GE Medical Systems

Technical Publications

Direction 5196540
Rev 3

Signa® Profile HD

Pre-Installation

Operating Documentation

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The above paragraph is in regard to equipment requiring installation only, and does not apply to supply items. The F.O.B point for these items is as shown in the Price Book.

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WARNING

- 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.
- DO NOT ATTEMPT TO SERVICE THE EQUIPMENT UNLESS THIS SERVICE MANUAL HAS BEEN CONSULTED AND IS UNDERSTOOD.
- FAILURE TO HEED THIS WARNING MAY RESULT IN INJURY TO THE SERVICE PROVIDER, OPERATOR OR PATIENT FROM ELECTRIC SHOCK, MECHANICAL OR OTHER HAZARDS.

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- CE MANUEL DE MAINTENANCE N'EST DISPONIBLE QU'EN ANGLAIS.
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- LE NON-RESPECT DE CET AVERTISSEMENT PEUT ENTRAÎNER CHEZ LE TECHNICIEN, L'OPÉRATEUR OU LE PATIENT DES BLESSURES DUES À DES DANGERS ÉLECTRIQUES, MÉCANIQUES OU AUTRES.

WARNUNG

- DIESES KUNDENDIENST-HANDBUCH EXISTIERT NUR IN ENGLISCHER SPRACHE.
- 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.

AVISO

- 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.
- SE UN ADDETTO ALLA MANUTENZIONE ESTERNO ALLA GEMS RICHIEDE IL MANUALE IN UNA LINGUA DIVERSA, IL CLIENTE È TENUTO A PROVVEDERE DIRETTAMENTE ALLA TRADUZIONE.
- 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.

警告

・このサービスマニュアルには英語版しかありません。
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注意:

- 本维修手册仅存有英文本。
- 非 GEMS 公司的维修员要求非英文本的维修手册时，客户需自行负责翻译。
- 未详细阅读和完全了解本手册之前，不得进行维修。
- 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.

During MR installation, some power cables and ground cables may be provided by customer. On installation sites in China, please make sure that the power cables and ground cables provided by customers have China Compulsory Certification.

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.

LIST OF EFFECTIVE PAGES

Tab (Section)	Page	REV
-	Title page Title page rear	2 -
(Warning and other important information)	a to c d	2 blank
Glossary/Introduction	to c	2
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SYSTEM SYSTEM OPTIONS SYSTEM CONFIGURATION		
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3 (Magnet Field Considerations)	3-1 to 3-10	2
INTRODUCTION HOMOGENEITY REQUIREMENTS STRUCTURAL STEEL EVALUATION OF PROPOSED SITES MAGNETIC FIELD MAGNET EXCLUSION ZONE ISOGAUSS LINE PLOTS		
4 (Site Environment)	4-1 to 4-24	2
INTRODUCTION TEMPERATURE AND HUMIDITY SPECIFICATIONS COOLING REQUIREMENTS ALTITUDE LIGHTING NOISE POLLUTION AMBIENT RFI AND EMI CONTRACTOR FURNISHED COMPONENTS VIBRATION MAGNET CHANGING MAGNETIC ENVIRONMENT SPECIFICATIONS		
5 (Power Requirement)	5-1 to 5-10	2
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RF SHIELD ROOM SPECIFICATION PHYSICAL CONSIDERATION WALLS FLOOR SHIELDING FLOOR LEVELING AND MAGNET ANCHORING PLUMBING ELECTRICAL SCAN ROOM UNIT OPENING		
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9 (System Cable Interconnect)	9-1 to 9-16	2
INTRODUCTION GROUND CABLE INTERCONNECTS POWER LINE INTERCONNECTS SYSTEM INTERCONNECTS (SIGNAL CABLE WIRING)		
10 (Safety Consideration)	10-1 to 10-16	2
INTRODUCTION HOMOGENEITY REQUIREMENTS STRUCTURAL STEEL EVALUATION OF PROPOSED SITES MAGNETIC FIELD MAGNET EXCLUSION ZONE ISOGAUSS LINE PLOTS		

REVISION HISTORY

REV	Date	Author	Primary Reason for Change
1	3/13/2007	Fan Lei	Initial Release
2	5/14/2007	Fan Lei	Air Cooling Table Updated
3	7/26/2007	Fan Lei	M4 Release.

SECTION 1 - SYSTEM CONFIGURATION

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1-1 SYSTEM

The Basic Signa Profile Magnetic Resonance system for the fixed site operation consists of the following major equipment (also see Illustration 1-2):

- 2 Kilogauss (0.2 Tesla) permanent magnet.
- Magnet enclosure and accessories for the magnet. Magnet enclosure includes magnet heater and thermal insulator and PAC (Physiological Acquisition Controller) and Transmit Coil, Gradient Coil.
- Coils: Gradient coils, RF Head coil
- Operator Workstation(OW) - Operator Workstation consists of GOC, OC DESK, 23-inch wide screen LCD monitor, keyboard, mouse and MOD. The Junction Box provides power connections for Patient Monitor equipment.
- Table (TBL) - Table consists of a Table for a Patient and RF Pre-Amplifier.
- Scan Room Unit (SRU) - Scan Room Unit consists of SRP (Scan Room Processor),Stepping Motor Driver, and Temperature Control Unit.CSB and Others
- Integrated Power System (IPS) - Integrated Power System consists of MGD(Multi-generational Data Acquisition), DCERD(Digital CERD), GPS(Switching Gradient Unit), CTLU, SRFD, PDU(Power Distribution Unit)
- System cables
- Standard Accessories consisting of (see Table 1-1 for details):
  - Extender for head coil
  - Head Holder with sponge
  - Security Straps
  - Cushions, Pads for a patient
  - Panic Switch
  - MR Phantom (SNR Measurement)
- Service Accessories consisting of:
  - DVD-ROMs

1-1 SYSTEM (continued)

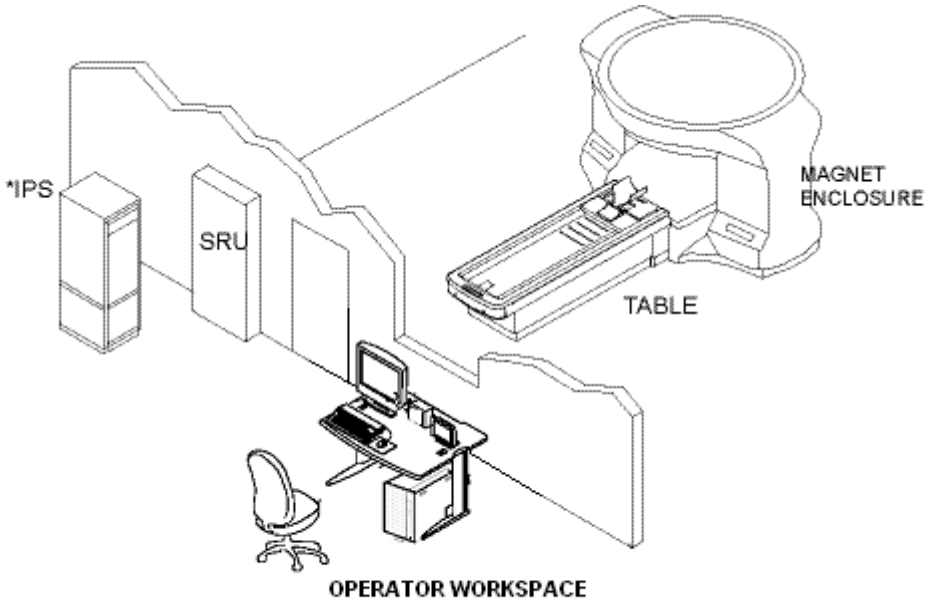
TABLE 1-1
STANDARD ACCESSORIES

ITEM NAME	QUANTITY	DESCRIPTION
BASE PAD	1	550 X 1430 X 20 (mm)
SPACE PAD	1	550 X 250 X 25 (mm)
ARM PAD	2	100 X 590 X 80 (mm)
KNEE PAD	1	TRIANGLE 470 X 720 (mm)
PAD 320	5	680 X 310 X 30 (mm)
PAD 620	1	680 X 610 X 30 (mm)
PAD 1590	1	680 X 1580 X 30 (mm)
BOTTOM PAD	1	490 X 1430 X 20 (mm)
INJECTION PAD	1	200 X 680 X 50 (mm)
SIDE WEDGE	2	TRAPEZOID 90 X 250 (mm)
HEAD CUSHION	2	80 X 22.5 X 320 (mm)
FOOT CUSHION	1	190 X 300 X 150 (mm)
KNEE CUSHION- 1	1	U- SHAPED 155 X 360 (mm)
KNEE CUSHION- 2	1	ϕ194 X 360 (mm)
KNEE CUSHION- 3	1	ϕ194 X 360 (mm)
CABLE HOOK	2	150 X 60 (mm)
HEAD SIDE WEDGE	2	TRAPEZOID 60 X 250 (mm)
SHOULDER WEDGE	2	TRAPEZOID 230 X 250 (mm)
SPINE CUSHION	1	300 X 200 X 50 (mm)
RECT CUSHION 1	2	370 X 135 X 25 (mm)
RECT CUSHION 2	2	370 X 135 X 12 (mm)
BODY STRAP WS (LONG STRAP)	1	STRAP 370 X 870 (mm)
BODY STRAP WL (LONG STRAP)	1	STRAP 370 X 1008 (mm)
BODY STRAP S	1	STRAP 150 X 848 (mm)
BODY STRAP L	1	STRAP 150 X 1008 (mm)
BODY STRAP WS (SHORT)	1	STRAP 370 X 528 (mm)
BODY STRAP WL (SHORT)	1	STRAP 370 X 813 (mm)

1-2 SYSTEM OPTIONS

- Chair for Operators Workstation
- Optional Application Software
- Laser Camera - Refer to *Direction 18030, Laser Cam Preinstallation*, for information on this option.
- Surface Coils
- Analog Filming Interface
- Digital Filming Interface
- Patient Monitor Camera

1-3 SYSTEM CONFIGURATION



* Dedicated equitpment room may not be required for IPS.
But simple enclosure is recommended.

SYSTEM CONFIGURATION
ILLUSTRATION 1-1

SECTION 2 - ROOM LAYOUT

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2-1 INTRODUCTION

When laying out a floor plan, special considerations 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 9, SYSTEM CABLE INTERCONNECT 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 6, RF SHIELDED ROOM.

2-1-1 Objects Affected by or that Affect the Magnet Field

TABLE 2-1
PROXIMITY LIMITS

GAUSS (mT) LIMIT (See Notes 1 & 2)	EQUIPMENT	
0.5 GAUSS (0.05mT) OR LESS	Nuclear cameras	
1 GAUSS (0.1mT) OR LESS	Positron Emission Tomography scanner Linear Accelerator Cyclotrons Accurate Measuring scale Image intensifiers Color TV/Color Monitor(without shielding)	Video display (color, B/W, monochrome) CT scanner Ultrasound Lithotriptor Electron microscope Advantage Windows Workstation
3 GAUSS (0.3mT) OR LESS	Refer to Section 4-11	
5 GAUSS (0.5mT) OR LESS	Cardio pacemakers Neurostimulators	Biostimulation devices Uncontrolled public and staff access
10 GAUSS (1mT) OR LESS	Shielded Color Monitor for Profile III	
30 GAUSS (3mT) OR LESS	MR equipment (Scan Control, Scan Room Unit, System Gradient Unit, Step Down Transformer, Regulated Step-down Transformer, UPS)	
50 GAUSS (5mT) OR LESS	MR equipment (Regulated Step Down Transformer or Main Disconnect Device (in U.S.A.))	Telephones Metal detector for screening
100 GAUSS (10mT) OR LESS	Service Tool Magnet Power Supply Cabinet 3M Laser Camera (without film processor)	Smoke/heat detector

Note1 Refer to SECTION 3, MAGNETIC FIELD CONSIDERATIONS, 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.

2-2 ROOM SIZE

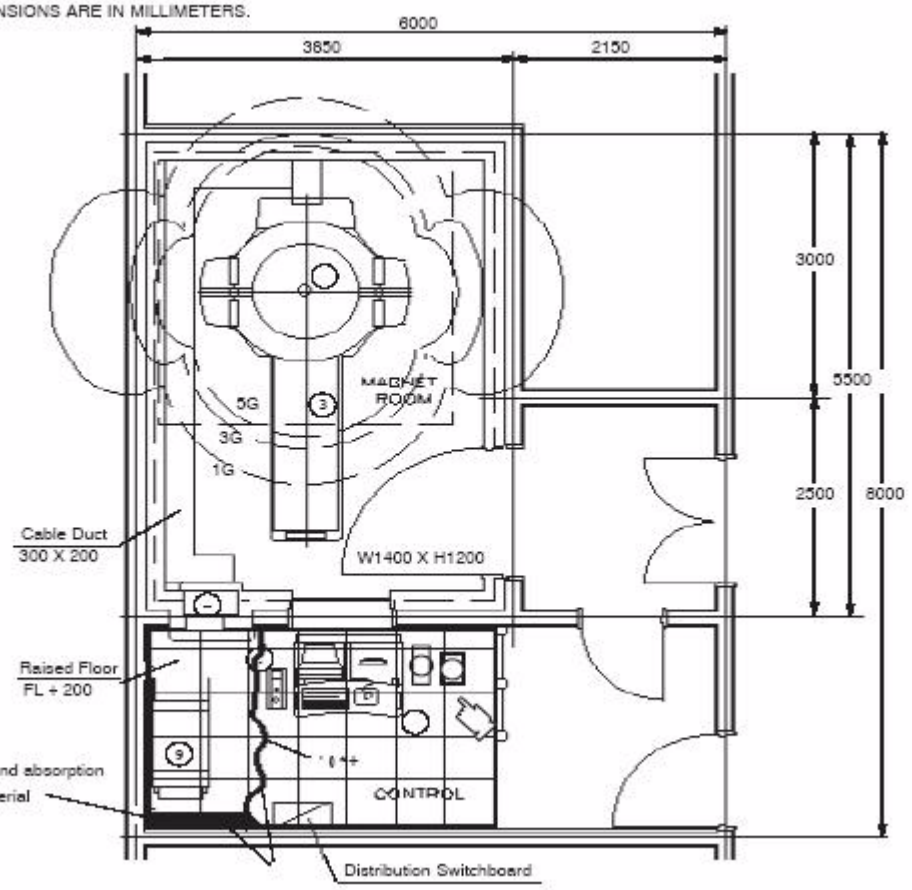
Table 2-2 is a list of minimum room dimensions necessary for adequate service access and patient/traffic concerns. Room layouts are shown in Illustration 2-1 and 2-2.
Equipment room can be deleted according to customers request if there is no sound noise problem caused by IPS.

TABLE 2-2
MINIMUM ROOM DIMENSIONS

ROOM	SUBSYSTEMS	MINIMUM AREA m^2	MINIMUM DIMENSIONS m
MAGNET ROOM	PERMANENT MAGNET PATIENT TABLE STORAGE CABINETS	17.0	3.4 X 5.0
OPERATOR CONTROL ROOM	GLOBAL OPERATOR CONSOLE OC DESK	7.5	2.5 x 3.0
EQUIPMENT ROOM	INTEGRATED POWER SYSTEM	4.5	1.5 x 3.0
OPERATOR CONTROL ROOM (IN CASE OF NO EQUIPMENT ROOM	GLOBAL OPERATOR CONSOLE INTEGRATED POWER SYSTEM OC DESK	10.0	2.5 x 4.0

2-3 TYPICAL SITE LAYOUT

NOTE 1:
ALL DIMENSIONS ARE IN MILLIMETERS.



NOTE 2
If raised floor is not used, cable pit or duct is required and the followig conditions must be satisfied.
IPS service maintenance area is kept(refer to illustration 2-19).
Cable pit or duct(for redundant cable handling)dimentions(mm) are at least 1000(w)x300(L)x300(D) .

NOTE 3
In Magnet room cable pit or duct dimensions(mm) are at least 300(w)x1000(L)x200(D).

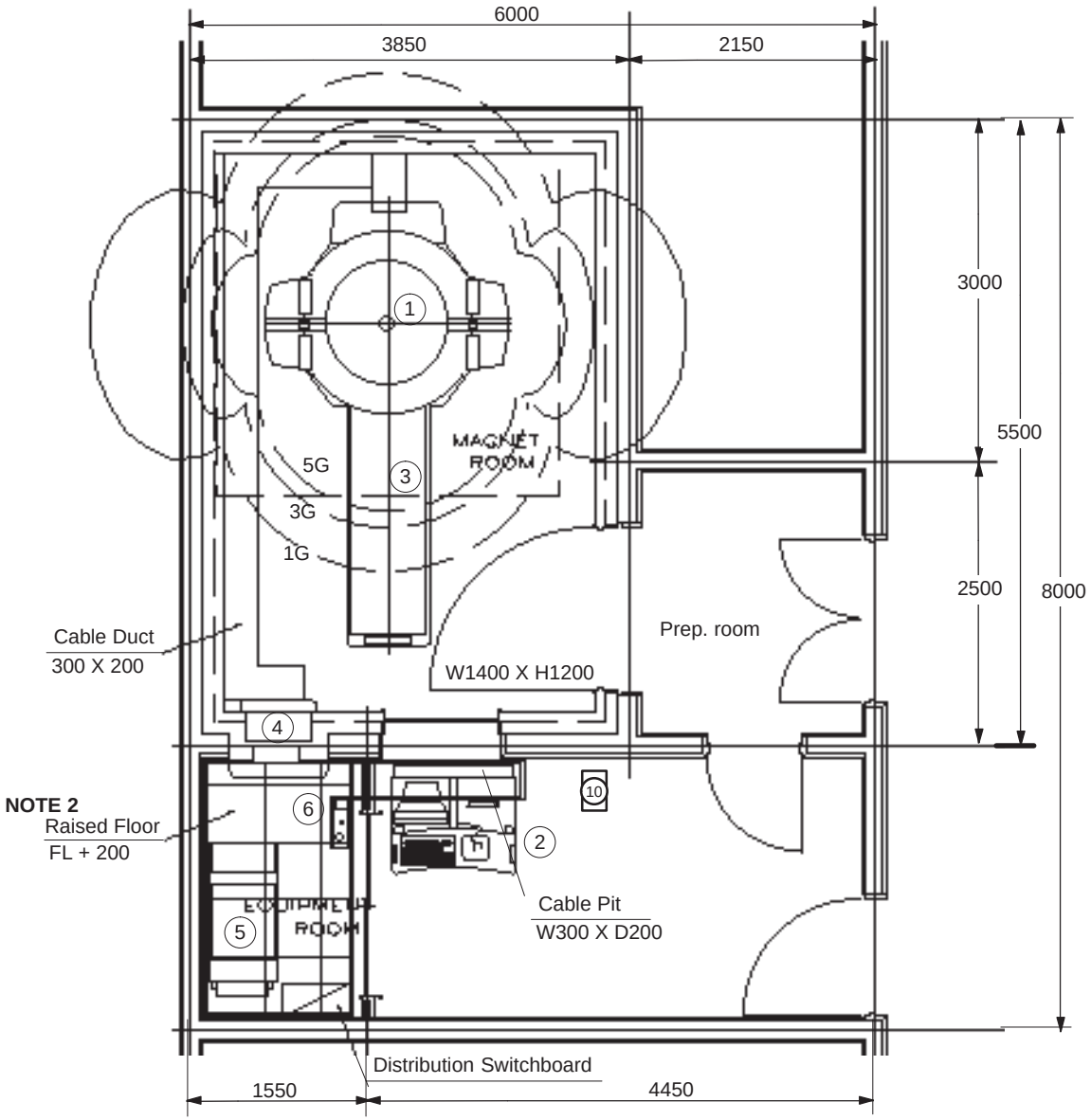
NOTE 4
Curtain and sound absorption material are recommended to reduce soound noise generated by IPS.

TYPICAL SITE LAYOUT WITHOUT EQUIPMENT ROOM
ILLUSTRATION 2-1

2-3 TYPICAL SITE LAYOUT (continued)

NOTE 1:

- ALL DIMENSIONS ARE IN MILLIMETERS.
- EQUIPMENT ROOM CAN BE DELETED ACCORDING TO CUSTOMERS REQUEST IF THERE IS NO SOUND NOISE PROBLEM CAUSED BY IPS.



NOTE 2:

- The minimum Equipment Room dimensions are 1500 x 3000. In this layout, maintenance area is kept by moving IPS to the open space.
- If raised floor is not used, cable pit or duct is required and the following conditions must be satisfied.
  IPS service maintenance area is kept (refer to illustration 2- 19).
  Cable pit or duct(for redundant cable handling) dimensions are at least 1**000(W) x 500(L) x 300(D)**.

NOTE 3:

- In Magnet room cable pit or duct dimensions(mm) are at least **300(W) x 1000(L) x 200(D)**.

TYPICAL SITE LAYOUT WITH EQUIPMENT ROOM
ILLUSTRATION 2-2

2-3 TYPICAL SITE LAYOUT (continued)

TABLE 2-3

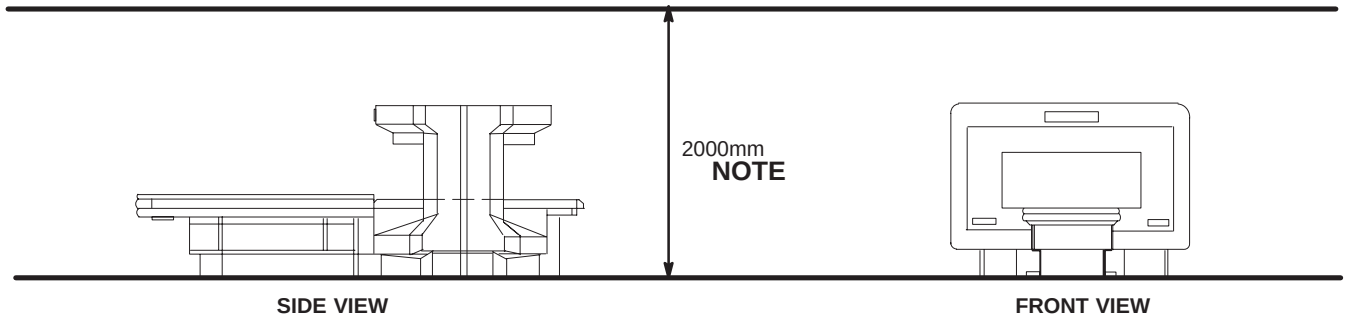
EQUIPMENT LIST (ILLUSTRATION 2-1 AND 2-2)

EQUIPMENT LIST	
1	0.2 TESLA PERMANENT MAGNET
2	OPERATOR CONSOLE
3	TABLE
4	SCAN ROOM UNIT
5	INTEGRATED POWER SYSTEM (Step Down Transformer (standard for outside Japan))
6	PATIENT COMFORT MODULE (OPTION)
7	REGULATED STEP DOWN TRANSFORMER (OPTION)
8	CHAIR FOR OPERATOR WORKSTATION (OPTION)

(6) TO (8) are not shown in Illustration 2- 1 & 2- 2

2-4 FINISHED CEILING HEIGHT (MAGNET ROOM)

ALL DIMENSIONS ARE IN MILLIMETERS.



RECOMMENDED MINIMUM CEILING HEIGHT
ILLUSTRATION 2-3

NOTE : The minimum ceiling height required for the equipment operation is 2000mm. However, the comfort of the patient is not considered.

2-5 MINIMUM DOOR SIZES

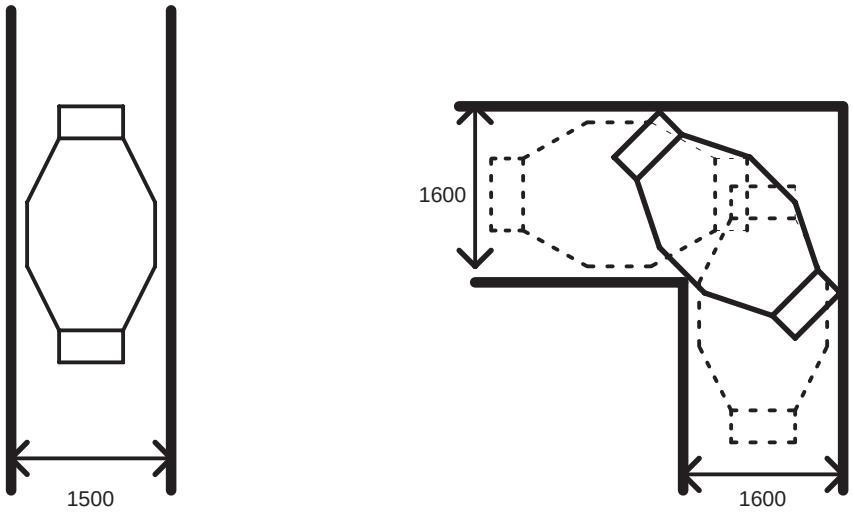
Installation or replacement of components listed on Table 2-4 must be taken into consideration when determining hallway and door dimensions.

TABLE 2-4
INSTALLATION / REPLACEMENT COMPONENT DIMENSIONS

COMPONENT	W x D x H mm	WEIGHT Kg	COMMENTS
Permanent Magnet	2040 x 1300 x 1374	10000	
BRIDGE	1132 x 1787 x 100	14	
TABLE	720 x 2100 x 600	250	
FRONT COVER	2200 x 730 x 1457	33	
REAR COVER	2200 x 680 x 1457	28	
SIDE COVER	280 x 69 x 1279	5	
TOP COVER	F1480 x 58H	12	
TOP SIDE COVER	280 x 409 x 109	3	

2-5-1 Magnet

After the magnet is uncrated the maximum magnet height dimension is 1380mm. The magnet is completely enclosed with plywood to prevent any ferrous materials from being drawn to the magnet.
The minimum dimensions for a straight path and a path with 90 degree turns for magnet delivery are shown in Illustration 2-4. (See Section 7-4, Removing Magnet from the Crate.)



STRAIGHT PATH

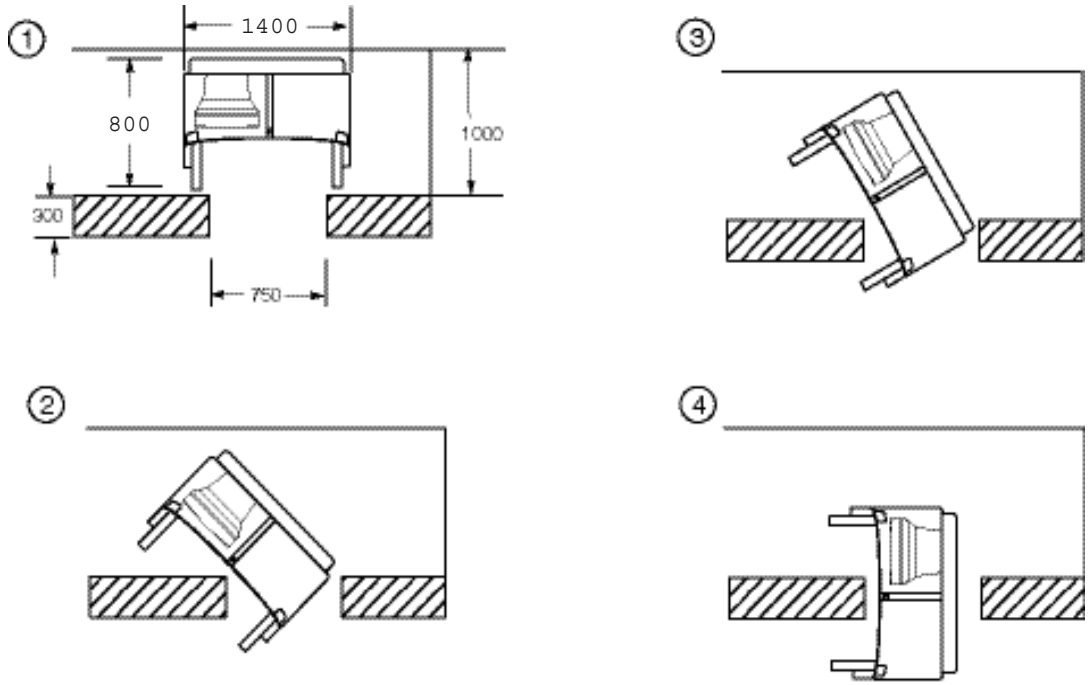
PATH WITH 90 DEGREE TURNS

UNIT : mm

DOOR WIDTH REQUIREMENTS
ILLUSTRATION 2-4

2-5-2 Operator Console

The minimum corridor width (1000mm) and the minimum door opening size (750mm if the wall thickness for the door opening is less than 300mm) is required to move the OC into the Operator room. For Profile 1 to Profile HSR only.



OC COURSE REQUIREMENT
ILLUSTRATION 2-5
Note: for Profile 5 and Profile HD system, no space requirement on OC movement.

2-5-3 Other Subsytems

Subsystem cabinets and magnet covers can pass through door openings of 750 mm wide by 1900mm high if the wall thickness for the door opening is less than 300mm.
Magnet room requires a minimum door opening of 1400mm for magnet installation.
Refer to Section 7, SHIPPING AND DELIVERY DATA for details of system component shipping dimensions.

WARNING!

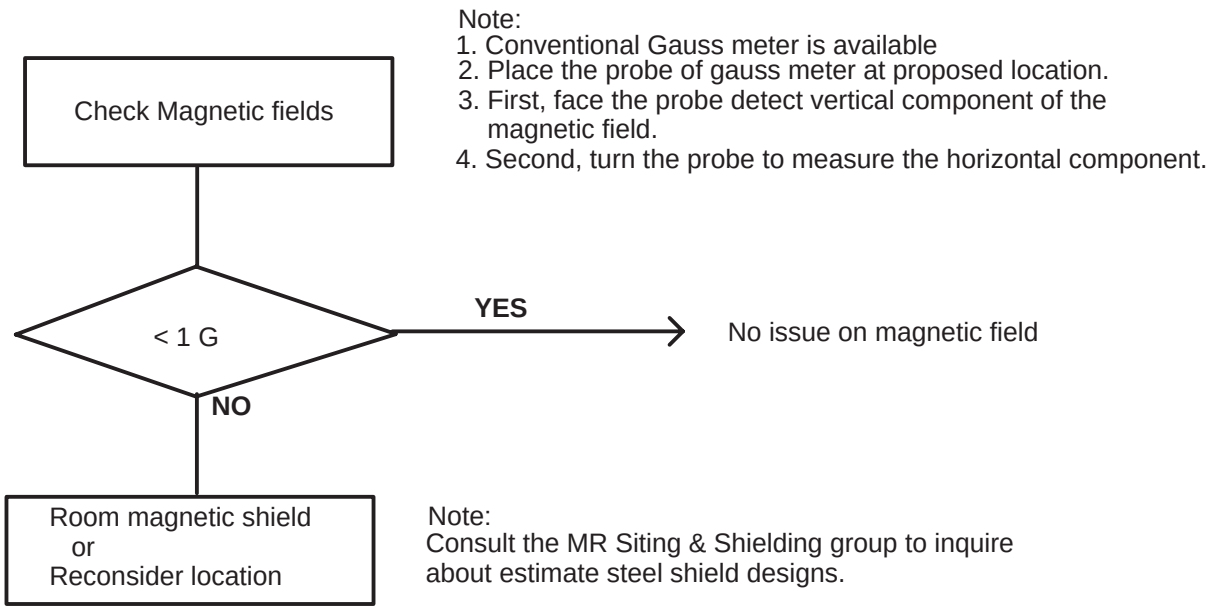
THERE IS A PERMANENT MAGNETIC FIELD AROUND THE MAGNET. BE SURE TO REMOVE ALL FERROUS OBJECTS AND EQUIPMENT THAT MAY BE INFLUENCED BY THE MAGNETIC FIELD FROM THE DELIVERY PATH BEFORE HANDLING THE MAGNET. REFER TO SECTION 3-6 FOR FRINGE FIELD INFORMATION.

2-6 MAGNET SITE LOCATION

An evaluation of the static magnetic fields at the proposed magnet location must occur prior to the determination of the final magnet location. Static magnetic fields increase or decrease B0 generated on 0.2T permanent magnet, and it is possible to cause the system center frequency to be out of allowable range. Specifications on allowable static magnetic fields are as follows:

< 1 Gauss for vertical and horizontal component

The flow chart illustrated in Illustration 2-5 shows the procedure for deciding magnet location.



Remarks;

It also should be taken into consideration to check if static magnetic fields still meet the specifications described above in case a new MRI is installed near the Signa Profile in the future.

TWO MAGNET INSTALLATION
ILLUSTRATION 2-6

2-7 CABLING CONSIDERATIONS

Several different methods for running cables are listed below and the customer should carefully consider the advantages and disadvantages of each.
Care must be taken to protect interconnecting cords and cables from physical damage. Branch Power circuit conductors must be enclosed in metal raceway or metal wire way when concealed or when installed under raised flooring.

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.

2-7-1 Floor Duct

Illustration 2-7 and 2-8 show examples of recessed floor ducts. Recessed floor ductwork has advantages when used within a single room or two adjacent rooms. It combines a neat functional appearance with accessibility and room for expansion. The disadvantage is the amount of work required to install it, and is generally prohibitive in existing construction. Recessed floor ducts can be used in the magnet room (see Illustration 2-7), however, they must meet the requirements in Section 6, RF SHIELDED ROOM.

2-7-2 Wall Duct

Wall ducts offer some unique advantages when routing cable. It is very practical to use in existing structures since it can be surface-mounted. There is no problem with preterminated cables since the entire wall duct system can be opened. Wall duct systems are relatively easy to expand as compared to other means of routing cables.

2-7-3 Raised Flooring

Raised flooring, although not required, has many advantages if used in both the equipment and control rooms due to the length 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 convenient method of separating electrical lines from hydraulic and water lines. However, if the area under the raised flooring is used for an air plenum, cables may have to be in floor ducts depending on local and national codes. (Refer to Section2-8, FLOORING.)

2-7-4 Conduit

Conduit has some important restrictions when used with an MR system. The primary problem is that the majority of cables used are preterminated, 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 conduit to pass the cable through with all other cables already in the conduit. Conduit should not be used for running 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. 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.

2-8 FLOORING

It may be possible to use the area under the raised floor, if employed, as an air conditioning plenum depending on local and national codes. Ensure that the raised flooring, if used, can support the equipment and any transport device needed to move the equipment. Also check local and national codes for fire protection requirements underneath the raised floor. If the area under the raised floor is to be used as an air plenum and for cable routing, 254 mm of clear space from the underside of the raised floor to the permanent floor is recommended. Cabling routed under the raised floor may affect air flow and needs to be considered if used as an air conditioning plenum. Note that the MR system interconnecting cables are not teflon coated.

If carpeting is used, it should either be anti-static carpeting or carpeting treated with an anti-static solution. Carpeting is not recommended in the magnet room.

Information of RF shielded room floor requirements can be found in Section 6, RF SHIELDED ROOM.

2-9 ARCHITECTURAL REMINDERS

1. Pay attention to isogauss limits, not only for placement of equipment rooms, but also for isogauss limits with re spect to outside environment.
2. Persons with cardiac pacemakers, neurostimulators and biostimulation devices must remain outside the recom mended five gauss exclusion zone.
3. The operator seated at the Operator Workstation must have an unobstructed view of patient on the table.
4. Operators in magnet room must have easy access to the scan control switches located on the front panel of the magnet enclosure.
5. A patient holding/emergency area should be located near the magnet room and direct patient access must be available from the magnet room to the patient holding/emergency area.
6. Metal detectors are recommended and should be shown in room layout drawings if used.
7. A telephone line is to be be supplied in the equipment room for Insite installation purposes. The line must be a dedicated direct-distance-dialing voice-grade telephone line with access located near Scan Controller. This tele phone line cannot be routed through a switchboard. Telephone lines are to be provided and paid for by the cus tomer.
8. It is recommended that the Magnet room viewing window be of fine mesh screening (as opposed to a "honey comb"-type pattern) for better visibility of the patient from the operator's console.
9. A lockable storage cabinet is recommended to be supplied for storage of GE Medical Systems service documen tation/tools. Cabinet is approximately 914mm wide, 457 mm deep, and 1829 mm high. A storage cabinet is available from GE Medical Systems.
10. 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 hu man contact as it relates to locating this equipment and chemicals in the control area.

2-10 FLOOR LOADING AND WEIGHTS

This section contains loading considerations for the MR system. Listed in Table 2-5 are the weights, floor loading and normal mounting methods for MR components.

2-10-1Magnet 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. 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 load bearing capacity.

2-10-2Anchoring and Seismic Considerations

The center of gravity for MR system components are given for use in seismic calculations. Check local or seismic codes to determine if the Magnet should be bolted to the floor. See Illustration 2-13. **It is the customer's responsibility to coordinate Magnet and table mounting methods with the RF shielded room vendor to prevent RF leaks and grounding problems.**
It is required that the Patient Table be bolted to the floor. The Magnet is to be bolted to the floor if required. See Illustration 2-13 for details.

TABLE 2-5
MR FLOOR LOADING(For ProfileHD)

COMPONENT	NET WEIGHT kg	OVERRALL W x D x H mm	WEIGHT/ AREA kg/m^2	LOAD PATTERN mm	NORMAL METHOD OF MOUNTING
Permanent Magnet with Enclosure	10000	2200x1927x1496	See Note1	Four base frame pads, each pad 280x320. See Illustration 2-13	Resting on floor, can be bolted to floor using bolts.
Patient Table	380 includes 180 patient	720 x 2100 x600	246	Circular leveling pads, each 60mm diameter. See Illustration 2-15	Bolt table base frame to floor with bolts.
Operator Work-Space Table with LCD Color Monitor	175	1400 x 800 x 850	239	Four caster 65 diameter and two adjusters 60 diameter	Set on floor
Scan Room Unit w/ Covers	120	910 x 557 x 1955	N/A	Mounted in wall with 72 M6 screws and 2 studs on floor. See Illustration 2-16 and Sec6-6	Mounted un wall
Intergrated Power System	550 Note 2 460 Note 3	580 x 972 x 1950	902	Five caster 65 diameter and two adjusters 60 diameter.	Set on floor
GOC	87	470 x 737 x 660	194	Four Pads	Set on floor

Note 1 Consult a structural engineer on method of calculation proper weigh/unit area for floor loading.
Note 2 Includes Step Down Transformer (Standard for outside Japan).
Note 3 Without Step Down Transformer (Japan only).

Aside: Weight/Area is defined as net weight/base area

2-11 COMPONENT DIMENSIONS

To assist in completing room layout, refer to Table 2-6 for list of Component Illustrations.

TABLE 2-6
COMPONENT ILLUSTRATION LIST

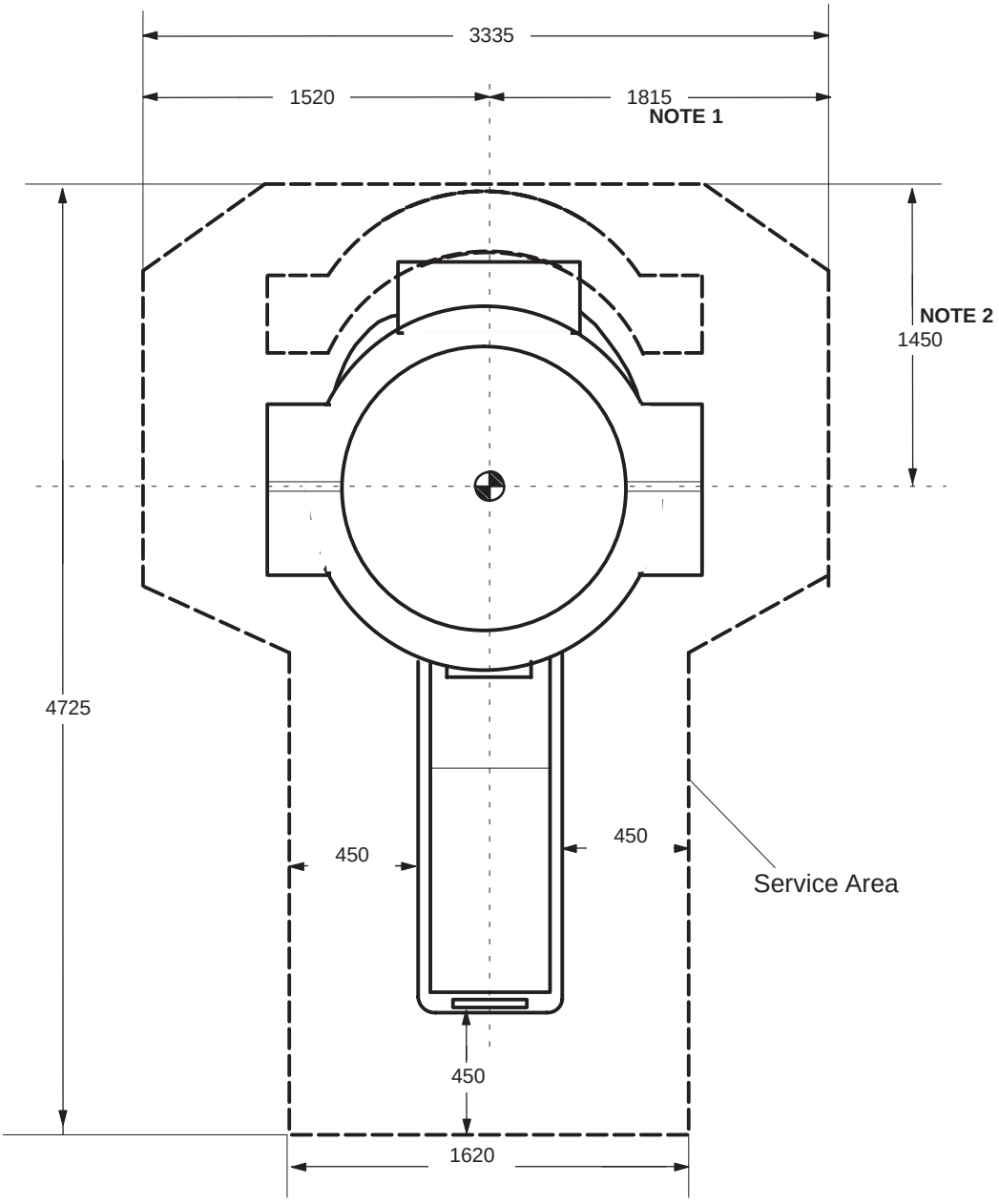
ILLUSTRATION NAME	ILLUSTRATION NUMBER
MAGNET (RECOMMENDED SERVICE AREA)	2- 6
TABLE AND MAGNET ENCLOSURE SHOWN WITH RAISED FLOOR DUCT ALTERNATIVE	2- 7
TABLE AND MAGNET ENCLOSURE SHOWN WITH RAISED FLOOR DUCT ALTERNATIVE(CLOSE UP)	2- 8
TABLE AND MAGNET ENCLOSURE SHOWN WITH RECESSED FLOOR DUCT ALTERNATIVE	2- 9
TABLE AND MAGNET ENCLOSURE SHOWN WITH RECESSED FLOOR DUCT ALTERNATIVE(CLOSE UP)	2- 10
ENCLOSURE DIMENSIONS	2- 11
MAGNET DIMENSIONS	2- 12
MAGNET- TABLE LOAD PATTERN	2- 13
MAGNET- TABLE LOAD PATTERN (MOBILE INSTALLATION)	2- 14
MAGNET- TABLE ANCHOR DETAILS	2- 15
SCAN ROOM UNIT (SRU)	2- 16
SCAN ROOM UNIT COVER DETAILS	2- 17
OPERATOR CONSOLE AND JUNCTION BOX	2- 18
INTEGRATED POWER SYSTEM	2- 20
PATIENT MONITOR CAMERA (OPTION)	2- 21
PATIENT MONITOR (OPTION)	2- 22
TABLE	2- 23
COLOR MONITOR (OPTION) (1)	2- 24
COLOR MONIT	2- 25

2-11 COMPONENT DIMENSIONS(continued)

NOTE:
- ALL DIMENSIONS ARE IN MILLIMETERS.
- INDICATES MAGNET ISOCENTER

NOTE 1: At least 1655 mm is needed for PAC. In this case, the PAC must be put on the right side o Magnet .

NOTE 2:
- Minimum space needed in order to install Extender without striking against the wall.
- 1680mm is recommended to have enough space when sending in the patient foot first.

