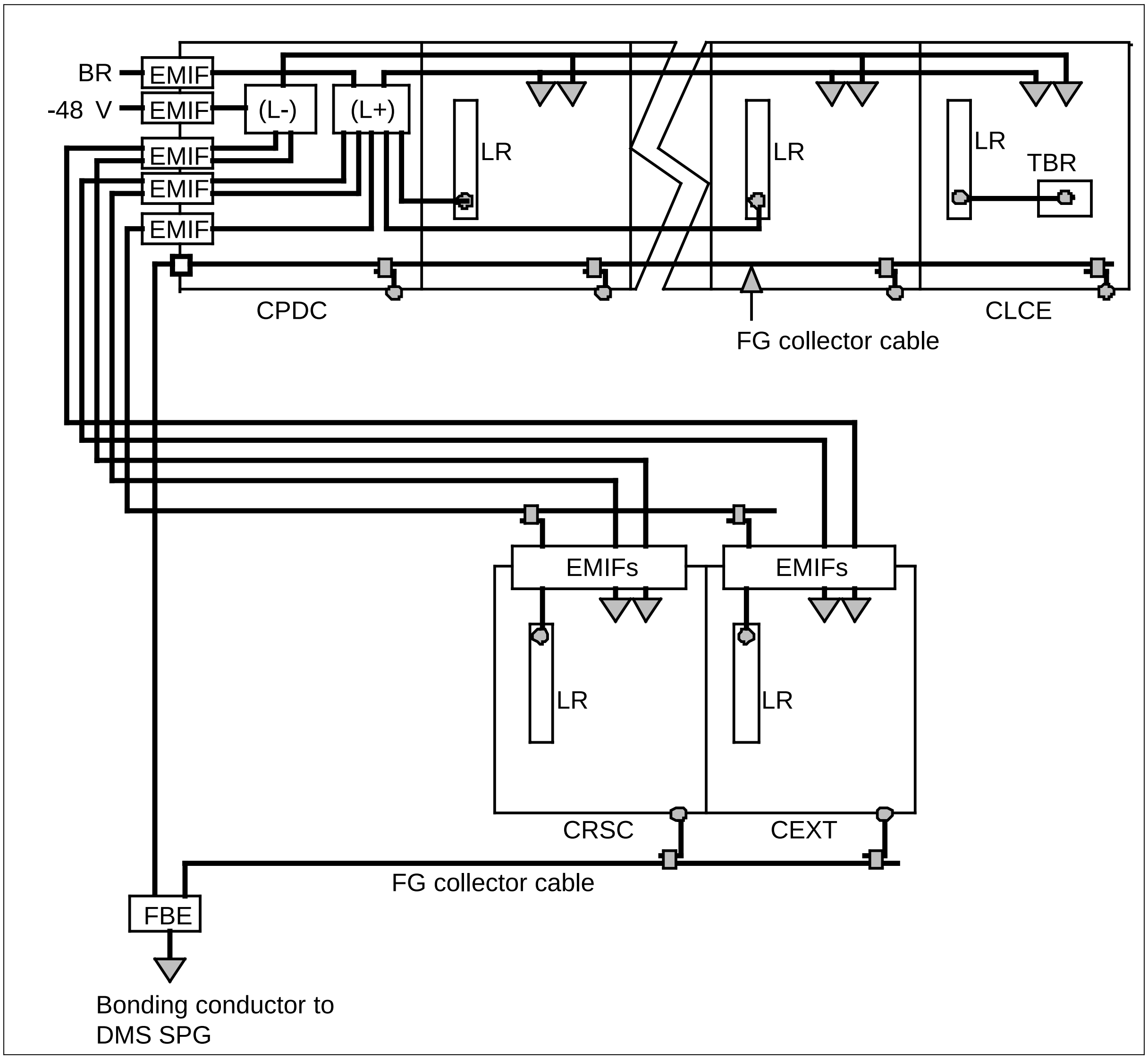
The general power and grounding rules that apply to a host DMS switch also apply to an RSC-S installation. For the addition of cabinets to an existing installation, the cabinets must be EMI-compliant. Install the cabinets as a separate lineup. The following special cabinet considerations also apply:

- The same CPDC must power the CEXT and its associated CRSC cabinets. The cabling length between a CEXT and CRSC cabinet must not exceed 6 m (20 ft).
- The same CPDC must power the CLCE and its associated CRSC cabinets. The cabling length between a CLCE and CRSC cabinet must not exceed 15 m (50 ft).
- A stand-alone CRSC cabinet does not require a CPDC in the same lineup.
- The CPDC circuit breakers are rated for 30 A.

10.4.1 RSC-S with integrated CPDC configuration

The internal power distribution used for a host DMS switch with an integrated CPDC configuration is also used for an RSC-S with an integrated CPDC configuration. An example of an RSC-S with an integrated CPDC configuration appears in Figure 10-18. Figure 10-18 also shows the addition of two vertically powered cabinets to the integrated CPDC lineup. The CPDC and the added cabinets require EMIFs for input power.

Figure 10-18 RSC-S with integrated CPDC configuration



An internal FG collector cable runs along the base of the cabinets in the integrated lineup. This No. 1/0 AWG cable terminates at the ground plate in the bottom of the EMI bulkhead of the CPDC. The ground plate in the CPDC is bonded to the FBE with a No. 1/0 AWG cable. A No. 6 AWG cable from the FG of each cabinet is C-tapped to the internal FG collector. The framework of the vertically powered cabinets is also bonded to the FBE with a No. 1/0 AWG, FG collector cable. This cable runs outside the cabinets.

A bonding conductor connects the FBE to the DMS SPG. The size of the bonding conductor depends on the distance between the FBE and SPG.

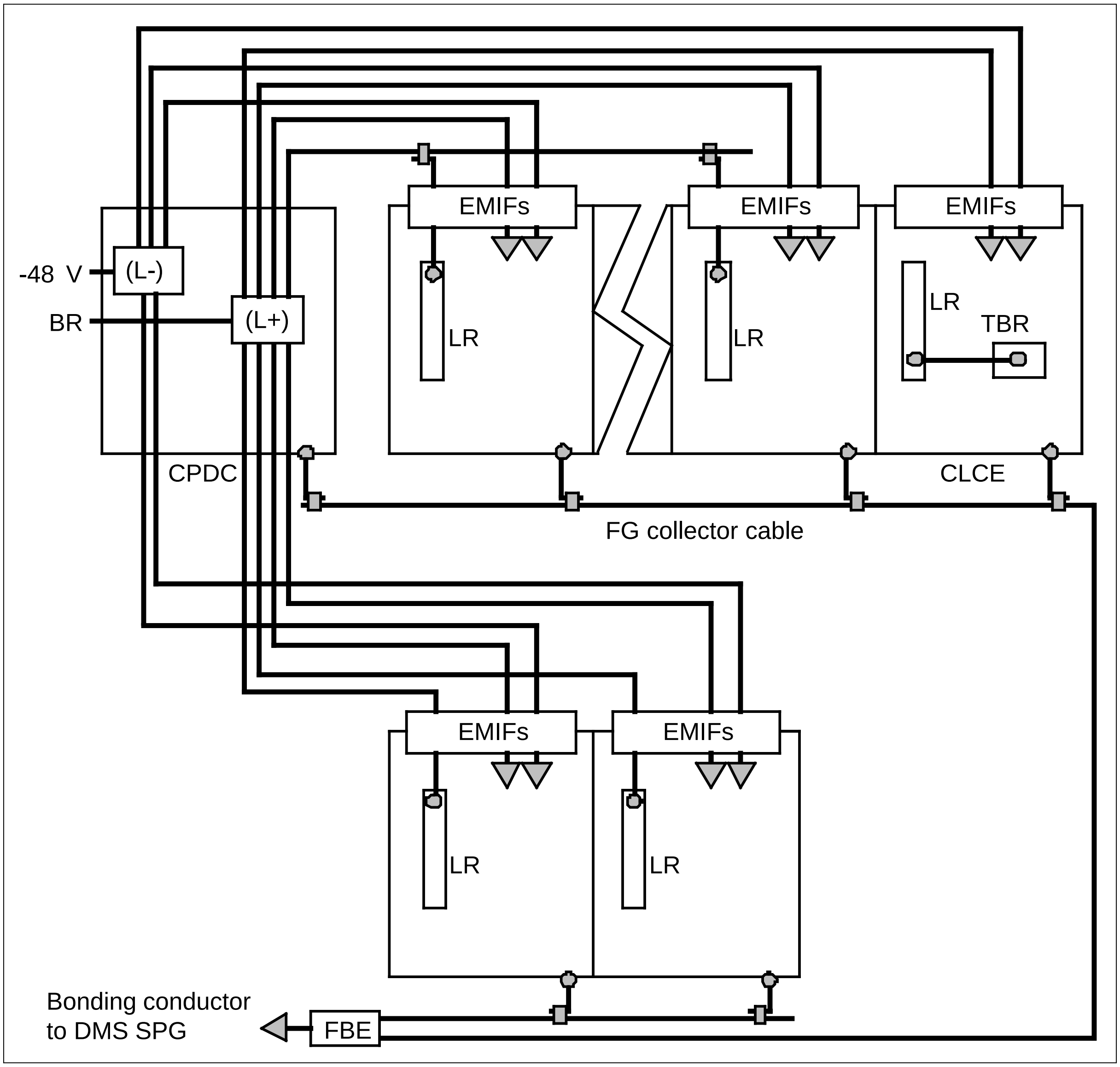
- Use No. 2/0 AWG cable when the conductive length is less than or equal to 15 m (50 ft).
- Use a 350 kcmil cable when the conductive length is greater than 15 m (50 ft). The conductive length is less than or equal to 45.7 m (150 ft).
- Use a 750 kcmil cable for a length greater than 45.7 m (150 ft).

A No. 6 AWG cable bonds the LR of each cabinet to BR in the CPDC. This requirement does not apply to CLCE cabinets. The CLCE cabinet has an internal LR connection to talk battery return. The LR bonding conductors from the added cabinets require EMIFs in the CPDC and in the cabinets.

10.4.2 RSC-S with centralized CPDC configuration

An RSC-S with a centralized CPDC configuration uses the same external power distribution as a host DMS switch with a centralized CPDC configuration. An example of an RSC-S with a central CPDC configuration appears in Figure 10-19.

Figure 10-19 RSC-S with centralized CPDC configuration



An FG collector cable runs outside the cabinets. This No. 1/0 AWG cable can run above or below the cabinets. The cable ends at the FBE. A No. 6 AWG cable from the FG of each cabinet is C-tapped to the FG collector.

A bonding conductor connects the FBE to the DMS SPG. The size of the bonding conductor depends on the distance between the FBE and SPG.

- Use No. 2/0 AWG cable when the conductive length is less than or equal to 15 m (50 ft).
- Use a 350 kcmil cable when the conductive length is greater than 15 m (50 ft). The conductive length is is less than or equal to 45.7 m (150 ft).
- Use a 750 kcmil cable for a length greater than 45.7 m (150 ft).

The CLCE cabinet has an internal LR connection to talk battery return. Refer to Figure 10-19. Other cabinets have the LR connected through an EMIF to BR in the CPDC. Use a No. 6 AWG cable to bond the LR to BR, or this cable can be C-tapped to an external LR collector cable that ends at BR.

10.4.3 Extension to an existing RSC

Existing RSC sites can contain frame equipment and cabinetized equipment. The frame and cabinetized equipment can be powered by one of the following:

- CPDCs, PDCs, or RMEs
- an approved power distribution center provided by the operating company

> ***Note:*** If the operating company provides a power distribution center other than a Nortel Networks CPDC, PDC, or RME, over-current protection devices used with the equipment must meet the following requirements:

- a 100% (no-trip) rating of 30 A (dc voltage)
- a voltage rating of 65 V dc
- an interrupting rating of 7500 A
- a circuit breaker or an equivalent non-time delay fuse that meets the delay specifications listed in Table 10-3

Table 10-3 Circuit breaker delay specifications (Sheet 1 of 2)

Percentage overload	Trip time in second (s)
100%	No trip
125%	2 to 60
150%	1.8 to 30
200%	1 to 10
400%	0.15 to 2
600%	0.04 to 1

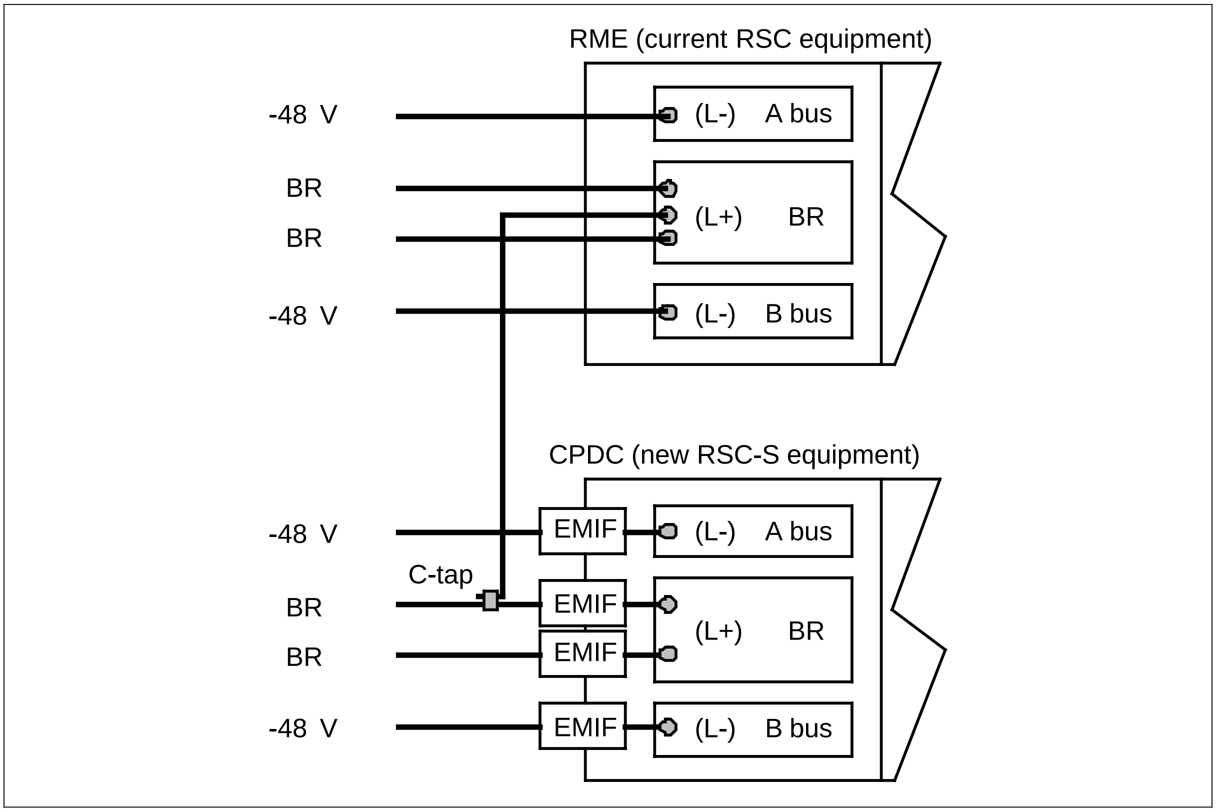
Table 10-3 Circuit breaker delay specifications (Sheet 2 of 2)

Percentage overload	Trip time in second (s)
800%	0.008 to 0.5
1000%	0.006 to 0.1

The following rules apply when adding new cabinets to a current RSC site:

- Use EMI-compliant cabinets (refer to Figure 10-19). If the current RSC lineup has an integrated CPDC equipped with EMIFs, this requirement does not apply.
- If the current RSC lineup is an integrated CPDC configuration, the following options apply:
  - Add new cabinets directly to the current lineup. You can add new cabinets if:
    - enough power is available in the current lineup
    - the EMI-compliant envelope is maintained
  - If not enough power is available, install one of the following:
    - a new lineup with cabinets with EMIFs (refer to Figure 10-18)
    - a new lineup with an integrated CPDC (refer to Figure 10-5).
- Power to a new cabinet lineup can come from an existing integrated CPDC lineup. You must add the EMIFs to the CPDC to power the new lineup (refer to Figure 10-9 and 10-18).
- The same CPDC must power all cabinets that communicate through DS-30A links.
- When an additional CPDC is required to power cabinets in different lineups that communicate through DS-30A links do the following:
  - Bond the BR bar of the new CPDC to the BR bar of the current power distribution facility (refer to Figure 10-20).
  - Make the length of the No. 1/0 AWG cable used to tie the BR bars together as short as possible. The cable should not be longer than 15 m (50 ft).

Figure 10-20 Extension to a current RSC



10.4.4 XA-Core Applications

Initial XA-Core installations must be equipped with PDCX (NTLX01AA) or SNXA (NTLX01AB) cabinets.

Existing DPCC or SCC DMS installations can be upgraded to XA-Core by using the options listed in Table 10-4.

