Date: Oct 28,2002
To: Holders of DIRECTION 2275665
Subject: **DIRECTION 2275665**
Enclosed are the REV 5 update pages.

SUMMARY OF CHANGES

- Added YD Magnet (MFO3 M4 Magnet) Information. Miscellaneous Correction.

UPDATE INSTRUCTIONS(This revision can only be inserted in Rev 4 manual);
To properly update your manual, perform the update instructions on the list below.

TAB	REMOVED PAGES	INSERTED PAGES
–	Title Page A to B	Title Page A to B
1	1– 7 to 1–12	1– 7 to 1–12
2	2–5 to 2–26 2–37 to 2–44	2–5 to 2–26 2–37 to 2–44
3	3–1 to 3–10	3–1 to 3–16
4	4– 7 to 4–8 4– 15 to 4–16	4– 7 to 4–8 4– 15 to 4–16
5	5–3 to 5–6	5–3 to 5–6
7	7–15 to 7–20 7–31 to 7–32	7–15 to 7–20 7–31 to 7–32
8	8–1 to 8–14	8–1 to 8–18

Yutaka Masumo

GEYMS TP GROUP–MR

GE Medical Systems

Technical Publications

Direction 2275665

Revision 5

Signa® Ovation

Pre–Installation

Architectural/Installation Planning Use Only

Operating Documentation

DAMAGE IN TRANSPORTATION

All packages should be closely examined at time of delivery. If damage is apparent, have notation of "bad order" placed by the delivering driver on all copies of freight or express bill. If damage is of a concealed nature, notify transportation agent as soon as possible to make an "inspection report of damage" but in any event not later than 15 days after delivery. A transportation company usually will not pay a claim for concealed damage if an inspection is not requested within this 15 day period. Complete instructions regarding claim procedure are found in section "S" of the Policy & Procedure Bulletins.

If shipment was handled by moving van service – uncrate – call Traffic – Milwaukee immediately when any damage is found. Do not attempt to call any local agent. At this time be ready to describe type of damage, type of equipment, serial numbers and if possible the order number.

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.

GE Medical Systems

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REVISION HISTORY

REV	DATE	PRIMARY REASON FOR CHANGE
0	Oct 11, 2000	Initial release
1	Dec 28, 2000	Product Name was changed to Signa Ovation. Added Cooling Cabinet Information. Miscellaneous Correction.
2	May 18, 2001	Update the Magnet Load Pattern. Miscellaneous Correction.
3	Oct 26, 2001	Added the Swing Table Style B ware plate location in Sec 2. Added MDP Document in Sec 11. Miscellaneous Correction.
4	Jan 18, 2002	Cable Interconnect List and Raceway description was updated according to the regulation.
5	Oct 28, 2002	Added YD Magnet (MFO3 M4 Magnet) Information. Miscellaneous Correction.

LIST OF EFFECTIVE PAGES

1–2 BASIC SYSTEM (Continued)

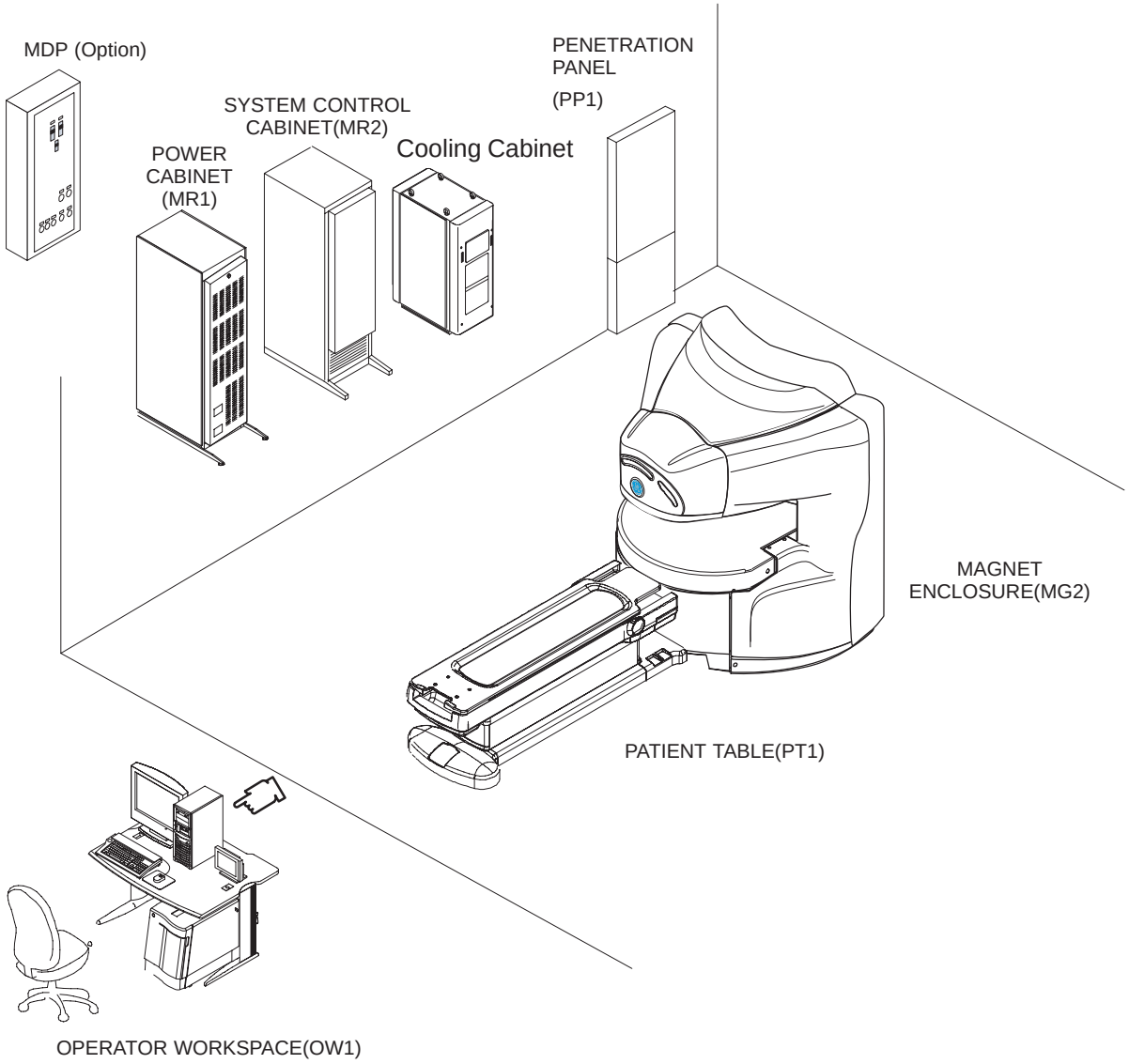
TABLE 1–14
STANDARD PHASED ARRAY COIL PACKAGE (REQUIRE ONE)

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

TABLE 1–15
SCANTOOL (REQUIRE ONE)

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

1–2 Basic System (Continued)



SIGNA Ovation SYSTEM MAJOR EQUIPMENT
ILLUSTRATION 1–1

1–3 SYSTEM OPTIONS

Note

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

The following are optional equipment and software.

TABLE 1–16
OPTIONAL APPLICATIONS (IF REQUIRED)

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

TABLE 1–17
OPTIONAL COILS (IF REQUIRED)

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

1–4 SYSTEM OPTIONS (continued)

TABLE 1–18
KINEMATIC DEVICE (IF REQUIRED)

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

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

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

TABLE 1–20
Main Disconnect (IF REQUIRED)

CATALOG	DESCRIPTION
R4503K	Main Disconnect

TABLE 1–21
Power Tech (IF REQUIRED)

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

1–5 FACILITY OPTIONS

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

Note

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

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

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

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

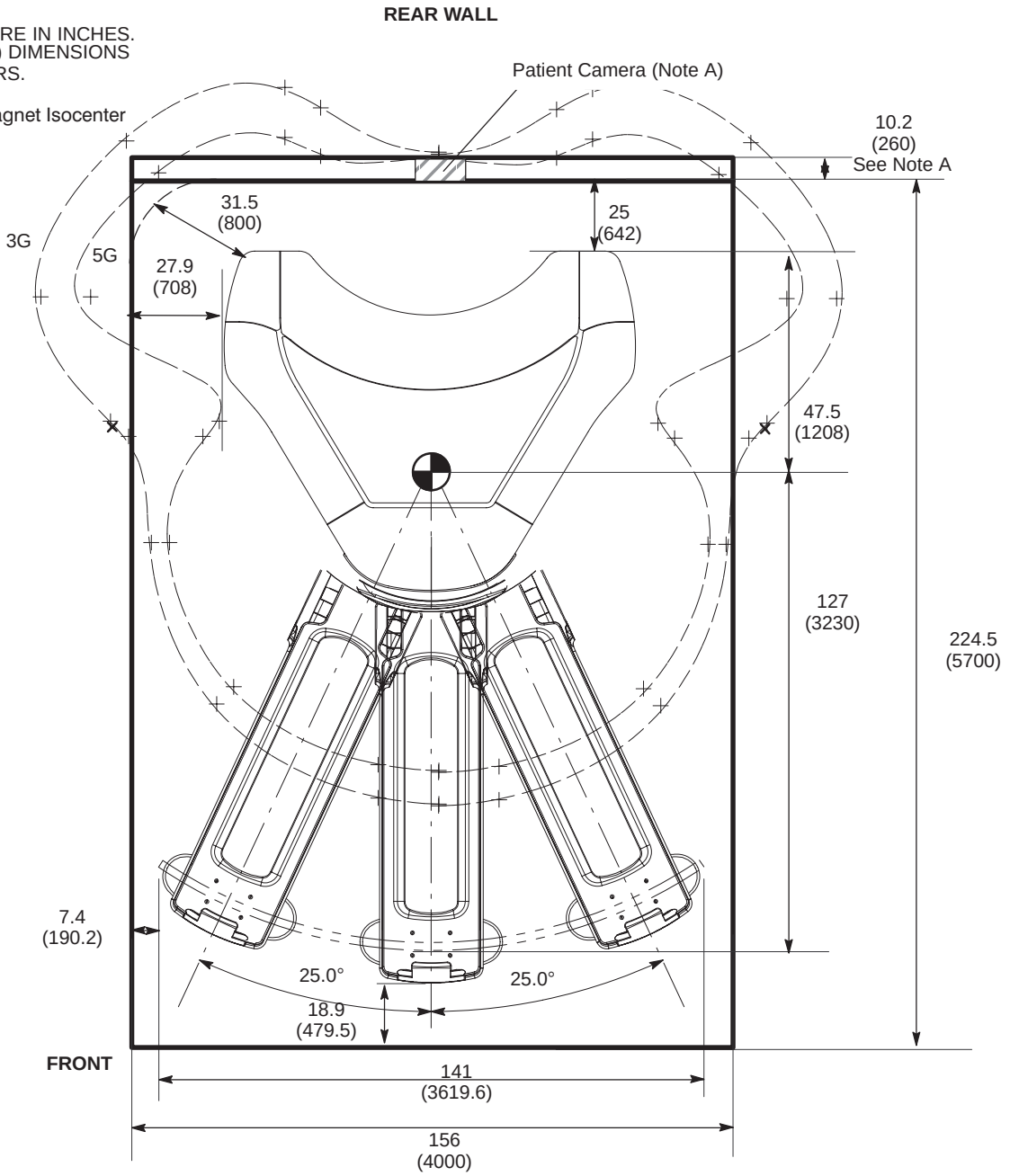
2 Absolute Minimum Equipment Room and Control Room dimensions do not permit placement of air conditioning in room. Nor do they permit space for any optional equipment such as Advantage Workstation option, Laser Camera, etc.

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

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

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

INDICATES Magnet Isocenter



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

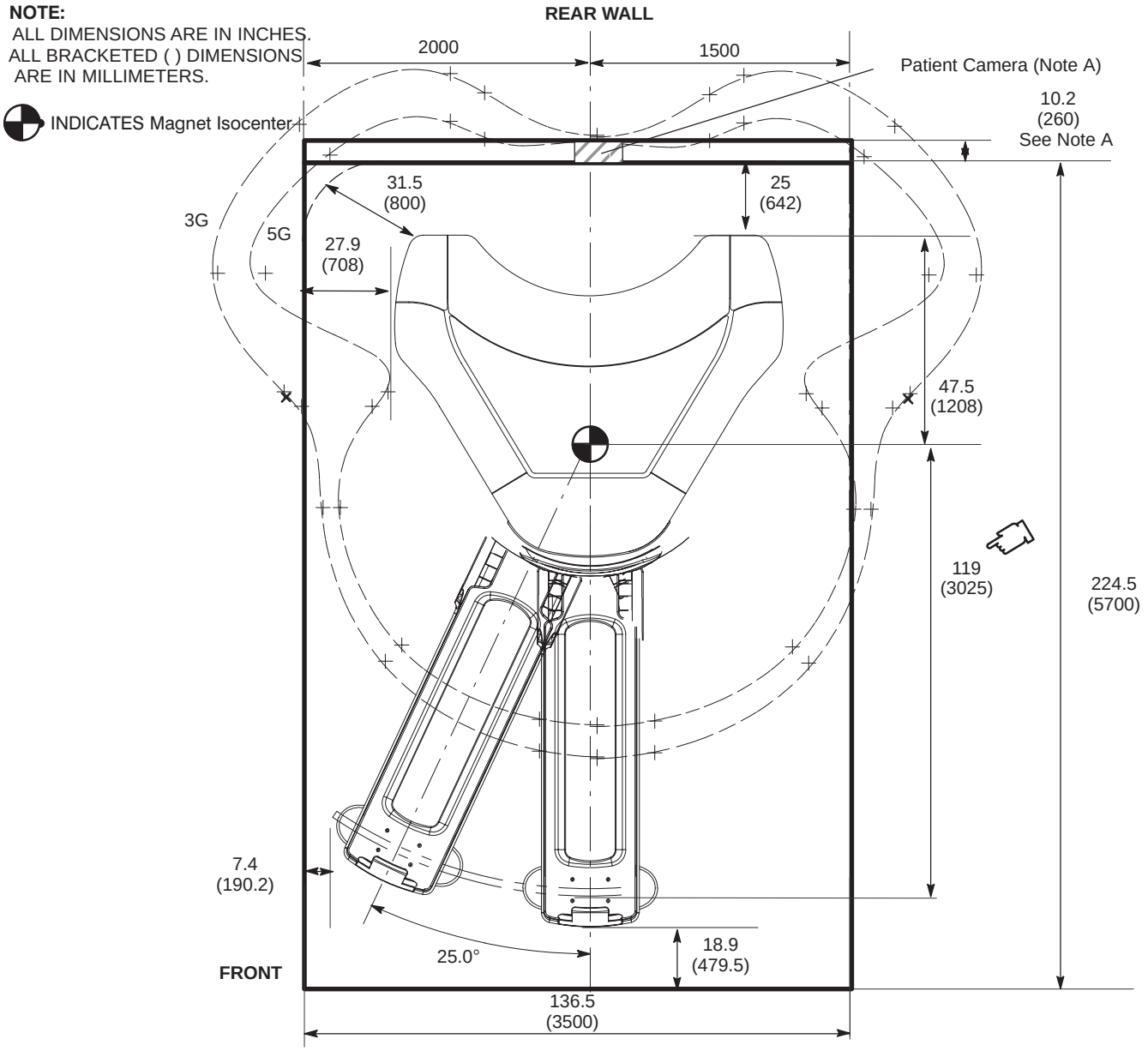
0.35T MAGNET, ENCLOSURE, & PATIENT TABLE (MINIMUM LAYOUT FOR TWO SIDE SWING WITH OUTSWINGING SWING DOOR)
ILLUSTRATION 2–1

Note 1

This is a minimum layout finished room without duct.

Note 2

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



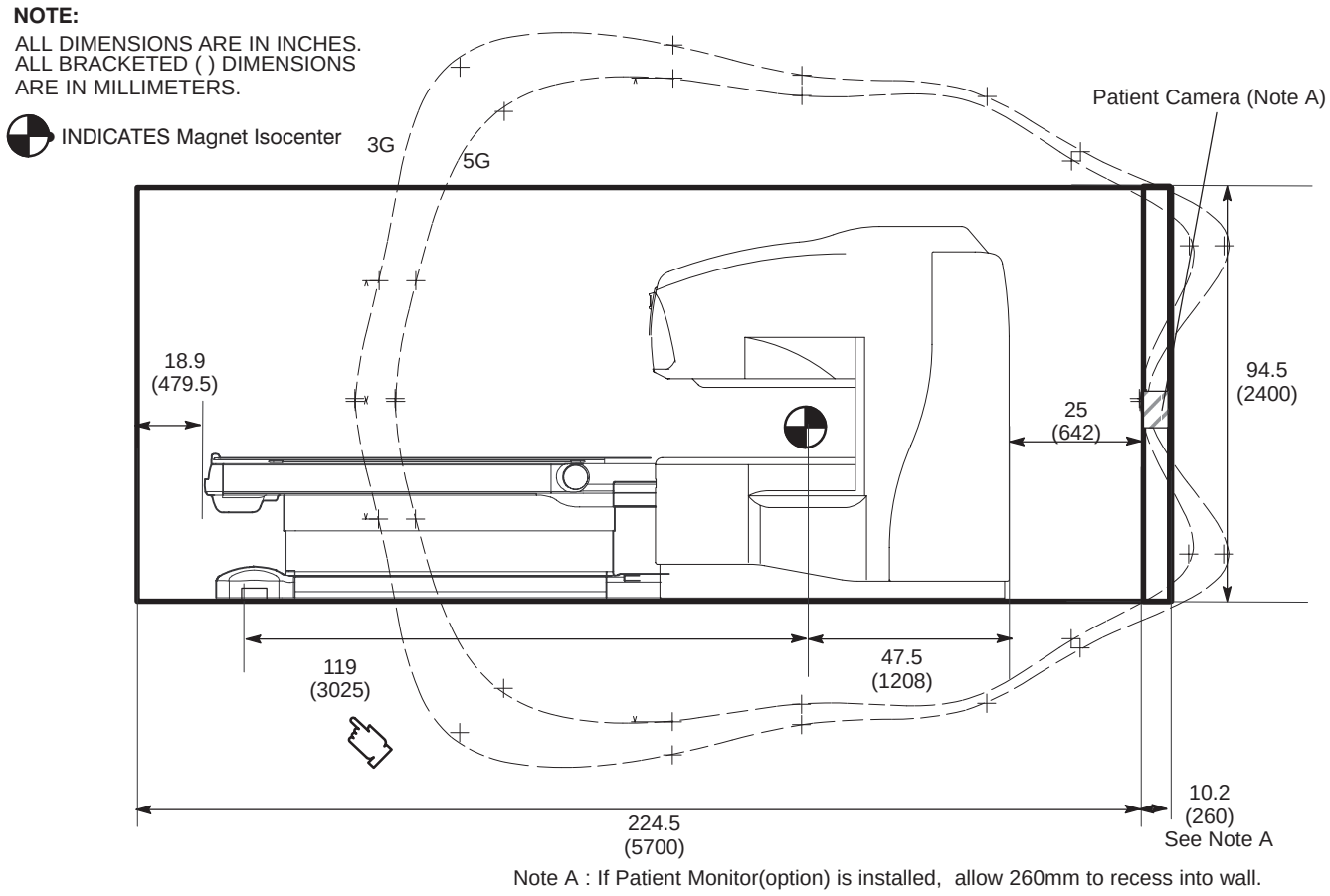
Note A : If Patient Monitor(option) is installed, allow 260mm to recess into wall.

