GE Medical Systems

Technical Publications

Direction 2275665

Revision 6

Signa® Ovation

Pre–Installation

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Operating Documentation

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- **THIS SERVICE MANUAL IS AVAILABLE IN ENGLISH ONLY.**
- **IF A CUSTOMER'S SERVICE PROVIDER REQUIRES A LANGUAGE OTHER THAN ENGLISH, IT IS THE CUSTOMER'S RESPONSIBILITY TO PROVIDE TRANSLATION SERVICES.**
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- **FALLS EIN FREMDER KUNDENDIENST EINE ANDERE SPRACHE BENÖTIGT, IST ES AUFGABE DES KUNDEN FÜR EINE ENTSPRECHENDE ÜBERSETZUNG ZU SORGEN.**
- **VERSUCHEN SIE NICHT, DAS GERÄT ZU REPARIEREN, BEVOR DIESES KUNDENDIENST–HANDBUCH NICHT ZU RATE GEZOGEN UND VERSTANDEN WURDE.**
- **WIRD DIESE WARNUNG NICHT BEACHTET, SO KANN ES ZU VERLETZUNGEN DES KUNDENDIENSTTECHNIKERS, DES BEDIENERS ODER DES PATIENTEN DURCH ELEKTRISCHE SCHLÄGE, MECHANISCHE ODER SONSTIGE GEFAHREN KOMMEN.**

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- **ESTE MANUAL DE SERVICIO SÓLO EXISTE EN INGLÉS.**
- **SI ALGÚN PROVEEDOR DE SERVICIOS AJENO A GEMS SOLICITA UN IDIOMA QUE NO SEA EL INGLÉS, ES RESPONSABILIDAD DEL CLIENTE OFRECER UN SERVICIO DE TRADUCCIÓN.**
- **NO SE DEBERÁ DAR SERVICIO TÉCNICO AL EQUIPO, SIN HABER CONSULTADO Y COMPRENDIDO ESTE MANUAL DE SERVICIO.**
- **LA NO OBSERVANCIA DEL PRESENTE AVISO PUEDE DAR LUGAR A QUE EL PROVEEDOR DE SERVICIOS, EL OPERADOR O EL PACIENTE SUFRAN LESIONES PROVOCADAS POR CAUSAS ELÉCTRICAS, MECÁNICAS O DE OTRA NATURALEZA.**

ATENÇÃO

- **ESTE MANUAL DE ASSISTÊNCIA TÉCNICA SÓ SE ENCONTRA DISPONÍVEL EM INGLÊS.**
- **SE QUALQUER OUTRO SERVIÇO DE ASSISTÊNCIA TÉCNICA, QUE NÃO A GEMS, SOLICITAR ESTES MANUAIS NOUTRO IDIOMA, É DA RESPONSABILIDADE DO CLIENTE FORNECER OS SERVIÇOS DE TRADUÇÃO.**
- **NÃO TENTE REPARAR O EQUIPAMENTO SEM TER CONSULTADO E COMPREENDIDO ESTE MANUAL DE ASSISTÊNCIA TÉCNICA.**
- **O NÃO CUMPRIMENTO DESTE AVISO PODE POR EM PERIGO A SEGURANÇA DO TÉCNICO, OPERADOR OU PACIENTE DEVIDO A‘ CHOQUES ELÉTRICOS, MECÂNICOS OU OUTROS.**

AVVERTENZA

- **IL PRESENTE MANUALE DI MANUTENZIONE È DISPONIBILE SOLTANTO IN INGLESE.**
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- **SI PROCEDA ALLA MANUTENZIONE DELL’APPARECCHIATURA SOLO DOPO AVER CONSULTATO IL PRESENTE MANUALE ED AVERNE COMPRESO IL CONTENUTO.**
- **NON TENERE CONTO DELLA PRESENTE AVVERTENZA POTREBBE FAR COMPIERE OPERAZIONI DA CUI DERIVINO LESIONI ALL’ADDETTO ALLA MANUTENZIONE, ALL’UTILIZZATORE ED AL PAZIENTE PER FOLGORAZIONE ELETTRICA, PER URTI MECCANICI OD ALTRI RISCHI.**

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- 本维修手册仅存有英文本。
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- 忽略本注意事项会对维修员，操作员或病人造成触电，机械伤害或其他伤害。

CAUTION

Do not use the following devices near this equipment. Use of these devices near this equipment could cause this equipment to malfunction.

Devices not to be used near this equipment

Devices which intrinsically transmit radio waves such as; cellular phone, radio transceiver, mobile radio transmitter, radio–controlled toy, etc.

Keep power to these devices turned off when near this equipment.

Medical staff in charge of this equipment is required to instruct technicians, patients and other people who may be around this equipment to fully comply with the above regulation.

Warning

Never use the following devices near this equipment. They may cause erratic function of this equipment.

Cellular phone, transceiver, mobile radio transmitter and radio–controlled toy, etc.

Keep those devices power–off near this equipment.

REVISION HISTORY

REV	DATE	PRIMARY REASON FOR CHANGE
0	Oct 11, 2000	Initial release
1	Dec 28, 2000	Product Name was changed to Signa Ovation. Added Cooling Cabinet Information. Miscellaneous Correction.
2	May 18, 2001	Update the Magnet Load Pattern. Miscellaneous Correction.
3	Oct 26, 2001	Added the Swing Table Style B ware plate location in Sec 2. Added MDP Document in Sec 11. Miscellaneous Correction.
4	Jan 18, 2002	Cable Interconnect List and Raceway description was updated according to the regulation.
5	Oct 28, 2002	Added YD Magnet (MFO3 M4 Magnet) Information. Miscellaneous Correction.
6	June 6, 2003	P2–12: Added Note about YD Magnet Minimum hallway. P2–31: Added New Power cabinet minimum ceiling height.

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GLOSSARY

EXCLUSION ZONE – Area where the magnetic flux density is greater than five gauss. Personnel with cardiac pacemakers, neurostimulators and other biostimulation devices must NOT enter this zone. Signs are posted outside the five gauss line alerting personnel of this requirement. Since the magnetic field is three-dimensional, signs are also posted on floors above and below the magnet room in which the five gauss line exists.

FERROUS MATERIAL – Any substance containing iron which is strongly attracted by a magnetic field.

GAUSS (G) – A unit of magnetic flux density. The earth's magnetic field strength is approximately one half gauss to one gauss depending on location. The internationally accepted unit is the Tesla (1 Tesla = 10,000 G).

GRADIENT – The amount and direction of the rate of change in space of the magnetic field strength. In the magnetic resonance system, gradient amplifiers and coils are used to vary the magnetic field strength in the X, Y and Z planes.

HOMOGENEITY – Uniformity. The homogeneity of the static magnetic field is an important quality of the magnet.

ISOCENTER – Center of the imaging volume ideally located at the magnet center.

ISOGAUSS LINE – An imaginary line or a line on a field plot connecting identical magnetic field strength points.

MAGNETIC FIELD (H) – The space around a magnet (or current carrying conductor) which can produce a magnetizing force on a body within it.

MAGNETIC RESONANCE (MR) – The absorption or emission of electromagnetic energy by nuclei in a static magnetic field, after excitation by a suitable radio frequency field.

MAGNETIC SHIELDING – Using material (e.g., steel) to redistribute a magnetic field, usually to reduce fringe fields.

PERMANENT MAGNET – A magnetic circuit formed of iron yoke and NdFeB magnetic material generating permanent magnetic field.

RADIO FREQUENCY (RF) – Frequency intermediate between audio frequency and infrared frequencies. Used in magnetic resonance systems to excite nuclei to resonance. Typical frequency range for magnetic resonance systems are 5 – 90 MHz.

RADIO FREQUENCY SHIELDING – Using material (e.g., copper or brass) to reduce interference from external radio frequencies. A radio frequency shielded room must be built for housing the imaging coils and may enclose the entire magnet.

RESONANCE – A large amplitude vibration caused by a relative small periodic stimulus of the same or nearly the same period as the natural vibration period of the system. In magnetic resonance imaging, the radio frequency pulses are the periodic stimuli which are at the same vibration period as the hydrogen nuclei being imaged.

SECURITY ZONE – Area within the magnet room where the magnet is located. Signs are posted outside the magnet room warning personnel of the high magnetic field existing in the magnet room and the possibility of ferrous objects becoming dangerous projectiles within this zone.

GLOSSARY (Continued)

SHIMMING – Correction of inhomogeneity of the main magnetic field due to imperfections in the magnet or to the presence of external ferromagnetic objects.

TESLA (T) – The internationally accepted unit of magnetic flux density. One tesla is equal to 10,000 gauss.

INTRODUCTION

This document contains the physical, magnetic, plumbing and electrical data necessary for planning and preparing a site for a magnetic resonance system. “Preinstallation work” is done to prepare the customer’s premises for the installation of the products sold. It is the responsibility of the purchaser to arrange for performance of this work. Such work includes:

- Installation of the electrical conduit, junction boxes, ducts, surface raceways, outlets and line safety switches.
- Installation of wires not supplied by General Electric such as: the facility input line to the power distribution panel, system transformer and facility power lines to the magnet room. The electrical contractor shall ring out and tag all wires as both ends. Color-coded wires are recommended for easier identification. Wires shall be continuous without splices. Insulation on all equipment ground wires must be green with a yellow stripe.
- Phone lines
- Installation of non-electrical lines such as an air conditioning equipment. Also, installation of recommended air, vacuum and oxygen lines into the magnet room. All lines must be clearly labeled.
- Installation of RF shielding in magnet room
- Installation of magnetic shielding in magnet room
- Site construction or renovation
- Installation of structural reinforcements as required
- Scheduling of riggers to move magnet (under General Electric direction) into its final location within the magnet room.

All works must be in compliance with national and local building and safety codes.

All site plans and preliminary concepts must be reviewed by GE Medical Systems MR Siting group prior to construction.

Unless specifically mentioned, GE Medical Systems Group does not provide or install the facility input power lines to the power distribution panel or the power lines required in the magnet room, nor raised flooring, conduit, junction boxes, ducts, plumbing, or RF shielded room illustrated in the document. This work should be performed by licensed contractors.

INTRODUCTION (continued)

All electrical installations that are preliminary to positioning of the equipment at the site prepared for the equipment shall be performed by licensed electrical contractors. In addition, electrical feeds into the Power Distribution Unit shall be performed by licensed electrical contractors. Other connections between pieces of electrical equipment, calibrations, and testing shall be performed by qualified GE Medical personnel. The products involved (and the accompanying electrical installations) are highly sophisticated, and special engineering competence is required. In performing all electrical work on these products, GE will use its own specially trained field engineers. All of GE's electrical work on these products will comply with the requirements of the applicable electrical codes. The purchaser of GE equipment shall only utilize qualified personnel (i.e., GE's field engineers, personnel of third–party service companies with equivalent training, or licensed electricians) to perform electrical servicing on the equipment.

SECTION 1 – SYSTEM CONFIGURATION

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1–1 INTRODUCTION

Magnetic Resonance (MR) system 0.35T Signa® Ovation is documented throughout this publication.

1–2 BASIC SYSTEM

The following tables list the major equipment which comprise the Signa Ovation system. Illustration 1–1 shows the major equipment of the Signa Ovation system.

TABLE 1–1
0.35T Signa OpenSmart SYSTEM ELECTRONICS MAJOR EQUIPMENT

CATALOG	DESCRIPTION
M20002BH System with Phased Array	Power cabinet containing the RF Amplifier, RF Power Monitor, power supplies for the Magnet Enclosure system components, Gradient Amplifiers, and Power Distribution Unit module with unregulated transformer (200/208/380/400/415/480 Volt, 50/60 Hz) with Power filter. System Cabinet consisting of integrated Systems Electronics subsystem, Combined Exciter/Receiver Operator Workspace equipment : Octane Computer, Workspace Cabinet, Mouse and Mouse Pad, LCD panel, and chair. Note, Refer to Tables 1–8, 1–9 and 1–10 for catalog choices required to complete Operator Workspace equipment. Cooling Unit Pneumatic Patient Alert System. Basic surface coils including Head coil and T/R Body coil Patient accessories such as : a phantom kit, patient log book, table pads, head cushion and sponges, chin and forehead straps, body wedges, knee cusions and security/restraint straps. Gating accessories which include : Patient cardiac leads, Peripheral gating probe, and respiratory bellows.

TABLE 1–2
MAGNET SUBSYSTEM

CATALOG	DESCRIPTION
M20002BM	0.35T Permanet Open Magnet Configuration with Gradient Coil, Body Coil, TCU, Heater, Shim tray, Insulater, Ladder and Attachments.

1–2 BASIC SYSTEM (Continued)

TABLE 1–3
SITE COLLECTOR KIT (REQUIRE ONE)

CATALOG	DESCRIPTION
M20002BK	Fixed Site Cables Penetration Panel and Penetration Panel Covers Enclosure Assembly Phantom Table wear Kit Table Rail Kit

TABLE 1–4
Electric Collector (REQUIRE ONE)

CATALOG	DESCRIPTION
M2001JA	MFO Electric Collector configuration with Linear Air Compressor, Mausee PAD,LCD Panel, Chair, System Cables etc.

TABLE 1–5
Operator Console (REQUIRE ONE) (SEE Note1 in Table)

CATALOG	DESCRIPTION
M2002JA	MFO Operator Console
Note 1 Operator Workspace equipment : Octane Computer, Workspace Cabinet. Note, Refer to Tables 1–7, 1–9, 1–10 and 1–12 for catalog choices required to complete Operator Workspace equipment.	

TABLE 1–6
PATIENT SWING TABLE (REQUIRE ONE)

CATALOG	DESCRIPTION
M2000TK	Patient Table for SIGNA Ovation System (not detachable)

TABLE 1–7
OPERATOR WORKSPACE MONITOR (REQUIRE ONE)

CATALOG	DESCRIPTION
M1000NZ	LCD Color Monitor

1–2 BASIC SYSTEM (Continued)

TABLE 1–8
OPERATOR WORKSPACE TABLE (REQUIRE ONE)

CATALOG	DESCRIPTION
M1000MW	Table for Operator Workspace See Note 1
Note 2 OW Table is an integral part of the regulatory approved system. OW Table provides mounting for several assemblies (e.g.OW Interface Module, OW Power Distribution Box, Modem, DASM) and cable routing for OW interconnects.	

TABLE 1–9
COUNTRY KITS (SELECT ONE)

CATALOG	DESCRIPTION
M1000MN	English Keyboard
M1000MP	French Keyboard
M1000MR	German Keyboard
M1000MS	Scandinavian Keyboard
M1000NH	Italian Keyboard
M1000NJ	Portuguese Keyboard
M1000NK	Spanish Keyboard

1–2 BASIC SYSTEM (Continued)

TABLE 1–10
RECON PROCESSOR

CATALOG	DESCRIPTION
M20002BE	S–BAM (320MB)

TABLE 1–11
FILMING INTERFACE (SEE NOTE 1 IN TABLE)

CATALOG	DESCRIPTION
M1000MJ	Analog DASM
M1000MK	Digital DASM
Note 1 Must choose one filming DASM Board unless DICOM Print will be used exclusively for software filming to DICOM print peripheral devices.	

TABLE 1–12
BAM MEMORY (SEE NOTE 1 IN TABLE)

CATALOG	DESCRIPTION
M23732SS	BAM 128 MB Board (M1090RW)
Note 1 System provides 1 LX BAM 320 MB board standerd with the system. A system may order up to 2 additional LX BAM 128 MB Bpard for a Maximum total of 576 MB LX BAM.	

TABLE 1–13
IIP GLOBAL MODEM (REQUIRE ONE)

CATALOG	DESCRIPTION
M1000NW	MR InSite Interactive Platform Global Modem

1–2 BASIC SYSTEM (Continued)

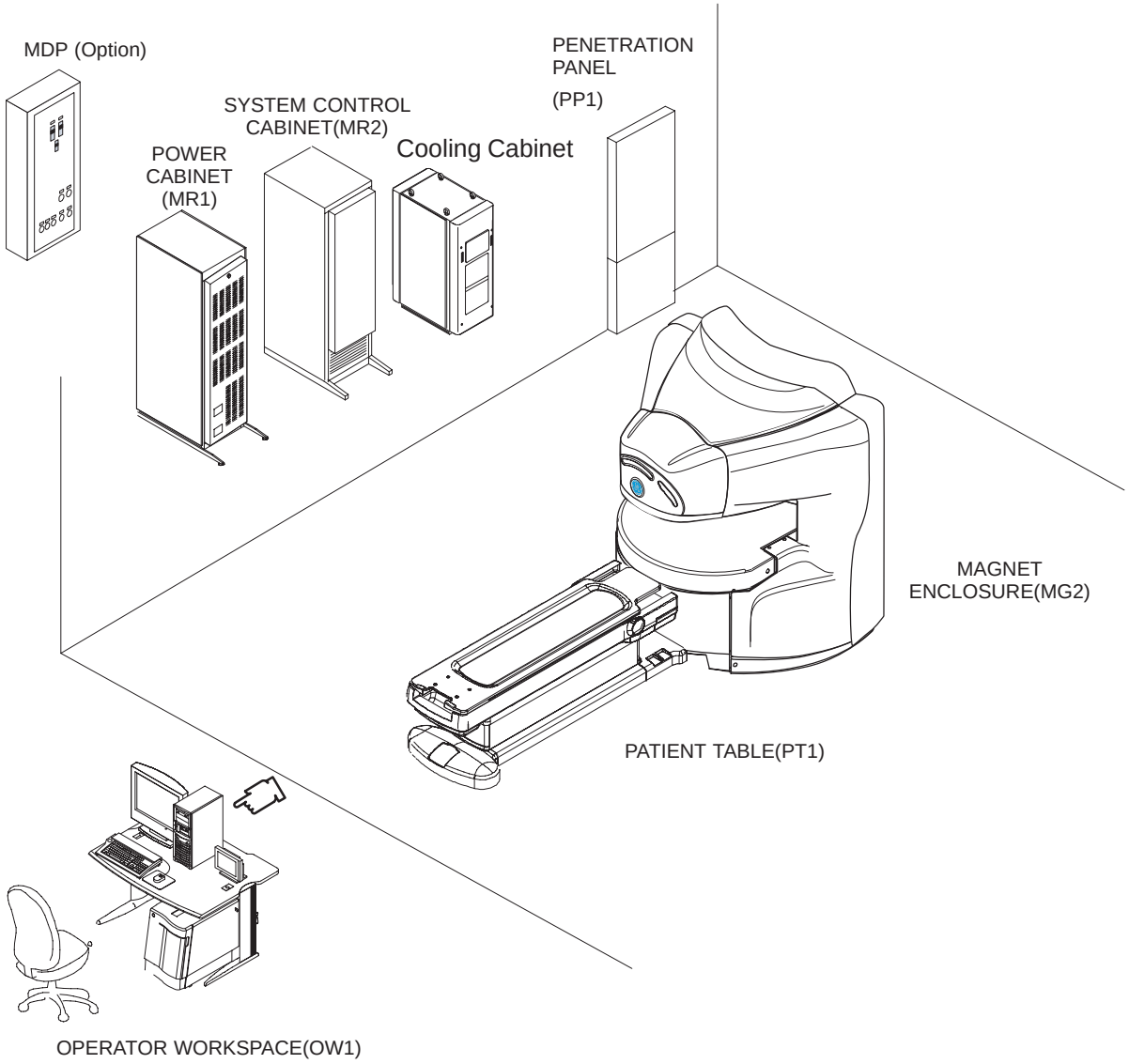
TABLE 1–14
STANDARD PHASED ARRAY COIL PACKAGE (REQUIRE ONE)

CATALOG	DESCRIPTION
M20112BC	C/T/L Array Coil Torso Array Coil (L) and (XL) Extremity/Foot Array (L) and (M) 9 inch 6 inch
Note 1 Head Coil and T/R Body coil are included in the System.	

TABLE 1–15
SCANTOOL (REQUIRE ONE)

CATALOG	DESCRIPTION
M20002BP	Scan Tool : MEMP, FSE, STIP, FLAIR, Cine, GRE/SPGR, Fast GRE/SPGR, SSFSE, 3 Plan, efgre3d, IVI, 3D/VOX Tool
M20012BP	MFO Tools : 2D/3D FRFSE, T1 FLAIR, SSFP, New Image Filter with SCIC

1–2 Basic System (Continued)



SIGNA Ovation SYSTEM MAJOR EQUIPMENT
ILLUSTRATION 1–1

1–3 SYSTEM OPTIONS

Note

SIGNA Ovation system required Pre–Install Kit.
* mark means W.I.P.(Work In Progress) at this timing

The following are optional equipment and software.

TABLE 1–16
OPTIONAL APPLICATIONS (IF REQUIRED)

CATALOG	DESCRIPTION
M20022BP*	EPI Package : SS/MS EPI
M20032BP*	EPI DWI Package : SS EPI DWI, MS EPI DWI (W/Navi Echo), SSFSE DWI
M20042BP*	LSDI : Line Scan Diffusion
M1033JB*	Smart Prep 2000
M1033JK*	Lx FuncTool 2000
M1033JA*	iDrive Pro
M1090PL*	Connect Pro
M20052BP	Multi Slice Multi Angle (for ROAmerica)

TABLE 1–17
OPTIONAL COILS (IF REQUIRED)

CATALOG	DESCRIPTION
M20002BC*	Torso Array (L) (ONE is included in standard coil package)
M20012BC*	C/T/L Array (ONE is included in standard coil package)
M20022BC*	Extremity Array (ONE is included in standard coil package)
M20032BC*	9 inch (ONE is included in standard coil package)
M20042BC*	6 inch (ONE is included in standard coil package)
M20052BC*	Open Breast Array
M20062BC*	Shoulder Array
M20072BC*	Wrist Array
M20082BC*	Torso Array (XL) (ONE is included in standard coil package)
M20092BC*	NV Array
M20102BC*	Open Body coil

1–4 SYSTEM OPTIONS (continued)

TABLE 1–18
KINEMATIC DEVICE (IF REQUIRED)

CATALOG	DESCRIPTION
M20002BA*	KNEE KINEMATIC DEVICE
M20012BA*	ANKLE KINEMATIC DEVICE
M20022BA*	C–SPINE KINEMATIC DEVICE

TABLE 1–19
Patient Monitoring system (IF REQUIRED)(See Note1 in Table)

CATALOG	DESCRIPTION
M21972SS	Patient Monitoring System
Note 1 Need additional arrange of construction at system install.	

TABLE 1–20
Main Disconnect (IF REQUIRED)

CATALOG	DESCRIPTION
R4503K	Main Disconnect

TABLE 1–21
Power Tech (IF REQUIRED)

CATALOG	DESCRIPTION
M1710CA	Power Tech (480V 60Hz)
M1710DA	Power Tech (380V 50/60Hz)

1–5 FACILITY OPTIONS

- Direct current (DC) lighting controller for the magnet room:
  - R4503AD 20 Amp Maximum Constant Lighting Level System, surface/semi–flush mount
  - R4503AF 20 Amp Maximum Variable Lighting Level System, surface/semi–flush mount
  - R4503AW 28 Amp Maximum Constant Lighting Level System, surface/semi–flush mount
  - R4503AY 28 Amp Maximum Variable Lighting Level System, surface/semi–flush mount. 50 Hz designs are available by special order.
- Variable DC dimmer lighting controller system (R4503AF).
- Signa System Seismic Anchorage Service (R4390JA) for system electronics.

Note

Magnet Seismic anchoring is the customer's responsibility to coordinate magnet mounting methods with the RF shielded room vendor to prevent RF leaks and secondary grounding problems. Refer to Section 7–9 MAGNET MOUNTING REQUIREMENTS INSIDE RF SHIELDED ROOM for details**.**

SECTION 2 – ROOM LAYOUTS

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2–1 INTRODUCTION

When laying out a floor plan there are special considerations that must be taken into account due to the magnetic field effect on certain medical implants (including cardiac pacemakers, neurostimulators, and biostimulation devices) and the environmental effect (motors,steel, etc.) on the field homogeneity. The maximum magnetic field in which the equipment can be located is listed in Table 2–1. Selected magnetic shielding of some devices and equipment is possible but must be handled on an individual basis. Refer to Section 6, INTERCONNECTION DATA, for cable length considerations.

The RF shielded room (Magnet Room) is unique in that the room must be shielded from outside radio frequency interference. This is done by enclosing the room with metal walls, floors and ceiling. These shielding requirements impose special considerations which are addressed in Section 7, RF SHIELDED ROOM.

The Magnet Room can be magnetically shielded to reduce the magnet fringe field or to shield the magnet from the effects of the external environment. Refer to Section 3–4, MAGNET FIELD, for magnet shielding considerations.

Note

The contents of this document do not support site plans for interventional procedures.

2–2 ROOM SIZES

Table 2–2 contains minimum room dimensions necessary for an MR suite. Table 2–2 also contains issues which are created by reduction in service access, operator access, and equipment space.

TABLE 2–1
PROXIMITY LIMITS

GAUSS (mT) LIMIT See Notes 1 & 2	EQUIPMENT	
0.5 GAUSS (0.05mT) OR LESS See Note 4	• Nuclear cameras	
1 GAUSS (0.1mT) OR LESS See Note 4	• Positron Emission Tomography scanner • Linear Accelerator • Cyclotrons • Accurate Measuring scale • Image intensifiers • Color TV	• Video display (color, B/W, monochrome) • CT scanner • Ultrasound • Lithotriptor • Electron microscope • Advantage Workstation with CRT monitor
3 GAUSS (0.3mT) OR LESS See Note 4	• Power transformers • Main electrical distribution transformers • Moving steel equipment such as: – Vehicular traffic – Fork lift trucks – Dumb waiters – Electric transport carts	 – Loading dock (truck traffic) – Elevators – Escalators – Helicopters (See Note 3)
5 GAUSS (0.5mT) OR LESS	• Cardiac pacemakers • Neurostimulators	• Biostimulation devices
10 GAUSS (1mT) OR LESS	• Magnetic tapes and floppy discs • Hard copy imagers • Line printers • Video Cassette Recorder (VCR) • Film processor • Credit cards, watches, and clocks • Telephone switching station • Water cooling equipment	• HVAC equipment • Major mechanical equipment room • Large steel equipment such as: – Emergency generators – Commercial laundry equipment – Food preparation area – Air conditioning chiller – Fuel storage tanks – Motors greater than 5 horsepower • X–ray tubes
30 GAUSS (3mT) OR LESS	• System Cabinet	
50 GAUSS (5mT) OR LESS	• Operator Workspace Cabinet • LCD Color Monitor (See note 4) • Main Disconnect Panel	• Cooling Unit • Telephones • Metal detector for screening
100 GAUSS (10mT) OR LESS	• Pneumatic Patient Alert Control Box	
200 GAUSS (20mT) OR LESS	• Penetration Panel • Power Cabinet	

Note 1 Refer to SECTION 3, MAGNETIC FIELD, for magnet field plots.

2 Recommended limits given above are based on general MR site planning guidelines. Actual susceptibility of specific devices may vary significantly depending on electrical design orientation of the device relative to the magnetic field and the degree of interference considered unacceptable.

3 Verify operating limits with provider of helicopter service

4 If gauss limit is more than indicated for OW with LCD Color Monitor then contact GE to determine impacts on OW equipment.

TABLE 2–2
MINIMUM ROOM INSIDE CLEAR SPACE DIMENSIONS
(VALUES DO NOT INCLUDE MAGNETIC AND/OR RF SHIELDING OR FINISHED WALL)

ROOM	0.35T SYSTEM CONFIGURATION MINIMUM VALUES
MAGNET ROOM See Note 1	
Width X Depth: ft–in. (m)	13.1 x 18.7 (4.0 x 5.7) See Note 3
Area: ft^2 (m^2)	245 (22.8)
Ceiling Height: ft–in. (m)	7.9 (2.4)
EQUIPMENT ROOM See Note 2	
Width X Depth: ft–in. (m)	11 x 8 (3.34 x 2.43)
Area: ft^2 (m^2)	88 (8.12)
CONTROL ROOM	
Width X Depth: ft–in. (m)	5* x 7 (1.52* x 2.13)
Area: ft^2 (m^2)	35 (3.24)
TOTAL SYSTEM AREA: ft^2 (m^2)	381.20 (35.36)

Note 1 Absolute Minimum Magnet Room dimensions will result in limited operator clearances and increased Magnet Service time.

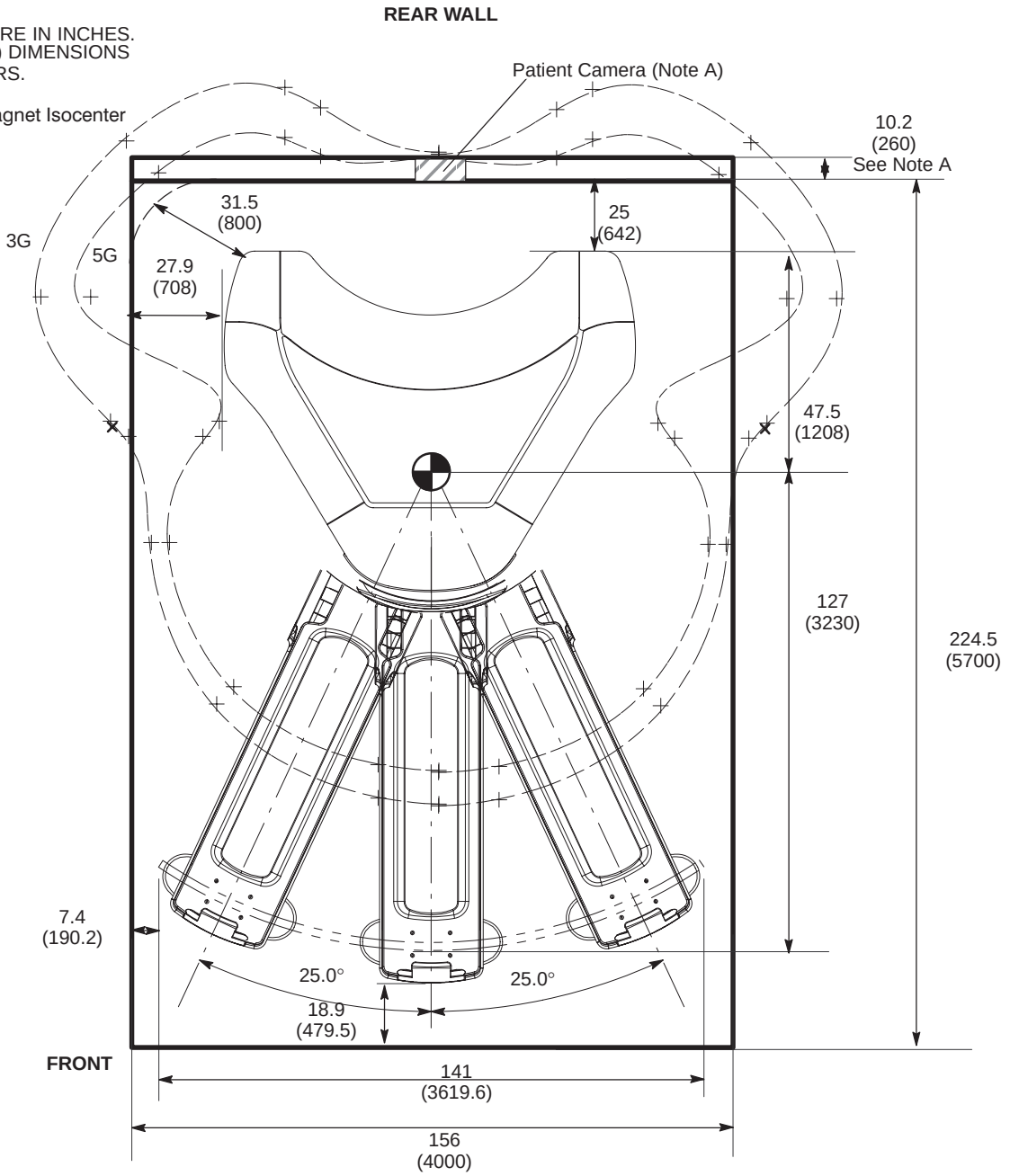
2 Absolute Minimum Equipment Room and Control Room dimensions do not permit placement of air conditioning in room. Nor do they permit space for any optional equipment such as Advantage Workstation option, Laser Camera, etc.

3 Room dimensions do not contain 5 gauss line to room. They will also not allow for a door swing into the magnet room with table in rotated position.

* Width is dependent on Magnet Room door location and customer's approval of limited space available for operator.

NOTE:
ALL DIMENSIONS ARE IN INCHES.
ALL BRACKETED ( ) DIMENSIONS ARE IN MILLIMETERS.

INDICATES Magnet Isocenter



Note A : If Patient Monitor(option) is installed, allow 260mm to recess into wall.

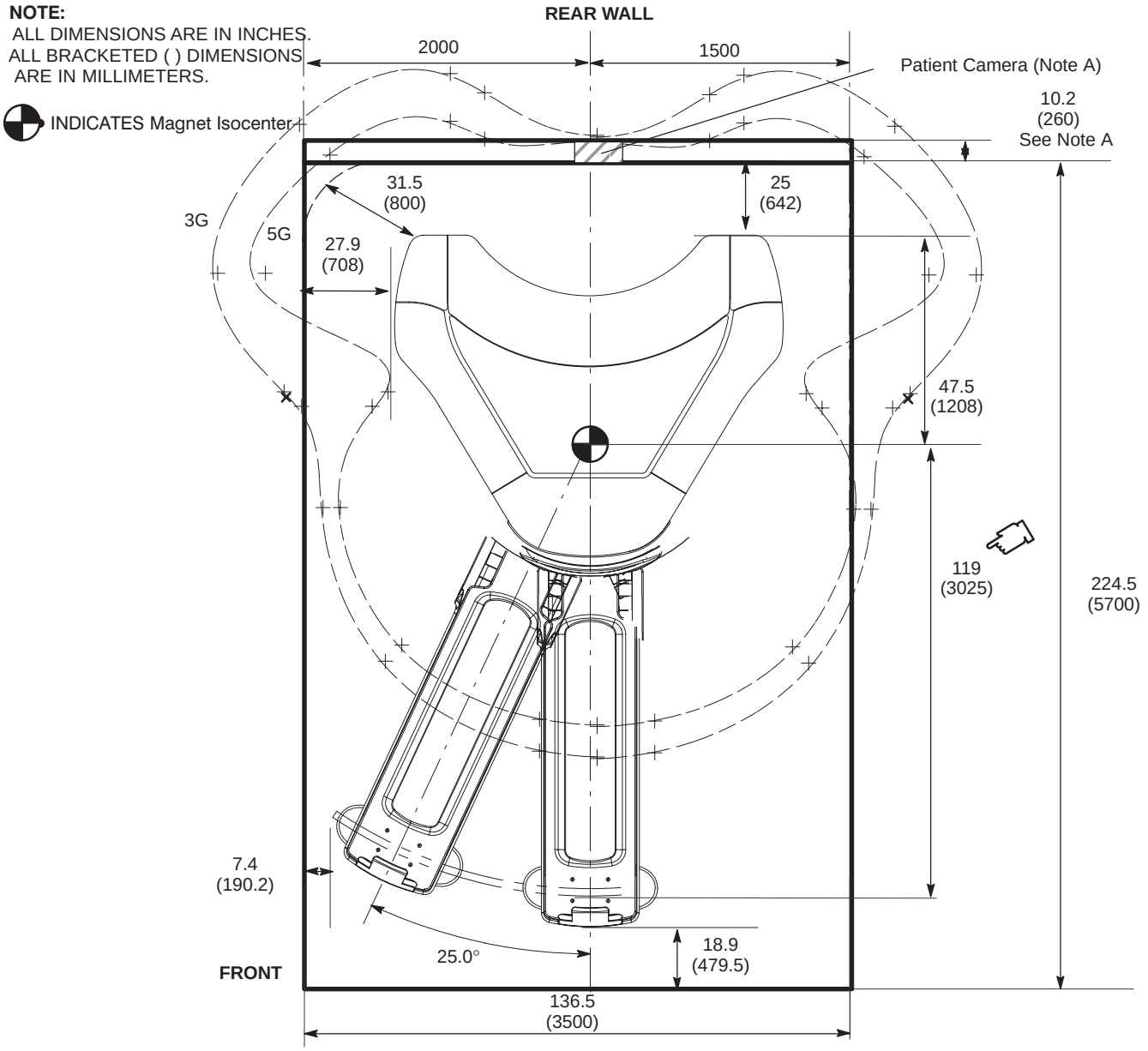
0.35T MAGNET, ENCLOSURE, & PATIENT TABLE (MINIMUM LAYOUT FOR TWO SIDE SWING WITH OUTSWINGING SWING DOOR)
ILLUSTRATION 2–1

Note 1

This is a minimum layout finished room without duct.

Note 2

5 Gauss line should be inside of the magnet room area.
It is necessary to shield the room so that 5 Gauss line is inside of magnet room if this minimum layout is applied.



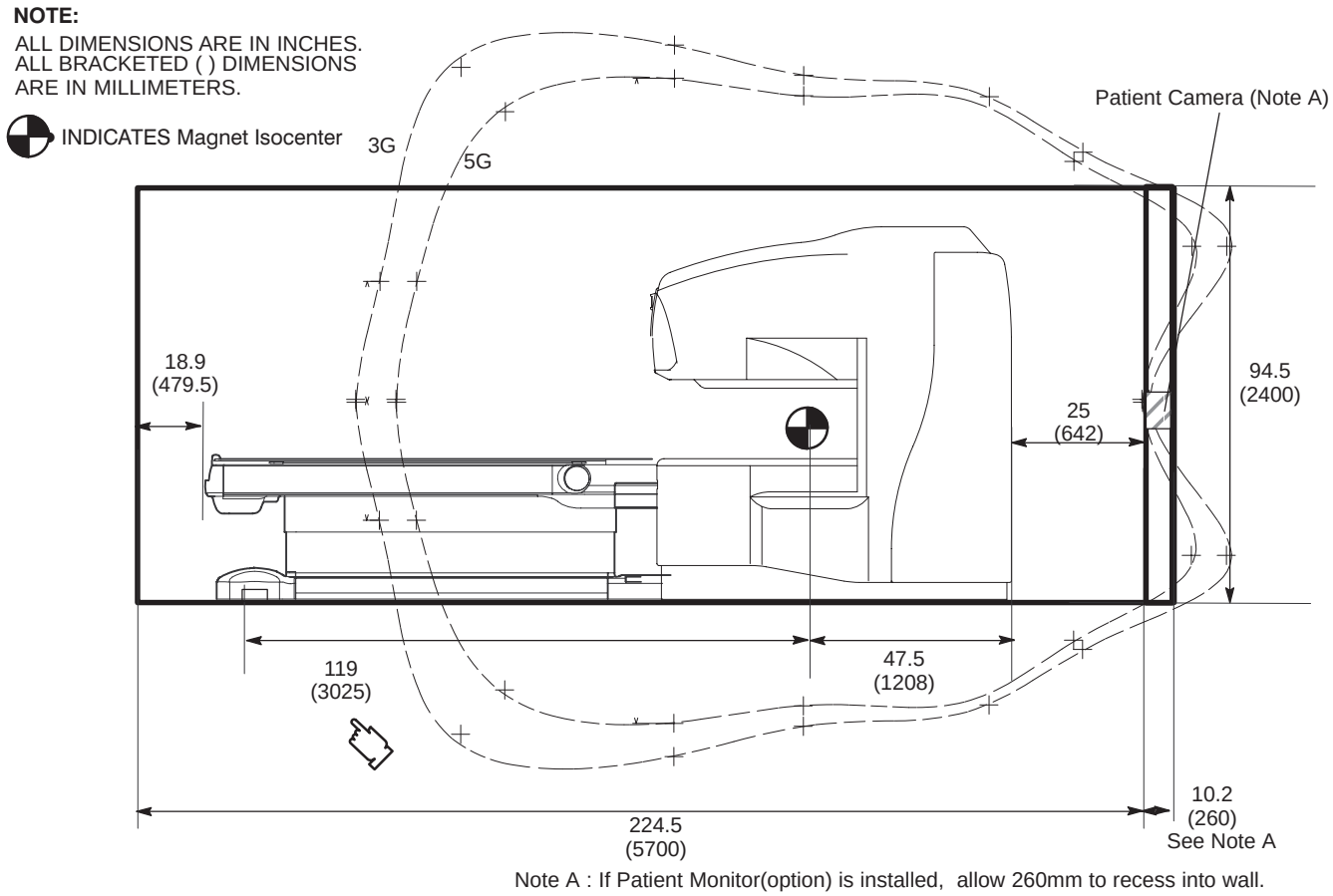
Note A : If Patient Monitor(option) is installed, allow 260mm to recess into wall.

0.35T MAGNET, ENCLOSURE, & PATIENT TABLE (MINIMUM LAYOUT FOR ONE SIDE SWING WITH OUTSWINGING SWING DOOR)
ILLUSTRATION 2–2

Note 1
This is a minimum layout finished room without duct.

Note 2
Since 5 Gauss line is out of the minimum room area,
it may be necessary to shield the room if minimum layout is applied.

Note 3
This minimum room layout is also applied for the system without table swing.

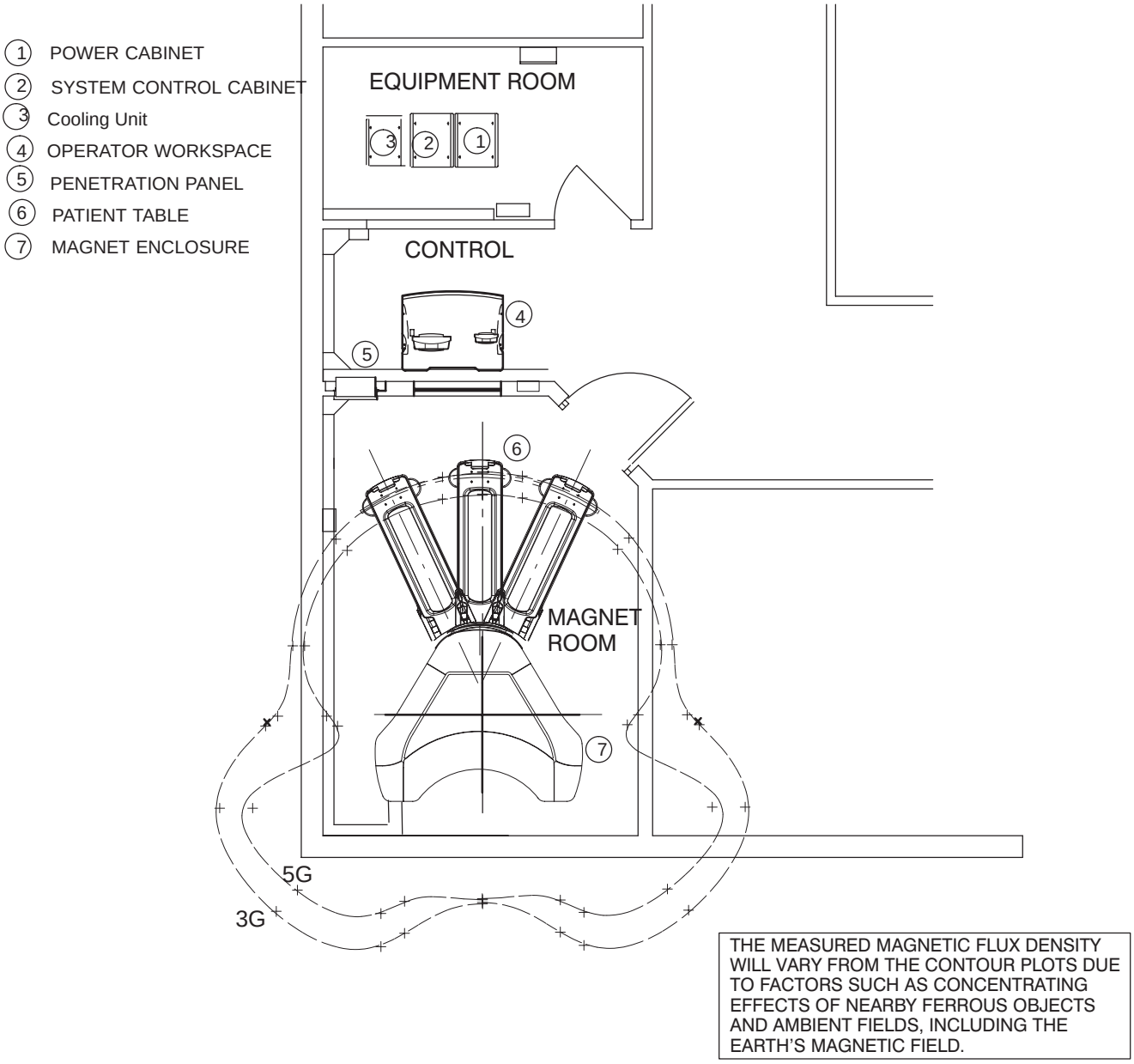


0.35T MAGNET, ENCLOSURE, & PATIENT TABLE (MINIMUM SERVICE AREA)
ILLUSTRATION 2–3

Note

Since 5 Gauss line is out of the minimum room area,
it may be necessary to shield the room if minimum layout is applied.

2–3 Typical Site Layout

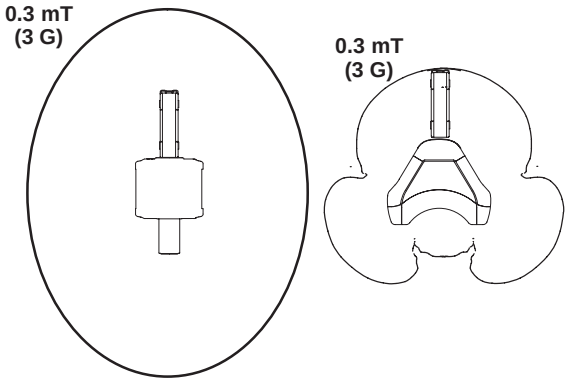


TYPICAL SITE LAYOUT
ILLUSTRATION 2–4

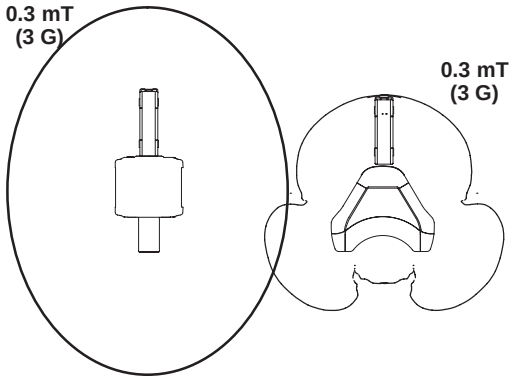
2–4 TWO MAGNET SITE LAYOUT

For two magnet installations interaction can occur between the magnetic fields. For 2 magnets not to interact at all (including when bringing magnet to field) the 3 gauss lines of each magnet must not intersect. If the 3 gauss lines intersect but remain outside each magnet's cryostat there will be interaction between the magnets when bringing to field. The orientation of the magnets is irrelevant. Consult the MR Siting & Shielding group for closer proximity of magnets.

Signa Ovation Magnet
vs Magnet with parallell magnet field

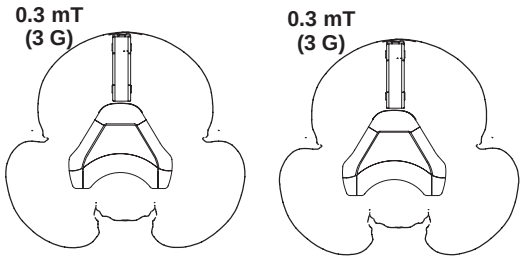


NO INTERACTION

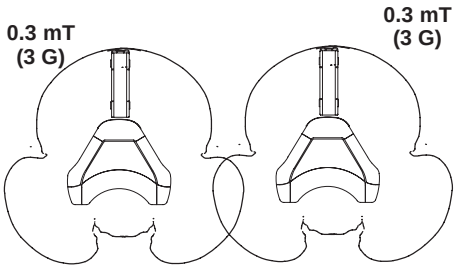


INTERACTION WHEN BRINGING MAGNET TO FIELD

Signa Ovation Magnet
vs Magnet with vertical magnetic field



NO INTERACTION



INTERACTION WHEN BRINGING MAGNET TO FIELD

Note
This specification is only applied for Signa Ovation.
Check the specification of the other Magnet also.

TWO MAGNET INSTALLATION
ILLUSTRATION 2–5

2–5 MINIMUM DOOR/HALLWAY SIZES

Table 2–3 lists minimum actual clearance opening dimensions for doors and hallways required by Signa equipment. Installation or replacement of components listed in Table 2–4 must be taken into consideration when determining hallway and door dimensions. Clearance for maneuvering around corners or turns must also be taken into consideration. Refer to SECTION 8, SHIPPING AND DELIVERY DATA, for Signa Component shipping dimensions.

TABLE 2–3
MINIMUM HALLWAY/DOOR DIMENSIONS

COMPONENT	MINIMUM HALLWAY/ DOOR WIDTH* in. (mm)	MINIMUM HALLWAY/ DOOR HEIGHT* in. (mm)	COMMENTS
Operator Workspace Table	32 (813)	80 (2032)	
Equipment Cabinets	36 (914)	80 (2032)	
Magnet	Refer to Note 1	Refer to Note 2	Refer to Table 2–4 for uncrated magnet dimensions.
RF Room Door	Refer to Section 7, RF SHIELDED ROOM	Refer to Section 7, RF SHIELDED ROOM	

Note * Minimum hallway and door dimensions are actual clearance openings. Width and height of rigging equipment is not included in above dimension.

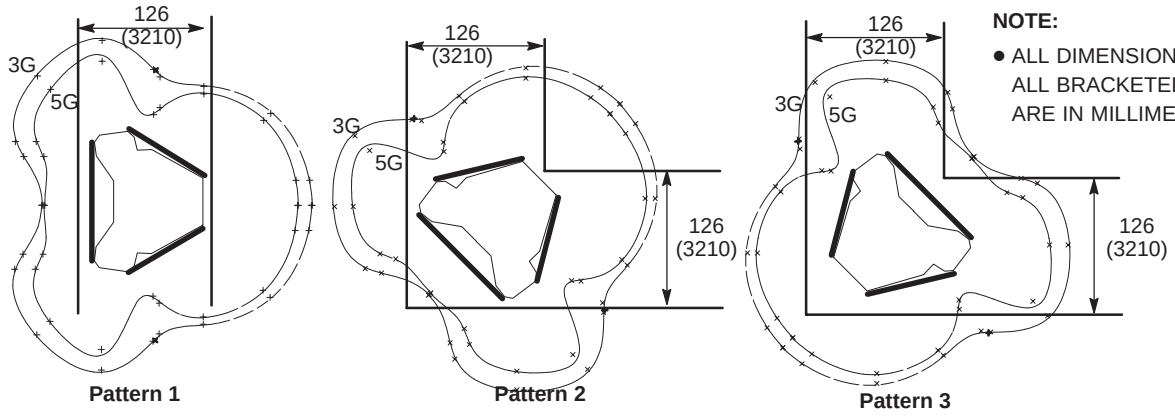
1 Minimum width depends on access route to removable panels of RF shielded room wall. For straight path (i.e. no bends or turns). It is recommended to allow 6 in. (153 mm) on both sides of magnet. Appropriate calculations must be performed if turns exist along proposed magnet delivery route. Illustration 2–6 shows dimensions for 90° turn.

2 Absolute minimum height clearance is 87.54 in. (2222 mm). Final dimension is dependent on rigger equipment used, refer to SECTION 8, SHIPPING AND DELIVERY DATA.

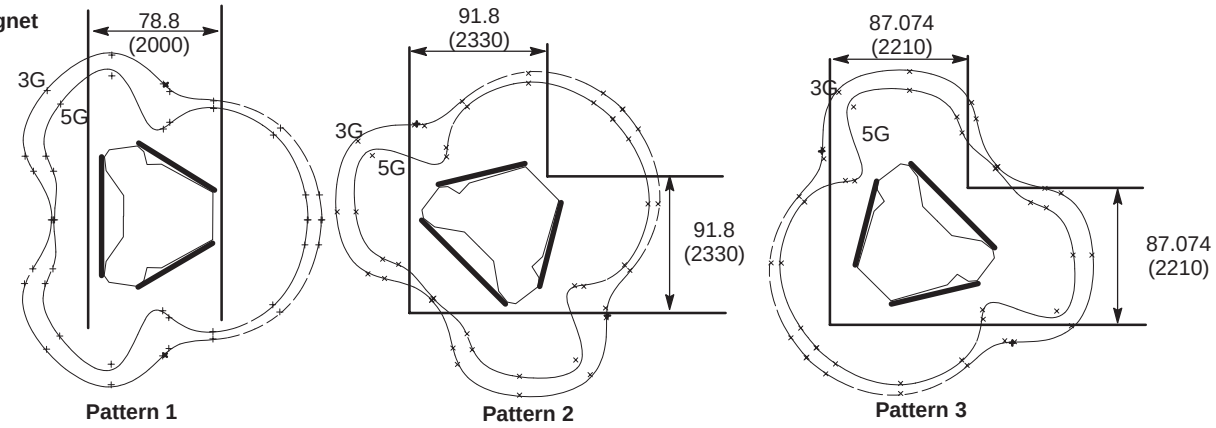
2–5 MINIMUM DOOR/HALLWAY SIZES (continued)

YD Magnet

NOTE: After the YD magnet has been jacked up, put on roller dollies and the jacks removed, same hallway size as a YC magnetit (2000mm wide) may be used.



YC Magnet



MAGNET MINIMUM DOOR/HALLWAY DIMENSIONS 90° TURN
ILLUSTRATION 2–6

Note

Since 5 Gauss line is out of the hallway, special care must be considered concerning the equipment near the hallway. Refer to Page2–4 “TABLE 2–1 PROXIMITY LIMITS”.

TABLE 2–4
COMPONENT DIMENSIONS FOR INSTALLATION/REPLACEMENT

COMPONENT	APPROXIMATE WEIGHT lbs (kg)	OVERALL DIMENSIONS Inches (mm)	COMMENTS
Magnet (uncrated)	Refer to comments.	Refer to comments.	Refer to Section 8, SHIPPING AND DELIVERY DATA, for dimensions, illustrations and weights.
Tx Coil	29.8 (13.5)	38.6(Φ980)	The RF Coil (upper & lower) are shipped separate from the magnet and installed at site.

2–6 CABLING CONSIDERATIONS

Several different methods for running cables are listed below and the customer should carefully consider the advantages and disadvantages of each.

Note

Customer current and future system utilization should be considered when determining method of running cables, i.e. surface floor duct or access floor behind magnet may not be acceptable if customer access is desired around the entire magnet.

Care must be taken to protect interconnecting cords and cables from physical damage (including water). Branch circuit conductors must be enclosed in metal raceway or metal wireway when concealed or when installed under raised flooring.

Consult local/national code for interconnects separation requirements (i.e. signal, power, etc.).

Note

If National Electric Code (NEC) is applied at the site, the following items must be complied.

1. MRI systems shall use non–ferrous metal raceways, covers, fasteners, in all exam/magnet rooms.
2. Raceways shall be certified/rated for electric power purposes.
3. Raceway minimum size shall be certified/rated for electric power purpose.
4. Raceways minimum size shall 18h x 31/2d, and divided into 3 equal partitions of total cross–sectional area.
5. PVC or other non–conductive material are NOT a substitute metal raceways.

2–6–1 Floor Duct

Recessed floor duct has advantages when used within a single room or two adjacent rooms. Floor duct combines a neat functional appearance with accessibility and room for expansion. The disadvantage is the amount of work required to install it, which is generally prohibitive in old installations. Floor ducts can be used in the Magnet Room, however, they must meet the requirements in **Section 7, RF SHIELDED ROOM**.

2–6–2 Raceway

Raceways offer some unique advantages when routing cables. It is very practical to use in existing structures since it is surface–mounted. There is no problem with pre–terminated cables since the entire raceway system can be opened. Raceway systems are relatively easy to expand as compared to other means of routing cables. However, surface–mounted raceways are not recommended for routing cables within the Magnet Room due to the number/size of cables and the trip hazard of the raceway.

2–6–3 Raised Flooring

Raised flooring is recommended for use in both the Equipment and Magnet Rooms due to the number and size of cables in the system. Cable accessibility and ease of alteration are just a few advantages of using raised flooring. Floor duct with dividers placed above the Magnet Room floor but beneath the raised flooring is a convenient method of separating electrical lines from water lines. However, if the area under the raised flooring is used for an air plenum, cables may have to be in raceway depending on local and national codes.

Note

The Signa system interconnecting cables in the Equipment room are FT4 rated, not air plenum rated.

2–6–4 Conduit

Conduit has some important restrictions when used with a MR system. The primary problem is that the majority of cables used are pre–terminated, which greatly simplifies interconnection, but makes cabling difficult because of the added dimensions of the connectors. As a consequence, conduit size must allow for the dimension of the connectors and the possibility of additional cables being added as the system is upgraded in the future. Always size the conduit to allow the cable to pass through with all other cables already in the conduit. Conduit should not be used for running the main GE MR system cables in the Magnet Room due to the number and size of conduits needed.

Note

MR personnel must have an unobstructed path from the patient table to the area directly behind the Magnet. Therefore cable routing methods must not interfere with this pathway.

Cable runs in the Magnet Room as well as throughout the system must be in accordance with local and national codes.

2–7 FLOORING

2–7–1 Cable Routing Areas

Use of a raised floor with covering to minimize static discharge is recommended in the Equipment Room and the portion of the Magnet Room for cable routing. For safety purposes in the Magnet Room, it is required that the raised flooring be made of aluminum. Depending on local and national codes, the area under the raised floor may possibly be used as an air conditioning plenum. If the area under the raised floor is to be used as an air plenum and for cable routing, 10 in. (254mm) of clear space from the underside of the raised floor to the permanent floor is recommended. Cabling, plumbing (water lines), etc. routed under the raised floor may affect air flow and needs to be considered if used as an air conditioning plenum. Also check local and national codes for fire protection requirements under raised floor.

Note

The Signa system interconnecting cables in the Equipment room are FT4 rated, not air plenum rated.

Ensure that the raised flooring, if used, can support the equipment and any transport device needed to move the equipment.

2–7–2 Finished Floor

The finished floor in the Magnet Room should be waterproof and be a conductive type flooring to reduce the possibility of a static discharge. Hard surface finished flooring is required in the Magnet Room for operation of the Swing Patient Table. Information on RF shielded room floor requirements can be found in Section 7, RF SHIELDED ROOM.

If carpeting is used in the Control Room, it should either be anti–static carpeting or treated with an anti–static solution.

2–8 SPECIAL SITING CONSIDERATIONS

The following system accessories or options have special siting concerns which need to be considered.

2–8–1 Pneumatic Patient Alert (PA1)

The Pneumatic Patient Alert system is a stand alone system that will allow the Patient to contact the Operator even when the intercom volume is turned down. The Control Box is to be located near the Operator Workspace. The Control Box audible and visual alarm will be activated by the patient squeeze bulb which is located on the Magnet Enclosure and connected by pneumatic tubing through the Penetration Panel to the Control Box. The Control Box should be mounted with consideration for ease of use by operator, remaining within sight of operator, and within 5 ft (1.5 m) of an electrical outlet. The Control Box can be powered from an outlet on the Operator Workspace. Refer to Illustration 2–29 for Control Box mounting dimensions.

2–8–2 Telephone Lines Requirements

Customer provided and paid for telephone lines must be supplied for system installation and serviceability purposes per Table 2–5.

TABLE 2–5
PHONE LINE REQUIREMENTS

CONFIGURATION	PHONE LINE	USE/LOCATION
Network connection & telephone lines	One voice–grade telephone line (voice line)	Available for Service Personnel use, located in the Control Room
	Network connection with static IP address	Access located near the Operator Workspace(OW) in the control Room.
Multiple telephone lines	One voice–grade telephone line (voice line)	Available for Service Personnel use, located in the Control Room
	One dedicated direct–distance–dialing voice–grade line(data line)	Access located near the Operator Workspace(OW) in the control Room. See Note1 .
Note 1: A dedicated direct–distance–dialing voice–grade telephone line can be shared for Operator Workspace(OW) requirement through the use of a multiplexer box. The following multiplexer boxes are available for customer purchase. 46–328475P1 4 Line Phone Multiplexer box; 115 VAC input power 46–328475P3 4 Line Phone Multiplexer box; 220 VAC input power		

2–9 ARCHITECTURAL REMINDERS

1. Pay attention to isogauss limits, not only for placement of equipment in rooms, but also for isogauss limits with respect to outside environment.

2. The customer is responsible for establishing protocols to warn persons with cardiac pacemakers, neurostimulators, and biostimulation devices of the potential danger of entering magnetic fields greater than 5 gauss (exclusion zone).

3. The operator seated at the Operator Workspace should have an unobstructed view of the patient on the Patient Table.

4. It is recommended that the Magnet Room viewing window be of fine mesh screening material (as opposed to a “honeycomb–type pattern”) for better visibility of the patient from the Operator Workspace.

5. Operators in Magnet Room must have easy access to the scan control switches located on both front side panels of the magnet enclosure.

6. A patient preparation/emergency area should be located near the Magnet Room and direct patient access must be available from the Magnet Room to a patient preparation/emergency area.

7. Customer provided and paid for telephone lines must be supplied for system installation and serviceability purposes per Section 2–8–2 Telephone Lines Requirements.

8. A lockable storage cabinet can be provided and maintained by GE Medical Systems Service for storage of GE Medical Systems service documentation/tools. Cabinet to be approximately 36 in. (914 mm) wide, 18 in. (457 mm) depth, and 72 in. (1829 mm) high.

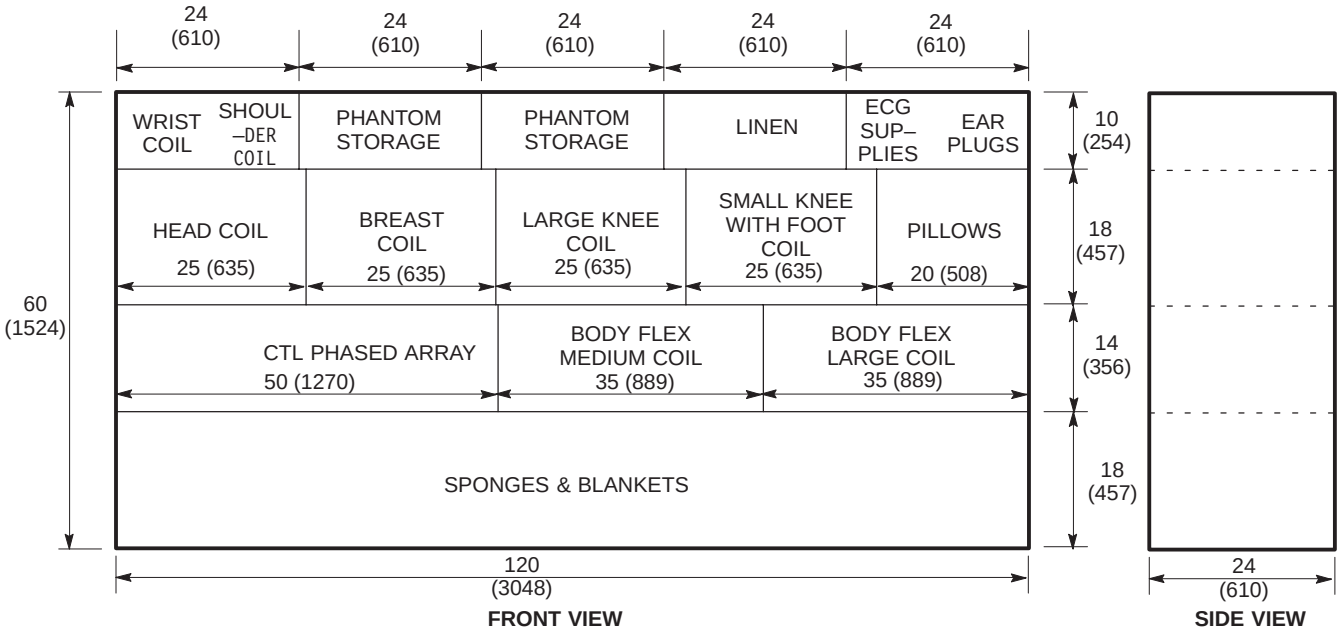
9. Corrosive chemicals must not be stored or used in the Equipment Room. These include chemicals used for film processor storage tanks, processor chemical recovery systems, etc. Such chemicals can contribute to increased equipment failures, increased system downtime, and decreased reliability. Film processor equipment installation must meet the manufacturer’s requirements (e.g. ventilation specifications) and all applicable national and local codes. Also, consideration should be given to the location of this equipment and chemical fumes relative to human contact as it relates to locating this equipment and chemicals in the control area.

10. Storage space for system accessories and supplies should be planned for and included in room layout drawings. Illustration 2–7 shows one suggestion for a shelf/cabinet arrangement developed by several MR Application Specialists and MR System Operators.

2–9 ARCHITECTURAL REMINDERS (Continued)

NOTE:

- ALL DIMENSIONS ARE IN INCHES. ALL BRACKETED () DIMENSIONS ARE IN MILLIMETERS.



SUGGESTION FOR ACCESSORIES & SUPPLIES STORAGE SHELF/CABINET
ILLUSTRATION 2–7

2–10 FLOOR LOADING AND WEIGHTS

This section contains loading considerations for the MR system. Listed in Table 2–6 are the weights, floor loading, and normal mounting methods for MR components.

TABLE 2–6
FLOOR LOADING

COMPONENT	NET WT lbs (kg)	OVERALL DIMENSIONS W x D x H in. (mm)	LOAD PATTERN in. (mm)	NORMAL MOUNTING METHOD
Magnet, Table Rail, Enclosure, and Coils	See Notes 1 & 3 & Refer to Section 8	81.5 x 81.5 x 95.8 (2070 x 2070 x 2434)	See Illustration 2–8 ~ 2–12.	Magnet & Table Dock Assembly Resting on base, bolted to floor with RF Screen Room vendor supplied/installed bolts and anchors.
Patient Swing Table (See Note 4)	1300 (591)	36 x 97 x 36 (914 x 2464 x 914)	See Illustration 2–13	Magnet end of Patient Swing Table connects to arc rail attached to magnet mounting plate.
Power Cabinet	1200 (545)	23.312 x 40 x 76.13 (592 x 1016 x 1933)	Rectangular base 22 x 33 (584 x 838). Four leveling pads each 1.5 (38) dia.	Casters for location. Set on floor on leveling pads.
System Cabinet	494 (225)	23.25 x 42 x 76.5 (591 x 1067 x 1943)	Rectangular base 22 x 30 (584 x 762). Four leveling pads each 1.5 (38) dia.	Casters for location. Set on floor on four leveling pads.
Operator Workspace Table with LCD Color Monitor (See Note 5)	175 (80)	54 x 43 x 52 (1372 x 1092 x 1321)	See Illustration 2–24.	Set on floor: Table on leveling pads & Cabinet rest on casters. Anchor Table to floor per Section 8.
Cooling Unit	394 (180)	23 x 30 x 65.5 (580 x 760 x 1665)	See Illustration 2–17.	Set on floor and rest on casters.
Operator Workspace Cabinet (See Note 5)	192 (87)	18.5 x 29 x 26 (470 x 737 x 660)	See Illustration 2–25.	Set on floor and rest on casters.

Note 1 Weight of magnet with enclosure, Gradient Coil, and Body Coil is 19,000 kg.

2 Consult a structural engineer on method of calculating proper weight/unit area for floor loading.

3 Refer to Section 2–5 MINIMUM DOOR/HALLWAY SIZES for Gradient Coil Assembly replacement weight and dimension requirements.

4 Patient Table weight includes 500 lbs (227 kg) patient.

5 The Operator Workspace Cabinet minimum area location is under the Workspace Table, see in Illustration 2–24. An alternate location is possible with the Operator Workspace Cabinet located against the right side of the Workspace Table.

* Optional Equipment.

2–10–1 Magnet Loading Considerations

In addition to the weight of the riggers equipment, special consideration must be given to the weight of the magnet along the delivery route. Refer to SECTION 8, SHIPPING AND DELIVERY DATA, for the shipping weight of the magnet (i.e. Gradient coil inside magnet bore and without an enclosure). Structural reinforcement may be required along the magnet delivery route. It is required that a structural engineering analysis be performed on the Magnet Room floor and delivery route to determine its load bearing capacity.

During magnet installation, leveling plates or shims MUST be installed between magnet feet and the magnet mounting plate to compensate for variation within levelness. Refer to Section 7 FLOORS for levelness requirements. GE Medical Systems supplied aluminum shims are installed to complete contact between entire surface of each of the four magnet feet and the floor.

2–10–2 Anchoring And Seismic Considerations

The center of gravity for MR system components are given for use in seismic calculations. If the MR cabinets are required by code to be anchored, refer to seismic drawings available on request from your local GEMS Installation Specialist.

The 0.35T Magnet may require the magnet steel plate be installed into the Magnet Room floor to shield the magnet field. The plate may be recessed into an existing floor and/or the floor may be built up to the top of the steel plate. The magnet steel plate must be utilized to shield under the Magnet and the magnet steel plate must be rigidly mounted directly to the concrete without any voids. Refer to **Section 7–4 Floor Shield.**

Note

It is the customer's responsibility to coordinate magnet steel plate connection and mounting methods with the RF shielded room vendor to shield the magnet field and secondary grounding problems.

Note

Magnet does not need to be anchored in a non–seismic area.

It is the responsibility of the customer to obtain any and all approvals necessary for the construction of equipment support and seismic anchoring.

2–10–3 Operator Workspace Mounting Requirements

The Operator Workspace Table sets on the floor with the Workspace Cabinet positioned under the Table towards the right side, see Illustration 2–24. Note, the Workspace Table must be bolted to the floor for safe use of the table and equipment positioned on the table.

2–11 COMPONENT DIMENSIONS

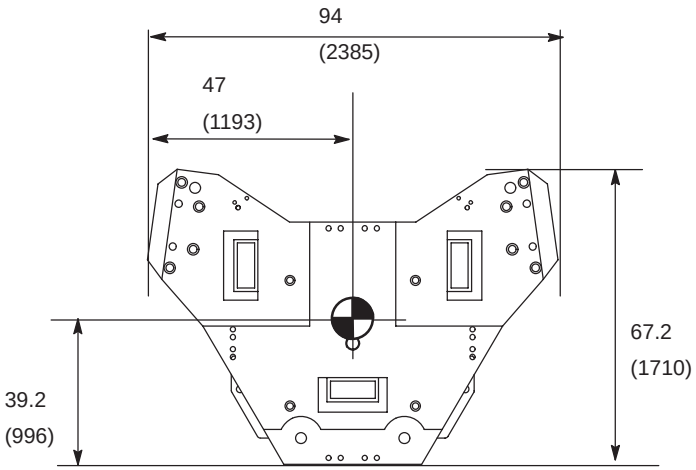
To assist in completing your room layout, refer to Table 2–7 for list of component Illustrations.

TABLE 2–7
MR SYSTEM COMPONENT ILLUSTRATIONS LIST

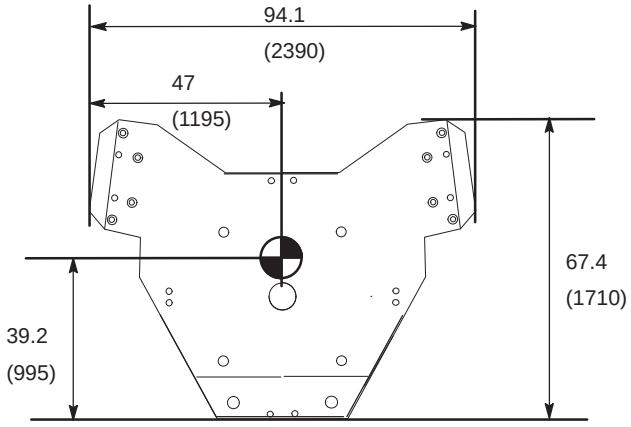
ILLUSTRATION NAME	ILLUSTRATION NUMBER
0.35T MAGNET WITHOUT ENCLOSURE	2–8
MAGNET LOAD PATTERN (1)	2–9
MAGNET LOAD PATTERN (2)	2–10
MAGNET LOAD PATTERN (3)	2–11
MAGNET LOAD PATTERN (4)	2–12
0.35T MAGNET, ENCLOSURE	2–13
0.35T MAGNET, ENCLOSURE, & PATIENT TABLE	2–14
0.35T MAGNET ENCLOSURE CABLE ACCESS (Duct)	2–15
0.35T MAGNET ENCLOSURE CABLE ACCESS (Pit)	2–16
POWER CABINET (MR3)	2–18
SYSTEM CONTROL CABINET (MR2)	2–19
Cooling Cabinet	2–19
PATIENT COOLING COMPRESSOR	2–20
PENETRATION PANEL (PP1)	2–21
PENETRATION PANEL COVER	2–22
OPERATOR WORKSPACE (OW1)	2–23
OPERATOR WORKSPACE CABINET (OW1 A2)	2–25
OPERATOR WORKSPACE COMPONENTS POSITIONED ON TABLE TOP – LCD COLOR MONITOR	2–26
OPERATOR WORKSPACE COMPONENTS POSITIONED ON TABLE TOP – OCTANE COMPUTER	2–27
OPERATOR WORKSPACE COMPONENTS POSITIONED ON TABLE TOP – KEYBOARD	2–28
PNEUMATIC PATIENT ALERT CONTROL BOX (PA1)	2–29
DC LIGHTING CONTROLLER – OPTIONAL	2–30
PATIENT MONITOR CAMERA AND VIDEO BOX(OPTION)	2–30
PATIENT MONITOR (OPTION)	2–31
MAIN DISCONNECT PANEL	2–32

NOTE:
- ALL DIMENSIONS ARE IN INCHES. ALL BRACKETED ( ) DIMENSIONS ARE IN MILLIMETERS.
- APPROX. WEIGHT 19000 kg
- INDICATES Magnet Gravity Center

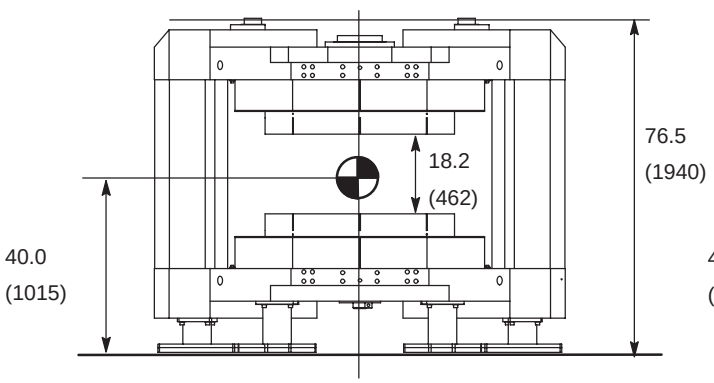
YD Magnet

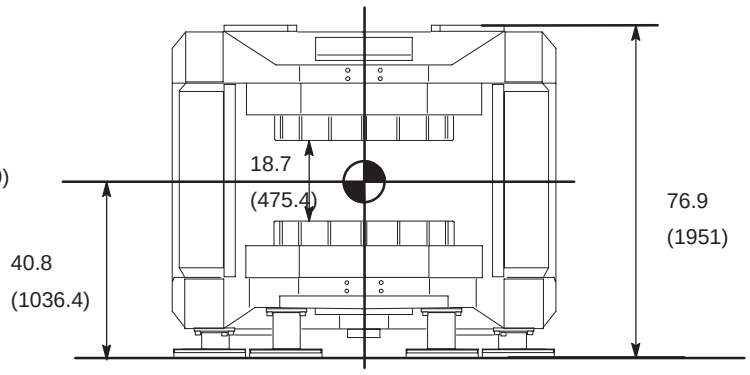


YC Magnet



TOP VIEW





FRONT VIEW

0.35T MAGNET WITHOUT ENCLOSURE
ILLUSTRATION 2–8

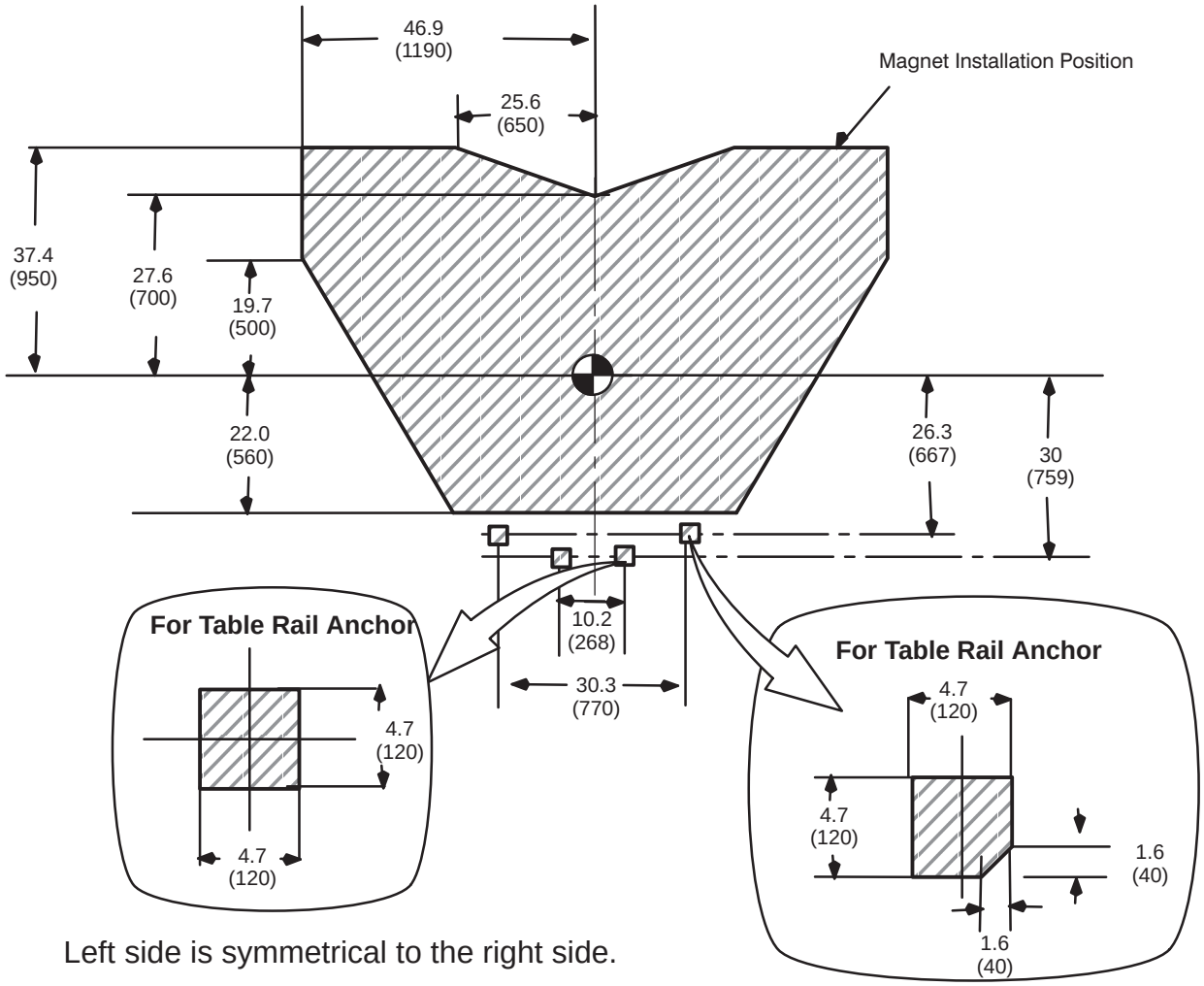
Note

The following procedure from Page2–22 to page 2–26 must be performed before Magnet Installation. If not performing this procedure before the Magnet installation, it will cause problem of whole installation process.

1. Draw the line for magnet and table anchor according to the following illustration.
   Then, cut the floor along the line and peal the finished floor.

NOTE:
ALL DIMENSIONS ARE IN INCHES.
ALL BRACKETED ( ) DIMENSIONS ARE IN MILLIMETERS.

INDICATES Magnet Isocenter



Left side is symmetrical to the right side.

MAGNET LOAD PATTERN (1)
ILLUSTRATION 2–9

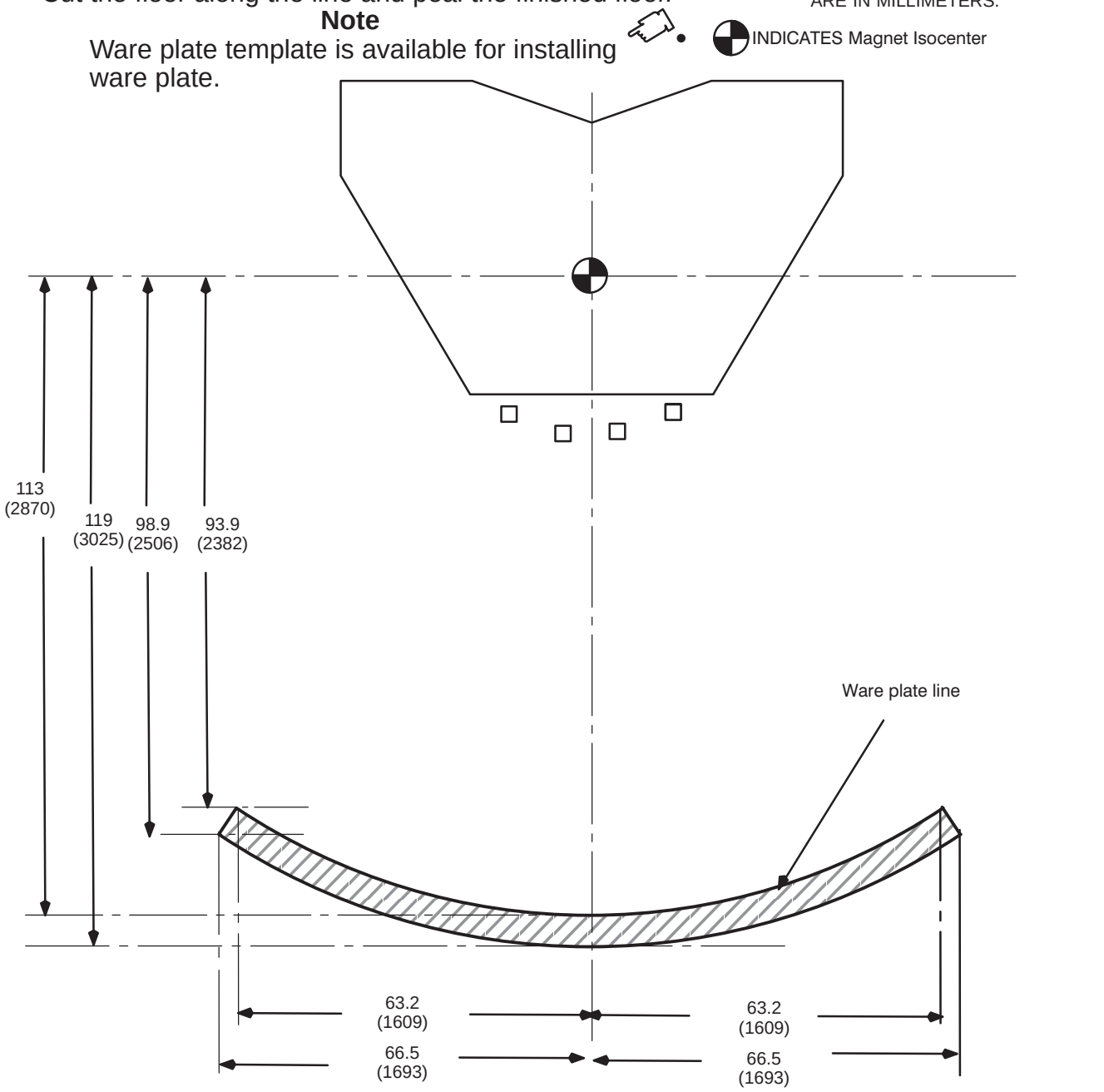
For Style B Table **Note**

Style B Table is shipped from 3Q of 2001.

2. Draw the ware plate line according to the following illustration. Cut the floor along the line and peal the finished floor.

Note

Ware plate template is available for installing ware plate.



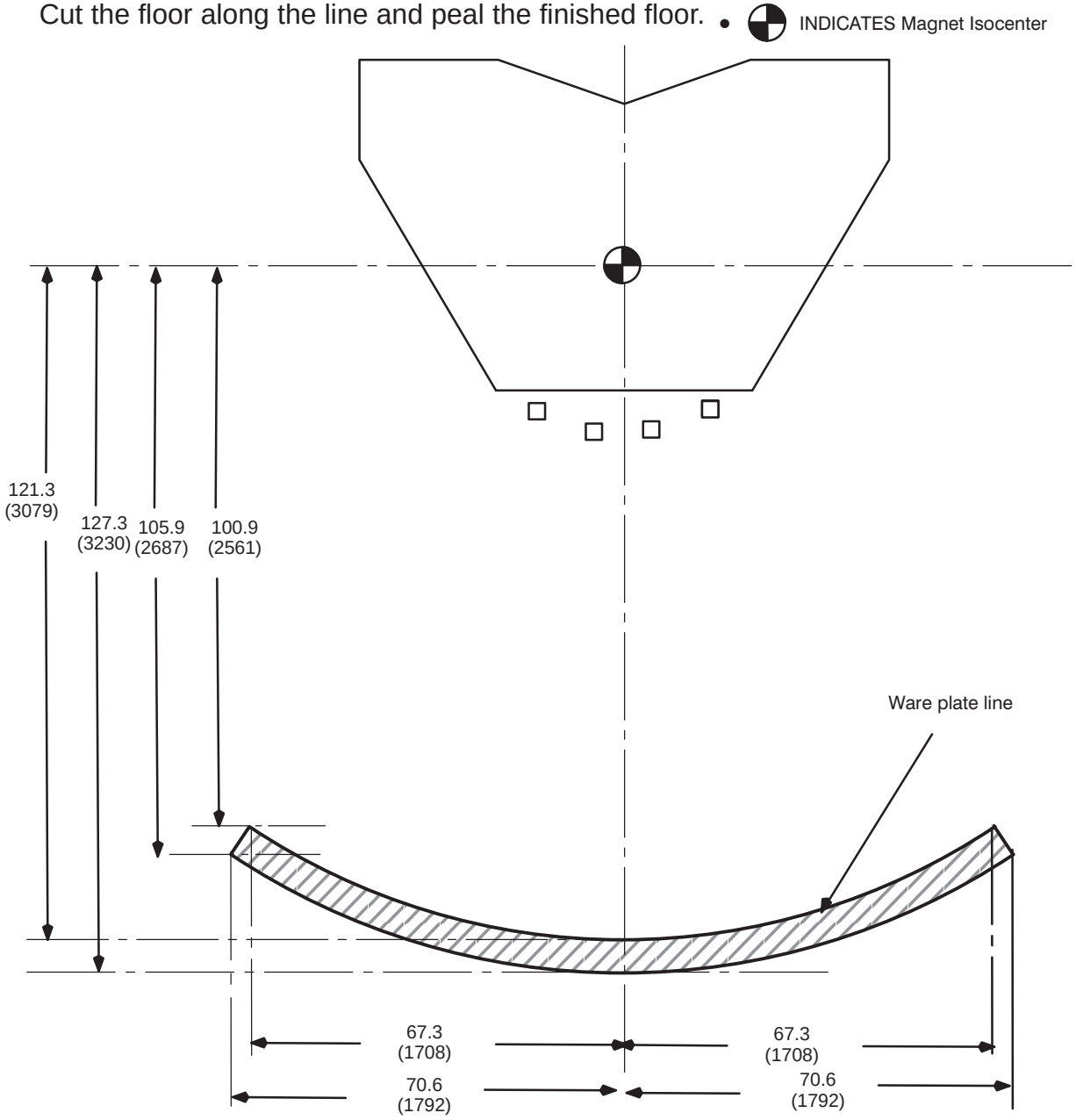
MAGNET LOAD PATTERN (2)
ILLUSTRATION 2–10

For Style A Table

Note

Style A Table is shipped before 3Q of 2001.

2. Draw the ware plate line according to the following illustration. Cut the floor along the line and peal the finished floor.

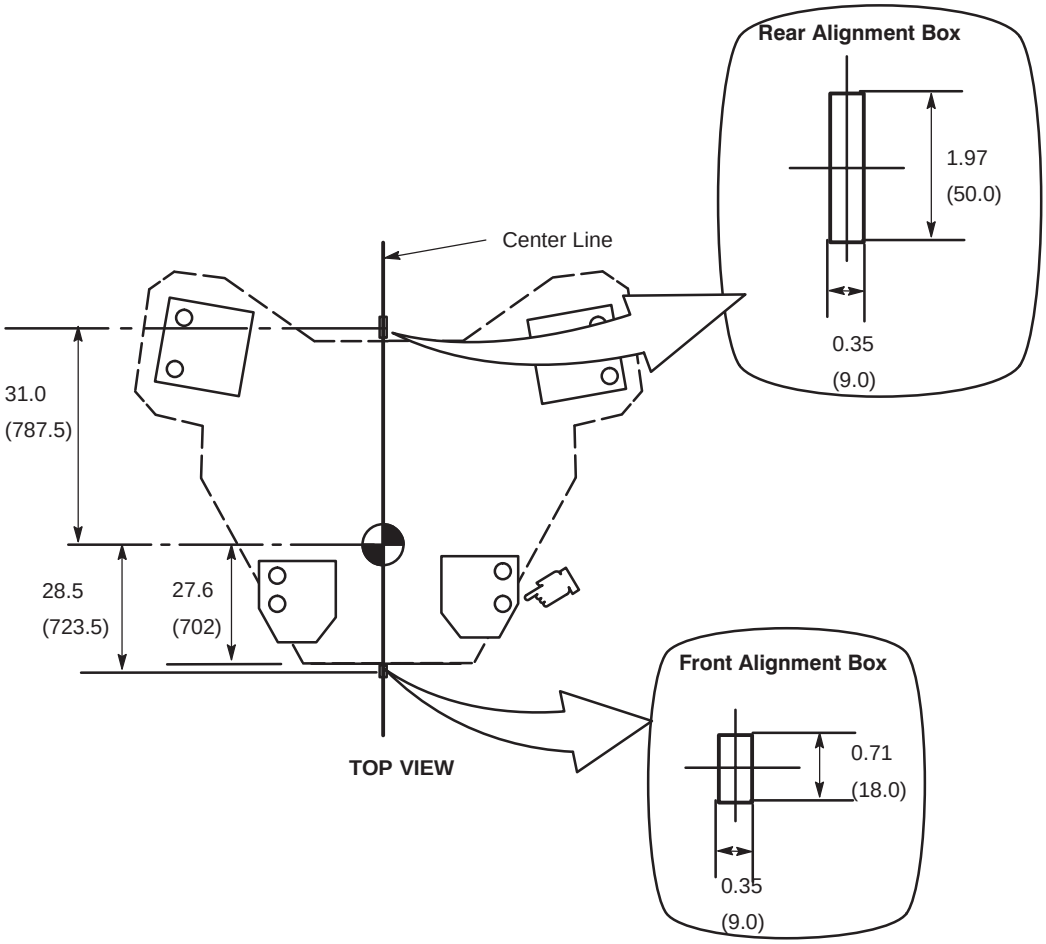


MAGNET LOAD PATTERN (2)
ILLUSTRATION 2–11

3. Draw Magnet Center line.
4. Draw Magnet Alignment box (Front and Rear).

NOTE:
ALL DIMENSIONS ARE IN INCHES.
ALL BRACKETED ( ) DIMENSIONS ARE IN MILLIMETERS.

INDICATES Magnet Isocenter



MAGNET LOAD PATTERN (3)
ILLUSTRATION 2–12

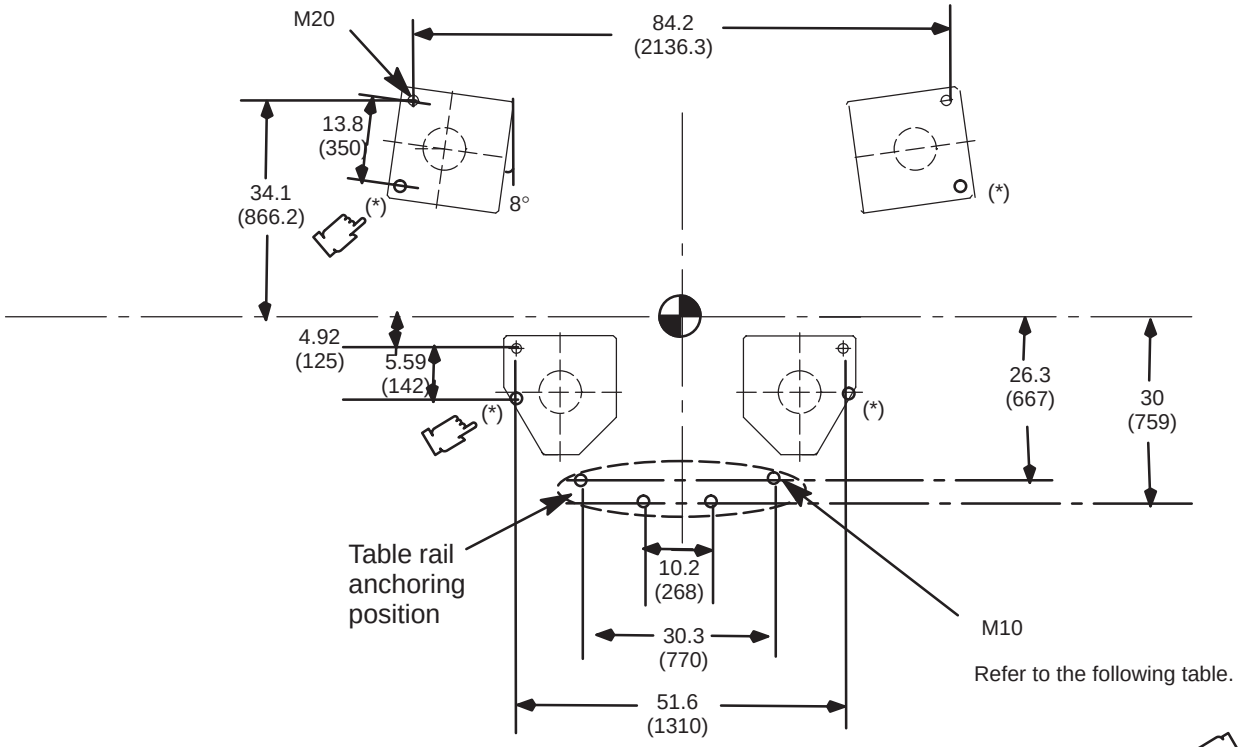
Note

It is necessary to anchor all Magnets even though Magnet is installed in non–seismic areas.

5. Draw the anchor position.
6. Make anchor hole for Magnet leg and Table rail.

• INDICATES Magnet Isocenter

NOTE:
ALL DIMENSIONS ARE IN INCHES.
ALL BRACKETED ( ) DIMENSIONS ARE IN MILLIMETERS.



(*) These anchor holes are added becaiuse of the seimic requirement in US. Use these anchor holes if necessary.

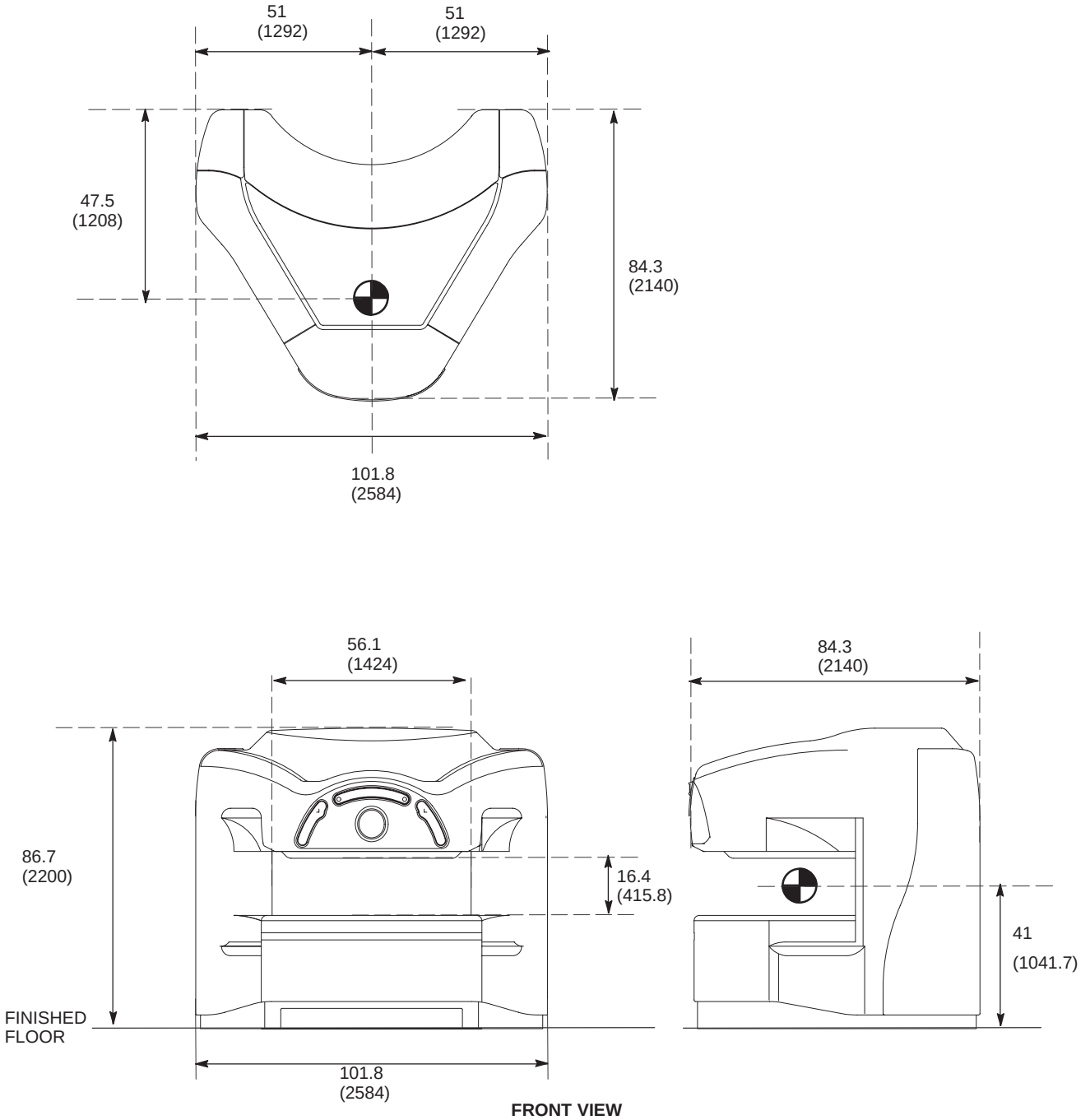
Table Rail Anchor Information

USED FOR	QUANTITY	DROP IN ANCHOR P/N	THREAD	HOLE/BIT DIAMETER	GAUGE DEPTH SETTING	SETTING TOOL P/N
BOLT TABLE RAIL TO FLOOR	4	2295359	M10	0.5 IN. (12.7 MM)	1.6 IN. (41.0 MM)*	46––252065P139

MAGNET LOAD PATTERN (4)
ILLUSTRATION 2–13

NOTE:
ALL DIMENSIONS ARE IN INCHES.
ALL BRACKETED ( ) DIMENSIONS
ARE IN MILLIMETERS.

INDICATES Magnet Isocenter



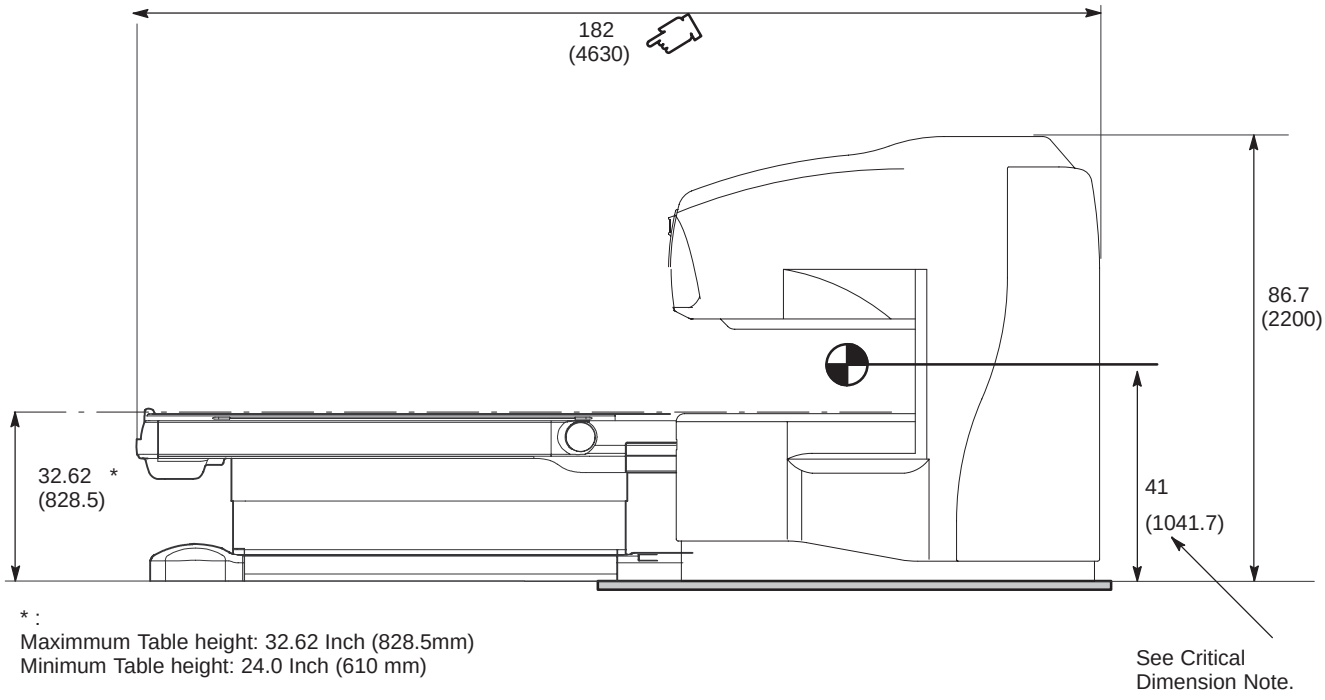
0.35T MAGNET, ENCLOSURE
ILLUSTRATION 2–14

NOTE:

- ALL DIMENSIONS ARE IN INCHES. ALL BRACKETED ( ) DIMENSIONS ARE IN MILLIMETERS.

INDICATES Magnet Isocenter

- THE CRITICAL DIMENSION OF 1041.7 MM +/– 3MM TO VERTICAL CENTER OF THE MAGNET AND PATIENT SWING TABLE REAR WHEEL PLATE MUST BE MUST BE MAINTAINED. THIS WILL ALLOW THE PATIENT SWING TABLE TO SWING WITHOUT OBSTRUCTION FROM THE FLOOR. REFER TO **SECTION 7–6–2 FLOORS.**



* :
Maximmum Table height: 32.62 Inch (828.5mm)
Minimum Table height: 24.0 Inch (610 mm)

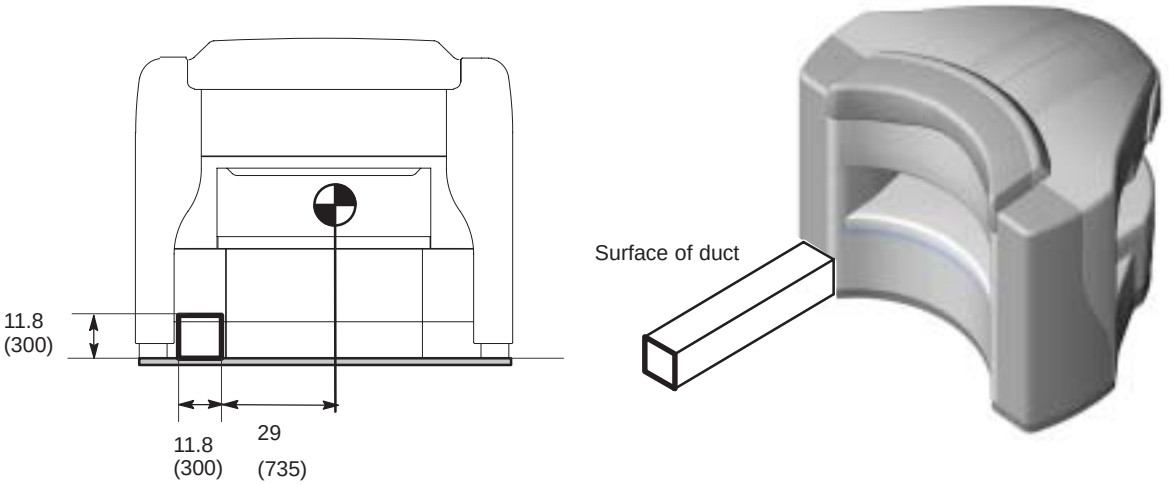
SIDE VIEW

0.35T MAGNET, ENCLOSURE, & PATIENT TABLE
ILLUSTRATION 2–15

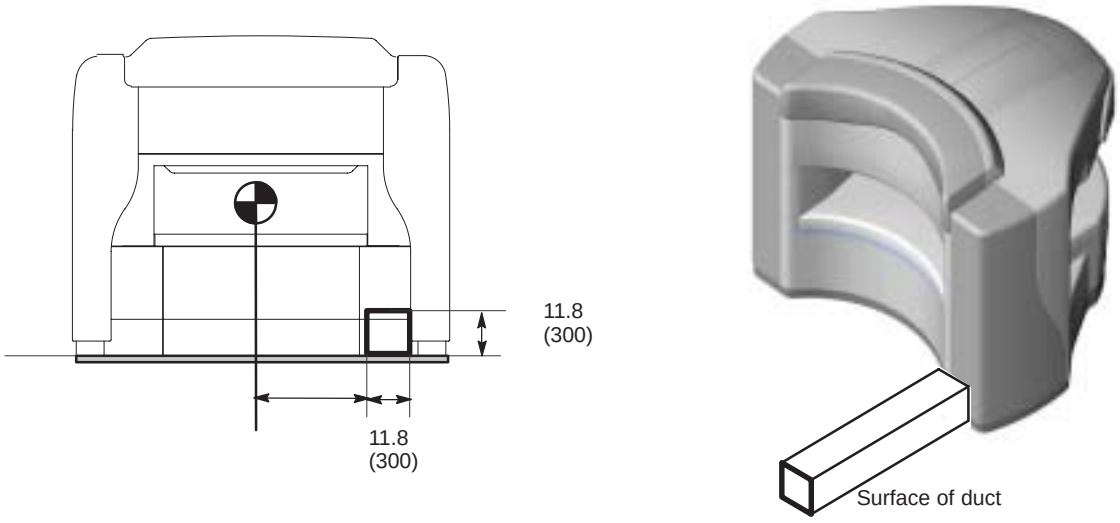
NOTE:
ALL DIMENSIONS ARE IN INCHES.
ALL BRACKETED ( ) DIMENSIONS
ARE IN MILLIMETERS.

INDICATES Magnet Isocenter

Case 1: Cable duct is installed at left side of magnet rear cover.



Case 2: Cable duct is installed at right side of magnet rear cover.

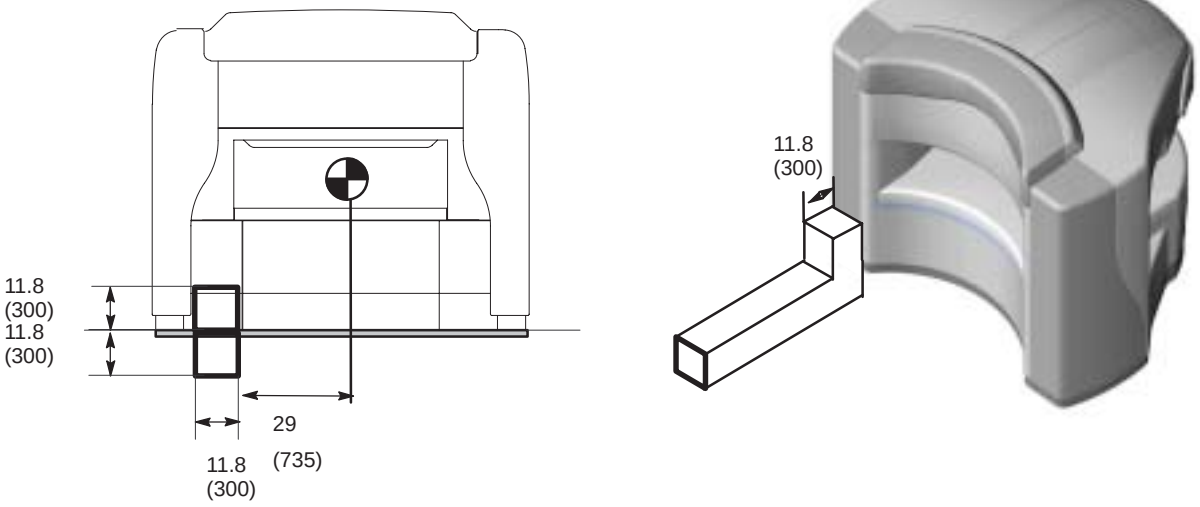


0.35T MAGNET ENCLOSURE CABLE ACCESS (DUCT)
ILLUSTRATION 2–16

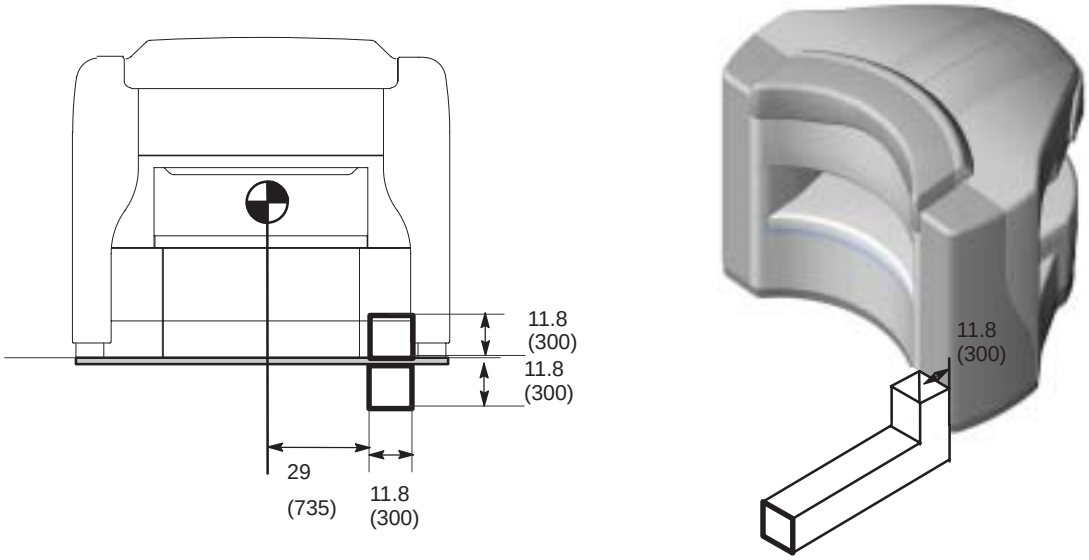
NOTE:
ALL DIMENSIONS ARE IN INCHES.
ALL BRACKETED ( ) DIMENSIONS
ARE IN MILLIMETERS.

INDICATES Magnet Isocenter

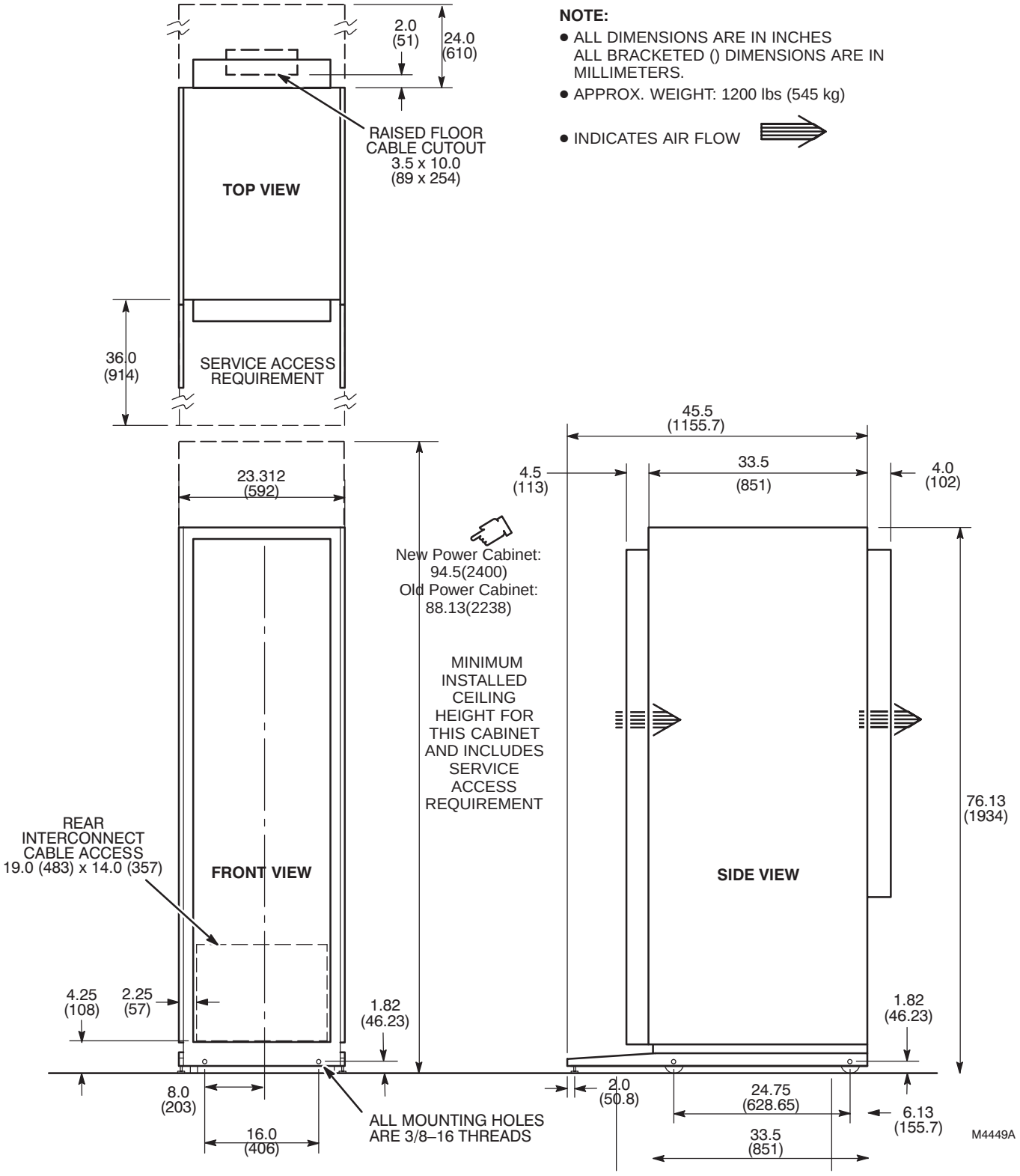
Case 1: Cable pit is located at left side of magnet rear cover.



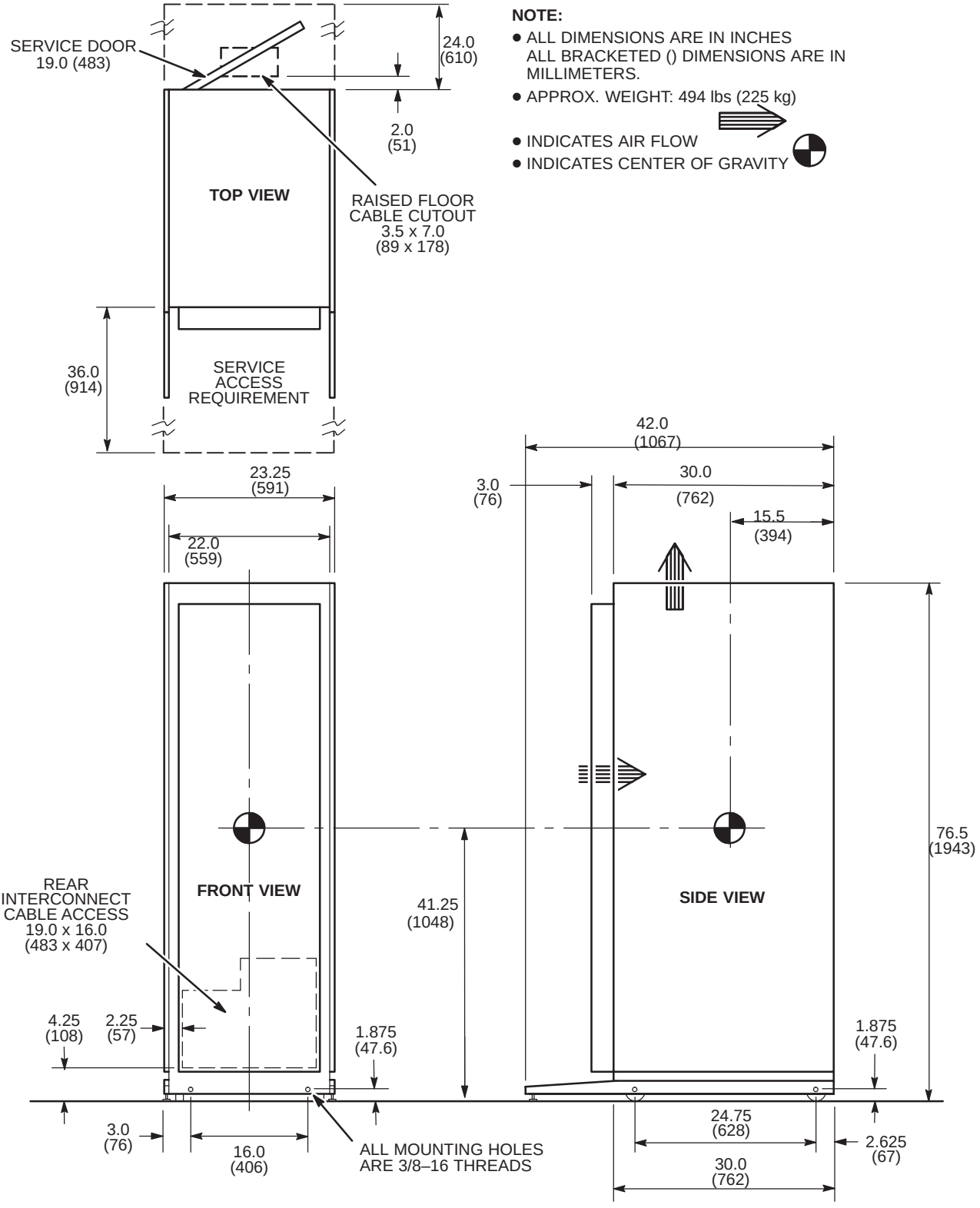
Case 2: Cable pit is locateded at right side of magnet rear cover.



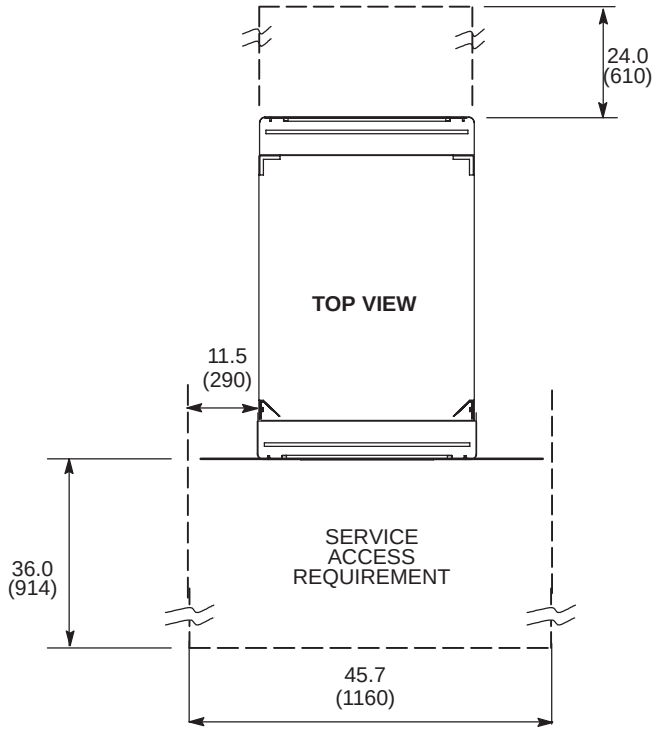
0.35T MAGNET ENCLOSURE CABLE ACCESS (PIT)
ILLUSTRATION 2–17



POWER CABINET (MR1)
ILLUSTRATION 2–18

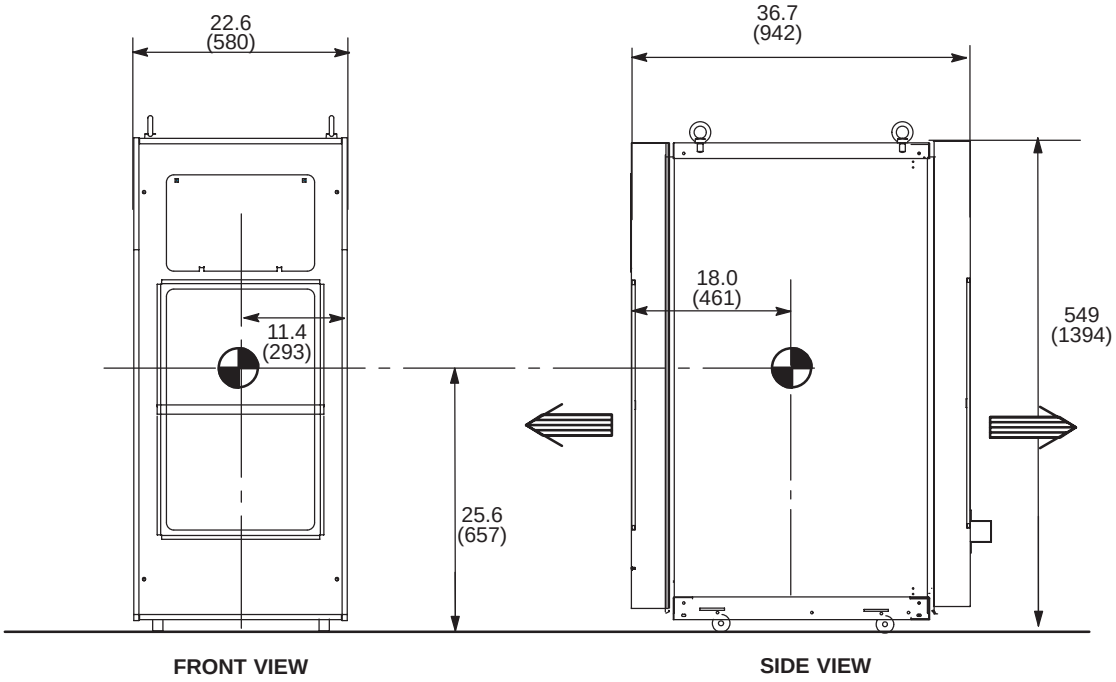


SYSTEM CABINET (MR2)
ILLUSTRATION 2–19



NOTE:

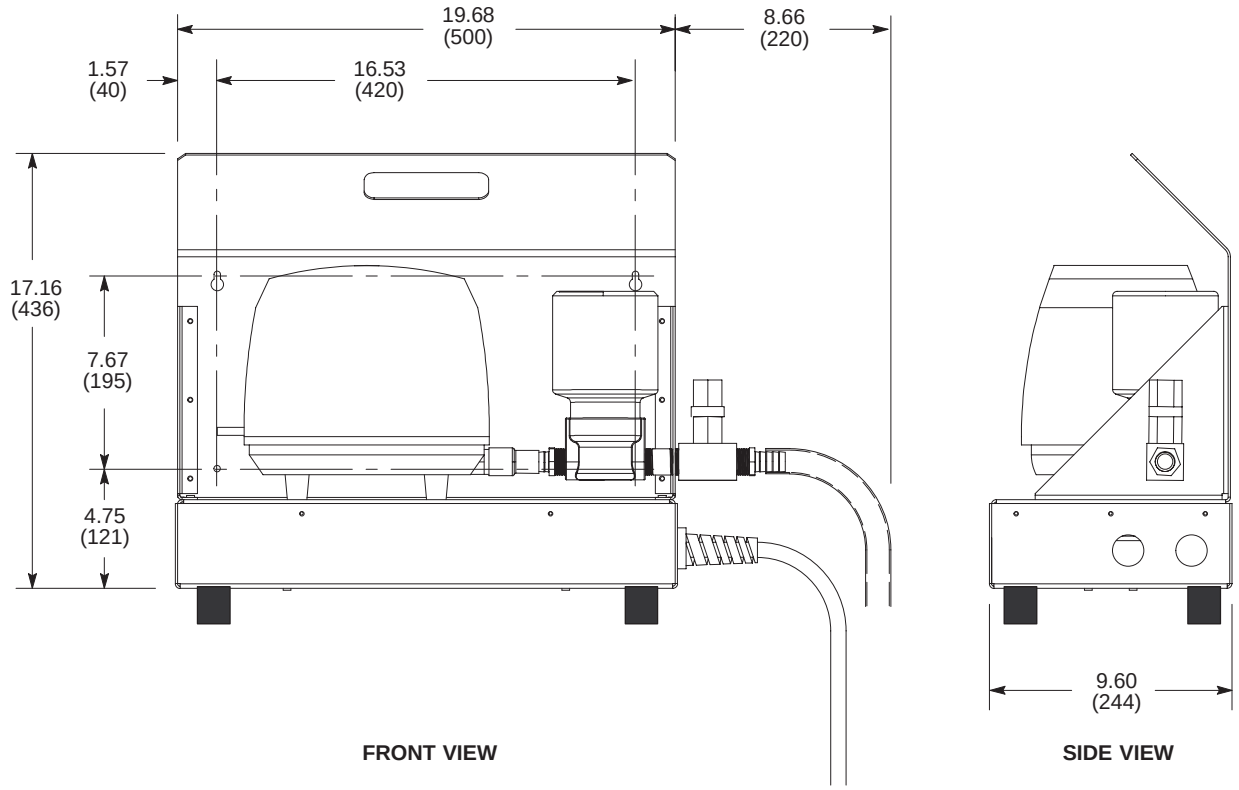
- ALL DIMENSIONS ARE IN INCHES
  ALL BRACKETED () DIMENSIONS ARE IN MILLIMETERS.
- APPROX. WEIGHT: Two Blower Type 425 lbs (194 kg)
  One Blower Type 267lbs (122 kg)
- INDICATES AIR FLOW
- INDICATES CENTER OF GRAVITY



COOLING CABINET
ILLUSTRATION 2–20

This Unit is placed on the floor.
Please Consider the area of this unit.

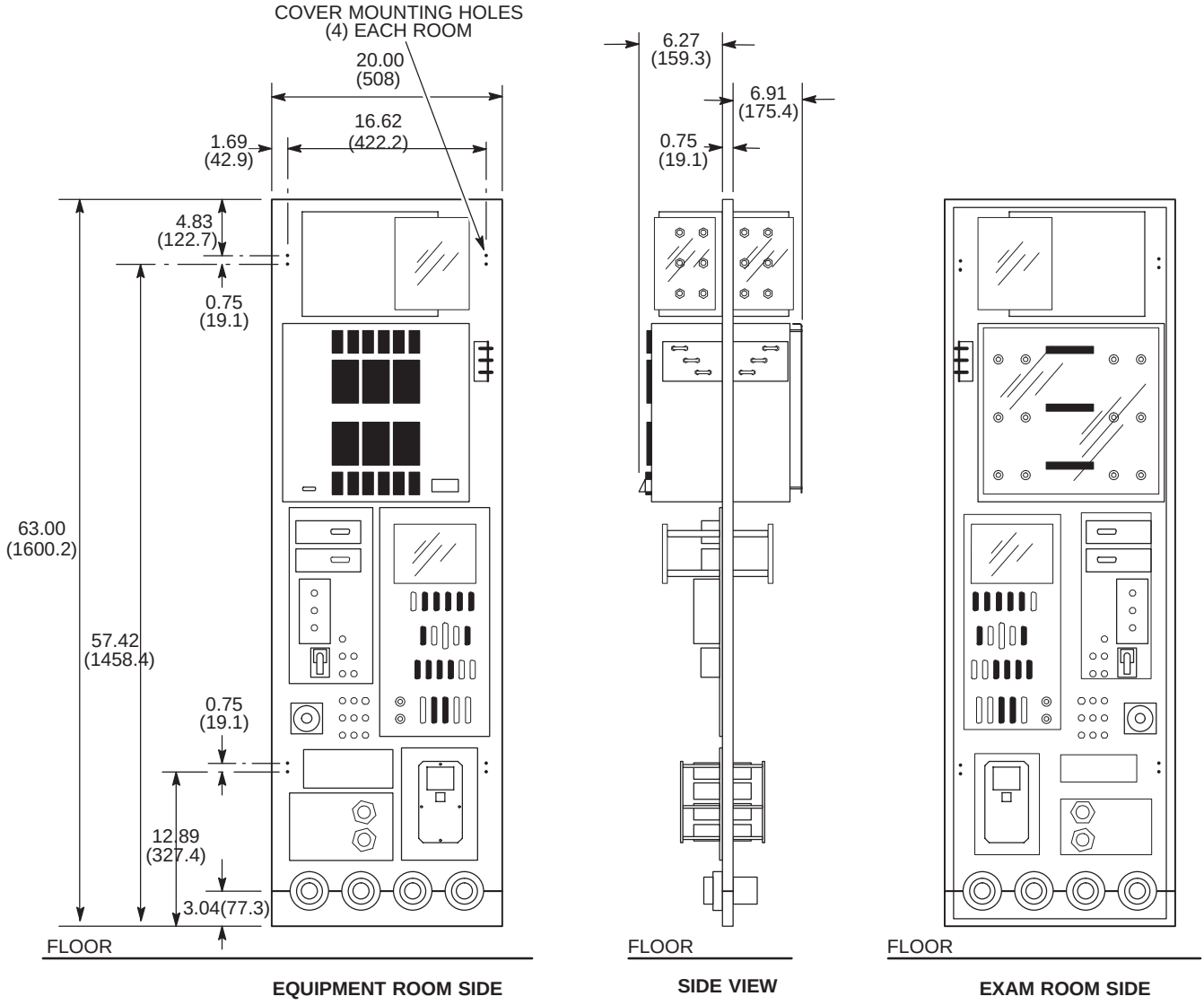
NOTE:
- ALL DIMENSIONS ARE IN INCHES ALL BRACKETED () DIMENSIONS ARE IN MILLIMETERS.
- APPROX. WEIGHT: 45 lbs (20.5 kg)



PATIENT COOLING COMPRESSOR
ILLUSTRATION 2–21

NOTE:

- ALL DIMENSIONS ARE IN INCHES. ALL BRACKETED ( ) DIMENSIONS ARE IN MILLIMETERS.
- APPROX. WEIGHT: 52 lbs (23.6 kg)

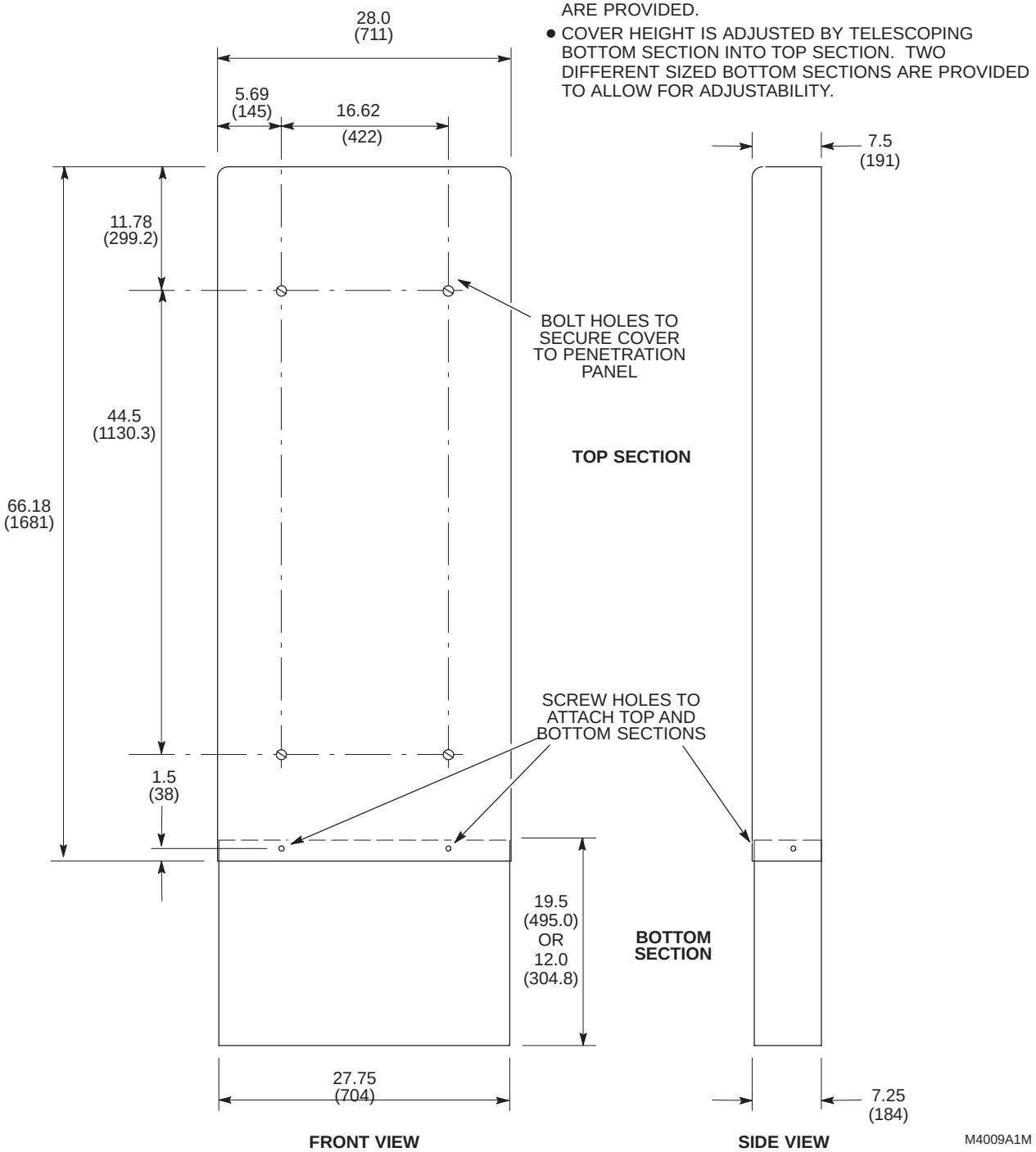


M4528A

PENETRATION PANEL (PP1)
ILLUSTRATION 2–22

NOTE:

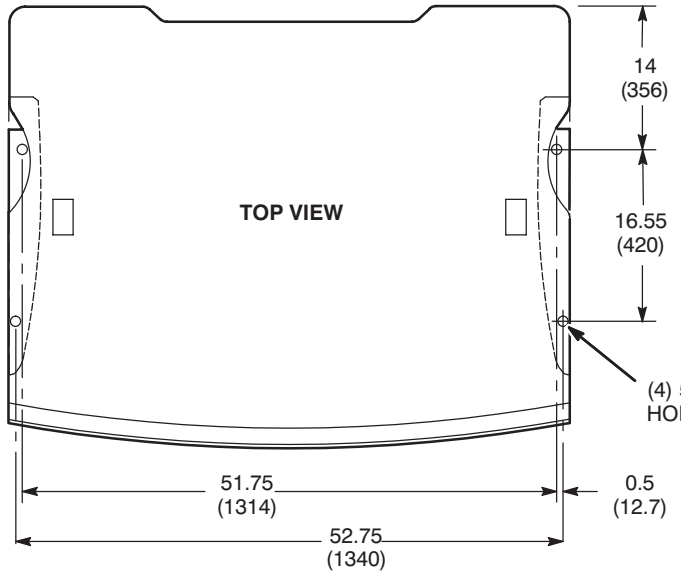
- ALL DIMENSIONS ARE IN INCHES
  ALL BRACKETED () DIMENSIONS ARE IN MILLIMETERS.
- COVER USED ON BOTH EXAM ROOM AND EQUIPMENT ROOM SIDES OF PENETRATION PANEL. TWO COVERS ARE PROVIDED.
- COVER HEIGHT IS ADJUSTED BY TELESCOPING BOTTOM SECTION INTO TOP SECTION. TWO DIFFERENT SIZED BOTTOM SECTIONS ARE PROVIDED TO ALLOW FOR ADJUSTABILITY.

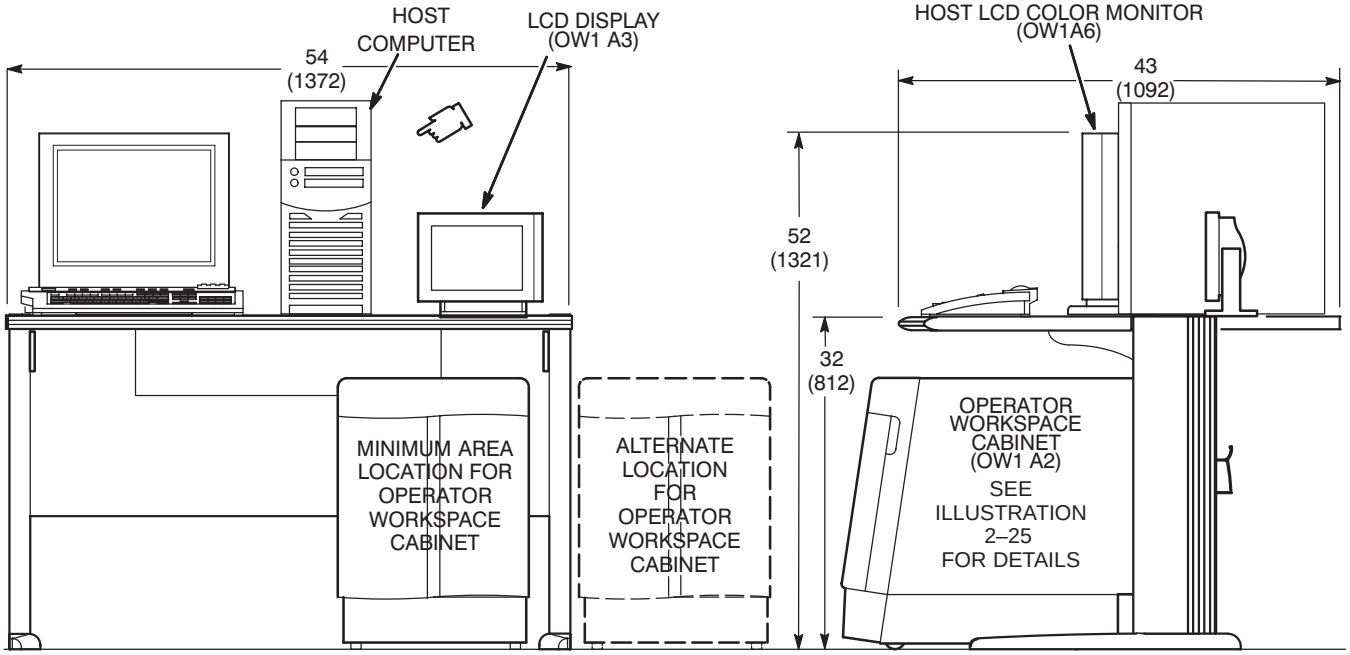


PENETRATION PANEL COVER
ILLUSTRATION 2–23

NOTE:

- ALL DIMENSIONS ARE IN INCHES.
  ALL BRACKETED () DIMENSIONS ARE IN MILLIMETERS.
- ASSEMBLIES WHICH MOUNT TO UNDERSIDE OF TABLE AND IN TABLE CABLE TRAY ARE NOT SHOWN.
- OW TABLE IS AN INTEGRAL PART OF THE REGULATORY APPROVED SYSTEM. OW TABLE PROVIDES MOUNTING FOR SEVERAL ASSEMBLIES (E.G. OW INTERFACE MODULE, OW POWER DISTRIBUTION BOX, MODEM, DASM) AND CABLE ROUTING FOR OW INTERCONNECTS. DIMENSIONS OF EQUIPMENT LOCATED ON TOP OF OW TABLE ARE PROVIDED IN ILLUSTRATIONS 2–26 THROUGH 2–28 OW TABLE TOP LAYOUT PLANNING PURPOSES.



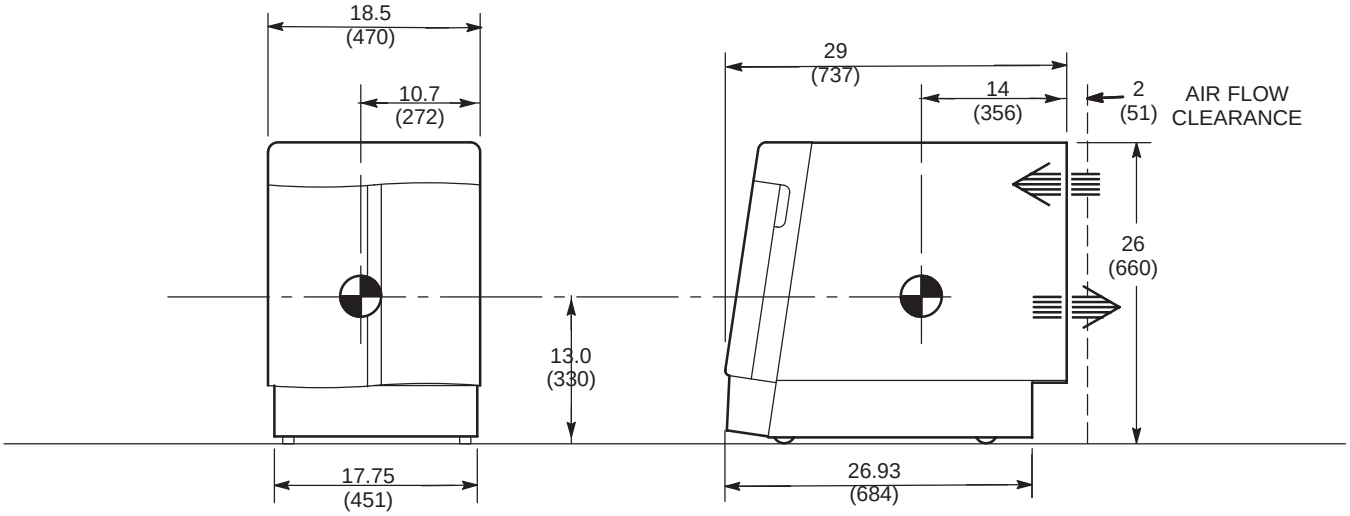


FRONT VIEW **SIDE VIEW**

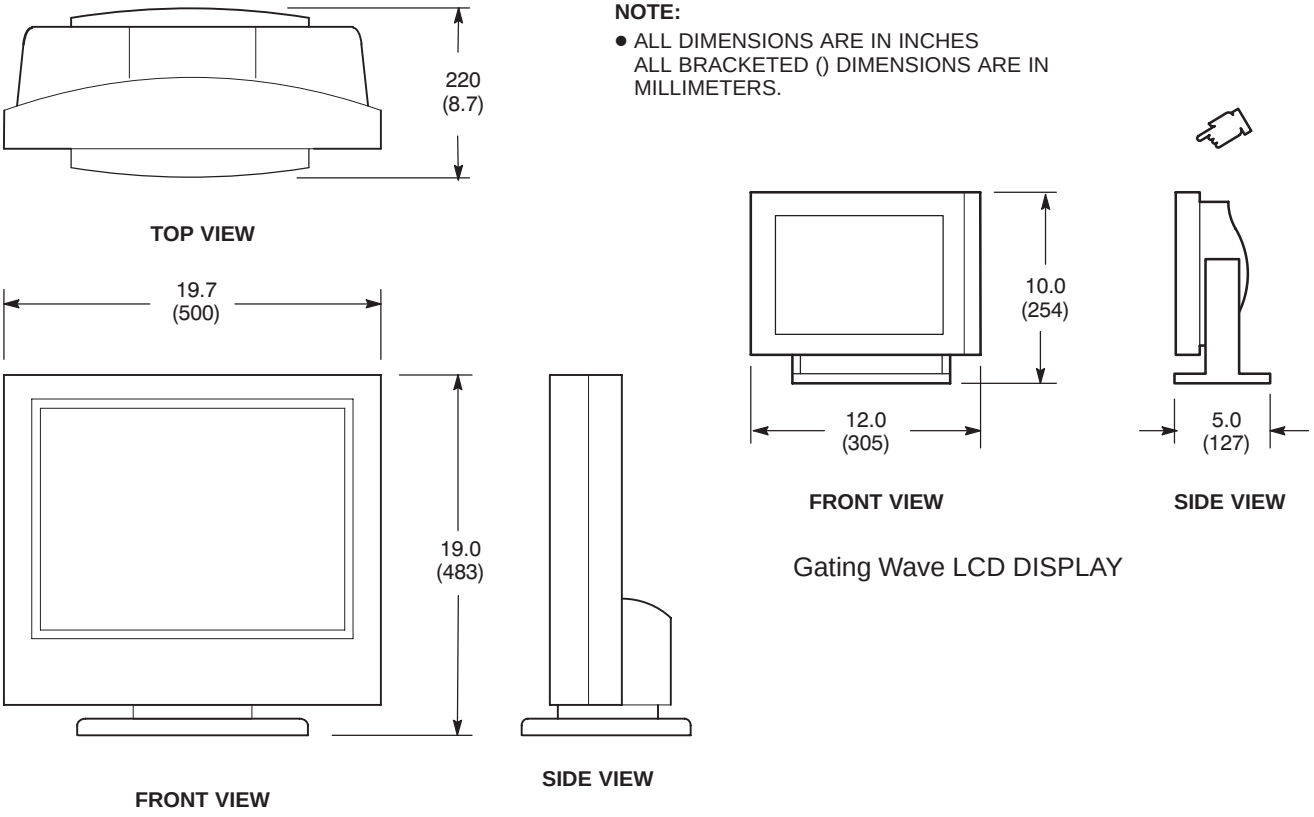
OPERATOR WORKSPACE (OW1)
ILLUSTRATION 2–24

NOTE:

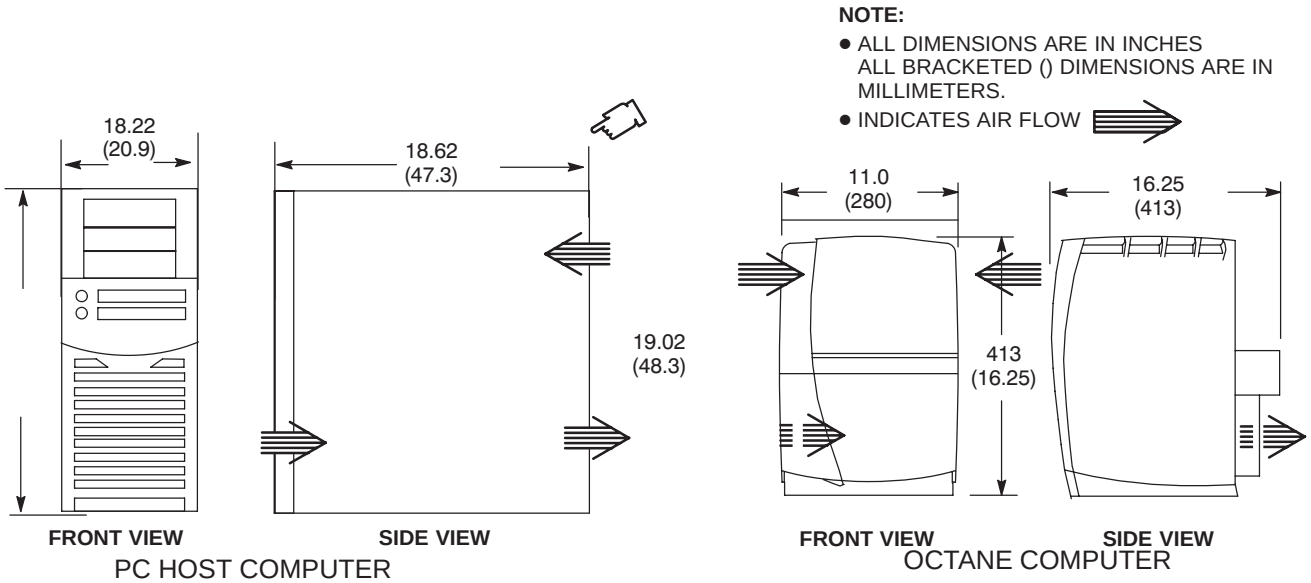
- ALL DIMENSIONS ARE IN INCHES ALL BRACKETED () DIMENSIONS ARE IN MILLIMETERS.
- APPROX. WEIGHT: 192 lbs (87 kg)
- INDICATES AIR FLOW
- INDICATES CENTER OF GRAVITY



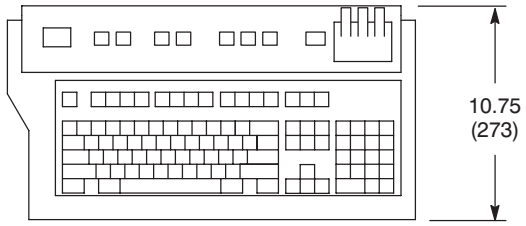
OPERATOR WORKSPACE CABINET (OW1 A2)
ILLUSTRATION 2–25



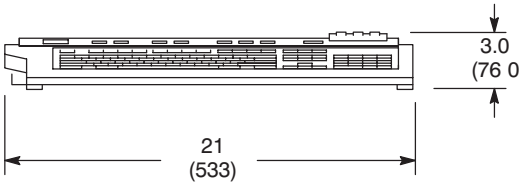
OPERATOR WORKSPACE COMPONENTS POSITIONED ON TABLE TOP – LCD COLOR MONITOR
ILLUSTRATION 2–26



OPERATOR WORKSPACE COMPONENTS POSITIONED ON TABLE TOP – OCTANE COMPUTER
ILLUSTRATION 2–27



TOP VIEW



FRONT VIEW

SIDE VIEW

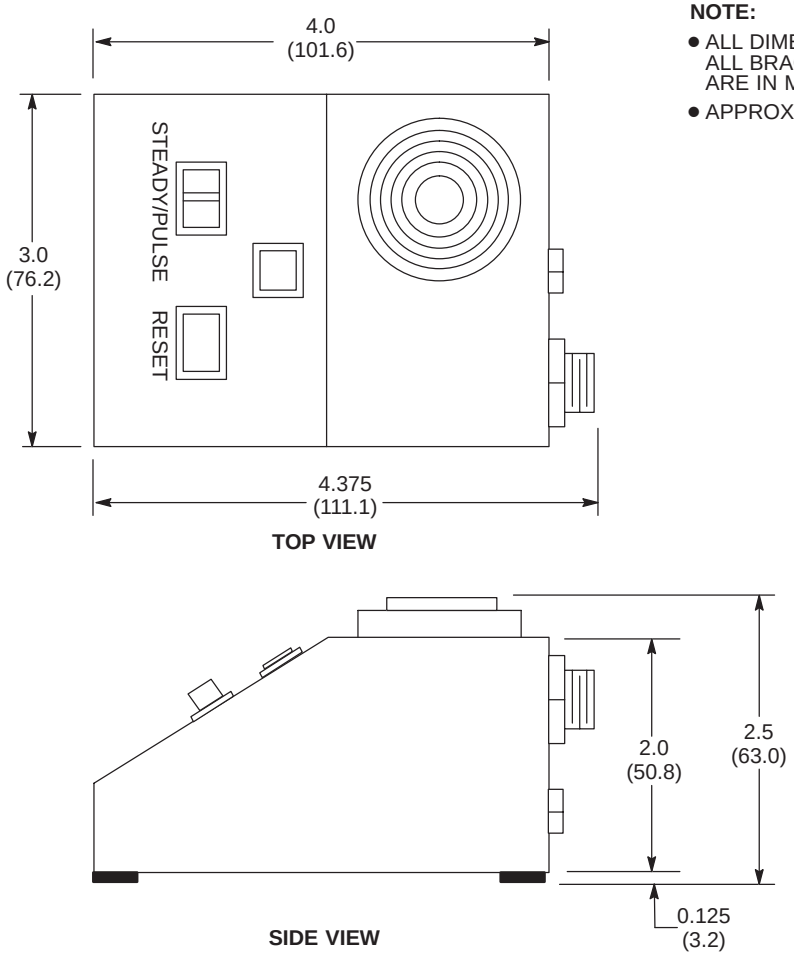
NOTE:

- ALL DIMENSIONS ARE IN INCHES
  ALL BRACKETED () DIMENSIONS ARE IN MILLIMETERS.

OPERATOR WORKSPACE COMPONENTS POSITIONED ON TABLE TOP – KEYBOARD
ILLUSTRATION 2–28

NOTE:

- ALL DIMENSIONS ARE IN INCHES. ALL BRACKETED ( ) DIMENSIONS ARE IN MILLIMETERS.
- APPROX. WEIGHT: 0.5 lbs (0.2 kg)

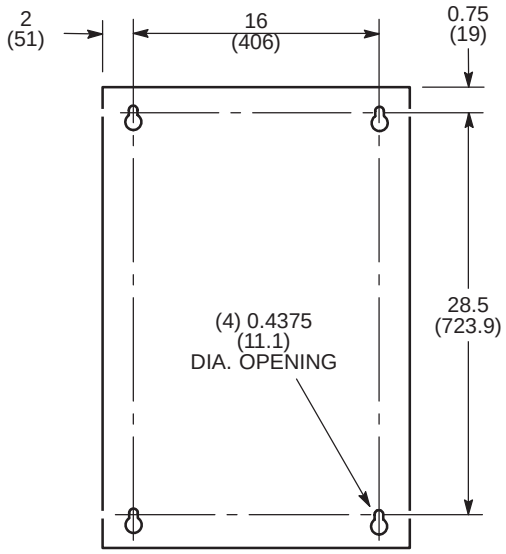


M4263A1

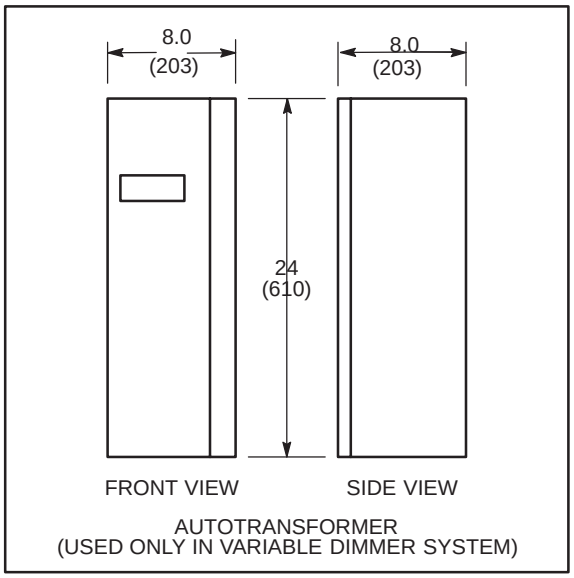
PNEUMATIC PATIENT ALERT CONTROL BOX (PA1)
ILLUSTRATION 2–29

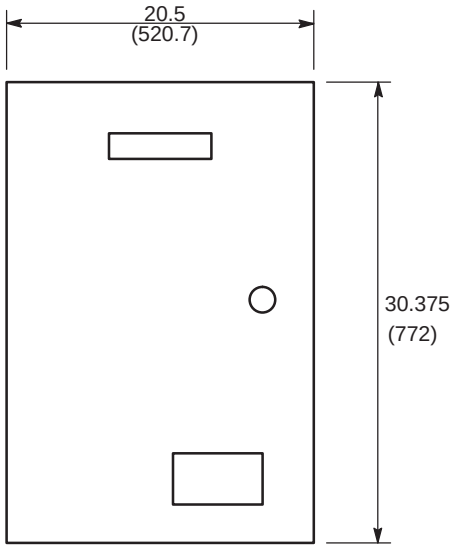
NOTE:

- ALL DIMENSIONS ARE IN INCHES. ALL BRACKETED ( ) DIMENSIONS ARE IN MILLIMETERS.
- APPROX. WEIGHTS:
  CONTROL PANEL: 155 lbs (70 kg)
  AUTOTRANSFORMER: 60 lbs (27 kg)

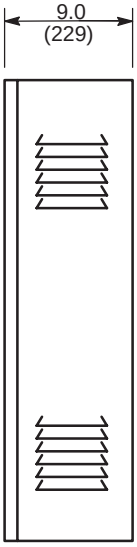


MOUNTING PATTERN
(CONTROL PANEL)





FRONT VIEW
(CONTROL PANEL)



SIDE VIEW
(CONTROL PANEL)

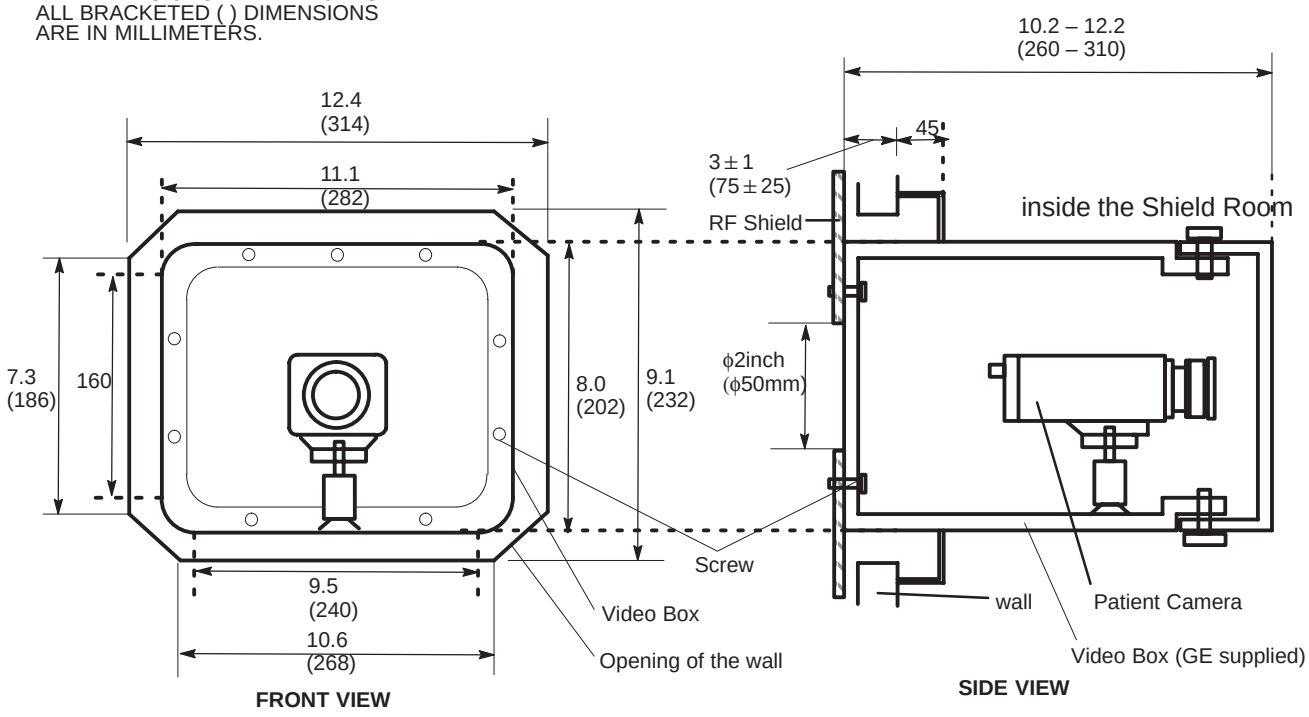
M1519A3M

DC LIGHTING CONTROLLER – OPTIONAL
ILLUSTRATION 2–30

2–11 COMPONENT DIMENSIONS (continued)

NOTE:

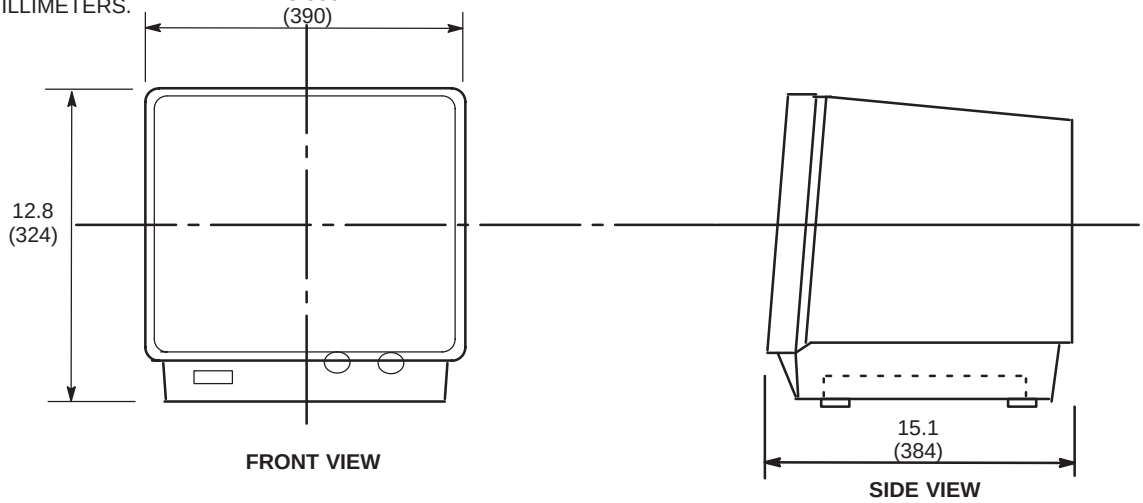
- ALL DIMENSIONS ARE IN INCHES. ALL BRACKETED ( ) DIMENSIONS ARE IN MILLIMETERS.



PATIENT MONITOR CAMERA AND VIDEO BOX(OPTION)
ILLUSTRATION 2–31

NOTE:

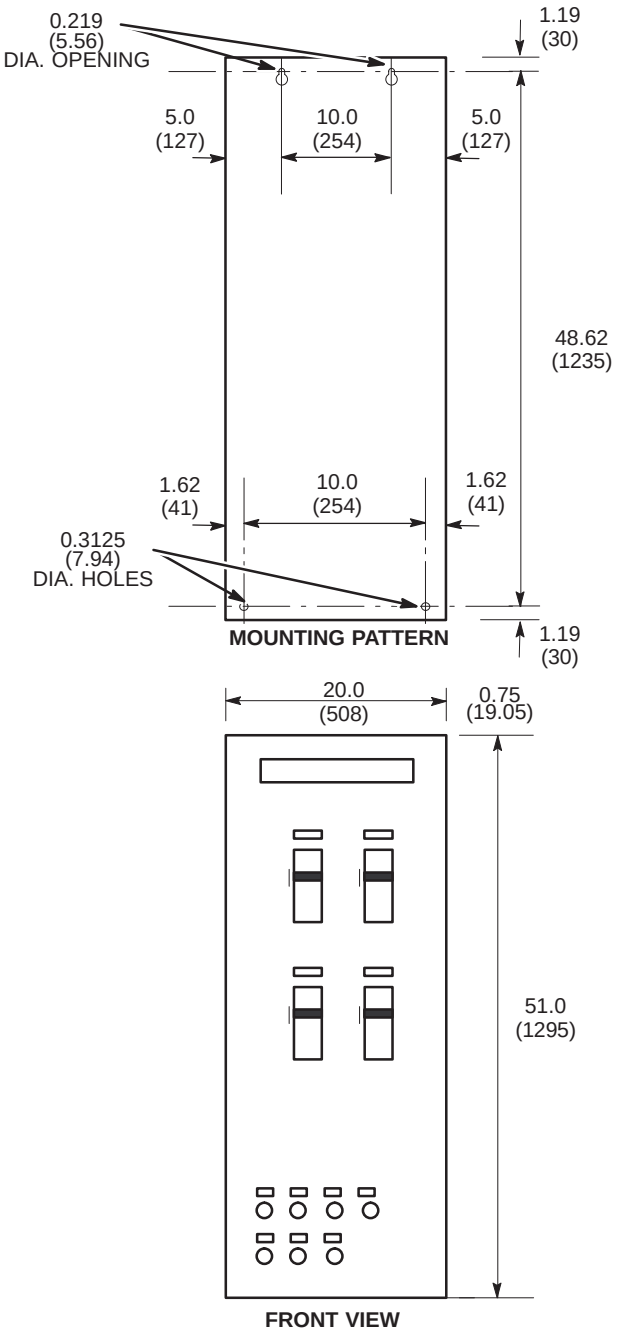
- ALL DIMENSIONS ARE IN INCHES. ALL BRACKETED ( ) DIMENSIONS ARE IN MILLIMETERS.



PATIENT MONITOR (OPTION)
ILLUSTRATION 2–32

Note

Main Disconnect Panel (MDP) is NOT used for Low Voltage Areas(200 or 208 Vrms). MDP is used only in the GEMS–AM Pole.



NOTE:

- ALL DIMENSIONS ARE IN INCHES ALL BRACKETED () DIMENSIONS ARE IN MILLIMETERS.
- APPROX. WEIGHT: 190 lbs. (86 kg)

MAIN DISCONNECT PANEL
ILLUSTRATION 2–33

SECTION 3 – MAGNETIC FIELD CONSIDERATIONS

TABLE OF CONTENTS

3–1 INTRODUCTION

The static magnetic field is three-dimensional and extends into space above and below the magnet as well as to the surrounding space on the same level. Objects within this three-dimensional space can be affected by the magnetic field (e.g., cardiac pacemakers, neurostimulators and other biostimulation devices) or can affect the magnetic field (e.g., structural steel, elevators and other large stationary or moving masses). Therefore, all ferromagnetic material within this three-dimensional magnetic field must be thoroughly examined to ensure that it is neither significantly affected by, nor affects, the magnetic field.

3–2 HOMOGENEITY REQUIREMENTS

Structural steel within the static magnetic field of the magnet has a definite impact on the homogeneity or uniformity of the field. Homogeneity is one of the most important criteria of the quality of the imaging.

3–3 STRUCTURAL STEEL EVALUATION OF PROPOSED SITES

Structural steel in the vicinity of the magnet causes perturbations in the magnetic field within the imaging region of the magnet. This may degrade the homogeneity of the magnet and thus degrade system performance.

The customer must provide information indicating size and location of all iron and steel within a 2 m radius of Magnet isocenter. This includes iron below the magnet such as sewer pipes, floor beams steel rebar in the concrete floor or structural members. Any structural steel required for the installation of the magnet at the particular site (i.e., floor reinforcement) must also be indicated.

Structural steel in the floor and in support of the floor can impact magnet homogeneity. Floor shield is required. See Section 6–4 for details.

If the magnetic field perturbations exceed the shimming (correcting) capability of the magnet subsystem, choose an alternate site.

3–4 MAGNETIC FIELD

Illustrations 3–1 through 3–3 are magnetic field plots of the Signa Ovation magnet without the 3mm steel plate and are to be used to characterize the magnetic field during transport. The floor of the magnet room utilizes the 3mm plate to provide a uniform environment for the magnet; Illustrations 3–4 through 3–6 characterize the magnetic field plots when the magnet resides on the 2.4 meter by 2.4 meter by 3mm thick plate. Please note that more magnetic field containment can be brought about through more extensive magnetic shielding. Custom magnetic shield designs are provided for Signa Ovation customers by the GE MR Siting and Shielding group.

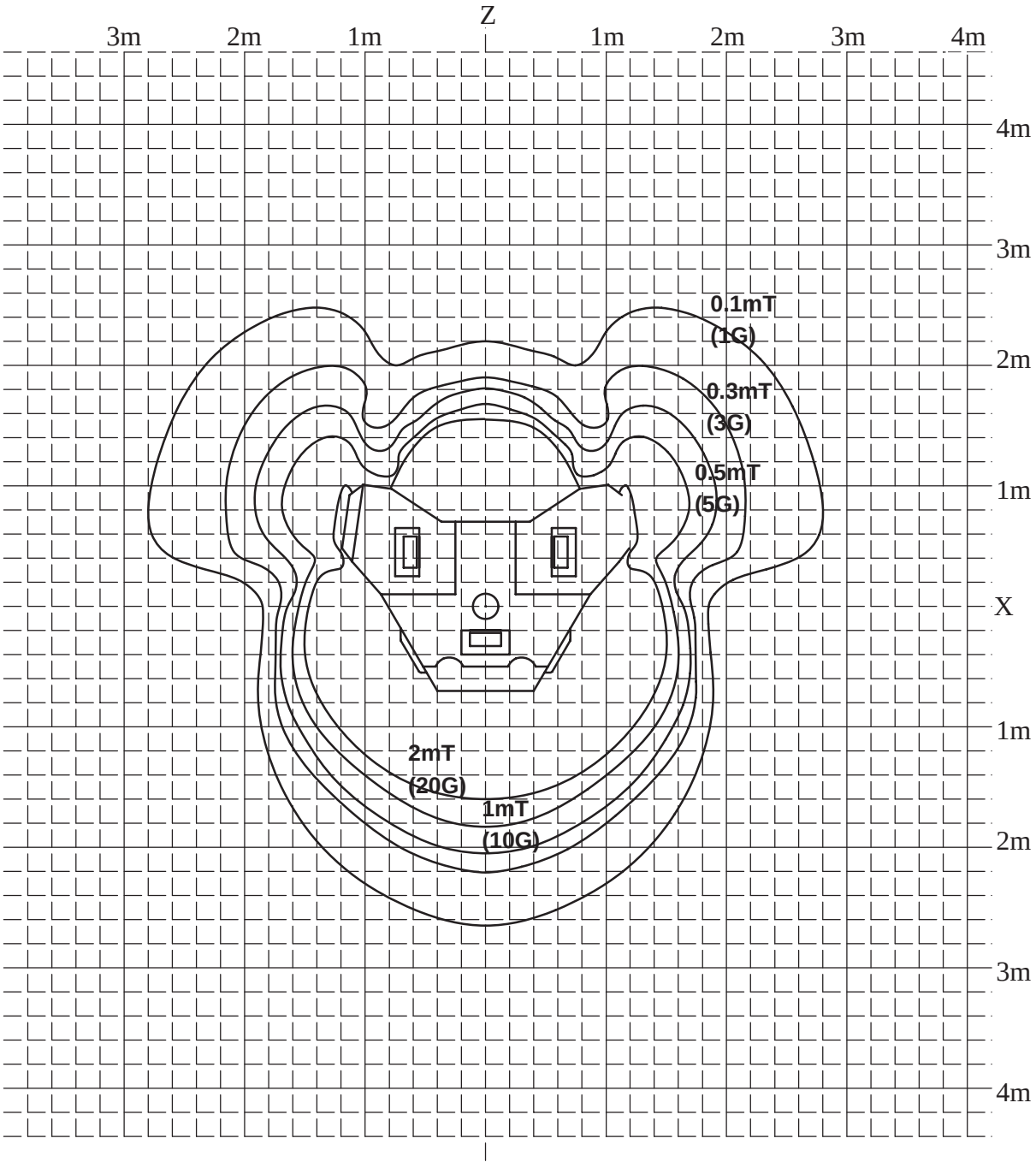
The actual magnetic field intensity at any point in the vicinity of the magnet may vary from the magnetic field plots due to factors such as the concentrating efforts of any nearby ferrous objects and ambient magnetic fields, including the earth‘s magnetic field. Therefore, those plots are only approximations of actual field intensities found at corresponding distance from the magnet‘s isocenter. These plots should be used as an aid in reviewing the location of the Signa Open Speed Mx MR with respect to hospital equipment and services (e.g. elevators, vehicular traffic, parking lots, etc...). Refer to *Section 2–3, TYPICAL SITE LAYOUT* for location of equipment within the magnetic field.

3–5 MAGNET EXCLUSION ZONE

The recommended five gauss exclusion zone for cardiac pacemakers, neurostimulators, and other biostimulation devices is shown in Illustrations 3–1 through 3–6. It should be noted the vertical view for the magnetic field plots show 2.8 m between floors for reference. If the distance between floors is a value other than 2.8 m, appropriate corrections must be made.

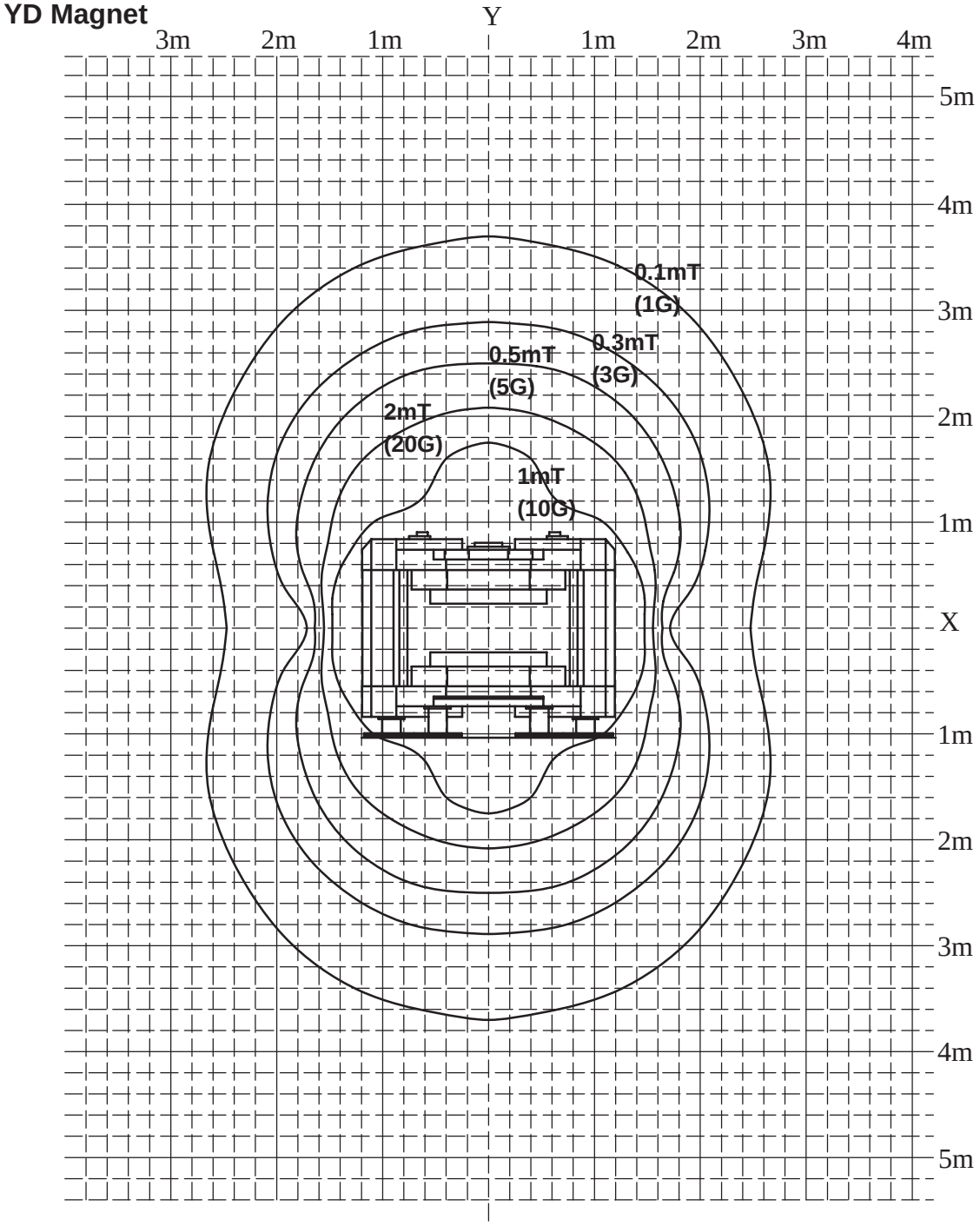
3–6 ISOGAUSS LINE PLOTS

YD Magnet



MAGNET ISOGAUSS LINE PLOT WITHOUT STEEEL PLATE (TOP VIEW)
ILLUSTRATION 3–1

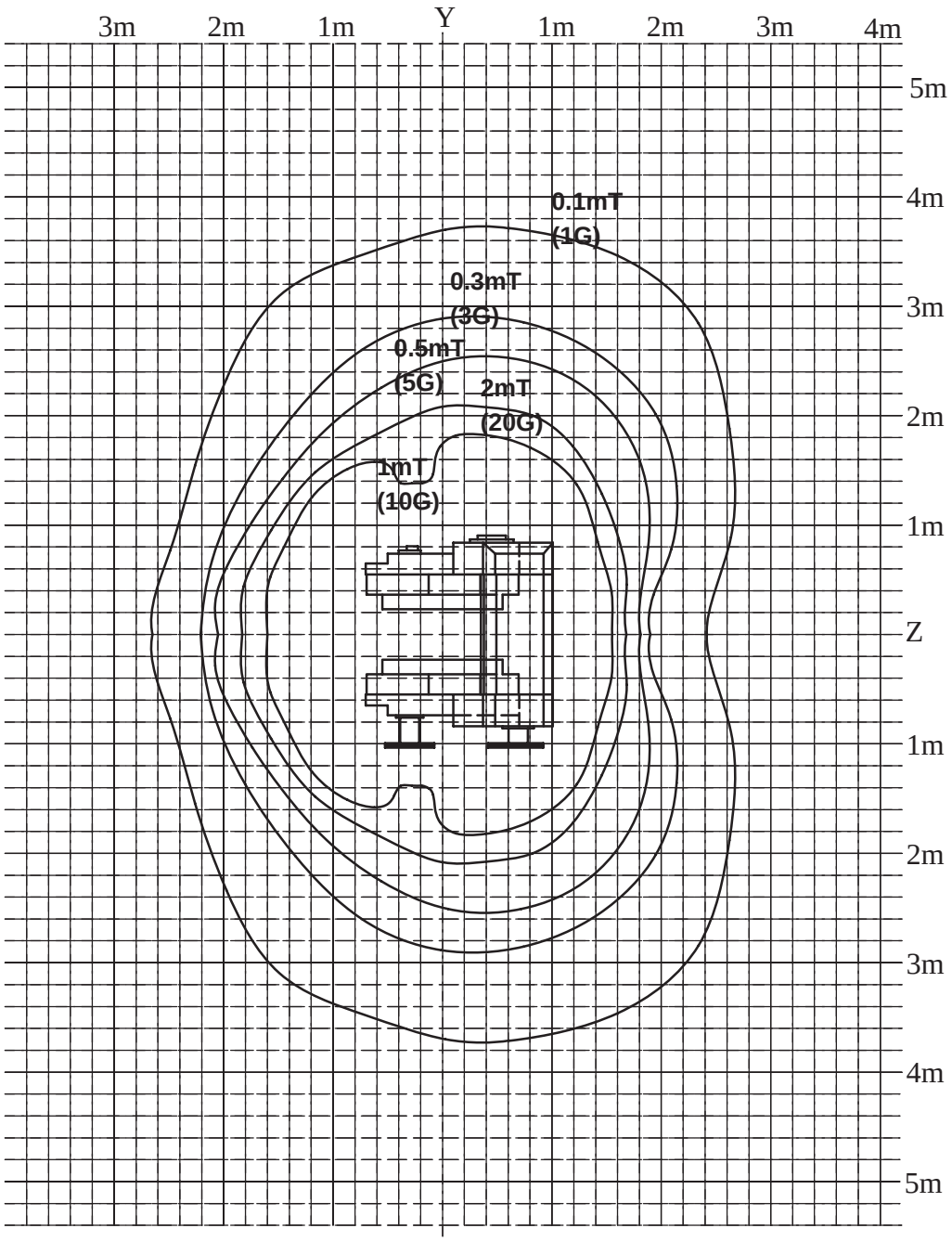
3–6 ISOGAUSS LINE PLOTS (continued)



MAGNET ISOGAUSS LINE PLOT WITHOUT STEEL PLATE(FRONT VIEW)
ILLUSTRATION 3–2

3–6 ISOGAUSS LINE PLOTS (continued)

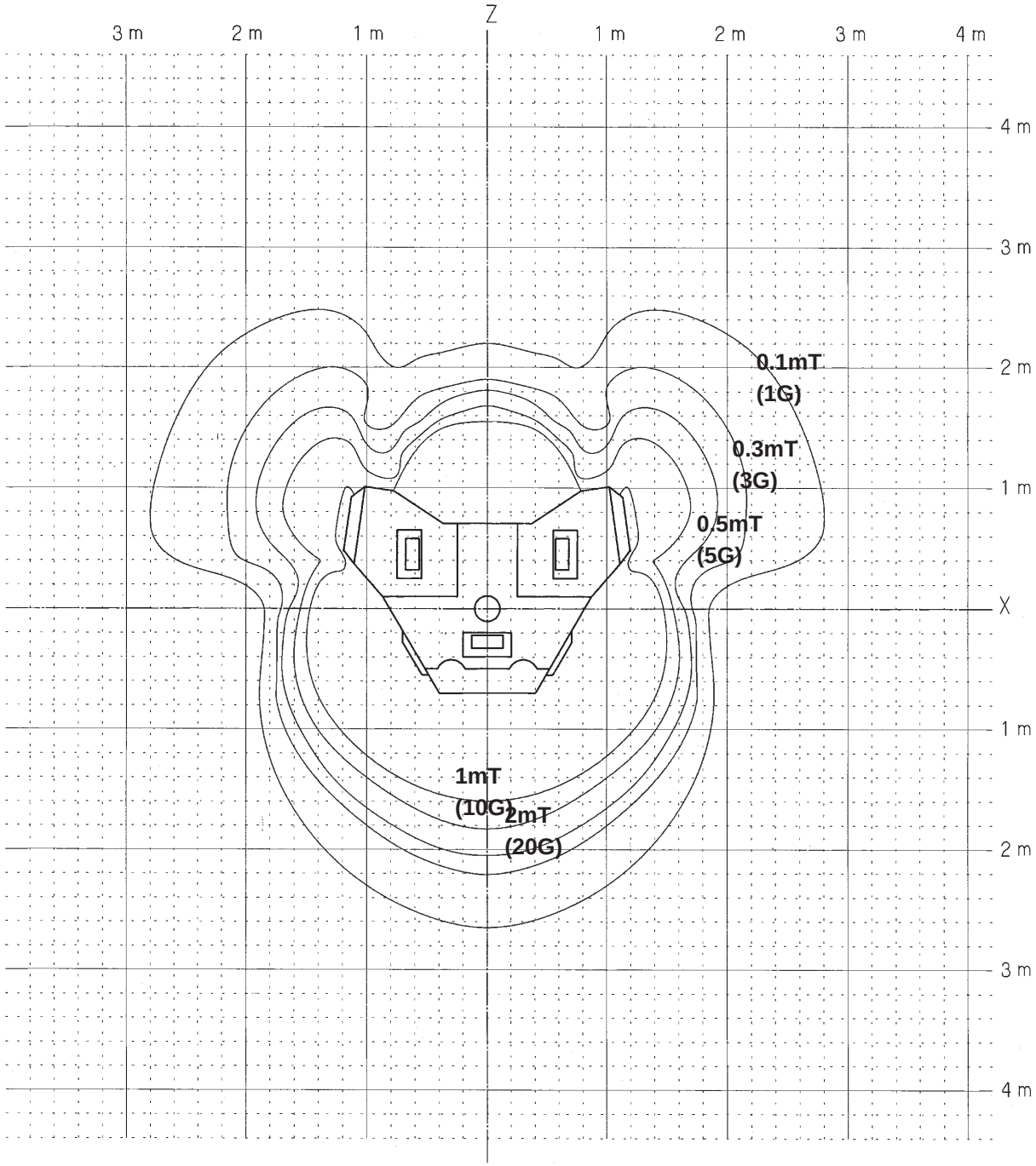
YD Magnet



MAGNET ISOGAUSS LINE PLOT WITHOUT STEEL PLATE(SIDE VIEW)
ILLUSTRATION 3–3

3–6 ISOGAUSS LINE PLOTS

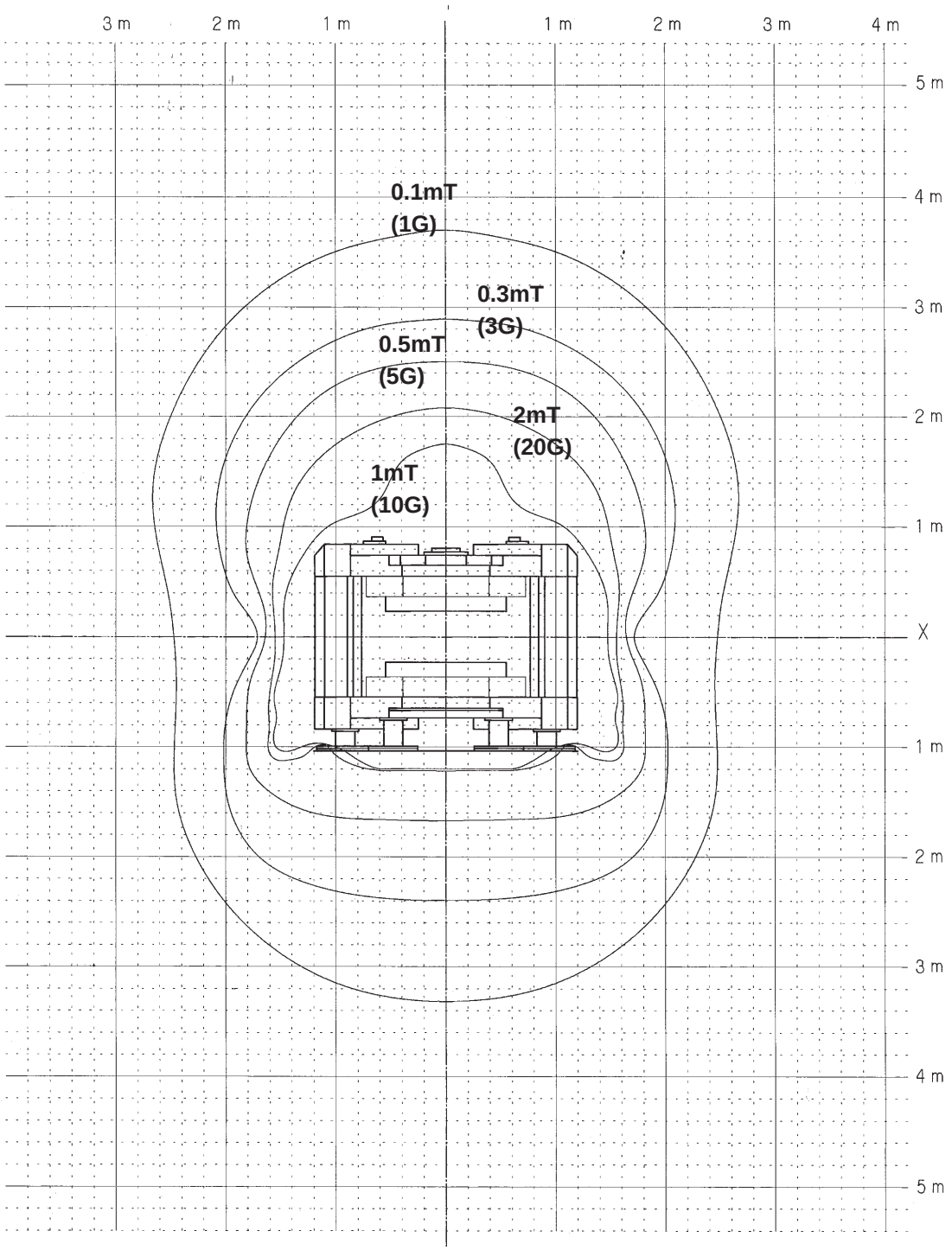
YD Magnet



MAGNET ISOGAUSS LINE PLOT WITH 2.4m X 2.4m STEEL PLATE(TOP VIEW)
ILLUSTRATION 3–4

3–6 ISOGAUSS LINE PLOTS (continued)

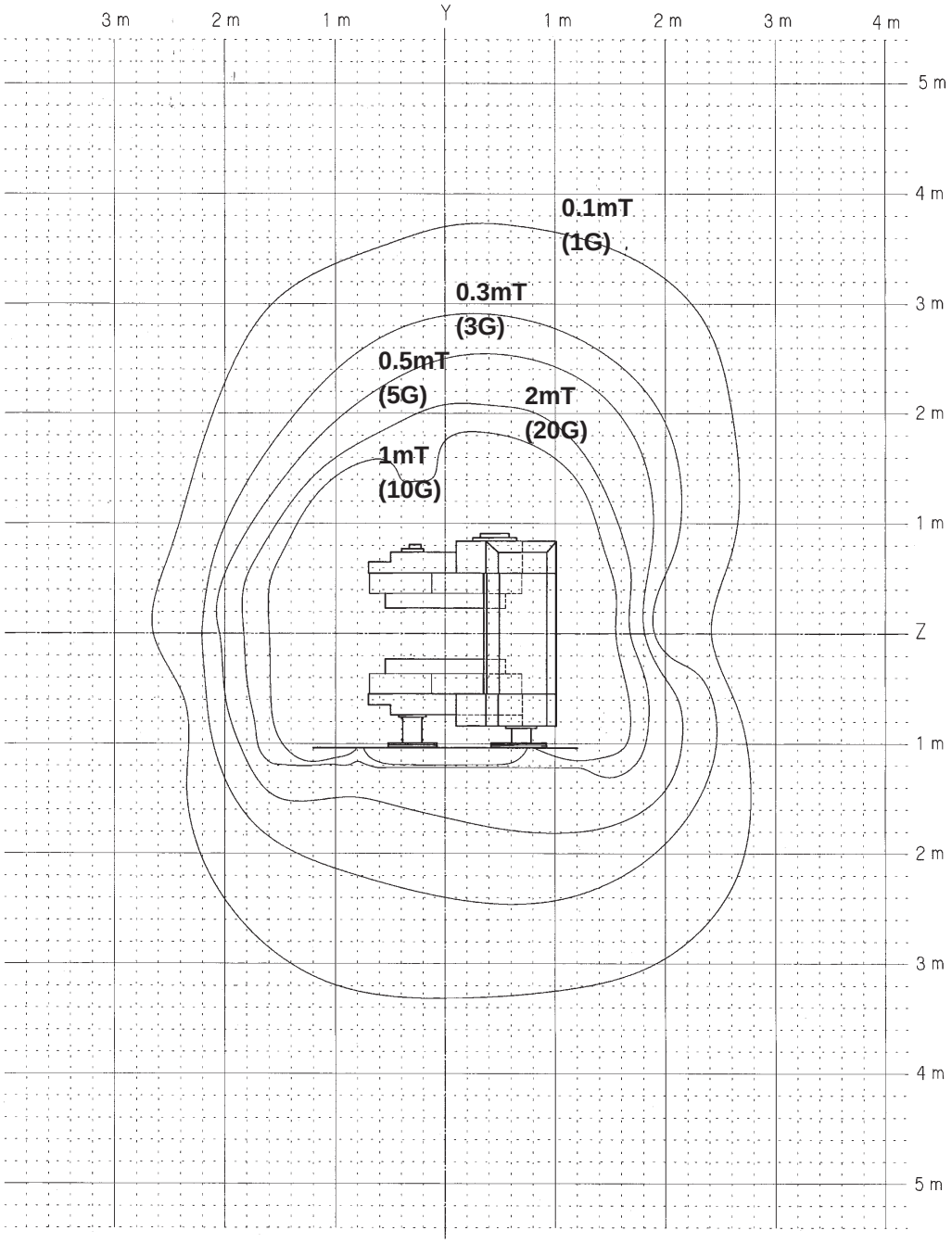
YD Magnet



MAGNET ISOGAUSS LINE PLOT WITH 2.4m X 2.4m STEEL PLATE(FRONT VIEW)
ILLUSTRATION 3–5

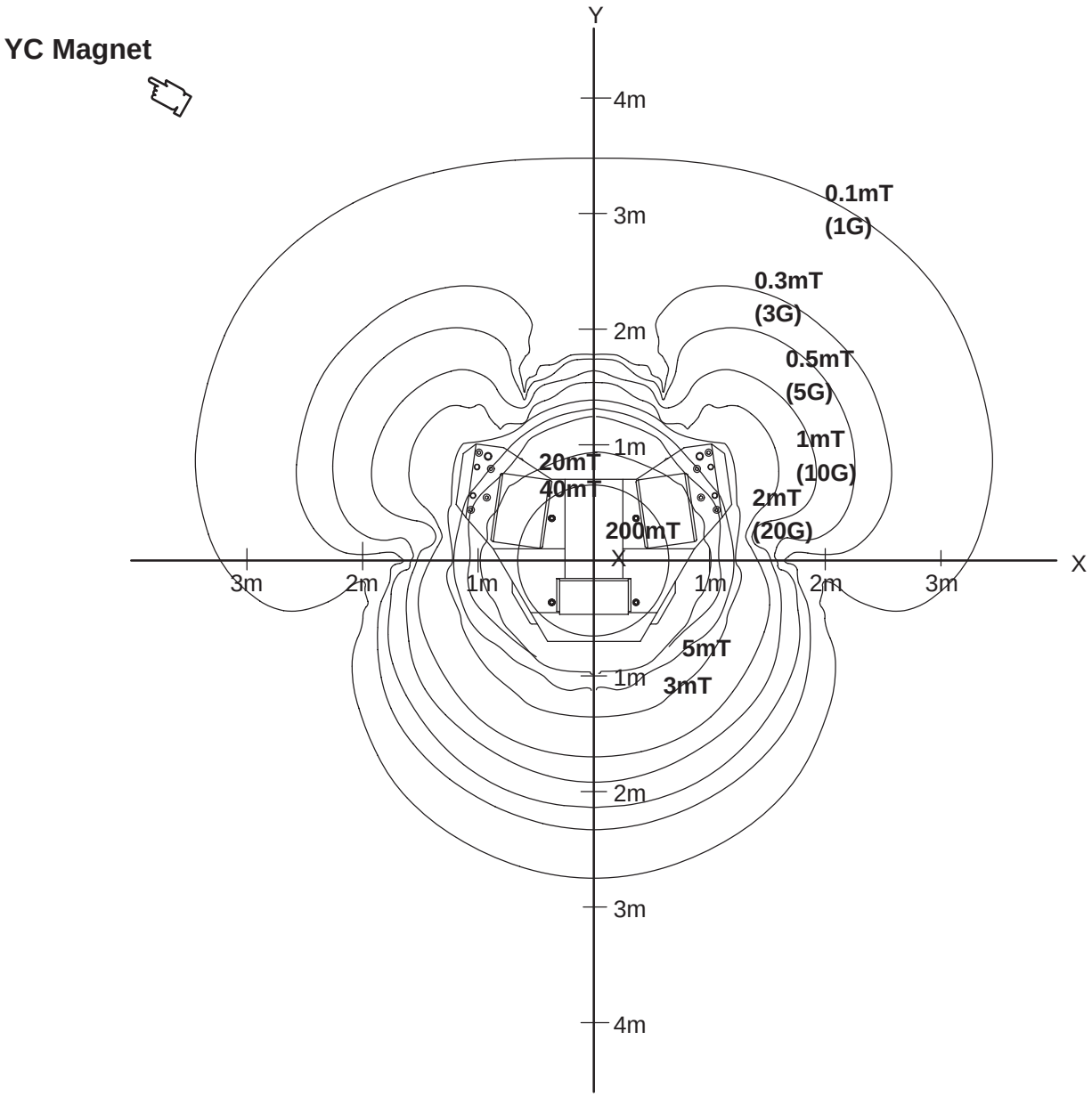
3–6 ISOGAUSS LINE PLOTS (continued)

YD Magnet



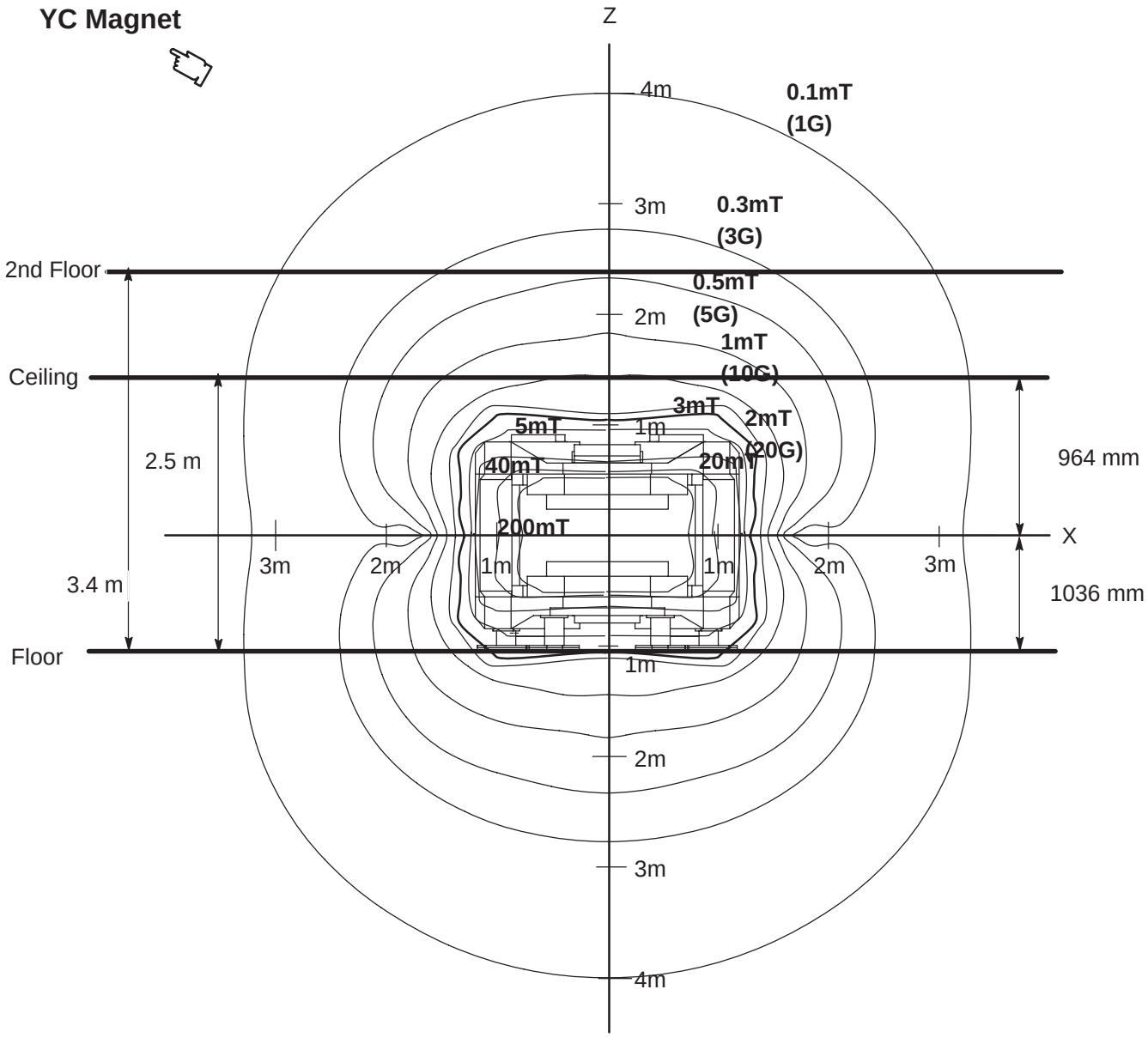
MAGNET ISOGAUSS LINE PLOT WITH 2.4m X 2.4m STEEL PLATE(SIDE VIEW)
ILLUSTRATION 3–6

3–6 ISOGAUSS LINE PLOTS



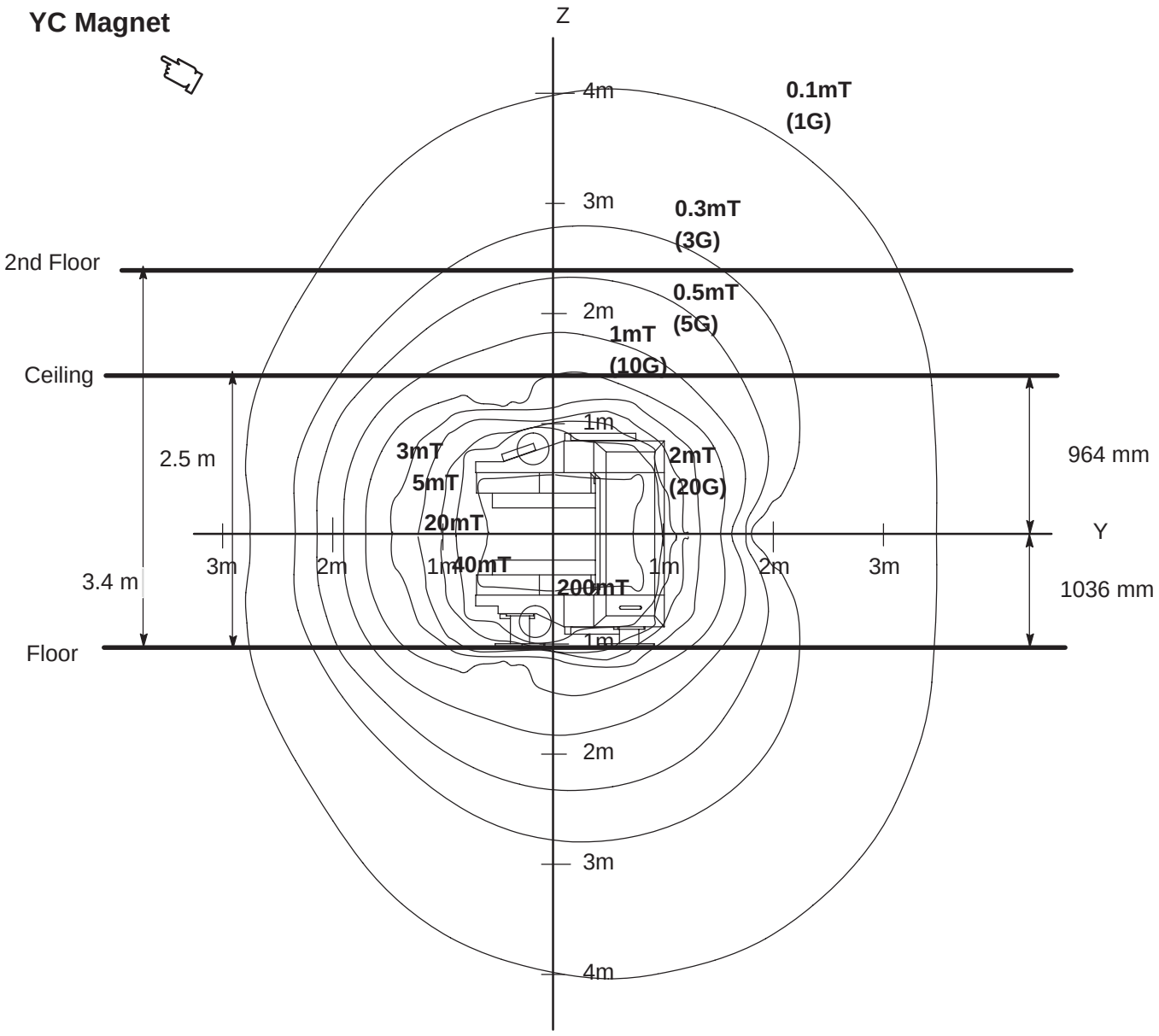
MAGNET ISOGAUSS LINE PLOT WITHOUT STEEL PLATE(TOP VIEW)
ILLUSTRATION 3–7

3–6 ISOGAUSS LINE PLOTS (continued)



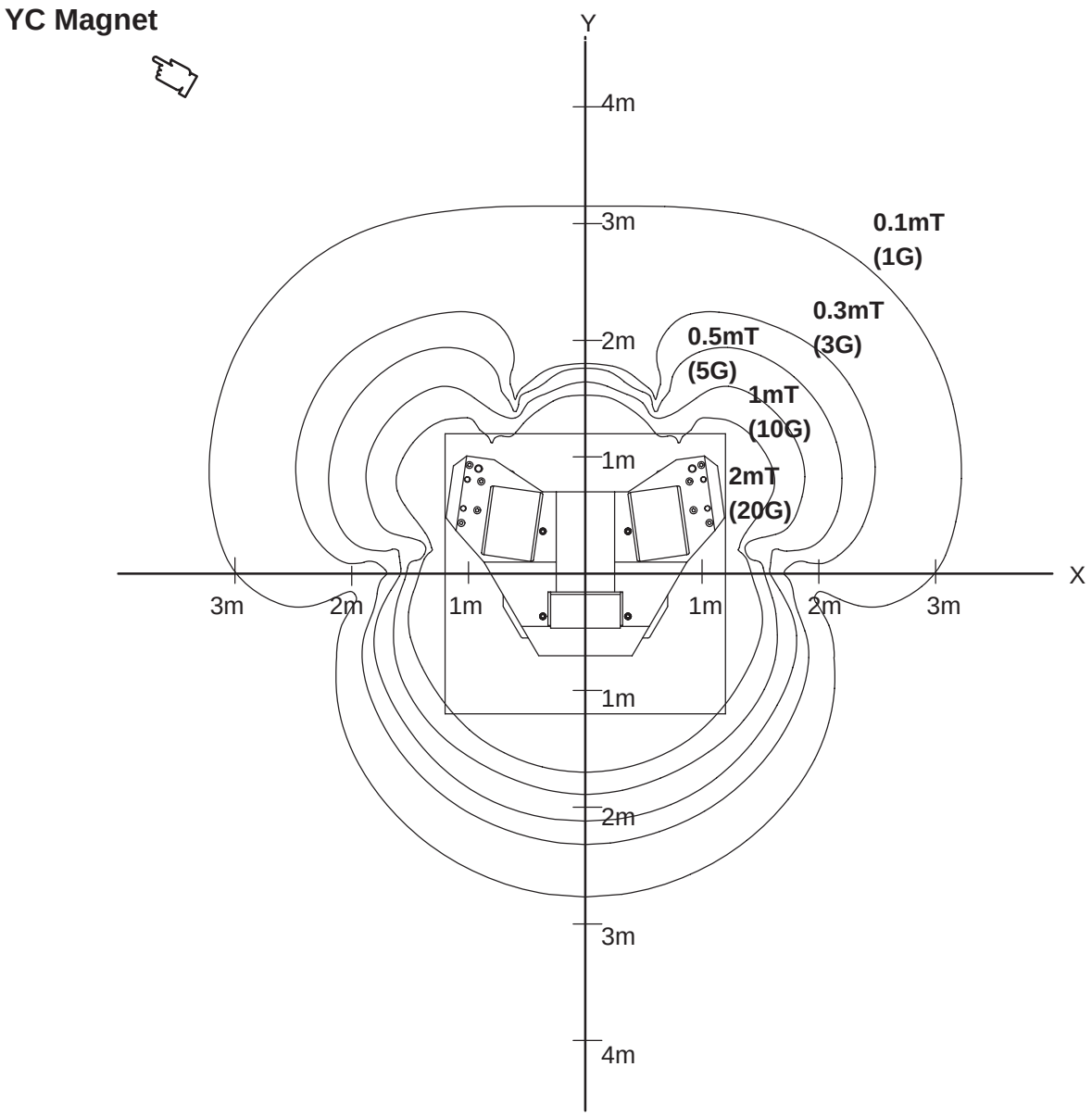
MAGNET ISOGAUSS LINE PLOT WITHOUT STEEEL PLATE (FRONT VIEW)
ILLUSTRATION 3–8

3–6 ISOGAUSS LINE PLOTS (continued)



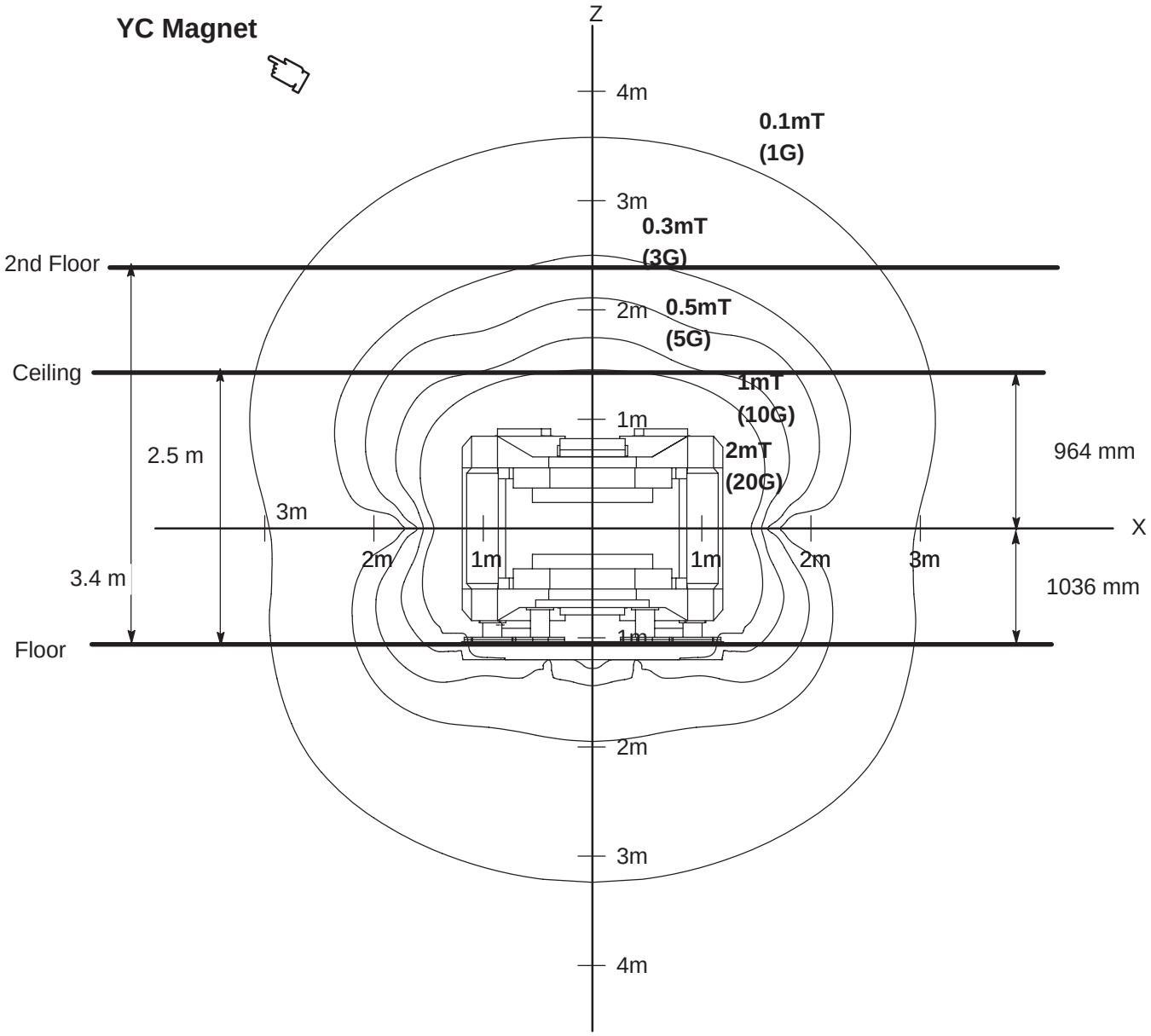
MAGNET ISOGAUSS LINE PLOT WITHOUT STEEL PLATE(SIDE VIEW)
ILLUSTRATION 3–9

3–6 ISOGAUSS LINE PLOTS



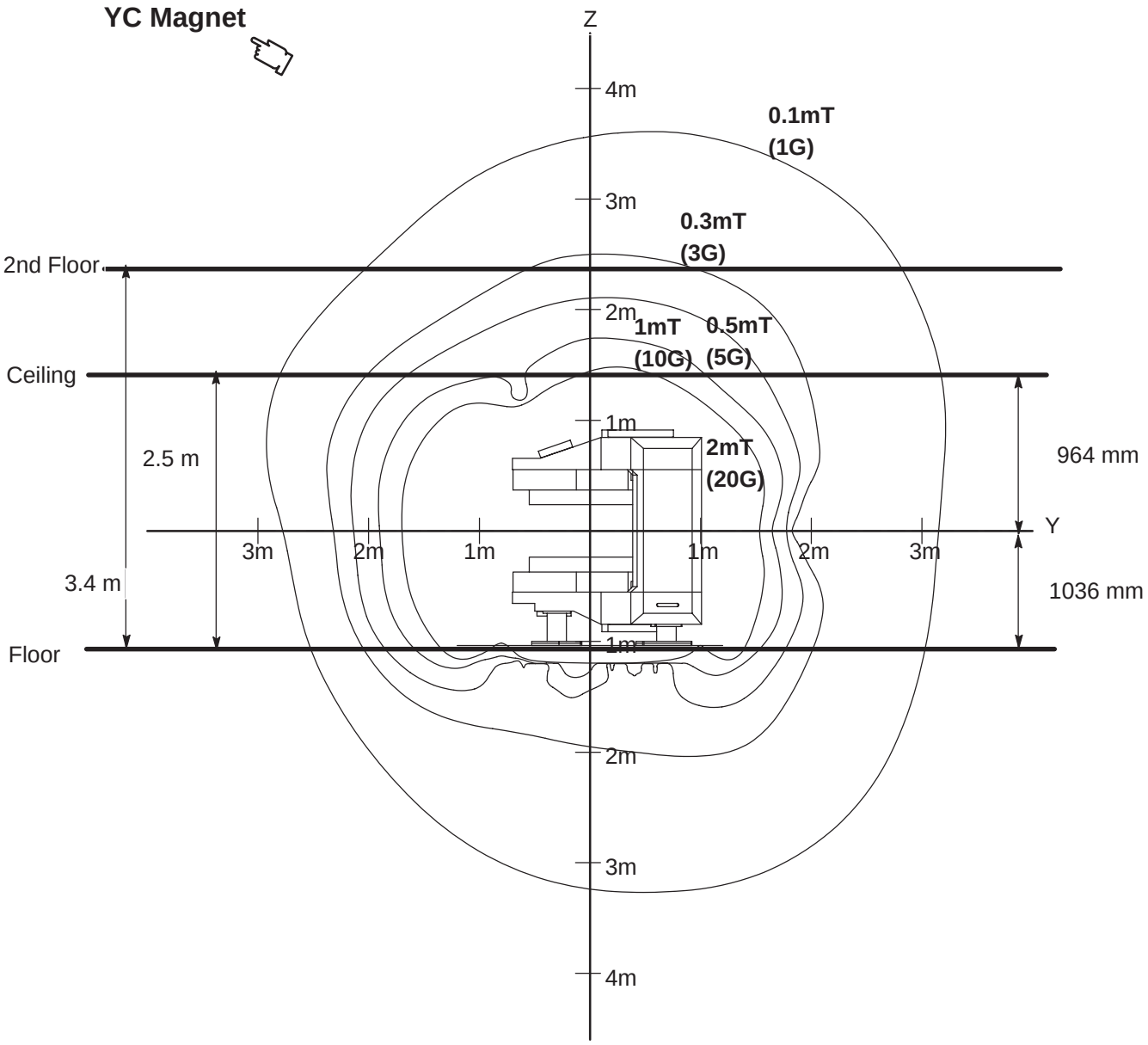
MAGNET ISOGAUSS LINE PLOT WITH 2.4m X 2.4m STEEL PLATE(TOP VIEW)
ILLUSTRATION 3–10

3–6 ISOGAUSS LINE PLOTS (continued)



MAGNET ISOGAUSS LINE PLOT WITH 2.4m X 2.4m STEEL PLATE(FRONT VIEW)
ILLUSTRATION 3–11

3–6 ISOGAUSS LINE PLOTS (continued)



MAGNET ISOGAUSS LINE PLOT WITH 2.4m X 2.4m STEEL PLATE(SIDE VIEW)
ILLUSTRATION 3–12

SECTION 4 – SITE ENVIRONMENT

TABLE OF CONTENTS

TABLE OF CONTENTS (Continued)

4–1 INTRODUCTION

The rating and duty cycles of all subsystems are applicable only if the room environment is maintained as specified in the following sections. The environment must be constantly maintained (i.e. holidays, weekends, etc.) to prevent exceeding these restrictions. Subjecting the equipment to consistent excessive temperatures and humidity above specifications may shorten the life of the internal electrical components.

4–2 TEMPERATURE AND HUMIDITY SPECIFICATIONS

Use the specifications listed in Table 4–1 for designing your HVAC (heating and air conditioning) system. Proper insulation and moisture barrier should be installed within the environmental controlled space (e.g. area above drop ceiling) for humidity, condensation, and temperature control.

To help prevent a patient from feeling uncomfortably warm during a scan, make sure the magnet room temperature does not exceed maximum temperature in specified Table 4–1.

TABLE 4–1
TEMPERATURE AND HUMIDITY SPECIFICATIONS

AREA	TEMPERATURE RANGE °F (°C)	TEMPERATURE REGULATION °F (°C)	TEMPERATURE CHANGE °F/Hr (°C/Hr)	HUMIDITY (%)	HUMIDITY CHANGE (%/Hr)	MAX. ROOM GRADIENT °C
Equipment Room at Inlet to Equipment	59–90 (15–32)	± 5 (3) within temperature range	5 (3)	30–75*	5	3**
Magnet Room	70–79 (21–26)		5 (3)	30–75	5	3
Operator's Control Room	59–90 (15–32*)		3 (2)	30–75*	5	3

Note * Non–condensing humidity with 50% nominal at 18.3°C.
** Room temperature gradient specification applies from floor to height of top discharge of equipment cabinets.

4–3 COOLING REQUIREMENTS

4–3–1 Air Cooling

The total air cooling requirement for the MR system varies depending on site construction, refer to Table 4–2 for the heat output of the equipment listed in the typical site location. These values do not include people, lighting, water cooling equipment and non–MR equipment. Use the air cooling Table 4–2 to calculate your cooling requirements for each room.

Equipment Room Requirements

In the Equipment Room care must be taken in locating the air conditioning supply and return ducts to direct air flow appropriately. An existing system can be used if it is adequate. The air conditioning supply vents should be located near the floor with the air directed toward the cabinets inlet. The returns should be above the cabinets near the equipment exhaust. Actual site average values will vary depending on system use (ie. protocols used, patient load, etc.). Note any variations of equipment location for your site when calculating your cooling requirements for each room.

Physical placement of the air conditioning equipment (compressor, etc.) is an important factor due to the homogeneous field requirements of the magnet. Therefore, it is important this equipment be located outside the 10 gauss line. Refer to Section 3, MAGNETIC FIELD CONSIDERATIONS, for plot of gauss lines.

Magnet Room Requirements

The Magnet Room must be an individual temperature zone controlled by a separate thermostat to allow for adjustments to meet room specifications in Section 4–2, TEMPERATURE AND HUMIDITY SPECIFICATIONS. The 0.35T magnet is sensitive to temperature changes. Care must be taken in locating the air conditioning supply and air ducts to the Magnet Room to ensure proper air flow. Supply ducts can be located by the Patient Table sides so conditioned air does not flow directly to the magnet. **Supply should not be located in the following areas:**

- On top of the magnet within an exclusion zone of 4.92 ft (1.5 m) from the center line of the magnet.
- On the side of the magnet within an exclusion zone of 4.92 ft (1.5 m) from the center line of the magnet.

Illustrations 4–1 and 4–2 show the air flow exclusion zone possible case for the location of the air supply and return ducts. There can be more than one supply or return ducts on the ceiling.

4–3–1 Air Cooling (Continued)

General Recommendations

A dedicated air conditioner with a dual compressor is preferred to avert shutdowns during repair of the primary air conditioner. Due to the large variation in heat loads, the compressors should be equipped with unloaders or hot gas bypass to prevent moisture stripping of the evaporator coils.

It is recommended that a temperature and humidity recorder be used during preinstallation and during actual installation and placed near the Gradient Cabinet air inlets to establish the true criteria. Refer to cooling table calculator in this section for each room's cooling requirements.

GE recommends the use of a 12 inch high raised flooring system for the equipment room (10 inch (254mm) minimum clearance from floor slab to underside of access flooring). Care must be taken in locating the air conditioning supply vents in the floor. The air conditioning supply vents should be located directly in front of the cabinet inlets.

Note

The 0.35 T Magnet is sensitive to temperature changes. If the Magnet Room air flow are not followed and an air flow exclusion zone is not respected, consistent operation of the system is not guaranteed.

TABLE 4–2
MAXIMUM MR AIR COOLING TABLE

	MAGNET ROOM (SEE NOTE 2& 3)		EQUIPMENT ROOM (SEE NOTE 4)		OPERATOR/CONTROL AREA	
	BTU/HR	WATT	BTU/HR	WATT	BTU/HR	WATT
Power Consumption	4,709	1,380	11,411	3,344	1,481	434

Note

1 Maximum heat output is defined for temperature and humidity as defined in Table 4–1.

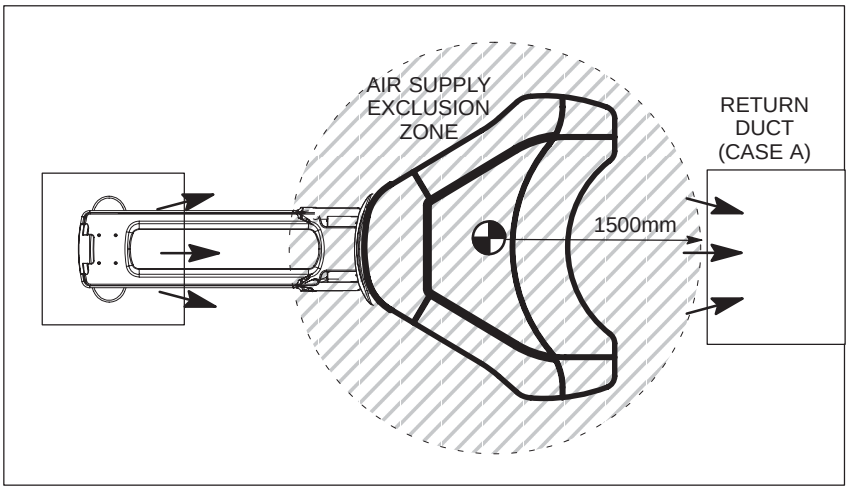
2 Magnet Room must be an individual temperature zone controlled by a separate thermostat to allow for adjustments to meet room specifications as listed in Section 4–1 TEMPERATURE AND HUMIDITY SPECIFICATIONS.

3 The 0.35T Magnet is sensitive to temperature changes. If the Magnet Room air flow are not followed and an air supply exclusion zone is not respected, consistent operation of the system is not guaranteed.

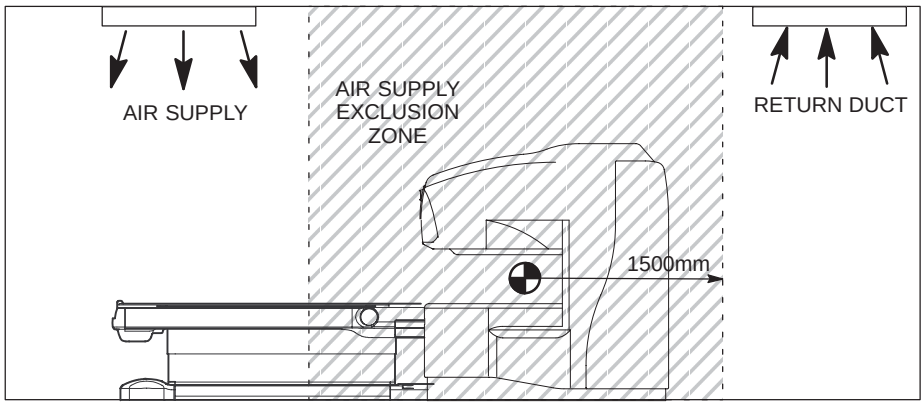
4 FOR THE EQUIPMENT ROOM ONLY: The air cooling load averaged over a working day (~12 hours) is typically 1/2 of the maximum value.

5 Operator Workspace equipment includes the following: LCD Color Monitor, Octane Computer, Workspace Cabinet, Mouse and Mouse Pad, LCD Panel, Keyboard, and interface modules mounted to Workspace Table

4–3–1 Air Cooling (Continued)



MAGNET ROOM AIR FLOW REQUIREMENTS (TOP VIEW)
ILLUSTRATION 4–1



MAGNET ROOM AIR FLOW REQUIREMENTS (SIDE VIEW)
ILLUSTRATION 4–2

4–4 ALTITUDE

The altidude limit of the system is 100ft(30.5m) below sea level to 11,808ft(3600m) above sea level.

4–5 LIGHTING

Direct Current (DC) lighting is required in the Magnet Room. Alternating Current (AC) lighting, other than fluorescent, may be used but the magnetic field of the system will significantly reduce the operating life of incandescent bulbs in AC lighting. DC Lighting product options are available from GE Medical Systems which provides for two circuits of DC power and adjustable light levels in the Magnet Room. Refer to Section1 FACILITY OPTIONS for catalog offerings. Refer to Table 4–3 for additional lighting requirements.

Note

Direct Current(DC) lighting is recommended in the Magnet Room.

TABLE 4–3
ROOM LIGHTING REQUIREMENTS

AREA	LIGHTING TYPE	LUMINOUS INTENSITY	NOTES
Magnet Room	Direct Current (DC) Incandescent or Quartz (See Notes) AC incandescent light bulbs.	• Minimum 300 lux around the front of the magnet for patient access. • Need provision to provide 300 lux above the magnet (non–magnetic, portable lighting is acceptable).	• Direct Current (DC) lighting is recommended in the Magnet Room to avoid RF noise. • Fluorescent lighting is not allowed in the Magnet Room to avoid RF noise. • Short filament length is recommended, linear lamps are not recommended because of the filament length and high incidence of filament failure. • The alternating current (AC) ripple from the DC power should be no greater than 5%. • Dimmers in the Magnet Room are not acceptable. If a low and high light is desired, the different levels must be selectable by a switch.
Operator Area	Customer defined	• Minimum 300 lux	• Lighting to minimize interference (ie. glare) on monitor at Operator Workspace. • Recommend light level be adjustable for operator comfort. • Dimmers can be used, must be on a circuit separate from Magnet Room dimmer circuit.
Equipment Room	Customer defined	• Minimum 300 lux	

4–6 NOISE

To reduce any background noise due to cabinet blowers, etc., acoustical ceilings, walls, and floors are recommended. The following are typical noise, level readings:

Operator Area	:	50 dB(A)
Equipment Room	:	75 dB(A)
Magnet Room	:	70 dB(A) during scans

4–7 ALARM DEVICES

4–7–1 System Cabinet

The System Cabinet has one temperature sensor and one control module which sounds an alarm located in the System Cabinet when temperature reaches 94° F (34.4° C). After 3 minutes of alarm condition PDU will revert to full off condition. Any external alarm device other than mentioned above must be supplied by the customer.

4–7–2 Pneumatic Patient Alert

The Pneumatic Patient Alert Control Box provides an audible and visual alarm near the operator when the patient depresses the hand held squeeze bulb. The control box is to be mounted with consideration for ease of use by operator, remaining in sight of operator, and within 5 ft. (1.5 m) of an electrical outlet. Note, an outlet on the Operator Console can be used when the Operator Console does not have International Compatible Cable Interconnect Kit. Options for control box location include mounting box vertically (on a wall or other vertical surface), horizontally (place box on a counter top, desk top, or other horizontal surface), or under a shelf within sight of operator.

4–8 AMBIENT RADIO FREQUENCY INTERFERENCE (RFI)

The MR System utilizes spatially encoded radio frequency information to create the MR image. Therefore, it is sensitive to ambient RFI. To protect the MR from ambient RFI (as well as the local environment from Magnetic Resonance RF), all sites require a 100 dB RF Shield, refer to Section 7, RF SHIELDED ROOM, for exact requirements. It is very unlikely that local signals will affect an MR System with a properly designed and installed RF Shield. During the site evaluation visit, GE notes the location of nearby sources of RFI and will advise if further information or on–site testing is required. Most sites do not require on–site testing. Listed in Table 4–4 are the recommended centerband and bandwidth frequencies to be used when measuring radio frequency interference. This table includes those frequency bands which are important for both proton imaging.

TABLE 4–4
RADIO FREQUENCY SURVEY SPECIFICATIONS

ISOTOPE	BANDCENTER MHz/Tesla	BANDWIDTH KHz/Tesla
^{1}H	14.85	50

When required, RFI site surveys are to be performed by cycling through the preceding frequency bands and a broad band range from 10MHz–100MHz. Special emphasis, however, should be placed on the ^{1}H band since this is used in proton imaging. The RFI site survey should be performed for a length of time necessary to determine, within a reasonable degree of certainty, that the RFI noise at the site will not exceed the 100 db attenuation provided by the RF shielded room. Note that any RFI site survey no matter how thorough, will not preclude the possibility of future or unmeasured RFI caused by new or intermittent sources.

The ambient RF noise measured should be less than 100 millivolt per meter (100 dB microvolt per meter). When a RFI site survey is required, it must be completed before the purchase and installation of the RF shielded room.

To ensure that 100 millivolt (or greater) RF noise peaks outside the bandwidths specified above do not actually extend into these bandwidths and exceed the 100 millivolt limit, adjust the resolution of the test equipment (spectrum analyzer) according to the equation:

- BW (resolution) = f_0 /50
- where:
  BW = Bandwidth (resolution)

  f_0 = Center frequency (14.98 MHz for ^{1}H at 0.35 Tesla)

4–9 POLLUTION

The site must be clean prior to delivery of the equipment. Although individual components have filters for optimum air filtration, care should be taken to keep air pollution to a minimum.

Since static discharge can cause system failures or affect its operation, carpeting should be of the anti–static type or treated with an anti–static solution.

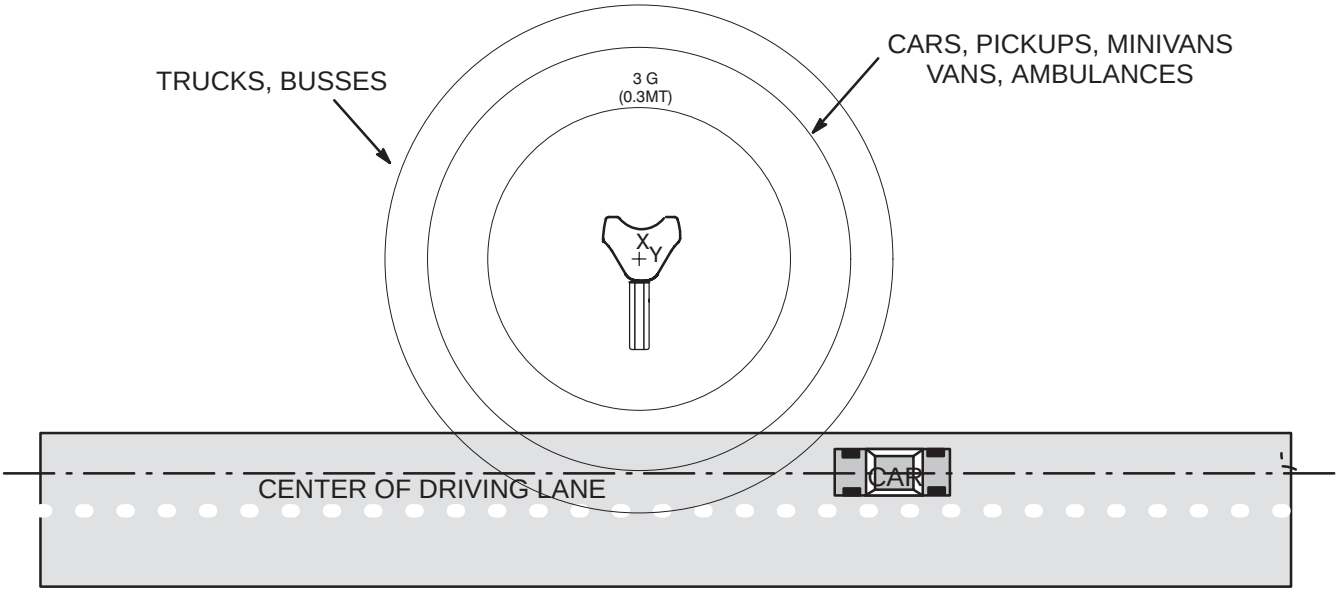
When cleaning tile floors, do not use steel wool which could enter cabinet enclosures and cause internal shorts.

The computer/equipment area requires that the air be filtered to remove 90 percent of all particles down to 10 microns and 80 percent of all particles from 10 to 5 microns in size.

4–10 CHANGING MAGNETIC ENVIRONMENT SPECIFICATIONS

4–10–1 Definition Of Moving Metal

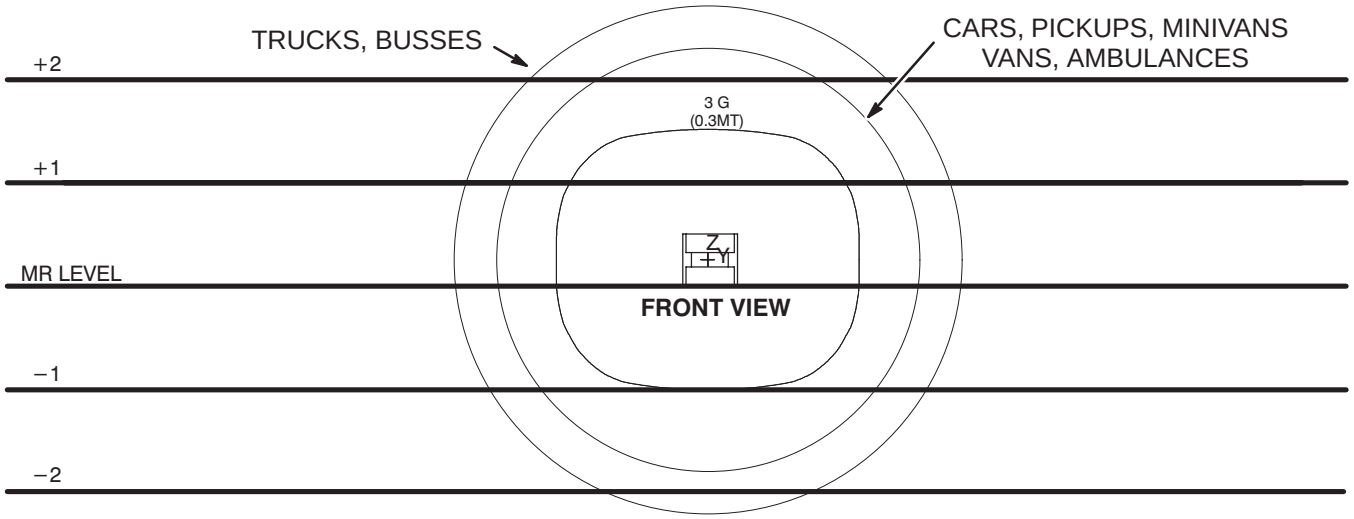
Moving metal means metal objects that move inside of the moving metal sensitivity line during system scans. For example, cars being driven inside the moving metal sensitivity line are moving metal. However, if a car or a dumpster is within the moving metal sensitivity line and **does not** move during scans, then it is not an issue. Note, the 3 gauss line proximity limit for metal objects still applies to magnets.



Note
Refer to Section 3–6 “ISOGAUSS LINE PLOTS” for detail Gauss line plot.

035T MAGNET MOVING METAL SENSITIVITY LINE PLOT
ILLUSTRATION 4–3

4–10–1 Definition Of Moving Metal (continued)



Note
Refer to Section 3–6 “ISOGAUSS LINE PLOTS” for detail Gauss line plot.

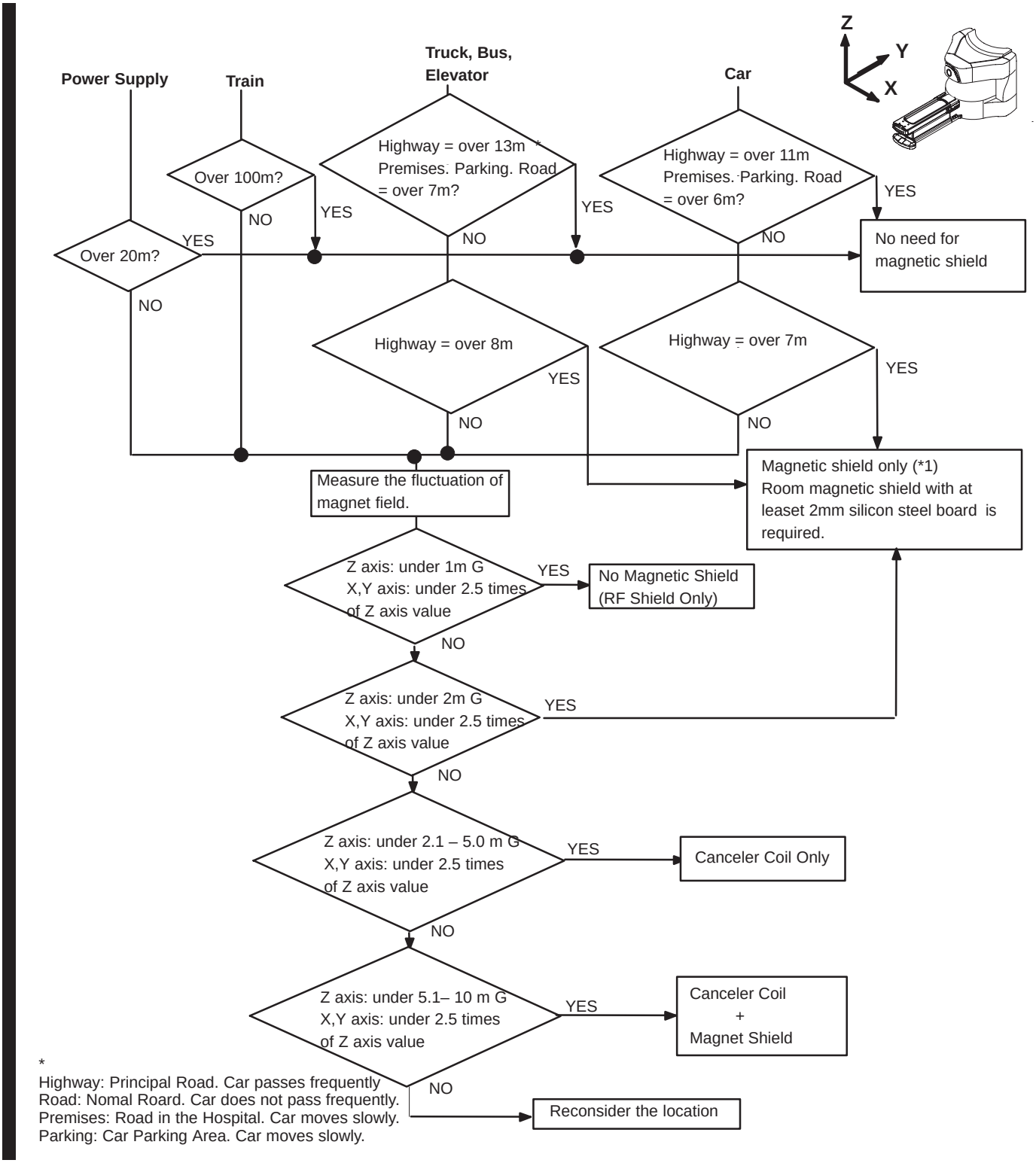
0.35T MAGNET MOVING METAL SENSITIVITY LINE PLOT
ILLUSTRATION 4–4

4–10–2 Countermeasure for Fluctuated Magnetic Field

Read the following notices before applying the flowchart in next page. (Illustration 4–9)

1. The thickness of silicon steel board used for Magnetic shield is 3mm thick.
2. “The distance of car and magnet” means the distance of the center line of the car which drives on the road and Magnet iso center.
3. If one of the followings is faced to the magnet field fluctuation source, the countermeasure using 6 sided (3mm thick) silicon steel board shield is not effective.
   - Door
   - Window
   - SRU
4. Floor shield plate(Metal plate for magnet field compensation) must be installed regardless of the flowchart.
5. If floor shield plate is located within 57mm under the floor, it can be magnet field compensation plate. If floor shield plate is located at 57mm under the floor, the thickness of the plate is 4.0～5.0mm thick. (8～11 pieces of 0.5mm thick plate).

4–10–2 Countermeasure for Fluctuated Magnetic Field (continued)



Counter measure instrument for fluctuated magnetic field
ILLUSTRATION 4–5

4–10–3 Distances For AC Power Lines, Transformers And Electric Motors

In general most AC equipment in sites is not an issue if it kept outside the 5 gauss line. If a site has large AC equipment (building mains, substations, electric trains, or subways) calculate or measure the field along the Z axis at the magnet isocenter.

Electrical currents flowing in high voltage power lines, transformers, and large generators or motors near the magnet can affect the magnetic field homogeneity that is essential to the proper performance of the MR System. Although it is highly unlikely that induced magnetic fields will be a problem, possible sources of AC interference are identified by GE during the site evaluation visit. GE will analyze this information and advise if further shielding or site rearrangement are necessary.

Magnetic field interference at 50 or 60 Hz must not exceed 1.8 milligauss RMS at the magnet location. The following equation can be used as a general guide in determining allowable current in feeder lines at a given distance from the magnet isocenter.

$$I = \frac{aX^2}{S}$$

where:

a= Coefficient

I= Maximum allowable RMS single phase current (in amps) or maximum allowable RMS line current (in amps) in three phase feeder lines

S=Separation (in meters) between single phase conductors or greatest separation between three phase conductors

X=Minimum distance (in meters) from the feeder lines to isocenter of the magnet

4–11 CONSTRUCTION MATERIALS

The following recommendations are for maintaining field homogeneity of the magnet. All construction must comply with local and national building codes.

Note

When welding in an MR room with system equipment installed, the return path for the welding must be in very close proximity to the welding. The close proximity is needed to make sure the welding currents do not cause damage to the system. Never use the building structure as a return path for welding.

Note

If National Electric Code (NEC) is applied at the site, the following items must be complied.

1. MRI systems shall use non–ferrous metal raceways, covers, fasteners, in all exam/magnet rooms.
2. Raceways shall be certified/rated for electric power purposes.
3. Raceway minimum size shall be certified/rated for electric power purpose.
4. Raceways minimum size shall 18h x 31/2d, and divided into 3 equal partitions of total cross–sectional area.
5. PVC or other non–conductive material are NOT a substitute metal raceways.

4–11–1 Floors

The magnet room floor should be poured slab on grade with polypropelene fiber impregnated or epoxy reinforced concrete. Non–magnetic stainless steel rebar or fiberglass rebar may also be used as a reinforcing material. Steel reinforcing rods or corrugated iron sheets should be avoided especially within the 50 gauss for the 0.35T magnet. If these materials exist at the site, or if installation of these materials is contemplated, they must be taken into account in the structural steel evaluation of the site. Refer to Section 3, MAGNETIC FIELD CONSIDERATIONS, for more information.

The 0.35T Magnet may require the magnet steel plate be installed into the Magnet Room floor to shield the magnet field. The plate may be recessed into an existing floor and/or the floor may be built up to the top of the steel plate. The magnet steel plate must be utilized to shield under the Magnet and the magnet steel plate must be rigidly mounted directly to the concrete without any voids. Refer to **Section 7–4 Floor Shield.**

The 0.35T magnet is capable of being shimmed with the maximum 60 kg/m^2 (12.2lb/ft^2) of ferrous steel in an area of 2.4 meters x 2.4 meters within 3–15 mm distance from the bottom of the magnet feet. See Table7–2 Steel Plate.

Steel rebar must not be positioned in such a manner as to interfere with anchor bolt locations for the magnet or magnet room equipment, refer to **Section 7–4 FLOOR SHIELDING .**

4–11–2 Walls, Ceilings, and Fixtures

General

Standard steel nails, screws, and other hardware are acceptable if properly secured. Any loose steel objects can be violently accelerated into the aperature of the magnet. Careful thought should be given to the selection of light fixtures, cabinets, wall decoration, etc. to minimize this potential hazard. For safety, all **removable** items within the magnet room such as switch box cover plates, light fixture components, mounting screws, etc. must be non–magnetic. If you have a specific question about material, bring it to the attention of your GE Installation Specialist.

Non–movable steel such as wall studs or HVAC components will produce negligible effect on the magnet.

4–11–3 Electrical conduits

Electrical conduit within the magnet room may be steel provided it is inside walls and ceilings. Note, conduit for a receptacle must be metallic. Ferromagnetic material inside the magnet room could inadvertently become a projectile.

4–12 VIBRATION

4–12–1 Scope

Certain MR procedures require an extremely stable environment to achieve high resolution image quality. Vibration is known to introduce field instabilities into the imaging system. The effects of vibration on image quality can be minimized during the initial site planning of the MR suite by minimizing the vibration environment.

The magnet may be sensitive to vibration in the frequency range of 0.5 to 80 Hz, depending on the amplitude of the vibration. In the area where the MR system is to be located, every precaution must be taken to ensure that vibration is minimized. In proposed magnet siting areas, the structural stability and behavioral characteristics can be assessed when the environment is questionable. The vibration profiles can then be used to estimate the magnetic stability. If necessary, engineers with appropriate structural dynamic systems knowledge can be employed by the customer to design the site to meet GE requirements. GE can assist in interpreting marginal site test results and predicting the impact on system performance.

To minimize the interference, the magnet should be placed on a solid floor, located as far as possible from the following vibration sources:

- parking lots
- roadways
- subways
- trains
- hallways
- hospital physical plants containing pumps, motors, air handling equipment, air conditioning units
- elevators

Note

Vibration isolation is recommended at for floor connection points of any air conditioning unit(s) to be installed to for cool the MR suite.

Note

Vibration testing is required if train, subway, and hospital physical plants are located near the proposed Ovation installation.

Vibration measurements should be made when the proposed site is located near any of the sources listed here. Measurements should be made using a spectrum analyzer capable of performing the test guidelines detailed in Sections 4–12–3, MR Site Vibration Test Guidelines through 4–12–5, Test Measurements.

Magnet Siting Requirement

The magnet must be rigidly bolted to the floor if local regulations require, or by local decision. If no regulation, it is not necessory to bolt Magnet. Vibration measurements on the magnet support must meet the guidelines defined in Section 4–12–2 Specifications.

4–12–2 Specifications

Steady State Vibration

The maximum steady state vibration transmitted through the floor should not exceed **10^{-3} m/s^2 rms** maximum single frequency above ambient baseline from **0.5 to 80 Hz**(measured in any 1 hour period daytime). In order to ensure that any discrete signal represents a real mechanical vibration source, the signal must have a bandwidth that typifies dynamic system response.

Transient Vibration

The behavioral characteristics must be such that any measurable transient disturbance must also be minimized to less than **0.01 m/s^2 peak to peak.**

4–12–3 MR Site Vibration Test Guidelines

Test Measurements

- Vibration measurements are in the range of 10^{-4} m/s^2. Test equipment must have the required sensitivity to these levels.
- All analyses are to be narrowband Fast FourierTransforms (FFT's) over the following frequency bands:

TABLE 4–5
FREQUENCY BANDS FOR FFT'S

Frequency Band	Frequency Resolution
0.2 to 50 Hz	Δf = **0.125 Hz**
0.2 to 250 Hz	Δf = **0.5 Hz**

- Time histories of the vibration must be recorded (i.e. acceleration levels vs. time). The resolution of the time history must be adjusted to clearly capture the transient events. The analyzer set–up will be site dependent.

4–12–4 Equipment (Spectral Analyzer) Set–up

- Frequency average a minimum of 20 linear averages (do not use peak holder or 1/3 octave analysis)
- Hanning window must be applied to the entire spectra

Spectrum analyzers capable of these measurements include the GenRad 2515, B&K 2032 or HP 3560A Dynamic Signal Analyzer. Accelerometers must have the capability to measure from 0.2 Hz beyond 250 Hz. Time histories can be recorded using any of the analyzers mentioned above. Good quality strip chart recorders may also be sufficient. Please note that the equipment above is mentioned for example only. It is the responsibility of the engineering test firm to provide equipment that will meet the test requirements.

4–12–5 Test Measurements

- **Ambient Baseline Condition:**

  All of the measurements defined in Sections 4–12–3, MR Site Vibration Test Guidelines and 4–12–4, Equipment Set–up must be made in a 'quiet' environment. In areas where excessive traffic, subway trains, etc. exist, a vibration measurement must also be made during periods without traffic or during periods of light traffic. Measurements must define the lowest levels of vibration possible at the site.

  The source of any steady state vibration disturbance whose levels exceed the 10^{-3} m/s^2 should be identified. A second measurement should be made with all of the identified contributors powered down. The majority of steady state vibration problems can be negated by isolating the vibration source.

- **Normal Condition:**

  All of the measurements listed above must be repeated during periods of 'normal' environmental conditions including the FET's and time histories. Transient measurements must be provided to define the dynamic disturbances the MR system might be exposed to. This transient disturbance is required for a true assessment of the site.

  Transient vibration is very difficult to eliminate. Should the environment exceed the 0.005 m/s^2, zero to peak, an alternative location should be identified. A second vibration measurement should be made to help identify a more stable location.

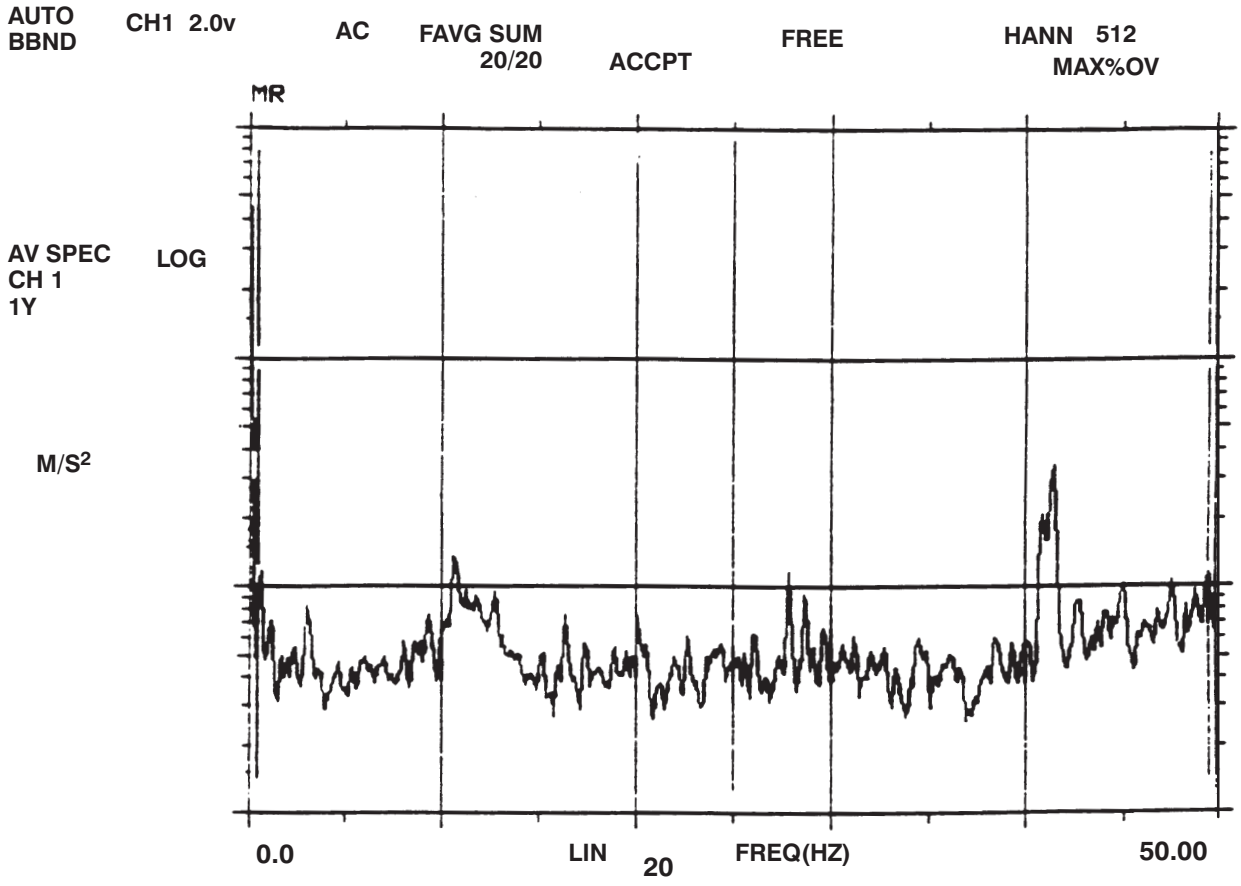
4–12–6 Presentation/Interpretation of Results

The recommended format for site vibration data collection, presentation, and analysis is illustrated in the four examples shown in Illustrations 4–6 through 4–9. Presentation of the data in any other format may result in an incorrect interpretation and diagnosis of the site. Additional data collection or presentation methods is at the option of the vibration testing service.

It is the responsibility of the customer's vibration testing service to interpret the results and determine if that site meets GE's specifications. If the vibration levels are too high, additional data acquisition may be necessary to determine the source of the vibration, propose a solution to the problem, or find an alternate site location.

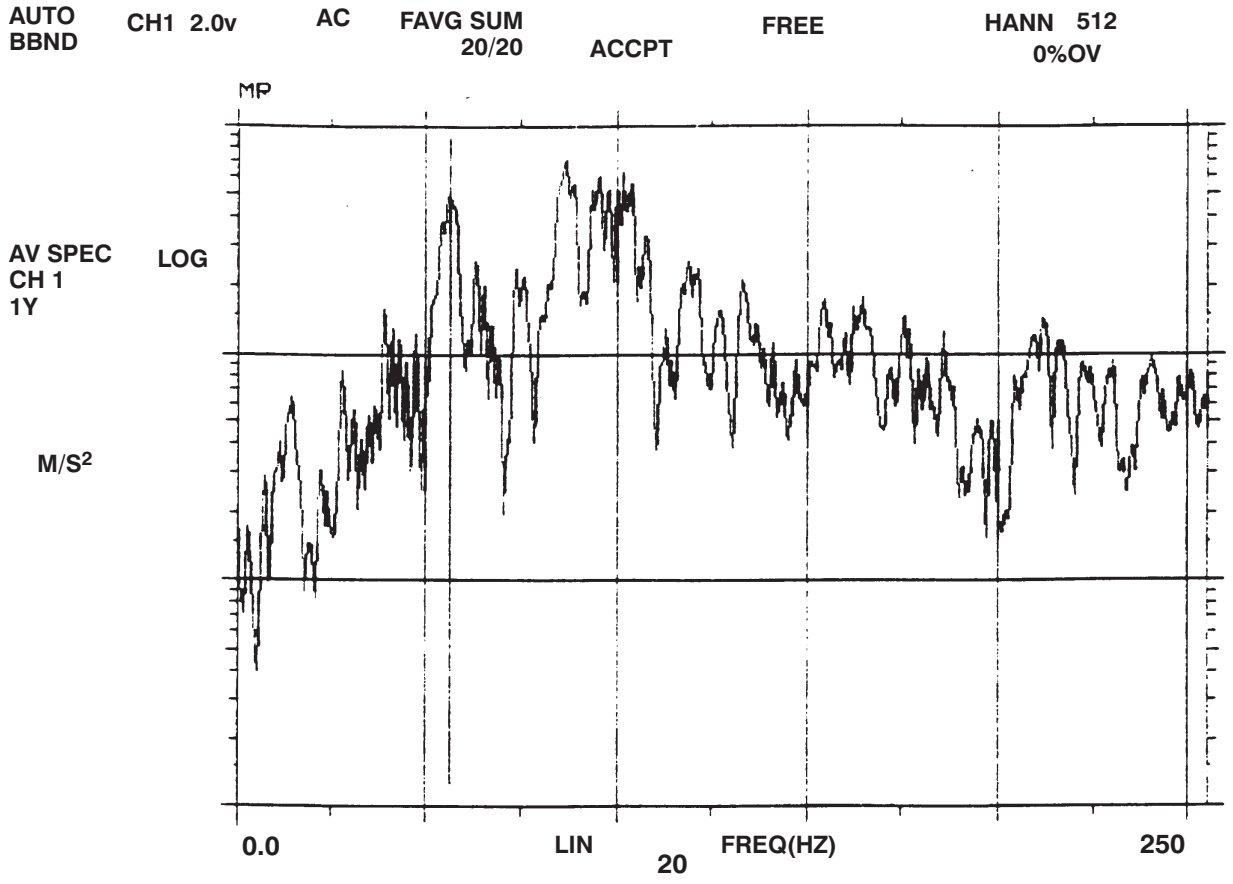
Any questions regarding test equipment requirements, test parameters, or general questions should be discussed with your GE Installation Specialist.

4–12–7 Presentation/Interpretation of Results (continued)



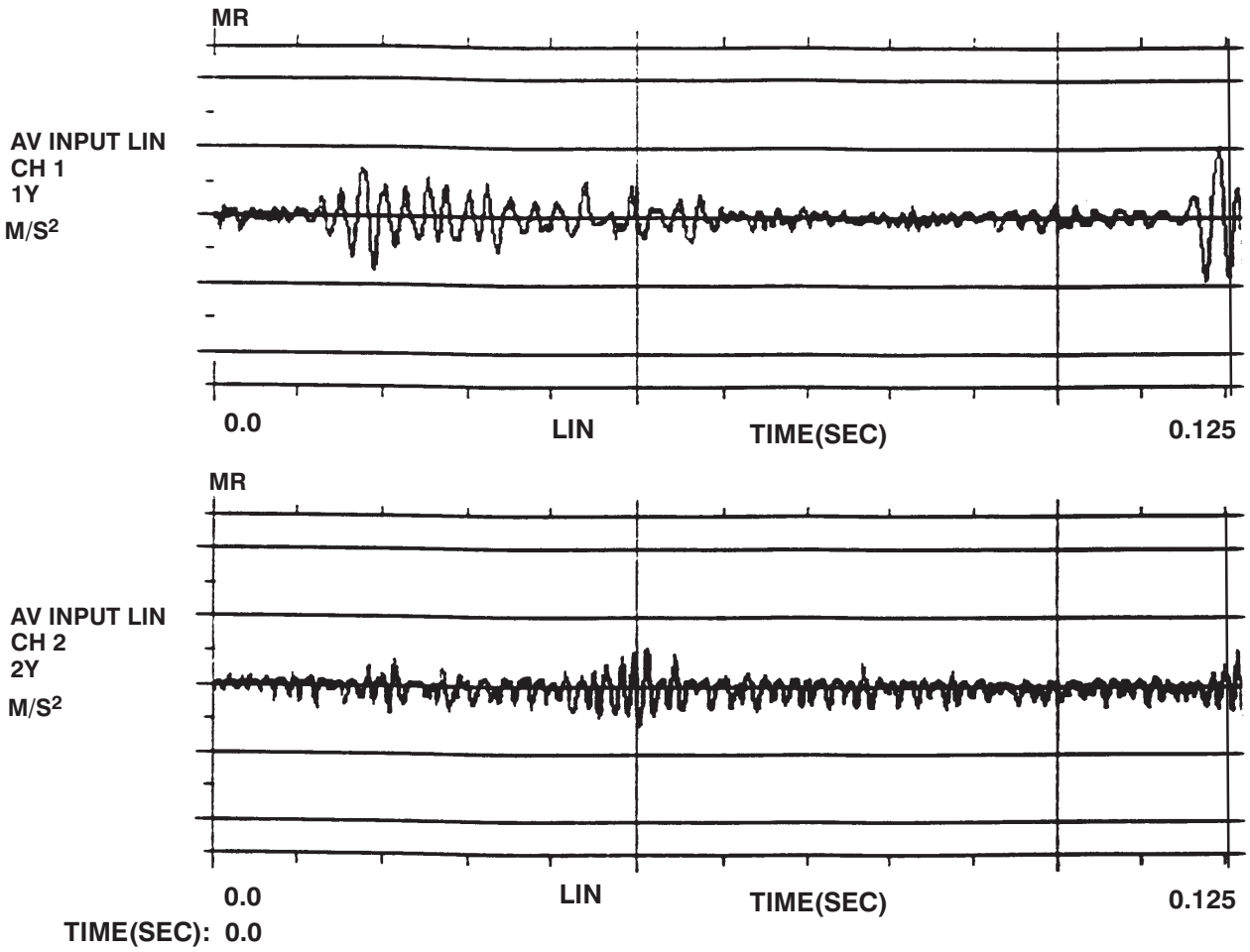
FFT 0.2 TO 50 Hz
ILLUSTRATION 4–6

4–12–7 Presentation/Interpretation of Results (continued)



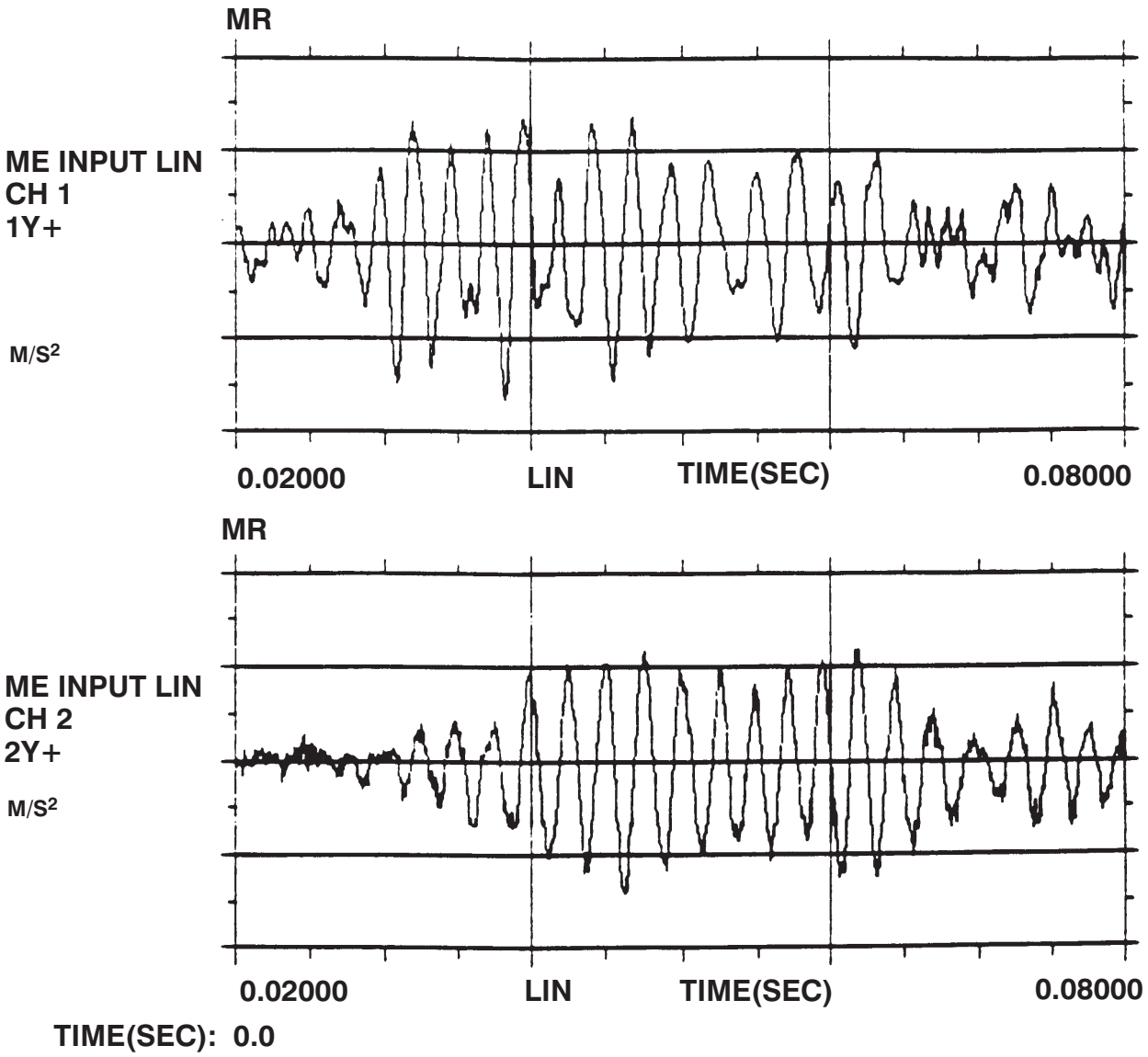
FFT 0.2 TO 1000 Hz
ILLUSTRATION 4–7

4–12–7 Presentation/Interpretation of Results (continued)



ACCELERATION TIME HISTORY
ILLUSTRATION 4–8

4–12–7 Presentation/Interpretation of Results (continued)



ACCELERATION TIME HISTORY
(ZOOM IN ON TRANSIENT EVENT)
ILLUSTRATION 4–9

SECTION 5 – POWER REQUIREMENTS

TABLE OF CONTENTS

5–1 INTRODUCTION

The MR system includes a Power Distribution Unit (PD1) module in the lower portion of the Power Cabinet (MR1) which distributes power to MR system components. Refer to Section 5–2, CRITICAL POWER REQUIREMENTS, for specifications of required facility input to the MR System. Refer to Table 5–1 for required customer power.

Customers should carefully consider the advantages and disadvantages of raised flooring, conduits, floor ducts, and surface raceways for running cables in accordance with local codes. If used, conduits should be large enough to pass any cable and its connector through with all other cables in the conduit.

To reduce voltage regulation problems and wiring costs, minimize the cable length between the primary power source and the Power Distribution Unit. When routing cables, keep all phase conductors and ground for a circuit in the same trough. Whenever possible, keep power cables away from signal and data cables. Use separate trough or dividers in duct. Recommended minimum wires sizes for each of the Main Disconnect Panel circuits are indicated in Tables 5–5 .

5–2 CRITICAL POWER REQUIREMENTS

Note

Main Disconnect Panel (MDP) is NOT used for Japan.

The system includes a Main Disconnect Panel (MDP) with Low Voltage Low Energy local and multi–point remote control capability in the feeder lines that supply input power to the Power Distribution Unit (PD1) and Temparature Control Unit (TCU). All work is to be done in accordance with national and local electrical codes.

Refer to Section 5–3, POWER DISTRIBUTION SYSTEM, for Main Disconnect Panel set up. Main Disconnect Panel consists of the following:

- A three–pole, 600 VAC circuit breaker rated for the current of the PDU circuit. The short–circuit current interrupting rating of the breaker is 25K Amperes to accommodate available fault current.
- A two pole, 600VAC circuit breaker rated for the current of the TCU. The short circuit current interrupting rating of the breaker is 3 K Amperes to accomodate available fault current.

Main Disconnect Panel is to be located so the top of the upper circuit breaker handle when in the ON postion do not exceed 78 inches (1981 mm) form the floor and visible to Power Distribution Unit (PD1) and the service personnel.

Refer to Table 5–3 for the requirements for facility inputs to the MDP PDU circuit and Table 5–3 for the requirements for facility essencial power to the MDP TCU.

5–2 CRITICAL POWER REQUIREMENTS (Continued)

TABLE 5–1
REQUIRED CUSTOMER POWER (Japan Only)

Note
See Note below if 200 volts are provided to site.

MR COMPONENT	VOLTAGE (VAC)	FREQUEN-CY	PHASE	MAX. AMPS	COMMENTS
Facility Power for Power Distribution Unit (PD1) power circuit (See Note 1) See Illustration 5–1	200	50/60 ± 3 Hz	3 phase conductors (L1, L2, L3 +G) See Comments	See Note 2	Recommend input configuration: 3 phase Grounded WYE with Neutral and Ground (5 wire system). Note, Neutral must be terminated prior to or inside the Main Disconnect Panel and not brought to the Power Cabinet. Optional input configuration: 3 phase DELTA with Ground (4 wire) input, recommend corner Grounded Delta configuration.
	380, 400, 415, 480			See Table 5–3	
Service Receptacle in Magnet Room	110–120 local voltage and portable transformers for voltages values	50/60 Hz	1	2.0	Receptacle required for small power tools

Note

1 PDU Module is located in the lower portion of the Power Cabinet (MR1).

2 Maximum amps dependent on voltage selected. Refer to Section 5–2, CRITICAL POWER REQUIREMENTS, Tables 5–3 and Table 5–4 for configuration and allowable input voltages/current demand.

3 TCU power are required immediately upon magnet arrival. If permanent site power is not ready, temporary power drop line must be made available. If site voltage is not any of the voltages listed above, customer must provide transformer and secondary circuit breaker to provide correct voltage and/or configuration.

5–2 CRITICAL POWER REQUIREMENTS (Continued)

TABLE 5–2
REQUIRED CUSTOMER POWER (Outside of Japan)

MR COMPONENT		VOLTAGE (VAC)	FREQUENCY	PHASE	MAX. AMPS	COMMENTS
Main Disconnect Panel (MDP)	Facility Power for Power Distribution Unit (PD1) power circuit See Illustration 5–1	380, 400, 415, 480 (See Note below this table for 200/208 VAC) ☜	50/60 ± 3 Hz 50/60 ± 3 Hz	3 phase conductors (L1, L2, L3 +G) See Comments	See Note 2 See Table 5–3	Recommend input configuration: 3 phase Grounded WYE with Neutral and Ground (5 wire system). Note, Neutral must be terminated prior to or inside the Main Disconnect Panel and not brought to the Power Cabinet. Optional input configuration: 3 phase DELTA with Ground (4 wire) input, recommend corner Grounded Delta configuration.
	Essential Power for Temperature Conrtrol Unit (TCU) power circuit See Illustration 5–1	460, 480 380, 400, 415	60 Hz 50 Hz	1+GND	See Note 2 See Table 5–4	Facility Essential Power (24 hours/day, 7 days per week) is required for the TCU. *Also see Note 2.* Hard wired at MDP TCU mounts on Penetration Panel (PP1).
Service Receptacle in Magnet Room		110–120 local voltage and portable transformers for voltages values	50/60 Hz	1	2.0	Receptacle required for small power tools

Note

1 PDU Module is located in the lower portion of the Power Cabinet (MR1).

2 Maximum amps dependent on voltage selected. Refer to Section 5–2, CRITICAL POWER REQUIREMENTS, Tables 5–3 and 5–4 for configuration and allowable input voltages/current demand.

3 TCU power are required immediately upon magnet arrival. If permanent site power is not ready, temporary power drop line must be made available. If site voltage is not any of the voltages listed above, customer must provide transformer and secondary circuit breaker to provide correct voltage and/or configuration.

Note

If the site has 200 or 208 incoming power, a step up 75KVA (480Y277) transformer is required. The transformer can be purchased from GE Industrial Systems. Also if using a step up transformer and the MDP is placed further then 10 feet from the transformer, an addition breaker must be installed between the secondary 480 volt output and the MDP. This is a code requirement.

5–2 CRITICAL POWER REQUIREMENTS (Continued)

TABLE 5–3
MDP PDU CIRCUIT FACILITY INPUT POWER REQUIREMENTS
(Refer to Table 5–3 for MDP TCU Circuit Requirements and Illustration 5–1 for configuration)

<table>
<tr><th>PARAMETER</th><th>REQUIREMENTS</th></tr>
<tr><td>CONFIGURATION</td><td>PDU MODULE LOCATION IN LOWER PORTION OF POWER CABINET:
● Recommend input configuration 3 phase Grounded WYE with Neutral and Ground (5 wire system). Note, Neutral must be terminated prior to or inside the Main Disconnect Panel and not brought to the Power Cabinet.
● Optional input configuration 3 phase DELTA with Ground (4 wire) input, recommend corner Grounded Delta configuration.</td></tr>
<tr><td>INPUT VOLTAGE</td><td>● 380, 400, 415, or 480 Vrms for PDU circuit of High Voltage MDP
● 200 or 208 Vrms for PDU (PD1)</td></tr>
<tr><td>FREQUENCY</td><td>50 ± 3 Hz or 60 ± 3 Hz</td></tr>
<tr><td>ALLOWABLE INPUT VOLTAGES/CURRENT DEMAND
See Note 1</td><td>
<table>
<tr><th rowspan="2">NOMINAL VOLTAGE (Vrms)</th><th rowspan="2">NORMAL RANGE ±±±10 PERCENT</th><th colspan="2">CURRENT (AMPS)</th><th rowspan="2">C RECOMMENDED MINIMUM STANDARD OVERCURRENT PROTECTION FOR ROOM FEED DISCONNECT</th></tr>
<tr><th>AMAXIMUM MOMENTARY</th><th>BCONTINUOUS</th></tr>
<tr><td>200</td><td>180–220</td><td>112</td><td>64</td><td>90 Amps</td></tr>
<tr><td>208</td><td>187–229</td><td>108</td><td>62</td><td>80 Amps</td></tr>
<tr><td>380</td><td>342–418</td><td>59</td><td>34</td><td>50 Amps</td></tr>
<tr><td>400</td><td>360–440</td><td>56</td><td>32</td><td>50 Amps</td></tr>
<tr><td>415</td><td>374–456</td><td>54</td><td>31</td><td>40 Amps</td></tr>
<tr><td>480</td><td>432–528</td><td>47</td><td>27</td><td>40 Amps</td></tr>
<tr><td colspan="5">NOTE: A Calculated at 35 KVA system Peak Instantaneous Power Demand & minimum voltage.
B Calculated at 20 KVA system Continuous Power Demand & minimum voltage.
C Overcurrent protection sized for 125% continuous current per National Electrical Code NEC 1999 Article 210–20 or NEC 1996 Article 220–3.</td></tr>
</table>
</td></tr>
<tr><td>PEAK INSTANTANEOUS POWER DEMAND <5 SECONDS</td><td>35 KVA (See Notes 1 and 2)</td></tr>
<tr><td>CONTINUOUS SUSTAINED POWER (> 5 seconds)</td><td>20 KVA (See Note 1)</td></tr>
<tr><td>AVERAGE POWER DEMAND (Based On Typical 30 Minutes Per Hour Patient Scan Time)</td><td>16 KVA</td></tr>
<tr><td>SYSTEM IDLE QUIESCENT</td><td>9 KVA at 0.9 lagging Power Factor</td></tr>
<tr><td>TRANSIENTS</td><td>Maximum transient voltage above nominal waveshape not to exceed 200 V for the nominal voltages 380, 400, 415, or 480 Vrms.</td></tr>
<tr><td>PHASE IMBALANCE</td><td>Difference between the highest phase line–to–line voltage and the lowest phase line–to–line voltage must not exceed 2%.</td></tr>
<tr><td>LOAD REGULATION AT LINE FREQUENCY</td><td>Wires to be sized such that the line voltage drop from power source to PDU is less than 2% of the nominal voltage for rated load of system.</td></tr>
<tr><td>GROUNDING</td><td>● Main facility ground wire to be minimum 1/0 AWG copper or same size as power feeder wire, which ever is larger.
● Main facility ground wire to be insulated.
● Ground impedance to earth at power source to be 2 ohms or less.
● Main facility ground wire to be bonded at every distribution box in an approved grounding block.</td></tr>
<tr><td colspan="2">Note 1 Breaker feeding system to be sized for Continuous Sustained Power.
2 Feeders must be sized for Peak Instantaneous Power Demand.</td></tr>
</table>

5–2 CRITICAL POWER REQUIREMENTS (Continued)

TABLE 5–4
MDP TCU CIRCUIT FACILITY ESSENTIAL POWER REQUIREMENTS
(Refer to Table 5–3 for MDP PDU Circuit Requirements & Illustration 5–1 for configuration)

<table>
<tr><th>PARAMETER</th><th>REQUIREMENTS</th></tr>
<tr><td>CONFIGURATION</td><td>TCU MODULE LOCATION ON PENETRATION PANEL(PP1):
● Recommend input configuration 1 phase and Ground (3 wire system). Note, Neutral must be terminated prior to or inside the Main Disconnect Panel and not brought to the Power Cabinet.</td></tr>
<tr><td>INPUT VOLTAGE / FREQUENCY</td><td>● 460, 480 Vrms at 60 ± 3 Hz
● 380, 400, 415 Vrms at 50 ± 3 Hz</td></tr>
<tr><td>ALLOWABLE INPUT VOLTAGES/CURRENT DEMAND</td><td>
<table>
<tr><th>NOMINAL VOLTAGE (Vrms)</th><th>NORMAL RANGE ±10 PERCENT</th><th>CURRENT (AMPS) [A] CONTINUOUS</th><th>[B] RECOMMENDED MINIMUM STANDARD OVERCURRENT PROTECTION FOR ROOM FEED DISCONNECT</th></tr>
<tr><td>380</td><td>342–418</td><td>8.8</td><td>15 Amps</td></tr>
<tr><td>400</td><td>360–440</td><td>8.3</td><td>15 Amps</td></tr>
<tr><td>415</td><td>374–456</td><td>8.0</td><td>15 Amps</td></tr>
<tr><td>460</td><td>414–506</td><td>7.2</td><td>10 Amps</td></tr>
<tr><td>480</td><td>432–528</td><td>6.9</td><td>10 Amps</td></tr>
<tr><td colspan="4">NOTE: A Calculated at 21 KVA system Continuous Power Demand & minimum voltage.
B Overcurrent protection sized for 125% continuous current per National Electrical Code NEC 1999 Article 210–20 or NEC 1996 Article 220–3.</td></tr>
</table>
</td></tr>
<tr><td>CONTINUOUS POWER</td><td>Continuous Operation For TCU: 3 KVA at 0.9 lagging Power Factor.</td></tr>
<tr><td>GROUNDING</td><td>● Main facility ground wire to be minimum 1/0 AWG copper or same size as power feeder wire, which ever is larger.
● Main facility ground wire to be insulated.
● Ground impedance to earth at power source to be 2 ohms or less.
● Main facility ground wire to be bonded at every distribution box in an approved grounding block.</td></tr>
</table>

5–3 POWER DISTRIBUTION SYSTEM

5–3–1 Main Disconnect Panel (MDP)

Note

Main Disconnect Panel (MDP) is NOT used for Japan.

The Signa Ovation system(high voltage configuration) includes a Main Disconnect Panel with multi–point remote control capability is shown in Illustration 5–1. The design of the MDP supplied with the system allows for power feed connection to meet the requirements of **SECTION 5–2 CRITICAL POWER REQUIREMENTS** of facility power for the PDU circuit and facility essential power for the TCU circuit.

Note

Loss of power automatically trips PDU circuit PD1 contactor in the MDP. Manual restart is required for the PDU circuit after restoration of power.

Note

The MDP circuit for TCU provides auto restart upon return of normal power. The MDP Emergency Off circuit for TCU auto restart function is controlled by the Emergency Off pushbuttons.

Check local and national codes to determine if an interlock to the air–conditioning unit in the Computer/Equipment Room is required in the protective disconnect set–up.

The emergency off buttons are to be mounted in the Magnet Room near each exit 60 in. (1524 mm) from the floor and connected to the protective disconnect device in order to disable the power to the PDU in emergency situations. The emergency off button is to be clearly labeled “Emergency Off” and visible to personnel in the Magnet Room. It is important that the button be labeled “off” and not “stop” since there exists an “Emergency Stop” button in the Signa system which powers down different equipment than the emergency off button installed by the facility. An additional emergency off button should be mounted in the equipment room near the exit door.

Note

The emergency off circuit disconnects power to the PDU and TCU. Power can be restored to the PDU by pressing the PDU ON pushbutton. Power can be restored to the TCU by pressing the common ON push button for TCU

The Main Disconnect Panel (MDP) is lockable to meet OSHA requirements for power Lockout/Tagout requirements. The MDP provides for the disconnection of the facility power to the PDU and disconnection of essential facility power to the TCU. Individual branch circuits for the PDU consisting of padlockable GE Spectra circuit breakers are provided. The MDP also provides the 2 emergency off buttons and contacts for an interlock to the air–conditioning units in the equipment room.

5–3–1 Main Disconnect Control (MDP) (Continued)

Note

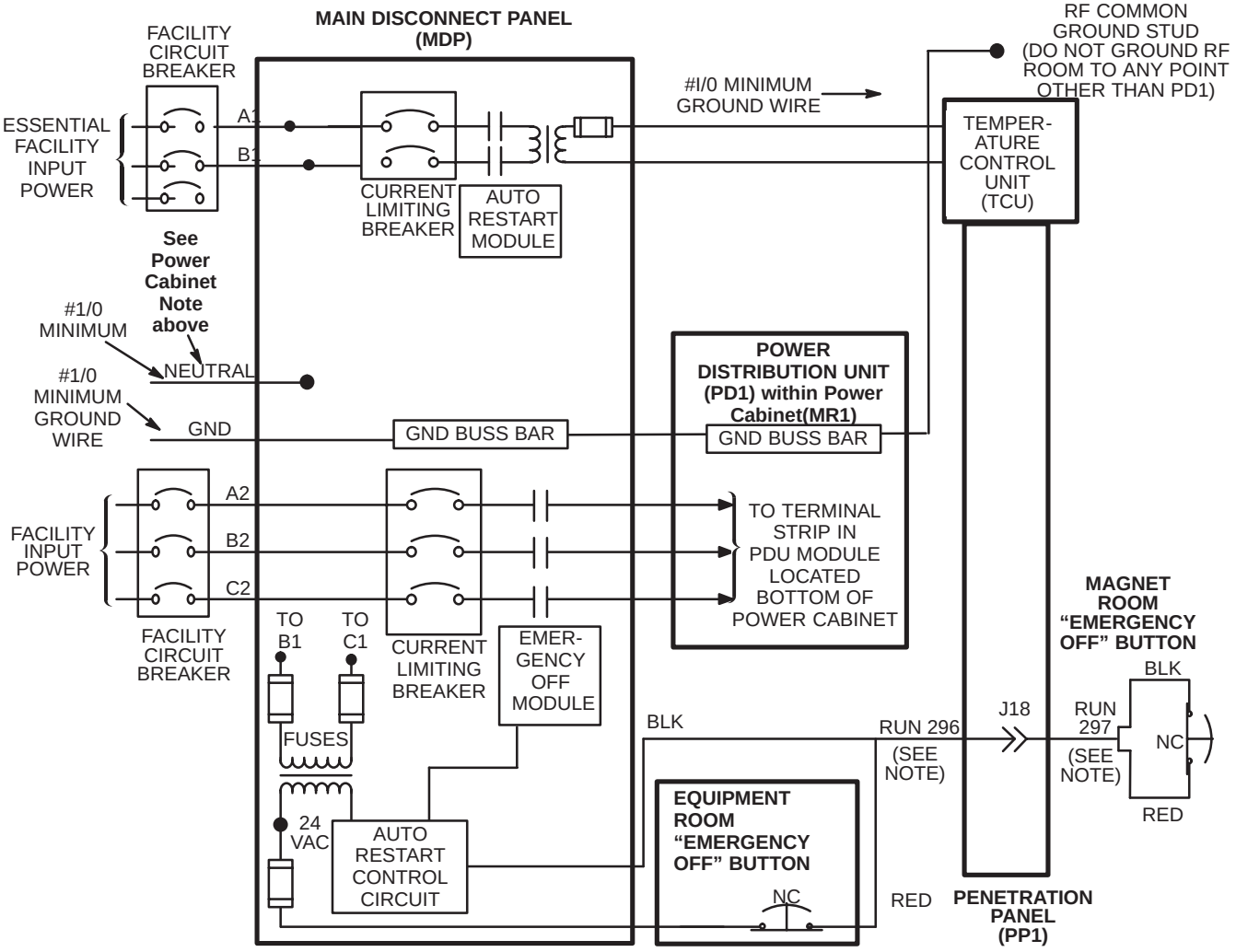
Main Disconnect Panel (MDP) is NOT used for Japan.

Note

Refer to Section 11 Main Disconnect Panel for more detail information.

Dual Feed

NOTE:
- RUNS 296 AND 297 ARE GE SUPPLIED CABLES. ALL OTHER WIRING IS CUSTOMER SUPPLIED.
- TWO EMERGENCY "OFF" BUTTONS ARE SUPPLIED WITH SYSTEM MDP.
- CIRCUIT BREAKERS ARE PROVIDED FOR PDU, CIRCUITS.
- LOSS OF POWER AUTOMATICALLY TRIPS PD1 CONTACTOR.
- IF 3 PHASE WYE WITH NEUTRAL AND GROUND (5 WIRE SYSTEM) INPUT USED THEN NEUTRAL MUST BE TERMINATED INSIDE THE MAIN DISCONNECT CONTROL AND NOT BROUGHT TO THE POWER CABINET

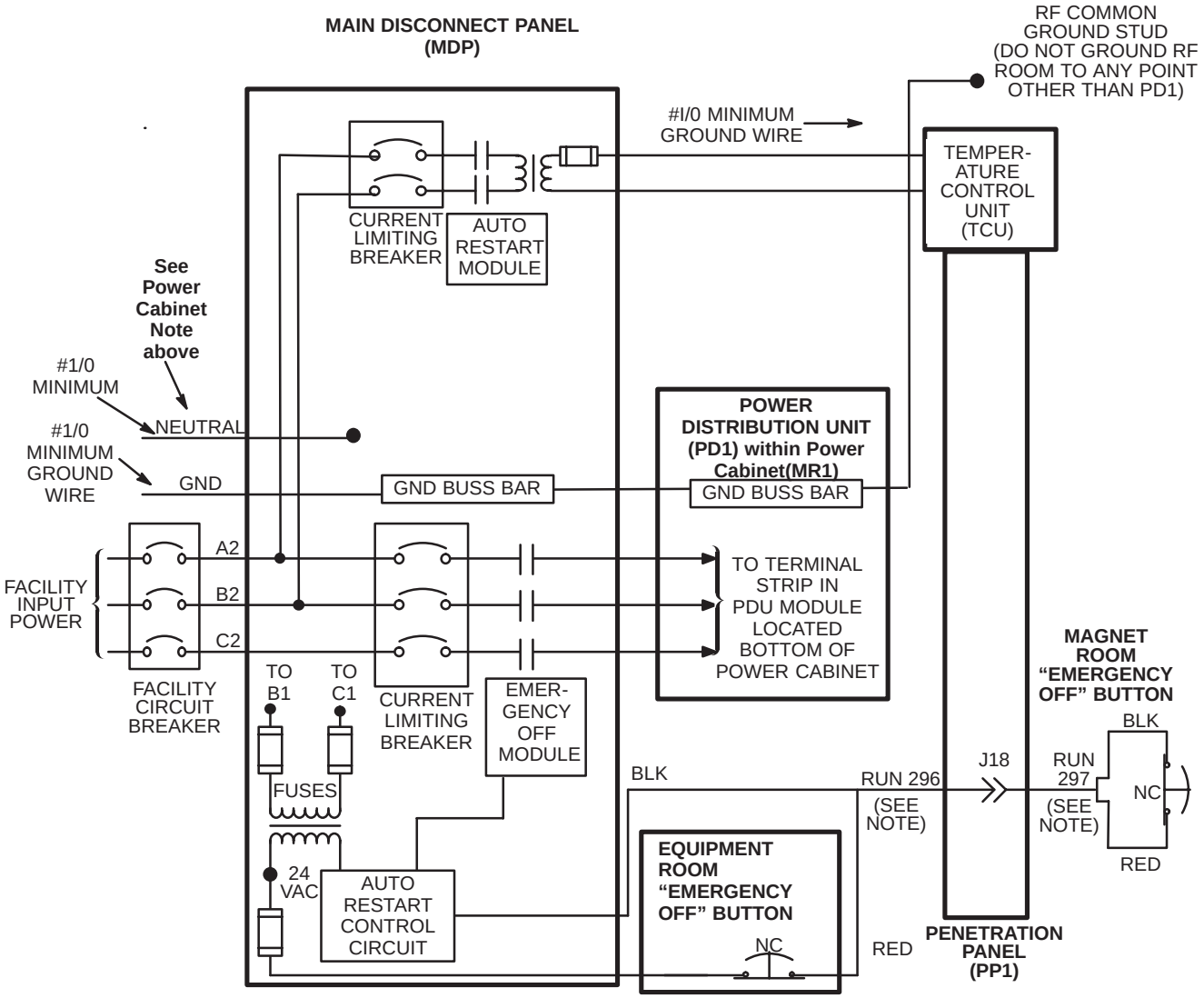


PROTECTIVE DISCONNECT SET–UP
ILLUSTRATION 5–1

5–3–1 Main Disconnect Control (MDP) (Continued)

Single Feed

NOTE:
- RUNS 296 AND 297 ARE GE SUPPLIED CABLES. ALL OTHER WIRING IS CUSTOMER SUPPLIED.
- TWO EMERGENCY "OFF" BUTTONS ARE SUPPLIED WITH SYSTEM MDP.
- CIRCUIT BREAKERS ARE PROVIDED FOR PDU, CIRCUITS.
- LOSS OF POWER AUTOMATICALLY TRIPS PD1 CONTACTOR.
- IF 3 PHASE WYE WITH NEUTRAL AND GROUND (5 WIRE SYSTEM) INPUT USED THEN NEUTRAL MUST BE TERMINATED INSIDE THE MAIN DISCONNECT CONTROL AND NOT BROUGHT TO THE POWER CABINET



PROTECTIVE DISCONNECT SET–UP
ILLUSTRATION 5–2

5–3–2 Feeder Size

The recommended facility feeders conductors shall be copper and the minimum size are listed in Table 5–5 for PDU circuit. Where the appropriate wire size listed in Tables 5–5 is not readily available use the next convenient wire size larger from that specified with 1/0 AWG (50 mm^2) being the largest allowable phase conductor the PD1 will accept. Larger feeder wires can be connected to the MDP with 1 AWG (50 mm^2) between the MDP and PD1.

Note

Tables 5–5 feeder minimum size is in AWG (mm^2). Feeder size is based on Table 310–16 of National Electrical Code and the conductors listed have an insulation rating of 75°C (167°F) or higher for maximum 2% voltage drop. Calculations are based on using Peak Power Demand for each system configuration and the lowest daily variation of –10%. If daily variations are not this large the feeder size can be recalculated for 2% voltage drop by facility engineer.

Note

The ground and neutral conductors shall be minimum size of 1/0 AWG copper or the same size as the feeder wire, which ever is larger. Lug connector for the ground wire is to be provided by the contractor, recommended Amp Inc. number 36919 lug.

TABLE 5–5
PDU RECOMMENDED FACILITY FEEDER SIZES*
(Refer to Table 5–5 for PDU Circuit Recommendation)

RUN LENGTH TO MDP ft (m)	ALL CONFIGURATIONS INPUT VOLTAGE (See Note 1)					
	200V [RANGE 180V – 220V]	**208V [RANGE 187V – 229V]**	**380V [RANGE 342V – 418V]**	**400V [RANGE 360V – 440V]**	**415V [RANGE 374V – 456V]**	**480V [RANGE 432V – 528V]**
0–50 (0–15.2)	0 AWG (50 mm^2)	1 AWG (42 mm^2)	4 AWG (25 mm^2)	4 AWG (25 mm^2)	6 AWG (16 mm^2)	6 AWG (16 mm^2)
51–100 (15.2–30.5)	0 AWG (50 mm^2)	1 AWG (42 mm^2)	4 AWG (25 mm^2)	4 AWG (25 mm^2)	6 AWG (16 mm^2)	6 AWG (16 mm^2)
101–150 (30.5–45.7)	3/0 AWG (83 mm^2)	2/0 AWG (70 mm^2)	4 AWG (25 mm^2)	4 AWG (25 mm^2)	6 AWG (16 mm^2)	6 AWG (16 mm2)
151–200 (46.0–61.0)	4/0 AWG (105 mm^2)	4/0 AWG (105 mm^2)	4 AWG (25 mm^2)	4 AWG (25 mm^2)	4 AWG (25 mm2)	6 AWG (16 mm2)
201–250 (61.3–76.2)	350MCM (174 mm^2)	350MCM (174 mm^2)	3 AWG (35 mm^2)	3 AWG (35 mm^2)	4 AWG (25 mm2)	4 AWG (25 mm2)
251–300 (76.5–91.4)	500MCM (250 mm^2)	400MCM (200 mm^2)	2 AWG (35 mm^2)	2 AWG (35 mm2)	3 AWG (35 mm2)	4 AWG (25 mm2)
301–350 (91.4–106.7)	600MCM (300 mm^2)	500MCM (250 mm^2)	1 AWG (50 mm^2)	2 AWG (35 mm^2)	2 AWG (35 mm^2)	4 AWG (25 mm2)
351–400 (106.7–121.9)	700MCM (105 mm^2)	600MCM (300 mm^2)	1/0 AWG (50 mm^2)	1 AWG (50 mm^2)	1 AWG (50 mm^2)	3 AWG (50 mm2)

Notes * Minimum wire size is calculated at maximum rating of 35 KVA for PDU circuit . All calculations use 2 AWG (35 mm^2) from MDP placed 20 feet (6.1 meters) from PD1. If MDP is located more than 20 feet (6.1 meters) from the PD1 then a facility/electrical engineer should recalculate wire size losses to ensure that losses do not exceed 2% for total run length from facility transformer to PD1.

1 The maximum conductor the Main Disconnect Control (MDP) can accept is #3/0 AWG (83 mm^2). For feeders larger than 3/0 AWG (83 mm^2) the wires must be reduced (ie. splice, junction box, etc.) to 3/0 AWG (83 mm^2) within 10 feet (3 meters) of MDP. It is important to note the maximum cable wire from the MDP to the PD1 must not be larger than 1/0 AWG (50 mm^2). PDU Module (PD1) is located in lower portion of the Power Cabinet (MR1).

5–3–2 Feeder Size (Continued)

TABLE 5–6
TCU RECOMMENDED FACILITY FEEDER SIZES*
(Refer to Table 5–6 for MDP PDU Circuit Recommendations**)**

RUN LENGTH TO MDP ft (m)	**ALL CONFIGURATIONS INPUT VOLTAGE (See Note 1)**				
	380V [RANGE 342V – 418V]	**400V [RANGE 360V – 440V]**	**415V [RANGE 374V – 456V]**	**460V [RANGE 414V – 506V]**	**480V [RANGE 432V – 528V]**
0–50 (0–15.2)	14 AWG (2.1 mm^2)	14 AWG (2.1 mm^2)	14 AWG (2.1 mm^2)	14 AWG (2.1 mm^2)	14 AWG (2.1 mm^2)
51–100 (15.2–30.5)	14 AWG (2.1 mm^2)	14 AWG (2.1 mm^2)	14 AWG (2.1 mm^2)	14 AWG (2.1 mm^2)	14 AWG (2.1 mm^2)
101–150 (30.5–45.7)	12 AWG (3.3 mm^2)	12 AWG (3.3 mm^2)	14 AWG (2.1 mm^2)	14 AWG (2.1 mm^2)	14 AWG (2.1 mm2)
151–200 (46.0–61.0)	10 AWG (5.3 mm^2)	12 AWG (3.3 mm^2)	12 AWG (3.3 mm^2)	12 AWG (3.3 mm2)	14 AWG (2.1 mm2)
201–250 (61.3–76.2)	10 AWG (5.3 mm^2)	10 AWG (5.3 mm^2)	10 AWG (5.3 mm^2)	12 AWG (3.3 mm2)	12 AWG (3.3 mm2)
251–300 (76.5–91.4)	10 AWG (5.3 mm^2)	10 AWG (5.3 mm^2)	10 AWG (5.3 mm2)	10 AWG (5.3 mm2)	12 AWG (3.3 mm2)
301–350 (91.4–106.7)	10 AWG (5.3 mm^2)	10 AWG (5.3 mm^2)	10 AWG (5.3 mm^2)	10 AWG (5.3 mm^2)	10 AWG (5.3 mm2)
351–400 (106.7–121.9)	8 AWG (8.4 mm^2)	10 AWG (5.3 mm^2)	10 AWG (5.3 mm^2)	10 AWG (5.3 mm^2)	10 AWG (5.3 mm2)

Notes * Minimum wire size is calculated at continuous rating of 21 KVA for Shield/Cryo Cooler Compressor Cabinets and TCU circuit.

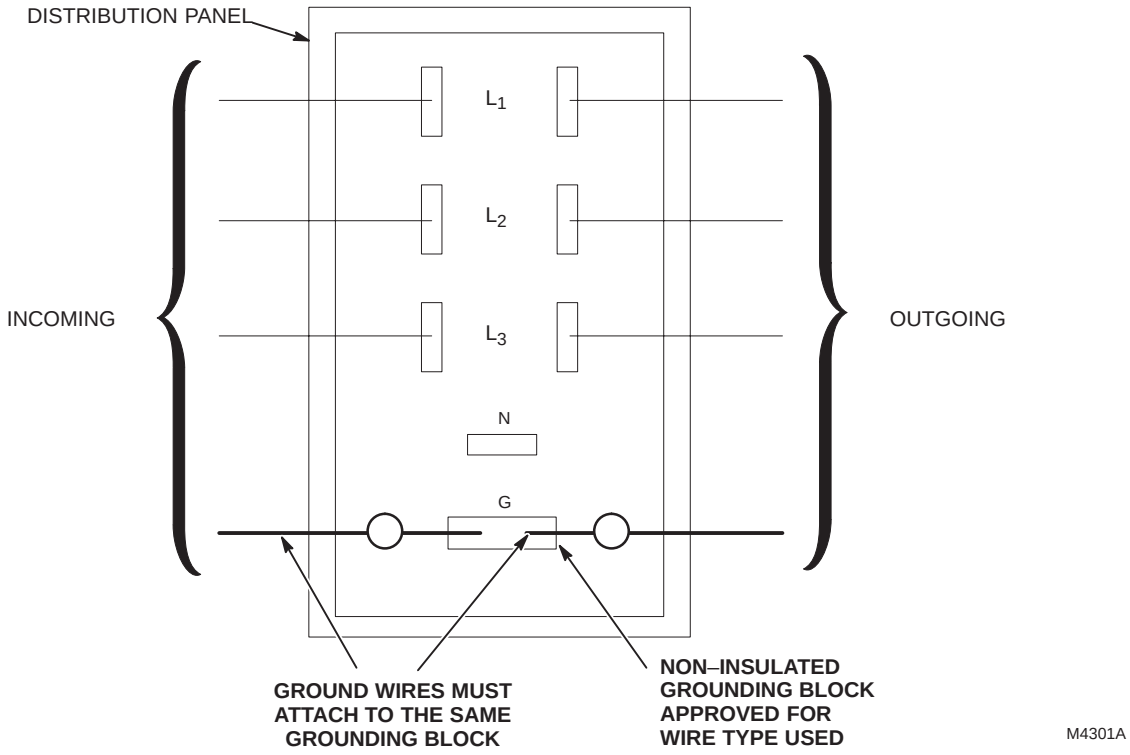
1 The maximum conductor the Main Disconnect Control (MDP) can accept is #3/0 AWG (83 mm^2). For feeders larger than 3/0 AWG (83 mm^2) the wires must be reduced (ie. splice, junction box, etc.) to 3/0 AWG (83 mm^2) within 10 feet (3 meters) of MDP.

5–4 GROUNDING

5–4–1 Facility Ground

The ground for the MR system shall originate at the system power source, ie. transformer or first access point of power into a facility, and be continuous to the MR system power disconnect in the room. This ground can be spliced with "High Compression Fittings" and should be terminated at each distribution panel it passes through. When it is broken for a connection to a panel, it shall be connected into an approved non–insulated grounding block with the incoming and outgoing ground in this same grounding block, which is then connected to the steel panel, never using the steel or other material of the panel as the block. See Illustration 5–3.

The connection at the power source shall be at the grounding point of the "Neutral – Ground" if a "Wye" transformer is used, or typical grounding points of separately derived system. In the case of an external facility, it shall be bonded to the facility ground point at the service entrance.



GROUND CONNECTION AT DISTRIBUTION PANEL
ILLUSTRATION 5–3

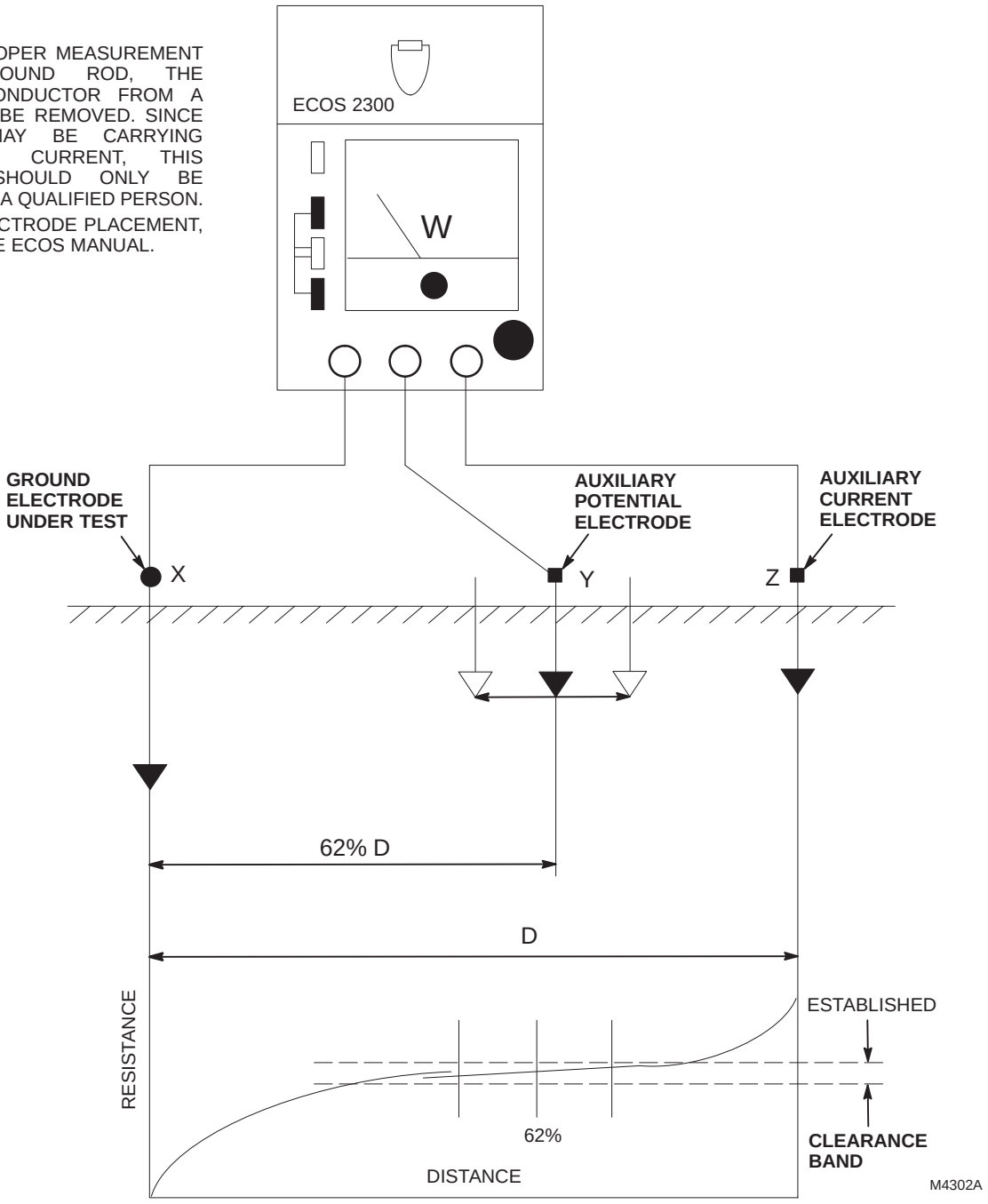
Ground Wire

The ground wire shall be copper wire with a minimum of AWG 1/0 or the same size as the power feeders whichever is larger. This means that if there is a primary feeder to a distribution panel of 500 MCM with a secondary feeder to the MR system of AWG 2 wire, the ground to the distribution panel shall be 500 MCM with an AWG 1/0 to the MR system. The ground wire impedance from the MR system disconnect, including the ground rod, shall not have an impedance greater than 2 ohms to earth as measured by one of the applicable techniques described in Section 4 of ANSI/IEEE Standard 142 – 1982. Refer to Illustration 5–4 for typical equipment and methods to measure the different portions of the 2 ohm impedance.

5–4–1 Facility Ground (Continued)

NOTE:

- TO ENSURE PROPER MEASUREMENT OF THE GROUND ROD, THE GROUNDING CONDUCTOR FROM A FACILITY MUST BE REMOVED. SINCE THIS WIRE MAY BE CARRYING AMOUNTS OF CURRENT, THIS PROCEDURE SHOULD ONLY BE PERFORMED BY A QUALIFIED PERSON.
- DETAILS OF ELECTRODE PLACEMENT, ETC., ARE IN THE ECOS MANUAL.



STANDARD HOOK–UP TO SYSTEM UNDER TEST FOR GROUND ROD IMPEDANCE
ILLUSTRATION 5–4

5–4–2 System Ground

The MR system is designed with minimum ground loops to prevent noise currents and natural disturbances from flowing through the low–level signal reference path.

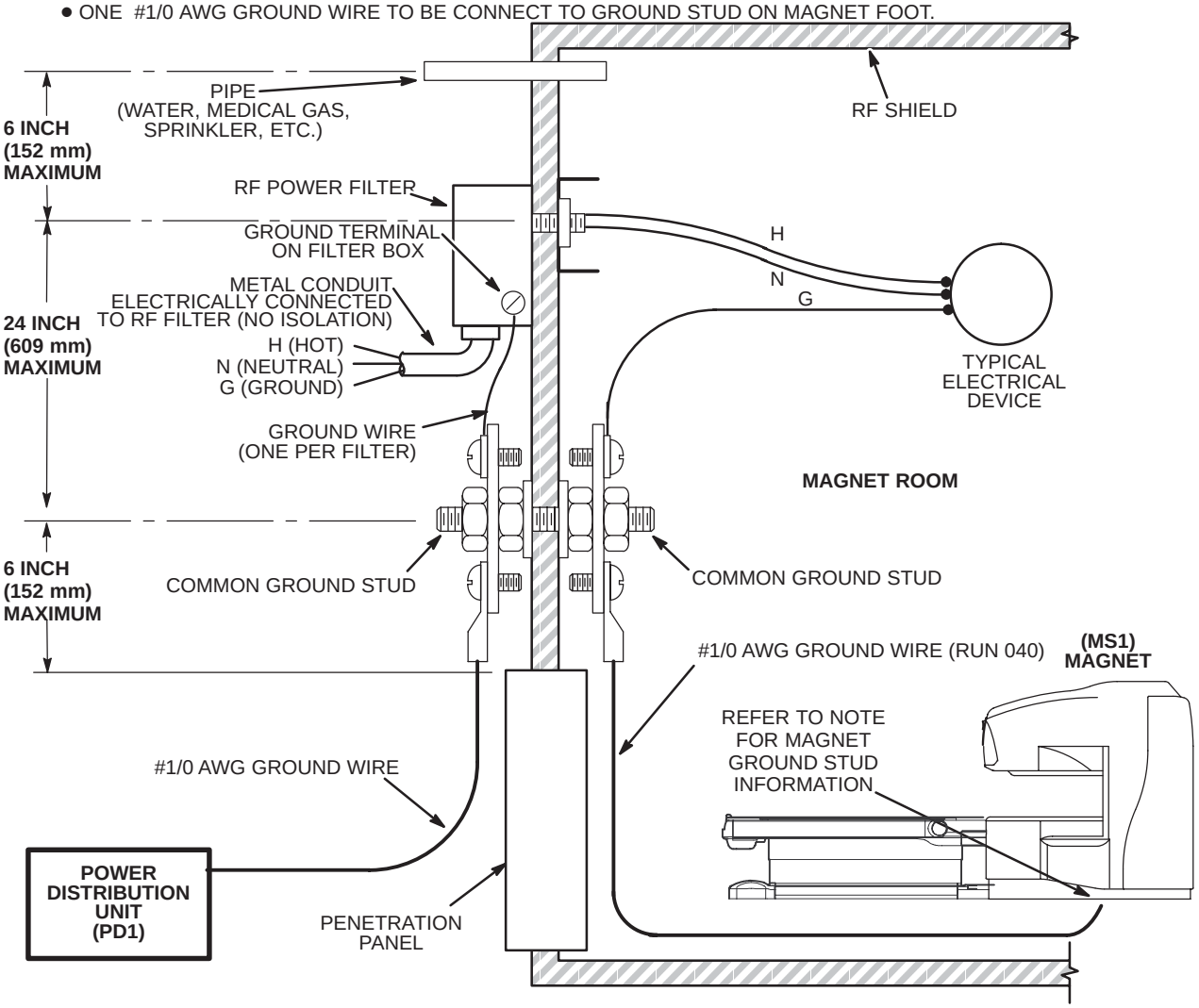
The three major grounding points in the MR system are: the system ground point (bus) in the System PDU (PD1), the enclosure ground points (ground studs located in each cabinet or enclosure), and the RF shielded room common ground point. **This RF shielded room common ground point is to be located within 6 in. (152 mm) of the GE supplied Penetration Panel.** Refer to Section 7, RF SHIELDED ROOM, for a further description of the RF shielded room common ground point.

To ensure patient safety and system performance, the conditions defined in Illustration 5–5 must be met when running power lines into the Magnet Room.

Any modifications or non–MR equipment grounds added to the MR ground system must be approved by your GE Service Representative in order to ensure safety and performance.

5–4–2 System Ground (Continued)

NOTE:
- ALL ITEMS SHOWN ARE CUSTOMER SUPPLIED EXCEPT POWER DISTRIBUTION UNIT, MAGNET, AND TWO #1/0 AWG GROUND WIRES BETWEEN MAGNET GROUND STUD AND RF COMMON GROUND POINT.
- **RESISTANCE BETWEEN ANY TWO GROUNDED DEVICES *MUST NOT EXCEED 0.1 OHM* TO ENSURE EQUAL POTENTIAL GROUND SYSTEM WITHIN MAGNET ROOM.**
- **LOCATE FILTERS WITHIN 2 FEET (600 mm) OF RF COMMON GROUND STUD WHICH MUST BE LOCATED WITHIN 6 INCHES (152 mm) OF PENETRATION PANEL.**
- ALL EXTERNAL CONDUIT MUST BE METAL AND ELECTRICALLY CONNECTED TO THE RF POWER FILTERS (IE. NO ISOLATION) UNLESS THE FILTERS ARE LOW VOLTAGE (<30 VOLTS).
- RF POWER FILTERS OF 30 VOLTS OR LESS MAY BE LOCATED ANYWHERE ON THE RF SHIELD **PROVIDED THE INCOMING CONDUIT IS NON–METALLIC OR IS DIELECTRICALLY ISOLATED AND WITH NO GROUND WIRE. IF THE INCOMING CONDUIT IS METALLIC AND/OR HAVE A GROUND WIRE, THESE FILTERS MUST ALSO BE LOCATED WITHIN 24 INCHES (609 mm) OF THE RF COMMON GROUND STUD.**
- ALL CONDUITS IN THE RF ROOM MUST BE METAL. STEEL IS ACCEPTABLE PROVIDED IT IS ADEQUATELY ANCHORED.
- ALL ELECTRICAL DEVICES (IE. OUTLETS, LIGHT FIXTURES, ETC.) MUST HAVE A GROUND WIRE FROM ITS POWER SOURCE AND BE GROUNDED TO RF ROOM SHIELD AT THE RF COMMON GROUND STUD AS SHOWN BELOW.
- ALL METALLIC PIPES ENTERING THE RF ROOM, EXCLUDING CRYOGENIC VENT AND FLOOR DRAINS, MUST BE LOCATED WITHIN 30 INCHES (762 MM) OF THE RF COMMON GROUND.
- ONE #1/0 AWG GROUND WIRE TO BE CONNECT TO GROUND STUD ON MAGNET FOOT.



MR MAGNET ROOM GROUNDING REQUIREMENTS AND TYPICAL DIAGRAM
ILLUSTRATION 5–5

5–5 POWER SOURCE MONITORING

The facility input power for the proposed system should be checked using a power line disturbance monitor for average line voltage, surges–sags, impulses, and frequency. Some of the recommended line analyzers which are designed for unattended monitoring are the Dranetz Models 656A or 658 and RPM Models 1651, 1656, or 1658.

Analysis should span a period to include two weekends so as to cover several days of normal use. The possibility of "brown–out" conditions which may be experienced in summer must be considered. Any existing power problems with large power consuming systems (x–ray units, CT scanners, etc.) or other computer installations at the proposed site should be reviewed as they may affect the MR system. Results of this analysis should be reviewed with your GE representative to determine if line conditioning is needed.

5–6 EMERGENCY POWER

5–6–1 Equipment Room

Facility emergency power (24 hours/day, 7 days/week) is required for the Temperature Control Unit.

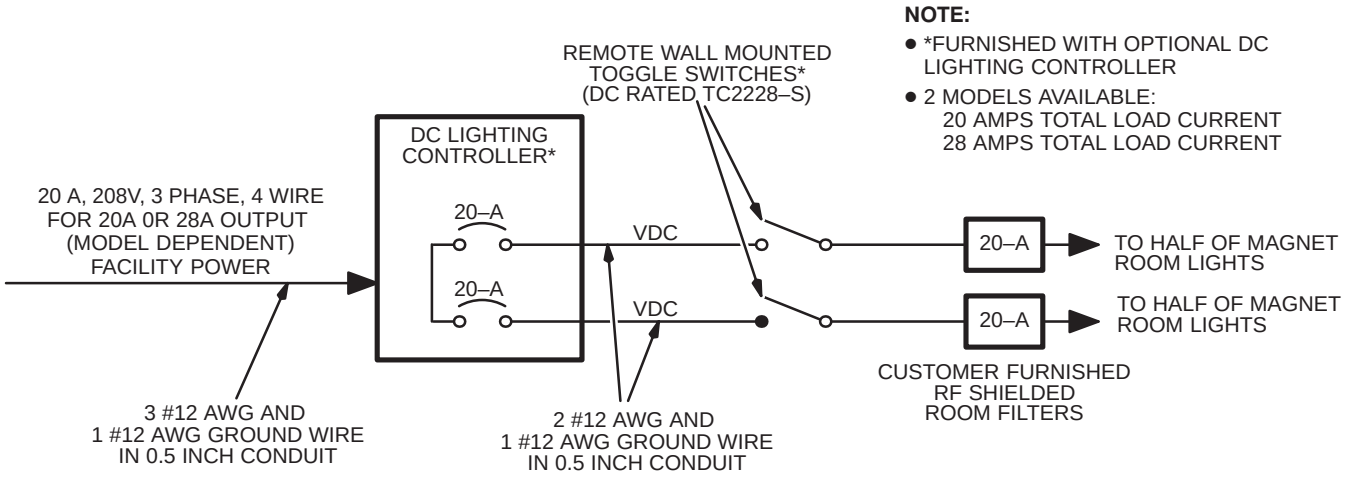
5–6–2 Magnet Room

Primary power should be distributed from the customer's emergency life–safety power branch to an emergency lighting source in the Magnet Room. All input power lines must be filtered upon entrance into the RF shielded room (Magnet Room) and grounded according to the requirements listed in Section 5–4–2, SYSTEM GROUND. Always check national and local codes for other emergency power requirements.

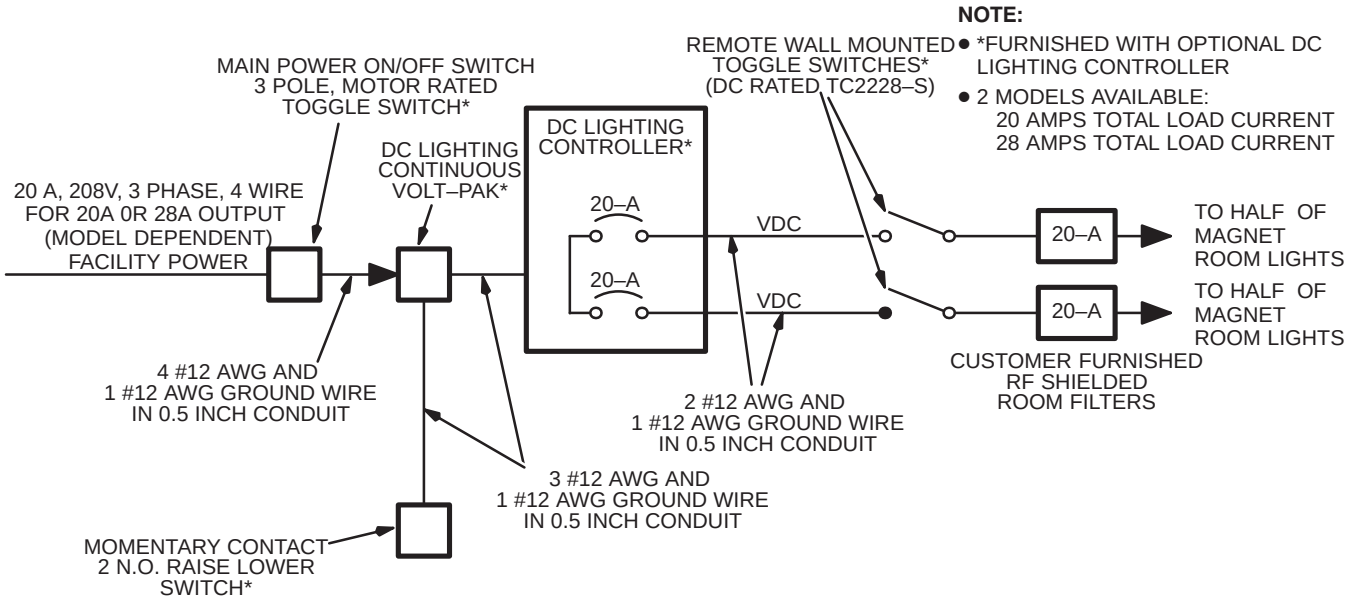
5–7 DC LIGHTING CONTROLLER (Facility Option)

Direct current (DC) powered lighting is recommended in the Magnet Room per Section 4–5 LIGHTING. A DC light controller is available from GE as well as a variable DC lighting controller system. The wiring diagrams for these units are shown in Illustrations 5–6 and 5–7. The input power, interconnect cabling, RF shielded room filters, and conduit are customer furnished.

5–7 DC LIGHTING CONTROLLER (Facility Option) (Continued)



DC LIGHTING CONTROLLER (Facility Option) WIRING DIAGRAM
ILLUSTRATION 5–6



VARIABLE DC LIGHTING CONTROLLER (Facility Option) WIRING DIAGRAM
ILLUSTRATION 5–7

SECTION 6 – INTERCONNECT DATA

TABLE OF CONTENTS

6–1 INTRODUCTION

Section 6, INTERCONNECT DATA, addresses cable interconnections and customer furnished components for the system. It's subsections are broken down as follows:

- 6–1 INTRODUCTION
  - overall system interconnects, component designations
- 6–2 PD1/POWER INTERCONNECTS
  - cable connections to the Power Distribution Unit, subsystem power distribution
- 6–3 EMERGENCY OFF WIRING
  - wiring to main disconnect for emergency off
- 6–4 SYSTEM INTERCONNECTS
  - cable interconnects for the system
- 6–5 CONTRACTOR FURNISHED COMPONENTS
  - miscellaneous components typically provided by a contractor

6–1–1 Component Designators

GE uses a Component Designator System as a means of identifying system components in a consistent manner. All subsystem cabinets and other components are referred to by their component designators in the diagrams and tables of this section. For example, the Power Cabinet is referred to as MR1. Refer to Table 6–1 for all component designators.

Note

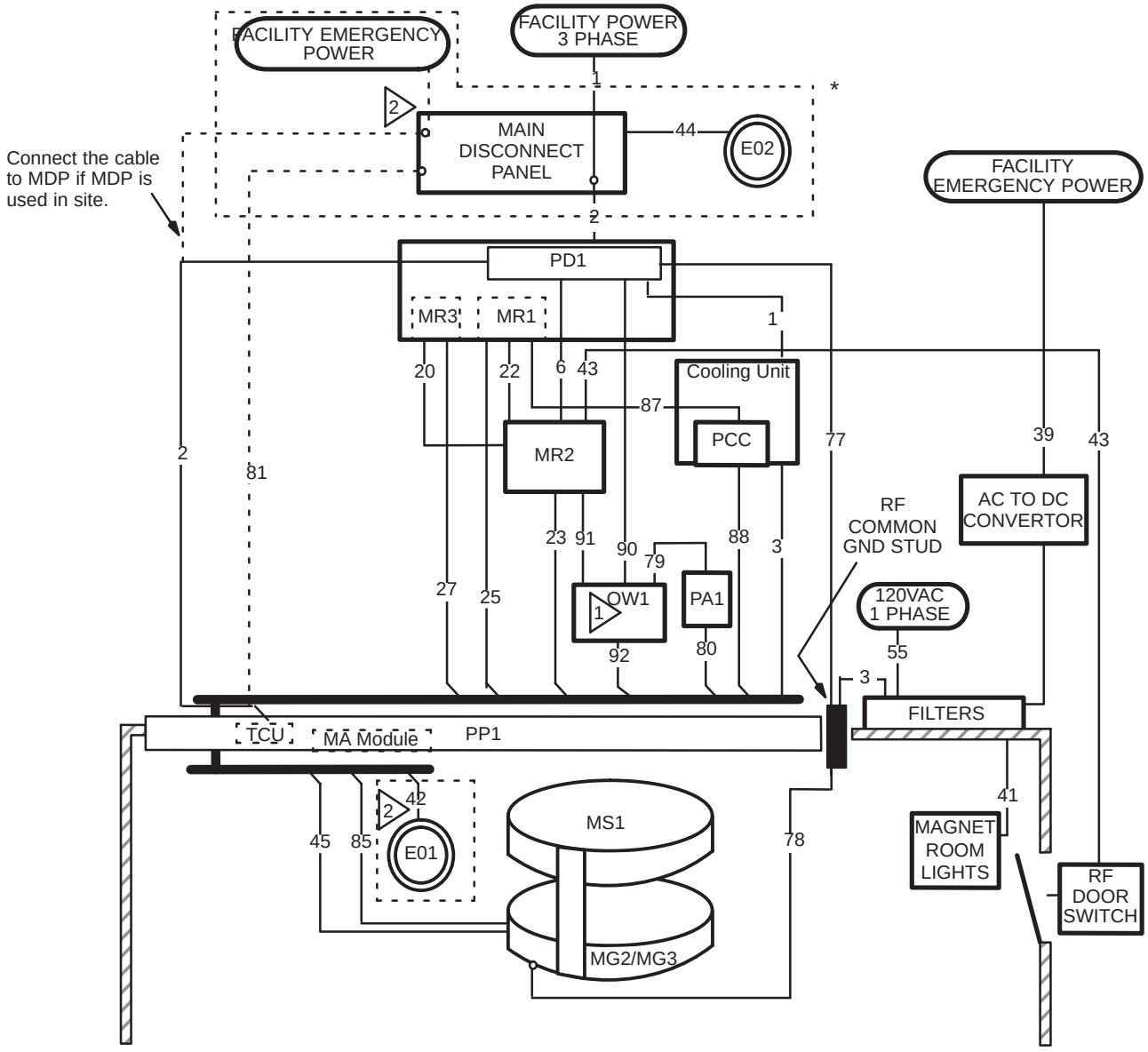
Main Disconnect Panel (MDP) and E01/E02 are NOT used for Japan.

TABLE 6–1
COMPONENT DESIGNATION

BASIC SYSTEM OR OPTION	COMPONENT DESIGNATOR	DESCRIPTION
Basic System	EO1/EO2	Emergency Off Buttons
	MDP	Main Disconnect Panel
	MG2/MG3	Magnet Enclosure
	MR1	Power Cabinet MR3 is a module in middle of cabinet PD1 is a module in lower portion of cabinet
	MR2	System Control Cabinet
	MR3	Gradient Driver (refer to MR1)
	MSM2	Remote Alarm Box
	OW1	Operator Workspace
	TCU	Temperature Control Unit (refer to PP1)
	MA Module	Middle Amplifier Module (Refer to PP1)
	PD1	Power Distribution Unit (refer to MR1)
	PA1	Pneumatic Patient Alert Control Box
	PP1	Penetration Panel TCU is mounted in Penetration Panel MA Module is mounted in Penetration Panel
	PT1	Patient Transport Table
	Cooling Unit	Cooling Unit
	PCC	Patient Cooling Compressor (PCC is a module in upper portion of Cooling Unit)

6–1–2 Group Interconnects

Illustration 6–1 show the Group Interconnect Diagram system. Each group contains one or more cables. This diagram should be referred to when using the tables in this section.



1. OPERATOR WORKSPACE (OW1) SUBSYSTEM EQUIPMENT IS PROVIDED WITH MAXIMUM LENGTH CABLES POSSIBLE. SEVERAL OW ASSEMBLIES ARE MOUNTED TO OW TABLE & OW INTERCONNECTS ARE ROUTED THROUGH TABLE CABLE TRAY. FOR REFERENCE USE ONLY THE OW1 RUN NUMBERS ARE 049, 792, 793, 794, 795, 796, 797, 798, 799, 806, & 807.
2. The module described in dotted is NOT used for Low Voltage Areas(200 or 208Vrms).

0.35T SYSTEM GROUP INTERCONNECT DIAGRAM
ILLUSTRATION 6–1

6–2 PD1/POWER INTERCONNECTS

6–2–1 Introduction

Table 6–2 contains information on interconnects between the Power Distribution Unit (PD1) located in the lower portion of the Power Cabinet and system components. The interconnects for the PD1 include the following:

- All GE–supplied subsystem power cables
- 5 cables to the PD1
- 2 auxiliary ground cables to the PD1.

Note that the main power and emergency off wiring (See Note1) are not included in this table. See Section 5, POWER REQUIREMENTS, for detailed information on PD1 main power connections. See Section 6–3, EMERGENCY OFF WIRING, for information on the emergency off circuit and PD1 interfacing(See Note1) .

Conduit or pipe is not recommended for cable runs since the system uses many prefabricated cables with large connectors. However, there may be instances in which conduit is used for power cables. In those cases, cables may be pulled by the lug terminal ends. This way the connector pulling dimensions on the plug ends will not be a factor for power cables.

Note1

Emergency OFF wiring is NOT used for Japan.

Note2

The power cables will probably need to be terminated at PD1 located in the lower portion of the Power Cabinet if conduit is used.

Unless otherwise specified, cables and components listed in Table 6–2 are supplied by GE.

6–2–2 Definition of Terms

The definitions of terms used in Table 6–2 are:

- Group Number: identifying number referenced to bundles (i.e. groups) of cables as shown in Illustration 6–1.
- Area: cross–sectional area of the combined cables in a group

Note

The group area was found by adding up the circular cross–sectional areas of all individual cables within a group. It does not take any fill factors or air space between cables into account. Adhere to applicable electrical codes for fill factors.

- Usable Length: total length of a cable MINUS any required take up within cabinets and the PD1

Note

Actual usable length will depend upon the routing within the PD1. Worst case (i.e. shortest) lengths are shown. The difference will be about 4 feet.

- Run Number: unique number assigned to each GE–supplied cable

Note

This number must be used when making special cable orders.

- Cable Diameter: diameter of an individual cable
- Cable Leads (AWG/No.): gauge of wires and total number of wires within a given cable

TABLE 6–2
POWER DISTRIBUTION UNIT (PD1) CABLES

GROUP NUMBER	GROUP AREA in. (mm)	FROM PD1* TO *SEE NOTE 1	USABLE LENGTH ft (m)	RUN NUMBER	CABLE DIAMETER in. (mm)	CABLE LEADS AWG/Number	RATING (V)	ACTUAL (V)	NOTES
6	0.905 (584)	MR2	26 (7.93)	030	0.92 (23.4)	#8/5	600	208	
				037	0.188 (4.78)	#10/1	600	0	Ground Cable
				703	0.375 (9.50)	#22/15	300	<30	See Note 2
				706	0.36 (9.14)	#22/9	300	<30	PD1 Remote Control See Note 3
77	0.27 (172)	RF COMMON GND STUD	—	—	0.584 (14.8)	#(1/0)/1			Customer supplied ground cable.
1	0.568 (367)	Cooling Unit	33 (10.0)	1007	0.75 (19.0)	#10/4	600	208	RF Cooling Power Line
				1008	0.41 (10.3)	# 4/1	600	0	Ground Cable
90	0.413 (266)	OW1	51 (15.5)	047	0.70 (17.78)	#10/4	600	208	
				048	0.188 (4.78)	#10/1	600	0	Ground Cable
2	0.175 (113)	PP1	52 (16.0)	1009	0.47 (12.0)	#10/2	600	208	TCU POWER Line See Note4

Note 1 The PDU is a module (PD1) in the lower portion of the Power Cabinet (MR1).
2 Plug pulling diameter x length for Run 703: 1.6 x 2.0 in. (41.1 x 50.8 mm) both ends.
3 Plug pulling diameter x length for Run 706: 1.3 x 2.0 in. (33.5 x 50.8 mm) both ends.
4 Connect the cable to MDP if MDP is used in site.

6–3 EMERGENCY OFF WIRING

Note

Emergency OFF wiring is NOT used for Japan.

6–3–1 Introduction

This section addresses wiring for the Emergency Off circuit (also known as protective disconnect circuit). Refer to Section 5–3, RECOMMENDED POWER DISTRIBUTION SYSTEM, for information on the recommended protective disconnect device and emergency off button locations and mounting.

The emergency off wiring for the MR system is unique because the wiring into the magnet room must be RF tight.

6–3–2 Protective Disconnect Device Connections

The emergency off circuit is shown in Section 5–3, POWER DISTRIBUTION SYSTEM, Illustration 5–1. The circuit utilizes the normally closed series loop shown. The MDP provides 2 emergency off buttons.

Note

The actual number of emergency off switches may vary from what is shown in Section 5–3, RECOMMENDED POWER DISTRIBUTION SYSTEM, Illustration 5–1.

6–3–3 Magnet Room Wiring

GE provides two cables for routing the emergency off circuit through the Penetration Panel and into the magnet room (Runs 296 and 297). Alternate wiring may be used by the customer; however, the use of these cables ensures that the emergency off wiring will be RF tight.

In Illustration 5–1 black and red wires are used for connections on the ends of Runs 296 and 297. Actually any pair of wires on these runs could be used so long as both ends are consistent with one another. (Runs 296 and 297 are actually nine wire cables.)

6–4 SYSTEM INTERCONNECTS

6–4–1 Introduction

Table 6–3 contains information on interconnects between all system components. Cables found in Tables 6–2 are not repeated here, although their groups are referenced for completeness. Conduit or pipe is not recommended for cable runs since the system uses many prefabricated cables with large connectors. Unless otherwise specified, cables and components listed in Table 6–3 are supplied by GE.

6–4–2 Definition of Terms

The definition of terms used in Tables 6–3 are:

- Group Number: identifying number referenced to bundles (i.e. groups) of cables as shown in Illustrations 6–1
- Between Units (From/To): component designators as found in Table 6–1
- Area: cross–sectional area of the combined cables in a group

Note

The group area was found by adding up the circular cross–sectional areas of all individual cables within a group. It does not take any fill factors or air space between cables into account. Adhere to applicable electrical codes for fill factors.

- Usable Length: total length of a cable MINUS any required take up within cabinets
- Run Number: unique number assigned to each GE–supplied cable

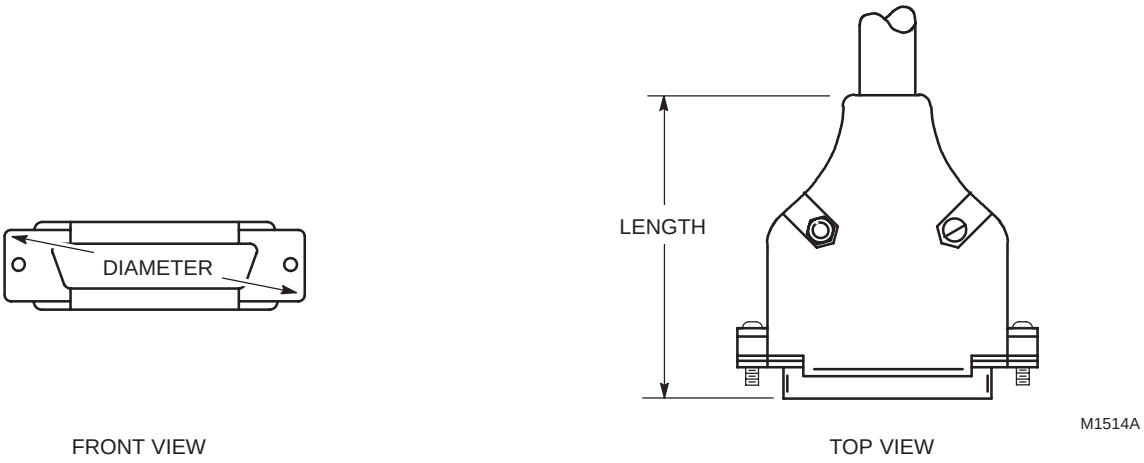
Note

The run number must be used when making special cable orders.

- Cable Diameter: diameter of an individual cable
- Plug Pulling Diameter x Length: cable plug dimensions as shown in Illustration 6–2

Note

In some cases, a cable has more than one connector on an end. These cables will have the number of connectors following the english dimensions of the plug pulling diameter times length (e.g. ’2.0x3.25 –x2’ means there are 2 connectors with dimensions of 2.0 in. diameter and 3.25 in. length). Of course, the same number of connectors apply to the metric dimensions as well.



SUBMINIATURE–D CONNECTOR PLUG PULLING DIMENSIONS
ILLUSTRATION 6–2

TABLE 6–3
INTERCONNECT LIST

GROUP NUMBER	GROUP AREA in. (mm)	BETWEEN UNITS		USABLE LENGTH ft (m)	RUN NUMBER	CABLE DIAMETER in. (mm)	PLUG PULLING DIAMETER X LENGTH in. (mm)		RATING (V)	ACTUAL (V)	NOTES
		FROM	TO				FROM	TO			
1	—	Facility Power	MDP	—	—	—	—	—	N/A		Customer Furnished.
1A	—	Facility Emergency Power	MDP	—	—	—	—	—	N/A		Customer Furnished.
2	—	MDP	PD1	—	—	—	—	—	N/A		Customer Furnished.
3	—	RF Filter	RF Common Ground Stud	—	—	—	—	—	N/A		Customer Furnished Ground.
4	—	—	—	—	—	—	—	—			Not Used
5	—	—	—	—	—	—	—	—			Not Used
6	—	PD1	MR2	—	—	—	—	—	N/A		Refer to Table 6–2.
7 to 19	—	—	—	—	—	—	—	—			Not Used

(Continued)

TABLE 6–3 (Continued)
INTERCONNECT LIST

GROUP NUMBER	GROUP AREA in. (mm)	BETWEEN UNITS		USABLE LENGTH ft (m)	RUN NUMBER	CABLE DIAMETER in. (mm)	PLUG PULLING DIAMETER X LENGTH in. (mm)		RATING (V)	ACTUAL (V)	NOTES
		FROM	TO				FROM	TO			
20	0.784 (506)	MR2	MR3 in MR1	14 (4.27)	710	1.04 (26.4)	1.04x2.00 (26.4x50.8)	1.04x2.00 (26.4x50.8)	N/A	0	Run 710 is flexible conduit containing fiber optic cable(s) with a minimum bend of 2 in. (51 mm).
21	—	—	—	—	—	—	—	—			Not Used
22	0.825 (533)	MR2	MR1	14 (4.27)	229	0.212 (5.38)	0.57x2.00 (14.5x50.8)	0.57x2.00 (14.5x50.8)	1900 VRSM	<30	
					702	0.35 (8.90)	1.30x2.00 (33.5x50.8)	1.30x2.00 (33.5x50.8)	300	<30	
					708	0.83 (21.1)	0.83x2.00 (21.1x50.8)	0.83x2.00 (21.1x50.8)	N/A	0	Run 708 is flexible conduit containing fiber optic cable(s) with a minimum bend of 2 in. (51 mm).
					774	0.44 (11.2)	2.30x2.00 (58.4x50.8)	2.30x2.00 (58.4x50.8)	300	<30	
23	1.064 (686)	MR2	PP1	31 (9.45)	231	0.212 (5.38)	0.57x2.00 (14.5x50.8)	0.57x2.00 (14.5x50.8)	1900 VRSM	<30	
					488	0.24 (6.1)	0.55x1.10 (14.0x27.9)	0.55x1.10 (14.0x27.9)	300	<30	
					489	0.24 (6.1)	0.55x1.10 (14.0x27.9)	0.55x1.10 (14.0x27.9)	300	<30	
					490	0.24 (6.1)	0.55x1.10 (14.0x27.9)	0.55x1.10 (14.0x27.9)	300	<30	
					711/ 712	1.04 (26.4)	1.04x2.00 (26.4x50.8)	1.04x2.00 (26.4x50.8)	300	0	Run 711/712 is a flexible conduit containing fiber optic cables with a minimum bend of 2 in. (51 mm).
					929	0.234 (5.94)	0.57x2.00 (14.5x50.8)	0.57x2.00 (14.5x50.8)	1900 VRSM	<30	

(Continued)

TABLE 6–3 (Continued)
INTERCONNECT LIST

GROUP NUMBER	GROUP AREA in. (mm)	BETWEEN UNITS		USABLE LENGTH ft (m)	RUN NUMBER	CABLE DIAMETER in. (mm)	PLUG PULLING DIAMETER X LENGTH in. (mm)		RATING (V)	ACTUAL (V)	NOTES
		FROM	TO				FROM	TO			
24	—	—	—	—	—	—	—	—			Not Used
25	2.245 (1448)	MR1	PP1	21 (6.40)	044	0.20 (5.1)	1.32x0.23 (33.5x5.8)	1.32x0.23 (33.5x5.8)	600	0	Ground Cable for MR1 System Support Module
					487	0.45 (11.4)	1.60x2.00 (40.6x50.8)	1.60x2.00 (40.6x50.8)	300	<30	
					726	0.45 (11.4)	1.60x2.00 (40.6x50.8)	1.60x2.00 (40.6x50.8)	300	<30	
					745/935	0.50 (12.7)	0.91x2.50 (23.0x63.5)	0.91x2.50 (23.0x63.5)	5000 Vrms	775	
					768	0.525 (13.3)	2.80x2.00 (70.4x50.8)	2.80x2.00 (70.4x50.8)	300	<30	
					769	0.44 (11.2)	2.30x2.00 (57.2x50.8)	2.30x2.00 (57.2x50.8)	300	<30	
					770	0.31 (7.9)	1.30x2.00 (33.5x50.8)	1.30x2.00 (33.5x50.8)	300	38.5VDC	
					771	0.415 (10.5)	2.30x2.00 (57.2x50.8)	2.30x2.00 (57.2x50.8)	300	38.5VDC	
					772	0.525 (13.3)	2.80x2.00 (70.4x50.8)	2.80x2.00 (70.4x50.8)	300	<30	
					773	0.64 (16.3)	1.60x2.00 (40.6x50.8)	1.60x2.00 (40.6x50.8)	1900 VRSM	1000VDC	
					775	0.212 (5.4)	0.57x1.125 (14.5x28.6)	0.57x1.125 (14.5x28.6)	1900 VRSM	1000VDC	
					777	0.212 (5.4)	0.57x1.125 (14.5x28.6)	0.57x1.125 (14.5x28.6)	4000VDC (887) 5000Vrms (932)	245	
					887/932	0.59 (15.0)	0.91x2.50 (23.0x63.5)	0.91x2.50 (23.0x63.5)	4000VDC (887) 5000Vrms (932)	245	
					888/933	0.59 (15.0)	0.91x2.50 (23.0x63.5)	0.91x2.50 (23.0x63.5)			
26	—	—	—	—	—	—	—	—			Not Used

(Continued)

TABLE 6–3 (Continued)
INTERCONNECT LIST

GROUP NUMBER	GROUP AREA in. (mm)	BETWEEN UNITS		USABLE LENGTH ft (m)	RUN NUMBER	CABLE DIAMETER in. (mm)	PLUG PULLING DIAMETER X LENGTH in. (mm)		RATING (V)	ACTUAL (V)	NOTES
		FROM	TO				FROM	TO			
27	3.450 (740.2)	MR3	PP1	33 (10.0)	1001	0.88 (22.4)	Hard wired	Ring Terminals	600	250	
					1002	0.88 (22.4)	Hard Wired	Ring Terminals	600	250	
					1003	0.88 (22.4)	Hard Wired	Ring Terminals	600	250	
28 to 38	—	—	—	—	—	—	—	—			Not Used
39	—	Facility Emerg Power	Filter	—	—	—	—	—			Refer to Section 5–7 for DC Lighting Controller option cabling.
40	—	—	—	—	—	—	—	—			Not Used
41	—	Filter	Magnet Room Lights	—	—	—	—	—			Refer to Sections 5–6 and 5–7.
42 *	0.096 (61.94)	PP1	E01	84 (25.6) **minus** takeup at EO1	297	0.35 (8.9)	1.30x2.00 (33.5x50.8)	Hard Wired	300	<30	Refer to Section 6–3.
43	0.096 (61.94)	MR2	RF Door Switch	67 (20.4) **minus** takeup at RF Door Switch	701	0.35 (8.9)	1.30x2.00 (33.5x50.8)	Hard Wired	300	<30	RF Door Switch provided by RF Screen Room vendor.
44 *	—	MDP	EO2	—	—	—	—	—			Customer Furnished. (Refer to Section 6–3.)

(Continued)

Note

Group Number 42 and 44 are only used for High Voltage Areas(380, 400, 415,or 480 Vrms).

TABLE 6–3 (Continued)
INTERCONNECT LIST

GROUP NUMBER	GROUP AREA in. (mm)	BETWEEN UNITS		USABLE LENGTH ft (m)	RUN NUMBER	CABLE DIAMETER in. (mm)	PLUG PULLING DIAMETER X LENGTH in. (mm)		RATING (V)	ACTUAL (V)	NOTES
		FROM	TO				FROM	TO			
45	5.145 (3314)	PP1	MG3	30 (9.15)					N/A	0	
					711/ 712	1.04 (26.4)	1.04x2.00 (26.4x50.8)	1.04x2.00 (26.4x50.8)			Run 711/712 is flexible conduit containing fiber optic cables with a minimum bend radius of 2 in. (51 mm).
					1016	0.525 (13.3)	2.80x2.00 (70.4x50.8)	2.80x2.00 (70.4x50.8)	300	<30	
					716	0.34 (8.64)	1.60x2.00 (40.6x50.8)	1.60x2.00 (40.6x50.8)	300	<30	
					746/912	0.50 (12.7)	0.91x2.50 (23x63.5)	0.91x2.45 (23x62.2)			
					1014	0.212 (5.38)	0.57x1.125 (14.5x28.6)	0.57x1.125 (14.5x28.6)	1900 VRSM	1000VDC	
					1015	0.212 (5.38)	0.57x1.125 (14.5x28.6)	0.57x1.125 (14.5x28.6)	1900 VRSM	1000VDC	
					841	0.35 (8.9)	1.30x2.00 (33.5x50.8)	1.30x2.00 (33.5x50.8)	300	<30	
					842	0.44 (11)	0.63x2.01 (15.9x51.1)	0.63x2.01 (15.9x51.1)	300	<30	
					843	0.525 (13.3)	2.80x2.00 (70.4x50.8)	2.80x2.00 (70.4x50.8)	300	<30	
					889	0.59 (15.0)	0.91x2.50 (23.0x63.5)	0.91x2.50 (23.0x63.5)			
					890	0.59 (15.0)	0.91x2.50 (23.0x63.5)	0.91x2.50 (23.0x63.5)			

(Continued)

TABLE 6–3 (Continued)
INTERCONNECT LIST

GROUP NUMBER	GROUP AREA in. (mm)	BETWEEN UNITS		USABLE LENGTH ft (m)	RUN NUMBER	CABLE DIAMETER in. (mm)	PLUG PULLING DIAMETER X LENGTH in. (mm)		RATING (V)	ACTUAL (V)	NOTES
		FROM	TO				FROM	TO			
45 (continue)	5.145 (3314)	PP1	MG3	30 (9.15)	906	0.415 (10.5)	2.30x2.00 (57.2x50.8)	2.30x2.00 (57.2x50.8)	300	38.5VDC	
					920	0.464 (11.8)	2.30x2.00 (57.2x50.8	2.30x2.00 (57.2x50.8	300	<30	
					921	0.35 (8.9)	1.30x2.00 (33.5x50.8)	1.30x2.00 (33.5x50.8)	300	38.5VDC	
					1020	0.24 (6.1)	0.55x1.10 (14.0x27.9)	0.55x1.10 (14.0x27.9)	1900Vrms	10	
					1021	0.36 (9.1)	0.55x1.10 (14.0x27.9)	0.55x1.10 (14.0x27.9)	1900Vrms	10	
					1022	0.24 (6.1)	0.55x1.10 (14.0x27.9)	0.55x1.10 (14.0x27.9)	1900Vrms	10	
					1019	0.24 (6.1)	0.55x1.10 (14.0x27.9)	0.55x1.10 (14.0x27.9)	1900Vrms	10	
					926	0.45 (11.4)	1.60x2.00 (40.6x50.8)	1.60x2.00 (40.6x50.8)	300	<30	
					927	0.45 (11.4)	1.60x2.00 (40.6x50.8)	1.60x2.00 (40.6x50.8)	300	<30	
					Air Line	1.0 (25.4)	air tubing	air tubing	N/A	0	Patient Comfort Compressor air line
					Air Line	2.4 (60.4)	air tubing	air tubing	N/A	0	RF Coil Compressor air line
46 to 54	—	—	—	—	—	—	—	—			Not Used
55	—	Facility Power	Filter	—	—	—	—	—			Customer Furnished Magnet Room power (refer to Sections5–1 and 7–4).
56 to 76	—	—	—	—	—	—	—	—			Not Used
	—	—	—	—	—	—	—	—			Not Used
77	—	PD1	RF COMMON GND STUD	—	– –	—	—	—			Refer to Table 6–2.

(Continued)

TABLE 6–3 (Continued)
INTERCONNECT LIST

GROUP NUMBER	GROUP AREA in. (mm)	BETWEEN UNITS		USABLE LENGTH ft (m)	RUN NUMBER	CABLE DIAMETER in. (mm)	PLUG PULLING DIAMETER X LENGTH in. (mm)		RATING (V)	ACTUAL (V)	NOTES
		FROM	TO				FROM	TO			
78	0.338 (218)	RF COMMON GND STUD	MS1 GND STUD	60 (18.29) **minus** takeup at RF Common GND Stud	040	0.464 (11.79)	Hard Wired	Ring Terminal	600	0	1 ground wire.
79	0.013 (8.0)	OW1	PA1	5 (1.5) **minus** takeup at PA1	—	0.13 (3.2)	3.00x3.00 (76.2x76.2)	0.38x1.75 (9.6x44.5)	N/A	0	
80**	0.049 (32.1)	PA1	MG2	97 (29.6) **minus** takeup at PA1	—	0.25 (6.4)	pneumatic tubing	pneumatic tubing	N/A	0	This pneumatic tubing is continuously routed from PA1 through PP1 and MG3 to MG3.
81	0.460 (297.3)	MDP	PP1	40 (12.2)	296	0.35 (8.9)	Hard Wired	1.30x2.00 (33.5x50.8)	N/A	0	Refer to Section 6–3.
82 to 84	—	—	—	—	—	—	—	—	300	<30	Not Used
85	3.450 (740.2)	PP1	MG3	30 (9.15)	1004	0.88 (22.4)	Ring Terminals	Ring Terminals	600	250	
					1005	0.88 (22.4)	Ring Terminals	Ring Terminals	600	250	
					1006	0.88 (22.4)	Ring Terminals	Ring Terminals	600	250	
87	0.643 (417)	PCC	MR1	27 (8.23) **minus** takeup at PCC	930	0.64 (16.3)	Hard Wired	12.28x3.85 (57.9x97.8)	300	120	
					931	0.64 (16.3)	Hard Wired	12.28x3.85 (57.9x97.8)	600	120	

Note ** If installation requires greater than 97 feet (29.6 meters) of pneumatic tubing between the squeeze bulb, located on the front of the Magnet Enclosure, and the Patient Alert Control Box (PA1), located near the Operator's Console or Operator Workspace, an Extender Kit (46–317758P2) must be ordered. The Extender Kit consists of a small Extender Box (to be mounted in Equipment Room) and 95 feet (29.0 meter) of pneumatic tubing.

(Continued)

TABLE 6–3 (Continued)
INTERCONNECT LIST

GRP NUMBER	GRP AREA in. (mm)	BETWEEN UNITS		USABLE LENGTH ft (m)	RUN NUMBER	CABLE DIAMETER in. (mm)	PLUG PULLING DIAMETER X LENGTH in. (mm)		RATING (V)	ACTUAL (V)	NOTES
		FROM	TO				FROM	TO			
88	0.785 (506)	PCC	PP1	See Notes	Air Line	1.0 (25.4)	Air Line	Air Line	N/A	0	This air line is cut and connected to PP1 at site: total length is 100 ft (30.5 m) including **both** Equipment and Magnet Rooms. For Magnet Room routing of this interconnects refer to Group 45.
3	—	Cooling Unit	PP1	See Notes	Air Line	2.4 (60.4)	Air Line	Air Line	N/A	0	This air line is cut and connected to PP1 at site: total length is 65.6ft (20.0 m) including **both** Equipment and Magnet Rooms. For Magnet Room routing of this interconnects refer to Group 45.
1	—	PD1	TBD	—	—	—	—	—			Refer to Table 6–2.
90	—	PD1	OW1	—	—	—	—	—			Refer to Table 6–2.
91	0.615 (398)	MR2	OW1	51 (15.5)	789	0.44 (11.2)	2.30x2.00 (57.2x50.8)	2.30x2.00 (57.2x50.8)	300	<30	
					791	0.44 (11.2)	2.30x2.00 (57.2x50.8)	2.30x2.00 (57.2x50.8)	300	<30	
					818	0.44 (11.2)	2.30x2.00 (57.2x50.8)	See Notes	300	<30	OW1 end of cable has 3 connectors, each connector plug pull dimensions are 2.3x2.0 (57.2x50.8).
					836	0.45 (11.4)	1.75x2.00 (44.5x50.8)	1.75x2.00 (44.5x50.8)	N/A	<30	Run 836 is flexible conduit containing fiber optic cable with a minimum bend of 4 .5 in. (114 mm).
92	0.293 (189)	PP1	OW1	53 (16.1)	788	0.44 (11.2)	2.30x2.00 (57.2x50.8)	2.30x2.00 (57.2x50.8)	300	<30	
					837	0.3 (7.6)	1.30x2.00 (33.0x50.8)	1.30x2.00 (33.0x50.8)	300	<30	
					838	0.3 (7.6)	1.30x2.00 (33.0x50.8)	1.30x2.00 (33.0x50.8)	300	<30	

6–5 CONTRACTOR FURNISHED COMPONENTS

Note

Emergency OFF BUTTONS are NOT used for Japan.

Table 6–4 lists contractor furnished components and details for connections to the system.

TABLE 6–4
CONTRACTOR FURNISHED COMPONENTS

ASSOCIATED EQUIPMENT	MATERIAL/LABOR PROVIDED BY CUSTOMER CONTRACTOR
SYSTEM EMERGENCY OFF BUTTONS (Emergency OFF BUTTONS are NOT used for Low Voltage Areas(200 or 208 Vrms.)	Install flush mounted wall switch box for single push button stations provided with system Main Disconnect Panel (MDP). Push button stations have one normally closed contact rated for 24 volts. Red emergency off push button switch have a guard to prevent inadvertent actuation. Also provided is nameplate "**SYSTEM EMERGENCY OFF**". Locate 60 in. (1524 mm) from floor near each exit in the magnet and equipment rooms. (See Section5–3, POWER DISTRIBUTION SYSTEM, and Section 6–3, EMERGENCY OFF WIRING.) **Note:** DO NOT label buttons "Emergency Stop" — they are not the same.
SYSTEM GROUND	Provide ground cable between RF shielded room common ground point and Power Distribution Unit (PD1). (See Section 5–4–2, SYSTEM GROUND, for cable specifications.)
EQUIPMENT POWER ● Pneumatic Patient Alert Control Box** ● Service Outlet in Magnet Room	Provide and install power, duct work, receptacle, and coverplate for each item listed. (See Section5 POWER REQUIREMENTS, for power specifications.)
MAIN DISCONNECT PANEL	Install system provided Main Disconnect Panel, see Section 5–3, POWER DISTRIBUTION SYSTEM, and Section 6–3, EMERGENCY OFF WIRING.)
PENETRATION PANEL MOUNTING HARDWARE	RF shielded room vendor to provide appropriate mounting hardware for GE supplied penetration panel. (See Section 7, RF SHIELDED ROOM.)
RF DOOR SWITCH AND CABLING	RF shielded room vendor to provide and install RF door switches on all RF shielded room doors. All switches must be wired in series. GE supplies a 100 ft (30.5 m) cable from System Cabinet which is terminated with 2 leads. These leads are connected to the set of switches. Switches must be in the open position when RF door is open but closed when door is closed. (See Section7, RF SHIELDED ROOM.)

Note * Optional Equipment.

** The Pneumatic Patient Alert Control Box can be powered from an outlet on the Operator Workspace.

SECTION 7 – RF SHIELD ROOM

TABLE OF CONTENTS

7–1 RF SHIELD ROOM SPECIFICATION

Every GE MR system requires that the Magnet Room be RF shielded. Table 7–1 contains the RF Shielded Room specifications.

TABLE 7–1
RF SHIELDED ROOM SPECIFICATIONS

PARAMETER	REQUIREMENTS
RF ATTENUATION	90dB (5MHZ – 25MHZ) electric wave 90dB (5MHZ – 25MHZ) magnetic wave
GROUND ISOLATION	1,000 ohms or greater
MATERIALS	The choice of material is the responsibility of the customer's architect and RF vendor. Normally, copper–brass or treated aluminum is used because these materials are non–magnetic and will not affect homogeneity. However, RF Shielding has also been fabricated from galvanized steel or by modifying steel magnetic shielding to produce the required RF attenuation. Any steel RF enclosure will affect the magnet's homogeneity and must be reviewed by GE Medical Systems MR Siting and Shielding Group. The door or any other moving or non–rigid parts must not be fabricated from magnetic materials.
SUPPORT	The design of the shield support system is the responsibility of the customer's architect and RF vendor. If magnetic steel panels are used, these materials must be rigidly supported to prevent any slight movement, from air pressure changes or other reasons, that could degrade magnet homogeneity and system performance. For safety reasons, magnetic steel material must be well anchored. Loose steel components can become dangerous projectiles and accelerate into the magnet.
TESTING	The customer's architect and RF vendor are responsible for conducting RF attenuation and ground isolation tests to verify that the shield meets GE specifications. This test must be performed after the opening is cut in the RF shielding for the GE penetration panel. The test must be conducted with an RF vendor supplied blank penetration panel and the same mounting hardware to be used with the GE penetration panel.
MAINTENANCE	Follow RF vendor's recommended maintenance. Alert GE Service Representative of any RF shielded room maintenance issues since there may be system performance impacts.
ACOUSTIC	RF Screen Room including all openings (i.e. windows, doors, vents, etc.) need acoustic properties to meet local regulations and customer requirements. **Note** RF Screen Room doors with <40db acoustic attenuation have caused customer acoustics issues.

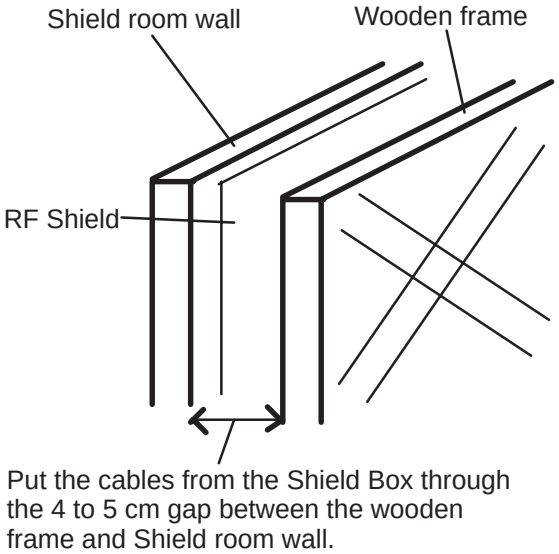
7–2 PHYSICAL CONSIDERATION

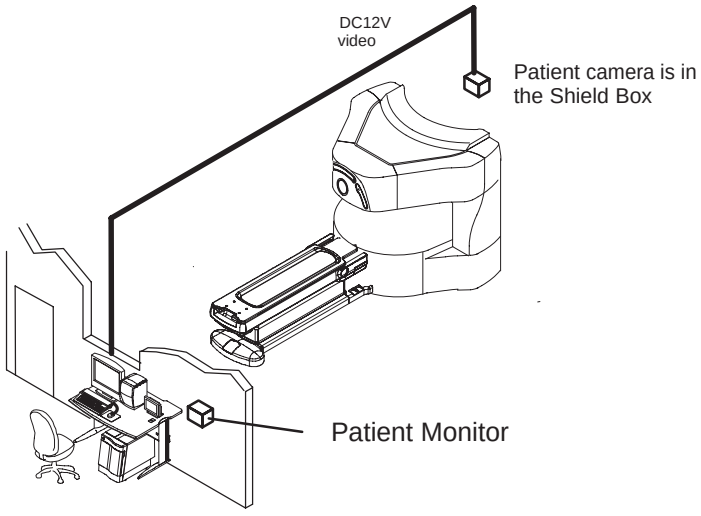
The RF shield room can be either a free standing structure or attached to the building. In either case, the RF shield must be electrically isolated from the building's ground.

7–3 PATIENT MONITOR (OPTION)

1. The Video Signal–cable and the Power–source cable needs to be wired outside of the RF Shield Room.
2. Provide a 50mm hole in the wall and attach the Video Box and camera and connect to the RF Shield Room wall with screws. Run cable 54 through the hole to the outside of the RF Shield Room and connect the Video Signal–cable to the Patient Monitor, Power–source cable to the Junction Box.

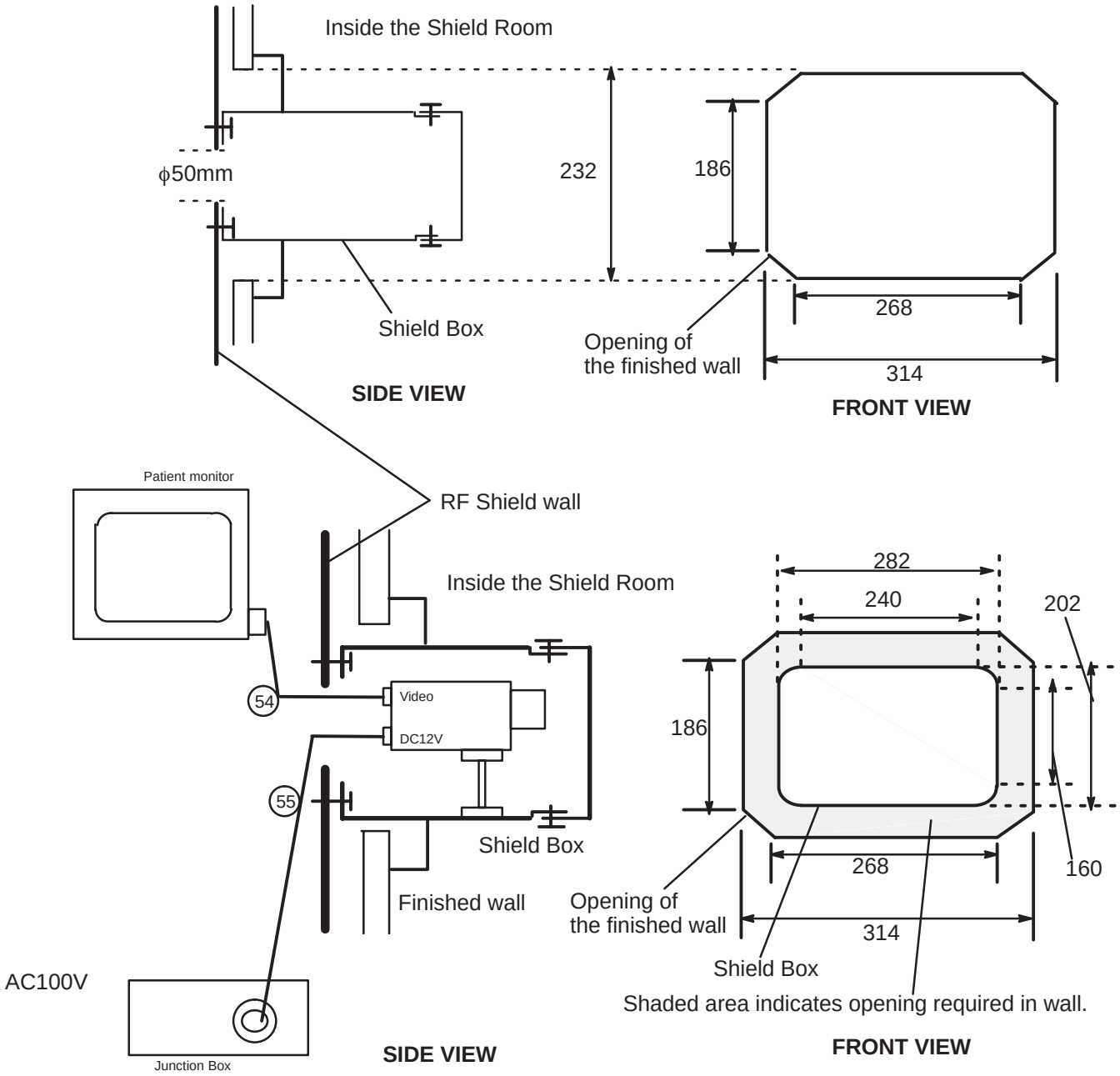
See Illustration 6–2 to 6–4 for detail, Illustration 6–5 for the view angle of the Patient Camera, and 6–6 for the height in which the camera should be put.





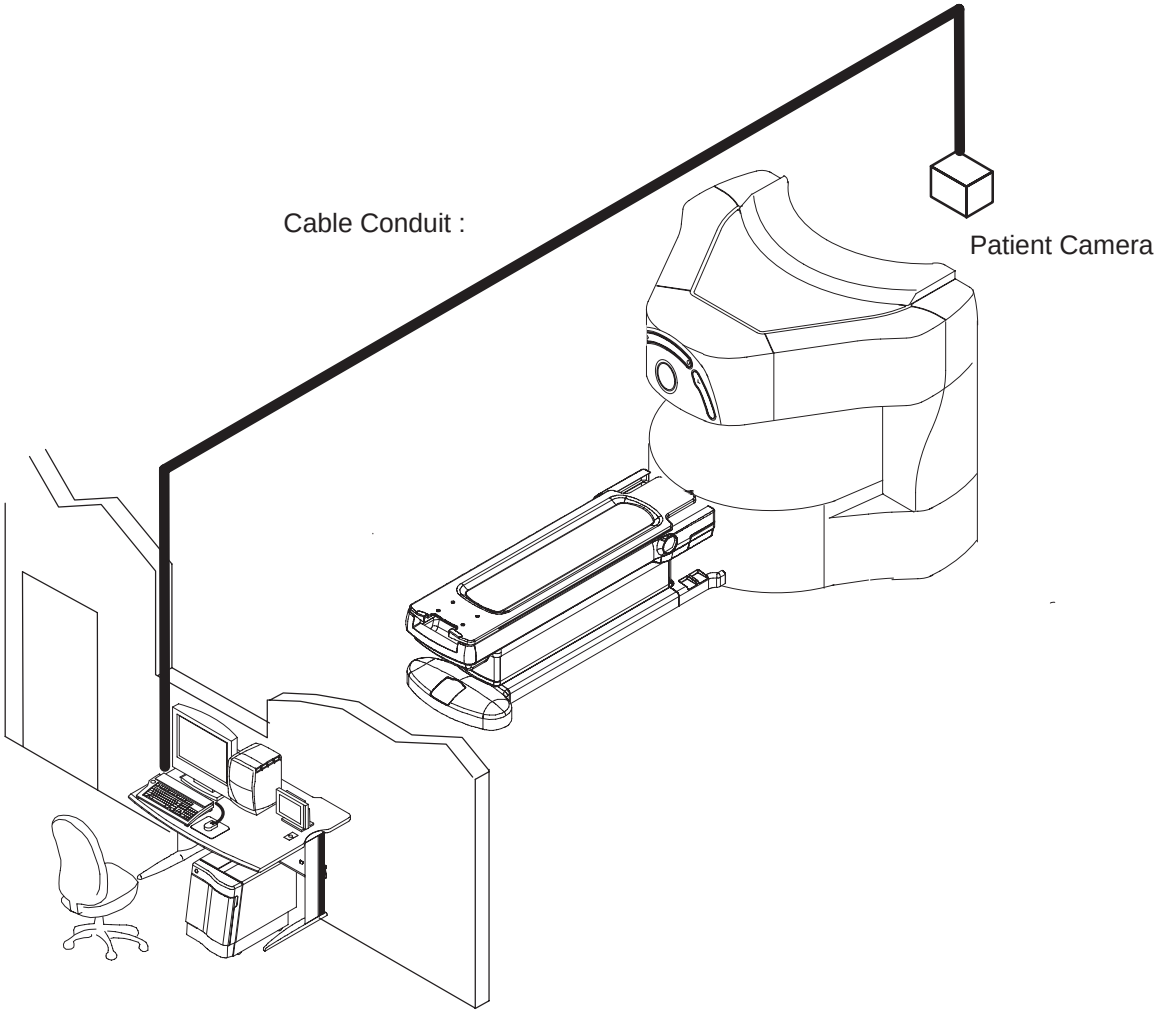
PATIENT CAMERA (OVER ALL VIEW)
ILLUSTRATION 7–1

7–3 PATIENT MONITOR (OPTION) (continued)



PATIENT CAMERA (DETAIL)
ILLUSTRATION 7–2

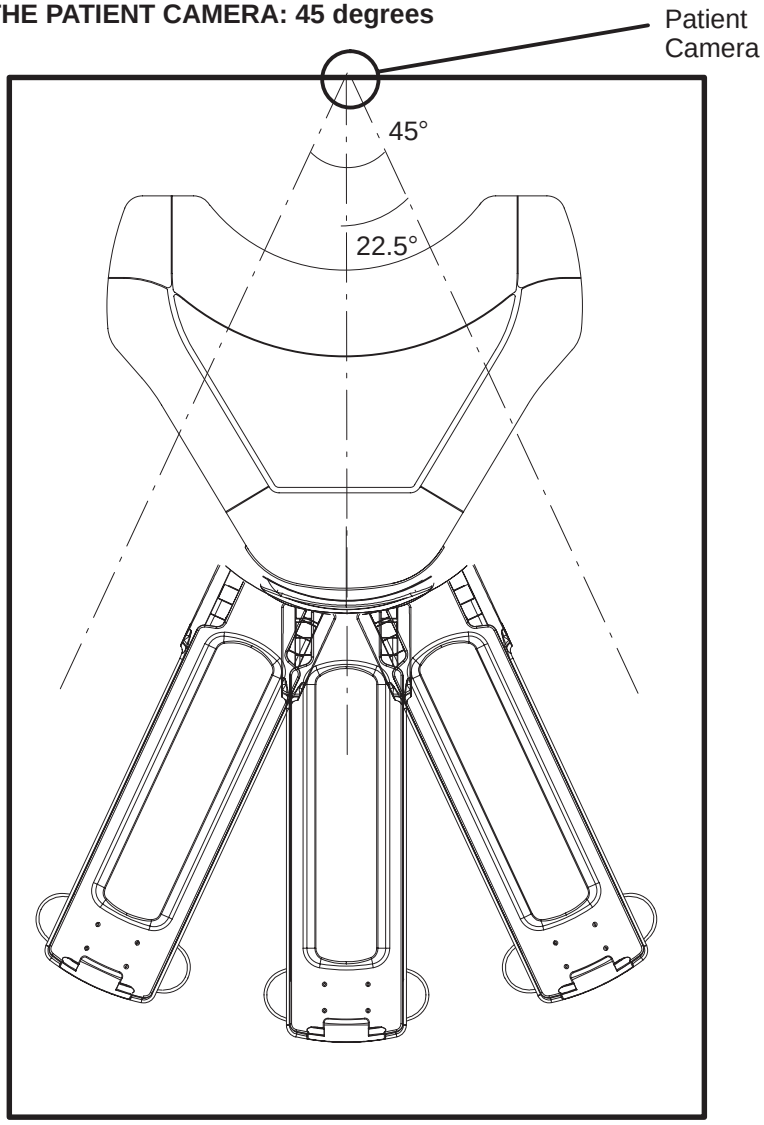
7–3 PATIENT MONITOR (OPTION) (continued)



OVERALL VIEW OF PATIENT CAMERA
ILLUSTRATION 7–3

7–3 PATIENT MONITOR (OPTION) (continued)

VIEW ANGLE OF THE PATIENT CAMERA: 45 degrees



PATIENT CAMERA VIEW ANGLE (TOP)
ILLUSTRATION 7–4

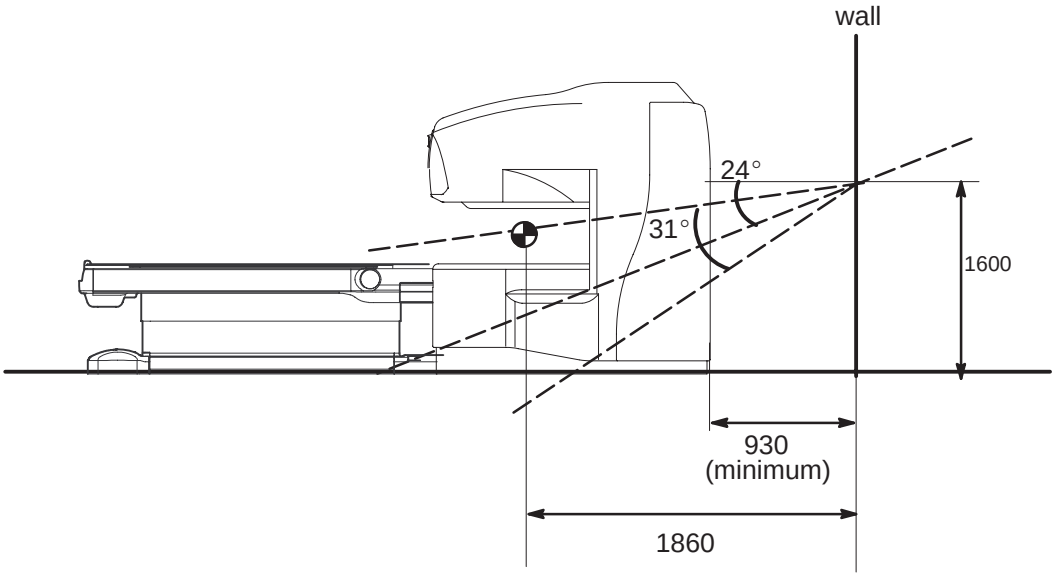
7–3 PATIENT MONITOR (OPTION) (continued)

INSTALLATION PLACE FOR PATIENT CAMERA

Installation place horizontally : At the Magnet center
vertically : see the chart below

ALL DIMENSIONS ARE IN MILLIMETERS.

Distance between the wall and the Magnet center (mm)	Height in which the Camera should be installed (mm)
1860	1600
2060	1618
2260	1760
2460	1840



PATIENT CAMERA VIEW ANGLE (SIDE)
ILLUSTRATION 7–5

7–4 FLOOR SHIELDING

Structural steel in the floor and in support of the floor influences the uniformity of the magnetic field. To minimize this effect, the steel plate specified in Table 7–1 and flow chart in Illustration 7–6 must be applied for the floor as a magnetic shield.

- At the factory,the magnet will be shimmed with a steel plate which has an equivalent effect on the uniformity to the steel plate on site. This steel plate must be laid prior to installation of the magnet. Lack of the steel plate on site will result in an inability to shim the magnet due to exceeding of shimming capability in vertical component.
- Verify that the ferrous magnetic mass in the concrete steel(beam) at the site according to the flow chart in Illustration 7–6.
- This steel plate can be placed under or over the layer of RF Shield. Refer to Illustration 7–9**.**
- The steel plate can be eliminated if the room magnetic shield has a steel plate on the floor to meet the requirements specified in Illustration 7–6. (Silicon steel is allowed to be used for the steel plate.)
- Requirements on the steel plate for floor shielding:
  1. Dimensions / steel thickness / location from the final surface floor : refer to Illustration 7–6
  2. Material : 1010 – 1020 (AISI)
     S15C or SS400 (JIS)
- For examples of layout for steel plate, refer to the following illustrations:
  Illustration 7–7 shows a case of 2.4m square dimensions. Magnet center should be located at the center of steel plate +/– 50mm.
  Illustration 7–8 : The steel plate may be partially cut to compensate for layout limitations of wire duct location and room wall edges.
  Illustration 7–9 shows the layout of vertical locations between the steel plate and RF Shield on the floor.
  Illustration 7–10 : The steel plate can be eliminated if the room magnetic shield has a steel plate on the floor that meets the specified requirements.
- Guide holes for the magnet anchor and the table are shown in Illustration 7–11 and 7–12. This should be done before the steel plate is laid on the floor,
  For the table anchor, either make a hole in the steel plate or cut off part of the steel plate.
  To avoid leveling problems, no screw holes are allowed within the footprint area of the leg of the magnet.

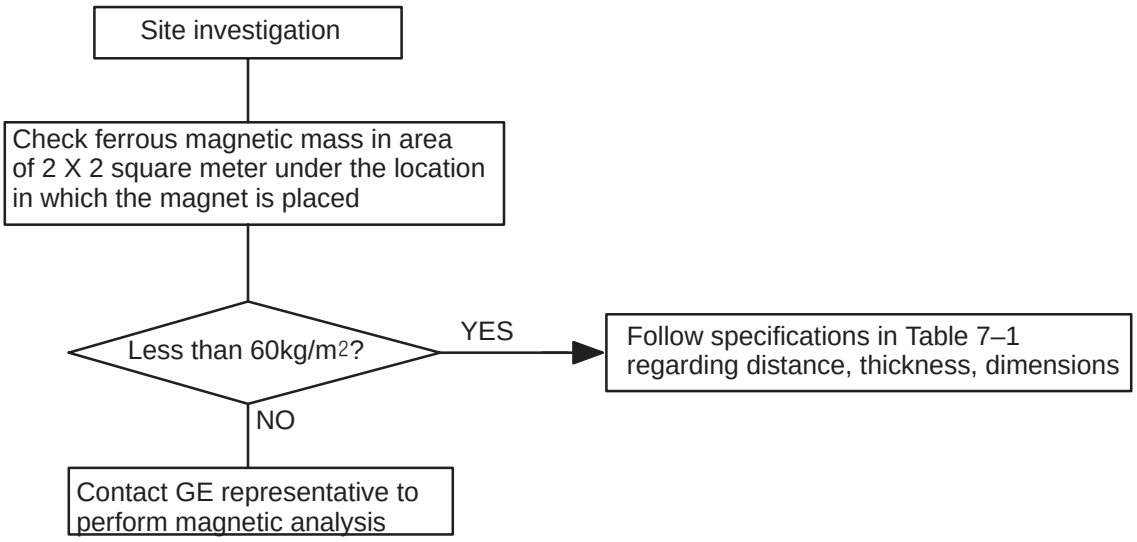
- If this plate can not be installed due to site restrictions or excessive steel over than 60kg/m^2 in the floor, a specific design must be performed by GE MR siting and shielding group. Contact your GE representative for help if there are any questions about this requirement.

TABLE 7–2
STEEL PLATE

Distance from the FL (L)	Dimensions	Thickness (Ta)
3–15 mm (0.12–0.59 inch)	2.4m x 2.4m (+/– 0.1m) (94.6 inch x 94.6 inch)	2.6–3.2mm (0.1–0.13inch)

7–4 FLOOR SHIELDING(continued)

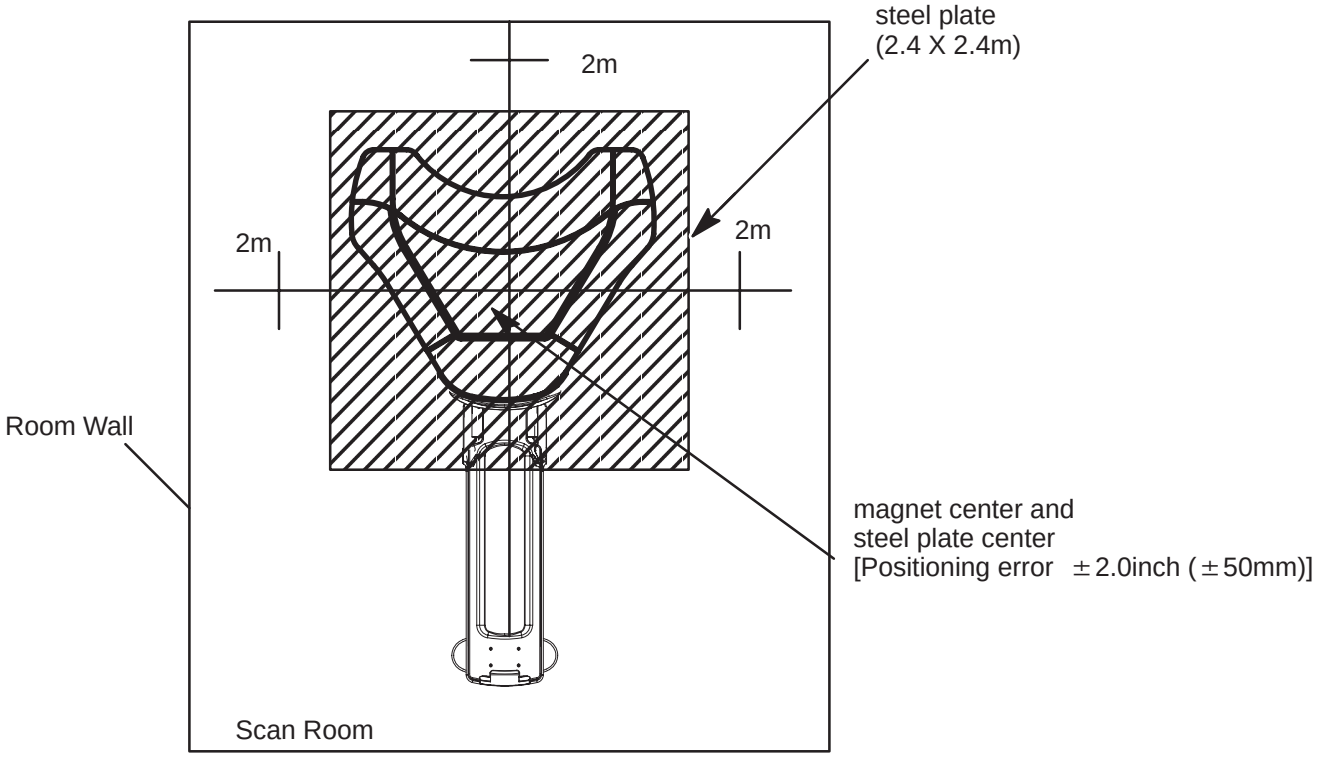
FLOW CHART FOR STEEL PLATE SPECIFICATIONS



FLOW CHART FOR STEEL PLATE SPECIFICATIONS
ILLUSTRATION 7–6

7–4 FLOOR SHIELDING(continued)

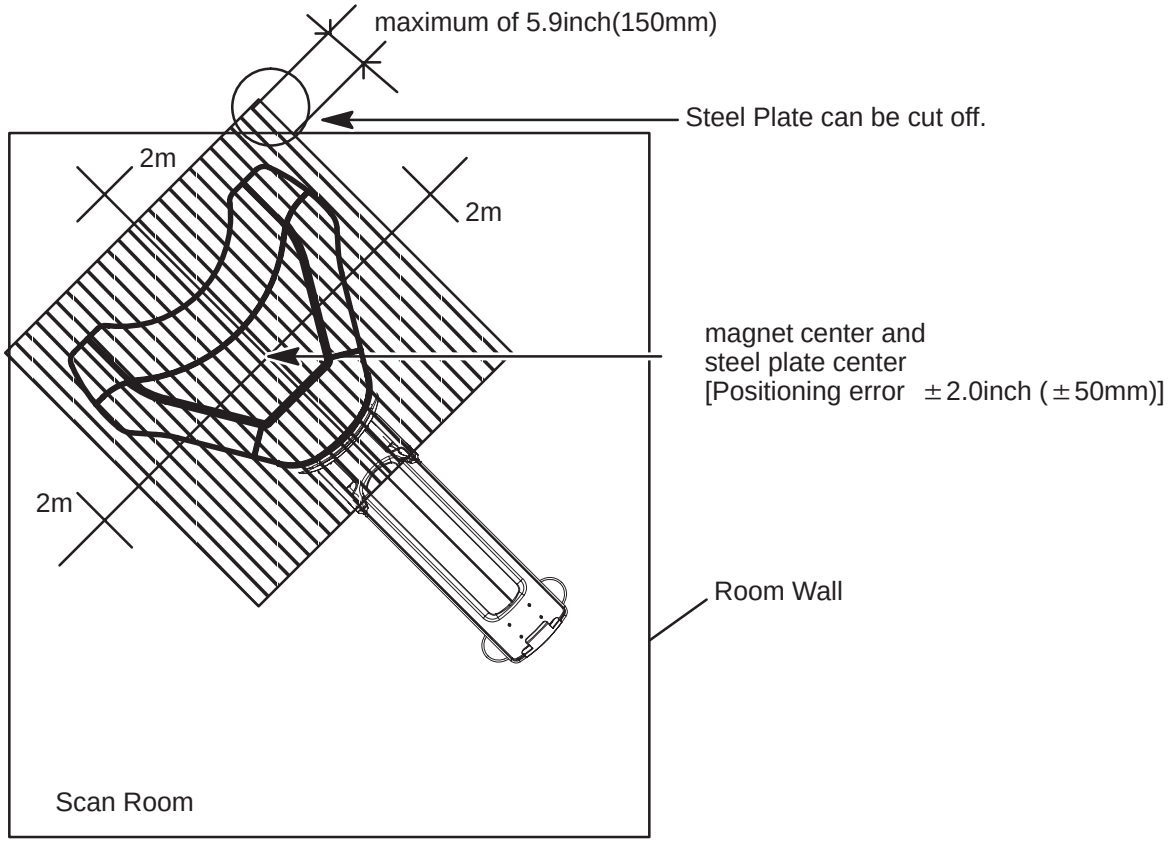
When Scan Room is large enough;



FLOOR SHIELD CONSTRUCTION EXAMPLE(WHEN SCAN ROOM IS LARGE ENOUGH)
ILLUSTRATION 7–7

7–4 FLOOR SHIELDING(continued)

When Scan Room is not large enough;

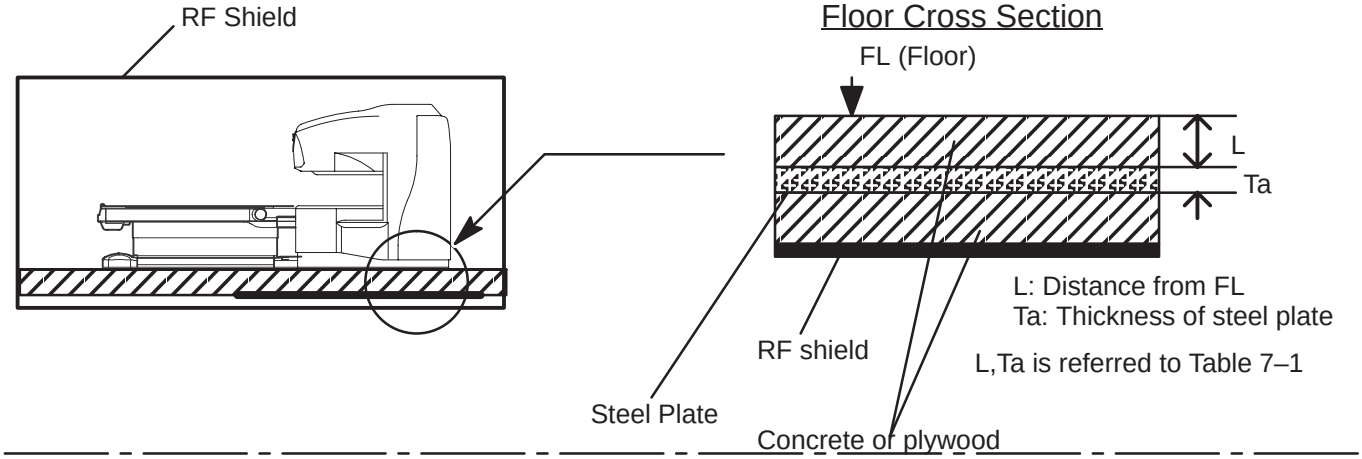


FLOOR SHIELD CONSTRUCTION EXAMPLE(WHEN SCAN ROOM IS NOT LARGE ENOUGH)
ILLUSTRATION 7–8

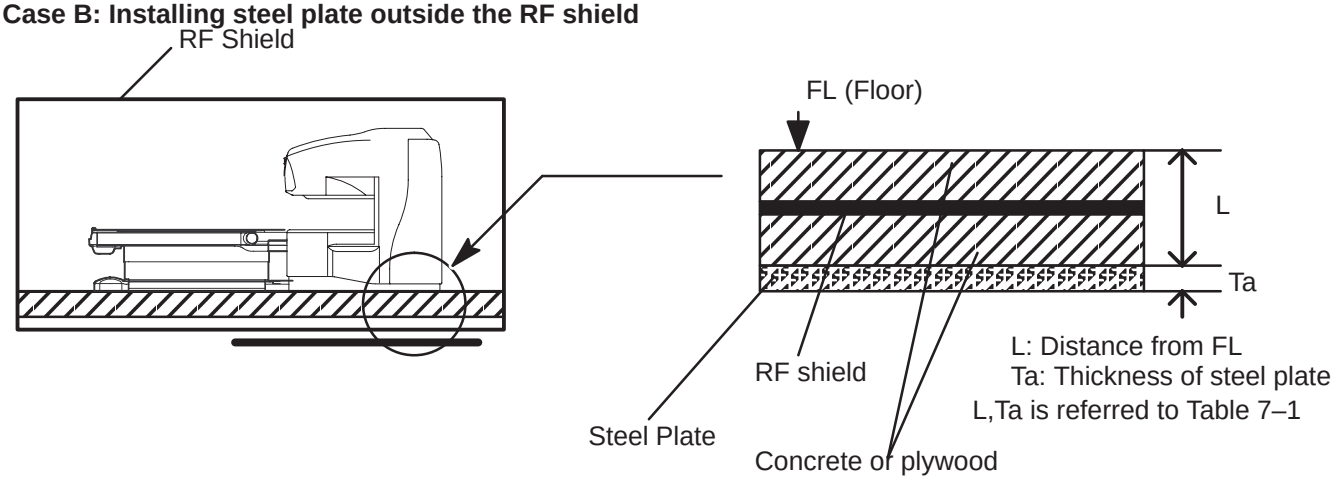
If 2.4m X 2.4m steel plate can not be installed because the Scan Room is not large enough, the steel plate can be partially cut.

7–4 FLOOR SHIELDING(continued)

Case A: Installing steel plate in the RF shield

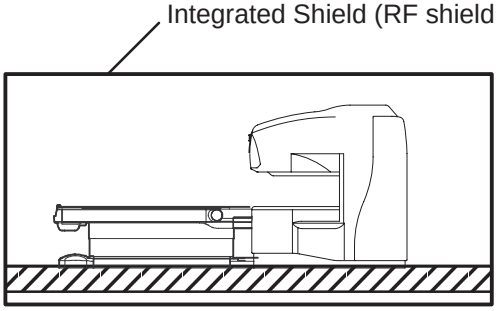


Case B: Installing steel plate outside the RF shield



NOTE1: The steel plate can be placed either over or under the RF Shield.
NOTE2: Silicon steel can also be used for steel plate.

Case C: Integrated Shield is used



Steel Plate can be eliminated if the room has a RF shield to meet the spec shown at Illustration 7–4.

*: In this case, thickness of the Integrated shield must be equivalent to the thickness of the steel plate. Refer to Illustration 7–6.

INTEGRATED STEEL SHIELD
ILLUSTRATION 7–9

7–4 FLOOR SHIELDING(continued)

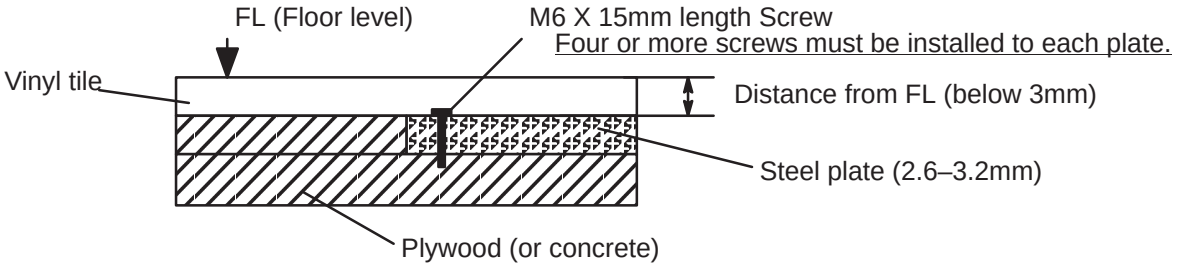
When installation of the steel plate is within 20mm from the floor, there is a possibility that the steel plate may get drawn to the magnet. To prevent this, the steel plate has to be bolted down to the floor. See the next page.

It is free to divide the steel plate into any suitable number. For example, dividing the steel plate into 4 (each plate will be1.2 X 1.2m) would make the steel plate easier to handle. Screw 4 places per each plate. Use M6 screw with 15mm in length. (If this screw length is fixed and is not long enough, use screw with more than 15mm in length (customer supplied).

7–4 FLOOR SHIELDING(continued)

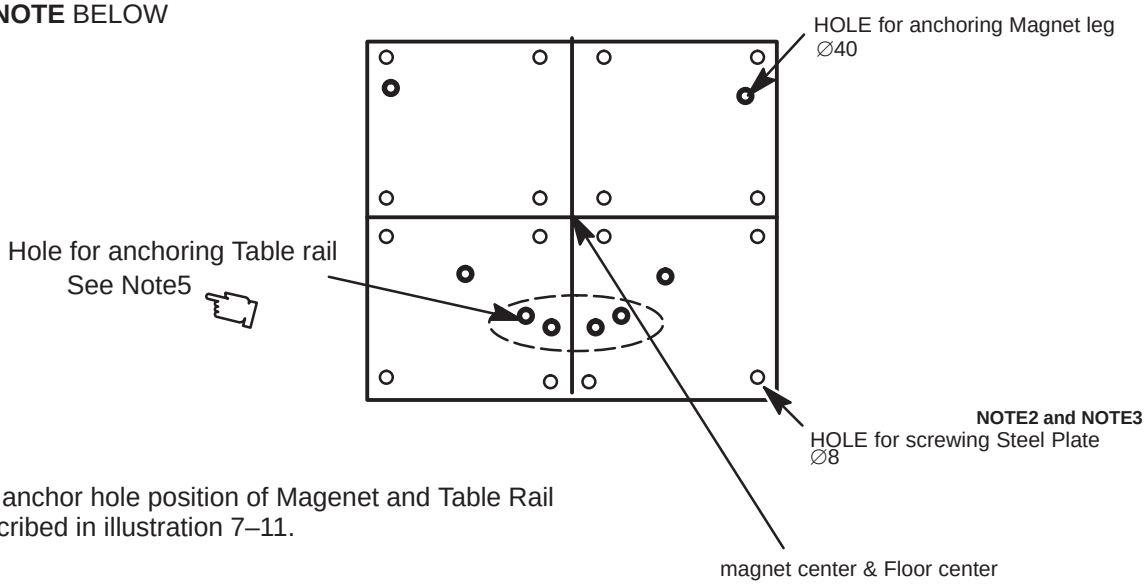
SAMPLE ILLUSTRATION:
(2.4mx2.4m steel plate is devided to four plates)

CROSS SECTION OF THE FLOOR



HOLE OF THE 2.4X2.4 STEEL PLATE

SEE **NOTE** BELOW



Detail anchor hole position of Magenet and Table Rail is described in illustration 7–11.

RF Room

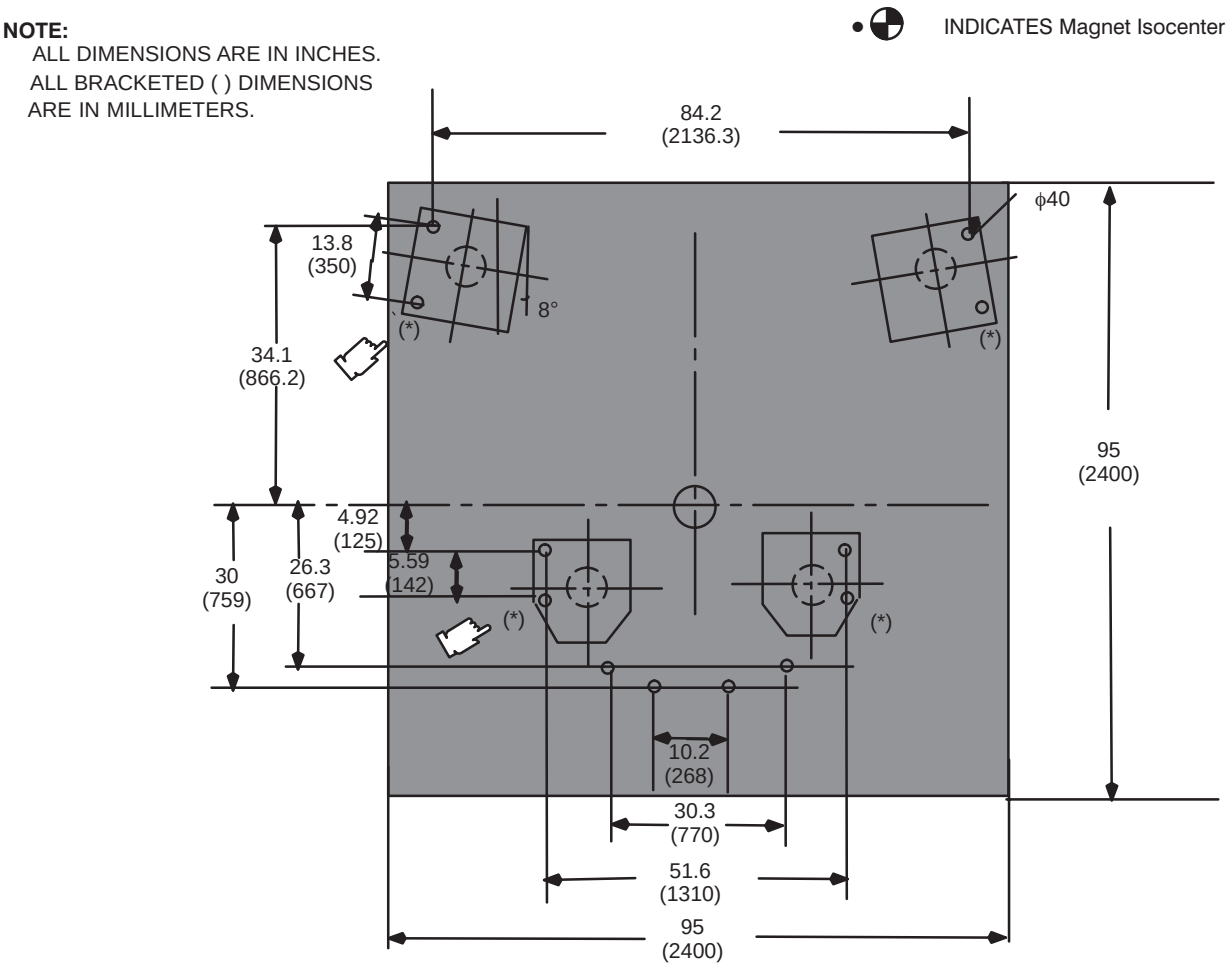
NOTE1: The anchor holes for the table must be considered when laying the steel plate on the entire room.
NOTE2: Screw holes are not allowed within the footprint area of the leg of the magnet to avoid leveling problems.
NOTE3: The use of steel screws instead of stainless screws for steel plate is allowed. However, there is a chance that the steel screw may be attracted to or fly into the magnet.
NOTE4: Measure the position of the steel plate (such as the distance from the wall) to make it easier to determine where the steel plate is after raising the floor (with vinyl tile).
NOTE5: In the GEMS–AM pole, the RF shield vendor is responsible for drilling rail anchoring hole.

2.4X2.4 STEEL PLATE
ILLUSTRATION 7–10

7–4 FLOOR SHIELDING(continued)

SAMPLE ILLUSTRATION:

STEEL PLATE with OVER 2.4X2.4 in Dimension and over 30mm in depth



(*) These anchor holes are added becaiuse of the seimic requirement in US. Use these anchor holes if necessary.

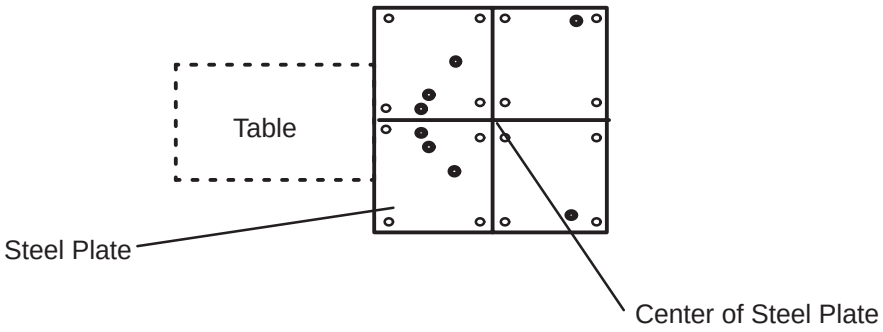
NOTE: Screws are not needed for steel plate with dimensions greater than 2.4m X 2.4m and located deeper than 30mm from the floor.

MAGNET MOUNTING PLATE
ILLUSTRATION 7–11

7–4–1 STEEL PLATE ANCHORING

Procedure for anchoring steel plate with dimensions of 2.4m X 2.4m and depth of under 30mm from the floor.

1. Verify the position of the magnet center.
2. Verify the center of the steel plate.
3. Place the steel plate. Verify that its position matches the position of the magnet center.
4. Fix the steel plate to the floor with screws. See Illustration 7–12.
5. Conduct the floor tile (or vinyl tile) construction over the steel plate.
6. Place the magnet. Verify that the magnet center comes within 50mm of the center of steel plate.



● = Hole for anchoring leg of the Magnet and Table rail
○ = Hole for anchoring Steel Plate to the floor

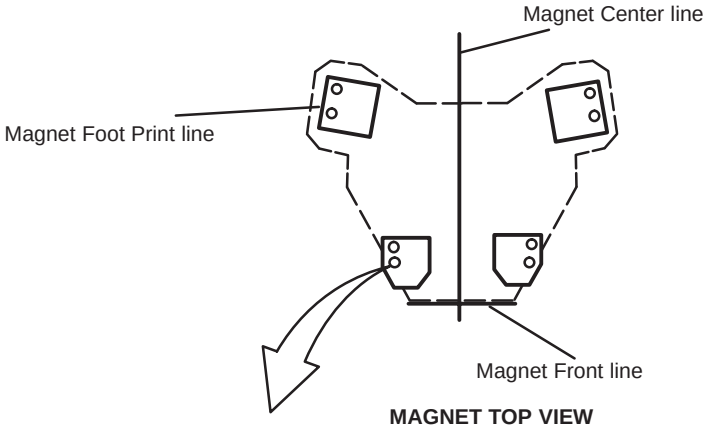
MAGNET AND STEEL PLATE
ILLUSTRATION 7–12

7–4–1 STEEL PLATE ANCHORING (continued)

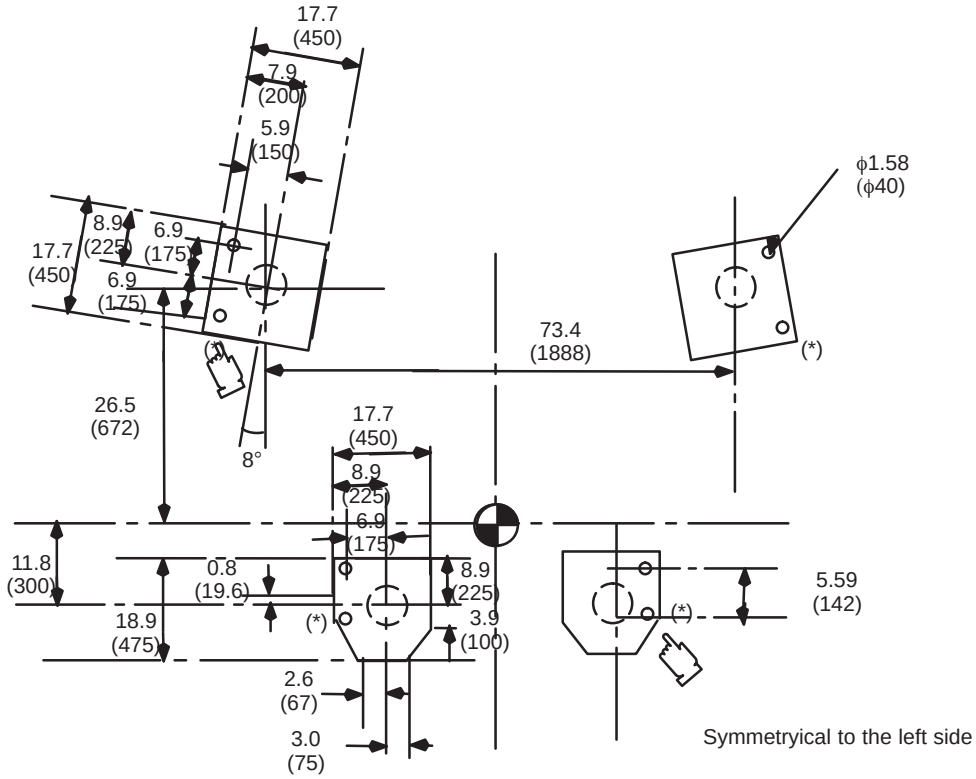
7. Draw lines of Magnet foot prints, center line, and Magnet front line. These lines are used for manet alignment.

NOTE:

- ALL DIMENSIONS ARE IN MILLIMETERS.



MAGNET TOP VIEW



MAGNET LOAD PATTERN

(*) These anchor holes are added becaiuse of the seimic requirement in US. Use these anchor holes if necessary.

MAGNET LOAD PATTERN (1)
ILLUSTRATION 7–13

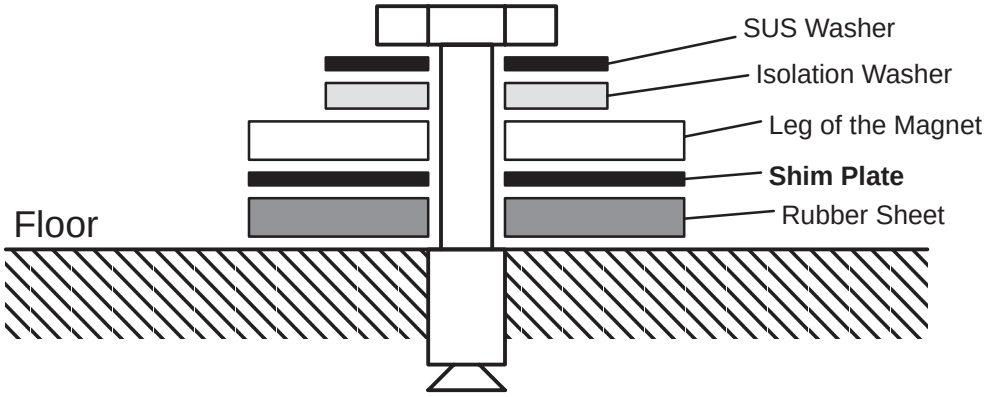
7–5 MAGNET ANCHORING

Note

It is necessary to anchor all Magnets even though Magnet is installed in non−seismic areas.

1. Conduct the Leveling of the Magnet. Use the Shim Plate(2mm thickness X 4 pieces, 1mm X 4) included with the Magnet. See *Signa Ovation Magnet Deliery & Installation Manual* attached to Magnet. (Custemer prepared)

LEVELING OF THE MAGNET



NOTE 1: In case there is floor raising construction after the anchoring of the bolt, there may be a case that the drill may not be long enough. In this case, the Anchor Bolt needs to be anchored beforehand.

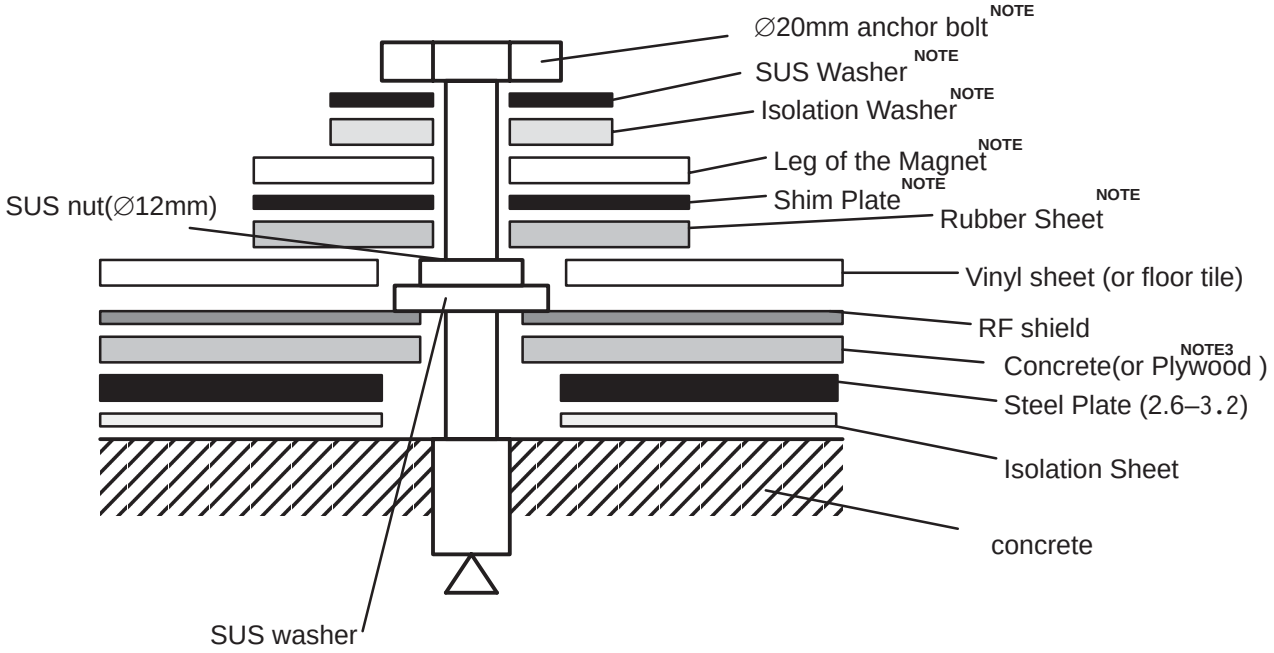
NOTE 2: If the strength of the anchored part is not strong enough, this needs to be considered by the customer.

LEVELING OF THE MAGNET
ILLUSTRATION 7−14

7–5 MAGNET ANCHORING(continued)

2. Fix the leg of the Magnet to the floor.

SAMPLE ILLUSTRATION:
WHEN STEEL PLATE IS LAID UNDER THE RF SHIELD



NOTE: GE Supplied (M20/75mm bolt size).
If not long enough, this needs to be supplied by the customer/RF Vendor.

NOTE 1: In case there is floor raising construction after the anchoring of the bolt, there may be a case that the drill may not be long enough. In this case, the Anchor Bolt needs to be anchored beforehand.

NOTE 2: If the strength of the anchored part is not strong enough, this needs to be considered by the customer.

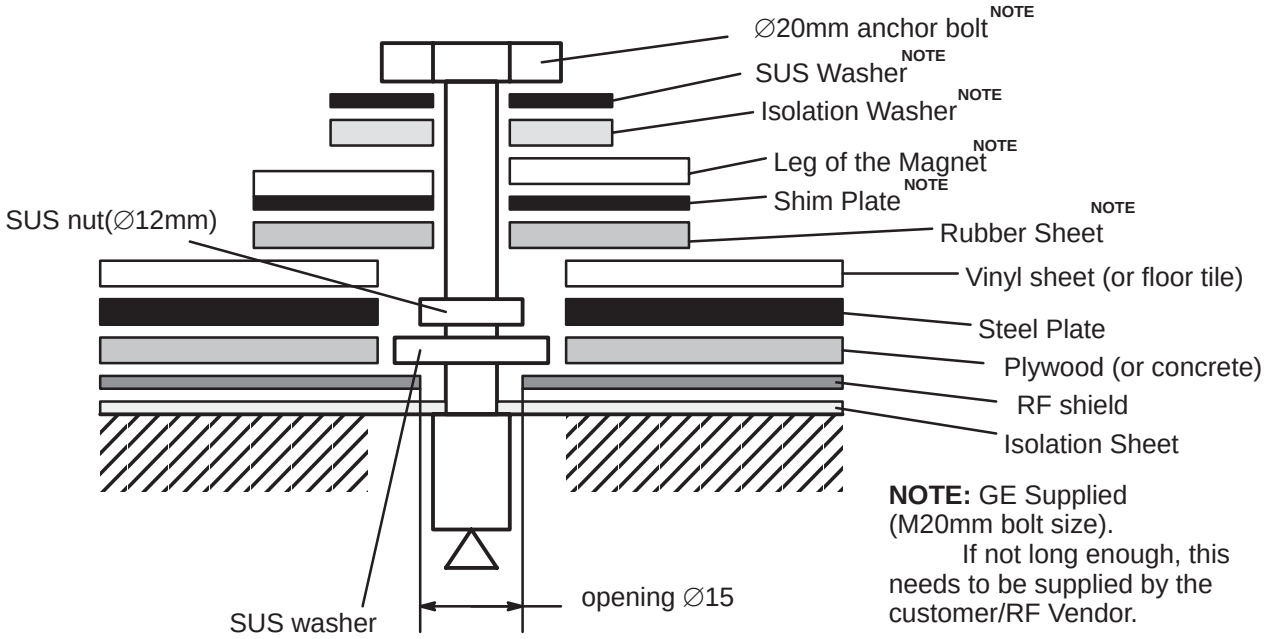
NOTE 3: Concrete is recommended. If using plywood, select plywood type by considering the Magnet weight.

NOTE 4: In GEMS–AM pole, the RF shield vendor is responsible for drilling Magnet anchor holes.

MAGNET ANCHOR BOLT (1)
ILLUSTRATION 7–15

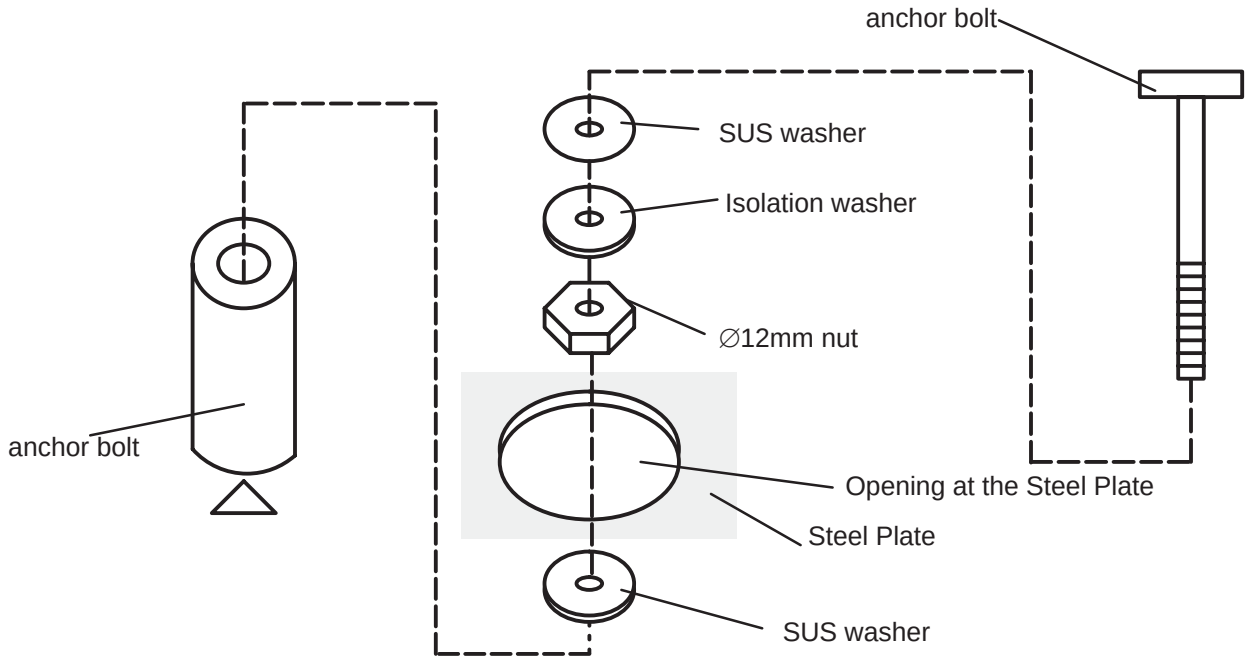
7–5 MAGNET ANCHORING(continued)

SAMPLE ILLUSTRATION:
WHEN STEEL PLATE IS LAID OVER THE RF SHIELD



NOTE 1: In case there is floor raising construction after the anchoring of the bolt, there may be a case that the drill may not be long enough. In this case, the Anchor Bolt needs to be anchored beforehand.

NOTE 2: If the strength of the anchored part is not strong enough, this needs to be considered by the customer.



MAGNET ANCHOR BOLT (2)
ILLUSTRATION 7–16

7–6 ELECTRICAL

The entry of any electrical lines into the RF shielded room must be filtered to ensure that the RF shielded room meets the minimum attenuation levels. The RF shielded room vendor must supply filters for all penetrations of the RF shielding excluding the lines entering through the GE supplied RF penetration panel. All filters (for electrical lines) must be located outside the 200 gauss line.

Note

AC outlets must have ground wires firmly attached per electrical codes to avoid intermittent grounding which can cause undesirable emi (electro magnetic interference) issues within the RF shielded room.

RF shielded room vendor should review with the electrical contractor the number of incoming power lines to the Magnet Room in determining the number of filters needed for electrical requirements.

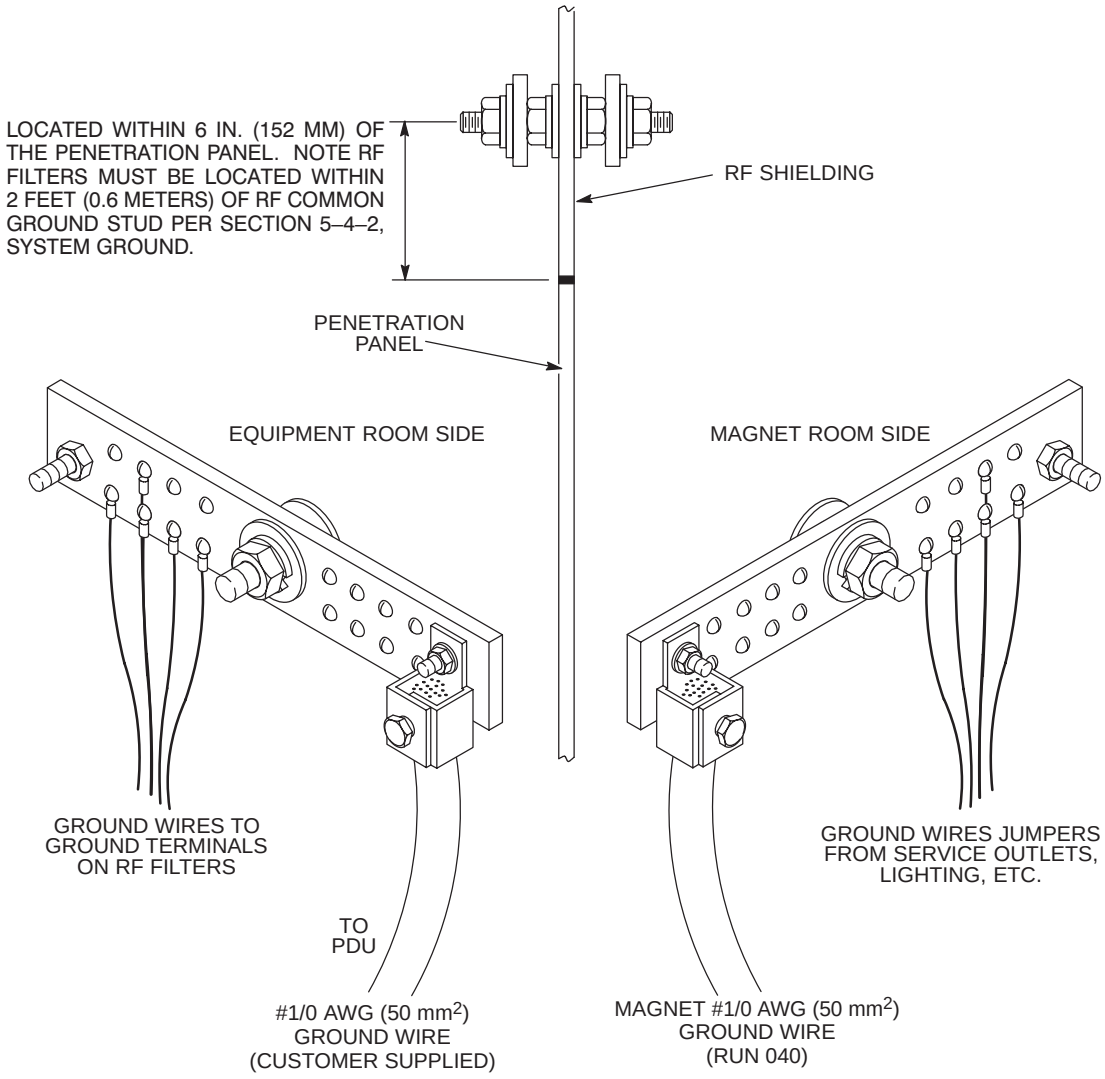
The power ground lines from customer supplied power filters must be grounded to the RF shield common ground point and be located as close as possible to the RF penetration panel. See Section 5, POWER REQUIREMENTS, for power and grounding requirements of all incoming power lines to the RF shielded room.

All lighting in the RF shielded room must be DC/incandescent. Dimmer switches must not be used; however, a selectable switch may be used to change the light intensity. For additional Magnet Room lighting information refer to Section 4, SITE ENVIRONMENT, Section 5, POWER REQUIREMENTS, and Section 6, INTERCONNECT DATA.

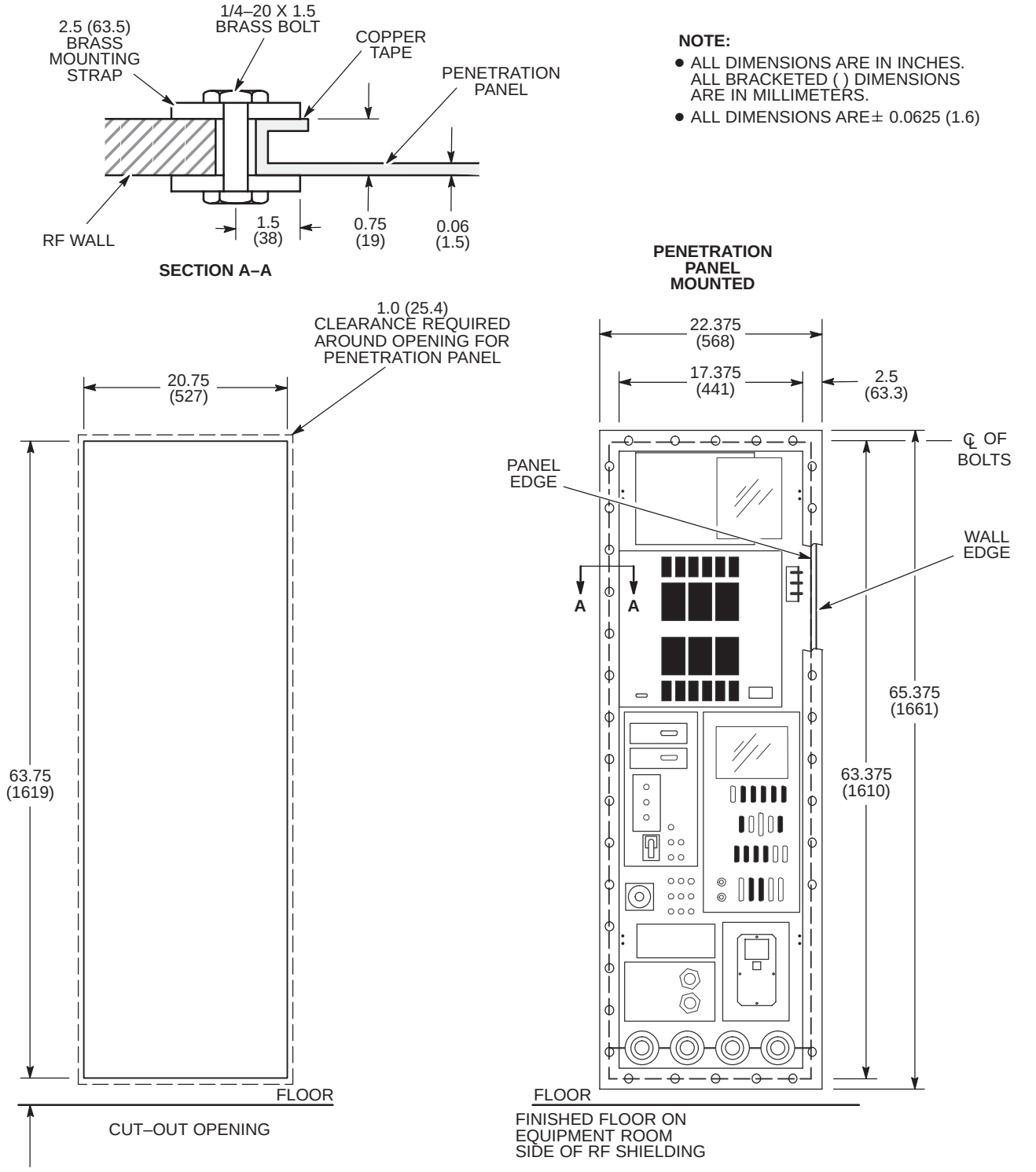
Common ground connection for shielded room must be located within 6 in. (152 mm) of the RF shielded room Penetration Panel with RF filters located within 2 feet (0.6 meters) of the RF common ground. RF shielded room vendor to provide this common ground connection on both sides of shielded room by means of a stud extending through the shielded room (see Illustration ILLUSTRATION 7–17). RF Common ground stud must be accessible for servicing purposes on both sides of shield room. For aesthetic purposes, it is recommended that the stud be positioned above the Penetration Panel so it is concealed behind the penetration panel cover (see Illustration ILLUSTRATION 7–20).

NOTE:

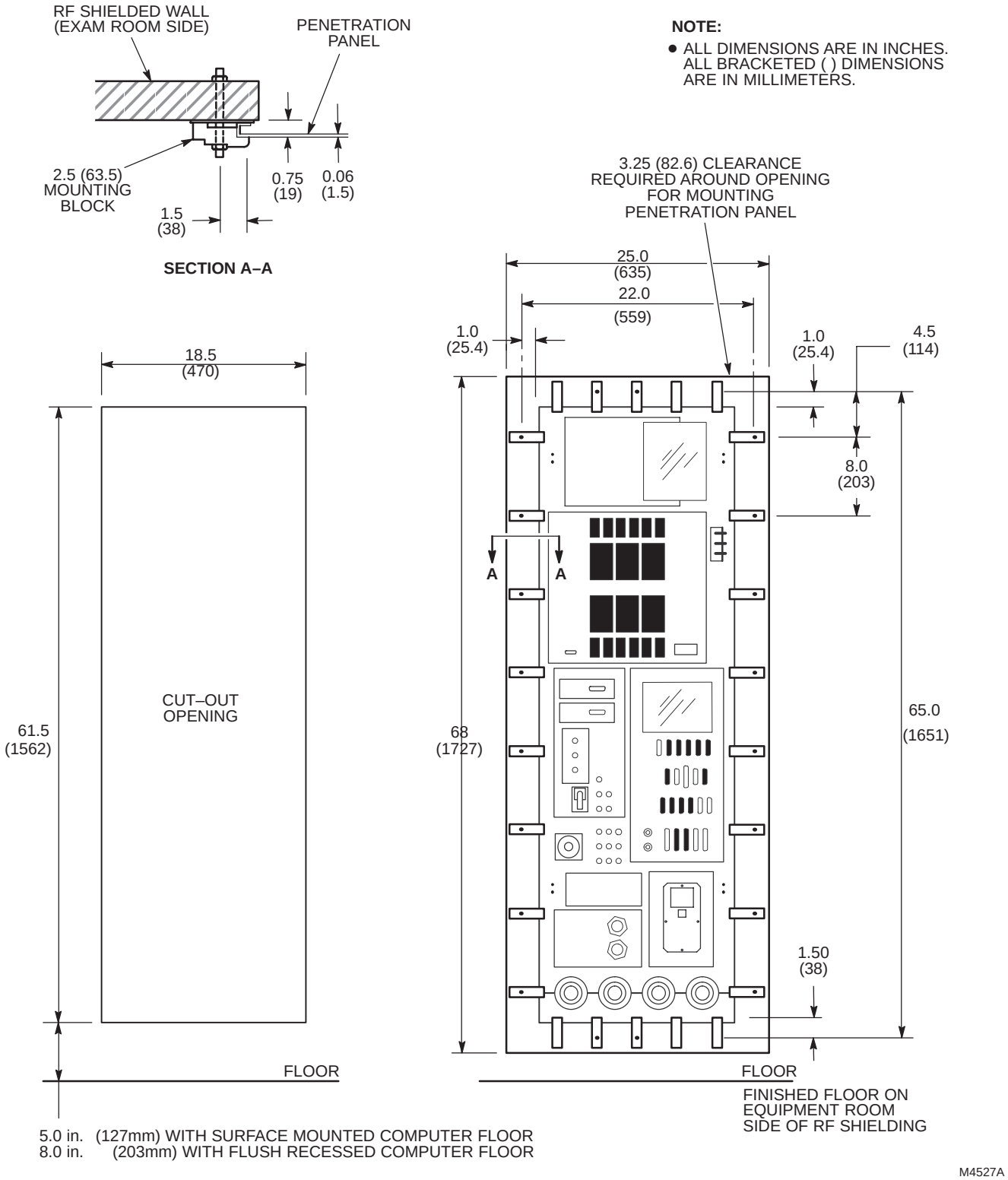
- ALL DIMENSIONS ARE IN INCHES. ALL BRACKETED ( ) DIMENSIONS ARE IN MILLIMETERS



RF COMMON GROUND PENETRATION STUD
ILLUSTRATION ILLUSTRATION 7–17



PENETRATION PANEL CUT OUT FOR 0.75 INCH (19 MM) THICK RF WALL
ILLUSTRATION ILLUSTRATION 7–18



PENETRATION PANEL CUT OUT FOR RF WALL THICKNESS VARYING FROM SMALL TO LARGE
ILLUSTRATION ILLUSTRATION 7–19

7–7 RF PENETRATION PANEL

Illustrations ILLUSTRATION 7–18 and ILLUSTRATION 7–19 show two different methods for mounting the GE MR penetration panel. Either method may be used depending on RF shielded room wall thickness. Ensure if the mounting method in Illustration ILLUSTRATION 7–18 is used, the RF wall thickness is 0.75 in. (19 mm) $\pm$ 0.0625 in. (1.6 mm). Check with RF shielded room vendor to determine appropriate mounting method. The penetration panel must be covered on both sides for safety. If GE supplied adjustable covers are not used, customer must furnish covers or enclosures with key or tool required for opening to limit access to the panel.

The penetration panel is to be mounted above the finished floor on the penetration cabinet side of the RF shielded room. GE supplies only the penetration panel as shown in Illustrations ILLUSTRATION 7–18 and ILLUSTRATION 7–19 . The mounting and clearance dimensions for the penetration panel covering are shown in Illustration ILLUSTRATION 7–20 .

RF shielded room vendor must provide the opening in the RF shielding and appropriate mounting hardware for the GE penetration panel. The RF shielded room acceptance test must be performed after the opening is cut in the RF shielding for the GE penetration panel. This acceptance test must be conducted with vendor supplied blank panel and the same mounting hardware to be used with the GE penetration panel. It is the facility's responsibility to ensure that the RF shielded room vendor testing meets the attenuation specifications listed in Section 7–1 , RF SHIELDED ROOM INTRODUCTION.

7–8 PHYSICAL CONSIDERATIONS

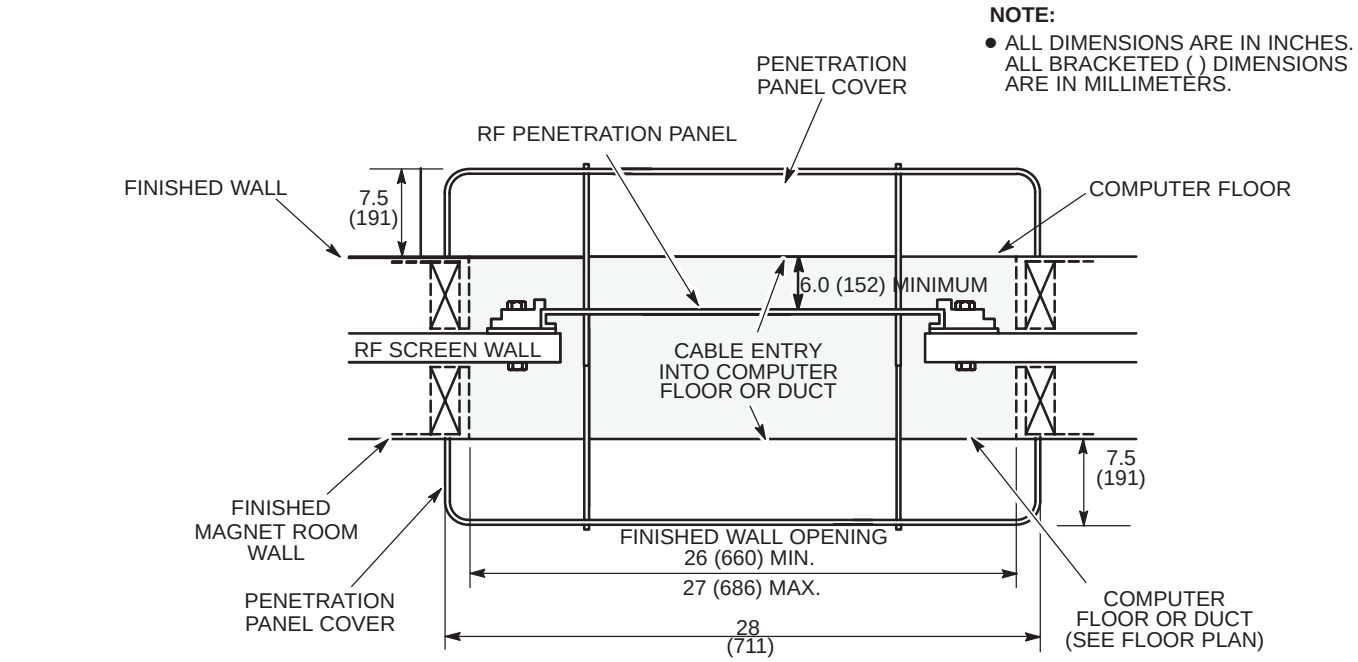
The RF shielded room can be either a free standing shielded structure or a shielded room within an existing room. Either style must be electrically isolated from earth ground by 1000 ohms or greater. Magnetic shields that are used as RF shield must also be isolated from ground by the same specification.

7–8–1 Doors and Other Openings

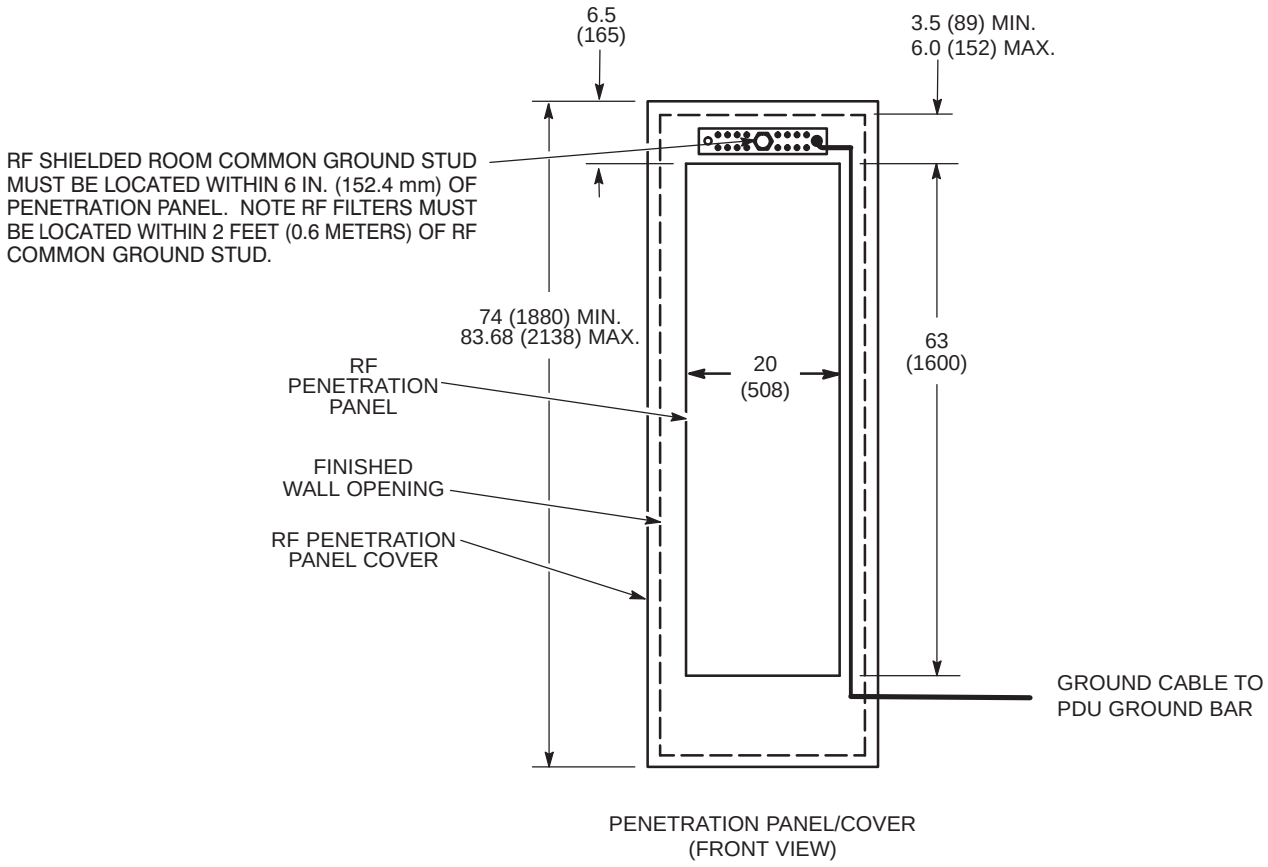
Shielded room doors are a major source of RFI leaks and should be kept to a minimum.

The main door requires a minimum finished opening of 43 in. (1092 mm) to allow patient transports to pass through the opening. However, a 48 in. (1219 mm) wide door is recommended for easy maneuvering of the patient transports. Maximum door sill height is 1 in. (25 mm) with a 10 degree maximum threshold inclination.

For moving the standard magnet into the room, a minimum 7ft(2134mm) wide by 8ft(2440mm) high removable panel wall or 10ft(3048mm) by 8ft(2440mm) roof hatch is required. This normally consists of several panels that are bolted together to ensure a good RF shield when opening is not in use. Since future access may be required for magnet entrance/exit through the removable panels, avoid permanently sealing the removable panels. Note the room removable wall panel or roof hatch opening may need to be larger to achieve the required opening defined above in this section. Consideration for clear opening dimensions is especially applicable to sites requiring magnetic shielding.



TOP VIEW



PENETRATION PANEL/COVER (FRONT VIEW)

PENETRATION PANEL/COVERING MOUNTING REQUIREMENTS
ILLUSTRATION ILLUSTRATION 7–20

7–8–2 Ceiling Height

Table TABLE 7–3 lists the Magnet Room absolute minimum ceiling height required for servicing the listed magnets. This height is required for the area directly above the magnet. GE Medical Systems, Modality Installation Planning Service group must be notified of any ceiling dimensions less than ceiling heights stated in Table TABLE 7–3 . Modality Installation Planning Service group can be reached at (262) 548–4800.

TABLE 7–3
MAGNET SERVICING CEILING HEIGHT REQUIREMENTS

MAGNET TYPE	ABSOLUTE MINIMUM CEILING HEIGHT MM See Note 1	COMMENTS
0.35T Magnet	2400	Magnet servicing is performed from a platform ladder which is positioned at the rear side of the Magnet.
Note 1 Absolute minimum ceiling height values are from magnet room finished floor to fixed ceiling.		

7–8–3 Walls

It is recommended that walls be covered to protect RF material and to add to the aesthetics of the room for patient comfort. Fire retarding material must be used per building codes. Consult RF shield room vendor for RF shielding service requirements prior to covering RF walls. Removable wall covering may be needed if periodic RF shield servicing is required to maintain RF integrity.

The recommended patient viewing window dimensions are 48 in. wide by 42 in. high (1219 mm x 1067 mm). The location of the window is dependent on the position of Operator Workspace position.

Note

The operator at the Operator Workspace must be able to view the patient during a scan.

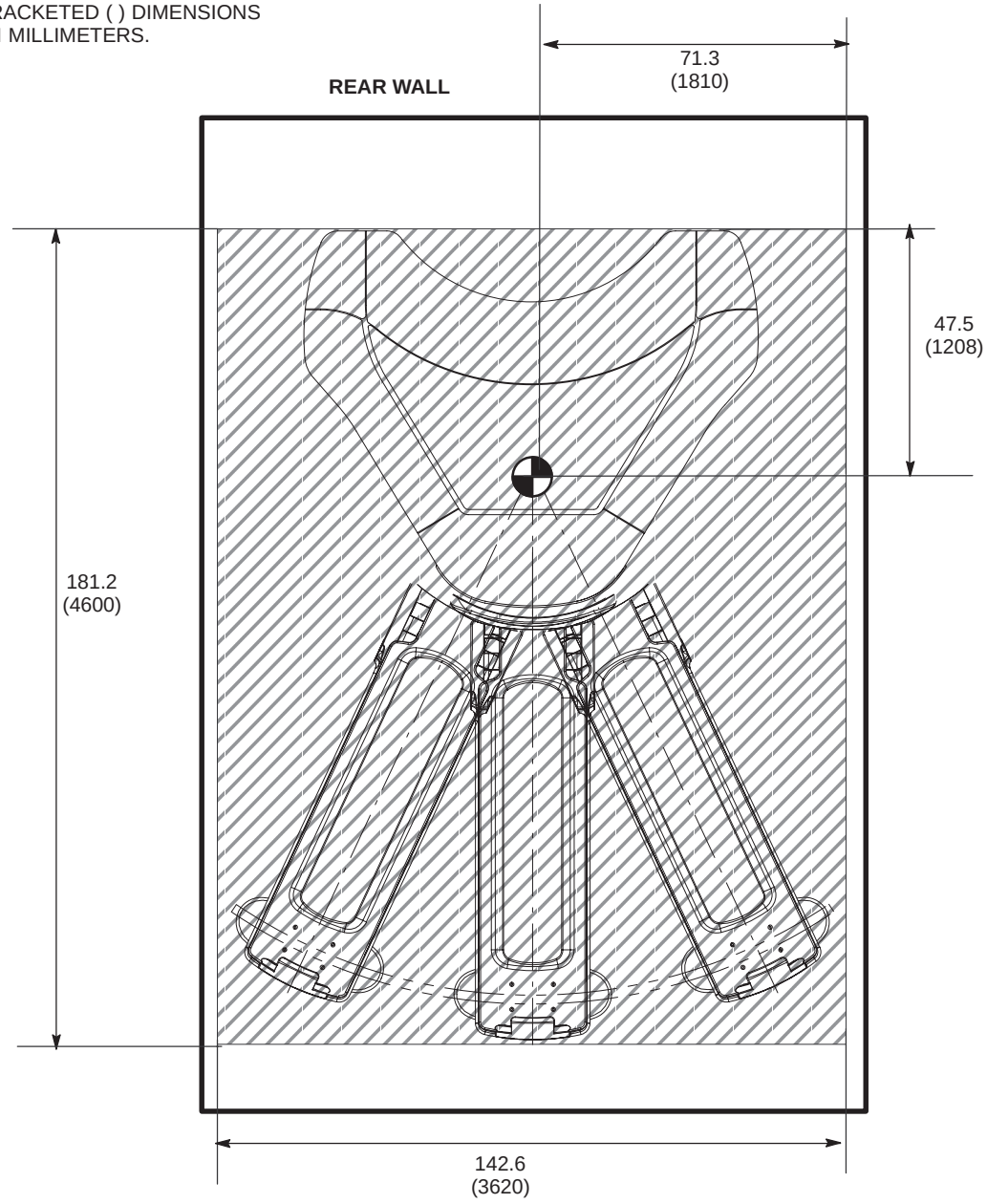
7–8–4 Floors

The Magnet Room floor levelness requirement is important for operation of the Patient Swing Table. Floor levelness in the Magnet Room must not be greater than 0.236 in. (6 mm) between depression and high spots and no higher than the surface which the rear Patient Swing Table wheels contact, within the area of the magnet enclosure and the Patient Swing Table area in front of the enclosure, see shaded area shown in Illustration 7–20.

Note, the critical dimension of 41.34 in. ±0.118 in. (1050 mm +/– 3mm) from finished floor to vertical center of the Magnet and Patient Swing Table rear wheel plate must be must be maintained. This will allow the Patient Swing Table to swing without obstruction from the floor.

The finished floor in the Magnet Room should be waterproof and be a conductive type flooring to reduce the possiblility of a static discharge. The floor covering must be hard–surfaced with the seams sealed to protect the RF flooring against possible water damage. This floor should also be easily replaceable to repair tiles that are damaged from occasional cryogen spillage. Removable access flooring in the Magnet Room must be aluminium or non magnetic for safety purposes.

NOTE:
ALL DIMENSIONS ARE IN INCHES.
ALL BRACKETED ( ) DIMENSIONS
ARE IN MILLIMETERS.



MAGNET FLOOR LEVELNESS AREA
ILLUSTRATION 7–21

7–9 MAGNET MOUNTING REQUIREMENTS INSIDE RF SHIELDED ROOM

Overview & Background Information

All GE MR systems require an RF enclosure which is commonly called an RF Shielded Room or an RF Screen Room. RF signals from sources outside of the RF Shielded Room are attenuated so they do not interfere with the MR system. Likewise, the RF signals produced by the MR scanner are kept from interfering with other RF devices. This RF quiet environment is necessary for the MR system to produce quality images.

RF Shield Rooms come in a variety of shapes and sizes but the feature they all have in common is a total RF shield produced by one continuous ground plane. This is achieved by making the magnet mounting plate, walls, floor, doors and ceiling out of an electrically conductive material such as copper, aluminum, brass, or steel. All the room components (the magnet mounting plate, walls, floor, ceiling, etc.) must be electrically bonded together to form one solid, common ground plane. Once this is established the ground plane is then tied to earth ground to create the RF shield. This ground point is known as the PRIMARY ground. The primary grounding technique works well for any battery powered devices that may be operated within the RF Shield Room. Devices requiring facility power or the introduction of facility power into the Screen Room requires a change in the primary grounding technique for the RF Shield Room. The RF Shield Room must now be grounded back to the facility power ground.

The addition of water systems or other grounds required by the national electrical code will cause the RF Shield Room ground impedance to be ZERO ohms. These additional grounds that connect the outside of the RF Shield Room to earth grounds are called SECONDARY grounds. It is the secondary grounding that needs to be controlled. If the secondary ground introduces any current to the RF Shield, indicating the RF Shield is a better ground path than the secondary ground, then the current can set up electrical fields on the surface of the RF Shield which may cause image artifact.

The equipment anchors are generally installed into the grade below the RF Shield Room because the floor thickness within the room does not provide the proper embedment depth. With this in mind the hardware used to anchor the equipment will be either a bolt or a stud. This hardware must penetrate the RF Shield and be in full contact with the shield thereby preventing RF leaks at the point of penetration as specified in **Section 7–9–1 RF Shield Integrity**. In this case, the anchoring hardware may be in direct electrical contact to the anchored equipment. The anchoring device that is set below the RF Shield Room floor must be isolated from ground. If it should come in contact with rebar or wire mesh and this in turn is contacting building steel then a secondary ground has been established and needs to be corrected. The magnet mounting plate is supplied with alternate mounting holes to assist in the avoidance of hidden rebar.

RF Shield Rooms that have the RF shield far enough below the finished floor in the room to allow the anchor to be installed without penetrating the shield have no issues with secondary grounding.

7–9 MAGNET MOUNTING REQUIREMENTS INSIDE RF SHIELDED ROOM (Continued)

The roles and responsibilities of the Customer, RF Shield Room vendor and GE Medical Systems are detailed below.

The Customer is responsible for the following tasks:

- Coordinate equipment anchor methods and anchor location with the contracted RF shield room vendor, structural engineer, and architect to prevent RF leaks and secondary grounding problems.
- Coordinate with the contracted RF shield room vendor, structural engineer, and architect the design of the Magnet Room floor per GE requirements.
- Obtain any and all approvals necessary for the construction of equipment support and seismic anchoring. Provide copy of building inspector's (inspection) report and approval on anchor method to GE Medical Systems local office.

The RF Shield Room vendor is responsible for the following tasks:

- Integration of the magnet mounting plate into the RF Shield Room floor design.
- GE Installation Specialist to assist RF Shield Room vendor by locating magnet isocenter during layout of magnet floor plate.
- Layout and installation of the magnet plate anchors, the plate can be utilized as template. Coordination with Building Contractor/Architect for proper floor preparation to prevent interference with rebar or structural steel that would cause a secondary ground path through the anchor.
- Magnet mounting plate shall be installed, anchored, epoxy cured, integrated to RF Shield, and plate to floor gap filled–in prior to magnet delivery to allow time to address any issues that may arise.
- Participate in the installation of the magnet mounting plate to insure proper integration with RF Shield floor.
- Perform ground impedance test on installed anchors prior to connection to RF Shield floor.
- RF Shield Room Vendor to perform pull test on all anchors and indicate the torque requirement met.
- Final finished height of anchor stud to be flush or below top surface of magnet mounting plate.
- Perform RF integrity test on room after anchors and studs are installed and connected to RF Shield.
- Provide copy of ground impedance and RF room integrity tests to GE Medical Systems local office
- All magnet mounting plate holes have been cleared of any debris and covered with RF tape prior to magnet positioning on mounting plate. Metal filings left in the holes may introduce image artifacts.
- In GEMS–AM pole, the RF vendor is responsible for drilling the Magnet and Table Rail anchor holes.

7–9 MAGNET MOUNTING REQUIREMENTS INSIDE RF SHIELDED ROOM (Continued)

GE Medical Systems is responsible for the following tasks:

- GE Installation Specialist to assist RF Shield Room vendor by locating magnet isocenter during layout of Magnet Room for Magnet anchors.
- GE Service to inspect and verify the magnet mounting plate installation is correct prior to magnet delivery. Carefully inspect the electrical connectivity of the anchor/stud to the RF Shield to make sure anchors are properly installed.
- GE Service to work with riggers to attach magnet per Magnet installation documentation requirements. Process includes magnet leveling, installing magnet feet shims, and tighting magnet feet mounting hardware to meet torque specification.

7–9–1 RF Shield Integrity

The anchor hardware must maintain RF shield integrity. This is accomplished by electrically sealing the stud at the penetration point on the RF shield. The method by which the electrical contact is made must take into account any stretch in the stud resulting from the applied clamping force (tension). RF tape applied over magnet mounting plate holes will minimize the ingress of debris (i.e. metal filings) in the holes which could introduce artifacts into the MR images. The RF room test should result in a specific attenuation at the operating frequency of the system under the following conditions:

1. Blank Penetration Panel installed

2. Electrical connection made between the anchor stud and the RF shield.

7–9–2 Electrical Isolation

The anchor hardware must not provide a secondary ground path for the RF Shield Room. A secondary ground may occur by having the anchor come in contact with steel rebar, wire mesh or structural steel in the floor. Ideally the ground impedance between the anchor and earth ground should be greater than 1000 ohms. This may not be possible due to moisture conditions in the concrete or soil beneath the concrete. Therefore the following requirements for ground isolation shall be observed:

1. A ground isolation test performed on each electrically conductive anchor and stud.
2. If the result is greater than1000 ohms on each stud then record the resulting measurement and give documentation to GE Medical Systems.
3. If the result is less than1000 ohms but greater than100 ohms, contact the power and grounding support personnel at GE Medical Systems and review process and site conditions.
4. If the result is less than100 ohms then it is very likely the anchor has made contact to steel rebar or wire mesh. In this case the steel in the floor will need to be removed or the anchors will need to be relocated. In either case GE Medical Systems must be notified and a retest performed after the corrective action is taken.
5. The test results must be recorded by RF Shield Room Vendor and the information forwarded to GE Medical Systems for the customers record file.

Electrical Isolation Measurement Method

Prior to attaching the primary ground and installing any power outlets, room lights, water supplies, etc. into the RF Shield Room, a ground isolation test is performed between the room's ground plane and earth ground.

- This measurement should be greater than 1000 ohms DC. However, the results of this measurement may appear lower for RF Shield Rooms located below or at grade level. This is caused by a capacitive voltage, setup by the measurement meter's DC voltage, between the RF Shield Room and earth ground.
- For RF Screen Rooms with a resistance reading less than 1000 ohms the following method should be used to determine if the low resistance reading is caused by this capacitive effect.
  - Use an analog meter with a D'Arsonval meter movement to make the measurement.
  - After making the measurement reverse the leads and watch for the measurement to start high and decrease to a lower resistance value. This change in measurement verifies the capacitive effect.
  - In this case the peak measurement is the approximate resistance between the RF Shield Room and earth ground.

7–9–3 Magnet Mounting Plate Anchors Installation Location

Coordination between the RF Shield Room Vendor and Building Contractor/Architect may be necessary to mark the location of the anchors to prevent interference with rebar or structural steel. A re–arrangement of the room layout may be necessary to ensure ground isolation.

7–10 MAGNET ROOM – WALL MOUNTED EQUIPMENT REQUIREMENTS

7–10–1 Emergency Off buttons

Customer supplied emergency off buttons to be located near each room exit including magnet and equipment rooms. These buttons must be clearly labeled, “Emergency Off”. Refer to Section 5, POWER REQUIREMENTS, for emergency off power requirements.

7–10–2 RF DOOR SWITCH

RF shielded room vendor must supply and install RF door switches on all RF shielded doors. These switches must be wired in series and a GE supplied cable (two loose lead conductors) will attach to one door switch. RF switches must be rated for 24 volts at 750 milliamperes maximum and the switches must be in the open position when the doors are open (switch contacts close when the doors are completely closed).

7–10–3 EMERGENCY EXIT

Emergency exiting from the Magnet Room is to be specified by the customer’s architect and contractor. Such measures as an out swinging door, emergency door latch release, easily removed window, or other measures must be designed into the room. Emergency exit instructions must be permanently and prominently mounted near the door and/or window.

SECTION 8 – SHIPPING AND DELIVERY DATA

TABLE OF CONTENTS

8–1 SHIPMENT

Domestic transportation for the MR system, including the magnet, will be via spring–ride moving van. Export transportation for the MR system overseas will be via air shipment in a pressurized cargo hold and magnet via boat. Refer to Table 8–1 for the shipping weights and dimensions of the major MR system components.

8–2 STORAGE REQUIREMENTS

If the system is stored before installation, it must be stored in a warehouse protected from weather. The storage temperature should be between –40° and 158°F(–40° and 70° C) and the relative humidity between 5 and 100 % (non–condensing). Air perature should be between 500 – 1060 Pa.

Magnet: The temperature for the magnet must be between **–40°F and 113°F (–40°C and 45°C)** and humidity up to 90 %. Air perature should be between 500 – 1060 Pa.

8–3 MAGNET CONSIDERATIONS

WARNING!

THE 5 GAUSS LINE WIDENS THE MOMENT THE MAGNET IS LIFTED OUT OF THE CONTAINER BY CRANE.

Consideration must be given to the delivery route of the magnet to ensure that the floor can support the magnet and any rigging equipment required to move it. A structural analysis should be performed by a professional structural engineer.

Special rigging equipment must be considered if the magnet is to be lowered to a different floor level than the receiving location level.

WARNING!

THERE IS A MAGNETIC FIELD PRESENT AROUND THE MAGNET AT TIME OF DELIVERY. CARE MUST BE TAKEN WHEN WORKING AROUND THE MAGNET.

8–4 SHIPPING DATA

TABLE TABLE 8–1
SHIPPING DATA

MR COMPONENT	APPROXIMATE W x D x H inches (mm)	APPROXI-MATE WEIGHT lbs (kg)	METHOD OF SHIPMENT
Magnet, coil, partial Enclosure installed	See Note 1	See Note 1	Domestic: rib cage crate International: enclosed crate with skid
Magnet Accessories (qty 4)	36 x 48 x 36 (914 x 1219 x 914)	150 (68)	skid with box cover
Tx Coil	78 x 78 x 7.8 (2000 x 2000 x 200)	66 (30)	crate
Patient Swing Table	45 x 52 x 110 (1143 x 1321 x 2794)	1575 (716)	crate/skid
Penetration Panel	64 x 22 x 15 (1626 x 559 x 381)	80 **(**36**)**	box
Power Cabinet	24 x 42 x 78 (610 x 1067 x 1981)	1205 **(**548**)**	on cabinet casters, wrapped with plastic
System Cabinet	24 x 33 x 78 (610 x 838 x 1981)	500 (227)	on cabinet casters, wrapped with plastic
Patient Comfort Compressor	20 x 10 x 20 (508 x 254 x 508)	45 (21)	box
SPT Phantom Set	34 x 32.5 x 60 (864 x 826 x 1524)	350 (159)	on cart casters with box cover
Operator Workspace Cabinet	25 x 38 x 34 (635 x 965 x 864)	200 (91)	skid
Operator Workspace LCD Color Monitor	27 x 33 x 27 (686 x 838 x 686)	125 (57)	skid
Operator Workspace equipment	32 x 32 x 23 (813 x 813 x 584)	100 (45)	box
Operator Workspace Table	45 x 54 x 37 (1143 x 1372 x 940)	180 (82)	box
Cooling Unit	45 x 54 x 37 (580 x 760 x 1665)	## (197)	box

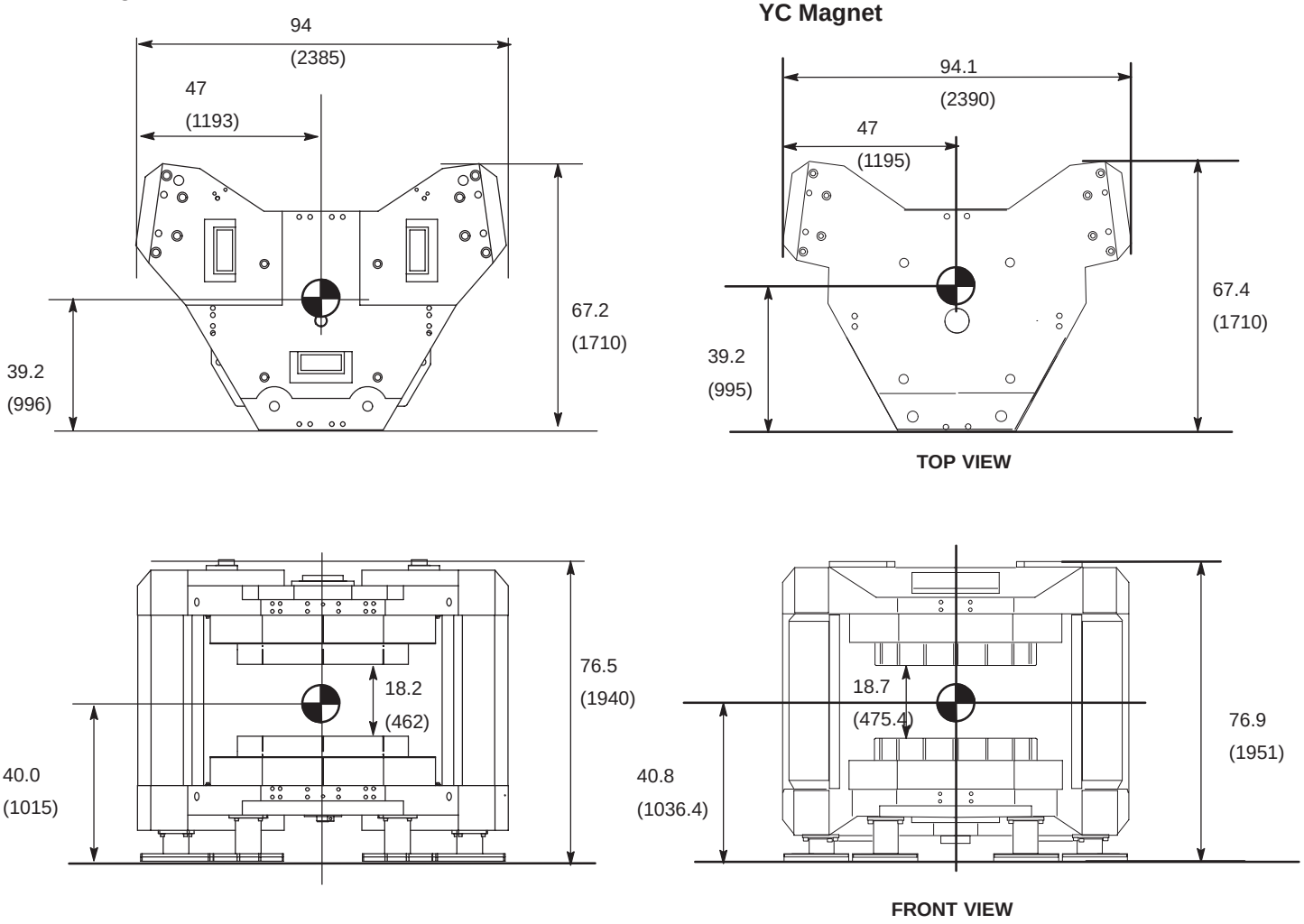
Note 1 Approximate magnet shipping weight (includes packaging material) and weight of magnet with Gradient coil, Enclosure, Electronics Module installed on magnet, lifting beams, crate :

configuration(Outside Japan):
93 x 144 x 107 (3290 x 3020 x 3210) — 64816 lbs (29400 kg)

configuration(Japan Only):
90 x 90 x 97.5 (3796 x 2250 x 3210) — 55100 lbs (25000 kg)

8–4 SHIPPING DATA (Continued)

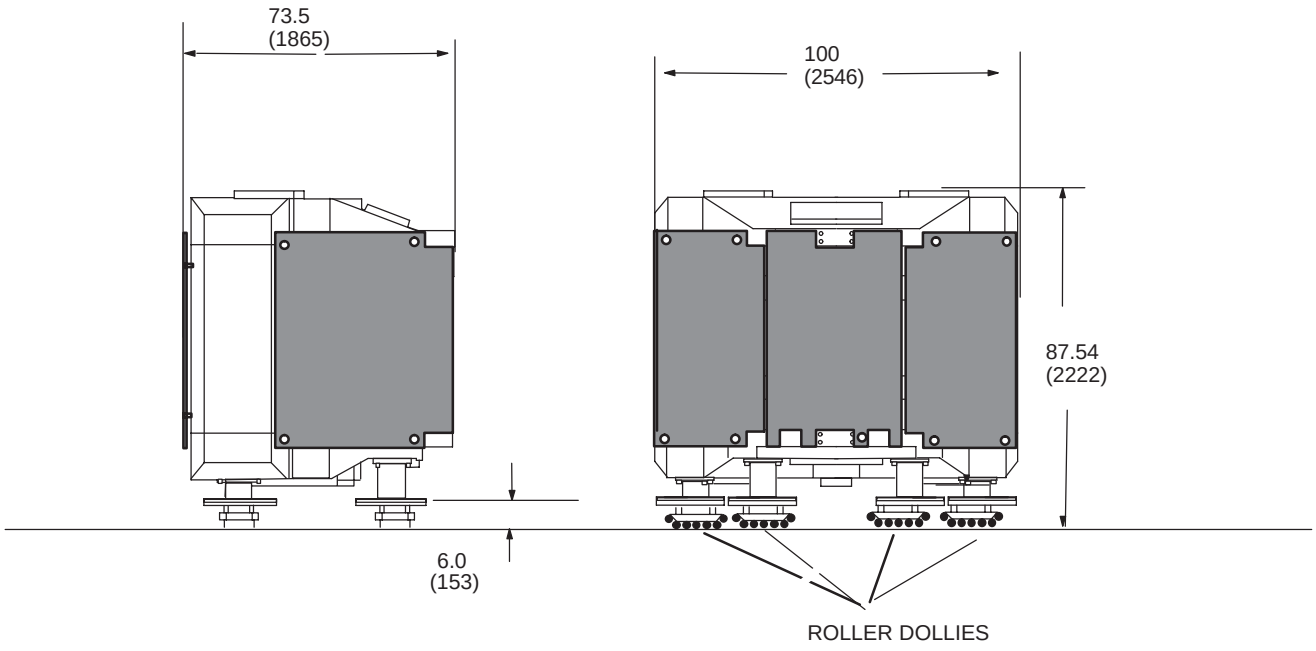
NOTE:
- ALL DIMENSIONS ARE IN INCHES. ALL BRACKETED ( ) DIMENSIONS ARE IN MILLIMETERS.
- APPROX. WEIGHT 19000 kg
- INDICATES Magnet Gravity Center



MAGNET MANEUVERING DIMENSIONS
ILLUSTRATION 8–1

8–4 SHIPPING DATA (Continued)

ALL DIMENSIONS ARE IN INCHES.
ALL BRACKETED ( ) DIMENSIONS
ARE IN MILLIMETERS.

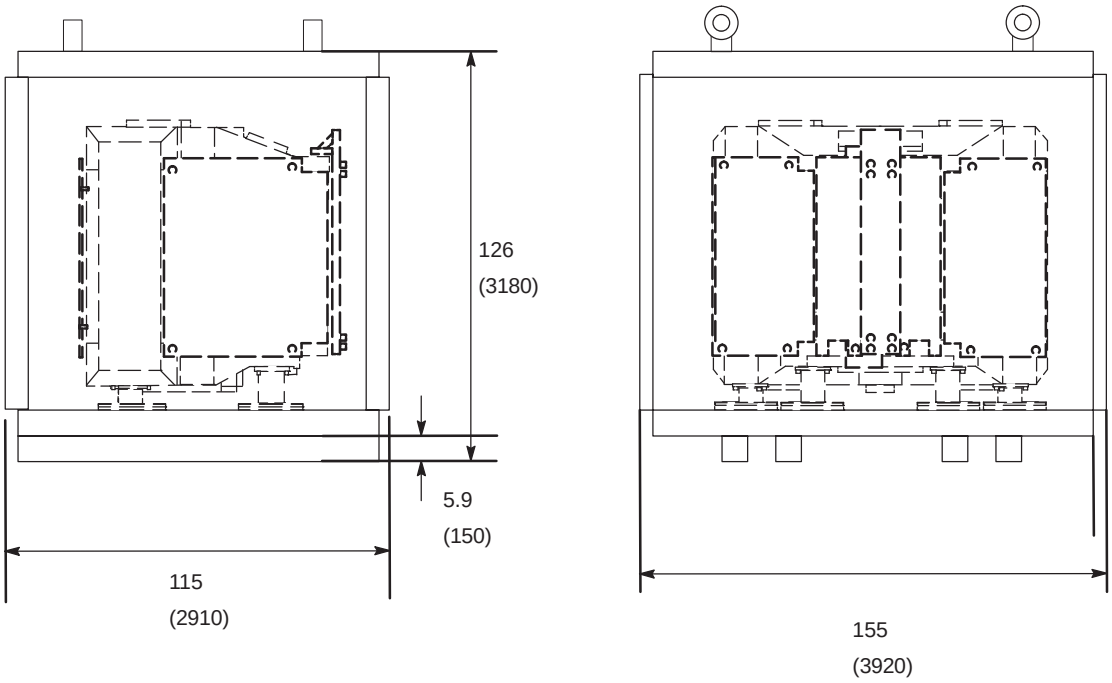


MAGNET WITH ROLLER SKIDS ATTACHED
ILLUSTRATION 8–2

8–4–1 MAGNET SHIPPING DATA (Outside of Japan)

For Outside Japan Only:

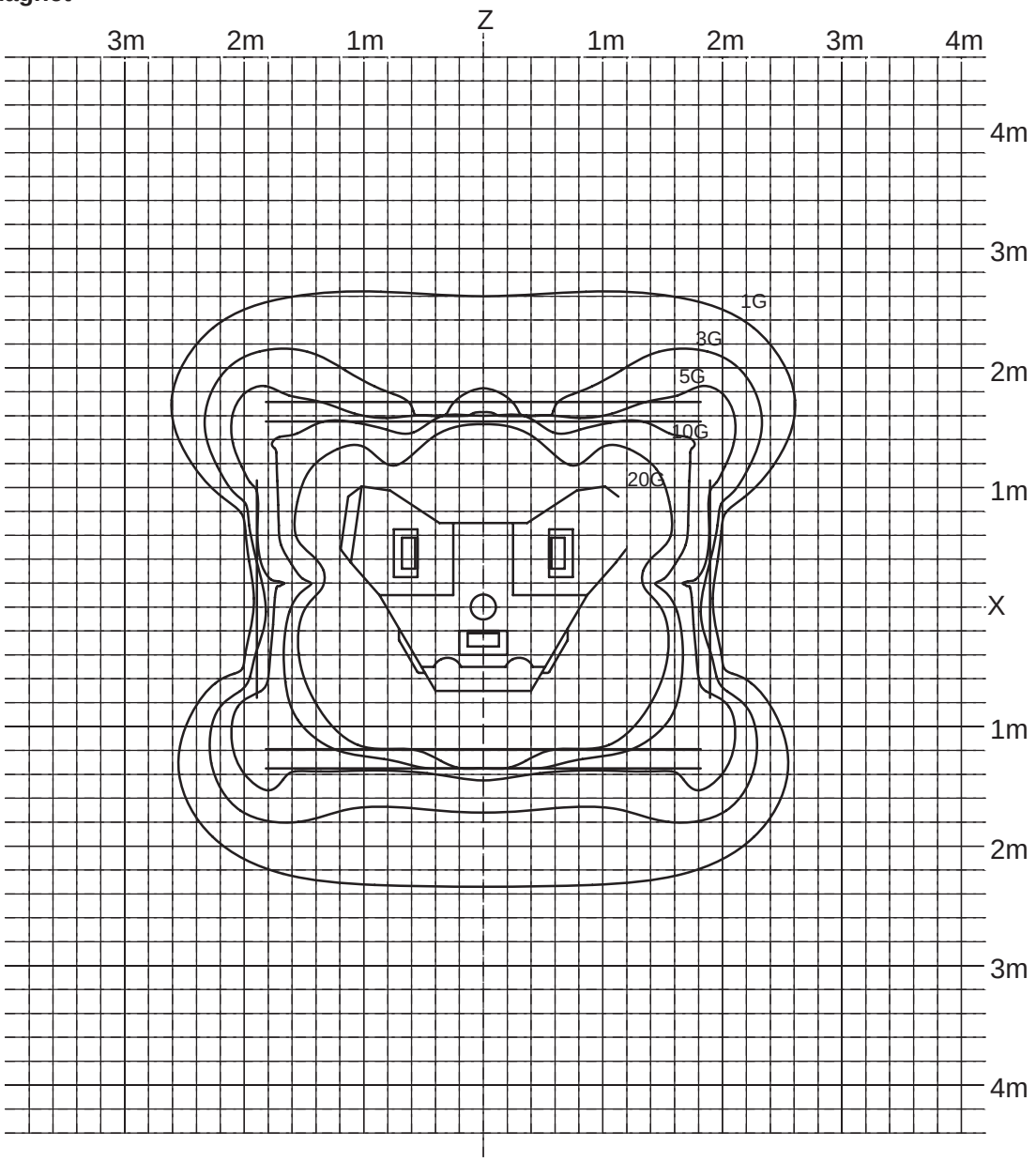
NOTE:
ALL DIMENSIONS ARE IN INCHES.
ALL BRACKETED ( ) DIMENSIONS
ARE IN MILLIMETERS.



MAGNET PACKED BY STEELCRATE
ILLUSTRATION 8–3

8–4–1 MAGNET SHIPPING DATA (Outside of Japan) (continued)

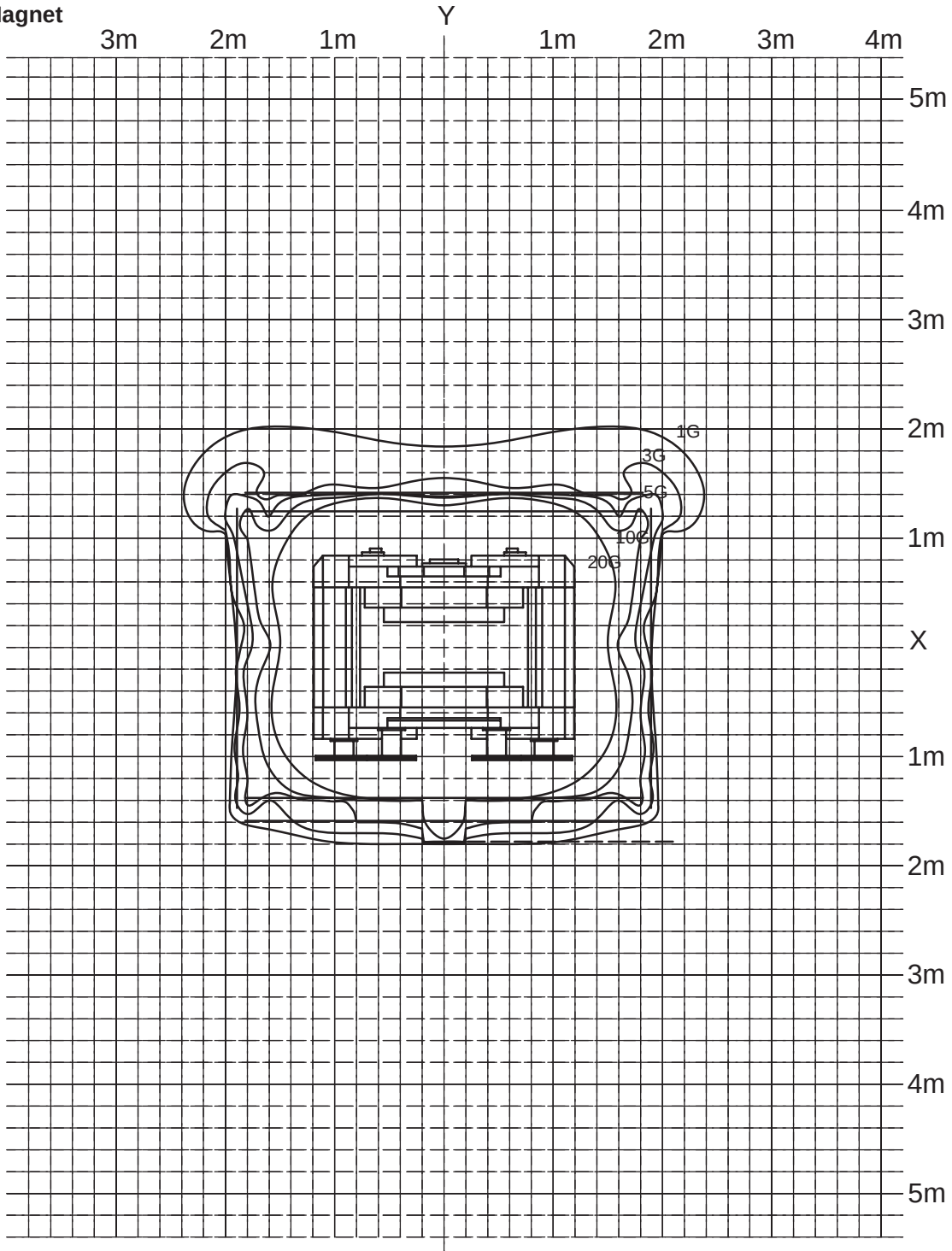
YD Magnet



MAGNET PACKED BY WOODEN CRATE (XZ FIELD)
ILLUSTRATION 8–4

8–4–1 MAGNET SHIPPING DATA (Outside of Japan) (continued)

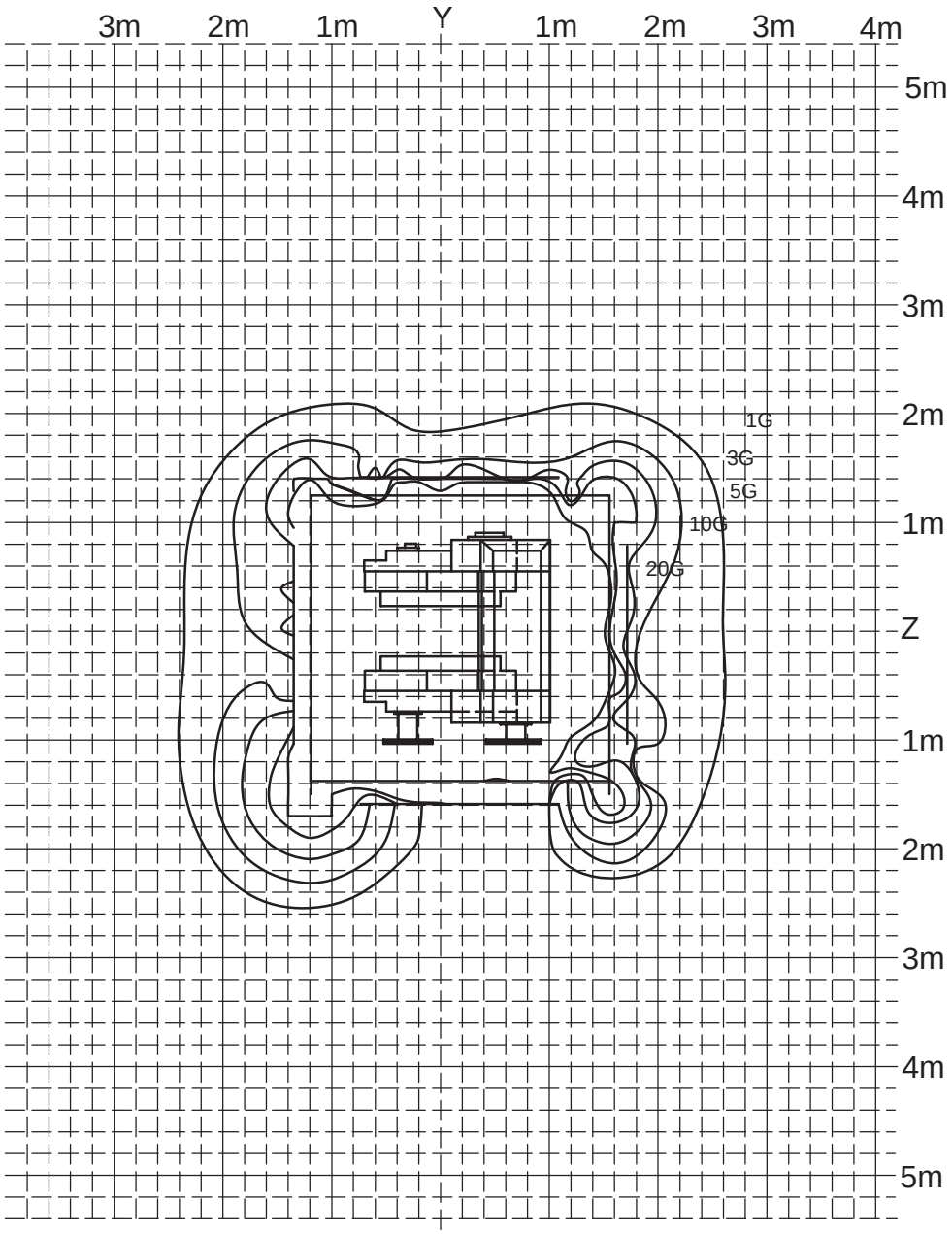
YD Magnet



MAGNET PACKED BY WOODEN CRATE (XY FIELD)
ILLUSTRATION 8–5

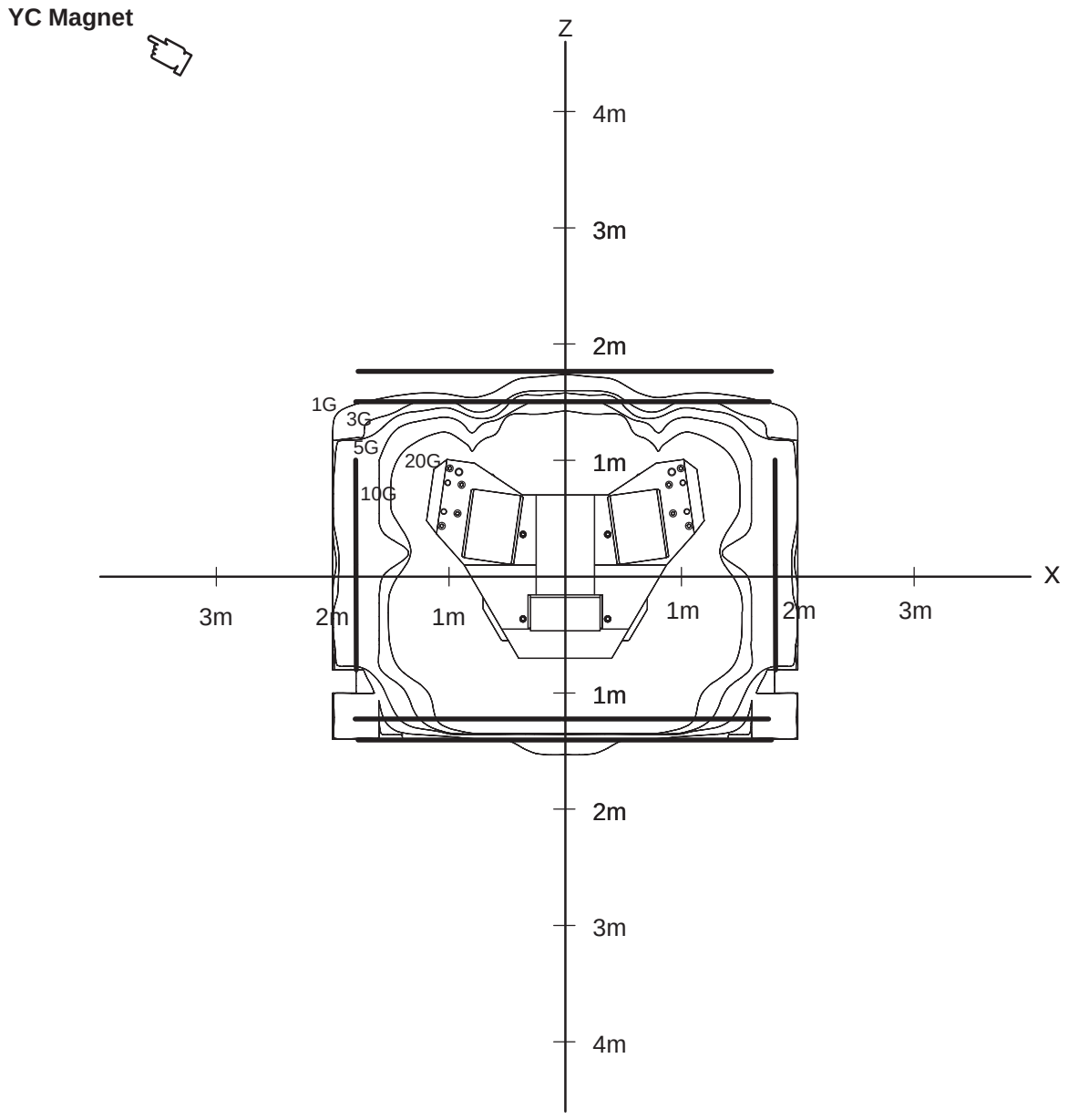
8–4–1 MAGNET SHIPPING DATA (Outside of Japan) (continued)

YD Magnet



MAGNET PACKED BY WOODEN CRATE (YZ FIELD)
ILLUSTRATION 8–6

8–4–1 MAGNET SHIPPING DATA (Outside of Japan) (continued)

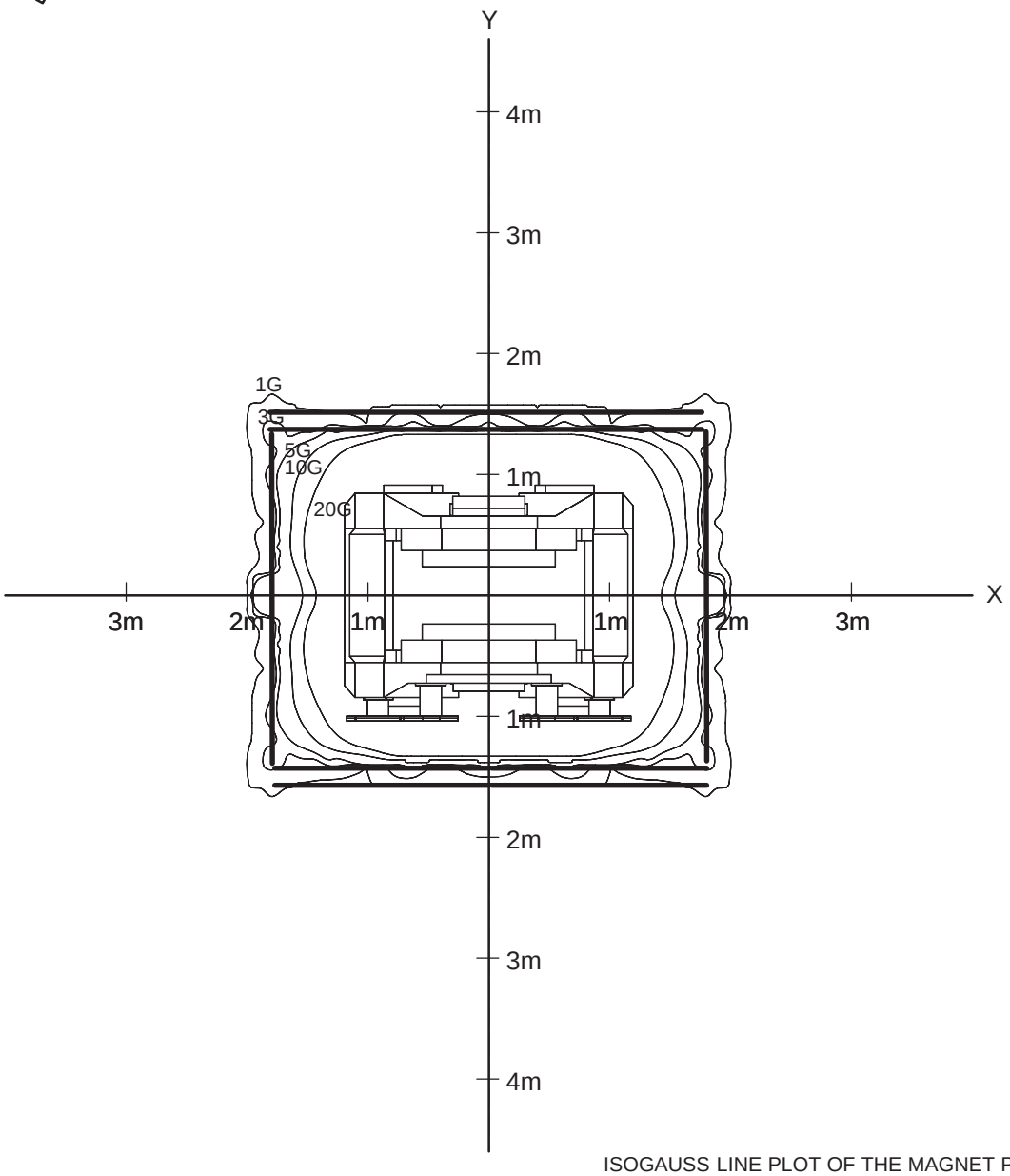


ISOGAUSS LINE PLOT OF THE MAGNET PACKED WITH THE CRATE FOR EXPORT

MAGNET PACKED BY WOODEN CRATE (XZ FIELD)
ILLUSTRATION 8–7

8–4–1 MAGNET SHIPPING DATA (Outside of Japan) (continued)

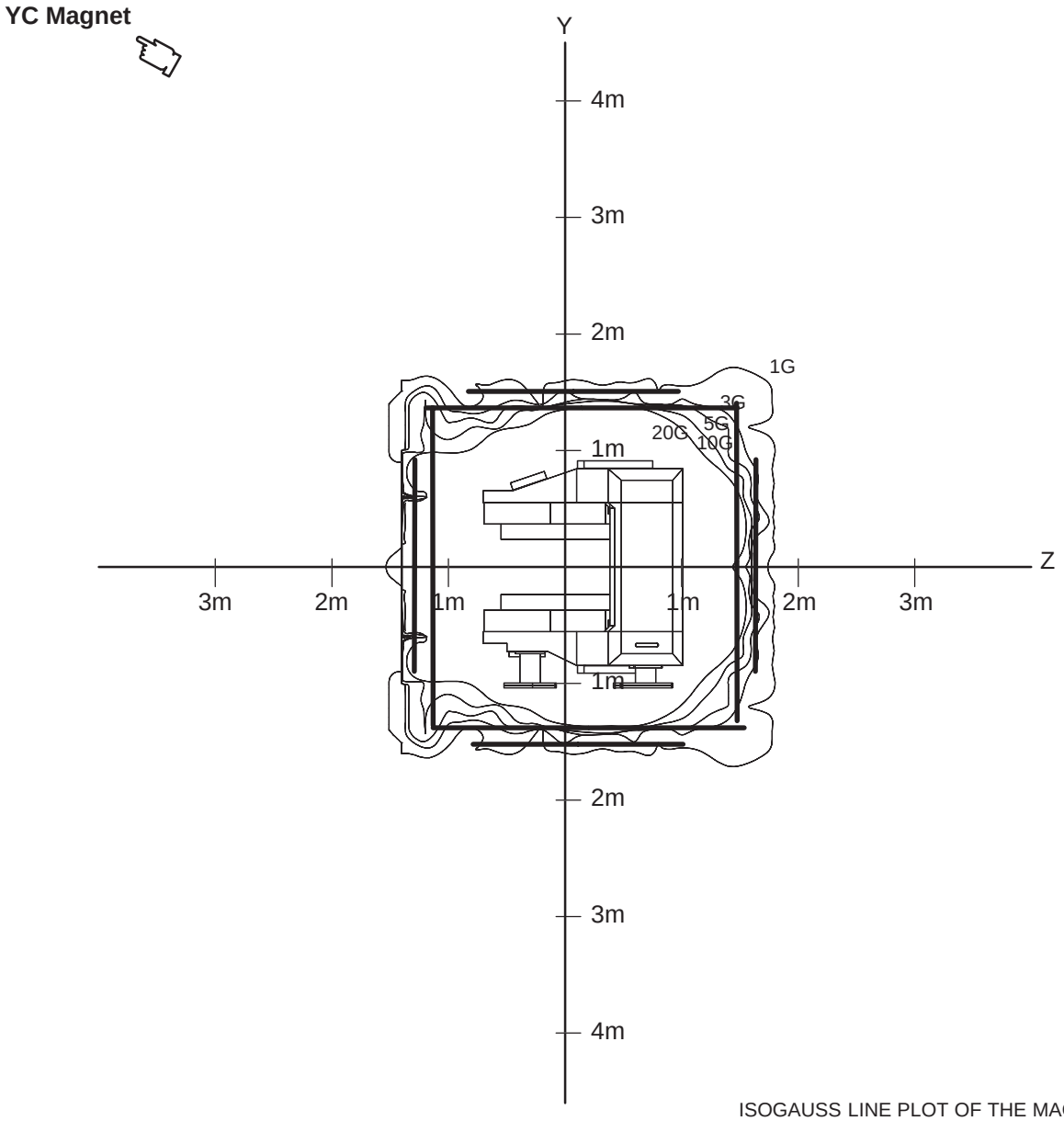
YC Magnet



ISOGAUSS LINE PLOT OF THE MAGNET PACKED WITH THE CRATE FOR EXPORT

MAGNET PACKED BY WOODEN CRATE (XY FIELD)
ILLUSTRATION 8–8

8–4–1 MAGNET SHIPPING DATA (Outside of Japan) (continued)



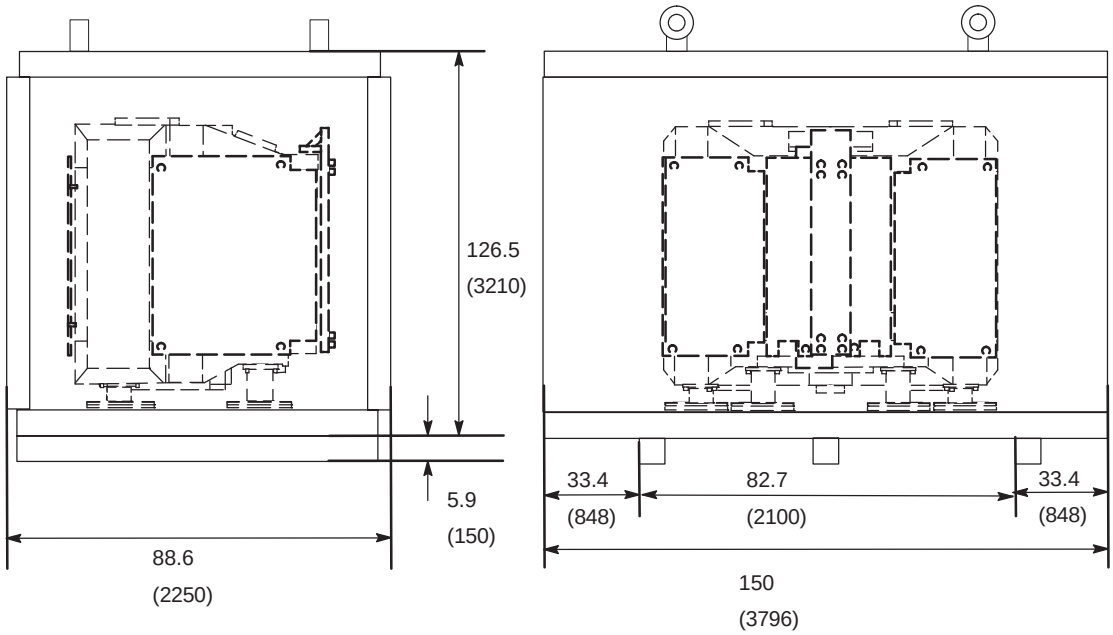
ISOGAUSS LINE PLOT OF THE MAGNET PACKED WITH THE CRATE FOR EXPORT

MAGNET PACKED BY WOODEN CRATE (YZ FIELD)
ILLUSTRATION 8–9

8–4–2 MAGNET SHIPPING DATA (Japan Only)

Japan Only:

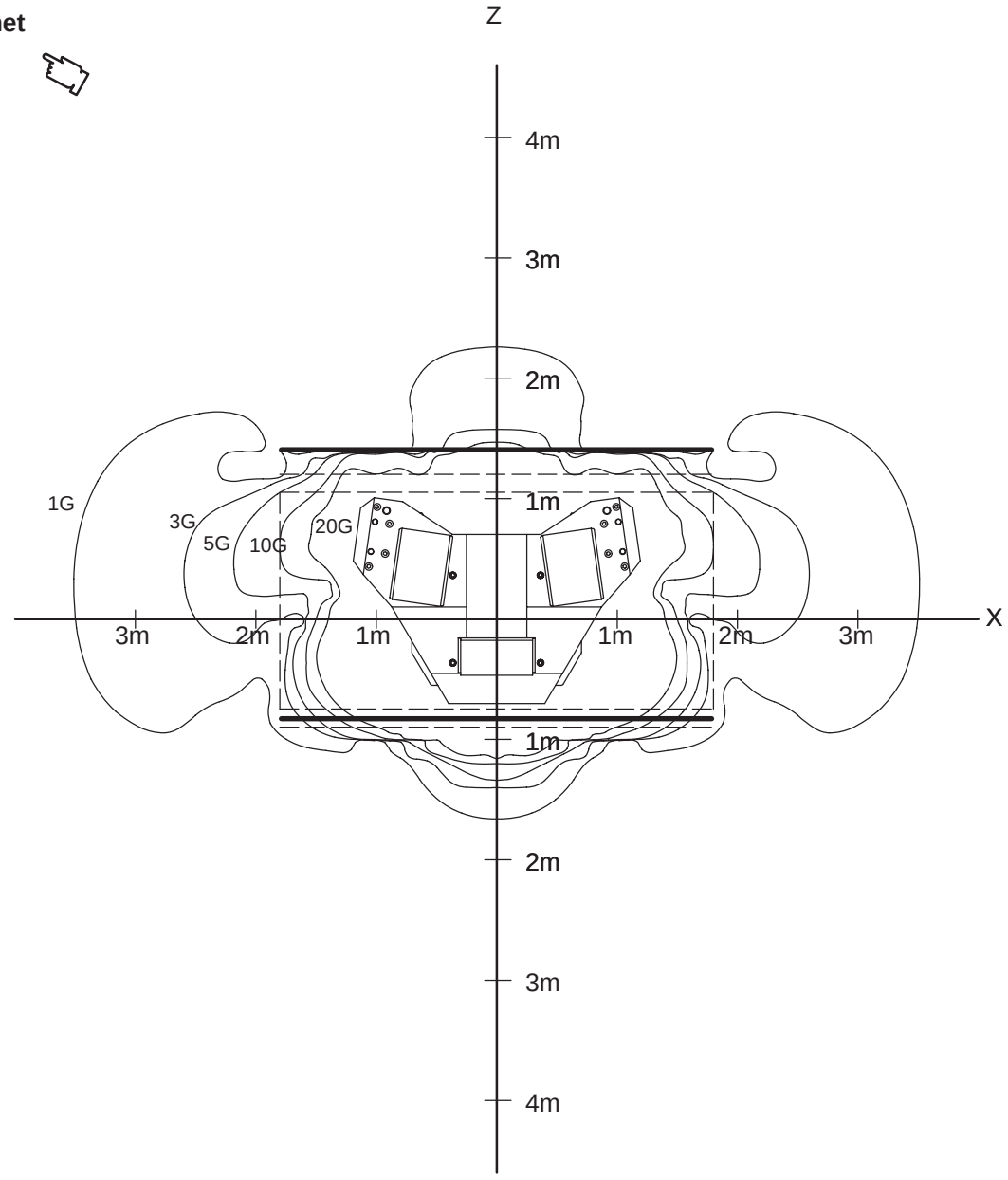
NOTE:
ALL DIMENSIONS ARE IN INCHES.
ALL BRACKETED ( ) DIMENSIONS
ARE IN MILLIMETERS.



MAGNET PACKED BY STEEL CRATE
ILLUSTRATION 8–10

8–4–2 MAGNET SHIPPING DATA (Japan Only) (continued)

YC Magnet

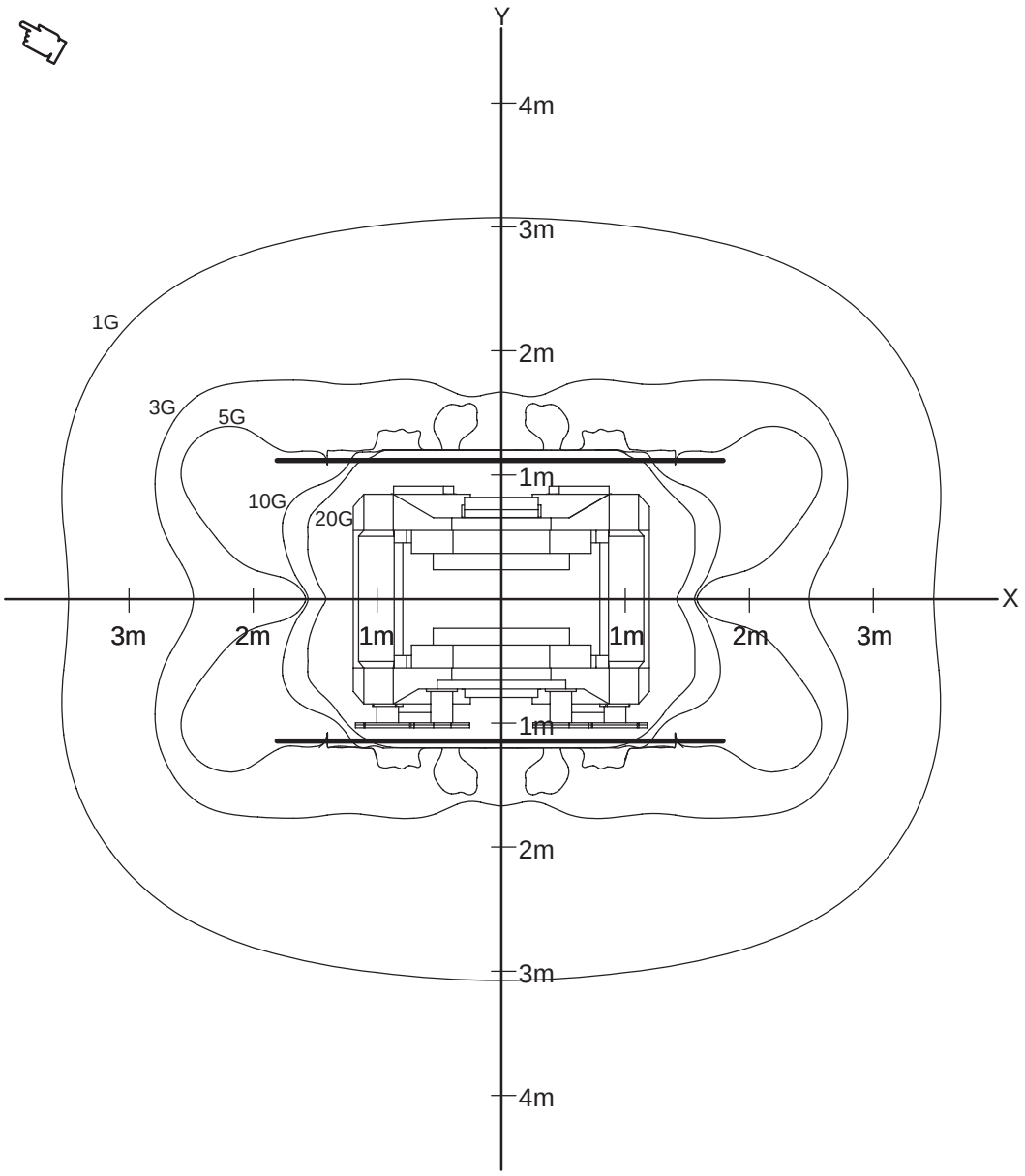


ISOGAUSS LINE PLOT OF THE MAGNET PACKED WITH THE CRATE FOR EXPORT

MAGNET PACKED BY WOODEN CRATE (XZ FIELD)
ILLUSTRATION 8–11

8–4–2 MAGNET SHIPPING DATA (Japan Only) (continued)

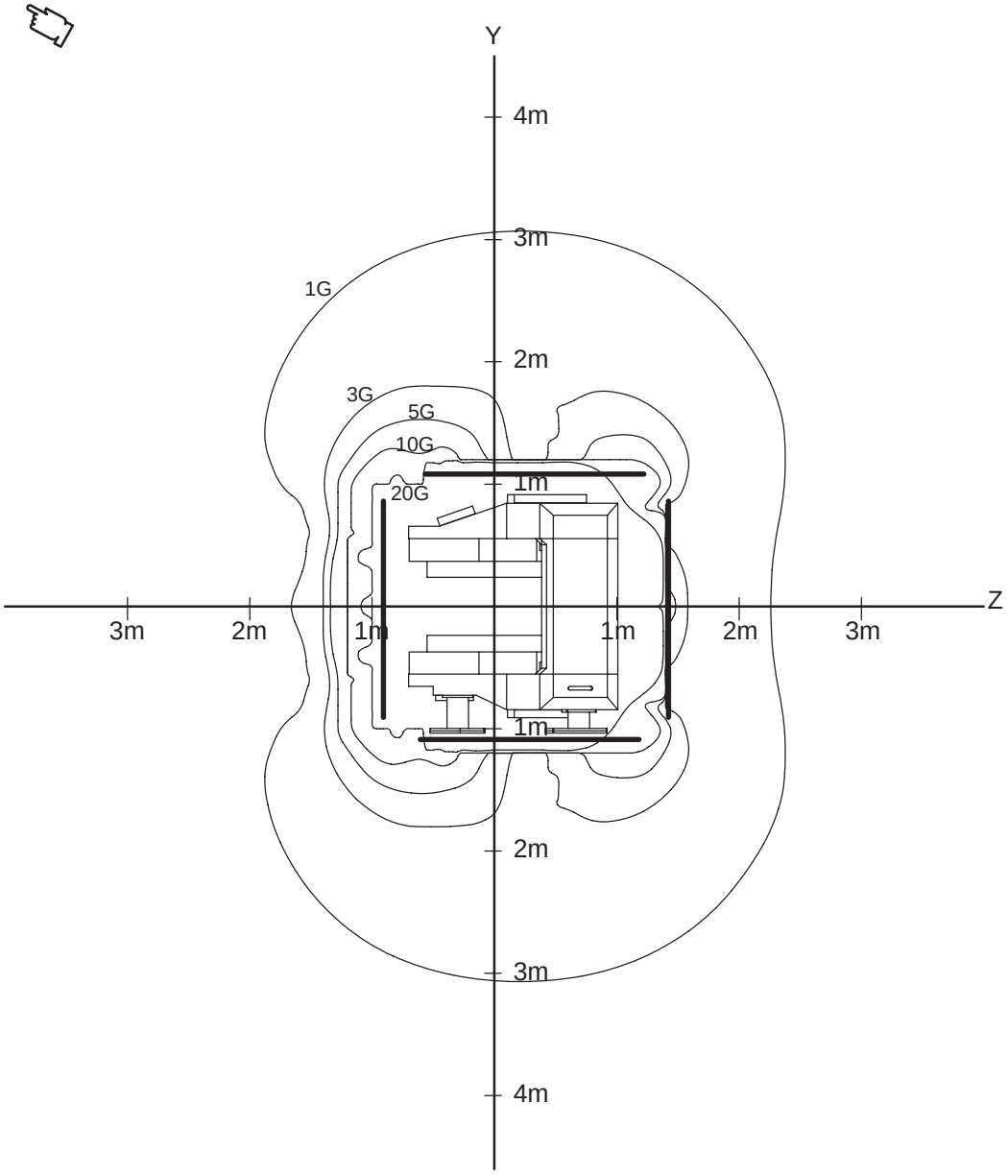
YC Magnet



MAGNET PACKED BY WOODEN CRATE (XY FIELD)
ILLUSTRATION 8–12

8–4–2 MAGNET SHIPPING DATA (Japan Only) (continued)

YC Magnet



MAGNET PACKED BY WOODEN CRATE (YZ FIELD)
ILLUSTRATION 8–13

SECTION 9 – PREINSTALLATION CHECKLIST / TOOLS AND TEST EQUIPMENT

TABLE OF CONTENTS

9–1 INTRODUCTION

"Preinstallation" refers to work necessary to plan and prepare a site for delivery and installation of equipment. Delay, confusion, and waste of manpower can be avoided by completing preinstallation work. It is recommended to have a GE Service Representative make on–site inspections during construction.

All work must be in compliance with national and local safety codes.

9–2 GENERAL PREINSTALLATION REMINDERS

– 1. Have final site construction drawings been installed per architectural drawings?

– 2. Have vehicle parking arrangements been made for installation personnel?

– 3. Is temporary storage space available for use during installation?

– 4. What is hospital smoking policy?

– 5. Are a first aid kit and non–ferrous fire extinguishers available at site?

– 6. Have facility arrangements been made for refuse disposal during installation?

9–3 PREPARATIONS REQUIRED IN ADVANCE OF MAGNET DELIVERY AND MOVING MAGNET INTO MAGNET ROOM

The following items must be completed prior to magnet delivery. A site inspection by GE Service Representative must be completed prior to magnet delivery to ensure site readiness.

– 1. Are all walls and ceiling in magnet room essentially complete except for removable section?

– 2. Has a clear route to the magnet room been defined for magnet installation (refer to Section 2–5, MINIMUM DOOR SIZES), or does the width of the door of the Magnet Room have 1.4m for the magnet to be brought in?

– 3. Is a secure space available to store equipment on site?

– 4. Have arrangements been made for the use of special rigging equipment for moving the magnet into the magnet room?

– 5. Has work in the Magnet Room been completed or suspended and the magnet room closed off to provide a dust–free, closed environment?

– 6. Has construction of the floor shielding in the Magnet Room, including the Floor Shield Plate of 3mm thickness, been done? (Refer to Section 7–4 Floor shielding.)

– 7. Has all equipment been removed from the magnet room to allow space for the magnet with rigging equipment?

– 8. Is the air conditioning in the Magnet Room in operational condition?

– 9. There is a magnetic field around the magnet at all times. Have you moved the equipment that must not be0 influenced by the magnetic field (such as devices using magnetic fields, and patients with pacemakers) out of the delivery route of the magnet ?

– 10. Is there more than 1.4m of width at the opening of the Magnet Room door for magnet delivery?

– 11. Is there a pilot hole in the floor for anchoring the Table and the Magnet? (Refer to Section 7–5 Magnet Anchoring.)

– 12. Notice the basic magnet field safty items to the person who deliver and install the magnet.

9–4 PREPARATIONS REQUIRED IN ADVANCE OF SYSTEM DELIVERY/INSTALLATION

The following items must be completed prior to system delivery. A site inspection by GE Service Representative must be completed prior to system delivery to ensure site readiness.

– 1 Has the floor been vacuum cleaned and free of all debris?

– 2 Have all necessary conduits or raceways for power cables been installed?

– 3 Has delivery route been defined for equipment (refer to Section 2–5, MINIMUM DOOR SIZES)?

– 4 Is system power available for connection to the Main Disconnect Panel?

– 5 Does incoming power have all the specified safety precautions and remote disconnects?

– 6 Is the operator's area complete to provide a dust–free environment for installation of the Operator WorkSpace and Power Cabinet(in case of no equipment room)?

– 7 Is air conditioning available in Equipment Room and Magnet Room? (**see note**)

Note

Magnet must be kept at required range of temperature for Magnet Installation and stabilization of the magnetic field. (See Section4–2 TEMPERATURE AND HUMIDITY SPECIFICATIONS)

– 8 Are functioning telephones, as defined in Section 2–9, ARCHITECTURAL REMINDERS, available at site for duration of installation?

9–5 PREPARATIONS REQUIRED IN ADVANCE OF MAGNET INSTALLATION IN THE MAGNET ROOM

– 1. Has the Magnet Room been completely closed (removable sections closed up and sealed)?

– 2. Has the Magnet Room been tested to ensure that the RF shielding meets requirements in Section 6–1, RF SHIELDED ROOM SPECIFICATION? The customer is to supply a copy of RF shielded room vendor test reports.

– 3. Have all ferrous metal objects been removed from the Magnet Room?

– 4. Have adequate signs (Safety and Exclusion Zones) been posted to warn personnel about dangers of magnetic field?

– 5. Have hospital personnel been informed of magnet safety precautions and procedures?

– 6. Has the SRU been installed?

– 7. Is all contractor construction work completed?

– 8. Has all contractor equipment that could affect shimming been removed from within the 3 gauss zone?

– 9. Have precautions been taken to prevent movement of large metal objects within the 3 gauss zone?

– 10. Have local fire department(s) and police department(s) been informed of unique characteristics (e.g. strong magnetic field, etc.) of magnet and correct precautions to take in event of emergencies?

9–6 TOOLS AND TEST INSTRUMENTS REQUIRED FOR INSTALLATION AND REPLACEMENT

The following list contains the tools and test equipment needed to install and calibrate MR System.

9–6–1 Rigger Supplied Equipment

1. Crane for removing magnet crate from the delivery truck and magnet from the crate.
2. Steel floor plates (8) to cover floors while transporting magnet, 1,000 mm x 300 mm x 6 mm (if required)
3. Wood blocks, assorted sizes
4. Motorized tow vehicle for PUSHING/PULLING magnet when it is on dollies (e.g. an electric fork lift)
5. Jacks and accessories for LIFTING Magnet, 10,000 kg .
6. Lifting straps for LIFTING Magnet, 10,000 kg .

9–6–2 Customer Supplied Equipment

1. Equipment for off loading electronics and other miscellaneous components.

9–6–3 Installation Equipment

1. Ramp for removing cabinets from pallets
2. Wrecking bar and claw hammer, 0.34 kg
3. Magnet moving fixture for lifting and moving magnet
4. Four (4) dual–life ratchet jacks and handles. Five ton (4,536 kg) capacity, 368 mm travel, maximum starting height 38 mm toe, 533 mm head
5. Free standing posts, plastic chain and warning signs for roping off site during installation and service activity
6. Steel shim plates for leveling magnet 28.5 x 32 cm , 1 mm and 2mm thick
7. Fixture for field plotting equipment (SV calibration kit)
8. Aluminum tape and aluminized polyester tape
9. Clear Plastic hose with 3m of length for magnet leveling

9–6–4 Accessories For The Magnet (GE Supplied)

1. Steel Shim Plates
2. Rubber Plate (28.5 x 32cm, 19mm thick, 4 pieces)
3. Tools for Mechanical Shimming
    - Extension stick
    - Handle
    - Hexagonal Wrench
    - Passive Shimming Kit
4. Eyebolt

9–6–5 Test Instruments Required for Installation and Adjustment

1. Dual trace oscilloscope with 100 (MHz) bandwidth and digital storage, Tektronix 2230
2. Battery operated digital multi–meter
3. Clip–on AC power meter, YEW 2433–11 600 V/200 A/200 KW
4. Dummy–load, fixed RF Attenuator, 20 watts, 30 dB (P9329VE)
5. Vector impedance meter, HP Type 4193A
6. Gauss meter, Walker Type MG4D
7. Battery operated insulation resistance meter, YEW Type 3213–24
8. Line analyzer: Dranetz Model 606–3 (3 channel) with the 101 frequency option or Dranetz Model line monitor plug in modules
9. NMR magnetometer–CERN Type (by Sentec or Metrolab) with probe for 0.2T field range
10. ECG simulator: Fogg ECG Kit (46–306797G1)

9–6–6 Tools Required for Installation, Adjustment, and Replacement

Note

- Indicated items are furnished with system as Service Kit

1. Extension cords, with ground conductor
2. Power strip, grounded type, with minimum of five outlets
3. Soldering iron, pencil type with solder and solder sucker
4. Micro clip leads, 14 pin and 16 pin Dip clips
5. Vinyl electrical tape and copper tape
6. Alcohol cleaning solution
7. Plastic or aluminum flashlight and penlight
8. Eddy Current Compensation Tool: Grafidy Kit (2150108)
9. Microguard meter
10. Service Item (2146851)

    SV RF Kit (2145465) consisting of:

    - BNC–BNC coax cable
    - 50 ohm terminator
    - DC cut 50 ohm terminator
    - BNC–N adaptor
    - BNC–BNC adaptor

    Installation Kit (DOM: 2146766, EXPORT: 2146768)

    Screw Kits

    - NM (non–magnetic) screw kit (2147485)
    - MG (magnetic) screw kit (2147486)
    - P (plastic) screw kit (2147487)

    Fuse Kit (2147490)

9–6–7 Tools Required for Installation, Adjustment, and Replacement (Continued)

11. Non–magnetic tools (See Table 8–1 for details)

TABLE 9–1
NON–MAGNETIC TOOL LIST

ITEM	**SIZE**mm
Single End Flare Nut Wrench	10 17 19
Adjustable wrench	50 300
Socket wrench (ISO)	
Hammer	1
Screw Driver	4.5 x 50 6 x 100 8 x 150
Phillips screw driver	1 2 3
Cutting Pliers	150
Diagonal Cutting Pliers	150
Needle nose Pliers	160
Slip Joint Pliers	200
Water Pump Pliers	250
Knife	75 x 175
Hex Key wrench	7 9 12 14 16
Scissors	
Pipe wrench	350

12. Standard Service Engineer Tools
13. SRU Dolly
14. IC Extraction Tool : for 84 pin PLCC
15. CLASS A Manual (2124628)

SECTION 10 – SAFETY CONSIDERATIONS

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10–1 INTRODUCTION

This section contains safety measures that must be conducted when rigging the permanent magnet. This must be checked and conducted before and during rigging with an attendance by person responsible from GE.

10–1–1 PURPOSE

The 3 items below state the purpose of this section.

1. Avoiding injury or damage to a person or an object due to an object becoming attracted to or flying into the magnet.
2. Avoiding magnetic field influence on medical equipment along the route for carrying the magnet.
3. Avoiding danger to people with medical equipment that will be adversely influenced by the magnetic field (such as pacemakers).

10–1–2 MAGNET

1. Magnet Isogauss Line Plot: See Illustrations 3–1 to 3–6 in section 3–6 ISOGAUSS LINE PLOTS.
2. Shape, Measurements, and Weight: See Illustration 2–8 0.35T MAGNET WITHOUT ENCLOSURE in Section 2–11 COMPONENT DIMENSIONS.
3. Magnetic Field Restrictions: See Table 2–1 PROXIMITY LIMITS in Section 2–1 INTRODUCTION**.**

10–2 CAUTIONS WHEN RIGGING THE MAGNET

Because this magnet is a permanent magnet, there will be a magnetic field when rigging the Magnet. This means that ferromagnetic objects (objects that are influenced by the magnet) will be drawn to the magnet. This magnet has a strength of 3500 gauss. The magnet can NOT be turned off. The following measures must be taken when rigging the magnet.

- Use nonmagnetic tools when working around the magnet. (Especially safty shose)
- If nonmagnetic tools (such as a bar) can not be prepared, upmost care must be taken to make sure they do not get drawn to the magnet. There may be a possibility that ferromagnetic tools may beget attracted to the magnet and cause injury.
- Do not take off the plywood boards around the magnet until the magnet is placed in the proper place in the magnet room, all work is completed , and room is free of magnetic objects.

NOTE: In case some ferromagnetic object gets drawn to the magnet, the plywood boards are needed for the following reasons:

- To protect the interior side of the magnet from damage.
- To prevent an inability to remove a ferromagnetic object that is stuck to the interior side of the magnet.
- To protect the magnetic field from being influenced by a ferromagnetic object left in or around the magnet. This will affect the performance of the entire system.

10–2 CAUTIONS WHEN RIGGING THE MAGNET (continued)

- Do not use steel wire to lift the Magnet. You will be unable to remove the steel wire from the Magnet. Use approved non–magnetic lifting straps.

- Use the designated point for jackup (except for special instructions from personnel from GE). See Magnet Derivery and Installation Manual (2283086) Illustration3–1 in Section 3 Magnet Mounting and Movement.

- Workers that fit the following description must not participate.

  people with pacemakers
  people with ferromagnetic objects inside their bodies

- Workers must not participate while carrying any of the following objects.

  magnetic card (such as credit card)
  analog watch
  floppy disk
  pen with ferromagnetic parts (the ferromagnetic part of the pen will go off and fly into the magnet)
  tools made of ferromagnetic materials
  safty shose (including the ferromagnetic protector)

- People who are not involved with rigging the magnet (especially people with pacemakers) must not enter the route for bringing in the magnet.

The magnet already has a magnetic field around it. The magnetic field will move with the magnet when bringing in the magnet. If a person with a pacemaker enters the 5 gauss line, the pacemaker may stop and cause this person's death.

- Fix or take away any metallic objects along the magnet's route.

There may be a possibility that metal objects that on or around the magnet's route may be drawn to the magnet. To prevent this, metallic objects (such as a fire extinguisher) must either be fixed to the floor or taken away temporarily.

- Influence on equipment along the magnet delivery route. (See Illustrations 3–1 to 3–6 in section 3–6.) The magnetic field will move with the magnet. The following problems may occur. (Only the major problems are listed.) See Table 2–1 PROXIMITY LIMITS in Section 2–1 INTRODUCTION**.**

  Equipment within the 1G line:

  Color TV : fading of color
  CT : a decline in picture quality
  X–ray TV : a decline and disorder in picture quality

  Equipment within the 3G line:

  black and white monitor : distortion in picture quality

  Equipment within the 5G line:

  pacemaker : stop

  Equipment within the 10G line:

  Magnetic card/tape : erasing of the data

SAMPLE WARNING SIGN
ILLUSTRATION 10–1

SECTION 11 – MAIN DISCONNECT PANEL

TABLE OF CONTENTS

CAUTION

Troubleshooting and servicing should be performed by qualified electrician.

WARNING!

AC and DC control power is present when the breakers are in the open position. AC power may originate from two separate sources. De-energize both prior to servicing this panel. UPS power is present when breakers are open.

This panel has been wired for use at 480V/60HZ, the panel can be converted for use at 380-400-415V/50HZ by changing the two transformer primary wiring connections from 480V to 400V. Refer to Page 11.

1- THEORY OF OPERATION

This panel incorporates a number of features desirable by MR installations to minimize down time, protect PDU (Power Distribution Unit) electronics, reduce operating costs, and reduce operational delays after a power outage. The panel comes wired for a common feed for the PDU and TCU (Temperature Control Unit). The panel can easily be field re-configured for dual feeds. Dual feeds consist of normal power feed for the PDU and a separate essential power source feed for the TCU.

The PDU branch circuit is controlled by an electrically held contactor, which opens on any loss of power. The TCU power circuits utilize a time-delayed automatic restarting control circuit, which restores power after a power outage. The time delay protects the TCU's sensitive electronic equipment from sags and surges which immediately follow power loss from black outs, storms, utility reclosure operations and out of phase Automatic Transfer Switch operations. The panel has a TCU contactor which is controlled by an autostart DC control circuit. DC battery control circuit protection time is based upon the condition of the battery but is expected to hold for at least 48 hours. The DC Battery has a life of 5 years at which time the battery and charger must be replaced to assure auto-restart capability.

PDU and TCU power Emergency Off disconnection is also provided by this panel. Two remote emergency off pushbuttons included with this panel and the cover-mounted emergency off pushbutton provide immediate shutdown for the entire system. Additional remote emergency off pushbuttons may be ordered from GE Supply 1-800-200-9760, if required for a particular installation. Remote emergency off pushbuttons are listed on page 27 of this manual. Restoration of power after an emergency off operation is accomplished by first pressing the Main Power ON pushbutton on the cover of the panel and subsequently pressing the PDU ON pushbutton.

Circuit breaker CB3 provides power for the TCU as indicated on the attached wiring diagram.

1-1 SPECIFICATIONS

1-1-1 ELECTRICAL SPECIFICATIONS

3 Phase, 3 Wire + Ground

UL 489 & CSA C 22.2

Interrupting Rating 25,000 AIC Symmetrical 50/60 Hertz

IEC 947-2 Interruption Capacity

380-415V, Ue, Icu 15,000 RMS Symmetrical AMPS 50/60 Hertz

380-415V, Ue, Ics 10,000 RMS Symmetrical AMPS 50/60 Hertz

1-1-2 ENVIRONMENTAL SPECIFICATIONS

FOR INDOOR USE ONLY

Temperature 59-86F (15-30C)

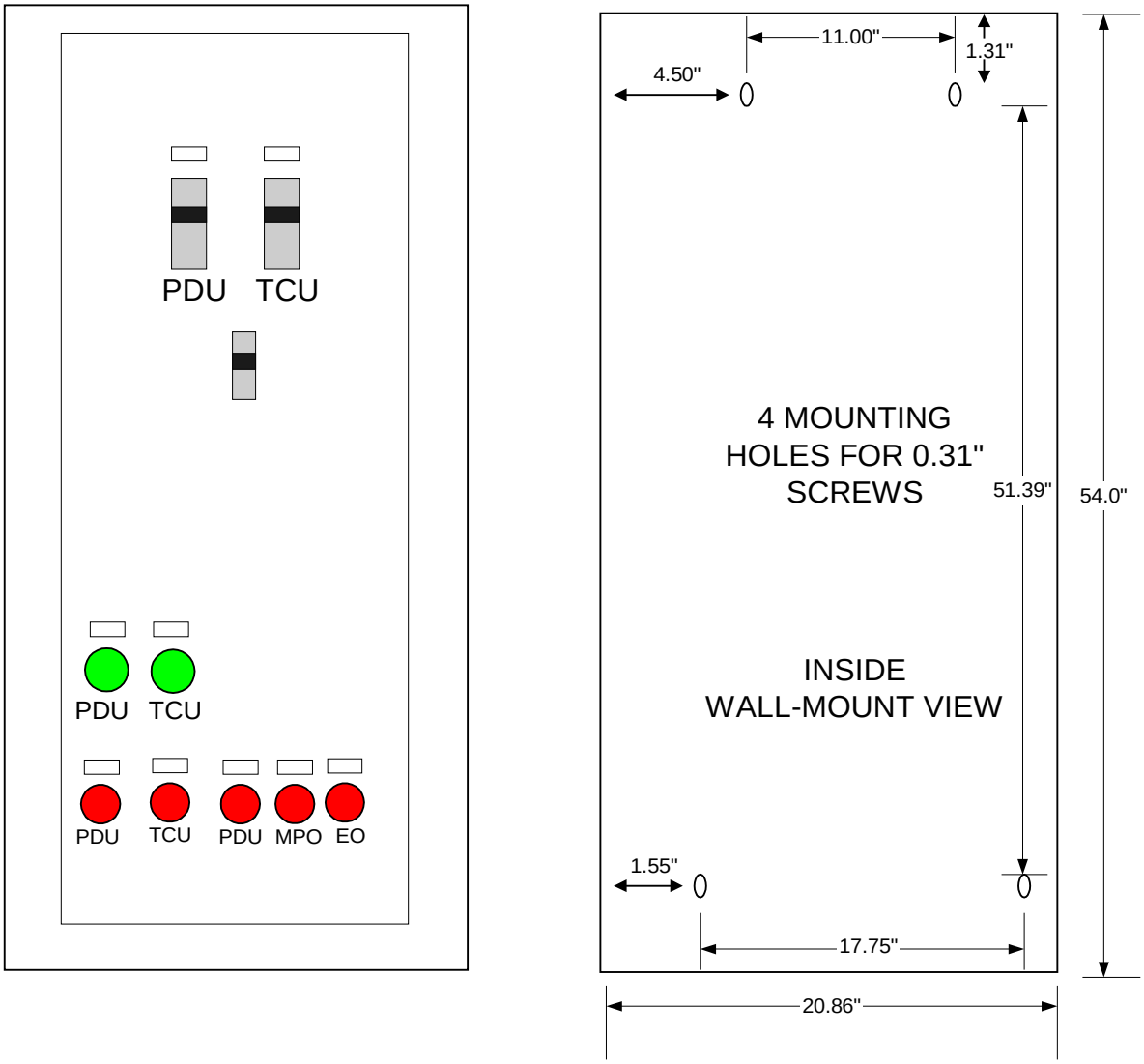
Humidity 30-75% NON CONDENSING

1-2 Panel Dimensions

Refer to Table 1-1 and Illustration 1-1 for the physical dimensions of the panel. The panel may be recessed approximately 6.95 inches (176.5 mm) into the wall for semi-flush installations. See Illustration 1-1 for the front view and mounting pattern of the Main Disconnect Panel.

TABLE 1-1
PANEL EXTERNAL PHYSICAL DIMENSIONS

PARAMETER	DIMENSIONS
Height	54.0 in. 1371.6 mm
Width	20.86 in. 508.0 mm
Depth	8.32 in. 211.33 mm
Weight	230 lbs 104.33 kg
Door Swing Radius	19.75 in. 501.65 mm

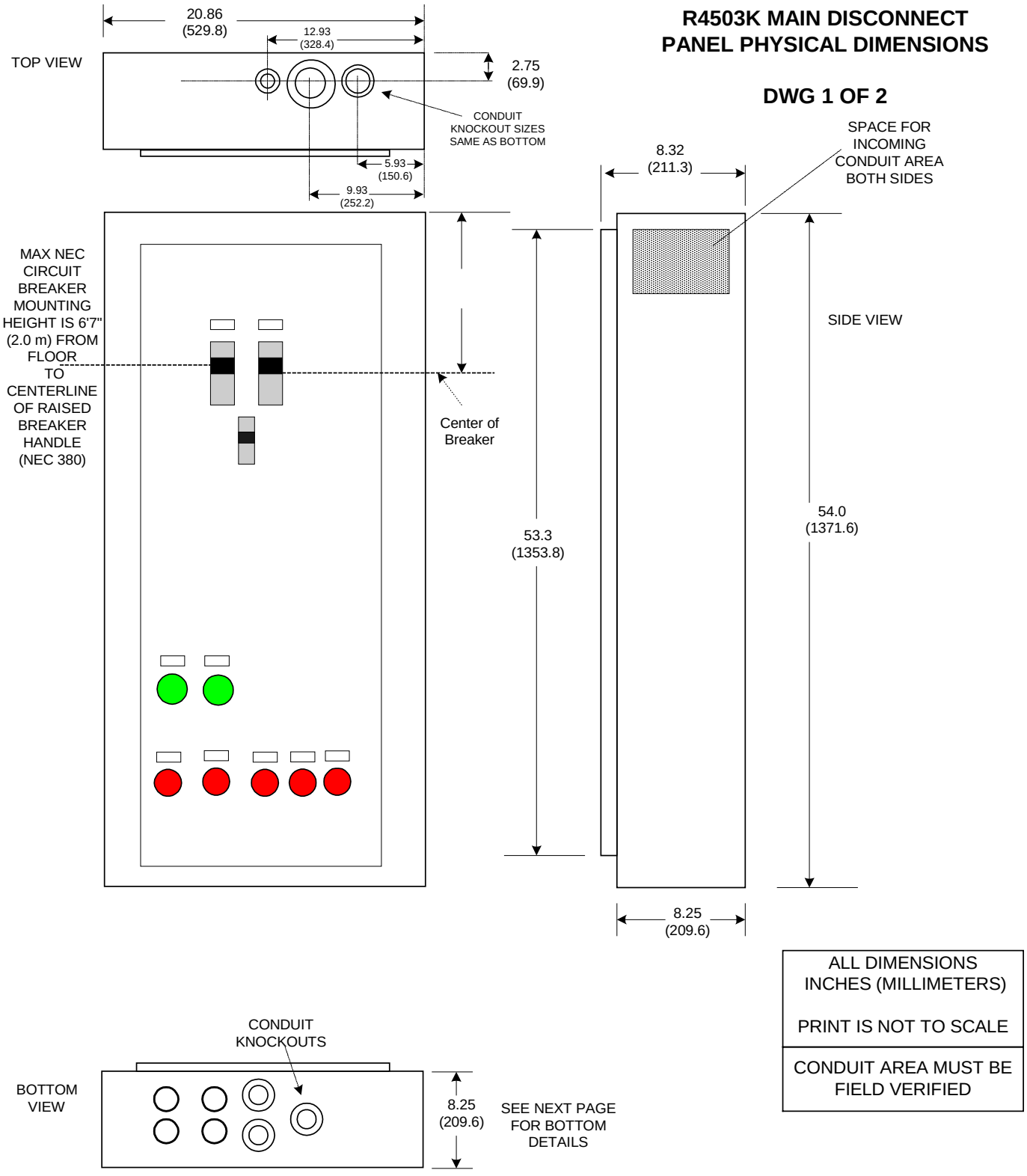


FRONT VIEW **MOUNTING PATTERN**

FRONT AND INTERIOR VIEW OF MAIN DISCONNECT PANEL
ILLUSTRATION 1-1

1-3 PANEL LAYOUT AND FULL PHYSICAL DRAWINGS

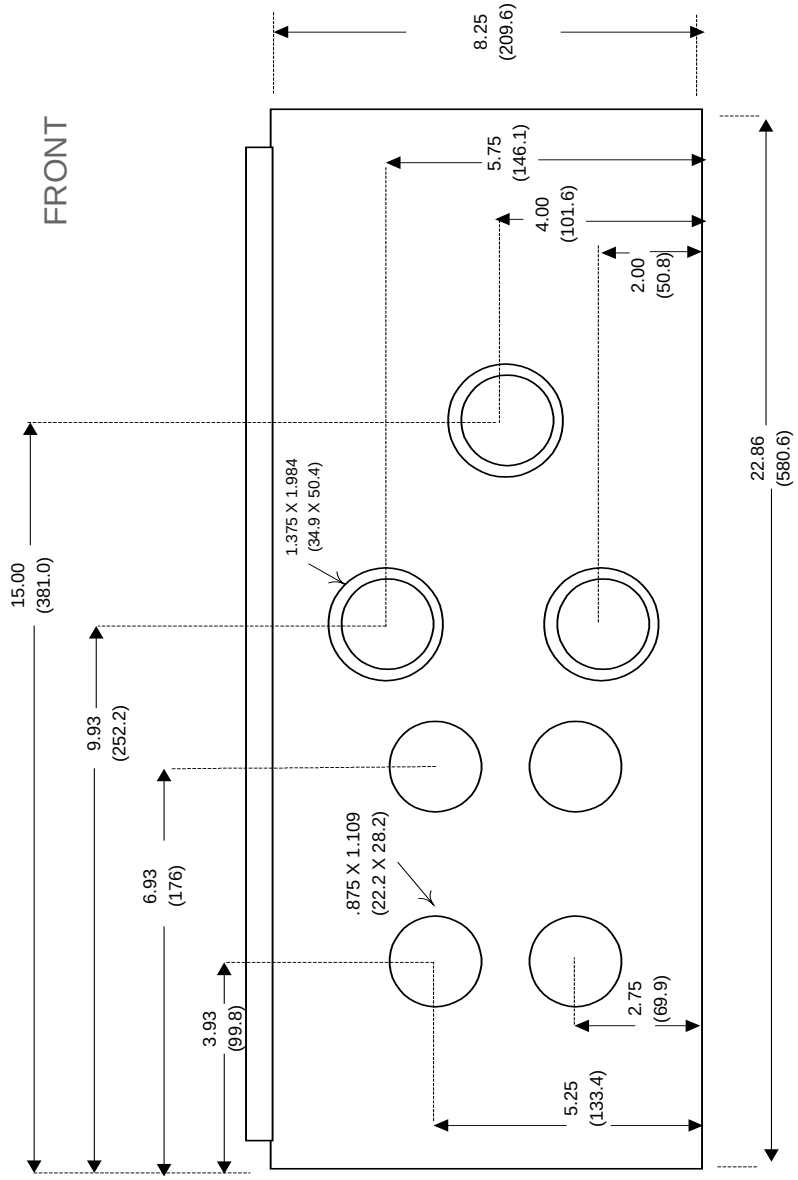
See Illustrations 1-2 and 1-3 for panel layout and full physical drawings including cable access holes and conduit knockout positions.



FULL PHYSICAL DRAWINGS
ILLUSTRATION 1-2

ALL DIMENSIONS ARE INCHES (MILLIMETERS)

DRAWING NOT TO SCALE



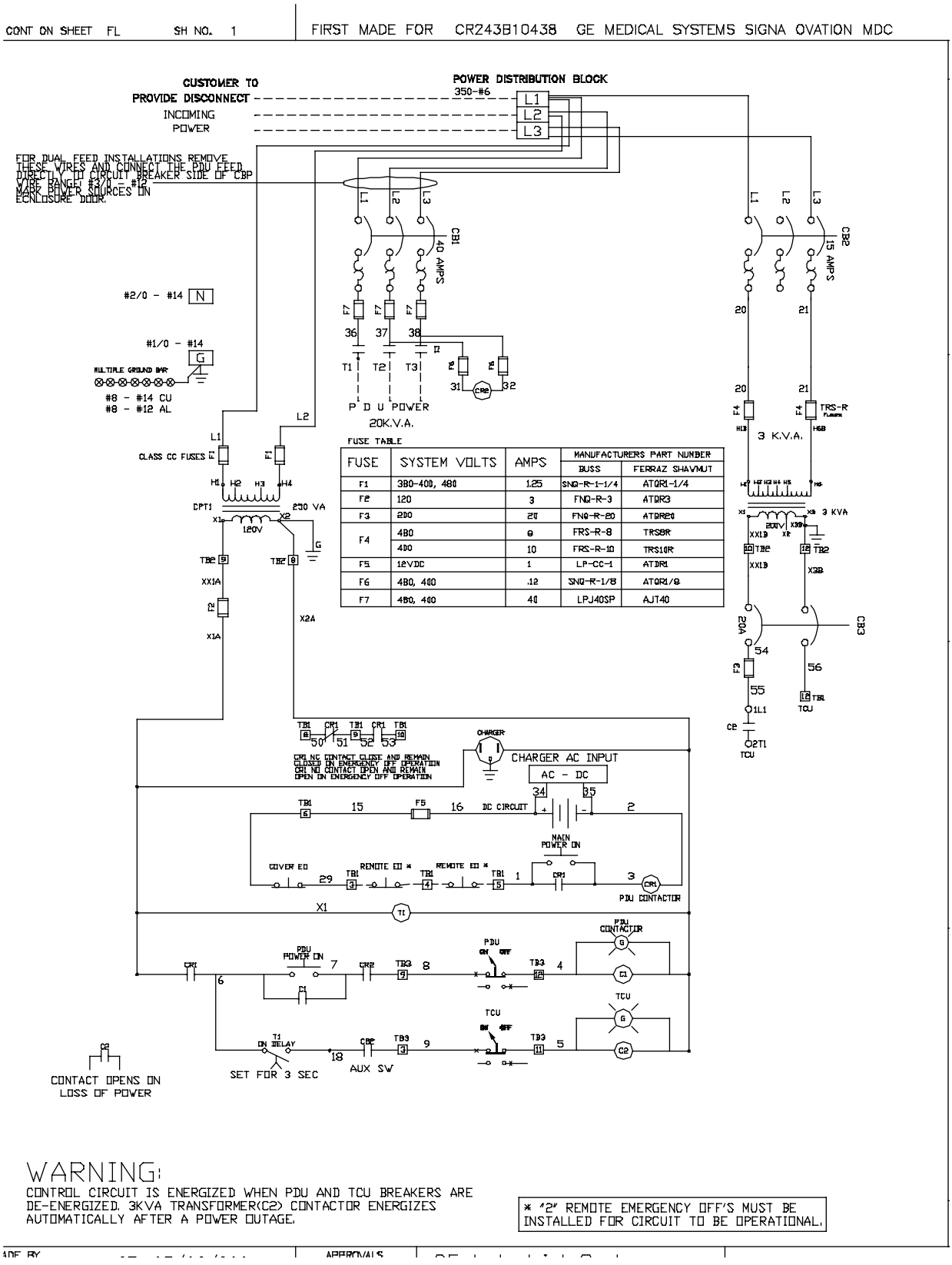
DWG 2 OF 2
BOTTOM VIEW

R4503K MAIN DISCONNECT PANEL
DIMENSIONAL DRAWING

DETAILED BOTTOM VIEW
ILLUSTRATION 1-3

1-4 WIRING DIAGRAM

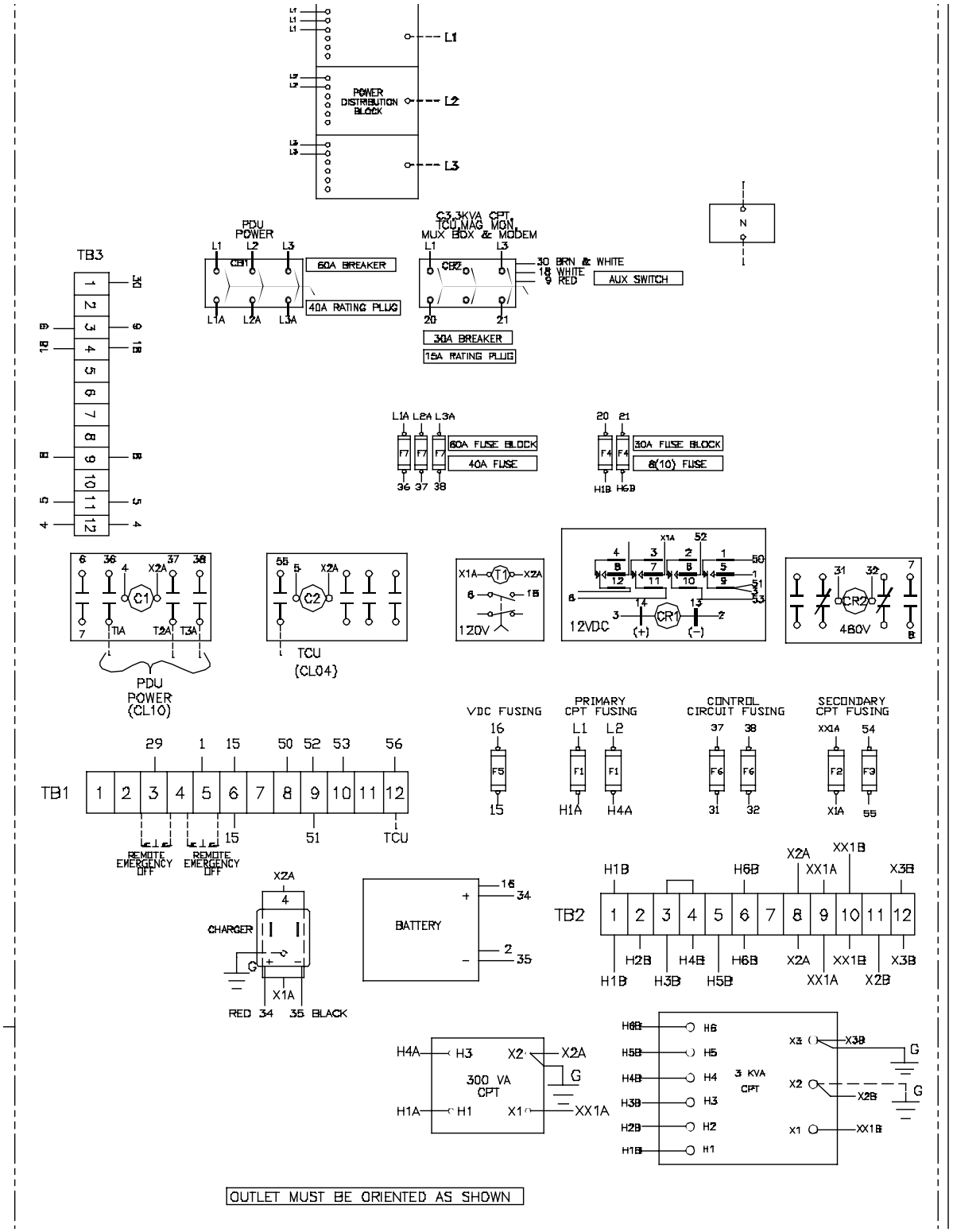
See illustration 1-4 (page 8) for the Main Disconnect Panel wiring diagram.



FUSE	SYSTEM VOLTS	AMPS	MANUFACTURERS PART NUMBER	
			BUSS	FERRAZ SHAWMUT
F1	380-400, 480	1.25	SNQ-R-1-1/4	ATQR1-1/4
F2	120	3	FNQ-R-3	ATDR3
F3	200	20	FNQ-R-20	ATDR20
F4	480	8	FRS-R-8	TRS8R
	400	10	FRS-R-10	TRS10R
F5	12VDC	1	LP-CC-1	ATDR1
F6	480, 400	.12	SNQ-R-1/8	ATQR1/8
F7	480, 400	40	LPJ40SP	AJT40

WARNING:
CONTROL CIRCUIT IS ENERGIZED WHEN PDU AND TCU BREAKERS ARE DE-ENERGIZED. 3KVA TRANSFORMER(C2) CONTACTOR ENERGIZES AUTOMATICALLY AFTER A POWER OUTAGE.

* "2" REMOTE EMERGENCY OFF'S MUST BE INSTALLED FOR CIRCUIT TO BE OPERATIONAL.



R4503K MAIN DISCONNECT PANEL WIRING DIAGRAM
ILLUSTRATION 1-5

1-5 Warning Labels

Warning labels shown in this section are provided with the MDP and are to be affixed to the Signa Ovation system equipment as indicated.

1-5-1 TCU

Two TCU labels are provided with the MDP. Illustration 1-6 shows the TCU warning label which is to be affixed to or near the TCU located on the system Penetration Panel. A TCU label should be affixed in both the Equipment Room and Magnet Room.

WARNING: THIS TEMPERATURE CONTROL UNIT IS FED BY AN AUTOMATIC RESTART CIRCUIT, WHICH ENERGIZES THE SYSTEM TEMPERATURE CONTROL UNIT AUTOMATICALLY AFTER A POWER INTERRUPTION.

TCU WARNING LABEL
ILLUSTRATION 1-6

2 INSTALLATION

2-1 Installation Single Feed

- Incoming power is connected to the main lugs located at the top of the Main Disconnect Panel. The main lug may be rotated 180 degrees to aid connection.
- The PDU is connected directly to the load side of contactor C1- terminals T1A, T2A, T3A.
- TCU connections are made at contactor C2 and circuit breaker CB3.
- Black, plastic, strain relief devices are shipped with the panel and must be installed on the TCU cable.
- Mounting height of the centerline of the top breakers must not exceed 6ft-7in. (2m) above the floor per National Electric Code (NEC # 380-8).
- Complete the label on the cover of the panel indicating the location and circuit of the power source providing power to this panel.
- Two labels are supplied indicating “Warning of automatic restart OF THE TCU” must be installed on the TEMPERATURE CONTROL UNIT. See section 1-5 “Warning Labels”.

The control circuit wiring must be completed by installing the two remote emergency off pushbuttons as shown on the wiring diagrams on the inside of the door. The PDU contactor and TCU contactor will not close unless the remote emergency off pushbuttons are installed or temporarily jumpered.

♦ ***For warranty parts or technical assistance contact GE SUPPLY – Milwaukee, WI (414) 527-6600, CST.***

2-2 Installation Dual Feed

- Re-configuring the panel for a normal feed for the PDU and an essential feed for the TCU 3 KVA transformer is accomplished by removing the cables between main lug terminal block and the PDU breaker, CB1. These wires are identified on the wiring diagram located on page 8 and inside the panel cover.
- The incoming normal power feed is connected directly to the top of CB1, PDU circuit breaker line side lugs.
- The TCU transformer input power and control power transformer, incoming power is terminated on the power distribution terminal block, which also supplies power to the control circuit.
- The primary of the control transformer control circuit must be fed from the same source as the TCU transformer to provide power for emergency shut down and automatic restarting.
- The PDU is connected directly to the load side of the contactor C1- terminals T1A, T2A, T3A.
- TCU connections are made at contactor C2 and circuit breaker CB3.
- Black, plastic, strain relief devices are shipped with the panel and must be installed on the TCU cable.
- Mounting height of the centerline of the top breakers must not exceed 6ft-7in. (2 m) above the floor per National Electric Code (NEC).
- Complete the label on the cover of the panel indicating the location and circuit of each power source providing power to this panel.
- Two labels are supplied indicating “Warning of automatic restart OF THE TCU” must be installed on the TEMPERATURE CONTROL UNIT. See section 1-5 “Warning Labels”.

The control circuit wiring must be completed by installing the two remote emergency off pushbuttons as shown on the wiring diagram on the inside of the door. The PDU and TCU contactors will not close unless the remote emergency off pushbuttons are installed or temporarily jumpered.

2-3 480V TO 400V CONVERSION

THIS PANEL HAS BEEN WIRED FOR USE AT 480V/60HZ, THE PANEL CAN BE CONVERTED FOR USE AT 380-400-415V/50HZ BY CHANGING THE TWO TRANSFORMER PRIMARY WIRING CONNECTIONS FROM 480V TO 400V. MAKE SURE POWER FEED(S) TO THE MDP ARE DISCONNECTED AND LOCKED OFF.

.250KVA Control Transformer CPT1

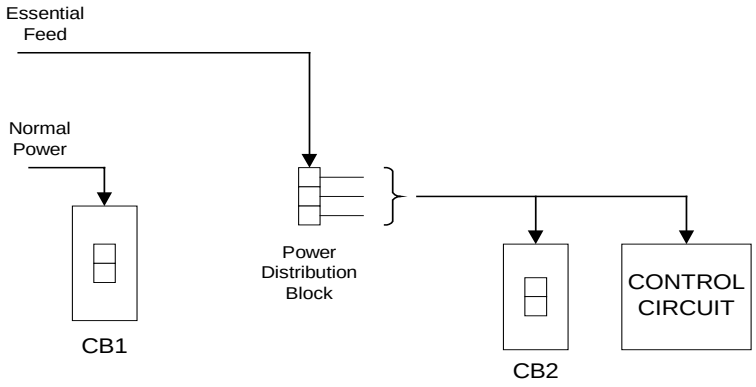
1. Open two pole fuse holder F1.
2. Remove wire originally connected to transformer terminal H4.
3. Connect wire from Step 2 to transformer terminal H3.
4. Close fuse holder F1.

3KVA Transformer

1. Verify that 15 Ampere CB3 is open.
2. Remove two dead front covers for fuse block F4.
3. Remove two TRS8R fuses.
4. At terminal block TB2 remove the wire or metal jumper connecting terminal 3 to terminal 4.
5. Connect a wire jumper between terminals H2 and H4 only.
6. Move wire from the top of terminal block 2, terminal 6, and reconnect to adjacent terminal 5.
7. Replace fuses in terminal block 4 with spare 10A, TRS10R fuses shipped with the panel.
8. Replace the dead front fuse holders.

2-4 DUAL FEED SYSTEM CONFIGURATION

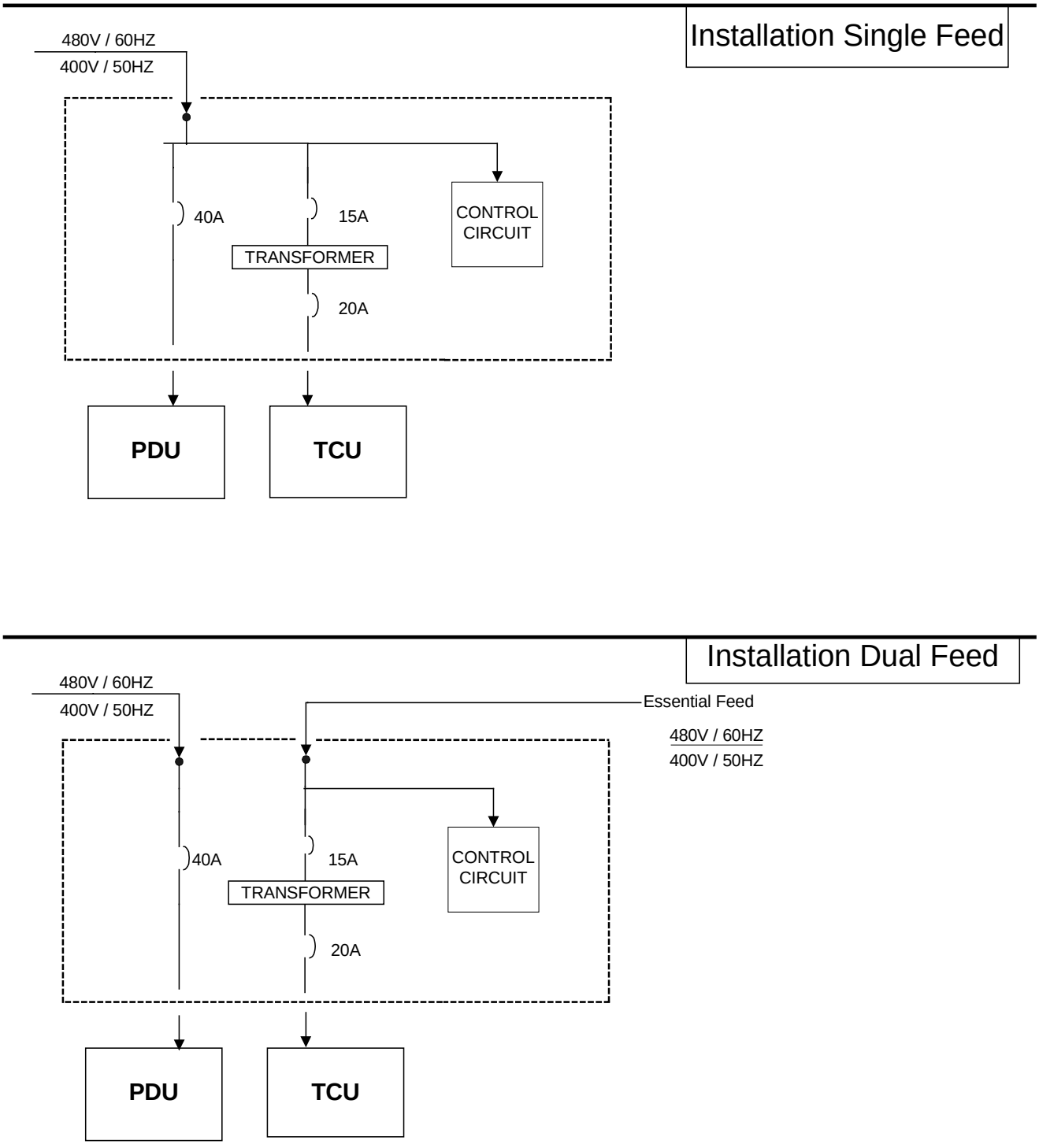
See illustration 2-1 for the Dual Feed System Configuration.



DUAL FEED SYSTEM CONFIGURATION
ILLUSTRATION 2-1

2-5 INCOMING POWER CONFIGURATION

See illustration 2-2 for the incoming power configuration.



INCOMING POWER CONFIGURATION
ILLUSTRATION 2-2

2-6 TESTING SINGLE FEED PANELS

WARNING!

AC AND DC CONTROL POWER IS PRESENT WHEN THE BREAKERS ARE IN THE OPEN POSITION. MAKE SURE NO ONE IS WORKING ON THE EQUIPMENT WHICH THIS PANEL FEEDS PRIOR TO TESTING THE PANEL.

TESTING ACTION	VERIFY
1. Press the main power ON pushbutton and PDU ON pushbutton. Verify the TCU and PDU selector switches are all set to ON.	1. Two green pilot lights should be on indicating proper contactor operation.
2. Press any emergency off pushbutton.	2. All contactors must de-energize and stay de-energized. All two pilot lights must be OFF. Verify that the TCU power is disconnected and the PDU power is disconnected.
3. Press the main power ON pushbutton and PDU ON pushbutton. Verify the PDU selector switches are all set to ON and repeat for all other emergency off pushbuttons.	3. All contactors must de-energize and stay de-energized after an emergency OFF operation. All pilot lights must be OFF when emergency OFF is pressed.
4. Press the main power ON pushbutton and PDU ON pushbutton. Verify the PDU selector switches are all set to ON.	4. All two green pilot lights should be ON indicating proper contactor operation.
5. Press any emergency off pushbutton.	5. All contactors must de-energize and stay de-energized. All two pilot lights must be OFF.
6. Starting with the de-energized state of #5, turn OFF incoming power from the breaker feeding power to this panel.	6. The two lights must be OFF indicating loss of power.
7. With incoming power OFF from step 6, now restore incoming power to panel (switch to ON).	7. Upon restoration of power all contactors must remain OFF. All pilot lights must be OFF. This demonstrates emergency off function remains disabled during a loss of power. No auto restart after any emergency OFF operation.

TESTING ACTION	VERIFY
8. Press the main power ON pushbutton and PDU ON pushbutton. Verify the TCU and PDU selector switches are all set to ON.	8. The two green pilot lights should be ON.
9. Individually rotate each on-off selector switch for the PDU, TCU to OFF then ON.	9. Each green indicating light should turn OFF and the respective contactor should open in OFF. Each green pilot light should turn on and its respective contactor close when turned ON as the selector switch is switched to ON.
10. Press the main power ON pushbutton and PDU ON pushbutton. Verify the TCU and PDU selector switches are all set to ON. Turn OFF incoming power from the breaker feeding power to this panel and restore power to the panel.	10. Both green pilot lights must be ON. PDU and TCU green indicating lights should turn OFF with loss of power. The TCU contactor and TCU green indicating light must turn ON with the restoration of power indicating the proper operation of the automatic restart feature. PDU pilot light turns off on any loss of power and remains off with restoration of power. PDU contactor opens and does not close upon power restoration. PDU does not automatically restart after a power loss. This demonstrates the DC supervisory circuit is operating properly and the TCU auto restart feature is operational.

2-7 TESTING DUAL FEED PANELS

WARNING!

AC AND DC CONTROL POWER IS PRESENT WHEN THE BREAKERS ARE IN THE OPEN POSITION. POWER ORIGINATES FROM TWO SEPARATE SOURCES. DE-ENERGIZE BOTH PRIOR TO SERVICING THIS PANEL. MAKE SURE NO ONE IS WORKING ON THE EQUIPMENT WHICH THIS PANEL FEEDS PRIOR TO TESTING THE PANEL.

TESTING ACTION	VERIFY
1. Press the main power ON pushbutton and PDU ON pushbutton. Rotate the TCU and PDU selector switches to ON.	1. Two green pilot lights should be ON indicating proper contactor operation.
2. Press any emergency off pushbutton.	2. All contactors must de-energize and stay de-energized. All two pilot lights must be OFF.
3. Press the main power ON and PDU ON pushbuttons. Verify TCU and PDU selector switches are all set to ON and repeat for all other emergency off pushbuttons.	3. All contactors must de-energize and stay de-energized. All three pilot lights must be OFF when emergency off is pressed.
4. Press the main power ON pushbutton and PDU ON pushbutton. Verify TCU and PDU selector switches are all set to ON. Individually rotate each on-off selector switch for the PDU and TCU to off then on.	4. Two green pilot lights should be ON indicating proper contactor operation. Each green indicating light should turn OFF and the respective contactor should open in OFF and close when switch is ON.
5. Press any emergency off button.	5. All contactors must de-energize and stay de-energized. All two pilot lights must be OFF.
6. Start with the de-energized state of #5, turn OFF both incoming power feeds from the normal power breaker and the essential power breaker feeding power to this panel.	6. All pilot lights must be OFF indicating system is de-energized.
7. Restore both the normal and essential power feeds to the panel.	7. Upon restoration of power all pilot lights and contactors must remain OFF. This demonstrates auto restart does not work after emergency off operations.

TESTING ACTION	VERIFY
8. Press the main power ON pushbutton and PDU ON pushbutton. Verify the TCU and PDU selector switches are all set to ON.	8. Both pilot lights should be ON.
9. De-energize power to the PDU breaker only from its source breaker.	9. PDU light and contactors C1 will turn OFF as it indicates system's actual state. TCU light will remain ON.
10. Restore power to PDU breaker from source breaker.	10. PDU breaker green pilot remains OFF and contactor C1 remains open. TCU green pilot light should remain ON.
11. Press main power ON push button. Press PDU power on pushbutton.	11. PDU breaker pilot light turns ON. TCU green pilot light should be ON.
12. De-energize TCU essential source breaker feeding this panel.	12. All pilot lights should be OFF and all contactors open as the AC control power is obtained from the essential power feed.
13. Restore TCU essential source breaker feeding power to this panel.	13. PDU pilot light remains off. TCU pilot light turns on with power restoration. Contactor C2 should close.
14. Press the main power ON pushbutton and PDU on pushbutton. Verify the TCU and PDU selector switches are all set to ON.	14. Two green pilot lights should be ON.
15. De-energize both normal PDU source power and essential source power to the panel and restore power to the panel.	15. Both green pilot lights must be ON. The PDU and TCU green pilot lights should turn OFF during the power outage. Upon restoration of power PDU pilot light and PDU contactor remains open. TCU pilot light turns on. Restoration of power must initiate "ON" operation of TCU pilot light and contactor C2 for the TCU. This demonstrates the DC supervisory circuit is operating properly and the TCU auto restart feature is operational.

3-TROUBLESHOOTING

Auto Restart function, PDU, and TCU contactors will not close unless the control circuit emergency off pushbuttons are wired as indicated on the wiring diagram.

Make sure the emergency off pushbuttons are wired through normally closed contacts.

Operation of any emergency off pushbutton should de-energize relay CR1, shutting the entire system down.

Check LED pilot light lamps for burnt out or broken in shipment.

Check to see that battery charger is firmly installed in its receptacle and 12VDC wired to the battery.

NOTES:

FOR WARRANTY PARTS OR TECHNICAL ASSISTANCE CONTACT:
GE SUPPLY – MILWAUKEE, WI. (414)-527-6600 CST

4-MAINTENANCE

4-1 General Maintenance

Note

The auto restart circuit requires the 7 Ah DC battery to be functional. Semi-annually verify that the 12V DC charging circuit is operational.

Battery and Charger Test

1. Unplug battery charger from receptacle.
2. Remove the (+) wire from the charger.
3. Plug in charger and measure DC voltage of charger.
   DC voltage must be between 12 and 13.65 volts. If less than 11 volts, replace charger.
4. With charging circuit de-energized, measure the DC battery voltage. If battery voltage is less than 11 volts replace battery. Whenever a battery is replaced the charger must also be replaced.

Normal operation of DC circuit is from DC charger with battery fully charged in float stage. If battery is suspect or questionable, replace immediately as this is an insignificant maintenance cost. The manufacturer of the battery is B & B Battery and the manufacturer for the charger is EDS, Inc. Contact GE Supply or BatteryStuff.com for battery replacement.

Battery# BP7-12
Charger# 11027

Specific battery maintenance and recharge/discharge information can be found in attached B & B documents and on the B & B web site (below).

Battery life is 5 years at which time it must be replaced. Initial date code on top of battery is read as (mm/dd/y/c). Where c = Q.C. inspector code.

B & B Battery can be located at: www.batterystuff.com

GE Supply
12221 W. Feerick St.
Milwaukee, WI 53222
Phone 414-527-6600
Fax 414-527-6652

GE Supply
National Service Center
9100 Purdue Road Suite 300
Indianapolis, IN 46268
Phone 1-800-243-7313

See illustration 4-1 and 4-2 for battery manufacturer's main data sheet.

Maintenance-Free Rechargeable Sealed Lead-Acid Battery

BP7-12

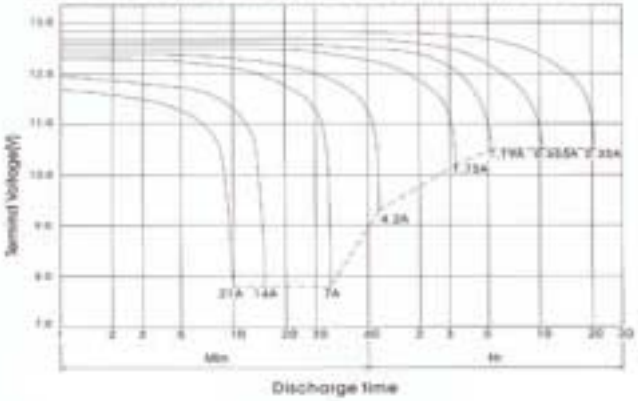
The battery is constructed by plates, separators, safety valves and container. Since the electrolyte is held by a glass-mat separator and plates, the battery can use in any direction and position without leakage.

PERFORMANCE SPECIFICATIONS

Nominal Voltage(V)	12 volts(6cells in series)
Nominal Capacity(AH)	
20 hour rate F.V.(1.75V/cell) (350mA to 10.50volts)	7.0A.H.
10 hour rate F.V.(1.75V/cell) (665mA to 10.50volts)	6.65A.H.
5 hour rate F.V.(1.75V/cell) (1190mA to 10.50volts)	5.95A.H.
1 hour rate F.V.(1.55V/cell) (4200mA to 9.30volts)	4.2A.H.
Approximate Weight	2600g.(5.73lbs.)
Terminal	
Standard	Type T2
Optional	Type T1
Internal Resistance (Fully Charged Battery)	<25mΩ
Maximum Discharge Current For 5 sec.(A)	105A
Maximum Charge Current(A)	2.1A
Ambient Temperature	
Charge	0°C(32°F)~40°C(104°F)
Discharge	-20°C(-4°F)~50°C(122°F)
Storage	-20°C(-4°F)~40°C(104°F)
Vibration test:	
Frequency: 16.7HZ	
Amplitude: 4mm	
Vibrate the battery horizontally or vertically for 60 minutes.The battery have no abnormality.	
Case	ABS
Dimension(mm/inch)	
Length ±1.5mm	151/5.95
Width ±1.5mm	65/2.56
Container Height ±1.5mm	93/3.66
Total Height ±2mm	98/3.86
Application	UPS.Laboratory Equipment,Toy-Cars,Power Packs,Fishing Lights.

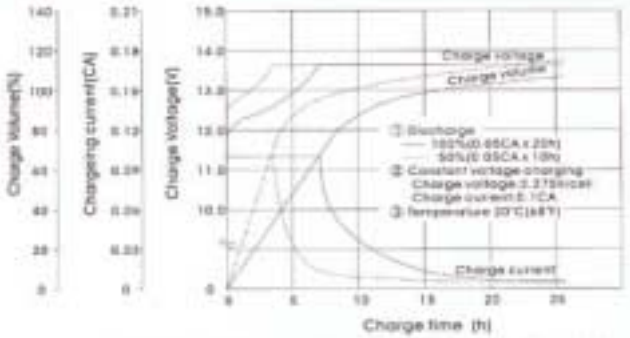
BATTERY MANUFACTURER DATA SHEET
ILLUSTRATION 4-1

BP7-12 Battery discharge characteristics (25°C/77°F)



BATTERY CHARGING CHARACTERISTICS

(Typical example of charge characteristics for the standby use)

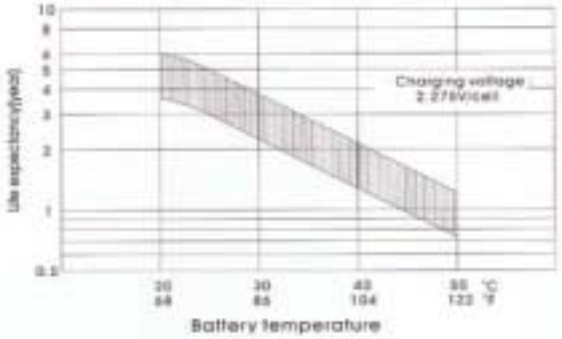


Charging Procedure

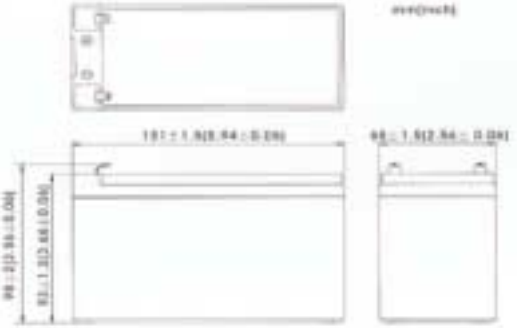
Application	Charging method	Charging voltage at 20°C (V/cell)	Temperature compensation coefficient of charging voltage (mV/°C/cell)	Max. charging current (CA)	Charging time 0.1CA, 20°C (h)		Temp (°C)
					100% discharge	50% discharge	
for standby power source	Constant voltage & Constant current charging (with current restriction)	2.25~2.30	-3.3 (-1.8mV/°C/cell)	0.2	24	20	0~40 (32~104°F)
For cycle service		2.40~2.50	-3 (-2.8mV/°C/cell)	0.3	16	10	

*Temperature compensation of charging voltage is not needed when using the batteries within 5°C to 35°C range.

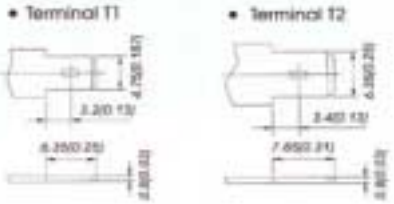
Effect of Temperature on Long Term Float Life



OUTER DIMENSIONS



TERMINAL TYPE mm(inch)



TERMINAL POSITION

B.B. BATTERY CO., LTD.

USA :
B&B BATTERY (USA) INC.
6415 RANDOLPH ST. CITY OF COMMERCE, C.A. 90040 U.S.A.
TEL: 1-323-278-1800
FAX: 1-323-278-1258 , 1-800-278-8599
Web Site: http://www.bb-battery.com

CHINA FACTORY:
CHENG DONG TRIAL AREA,
HUANG GANG, RAOPING
GUANG DONG, CHINA, 515700
TEL: 86-768-7601001-2
FAX: 86-768-7601469
E-mail: bbchina@pub.chaozhou.gd.cn

UK:
B & B BATTERY (UK) CO. LTD.
32 MOOR FIELD
WHALLEY, CLITHEROE
LANCS, ENGLAND BB7 9BA
TEL: 44-(0)1254-824720
FAX: 44-(0)1254-823225

HONG KONG OFFICE:
NATIONAL TRADING LTD.
6D HILTON TOWER,96
GRANVILLE RD,TSIMSHATSUI
EAST,KLN.,HONG KONG.
TEL: 852-2301-3800
FAX: 852-2739-1162
E-mail: bbhk@hkstar.com

JAPAN:
B & B BATTERY(JAPAN) CO. LTD.
1375-11 NARAHARA-MACHI
HACHIOJI, TOKYO 193-0803, JAPAN
TEL: 81-426-256-537
FAX: 81-426-256-537

TAIWAN OFFICE:
B & B BATTERY CO. LTD.
TEL: 886-2-22990887 , 22990850
FAX: 886-2-22989702

MH19884

BATTERY MANUFACTURER DATA SHEET
ILLUSTRATION 4-2

4-2 Battery Manufacturer's Application Notes

BB BP batteries are highly efficient maintenance free electrochemical systems designed to provide years of trouble free electrical energy. The performance and service life of these batteries can be maximized by observing the following guidelines:

1. Heat kills batteries. Avoid placing batteries in close proximity to heat sources of any kind. The longest service life will be attained where the battery temperature does not exceed 20°C. (also see notes 3 & 8 hereunder). When calculating the correct float voltage setting, whether or not temperature compensation is required, full consideration must be given to the temperature of the battery and room ambient. For the purpose of the calculation, consider the temperature of a battery on float to be 1°C. above local ambient. Also, if the battery is used in an enclosure, the temperature gradient of the enclosure itself must be included in the calculation. i.e. The operating temperature of the battery is given by: -Room temperature + enclosure temperature +1°C.

2. Since a battery may generate ignitable gases, do not install close to any equipment that can produce electrical discharges in the form of sparks.

3. When the battery is operated in a confined space, adequate ventilation should be provided.

4. The battery case is manufactured from high impact ABS plastic resin. It should not be placed in an atmosphere of, or in contact with organic solvents or adhesive materials.

5. Correct terminals should be used on battery connecting wires. Soldering is not recommended but if unavoidable please refer to us for further guidance.

6. Avoid operating at temperatures outside the range -15 to +50°C. for float/standby applications and +5 to +35°C. for cyclic use.
7. When there is a possibility of the battery being subjected to heavy vibration or mechanical shock, it should be fastened securely and the use of shock absorbent material is advisable.

8. When connecting the batteries, free air space must be provided between each battery. The recommended minimum space between batteries is 0.02 inches (5mm) to 0.04 inches (10mm). In all installations due consideration must be given to adequate ventilation for the purposes of cooling.

9. When the batteries are to be assembled in series to provide more than 100V, proper handling and safety procedures must be observed to prevent accidental electric shock. (See note #15 below).

10. If 2 or more battery groups are to be used, connected in parallel, they must be connected to the load through lengths of wires, cables or busbars that have the same loop line resistance as each other. This makes sure that each parallel bank of batteries presents the same impedance to the load as any other of the parallel banks thereby ensuring correct equalization of the source to allow for maximum energy transfer to the load.
11. To obtain maximum life, the ripple current flowing in the battery, from any source, should not exceed 0.1C Amps R.M.S.

12. When cleaning the battery case, ALWAYS use a water soaked wet or dampened cloth but NEVER use oils, organic solvents such as petrol, paint thinners etc. DO NOT even use a cloth that is impregnated or has been in contact with any of these or similar substances.

13. Do not attempt to dismantle the battery. If accidental skin/eye contact is made with the electrolyte, wash or bathe the affected area/part straight away with liberal amounts of clean fresh water and seek IMMEDIATE medical attention.

14. DO NOT INCINERATE batteries as they are liable to rupture if placed into a fire. Batteries, that have reached the end of their service life, can be returned to us for safe disposal.

15. Touching electrically conductive parts might result in an electric shock. Be sure to wear rubber gloves before inspection or maintenance work.

16. The use of mixed batteries with different capacities, that may have been subjected to different uses, be of different ages and are of different manufacturers is liable to cause damage to the battery itself and/or the associated equipment. If this is unavoidable please consult us beforehand.

17. To obtain maximum life, batteries should never be stored in a discharged state.

18. In order to obtain maximum working life, when the batteries are used in an UPS system, the following is advised:-
    (a) Where the D.C. input exceeds 60 volts, each battery should be insulated from the battery stand by using suitable polypropylene or polyethylene material.
    (b) In high voltage systems the resistance between battery and stand should always be greater than 1 Megohm. An appropriate alarm circuit could be incorporated to monitor any current flow.

4-3 Battery Manufacturer's Material Safety Data Sheet

B & B Battery (U.S.A.), Inc.

6414 Randolph Street, City of Commerce, CA 90040 (323) 278-1900 Fax (323) 278-1268

MATERIAL SAFETY DATA SHEET

PRODUCT NAME: Sealed Maintenance free Lead Acid Batteries
DATE: 7/1/00
ISSUED BY: ENGINEERING
TELEPHONE NO: (323) 278-1900

HAZARDOUS COMPONENTS

COMPONENTS	%WEIGHT	TLV	LD50 ORAL	LC50 INHALATION	LC50 CONTACT
Lead (Pb, PbO2, PbSo)	About 70%	N/A	(500) mg/Kg	N/A	N/A
Sulfuric Acid	About 20%	1 mg/m3	(2.140) mg/Kg	N/A	N/A
Fiberglass Separator	About 5%	N/A	N/A	N/A	N/A
Styron R 478 (Polystyrene)	About 5%	N/A	N/A	N/A	N/A

PHYSICAL DATA

COMPONENTS	DENSITY	MELTING POINT	SOLLUBILITY (H^2O)	ODOR	APPEARANCE
Lead	11.34	327.4°C (Boiling)	None	None	Silver-Gray Metal
Lead Sulfate	6.2	1070°C (Boiling)	40 mg/l (15°C)	None	White Powder
Lead Dioxide	9.4	290°C (Boiling)	None	None	Brown Powder
Sulfuric Acid	About 1.3	About 114°C (Boiling)	100%	Acidic	Clear Colorless Liquid
Fiberglass Sep.	N/A	N/A	SLIGHT	TOXIC	WHITE FIBROUS GLASS
478 Polyslyrene	N/A	N/A	NONE	NO ODOR	SOLID

FLAMMABILITY DATA

COMPONENTS	FLASHPOINT	EXPLOSIVE LIMITS	COMMENTS
Lead	None	None	
Sulfuric Acid	None	None	
Hydrogen		4% - 74.2%	Sealed batteries can emit hydrogen only if over charged (float voltage> 2.4 VPC)
Fiberglass Sep.	N/A	N/A	Toxic vapors may be released. In case of fire: wear self-contained breathing apparatus.
478 Polyslyrene	None	N/A	Temperatures over 300 °C (572°F) may release combustible gases. In case of fire: wear positive pressure self-contained breathing apparatus.

FIRST AID

SULFURIC ACID PRECAUTIONS

SKIN CONTACT: Flush with water, see physician if contact area is large or if blisters form.
EYE CONTACT: Call physician immediately and flush with water until physician arrives.
Ingestion: Call physician. If patient is conscious, flush mouth with water, have the patient drink milk or sodium bicarbonate solution.

DO NOT GIVE ANYTHING TO AN UNCONSCIOUS PERSON.

B & B MATERIAL SAFTEY DATA SHEET FOR BP7-12 BATTERY
ILLUSTRATION 4-3

REACTIVITY DATA

COMPONENT	Sulfuric Acid
STABILITY	Stable at all temperatures
POLYMERIZATION	Will not polymarize
INCOMPATIBILITY	Reactive metals, strong bases, most organic compounds
DECOMPOSITION PRODUCTS	Sulfuric dioxide, trioxide, hydrogen sulfide, hydrogen
CONDITIONS TO AVOID	Prohibit smoking, sparks, etc. from battery charging area. Avoid mixing acid with other chemicals.

SPILL OR LEAK PROCEDURES

STEPS TO TAKE IN CASE OF LEAKS OR SPILLS

If sulfuric acid is spilled from a battery, neutralize the acid with sodium bicarbonate (baking soda), sodium carbon (soda ash), or calcium oxide (lime).
Flush the area with water discard to the sewage systems. Do not allow unneutralized acid into the sewage system.
WASTE DISPOSAL METHOD:
Neutralized acid may be flushed down the sewer. Spent batteries must be treated as hazardous waste and disposed of according to local state, and federal regulations. A copy of this material safety data must be supplied to any scrap dealer or secondary smelter with battery.

PROTECTION

EXPOSURE	PROTECTION	COMMENTS
SKIN	Rubber gloves, Apron	Protective equipment must be worn if battery is cracked or otherwise damaged.
RESPIRATORY	Respirator (for lead)	A respirator should be worn during reclaim operations if the TLV exceeded.
EYES	Safety goggles, Face Shield	

ELECTRICAL SAFETY

Due to the battery's low internal resistance and high power density. High levels of short circuit can be developed across the battery terminals. Do not rest tools or cables on the battery. Use insulated tools only.
Follow all installation instruction and diagrams when installing or maintaining battery systems.

HEALTH HAZARD DATA

LEAD: The toxic effects of lead are accumulative and slow to appear. It affects the kidneys, reproductive, and central nervous system.
The symptoms of lead overexposure are anemia, vomiting, headache, stomach pain (lead colic), dizziness, loss of appetite, and muscle and joint pain. Exposure to lead from a battery most often occurs during lead reclaim operations through the breathing or ingestion of lead dusts and fumes.
THIS DATA MUST BE PASSED TO ANY SCRAP OR SMELTER WHEN A BATTERY IS RESOLD.

SULFURIC ACID: Sulfuric acid is a strong corrosive. Contact with acid can cause severe burns on the skin and in the eyes. Ingestion of sulfuric acid will cause GI tract burns. Acid can be release if the battery case is damaged or if the vents are tampered with.

FIBERGLASS SEPARATOR: Fibrous glass is an irritant of the upper respiratory tract, skin and eyes. For exposure up to 10F/CC use MSA Comfoll with type H filter. Above 10F/CC up to 50F/CC use Ultra-Twin with type H filter.
This product is not considered carcinogenie by NTP or OSHA.

B & B MATERIAL SAFETY DATA SHEET FOR BP7-12 BATTERY
ILLUSTRATION 4-4

4-4 BATTERY FEATURES

The following is a list of features of the B & B batteries.

SEALED CONSTRUCTION

BB unique construction and sealing technique ensures that no electrolyte leakage should occur from the terminals or case of any BP battery. This feature provides for safe and efficient operation of BP batteries in any orientation. BB BP batteries are classified as “Non-Spillable” and meet all requirements of the International Air Transport Association. (I.A.T.A. Dangerous Goods Regulations).

ELECTROLYTE SUSPENSION SYSTEM

All BB BP batteries utilize an electrolyte suspension system consisting of a glass fiber separator material. This suspension system helps to achieve maximum service life, by fully retaining the electrolyte and preventing its escape from the separator material. No silica gels or other contaminants are used.

GAS GENERATION

BP batteries incorporate a unique BB design that effectively recombines over 99% of the gas generated during normal usage.

MAINTENANCE FREE OPERATION

During the life of BP batteries, there is no need to check their specific gravity or add water etc. In fact, there are no provisions for such maintenance functions to be carried out.

OPERATION IN ANY ORIENTATION

The combination of sealed construction and BB’s electrolyte suspension system permits operation of BP batteries in any orientation without loss of capacity, electrolyte, or service life.

LOW PRESSURE VENTING SYSTEM

BB BO batteries are equipped with a safe, low pressure venting system, which is designed to release excess gas and reseal automatically in the event of the internal gas pressure rising to an unacceptable level. This low pressure venting system, coupled with the significantly high recombination efficiency, make BB BP batteries one of the safest valve regulated lead acid batteries available.

HEAVY DUTY GRIDS

The heavy duty lead calcium alloy grids in BP batteries provide an extra margin of performance and service life in both float and cyclic applications, even in conditions of deep discharge.

CYCLIC SERVICE LIFE

Depending upon the average depth of discharge, over 1,000 discharge/recharge cycles can be expected from BP batteries.

FLOAT SERVICE LIFE

The expected service life of BP batteries used in standby applications is typically 5 years; however, experience has shown that their service life often exceeds 6 years, if the BP batteries are operated strictly within specification.

4-5 General Battery and Charger Specifications

Refer to Tables 4-1 and 4-2 for manufacturer's general specifications for the B & B BP7-12 battery and the EDS 11027 charger.

TABLE 4-1
GENERAL BATTERY SPECIFICATIONS

B&B Model #	Nominal Voltage (V)	Nominal Capacity 20 hr rate (mA)	Discharge Current 20 hr rate (mA)	Dimensions								Approx. Weight		Standard Terminal Type
				Length		Width		Height		H.O.T.				
				in.	mm.	in.	mm.	in.	mm.	in.	mm.	lbs.	kg.	
BP7-12	12	7.0	350	5.95	151	2.56	65	3.7	94	3.86	98	5.7	2.6	T2

GENERAL CHARGER SPECIFICATIONS

TABLE 4-2

EDS Model#	Nom. Voltage (V)	Voltage Range (V)	Nominal Current (A)	Type of Charger
11027	12	13.6- 14.70	0.70	Dual Voltage Auto

Charger Dimensions							
Length		Width		Height		Approx. Weight	
Inches	mm	inches	mm	inches	mm	lbs	kg
3.4	86.4	2.8	71.1	2.3	58.42	1.3	0.59

5 PARTS LIST

5-1 Renewable Parts

See Table 5-1 for renewable parts for the Ovation main disconnect panel.

Table 5-1
LIST FOR RENEWABLE PARTS

Part	Volts	Amps	Manufacturer Part Number	
			Buss	Gould-Shawmut
Fuse F1	380,480	1.25	SNQ-R-1-1/4	ATQR1-1/4
Fuse F2	120	3	FNQ-R-3	ATQR3
Fuse F3	200	20	FNQ-R-20	ATQR20
Fuse F4	480	8	FRS-R-8	TRS8R
	400	10	FRS-R-10	TRS10R
Fuse F5	12VDC	1	LP-CC-1	ATDR1
Fuse F6	480, 400	0.12	SNQ-R-1/8	ATQR1/8
Fuse F7	480,400	40	LPJ40SP	AJT40
Red PB Operator*			CR104PBG00R1	
Contact Block*			CR104PXC01F	
Name Plate*			CR104PXN2RP009 “Emergency Off”	
SS Wall Plate*			CR2940BD201D	
Selector Switch			P9SSMD0V	
Pilot Lamp (Green)			080BA9S6LV	
Battery	12 DC	-	BP7-12	
Battery Charger	12 DC	0.80	11027	
* = Component parts of additional remote emergency OFF pushbutton				

All of the above parts are in stock at GE Supply Milwaukee (414)-527-6600.

5-2 Replacement Parts

See Table 5-2 for replacement parts for the Openspeed System main disconnect panel.

Table 5-2
LIST FOR REPLACEMENT PARTS

Part	Manufacturer Part Number		
Power Distribution Block	4000N51P062		
Neutral Block	4000N51P059		
CB1	SEHA36AT0060		
40 AMP Plug	SRPE60A40		
CB2	SEHA36AT0030		
15 AMP Plug	SRPE30A15		
CB3	V07220		
F1 and F6 Fuse Blocks	3007N36P002		
F2 and F3 Fuse Blocks	3007N36P001		
F5 Fuse Block	3007N38P001		
F4 Fuse Block	3007N39P009		
F4 Dead Front Cover	3007N39P010		
F7 Fuse Block	3007N39P006		
F7 Dead Front Cover	3007N39P007		
C1	CL10A311MJS		
C2	CL04A310MJ		
CPT1	9T58E0506		
3KVA Transformer	5000N53P001		
CR1	4001N42P001		
CR2	RL4RA022TU		
T1	RL4RA040TJ	BTLF30C	
Charger-Recepticle, Box, and Cover	3009N13P003	3009N14P001	3009N14P004
Main Power and PDU Power “ON” PB’s	P9SPNVG		
PDU “ON-OFF” Selector Switches	P9SSMD0V		
PDU Light Operators and Power Supply MOD’s	P9SLVD	P9PTNVJLV	