Table 10-4 Upgrade options

Existing cabinet		Complete upgrade of existing cabinet		Upgrade of the existing and a new extension of XA-Core cabinet			
PEC code	**Desc**	**PEC code**	**Desc**	**PEC code**	**Desc**	**PEC code**	**Desc**
NT9X01BA	DPCC	NT9X01BC	DPCC	NT9X01BB	DPCC	NTLX01CA	EXTX
NT9X01JA	DPCC	NT9X01JD	DPCC	NT9X01JC	DPCC	NTLX01CA	EXTX
NT9X01JB	DPCC	NT9X01JF	DPCC	NT9X01JE	DPCC	NTLX01CA	EXTX
NT9X01MB	SCC	NT9X01MD	SCC	NT9X01MC	SCC	NTLX01CA	EXTX

Note: All rules regarding LR referencing apply unchanged to all the above front end processor cabinets. Also, the EXTX cabinets do not have and do not require an external LR connection.

Existing front end cabinets can be replaced as shown in Table 10-5.

Table 10-5 Options for replacement of existing cabinets

Existing cabinet		**New cabinet**	
PEC code	**Description**	**PEC code**	**Description**
NT9X01BA	DPCC	NTLX01AA	DPCX
NT9X01JA	DPCC	NTLX01AA	DPCX
NT9X01JB	DPCC	NTLX01AA	DPCX
NT9X01MB	SCC	NTLX01AB	SNXA

11 DMS-100 wireless system

This section describes the grounding requirements for the DMS-100 wireless system.

11.1 System description

The DMS Wireless system is designed to allow existing in service and new DMS switches to control CDMA, TDMA, and/or AMPS wireless networks through BSC and/or ICPs and applicable BTS equipment. The original Wireless systems included a dedicated DMS MTX switch controlling the ICPs and/or BSC and subsequently the applicable BTSs.

The DMS Wireless system as described in this section must be implemented in North American installations only. This limitation restricts the system grounding and bonding topologies of the DMS, the BSC, and the ICPs to IBN (Isolated Bonding Network) only.

11.2 DMS switches

The DMS switches used for DMS Wireless switches can be DMS-100/200 switches, using open frames and/or cabinetized (C28 and C42) packaging, and equipped with SR60 or SR70EM central processing unit (CPU). No other processor type is currently supported. Internal and system level power and grounding aspects of DMS switches (open frame and cabinetized) are controlled by this document. The DMS switch portion of the DMS Wireless system assumes full compliance to all applicable documents and deals with restrictions, collocation and outside connectivity issues only. One DMS switch can control one BSC only.

11.3 Meridian cabinets for TDMA and AMPS

Some Meridian (MTX) cabinets that the TDMA and AMPS require for operation are not available in a standard DMS frame or C28 cabinet configuration. These cabinets include:

- ICP (MCTM-I, NTNX33CA)
- DSPM (MDSP, NTAX82AA)
- EDSPM (MEDP, NTAX82AB)

These cabinets must be kept in a separate lineup, since Meridian cabinets are not fully compatible with Model B C28/C42 cabinets. Meridian lineups always require a power distribution cabinet to be part of the lineup to create an EMI enclosure.

The Meridian lineup will always start with an MCAM (NTNX37BA) cabinet. Also, the LR (logic return) of each cabinet in the Meridian lineup is always referenced to the BR bar of the MCAM cabinet through the collector cable. No external connectivity of the LR is required. This strategy differs from the standard DMS LR referencing methods. These two differences make the Meridian cabinet internally non-compliant with the DMS frames/cabinets because of different powering and LR schemes. However, a dedicated Meridian lineup can be part of the DMS switch.

11.4 BSC equipment

The BSC equipment is typically packaged into C28 cabinets. Some older BSCs are packaged into the original 31 inch deep open frames. One BSC can control up to 132 BTSs.

11.5 BTS for the CDMA operation

The CDMA BTS product line consists of indoor and outdoor versions of BTS equipment operating at 800 MHz or 1900 MHz frequencies. To provide full flexibility, indoor BTSs can be collocated with DMS and BSC equipment.

The 800 MHz outdoor BTS is not presently available.

The available indoor BTS systems are the 1900 MHz Indoor and the 800 MHz Indoor.

11.5.1 1900 MHz Indoor BTS

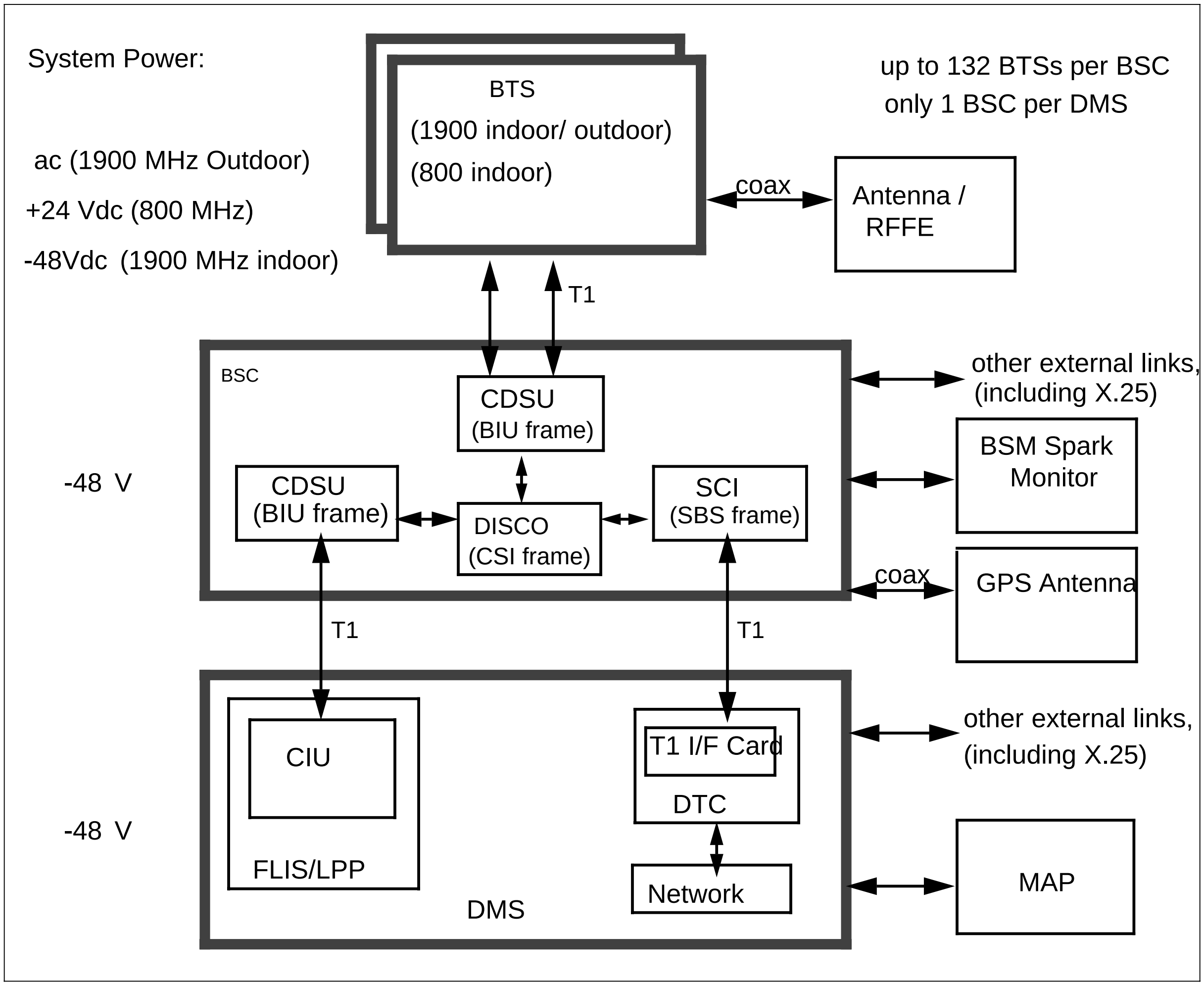
The 1900 MHz Indoor BTS system is installed in C28 cabinets and is powered by a -48 V power plant.

11.5.2 800 MHz Indoor BTS

The 800 MHz Indoor BTS system is installed in C28 cabinets. However, the original 800 MHz Indoor BTS was a frame based product. Both 800 MHz indoor BTS products are +24 V powered.

The overall DMS Wireless system connectivity is shown in Figure 11-1.