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

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

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

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

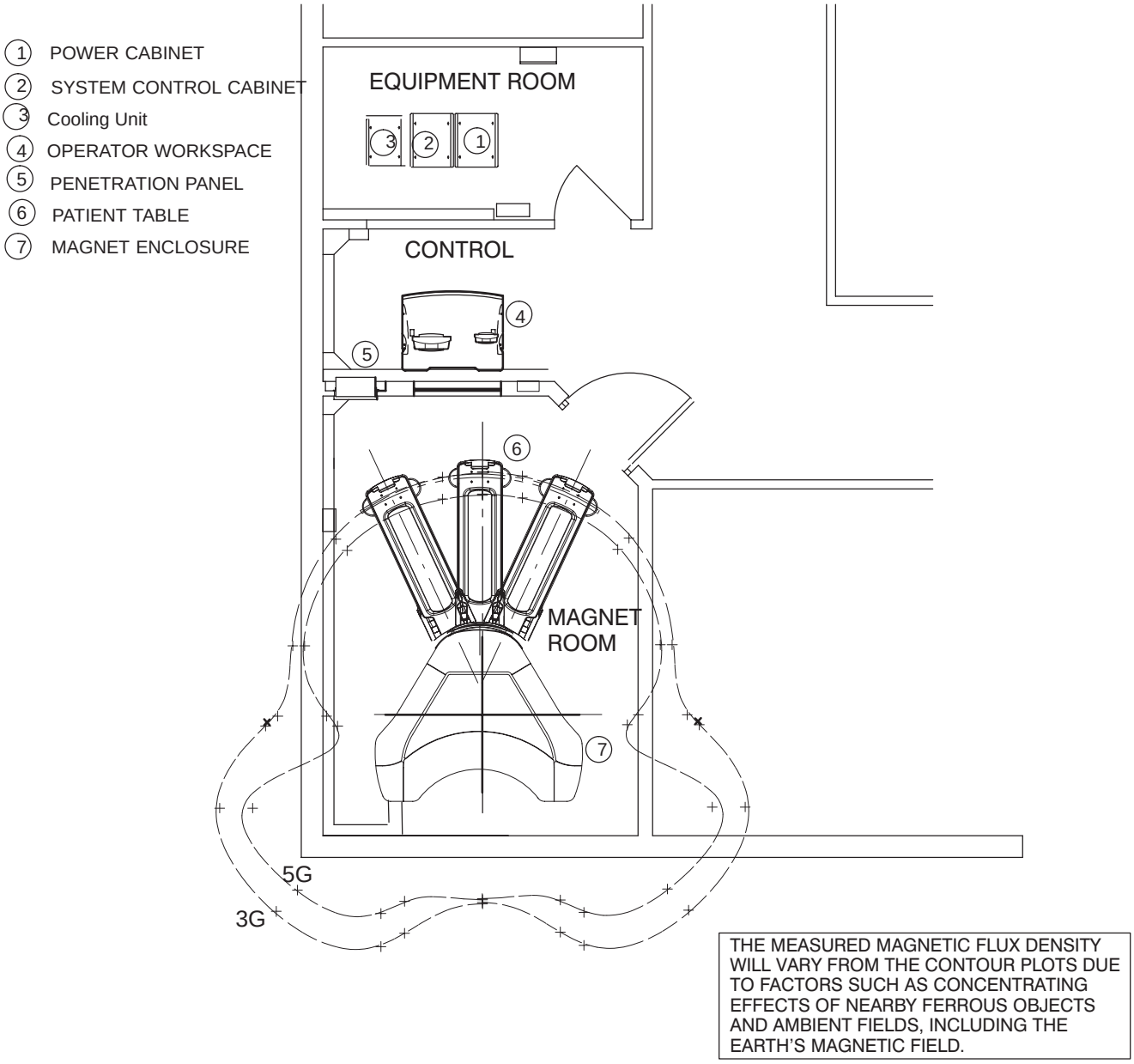


0.35T MAGNET, ENCLOSURE, & PATIENT TABLE (MINIMUM SERVICE AREA)
ILLUSTRATION 2–3

Note

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

2–3 Typical Site Layout

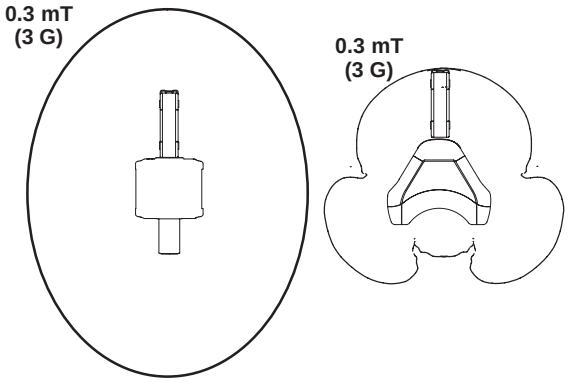


TYPICAL SITE LAYOUT
ILLUSTRATION 2–4

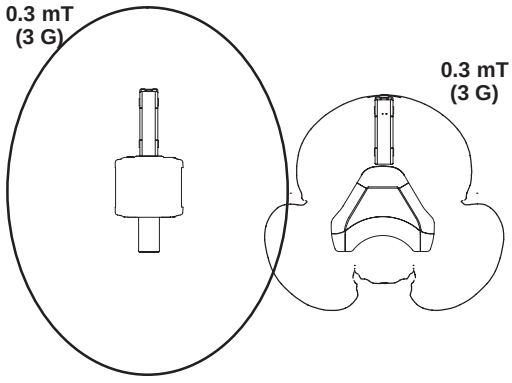
2–4 TWO MAGNET SITE LAYOUT

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

Signa Ovation Magnet
vs Magnet with parallell magnet field

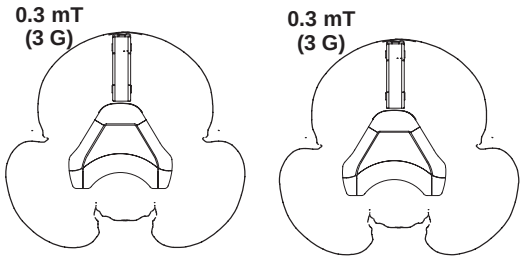


NO INTERACTION

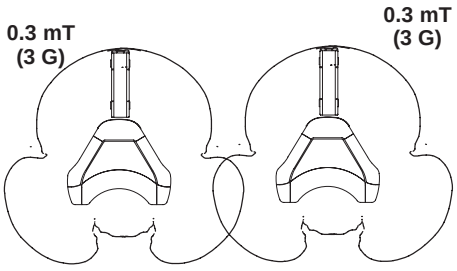


INTERACTION WHEN BRINGING MAGNET TO FIELD

Signa Ovation Magnet
vs Magnet with vertical magnetic field



NO INTERACTION



INTERACTION WHEN BRINGING MAGNET TO FIELD

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

TWO MAGNET INSTALLATION
ILLUSTRATION 2–5

2–5 MINIMUM DOOR/HALLWAY SIZES

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

TABLE 2–3
MINIMUM HALLWAY/DOOR DIMENSIONS

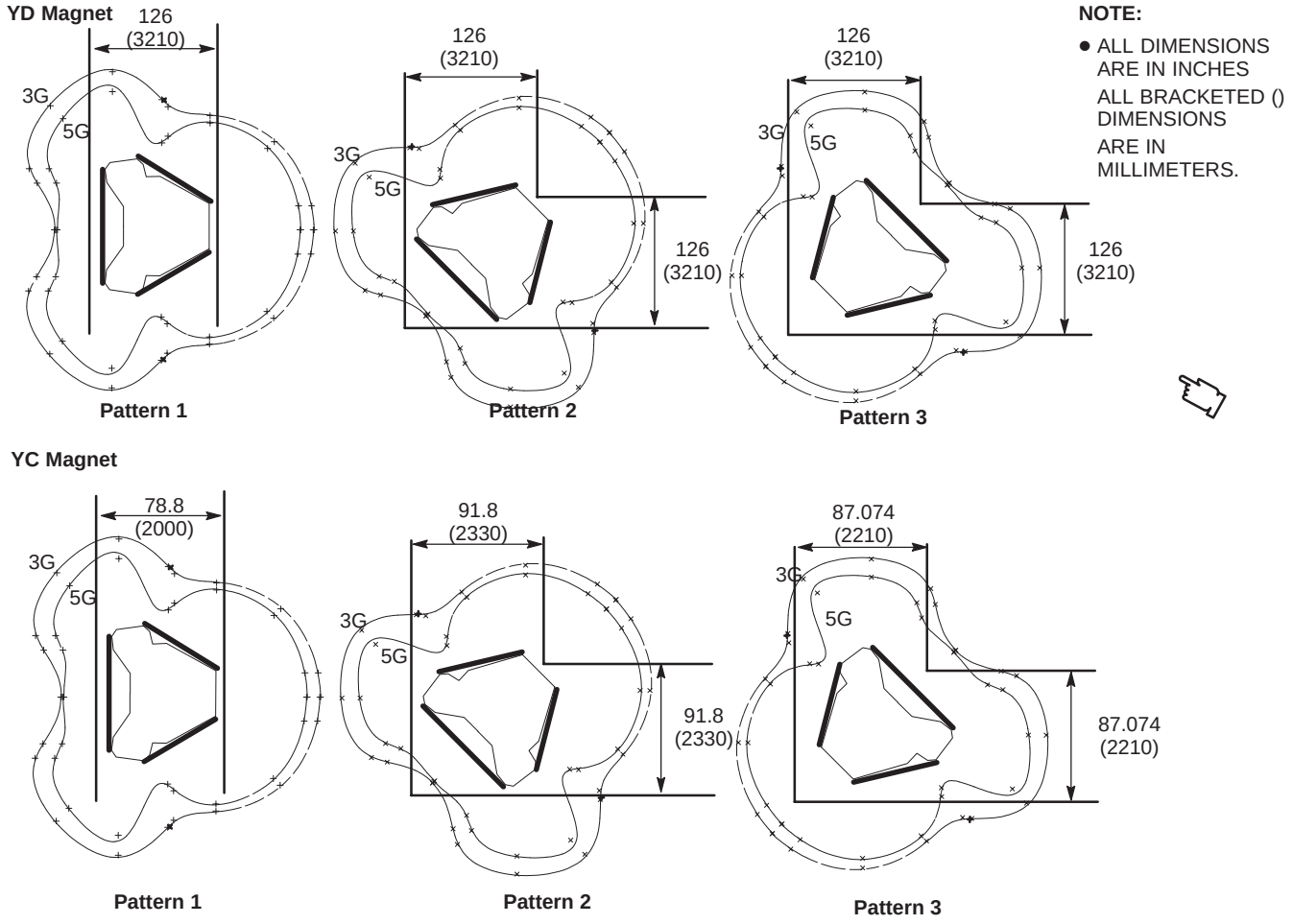
COMPONENT	MINIMUM HALLWAY/ DOOR WIDTH* in. (mm)	MINIMUM HALLWAY/ DOOR HEIGHT* in. (mm)	COMMENTS
Operator Workspace Table	32 (813)	80 (2032)	
Equipment Cabinets	36 (914)	80 (2032)	
Magnet	Refer to Note 1	Refer to Note 2	Refer to Table 2–4 for uncrated magnet dimensions.
RF Room Door	Refer to Section 7,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

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

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

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

2–5 MINIMUM DOOR/HALLWAY SIZES (continued)



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

Note

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

TABLE 2–4
COMPONENT DIMENSIONS FOR INSTALLATION/REPLACEMENT

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

2–6 CABLING CONSIDERATIONS

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

Note

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

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

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

Note

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

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

2–6–1 Floor Duct

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

2–6–2 Raceway

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

2–6–3 Raised Flooring

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

Note

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

2–6–4 Conduit

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

Note

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

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

2–7 FLOORING

2–7–1 Cable Routing Areas

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

Note

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

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

2–7–2 Finished Floor

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

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

2–8 SPECIAL SITING CONSIDERATIONS

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

2–8–1 Pneumatic Patient Alert (PA1)

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

2–8–2 Telephone Lines Requirements

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

TABLE 2–5
PHONE LINE REQUIREMENTS

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

2–9 ARCHITECTURAL REMINDERS

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

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

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

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

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

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

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

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

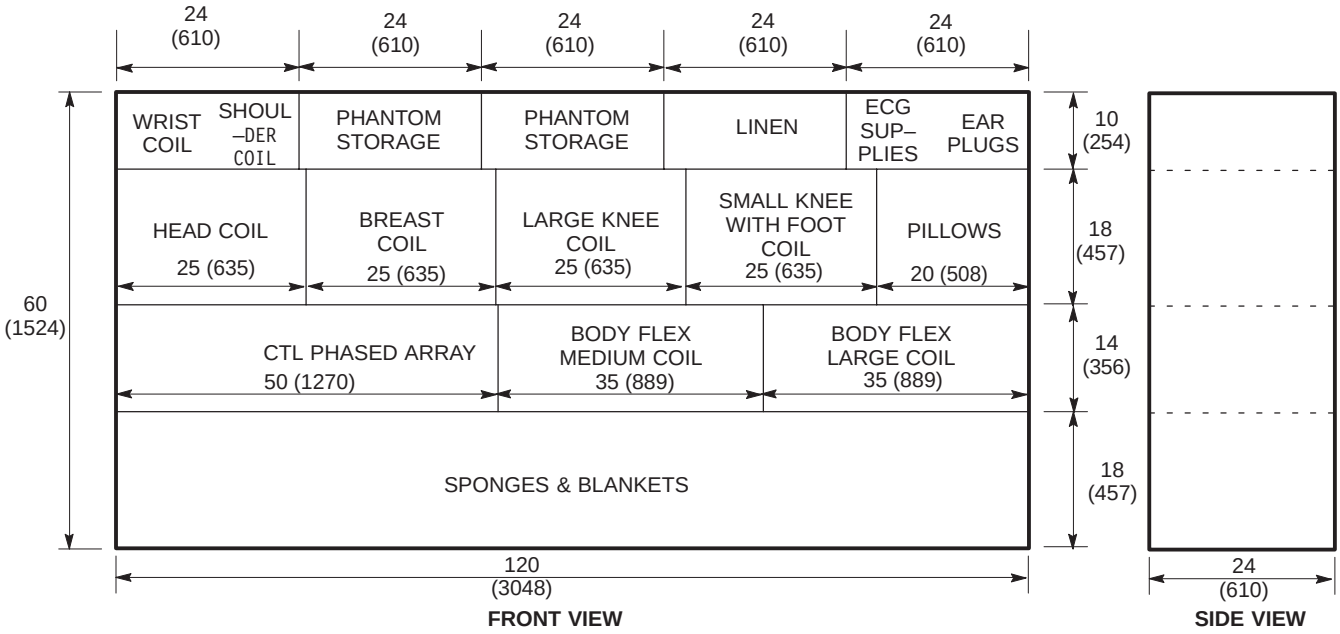
9. Corrosive chemicals must not be stored or used in the Equipment Room. These include chemicals used for film processor storage tanks, processor chemical recovery systems, etc. Such chemicals can contribute to increased equipment failures, increased system downtime, and decreased reliability. Film processor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

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

2–9 ARCHITECTURAL REMINDERS (Continued)

NOTE:

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



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

2–10 FLOOR LOADING AND WEIGHTS

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

TABLE 2–6
FLOOR LOADING

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

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

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

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

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

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

* Optional Equipment.

2–10–1 Magnet Loading Considerations

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

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

2–10–2 Anchoring And Seismic Considerations

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

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

Note

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

Note

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

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

2–10–3 Operator Workspace Mounting Requirements

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

2–11 COMPONENT DIMENSIONS

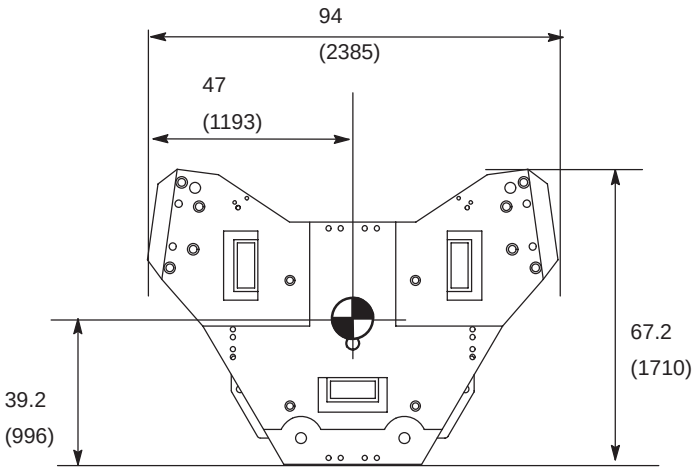
To assist in completing your room layout, refer to Table 2–7 for list of component Illustrations.

TABLE 2–7
MR SYSTEM COMPONENT ILLUSTRATIONS LIST

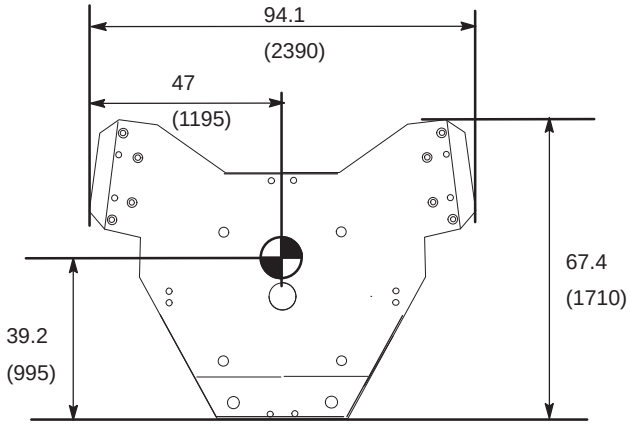
ILLUSTRATION NAME	ILLUSTRATION NUMBER
0.35T MAGNET WITHOUT ENCLOSURE	2–8
MAGNET LOAD PATTERN (1)	2–9
MAGNET LOAD PATTERN (2)	2–10
MAGNET LOAD PATTERN (3)	2–11
MAGNET LOAD PATTERN (4)	2–12
0.35T MAGNET, ENCLOSURE	2–13
0.35T MAGNET, ENCLOSURE, & PATIENT TABLE	2–14
0.35T MAGNET ENCLOSURE CABLE ACCESS (Duct)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

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

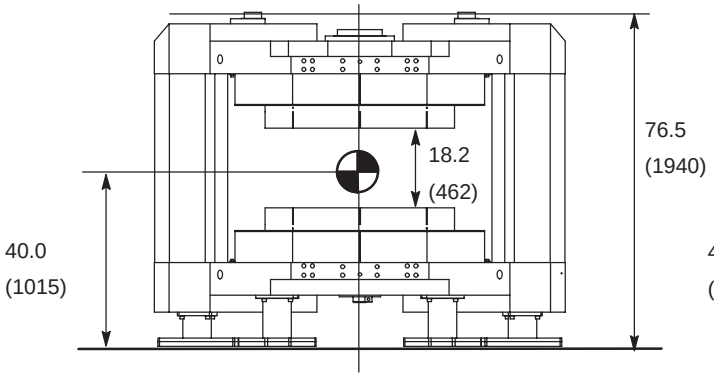
YD Magnet

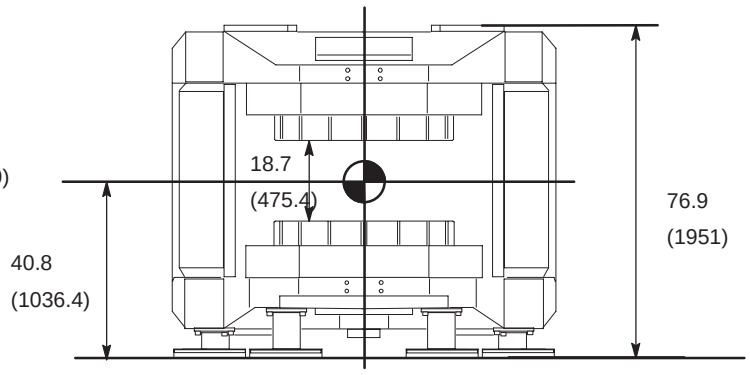


YC Magnet



TOP VIEW





FRONT VIEW

0.35T MAGNET WITHOUT ENCLOSURE
ILLUSTRATION 2–8

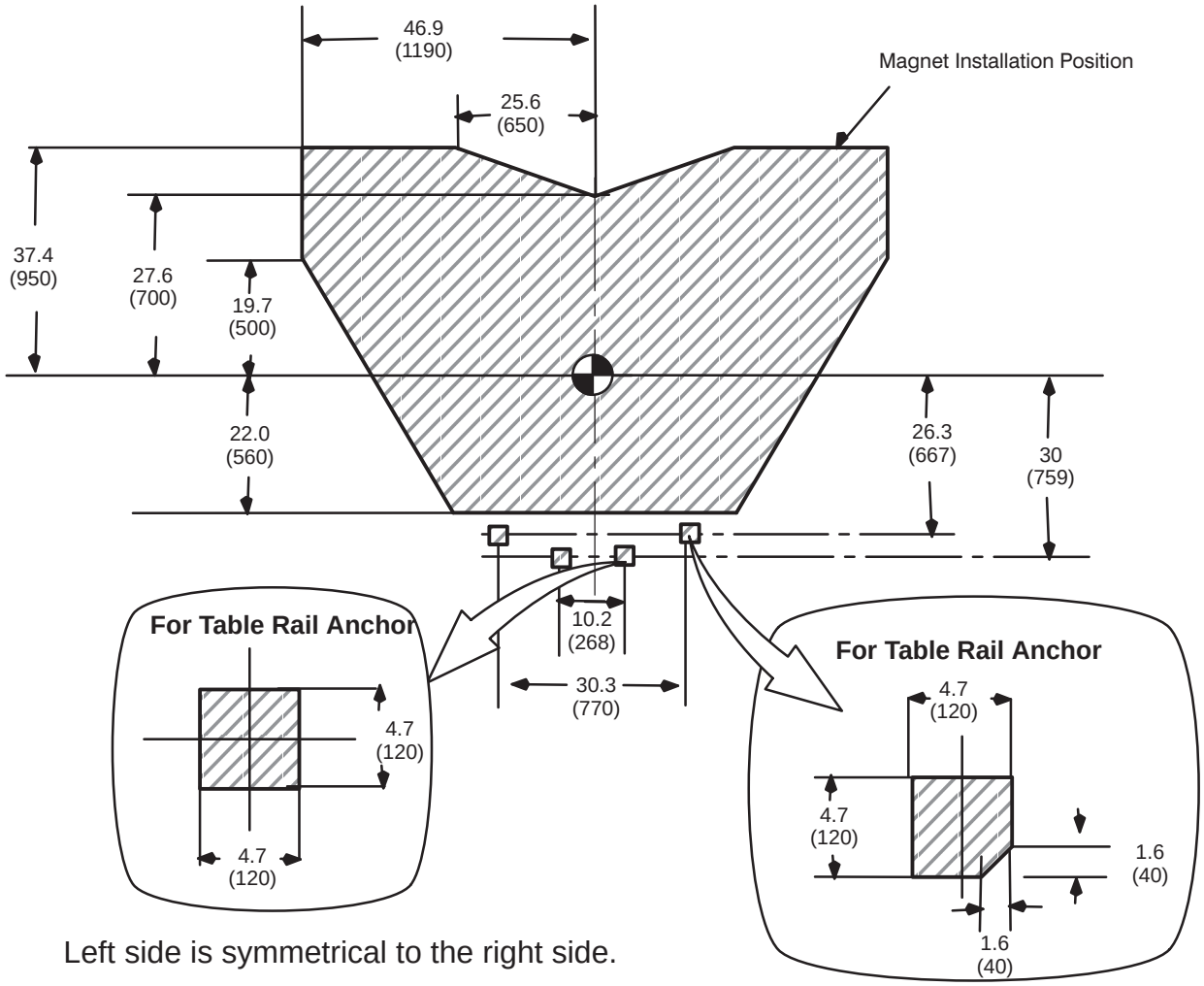
Note

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

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

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

INDICATES Magnet Isocenter



Left side is symmetrical to the right side.

MAGNET LOAD PATTERN (1)
ILLUSTRATION 2–9

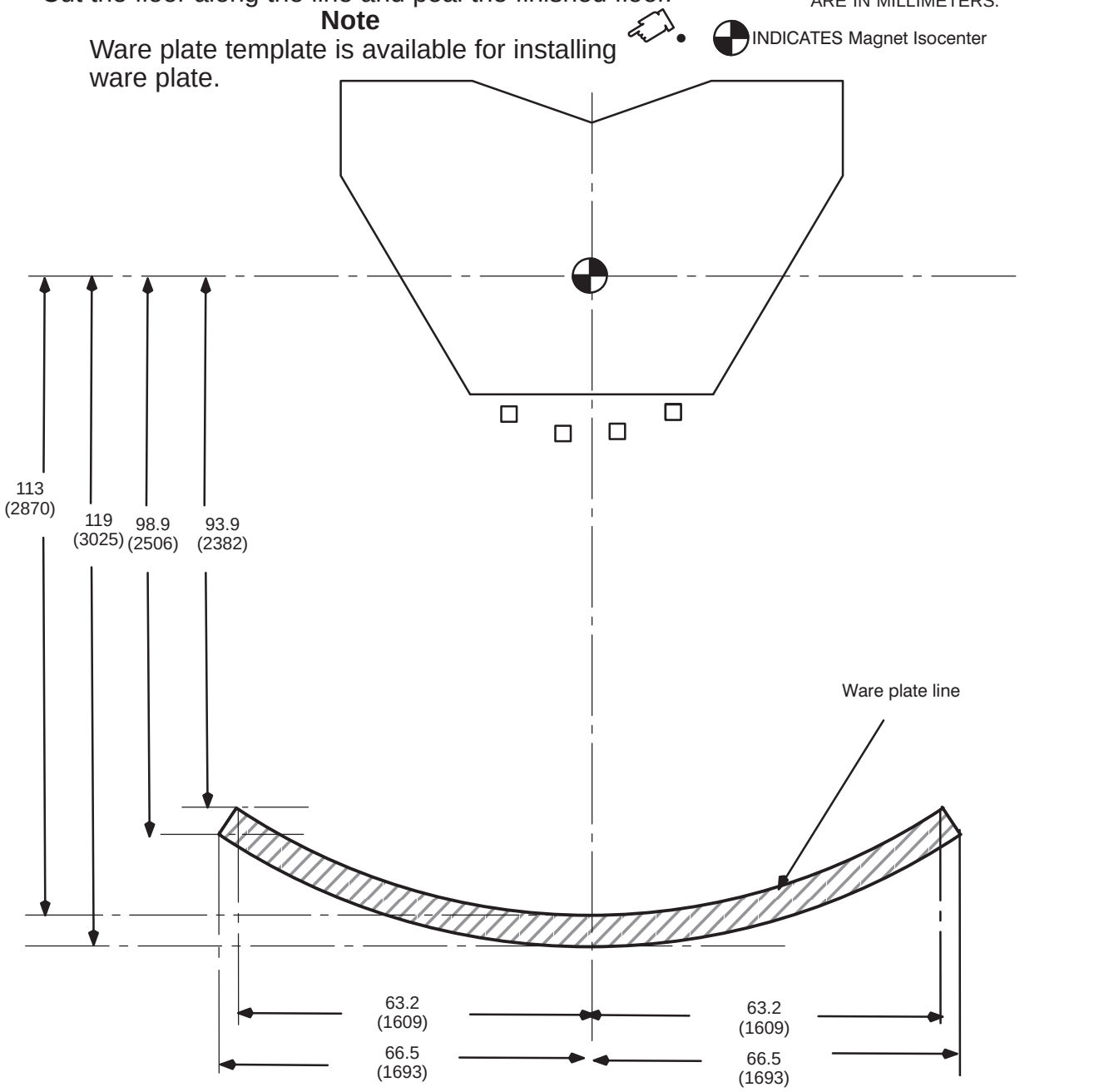
For Style B Table **Note**

Style B Table is shipped from 3Q of 2001.

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

Note

Ware plate template is available for installing ware plate.



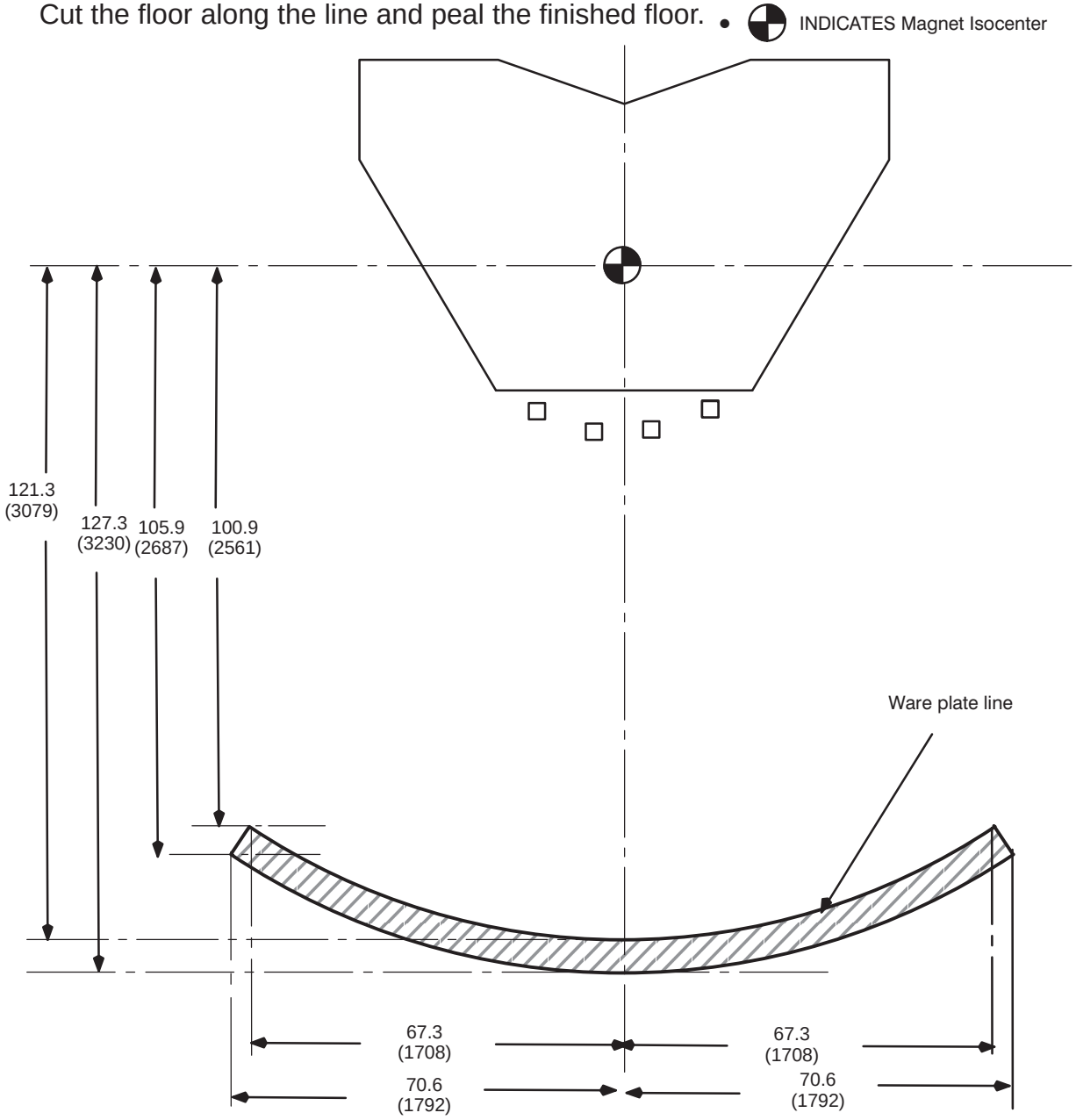
MAGNET LOAD PATTERN (2)
ILLUSTRATION 2–10

For Style A Table

Note

Style A Table is shipped before 3Q of 2001.

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

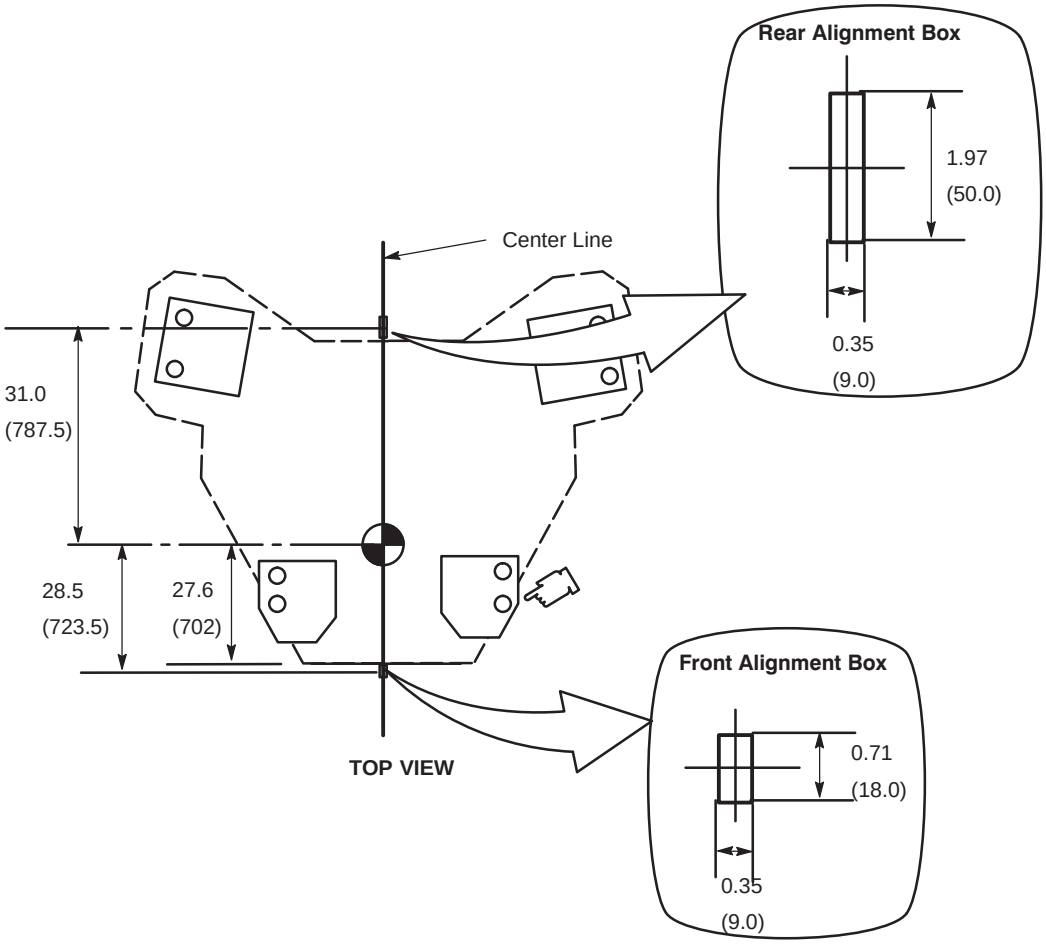


MAGNET LOAD PATTERN (2)
ILLUSTRATION 2–11

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

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

INDICATES Magnet Isocenter



MAGNET LOAD PATTERN (3)
ILLUSTRATION 2–12

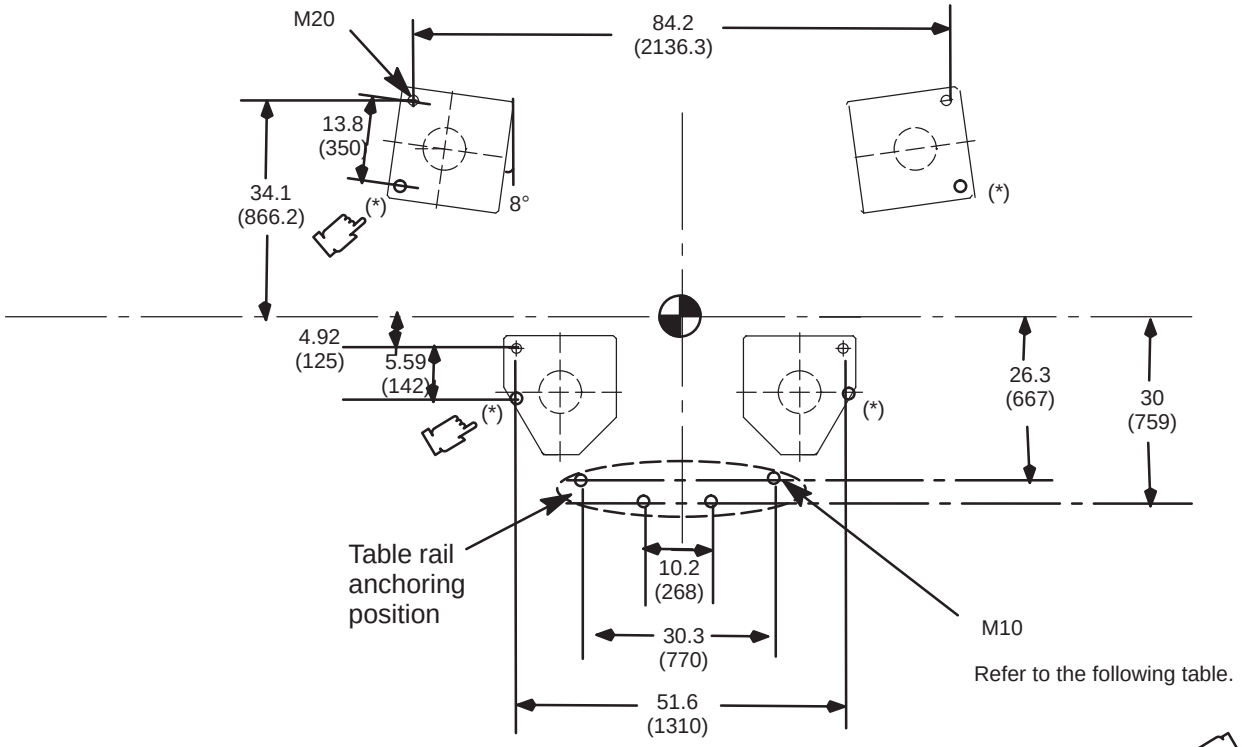
Note

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

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

• INDICATES Magnet Isocenter

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



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

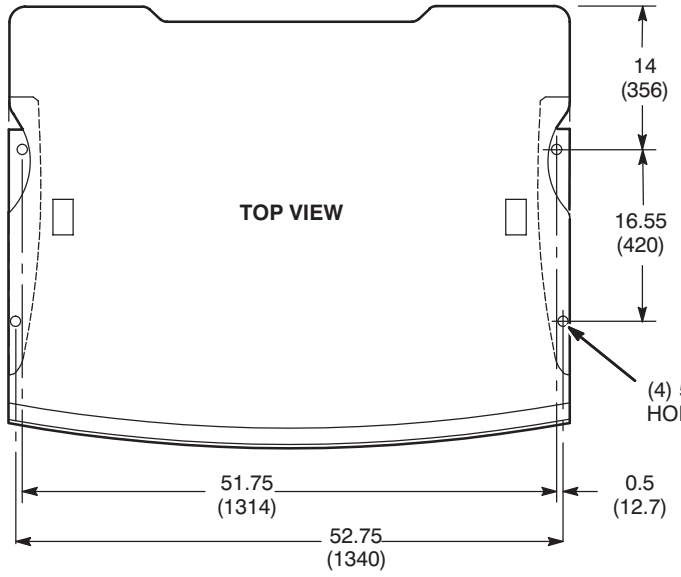
Table Rail Anchor Information

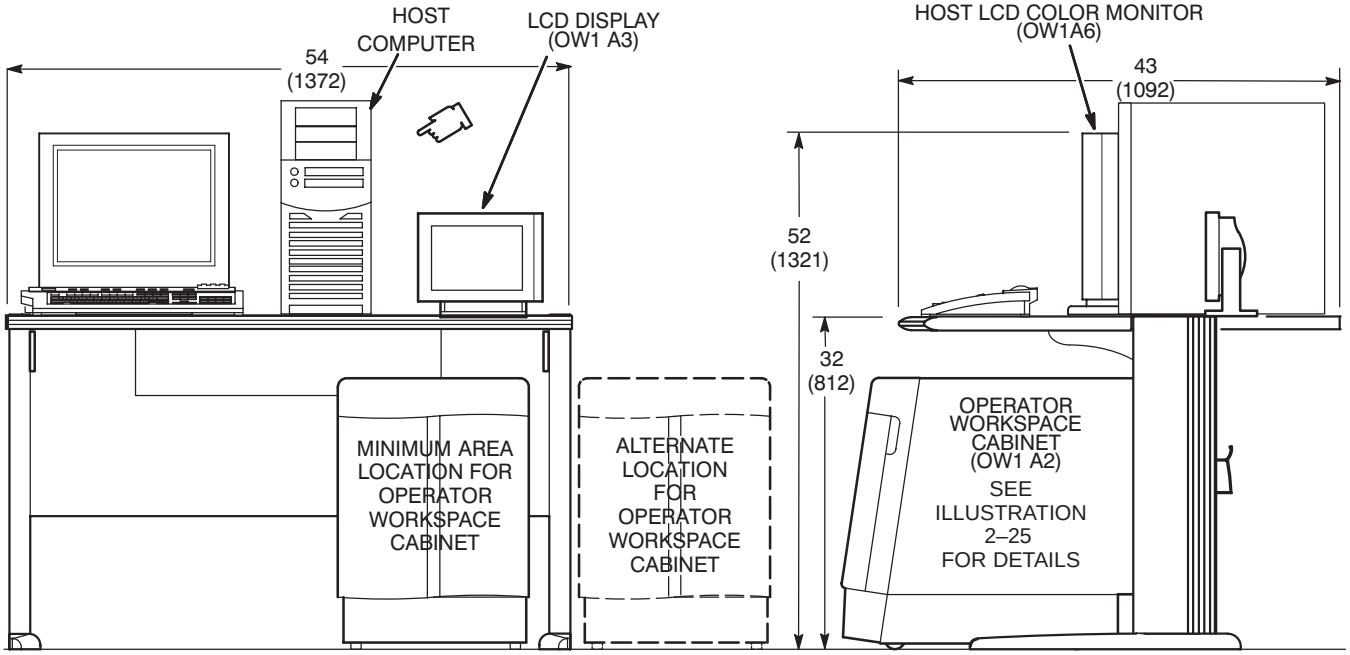
USED FOR	QUANTITY	DROP IN ANCHOR P/N	THREAD	HOLE/BIT DIAMETER	GAUGE DEPTH SETTING	SETTING TOOL P/N
BOLT TABLE RAIL TO FLOOR	4	2295359	M10	0.5 IN. (12.7 MM)	1.6 IN. (41.0 MM)*	46––252065P139

MAGNET LOAD PATTERN (4)
ILLUSTRATION 2–13

NOTE:

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



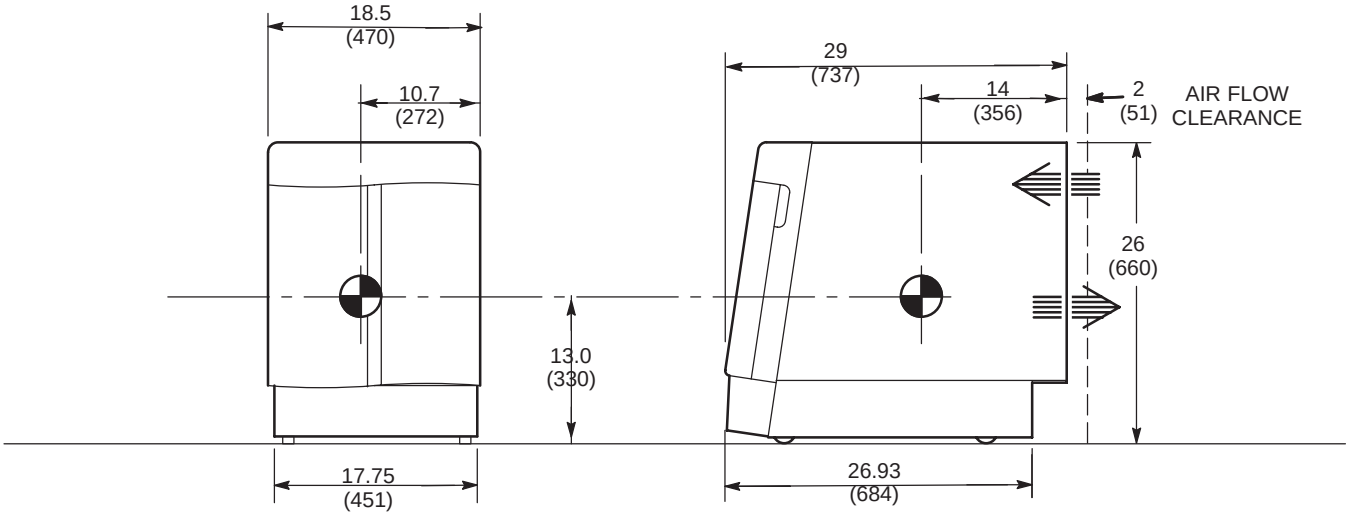


FRONT VIEW **SIDE VIEW**

OPERATOR WORKSPACE (OW1)
ILLUSTRATION 2–24

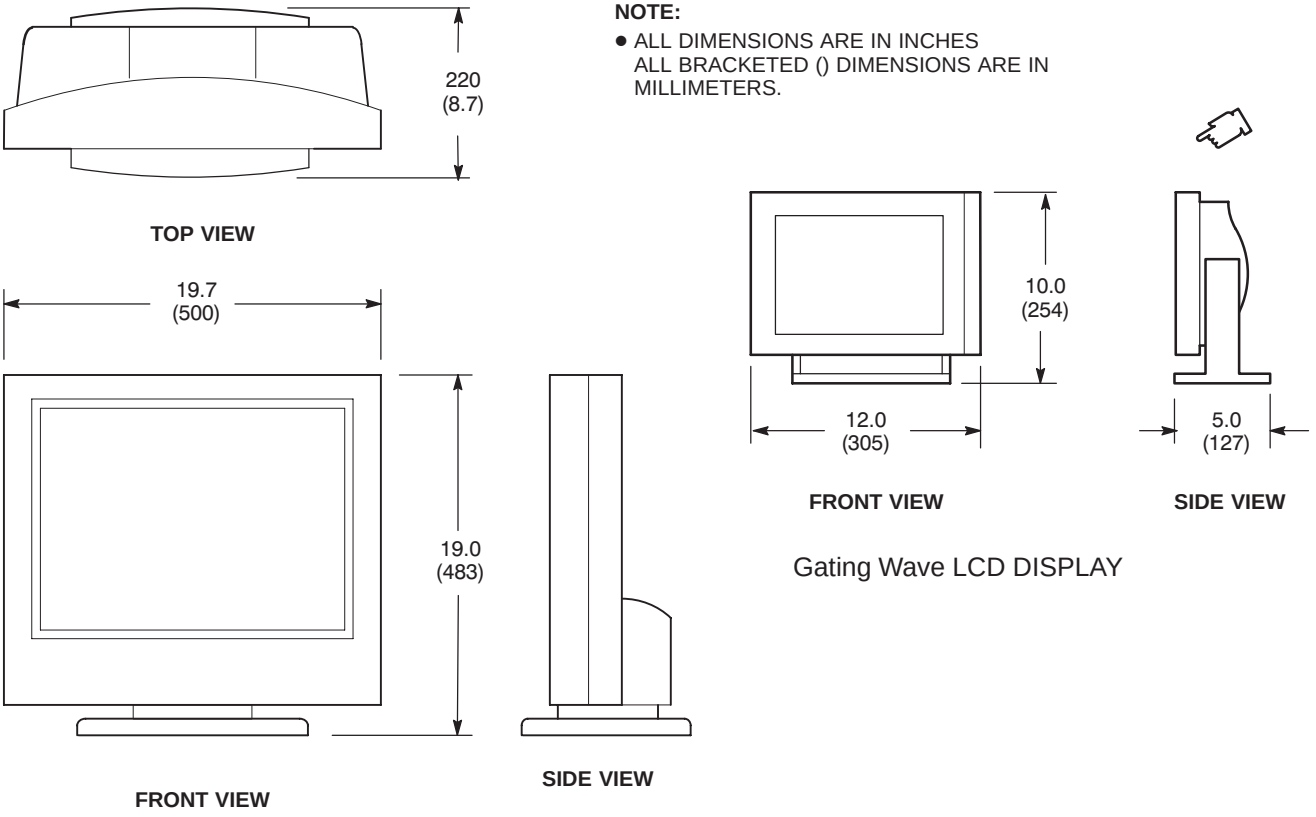
NOTE:

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

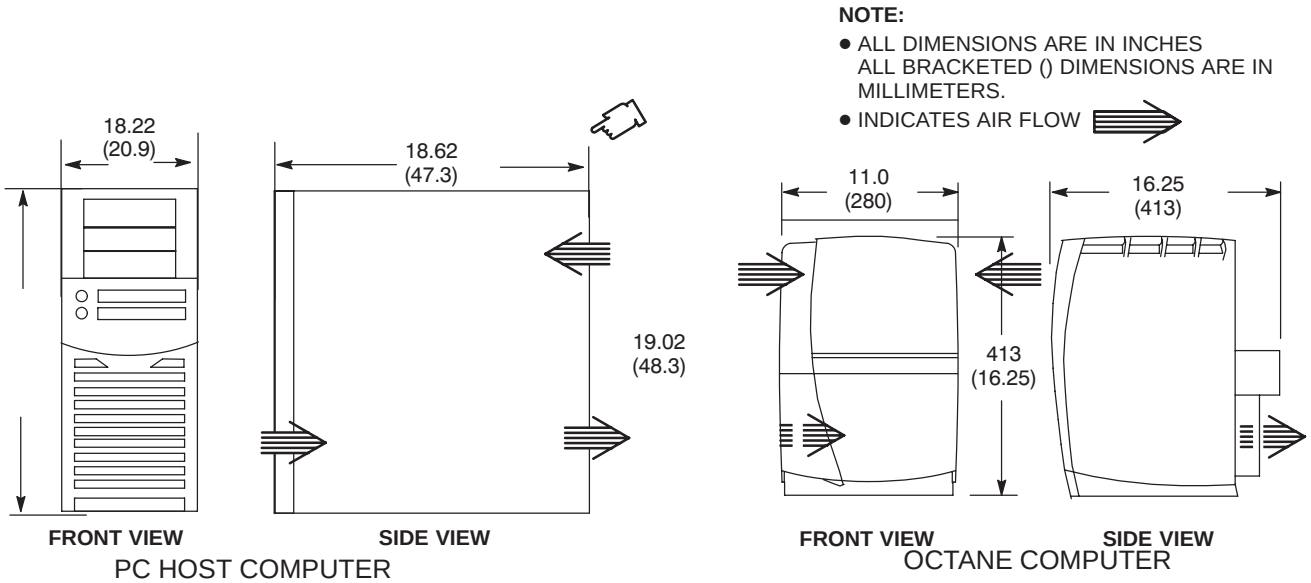


FRONT VIEW **SIDE VIEW**

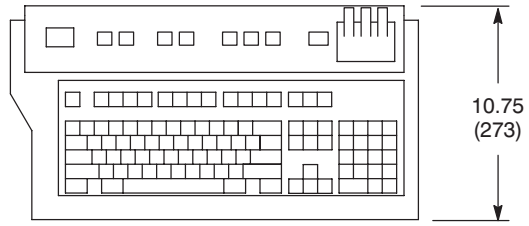
OPERATOR WORKSPACE CABINET (OW1 A2)
ILLUSTRATION 2–25



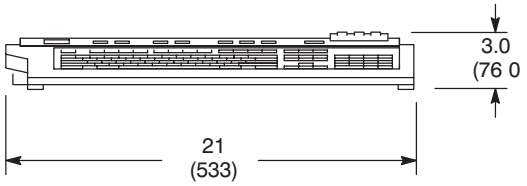
OPERATOR WORKSPACE COMPONENTS POSITIONED ON TABLE TOP – LCD COLOR MONITOR
ILLUSTRATION 2–26



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



TOP VIEW



FRONT VIEW

SIDE VIEW

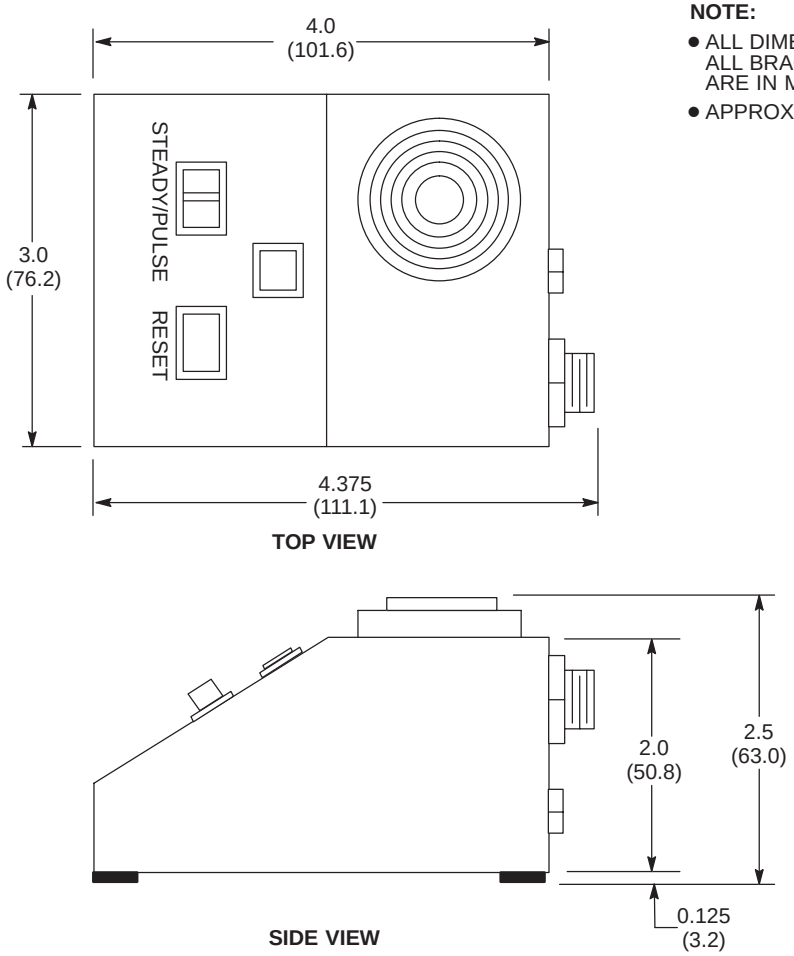
NOTE:

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

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

NOTE:

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

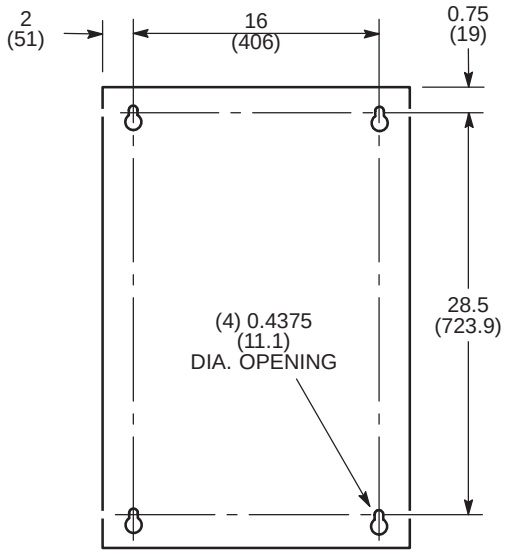


M4263A1

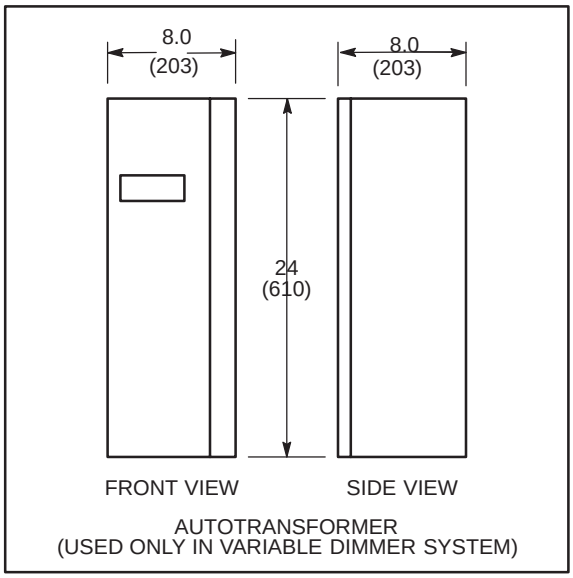
PNEUMATIC PATIENT ALERT CONTROL BOX (PA1)
ILLUSTRATION 2–29

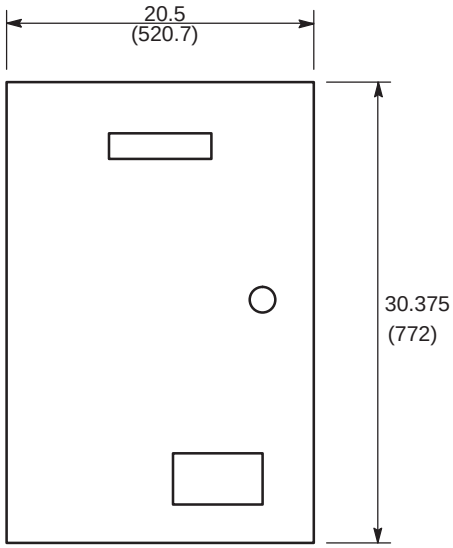
NOTE:

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

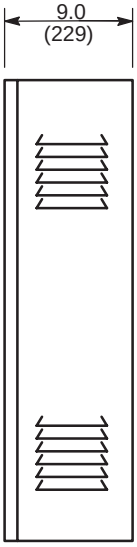


MOUNTING PATTERN
(CONTROL PANEL)





FRONT VIEW
(CONTROL PANEL)



SIDE VIEW
(CONTROL PANEL)

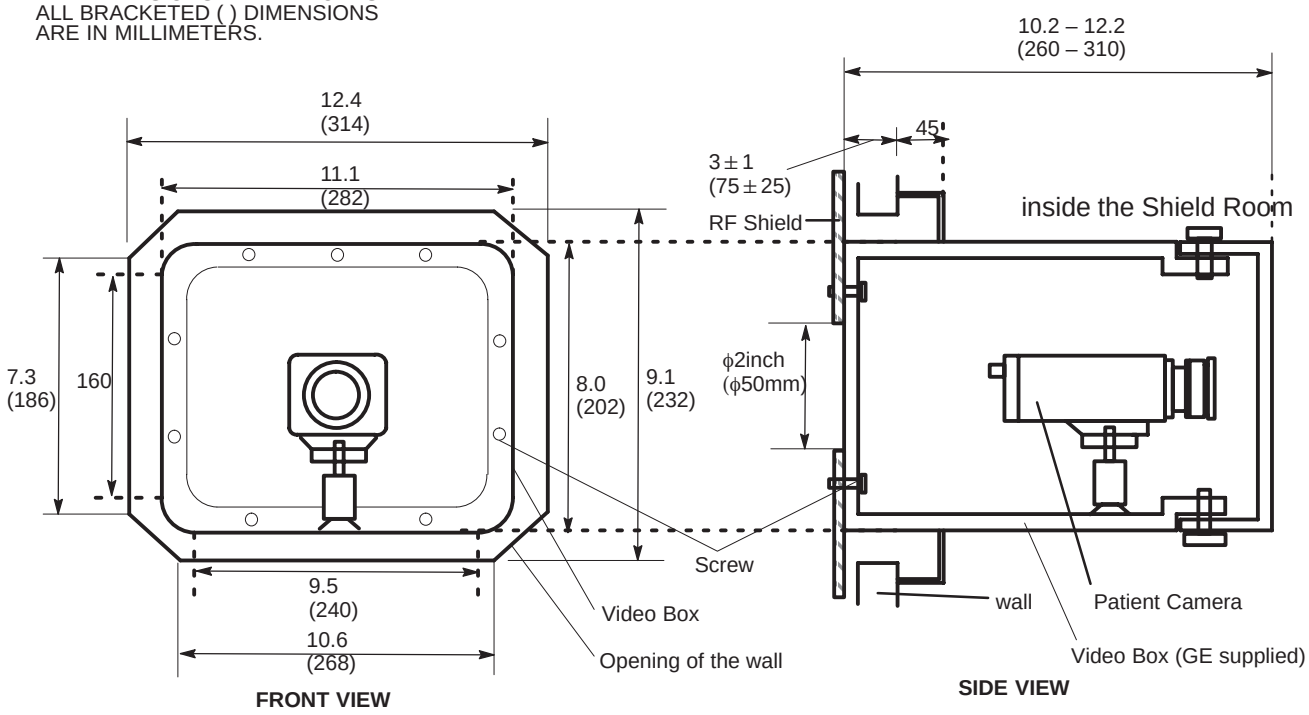
M1519A3M

DC LIGHTING CONTROLLER – OPTIONAL
ILLUSTRATION 2–30

2–11 COMPONENT DIMENSIONS (continued)

NOTE:

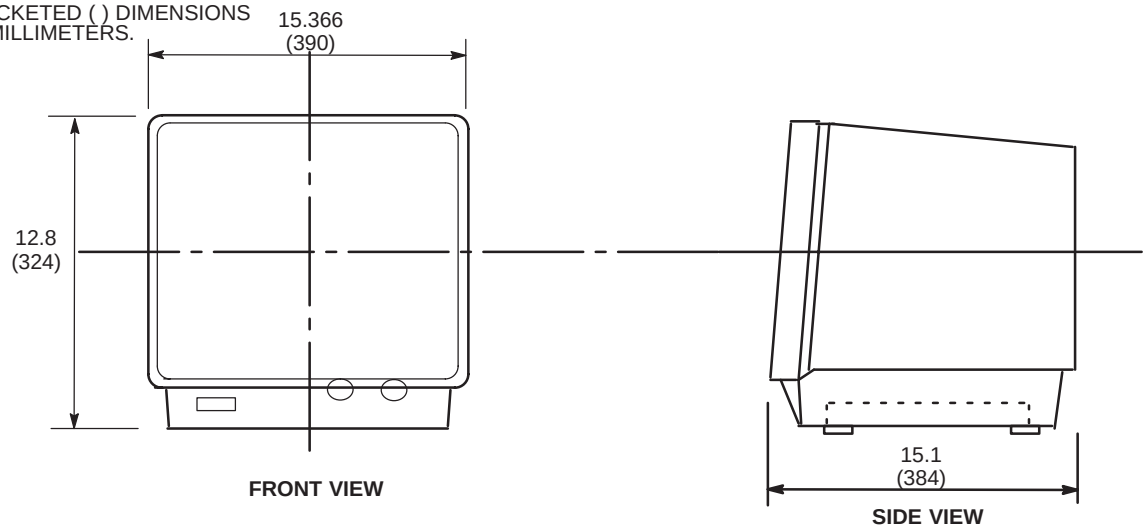
- ALL DIMENSIONS ARE IN INCHES. ALL BRACKETED ( ) DIMENSIONS ARE IN MILLIMETERS.



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

NOTE:

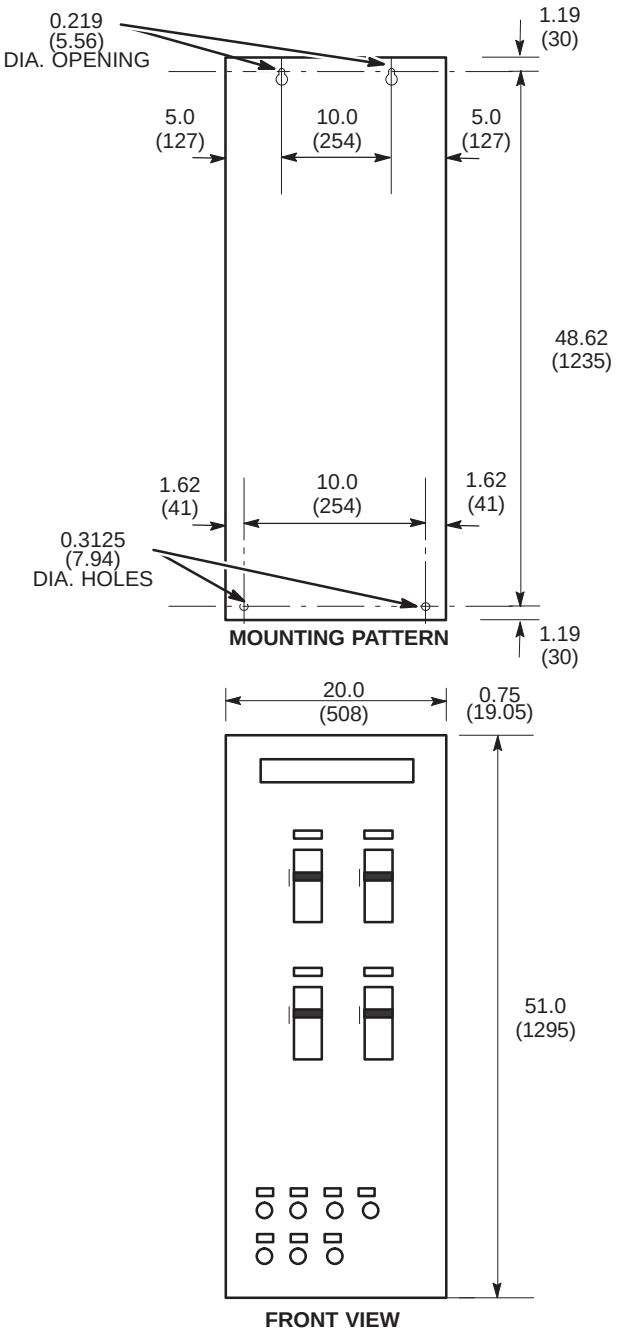
- ALL DIMENSIONS ARE IN INCHES. ALL BRACKETED ( ) DIMENSIONS ARE IN MILLIMETERS.



PATIENT MONITOR (OPTION)
ILLUSTRATION 2–32

Note

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



NOTE:

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

MAIN DISCONNECT PANEL
ILLUSTRATION 2–33

SECTION 3 – MAGNETIC FIELD CONSIDERATIONS

TABLE OF CONTENTS

3–1 INTRODUCTION

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

3–2 HOMOGENEITY REQUIREMENTS

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

3–3 STRUCTURAL STEEL EVALUATION OF PROPOSED SITES

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

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

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

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

3–4 MAGNETIC FIELD

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

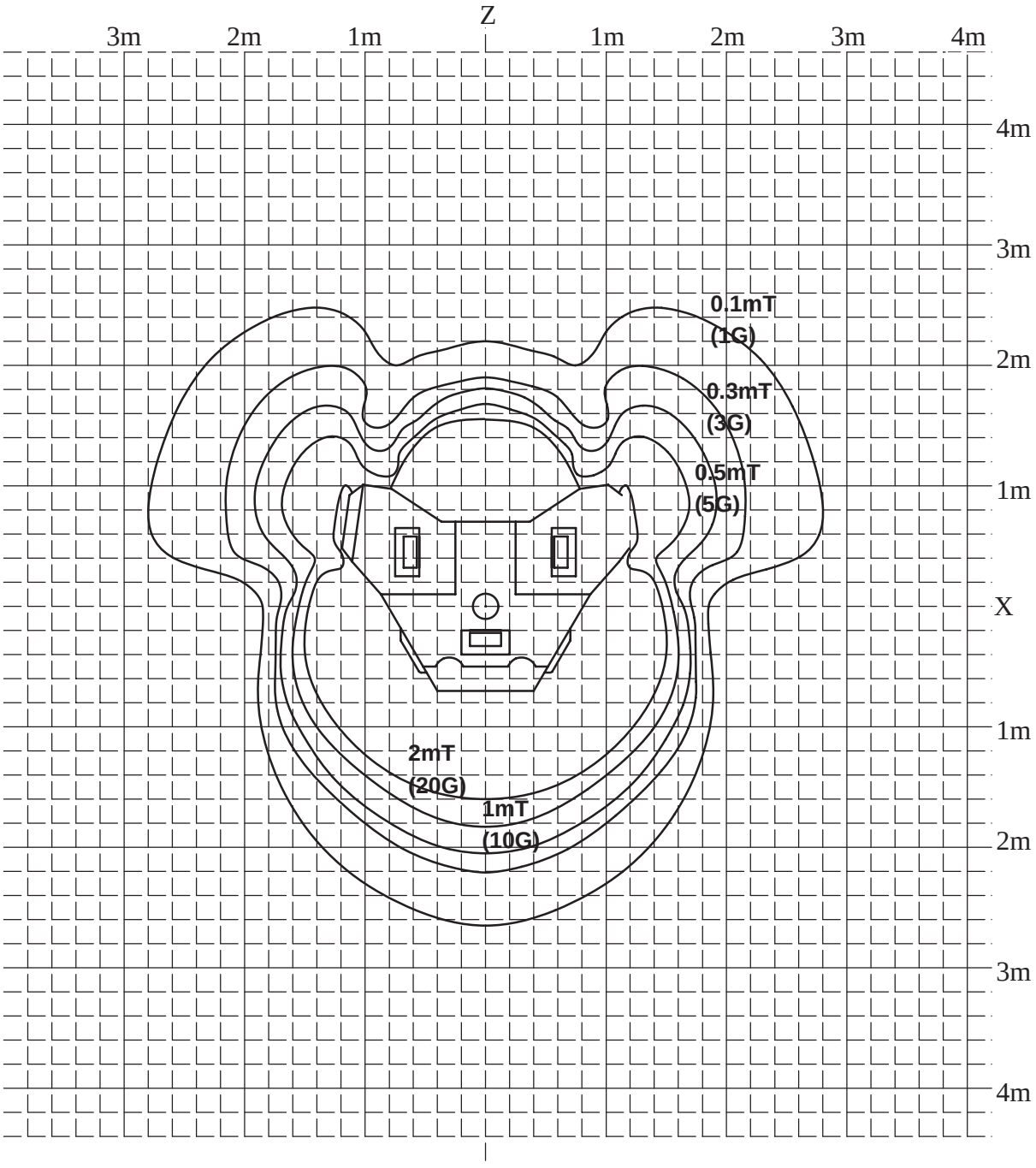
The actual magnetic field intensity at any point in the vicinity of the magnet may vary from the magnetic field plots due to factors such as the concentrating efforts of any nearby ferrous objects and ambient magnetic fields, including the earth‘s magnetic field. Therefore, those plots are only approximations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

3–5 MAGNET EXCLUSION ZONE

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

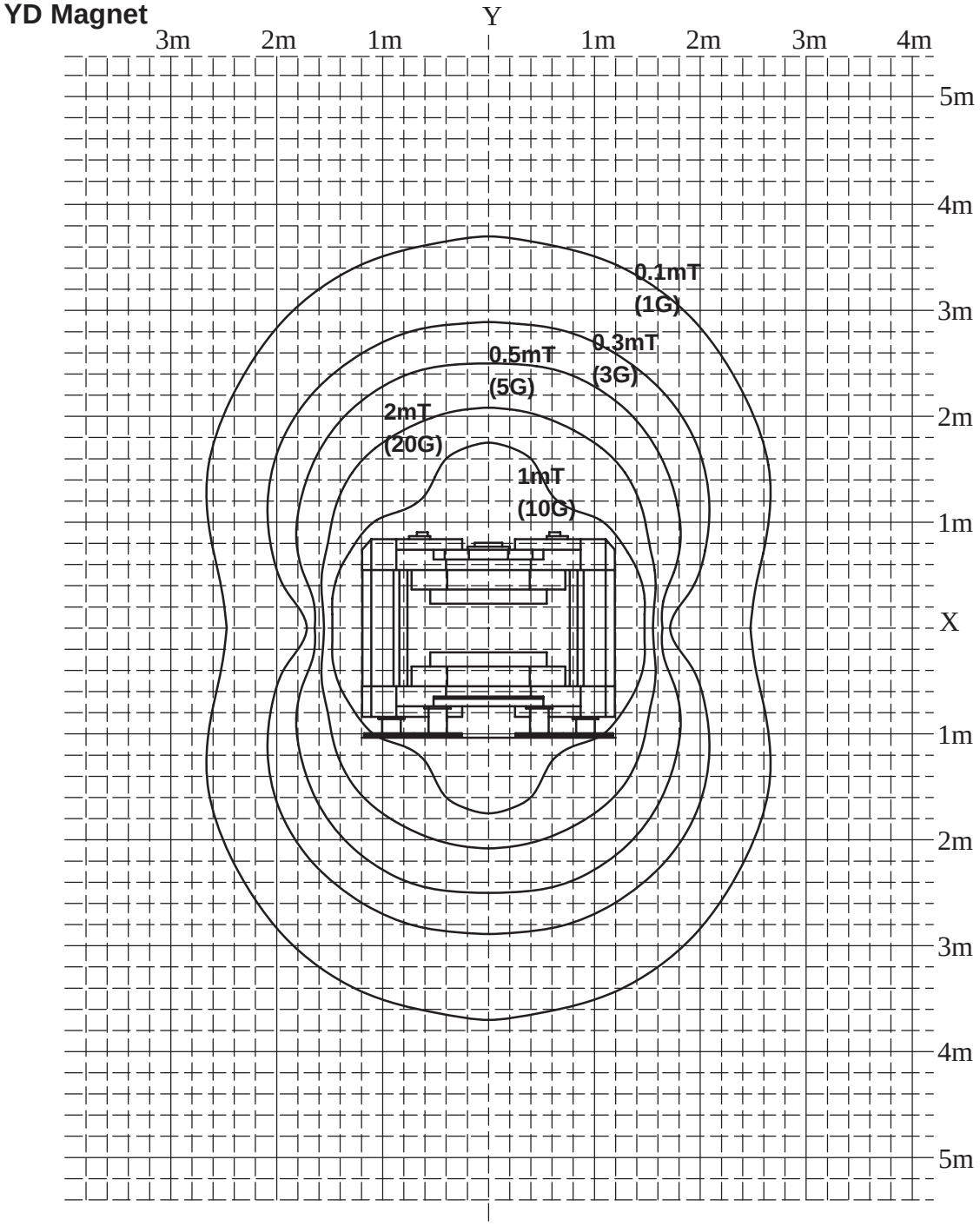
3–6 ISOGAUSS LINE PLOTS

YD Magnet



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

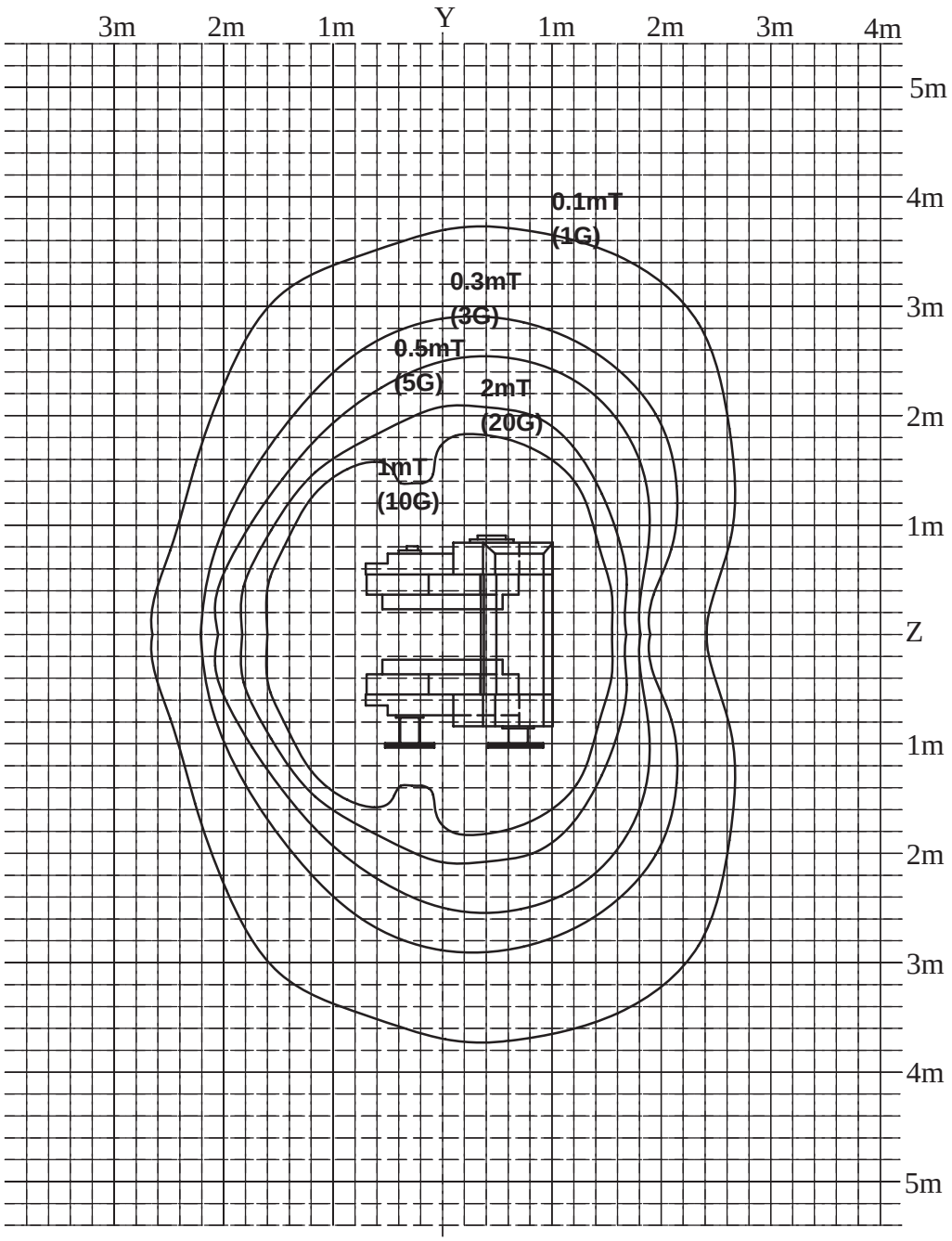
3–6 ISOGAUSS LINE PLOTS (continued)



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

3–6 ISOGAUSS LINE PLOTS (continued)

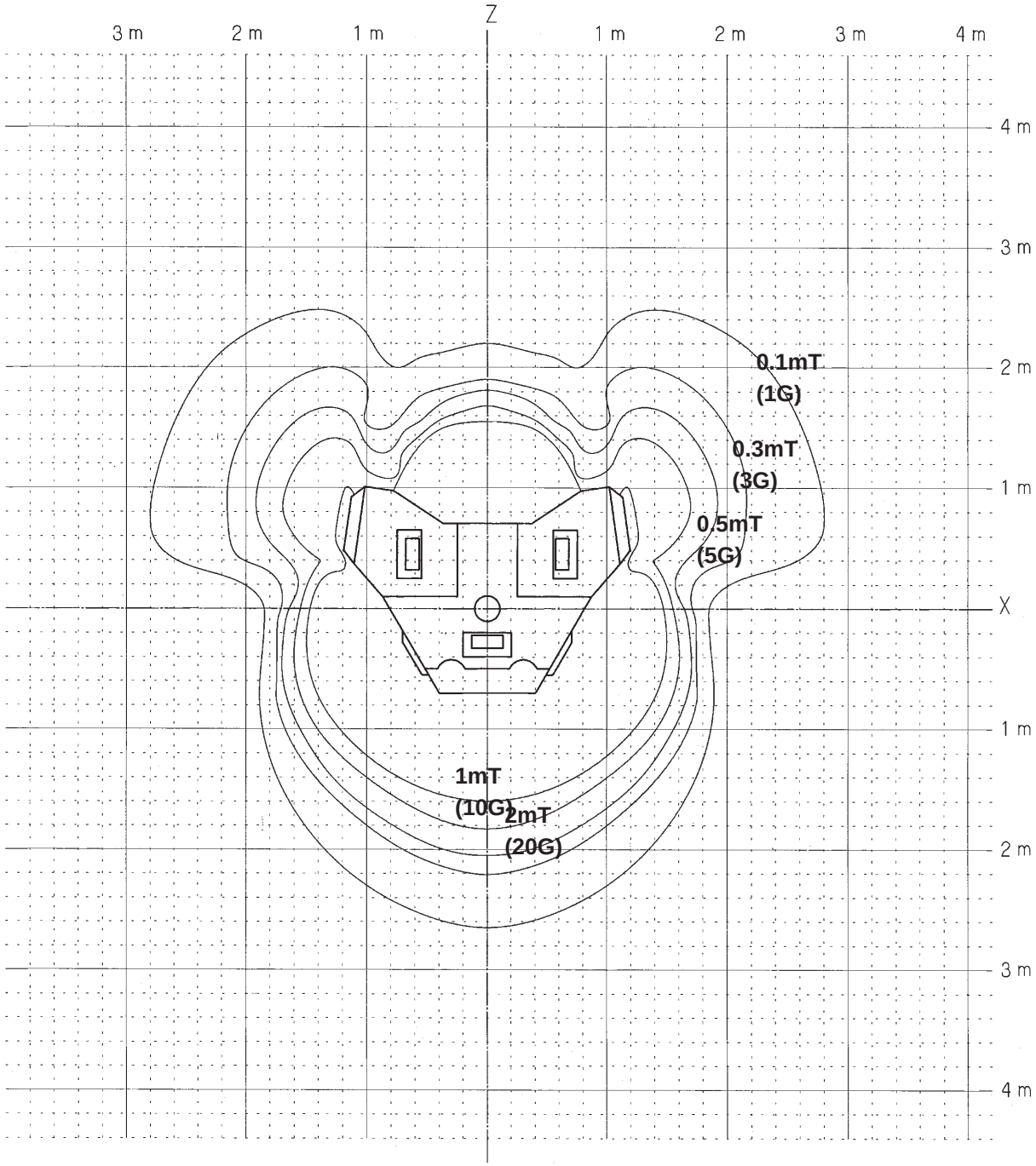
YD Magnet



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

3–6 ISOGAUSS LINE PLOTS

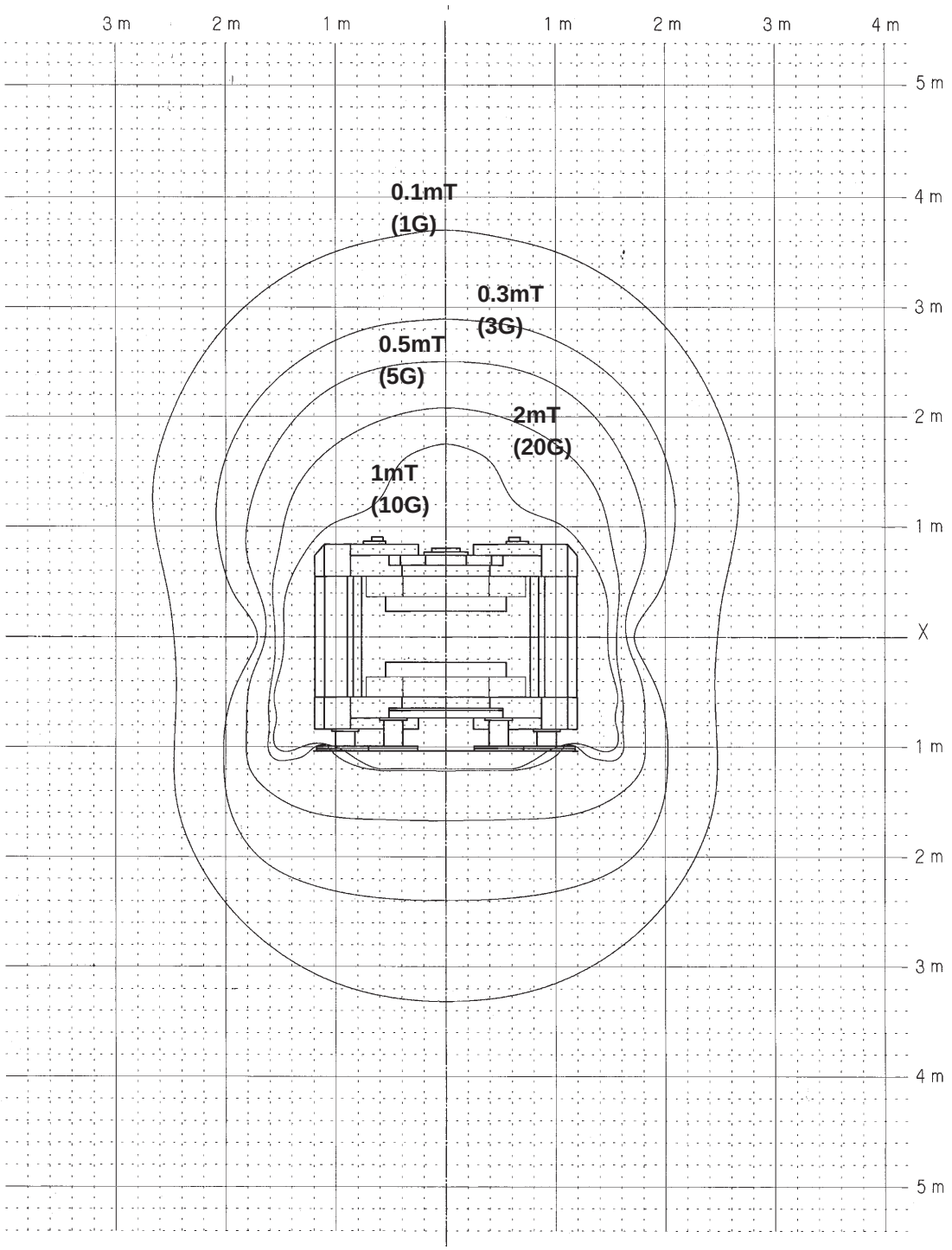
YD Magnet



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

3–6 ISOGAUSS LINE PLOTS (continued)

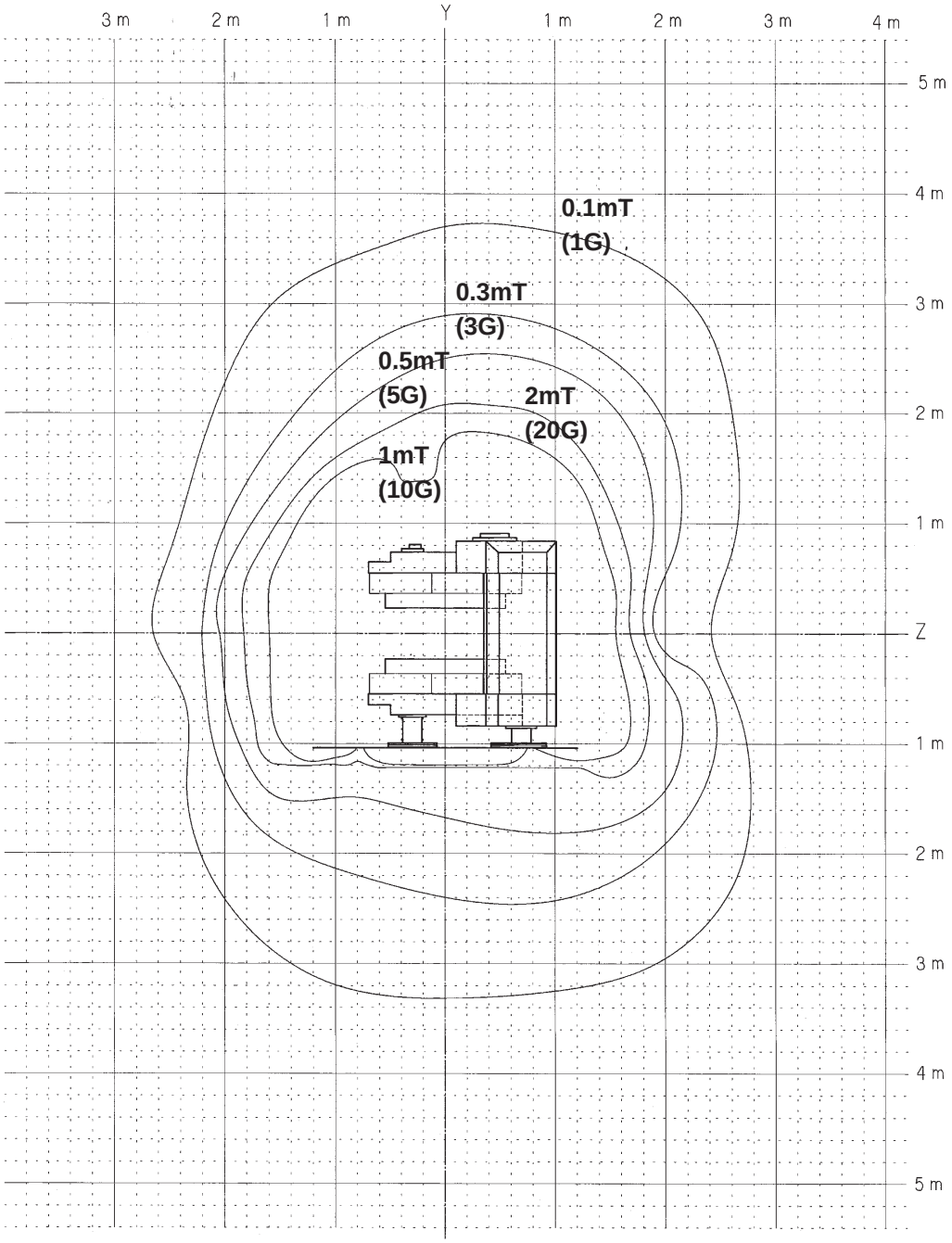
YD Magnet



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

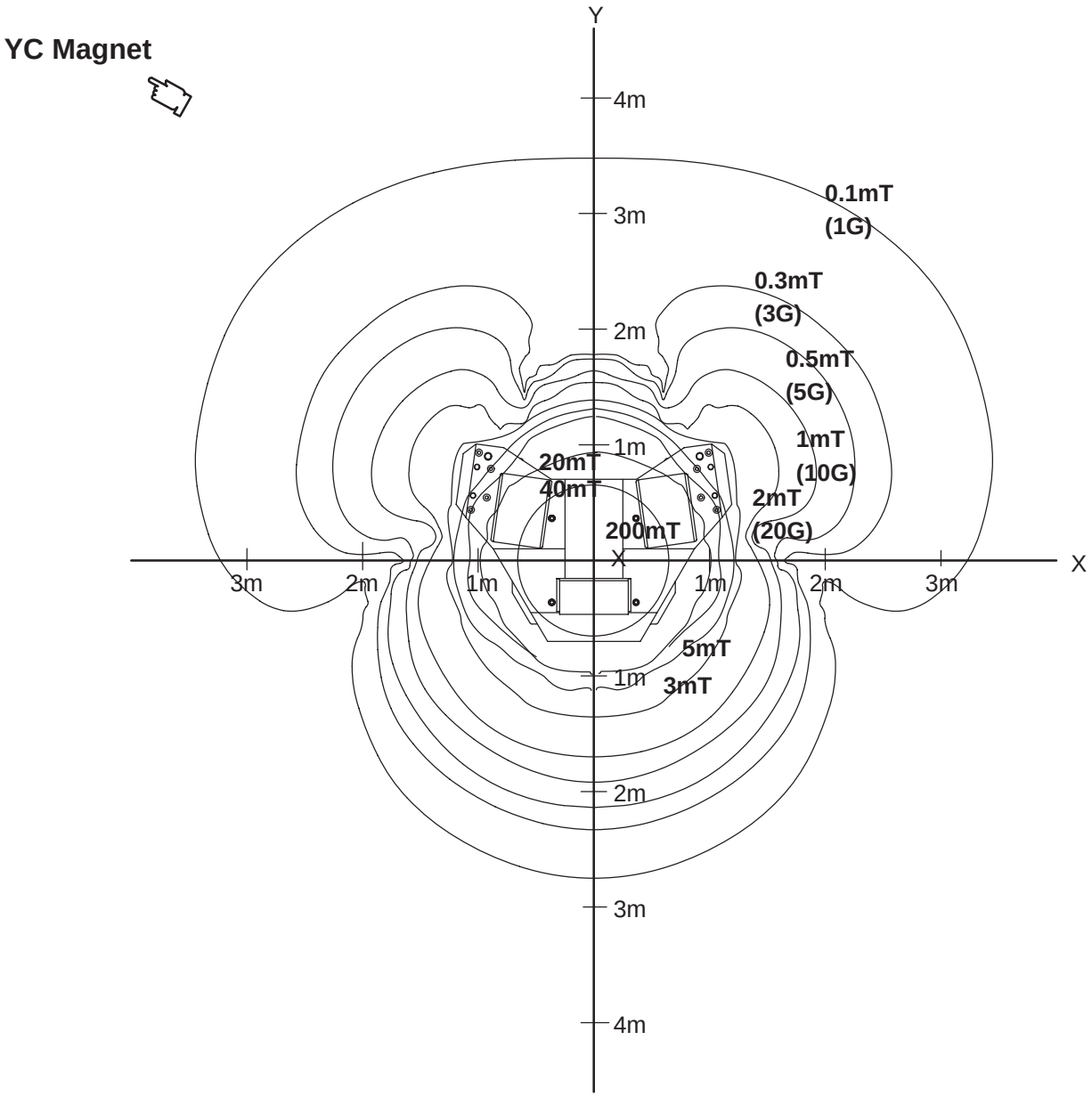
3–6 ISOGAUSS LINE PLOTS (continued)

YD Magnet



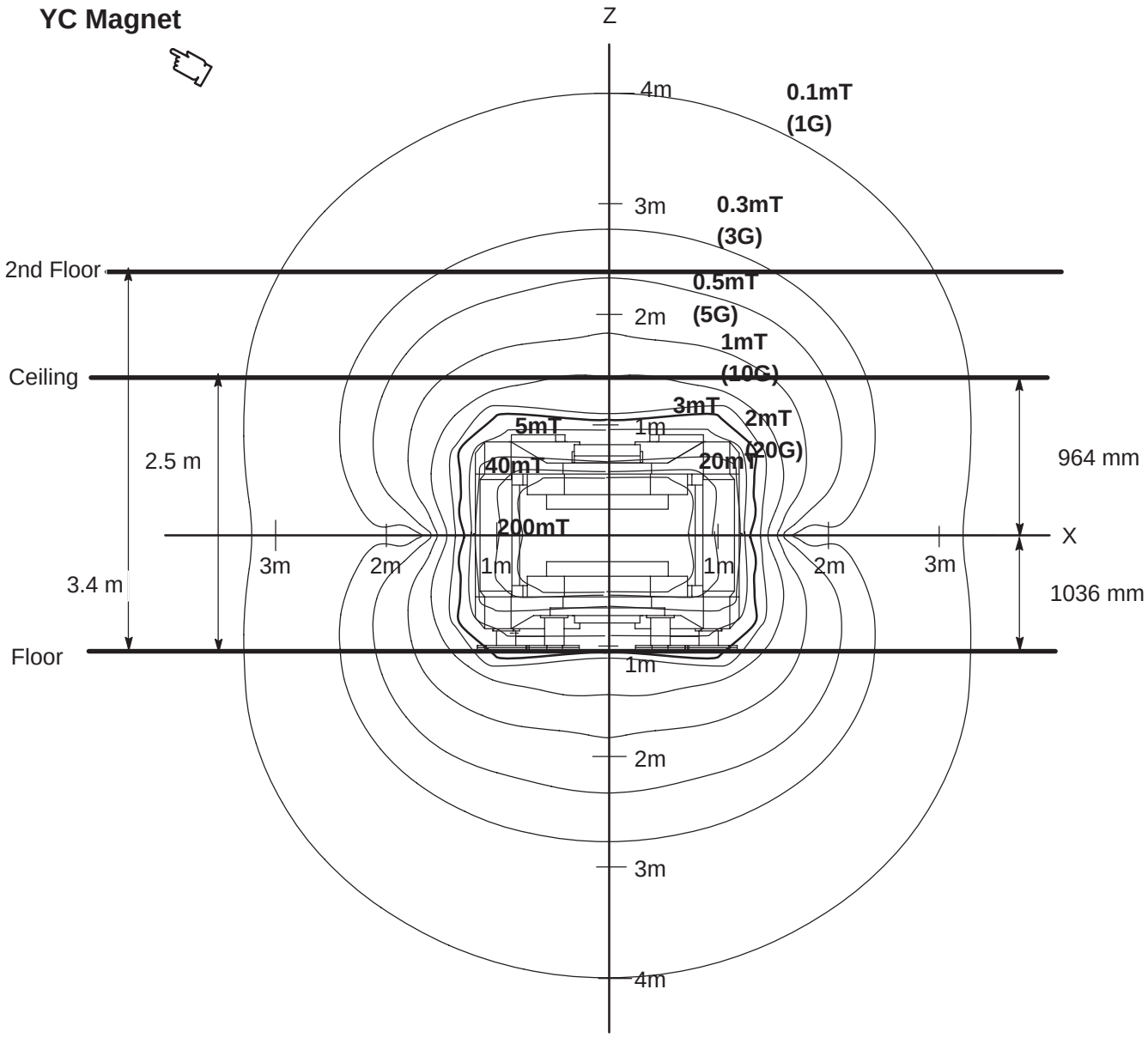
MAGNET ISOGAUSS LINE PLOT WITH 2.4m X 2.4m STEEL PLATE(SIDE VIEW)
ILLUSTRATION 3–6

3–6 ISOGAUSS LINE PLOTS



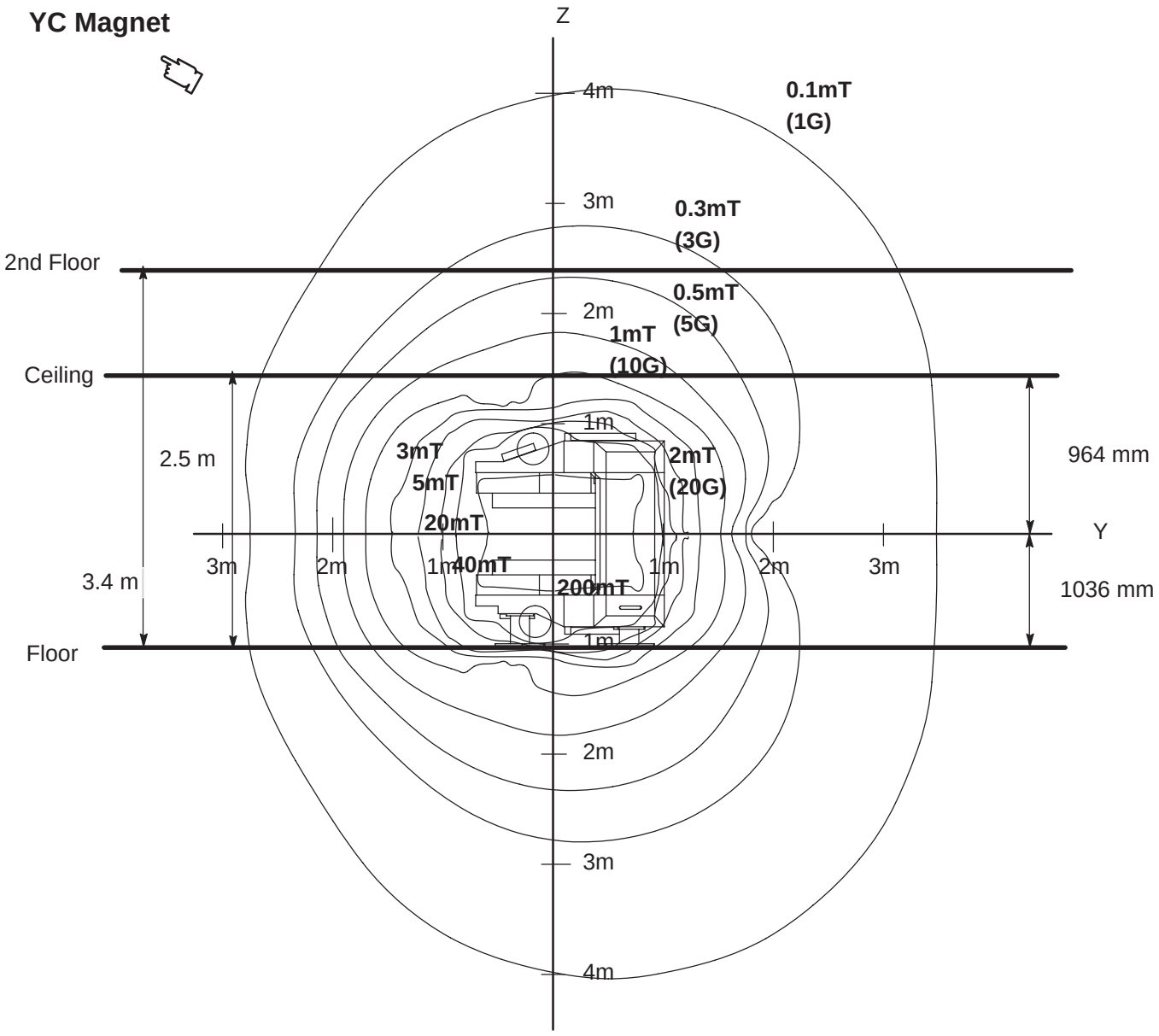
MAGNET ISOGAUSS LINE PLOT WITHOUT STEEL PLATE(TOP VIEW)
ILLUSTRATION 3–7

3–6 ISOGAUSS LINE PLOTS (continued)



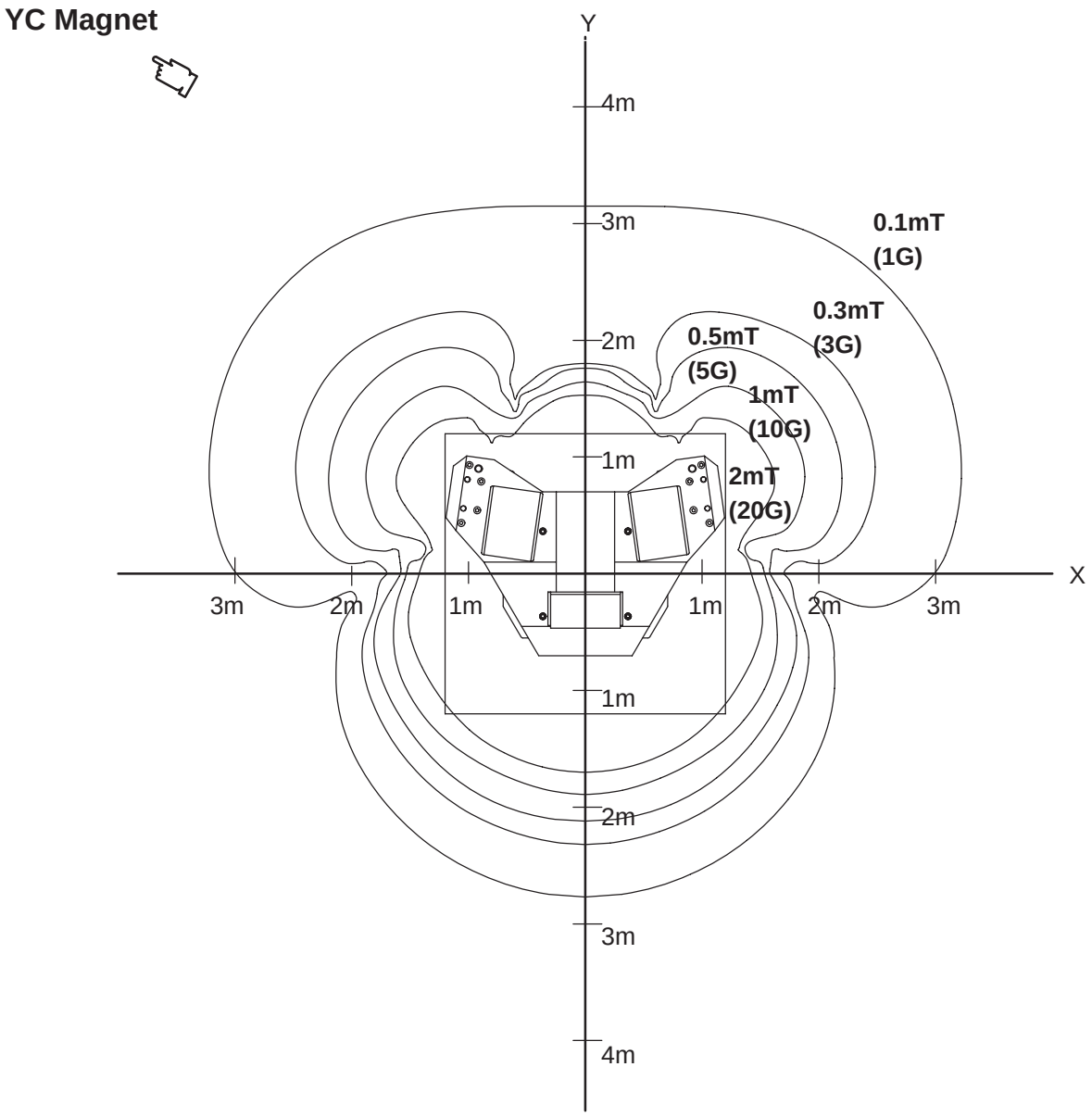
MAGNET ISOGAUSS LINE PLOT WITHOUT STEEEL PLATE (FRONT VIEW)
ILLUSTRATION 3–8

3–6 ISOGAUSS LINE PLOTS (continued)



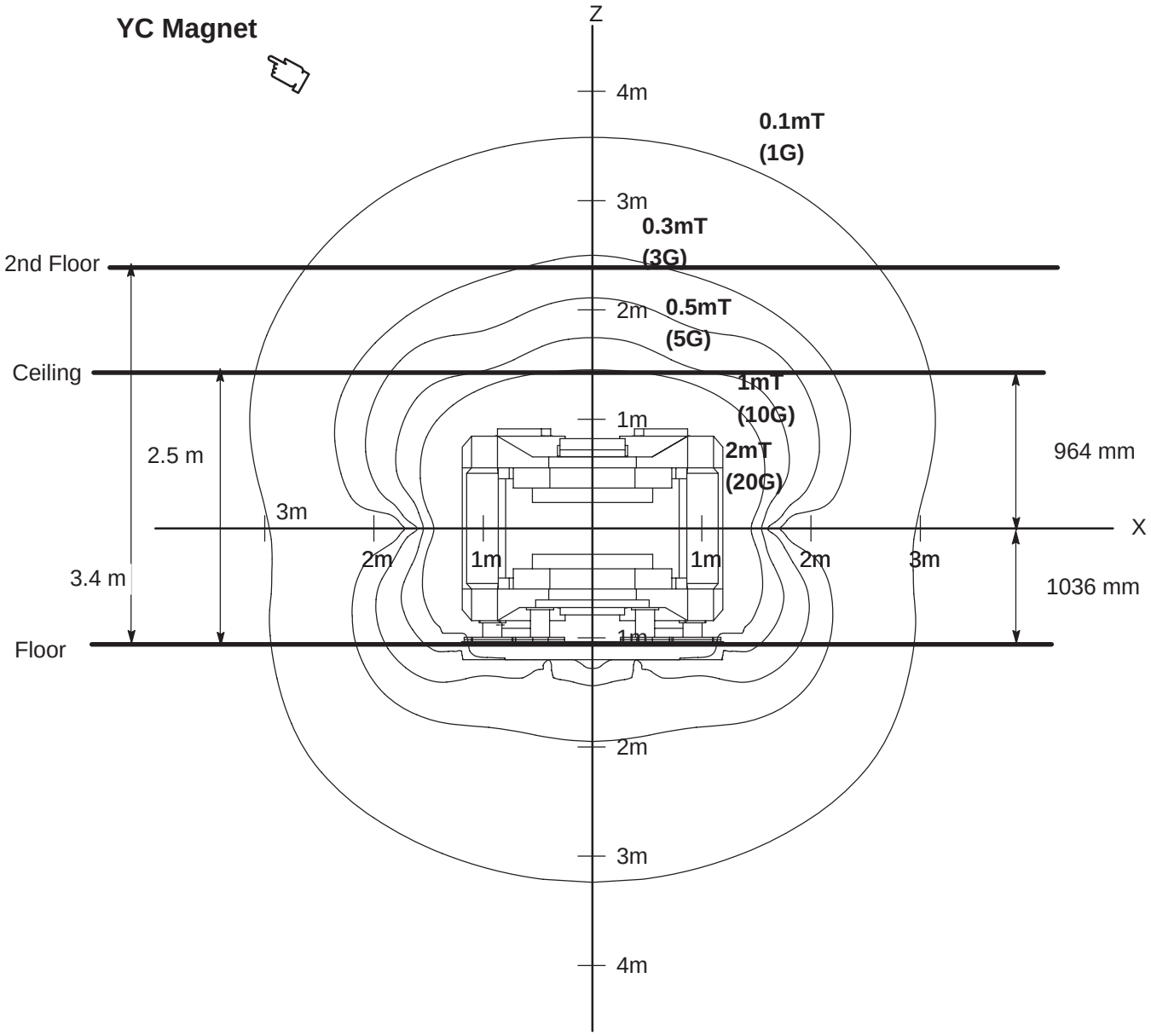
MAGNET ISOGAUSS LINE PLOT WITHOUT STEEL PLATE(SIDE VIEW)
ILLUSTRATION 3–9

3–6 ISOGAUSS LINE PLOTS



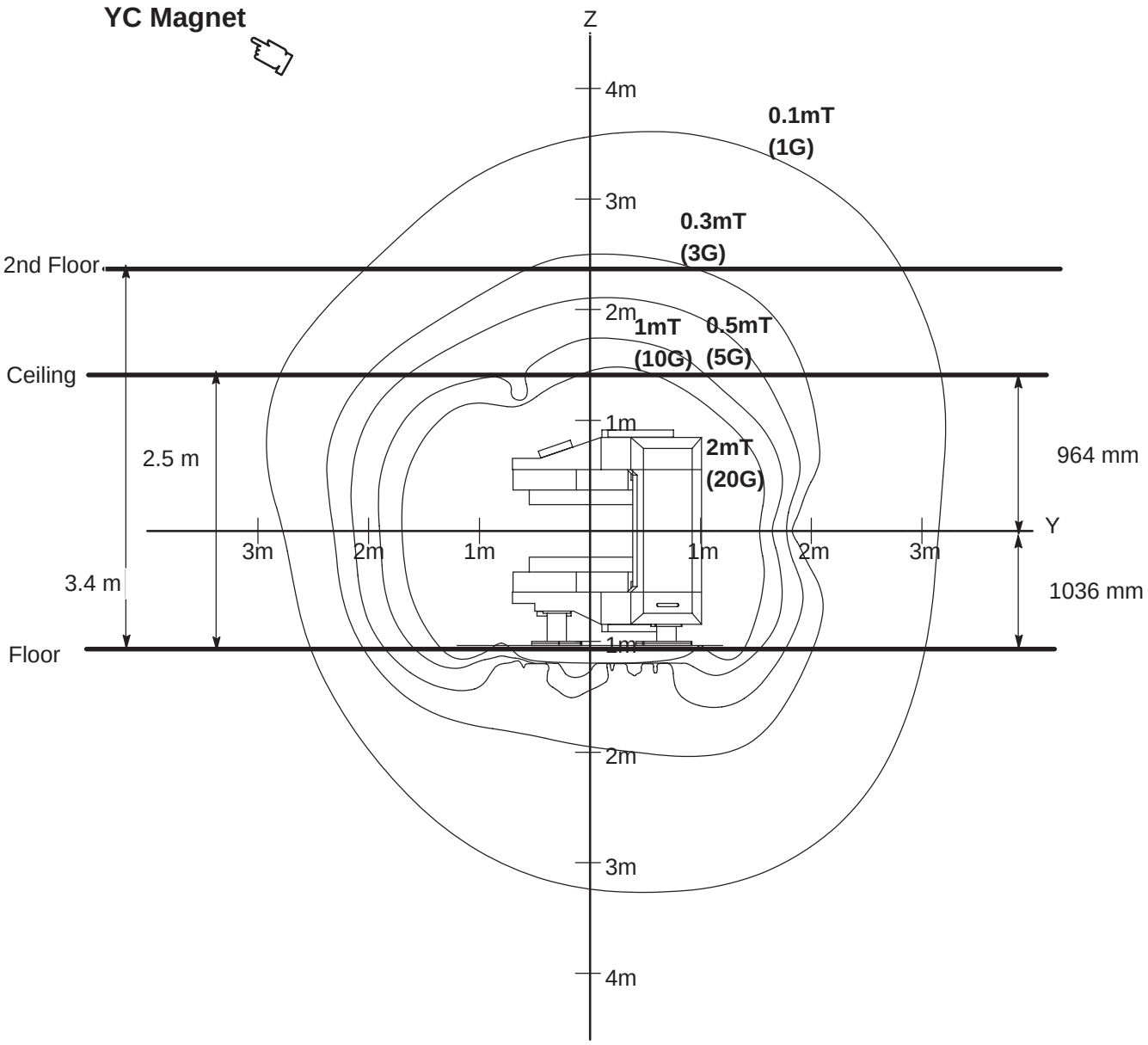
MAGNET ISOGAUSS LINE PLOT WITH 2.4m X 2.4m STEEL PLATE(TOP VIEW)
ILLUSTRATION 3–10

3–6 ISOGAUSS LINE PLOTS (continued)



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

3–6 ISOGAUSS LINE PLOTS (continued)



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

4–4 ALTITUDE

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

4–5 LIGHTING

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

Note

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

TABLE 4–3
ROOM LIGHTING REQUIREMENTS

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

4–6 NOISE

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

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

4–7 ALARM DEVICES

4–7–1 System Cabinet

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

4–7–2 Pneumatic Patient Alert

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

4–11–2 Walls, Ceilings, and Fixtures

General

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

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

4–11–3 Electrical conduits

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

4–12 VIBRATION

4–12–1 Scope

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

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

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

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

Note

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

Note

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

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

Magnet Siting Requirement

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

5–1 INTRODUCTION

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

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

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

5–2 CRITICAL POWER REQUIREMENTS

Note

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

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

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

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

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

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

5–2 CRITICAL POWER REQUIREMENTS (Continued)

TABLE 5–1
REQUIRED CUSTOMER POWER (Japan Only)

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

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

Note

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

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

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

5–2 CRITICAL POWER REQUIREMENTS (Continued)

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

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

Note

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

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

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

Note

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

5–2 CRITICAL POWER REQUIREMENTS (Continued)

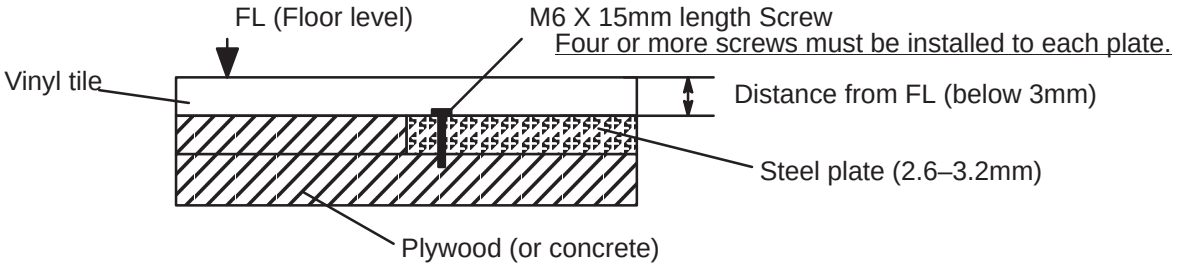
TABLE 5–3
MDP PDU CIRCUIT FACILITY INPUT POWER REQUIREMENTS
(Refer to Table 5–3 for MDP TCU Circuit Requirements and Illustration 5–1 for configuration)

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

7–4 FLOOR SHIELDING(continued)

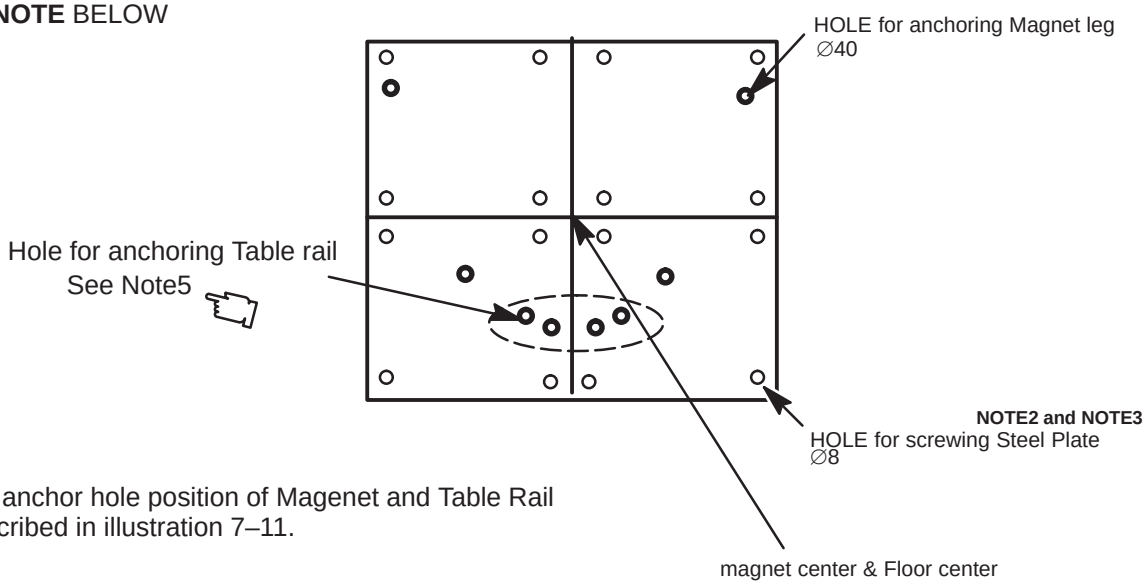
SAMPLE ILLUSTRATION:
(2.4mx2.4m steel plate is devided to four plates)

CROSS SECTION OF THE FLOOR



HOLE OF THE 2.4X2.4 STEEL PLATE

SEE **NOTE** BELOW



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

RF Room

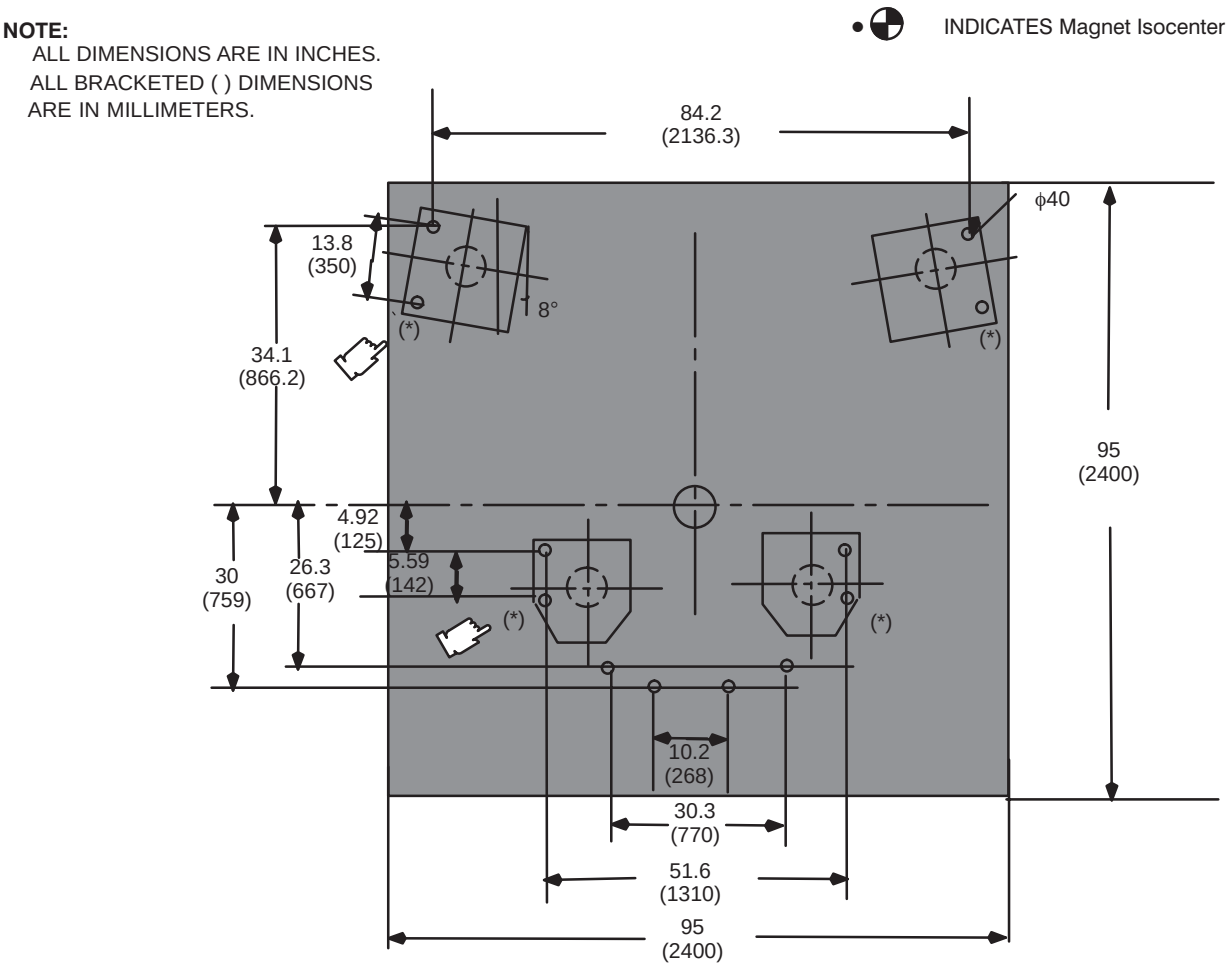
NOTE1: The anchor holes for the table must be considered when laying the steel plate on the entire room.
NOTE2: Screw holes are not allowed within the footprint area of the leg of the magnet to avoid leveling problems.
NOTE3: The use of steel screws instead of stainless screws for steel plate is allowed.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

2.4X2.4 STEEL PLATE
ILLUSTRATION 7–10

7–4 FLOOR SHIELDING(continued)

SAMPLE ILLUSTRATION:

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



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

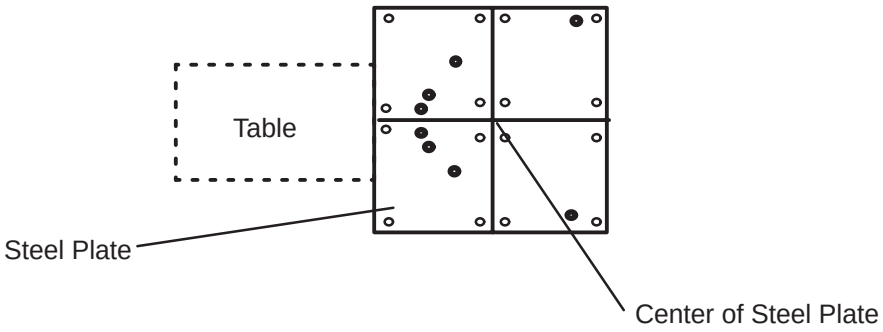
NOTE: Screws are not needed for steel plate with dimensions greater than 2.4m X 2.4m and located deeper than 30mm from the floor.

MAGNET MOUNTING PLATE
ILLUSTRATION 7–11

7–4–1 STEEL PLATE ANCHORING

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

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



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

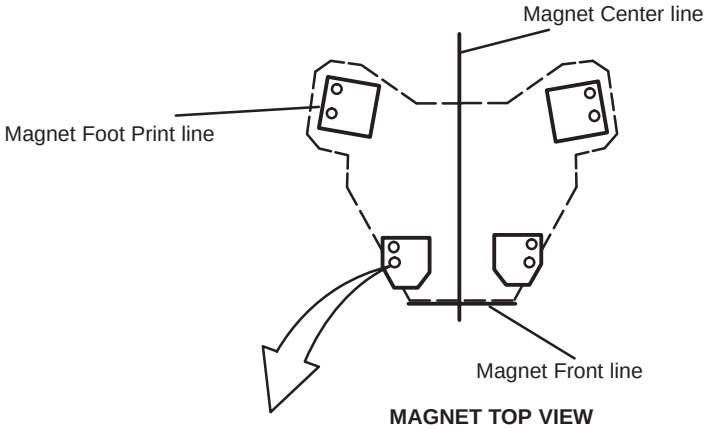
MAGNET AND STEEL PLATE
ILLUSTRATION 7–12

7–4–1 STEEL PLATE ANCHORING (continued)

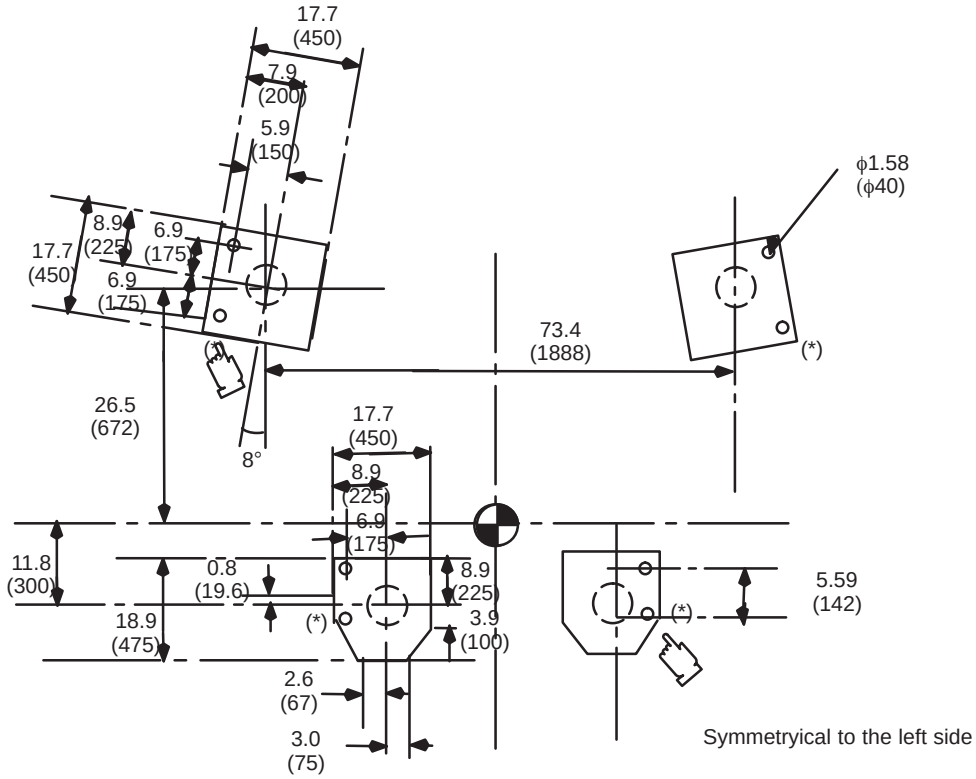
7. Draw lines of Magnet foot prints, center line, and Magnet front line. These lines are used for manet alignment.

NOTE:

- ALL DIMENSIONS ARE IN MILLIMETERS.



MAGNET TOP VIEW



MAGNET LOAD PATTERN

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

MAGNET LOAD PATTERN (1)
ILLUSTRATION 7–13

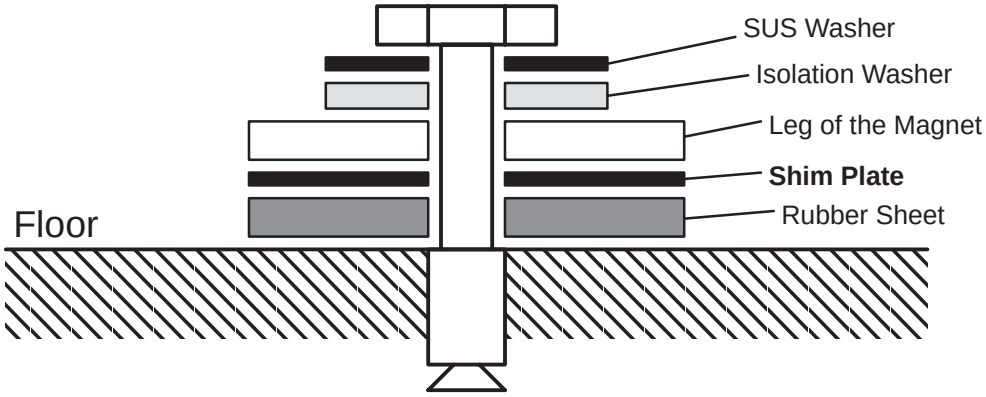
7–5 MAGNET ANCHORING

Note

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

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

LEVELING OF THE MAGNET



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

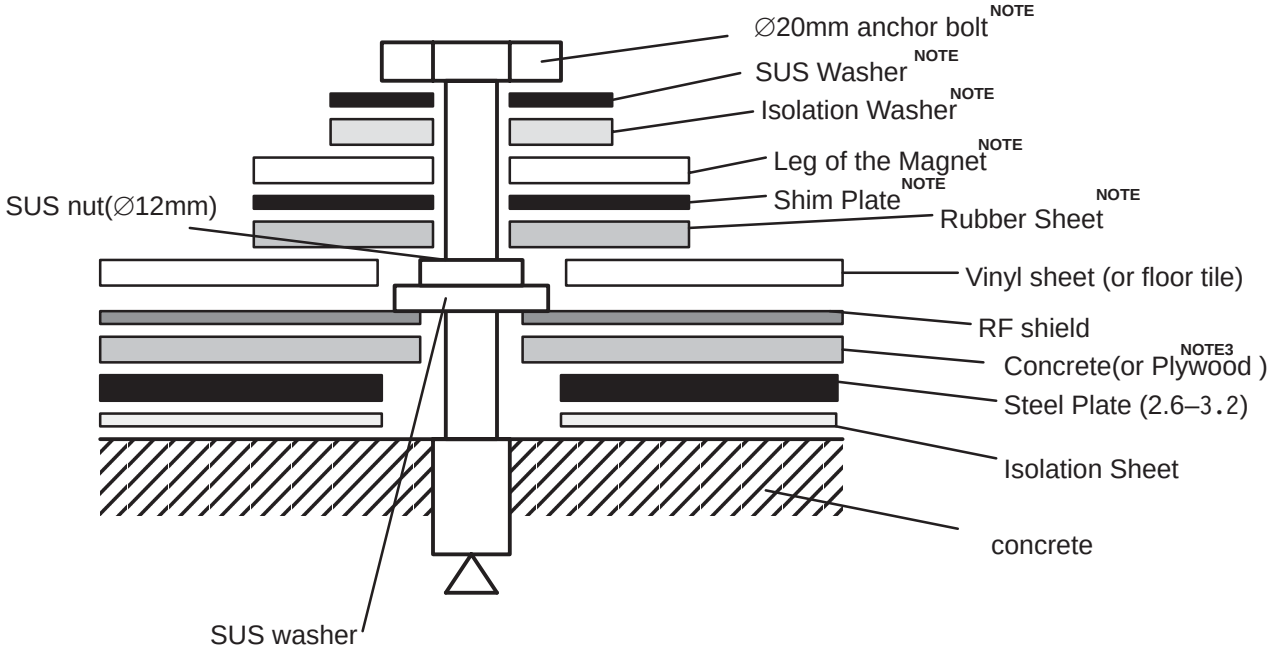
NOTE 2: If the strength of the anchored part is not strong enough, this needs to be considered by the customer.

LEVELING OF THE MAGNET
ILLUSTRATION 7−14

7–5 MAGNET ANCHORING(continued)

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

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



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

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

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

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

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

MAGNET ANCHOR BOLT (1)
ILLUSTRATION 7–15

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

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

The Customer is responsible for the following tasks:

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

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

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

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

GE Medical Systems is responsible for the following tasks:

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

7–9–1 RF Shield Integrity

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

1. Blank Penetration Panel installed

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

SECTION 8 – SHIPPING AND DELIVERY DATA

TABLE OF CONTENTS

8–1 SHIPMENT

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

8–2 STORAGE REQUIREMENTS

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

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

8–3 MAGNET CONSIDERATIONS

WARNING!

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

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

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

WARNING!

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

8–4 SHIPPING DATA

TABLE TABLE 8–1
SHIPPING DATA

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

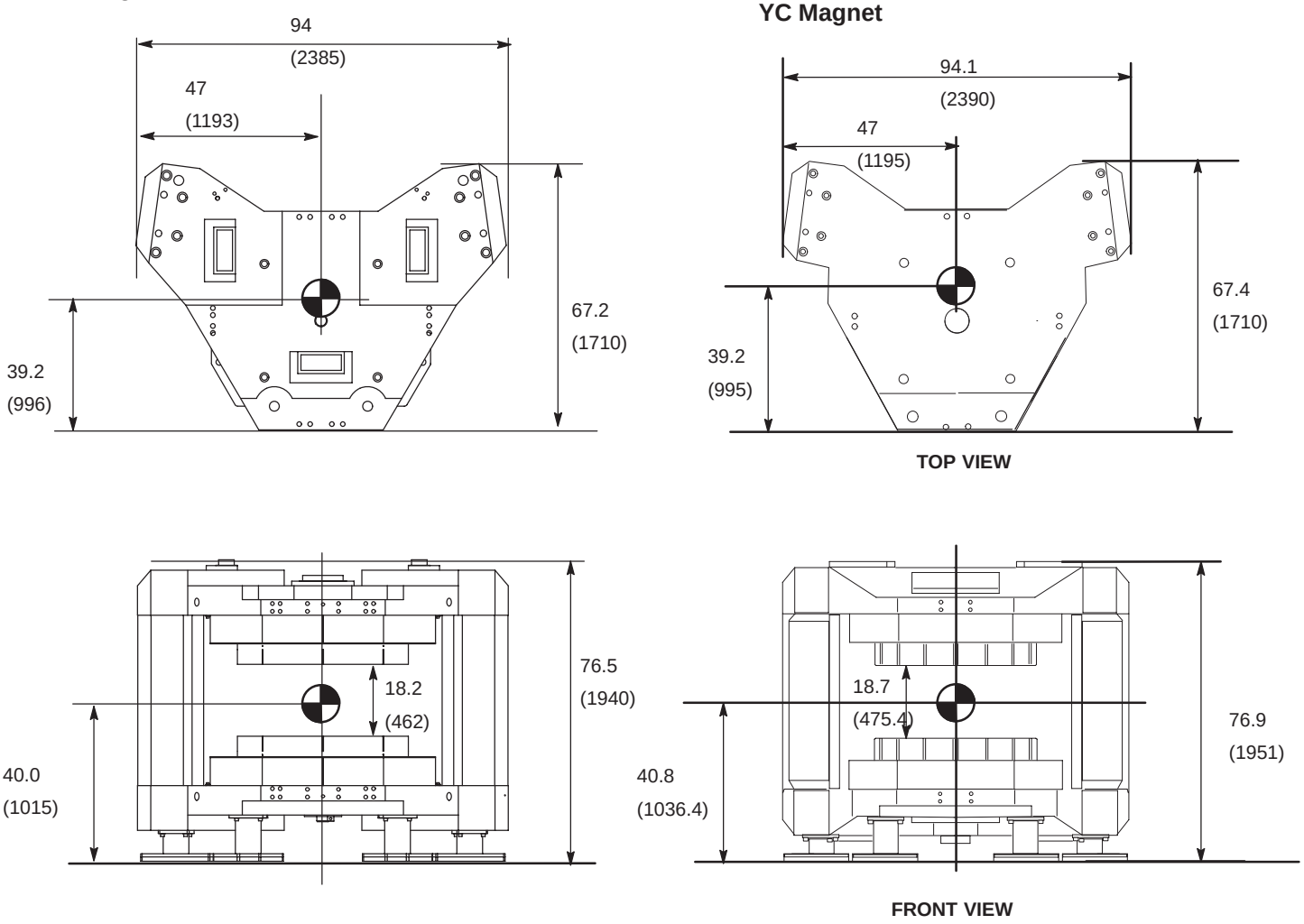
Note 1 Approximate magnet shipping weight (includes packaging material) and weight of magnet with Gradient coil, Enclosure, Electronics Module installed on magnet, lifting beams, crate :

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

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

8–4 SHIPPING DATA (Continued)

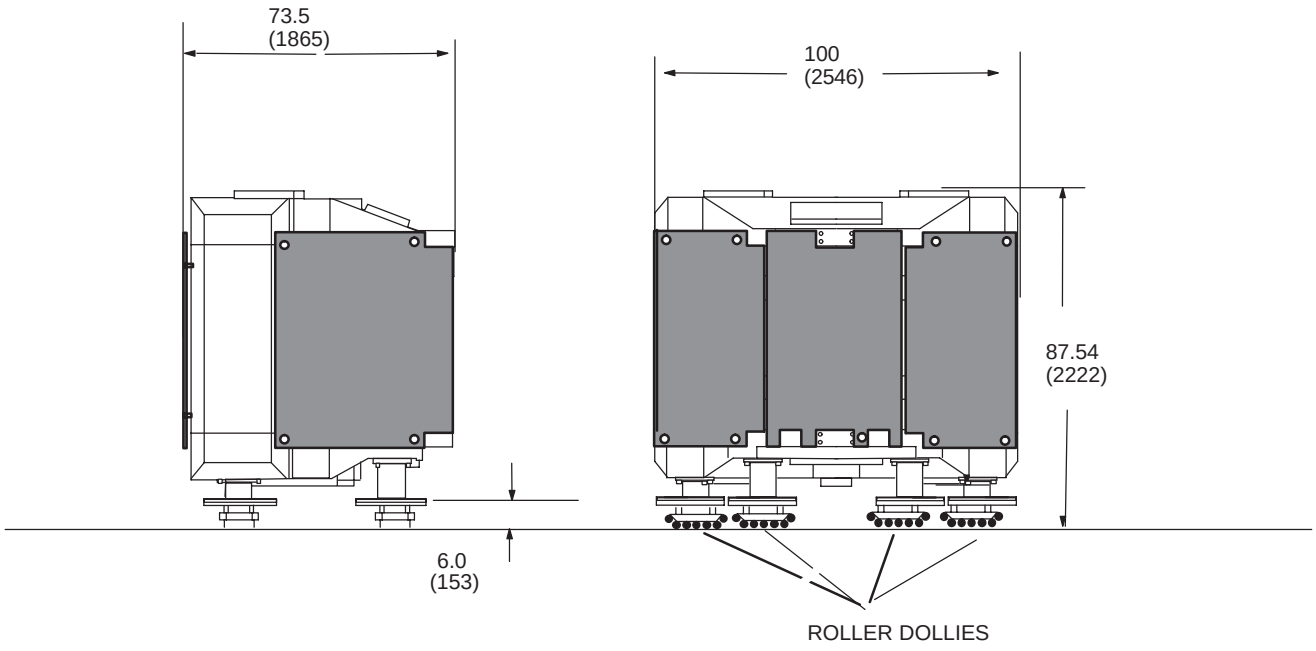
NOTE:
- ALL DIMENSIONS ARE IN INCHES. ALL BRACKETED ( ) DIMENSIONS ARE IN MILLIMETERS.
- APPROX. WEIGHT 19000 kg
- INDICATES Magnet Gravity Center



MAGNET MANEUVERING DIMENSIONS
ILLUSTRATION 8–1

8–4 SHIPPING DATA (Continued)

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

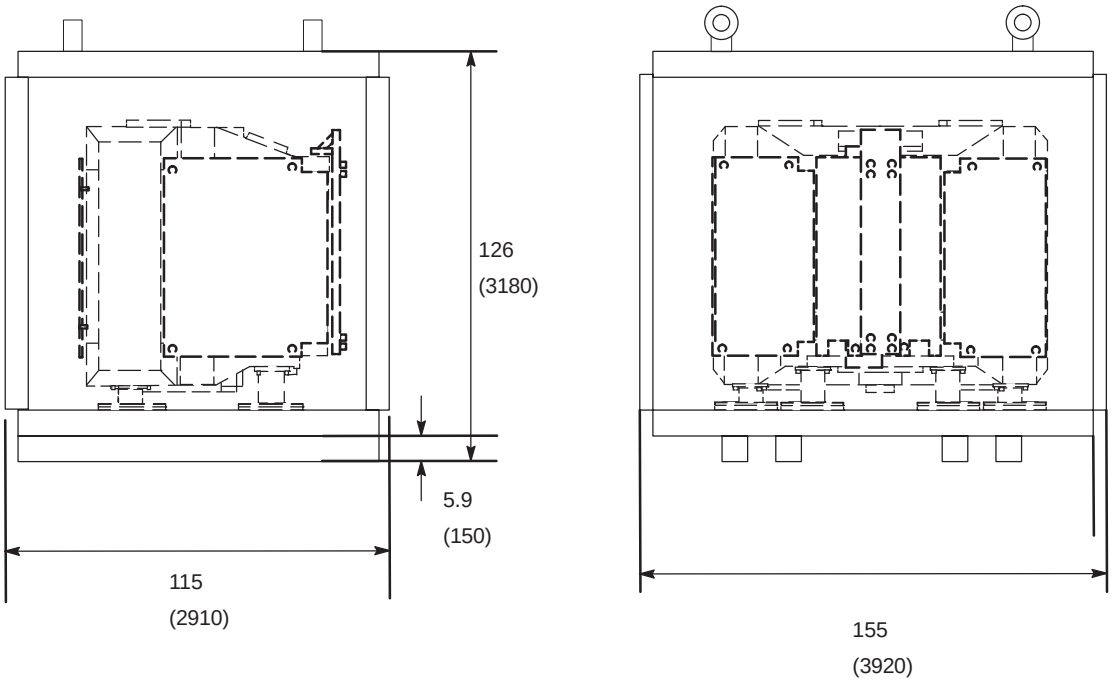


MAGNET WITH ROLLER SKIDS ATTACHED
ILLUSTRATION 8–2

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

For Outside Japan Only:

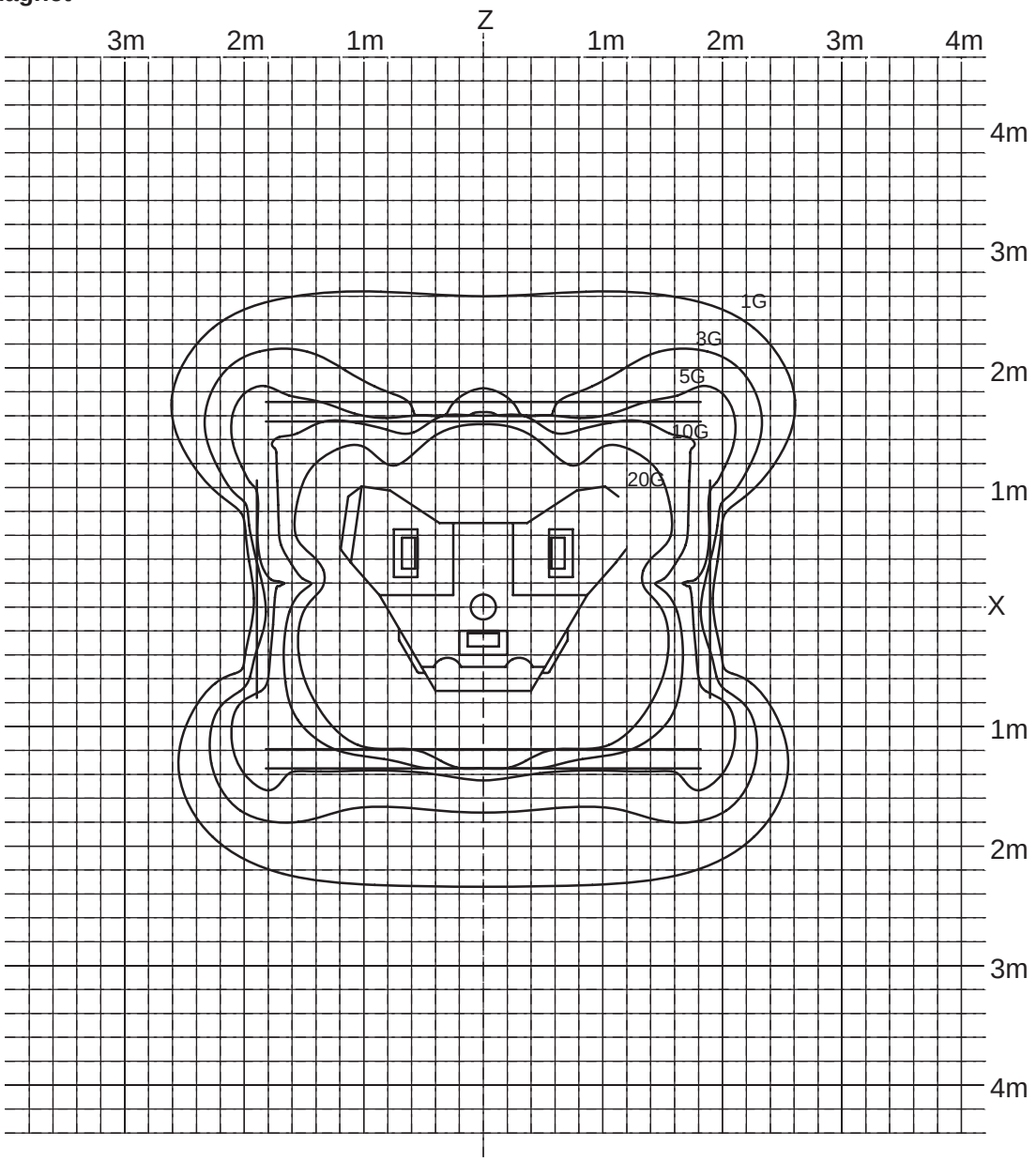
NOTE:
ALL DIMENSIONS ARE IN INCHES.
ALL BRACKETED ( ) DIMENSIONS
ARE IN MILLIMETERS.



MAGNET PACKED BY STEELCRATE
ILLUSTRATION 8–3

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

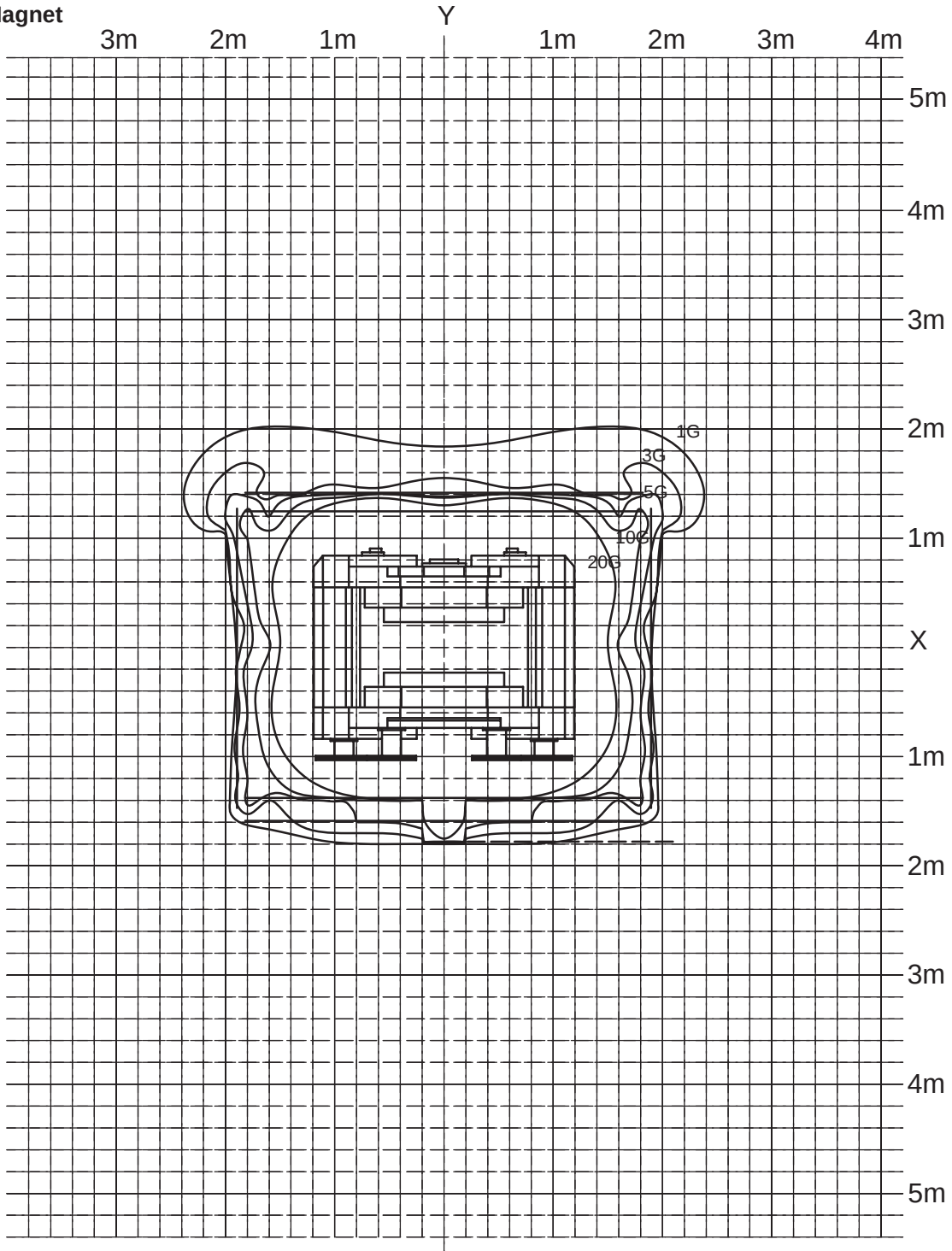
YD Magnet



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

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

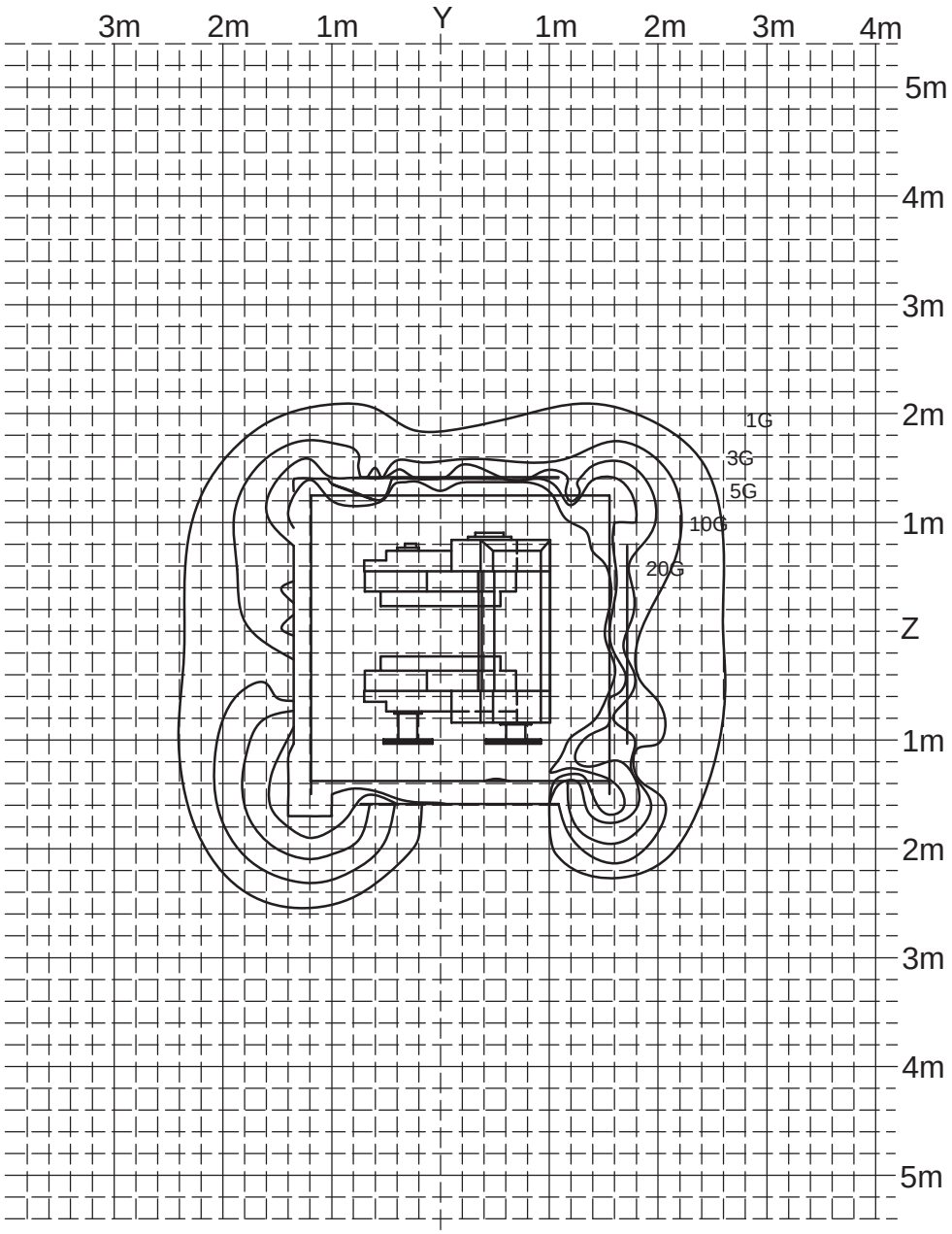
YD Magnet



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

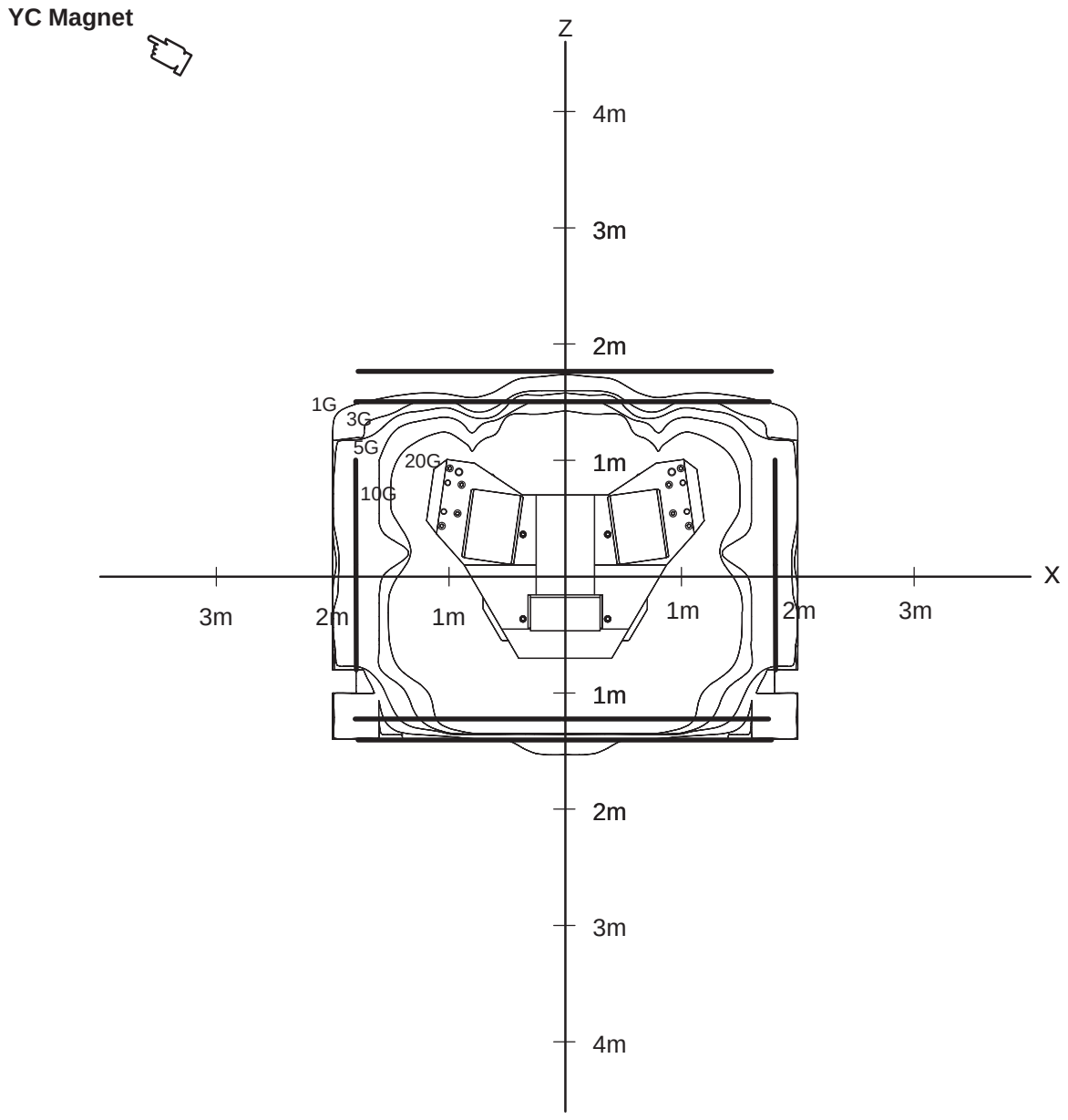
8–4–1 MAGNET SHIPPING DATA (Outside of Japan) (continued)

YD Magnet



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

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

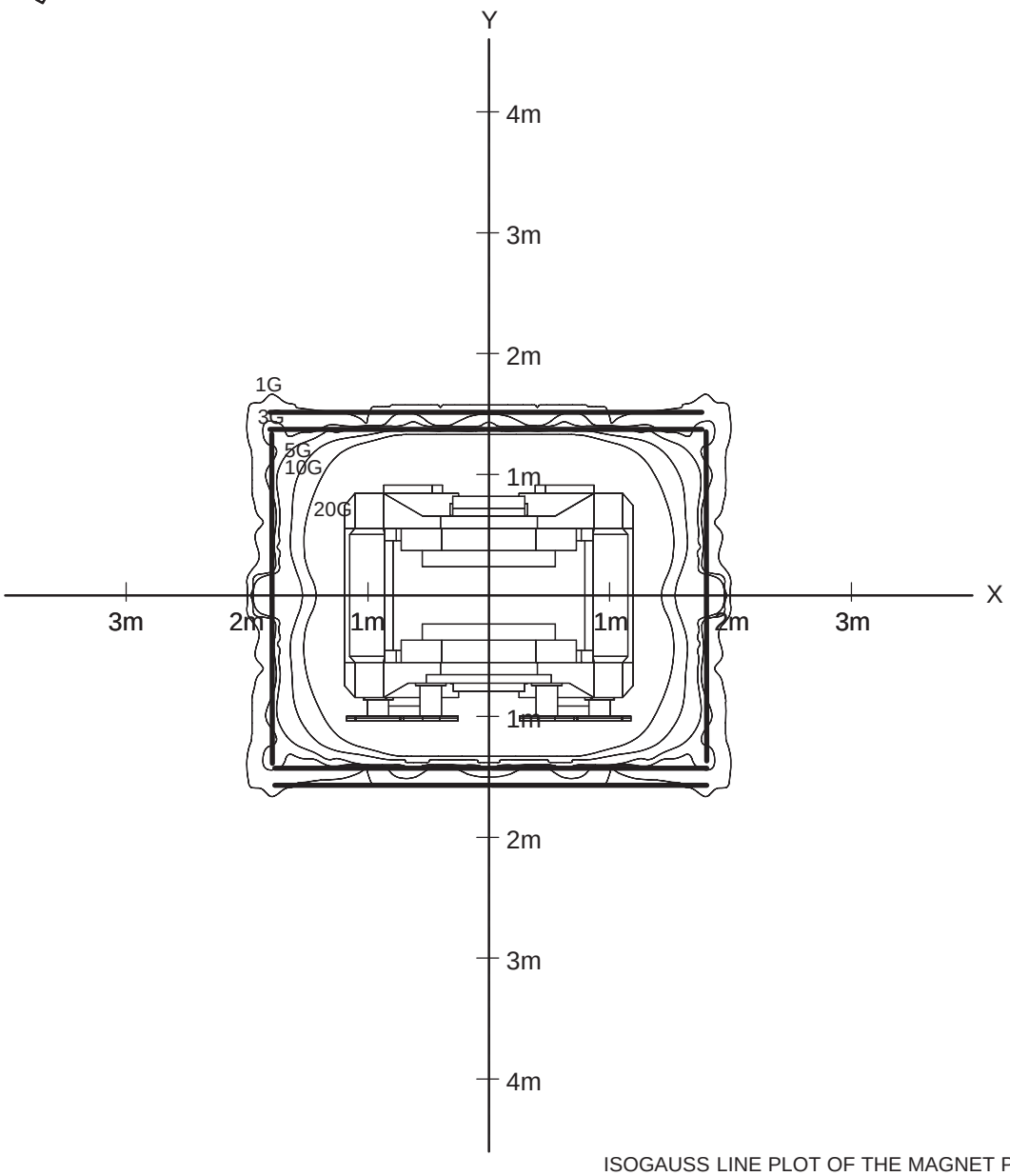


ISOGAUSS LINE PLOT OF THE MAGNET PACKED WITH THE CRATE FOR EXPORT

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

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

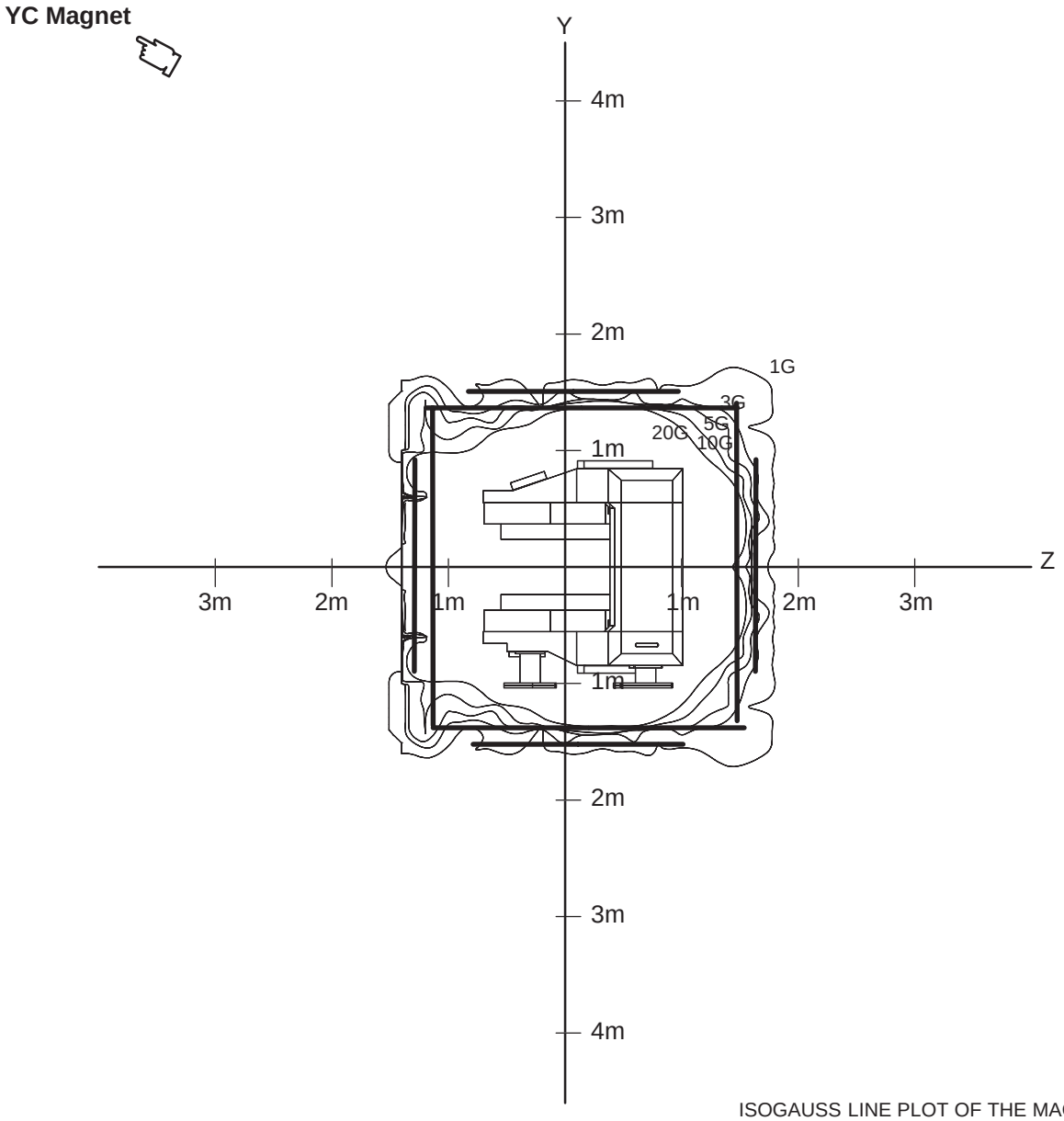
YC Magnet



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

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

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



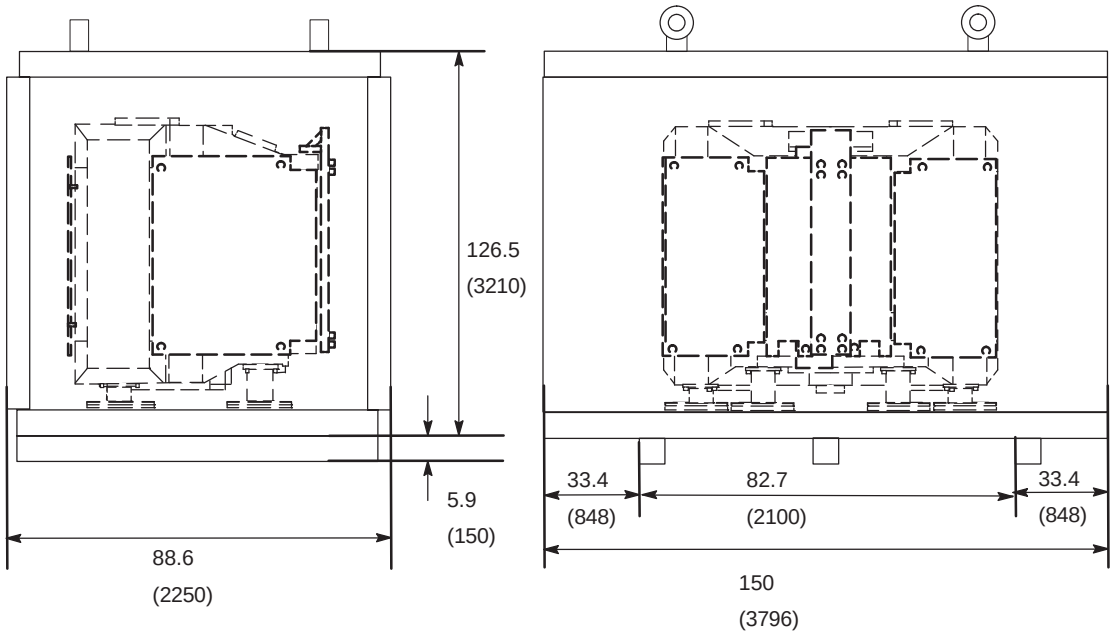
ISOGAUSS LINE PLOT OF THE MAGNET PACKED WITH THE CRATE FOR EXPORT

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

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

Japan Only:

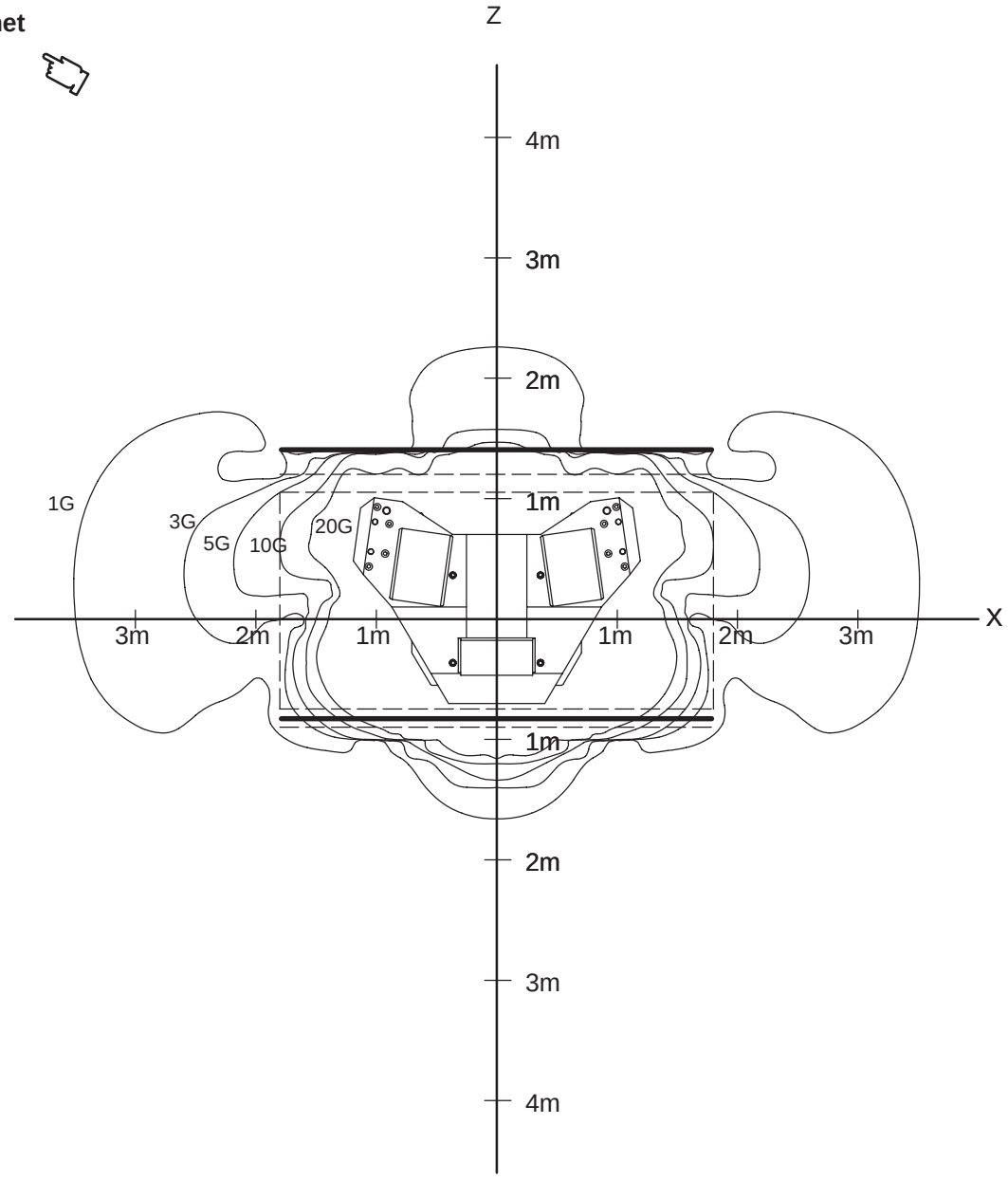
NOTE:
ALL DIMENSIONS ARE IN INCHES.
ALL BRACKETED ( ) DIMENSIONS
ARE IN MILLIMETERS.



MAGNET PACKED BY STEEL CRATE
ILLUSTRATION 8–10

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

YC Magnet

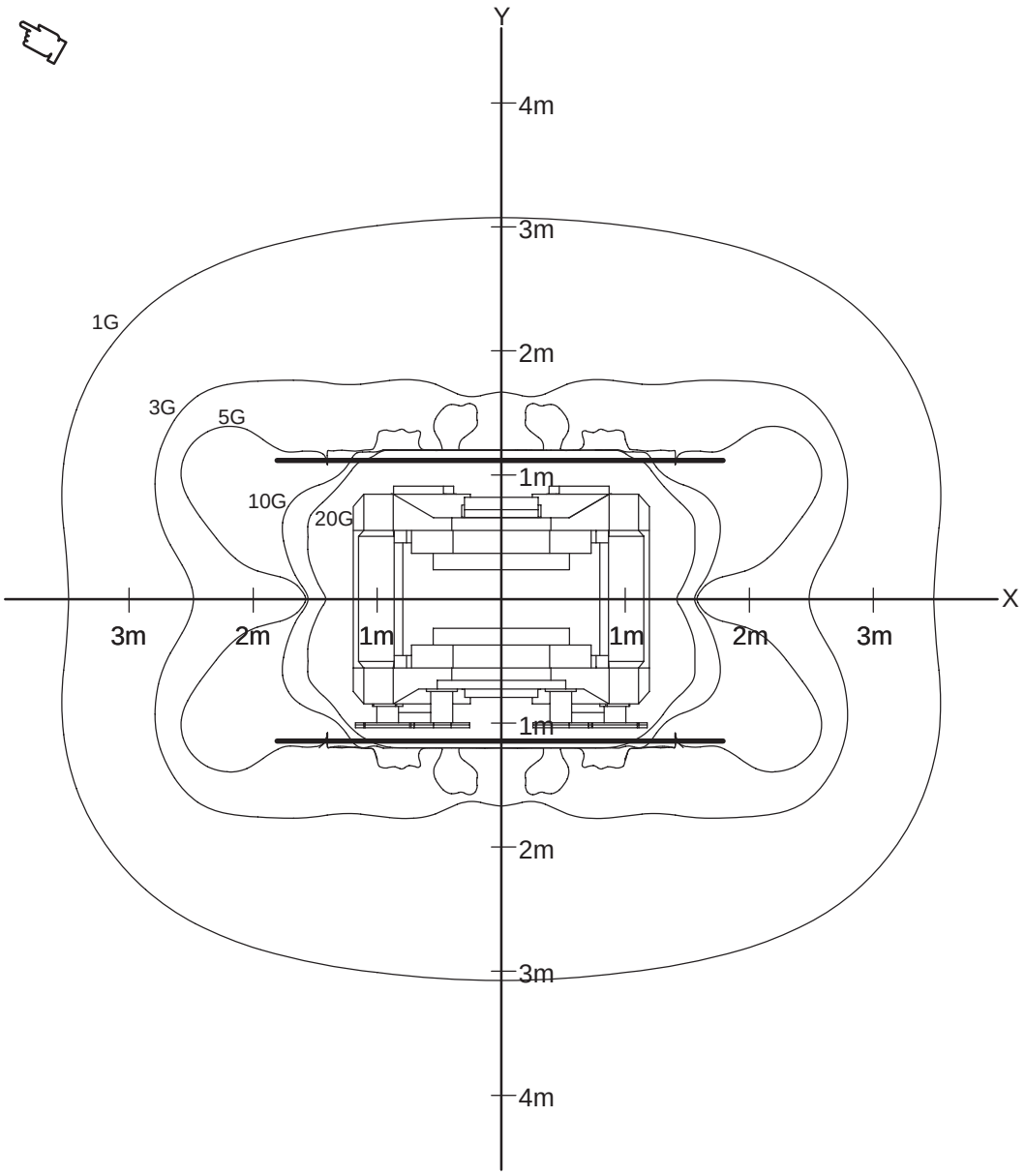


ISOGAUSS LINE PLOT OF THE MAGNET PACKED WITH THE CRATE FOR EXPORT

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

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

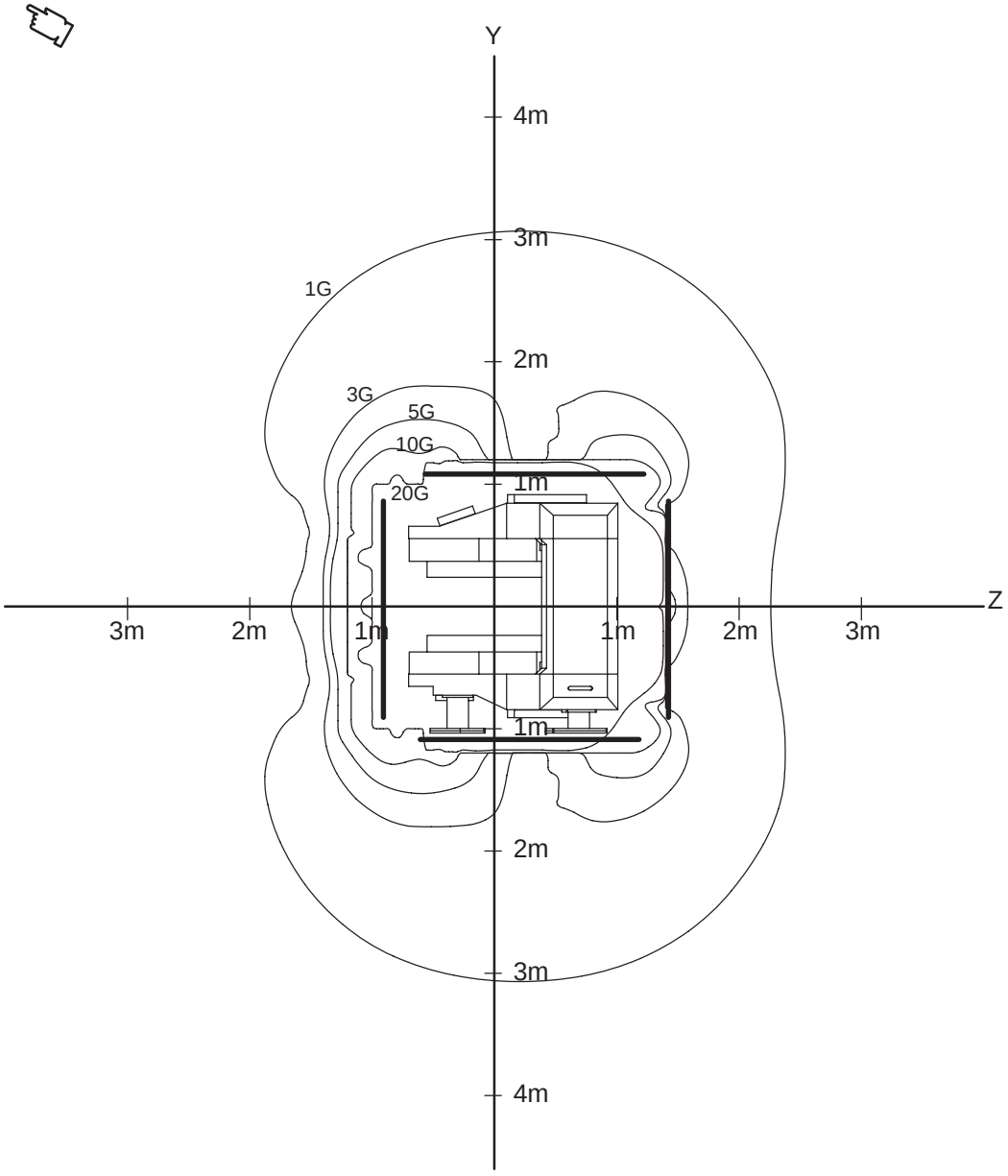
YC Magnet



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

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

YC Magnet



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