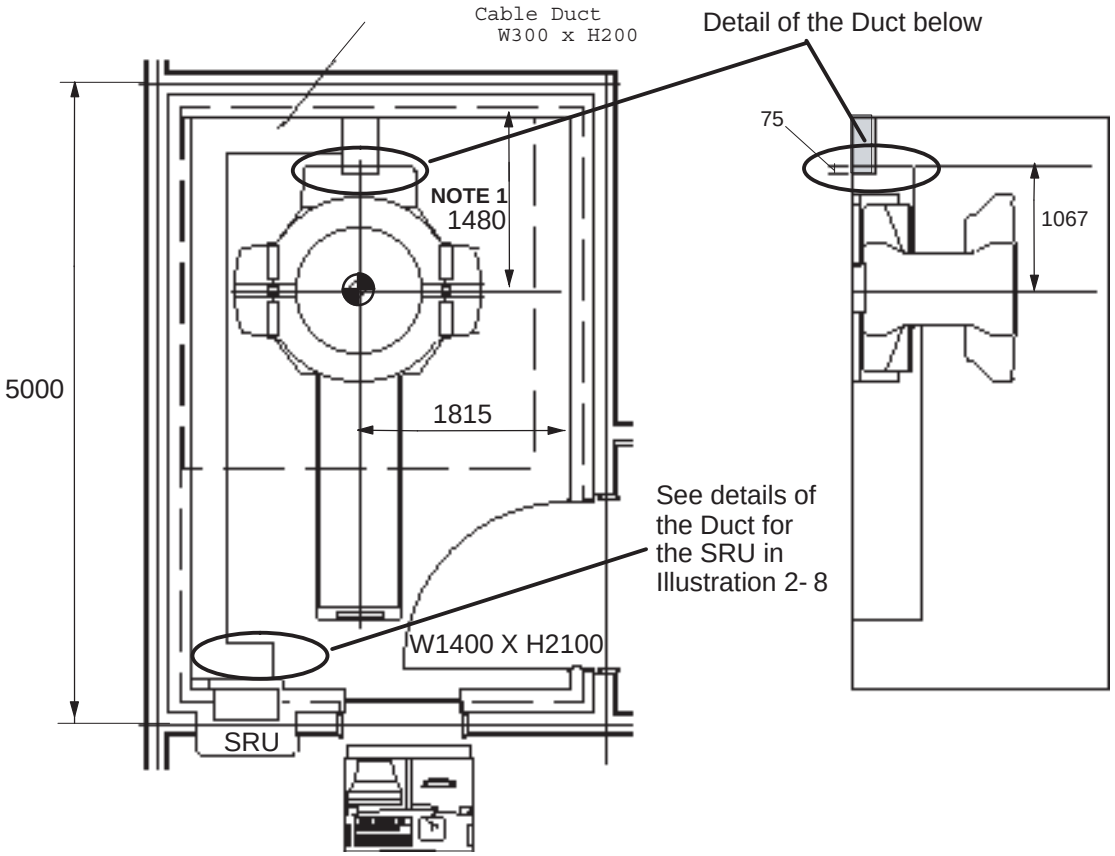


MAGNET (RECOMMENDED SERVICE AREA)
ILLUSTRATION 2-7

2-11 COMPONENT DIMENSIONS (continued)

NOTE:
- ALL DIMENSIONS ARE IN MILLIMETERS.
- INDICATES MAGNET ISOCENTER

NOTE 1:
- Minimum space needed in order to install Extender without striking against the wall.
- 1680mm is recommended to have enough space when sending in the patient foot first.



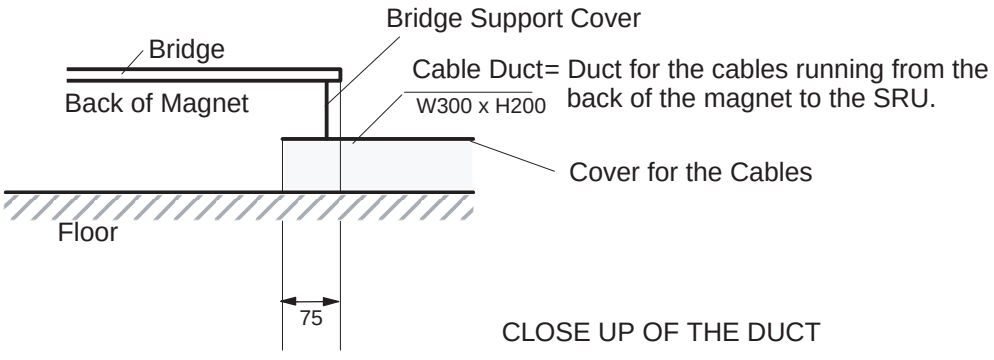


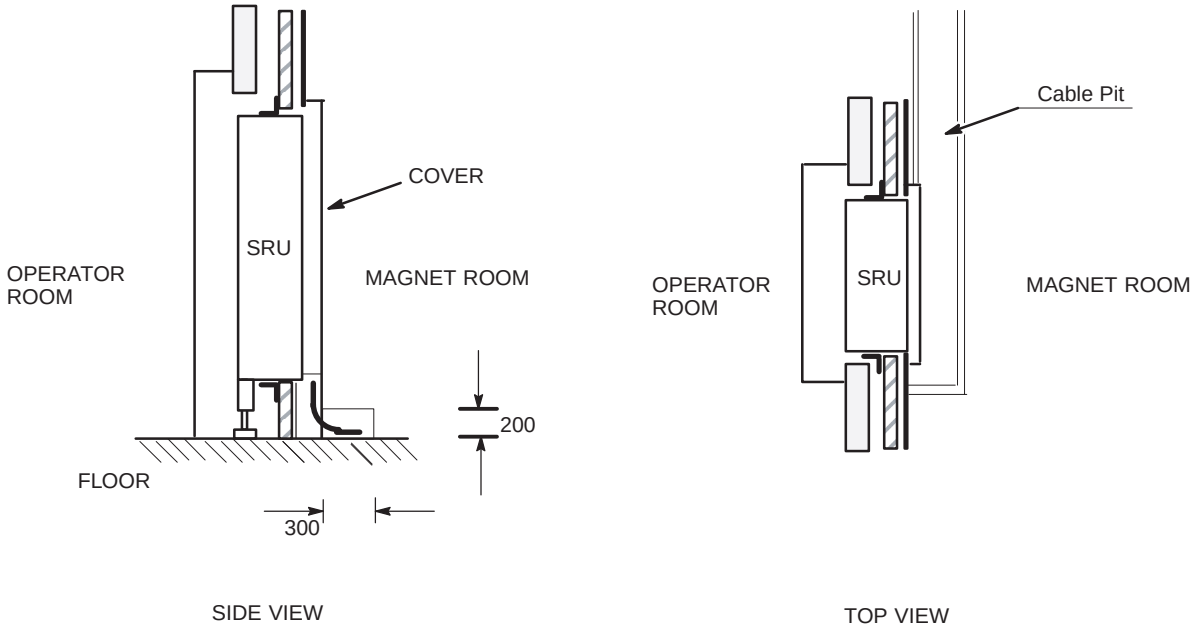
TABLE AND MAGNET ENCLOSURE SHOWN WITH RAISED FLOOR DUCT ALTERNATIVE
ILLUSTRATION 2-8

2-11 COMPONENT DIMENSIONS (continued)

DETAIL OF THE DUCT ON THE SRU SIDE:

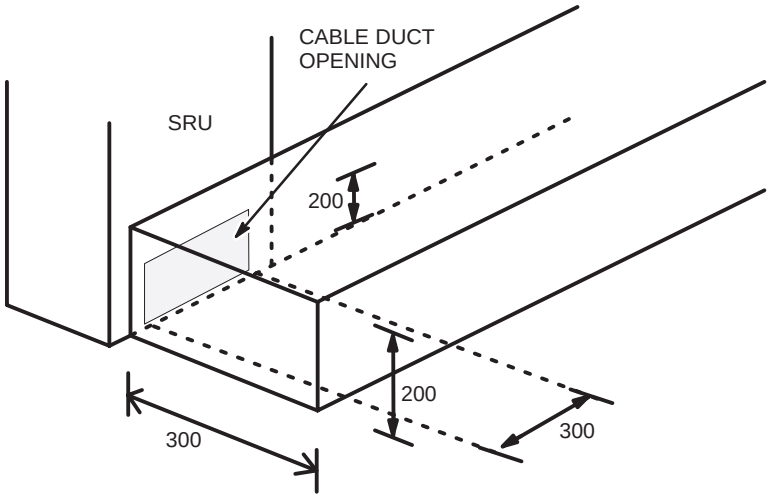
NOTE:

- ALL DIMENSIONS ARE IN MILLIMETERS.
- MINIMUM DUCT DIMENSIONS(CAPACITY) ARE 300(W)X1000(L)X200(D).



SIDE VIEW

TOP VIEW



DETAIL OF DUCT ON THE SRU SIDE

DUCT ON THE SRU SIDE(CLOSE UP)
ILLUSTRATION 2-9

2-11 COMPONENT DIMENSIONS (continued)

NOTE:

- ALL DIMENSIONS ARE IN MILLIMETERS.
- INDICATES MAGNET ISOCENTER

NOTE 1:

- Minimum space needed in order to install Extender without striking against the wall.
- 1680mm is recommended to have enough space when sending in the patient foot first.

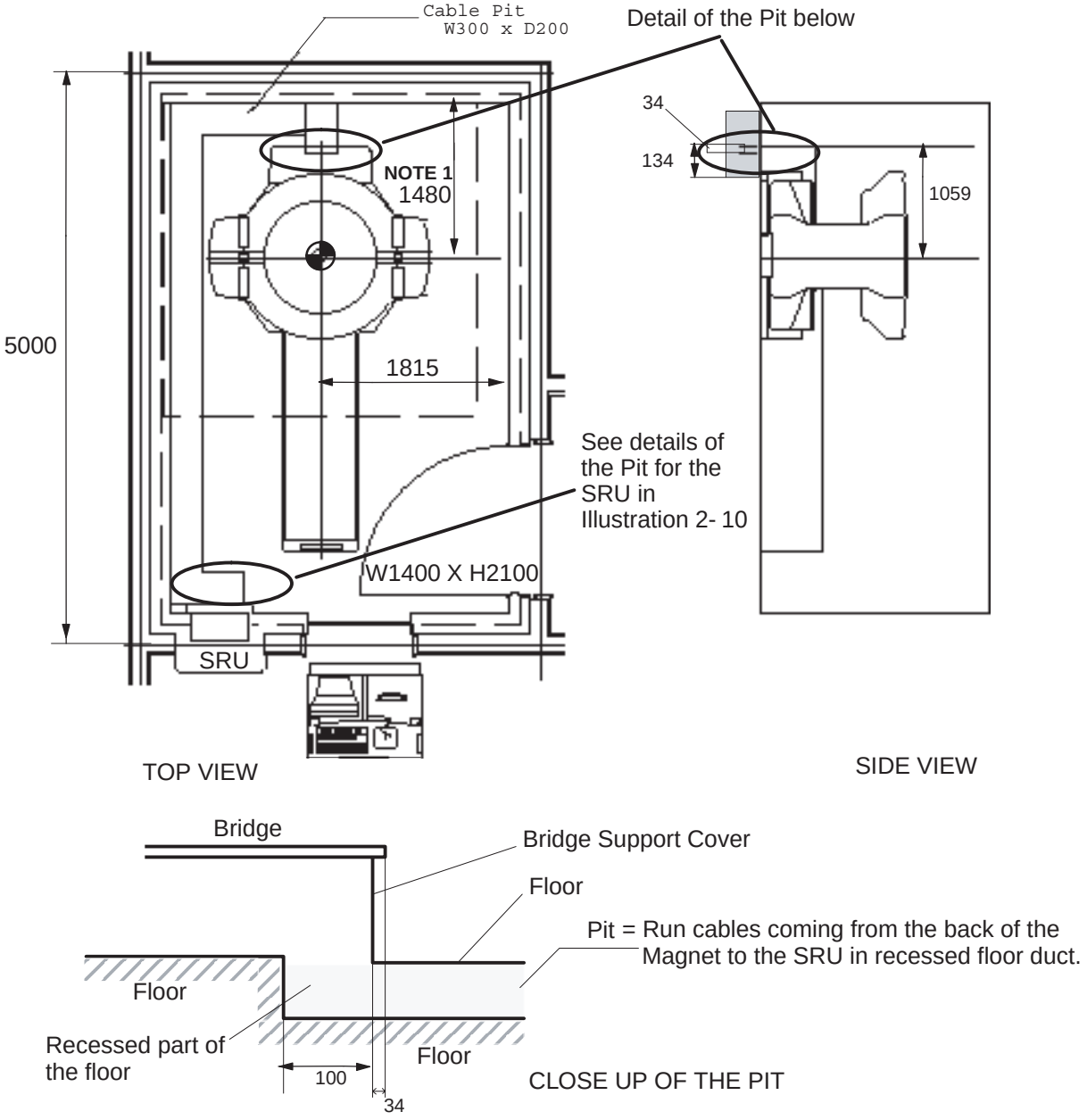


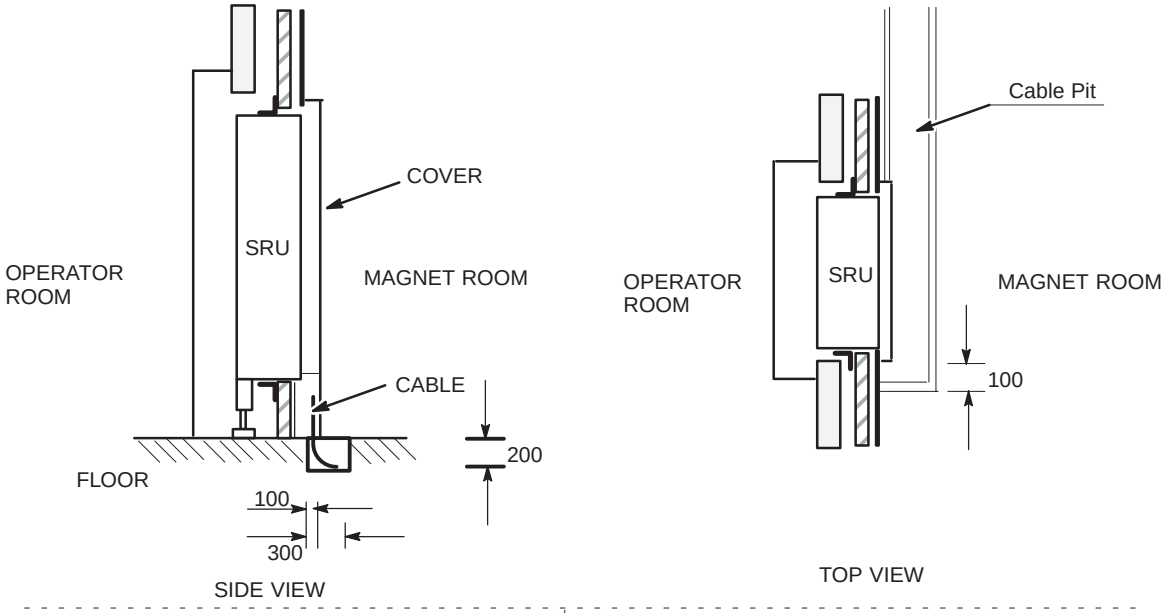
TABLE AND MAGNET ENCLOSURE SHOWN WITH RECESSED FLOOR DUCT ALTERNATIVE
ILLUSTRATION 2-10

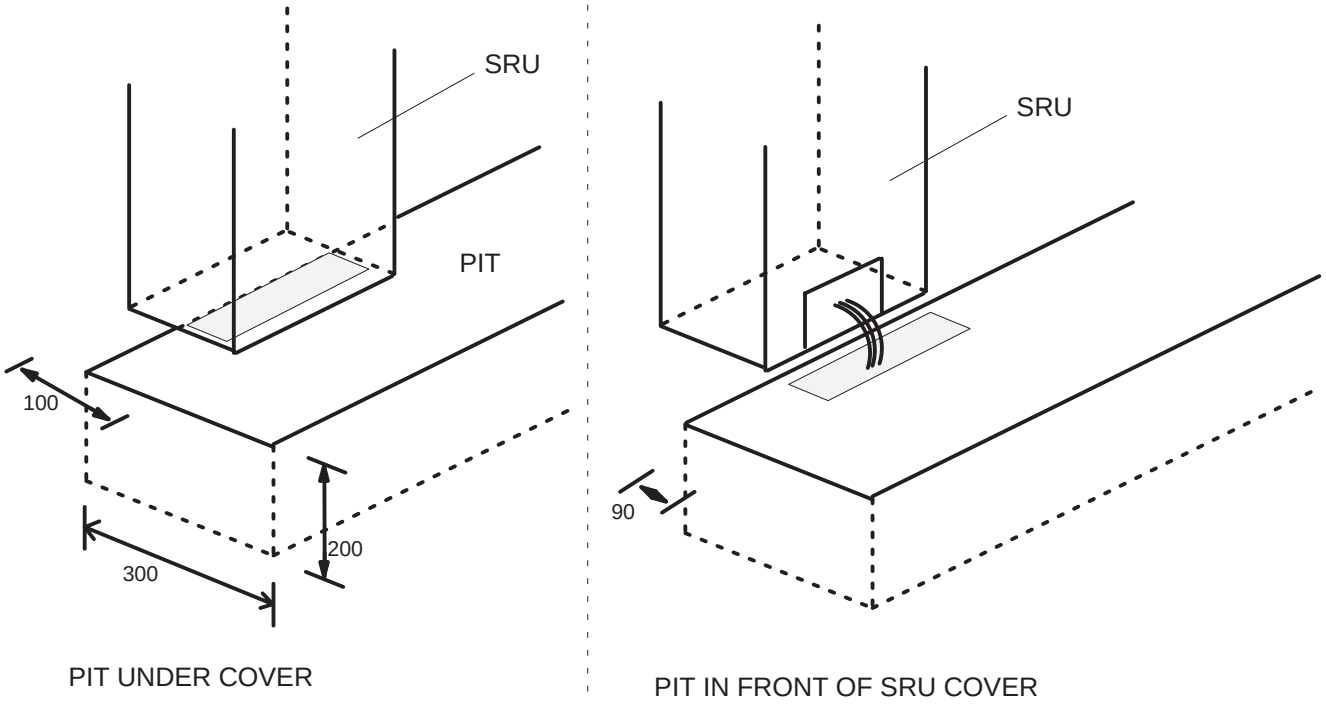
2-11 COMPONENT DIMENSIONS (continued)

DETAIL OF PIT ON THE SRU SIDE:

NOTE:

- ALL DIMENSIONS ARE IN MILLIMETERS.
- MINIMUM PIT DIMENSIONS(CAPACITY) ARE 300(W)X1000(L)X200(D)



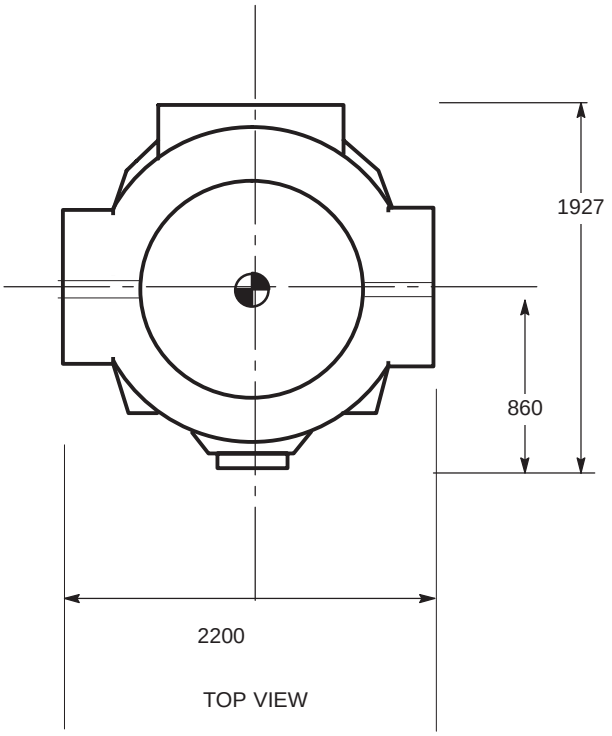


PIT ALTERNATIVE ON THE SRU SIDE(CLOSE UP)
ILLUSTRATION 2-11

2-11 COMPONENT DIMENSIONS (continued)

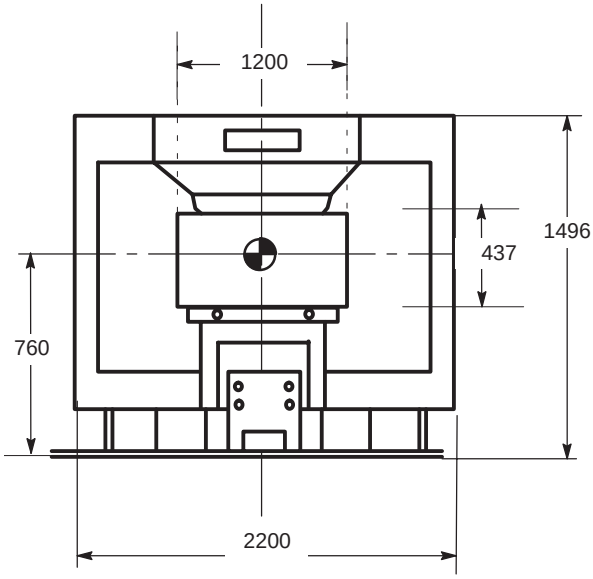
NOTE:

- ALL DIMENSIONS ARE IN MILLIMETERS.
- WEIGHT: 10000 Kg (includes weight of Magnet)
- INDICATES CENTER OF GRAVITY

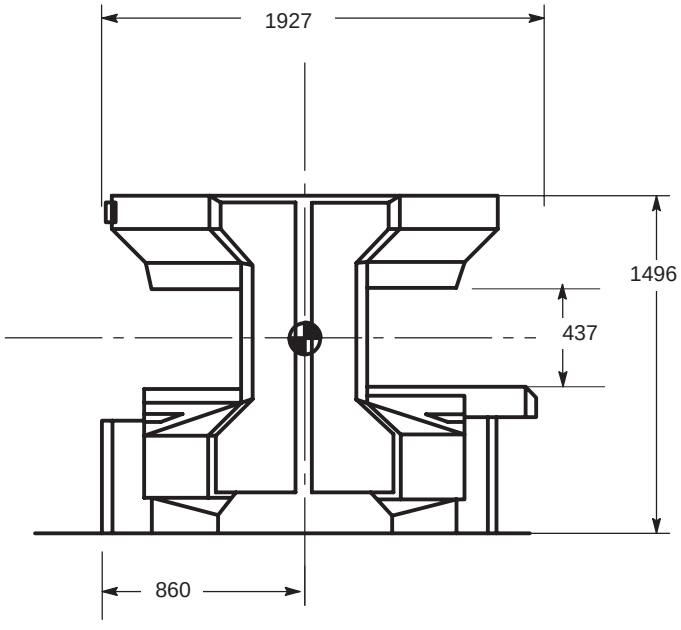


TOP VIEW

MAGNET ISOCENTER

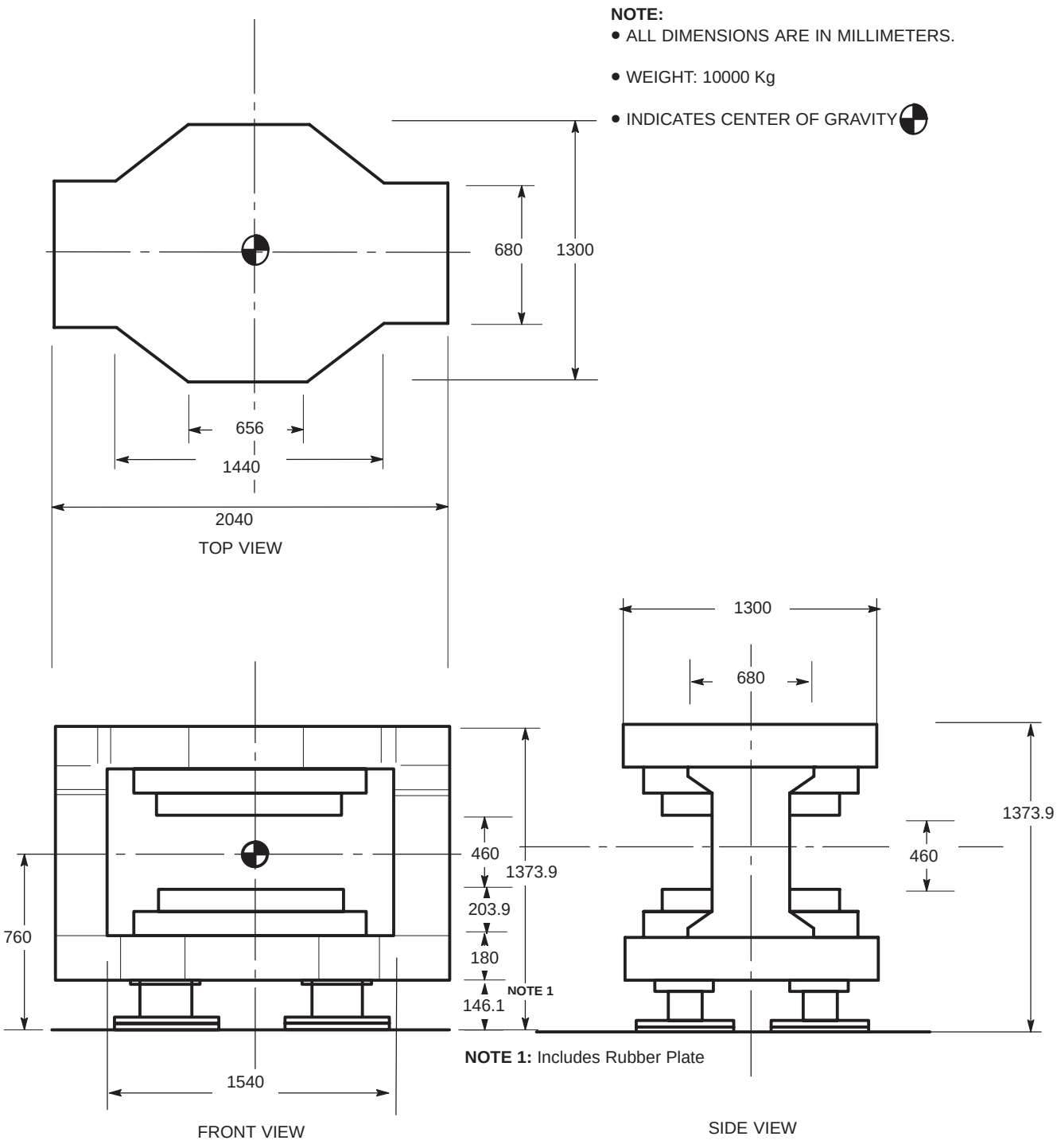


FRONT VIEW



SIDE VIEW

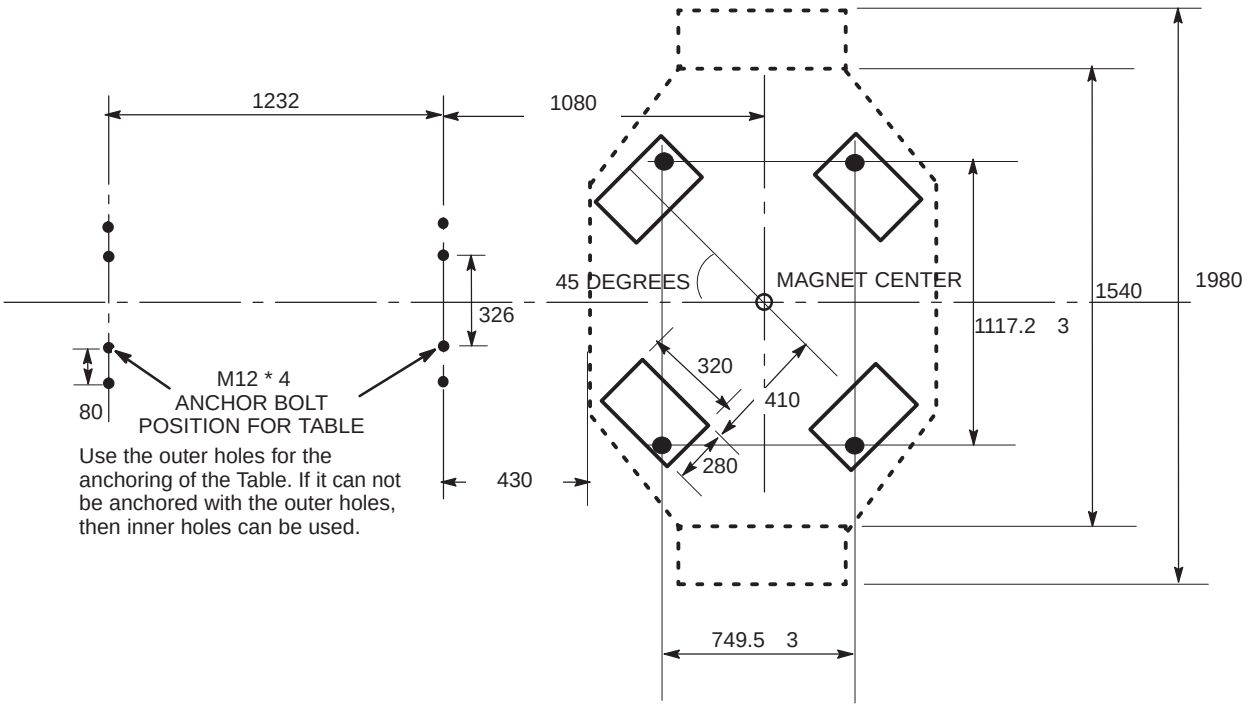
2-11 COMPONENT DIMENSIONS (continued)



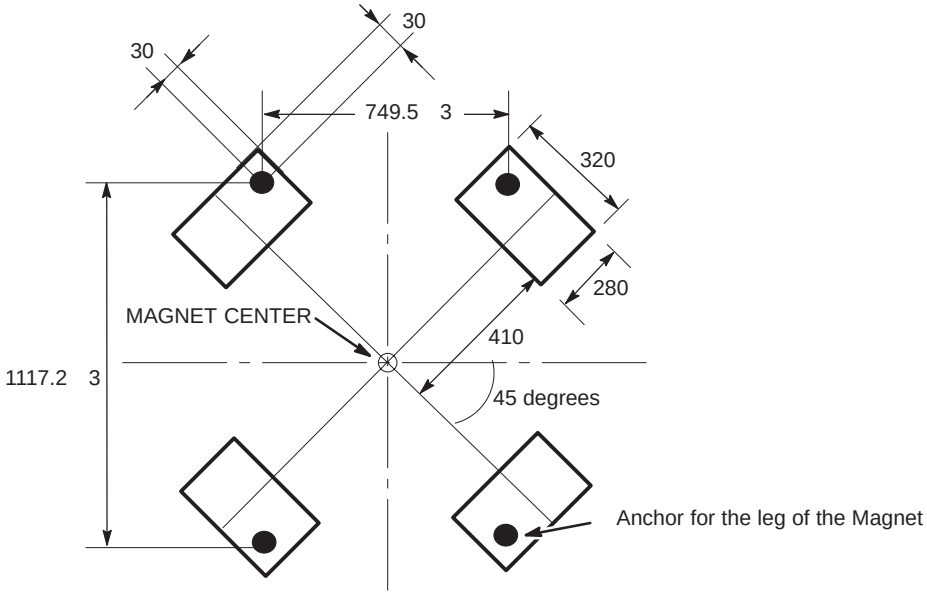
MAGNET DIMENSIONS
ILLUSTRATION 2-12

2-11 COMPONENT DIMENSIONS (continued)

NOTE:
- ALL DIMENSIONS ARE IN MILLIMETERS.

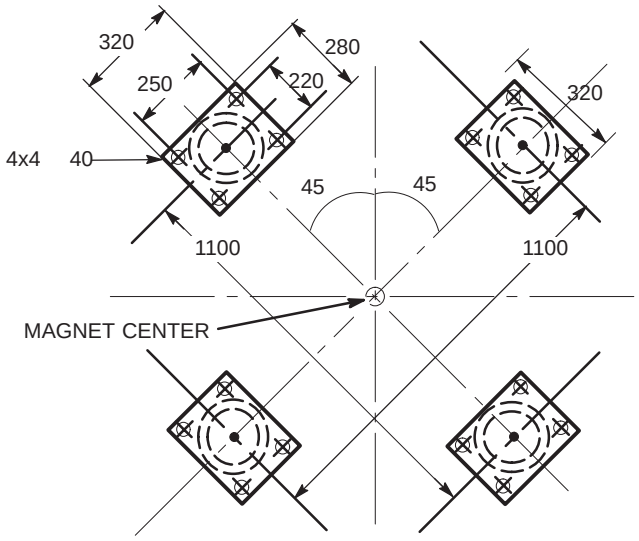


CLOSE UP OF THE LEG OF THE MAGNET



MAGNET-TABLE LOAD PATTERN
ILLUSTRATION 2-13

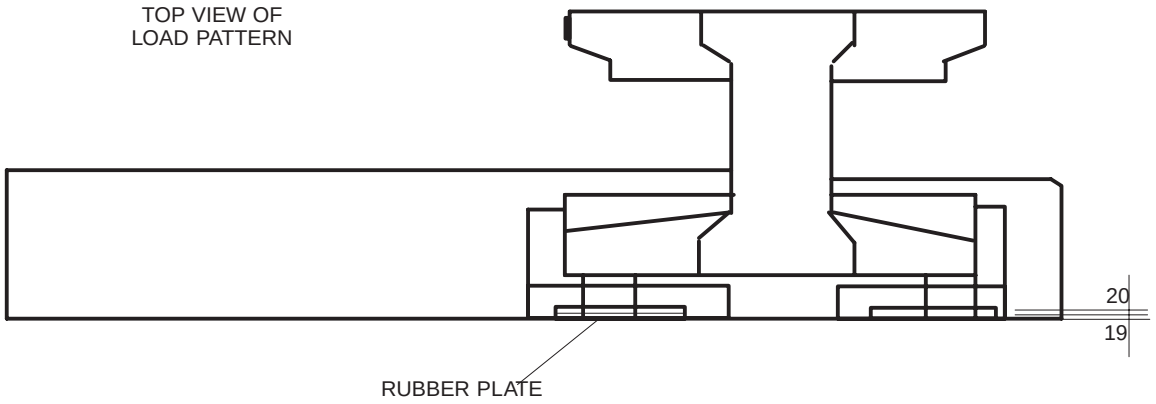
2-11 COMPONENT DIMENSIONS (continued)

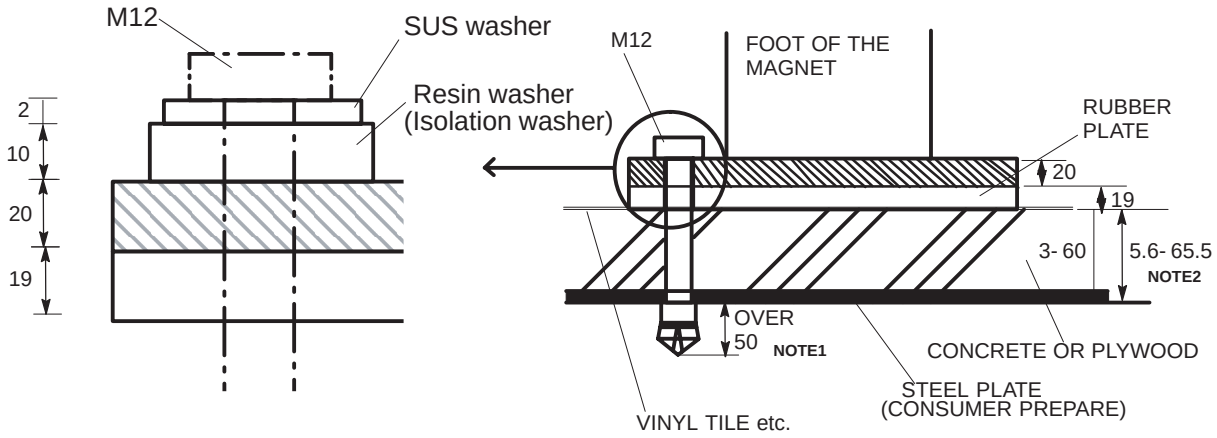


MAGNET LOAD PATTERN (MOBILE INSTALLATION)
ILLUSTRATION 2-14

2-11 COMPONENT DIMENSIONS (continued)

NOTE:
- ALL DIMENSIONS ARE IN MILLIMETERS.





ATTACHMENT OF THE MAGNET TO THE FLOOR

NOTE1: For sites that do not have enough drill length for anchoring Anchor Bolts, the Anchor Bolt needs to be anchored previously. GE provides M12x75 mm bolt(4) only. For other bolts, vender or customer supplied.

NOTE 2: For details, see Section 6- 4, Floor Shielding Table 6- 2.

NOTE3: GE provides M12x40 mm Table anchor bolt(4) only. Use drill blade 18mm in diameter and drill more than 50mm in depth. For other bolts, vender or customer supplied.

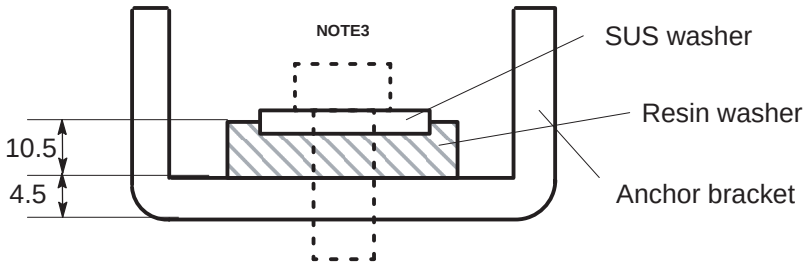


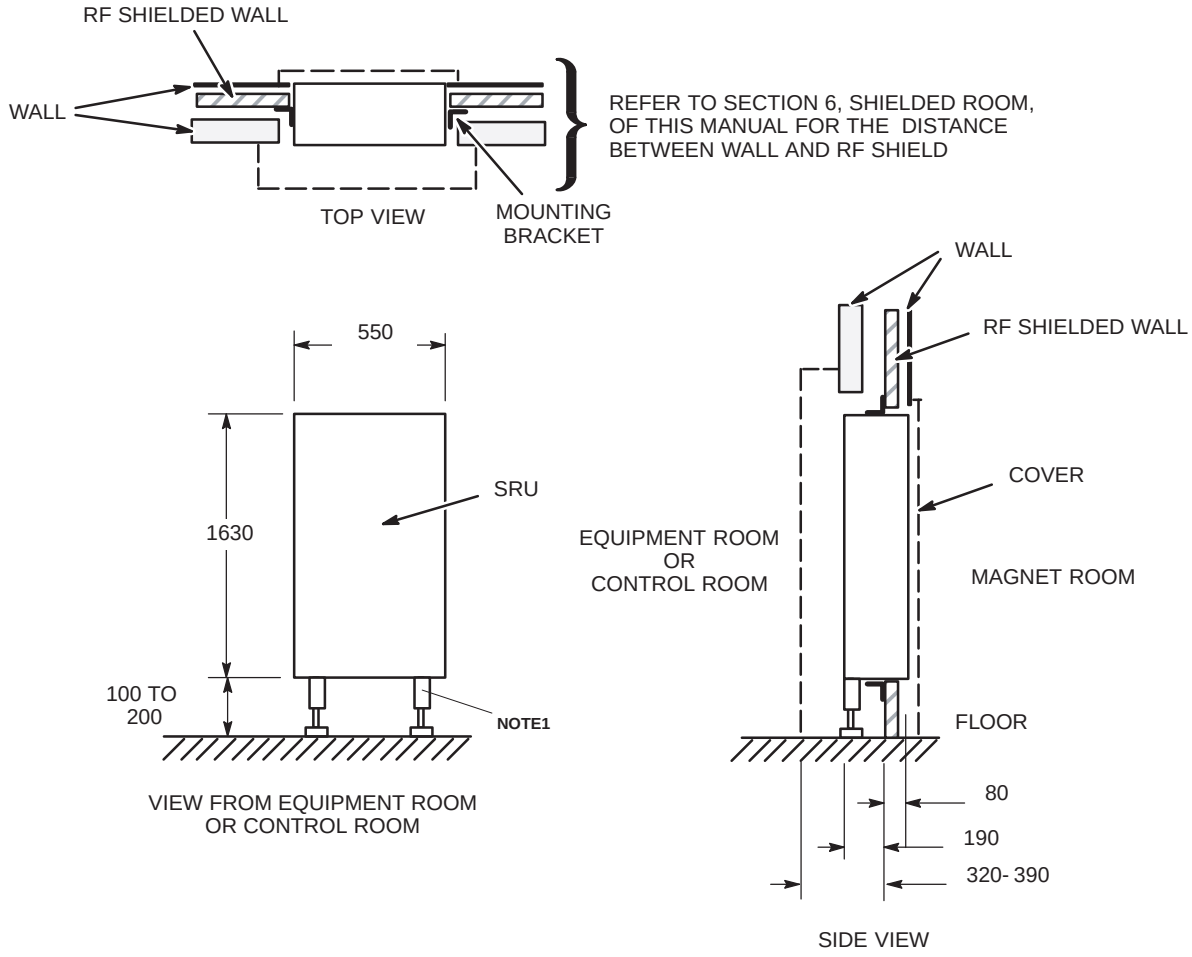
TABLE ANCHOR ATTACHMENT

MAGNET-TABLE ANCHOR DETAILS
ILLUSTRATION 2-15

2-11 COMPONENT DIMENSIONS (continued)

NOTE:

- ALL DIMENSIONS ARE IN MILLIMETERS.
- WEIGHT: 120kg - Including covers



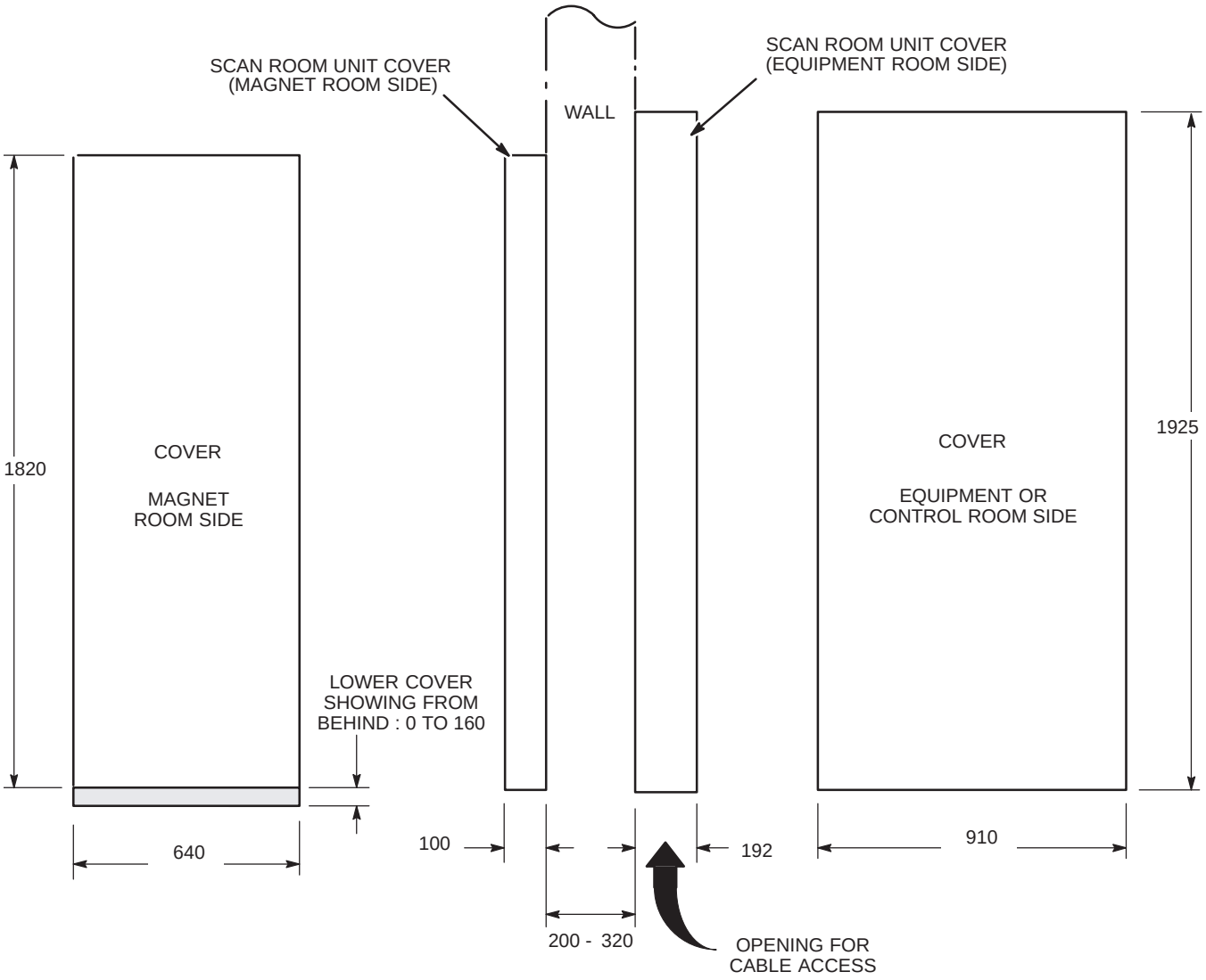
NOTE 1: Make sure to install SRU Support Rod. If not possible, conduct necessary procedures to RF Shield Wall so that the wall will have enough strength.

SCAN ROOM UNIT (SRU)
ILLUSTRATION 2-16

2-11 COMPONENT DIMENSIONS (continued)

NOTE:

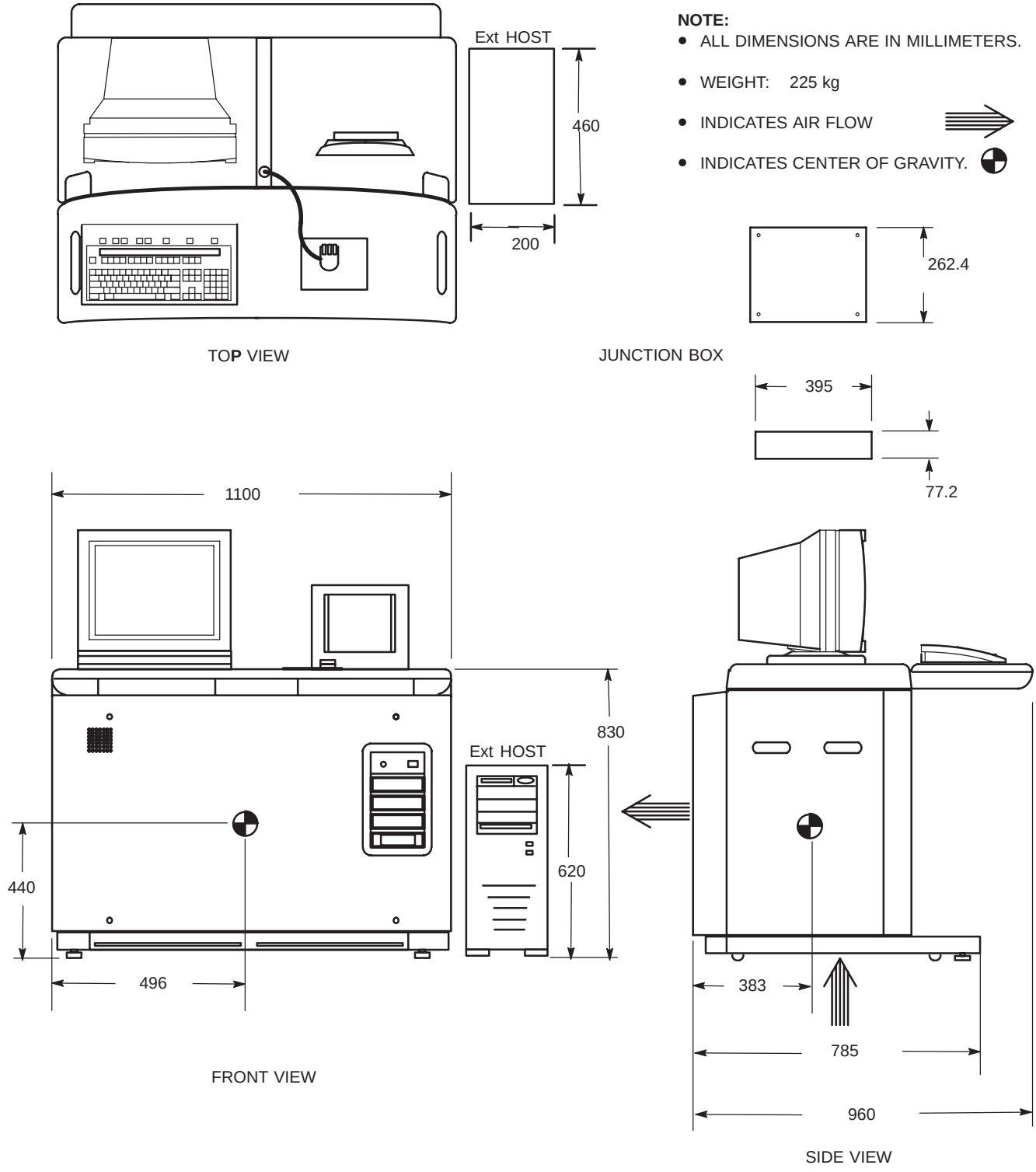
- ALL DIMENSIONS ARE IN MILLIMETERS.
- WALL OPENING AND MOUNTING HOLES FOR THE SRU ARE DESCRIBED IN ILLUSTRATION 6- 3 AND 6- 4 OF THIS MANUAL.



SCAN ROOM UNIT COVER DETAIL
ILLUSTRATION 2-17

2-11 COMPONENT DIMENSIONS (continued)

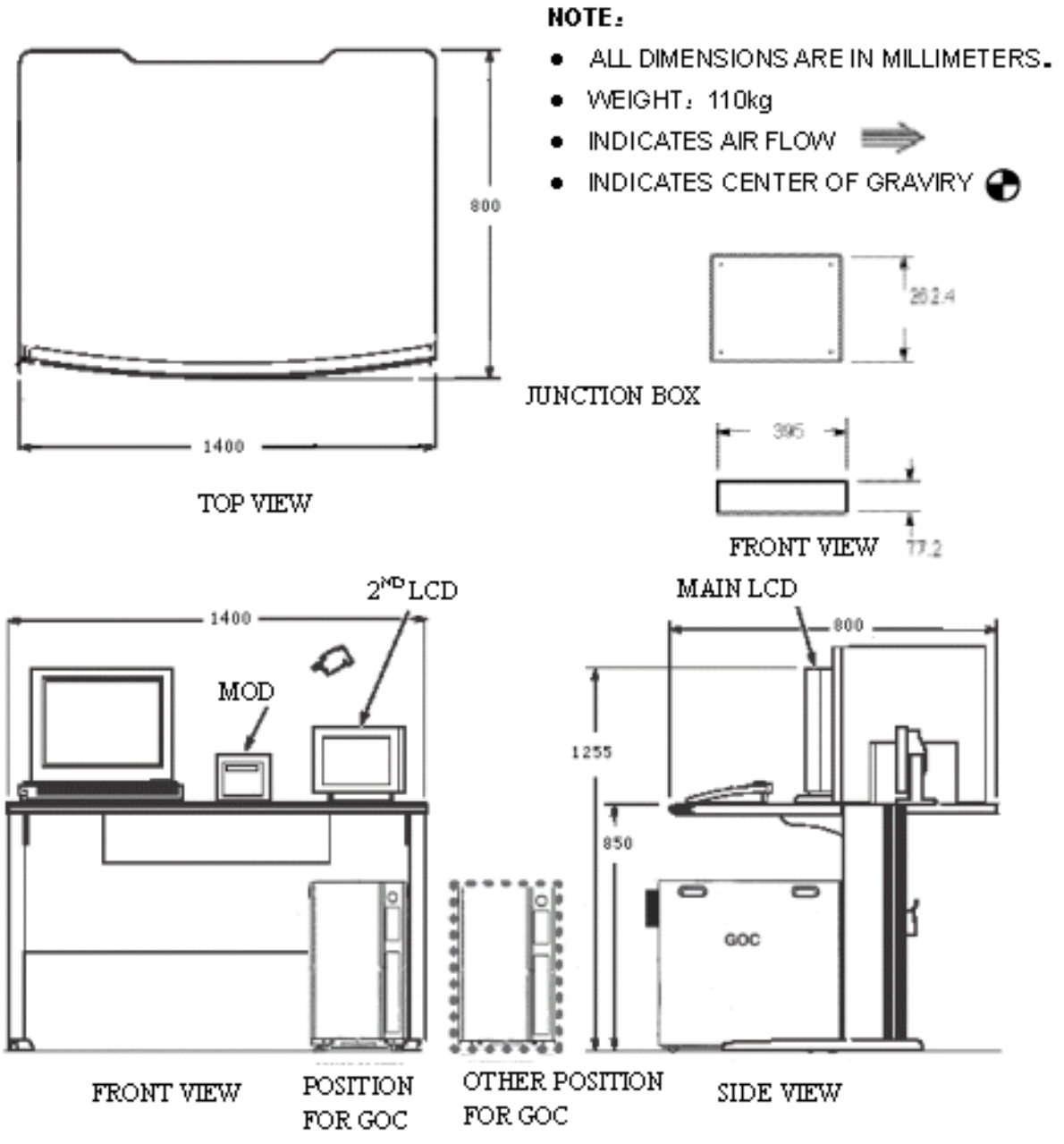
For Signa Profile 1 to Profile HighSR:



OPERATOR CONSOLE AND JUNCTION BOX
ILLUSTRATION 2-18

2-11 COMPONENT DIMENSIONS (continued)

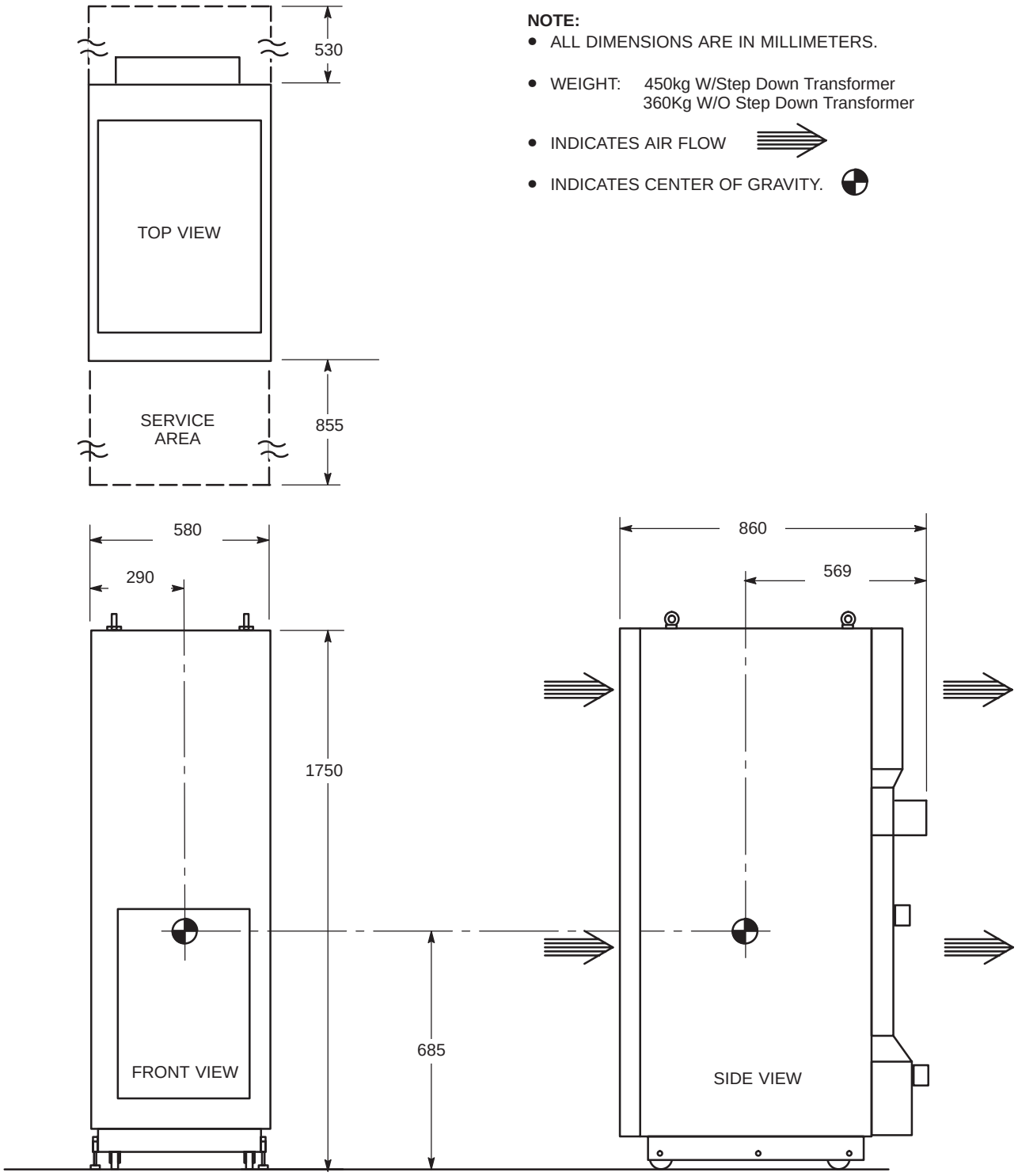
For Signa Profile5 and Profile HD:



OPERATOR CONSOLE
ILLUSTRATION 2-19

2-11 COMPONENT DIMENSIONS (continued)

For Signa Profile 1 to Profile HighSR:



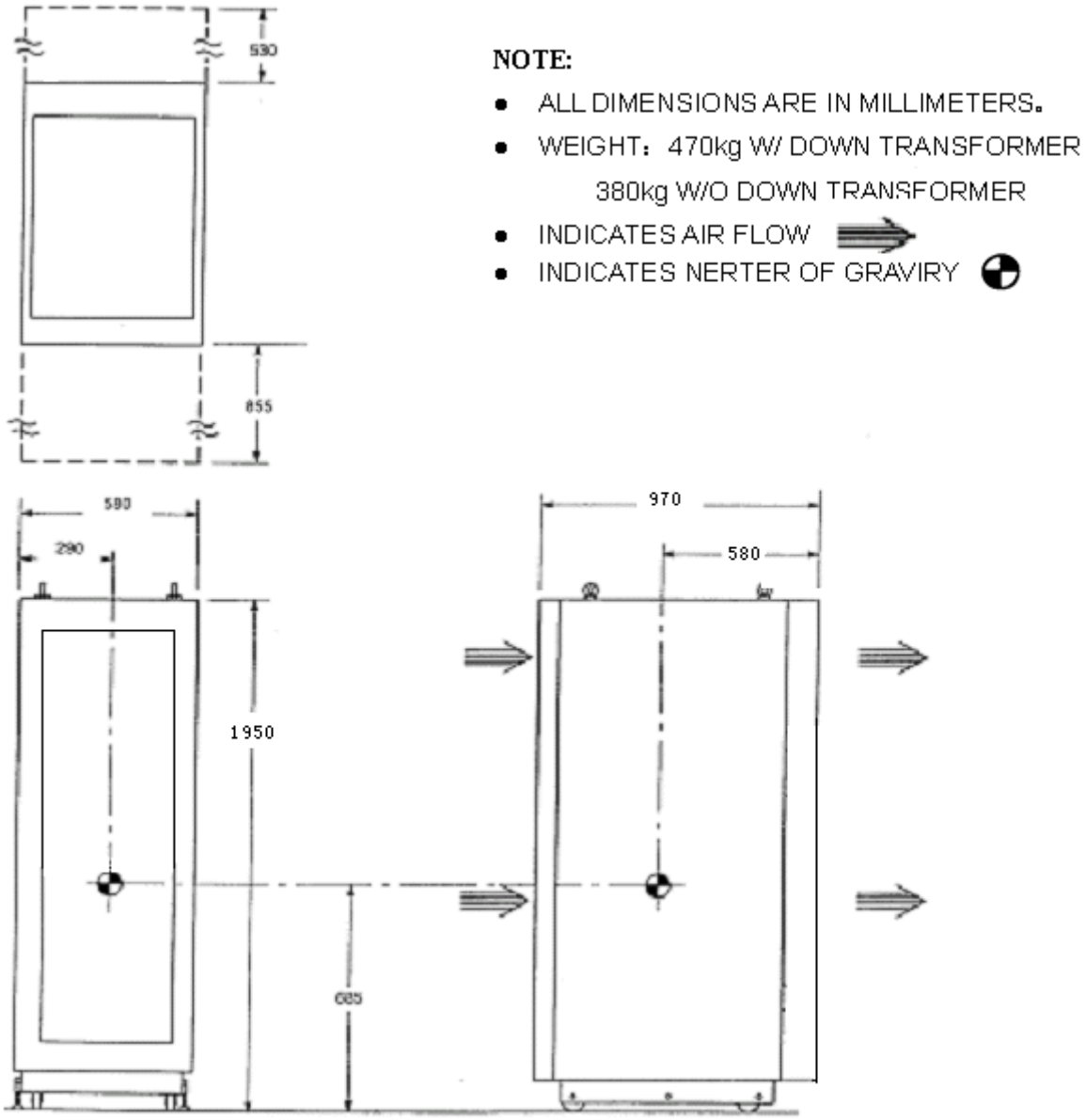
NOTE:

- ALL DIMENSIONS ARE IN MILLIMETERS.
- WEIGHT: 450kg W/Step Down Transformer
  360Kg W/O Step Down Transformer
- INDICATES AIR FLOW
- INDICATES CENTER OF GRAVITY.

INTEGRATED POWER SYSTEM
ILLUSTRATION 2-20

2-11 COMPONENT DIMENSIONS (continued)

For Signa Profile5 and Profile HD:

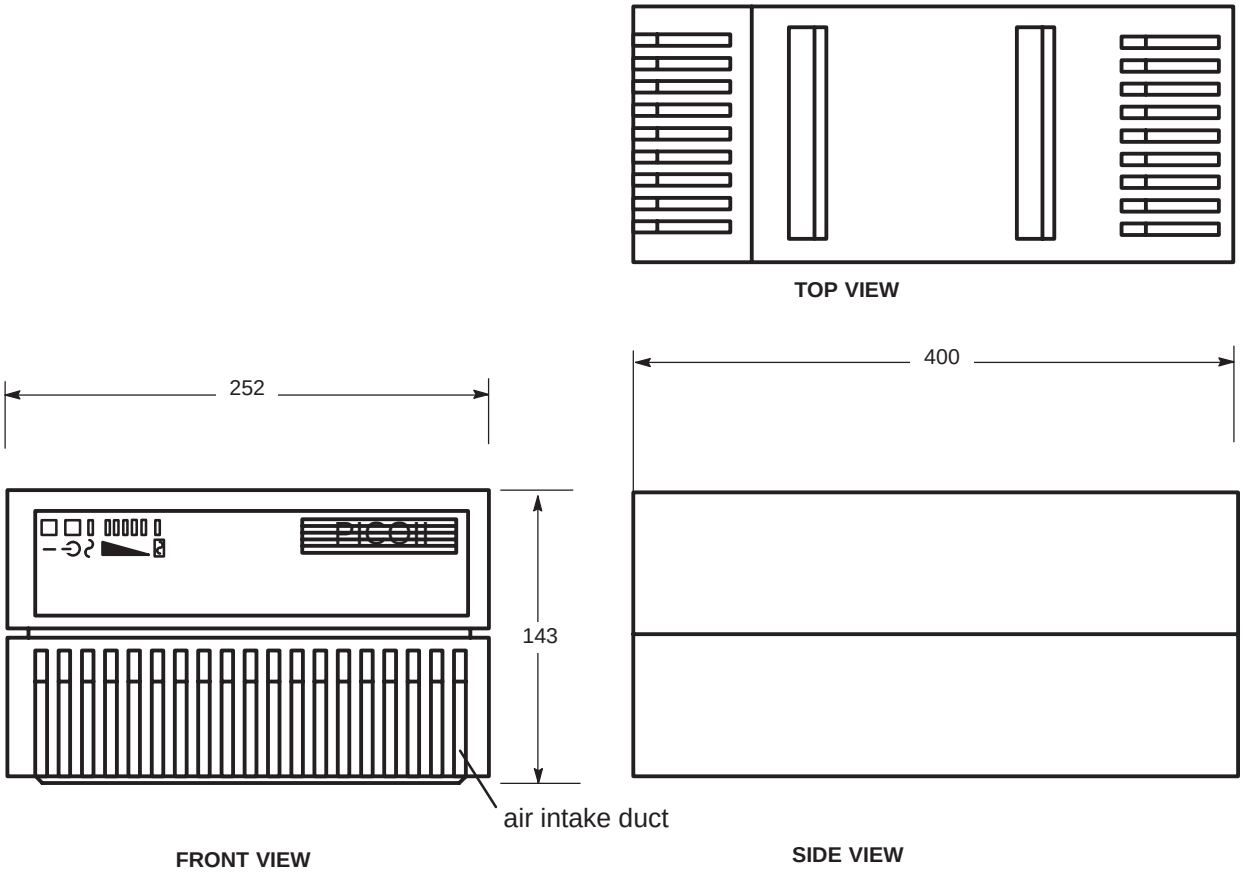


INTEGRATED POWER SYSTEM
ILLUSTRATION 2-21

2-11 COMPONENT DIMENSIONS (continued)

For Profile 1 to Profile HSR only

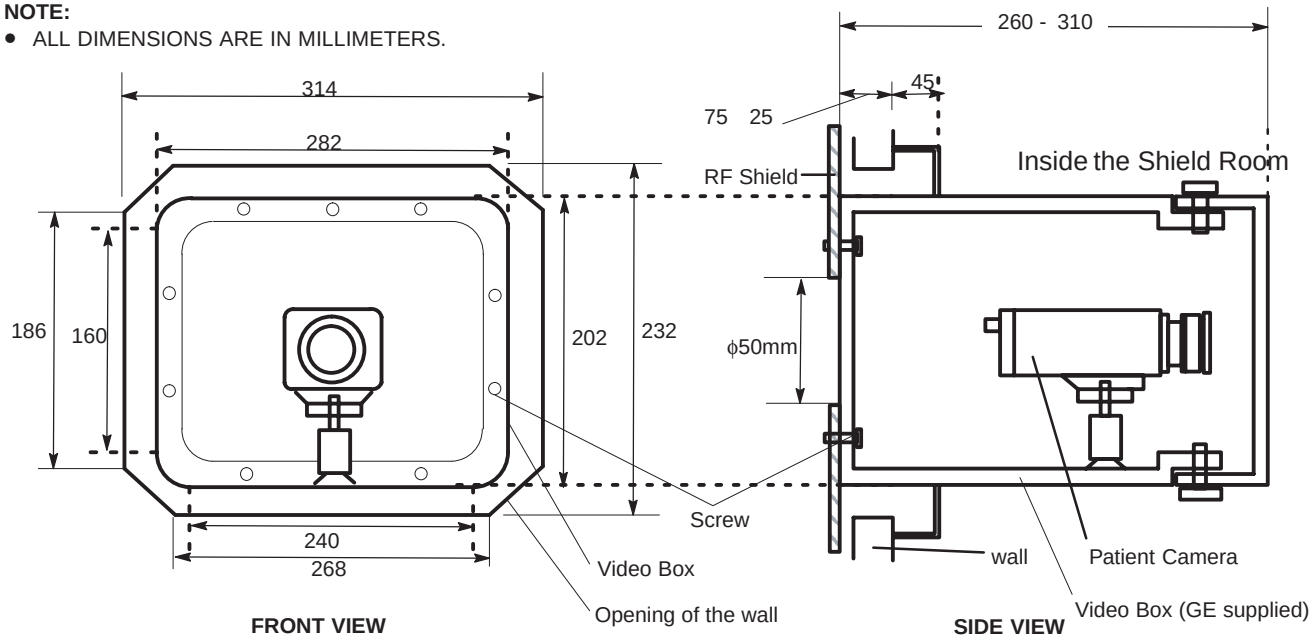
NOTE:
- ALL DIMENSIONS ARE IN MILLIMETERS.
- WEIGHT: 19.5Kg



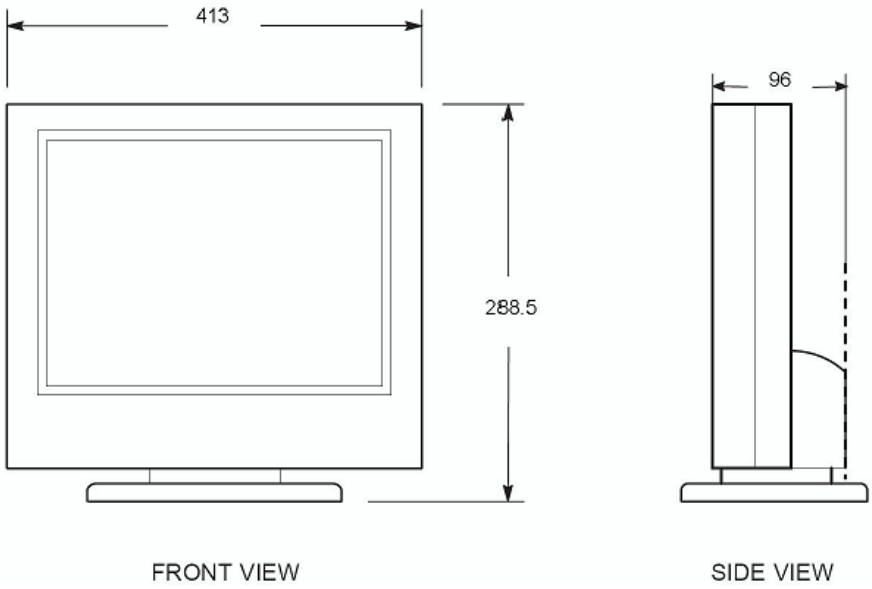
UNINTERRUPTABLE POWER SUPPLY (UPS)
ILLUSTRATION 2-22

2-11 COMPONENT DIMENSIONS (continued)

NOTE:
- ALL DIMENSIONS ARE IN MILLIMETERS.



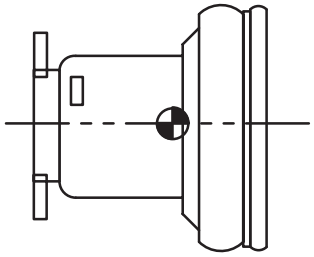
PATIENT MONITOR CAMERA AND VIDEO BOX(OPTION)
ILLUSTRATION 2-23

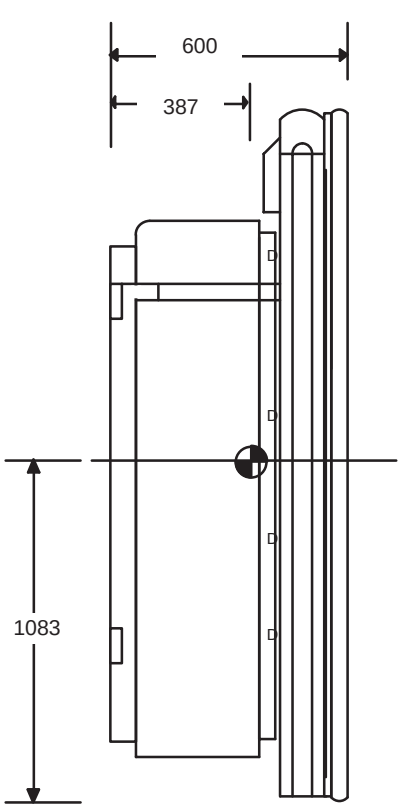


PATIENT MONITOR (OPTION)
ILLUSTRATION 2-24

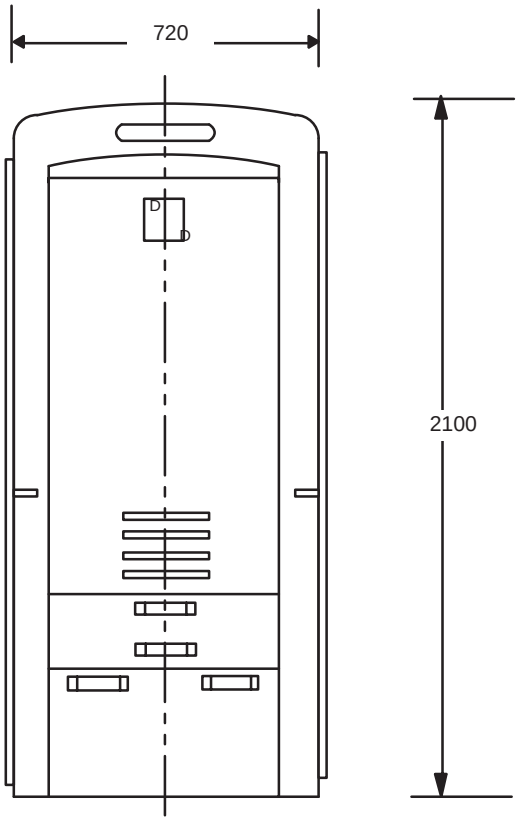
2-11 COMPONENT DIMENSIONS (continued)

NOTE:
- ALL DIMENSIONS ARE IN MILLIMETERS.
- WEIGHT: 250 kg
- INDICATES CENTER OF GRAVITY.





SIDE VIEW

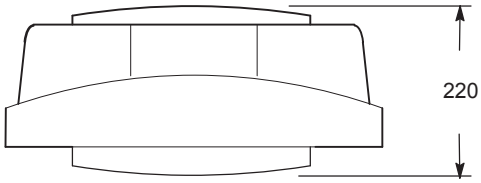


TOP VIEW

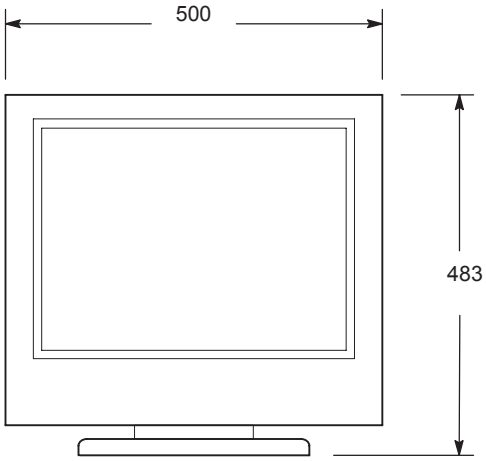
TABLE
ILLUSTRATION 2-25

2-11 COMPONENT DIMENSIONS (continued)

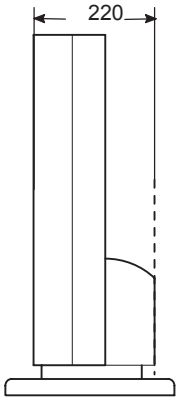
For Signa Profile1 to HighSR:



TOP VIEW



FRONT VIEW



SIDE VIEW

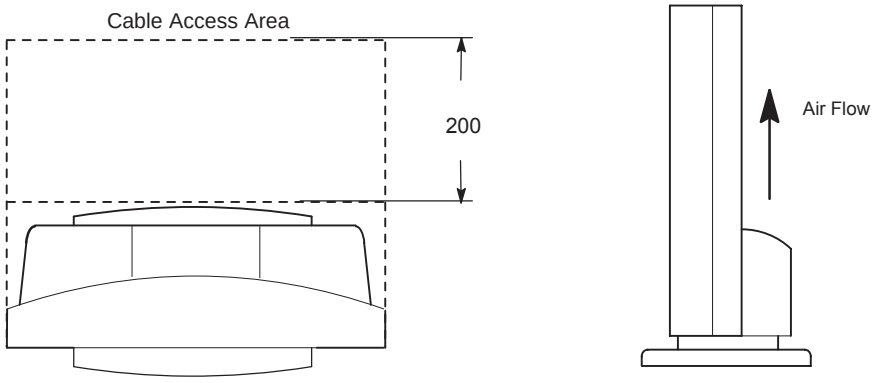
NOTE:
ALL DIMENSIONS ARE IN MILLIMETERS.

COLOR MONITOR(1)
ILLUSTRATION 2-26

2-11 COMPONENT DIMENSIONS (continued)

For Signa Profile1 to HighSR:

NOTE:
ALL DIMENSIONS ARE IN MILLIMETERS.

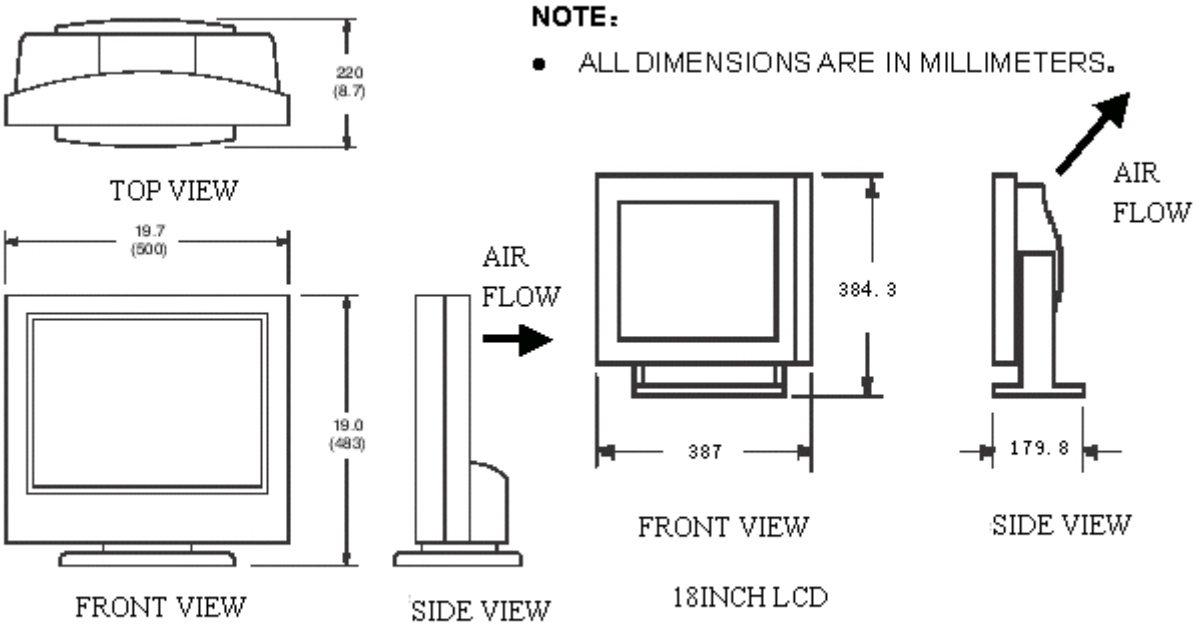


TOP VIEW **SIDE VIEW**

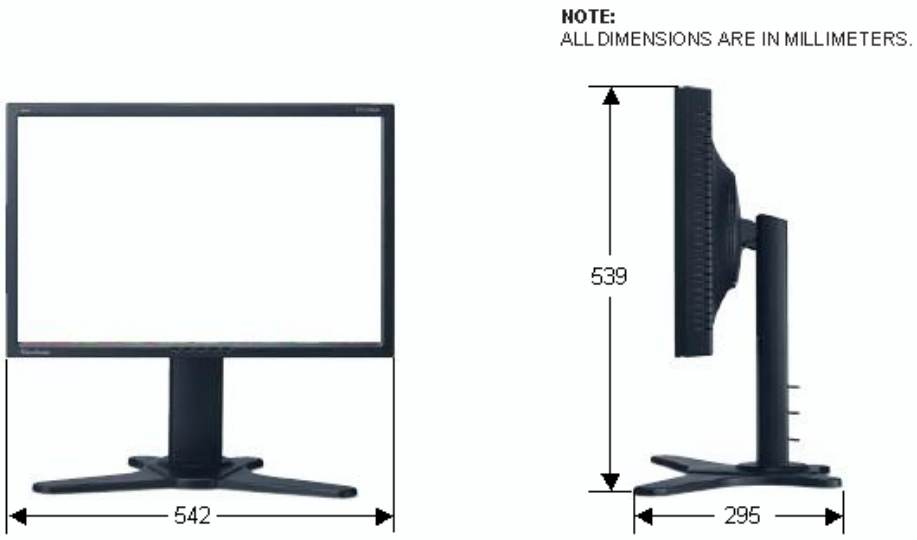
COLOR MONITOR(2)
ILLUSTRATION 2-27

2-11 COMPONENT DIMENSIONS (continued)

For Signa Profile5 and Profile HD:



COLOR MONITOR(3)
ILLUSTRATION 2-28



COLOR MONITOR(4)
ILLUSTRATION 2-29

SECTION 3 - MAGNETIC FIELD CONSIDERATIONS

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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 lever 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

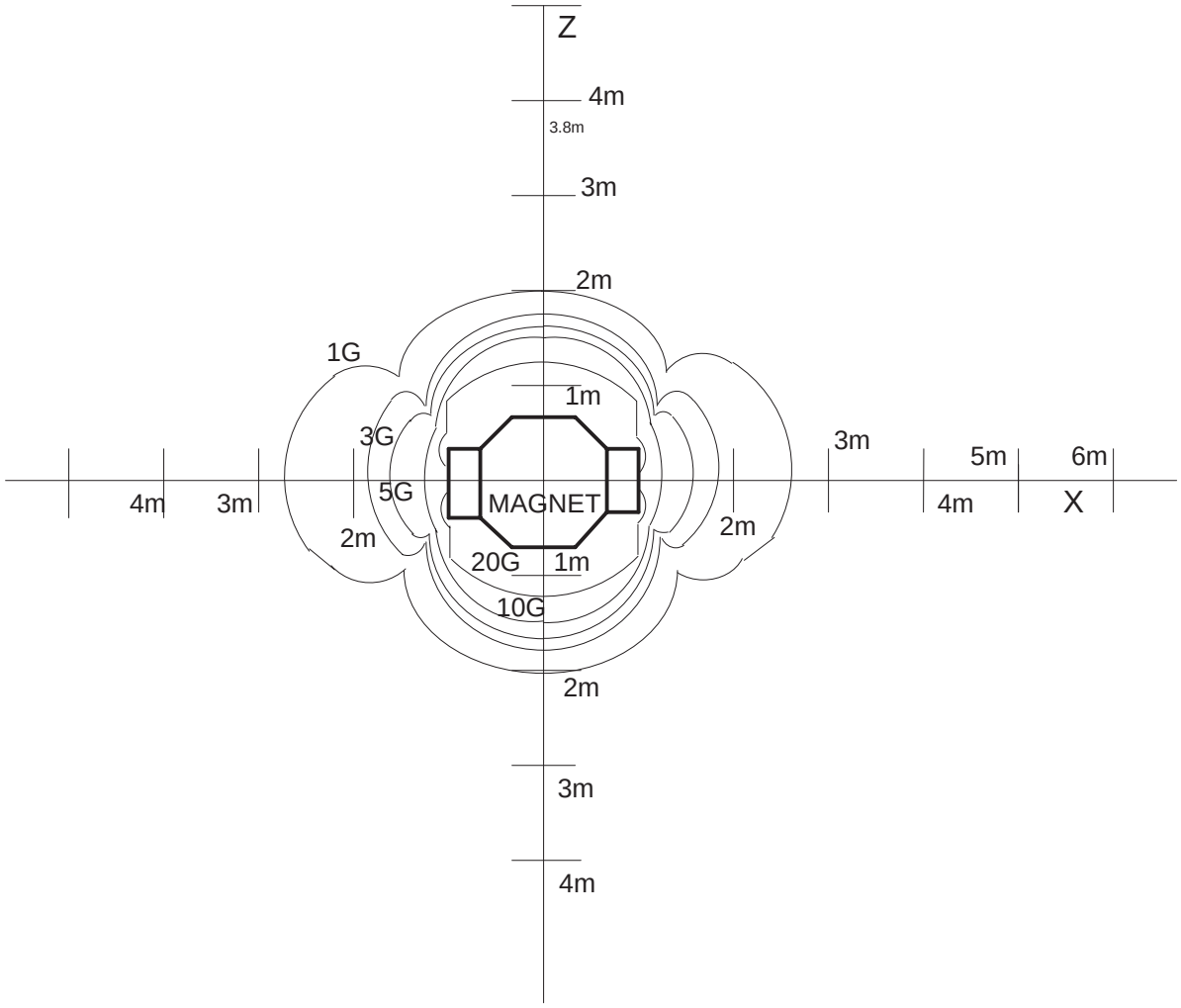
Illustrations 3-1 through 3-3 are magnetic field plots of the Profile magnet without the 6mm steel plate and are to be used to characterize the magnetic field during transport. The floor of the magnet room utilizes the 6mm plate to provide a uniform environment for the magnet; illustrations 3-4 through 3-6 characterize the magnetic field plots when the magnet resides on the 2.4 meter by 2.4 meter by 6mm 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 Profile 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 Profile MR with respect to hospital equipment and services (e.g. elevators, vehicular traffic, parking lots, etc...). Refer to *Section 2, 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

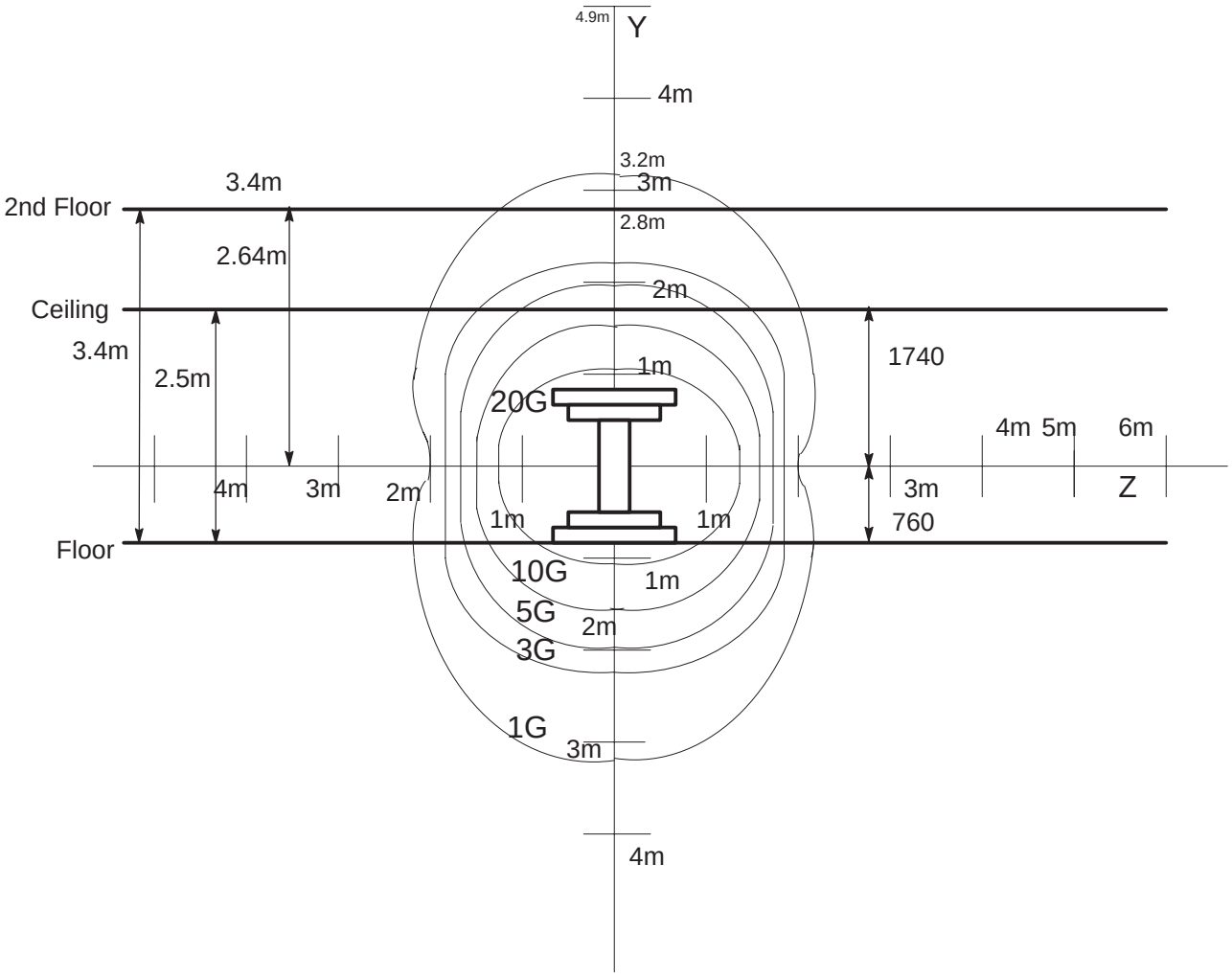


ISOGAUSS LINE PLOT WITHOUT THE STEEL PLATE FOR REFERENCE ONLY.

STEEL PLATE IS REQUIRED FOR THE ACTUAL SITING. REFER TO TABLE 6- 2.

MAGNET ISOGAUSS LINE PLOT WITHOUT STEEL PLATE(TOP VIEW)
ILLUSTRATION 3-1

3-6 ISOGAUSS LINE PLOTS (continued)

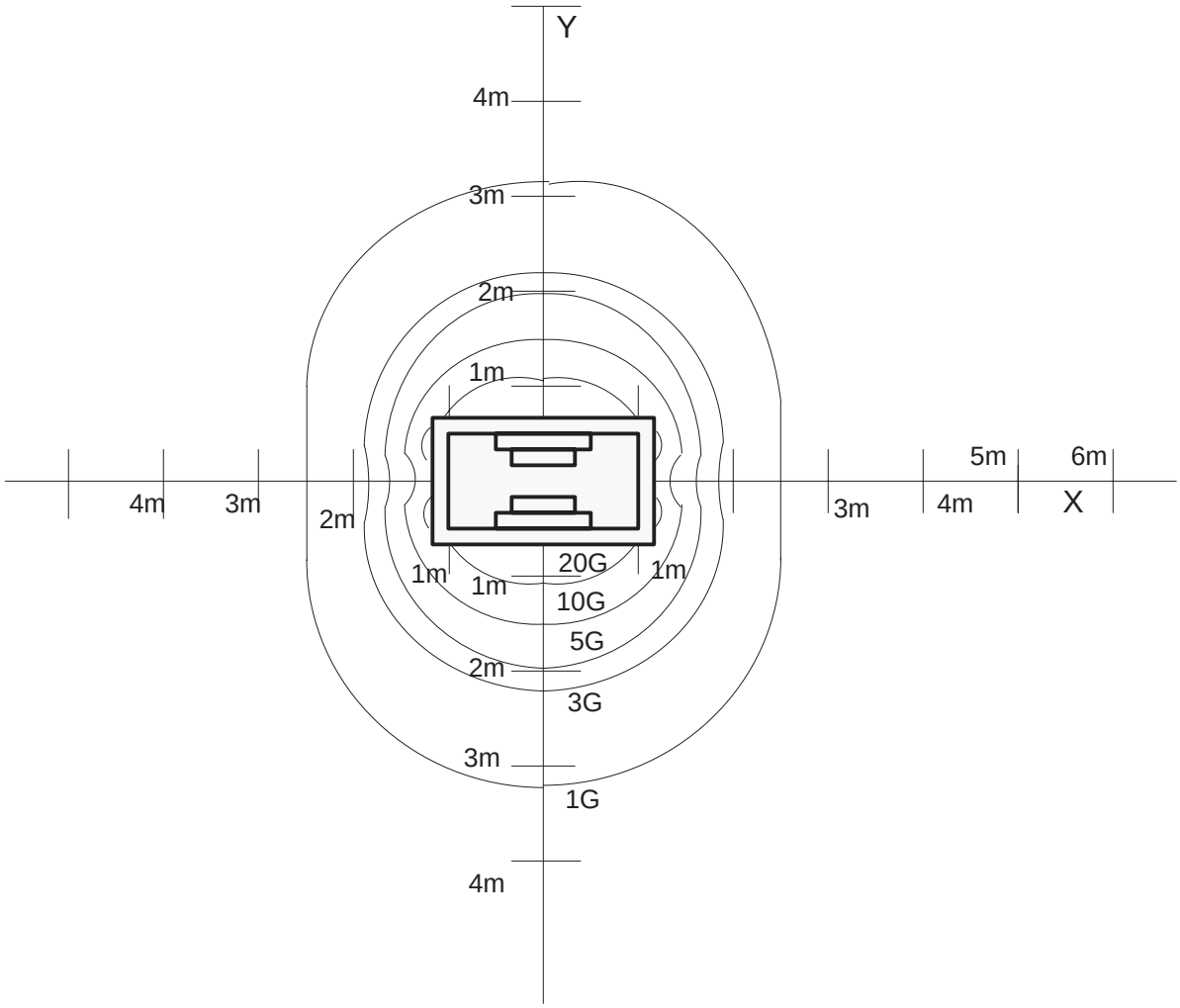


ISOGAUSS LINE PLOT WITHOUT THE STEEL PLATE FOR REFERENCE ONLY.