Figure 11-1 DMS Wireless connectivity for CDMA Systems



11.6 TDMA/AMPS cell site systems

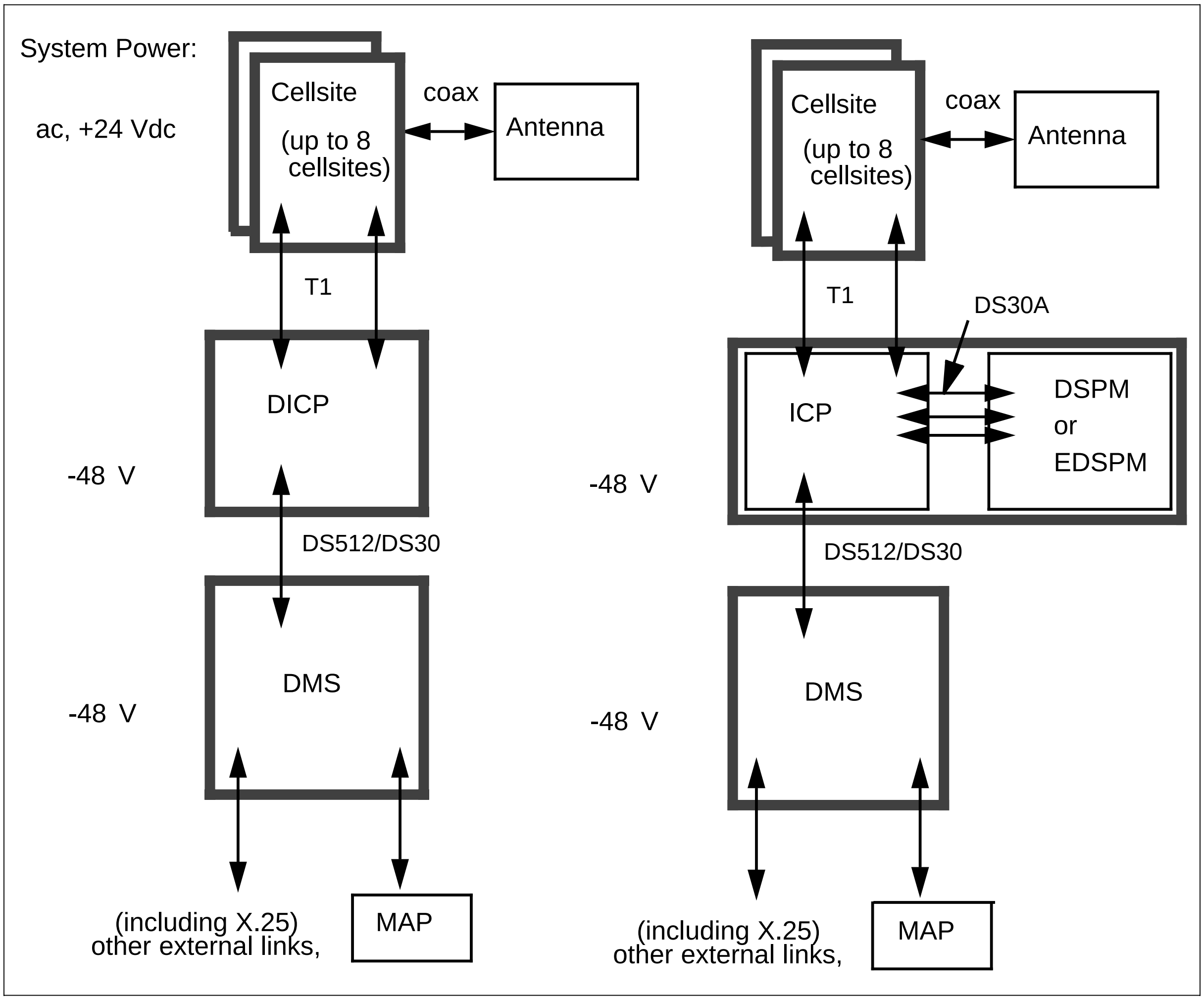
There are two configuration for the ICP lineup

- DICP, using NTAX75AA cabinets
- ICP, using NTNX33CA cabinets in conjunction with DSPM (NTAX82A) or EDSPM (NTAX82AB) cabinets

The two configurations are shown in Figure 11-2. The communication links between the DMS switch and the ICP/DICPs are DS512 (fiber links) or DS30 (dc-isolated twisted pair) links. Communication within cell sites is through T1 links. DS30A (dc-coupled) links are limited to the internal communication between cabinets of the Meridian lineup and used in the ICP option only. There are no other external links.

The MCAM cabinet of the Meridian lineup is grounded to the DMS FBE bar. No external LR connection is required.

Figure 11-2 DMS Wireless connectivity configurations for TDMA/AMPS systems



11.7 System overview

11.7.1 Layout

The subsystems of DMS Wireless equipment must be installed in separate lineups to provide visual distinction. This is especially true for those systems using C28 cabinets.

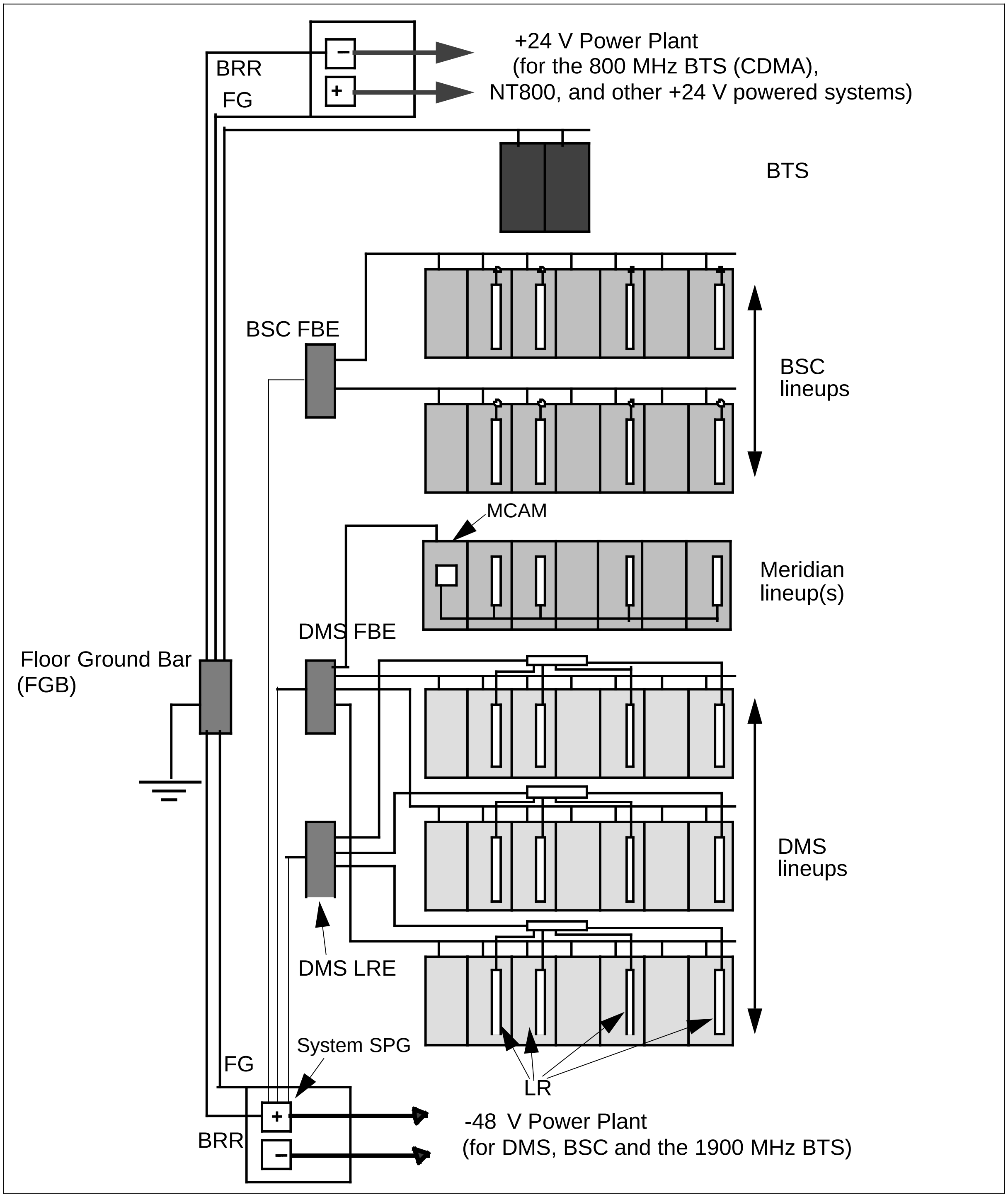
If the DMS Wireless subsystems cannot be separated into individual lineups, a gap of at least 3 in. must be provided between cabinets of two subsystems installed in the same lineup. Each of the two subsystems must be equipped with end guards to close the ends of the partial lineups and make the end cabinets EMI compliant. Use of ac receptacles and light switches must be avoided on those endguards that face each other with a limited space between them. Each half lineup must be treated as a separate lineup with respect to framework ground connections.

