



# **SIGNA™ 7T**

## Preinstallation Manual

5809186-1EN

Revision 2

GE HealthCare Confidential

*General Service Documentation*

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## DOC0371395 - Global Language Procedure

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# 1 Introduction

## 1.1 Preinstall Manual Introduction



(Applies to all subsections within this section)

### 1.1.1 Document Purpose

This preinstallation manual provides the necessary information to prepare a site for system installation. Specifically, this manual provides information:

1. To define system requirements and interactions.
2. For the effective arrangement and interconnection of system components.
3. The customer is responsible for:
  - 3.1. Compliance with all local and national codes and regulations
  - 3.2. Siting requirements for customer-specific site procedures (medical, MR, safety, and so on)
  - 3.3. Any special architectural requirements (for example, seismic codes)

The implementation of all requirements and adherence to all specifications in this manual is the responsibility of the customer or its architect and engineers. Refer any questions to the GE HealthCare Project Manager of Installation (PMI).








### 1.1.2 Intended User

The primary users of this manual are the customer, the customer's architectural planner, and/or the customer's contractors.








### 1.1.3 Who Should Read This Manual

The following personnel must be aware of the content listed in the following sections:

**Table 1-1 Personnel Index**

Section	Personnel						
							
	Architect	General Contractor	Customer	Electrician	Plumber	HVAC	RF Vendor
1.1 Preinstall Manual Introduction	X	X	X	X	X	X	X
2.1 System Level Requirements for Installing into Existing MR Suite	X	X					
2.2 System components	X	X					
2.3 MR Suite Minimum Room Size Requirements	X						
2.4 MR System Seismic Requirements	X	X					
2.5 Structure-borne Vibration Control Specifications	X						
2.6 MR Suite Magnetic Field Specifications	X		X				
2.7 Multiple MR System Requirements	X						
2.8 MR Suite Temperature and Humidity	X	X			X	X	
2.9 Facility Coolant Requirements	X	X			X	X	
2.10 MR Suite Electrical Requirements	X			X			
2.11 MR System Shipping and Receiving	X						
3.1 Magnet Room Introduction	X	X					
3.2 Magnet Room Structural Requirements	X						
3.2.1 Overview	X						
3.2.2 Environmental Steel Limits	X						
3.2.3 Vibration Requirements	X	X				X	
3.3 Magnetic Shielded Room Requirements	X						
3.4 Penetration Panel Wall Opening Requirements	X						





**Table 1-1 Personnel Index** (Table continued)

Section	Personnel						
							
	Architect	General Contractor	Customer	Electrician	Plumber	HVAC	RF Vendor
3.5.1 Ferrous Materials in the Magnet Room	x	x	x				
3.5.2 Walls	x						
3.5.3 Magnet Preinstallation Markings	x						
3.5.4 Penetration Panel Closet	x						
3.5.5 Penetration Panel Closet Specifications	x						
3.5.6 Doors, Magnet Access Openings, and Patient Viewing Windows	x						
3.5.7 Finished Ceiling	x						
3.5.8 Magnet Room Floors	x	x					
3.5.10 Storage Cabinets	x	x					
3.6 Magnet Room Equipment Specifications	x	x					
3.7 Magnet Room Lighting Requirements	x			x			
4 Equipment Room chapter	x	x					
5 Control Room chapter	x	x					
7.1 MR System Interconnects Specifications	x	x		x			
7.2 MR System Interconnects Routing Requirements	x	x		x			
7.3 Facility-Supplied System Interconnects Specifications	x	x		x	x	x	
8.1 Glossary	x	x	x	x	x	x	x
8.2 MR Site Vibration Test Guidelines	x						
8.3 Sample Calculation AC Power Equipment Minimum Distance	x						
8.4 Selecting Anchor Size	x	x					

## 1.1.4 Related Publications

The preinstallation requirements in the following publications are applicable to all systems. This document and all documents referenced herein shall be provided to the Responsible Organization or Operator as a supplement to the product instructions for use and/or technical description.

**Table 1-2 Additional Preinstallation Requirements**

Publication Number	Title	Personnel who must be aware of the content
5850262-1EN	<i>Acoustic Room Details</i>	
5850261-1EN	<i>International Electrotechnical Commission (IEC) Electro-magnetic Compatibility (EMC)</i>	
5850263-1EN	<i>Magnet Room Venting</i>	
5850260-1EN	<i>RF Shielded Room</i>	







## 1.1.5 Document Overview

This manual describes requirements and specifications for the following:

1. General system requirements that apply to the entire MR suite
2. Shipping and delivery
3. Magnet Room
4. Equipment Room
5. Control Room
6. Interconnects within and between the rooms listed above

## 1.2 Symbols Key

Table 1-3 Symbols Key

Symbol/Unit	Definition
	Center of gravity
	Magnet isocenter
	Service area
	Airflow
	Space for airflow and cables
	Valve

## 2 General System Level

### 2.1 System Level Requirements for Installing into Existing MR Suite



When planning for the installation of this system in an existing GE HealthCare MR suite, all requirements in this manual must be met because these rooms are considered new installations.