STEEL PLATE IS REQUIRED FOR THE ACTUAL SITING. REFER TO TABLE 6- 2.

MAGNET ISOGAUSS LINE PLOT WITHOUT STEEL PLATE(SIDE VIEW)
ILLUSTRATION 3-2

3-6 ISOGAUSS LINE PLOTS (continued)

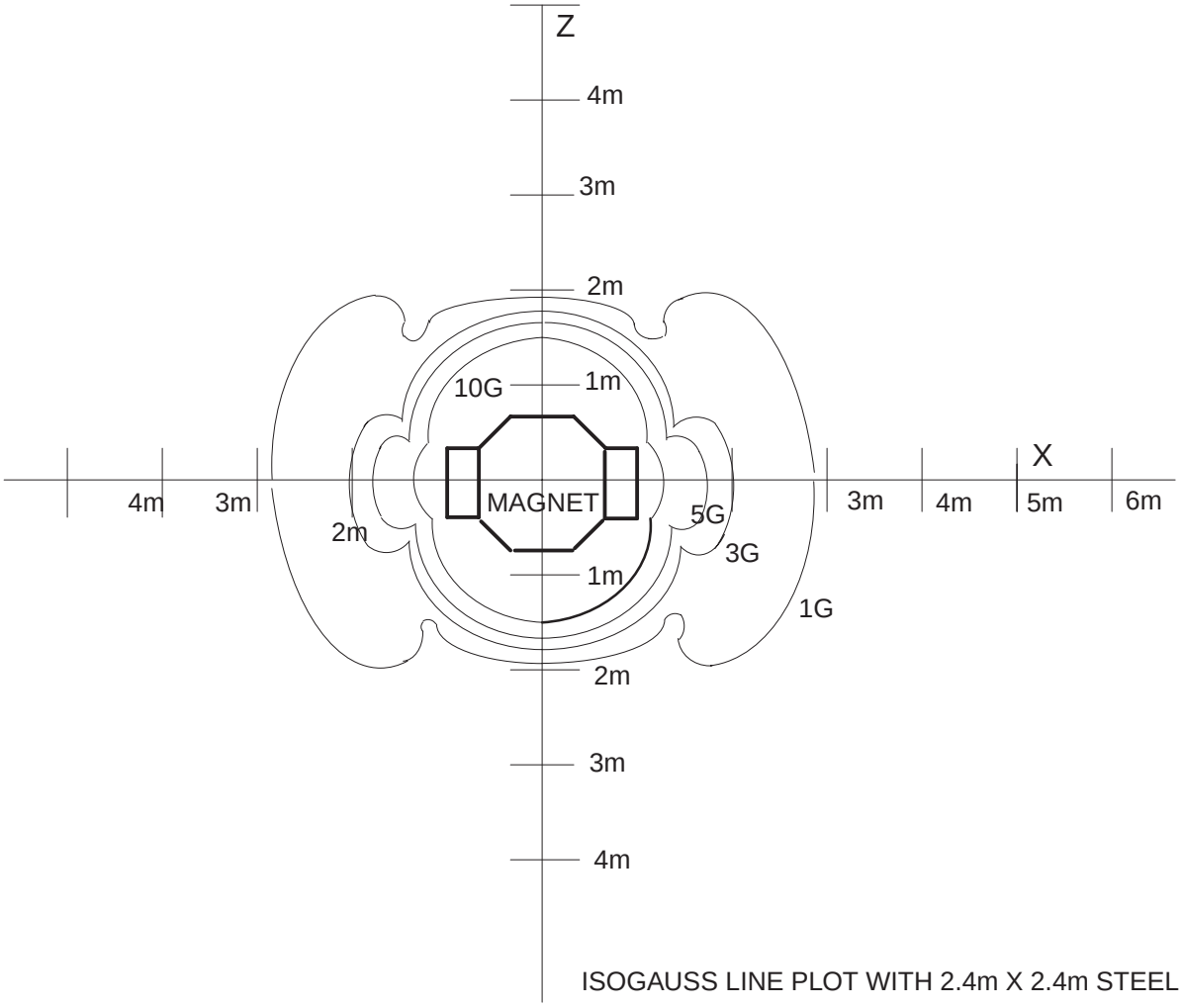


ISOGAUSS LINE PLOT WITHOUT THE STEEL PLATE FOR REFERENCE ONLY.

STEEL PLATE IS REQUIRED FOR THE ACTUAL SITING. REFER TO TABLE 6- 2.

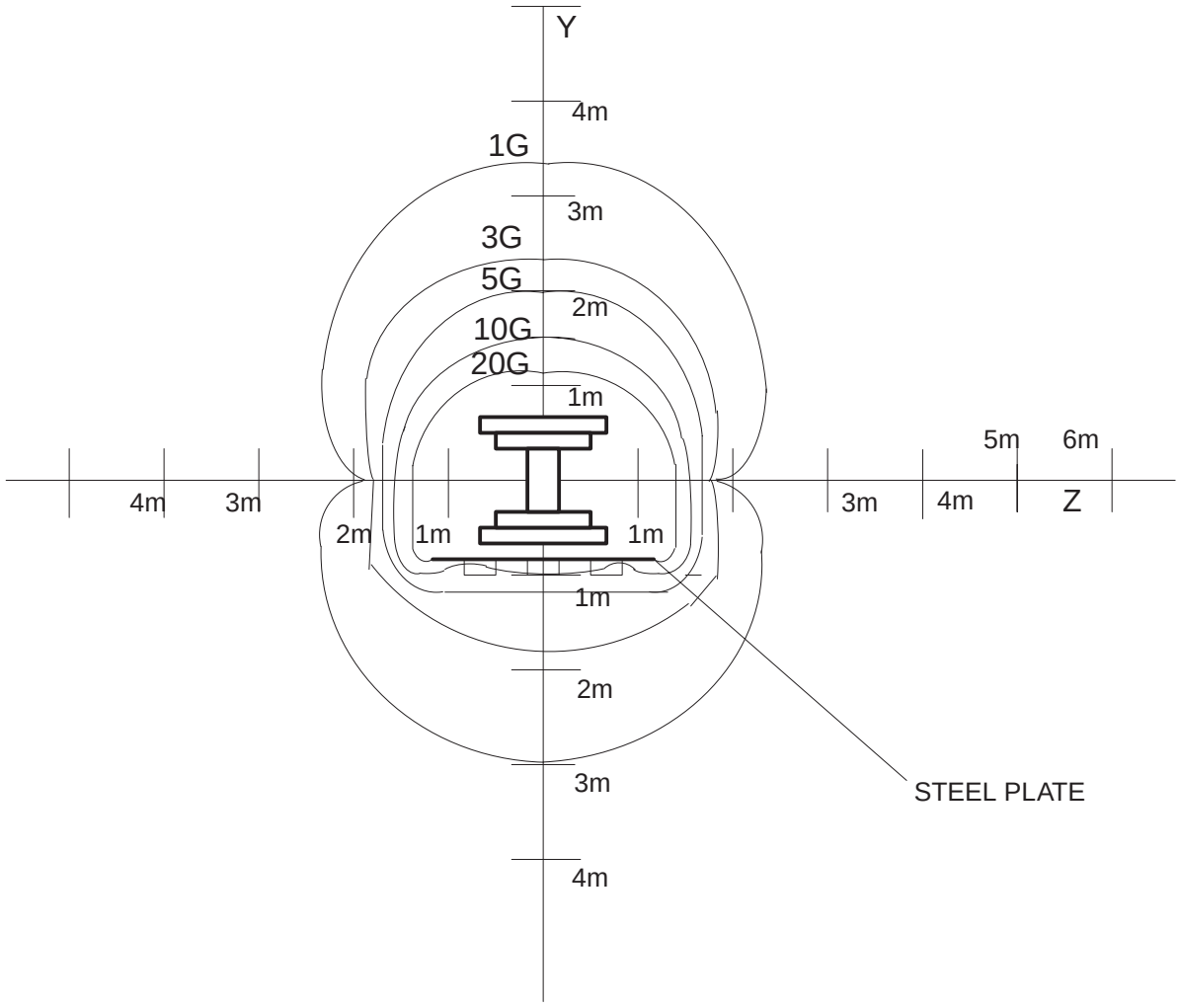
MAGNET ISOGAUSS LINE PLOT WITHOUT STEEL PLATE(FRONT VIEW)
ILLUSTRATION 3-3

3-6 ISOGAUSS LINE PLOTS (continued)



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

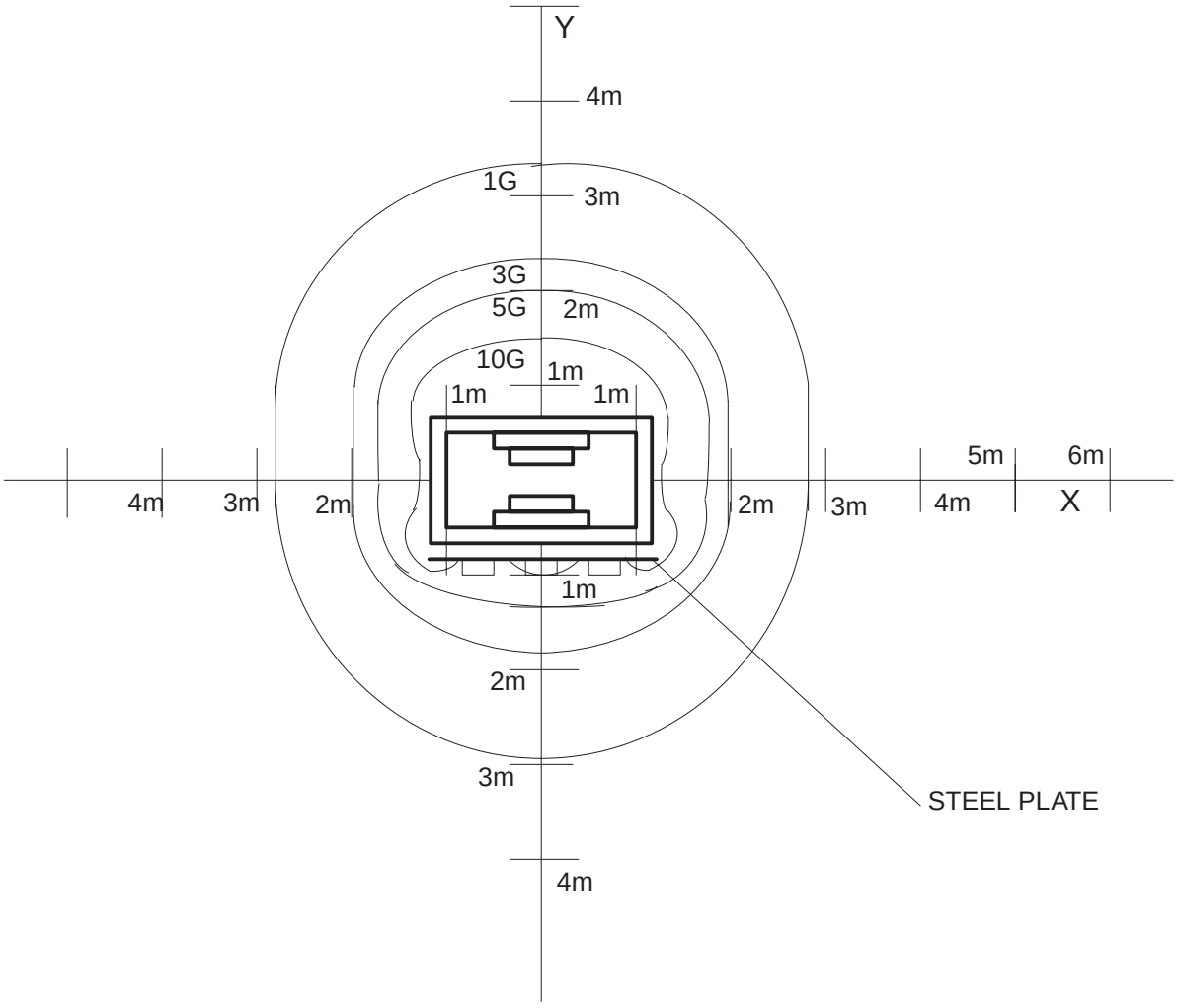
3-6 ISOGAUSS LINE PLOTS (continued)



ISOGAUSS LINE PLOT WITH 2.4m x 2.4m STEEL PLATE

MAGNET ISOGAUSS LINE PLOT WITH 2.4M X 2.4M STEEL PLATE(SIDE VIEW)
ILLUSTRATION 3-5

3-6 ISOGAUSS LINE PLOTS (continued)



ISOGAUSS LINE PLOT WITH 2.4 X 2.4m STEEL PLATE

MAGNET ISOGAUSS LINE PLOT WITH 2.4M X 2.4M STEEL PLATE(FRONT VIEW)
ILLUSTRATION 3-6

SECTION 4 - SITE ENVIRONMENT

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4-1 INTRODUCTION

The rating and duty cycles of all subsystems apply 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. The temperature in the magnet room must always be maintained in the specified range to avoid overheating of the magnet. Subjecting the equipment to consistent excessive temperatures above (27°C) 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, ventilation, and air conditioning) system. Proper insulation moisture barrier should be installed within the environmental controlled space (e.g. area above drop ceiling) for humidity, condensation, and temperature control.

TABLE 4-1
TEMPERATURE AND HUMIDITY SPECIFICATIONS

	TEMPERATURE RANGE °C	TEMPERATURE REGULATION °C	TEMPERATURE CHANGE °C/HR	HUMIDITY (%) Note 1	HUMIDITY CHANGE (%/HR)	MAX ROOM GRADIENT °C Note 2
Magnet Room	22 - 26 Note 4	Per patient comfort Note 3	4 Note 4	30 - 70	5	3
Operator s Control Room	15 - 30	-	5	20 - 80	5	6
Equipment Room Note 5	15 - 30	-	5	20 - 80	5	6

Note 1: Non- Condensing humidity with 50 % nominal.

Note 2: Room temperature gradient specification applies from floor to height of top discharge of equipment cabinets.

Note 3: To help prevent a patient from feeling uncomfortably warm during a scan, ensure that the magnet room temperature does not exceed the specified limit. Do NOT power OFF air conditioner during weekend or holidays.

Note 4: Magnet is sensitive to temperature change, refer to Section 4 - 3- 1,Air Cooling, for air conditioning duct location requirements. (F=1.8C+32 F:Fahrenheit, C:Centigrade)

Note 5: Equipment room can be deleted depending on customers request if there is no sound noise problem caused by IPS.

Note

It is very important that the air conditioning equipment and ducting be designed to provide adequate air flow to each MR cabinet or console. The designer must review the air cooling characteristics of each cabinet as described in Table 4-2 and provide sufficient air flow to match the individual heat load of each unit. Under no circumstances may the air outlet temperature of any cabinet be allowed to exceed 32°C . If the air temperature entering the equipment is 24°C , the minimum air flow is 15.0 m^3/min. If the air conditioning service is interrupted for an extended period of time, be sure that the room temperature is back within the specified limits before operating the system.

4-3 COOLING REQUIREMENTS

4-3-1 Air Cooling

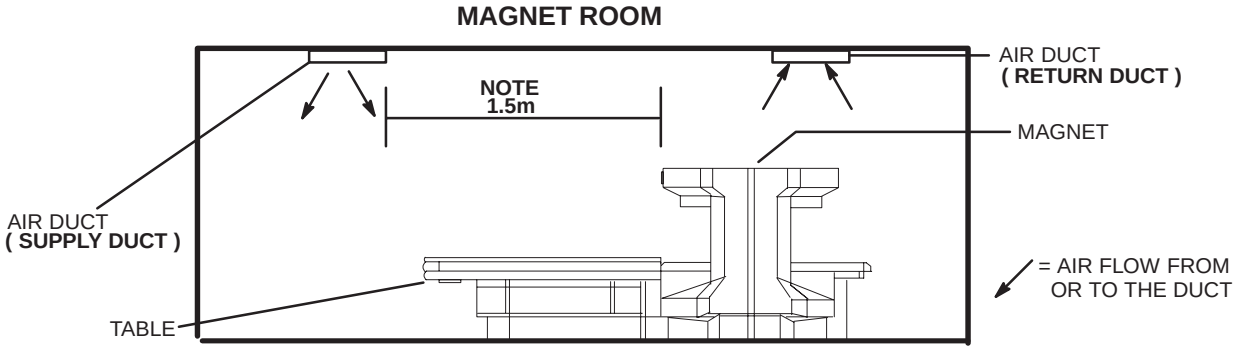
Always keep air conditioner ON to maintain Magnet room temperature specification. Air conditioning is a very important factor in Magnet room planning. Since a Profile magnetic's center frequency is controlled by the magnetic's temperature. It is critical that the pre-installation manual be followed closely. Placing air(HVAC) supply and return ducts in the recommended location will prevent a temperature gradient across Magnet. A temperature gradient beyond specification will cause image quality problems.

The total air cooling requirement for the MR system (excluding the options as listed in Table 4-2) varies depending on site construction. These values do not include people, lights, water cooling equipment and non-MR equipment. Use the air cooling Table 4-2 for calculating your cooling requirements for each 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 cabinet inlets. The returns should be above the cabinets near the equipment exhaust (see Note in Section 4-2, TEMPERATURE AND HUMIDITY SPECIFICATIONS).

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 that this equipment be located outside the 10 gauss line. Refer to Section 3, MAGNETIC FIELD for plot of gauss lines.

It is recommended that a temperature and humidity recorder be used during preinstallation and during actual installation and placed near the magnet inlets to establish the true values. Refer to the cooling table 4-2 in this section for each room's cooling requirements.

Because magnets are sensitive to temperature change, care must be taken in locating the air conditioning supply and air ducts to the Magnet Room to ensure proper air flows. Supply ducts are to be located by patient table sides so conditioned air does not flow directly to the magnet. Return Ducts are to be located near magnet side to maintain circular air flow. See Illustration 4-1.



MAGNET ROOM AIR FLOW REQUIREMENTS
ILLUSTRATION 4-1

NOTE: Magnet is sensitive to temperature change. If this caution (magnet must be 1.5m away from the AIR DUCT (SUPPLY DUCT)) is not followed, consistent operation of the system is not guaranteed.

4-3-1 Air Cooling (continued)

TABLE 4–2
AIR COOLING TABLE

MR COMPONENT	MAGNET ROOM		OPERATOR/EQUIPMENT CONTROL ROOM	
	BTU/hr	WATT (W)	BTU/hr	WATT (W)
Permanent Magnet with Enclosure	512	150		
Monitor			1,481	434
Integrated Power System (IPS)			7,637	2,238
MGD				260
DCERD				178
Gradient Power Supply (GPS)				1,200
RF Amplifier				600
Scan Room Unit (SRU)			307	90
Patient Monitor (OPTION)			102	30
Laser Camera I/F (OPTION)			68	20
Room Sub Total	512	150	9,595	2,812

Note 1: Heat output during operation is defined for temperature and humidity as defined in Table

Note 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 4–2, TEMPERATURE AND HUMIDITY SPECIFICATIONS.

Note 3: The 0.2T Magnet is sensitive to temperature changes. If the Magnet Room air flow requirements are not followed and an air supply exclusion zone is not respected, consistent operation of the system is not guaranteed.

Note 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.

Note 5: Operator Workspace equipment includes the following: LCD Color Monitor, GOC Cabinet, Mouse and Mouse Pad, LCD Panel, and Keyboard.

4-4 ALTITUDE

The altitude limit of the system is 30 m(106KPa)below to 3000 m(106KPa) above sea level.

4-5 LIGHTING

Incandescent lighting is required in the Magnet room to avoid RF noise. If a low and high light level is desired in the Magnet room, the different levels must be selectable by a switch since dimmers are not acceptable. Dimmers can be used outside of magnet room if they are on a separate circuit. Fluorescent lighting may be used in the operator control room and the equipment room.

TABLE 4-3
LIGHTING

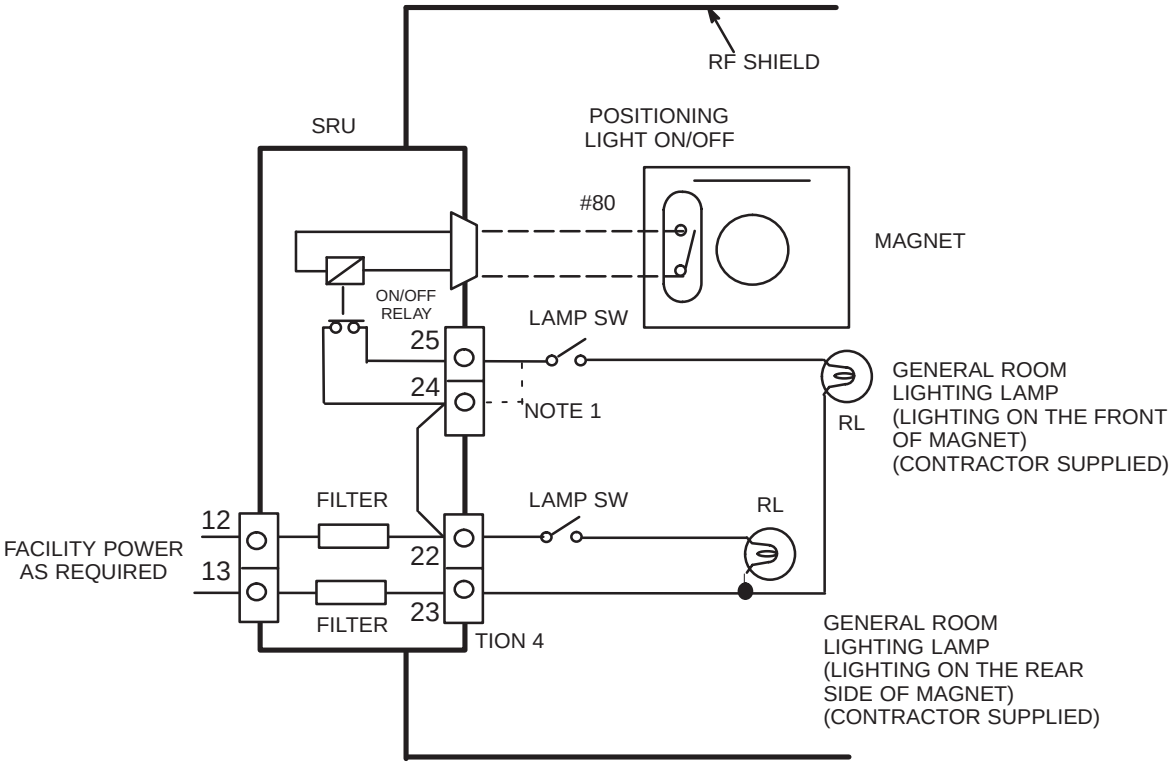
AREA	LUMINOUS INTENSITY	LIGHTING	CONTROLS
Magnet Room	More than 100 LX (9.3 FC)	Incandescent Lighting	ON - OFF (Note 1)
Operator Control Room	More than 300 LX (28 FC)	Fluorescent Lighting	Dimmer can be used. (Note 2)
(Equipment Room)	More than 300 LX (28 FC)	Fluorescent Lighting	ON - OFF

Note: 1.The on-timing of the lighting of the positioning light may be synchronized to the off-timing of the lighting in the magnet room. When the position light is turned on, the light in the magnet room should be turned off, when the positioning light is turned off, the light in the magnet room should be turned on. On-Off Relay is located in the SRU. The timing diagram of the lighting is shown in Illustration 4- 2.

2.Selectable lighting is recommended in the operator control room in order not to interfere with the monitor of the operator console.

3.Equipmet room can be deleted according to customers request if there is no sound noise problem caused by IPS.

4-5 LIGHTING (continued)



NOTE 1:
IF SYNCHRONIZED LIGHTING IS NOT DESIRED, REAR LIGHTING MUST BE SWITCHED SEPARATELY FROM FRONT LIGHTS AS SHOWN.

TIMING DIAGRAM (OPTIONAL)
ILLUSTRATION 4-2

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	:	63 dB(A)
Equipment Room	:	70 dB(A)
Magnet Room	:	70 dB(A) during scans

Equipment room can be deleted according to customers request if there is no sound noise problem caused by IPS.

4-7 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 equipment area requires that the air filtration be 90 percent of all particles down to 10 microns and 80 percent of all particles down to five microns.

Equipment Room should be kept clean. No tobacco fumes are allowed. If the Operator Area and Equipment Area are placed in one room, make sure that the tobacco fumes in the Operator Area do not go into the Equipment Area.

4-8 AMBIENT RFI AND EMI

4-8-1 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 90 dB RF Shield. Refer to Section 6, RF SHIELDED ROOM SPECIFICATION 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.

Table 4-4 lists the recommended centerband and bandwidth frequencies to be used when measuring radio frequency interference.

TABLE 4-4
RADIO FREQUENCY SURVEY SPECIFICATIONS

ISOTOPE	BANDCENTER MHz/Tesla	BANDWIDTH Hz/Tesla
^{1}H	42.576	228,000

When required, RFI site surveys are to be performed by cycling through the preceding frequency bands and a broad band range from 5 MHz - 100 MHz. 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 90dB 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 millivolts per meter (100 dB microvolts 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 (8.52 MHz for ^{1}H at 0.2 Tesla)

4-8-2 Induced Electro Magnetic Interference Fields (EMI)

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. Balanced three phase power lines can conduct significantly more current than a single phase line before they become detrimental to 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 rearrangements are necessary.

Magnetic field interference (50 or 60 Hz) must not exceed 2 milligauss rms at the isocenter of the magnet. The following equation can be used as a general guide in determining acceptable current in feeder lines at a given distance from the magnet isocenter.

Where: 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.

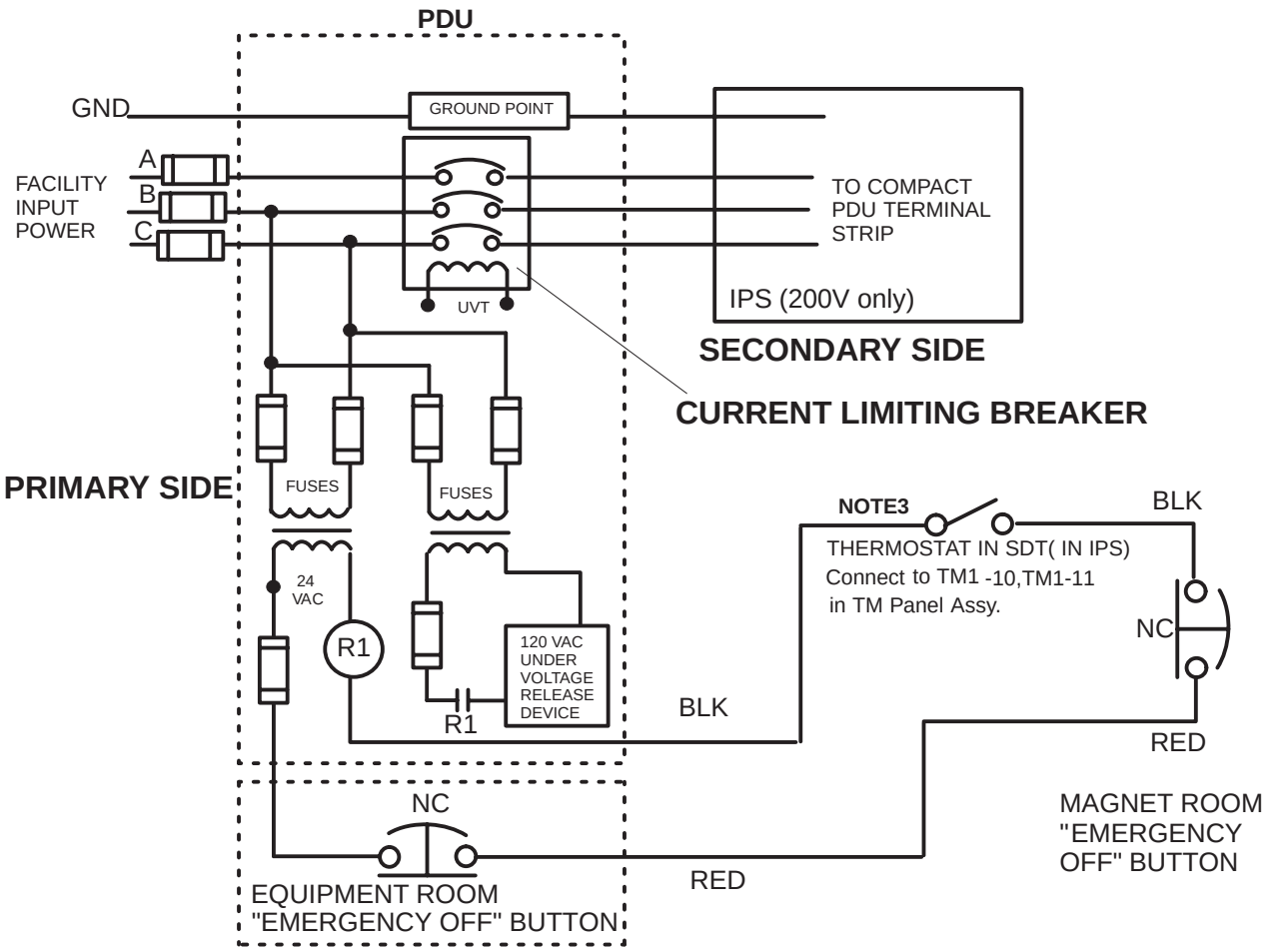
4-9 CONTRACTOR FURNISHED COMPONENTS

TABLE 4-5
CONTRACTOR FURNISHED COMPONENTS

ASSOCIATED EQUIPMENT	MATERIAL/LABOR PROVIDED BY CUSTOMER CONTRACTOR
System Emergency Off Buttons	Provide and install wall switch box for single push button stations flush mounted. Provide red emergency off push button switch with a guard to prevent inadvertent actuation. Also provide nameplate "SYSTEM EMERGENCY OFF". Locate 1524 mm from floor near each exit in the magnet and equipment rooms. **SEE ILLUSTRATION 4- 3**. **Note** DO NOT label buttons "Emergency Stop"--- they are NOT the same.
Power in Operator Control Area	Provide and install power outlet and wall duct. Refer to Table 5- 1 (in Section 5- 1 INTRODUCTION) for power specifications.
System Power and Ground Cable	Provide Power and ground cables between IPS and MDC, MDC and Main Power. Refer to Sections 5- 2, POWER REQUIREMENTS and 5- 5, SYSTEM GROUND, for cable specifications.
Main Disconnect Control (MDC) **Note 1**	Contractor to provide and install Main Disconnect Control for power distribution per local codes. Refer to Section 5- 2, POWER REQUIREMENTS.

NOTE 1: A special design MDC panel is available which protects against long term magnet heater power loss in case of short duration incoming power interruption. (Undervoltage trip delay)
An integrated transient voltage surge suppressor(TVSS) is also available and highly recommended for sites without power conditioning.
Integrated undervoltage trip and TVSS MDCs are required for all Profile systems sold in USA.

4-9 CONTRACTOR FURNISHED COMPONENTS(continued)



NOTE1: In order to turn off the power of the primary side after pushing "EMERGENCY OFF", turn off the CURRENT LIMITING BREAKER. "EMERGENCY STOP"on Keyboard or on Front Magnet Cover does not turn off the primary side.

NOTE2: Undervoltage Device automatically trips breaker when coil voltage drops to a specific percent of rated value. Undervoltage Trip (UVT).

NOTE3: The connecting cable for the Thermostat must be prepared by the user.

TYPICAL PROTECTIVE DISCONNECT SET-UP (EMERGENCY OFF)
ILLUSTRATION 4-3

4-10 VIBRATION

4-10-1 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.

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 4-10-3, MR Site Vibration Test Guidelines through 4-10-5, 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 necessary to bolt Magnet. Vibration measurements on the magnet support must meet the guidelines defined in Section 4-10-2.

4-10-2 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.**

4-10-3 MR Site Vibration Test Guidelines

Test Measurements

- Vibration measurements are in the range of 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 4-6

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 de pendent.

4-10-4 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.

4-10-5 Test Measurements

•Ambient Baseline Condition:

All of the measurements defined in Sections 4-10-3, MR Site Vibration Test Guidelines and 4-10-4, 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 zero to peak, an alternative location should be identified. A second vibration measurement should be made to help identify a more stable location.

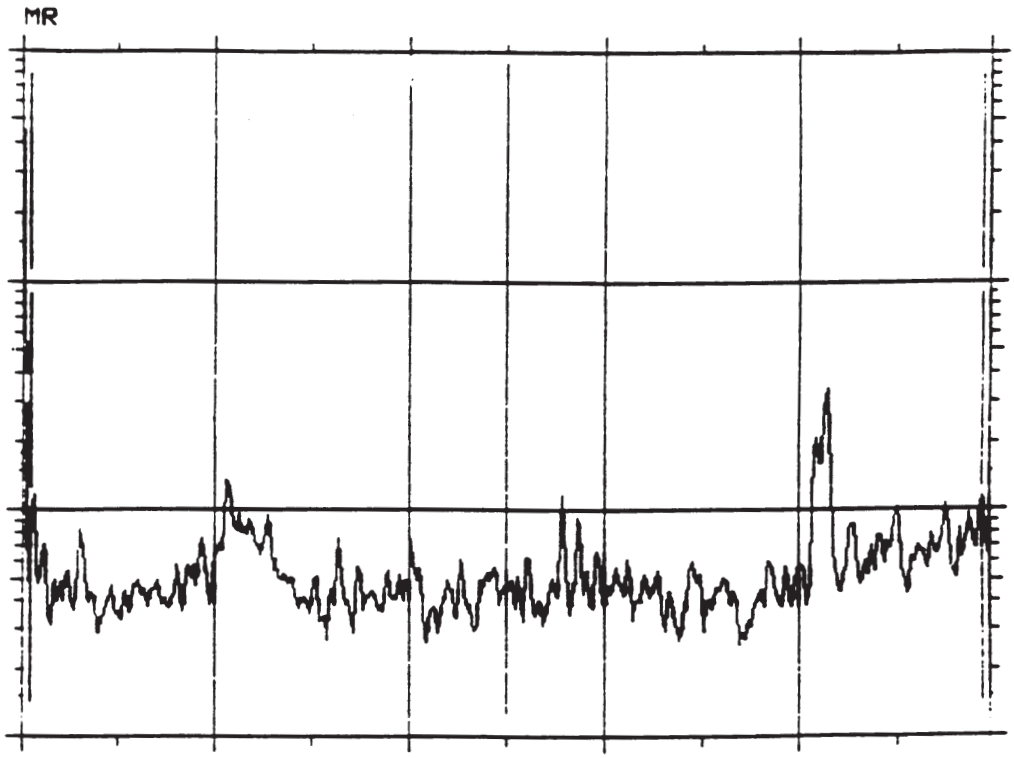
4-10-6 Presentation/Interpretation of Results

- The recommended format for site vibration data collection, presentation, and analysis is illustrated in the four examples shown in Illustrations 4-4 through 4-7. 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.

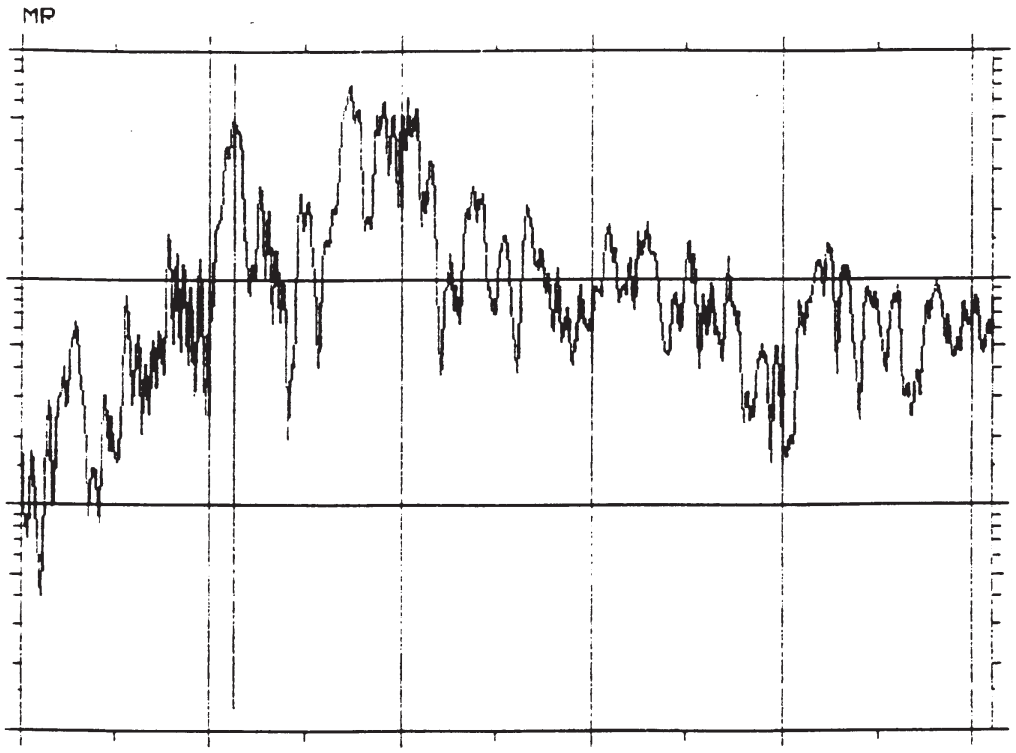
- Any questions regarding test equipment requirements, test parameters, or general questions should be discussed with your GE Installation Specialist.

4-10-6 Presentation/Interpretation of Results



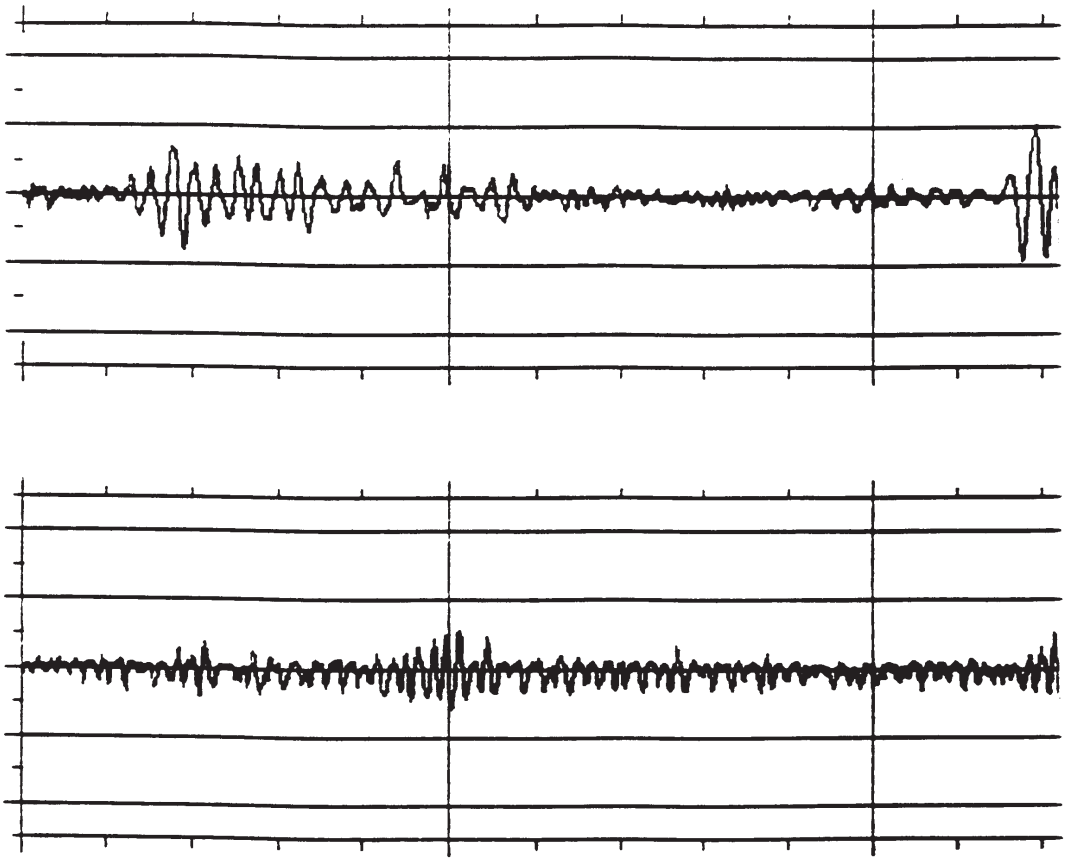
FFT 0.2 TO 50 HZ
ILLUSTRATION 4-4

4-10-6 Presentation/Interpretation of Results (continued)



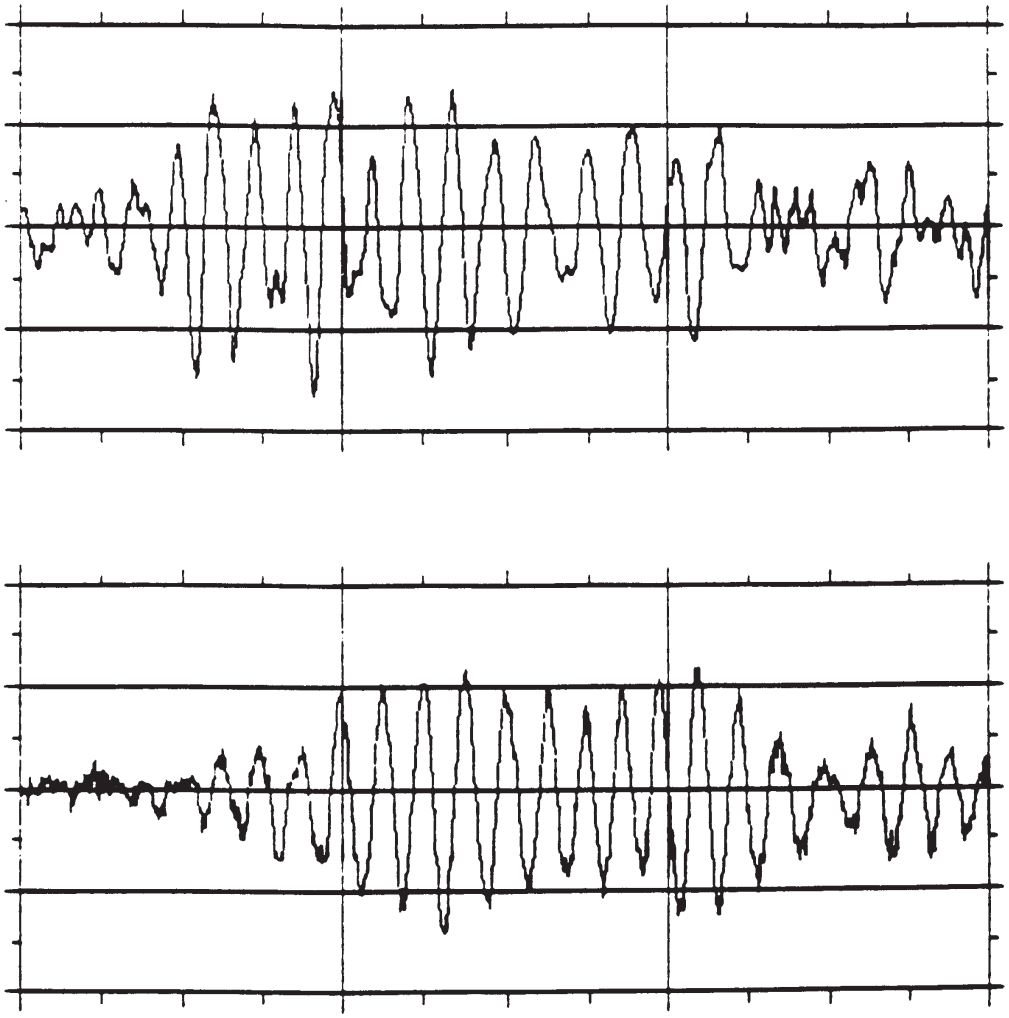
FFT 0.2 TO 1000 HZ
ILLUSTRATION 4-5

4-10-6 Presentation/Interpretation of Results (continued)



ACCELERATION TIME HISTORY
ILLUSTRATION 4-6

4-10-6 Presentation/Interpretation of Results (continued)



ACCELERATION TIME HISTORY
(ZOOM IN ON TRANSIENT EVENT)
ILLUSTRATION 4-7

4-11 MAGNET CHANGING MAGNETIC ENVIRONMENT SPECIFICATIONS

Definition of Moving Metal

The term ”moving metal” refers to ferrous objects such as automobiles, elevators, and dumpsters that, when passing through the sensitivity zone of the magnet may cause perturbations in its internal magnetic field which may cause imaging distortions. Note that in general, if these objects are stationary during scanning, no effect will be seen.

4-11-1 EMI investigation at sites

Moving metal has an impact on the system performance, especially image quality. An EMI investigation should be conducted according to the flow chart illustrated in illustration 4-8.

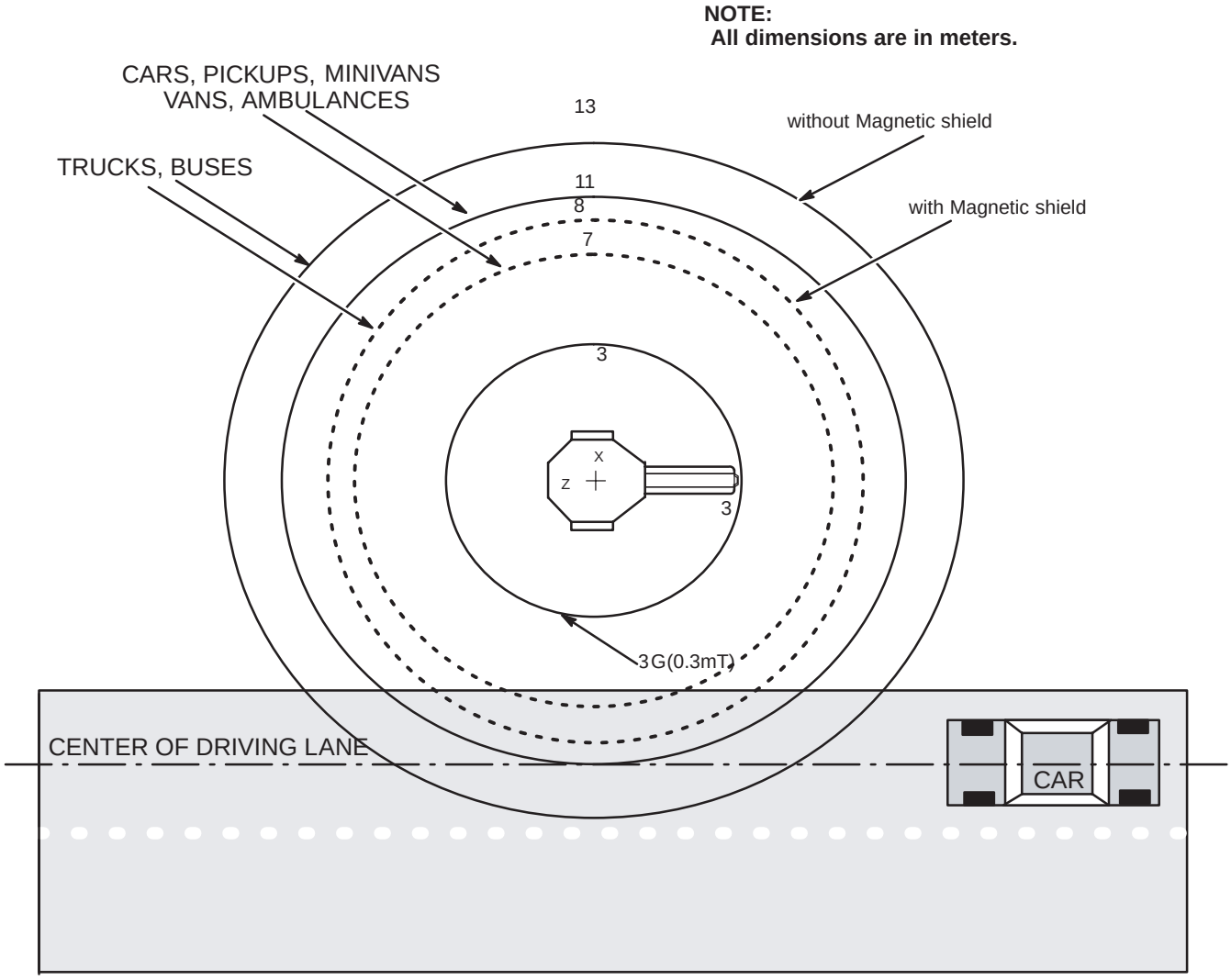
4-11-2 Guideline for objects on required distance

Refer to table 4-7 and Illustrations 4-8. The data given is for reference purposes; suspect sites should be measured with a flux gate sensor to assure compliance with specifications.

TABLE 4-7

QUICK CHECK EMI ENVIRONMENT AT SITES : REQUIRED MINIMUM DISTANCE

Object	Required minimum distance from magnet center (m)	
	w/o room magnetic shield	2mm silicon steel room magnetic shield
Train	50	40
Cars, Minivan, Vans, Pickup Trucks	11	7
Trucks, Buses	13	8
AC line	5	4
Objects < 181kg	3	Outside magnet room
Elevator	11	7



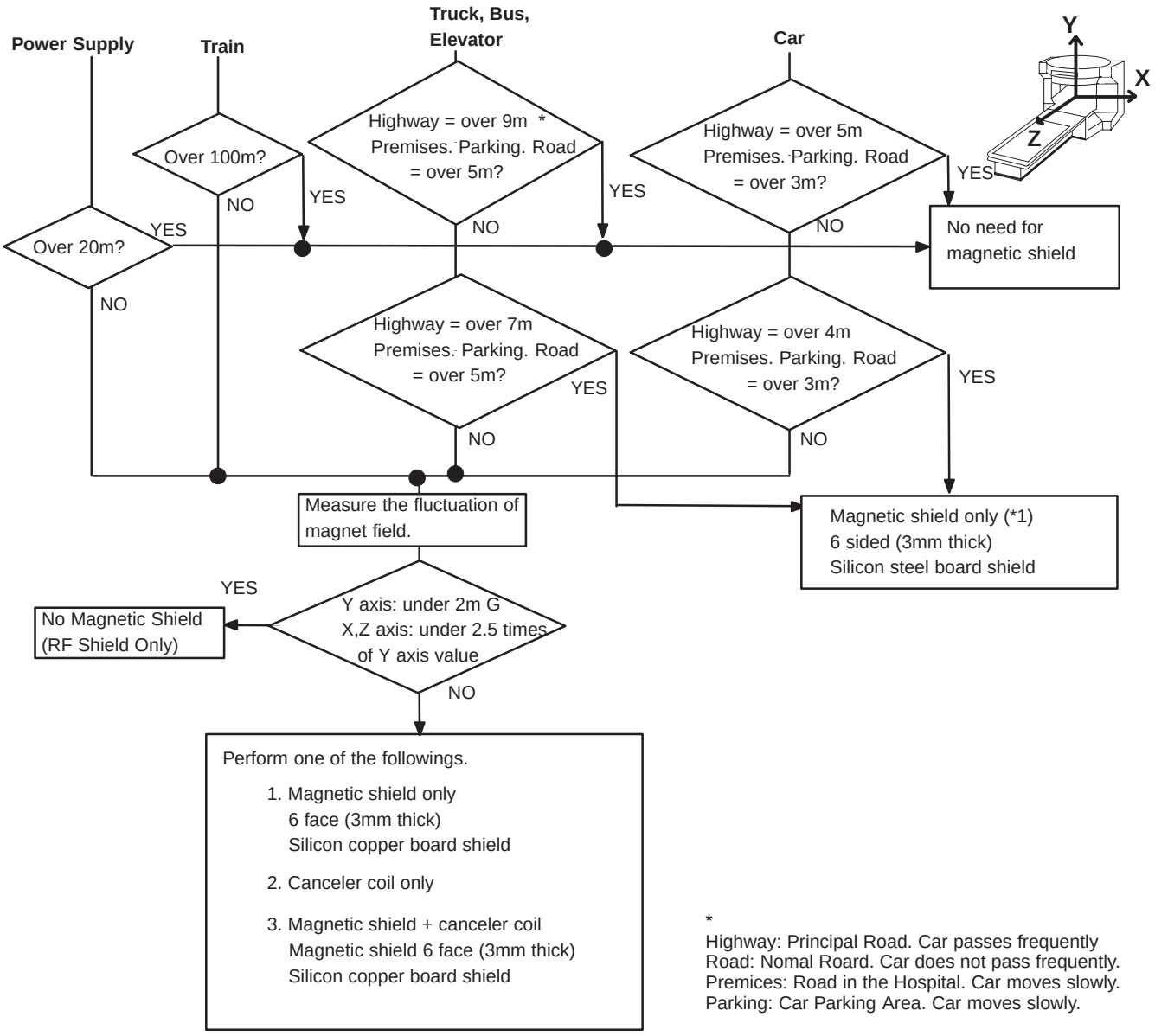
MOVING METAL SENSITIVITY LINE PLOT
(MR CENTER LEVEL)
ILLUSTRATION 4-8

4-11-3Countermeasure 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).

4-11-3Countermeasure for Fluctuated Magnetic Field (continued)



*
Highway: Principal Road. Car passes frequently
Road: Nomal Roard. Car does not pass frequently.
Premices: Road in the Hospital. Car moves slowly.
Parking: Car Parking Area. Car moves slowly.

COUNTER MEASURE INSTRUMENT FOR FLUCTUATED MAGNETIC FIELD
ILLUSTRATION 4-9

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SECTION 5 - POWER REQUIREMENTS

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5-1 INTRODUCTION

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 with 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 system transformer. 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 dividers in duct. Refer to Table 5-1 for required customer power.

TABLE 5-1
ELECTRICAL REQUIREMENTS

MR COMPONENT	VOLTAGE VAC	FREQUENCY Hz	PHASE	MAX AMPS	NOTES
Primary Power Source	200 **See Note 1**	50 / 60	3	50 A	

Note 1: Integrated Power System (IPS) Cabinet input voltage for Japan is 200 V. Step Down Transformer (SDT) with input voltages 380, 415, 480 VAC 50/60 Hz is standard for outside Japan. Customer supplied transformer is required for other voltages to convert local voltage to either 380, 415 or 480 VAC . IPS cabinet input voltge for USA is 480VAC.

5-2 POWER REQUIREMENTS

Configuration: Three phase wye(without neutral line) or delta.
Maximum Power Demand: 13 KVA
Average (while scanning) Power Demand: 5 KVA
Standby (no scan) Power Demand: 3 KVA
Frequency: 50 Hz + 0.5 Hz or 60 Hz + 0.5 Hz
System Voltage: 200VAC+8% (380/415/480VAC+8% for outside Japan with SDT)
Daily Voltage Variation: + 5 % from nominal under worst case of line and load regulation.

Note
5% (percent impedance) corresponds to 0.23Ω on 200 VAC lines at 14 KVA transformer.

Voltage Transients: Transients, other than those created by the MR system, shall not be more than 800 volts peak (on a 480 V line) with a duration of less than 75 microseconds.

Regulation: 5 % max at 13 KVA max power demand.

Phase Balance: 2 % maximum phase-to-phase line voltage difference from the lowest phase.

Ground Conductor: An isolated and dedicated ground using copper wire the same size as the power conductors or 25 mm^2 (AWG3, AWG 0 with PowerTECH) which ever is larger will be used. The dedicated ground shall originate at the ground connection of the supplying transformer or distribution panel and shall not have other connections to it until the ground bus in the IPS.

Note
Ground impedance to earth at power source is required to be 2 ohms or less.

5-3 PRIMARY FEEDER SIZE

The recommended primary feeder minimum size for the facility is listed in Table 5-2.

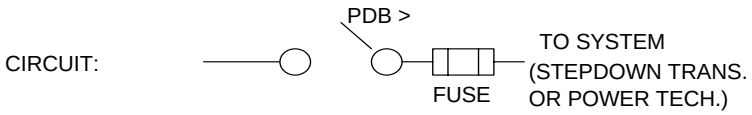
TABLE 5-2
PRIMARY FEEDER SIZE

LENGTH m	CONDUCTOR SIZE mm^2 (AWG)		
	380V, 415V	480 V	200 V NOTE1
20	8(8)	8(8)	22(4)
30	8(8)	8(8)	22(4)
40	8(8)	8(8)	22(4)
50	8(8)	8(8)	34(2)
60	8(8)	8(8)	34(2)
70	14(6)	8(8)	34(2)
80	14(6)	8(8)	34(2)
90	14(6)	14(6)	34(2)
100	14(6)	14(6)	34(2)

NOTE1: This number is for reference only

This is based upon the following conditions:
Step Down Transformer: 2 % Voltage Drop
Primary Feeder Regulation: 3 % Voltage Drop

FUSE CAPACITY AND WIRE GAUGE

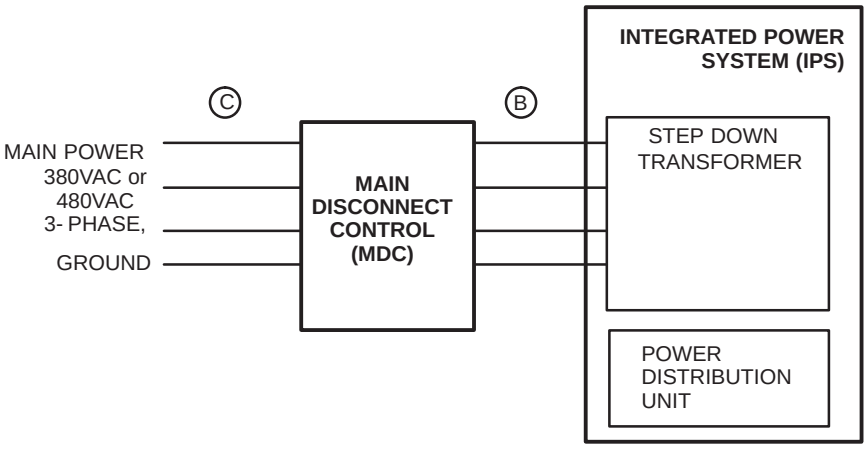


INPUT VOLTAGE	FUSE(watt)	WIRE
380V / 50Hz	30 A	AWG #4
415V / 50Hz	30 A	AWG #4
480V / 60Hz	30 A	AWG #4

THIS MENTION IS NEEDED ON ALL EXPORT ITEMS

5-4 POWER CONNECTION

Connections of power cables will differ according to the main power configuration supplied. Refer to the following, Illustrations 5-1 through 5-3.

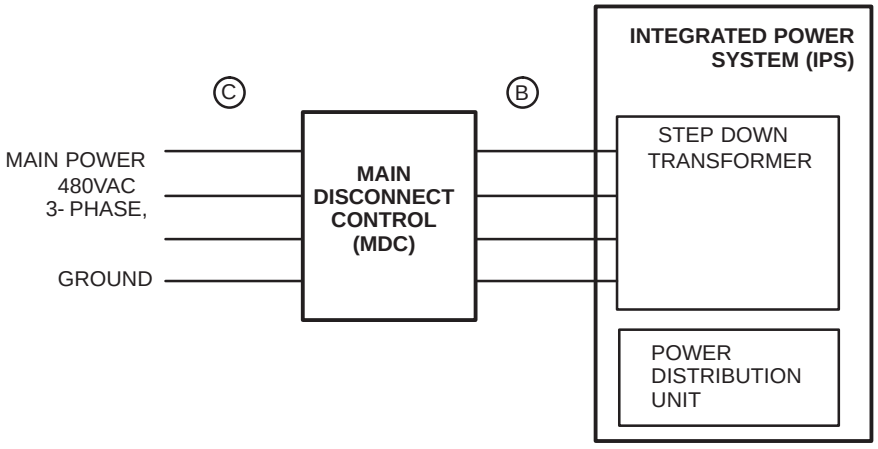


NOTE: Neutral line is not used in system.

Ⓑ Ⓒ CUSTOMER SUPPLIED, REFER TO SECTION 5- 3, PRIMARY FEEDER SIZE

MAIN POWER CONNECTION (50HZ OR 60HZ, 380VAC OR 480VAC, "Y" MAIN)
ILLUSTRATION 5-1

5-4 POWER CONNECTION (continued)

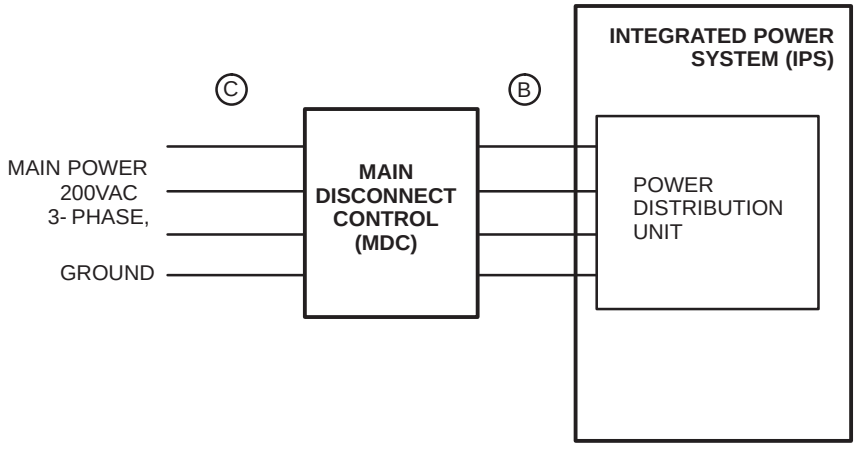


NOTE: Neutral line is not used in system.

Ⓑ Ⓒ CUSTOMER SUPPLIED, REFER TO SECTION 5- 3, PRIMARY FEEDER SIZE

MAIN POWER CONNECTION (480VAC, "DELTA" MAIN)
ILLUSTRATION 5-2

5-4 POWER CONNECTION (continued)



Ⓑ Ⓒ CUSTOMER SUPPLIED, REFER TO SECTION 5- 3, PRIMARY FEEDER SIZE

MAIN POWER CONNECTION (200VAC, "D" MAIN)- JAPAN ONLY
ILLUSTRATION 5-3

5-5 SYSTEM GROUND

The 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 Integrated Power System Cabinet, the enclosure ground points (ground studs located in each cabinet or enclosure), and the SRU ground point.

To ensure patient safety and system performance, the following conditions must be met when running power lines into the magnet room:

- For facility and emergency power lines entering the magnet room, the ground wire of each power line must be grounded to the SRU ground point. There must also be a jumper cable from the RF shielding (at the point of contact with the ground wire) to the SRU ground connection. A ground cable is then connected between the SRU ground point and the IPS. This resistance to the SRU ground connection must not exceed 0.1 ohms.
- Resistance between any two grounded devices must not exceed 0.1 ohm to ensure equal potential ground system within the magnet room.
- All conduits in the RF Room must be metal.
- All electrical devices (ie. outlets, light fixtures, etc.) must have a ground wire from their power sources and be grounded to RF Room Shield.

Any modifications or non-MR equipment grounds added to the MR ground system must be approved by your General Electric representative in order to ensure safety and performance.

5-6 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. Refer to Power Analysis available from MR Siting for information on setting-up a power line analyzer and evaluating the results. Some of the recommended analyzers which are designed for unattended monitoring are the Dranetz Model 626 and BMI Model 4800.

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 General Electric representative to determine if customer provided line conditioning is needed.

5-7 RECOMMENDED EMERGENCY POWER

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 9-2, GROUND CABLE INTERCONNECTS. Always check international, national and local codes for other emergency power requirements.

SECTION 6 - RF SHIELD ROOM

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6-1 RF SHIELD ROOM SPECIFICATION

Every GE MR system requires that the Magnet Room be RF shielded. Table 6-1 contains the RF Shielded Room specifications.

TABLE 6-1
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.

6-2 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.

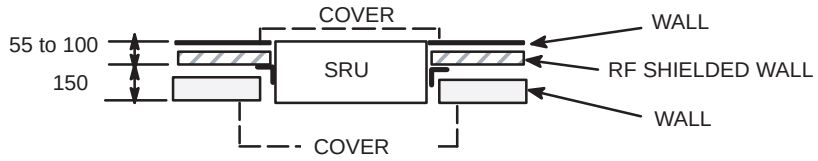
6-3 WALLS

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 1067mm). 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.

6-3-1 SRU

It is recommended that the equipment room wall be approximately 150 mm from the RF shield, and the wall of the Magnet room be between 55 mm and 100 mm from the RF shield. When the equipment room wall is closer than 150 mm, the cover of the SRU (equipment room side) will contact with parts on SRU. When it is farther than 150 mm, adjusting the stud of the cover will be difficult. See Illustration 6-1.



CONTROL OR EQUIPMENT ROOM SIDE

TOP VIEW

NOTE : 1
ALL DIMENSIONS ARE IN MILLIMETERS.

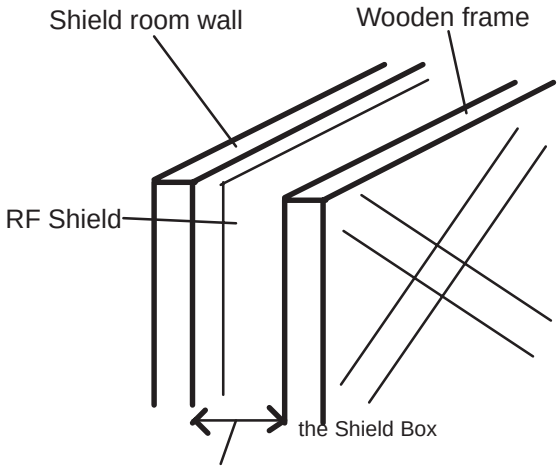
NOTE : 2
MAGNET ROOM SIDE
THE MAXIMUM DISTANCE ALLOWED OF THE EQUIPMENT ROOM WALL FROM RF SHIELD IS 210 mm .

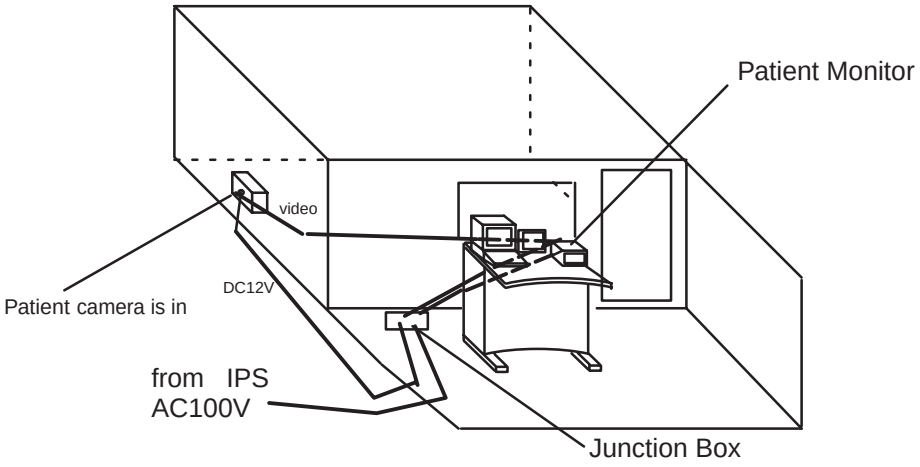
RF SHIELD CLEARANCE DETAIL (SRU)
ILLUSTRATION 6-1

6-3-2 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.

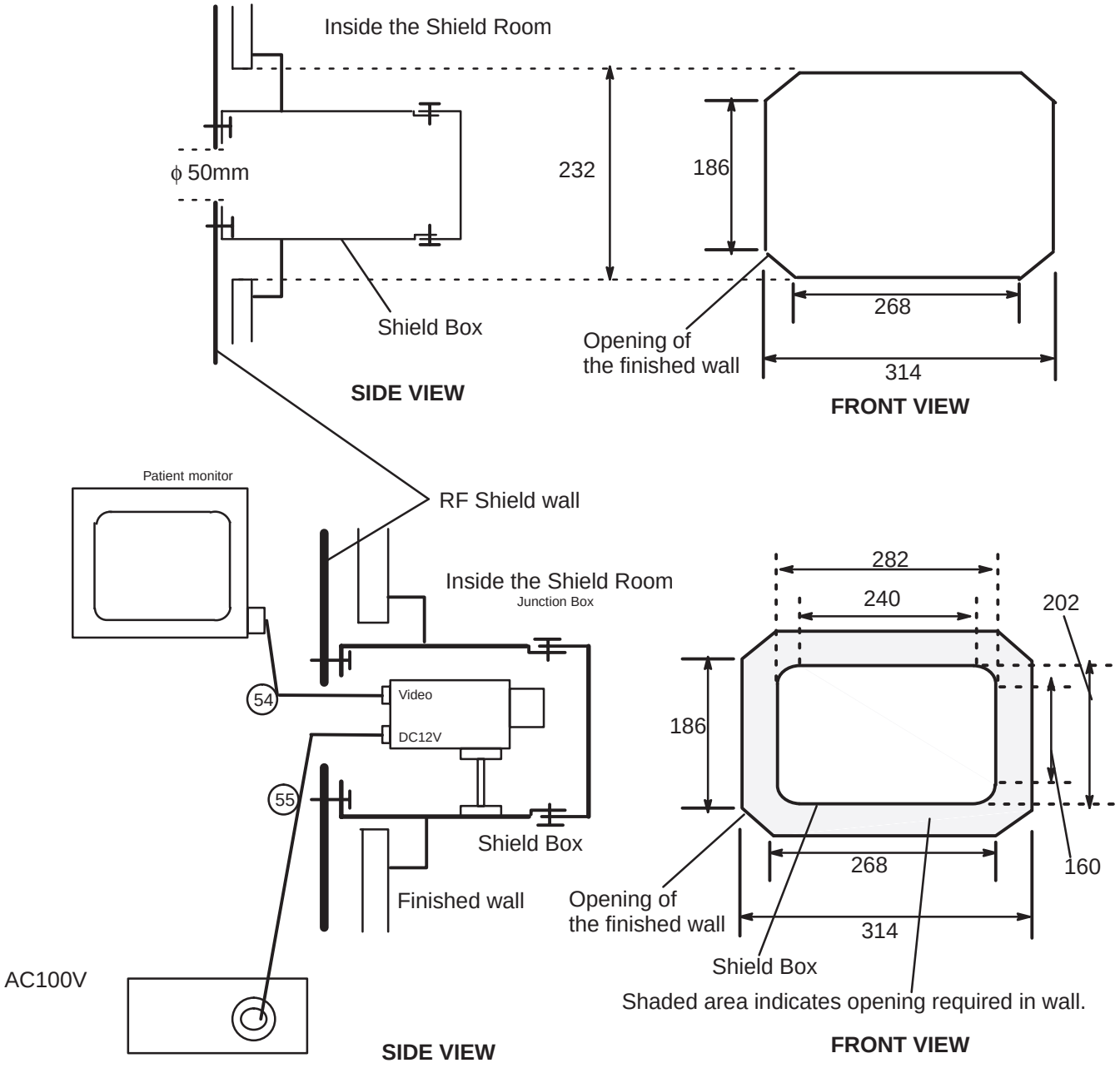
See Illustration 6-2 to 6-4 for detail, Illustration 6-5 for the view angle of the Patient Camera, and 6-6 for the height in which the camera should be put.





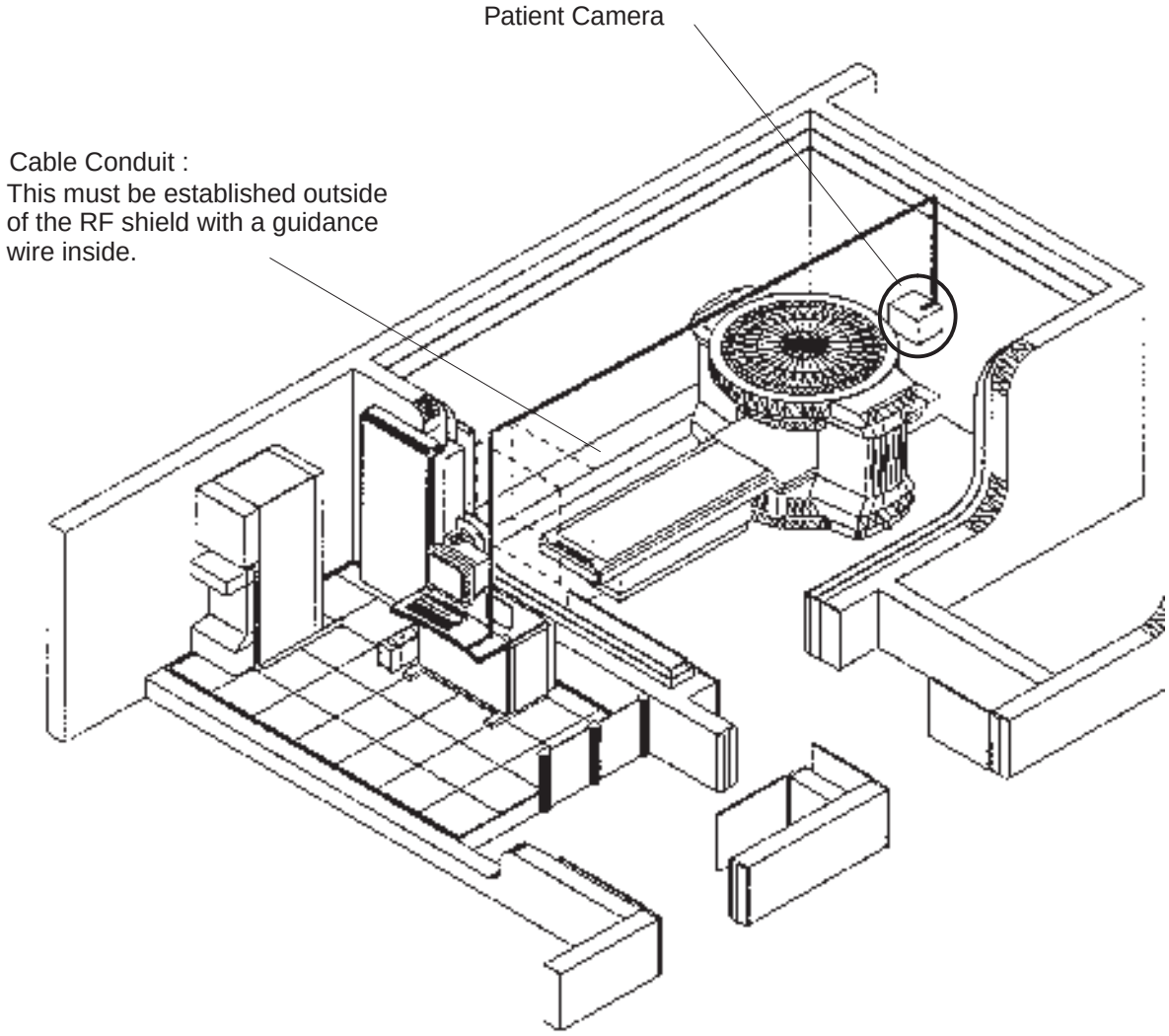
PATIENT CAMERA (OVERWALL VIEW)
ILLUSTRATION 6-2

6-3-2 PATIENT MONITOR (OPTION) (continued)



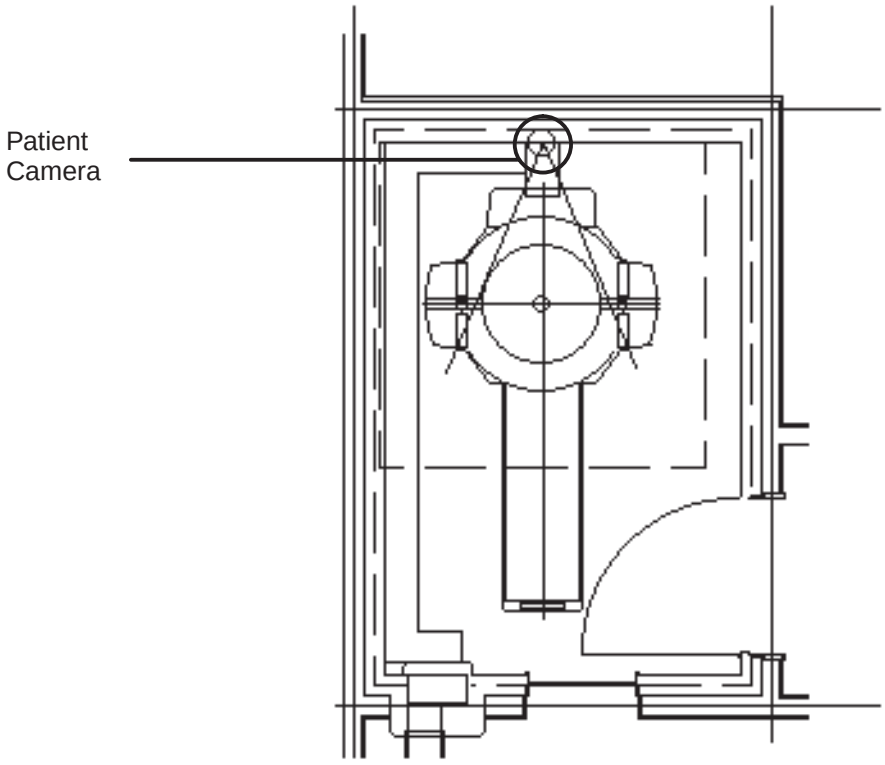
PATIENT CAMERA (DETAIL)
ILLUSTRATION 6-3

6-3-2 PATIENT MONITOR (OPTION) (continued)



OVERALL VIEW OF PATIENT CAMERA
ILLUSTRATION 6-4

6-3-2 PATIENT MONITOR (OPTION) (continued)



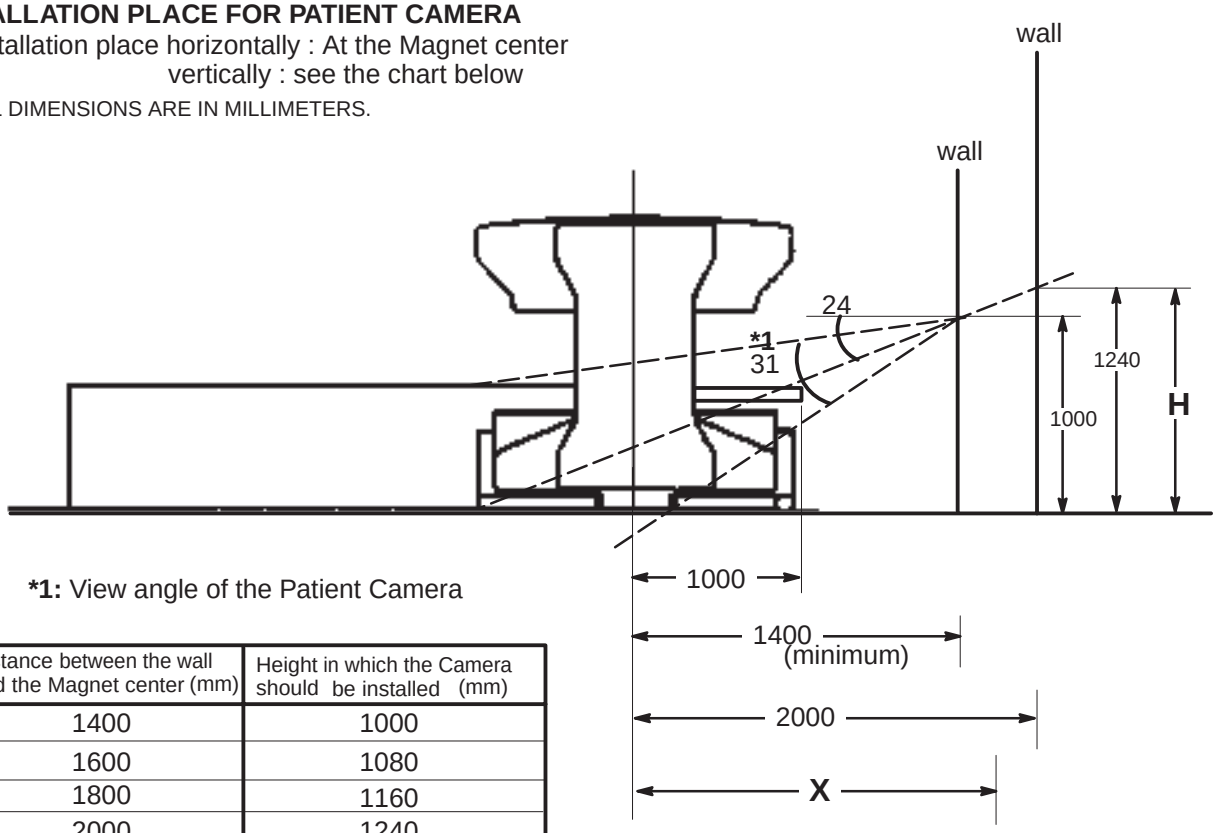
PATIENT CAMERA VIEW ANGLE (TOP)
ILLUSTRATION 6-5

6-3-2 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.



***1:** View angle of the Patient Camera

Distance between the wall and the Magnet center (mm)	Height in which the Camera should be installed (mm)
1400	1000
1600	1080
1800	1160
2000	1240

Determining the height of the Patient Camera:
X:distance between the wall and the Magnet center
H:height between the floor and the Camera

$$H = 1000 + 80(X - 1400) / 200$$

Use this equation to determine the height of the Patient Camera

PATIENT CAMERA VIEW ANGLE (SIDE)
ILLUSTRATION 6-6

6-4 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 6-2 and flow chart in Illustration 6-7 must be placed in on the floor as a magnetic shield.

- •At a factory, 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 6-7.
- •This steel plate can be placed under or over the layer of RF Shield. Refer to Illustration 6-10**.**
- •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 6-7. (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 6-7
  2. Material : 1010 - 1020 (AISI)
  S15C or SS400 (JIS)
- For examples of layout for steel plate, refer to the following illustrations:
  Illustration 6-8 shows a case of 2.4m square dimensions. Magnet center should be located at the center of steel plate +/- 50mm.
  Illustration 6-9 : The steel plate may be partially cut to compensate for layout limitations of wire duct location and room wall edges.
  Illustration 6-10 shows the layout of vertical locations between the steel plate and RF Shield on the floor.
  Illustration 6-11 : 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 6-12 and 6-13. 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.

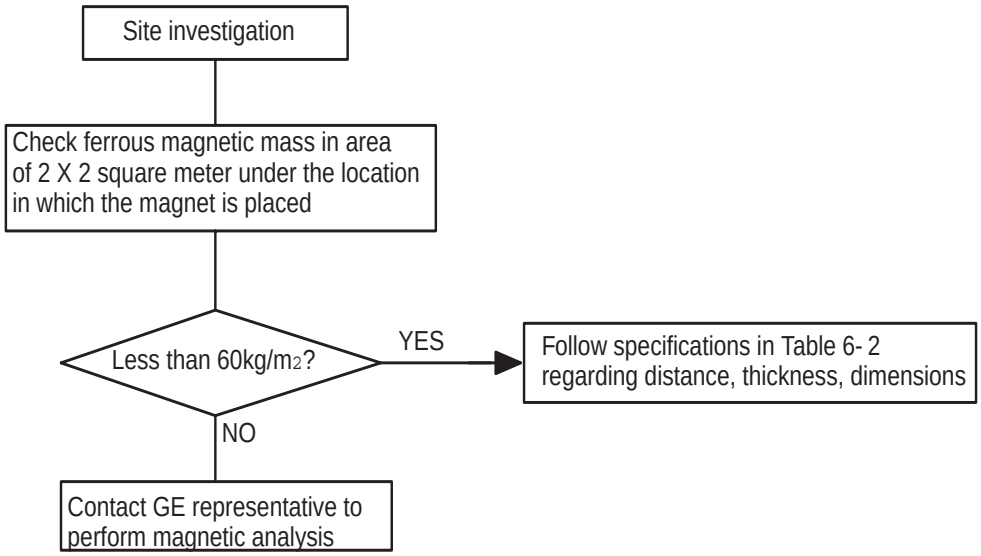
TABLE 6-2

STEEL PLATE

Distance from the FL (mm)	Distance (m X m)	Thickness (mm)
3 - 15	2.4 X 2.4 (+/- 0.1)	2.6 - 3.2

6-4 FLOOR SHIELDING(continued)

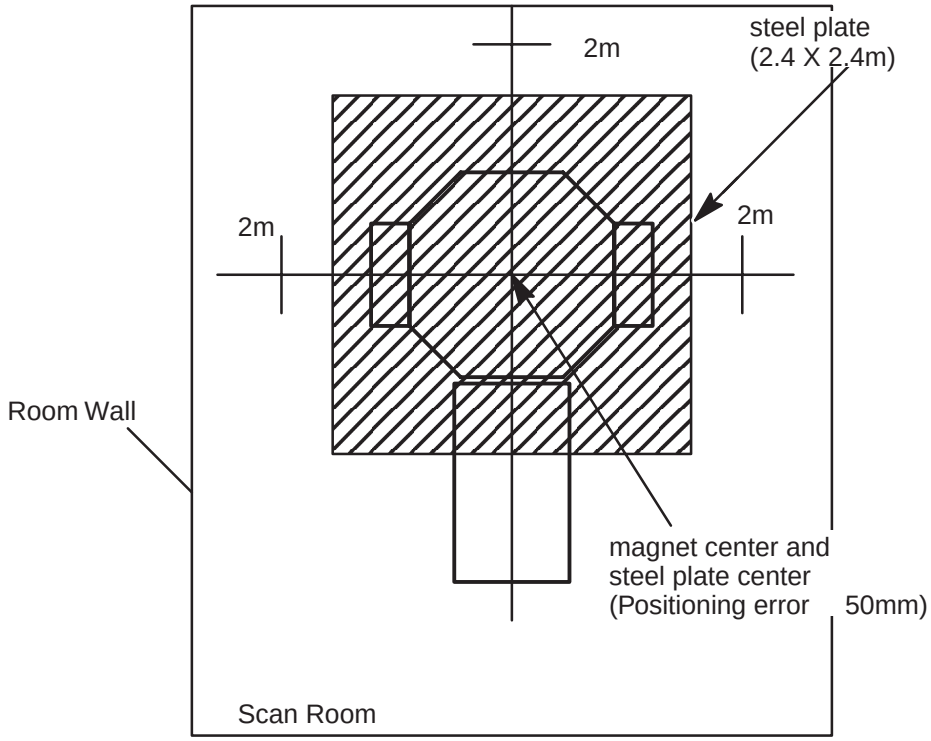
FLOW CHART FOR STEEL PLATE SPECIFICATIONS



FLOW CHART FOR STEEL PLATE SPECIFICATIONS
ILLUSTRATION 6-7

6-4 FLOOR SHIELDING(continued)

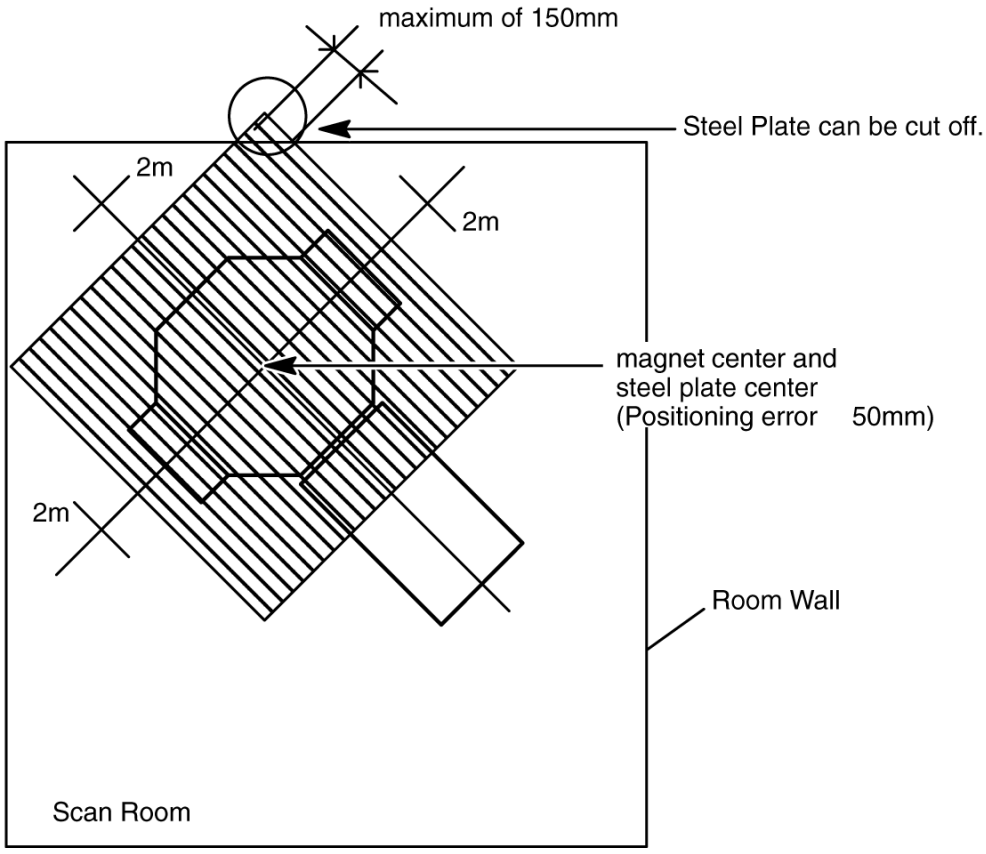
When Scan Room is large enough;



FLOOR SHIELD CONSTRUCTION EXAMPLE(WHEN SCAN ROOM IS LARGE ENOUGH)
ILLUSTRATION 6-8

6-4 FLOOR SHIELDING(continued)

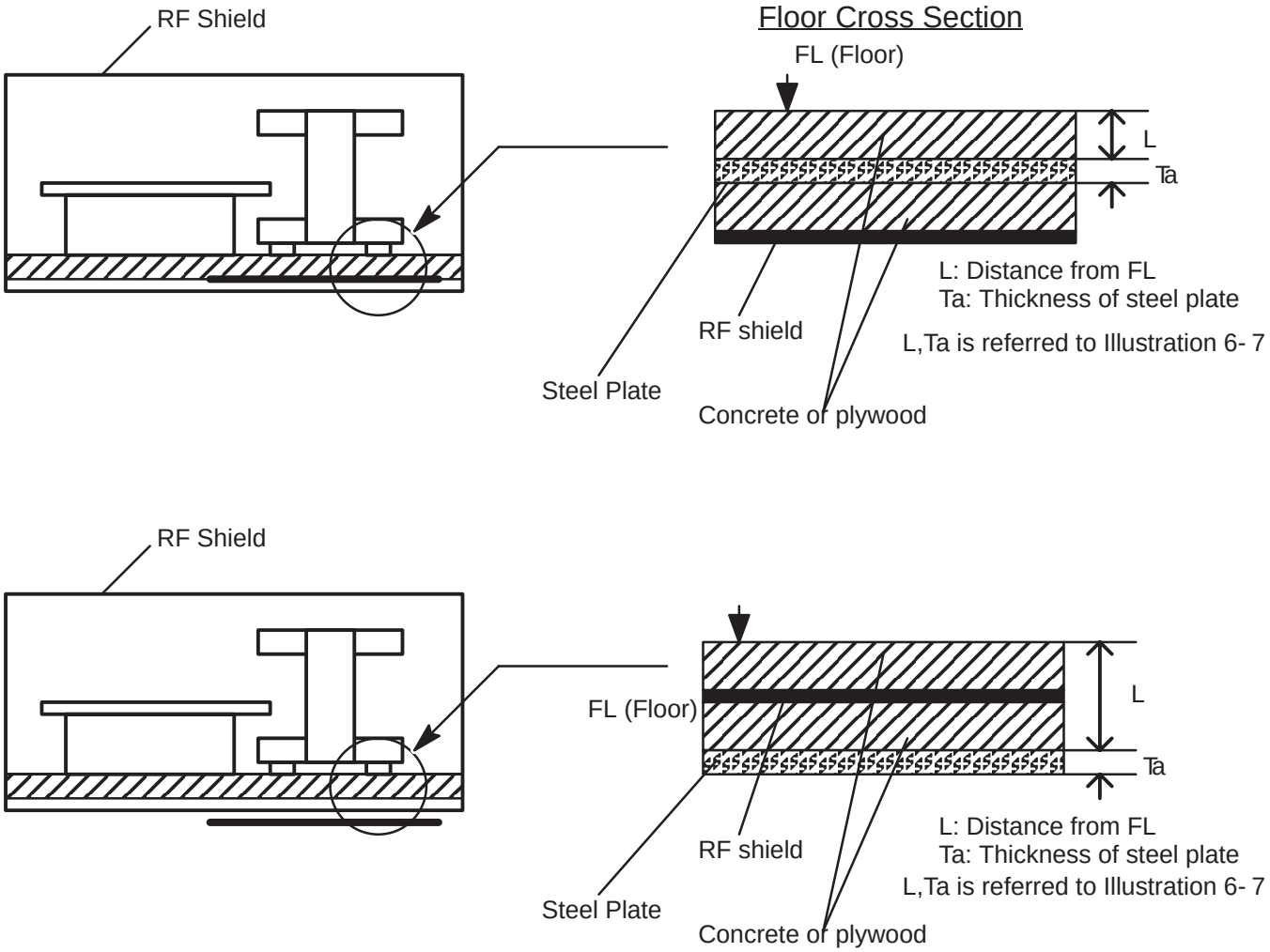
When Scan Room is not large enough;



FLOOR SHIELD CONSTRUCTION EXAMPLE(WHEN SCAN ROOM IS NOT LARGE ENOUGH)
ILLUSTRATION 6-9

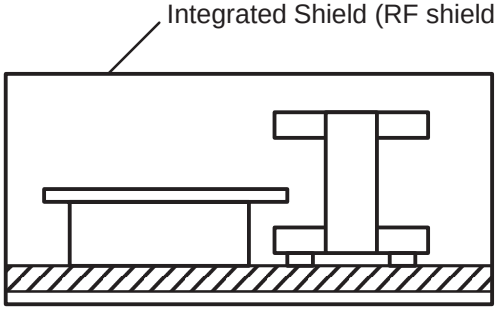
If 2.4m X 2.4m steel plate can not be installed because the Scan Room is not large enough, the steel plate can be partially cut.

6-4 FLOOR SHIELDING(continued)



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

FLOOR CROSS SECTION
ILLUSTRATION 6-10



Steel Plate can be eliminated if the room has a RF shield to meet the spec shown at Illustration 6- 7.

INTEGRATED STEEL SHIELD
ILLUSTRATION 6-11

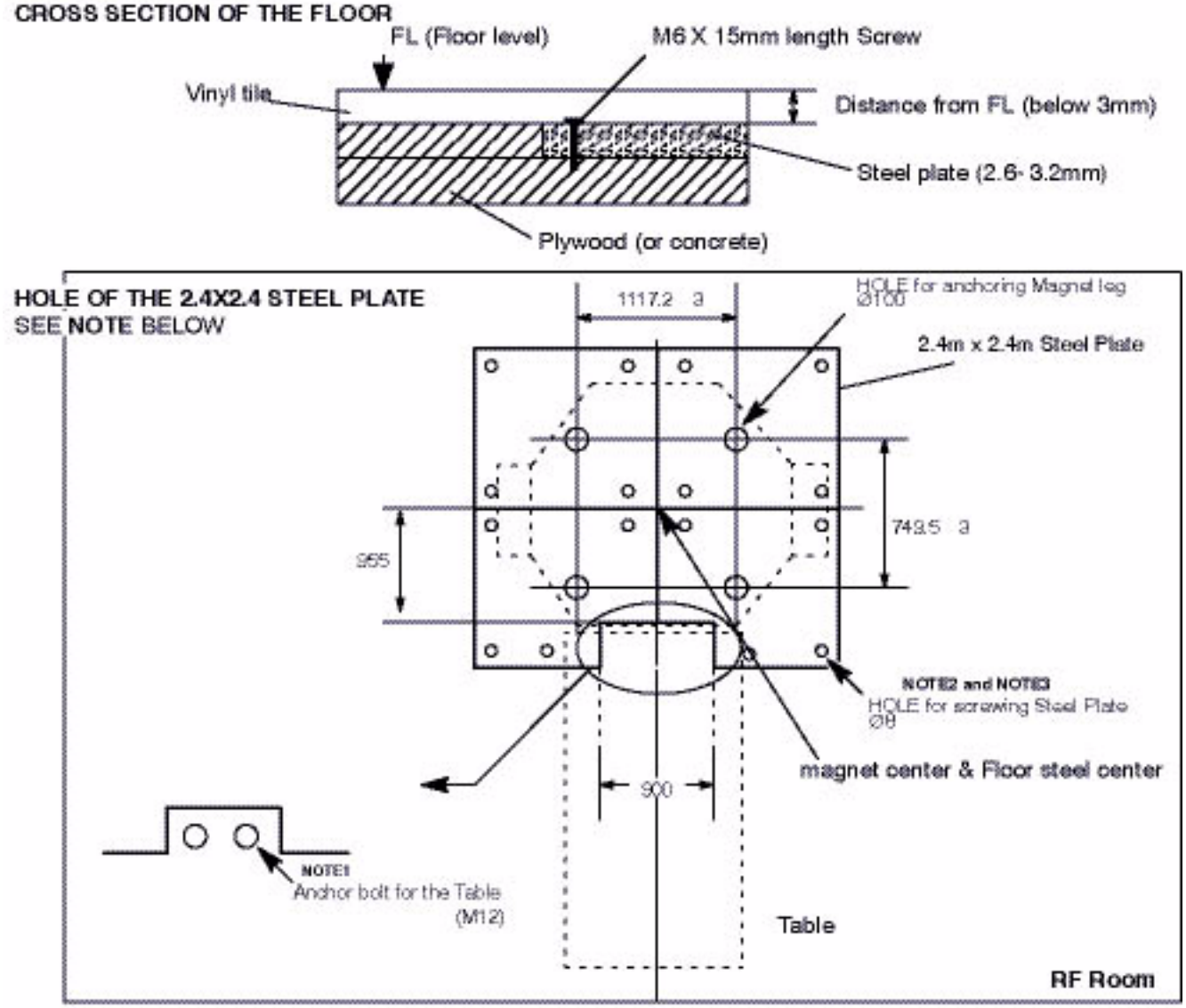
6-4 FLOOR SHIELDING(continued)

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 illustration below.

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).

6-4 FLOOR SHIELDING(continued)

SAMPLE ILLUSTRATION:



NOTE1: The anchor holes for the table must be considered when laying the steel plate on the entire room. Either make a hole in the steel plate or cut off part of the steel plate.

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.

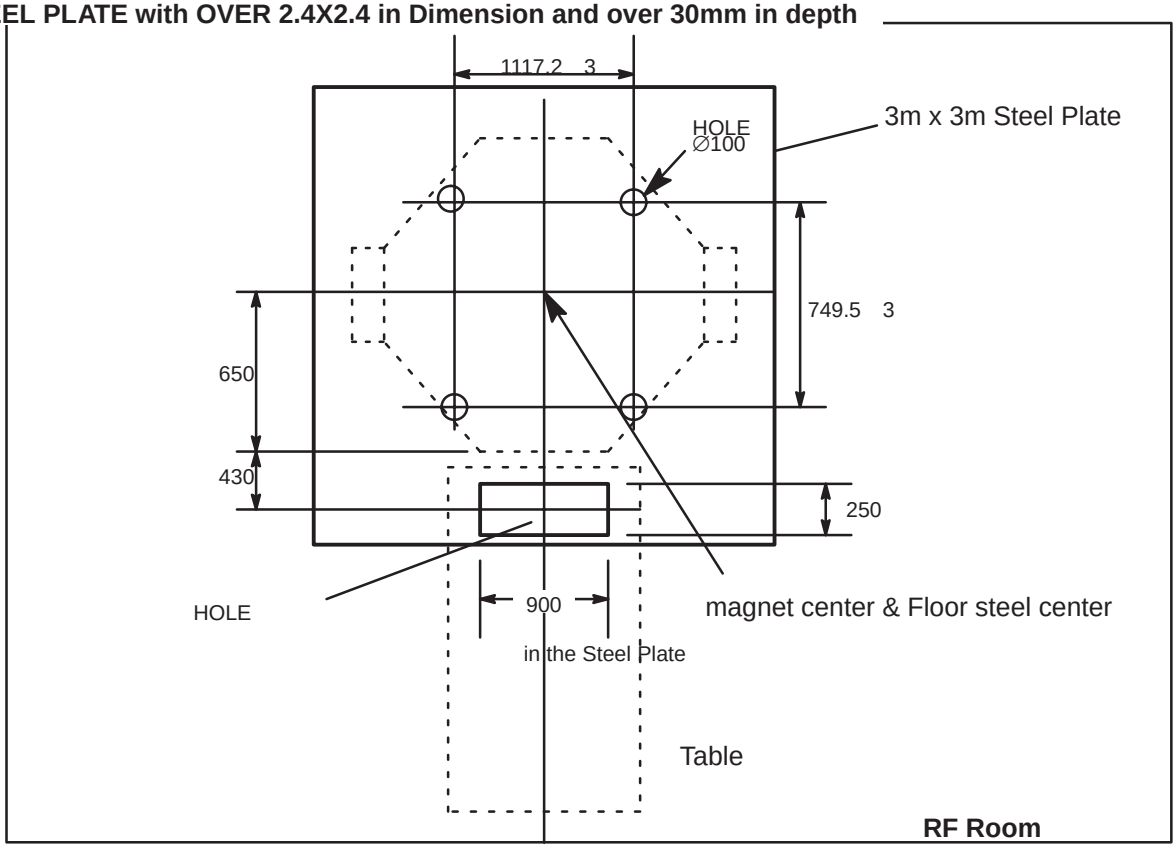
NOTE4: Measure the position of the steel plate (such as the distance from the wall) to make it easier to determine where the steel plate is after raising the floor (with vinyl tile).

2.4X2.4 STEEL PLATE
ILLUSTRATION 6-12

6-4 FLOOR SHIELDING(continued)

SAMPLE ILLUSTRATION:

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



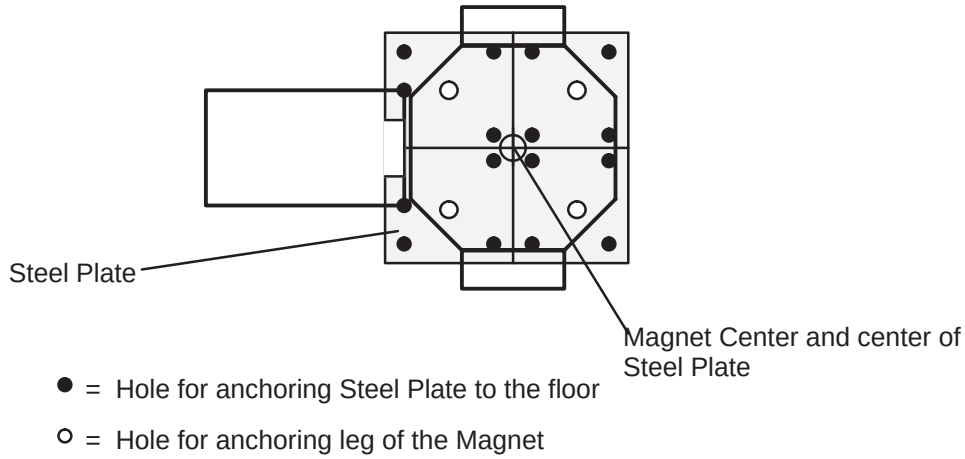
NOTE: Screws are not needed for steel plate with dimensions greater than 2.4m X 2.4m and located deeper than 30mm from the floor.

3X3 STEEL PLATE
ILLUSTRATION 6-13

6-4-1 STEEL PLATE ANCHORING

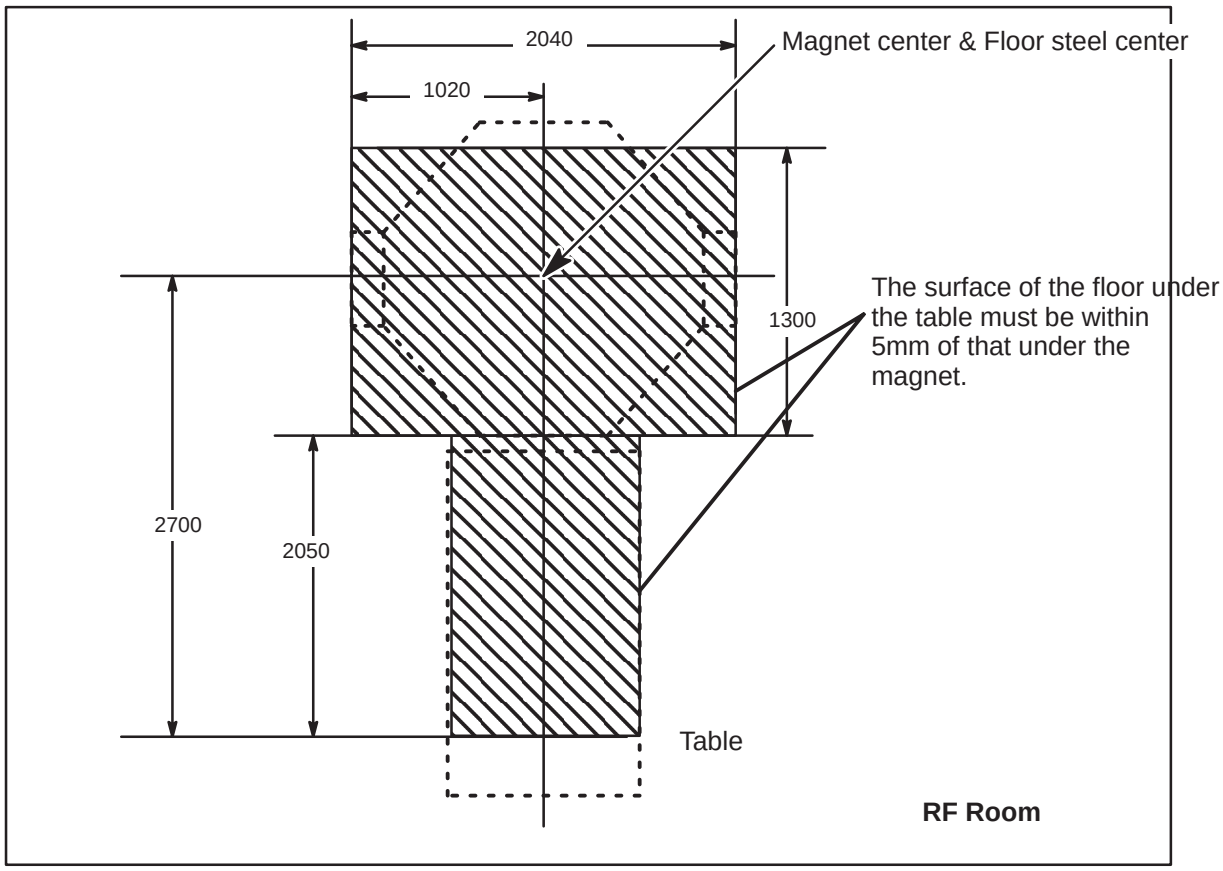
Procedure for anchoring steel plate with dimensions of 2.4m X 2.4m and depth of under 30mm from the floor.

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 6-14.
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.



MAGNET AND STEEL PLATE
ILLUSTRATION 6-14

6-5 FLOOR LEVELING AND MAGNET ANCHORING

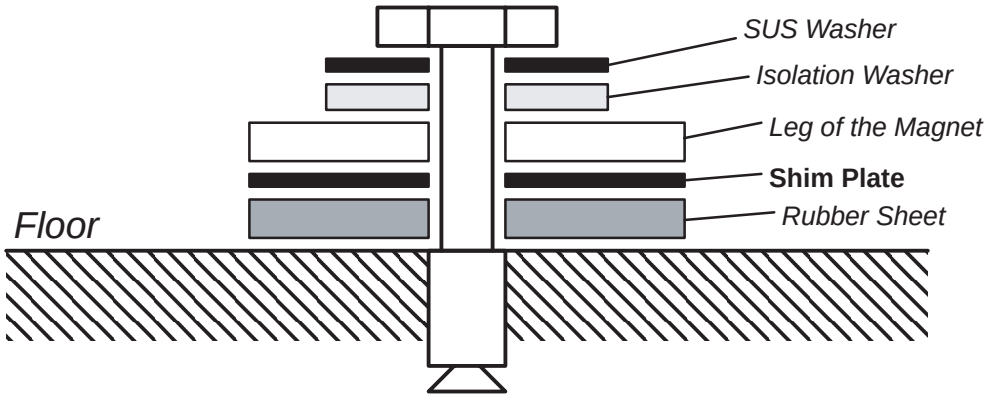


FLOOR LEVELING
ILLUSTRATION 6-15

6-5 FLOOR LEVELING AND ANCHORING(continued)

1. Conduct the Leveling of the Magnet. Use the Shim Plate(2mm thickness X 4 pieces, 1mm X 4) included with the Magnet. See *Direction 2160120 Signa Profile Magnet Leveling Manual* attached to Magnet.

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.

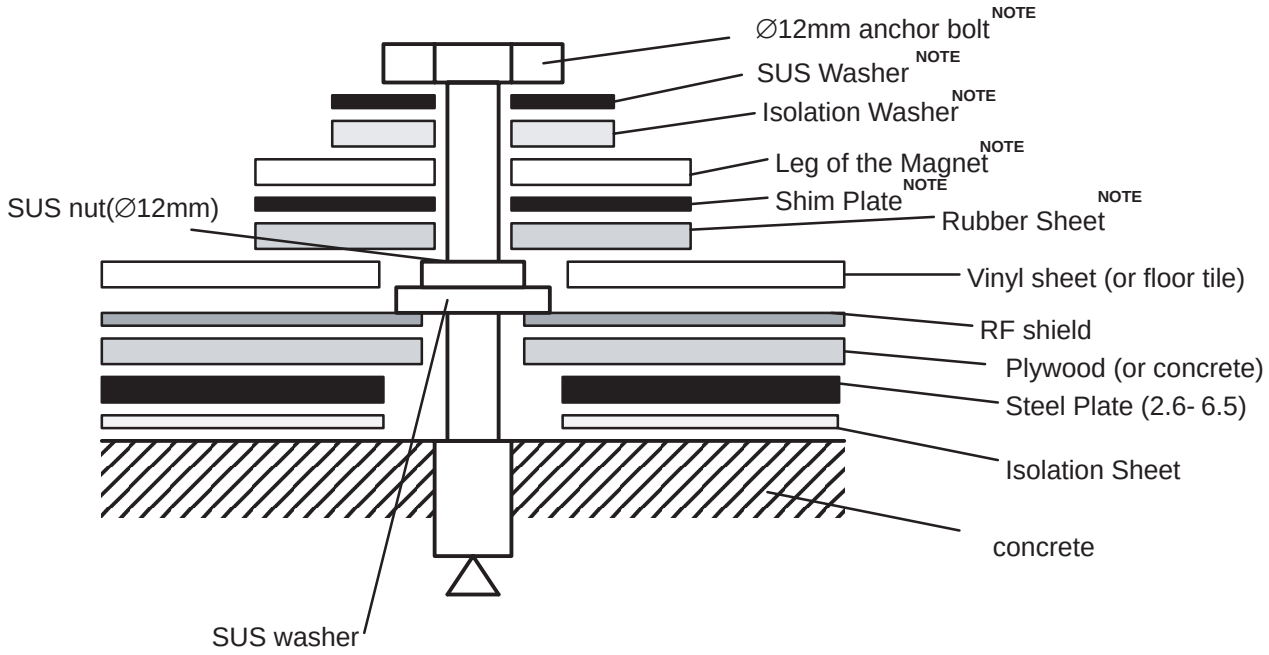
NOTE 2: If the strength of the anchored part is not strong enough, this needs to be considered by the customer.

LEVELING OF THE MAGNET
ILLUSTRATION 6-16

6-5 FLOOR LEVELING AND ANCHORING(continued)

2. Fix the leg of the Magnet to the floor. See Section 2-11, 2-13 6-17, and 6-18 for details.

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



NOTE: GE Supplied (M12/75mm bolt size).
If not long enough, this needs to be supplied by the customer/RF Vendor.

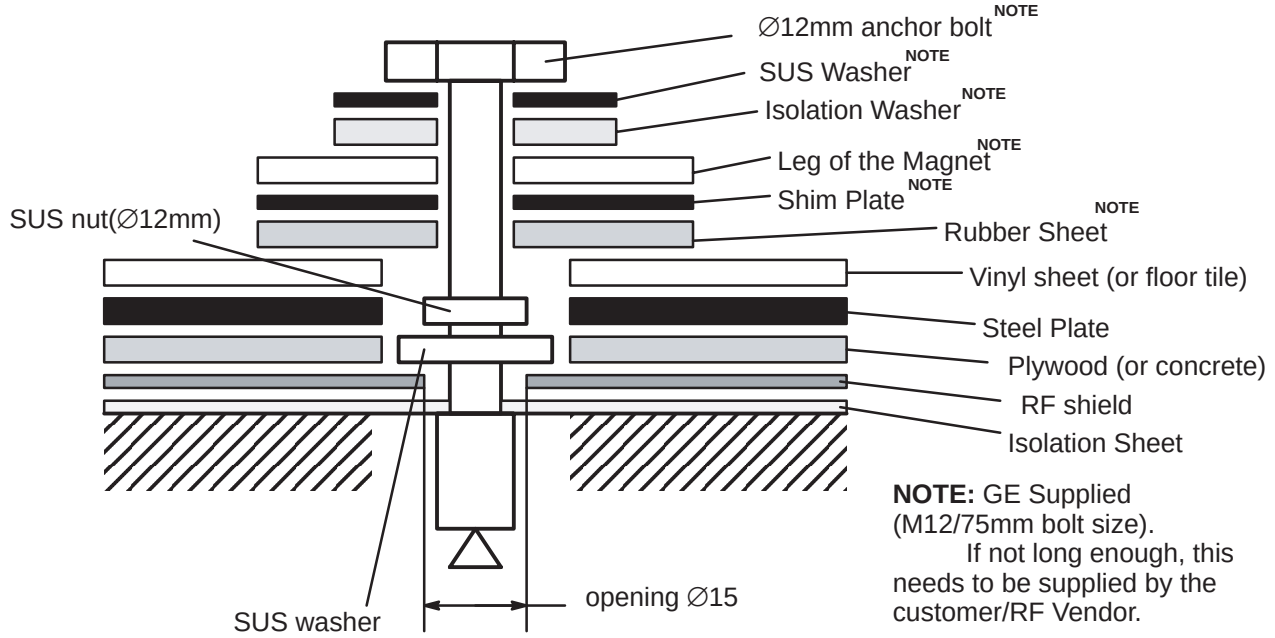
NOTE 1: In case there is floor raising construction after the anchoring of the bolt, there may be a case that the drill may not be long enough. In this case, the Anchor Bolt needs to be anchored beforehand.

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

MAGNET ANCHOR BOLT (1)
ILLUSTRATION 6-17

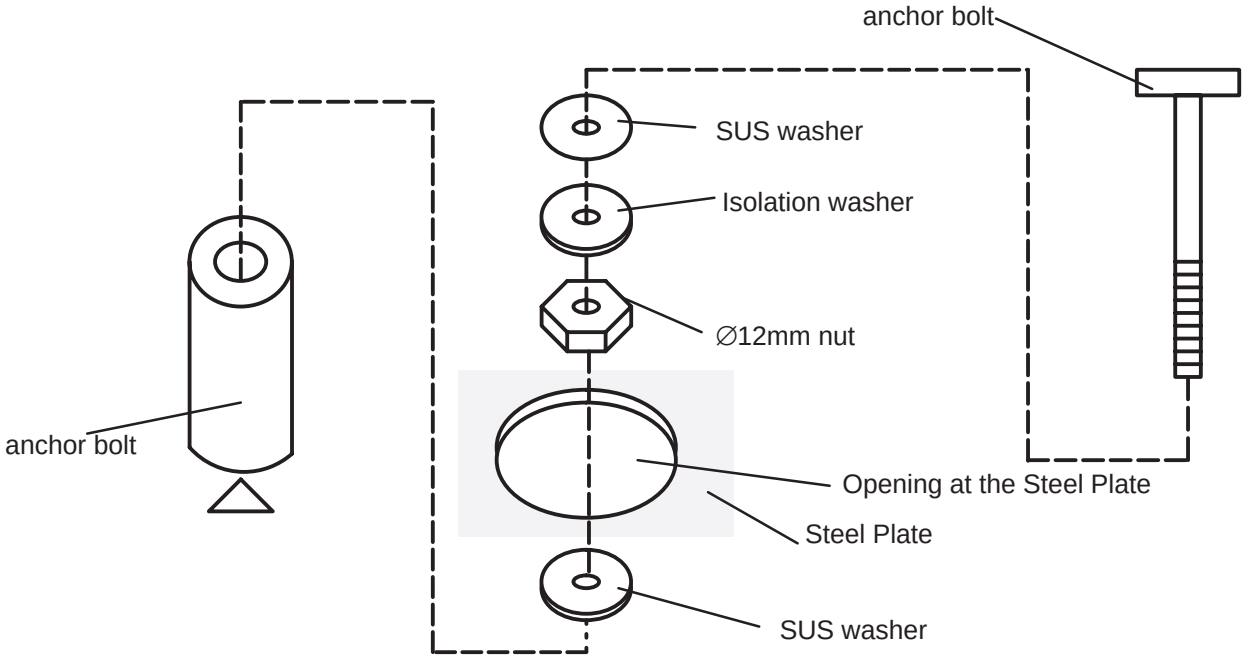
6-5 FLOOR LEVELING AND ANCHORING(continued)

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 6-18

6-6 PLUMBING

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.

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.

6-6-1 Water

All pipe waveguides must meet the 100 dB requirements. If a floor drato be installed in the Magnet Room, it must be electrically isolated and meet the 100 dB requirements. All plumbing must be consistent with local codes.

6-6-2 Medical Gases

The customer should consider if medical gases are to be piped into the Magnet Room along with suction service for patient life support. Remember, all non-electrical entries into the Magnet Room must use appropriate waveguide. Special precaution must be taken to ensure that ferromagnetic medical gas cylinders are not brought into the Magnet Room.

6-6-3 Sprinklers

If using sprinklers in the Magnet Room, dry pipe systems have the advantage of reducing ground problems. However, all decisions regarding fire protection systems are the customer's responsibility. If wet-type sprinkler system is used, pipe penetration should be limited to one location.

6-7 ELECTRICAL

All lighting inside the RF shielded room must be incandescent.

All electrical or non-electrical (air, oil) lines entering the RF Shielded room must be filtered to ensure that the minimum attenuation levels are met. External connections to these filters or wave guides must be made with appropriate connectors to ensure that the RF Shield room does not become grounded.

The GE supplied SRU (Scan Room Unit) contains all the filters required for GE system, plus some additional filters which may be used for customer services. These additional filters have ratings as listed in Table 6-3.

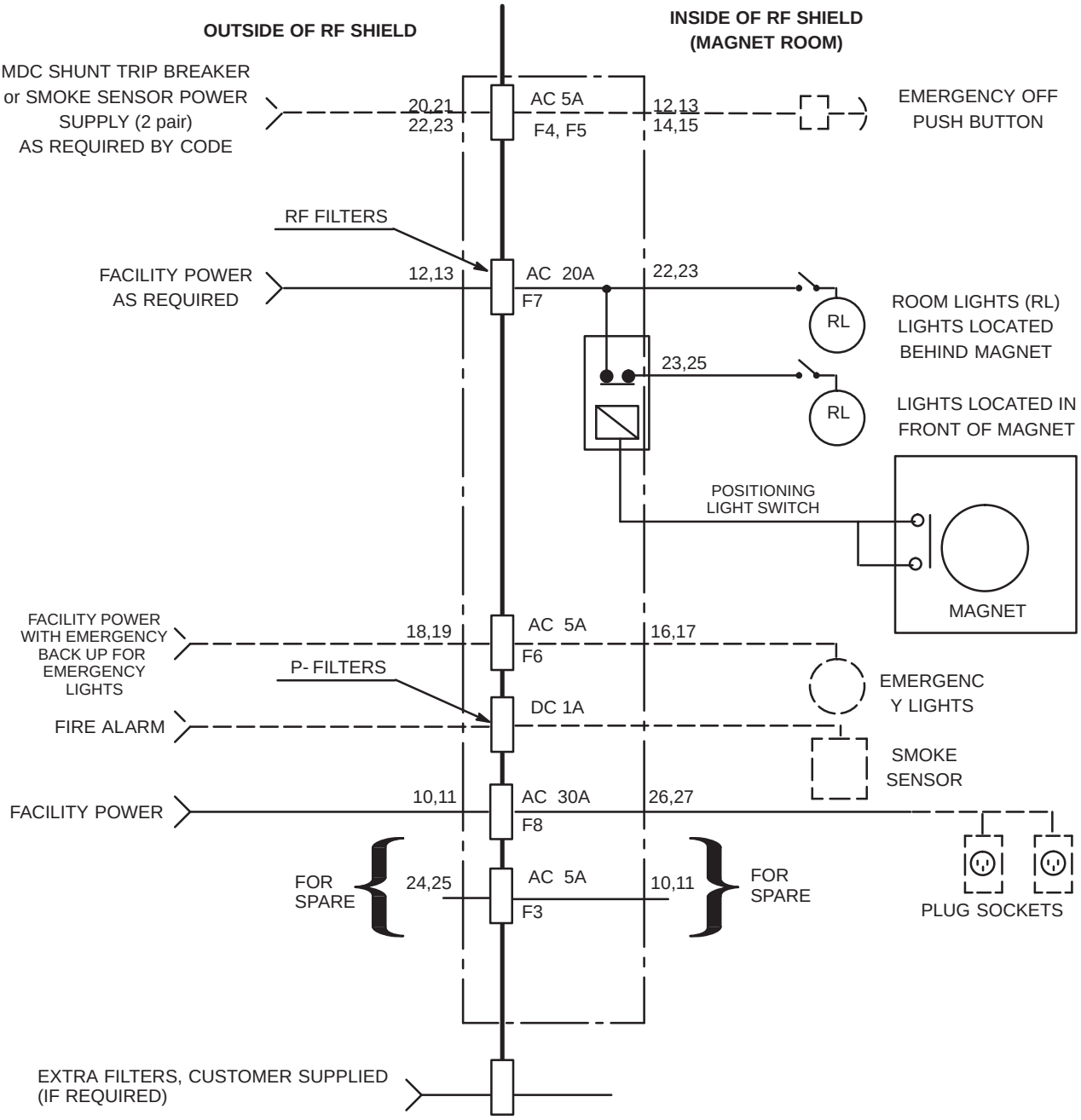
TABLE 6-3
FILTERS AVAILABLE FOR CUSTOMER USE

Voltage	Ampere	Specification	Qty	# of cables	Location	Note
250V AC	30A	Less than 1V Drop	1	2 wires	SRU	
250V AC	20A	Less than 1V Drop	1	2 wires	SRU	
250V AC	5A	Less than 1V Drop	4	2 wires	SRU	
100V DC	6A	-	4	2 lines	P- Filter assy on SRU.	

Typical applications of Table 6-3 filters are shown in Illustration 6-19 and 6-20.
Illustration 6-19 describes typical RF Filter Application without common ground stud.
Illustration 6-20 describes typical RF Filter Application with common ground stud.
If any grounding problem occurs, it is recommended to ground as illustration 6-20.

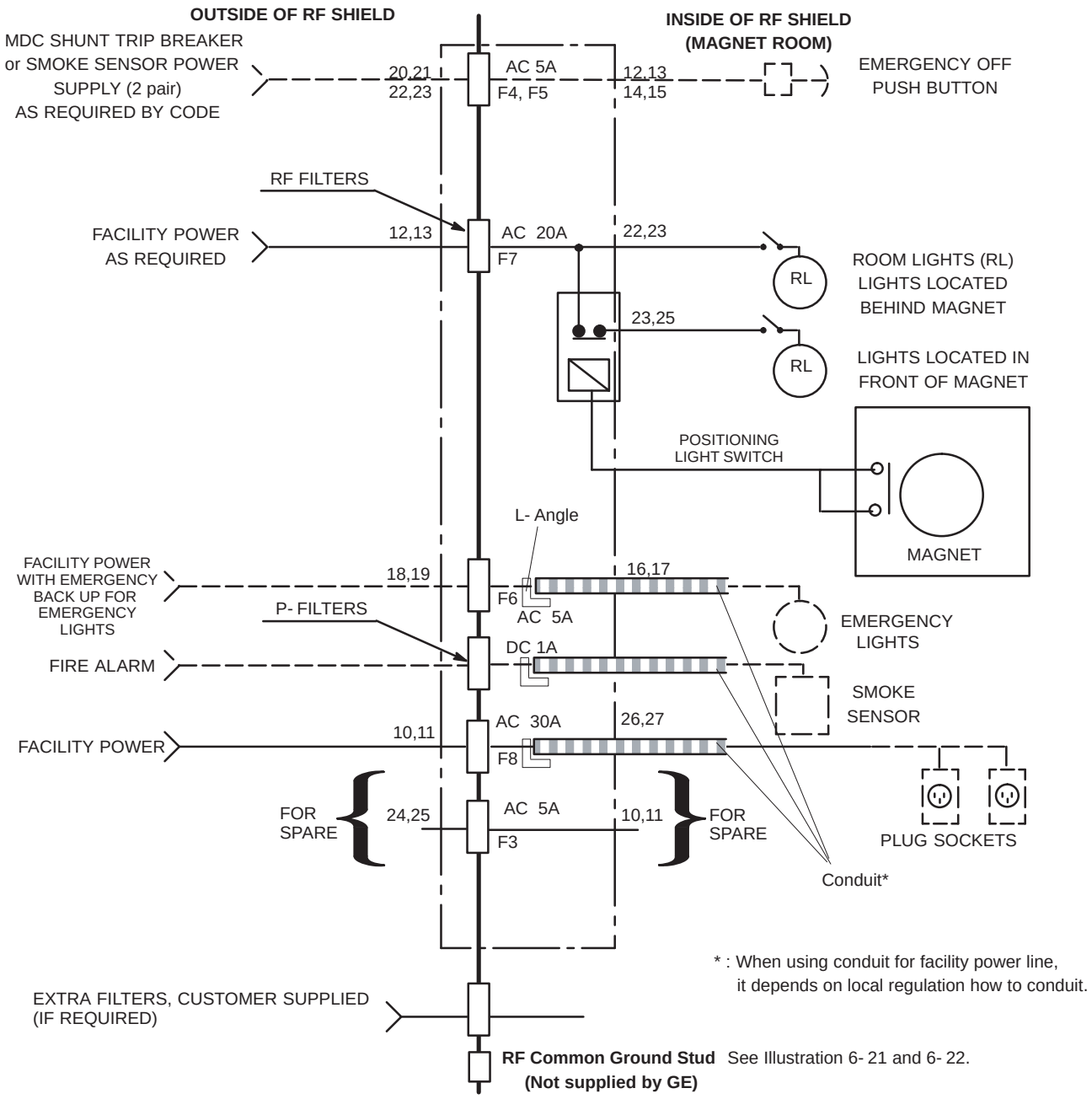
The mounting procedure for SRU is described in Section 6-8, SCAN ROOM UNIT OPENING.

6-7 ELECTRICAL (Continued)



TYPICAL RF FILTER APPLICATION WITHOUT RF COMMON GROUND STUD
ILLUSTRATION 6-19

6-7 ELECTRICAL (Continued)

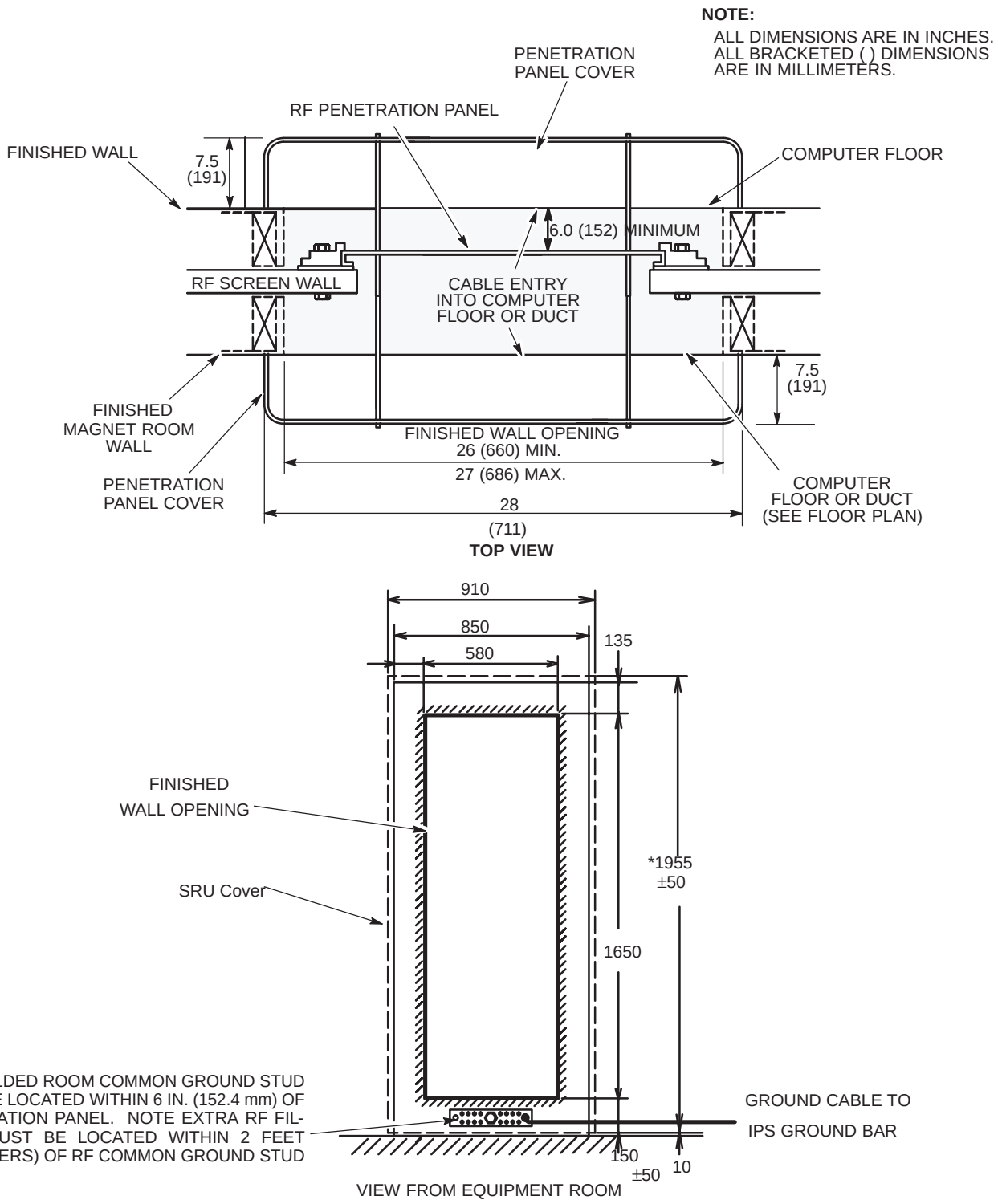


* : When using conduit for facility power line, it depends on local regulation how to conduit.

NOTE: TYPICAL APPLICATION SHOWN. INDIVIDUAL SITE REQUIREMENTS MUST BE IN COMPLIANCE WITH NATIONAL AND LOCAL BUILDING AND SAFETY CODES.

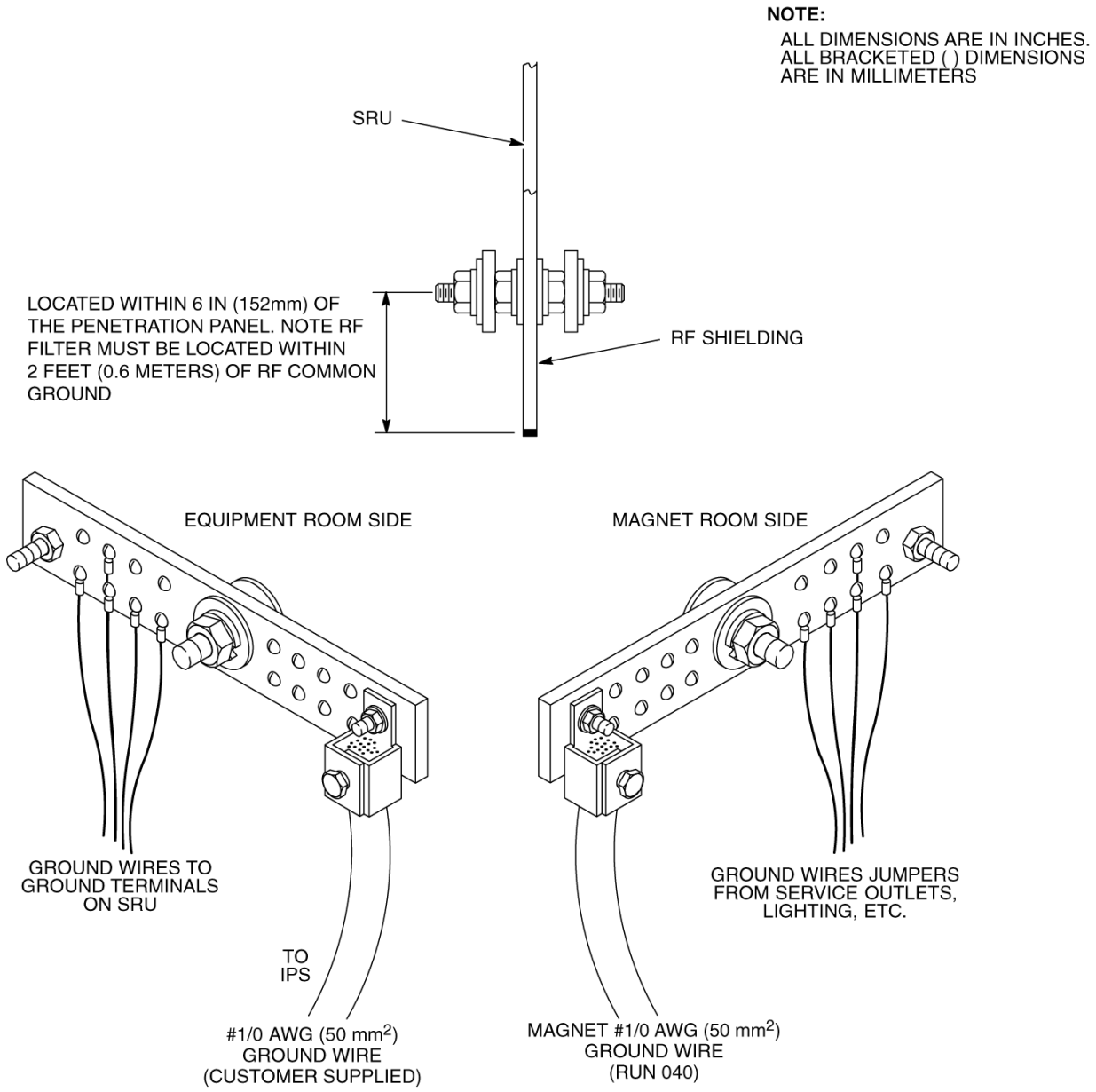
TYPICAL RF FILTER APPLICATION WITH RF COMMON GROUND STUD
ILLUSTRATION 6-20

6-7 ELECTRICAL (Continued)



SRU/COVERING MOUNTING REQUIREMENTS
ILLUSTRATION 6-21

6-7 ELECTRICAL (Continued)



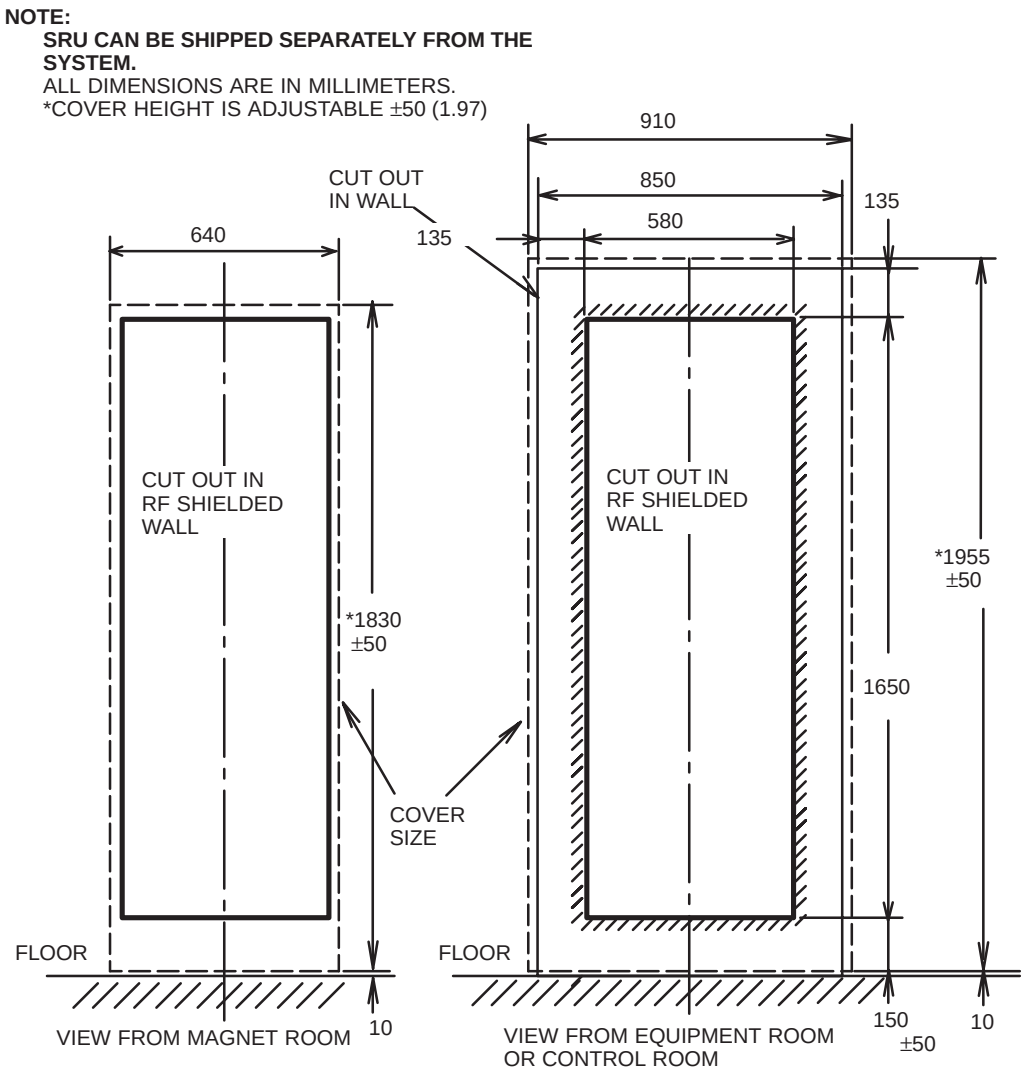
RF COMMON GROUND PENETRATION STUD
ILLUSTRATION 6-22

6-8 SCAN ROOM UNIT OPENING

The Scan Room Unit must be located in the wall between the Magnet room and the equipment room or the control room. See Illustration 2-15 (in Section 2-11, COMPONENT DIMENSIONS).

RF shielded room vendor must provide the opening in the RF shielding and appropriate holes for mounting the Scan Room Unit (see Illustrations 6-20 and 6-22). The RF shielded room acceptance test must be performed after the opening is cut in the RF shielding for the General Electric Scan Room Unit. This acceptance test must be conducted with a vendor supplied penetration panel. Refer to the **NOTE** below. It is the facility's responsibility to ensure that the RF shielded room vendor testing meets the attenuation specifications listed in Section 6-1, RF SHIELD ROOM SPECIFICATION. All mounting hardware (covers, screws, brackets, etc.) is supplied with MR system.

If the wall (including RF shielded wall) is thicker than 540 mm, the cut out in the wall needs to be larger than the cover in order to install the cover. Refer to Illustration 6-20.



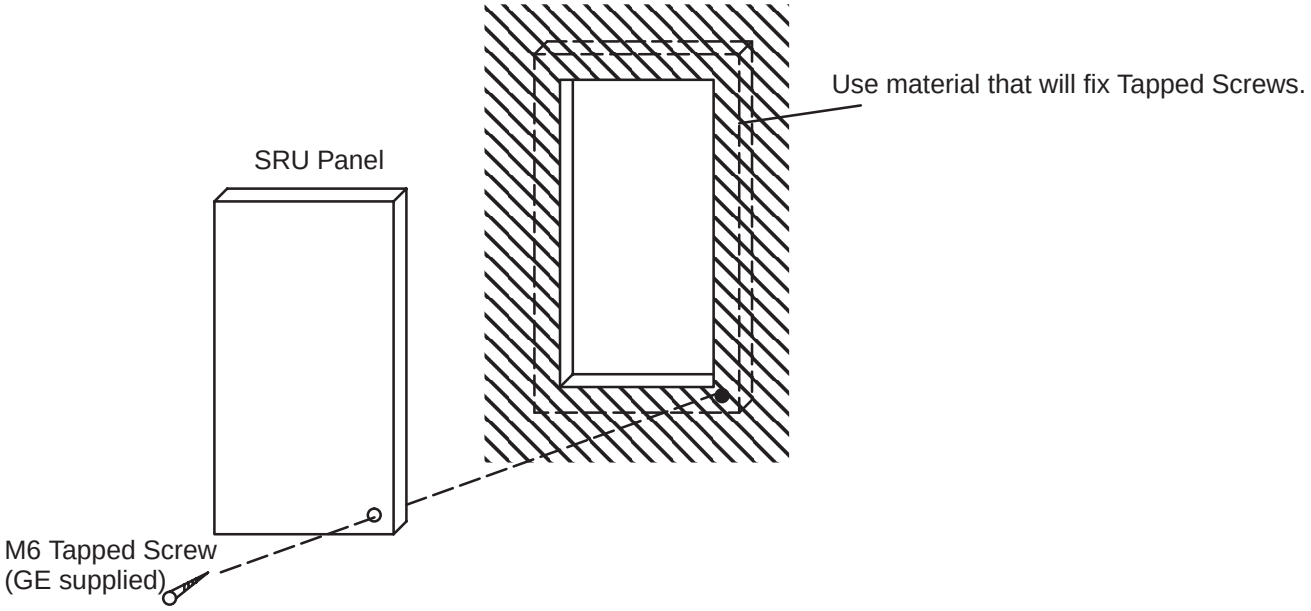
CUT OUT FOR SCAN ROOM UNIT
ILLUSTRATION 6-23

6-8 SCAN ROOM UNIT OPENING (continued)

SRU Installation

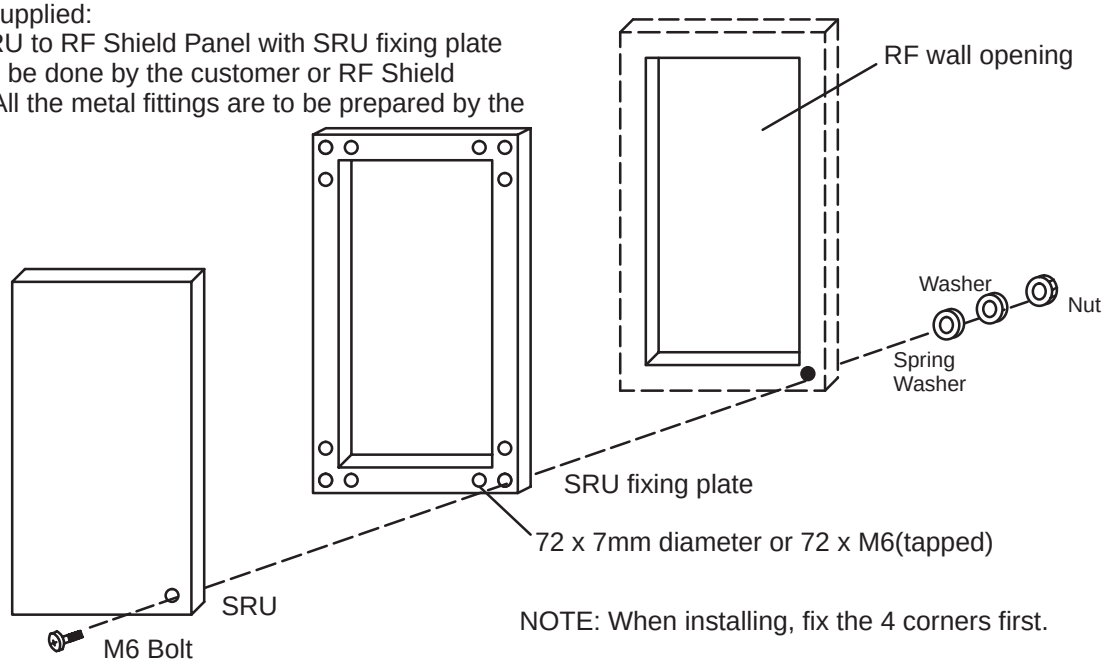
Recommended:

Attach SRU directly by using Tapped Screws.



Customer Supplied:

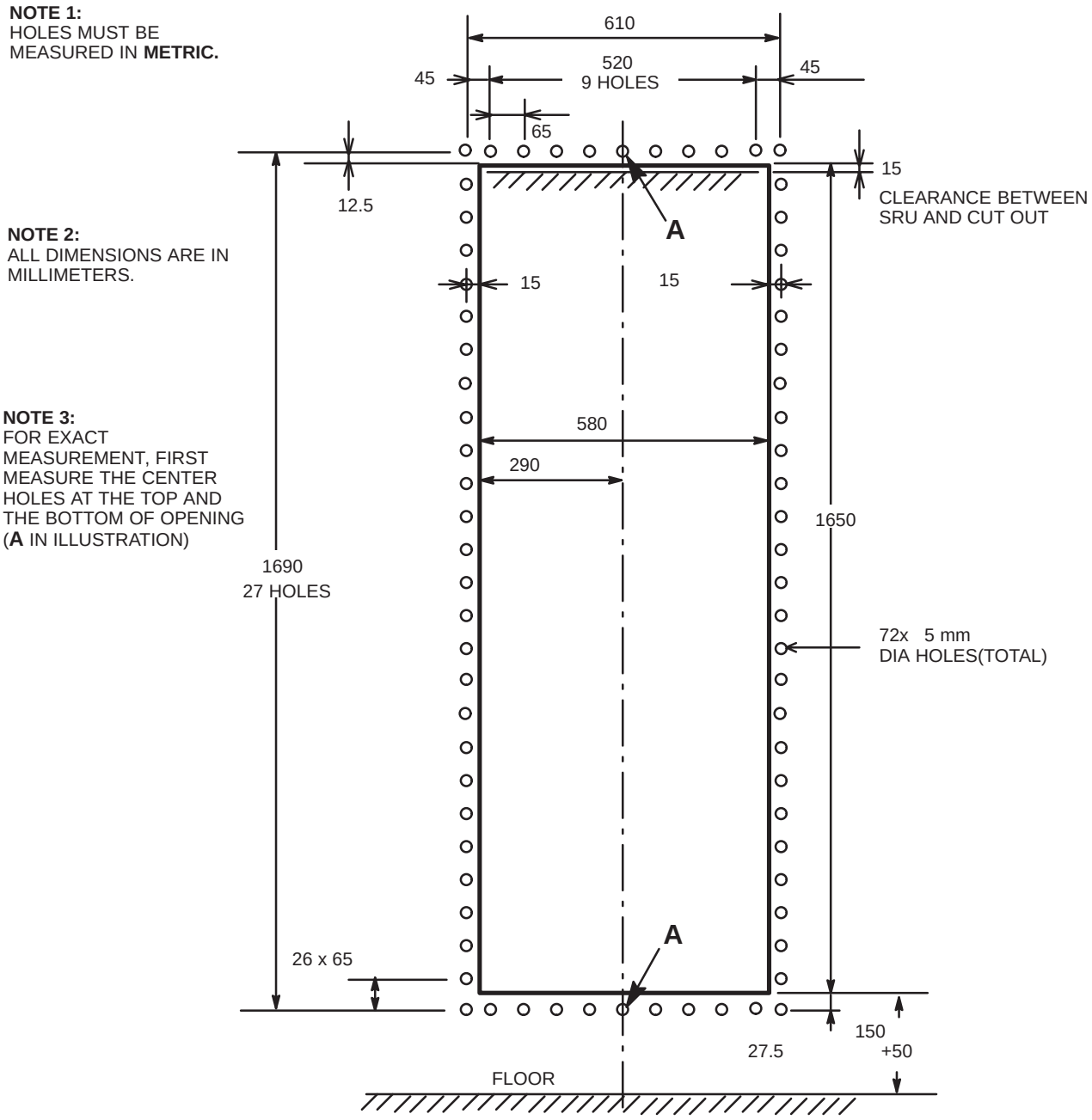
Attach SRU to RF Shield Panel with SRU fixing plate (This is to be done by the customer or RF Shield vendor). All the metal fittings are to be prepared by the customer.



SRU INSTALLATION
ILLUSTRATION 6-24

6-8 SCAN ROOM UNIT OPENING (continued)

Drill the 72 pilot holes on the RF shielded wall by using a 5 mm f drill bit for mounting screws (M6 tapped screws) as shown in Illustration 6-21.



MOUNTING HOLES FOR SCAN ROOM UNIT
ILLUSTRATION 6-25

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SECTION 7 - SHIPPING AND DELIVERY DATA

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7-1 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 7-1 for the shipping weights and dimensions of the major MR system components.

7-2 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 -34°C and 60°C and the relative humidity between 0 and 90 % (non-condensing).

Magnet: The temperature for the magnet must be between -30°C and 45°C and humidity up to 80%.

7-3 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.

note

There is a magnetic field present around the magnet at time of delivery. Care must be taken when working around the magnet.

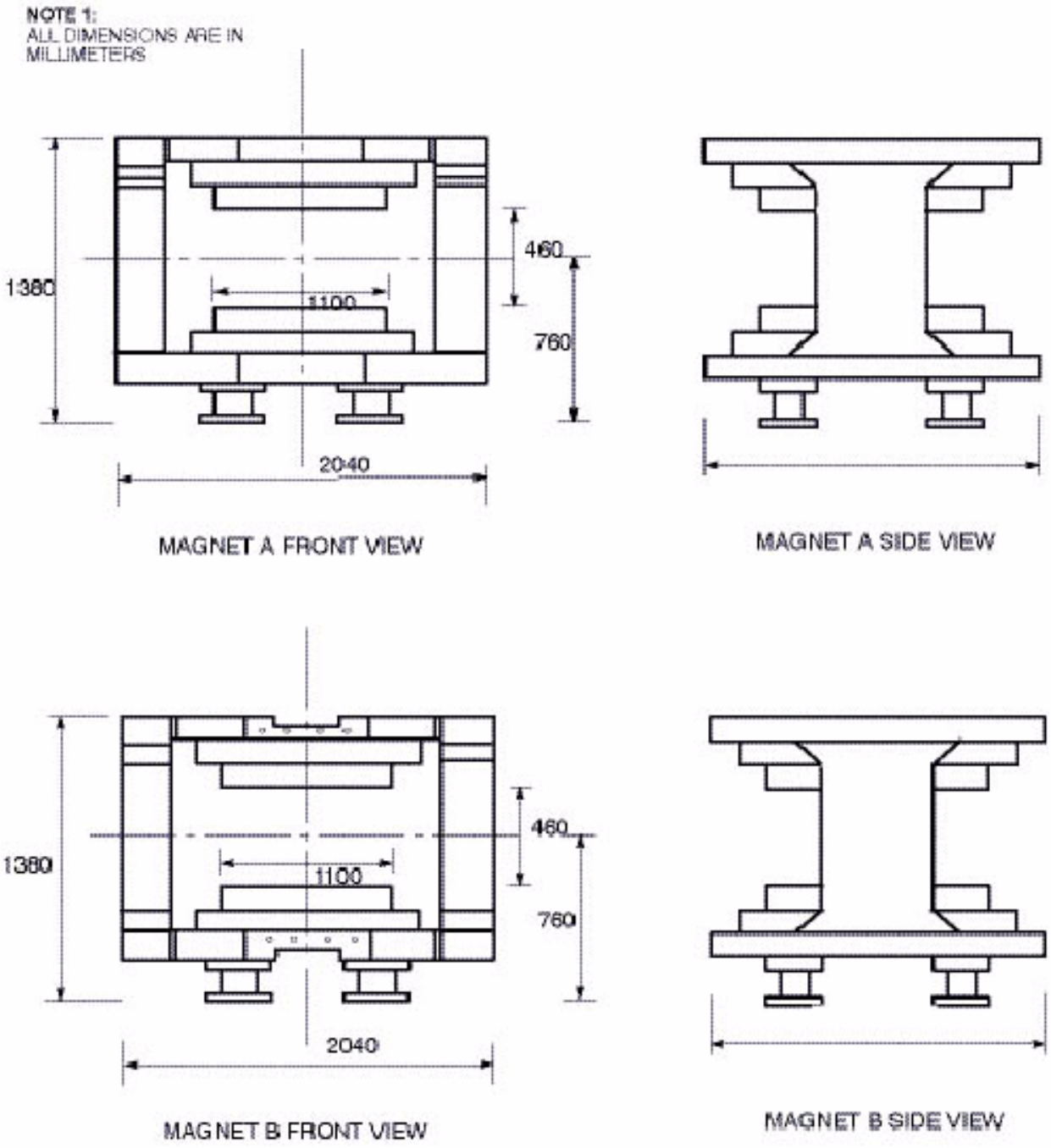
7-4 SHIPPING DATA

TABLE 7-1

SHIPPING DATA

COMPONENT	W x D x H	WEIGHT kg	METHOD OF SHIPMENT	CONTENTS OF SHIPMENT
0.2T Permanent Magnet	2000 x 2300 x 1900	11000	Crate	Magnet with Gradient coil & RF shield
Accessories	2410 x 320 x 310	10	Crate	
Operator Workspace Cabinet	635 x 965 x 864	91	Skid	
Operator Workspace LCD Color Monitor	686 x 838 x 686	57	Skid	Monitor, ICM, Keyboard, LCD
Operator Workspace Equipment	813 x 813 x 584	45	Box	
Operator Workspace Table	1143 x 1372 x 940	82	Box	
Integrated Power System	850 x 1320 x 2290	430	Crate	if there is a step down transformer, the weight would be 520kg.
Scan Room Unit (SRU)	670 x 1040 x 2070	220	Carton	SRU
Table	2200 x 880 x 850	299	Crate	Table
Frame Assy	1550 x 850 x 600	105	Crate	Frame
Front Cover	2250 x 1270 x 1650	153	Crate	Front Cover and Bridge
Rear Cover	2250 x 980 x 1510	153	Crate	Rear Cover
Cable	700 x 850 x 1190	201	Carton	Cables
Cable	700 x 850 x 1190	80	Carton	Cables
TX Coil	610 x 1390 x 1250	104	Box	
Body Flex Coil Medium		20	Carton	Pads

7-4 SHIPPING DATA (Continued)

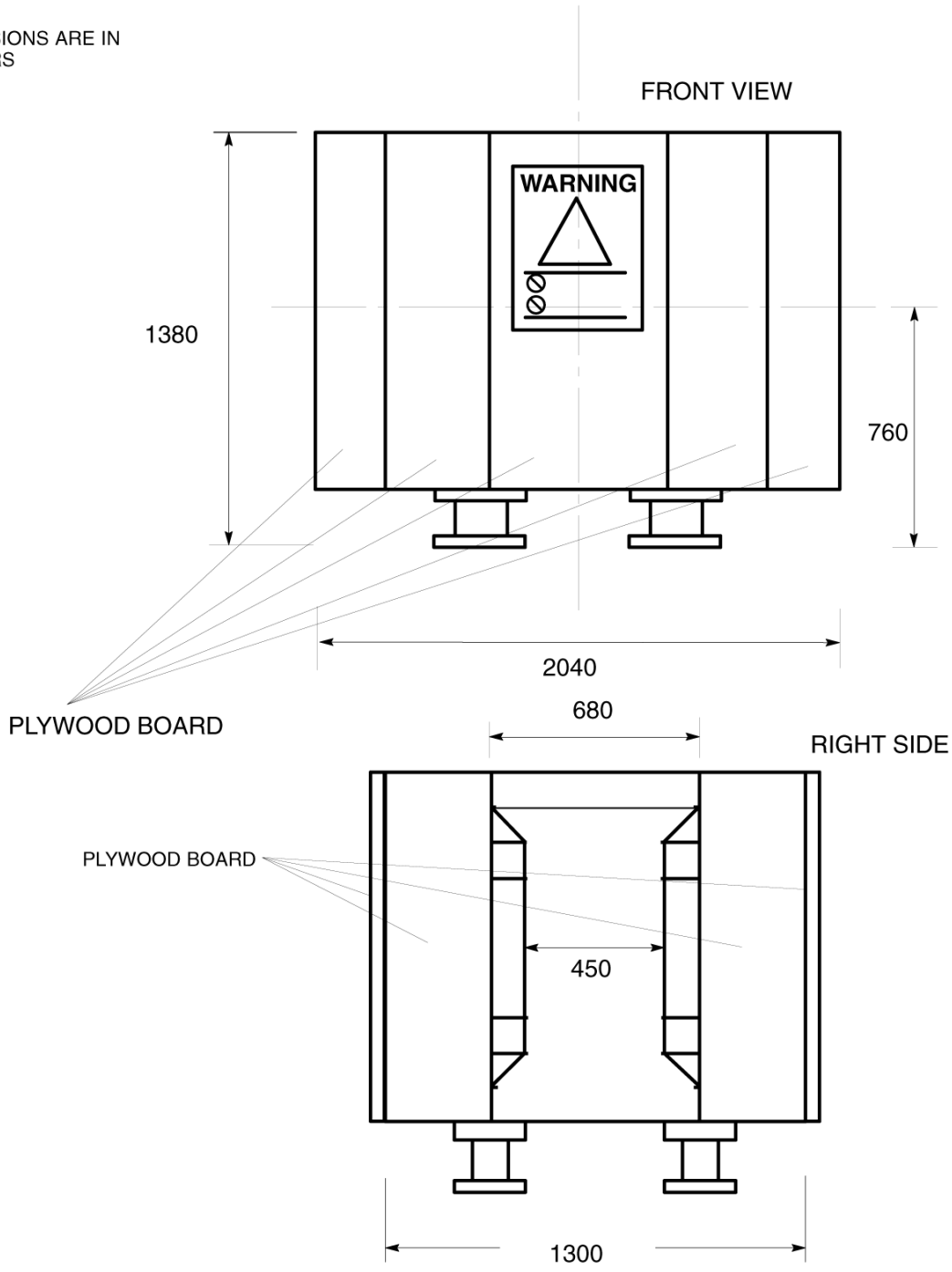


MAGNET MANEUVERING DIMENSIONS
ILLUSTRATION 7-1

7-4 SHIPPING DATA (Continued)

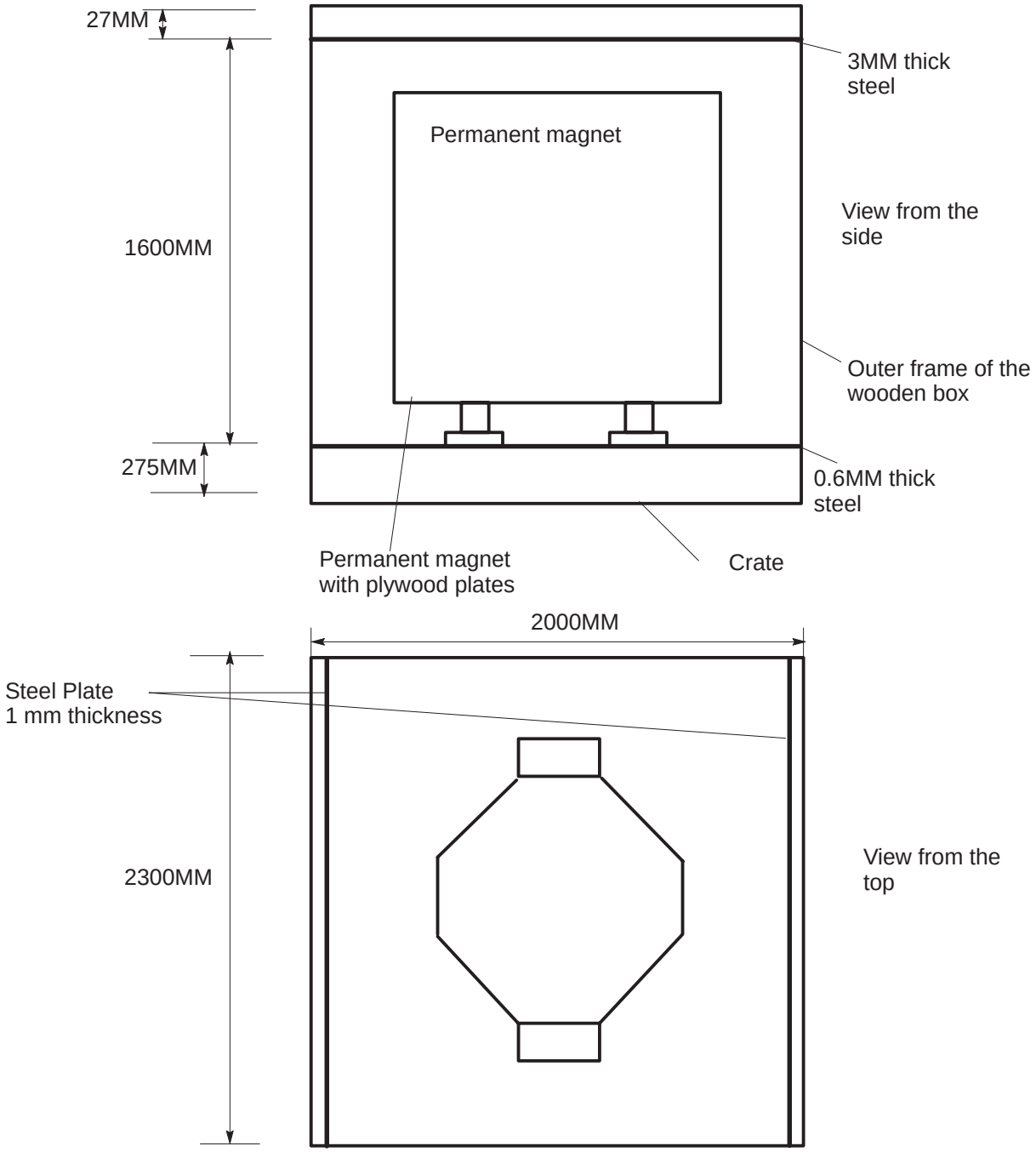
For Export Only:

NOTE 1:
ALL DIMENSIONS ARE IN MILLIMETERS



MAGNET MANEUVERING DIMENSIONS (WITH PLYWOOD BOARD)
ILLUSTRATION 7-2

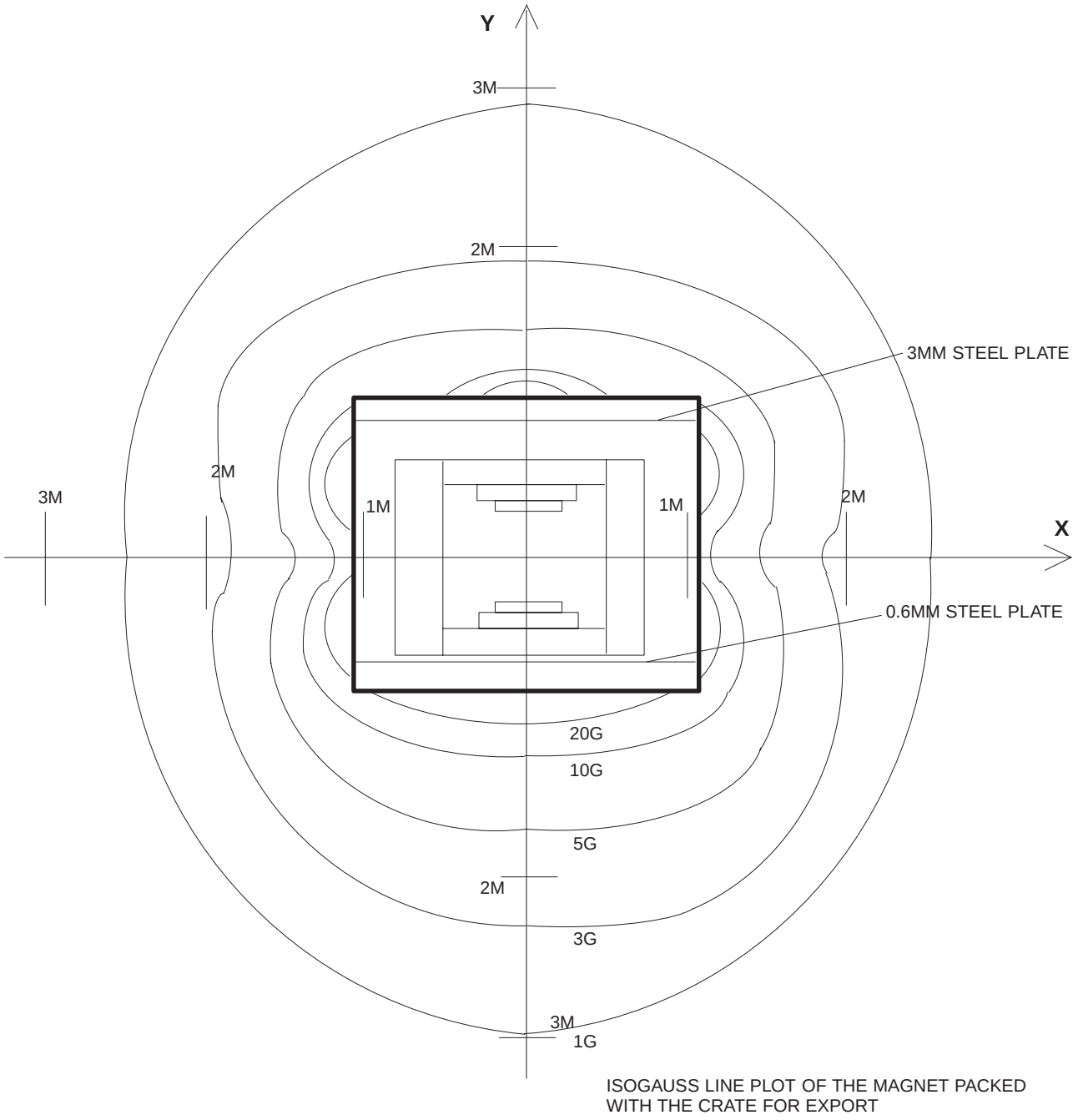
7-4 SHIPPING DATA (Continued)



MAGNET PACKED BY WOODEN CRATE
ILLUSTRATION 7-3

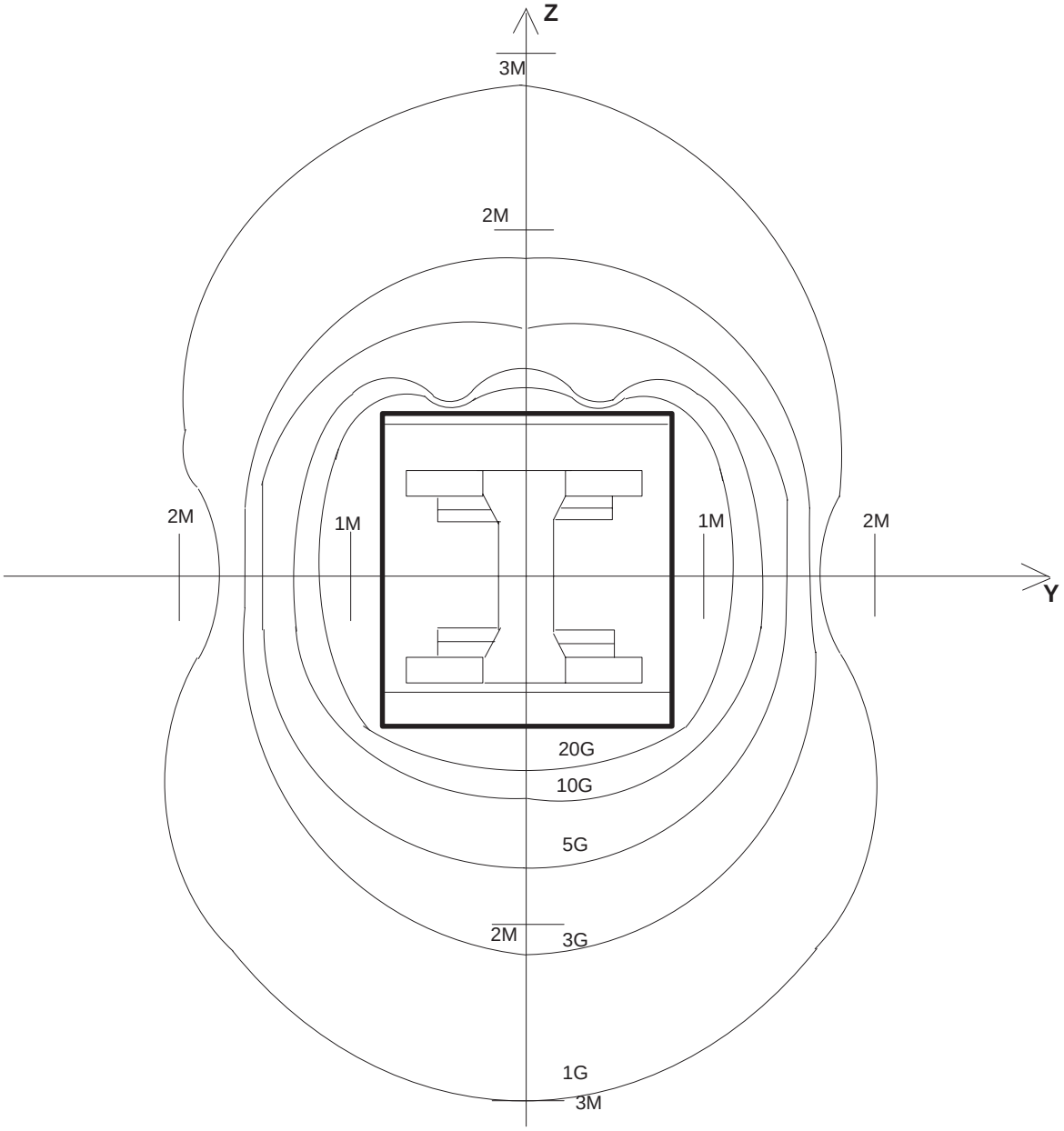
The magnet is delivered within the container. The type of the container is Opened top with a size of 20(ft) x 8(ft) x 8(ft).

7-4 SHIPPING DATA (Continued)



MAGNET PACKED BY WOODEN CRATE (XY FIELD)
ILLUSTRATION 7-4

7-4 SHIPPING DATA (Continued)

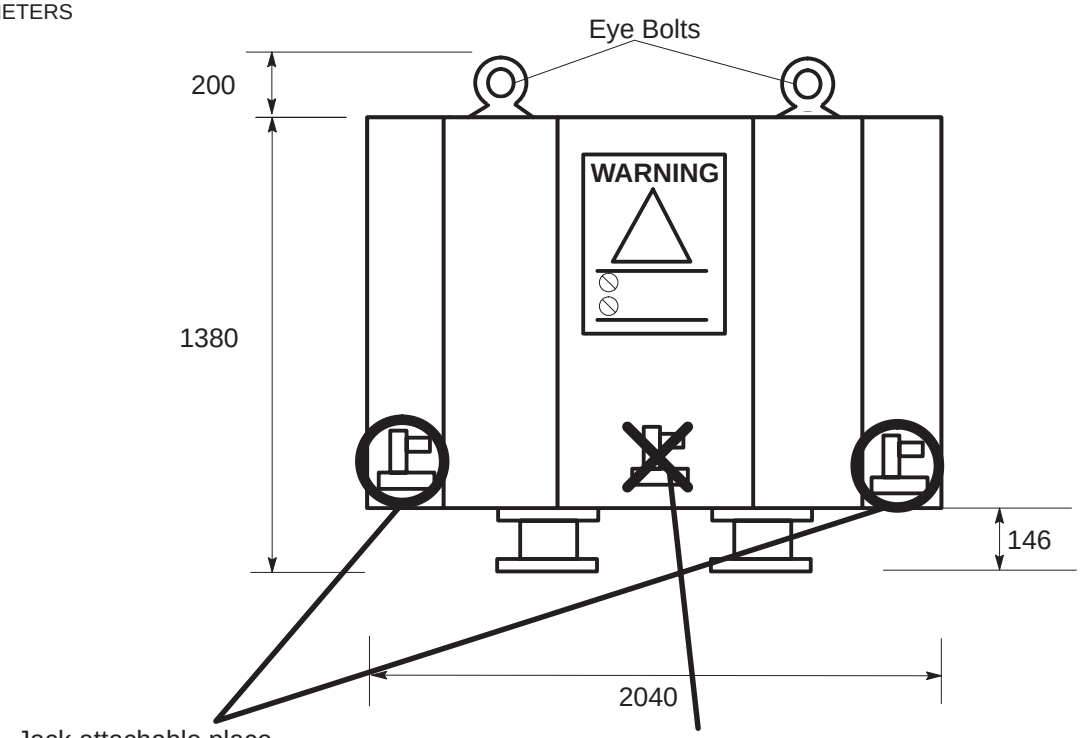


ISOGAUSS LINE PLOT OF THE MAGNET PACKED WITH THE CRATE FOR EXPORT

MAGNET PACKED BY WOODEN CRATE (YZ FIELD)
ILLUSTRATION 7-5

7-4 SHIPPING DATA (Continued)

NOTE :
ALL DIMENSIONS ARE IN MILLIMETERS



JACK ATTACHMENT
ILLUSTRATION 7-6

NOTE: The side with FRONT sign is the Table side.

WARNING!

IN CASE JACK IS MADE OF STEEL, BE VERY CAREFUL WHEN HANDLING NEAR THE MAGNET. STEEL-MADE JACKS WLLL BE DRAWN TO THE MAGNET.

7-5 MAGNET RIGGING

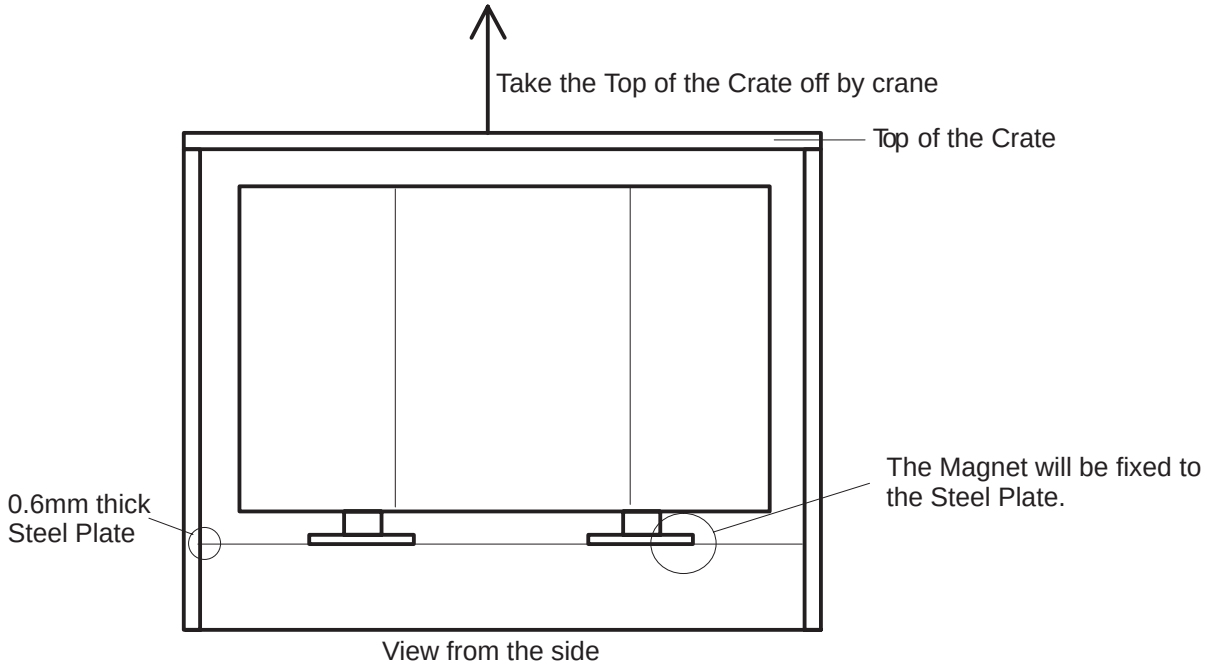
HANDLING INFORMATION:
MAXIMUM WEIGHT: 11000KG
MAXIMUM TILT: 30 DEGREES
MAXIMUM SHOCK LOADS: 7G

1. Open the top of the sea container.
2. See Illustration 7-7. Connect crane (forklift) to the top of the crate and open the top of the wooden crate.

NOTE:
THERE IS A 3mm THICK STEEL PLATE ATTACHED TO THE TOP OF THE CRATE. THIS WEIGHS ABOUT 150KG.

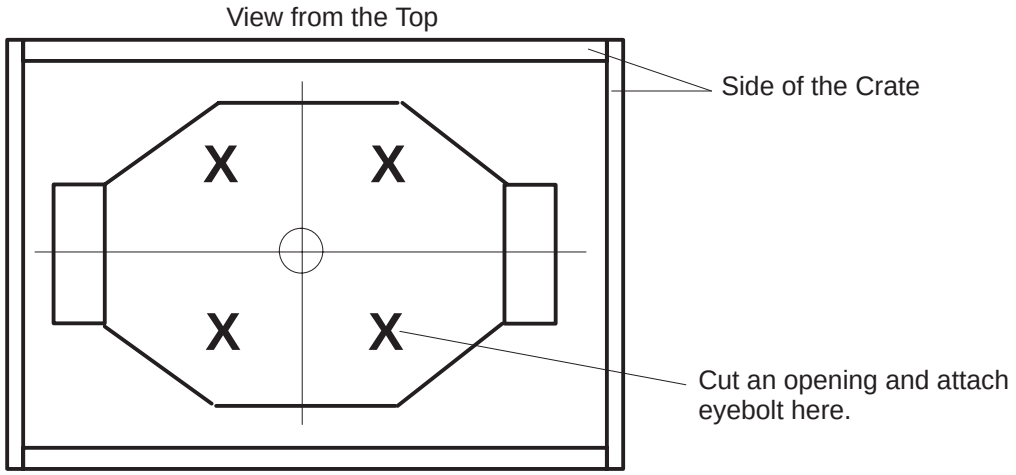
WARNING!

THE 5 GAUSS LINE WIDENS ABOUT 1M WHEN THE CRATE IS OPENED. BE SURE TO KEEP ALL FERROUS OBJECTS AND EQUIPMENT THAT MAY BE INFLUENCED BY THE MAGNET (SUCH AS PEOPLE WITH PACEMAKERS, MAGNETIC CARDS) AWAY FROM THE MAGNET.



TOP CRATE REMOVAL
ILLUSTRATION 7-7

7-5 MAGNET RIGGING(continued)



EYE BOLT LOCATION
ILLUSTRATION 7-8

3. Cut an opening at the 4 places marked on the top of the magnet and install 4 eyebolts. See Illustration 7-8.
4. Remove all 4 sides of the crate.

WARNING!

THE 5 GAUSS LINE WIDENS WHEN THE CRATE IS OPENED. BE SURE TO KEEP ALL FERROUS OBJECTS AND EQUIPMENT THAT MAY BE INFLUENCED BY THE MAGNET (SUCH AS PEOPLE WITH PACEMAKERS, MAGNETIC CARDS) AWAY FROM THE MAGNET. SEE SECTION 3-6 ISOGAUSS LINE PLOTS FOR THE ILLUSTRATION OF THE MAGNETIC FIELD.

5. Remove all nuts that fix the leg of the magnet to the crate and remove the aluminum cover.
   NOTE: DO NOT REMOVE THE WOOD PANELS THAT ARE AROUND THE SIDES OF THE MAGNET.
6. Prepare 4 Roller Skids on the ground. The magnet will go on this.
7. Connect crane to the eyebolt at the top of the magnet. Lift the magnet and place it on the roller skids. Then take off the eyebolts. See Illustration 7-8.

NOTE:
MAKE SURE TO CHECK THE DIRECTION OF THE MAGNET BEFORE LIFTING SO THAT THE FRONT AND BACK SIDES WILL BE CORRECTLY ORIENTED. THE MAGNET CAN NOT BE TURNED AROUND INSIDE THE MAGNET ROOM.

8. Check the contents to see that no parts are missing. Also check the magnet for damage during delivery.

NOTE:
DO NOT REMOVE THE WOOD PANELS AROUND THE SIDES OF THE MAGNET.

7-5 MAGNET RIGGING (continued)

9. Deliver the magnet to the Magnet Room. See Illustration 7-6. MAKE SURE TO ATTACH THE JACK TO THE PROPER PLACE. **DO NOT ATTACH THE JACK TO THE PLACE SHOWN IN THIS ILLUSTRATION**.

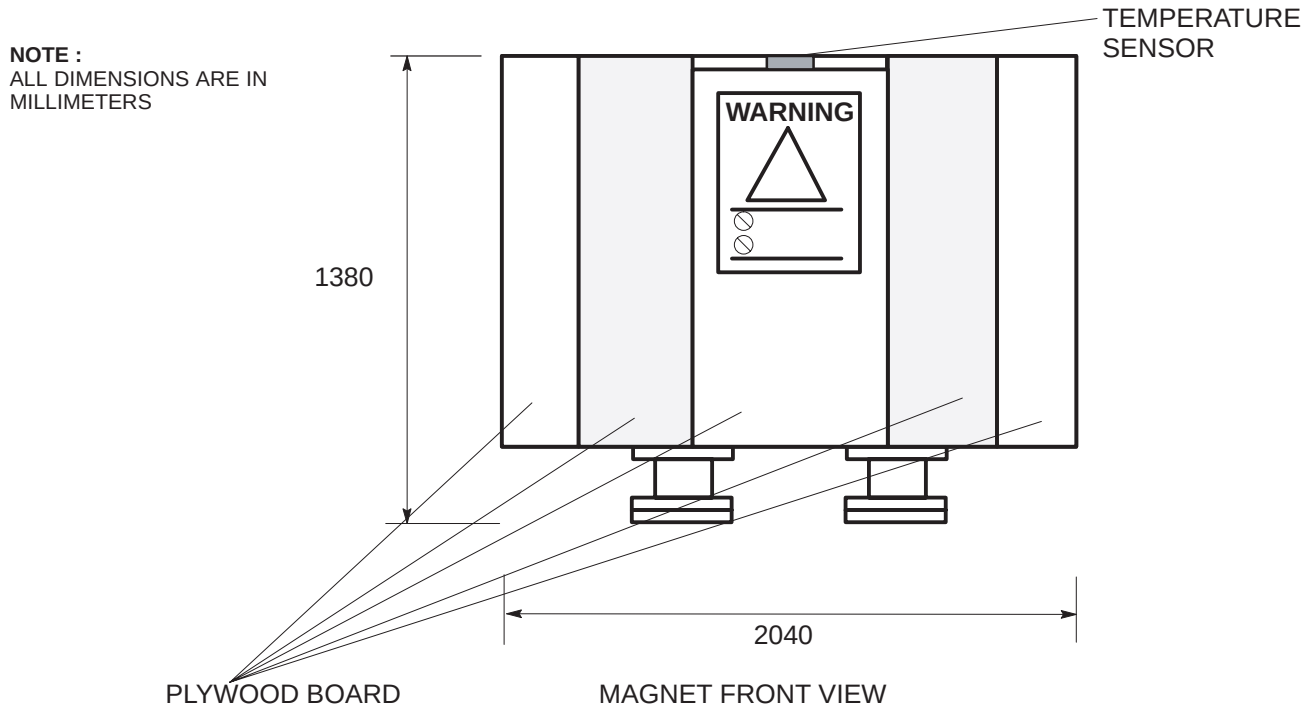
WARNING!

BE SURE TO KEEP CLEAR ALL FERROUS OBJECTS AND EQUIPMENT THAT MAY BE INFLUENCED BY THE MAGNET (SUCH AS PEOPLE WITH PACEMAKERS, MAGNETIC CARDS). SEE SECTION 3-6 - ISOGAUSS LINE PLOTS FOR ILLUSTRATIONS OF THE MAGNETIC FIELD. REFER TO SECTION 2 FOR MORE CONSIDERATIONS.

10. Sweep the Magnet Room thoroughly for iron powder and other metallic objects.
11. See Illustration 7-7. Check the temperature sensor on the magnet. Be sure magnet temperature did not exceed 45 degrees.
12. Take the wooden panels and the plastic cover off and conduct Leveling of the Magnet. After that, put the wooden panels and plastic cover back on.

NOTE:
Verify the front side and rear side of the magnet. The side with the gradient cable is the rear side.

NOTE:
IF MAGNET TEMPERATURE HAS EXCEEDED 45 DEGREES, PLEASE CONTACT THE LOCAL SERVICE SUPPORT CENTER.



TEMPERATURE SENSOR LOCATION
ILLUSTRATION 7-9

SECTION 8 - PREINSTALLATION CHECKLIST / TOOLS AND TEST EQUIPMENT

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8-1 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.

8-2 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?

8-3 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 6mm thickness, been done? (Refer to Section 6.)
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 be 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 6.)

8-4 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 Control?
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 Console and IPS (in case of no equipment room)?
7. Is air conditioning available in Equipment Room and Magnet Room? (**see note**)
8. Are functioning telephones, as defined in Section 2-9, ARCHITECTURAL REMINDERS, available at site for duration of installation?

NOTE:

Magnet must be kept at required range of temperature for Magnet Installation and stabilization of the magnetic field.

8-5 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?

8-6 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.

8-6-1 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, 10000 kg .
6. Lifting straps for LIFTING Magnet, 10000 kg .

8-6-2 Customer Supplied Equipment

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

8-6-3 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

8-6-4 Accessories For The Magnet

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

8-6-5 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. Density meter (Required for Adjustment of MFC III)
9. Line analyzer: Dranetz Model 606-3 (3 channel) with the 101 frequency option or Dranetz Model line monitor plug in modules
10. NMR magnetometer-CERN Type (by Sentec or Metrolab) with probe for 0.2T field range
11. ECG simulator: Fogg ECG Kit (46-306797G1)

8-6-6 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)

8-6-6 Tools Required for Installation, Adjustment, and Replacement (Continued)

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

TABLE 8-1
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 9 - SYSTEM CABLE INTERCONNECT

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9-1 INTRODUCTION

SYSTEM CABLE INTERCONNECTION describes cable interconnections and customer furnished components for the system. Its subsections are broken down as follows:

- SECTION 9-1 INTRODUCTION
  - Overall system Interconnects, Component Designators.
- SECTION 9-2 GROUND CABLE INTERCONNECTS
  - Ground Cable Connections.
- SECTION 9-3 POWER LINE INTERCONNECTS
  - Cable Connections from the Main Disconnect Control to the Integrated Power System, and Cable Connections from the Integrated Power System to all subsystems.
- SECTION 9-4 SYSTEM INTERCONNECTS (SIGNAL CABLE WIRING)
  - Signal Cable Interconnects for the system to the Table.

9-1-1 Component Designator

General Electric 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 Operator Console is referred to as OC.) Refer to Table 9-1, COMPONENT DESIGNATION for all component designators.

TABLE 9-1

COMPONENT DESIGNATION

COMPONENT DESIGNATOR	DESCRIPTION
MAG	Permanent Magnet
MDC	Main Disconnect Control (Customer Supplied)
OC	Operator Console which includes: - Monitor & LCD - Keyboard & Mouse - ICM - AC Junction Box
IPS	Integrated Power System with Step Down Trans former(standard for outside Japan)
SRU	Scan Room Unit
TBL	Table

9-1-2 Definition Of Terms

The definitions of terms used in Table 9-2 are:

- Between Components (From/To): component designations as found in Table 9-1.
- Group Number: identifying number referenced to bundles (i.e. groups) of cables.
- Area: cross-sectional area of the combined cables in a group.

Note

The group area is determined by adding up the circular cross-sectional areas of all individual cables with 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 components.

Note

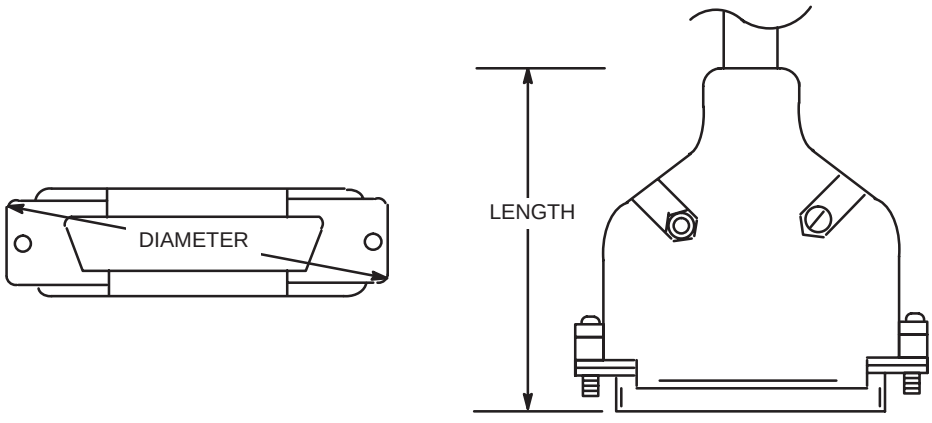
Actual usable length will depend upon the routing within the components. Worst case (i.e. shortest) lengths are shown. The difference will be about 1.2 m.

- Cable Number: unique number assigned to each GE-supplied cable.

Note

This number must be used when making special cable orders.

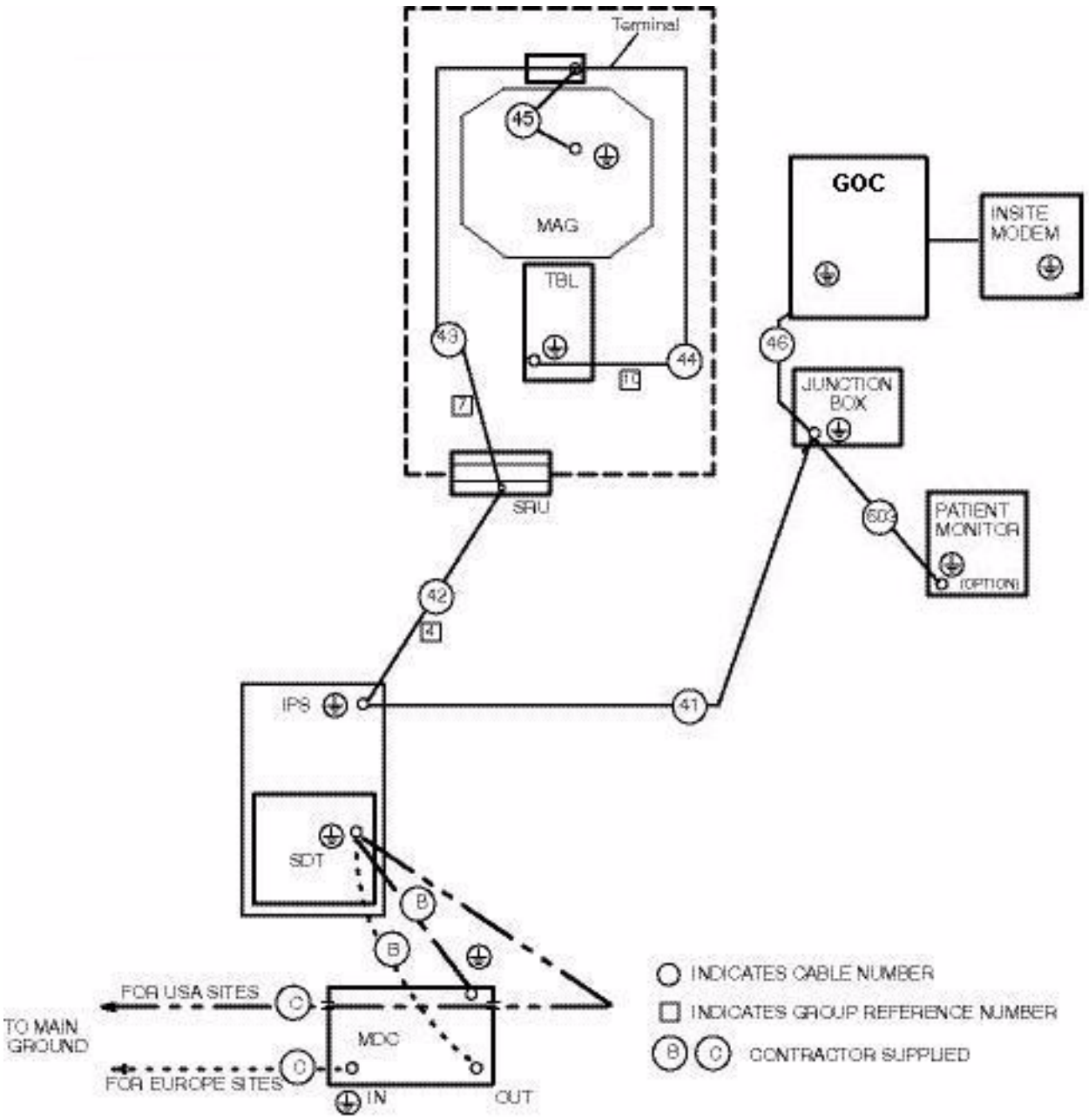
- Cable Diameter: diameter of an individual cable.
- Cable Leads (AWG/No.): gauge of wires and total number of wires within a given cable.
- Connector diameter and length indicated are the plug pulling diameter and length of a cable. See Illustration 9-1.



CABLE PLUG DIMENSIONS
ILLUSTRATION 9-1

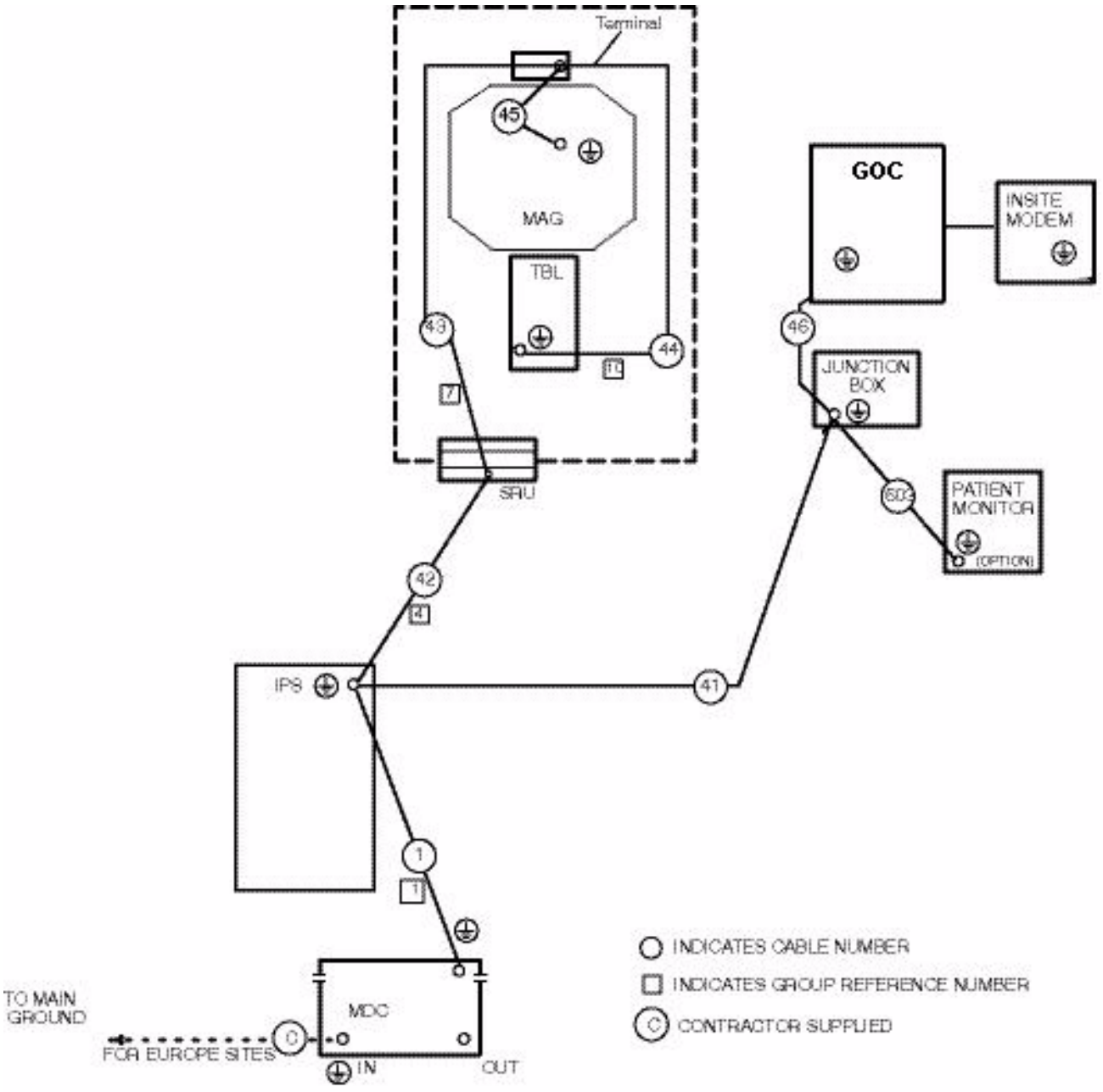
9-2 GROUND CABLE INTERCONNECTS

The Profile system is designed with minimum ground loops to prevent noise currents and natural disturbances from flowing through the low-level signal reference path.
Any modifications or non-MR equipment grounds added to the MR ground system must be approved by the General Electric representative in order to ensure safety and performance.
The System Ground Interconnects are shown in Illustrations 9-2 and 9-3.



NOTE : THE GROUND FOR RF SHIELD SHOULD BE ISOLATED FROM THE BUILDING GROUND.

GROUND CABLE INTERCONNECT WITH SDT(STANDARD FOR OUTSIDE JAPAN)
ILLUSTRATION 9-2



NOTE : THE GROUND FOR RF SHIELD SHOULD BE ISOLATED FROM THE BUILDING GROUND.

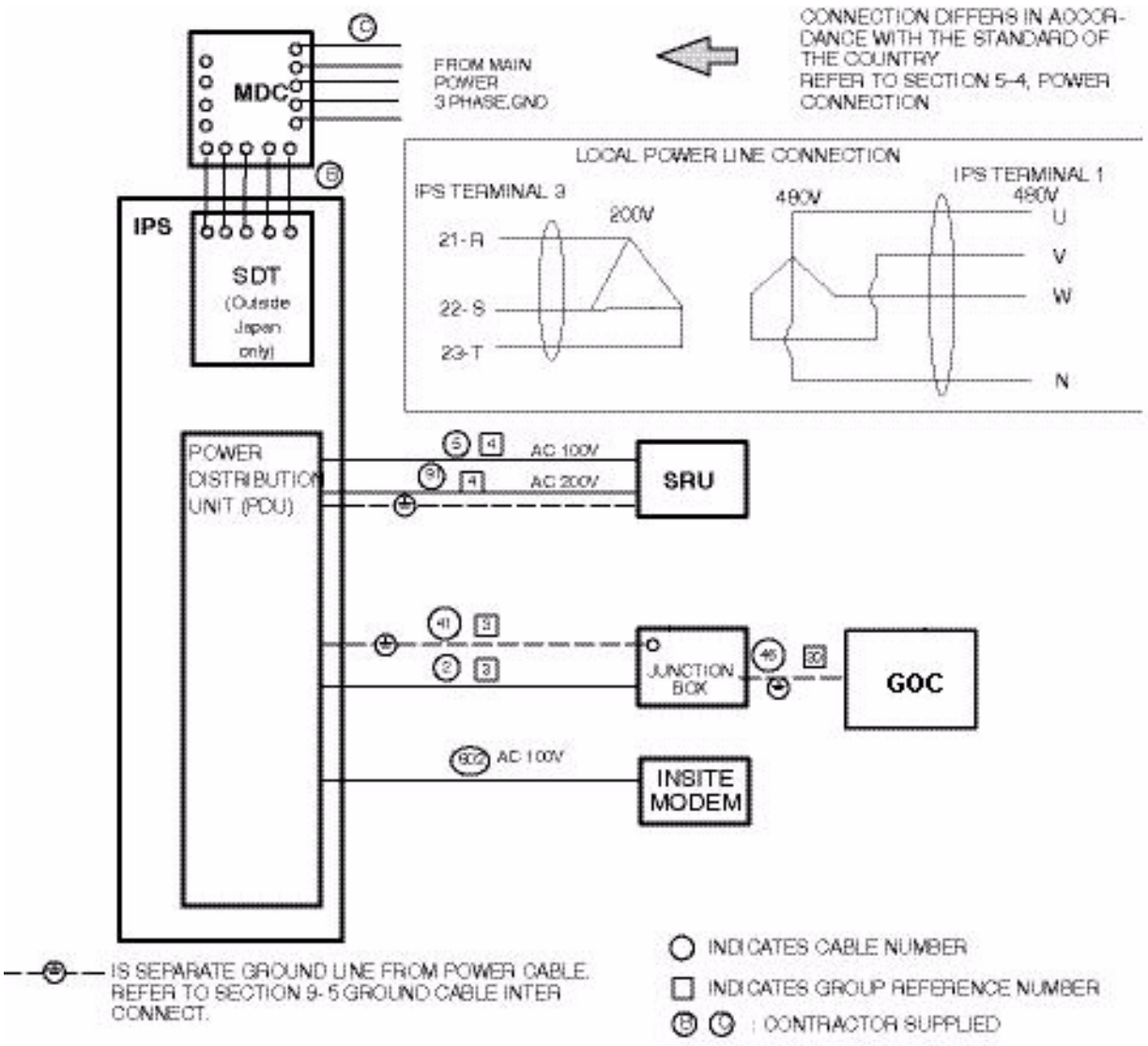
GROUND CABLE INTERCONNECT WITHOUT SDT(STANDARD FOR OUTSIDE JAPAN)
ILLUSTRATION 9-3

9-3 POWER LINE INTERCONNECTS

Table 9-2 and Illustrations 9-4, 9-5 and 9-6 contain information on power line interconnects between system components.

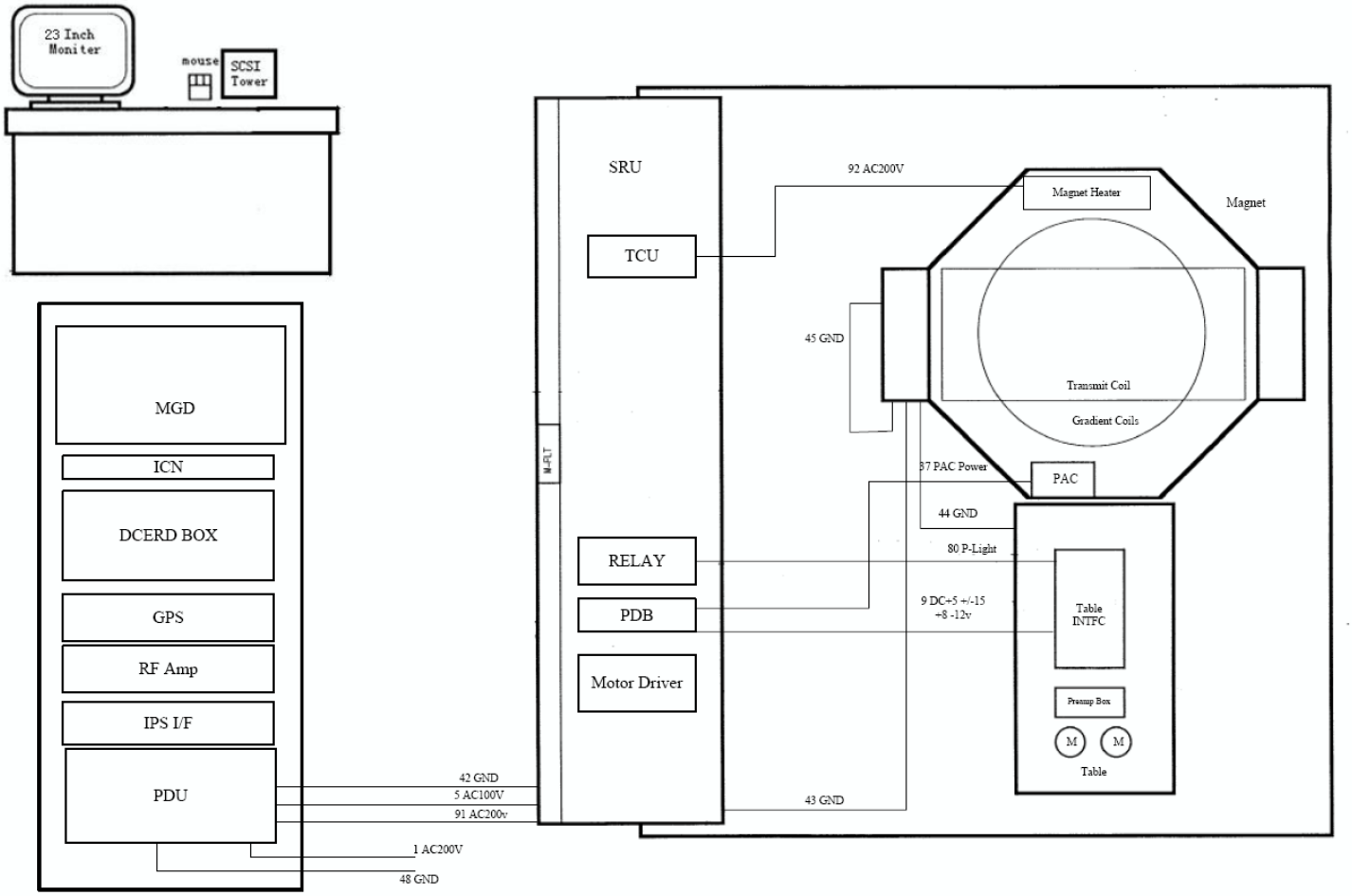
Conduit or pipe is not recommended for cable runs since the system uses many prefabricated cables with large connectors. However, there may be instances in which conduit is used for power cables. In those cases, cables may be pulled by the lug terminal ends. This way the connector pulling dimensions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

Unless otherwise specified, cables (except B and C) and components listed in Table 9-2 are supplied by General Electric.



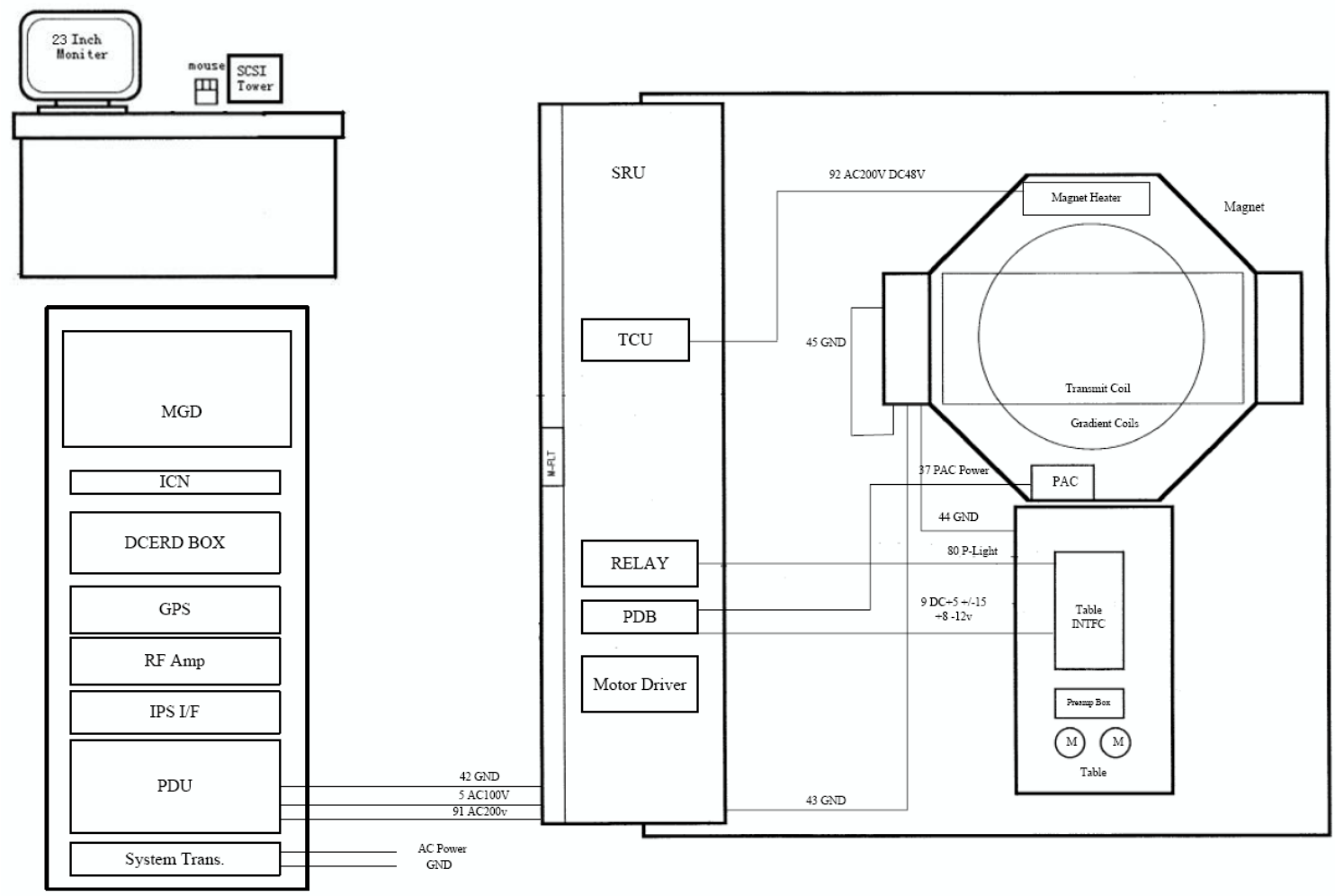
MAIN POWER CONNECTIONS
ILLUSTRATION 9-4

9-3 POWER LINE INTERCONNECTS(continued)



POWER CONNECTIONS (FOR JAPAN)
ILLUSTRATION 9-5

9-3 POWER LINE INTERCONNECTS(continued)



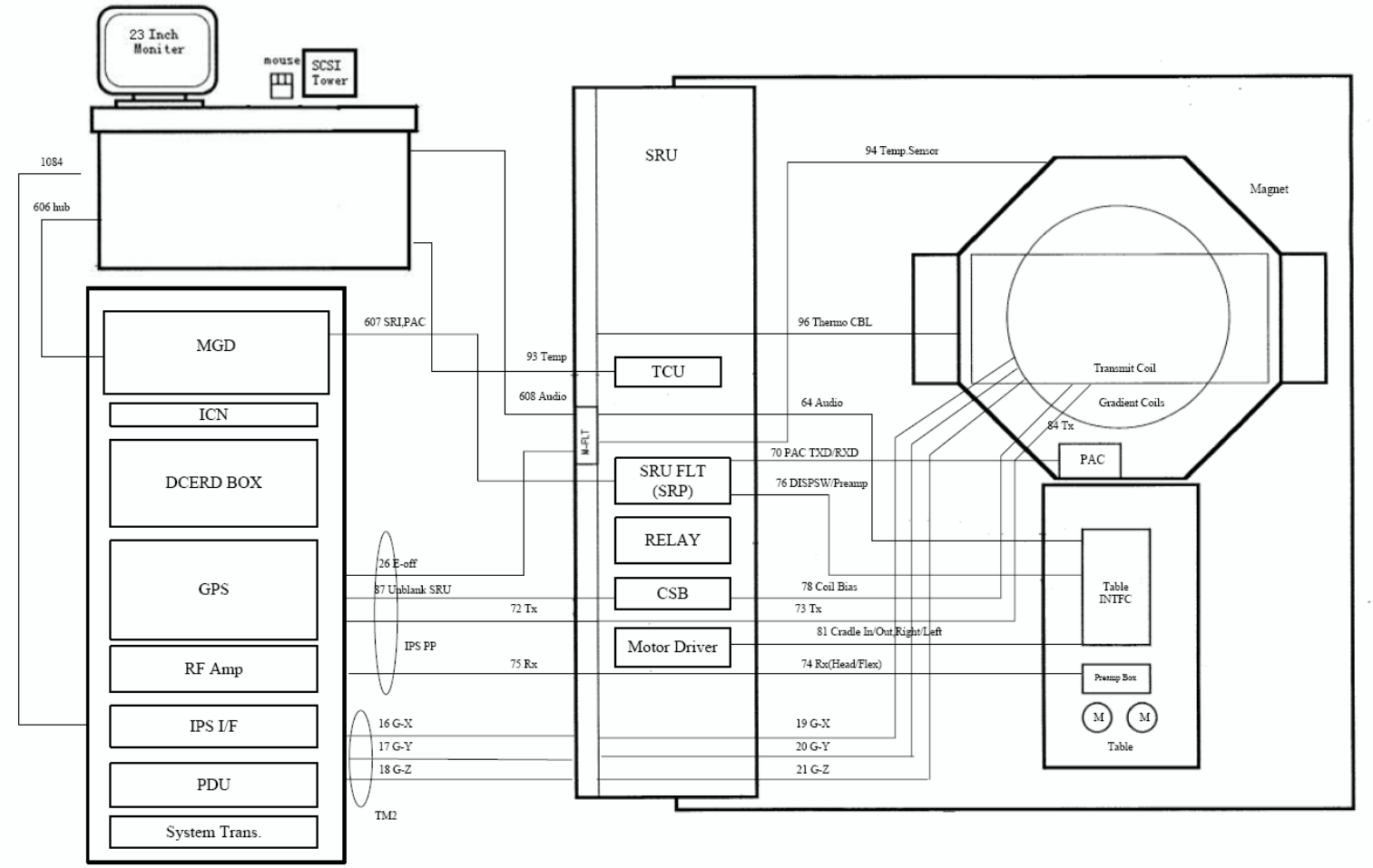
POWER CONNECTIONS (FOR OUTSIDE JAPAN)
ILLUSTRATION 9-6

9-4 SYSTEM INTERCONNECTS (SIGNAL CABLE WIRING)

Table 9-2 and Illustrations 9-7 and 9-8 contain information on interconnects between all system components. Conduit or pipe is not recommended for cable runs since the system uses many prefabricated cables with large connectors. Unless otherwise specified, cables (except B and C) and components listed in Table 9-2 are supplied by General Electric.

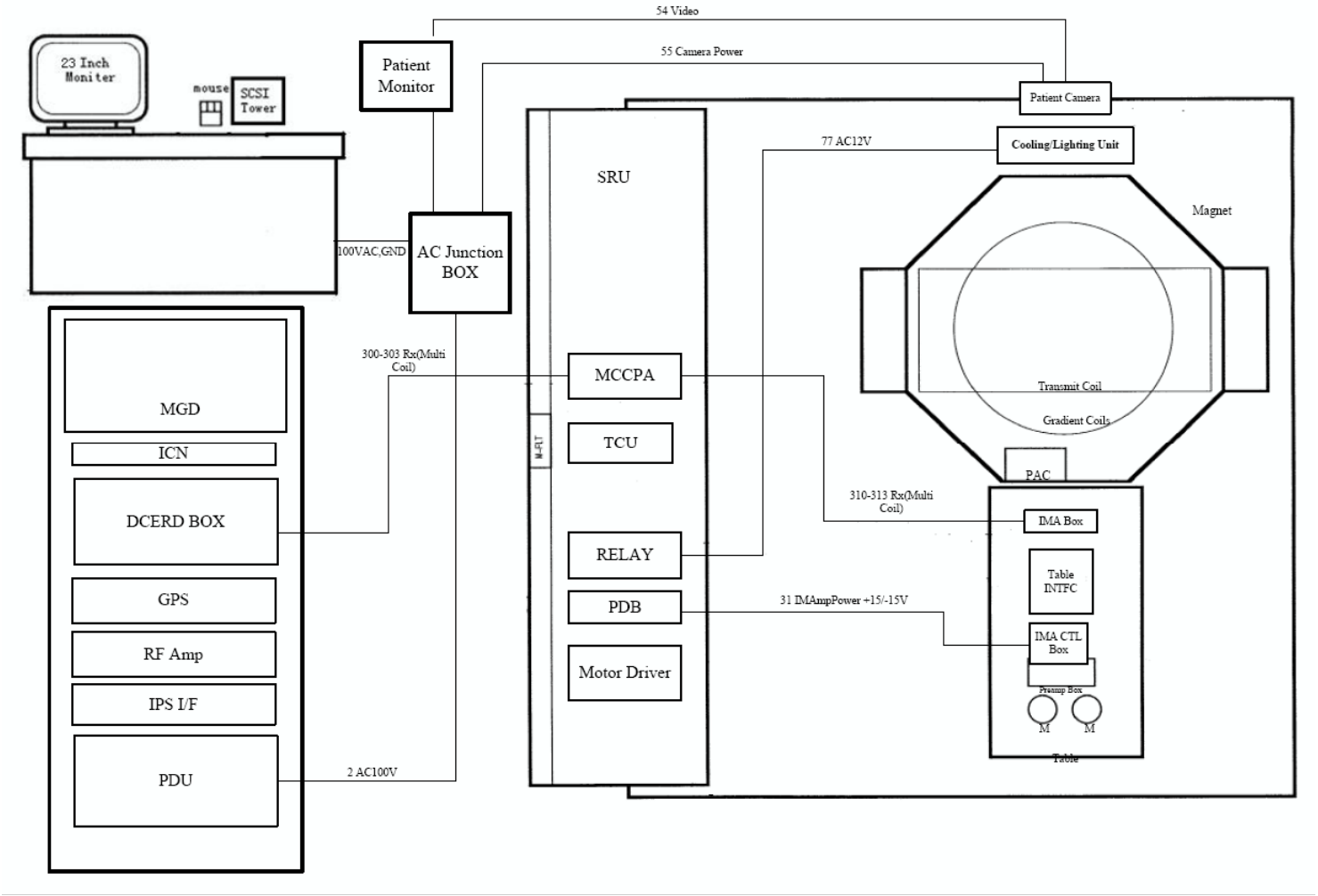
Note1

RF X-mit (transmit) and Receive cables should have their own conduit or raceways. This means that these two cables should not be bundled to the others or each other at any point. For any penetration through the RF or magnet room the conduit or raceway shall be seam welded at each penetration. There shall be plastic reliefs at each end of the conduit to prevent damage to the cables.



SYSTEM INTERCONNECTS
ILLUSTRATION 9-7

9-4 SYSTEM INTERCONNECTS (SIGNAL CABLE WIRING) (Continued)



SYSTEM INTERCONNECTS FOR OPTIONS
ILLUSTRATION 9-8

TABLE 9-2
CABLE LIST
Note
Cable B and C are contractor supplied. Follow local codes for sizing. AWG4 : 25mm^2 Minimum

GRP REF No.	CBL No.	LENGTH m	CONDUCTOR DESCRIPTION			BETWEEN COMPONENTS	PLUG/ CONN	RATING (V)	ACTUAL (V)	NOTE
		CABLE	SECT AREA	CORE No:c PAIR No: p	DIAMETER (mm)	FROM	FROM			
		USABLE RUN				TO	TO			
1	1	15	AWG- 4	3C	26.2	PDB		600	200	AC200V 3PHASE
		13				IPS	M8			
	B	AS REQ	AWG- 4	1C		MDC		-		BY CUSTOMER GND
						SDT	M8			
	C	AS REQ	AWG- 4	1C		MAIN POWER		-		BY CUSTOMER GND
						MDC				
3	2	20	AWG- 16	3C	9	IPS	M4	600	100	AC100V 1PHASE GND
		17				JUNCTION BOX				
4	5	10	AWG- 10	2C	12.5	IPS	M4	600	100	AC100V 1PHASE
		7				SRU	M4			
9	9	20	AWG- 14X5	14C	19.0 WITH SHIELD	SRU	MATE- N(U) 12C	600	<30	DC5V, 15V, 8V, 12V E- OFF
		14	AWG- 18X9			TABLE	MATE- N(U) 12C			
4	16	10	AWG- 8	2 C	22.4 WITH SHIELD	IPS	M5	600	300	GPS- G COIL X
		9				SRU	M5			
4	17	10	AWG- 8	2C	22.4 WITH SHIELD	IPS	M5	600	300	GPS- G COIL Y
		9				SRU	M5			
4	18	10	AWG- 8	2C	22.4 WITH SHIELD	IPS	M5	600	300	GPS- G COIL Z
		9				SRU	M5			
15	19	10	AWG- 8	2C	22.4 WITH SHIELD	SRU	M5	600	300	SGS- G COIL X
		9				MAGNET TERMINAL	M5			
15	20	10	AWG- 8	2C	22.4 WITH SHIELD	SRU	M5	600	300	SGS- G COIL Y
		9				MAGNET TERMINAL	M5			
15	21	10	AWG- 8	2C	22.4 WITH SHIELD	SRU	M5	600	300	SGS- G COIL Z
		9				MAGNET TERMINAL	M5			
4	26	20	AWG- 18	4C	7.2	IPS	MATE- N(U) 4C	300	<30	300MAG E- OFF
		17				SRU	MATE- N(U) 4C			
7	37	20	AWG- 20	5P	9.8 WITH SHIELD	SRU	MATE- N(U) 9C	300	<30	PAC POWER
		14				MAGNET	Sub- D15pin			
2	41	20	AWG- 4	1C	12.1	IPS	M8	600	0	GND
		17				JUNCTION BOX	M6			
4	42	10	AWG- 4	1C	12.1	IPS	M8	600	0	GND
		7				SRU	M6			
15	43	15	AWG- 4	1C	12.1	SRU	M6	600	0	GND
		13				MAG	M8			
10	44	4	AWG- 4	1C	12.1	MAG	M8	600	0	GND
		3				TABLE	M6			

TABLE 9-3
CABLE LIST

GRP REF No.	CBL No.	LENGTH m	CONDUCTOR DESCRIPTION			BETWEEN COMPONENTS	PLUG/ CONN	RATING (V)	ACTUAL (V)	NOTE
		CABLE	SECT	CORE No:c	DIAMETER	FROM	FROM			
		USABLE RUN	AREA	PAIR No: p	(mm)	TO	TO			
12	45	1	AWG- 4	1C	12.1	MAG	M8	600	0	GND
						MAG earth	M10			
1	48	15	AWG- 4	1C X 2	12.1	PDB	Open	600	0	GND
		13				IPS	M8			
26	54	30	3C2V	1C	5.6	PATIENT MONITOR	BNC	1000 VDC	<30	VIDEO (PART OF PATIENT MONITOR)
		28				PATIENT CAMERA	BNC			
27	55	30	AWG- 20	2P	4.9 WITH SHIELD	JUNCTION BOX	M4	300	<30	+12VD(PART OF PATIENT MONITOR)
		28				PATIENT CAMERA	HR 10A 6PIN			
9	64	20	AWG- 28	5P	7.7 WITH SHIELD	SRU	PS- 10	300	<30	AUDIO
		14				TABLE	PS- 10			
7	70	20	FIBER OPTIC	2C	6.8	SRU	HFBR- 4506	N/A	0	PAC TxD / RxD
		13				MAG (PAC)	HFBR- 4506			
4	72	15	8D-FB	1C	11	IPS(PP)	N	1000	448	RF- TRANS
		12				SRU	N			
15	73	10	8D-FB	1C	11	SRU	N	1000	448	RF- TRANS
		10				TABLE	N			
9	74	12	5D-FB	1C	7.6	SRU	N	1000	10	RF- RECV
		9				TABLE	N			
5	75	20	5D-FB	1C	7.6	OC	BNC	1000	10	RF- RECV
		17				SRU	N			
9	76	20	AWG- 28	45P	10.6 WITH SHIELD	SRU	PS- 40/50	30	<30	M DISPLAY/SW PRE AMP
		14				TABLE	PS- 40/50			
15	77*	15	AWG- 18	4C	7 WITH SHIELD	SRU	M3.5	600	100 500	COOLING/LIGHTING POWER (AC100V)
		14				COOLING	MATE- N(U)6C			
15	78	14	AWG- 18X8	4C	23.4 WITH SHIELD	SRU	MATE- N(U)6CX2	600	100	COIL SWITCH BIAS
		11				Tx COIL	MATE- N(U)2CX4			
9	80	15	AWG- 14X8 AWG-	8C	16 WITH SHIELD	SRU	MATE- N(U)9C, M3	600	100	E.VALVE/POS.LIGHT BREAKE/E- OFF
		14				TABLE	MATE- N(U)9C			
9	81	20	AWG- 20	10C	12.7	SRU	MATE- N(U)12C	300	<30	STEEPING MOTOR DRIVER
		14				TABLE	MATE- N(U)12C			
4	87	23	FIBER OPTIC	2C	6.8	IPS	HFBR- 4503	N/A	0	UNBLANK
		17				SRU	HFBR- 4513			
4	91	20	AWG- 16	2C	8	IPS	M4	600	200	TEMP CTL UNIT POWER
		17				SRU	M3			
15	92	18	AWG- 16	4C	12.0 WITH SHIELD	SRU	MATE- N(U)CAP 4PIN	600	200	HEATER POWER 200VAC,48VDC
		11				MAGNET	MATE- N(U)CAP 4PIN			
4	93	15	AWG- 28	13P	8.0 WITH SHIELD	IPS	SUB- D25PIN	300	<30	TCU SERIAL I/F *
		12				SRU	SUB- D25PIN			
15	94	18	AWG- 24	3C	9.0 WITH SHIELD	SRU	MATE- N(U) PLUG 4PIN	600	<30	TEMP SENSOR *
		14				MAGNET	MATE- N(U) PLUG 4PIN			

TABLE 9-4
CABLE LIST

GRP REF No.	CBL No.	LENGTH m	CONDUCTOR DESCRIPTION			BETWEEN COMPONENTS	PLUG/ CONN	RATING (V)	ACTUAL (V)	NOTE
		CABLE	SECT	CORE No:c	DIAMETER	FROM	FROM			
		USABLE RUN	AREA	PAIR No: p	(mm)	TO	TO			
	96	5	AWG- 18	2C	WITH SHIELD	SRU	MATE- N(U) PLUG 3PIN	600	<30	Thermostat
		4				MAGNET	MATE- N(U) PLUG 3PIN			
	603	20	AWG-10	4C	20	OC	HUBBELL HBL2413	300	100	OC Power
						IPS	JST V5.5-5, 14-5NS			
	606	22	AWG-24	4P	6	OC	RJ45	300	<30	Ethernet
						IPS	RJ45			
	607	23	FIBER OPTIC	7C	9.6	IPS	HFBR - 4503/13	N/A	0	PAC/SRP (TxD/RxD)
		17				SRU	HFBR - 4503/13			
	608	20	AWG- 28	5P	7.7 WITH SHIELD	OC	D-SUB25	300	<30	AUDIO
		17				SRU	PS- 10			
	1064	3	AWG-30	25P	10.0 WITH SHIELD	OC	VHDCI68 male	30	<30	SCSI Tower
						SCSI Tower	Centronic50 male			
	1065	3	AWG-18	3C	6.3	OC	power connector male	300	100	LCD Power
						HDTV	power connector Female			
	1070	3	AWG-18	3C	6.3	OC	power connector male	300	100	SCSI Tower Power
						SCSI Tower	power connector Female			
	1084	18.3	AWG-24	5P	7.3 WITH SHIELD	OC	SUB -D9PIN	300	<30	Comm
						IPS	SUB -D9PIN			
	1256	4	AWG- 28	25P	shield	OC	Half-pitch50 male	30	<30	SCIM
						SCIM	Half-pitch50 male			
	2037	3	AWG-28	5C	7.0 WITH SHIELD	OC	DVI	30	<30	LCD
						HDTV	DVI			

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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.

10-1-1PURPOSE

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).

10-1-2MAGNET

1. Magnet Isogauss Line Plot: See Illustrations 3-1 to 3-6 in section 3-6
2. Shape, Measurements, and Weight: See Illustration 2-11 in Section 2-11
3. Magnetic Field Restrictions: See Table 2-1 in Section 2-1-1

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 2000 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.
- •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 illustration 7-6 JACK ATTACHMENT in Section 7.
- 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
- 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 in Section 2-1-1.

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

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