11.7.2 System grounding

Since the implementation of DMS Wireless switches is limited to North America, the system level topology of the DMS and BSC equipment is always IBN.

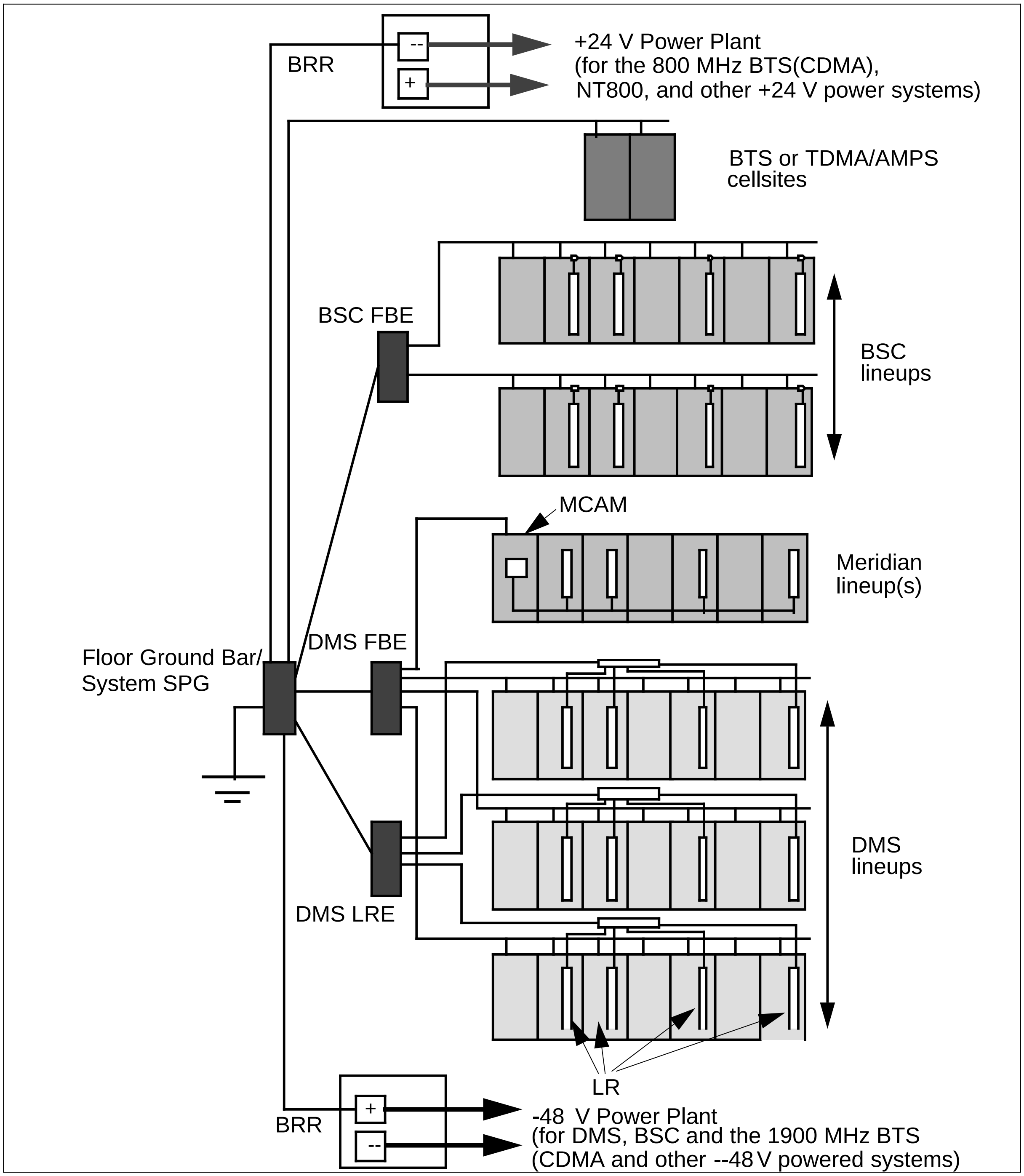
A typical DMS Wireless system using shared power plants is shown in Figure 11-3.

Figure 11-3 DMS Wireless layout using shared power plants



A DMS Wireless system using dedicated power plants is shown in Figure 11-4.

Figure 11-4 DMS Wireless layout using dedicated power plants



If the DMS Wireless subsystems are not collocated, each subsystem shall be treated as a separate system.

The DMS is designed with logic returns (LR) isolated from the framework ground (FG). The LR collector cables from each lineup are terminated at the LRE bar, the FG collector cables from each lineup are terminated at the FBE bar.

The LR of the Meridian lineup is internal. The LR of each cabinet is bonded to an LR collector cable, which is bonded to the BR bar of the MCAM cabinet. No external LR connectivity is required.

The BSC lineup bonds the LR of each cabinet internally, resulting in no external LR connections. The collector cables from each lineup must be terminated at the BSC grounding bar with similar functionalities to the DMS FBE.

Physical and electrical separation of the DMS Wireless subsystem (the DMS including the Meridian lineup from the BSC lineup) is recommended for the following reasons:

- The BSC requires GPS antenna cables to be referenced to its FG, that potentially could conduct lightning currents.
- The DMS serves wired as well as wireless lines. Merging the two systems together by eliminating the BSC FBE and terminating its FG collector cables of the BSC lineups on the DMS FBE results in creation of a single system, that may be more vulnerable to external exposures than when the two subsystems are separately bonded to their respective FBEs.
- During exposure of the BSC to a lightning surge conducted by the GPS antenna, surge voltages could be created that exceed the standard DMS isolation levels of 500 V dc.

The colocated BTS systems are smaller in size, typically consisting of one cabinet (1900 MHz BTS) or two cabinets (800 MHz BTS). The FG collector cable must be terminated on the floor ground bar (FGB). There is no BTS FBE involved. In addition, the 800 MHz Indoor systems internally connect BR to FG, resulting in some return current being conducted in the FG cables. If the +24 V power plant is dedicated to the BTS only, most of this return current can be eliminated form the FG conductors by an arrangement of the power plant referencing its BR through the BTS equipment and having no external BRR conductor.

Most of the TDMA and AMPS cellsites are powered from a +24 V power plant. Their BR is typically bonded to FG. As a result of this arrangement, a substantial portion of the return current is conducted through the FG conductors under normal operating conditions. TDMA and AMPS cellsite equipment is typically not colocated with the switch. However, in case of colocated TDMA and AMPS cell sites the rules described above apply as well.

11.7.3 System powering

Guidelines for location of the dc power plant with respect to IBN equipment are provided in Section 5 in this document. Powering guidelines for open frame DMS are given in Section 4 in this document. General powering guidelines for cabinetized DMS are provided in Section 10 in this document.

For most applications, the shared power plant arrangement shown in Figure 11-3 is recommended, because this configuration allows other IBN as well as CBN equipment to be powered by the same power plants without affecting or compromising the other equipment. In this setup a section of the BR bar of the -48 V power plant is used as the single point ground (SPG) connection of all subsystems of the DMS Wireless switch (excluding the 800 MHz BTS that is +24 V powered).

To keep the maintenance and troubleshooting of DMS Wireless subsystems as simple as possible, cross-powering of subsystems is not allowed.

The standard DMS voltage range of -43.75 to -55.8 V (measured at the PDC) is acceptable for the Meridian lineup(s), the BSC and the 1900 MHz Indoor BTS.

The 800 MHz Indoor system requires a +24 V power source. The allowed configurations of this power plant are shared or dedicated. Figures 11-3 and 11-4 show the options in a DMS Wireless configuration. The full performance operating range of a nominal +24 V powered 800 MHz indoor BTS is from +22 V to +30 V (full output) and from +20 V to +22 V with limited output.

11.7.3.1 DMS

An open frame DMS is powered through its PDC frames that require an A and a B feeder, each fused at not more than 600 A at the power plant. Similarly, a cabinetized DMS is powered through its CPDC cabinets with an A and a B feeder, each fused at not more than 600 A at the power plant. Internal loads of the DMS are powered from fuses or breakers of the PDC, or CPDC. In addition, DMS installations using EAS (Enhanced Alarm System) also require a dedicated ABS feeder from the power plant.

11.7.3.2 BSC

A BPD is the power distribution cabinet of a BSC system. The BPD requires two A and two B feeds, each fused at a maximum of 200 A at the power plant. The ABS feeder of the BPD is derived from the BPD. A BSC system typically requires one BPD cabinet.

11.7.3.3 1900 MHz indoor BTS

A 1900 MHz Indoor BTS requires two A feeders and two B feeders and a dedicated ABS feeder from the same power source. Each feeder is protected by a 30 A overcurrent device at the power plant or customer provided branch panel (BP) local to the BTS.

11.7.3.4 800 MHz indoor BTS

An 800 MHz indoor BTS requires one feeder for each frame or cabinet (DIG and RF). Each feeder is protected by a 70 A overcurrent protection device at the power plant.

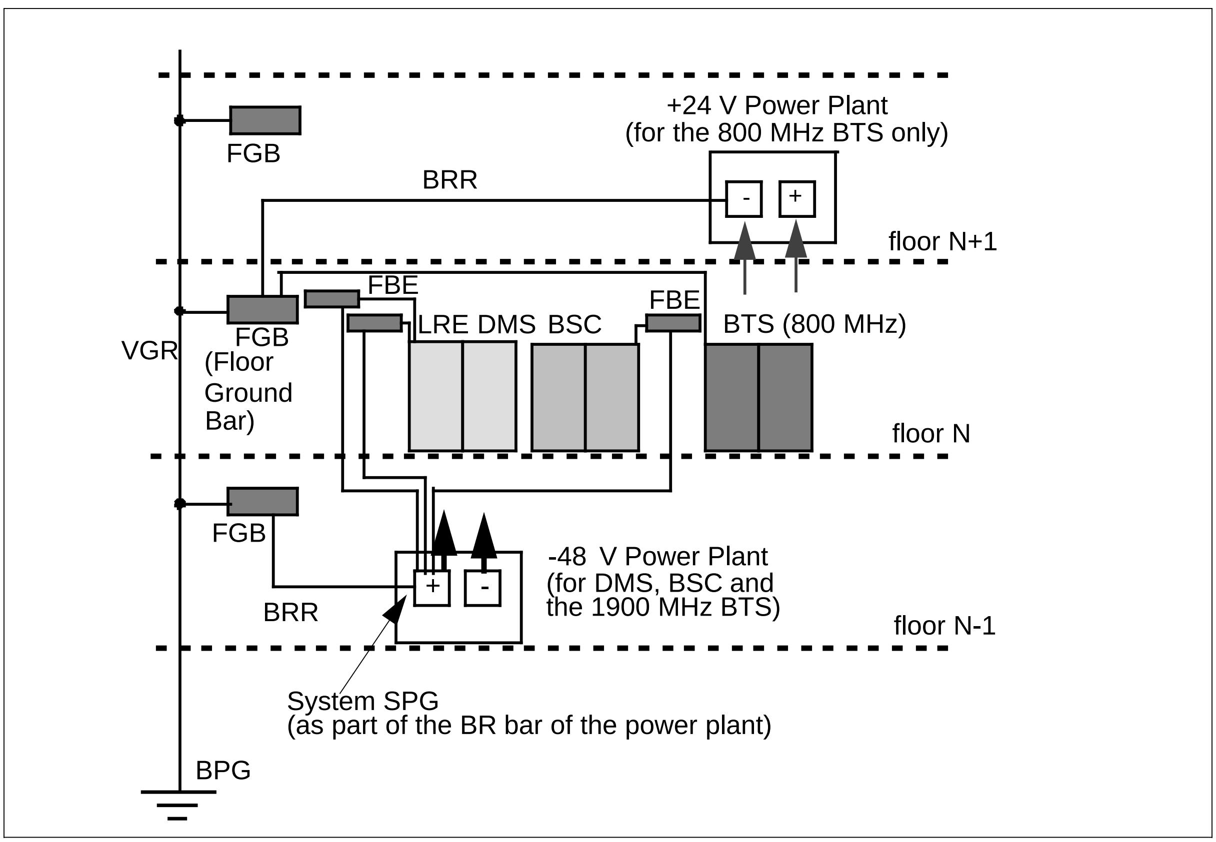
11.7.4 Power plant locations and referencing

Subsystems of the DMS Wireless system can be powered by a shared power plant, or by dedicated -48 V power plants. The 800 MHz Indoor BTS always require a +24 V power plant that can be shared with other +24 V systems, or dedicated to the BTS.

If the DMS Wireless subsystems are not colocated, each subsystem must be treated as an independent system.

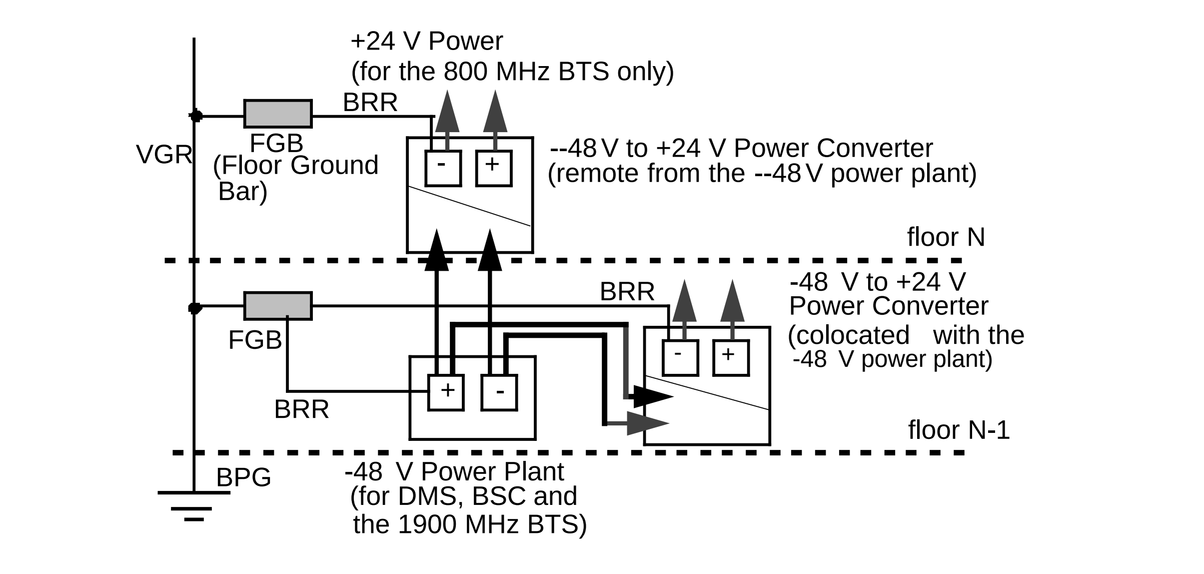
For the colocated subsystems, the power plant(s) are preferably located and referenced to the building grounding system on the same floor as the equipment. The separation between the equipment and the power plant must not exceed one floor. The same one-floor rule applies to the equipment distribution as well as power plant referencing. See Figure 11-5 for the maximum allowed distribution of the colocated equipment.

Figure 11-5 DMS Wireless powering



For those applications where one of the two used supply voltages (+24 V or -48 V) is derived from the other power plant through a dc-to-dc converter, the BRR connection to ground of the converter output shall not be farther than one floor away from the BRR connection to ground of the other power plant. When colocated with the -48 V power plant, the converter +24 V output shall be bonded to the same FGB as the BRR of the -48 V plant. See Figure 11-6. In addition, the converter plant must have input/output isolation. All DMS family power and grounding rules in this document also apply to the DMS Wireless configurations.

Figure 11-6 Example of the dc-to-dc converter referencing



11.7.5 External communication links

All external communication links and links between the DMS, BSC and BTSs must be dc-isolated. The shield of the shielded twisted pair links, such as T1 links shall be bonded at one end only, as follows:

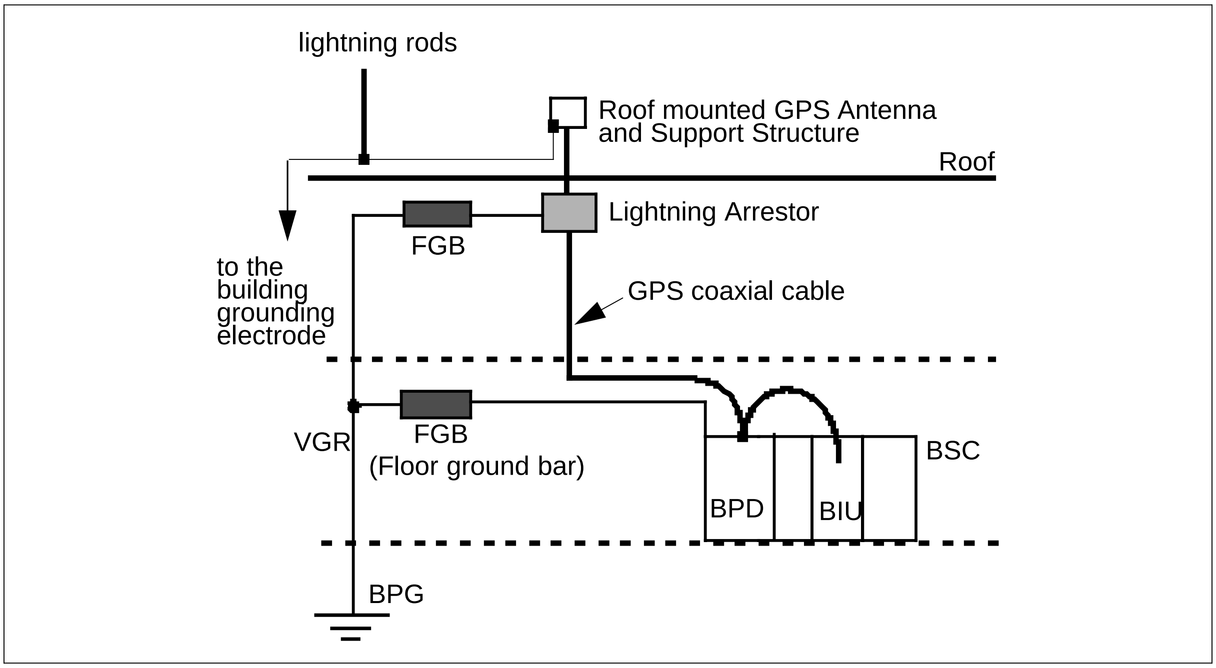
- DMS/DSX, the shield bonded at the DMS end, isolated at the DSX end
- BSC/DSX, the shield bonded at the DSX end, isolated at the BSC end
- BTS/DSX, the shield bonded at the BTS end, isolated at the DSX end

All other dc-coupled external links of the DMS Wireless system must be made dc-isolated by using one of the following approved methods:

- optoisolator
- back-to-back modems
- convert the link to a different dc-isolated link

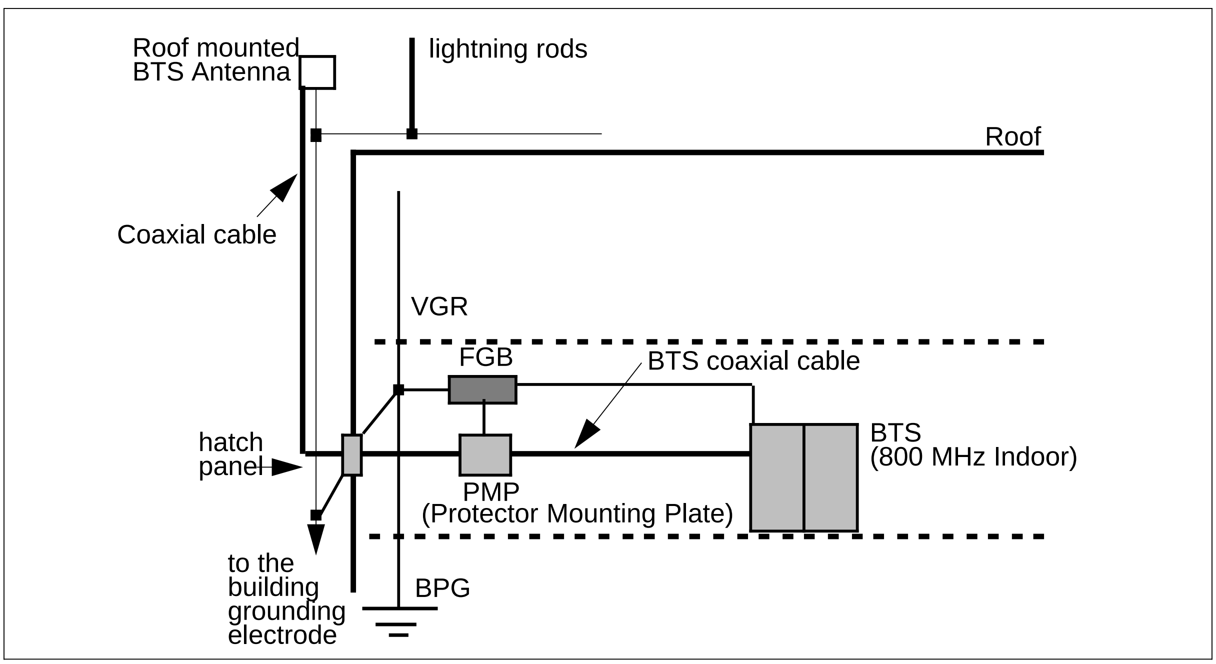
Details of the GPS coaxial cable for the BSC are summarized in Figure 11-7.

Figure 11-7 BSC GPS cable



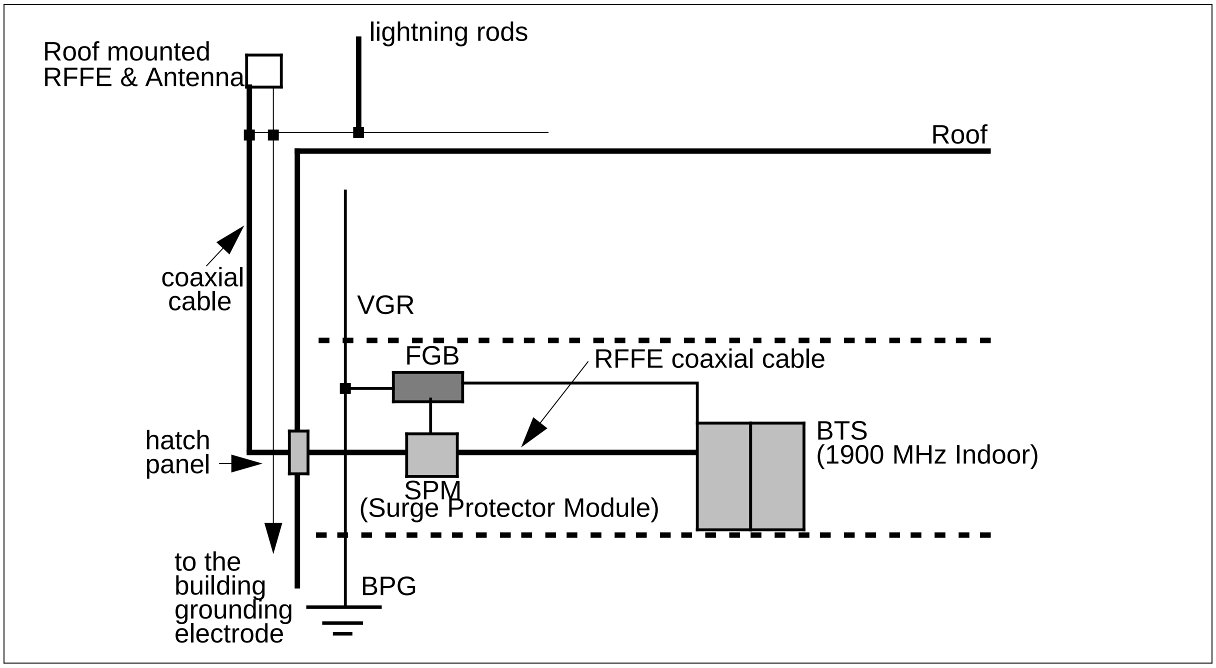
The bonding and protection of the 800 MHz BTS coaxial cables is shown in Figure 11-8.

Figure 11-8 800 MHz BTS coaxial cables



The bonding of the 1900 MHz RFFEs is shown in Figure 11-9.

Figure 11-9 Bonding of the 1900 MHz RFFEs



12 Glenayre MVP 4240

This section describes the grounding requirements for Glenayre modular voice processing (MVP) 4240.

12.1 Glenayre MVP 4240

The Glenayre MVP 4240 is an add-on feature to a DMS switch. Presently, Glenayre MVP 4240 is deployed in North America only and uses only the IBN system bonding topology.

12.2 MVP Installation

The Glenayre MVP 4240 must be installed as a dedicated lineup within the DMS switch. The Glenayre MVP 4240 receives power from outside of the DMS because the MVP requires feeders that exceed the CPDC capability. The ac feeder required to power remote CRTs and/or modems must follow the rules for supplying IMAP ac power (powered from outside of the DMS IBN) as described in this document. An inverter in the peripheral cabinet supplies internal ac power required for the CRT and modems. Glenayre is responsible for the inverter in the peripheral cabinet. All external communication links must be dc-isolated.

All MVP cabinets must be located within the IBN of the host DMS switch in one lineup. All MVP cabinets must be isolated from incidental grounds by installing approved isolation hardware under each cabinet.

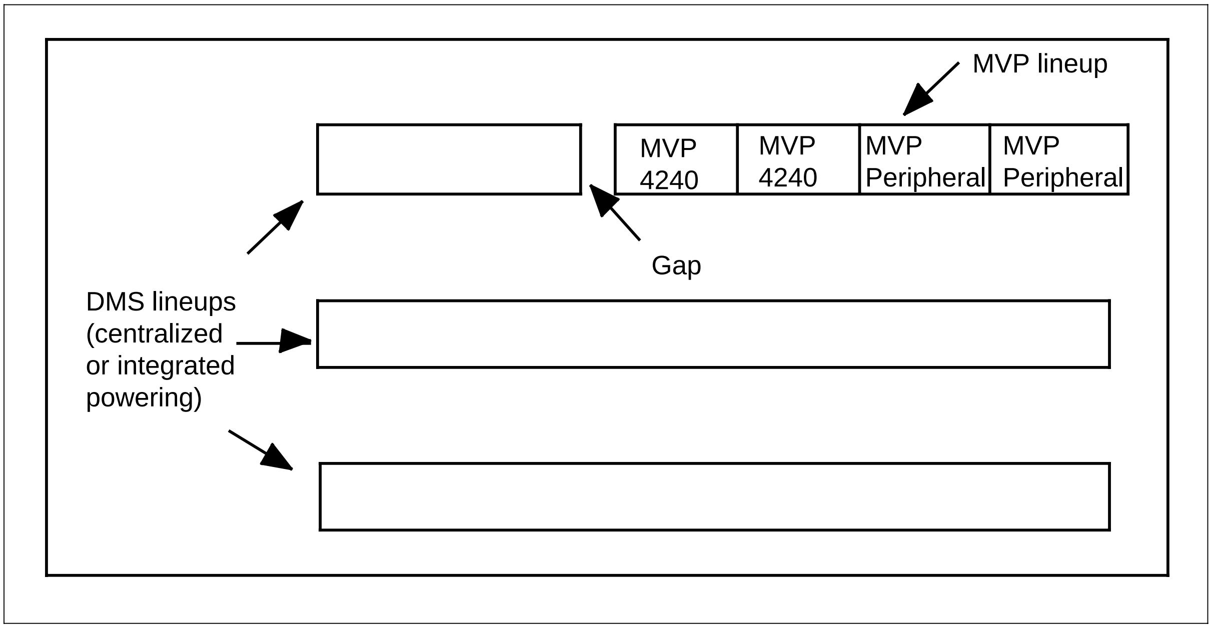
All dc-coupled external links must be made dc-isolated by using one of the following approved methods:

- optoisolator
- back-to-back modems
- convert the link to a different dc-isolated link

12.3 The Glenayre MVP 4240 lineup

The Glenayre MVP 4240 includes the main MVP cabinets and optional MVP peripheral cabinets. Because the dc-powered Glenayre MVP 4240 is not available in C28 cabinets, it cannot be integrated into a cabinetized or open frame DMS lineup.

Figure 12-1 Example of an MVP lineup in DMS



Framework ground

The grounding of the MVP lineup follows standard DMS framework grounding rules:

- The DMS cabinets must be bonded and grounded according to Section 10 in this document.
- The DMS open frames must be bonded and grounded according to Section 9 in this document.
- The MVP lineup must always be bonded the same way for all types of host DMS switches.
- All MVP cabinets must be isolated from any contact with incidental grounds. All MVP cabinets must be bonded to the DMS SPG through the DMS FBE bar as follows:
  - — A No. 0 AWG framework ground collector cable must be run externally from the DMS framework bonding equalizer (FBE) to the MVP lineup.
  - — A No. 6 AWG cable must be run from each MVP cabinet's FG stud (for each MVP 4240 and each MVP peripheral cabinet) and C-tapped to the FG collector cable.
  - — Two-hole lugs must be used wherever possible to terminate cables (refer to CS4122.00, section 8.3 for installation procedures).

The factory-installed internal jumper cable between ‚Safety Ground' and ‚Telco Ground' must always be left in place in all North American installations. Separation of the two ground planes is strictly an option used in some off-shore applications.

Logic return

The MVP 4240 cabinets including the peripheral cabinets require no external LR connectivity. The MVP is ISG compatible, but is not ISG compliant. This topology is acceptable to the DMS internal grounding configuration.

12.4 DC power

MVP 4240 cabinets

Because the main MVP 4240 cabinet draws normally about 27 A dc (32 A dc inrush) it cannot be powered from the DMS CPDC or PDC. The required dc power must be supplied from the same power plant that supplies power to the host DMS switch. The MVP cabinets must be powered directly from a spare breaker or fuse at the power plant's distribution bay or indirectly through a BDFB (Battery Distribution Fuse Bay, or dc panelboard) powering other IBN equipment. BDFBs that power CBN equipment and have a BR (battery return) bonded to FG (framework ground) are not suitable for this purpose.

Each circuit shall be protected either by a 40 A fuse or by a 35 A breaker.

The cable size shall be selected to meet the cabling distance, according to the following table.

Table 12-1 MVP 4240 cabinets

Cable size (AWG)	Distance (m)	Distance (ft)
No. 8	<16.5	<49.5
No. 6	<26.0	<79.0
No. 4	<41.0	<125.0
No. 2	<65.6	<200.0

Longer distances must be planned to ensure that the overall voltage drop on the feeder cable does not exceed 1.75 V.

> ***Note:*** The main unit can accept cable sizes up to No. 4 AWG. If larger cables must be used, they shall be C-tapped into a short run of No. 4 AWG cable before being terminated at the input terminals of the MVP unit.

MVP peripheral cabinet

The servers are in the peripheral cabinet. There can be from one to eight servers in the peripheral cabinet. However, the first peripheral cabinet must also contain an ac-powered CRT and its inverter. This added equipment limits the number of servers in the first peripheral cabinet to a maximum of four.

Each peripheral cabinet requires one or two dc feeders. One feeder is required for up to four servers, or three servers and the inverter. If the cabinet is equipped with additional servers (numbers five through eight, or number four in the first cabinet), a second feeder of the same size is required. The current drain of a feeder powering four servers is normally about 40 A. Each peripheral MVP circuit must be protected by a 60 A fuse or by a 50 A breaker.

> ***Note:*** The real current drain of the feeders varies because of the number of powered servers and server options. The 40 A load reflects a fully populated and fully configured server setup. To simplify installation, Nortel Networks recommends that each feeder is a 40 A feeder regardless of the number of servers and their options.

Select the cable size based on the cable distance. The following table lists the cable size requirements for the distance

Table 12-2 MVP peripheral cabinets

Cable size (AWG)	Distance (m)	Distance (ft)
No. 6	<17.5	<53.3
No. 4	<27.7	<84.4
No. 2	<38.8	<135.0
No. 1	<55.6	<169.5
No. 0	<70.4	<214.6

Longer distances must be planned to ensure that the overall voltage drop on the feeder cable does not exceed 1.75 V.

> ***Note:*** The peripheral cabinet can accept cable sizes up to No. 6 AWG. If larger cables must be used, they must be C-tapped into a short run of No. 6 AWG cable before being terminated at the input terminals of the MVP peripheral unit.

12.5 AC power

External ac power is required only for powering CRTs and/or modems connected to the main MVP 4240 cabinet. The external ac power required for this purpose must not come from the DMS system. Nortel Networks recommends that power used for the DMS IMAP terminals also be used for MVP ac-powered CTRs and associated modems.

The ac power required to feed the CRT and the modems located in the first peripheral cabinet must come from an inverter. This inverter must be located in the same cabinet and must be powered from the cabinet's dc distribution panel.

12.6 Communication links

All external communication links must be dc-isolated using appropriate isolation hardware (such as ED8T48-01 or other suitable types of optoisolators).

The links that do not require additional attention include the following:

- SS7 links; V.35 links isolated at the DMS/STP end at the NT9X77AB card
- T1 links, which are inherently dc-isolated.
- 10BaseT is a LAN link. 10BaseT is an inherently isolated link.
- Ethenet link which is a link connecting the MVP with its peripheral cabinet. Ethernet is an inherently isolated link.
- Coax link interconnects the main MVP cabinet with the peripheral cabinet only, therefore it is not a truly external link. The coax link is not dc-isolated.

All RS-232 links require additional attention. All RS-232 links connecting terminals, modems, and SMDI connections to the DMS need to be intercepted with an optoisolator or otherwise made dc-isolated.

DMS-100 Family

Power Distribution and Grounding Systems

User Guide

Product Documentation-Dept. 3423
Nortel Networks
P.O. Box 13010
RTP, NC 27709-3010
1-877-662-5669
Electronic mail: cits@nortelnetworks.com

Publication number: 297-1001-156
Product release: 2000Q1
Document release: Standard 04.01
Date: February 2000
Publsihed in U.S.A.

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