When upgrading from a Signa OpenSpeed system, extensive building updates are required. The facility must remove any Magnet Room isolation system.

1. If the existing MR suite contains a GE HealthCare system, the vibration environmental assessment must be done using the High Speed (magnetic field) Stability tool.



#### NOTE

The customer may have to hire a vibration consultant based on the results of the analysis.

2. Some GE HealthCare MR suites with overhead cabling may need to be modified to meet current cable tray requirements, such as minimum width and position. See [7.2 MR System Interconnects Routing Requirements on page 109](#).
3. Remove, cover, or fill in abandoned ducts or troughs from the Equipment and Magnet Rooms. Access/computer room flooring in the Equipment Room can either be removed or assessed and reinforced to support heavier cabinets.
4. Structural vibration levels may be higher at some frequencies than other MR Systems, which may increase acoustic levels. Refer to [2.5 Structure-borne Vibration Control Specifications on page 21](#).
5. RF vendor responsibilities:
  - 5.1. The old dock anchor cannot be reused. It must be removed and the hole filled in. The new anchor is reset after the magnet is installed. For upgrades that reuse the existing magnet, contact the PMI for further details about the potential reuse of the old dock anchor.
  - 5.2. The RF shield ceiling must support the cable routing mechanism and cables. Reinforce RF shield ceiling (see [7.2 MR System Interconnects Routing Requirements on page 109](#)).
  - 5.3. Two penetration panel openings are required and must meet the requirements in: *RF Shielded Room Requirements*, 5850260-1EN.
  - 5.4. RF shield attenuation must comply with: *RF Shielded Room Requirements*, 5850260-1EN
6. Cryogen vent may need to be relocated to align with the Magnet Cryogen Vent opening. The cryogen vent must meet all cryogen venting requirements (see *Magnet Room Venting Requirements*, 5850263-1EN).

## 2.2 System components



(Applies to all subsections within this section)

This system consists of the following components:

### 2.2.1 Magnet Room

1. 7.0T Magnet and Magnet Enclosure (MAG)
2. Rear Pedestal (PED)
3. Patient Transport Table (PT)
4. Magnet Rundown Unit (MRU)



#### NOTE

An optional remote MRU may be located outside the Magnet Room.

5. Remote Oxygen Sensors

### 2.2.2 Equipment Room

1. Main Disconnect Panel (MDP)
2. Integrated System Cabinet (ISC)
3. Integrated Cooling Cabinet (ICC)
4. Integrated System Cabinet (ISC) Penetration Panel (PP)
5. Integrated Cooling Cabinet (ICC) Secondary Penetration Wall (SPW)
6. Cryocooler Compressors (CRY1 and CRY2)
7. Magnet Monitor (MON1 and MON2)
8. RF Amplifier Cabinet (RF), includes Multi-Nuclear Spectroscopy (MNS)
9. High Order Shim Power Supply Cabinet (HOS)

### 2.2.3 Control Room

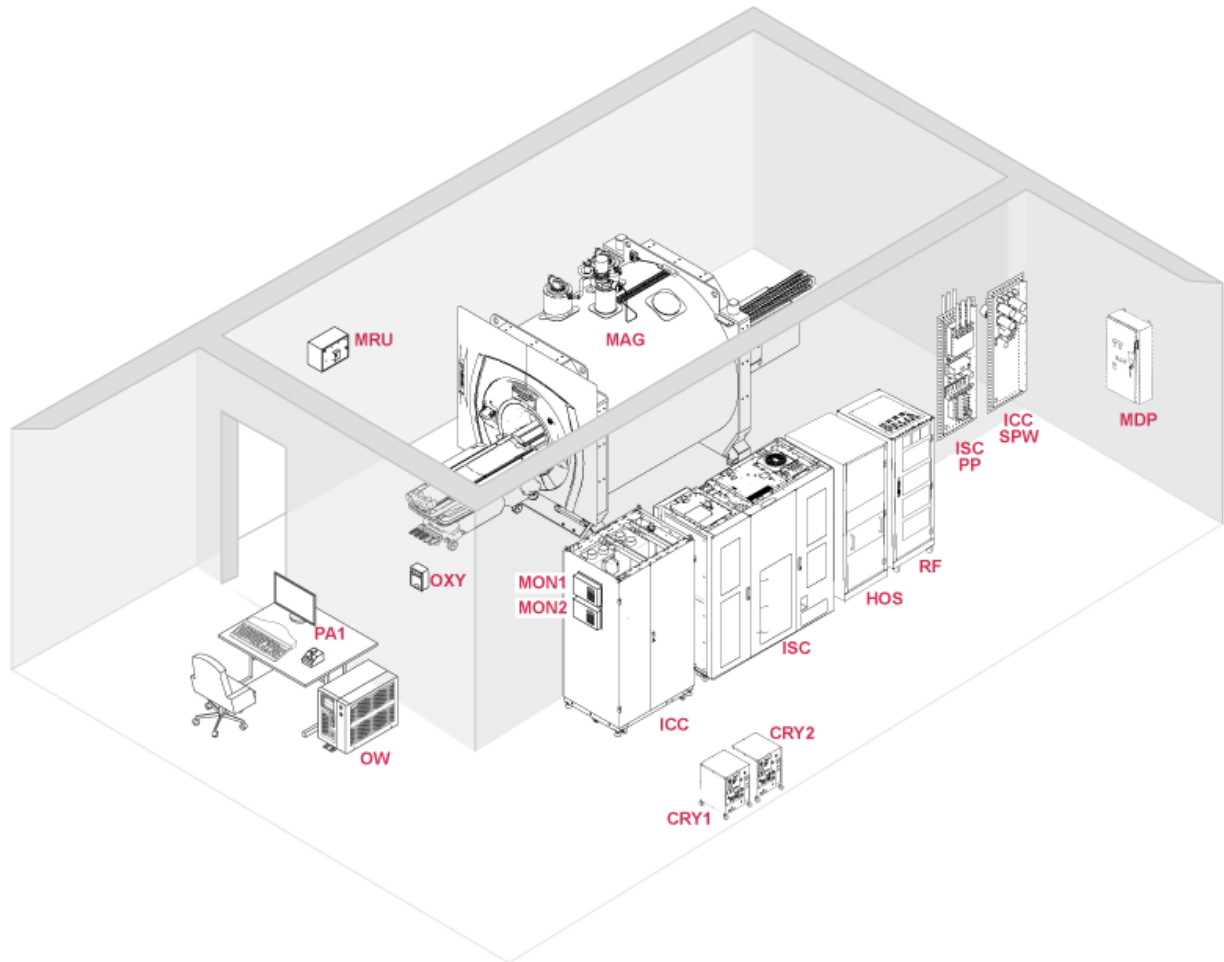
1. Operator Workspace equipment (OW)
2. Pneumatic Patient Alert System (PA1)
3. Optional: Oxygen Monitor (OXY)

### 2.2.4 Accessories

1. Patient accessories, including RF coils, phantoms, cushions, sponges, straps, and wedges
2. Gating accessories, including patient cardiac leads, peripheral gating probe, and respiratory bellows

## 2.2.5 System Overview

Figure 2-1 System overview (example)



### NOTE

OXY shown above is an optional component of the system.

## 2.3 MR Suite Minimum Room Size Requirements



Room dimensions shown in the table below are the minimum finished room space requirements to safely install and service the MR System. Minimum dimensions are for service only. Room size may increase due to the items listed below, which are not included in the minimum area dimensions:

1. Building code requirements (for example, exit routes, door placement, seismic mounting requirements, local and national electrical codes, and so on).
2. Equipment and Magnet Room evacuation routes to comply with facility emergency procedures.
3. System requirements, including cable run locations, cryogen venting, patient observation requirements, and penetration panel placements.
4. Penetration panel closet and all associated areas.
5. GE HealthCare optional equipment.
6. Non-GE HealthCare equipment options (such as additional AC or water cooling equipment in the Equipment Room).
7. Clinical workflow considerations.
8. Accessory storage. Refer to *Customer Site Storage Requirements*, 5182674 (available in the Customer Documentation Portal), or contact the GE HealthCare Project Manager of Installation (PMI) for any additional accessory storage requirements.
9. Magnetic field containment, for example, the 5 gauss line to the room. If fringe field containment is needed, see [2.6 MR Suite Magnetic Field Specifications on page 22](#).
10. The minimum service area shown must be kept clear of permanent or installed cabinetry, the MRU, the penetration closet, millwork, shelving, coil storage fixtures, furniture, and so on.

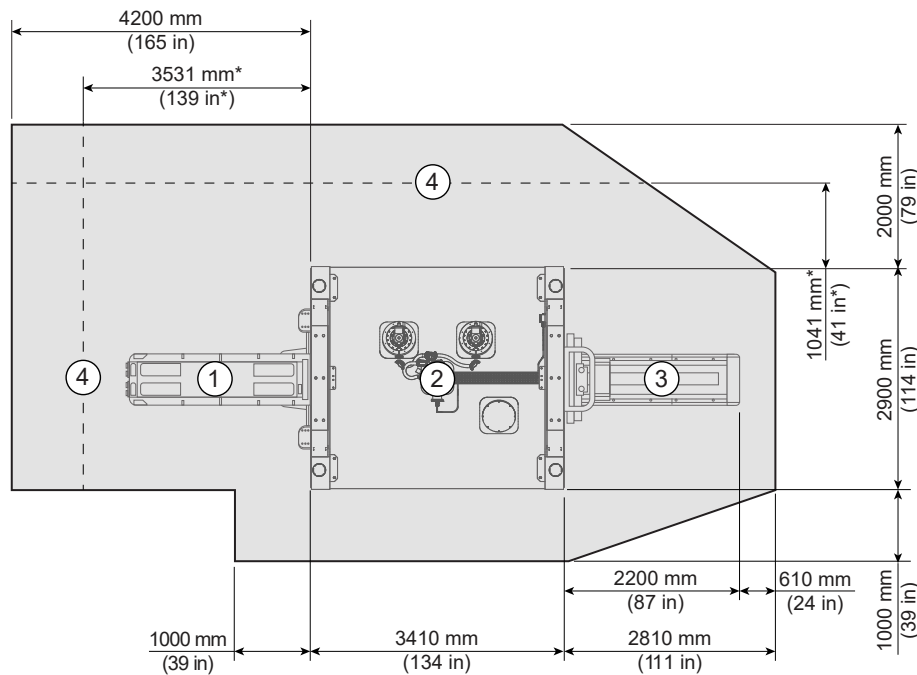
**Table 2-1 Room Dimensions to Satisfy Minimum Service Area Requirements**

Configuration	Equipment Room <sup>1</sup>			Magnet Room <sup>2</sup>			Control Room		Total System Area m <sup>2</sup> (ft <sup>2</sup> )
	W x D mm (in.)	Area m <sup>2</sup> (ft <sup>2</sup> )	Ceiling Height mm (in.)	W x D mm (in.)	Area m <sup>2</sup> (ft <sup>2</sup> )	Finished Ceiling Height mm (in.)	W x D mm (in.)	Area m <sup>2</sup> (ft <sup>2</sup> )	
Minimum Room Size (with <b>Normal</b> service clearance)	4722 x 2807 (185.9 x 110.5)	12.53 (134.8)	2680 (105.5)	5900 x 10420 (232.3 x 410.2)	55 (592)	4000 (157.5) (Finished ceiling height to recessed floor)	1524 x 2134 (60 x 84)	3.2 (35)	70.8 (761.6)

**Table 2-1 Room Dimensions to Satisfy Minimum Service Area Requirements (Table continued)**

Configuration	Equipment Room <sup>1</sup>			Magnet Room <sup>2</sup>			Control Room		Total System Area m <sup>2</sup> (ft <sup>2</sup> )
	W x D mm (in.)	Area m <sup>2</sup> (ft <sup>2</sup> )	Ceiling Height mm (in.)	W x D mm (in.)	Area m <sup>2</sup> (ft <sup>2</sup> )	Finished Ceiling Height mm (in.)	W x D mm (in.)	Area m <sup>2</sup> (ft <sup>2</sup> )	
Minimum Room Size (with <b>Special</b> service clearance)	4722 x 2807 (185.9 x 110.5)	12.53 (134.8)	2680 (105.5)	4941 x 9751 (194.5 x 383.9)	44 (473)	3700 (145.7) (Finished ceiling height to recessed floor)	1524 x 2134 (60 x 84)	3.2 (35)	59.8 (642.9)
<b>Note:</b>									
<sup>1</sup> See <a href="#">Figure 4-1 Typical Minimum Equipment Room with Service Clearances</a> on page 77 for specific dimensions									
<sup>2</sup> See <a href="#">Figure 2-2 Minimum Magnet Service Area (Top View)</a> on page 18 for specific dimensions									

**Figure 2-2 Minimum Magnet Service Area (Top View)**



Item	Description	Item	Description
1	Patient Table	3	Rear Pedestal
2	Magnet	4	Special provision dimension

\* If special service clearance is required, engineering must be notified. Engineering will provide a special service provision.



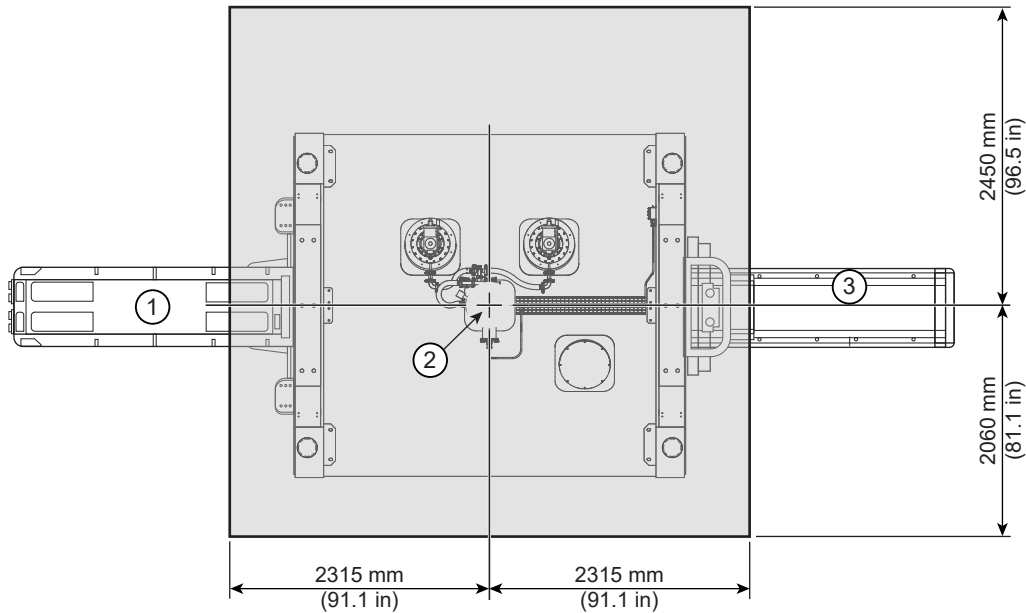
**NOTE**

The shaded area indicates minimum service area. The area inside of the dotted lines indicates special minimum service area.

The following requirements apply to the Magnet Room finished ceiling:

1. Minimum Magnet Room suspended ceiling height is 4000 mm (157.5 in.) to the recessed floor, where the magnet is mounted on. If ceiling height needs to be lower than 4000 mm, the engineering team must be notified so that provisions can be made for the installation. The absolute minimum ceiling height is 3700 mm (145.7 in.). See [Figure 2-3 Area for Minimum Magnet Ceiling Height \(Top View\)](#) on page 19.
2. The ceiling service area should be kept clear of overhead items, including soffits, HVAC, plumbing components, and brackets. Permanent or installed objects in this area may prevent or delay magnet service or operation.

**Figure 2-3 Area for Minimum Magnet Ceiling Height (Top View)**



Item	Description	Item	Description
1	Patient Table	3	Rear Pedestal
2	Magnet Isocenter	-	-



**NOTE**

The shaded area within solid lines indicates floor to ceiling minimum height of 4000 mm (157.5 in).

## 2.4 MR System Seismic Requirements



Contact the Project Manager of Installation with any questions.

1. The customer is responsible for seismic anchoring of GE HealthCare components.
2. Center of gravity, weight, physical dimensions, and attachment points are provided for seismic calculations. Refer to the specifications or illustrations for each component (see [Magnet](#)

[Room Equipment Specifications on page 72](#), [Equipment Room on page 76](#), and [Control Room on page 95](#) ).

## 2.5 Structure-borne Vibration Control Specifications



Structure-borne acoustic issues tend to occur at MR installations above the ground floor of the facility. If required, the customer should consult an acoustic engineer for a solution to attenuate this transmitted vibration.

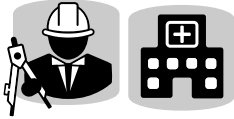
### Low Frequency Magnet Floor Vibration Notes:



#### NOTE

1. Vibration transfer may be the result of customer specific building construction as low levels of vibration transmit into the building through airborne and structure-borne paths. Customer MR clinicians recognize the vibration is typically short bursts repeated multiple times as the scan progresses.
2. The customer should consider the impact of this vibration for the evaluation and design solution.

## 2.6 MR Suite Magnetic Field Specifications



(Applies to all subsections within this section)

### 2.6.1 Magnetic Fringe Field

The following illustrations show the isogauss plot lines for the Tesla 7T900 actively shielded magnet. This information must be used to evaluate potential site interaction of GE HealthCare equipment with other non-GE HealthCare equipment, interaction with ferrous materials on the site, and to locate personnel and equipment within the site.

The 0.5 mT (5G) line can expand to 9.0 m (29.5 ft.) axially and 6.5 m (21.3 ft.) radially for up to 60 seconds in the rare event of a quench.

The isogauss plots show an idealized magnetic field relative to magnet isocenter. The actual field strength can be affected by any of the following:

- Magnetic shielding
- Earth's magnetic field
- Other magnetic fields
- Stationary or moving metal

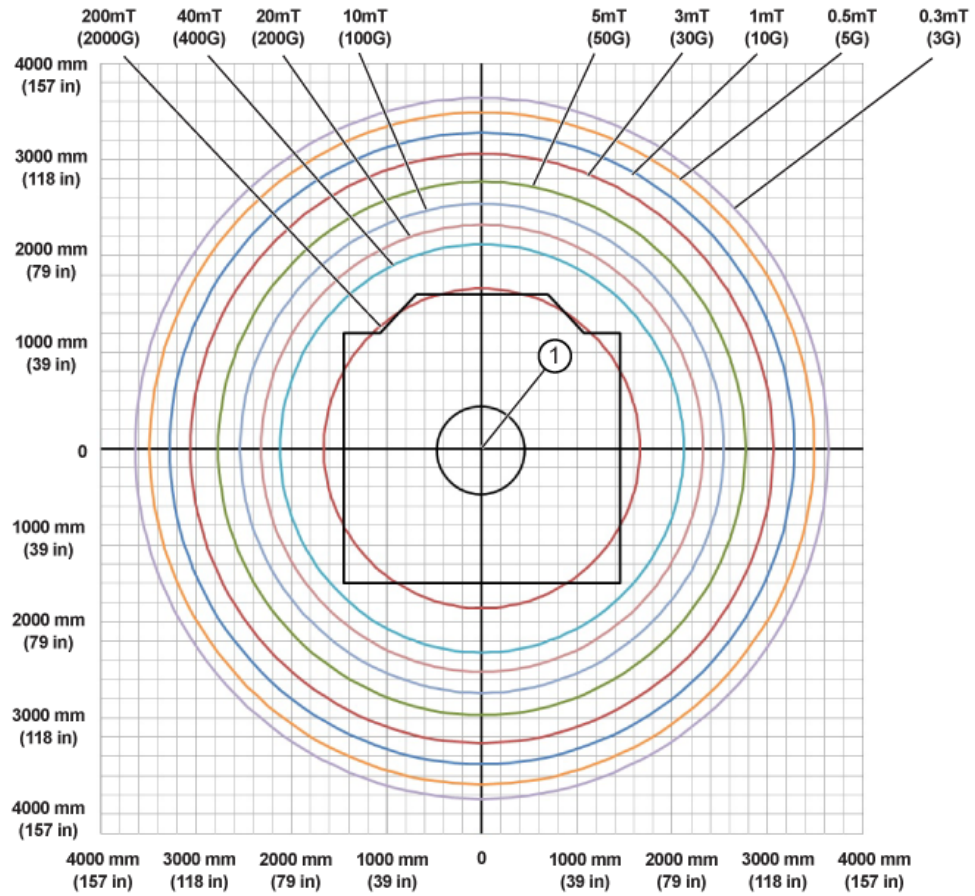
For sites to be upgraded to SIGNA 7T platform, the existing magnet will be used. The isogauss plots of the existing magnet is contained in the site specific construction drawings. This information must be used to evaluate magnetic fringe field impact. Customer should contact GE HealthCare PMI or Engineering team if the construction drawings are unavailable on site.



#### **NOTE**

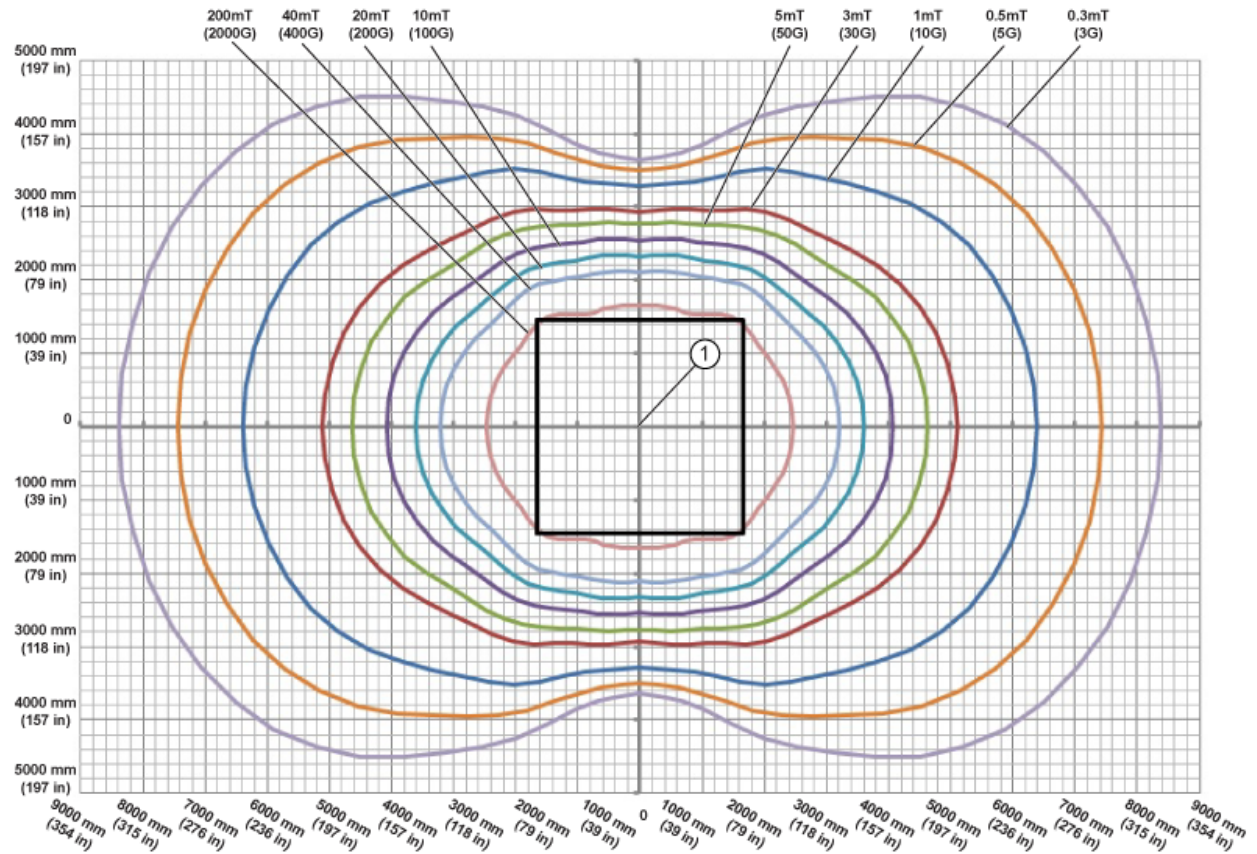
Drawings and design data of existing GE HealthCare 7T installed based are stored in GE HealthCare siting design center.

**Figure 2-4 Magnetic Fringe Field Front View**



Item	Description
1	Magnet isocenter

**Figure 2-5 Magnetic Fringe Field - Top and Side Views of Field Contours**

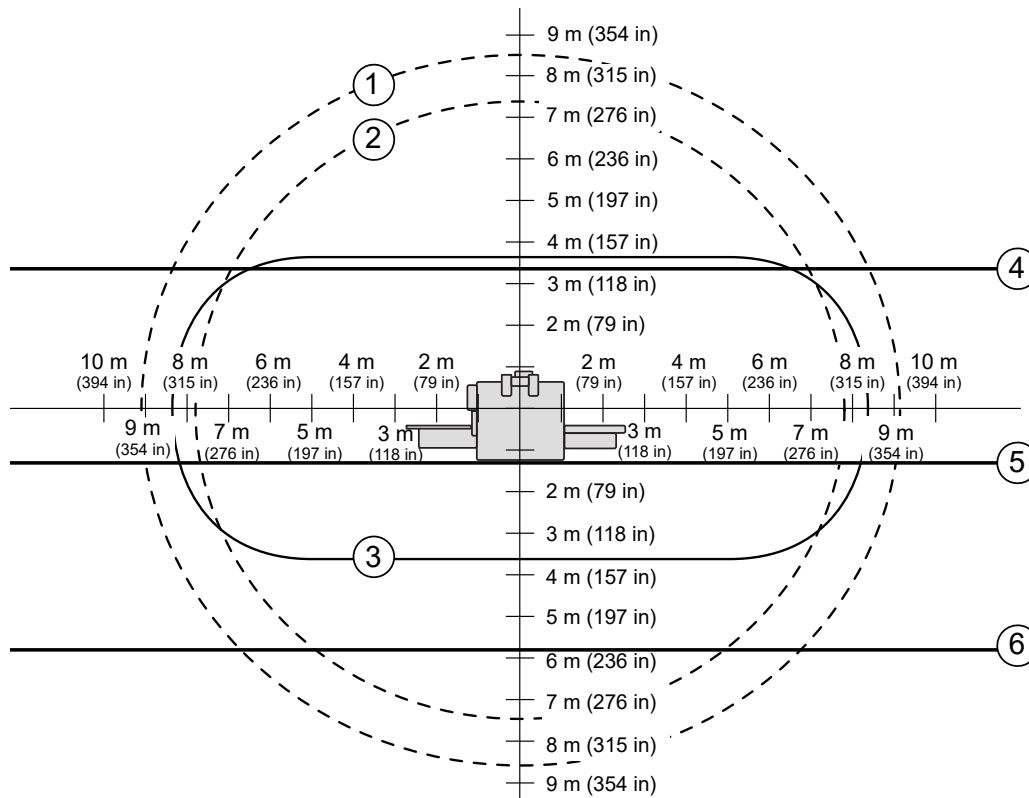


Item	Description
1	Magnet isocenter

## 2.6.2 Interference from Changing Magnetic Fields

Metal objects moving within the magnet sensitivity lines can produce a field disturbance during clinical imaging. If the metal object is moving it will produce a fluctuating dipole type of field which causes image artifacts. As an example, a car driven inside the moving metal line will act as a dipole and produce a time varying field which changes the magnet's main field during the scanning. The same vehicle may park within the moving metal line and remain parked during clinical scanning without impact to the main field.

**Figure 2-6 Magnet Moving Metal Sensitivity Line Plot (Side View)**



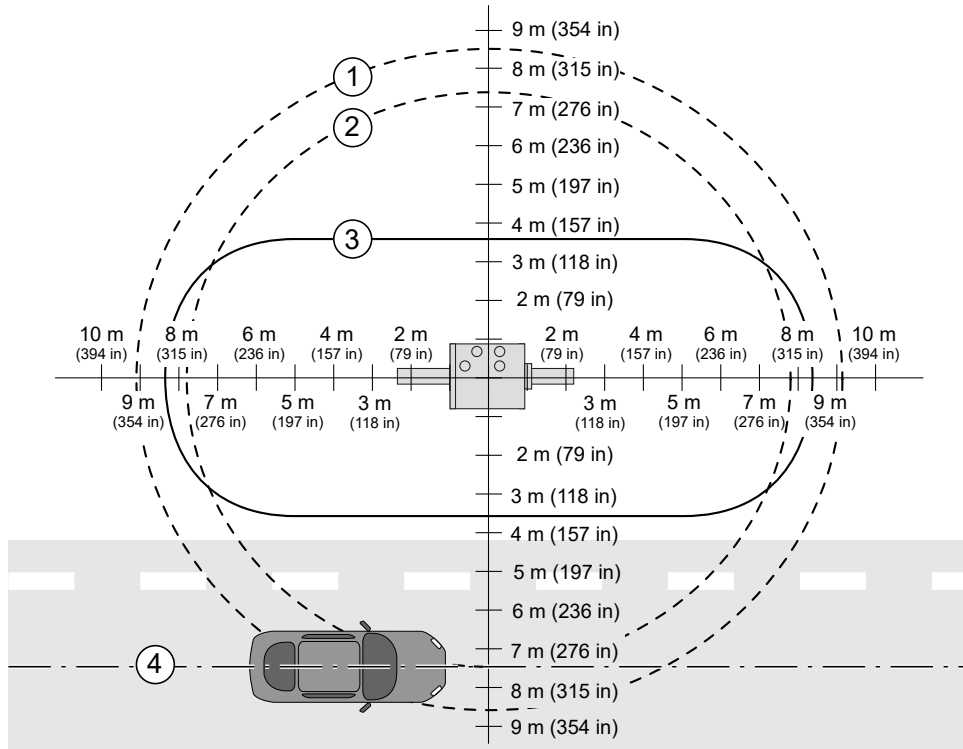
Item	Description	Item	Description
1	Trucks, Buses	4	Floor Above
2	Cars, Pickups, Vans, Ambulances	5	Magnet Room Floor
3	3 Gauss line	6	Floor Below



**NOTE**

The magnet isocenter, which is 1400 mm (55 in.) above the recessed floor, is the origin of both the x-axis and the y-axis.

**Figure 2-7 Magnet Moving Metal Sensitivity Line Plot (Top View)**



Item	Description	Item	Description
1	Trucks, Buses	3	3 Gauss line
2	Cars, Pickups, Vans, Ambulances	4	Center of Driving Lane

**Table 2-2 Magnet Moving Metal Requirements**

Metal Objects Category	Definition Of Distance Location	Magnet Minimum Distance Radial X Axial <sup>1</sup> m (ft.)
Objects 45.36 - 181.44 kg (100 - 400 lb.)	Distance from isocenter radial x axial	0.3 mT (3 G) line
Cars, Minivans, Vans, Pickup Trucks, