Critical Release Notice

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The content of this customer NTP supports the SN06 (DMS) and ISN06 (TDM) software releases.

Bookmarks used in this NTP highlight the changes between the baseline NTP and the current release. The bookmarks provided are color-coded to identify release-specific content changes. NTP volumes that do not contain bookmarks indicate that the baseline NTP remains unchanged and is valid for the current release.

Bookmark Color Legend

Black: Applies to new or modified content for the baseline NTP that is valid through the current release.

Red: Applies to new or modified content for NA017/ISN04 (TDM) that is valid through the current release.

Blue: Applies to new or modified content for NA018 (SN05 DMS)/ISN05 (TDM) that is valid through the current release.

Green: Applies to new or modified content for SN06 (DMS)/ISN06 (TDM) that is valid through the current release.

Attention!

Adobe® Acrobat® Reader™ 5.0 is required to view bookmarks in color.

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297-1001-158

DMS-100 Family

Grounding Audit Procedures

Procedural Manual

All BCS levels   Standard 02.03   April 1999

northern telecom

DMS-100 Family

Grounding Audit Procedures

Procedural Manual

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May 1995

Standard 02.02

This guide was reissued to modify the following questionnaire items and figures:

- item 3.5 of procedure 2–2: Changed No. 2 AWG to No. 1/0 AWG.
- item 4.10 of procedure 2–2: Changed FBE to LRE.
- item 4.13 of procedure 2–2: Old item 4.13 repeated 4.12.
- item 15.1 of procedure 2–2: Deleted reference to pin 40.
- items 1.1 and 1.2 of procedure 2–8: Added solid state arresters.
- item 2.6 of procedure 2–10: Changed 1200 feet to 1000 feet.
- item 2.16 of procedure 2–10: Combined old 2.16 and 2.17 into 2.16.
- figures 16., 17., and 18.: Changed IMAP arrow to MAP arrow.

April 1994

Standard 02.01

This guide was reissued for the following reasons:

- to compose NTP 297-1001-158 in a new typographical style (restructured format)
- to comply with the generic design intent, terminology, and definitions of applicable Northern Telecom Corporate Standards and NTP 297-1001-156, *DMS-100 Family Power Distribution and Grounding Guide*
- to improve the composition, arrangement, and structure of the content

- to simplify and improve the text, figures, and tables

May 1989

Standard 01.04

Reissued for updates.

April 1988

Standard 01.02

First standard release of this guide.

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About this document

How to check the version and issue of this document

The version and issue of the document are indicated by numbers, for example, 01.01.

The first two digits indicate the version. The version number increases each time the document is updated to support a new software release. For example, the first release of a document is 01.01. In the *next* software release cycle, the first release of the same document is 02.01.

The second two digits indicate the issue. The issue number increases each time the document is revised but rereleased in the *same* software release cycle. For example, the second release of a document in the same software release cycle is 01.02.

To determine which version of this document applies to the software in your office and how documentation for your product is organized, check the release information in *DMS-100 Family Guide to Northern Telecom Publications*, 297-1001-001.

What precautionary messages mean

The types of precautionary messages used in NT documents include attention boxes and danger, warning, and caution messages.

An attention box identifies information that is necessary for the proper performance of a procedure or task or the correct interpretation of information or data. Danger, warning, and caution messages indicate possible risks.

Examples of the precautionary messages follow.

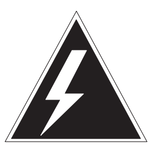
ATTENTION Information needed to perform a task

> **ATTENTION**
> If the unused DS-3 ports are not deprovisioned before a DS-1/VT Mapper is installed, the DS-1 traffic will not be carried through the DS-1/VT Mapper, even though the DS-1/VT Mapper is properly provisioned.

DANGER Possibility of personal injury

> **DANGER**
> **Risk of electrocution**
> Do not open the front panel of the inverter unless fuses F1, F2, and F3 have been removed. The inverter contains high-voltage lines. Until the fuses are removed, the high-voltage lines are active, and you risk being electrocuted.

WARNING Possibility of equipment damage



> **WARNING**
> **Damage to the backplane connector pins**
> Align the card before seating it, to avoid bending the backplane connector pins. Use light thumb pressure to align the card with the connectors. Next, use the levers on the card to seat the card into the connectors.

CAUTION Possibility of service interruption or degradation

> **CAUTION**
> **Possible loss of service**
> Before continuing, confirm that you are removing the card from the inactive unit of the peripheral module. Subscriber service will be lost if you remove a card from the active unit.

How commands, parameters, and responses are represented

Commands, parameters, and responses in this document conform to the following conventions.

Input prompt (>)

An input prompt (>) indicates that the information that follows is a command:

>BSY

Commands and fixed parameters

Commands and fixed parameters that are entered at a MAP terminal are shown in uppercase letters:

>BSY CTRL

Variables

Variables are shown in lowercase letters:

>BSY CTRL ctrl_no

The letters or numbers that the variable represents must be entered. Each variable is explained in a list that follows the command string.

Responses

Responses correspond to the MAP display and are shown in a different type:

```
FP 3 Busy CTRL 0: Command request has been submitted.
FP 3 Busy CTRL 0: Command passed.
```

The following excerpt from a procedure shows the command syntax used in this document:

1 Manually busy the CTRL on the inactive plane by typing

>BSY CTRL ctrl_no
and pressing the Enter key.

where

ctrl_no   is the number of the CTRL (0 or 1)

Example of a MAP response:

```
FP 3 Busy CTRL 0: Command request has been submitted.
FP 3 Busy CTRL 0: Command passed.
```

1. Introduction

Terms, abbreviations, and acronyms used in this document should be understood by the person performing a grounding audit. The following definitions, list of abbreviations and acronyms, and cross reference table are provided to assist the users of this audit procedure.

1.1. Definitions

The following definitions conform as closely as possible to those of the National Electrical Code (NEC) and the Canadian Electrical Code (CEC).

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.

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 used to connect 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.

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, metallic plumbing, ac power conduit, ac equipment grounding conductors, bonding conductors, and cable racks. The CBN is a mesh topology and is connected to the building grounding electrode system.

DMS-100 Family:

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

DMS single point ground (DMS SPG):

A single point where the framework bonding equalizer (FBE), the logic return equalizer (LRE), the serving ac equipment grounds (ACEG), the integrated collector bar (ICB), and the serving dc-power plant battery return reference (BRR) are connected to ground. The DMS SPG is usually one of the following types of busbars: building principal ground (BPG), floor ground bar (FGB), dedicated SPG bar, or a dedicated section of the serving dc-power plant battery return (BR) bar. In non-ISG configurations, the framework ground bus (rather than the FBE and LRE) is connected to the DMS SPG.

floor ground bar (FGB):

A copper bar on each floor of a building provided for equipment grounding. The FGB is connected to the VGR and effectively 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. It is recommended that no other conductors are connected to the framework ground bus.

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 is in accordance with ANSI standards. This term has been used incorrectly for various functions and hardware of the grounding system. Use of the term ground window in this document is limited to avoid misunderstanding and confusion.

incidental ground:

An unplanned grounding connection.

integrated collector bar (ICB):

An insulated copper plate used for bonding to the DMS SPG all metallic objects that are outside the IBN but within 2 m (7 ft) of the IBN and that are

8not already connected to the DMS SPG. These metallic objects include any noninsulated metallic objects that could be intentionally or unintentionally connected to the building CBN and cannot be insulated from that CBN.

isolated bonding network (IBN):

A bonding network that has a single point of connection to either 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 separated from the framework ground. DMS-100F systems configured without ISG have equipment logic returns referenced 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 is connected to the LRE. Subsequent LRBs in the same lineup are daisy chained to the first LRB. Each vertical logic return bar of an equipment row referenced to the LRE is connected to an LRB. The DMS core is treated as a separate equipment row with respect to the LRB. The LRB of the core is preferably located 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.

single point ground (SPG):

A single connection used to reference equipment or a system to ground. In an ideal IBN arrangement, no dc current flows through the single point connection unless a fault condition exists.

vertical ground riser (VGR):

A continuous conductor extending ground potential throughout the height of a multifloor building. The size of this conductor is either 750 kcmil or is equal to or larger than the largest conductor used for power distribution in the building. The FGBs on various floors are connected to the VGR.

vertical logic return bar:
A copper bar vertically mounted inside several types of DMS frames and used to reference the logic return to the LRB.

1.2. Abbreviations and acronyms

The following list is provided as a reference for a quick identification of abbreviations and acronyms used in this document.

AAE: auxillary access equipment (frame)

ac: alternating current

ACEG: alternating current equipment ground

AWG: American Wire Gauge

BMC: billing media converter

BN: bonding network

BPG: building principal ground

BR: battery return

BRR: battery return reference

CEGB: cable entrance ground bar

CBN: common bonding network

CC: central control

CCC: central control complex

CEC: Canadian Electrical Code

CO: central office

CSA: Canadian Standards Association

dc: direct current

DCE: digital carrier equipment (frame)

DMS: Digital Multiplex System

DMS-100F: DMS-100 Family

DMS SPG: DMS single point ground

DNC: dynamic network controller

DNI: digital network interconnecting (frame)

DPCC: dual plane combined core cabinet

DPP: distributed processing peripheral

DSNE: dual shelf network equipment (frame)

DTE: digital trunk equipment (frame)

EIA: Electronic Industries Association

ENET: enhanced network

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

GWB: ground window bar

IAC: integrated access control (frame)

IBN: isolated bonding network

ICB: integrated collector bar

IGB: intermediate ground bar

IGP: isolated ground plane (BOC terminology)

IGZ: isolated ground zone (REA terminology)

IMAP: integrated MAP

IOC: input/output controller

IOE: input/output controller equipment (frame)

ISDN: integrated system digital network

ISG: isolated system grounding

kcmil: thousand circular mils

LCE: line concentrating equipment (frame)

LCM: line concentrating module

LGC: line group controller

LGE: line group controller equipment (frame)

LIM: link interface module

LIU: link interface unit

LME: line module equipment (frame)

LR: logic return

LRB: logic return bar

LRE: logic return equalizer

MAP: maintenance and administration position

MDF: main distribution frame

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

MTC: magnetic tape center (frame)

NEC: National Electrical Code

NETC: network combined (frame)

NFPA: National Fire Protection Association

NTP: Northern Telecom publication

OPGPB: office principal ground point bar

PCE: position controller equipment (frame)

PDC: power distribution center

RCE: remote concentrating equipment (frame)

RCME: remote control and maintenance equipment (frame)

REA: Rural Electrification Administration

RLCM: remote line concentrating module

RLM: remote line module

RME: remote maintenance equipment (frame)

RSE: remote service equipment (frame)

RTIF: reset terminal interface

SCC: single core cabinet

SP: supervisory panel

SPG: single point ground

ST7E: signaling terminal 7 equipment (frame)

TAMI: TPC administration and maintenance interface

TBB: transmission bonding bar

TBR: talk battery return

TOPS: Traffic Operator Position System

TOPS MP: Traffic Operator Position System Multipurpose

TOPS MPX: Traffic Operator Position System Multipurpose Extended

TPC: TOPS position controller

TME: trunk module equipment (frame)

TR: Technical Reference (Bell Communications Research)

UPS: uninterruptible power supply

VDU: video display unit

VGR: vertical ground riser

1.3. Cross reference of terms

The following table is a quick cross-reference of terms used by Northern Telecom, the BOCs, REA, and others.

Cross reference of terms

NT	BOC	REA	OTHERS
battery return (BR)	–48 V 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 – PGP bus	master ground bar (MGB)	– COG – 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 – CO ground bar – CO ground bus	floor bar	– COG – COGB – C.O. GRD

—continued—

Cross reference of terms (continued)

NT	BOC	REA	OTHERS
framework bonding bar (FBB)			
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 – vertical riser		– C.O. ground riser – equipment ground riser – GRD riser – riser – VERT EQLR
—end—			

2. Grounding audit procedures

The grounding audit is used to check the grounding system at an existing DMS-100F site or at a site where DMS-100F equipment is to be installed. The audit checks the grounding pertinent to DMS-100, DMS-100/200, S/DMS SuperNode, and DMS-200 TOPS installations. It is not intended to cover all grounding and equipment associated with a site.

2.1. Skills

The person that performs this grounding audit should be familiar with DMS-100F type installations and grounding documentation, and have a good understanding of isolated bonding network (IBN) and common bonding network (CBN) concepts. Also, familiarity with the grounding documents of the operating company being audited and understanding of the NEC or CEC are recommended.

2.2. Precautions

Before touching any grounding conductor, check the voltage between the grounding conductor and any nearby metallic structures that may be grounded to the building steel. Do not disconnect any grounding conductors unless specifically instructed to do so by this grounding audit.

2.3. Required equipment

The following equipment is required to perform the grounding audit:

- ac/dc clamp-on ammeter capable of measuring current on a 750 kcmil cable (AWS DIGISNAP, Model DSA–2003, or equivalent)
- voltmeter (capable of measuring up to 100 V dc or more)
- ohmmeter (capable of measuring down to tenths of an ohm)
- screwdriver
- flashlight.

2.4. Audit procedures

The grounding audit consists of the following equipment audit procedures. Site information is always required for an audit. Procedures 2–2 through

2–10 can be performed in any order, and only the procedures pertinent to a particular site need to be performed.

PROCEDURE	EQUIPMENT	PAGE
2–1	Site information	2–3
2–2	DMS switch equipment	2–6
2–3	MAP equipment	2–14
2–4	DC power equipment	2–16
2–5	AC power equipment	2–17
2–6	Building grounding system	2–19
2–7	Entrance cables and CEGB	2–21
2–8	MDF equipment	2–22
2–9	Radio/microwave equipment	2–24
2–10	DMS TOPS equipment	2–25

The procedures contain numbered questions that can be answered as yes (Y), no (N), or not applicable (N/A). A not-applicable indication should be given to a question that does not apply to the site being audited. The no answer may indicate a deviation or a problem with the grounding system.

Y	N	N/A
[ ]	[ ]	[ ]

Not all numbered entries have yes, no, or not applicable responses. A check box or blank space is provided where a checked response or recorded information is needed.

2.4.1.Site information

Procedure 2-1
Site information

1 Office information

1.1 Date of audit: ____________________

1.2 Name of site: ____________________

____

1.3 Office base number: ____________________

1.4 Customer: ____________________

____

1.5 City/state: ____________________

1.6 Auditor’s name: ____________________

1.7 Other persons attending: ____________________

____

____

1.8 Reason for audit: ____________________

____

____

____

____

1.9 Type of DMS equipment:

a) DMS switch equipment (specify DMS–100, DMS–200, DMS–STP, and so on):

____

b) DMS TOPS equipment (specify TOPS MPX, MP, or 04):

____

1.10 Is this site an ISG or non–ISG installation?

[ ] ISG
[ ] Non–ISG

1.11 When was the DMS equipment installed? ____________________

____

____

____

____

____

1.12 Who installed various parts of the DMS equipment? ____________________

1.13 Describe any problems in the DMS equipment that can be (or have been) attributed to the grounding and bonding system.

1.14 In addition to Procedure 2–1, check the other equipment procedures that will be used during this audit:

	EQUIPMENT	PROCEDURE	PAGE
[ ]	DMS switch equipment	2–2	2–6
[ ]	MAP equipment	2–3	2–15
[ ]	DC power equipment	2–4	2–17
[ ]	AC power equipment	2–5	2–18
[ ]	Building grounding system	2–6	2–20
[ ]	Entrance cables and CEGB	2–7	2–22
[ ]	MDF equipment	2–8	2–23
[ ]	Radio/microwave equipment	2–9	2–25
[ ]	DMS TOPS equipment	2–10	2–26

2. Grounding schematics

DMS switch equipment:

2.1 Either before or while performing this audit, make a schematic (consisting of one or more drawings) of the switch equipment grounding system (see Figures 3–1 through 3–33 for drawing examples). The drawings must depict the switch as it appears at the time of the audit and should contain the following information:

- dashed lines that identify cables to be added
- triangles that contain an alphabetical character indicating a recommendation for a particular cable or other component
- an attached sheet of recommendations that identify the alphabetical characters and associated cables, wire sizes, and terminations at each location

2.2 Identify the following equipment on the drawings:

- SPG, FBE, LRE, and LRB
- specific frames
- collocated equipment

2.3 Measure ac and dc current on the grounding cables at the various ground bars and record on the drawings.

2.4 Record grounding and bonding violations on the drawings.

DMS TOPS equipment:

2.5 Either before or while performing this audit, make a schematic (consisting of one or more drawings as needed) of the DMS TOPS office grounding system (see Figures 4–1 through 4–16 for drawing examples). The drawings must depict the office as it appears at the time of the audit and should contain the following information:

- dashed lines that identify cables to be added
- triangles that contain an alphabetical character indicating a recommendation for a particular cable or other component
- an attached sheet of recommendations that identify the alphabetical characters and associated cables, wire sizes, and terminations at each location

2.6 Identify the following DMS TOPS equipment on the drawings:

- SPG (TOPS SPG or DMS SPG, see Note in Figures 4–4 through 4–9)
- TOPS MPX
- TOPS MP
- TOPS 04

2.7 Record grounding and bonding violations on the drawings.

2.4.2.DMS switch equipment

Procedure 1.
DMS switch equipment

		Y	N	N/A
1	Isolation of DMS IBN Refer to Figures 3–1, 3–2, and 3–3.	[ ]	[ ]	[ ]
1.1	Are all DMS frames isolated (insulated or separated by appropriate spacing) from building and other incidental grounds?	[ ]	[ ]	[ ]
1.2	Is all equipment that is tied to the DMS framework isolated from the building and other incidental grounds?	[ ]	[ ]	[ ]
1.3	Does all equipment tied to the DMS switch have BR isolated from the framework? This includes the equipment in MIS and IOE frames, and any external equipment that has its framework tied to the DMS framework.	[ ]	[ ]	[ ]
1.4	Are the frame grounds of the isolated equipment free of any non–isolated frame grounds or other incidental grounds all the way back to the DMS SPG?	[ ]	[ ]	[ ]
1.5	For personnel safety reasons, there should be either a 2–m (7–ft) separation between isolated and non–isolated equipment or isolation screens placed between the two types of equipment. Has either the 2–m (7–ft) separation been maintained or are there isolation screens between the two types of equipment?			
1.6	All metallic items (such as air conditioning ducts and cable racks) that might contact a non–DMS ground reference and are within 2 m (7 ft) of the DMS IBN should be treated by one of the following methods:	[ ]	[ ]	[ ]
	a) Is the equipment isolated from building and incidental grounds and bonded to the DMS SPG?	[ ]	[ ]	[ ]
	b) Is the non–isolated equipment bonded back to the DMS SPG? (Typically, the ICB is used for this bonding.)			
	ISG offices:	[ ]	[ ]	[ ]
1.7	Do all frames have isolation pads under every frame?			
1.8	As a part of the initial DMS equipment installation, the megger test requirements of Northern Telecom (resistance greater or equal to 2 megohms at 500 V dc) are checked. If a record is available, post the reading that was obtained. ____________			
	BOC offices:	[ ]	[ ]	[ ]
1.9	Are ground cables to the MDF, wave guides, and cable racks from other systems at least 1 m (3 ft) from the boundaries of the DMS area?	[ ]	[ ]	[ ]
1.10	Are all DMS frames within 200 conductor feet of the FGB (or BPG) to which the DMS SPG is connected? (Total distance is the sum of the distances between the furthest FBB and FBE, the FBE and DMS SPG, and the SPG and FGB or BPG).			

2 DMS SPG

The DMS switch and its serving power plant must be grounded only at the DMS SPG. Depending on the site configuration, a section of the BR bar in the dc power plant, the BPG, an FGB, or a separate DMS–dedicated bar may be used for the DMS SPG (see Figures 3–1 through 3–6). See Table 1–1 for terms used by various operating companies to designate these bars.

2.1 Which one of the following ways is used to implement the DMS SPG?

- [ ] an FGB
- [ ] a dedicated SPG bar bonded to the building grounding system
- [ ] the BPG
- [ ] a section of the BR bar on the power plant
- [ ] another method as described below:

____

____

____

____

		Y	N	N/A
2.2	Is the DMS SPG located within one floor of the DMS switch?	[ ]	[ ]	[ ]
2.3	Are the DMS framework ground (and logic return for an ISG office) and BRR connected to the SPG bar in the sequence shown in Figure 3–4?	[ ]	[ ]	[ ]
2.4	If this is not a structural steel building and the DMS SPG is implemented as an FGB, is the SPG isolated from the building concrete?	[ ]	[ ]	[ ]
2.5	If the SPG is not implemented as an FGB, is the SPG connected to the FGB (or BPG) with a cable sized at least 750 kcmil?	[ ]	[ ]	[ ]
2.6	For a BOC office, is the DMS SPG located within 100 horizontal feet of the DMS switch?	[ ]	[ ]	[ ]
2.7	For an office with a power plant shared by CBN equipment and the DMS IBN, are all power feeders to CBN equipment routed close to the SPG and are BR cables bonded to the DMS SPG?	[ ]	[ ]	[ ]
2.8	Is the SPG the only point of connection between the DMS framework and the building grounding system?	[ ]	[ ]	[ ]
2.9	If this is an REA office, is the ground window bar free of non–isolated (CBN) equipment grounds?	[ ]	[ ]	[ ]
2.10	Are all ground cables identified?	[ ]	[ ]	[ ]
2.11	Are all connections tight?	[ ]	[ ]	[ ]
2.12	Are all bolted joints free of damaged hardware?	[ ]	[ ]	[ ]
2.13	Are all connections free of signs of corrosion?	[ ]	[ ]	[ ]

3 DMS framework bonding

In an ISG office, an FBE bar is used to bond DMS frames to the DMS SPG. One FBB in each frame lineup is connected to the FBE (see Figure 3–5).

In a non–ISG office, a framework ground bus is used to bond DMS frames to the DMS SPG. The framework ground bus is the start and end of a ground loop formed with conductors that interconnect the FBBs of all PDCs in the frame lineups. Refer to Figure 3–6.

		Y	N	N/A
3.1	Is the FBE or framework ground bus free of ground connections other than those specified above?	[ ]	[ ]	[ ]
3.2	Are miscellaneous storage cabinets that are isolated from the building connected to the FBE or framework ground bus?	[ ]	[ ]	[ ]
3.3	Is the FBE or framework ground bus connected to the DMS SPG by appropriately sized cables? Use the following information to determine cable sizing. (Circle the parameters used to answer this question.)	[ ]	[ ]	[ ]
	All initial offices engineered as of June 1988 should use the following cable sizes for SPG connections to the DMS IBN (to the FBE and LRE in an ISG office, or to a framework ground bus in a non–ISG office):	[ ]	[ ]	[ ]

Cable length	Cable size
50 ft or less	No. 2/0 AWG
over 50 ft, but not over 150 ft	350 kcmil
greater than 150 ft	750 kcmil

Non–ISG offices engineered prior to June 1988 used the following cable sizes for SPG connections to the DMS IBN:

Cable length	Cable size
100 ft or less	No. 1/0 AWG or larger
greater than 100 ft	750 kcmil

ISG office:

		Y	N	N/A
3.4	Is there a No. 1/0 AWG cable between the FBE and an FBB of each DMS lineup? (When a column or gap breaks a lineup into two partial lineups, a separate cable connection from each partial lineup to the FBE is required.)	[ ]	[ ]	[ ]
3.5	If there is a PDC in the lineup, is the FBE cable connected with a No. 1/0 AWG cable to the FBB that is located above the PDC?	[ ]	[ ]	[ ]
3.6	Does current flow between the FBE and DMS SPG measure zero (0) amperes? Record reading here. ____________	[ ]	[ ]	[ ]

Non–ISG office:

		Y	N	N/A
3.7	Do the No. 1/0 AWG cables form a complete loop that starts and ends at the framework ground bus and includes the FBBs of all PDCs in the frame lineups.	[ ]	[ ]	[ ]
3.8	Are 750 kcmil equalizer cables in place between battery return plates of the PDCs?	[ ]	[ ]	[ ]

4 Logic return bonding

In an ISG office, an LRE bar is used to provide the ground reference to the internal logic circuitry of the DMS frames. One LRB in each frame lineup is connected to the LRE. Refer to Figure 3–5.

In a non–ISG office, logic circuitry is internally referenced to the DMS framework ground or battery return as required by the type of frame. Refer to Figure 3–6.

		Y	N	N/A
4.1	Is the LRE connected to the DMS SPG by appropriately sized cables? Use the following information below to determine required cable sizing. (Circle the parameters used to answer this question.)	[ ]	[ ]	[ ]

All initial offices engineered as of June 1988 should use the following cable sizes for SPG connections to the DMS IBN (to the FBE and LRE in an ISG office, or to a framework ground bus in a non–ISG office):

Cable length	Cable size
50 ft or less	No. 2/0 AWG
over 50 ft, but not over 150 ft	350 kcmil
greater than 150 ft	750 kcmil

Non–ISG offices engineered prior to June 1988 used the following cable sizes for SPG connections to the DMS IBN:

Cable length	Cable size
100 ft or less	No. 1/0 AWG or larger
greater than 100 ft	750 kcmil

		Y	N	N/A
4.2	Are all cables identified?	[ ]	[ ]	[ ]
4.3	Are all cables free of splices?	[ ]	[ ]	[ ]
4.4	Are all connections tight?	[ ]	[ ]	[ ]
4.5	Do all bolted joints properly use washers and locknuts?	[ ]	[ ]	[ ]
4.6	Are all bolted joints free of damaged hardware?	[ ]	[ ]	[ ]
4.7	Are all connections free of signs of corrosion?	[ ]	[ ]	[ ]

ISG office:

		Y	N	N/A
4.8	Is the LRE bar insulated from the CBN and the DMS framework?	[ ]	[ ]	[ ]
4.9	Is the LRE bar connected to the closest LRB in each lineup by a No. 1/0 AWG or larger sized cable?	[ ]	[ ]	[ ]
4.10	Does current flow between the LRE and DMS SPG measure zero (0) amperes? Record reading here. ________________	[ ]	[ ]	[ ]
4.11	Is the LRE free of other connections?	[ ]	[ ]	[ ]
4.12	If there is more than one LRB in a lineup, are the LRBs in that lineup connected to each other in series by No. 1/0 AWG cables?	[ ]	[ ]	[ ]
4.13	Are the LRBs connected to LR bars in the frames by No. 6 AWG or larger cables?	[ ]	[ ]	[ ]
4.14	Are all LRBs isolated from the framework?	[ ]	[ ]	[ ]

5 Grounding connections within DMS frames

Refer to Figures 3–5 and 3–6.

		Y	N	N/A
5.1	Are the LRs of the two central control (CC) frames (CCC and associated IOE, MEX, MOE or dedicated MIS, or MTC frames) tied together to form a single–point connection? (See core LRB core SPG in Figures 3–5 and 3–6.)	[ ]	[ ]	[ ]
5.2	Are the LRs of the input/output controller (IOC) shelves in the IOE frames strapped together from frame to frame?	[ ]	[ ]	[ ]
5.3	If this is an ISG office, are the cross–aisle cable troughs isolated at one end from the DMS framework?	[ ]	[ ]	[ ]
5.4	If this is an office upgraded to ISG, were all strap connections between the LR bars removed?	[ ]	[ ]	[ ]
5.5	For non–ISG offices, does each frame have a path back to the framework ground bus? This path may be through an FBB in another lineup. (Refer to Figure 3–6).	[ ]	[ ]	[ ]

6 MIS frames

See Figure 3–7.

		Y	N	N/A
6.1	Is the sum of the –48 V and BR currents to each piece of dc–powered equipment within the miscellaneous frame equal to zero?	[ ]	[ ]	[ ]
6.2	Are the chassis of all equipment in the MIS connected to the framework ground, BR, or LR? (Any chassis connected to BR or LR must be isolated from the framework. If in doubt, use a continuity checker to verify this.)	[ ]	[ ]	[ ]
6.3	List the manufacturer, model number, and quantity of all equipment in the MIS frames.			

Equipment	Manufacturer	Model	Quantity

7 TME frames—ISG office

Refer to Figure 3–9.

		Y	N	N/A
7.1	Do all shelves have logic return strapped to filter ground?	[ ]	[ ]	[ ]

			Y	N	N/A
8	Modem frames—ISG office				
	8.1	Is LR connected to the LRB of the IOE? (See Figures 3–10.)	[ ]	[ ]	[ ]
	8.2	Are the inverters isolated from the DMS framework and bonded to LR?	[ ]	[ ]	[ ]
	8.3	Are all modem shelves isolated from the framework and bonded to LR? (Exception: for dc–powered modems with BR tied to the chassis, the chassis is not tied to the LR.)	[ ]	[ ]	[ ]
	8.4	Are all modems powered by isolated DMS inverters or from the –48 V and BR used within the DMS switch?	[ ]	[ ]	[ ]
9	LCE and RLCM frames		Y	N	N/A
	9.1	Are terminals 1, 2, 5, and 6 of TB2 in each LCE tied together?	[ ]	[ ]	[ ]
	9.2	In each LCE, is the FBB free of any straps from terminals 1, 2, 5, and 6 of TB2?	[ ]	[ ]	[ ]
	9.3	In each RLCM, is a No. 6 AWG cable used to connect the LR bar to the TBR in the FSP of the RLCM? (Refer to Figure 3–11.)	[ ]	[ ]	[ ]
10	LGE, RCE, and RME frames		Y	N	N/A
	10.1	Is the LR of each frame referenced to the BR of its associated PDC, and not to its framework ground (see Figure 3–12)? (In DMS–200 ISG offices, the LR is strapped to the LRB, or in some earlier offices, the LR is connected to the DMS framework ground bar.)	[ ]	[ ]	[ ]
	10.2	If the answer to question 10.1 is no, has the office been scheduled to implement this change?	[ ]	[ ]	[ ]
11	DPP or BMC—new office		Y	N	N/A
	11.1	Is the chassis of the DPP or BMC connected to framework ground?	[ ]	[ ]	[ ]
	11.2	Is the logic return of the DPP or BMC connected to the LR bar of the frame?	[ ]	[ ]	[ ]
12	RSM shelves		Y	N	N/A
	12.1	In an ISG office, is the shelf LR tied to filter ground?	[ ]	[ ]	[ ]
	12.2	In a non–ISG office, is the shelf LR tied to the frame's LR?	[ ]	[ ]	[ ]

13 DNC equipment—ISG office

		Y	N	N/A
13.1	Is the DNC equipment isolated from incidental grounds?	[ ]	[ ]	[ ]
13.2	Is the DNC dc–powered?	[ ]	[ ]	[ ]
13.3	Is the DNC equipment isolated from the DMS equipment?	[ ]	[ ]	[ ]
13.4	Is the frame ground of the DNC tied directly to the DMS SPG?	[ ]	[ ]	[ ]
13.5	If the LIU is mounted in a DMS frame, but is isolated from the framework and powered by an isolated inverter, are back–to–back modems used for communication between the LIU and the DMS switch?	[ ]	[ ]	[ ]
13.6	If the LIU is mounted outside the DMS switch, are back–to–back modems used for communication between the LIU and the DMS switch?	[ ]	[ ]	[ ]

14 Tape drives

		Y	N	N/A
14.1	On Cook tape drives, has the jumper between TB1 Pins 5 and 6 been removed?	[ ]	[ ]	[ ]
14.2	On Cook tape drives, is TB1 Pin 6 connected to the IOE framework (or to the LR when TB1, Pin 3 is not connected)?	[ ]	[ ]	[ ]
14.3	On Cook tape drives in new offices, is TB1 Pin 3 connected to LR?	[ ]	[ ]	[ ]
14.4	On Hewlett Packard tape drives, is the chassis isolated from the DMS framework?	[ ]	[ ]	[ ]

15 Cable shields

		Y	N	N/A
15.1	Are the shields of all cables between the DMS switch and the DSX connected only to the DMS switch?	[ ]	[ ]	[ ]

16 Ground mats

		Y	N	N/A
16.1	Are the ground mats (if used) strapped to the DMS framework ground and not to LR?	[ ]	[ ]	[ ]

17 Transmission equipment located in a DMS lineup

Transmission equipment can be classified as Class 1 if it does not require a connection between BR and its framework, or as Class 2 if it has, or requires a connection between BR and its framework.

Class 1 equipment located within the DMS lineups:

		Y	N	N/A
17.1	Is the frame isolated from building and incidental grounds as are the DMS frames?	[ ]	[ ]	[ ]
17.2	Check the following DMS framework ground and personnel safety rules and indicate those that have been or have not been applied.			
	a) The frame grounds of isolated equipment are free of any non–isolated frame grounds or other incidental grounds all the way back to the DMS SPG?	[ ]	[ ]	[ ]
	b) Either a 2–m (7–ft) separation between isolated and non–isolated equipment has been maintained or isolation screens separate the two types of equipment?	[ ]	[ ]	[ ]
	c) All metallic items (such as air conditioning ducts and cable racks) that might contact a non–DMS ground reference and are within 2 m (7 ft) of the DMS IBN have been treated by one of the following methods: [ ] Equipment isolated from building and incidental grounds is bonded to the DMS SPG. [ ] Non–isolated equipment is bonded back to the DMS SPG. (Typically, the ICB is used for this bonding, see Figure 3–3.)	[ ]	[ ]	[ ]
17.3	Is the battery supply obtained from the nearest DMS PDC in accordance with DMS power feeder rules?	[ ]	[ ]	[ ]
17.4	Is the equipment free of internal gas tubes that bypass voltage surges to their chassis?	[ ]	[ ]	[ ]
	If equipment is Class 1, and is not located within a DMS lineup:			
17.5	Is the battery supply obtained from a supplementary fuse panel located on the power plant?	[ ]	[ ]	[ ]
	Class 2 equipment:			
17.6	Is the equipment located somewhere other than within a DMS lineup?	[ ]	[ ]	[ ]
17.7	Is the DMS framework ground free of any connections to the Class 2 equipment framework grounds?	[ ]	[ ]	[ ]
17.8	Does the Class 2 equipment get its battery supply from a supplementary fuse panel located on the main power plant?	[ ]	[ ]	[ ]

2.4.3.MAP equipment

Procedure 2.
MAP equipment

1 MAP equipment

Typical equipment configurations are shown in Figures 3–15 through 3–20. An integrated MAP (IMAP) is located in the CBN and is the recommended installation. If installed as a part of an IBN, maintenance and administration equipment is referred to as a MAP. Earlier MAP installations were always part of the DMS IBN.

If this is an IMAP installation (see Figure 3–15):		Y	N	N/A
1.1	Is the IMAP equipment using power that originates from outside of the DMS IBN area?	[ ]	[ ]	[ ]
1.2	Is all communication between the IMAP and DMS switch by way of modems or isolating current loops? EIA RS–232 connections are not allowed. Check the IOC terminal device assignment (Table TERMDEV) to confirm that EIA connections are not used.	[ ]	[ ]	[ ]
1.3	Are the PAC poles bonded to building steel?	[ ]	[ ]	[ ]
1.4	Is the ac green wire connected to building steel or to an FGB that is located on the same floor as the IMAP equipment?	[ ]	[ ]	[ ]
1.5	Is all metal work in the IMAP area that requires grounding connected to an FGB that is located on the same floor as the IMAP?	[ ]	[ ]	[ ]
If this is a MAP installation (see Figure 3–16):				
1.6	Is all communication between the MAP and DMS switch by way of modems or current loops? EIA RS–232 connections are not allowed. Check the IOC terminal devices assignment (Table TERMDEV) to confirm that EIA connections are not used.	[ ]	[ ]	[ ]
1.7	Are the PAC poles isolated from building steel?	[ ]	[ ]	[ ]
1.8	Is the inverter–powered receptacle box isolated from building ground? (Check the receptacle at or near the top of the PAC pole.)	[ ]	[ ]	[ ]
1.9	If non–isolating receptacles (brown or PAC pole receptacles) are used, are they isolated from building ground?	[ ]	[ ]	[ ]
1.10	Are the inverter–powered receptacles used to power only isolated equipment? No non–isolated equipment should be used in the MAP area.	[ ]	[ ]	[ ]
1.11	Is the green wire of the inverter free of incidental grounds?	[ ]	[ ]	[ ]
1.12	Is the grounding wire in the cable coming from the inverter connected to the green wire and box of the receptacle?	[ ]	[ ]	[ ]

Earlier MAP installation in an ISG office (see Figure 3–17):

		Y	N	N/A
1.13	Are the reset terminal interface (RTIF) VDUs using either current loop or modem–to–modem communication to the DMS switch?	[ ]	[ ]	[ ]
1.14	If this is a remote ISG office, are isolated DMS inverters used to power all devices connected to ac–powered modems located within the DMS switch?	[ ]	[ ]	[ ]
1.15	If ac–powered modems are used, are both the device (VDU, printer, or RTIF) and the modem connected to it powered from the same power source?	[ ]	[ ]	[ ]

2.4.4.DC power equipment

Procedure 3.
DC power equipment

1 DC power plant

Refer to Figures 3–21 through 3–23.

		Y	N	N/A
1.1	Is the BR bar of the power plant isolated from the framework of the power plant?	[ ]	[ ]	[ ]
1.2	If the BR bar is not isolated, is the DMS SPG located in the immediate vicinity of the power plant?	[ ]	[ ]	[ ]
1.3	Is the BR bar bonded to the DMS SPG by a 750–kcmil BRR cable?	[ ]	[ ]	[ ]
1.4	Is the BRR cable clearly identified at the SPG and at the BR bar?	[ ]	[ ]	[ ]
1.5	Is the BRR the one and only reference from the BR bar of the power plant to the building grounding system?	[ ]	[ ]	[ ]
1.6	Is the framework of the power plant bonded to the FGB that is located on the same floor as the power plant?	[ ]	[ ]	[ ]
1.7	Are metallic battery racks bonded to the FGB that is located on the same floor?	[ ]	[ ]	[ ]

BOC office:

		Y	N	N/A
1.8	Is there an appropriately sized, additional grounding conductor run from the framework of the power plant to the DMS SPG?	[ ]	[ ]	[ ]
1.9	Is the additional conductor routed with the BRR?	[ ]	[ ]	[ ]
1.10	If the power plant is shared by CBN equipment and the DMS IBN, are all power feeders routed through the GW and are all BR cables bonded to the DMS SPG before being routed to the equipment being powered?	[ ]	[ ]	[ ]

2.4.5.AC power equipment

Procedure 4.
AC power equipment

1 AC power equipment

Current DMS–100F switches are configured for ac–free operation in which all convenience outlets that are integral to the DMS switch are fed from inverters that are also integral to the switch. Earlier switch installations that do not power internal ac loads from internal inverters use external ac power supplied by the operating company. All ac power facilities must be grounded in accordance with Section 7 of NTP 297–1001–156.

		Y	N	N/A
1.1	Is the DMS switch an ac–free switch? If the answer is ”yes”, the remainder of this procedure does not apply.	[ ]	[ ]	[ ]
1.2	If ac brought into the DMS area, is all of it distributed from either a dedicated ac distribution panel (see Figures 3–24 and 3–25) or a dedicated junction box (see Figure 3–26)?	[ ]	[ ]	[ ]
1.3	If a dedicated ac distribution panel is used, is it insulated from the building and installed as shown in Figures 3–24 and 3–25?	[ ]	[ ]	[ ]
1.4	Is an ac reference conductor installed in accordance with Figure 3–24, 3–25, or 3–26?	[ ]	[ ]	[ ]
1.5	Are all conductive junction boxes, conductors, and ducts located within the DMS area insulated in accordance with the applicable figure?	[ ]	[ ]	[ ]

1.6 All convenience outlets fed from external ac must be of the same type (standard or orange) and must be installed in accordance with one of the arrangements shown in Figure 3–27. Verify and indicate the arrangement (A, B, C, or D) used.

[ ] A (see Note)
[ ] B (see Note)
[ ] C
[ ] D

Note: BOC practices call for arrangement A. If the operating company has no applicable practices, arrangement B should have been used.

		Y	N	N/A
1.7	If an isolation transformer is used, is it installed in accordance with Figure 3–28?	[ ]	[ ]	[ ]
1.8	Is the ac panel serving the DMS switch located within the DMS IBN?	[ ]	[ ]	[ ]
1.9	Is there a separate neutral for each ac circuit to the DMS switch?	[ ]	[ ]	[ ]
1.10	Is there a separate green wire for each ac circuit, or at least one green wire for each conduit?	[ ]	[ ]	[ ]

		Y	N	N/A
1.11	Is the metal ductwork isolated from incidental ground?	[ ]	[ ]	[ ]
1.12	If this is an ISG office, are the green wires bonded to the duct?	[ ]	[ ]	[ ]
1.13	Is the conduit between the ac panel box and DMS switch sized 3/4–inch or larger (depending on the number of circuit conductors)?	[ ]	[ ]	[ ]
1.14	Are DMS ac–circuit breakers rated at 15 A for frame–mounted lights and at 15 A or 20 A for center–aisle lights?	[ ]	[ ]	[ ]
1.15	Are the modems that are connected to the IOE frame (IOC) by an EIA RS–232 connection powered by DMS inverters?	[ ]	[ ]	[ ]
1.16	Is every section of the duct with attached conduit bonded to the ACEG conductors of the circuits serving the DMS switch?	[ ]	[ ]	[ ]
1.17	Is the end of the aisle 4– by 8–in. box bonded to the ACEG conductors of the circuits serving the DMS switch?	[ ]	[ ]	[ ]
1.18	Do the ac light switches, including the low–intensity light switches, have a separate green wire run to the box?	[ ]	[ ]	[ ]
If the ac neutral of the standby engine–alternator is switched at the transfer box:				
1.19	Is the neutral of the alternator bonded to the nearest effective ground?	[ ]	[ ]	[ ]
1.20	Are the ACEG wires bonded to the neutral of the alternator?	[ ]	[ ]	[ ]
1.21	Is the chassis of the standby engine–alternator bonded to its neutral either at the alternator or at the first disconnect for the alternator?	[ ]	[ ]	[ ]
If the ac neutral of the alternator is not switched at the transfer box:				
1.22	Is the chassis of the alternator free of bonds to its neutral at the alternator or first disconnect for the alternator?	[ ]	[ ]	[ ]
1.23	Is the chassis of the alternator bonded to the green wire network of the commercial ac system?	[ ]	[ ]	[ ]
For offices that bring the conduit from the ac panel serving the DMS switch to within three feet of the SPG and that have the conduit and green wire bonded to the SPG:				
1.24	Is the conduit run between the DMS switch and the SPG insulated from incidental grounds?	[ ]	[ ]	[ ]

2.4.6.Building grounding system

Procedure 5.
Building grounding system

1 BPG

The BPG is the main point within a building at which the ground reference potential is established (see Figures 3–29 through 3–33). See Table 1–1 for other terms used in the industry.

1.1 Check which of the following are connected to the BPG.

[ ] a) ac neutral bus of the main ac power entrance service panelboard
[ ] b) vertical ground riser or risers for multistory buildings
[ ] c) metal underground water pipe
[ ] d) metal frame of building
[ ] e) concrete–encased electrode
[ ] f) ground ring
[ ] g) rod or pipe electrodes*
[ ] h) plate electrodes*
[ ] i) other local metal underground systems or structures*

* These items are specified by the NEC for locations where items c) through f) are not available.

		Y	N	N/A
1.2	If the metallic water pipe is used as a ground electrode, is a No. 4/0 AWG cable jumper placed across the water meter and any insulating joints in the metallic water pipe to ensure electrical continuity (see Figure 3–29)? (Permission from the owner of the water system may be required to install jumpers.)	[ ]	[ ]	[ ]
1.3	Is the BPG isolated from its mounting surface? (If this is a BOC office, check the N/A response box.)	[ ]	[ ]	[ ]
1.4	If the BPG is the only busbar in the building (a small single–floor building, for example) to which all building systems are referenced, are all cables bonded to the BPG in the order shown in Figure 3–31? (Not all cables shown in Figure 3–31 are present at all sites.)	[ ]	[ ]	[ ]

1.5 Resistance measurements to earth should have been made within the last year. List the actual resistance magnitude and measurement method used.

Date of last measurement: ______________________
Resistance value: ______________________
Measurement method: ______________________

A desirable resistance for NEC regulations is 25 ohms or less, and CEC does not set a limit. However, a regulation of 5 ohms or less is preferred.

2 VGR

VGRs extend the ground potential of the BPG throughout the height of a multifloor building.

		Y	N	N/A
2.1	If single VGR is used, is it installed in accordance with Figure 3–29?	[ ]	[ ]	[ ]
2.2	If there are multiple VGRs, are the risers located within 61 m (200 ft) of each other as shown in Figure 3–30?	[ ]	[ ]	[ ]
2.3	If there are multiple VGRs, are the risers bonded together at every third floor or as often as specified by the operating company?	[ ]	[ ]	[ ]
2.4	Are the bonding cables between multiple VGRs and between FGBs and VGRs at least the size of the associated VGRs?	[ ]	[ ]	[ ]
2.5	Are the sizes of the VGR conductors either 750 kcmil or equal to or larger than the largest conductor used for power distribution in the building? (See Figure 3–29.)	[ ]	[ ]	[ ]

3 FGB

In a multifloor building, FGBs on various floors are connected to the VGR. In a large single–floor building, FGBs can also be used to connect the grounding conductors of communication equipment to the BPG. In a small single–floor building, the BPG can be used as an FGB.

		Y	N	N/A
3.1	Is all the equipment bonded to an FGB located within a 61–m by 61–m (200–ft by 200–ft) square, and not more than 43 m (142 ft) from the FGB (direct line, not cable run)?	[ ]	[ ]	[ ]
3.2	Are the FGBs connected to VGRs per Figure 3–29 or 3–30?	[ ]	[ ]	[ ]
3.3	If the building is of concrete construction, are all FGBs isolated from the building concrete (see Figure 3–32)?	[ ]	[ ]	[ ]
3.4	If the building is of steel frame construction, are all FGBs bonded to the steel by exothermic welds (see Figure 3–33)?	[ ]	[ ]	[ ]

4 Grounding system conductors

		Y	N	N/A
4.1	All all cables identified?	[ ]	[ ]	[ ]
4.2	Are all cables free of splices?	[ ]	[ ]	[ ]
4.3	Are all connections tight?	[ ]	[ ]	[ ]
4.4	Are all bolted joints free of damaged hardware?	[ ]	[ ]	[ ]
4.5	Are all connections free of signs of corrosion?	[ ]	[ ]	[ ]

2.4.7.Entrance cables and CEGB

Procedure 6.
Entrance cables and CEGB

			Y	N	N/A
1	Entrance cables				
	1.1	Are the cable shields connected to the CEGB, protector bar, MDF, or BPG by the most direct routes in accordance with practices of the operating company?	[ ]	[ ]	[ ]
	1.2	In an REA office, do all the cable shields have isolation gaps between the shield ends, and are the shields bonded on the entry side of the gap?	[ ]	[ ]	[ ]
	1.3	Are all cables free of splices?	[ ]	[ ]	[ ]
	1.4	Are all connections tight?	[ ]	[ ]	[ ]
	1.5	Are all bolted joints free of damaged hardware?	[ ]	[ ]	[ ]
	1.6	Are all connections free of signs of corrosion?	[ ]	[ ]	[ ]
2	CEGB		Y	N	N/A
	2.1	Is a CEGB used? If the answer is no, the remainder of this procedure does not apply.	[ ]	[ ]	[ ]
	2.2	Is the CEGB located close to the ends of the entrance cable shields on the entry side of the building?	[ ]	[ ]	[ ]
	2.3	Is the CEGB insulated from the mounting surface? (REA offices require this.)	[ ]	[ ]	[ ]
	2.4	Is the CEGB connected to the BPG or FGB (according to operating company practices) with insulated No. 6 AWG (or larger) cable?	[ ]	[ ]	[ ]
	2.5	Are all cables free of splices?	[ ]	[ ]	[ ]
	2.6	Are all connections tight?	[ ]	[ ]	[ ]
	2.7	Are all bolted joints free of damaged hardware?	[ ]	[ ]	[ ]
	2.8	Are all connections free of signs of corrosion?	[ ]	[ ]	[ ]

2.4.8.MDF equipment

Procedure 7.
MDF equipment

1 MDF

This check concentrates on the ground path of the protectors installed in the circuits going to the DMS switch. It is important that protector current not flow between the DMS switch framework, logic, and BR grounds. It is also important that tip and ring potentials be close to the ground potential of the DMS switch.

		Y	N	N/A
1.1	Are arresters used at the MDF? (Arresters may be solid state, gas tube, or carbon types. Solid state arresters are recommended.)	[ ]	[ ]	[ ]
1.2	Identify the types (solid state, gas tube, or carbon), and the manufacturer, model number, and rating of the protectors used on the MDF. Type: ____________ Manufacturer: ____________ Model number: ____________ Rating: ____________			
1.3	Have protector grounding connections to the MDF ground bar been made in accordance with operating company practices?	[ ]	[ ]	[ ]
1.4	Have MDF ground bar connections to the building grounding system been made in accordance with operating company practices? Typically, in REA single–floor offices the MDF or protector frame ground is connected to the master ground bar; whereas in BOC offices, this ground is connected to both the DMS SPG and the nearest FGB.	[ ]	[ ]	[ ]
1.5	If cable shields are brought to the MDF, are they connected to the ground bar of the MDF in accordance with the practices of the operating company?	[ ]	[ ]	[ ]
	Additional requirements for REA offices with master ground bars (MGBs):			
1.6	Are all leads connected in the appropriate sequence on the MGB as required by the REA or the grounding specifications of the operating company?	[ ]	[ ]	[ ]
1.7	When located on the same floor as the MGB, is the main distribution frame (MDF) or protector frame for the DMS switch connected to the MGB?	[ ]	[ ]	[ ]
1.8	Are all ground cables identified?	[ ]	[ ]	[ ]
1.9	Are all ground cables free of splices? (This includes the connections between the horizontal ground bars of the MDF.)	[ ]	[ ]	[ ]

		Y	N	N/A
1.10	Are all connections tight?	[ ]	[ ]	[ ]
1.11	Are all bolted joints free of damaged hardware?	[ ]	[ ]	[ ]
1.12	Are all connections free of signs of corrosion?	[ ]	[ ]	[ ]
1.13	Are all connections free of painted surfaces?	[ ]	[ ]	[ ]

2.4.9.Radio/microwave equipment

Procedure 8.
Radio/microwave equipment

1 Radio/microwave equipment

1.1 Where is the tower located?

[ ] next to the building
[ ] on the roof of the building

		Y	N	N/A
	If the tower is next to the building:			
1.2	Does the tower have its own ground ring?	[ ]	[ ]	[ ]
1.3	Does each leg of the tower have a connection to the tower grounding electrode system?	[ ]	[ ]	[ ]
1.4	Are all ground leads routed downward with no bends having a radius of less than one foot?	[ ]	[ ]	[ ]
1.5	Is the ground ring of the tower connected outdoors to the CO grounding electrode system by the most direct route and with appropriately sized bare copper wire?	[ ]	[ ]	[ ]
1.6	Is the wave guide or coax shield bonded to a leg of the tower at the top where they first meet, and bonded at the bottom immediately before the cable bends away from the tower?	[ ]	[ ]	[ ]
	If the tower is mounted on the roof of the building:			
1.7	Are the tower legs bonded together in a ring on the roof?	[ ]	[ ]	[ ]
1.8	If the building is a structural steel building, is the tower ground ring bonded to building structural steel at multiple peripheral points?	[ ]	[ ]	[ ]
1.9	If the tower has a ground field and the building is a structural steel building, is the structural steel bonded outside of the building to the tower ground field?	[ ]	[ ]	[ ]
1.10	If the building is not a structural steel building, are the tower legs bonded to the tower ground field by multiple grounding conductor runs outside the building?	[ ]	[ ]	[ ]
1.11	Are all metal objects within 6 feet of the tower ground ring or the tower itself bonded to the ring ground?	[ ]	[ ]	[ ]
	For all towers:			
1.12	For REA offices, if a bulkhead plate is used, is it bonded to the tower ground field by the most direct route?	[ ]	[ ]	[ ]
1.13	For BOC offices, if a bulkhead plate is used, is it bonded to an FGB on the same floor?	[ ]	[ ]	[ ]
1.14	Are all cabinets that are located within the building and associated with the tower system connected to an appropriate FGB?	[ ]	[ ]	[ ]
1.15	Are all cables free of splices?	[ ]	[ ]	[ ]

2.4.10.DMS TOPS equipment

Procedure 9.
DMS TOPS equipment

1 TOPS MPX

The TOPS MPX (operator workstations and MPX equipment frames) should be installed in the CBN (see Figures 4–2 and 4–3). If requested by an operating company, a TOPS MPX system can be installed as an IBN (see Figures 4–4 and 4–5).

1.1 Indicate where the operator workstations are located:

- [ ] workstations and associated MPX equipment frames are located on the same floor
- [ ] workstations and associated MPX equipment frames are located on different floors
- [ ] workstations are located in the same building as the associated host DMS switch
- [ ] workstations are not located in the same building as the associated host DMS switch

1.2 Indicate how the operator workstations are powered:

- [ ] ac panel dedicated to TOPS MPX equipment
- [ ] branch circuits
- [ ] stand–alone inverter
- [ ] uninterruptible power source

	Y	N	N/A
1.3 Are the monitor and terminal base unit of each workstation grounded by way of ACEG conductors as shown in Figure 4–1?	[ ]	[ ]	[ ]
1.4 Are the workstations within 366 cable meters (1200 cable feet) of the associated MPX equipment frames?	[ ]	[ ]	[ ]
1.5 Are TOPS MPX equipment frames bonded to the building grounding system with at least a No. 6 AWG wire?	[ ]	[ ]	[ ]

For TOPS MPX workstations installed in the CBN:

Note that insulation between the TOPS MPX equipment frames and the floor is not required.

	Y	N	N/A
1.6 Are all customer–provided furniture and privacy panels that have metallic content bonded to an appropriate ground reference such as an FGB?	[ ]	[ ]	[ ]

In a raised floor installation, customer–provided furniture and privacy panels may be bonded to a ground plane or grid that is bonded to an FGB.

For TOPS MPX workstations installed as an IBN:

	Y	N	N/A
1.7 Are the green wires of the ac circuits for the workstations referenced to the system SPG (see Figures 4–4 and 4–5)?	[ ]	[ ]	[ ]

		Y	N	N/A
1.8	Is a power strip used to connect the TOPS MPX workstations and DSU power cords to the ACEG electrical outlet?	[ ]	[ ]	[ ]
1.9	Is the ACEG junction box bonded to the SPG within a maximum distance of 1 m (3 feet)?	[ ]	[ ]	[ ]
1.10	Is all the conduit between the workstations and the SPG isolated from incidental grounds?	[ ]	[ ]	[ ]
1.11	Are the ac receptacles free of any non–isolated equipment plugged into the receptacles?	[ ]	[ ]	[ ]
1.12	Are the workstations located within one floor of the system SPG?	[ ]	[ ]	[ ]
1.13	If bonded to the SPG, are MPX equipment frames insulated from the floor?	[ ]	[ ]	[ ]
1.14	Are all customer–provided furniture and privacy panels that have metallic content bonded to the system SPG with at least No. 10 AWG wire?	[ ]	[ ]	[ ]

2 TOPS MP

Operator workstations for TOPS MP should be installed in the CBN (see Figures 4–6 and 4–7). If requested by an operating company, TOPS MP workstations can be installed as an IBN (see Figures 4–8 and 4–9). The AAE, PCE, and CBT cabinets are always installed as an IBN as shown in Figures 4–6 through 4–9).

2.1 Indicate where the operator workstations are located:

- [ ] workstations and associated AAE and PCE cabinets are located on the same floor
- [ ] workstations and associated AAE and PCE cabinets are located on different floors
- [ ] workstations are located in the same building as the associated host DMS switch
- [ ] workstations are not located in the same building as the associated host DMS switch

2.2 Indicate how the operator workstations are powered:

- [ ] ac panel dedicated to TOPS MP equipment
- [ ] branch circuits
- [ ] stand–alone inverter
- [ ] uninterruptible power source

		Y	N	N/A
2.3	Are the display monitors grounded by way of ACEG conductors as shown in Figure 4–10?	[ ]	[ ]	[ ]
2.4	Are the workstations grounded as shown in Figure 4–11?	[ ]	[ ]	[ ]

		Y	N	N/A
2.5	Are bonding and grounding conductor sizes of the workstations in agreement with Table 4–1? If not, list the conductors that do not meet the requirements of Table 4–1. ______________________________ ______________________________ ______________________________ ______________________________	[ ]	[ ]	[ ]
2.6	Are the operator workstations within 366 cable meters (1000 cable feet) of the associated AAE, PCE, and CBT cabinets?	[ ]	[ ]	[ ]
For TOPS MP workstations installed in the CBN:				
2.7	Are all customer–provided furniture and privacy panels that have metallic content bonded to an appropriate ground reference such as an FGB? In a raised floor installation, customer–provided furniture and privacy panels may be bonded to a ground plane or grid that is bonded to an FGB.	[ ]	[ ]	[ ]
For TOPS MP workstations installed as an IBN:				
2.8	Are the workstations located within one floor of the system SPG?	[ ]	[ ]	[ ]
2.9	Are the green wires of the ac circuits for the workstations referenced to the system SPG (see Figures 4–7 and 4–8)?	[ ]	[ ]	[ ]
2.10	Is the ACEG junction box bonded to the SPG within a maximum distance of 1 m (3 ft)?	[ ]	[ ]	[ ]
2.11	Is all the conduit between the workstations and the SPG isolated from incidental grounds?	[ ]	[ ]	[ ]
2.12	Are the ac receptacles free of any plugged–in non–isolated equipment?	[ ]	[ ]	[ ]
2.13	Are all customer–provided furniture and privacy panels that have metallic content bonded to the system SPG with at least No. 10 AWG wire?	[ ]	[ ]	[ ]
2.14	Is all TOPS MP equipment referenced to only one SPG?	[ ]	[ ]	[ ]

For AAE, PCE, and CBT cabinets:

		Y	N	N/A
2.15	Are all AAE, PCE, and CBT cabinets isolated from incidental grounds?	[ ]	[ ]	[ ]
2.16	Are the bonding and grounding conductor sizes of the AAE, PCE, and CBT cabinets in agreement with Table 4–2? If not, list the conductors that do not meet the requirements of Table 4–2. ______________________________ ______________________________ ______________________________ ______________________________	[ ]	[ ]	[ ]
	In some earlier installations, the frame ground of the AAE was bonded directly to the DMS SPG of the power plant feeding the AAE and PCE cabinets. If this is such an installation, is the bonding cable at least as large as the power feeds to the AAE?	[ ]	[ ]	[ ]
2.17	Is the LR of the PCE bonded to the DMS SPG with at least a No. 6 AWG cable?	[ ]	[ ]	[ ]
2.18	Is the BR of the power plant bonded to the DMS SPG by with a 750 kcmil cable?	[ ]	[ ]	[ ]
2.19	Is there only one DMS SPG associated with the power plant?	[ ]	[ ]	[ ]
2.20	Is the DMS SPG located within one floor of the AAE and PCE frames?	[ ]	[ ]	[ ]
2.21	Is all communication between the PCE or AAE and the TAMI, printers, and VDUs done through modems?	[ ]	[ ]	[ ]

3 TOPS 04

Operator workstations for TOPS 04 are installed as an IBN (see Figures 4–14 and 4–15). At most sites, a cluster of workstations is powered from the existing dc power facility used to operate other equipment. Northern Telecom recommended that TOPS 04 workstations be powered from a distribution panel local to the workstations.

3.1 Indicate where the operator workstations are located:

- [ ] workstations are located in the same building as the associated host DMS switch
- [ ] workstations are not located in the same building as the associated host DMS switch

3.2 Indicate how the operator workstations are powered:

- [ ] dc distribution panel local to TOPS 04
- [ ] dc power plant dedicated to TOPS 04
- [ ] shared dc power plant
- [ ] dc–dc converter plant with isolated input/output

		Y	N	N/A
3.3	Are the workstations grounded as shown in Figure 4–14?	[ ]	[ ]	[ ]
3.4	Are all workstations referenced to only one system SPG?	[ ]	[ ]	[ ]
3.5	Are all workstations isolated from incidental grounds?	[ ]	[ ]	[ ]
3.6	Are all workstations located within one floor of the system SPG (see Figures 4–15 and 4–16)?	[ ]	[ ]	[ ]
3.7	Are all customer–provided furniture and privacy panels that have metallic content bonded to the system SPG with at least No. 10 AWG wire?	[ ]	[ ]	[ ]
3.8	Is the BR bar of the power plant bonded to the SPG with a 750 kcmil cable?	[ ]	[ ]	[ ]
3.9	If the workstations are located more than one floor away from the point where the dc power plant is bonded to the building grounding system,	[ ]	[ ]	[ ]
	a) Is a dc–dc converter plant used to provide isolated dc power (see Figure 4–16)?	[ ]	[ ]	[ ]
	b) Is isolated dc power provided to the workstations?	[ ]	[ ]	[ ]

3. Drawings for DMS switch equipment

An integral part of the audit is a carefully prepared schematic of the office grounding system. The accuracy of this schematic is valuable for analyzing and resolving identified grounding problems. The schematic of the building grounding system made during the DMS switch office audit should be in agreement with the information provided in the following figures and tables.

3.1. DMS switch equipment

Figure 3-1.
Example of DMS switch bonding and grounding for BOC office

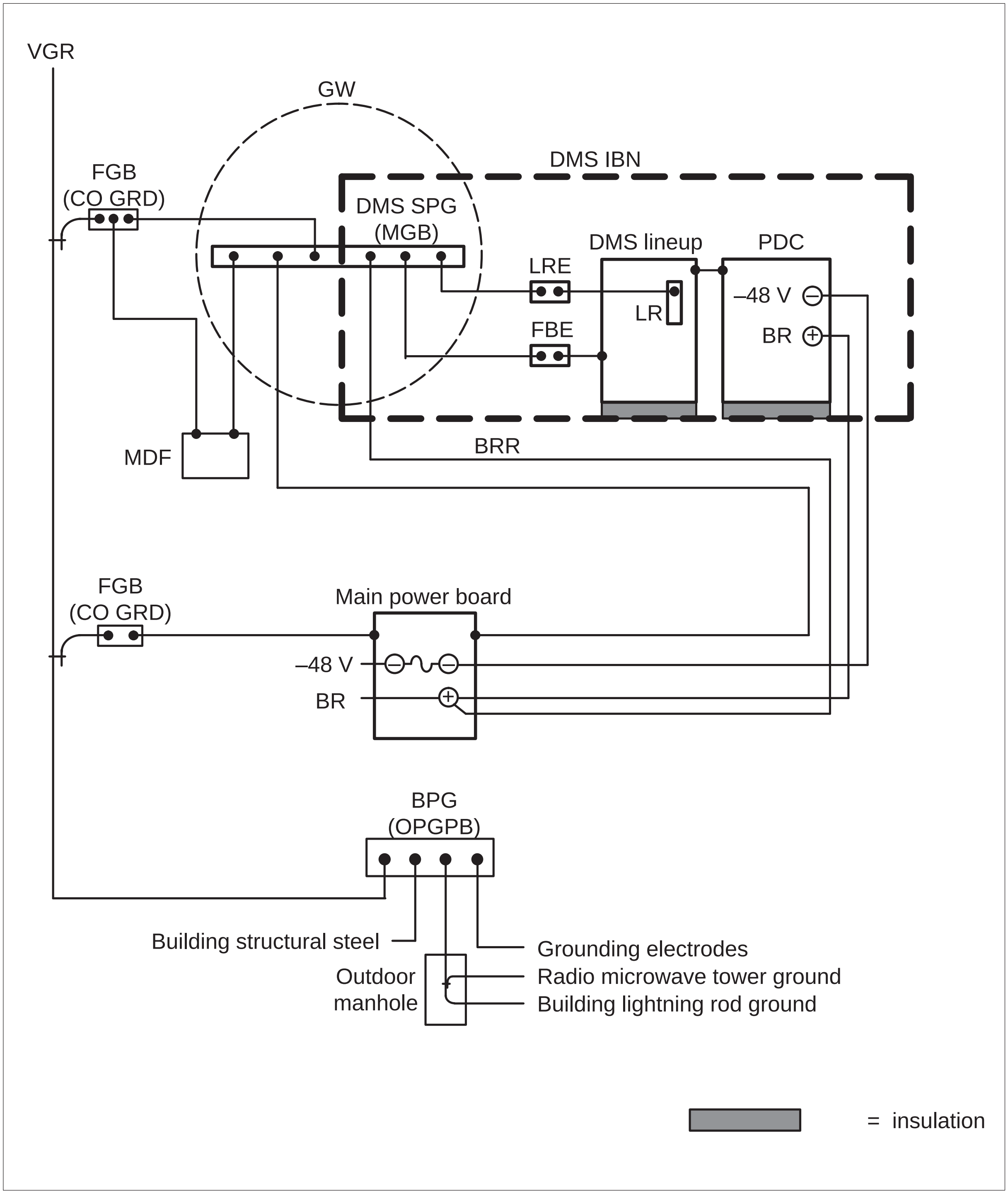


Figure 3-2.
Example of DMS switch bonding and grounding for REA office

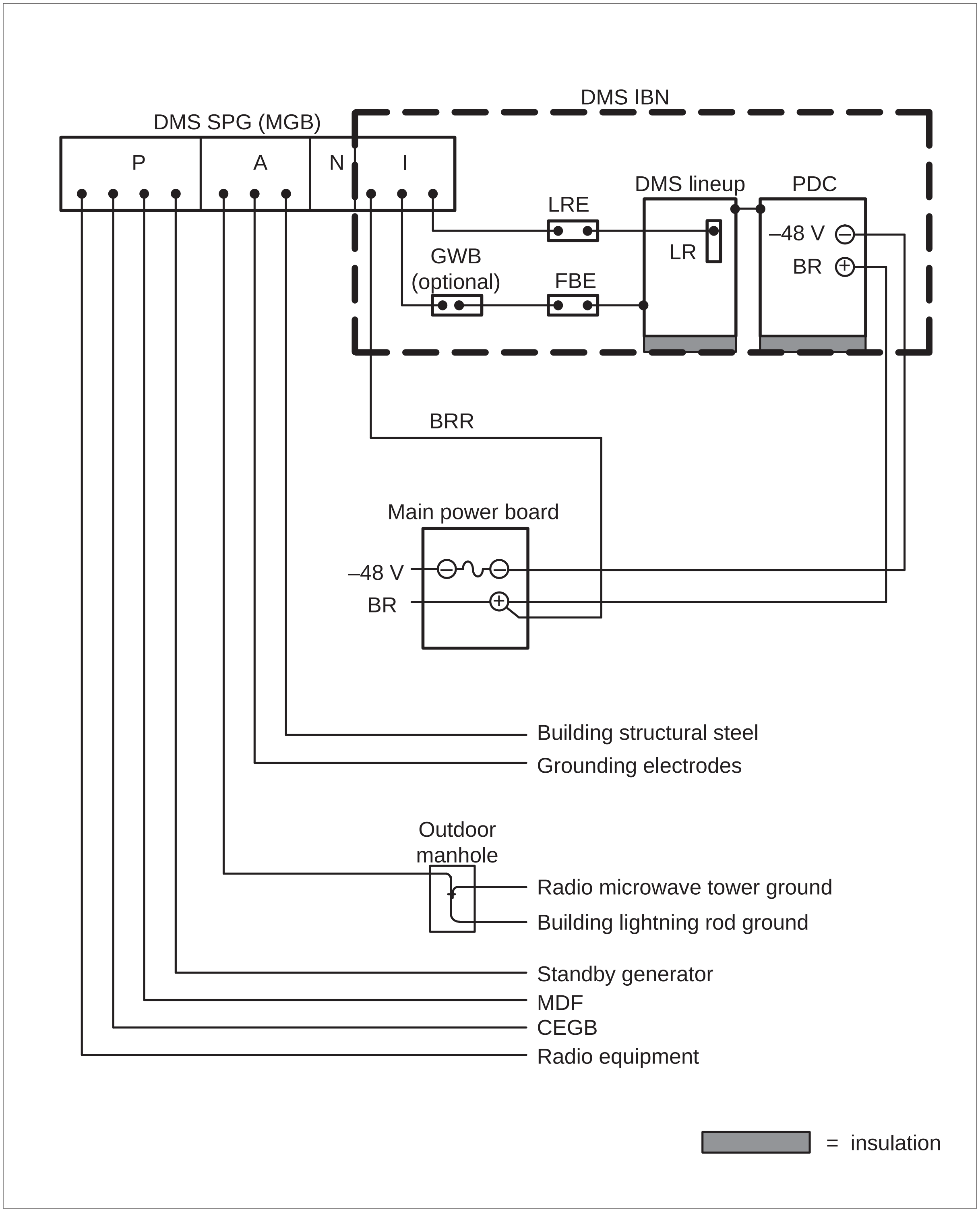


Figure 3-3.
Isolation of DMS IBN

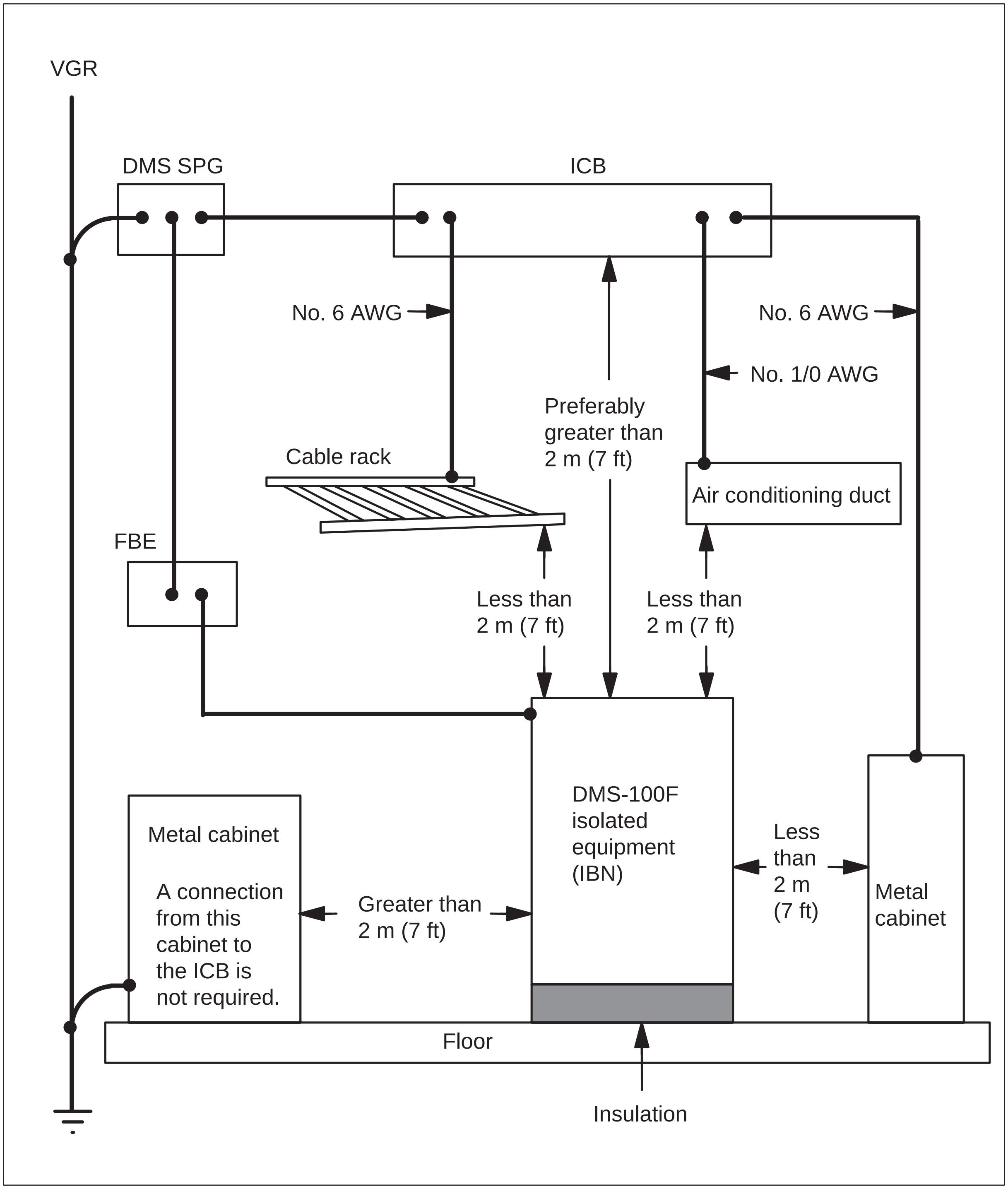
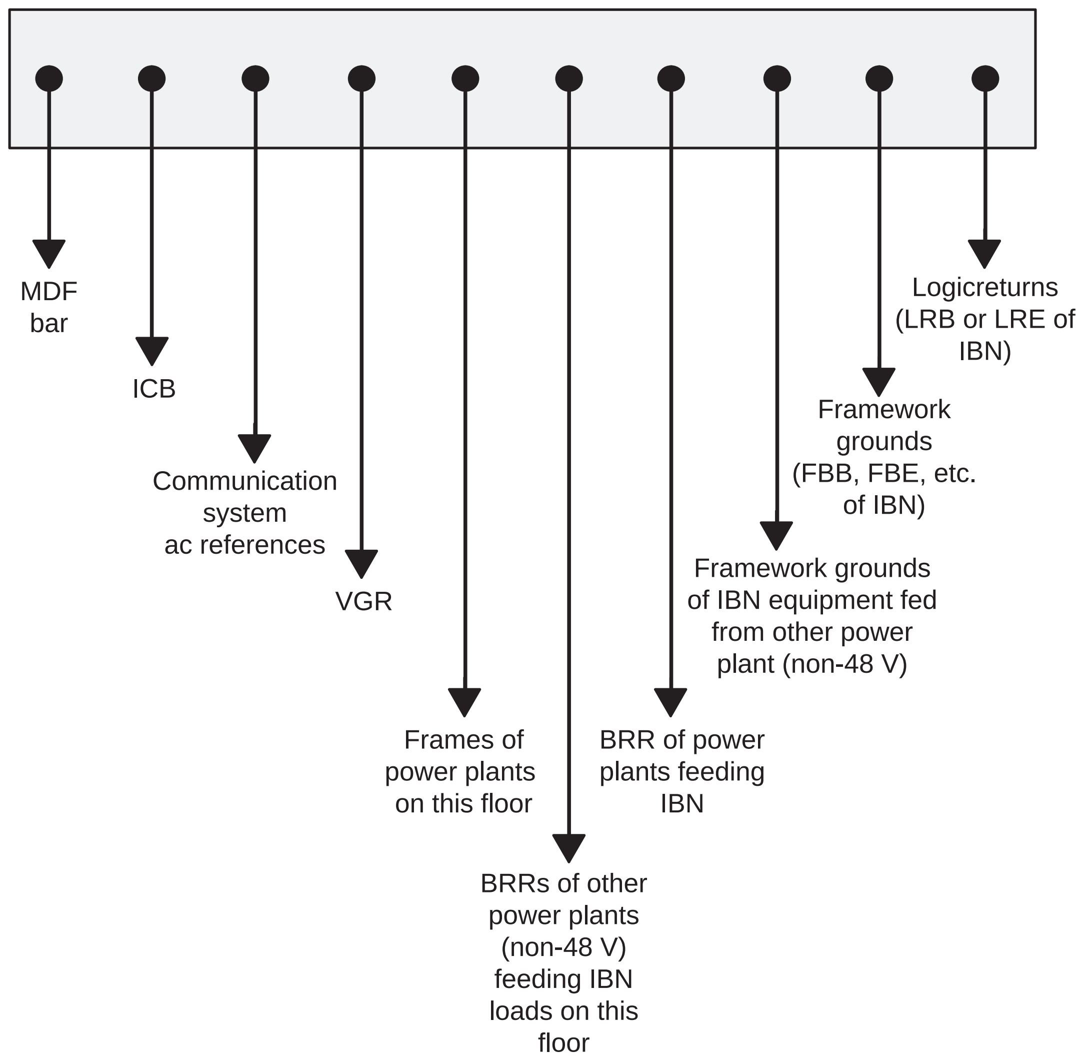
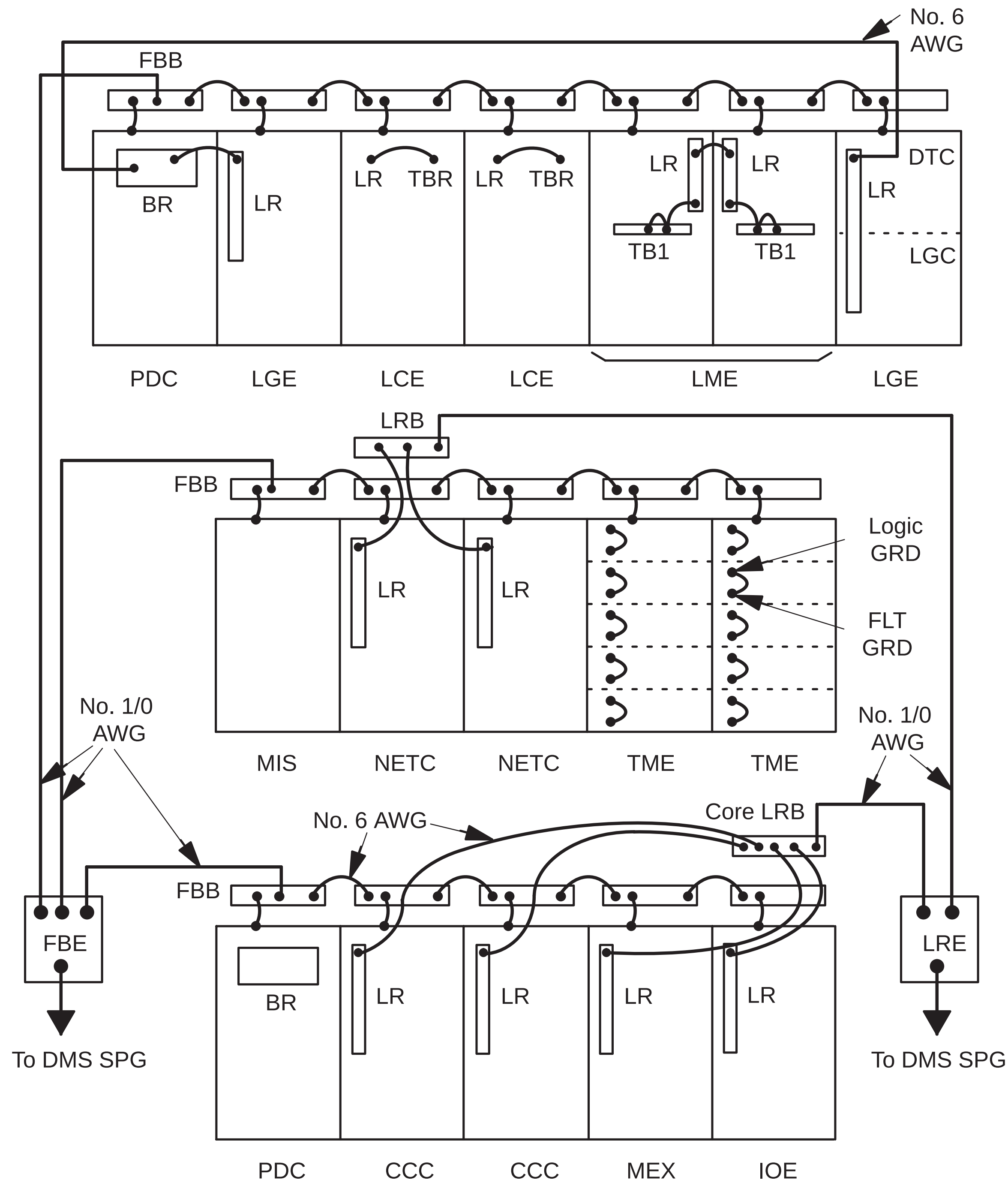


Figure 3-4.
Example of FGB used as SPG



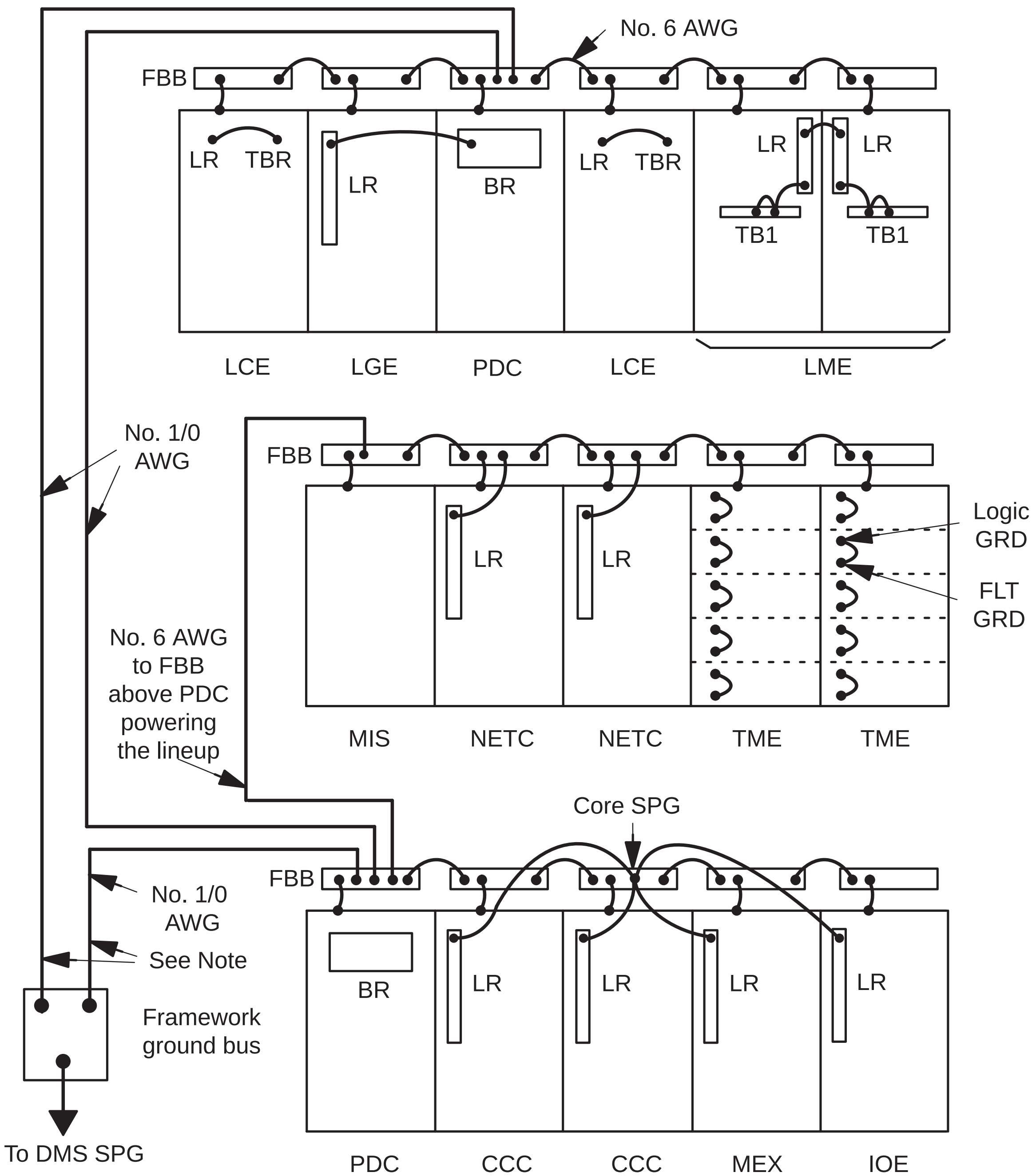
Note: Ignore the connections not available in a specific application while maintaining the sequence of the available connections.

Figure 3-5.
Typical 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 3-6.
Typical non-ISG DMS-100F framework bonding and logic return networks

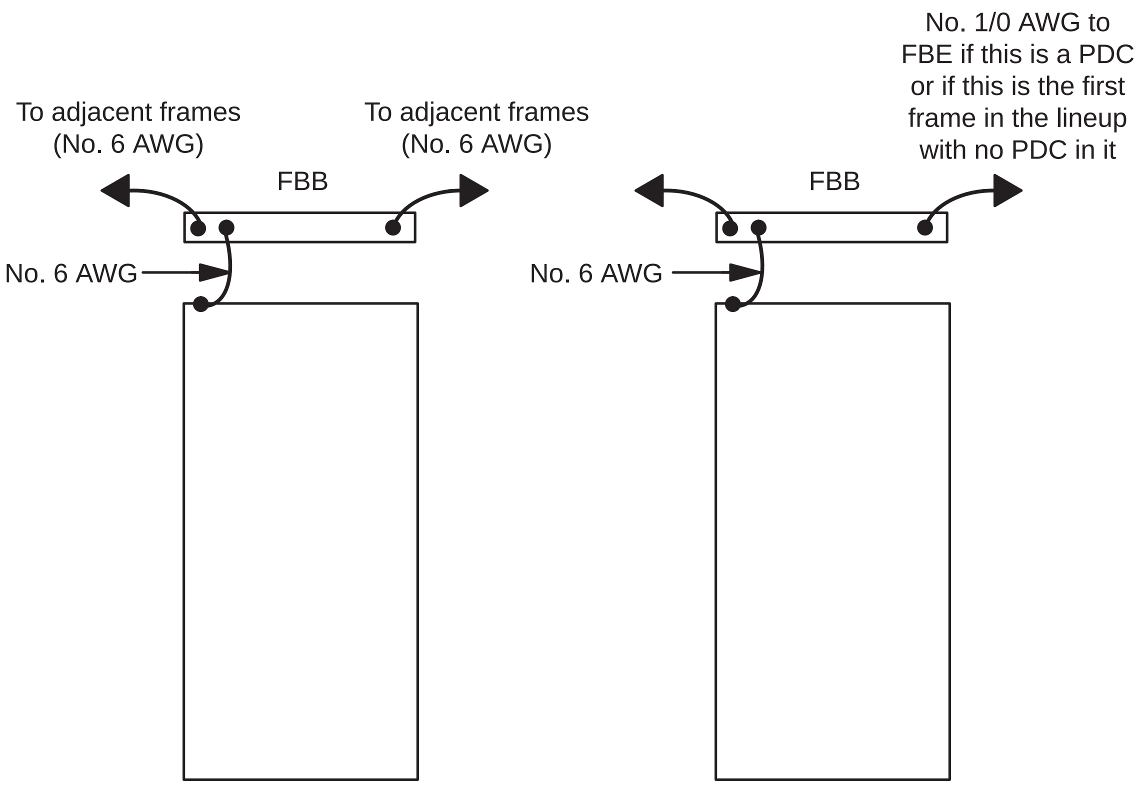


Note: Earlier installations may have framework ground referenced to the BR plate of PDC-00.

Figure 3-7.
Frame index A–(ISG only)

The following frames belong to index A:

DNI	NT0X18AA	
DNI	NT0X18CB	
FIE	NT0X46AE	
KSE	NT5X56AA	
MIS	NT0X02AA	
MIS	NT0X02AB	(Note 1)
MSS	NT0X85AA	
PDC	NT0X42AA	
PDC	NT0X42BA	
RME, RSE	NT0X02AB	(Note 2)
SLC	NT0X56AA	
SSC	NT9X01FA	

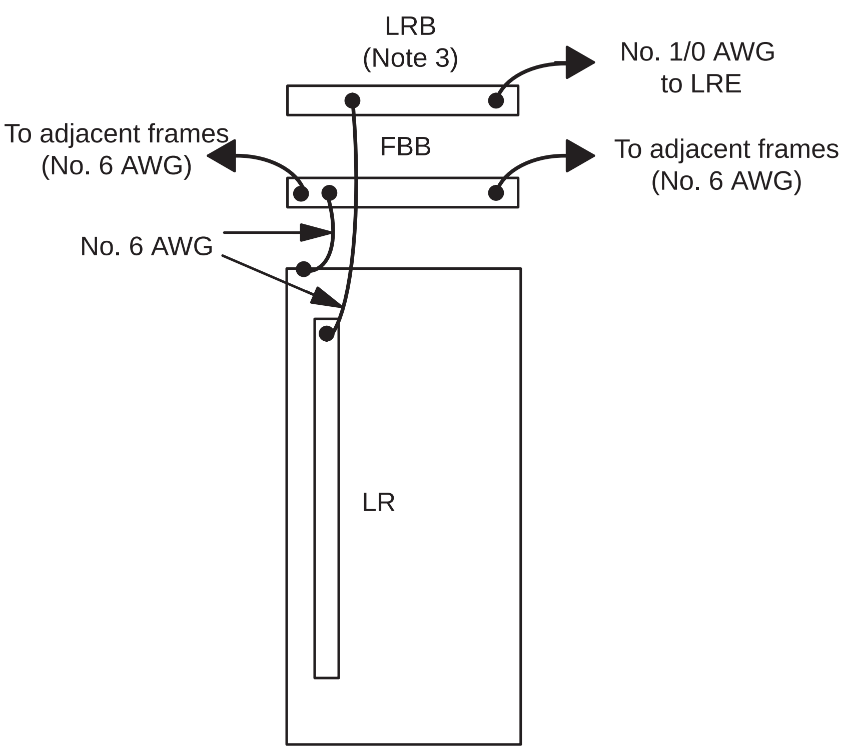


Note 1: For MIS frames equipped with modems, modem shelves, or inverters see index D.
Note 2: For RME/RSE frames equipped with modems, modem shelves, or inverters see index F.

Figure 3-8.
Frame index B–(ISG only)

The following frames belong to index B:

DCE	NT0X46AA		NET	NT0X48AH	(Note 2)
DCE	NT0X46BA		NET	NT0X48AJ	(Note 2)
DTE	NT6X01AA	(Note 1)	NETC	NT5X13AA	
DSNE	NT6X10AA		NETC	NT5X13BA	
IDTE	NT6X01BA	(Note 1)	MS6E	NT6X06AA	
N6E	NT5X08AA		MS6E	NT6X06AB	
N6E	NT5X08AB		MS6E	NT6X06AC	
NET	NT0X48AA	(Note 2)	SCSE	NT6X15AB	
NET	NT0X48AB	(Note 2)	SCSE	NT6X15AA	
NET	NT0X48AC	(Note 2)	TAE	NT5X12AA	
NET	NT0X48AG	(Note 2)	TAE	NT5X12AB	



Note 1: For DMS-200 and DMS-300 applications only, the DTE/IDTE vertical logic return bar shall be connected as shown above for index B. For all other applications, the DTE/IDTE vertical logic return bar shall be connected to the BR plate of the PDC that supplies their power.

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

Note 3: Typically, there is one LRB per lineup. Additional LRBs can be added to a lineup when necessary.

Figure 3-9.
Frame index C—(ISG only)

The following frames belong to index C:

ITME	NT0X46AB
TME	NT0X46AA

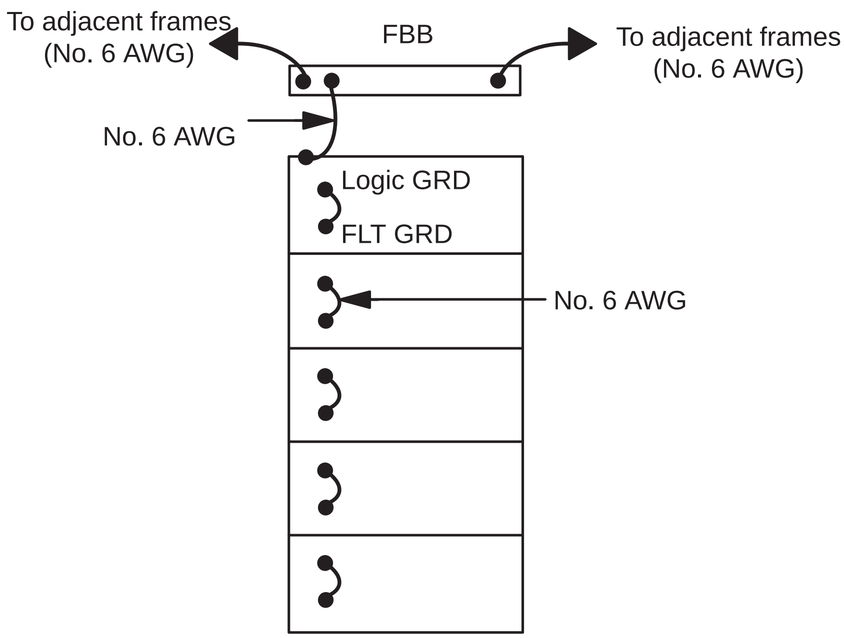
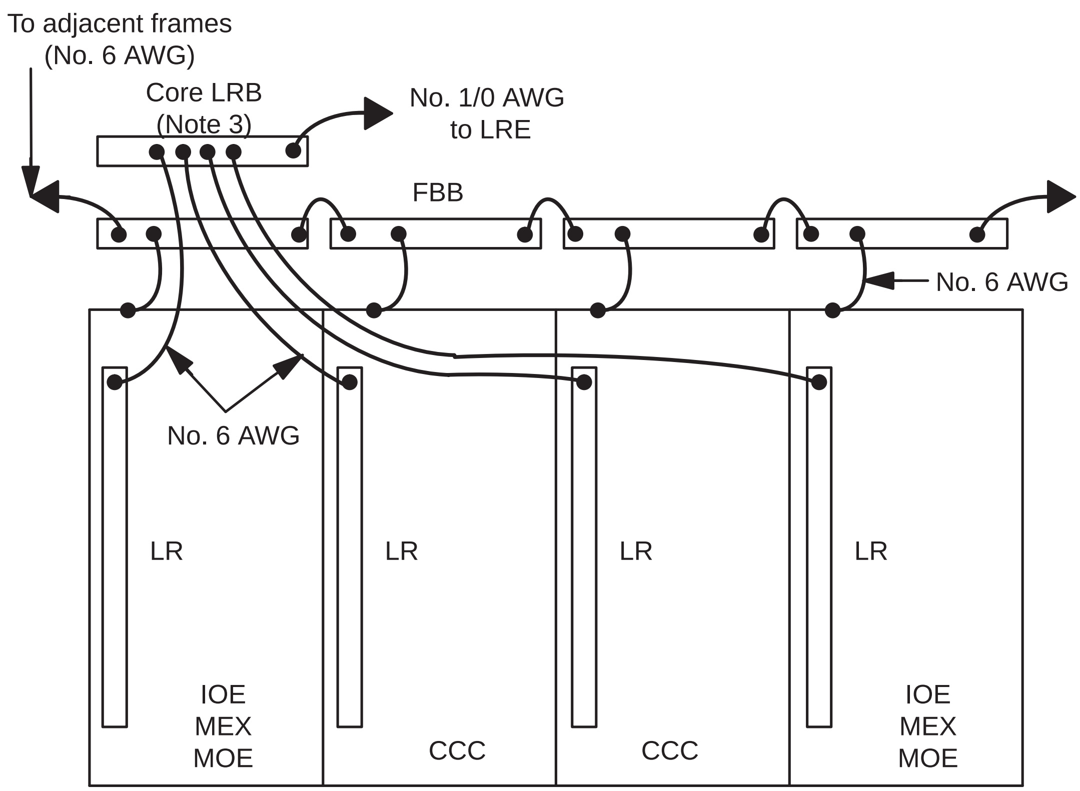


Figure 3-10.
Frame index D—(ISG only)

The following frames belong to index D:

CCC	NT0X41AC	(Note 1)	IOE	NT0X43AD	
CCC	NT0X41AJ	(Note 1)	MEX	NT0X41AB	(Note 1)
CCC	NT3X45AA		MEX	NT0X41AK	(Note 1)
CCC	NT3X45DA		MEX	NT3X45DB	
CCC	NT3X45DW		MEX	NT3X45AB	
CCC	NT3X45EA		MEX	NT3X45CB	
CCC	NT3X45EW		MOE	NT0X43BA	(Note 2)
CCC	NT3X45CA		MTC	NT0X43AB	
IOE	NT0X43AA	(Note 1)	MTC	NT0X43AC	



Note 1: These frames have two vertical logic return bars per frame connected together with No. 6 AWG cable.

Note 2: The modem equipment frame (MOE or a dedicated MIS) shall be located 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 to the core LRB shall not exceed 50 ft.

Note 3: All frames of frame index D must be connected to the core LRB. No other frames can be connected to the core LRB.

Figure 3-11.
Frame index E—(ISG only)

The following frames belong to index E:

ISLE	NT8X70AA
LCE	NT6X03AA
LCE	NT6X03AC
LCE	NT6X03RA
LCE	NT6X03RB
LCEI	NTBX30AB
LCEI	NTBX60AA
RLCM	NT6X14AA

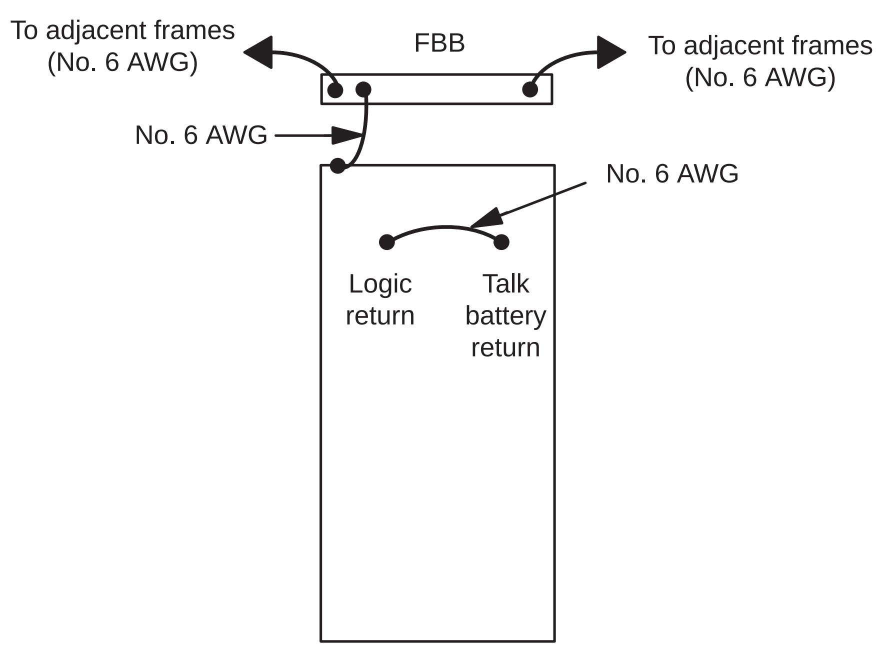
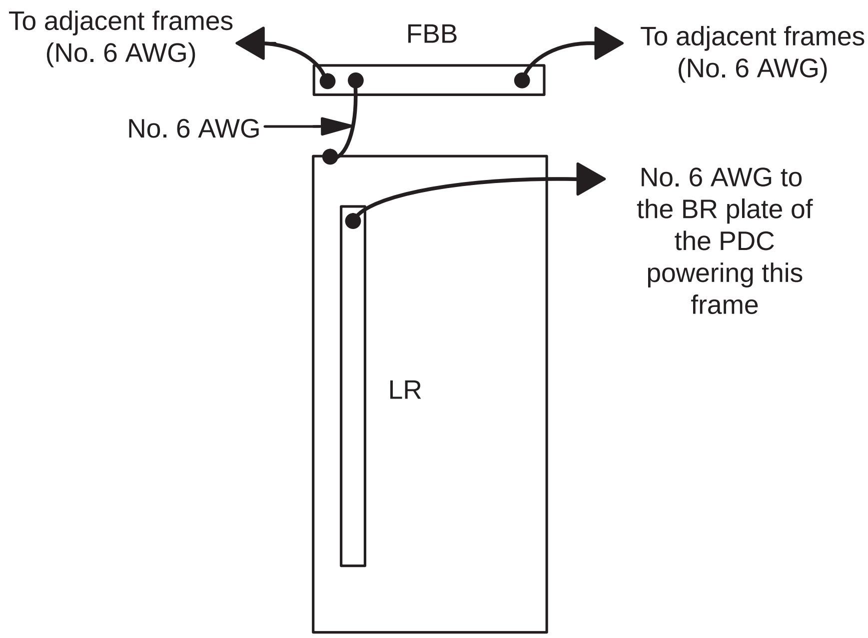


Figure 3-12.
Frame index F—(ISG only)

The following frames belong to index F:

CPEI	NT6X01AB		LTE/ILTE	NT6X01AA	
DLE	NT7X50AA		MS7E	NT6X31AA	
DME	NT6X29AA		RCE	NT6X10AC	
DTE, IDTE	NT6X01AA	(Note 1)	RME, RSE	NT0X02AB	(Note 2)
IAE	NTBX40AA		SME, SMS	NT6X01AA	
LGE/ILGE	NT6X01AA		ST6E, ST7E, STE	NT6X09AA	



Note 1: For DMS-100 and DMS-100/200 applications only, the DTE/IDTE vertical logic return bar shall be connected as per this index. For all other applications the DTE/IDTE vertical logic return bar shall be connected to the LRB of the lineup.

Note 2: When RME or RSE frames are equipped with modems, modem shelves, or inverters, these frames are provisioned with a vertical logic return bar that is connected to the BR plate of the RME/RSE.

Figure 3-13.
Frame index G—(ISG only)

The following frames belong to index F:

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

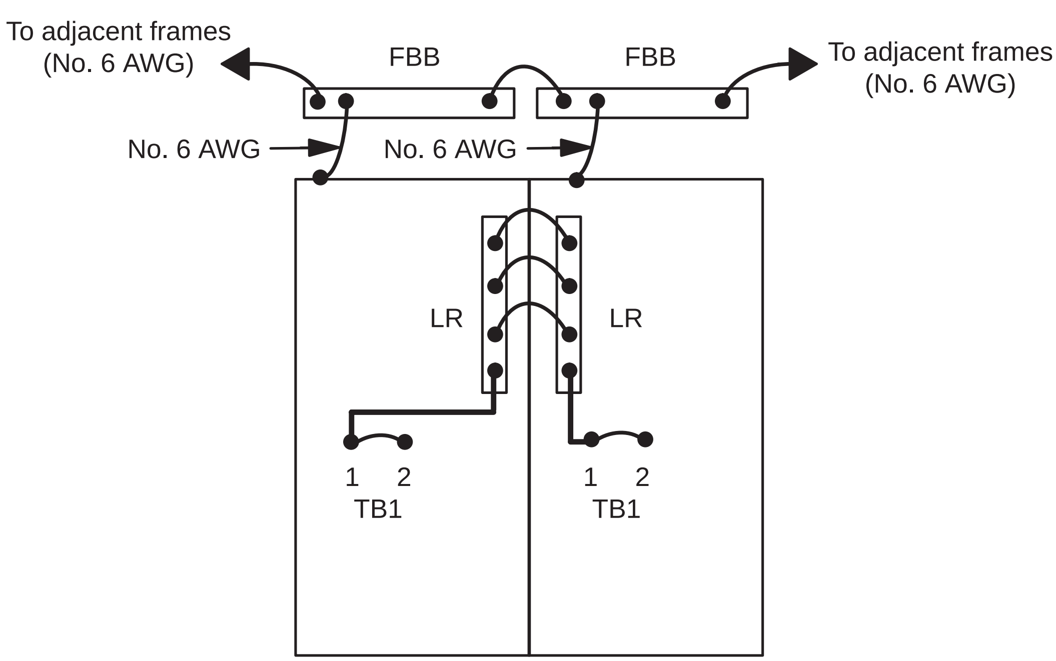
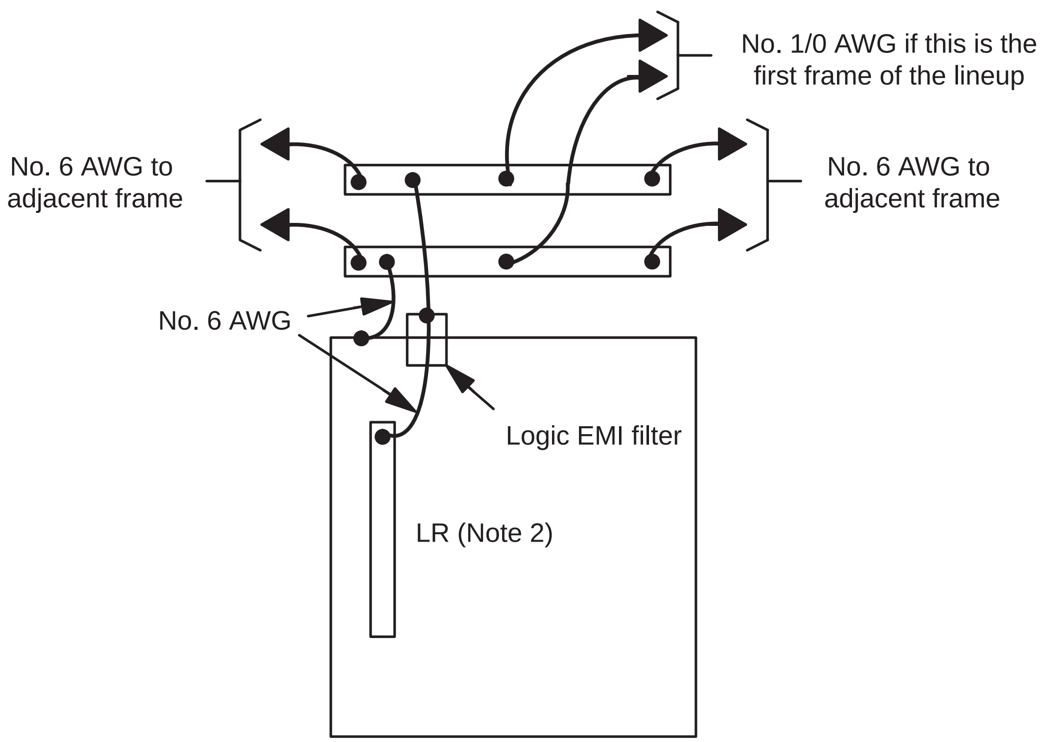


Figure 3-14.
Frame index H—(ISG only)

The following frames belong to index H:

CMDC	NT9X01AA
DPCC	NT9X01JA
DPCC	NT9X01BA
MSDC	NT9X01CA
MSSC	NT9X01GA
MSDC	NT9X01LA
ENET	NT9X05AB
LIM	NT9X70AA

Core cabinets (Note 1)

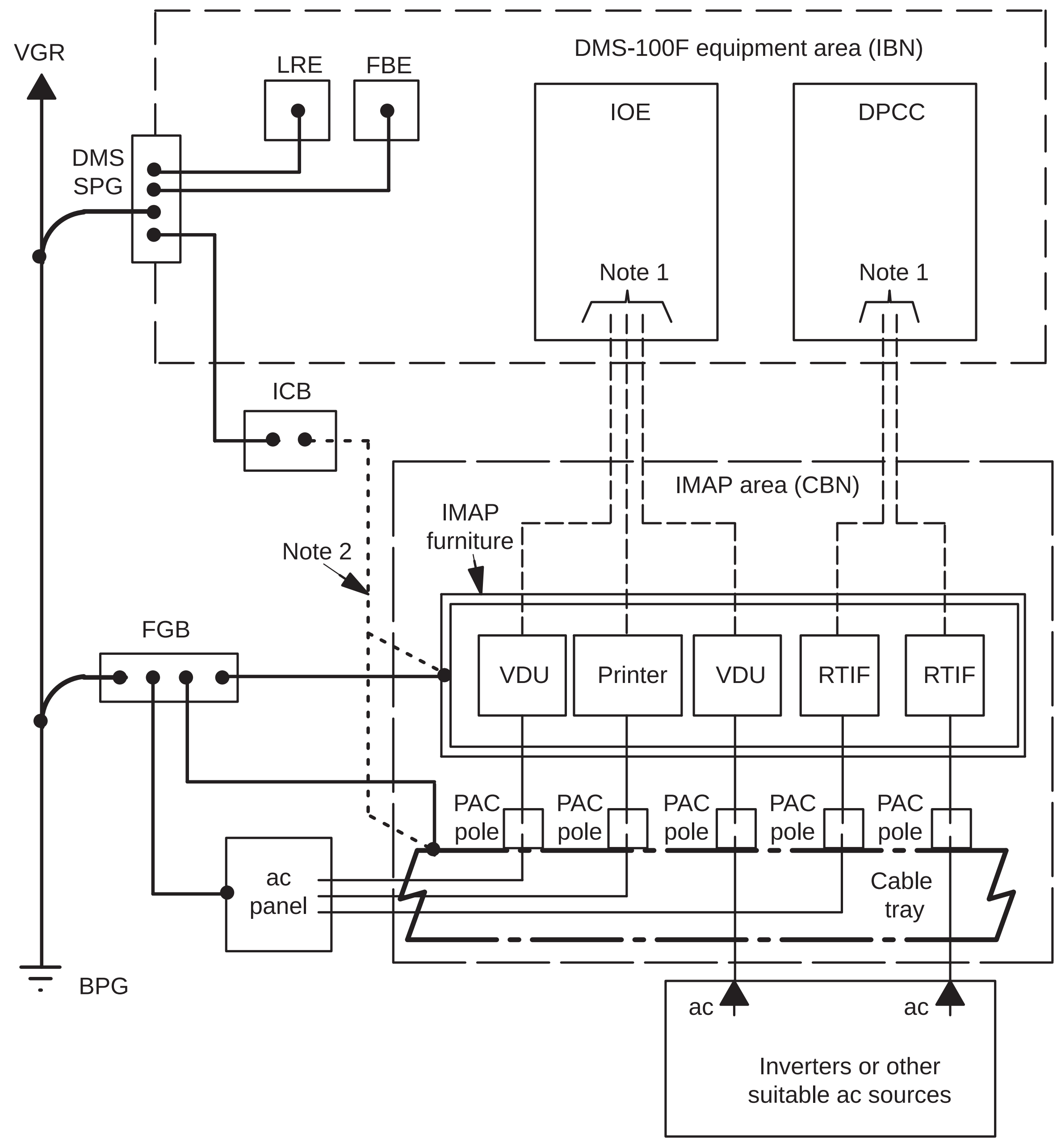


Note 1: The LRB of a core cabinet shall be connected to the core LRB, typically located over the IOE using a No. 1/0 AWG cable.

Note 2: These cabinets have two vertical logic return bars per cabinet internally connected together with No. 6 AWG cable. Earlier cabinets have two logic EMI filters per cabinet.

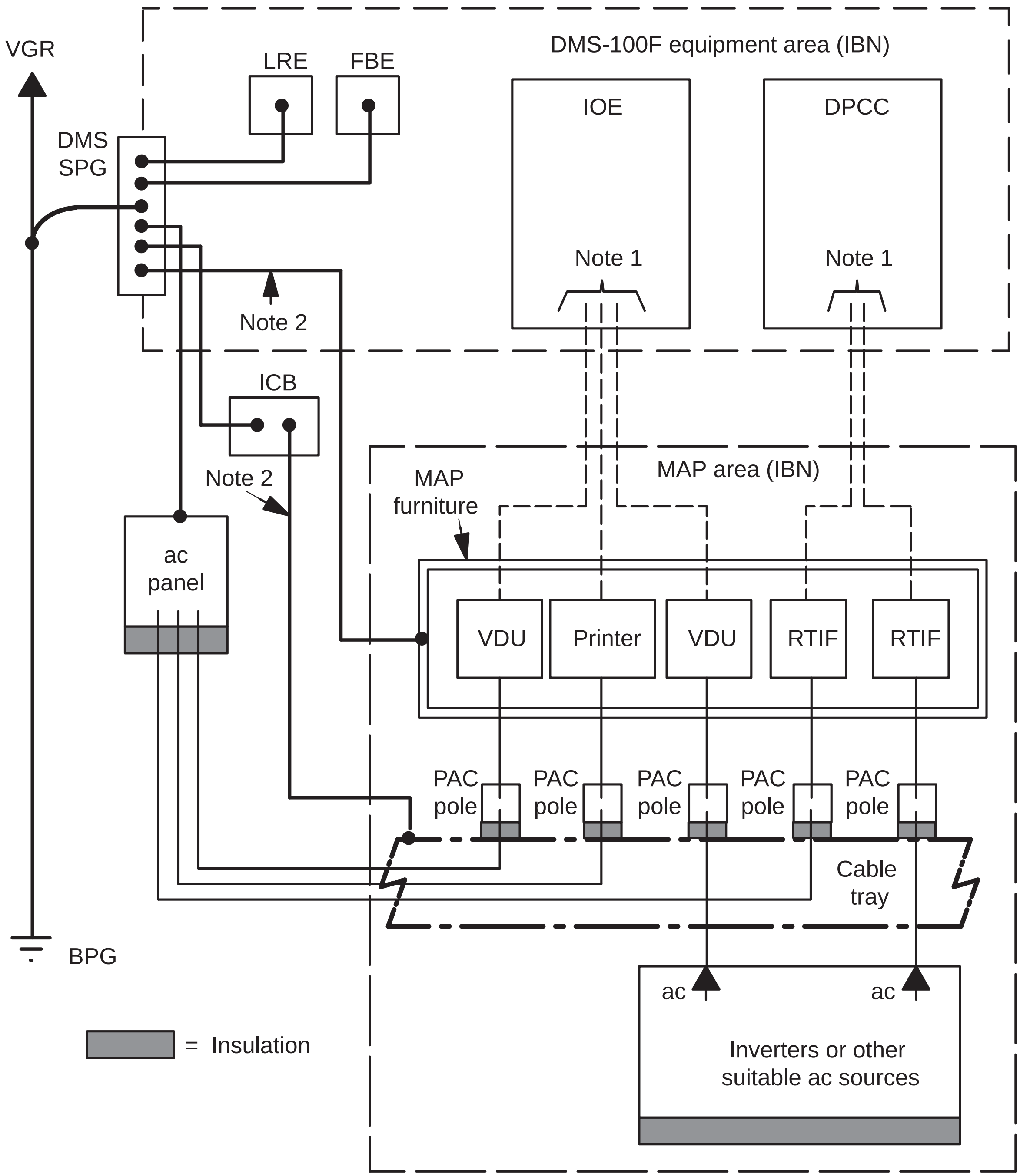
3.2. MAP equipment

Figure 3-15.
Typical IMAP power and grounding



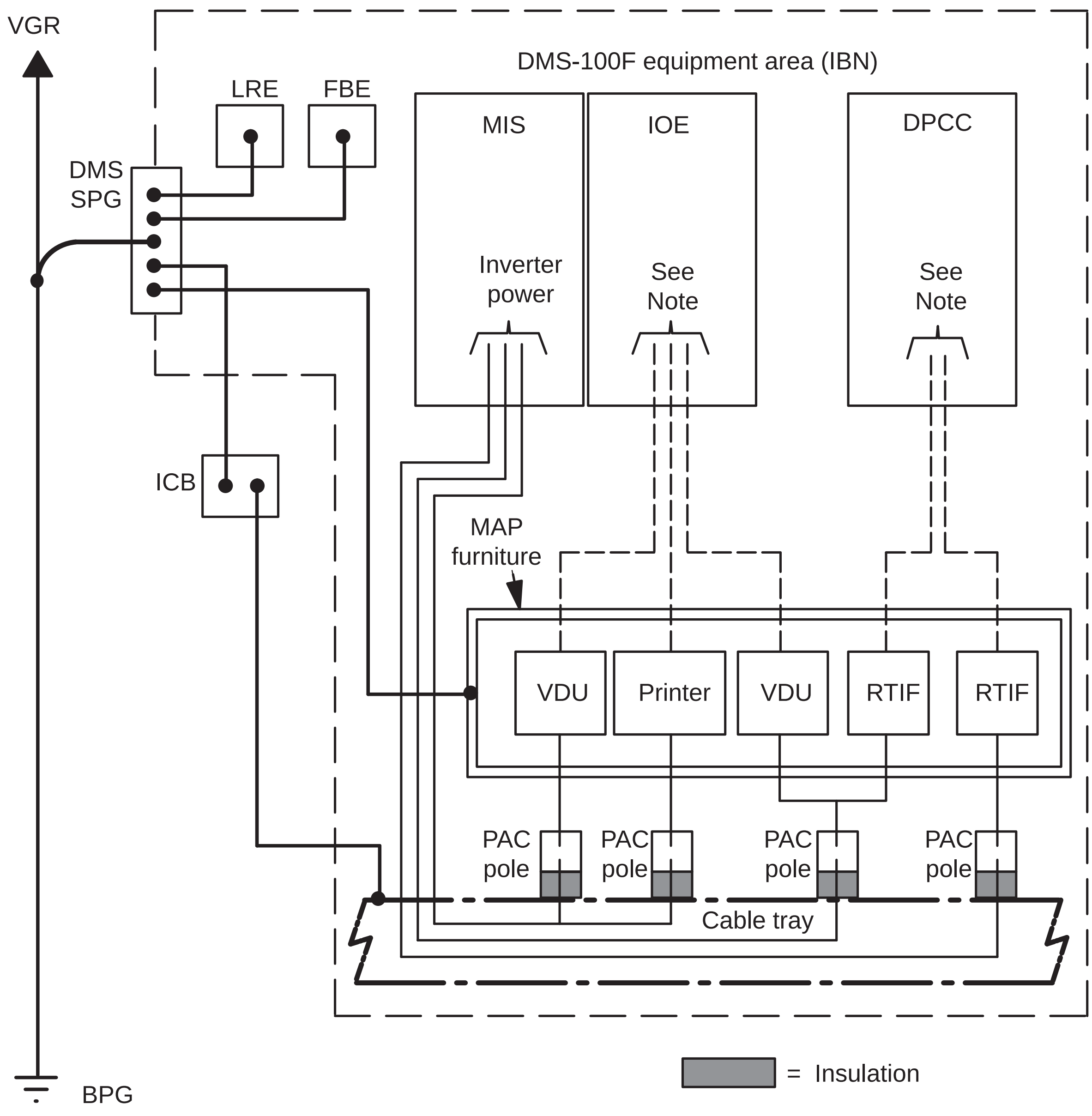
Note 1: These links are current loops or other isolated communication links.
Note 2: Connect to the ICB rather than the FGB when located within 2 m (7 ft) of the switch IBN and not already bonded to the FGB or DMS SPG.

Figure 3-16.
Typical MAP power and grounding



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

Figure 3-17.
Typical earlier MAP power and grounding for ISG DMS



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

Figure 3-18.
Typical earlier MAP power and grounding for non-ISG DMS

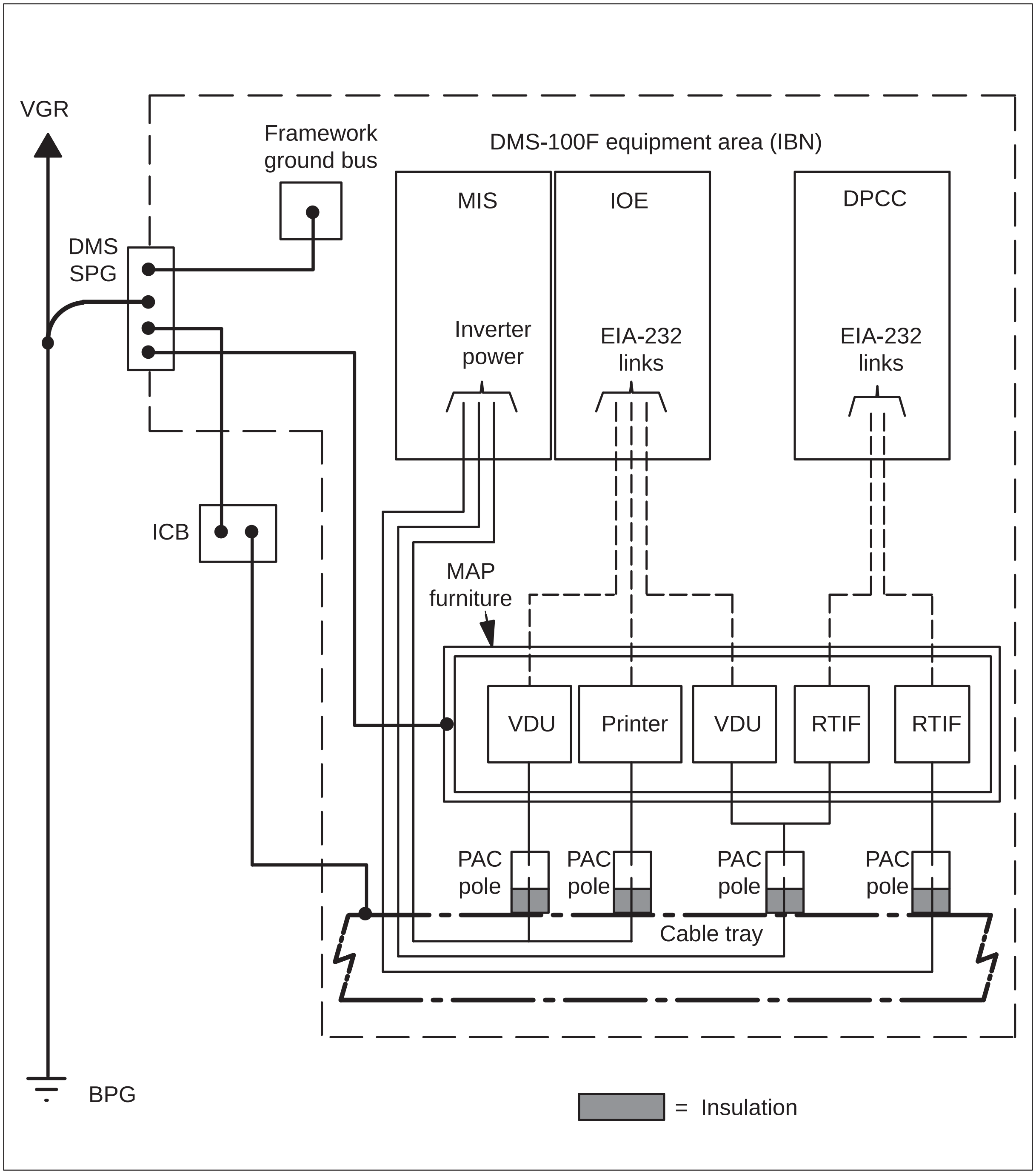
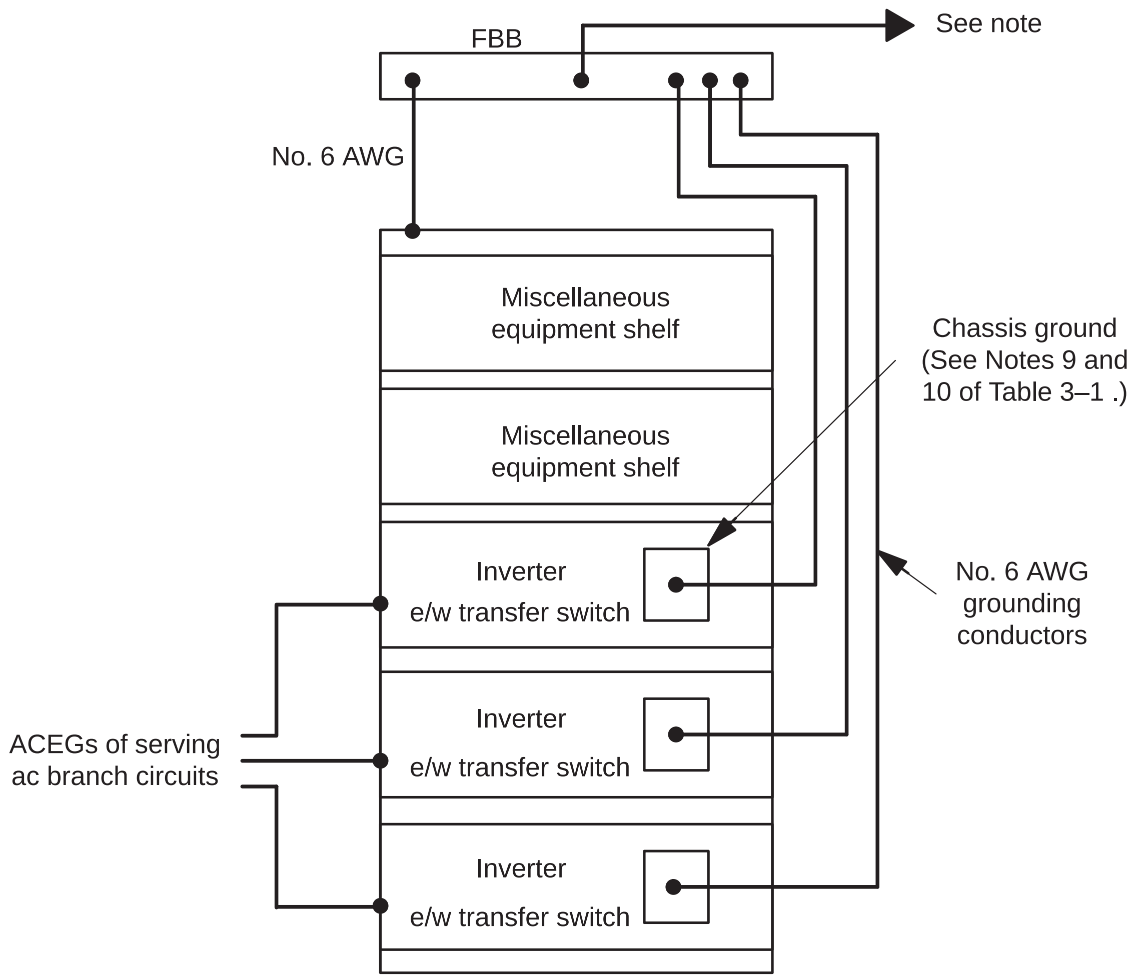
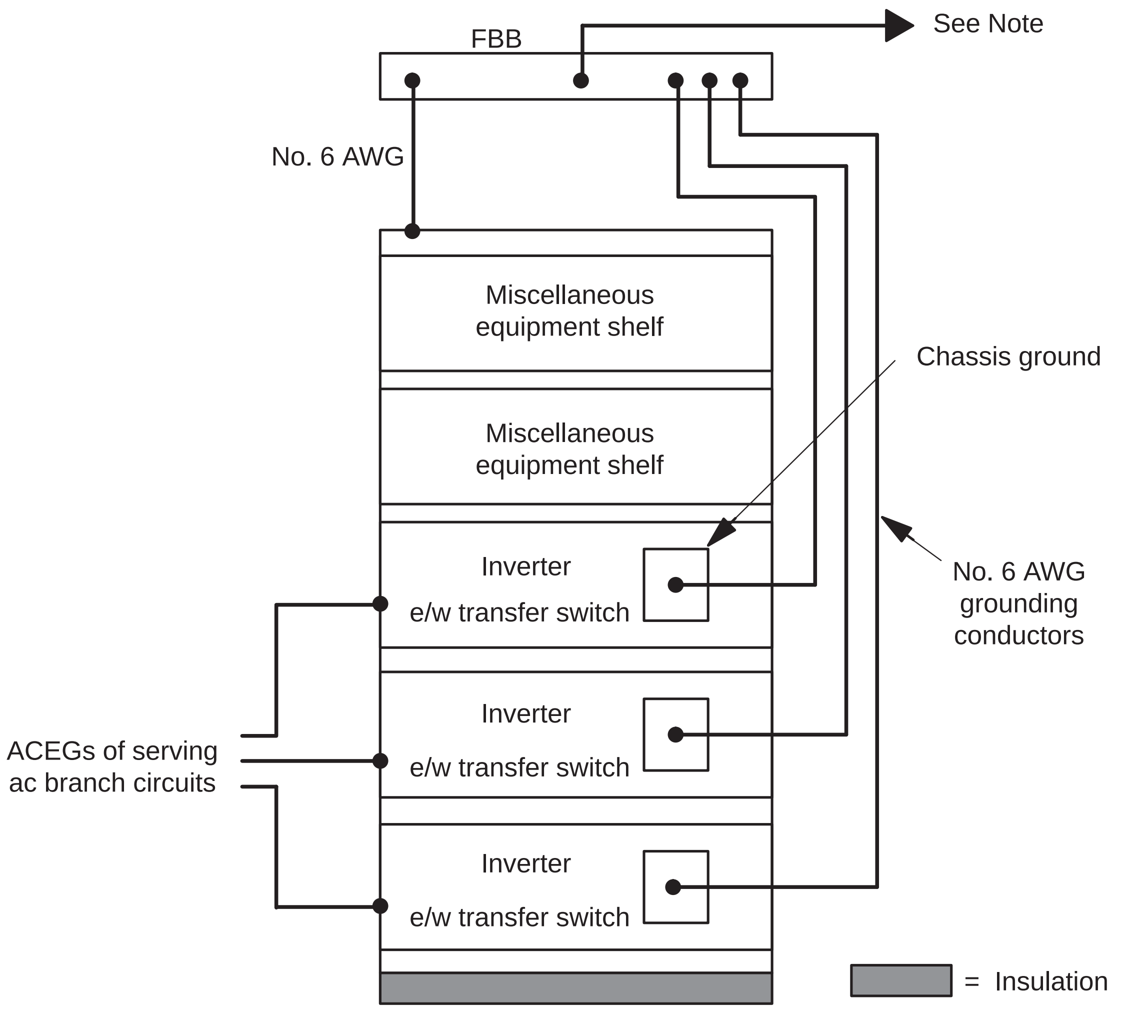


Figure 3-19.
Typical IMAP MIS frame—rear view



Note: Bond to a ground bar that is connected to the ground reference point of the serving dc power plant. This is usually the FGB or the DMS SPG. The size of this bonding conductor shall be as large as the size of the inverter input conductors, but no smaller than No. 6 AWG.

Figure 3-20.
Typical MAP MIS frame—rear view



Note: Bond to the DMS SPG. The size of this bonding conductor shall be as large as the size of the inverter input conductors, but no smaller than No. 6 AWG.

Table 3-1
IMAP, MAP, and earilier MAP grounding requirements

	MAINTANANCE AND ADMINISTRATION POSITION INSTALLED AS		**EARLIER MAP INSTALLATIONS**	
ITEM	**IMAP (ISG or NON–ISG)**	**MAP (ISG or NON–ISG)**	**ISG**	**NON–IGS**
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-232C	No	No	No	Yes (Note 6)
Current loop or modem-to-modem	Yes	Yes	Yes	Yes (option) (Note 7)

Note 1: Isolated from the DMS, referenced to a non-DMS essential or protected ACEG conductor through the green wire of the PAC pole. Isolation from foreign grounds is not required.
Note 2: The PAC pole should not be fed from two ac sources of different power quality.
Note 3: Isolated from foreign grounds such as walls, ceiling, non-DMS metallic objects. Referenced to DMS inverters through the ac equipment grounding (ACEG) conductor (green wire).
Note 4: May be bonded to the DMS SPG when the DMS SPG is located on the same floor as the IMAP. The 2-m (7-ft) rule should be applied if the IMAP equipment is within 2 m (7 ft) of the DMS.
Note 5: May be bonded to the ICB rather than the DMS SPG as required.
Note 6: DMS inverters are required when EIA-232 communications are used.
Note 7: When current loops or modem-to-modem communications are used, power for the MAP can be obtained from DMS inverters or protected ac if the feeder of the protected ac is referenced to the DMS SPG.
Note 8: Powered from DMS 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 may be additionally connected to a grounding electrode conductor (NEC Article 250–26 or CEC Section 10–206) or to the nearest effective grounding structure as required by the customer.
Note 11: The serving ac power distribution shall meet IBN grounding requirements.

—continued—

Table 3-1
IMAP, MAP, and earilier MAP grounding requirements (continued)

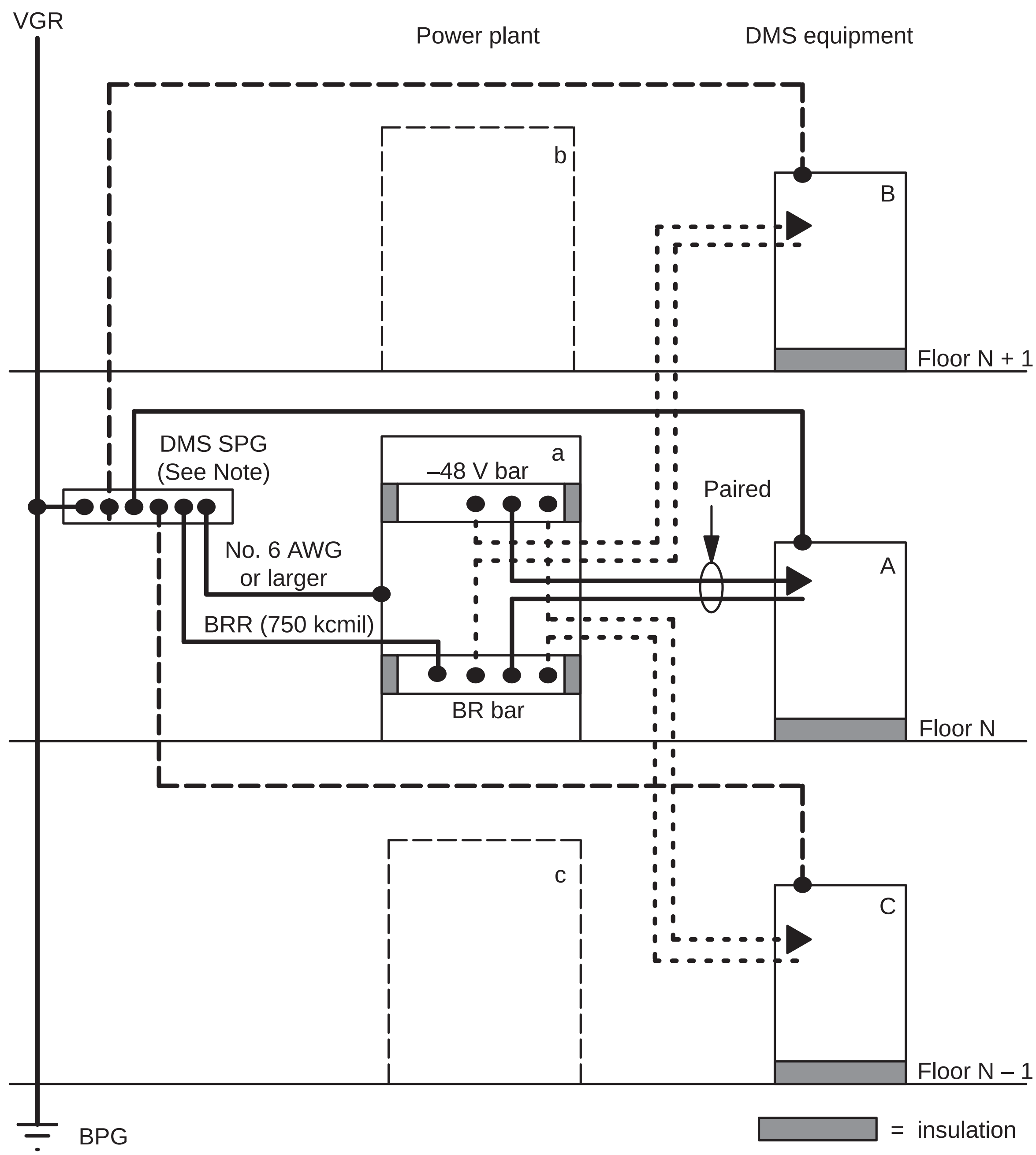
ITEM	IMAP (ISG or NON–ISG)	MAP (ISG or NON–ISG)	ISG	NON–IGS
Powered from the DMS-100F	No	No	Yes (Note 8)	Yes (Note 8)
Powered from the CBN	Yes (Notes 9 and 10)	Yes (Notes 9 and 11)	No	No (Note 7)

Note 1: Isolated from the DMS, referenced to a non-DMS essential or protected ACEG conductor through the green wire of the PAC pole. Isolation from foreign grounds is not required.
Note 2: The PAC pole should not be fed from two ac sources of different power quality.
Note 3: Isolated from foreign grounds such as walls, ceiling, non-DMS metallic objects. Referenced to DMS inverters through the ac equipment grounding (ACEG) conductor (green wire).
Note 4: May be bonded to the DMS SPG when the DMS SPG is located on the same floor as the IMAP. The 2-m (7-ft) rule should be applied if the IMAP equipment is within 2 m (7 ft) of the DMS.
Note 5: May be bonded to the ICB rather than the DMS SPG as required.
Note 6: DMS inverters are required when EIA-232 communications are used.
Note 7: When current loops or modem-to-modem communications are used, power for the MAP can be obtained from DMS inverters or protected ac if the feeder of the protected ac is referenced to the DMS SPG.
Note 8: Powered from DMS 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 may be additionally connected to a grounding electrode conductor (NEC Article 250–26 or CEC Section 10–206) or to the nearest effective grounding structure as required by the customer.
Note 11: The serving ac power distribution shall meet IBN grounding requirements.

—end—

3.3. DC power equipment

Figure 3-21.
Recommended power plant configuration



Note: Physically, the DMS SPG may be identical with the FGB, or it may be a separate bar (such as the MGB located in the GW used by the BOCs).

Figure 3-22.
Near power plant feeding DMS-100F and CBN equipment

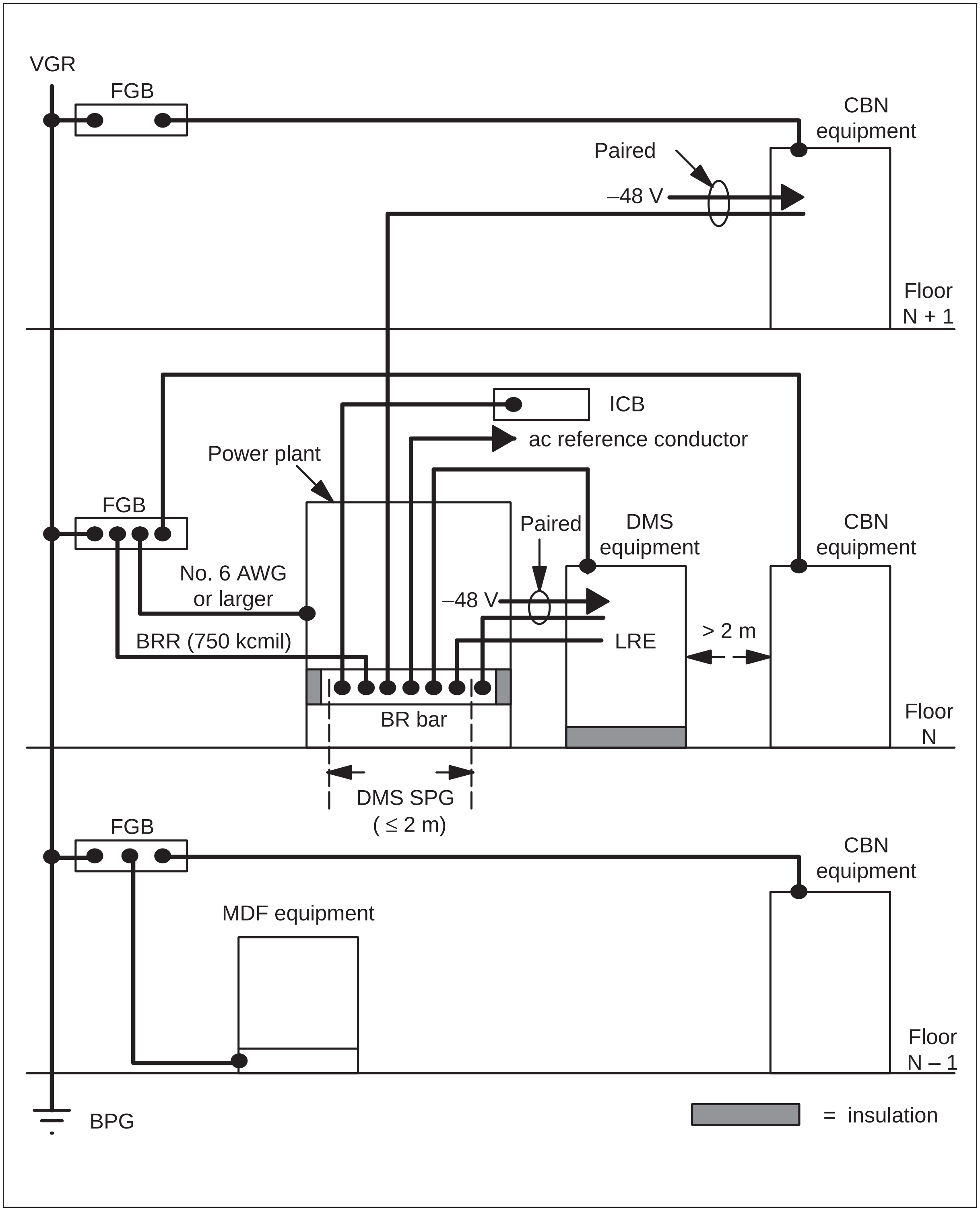
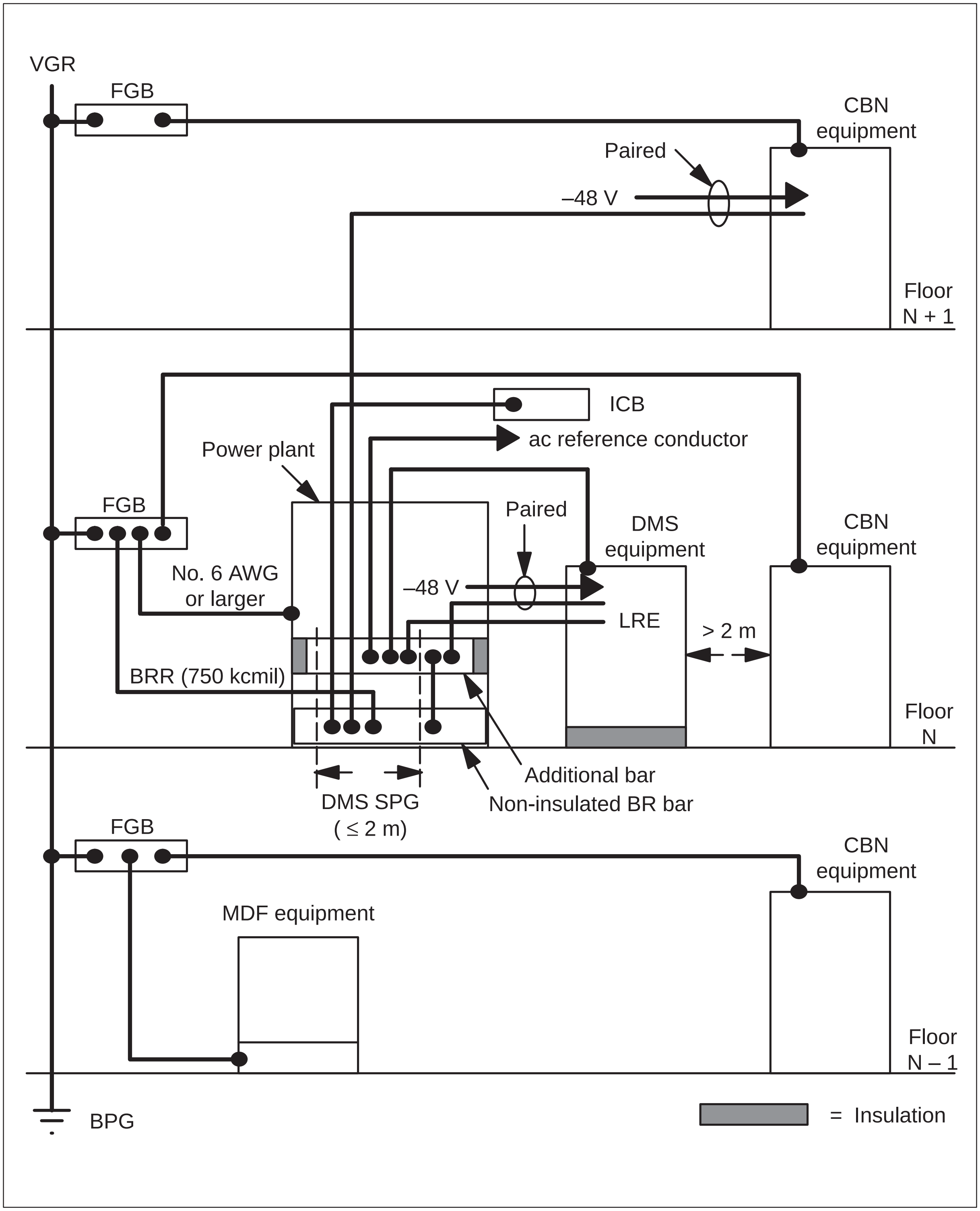
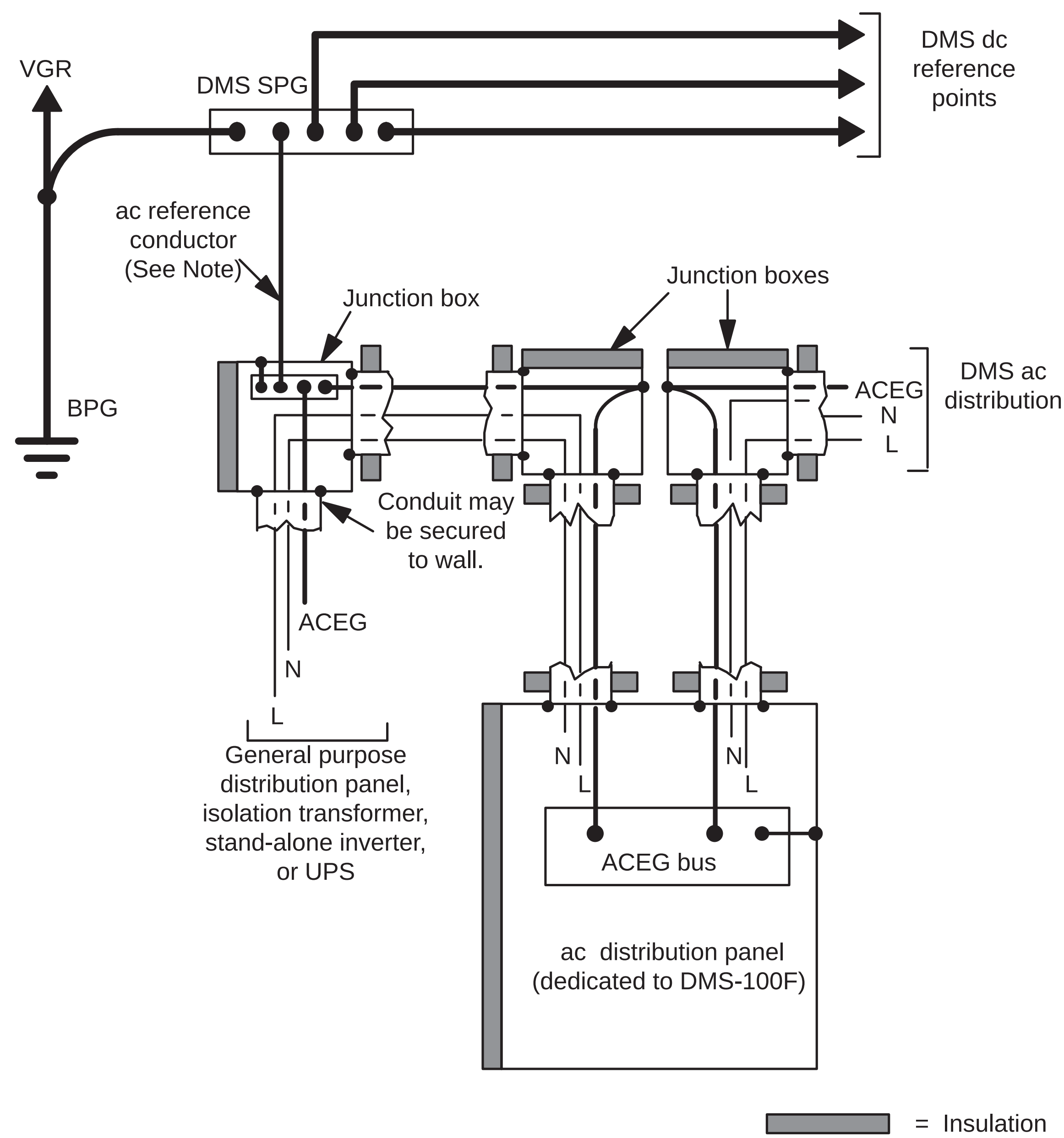


Figure 3-23.
Near power plant with non-insulated BR bar feeding DMS-100F and CBN equipment



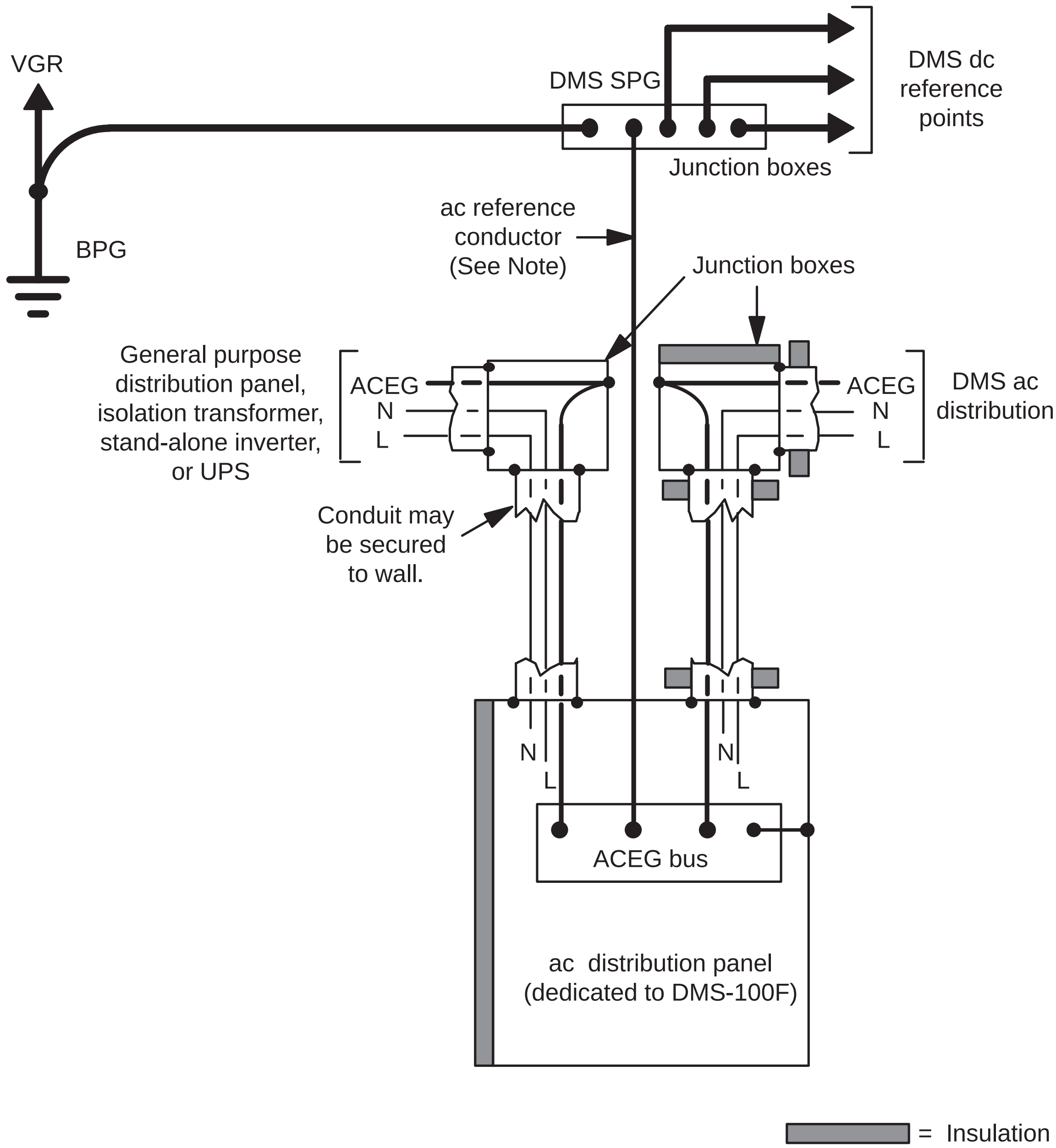
3.4. AC power equipment

Figure 3-24.
Recommended method of ac referencing



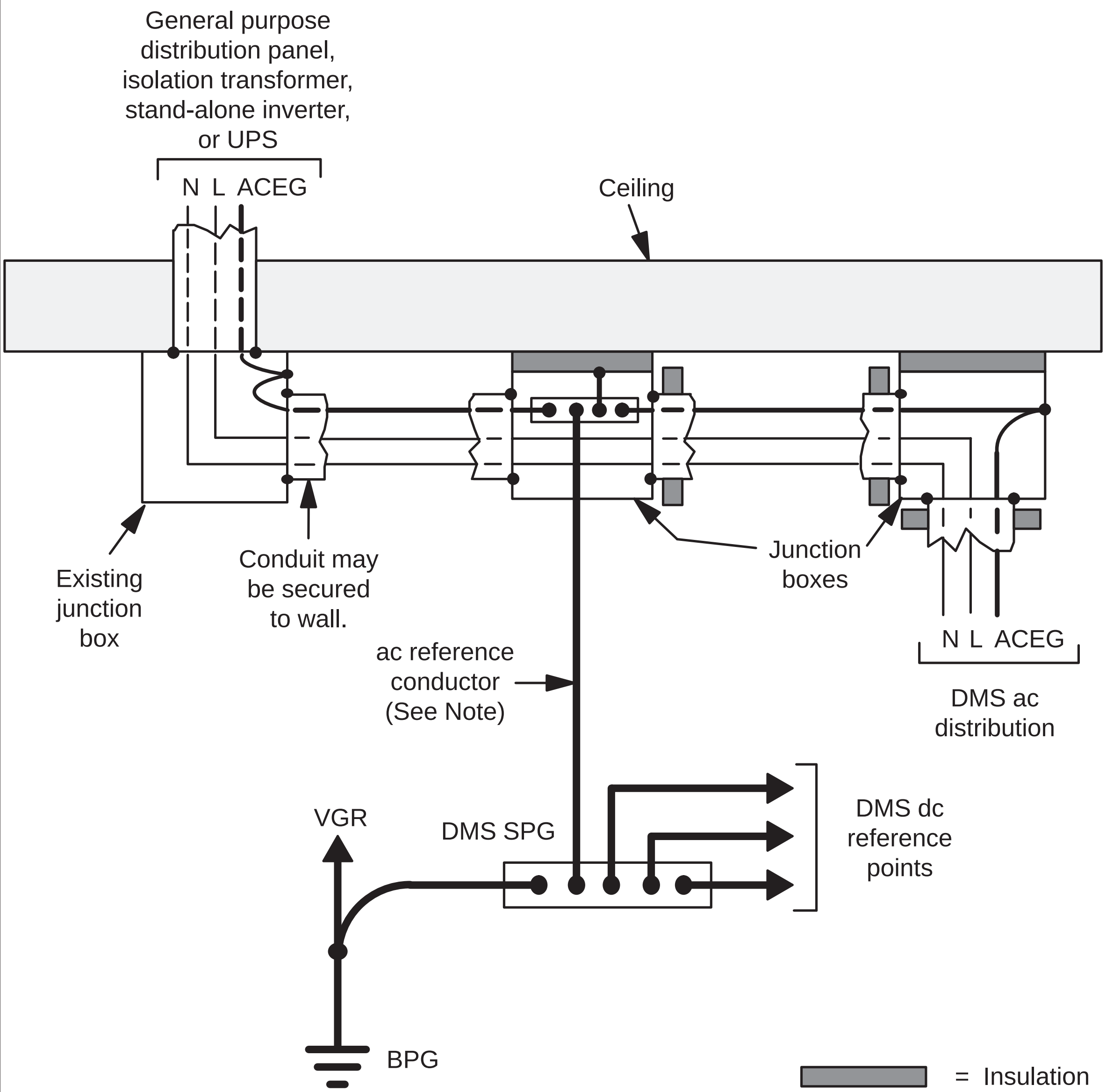
Note: This conductor shall be No. 6 AWG or larger. Its length shall not exceed 1 m (or 3 ft) unless otherwise agreed between Northern Telecom and the operating company.

Figure 3-25.
Alternate method of ac referencing



Note: This conductor shall be No. 6 AWG or larger. Its length shall not exceed 1 m (or 3 ft) unless otherwise agreed between Northern Telecom and the operating company.

Figure 3-26.
Recommended method of referencing ac branch circuits



Note: This conductor shall be No. 6 AWG or larger. Its length shall not exceed 1 m (or 3 ft) unless otherwise agreed between Northern Telecom and the operating company.

Figure 3-27.
Termination of grounding conductors in DMS equipment receptacles

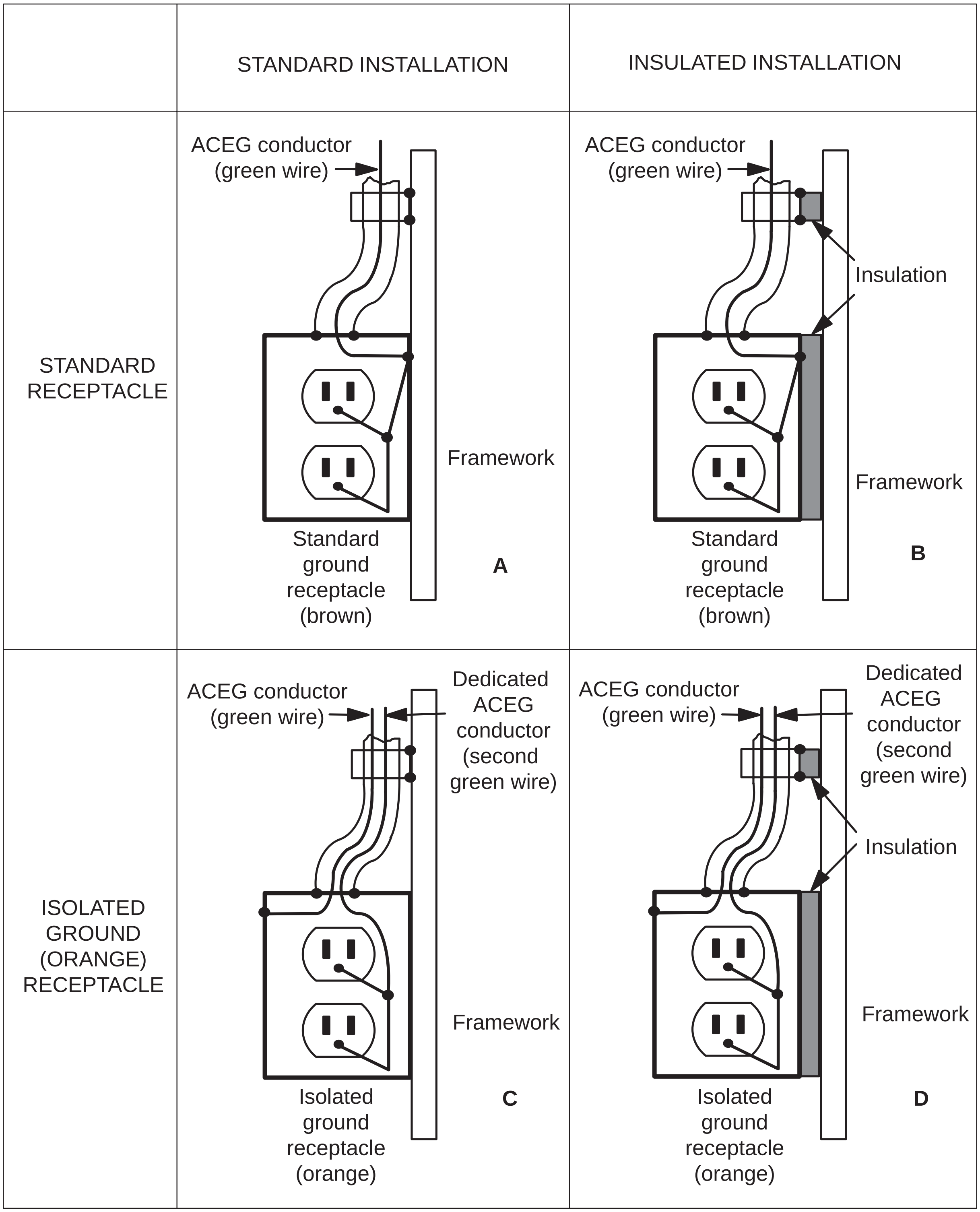
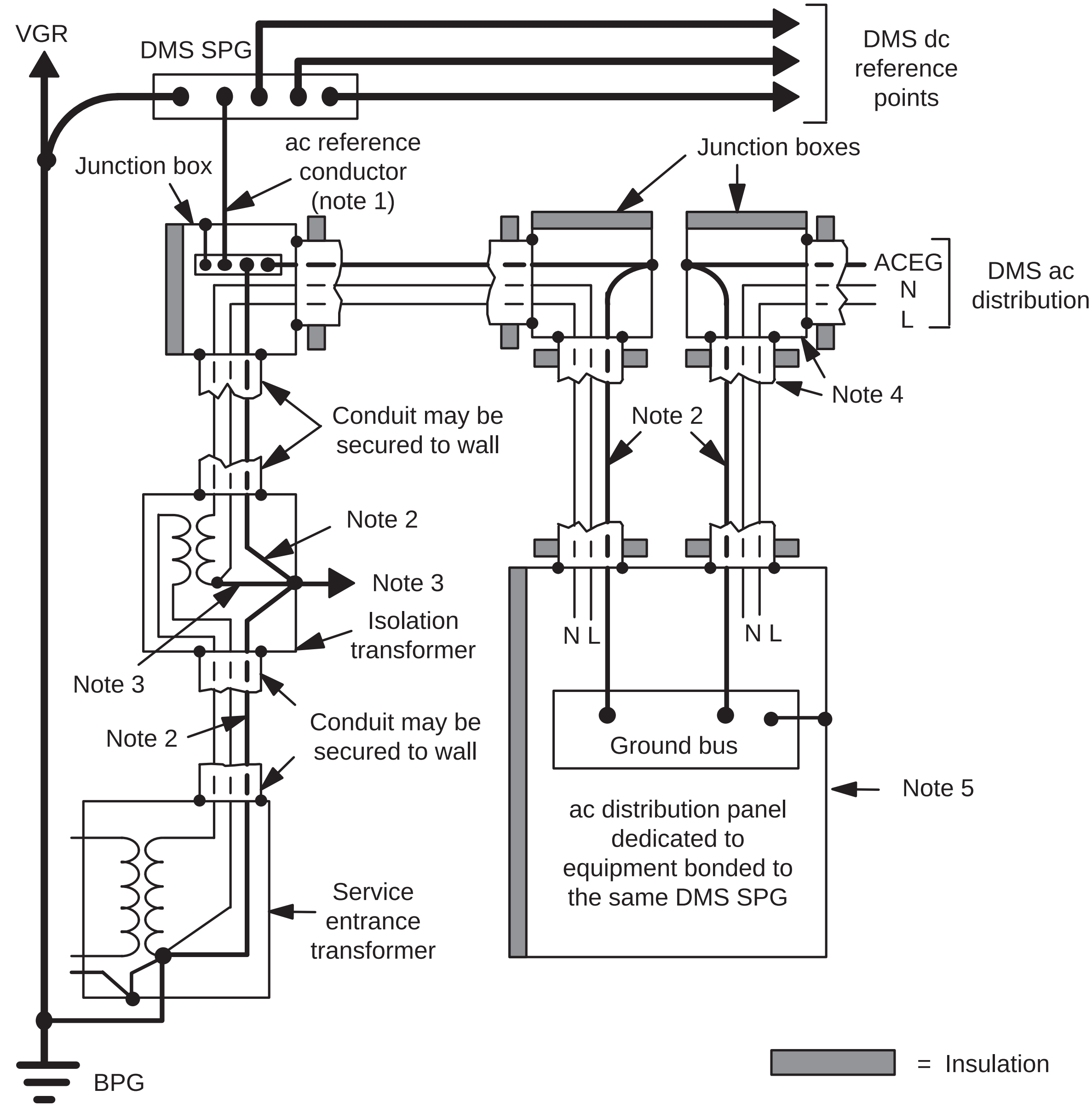


Figure 3-28.
Installation of an isolation transformer



Note 1: This conductor shall be No. 6 AWG or larger. Its length shall not exceed 1 m (3 ft) unless otherwise agreed to by the customer.

Note 2: See Table 250–95 in NEC or Table 16 in CEC, to determine the minimum wire size.

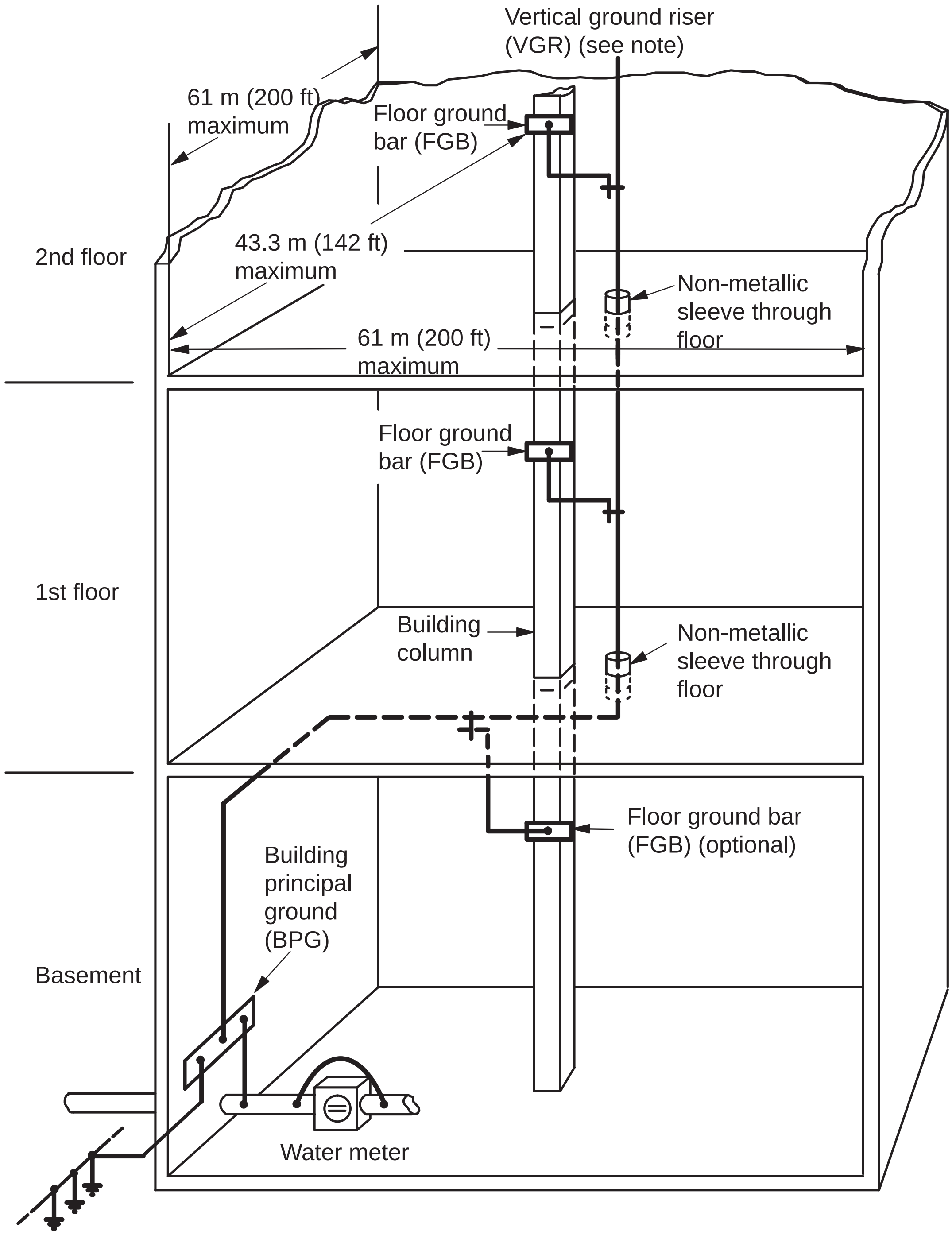
Note 3: Run this conductor to the nearest effective ground established in concurrence with the customer. See Table 250–94 in NEC or Table 17 in CEC for a minimum wire size.

Note 4: Junction boxes, ac panel, and conduit beyond the referenced junction box shall be isolated from building structure and incidental grounds.

Note 5: The ac distribution panel shall be equipped with a main disconnect device.

3.5. Building grounding system

Figure 3-29.
Typical arrangement of the building grounding system



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

Figure 3-30.
Typical arrangement of the building grounding system for a large building

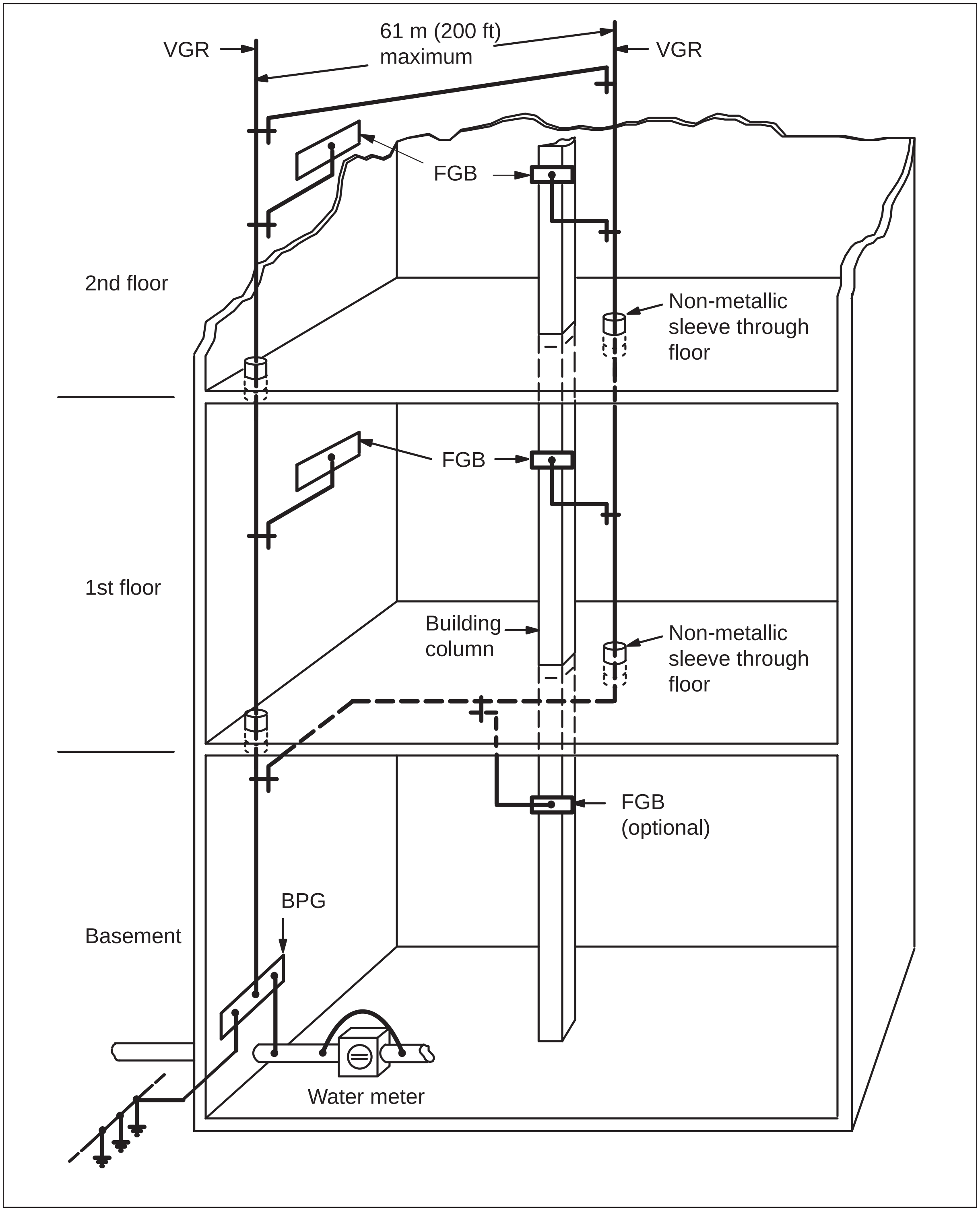
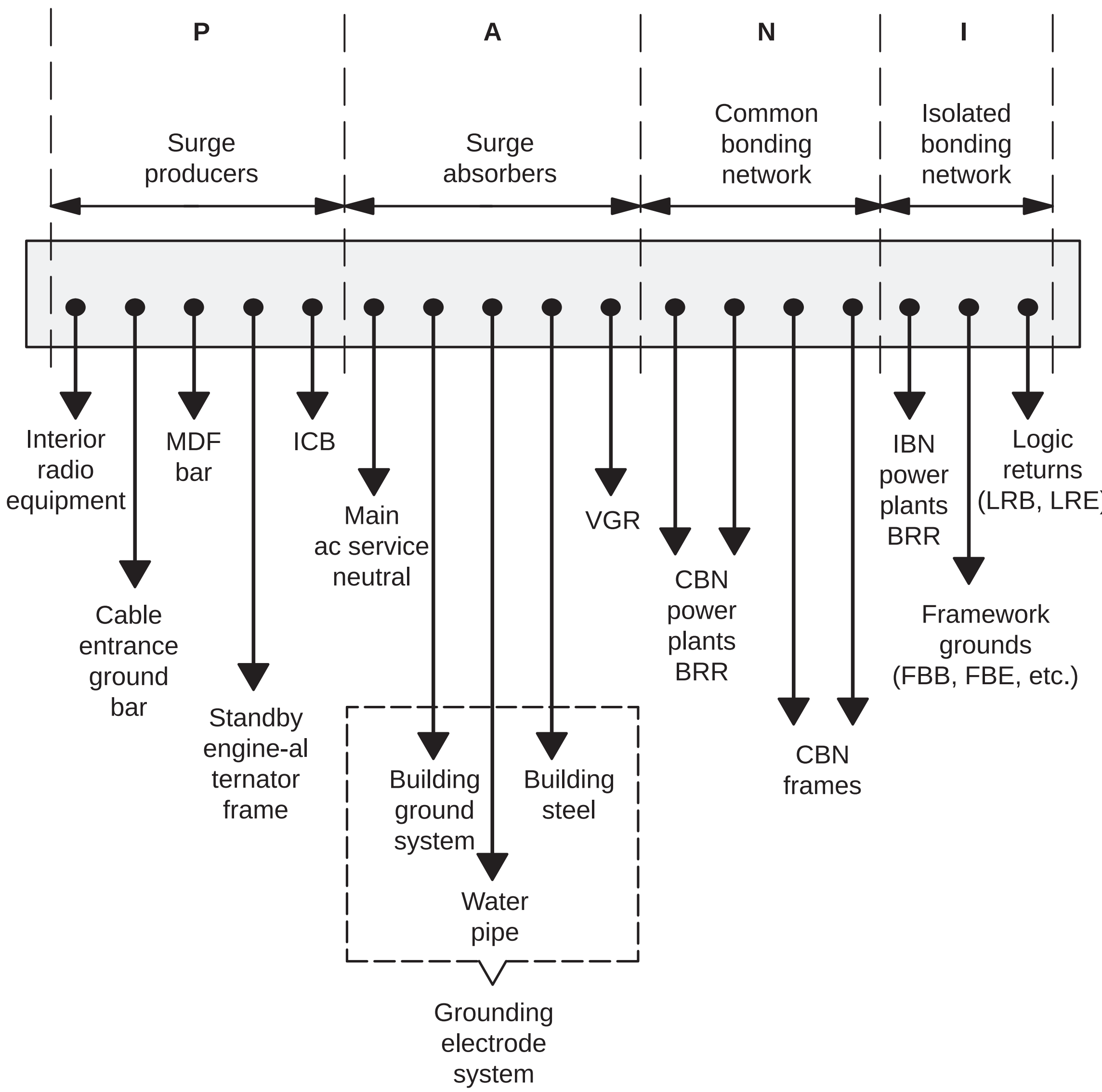


Figure 3-31.
Building principal ground connection sequence



Note: Ignore the connections not available in a specific application while maintaining the sequence of the available connections.

Figure 3-32.
Typical method for isolating the FGB

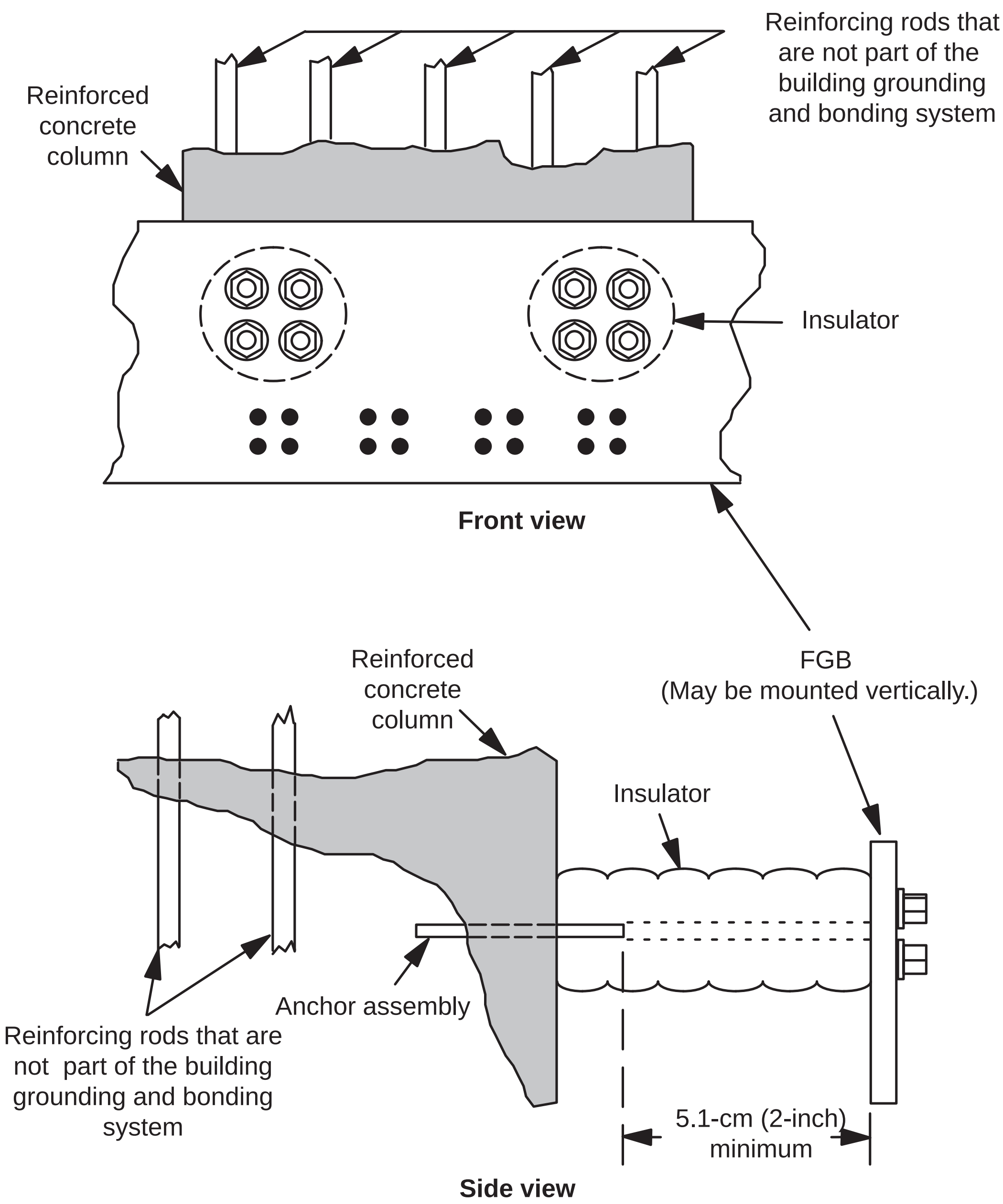
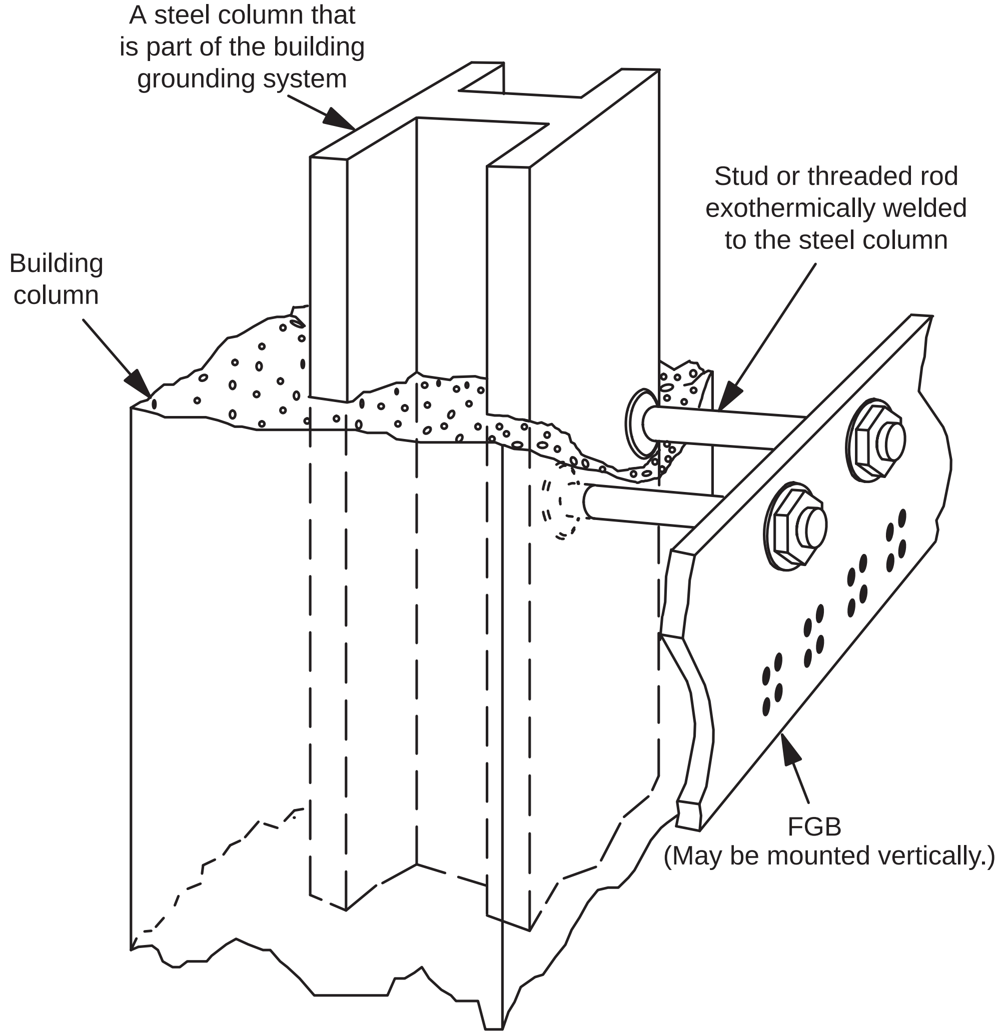


Figure 3-33.
Typical method of bonding the FGB onto the building steel column



4. Drawings for DMS TOPS audit

A site may contain only TOPS MPX, TOPS MP, or TOPS 04 equipment, or a combination of these equipment types. Drawings for all three types are provided in this section to facilitate the grounding audit of a DMS TOPS office.

An integral part of the audit are carefully prepared drawings of the TOPS office grounding system. The accuracy of these drawings is valuable for analyzing and resolving identified grounding problems. Drawings made during the audit of a TOPS office may differ from the drawings provided in this section; however, drawings made during the audit should be in topological agreement with the information provided by the following figures and tables.

4.1. TOPS MPX

Figures 4-1. to 4-5. apply only to TOPS MPX equipment.

Figure 4-1.
TOPS MPX workstation

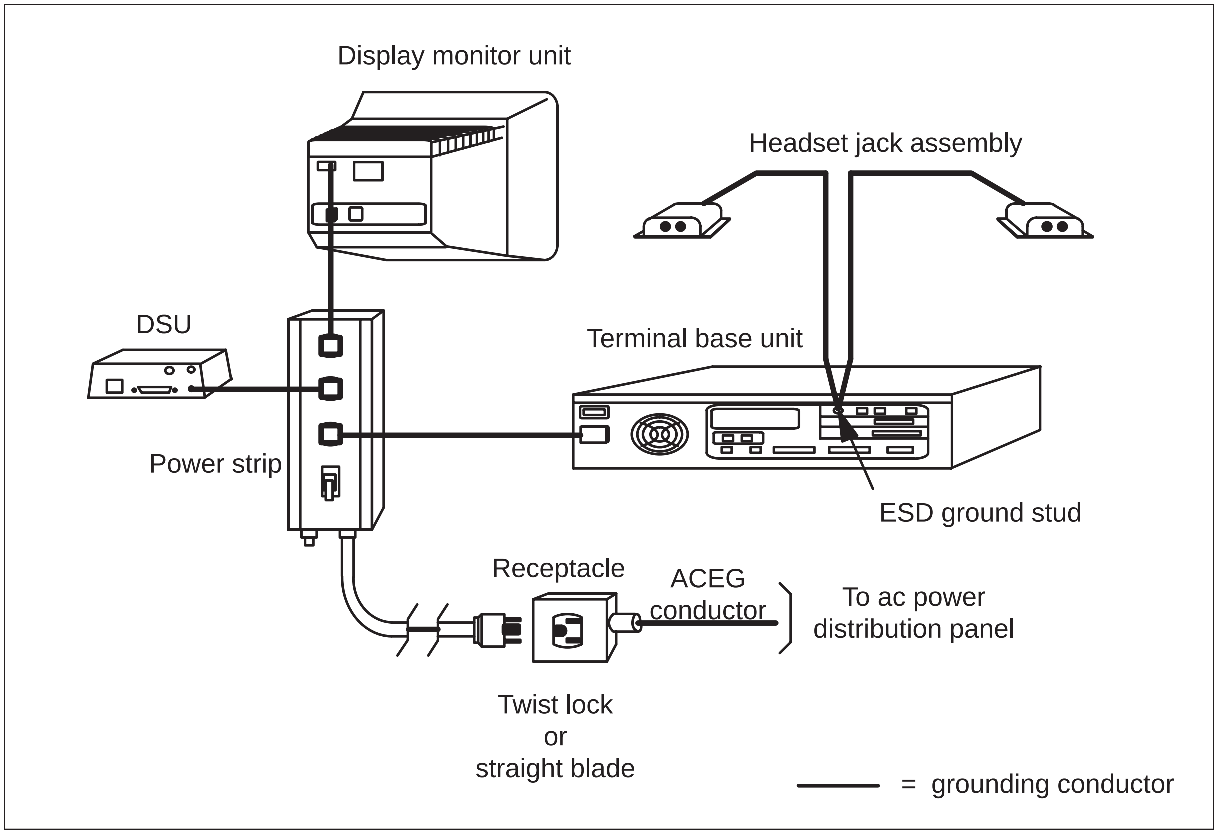


Figure 4-2.
TOPS MPX grounding: typical single-floor CBN installation

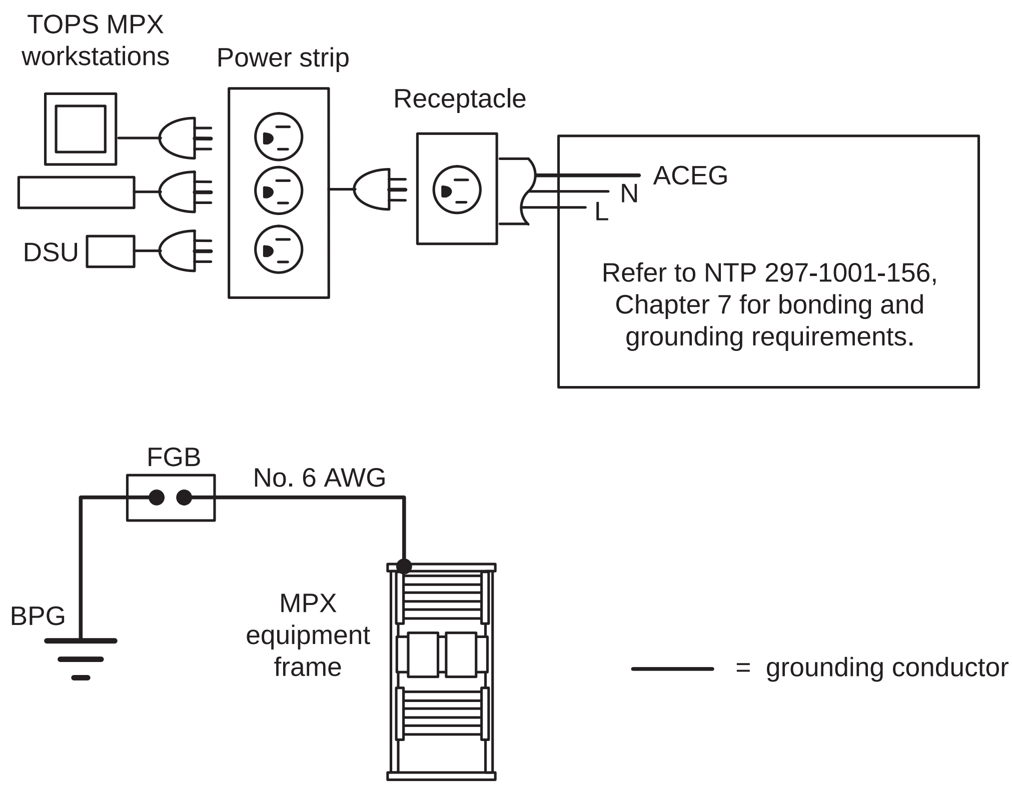


Figure 4-3.
TOPS MPX grounding: typical multifloor CBN installation

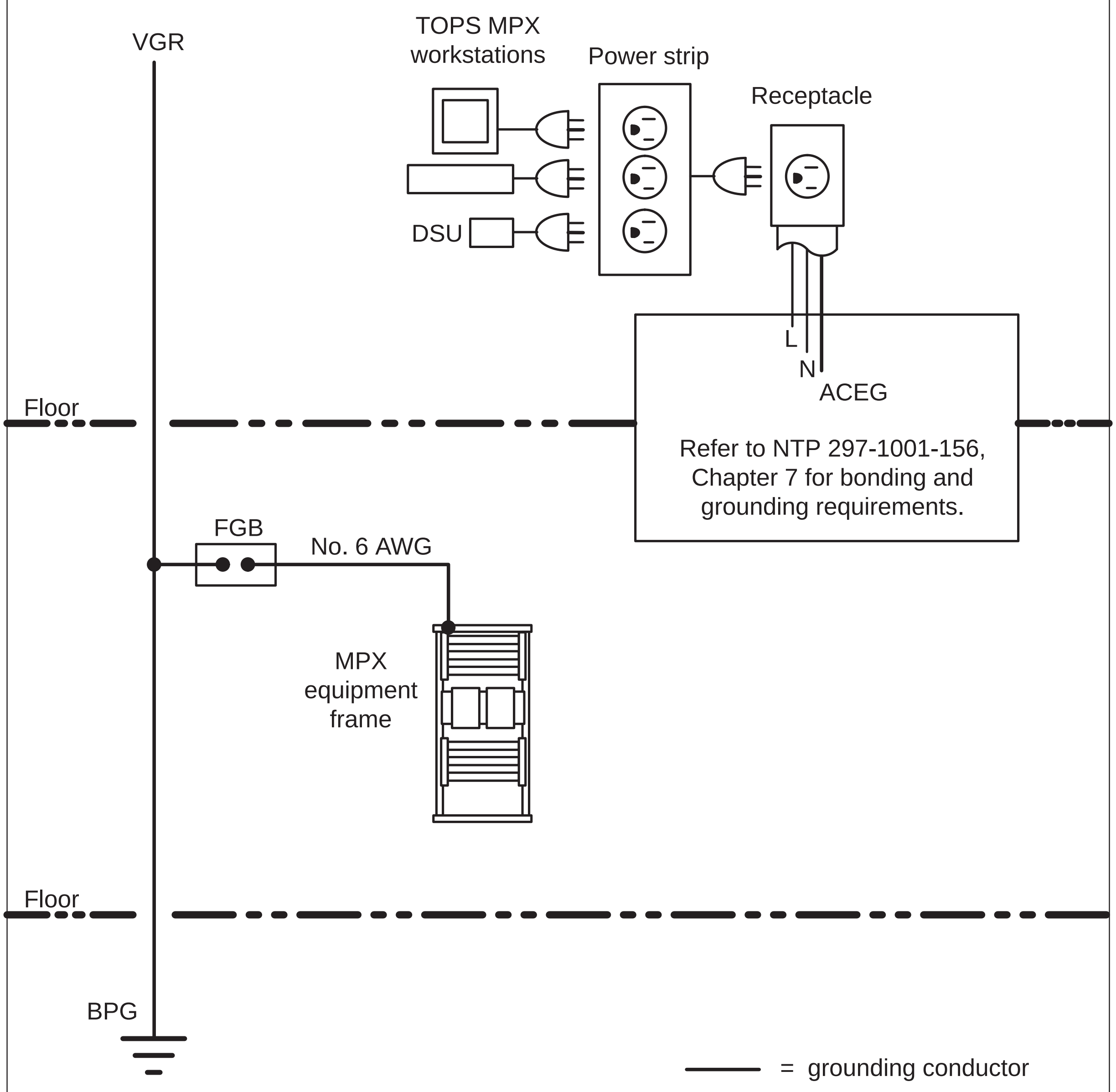
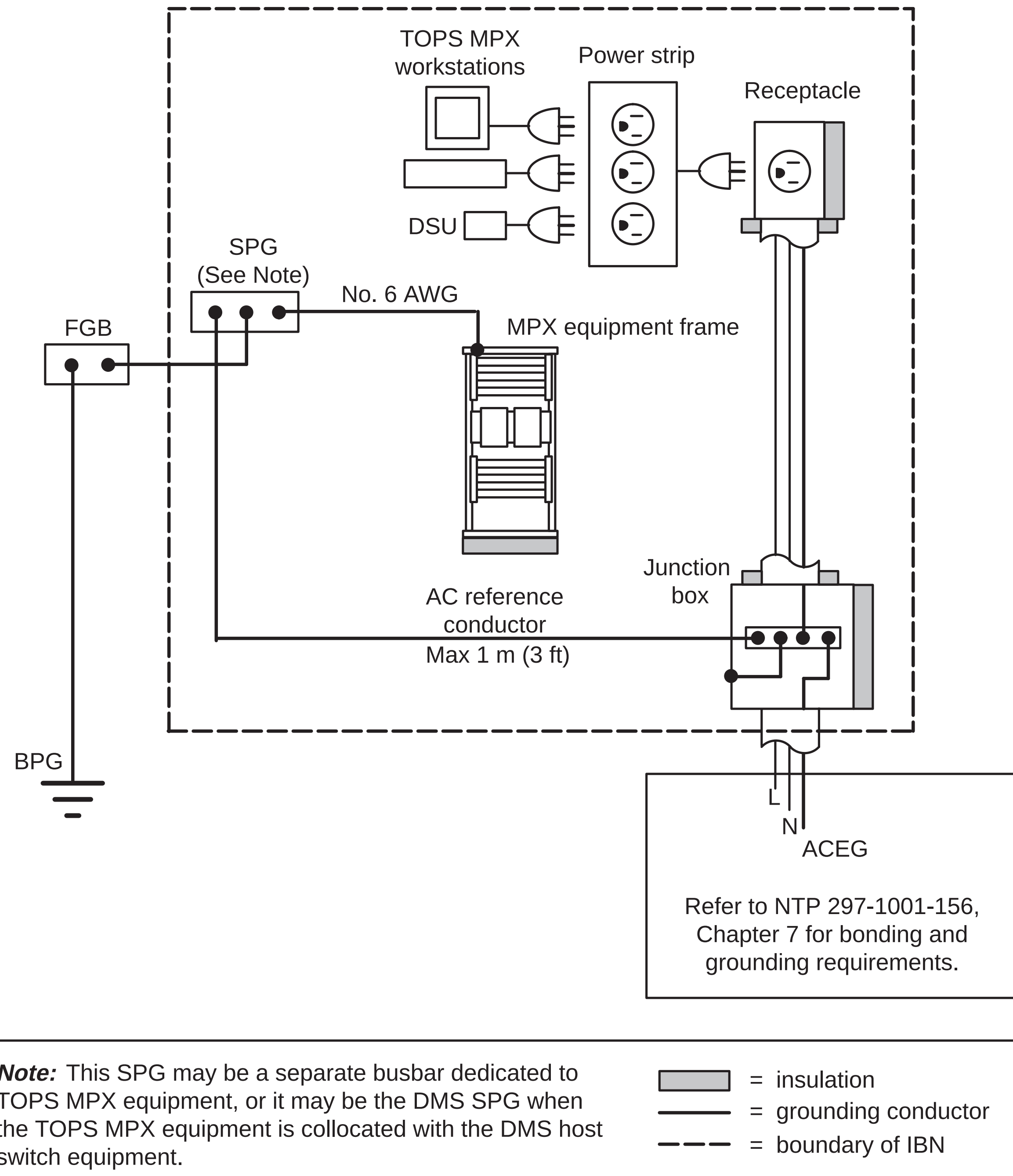
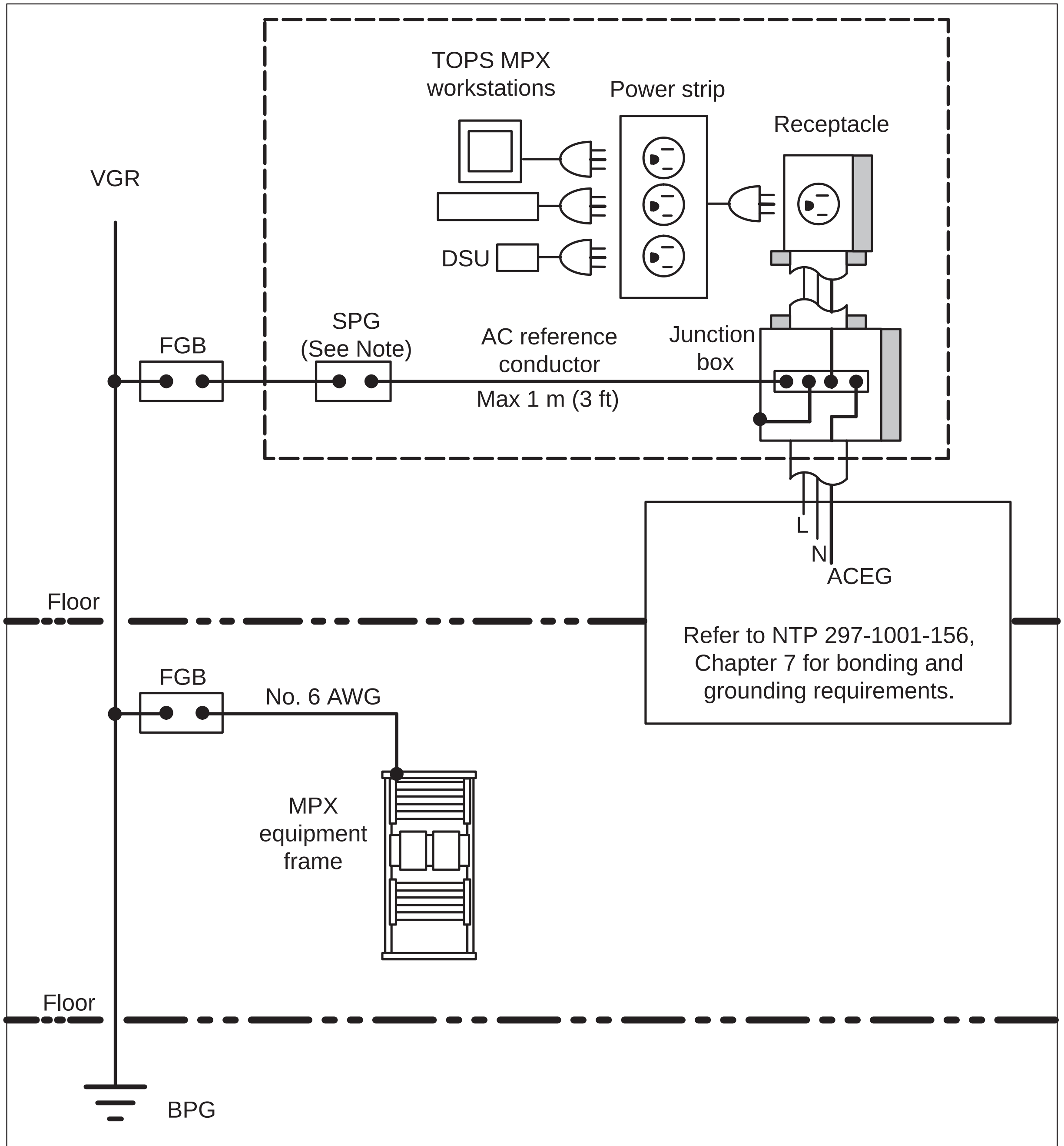


Figure 4-4.
TOPS MPX grounding: typical single-floor IBN installation



Note: This SPG may be a separate busbar dedicated to TOPS MPX equipment, or it may be the DMS SPG when the TOPS MPX equipment is collocated with the DMS host switch equipment.

Figure 4-5.
TOPS MPX grounding: typical multifloor IBN installation



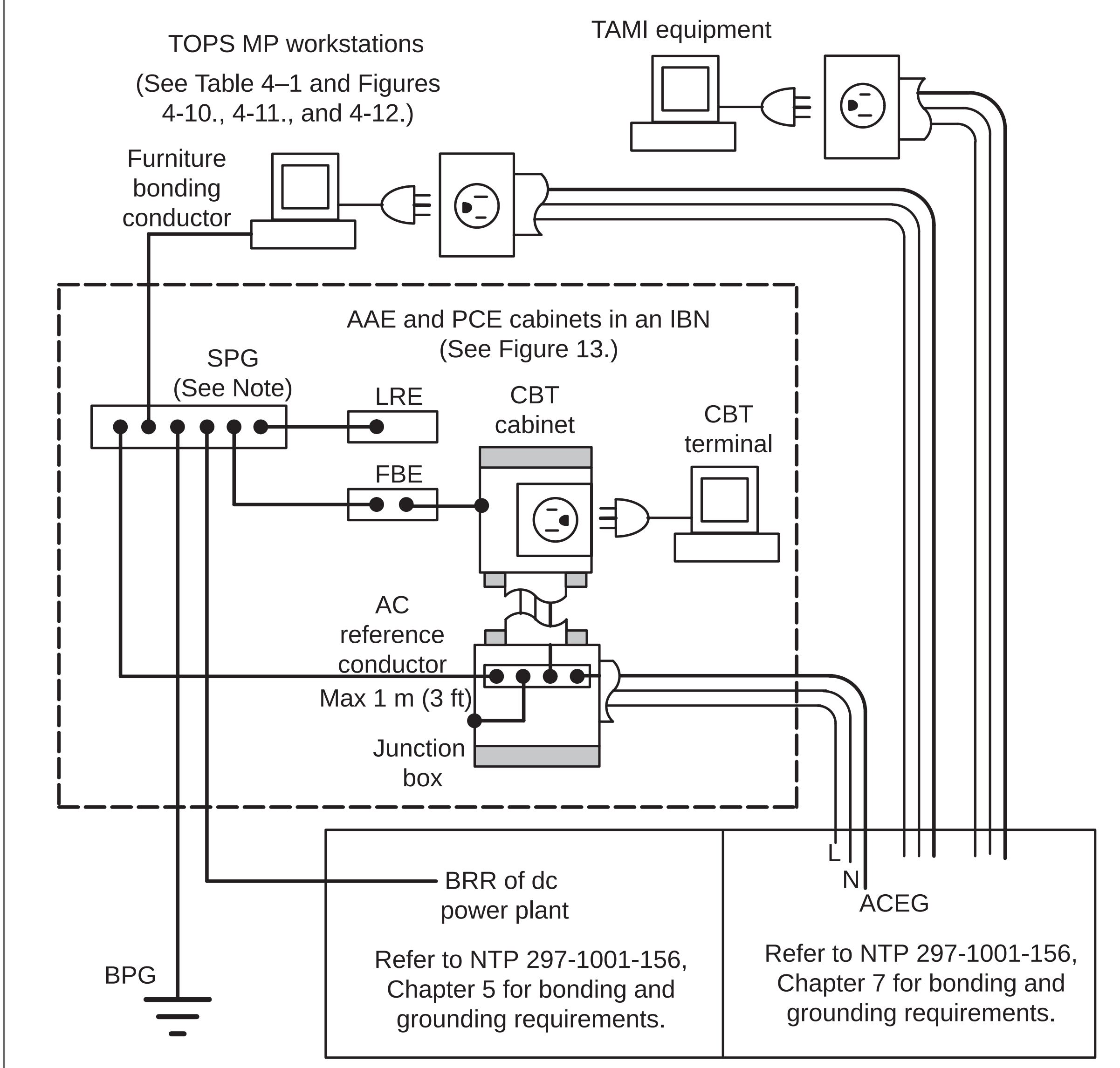
Note: This SPG may be a separate busbar dedicated to TOPS MPX equipment, or it may be the DMS SPG when the TOPS MPX equipment is collocated with the DMS host switch equipment.

= insulation
= grounding conductor
= boundary of IBN

4.2. TOPS MP

The following figures and tables apply only to TOPS MP equipment.

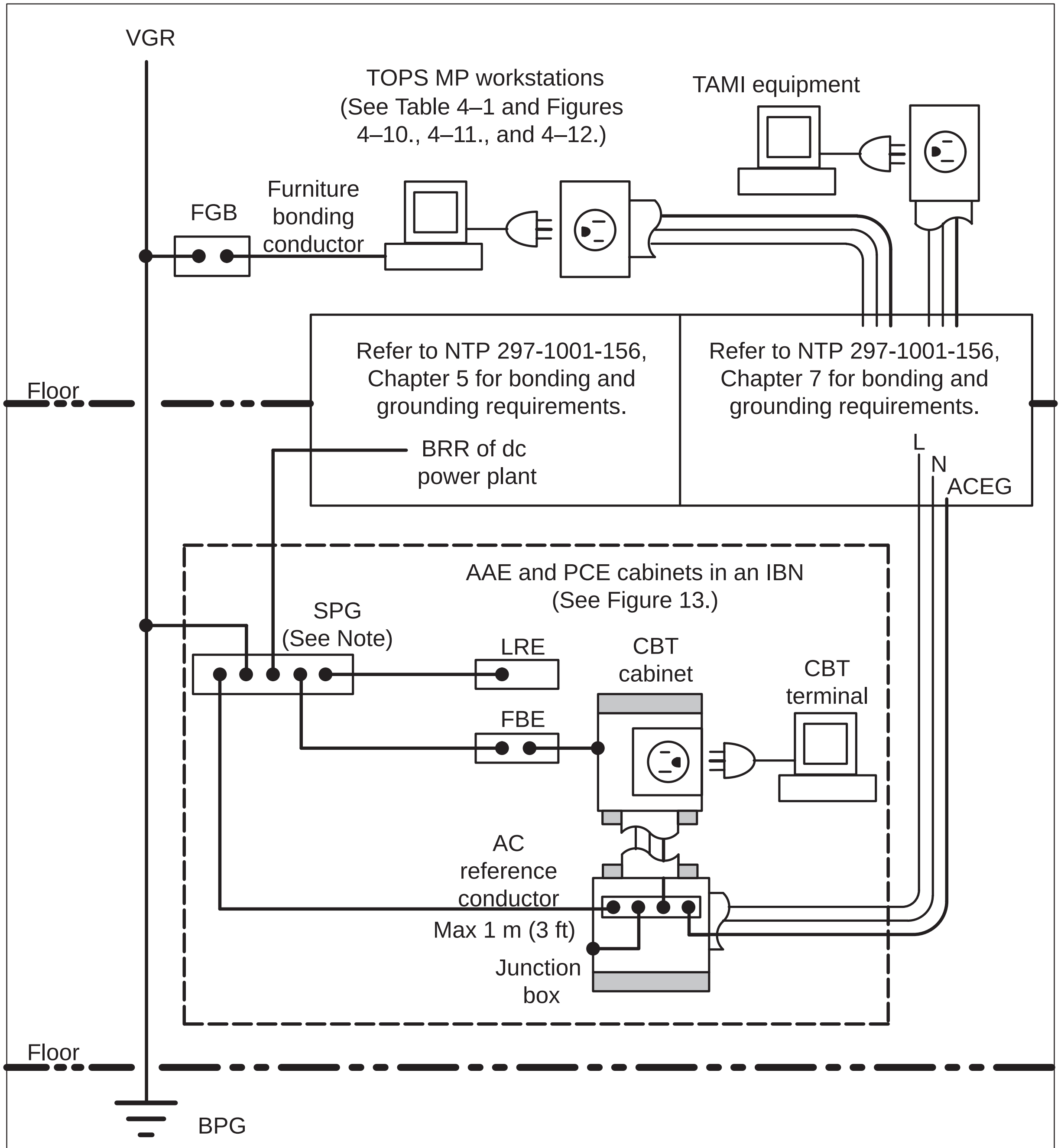
Figure 4-6.
TOPS MP grounding: typical single-floor CBN installation



Note: This SPG may be a separate busbar dedicated to TOPS MP equipment, or it may be the DMS SPG when the TOPS MP equipment is collocated with the DMS host switch equipment.

= insulation
= grounding conductor
= boundary of IBN

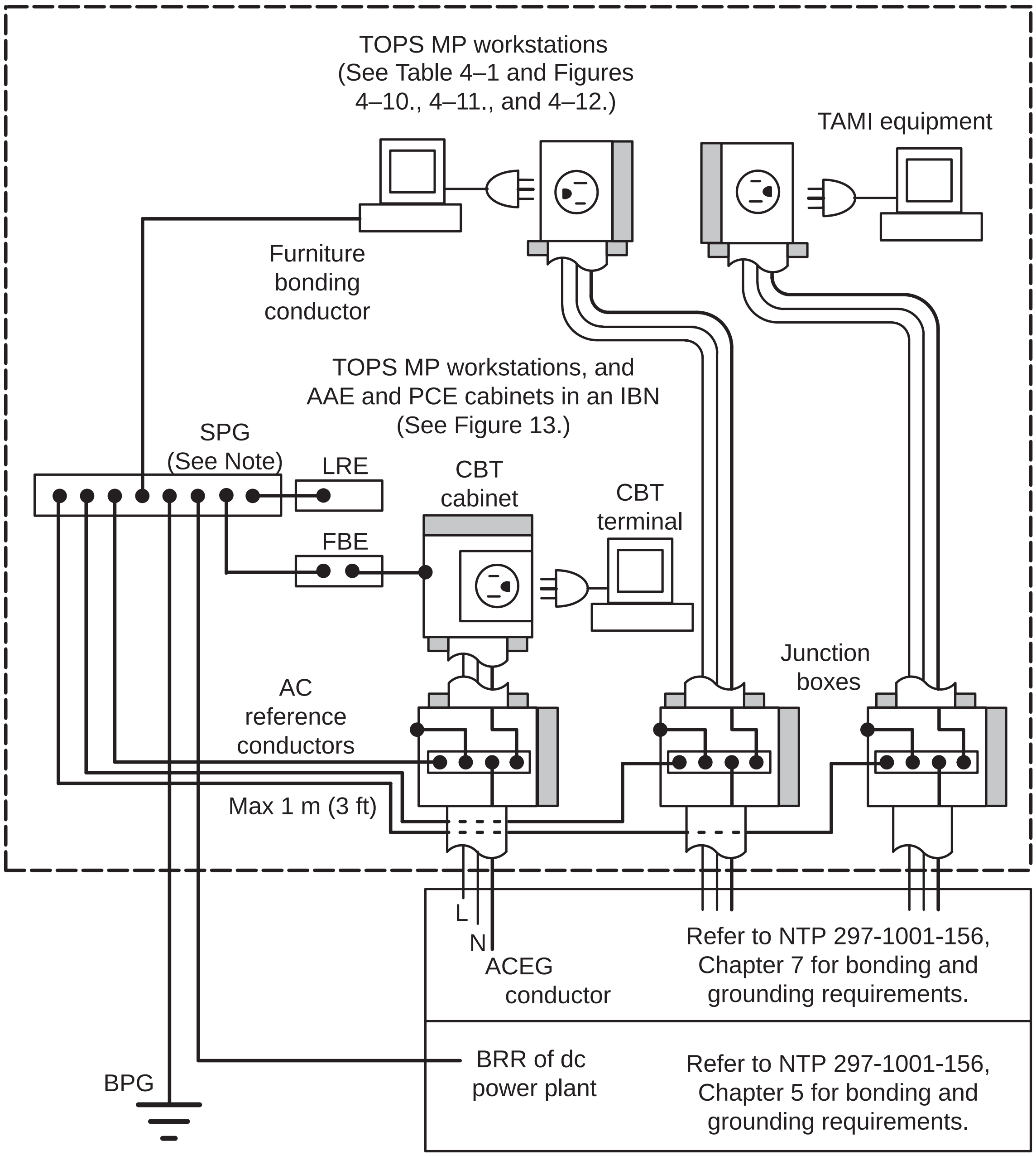
Figure 4-7.
TOPS MP grounding: typical multifloor CBN installation



Note: This SPG may be a separate busbar dedicated to TOPS MP equipment, or it may be the DMS SPG when the TOPS MP equipment is collocated with the DMS host switch equipment.

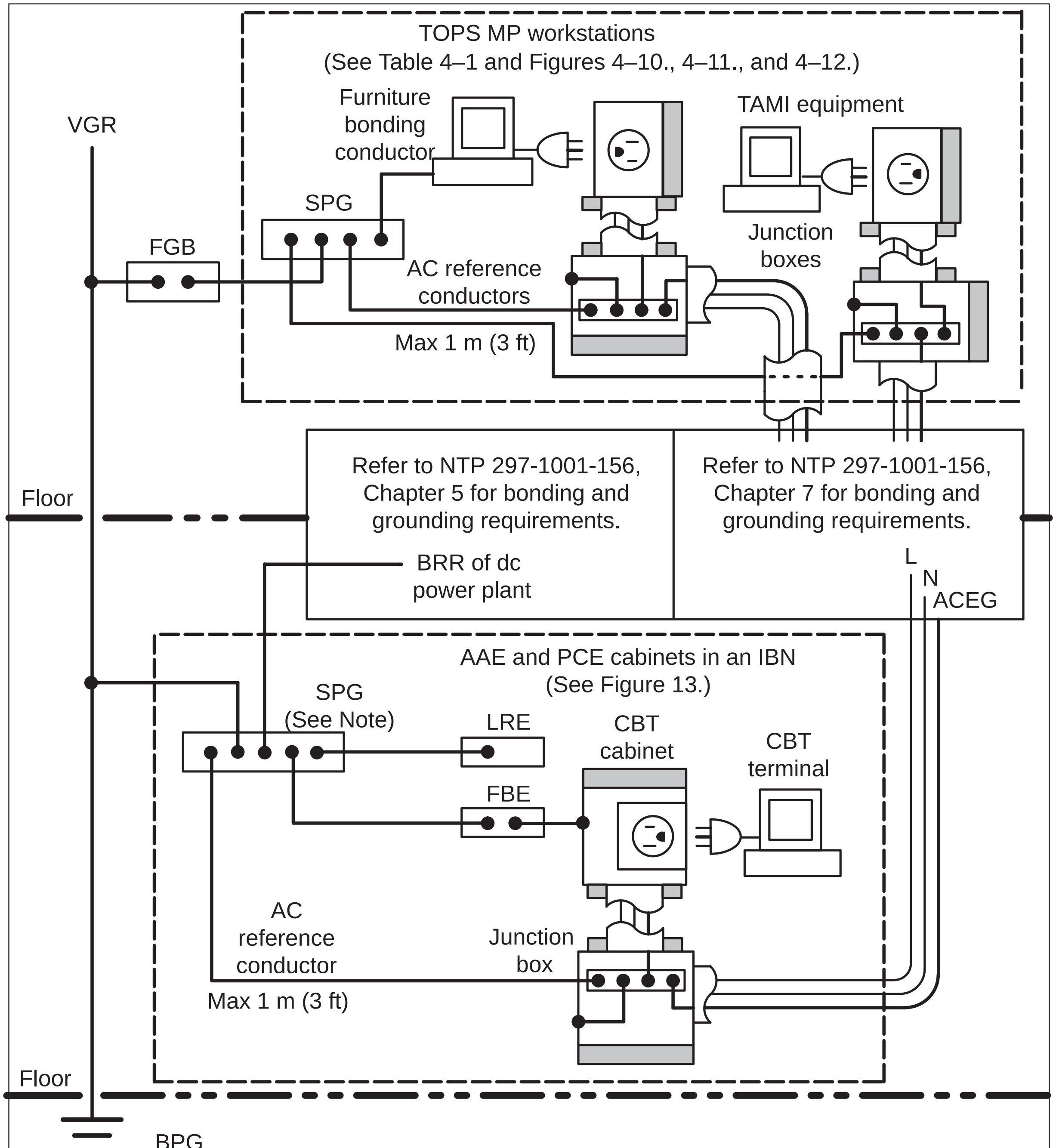
= insulation
= grounding conductor
= boundary of IBN

Figure 4-8.
TOPS MP grounding: typical single-floor IBN installation



Note: This SPG may be a separate busbar dedicated to TOPS MP equipment, or it may be the DMS SPG when the TOPS MP equipment is collocated with the DMS host switch equipment.

Figure 4-9.
TOPS MP grounding: typical multifloor IBN installation



Note: This SPG may be a separate busbar dedicated to TOPS MP equipment, or it may be the DMS SPG when the TOPS MP equipment is collocated with the DMS host switch equipment.

= insulation
= grounding conductor
= boundary of IBN

Figure 4-10.
TOPS MP terminal

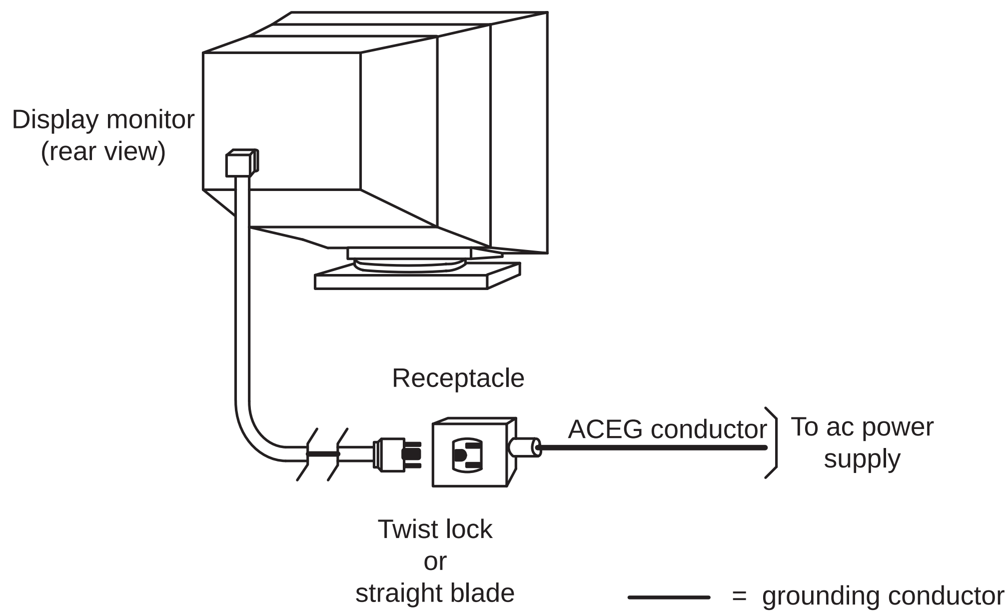


Figure 4-11.
TOPS MP workstation

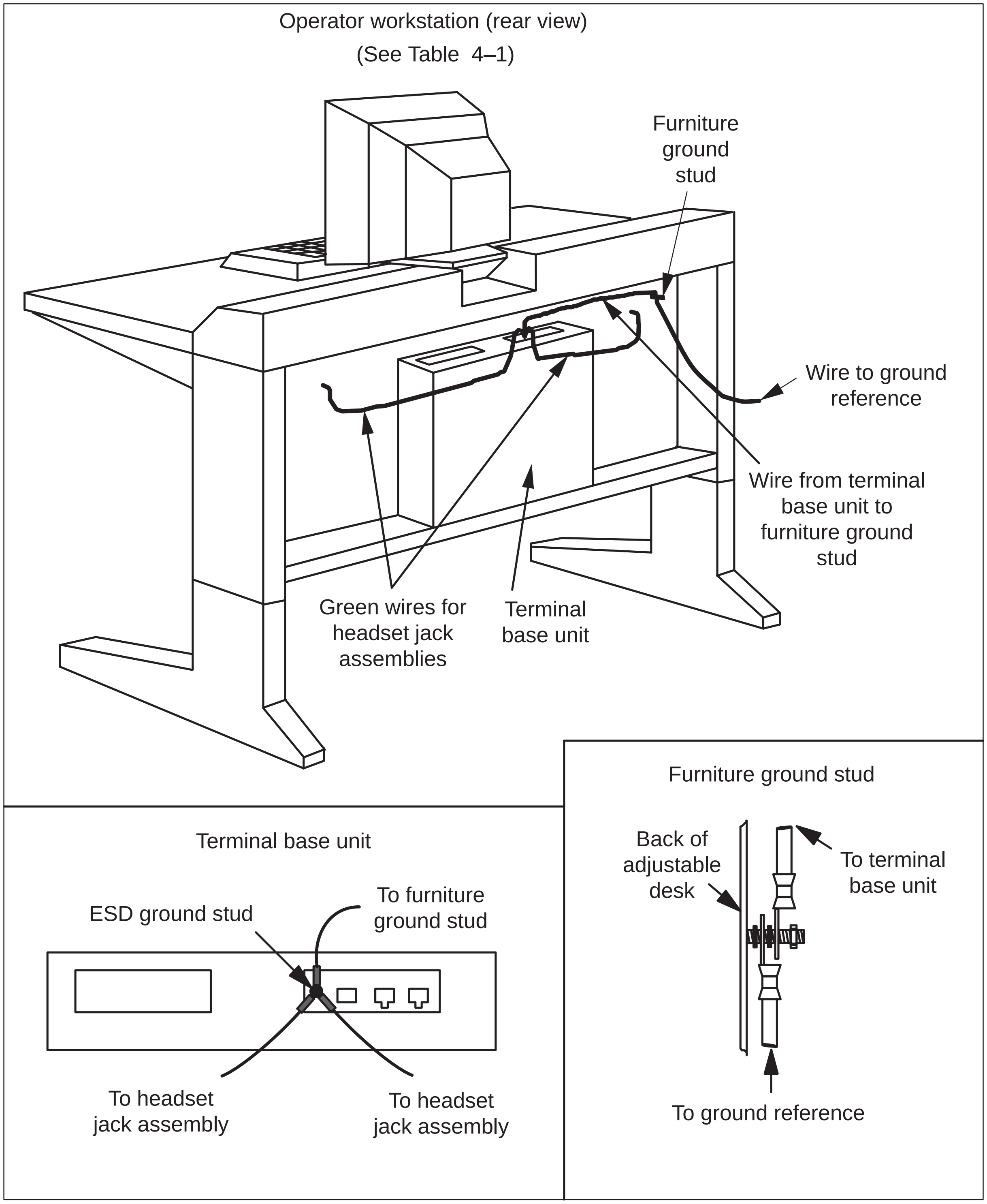
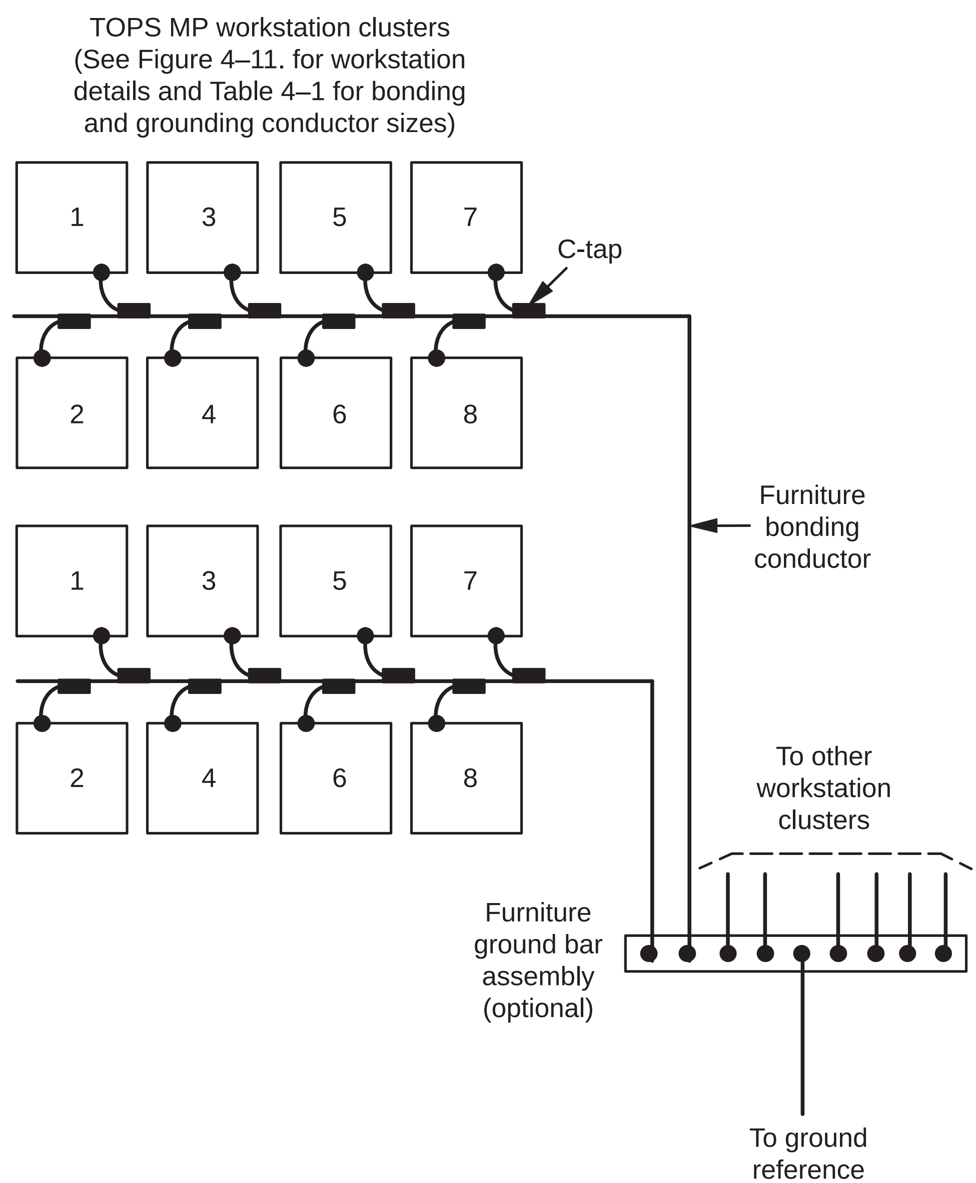
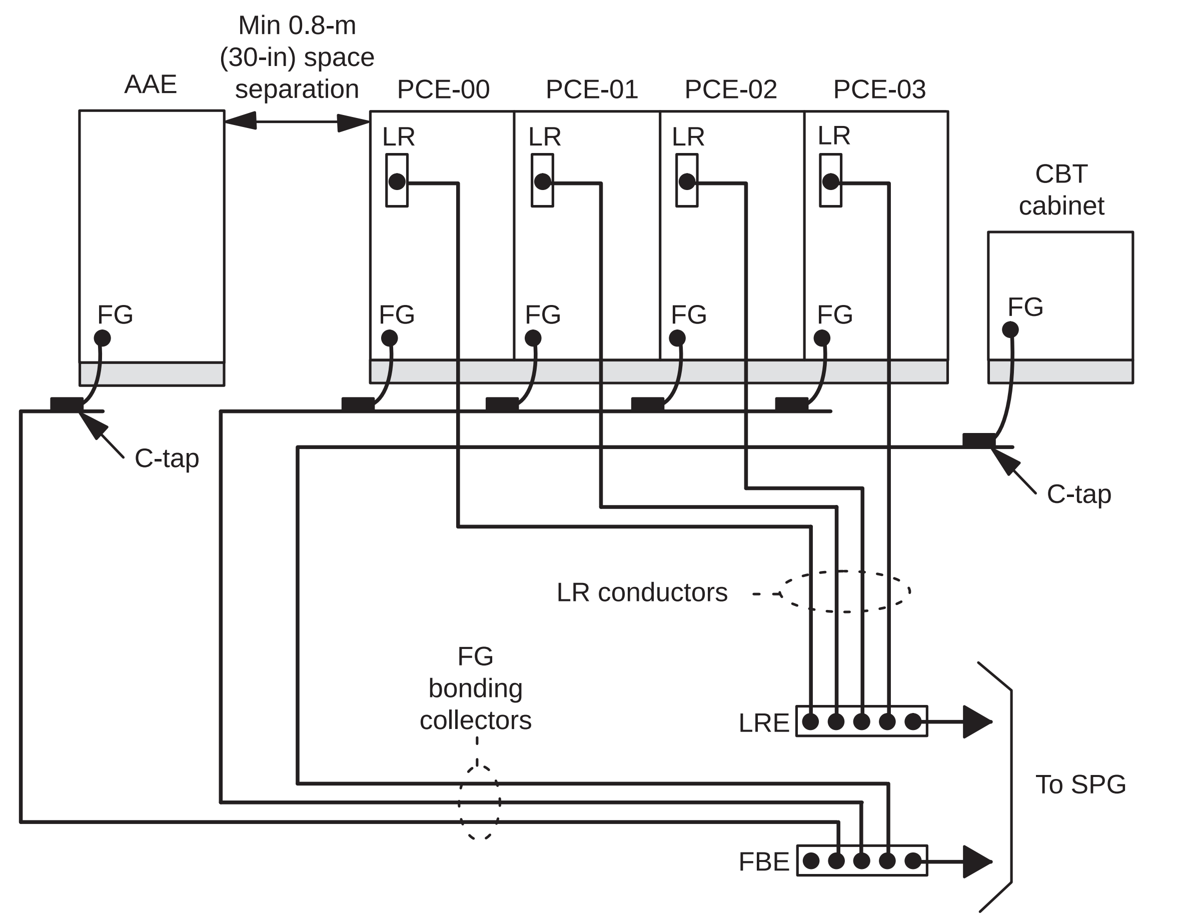


Figure 4-12.
Bonding of TOPS MP workstations: typical configuration



Note: At some earlier sites, workstations may have been interconnected together and then bonded to the furniture bonding conductor.

Figure 4-13.
TOPS MP grounding: AAE, PCE, and CBT cabinets (IBN)



Note 1: See Table 4–2 for bonding and grounding conductor sizes.

Note 4: The FG bonding collectors and LR conductors may be routed through a cable trough located above the cabinet lineup, or routed through a raised floor below the lineup.

Note 3: At some earlier sites, the framework of the AAE cabinet may have been bonded directly to the SPG, or to the FBE of other existing DMS equipment.

Note 2: The framework of the PCE cabinets at some earlier sites may have been bonded together with cables and then bonded to the framework of the AAE cabinet. Also, the logic returns between PCE cabinets may have been interconnected, and then connected directly to the SPG, or to the LRE of other existing DMS equipment.

CBT = computer based training
FBE = framework bonding equalizer
FG = framework ground
LR = logic return
LRE = logic return equalizer
[shaded box] = insulation

Table 4-1
Bonding and grounding conductor sizes for TOPS MP workstation

Conductor	Size	Length/inpedance
Headset jack assembly to ESD ground stud on terminal base	No. 14 AWG	
ESD ground stud on terminal base to furniture ground stud	No. 10 AWG	As short as possible (< 1 ohm)
Furniture ground stud to furniture bonding conductor	No. 10 AWG	As short as possible (< 1 ohm)
Furniture bonding conductor to furniture ground bar assembly	No. 6 AWG (minimum)	< 1 ohm
Furniture ground bar assembly to ground reference	No. 1/0 AWG	< 1 ohm
—end—		

Table 4-2
Bonding and grounding conductor sizes for AAE, PCE and CBT cabinets

Conductor	Size	Length
SPG to FBE or LRE	No. 2/0 AWG 350 kcmil 750 kcmil	0–15.2 m (0–50 ft) 15.2–45.7 m (50–150 ft) > 45.7 m (150 ft)
FBE to lineup of AAE, PCE, and CBT cabinets	No. 1/0 AWG No. 4/0 AWG	0–15.2 m (0–50 ft) 15.2–30.5 m (50–100 ft)
FG bonding collector to FG of AAE cabinet	No. 1/0 AWG	As short as possible
FG bonding collector to FG of PCE cabinet	No. 6 AWG	As short as possible
LRE to LR of PCE cabinet	No. 6 AWG No. 1/0 AWG	0–15.2 m (0–50 ft) 15.2–30.5 m (50–100 ft)
FG bonding collector to FG of CBT cabinet	No. 6 AWG	As short as possible
—end—		

4.3. TOPS 04

Figures 4-14., 4-15., and 4-16. apply only to TOPS 04 equipment.

Figure 4-14.
Grounding of TOPS 04 workstations

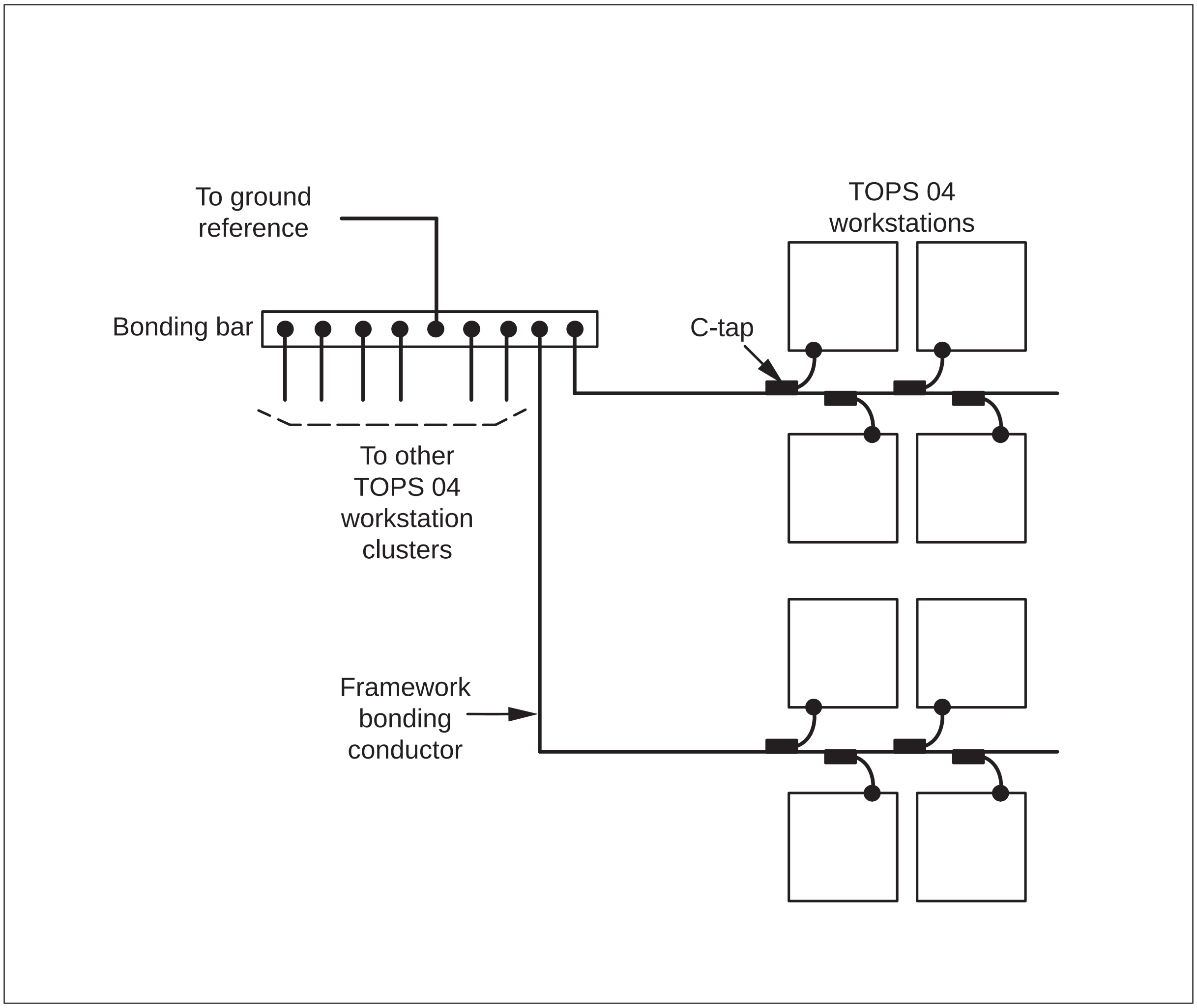
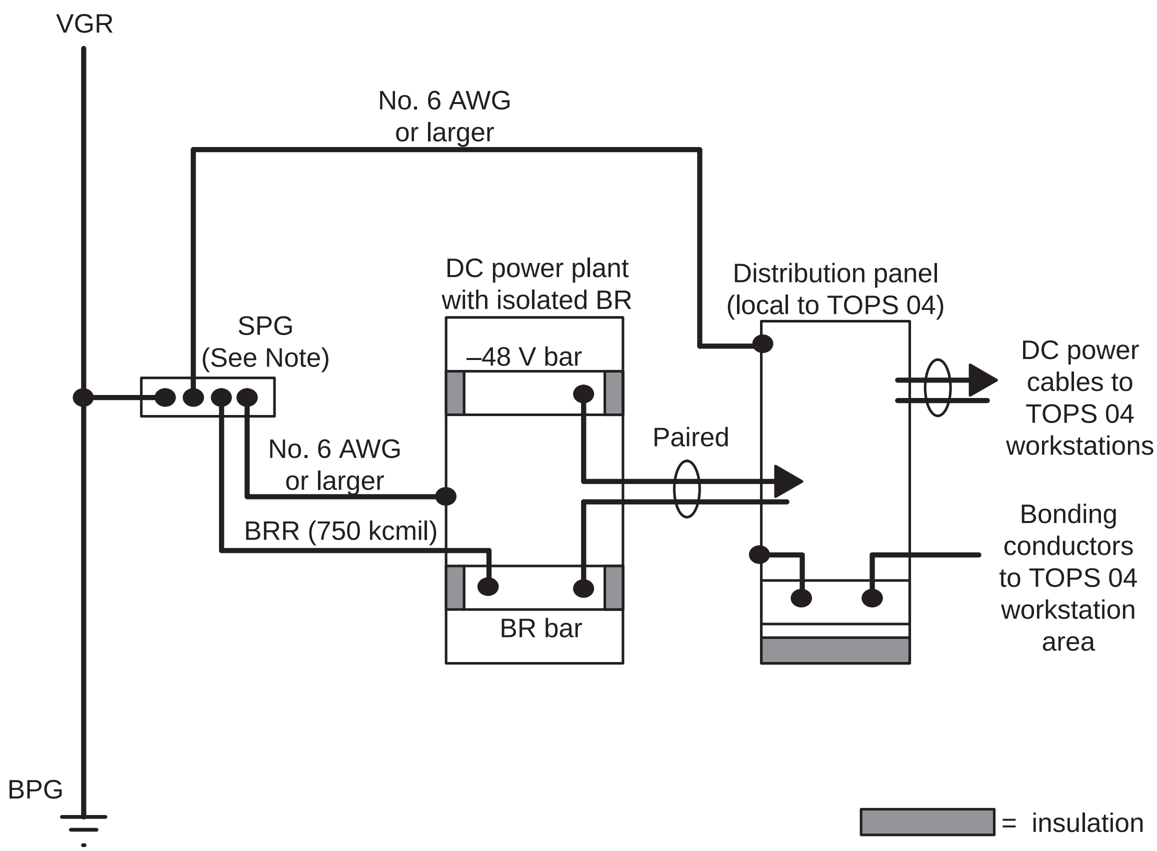
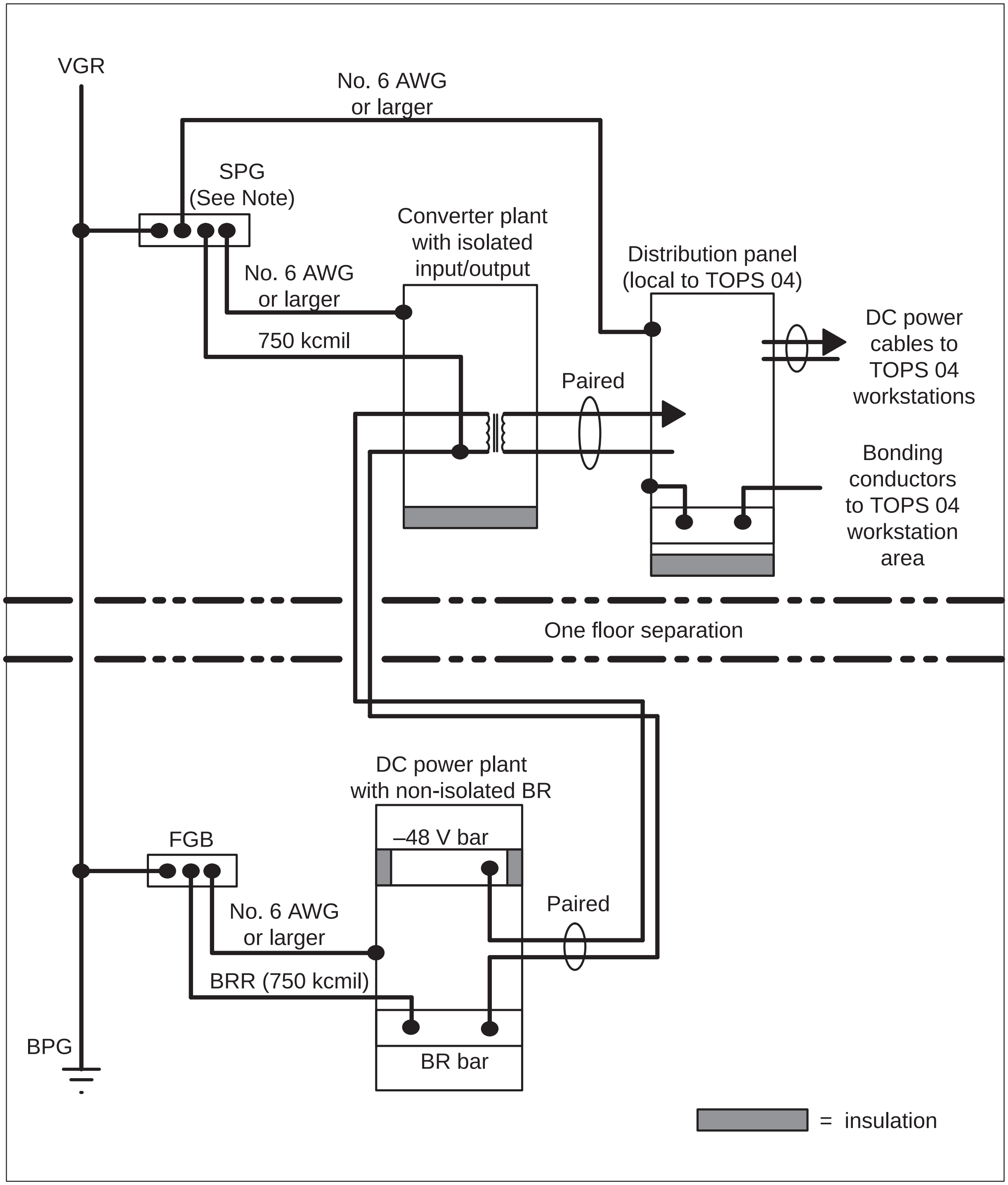


Figure 4-15.
Typical local power plant arrangement for TOPS 04



Note: Physically, the SPG may be identical with the FGB, or it may be a separate bar (such as the MGB located in the GW used by the BOCs).

Figure 4-16.
Typical remote power plant arrangement for TOPS 04



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DMS-100 Family

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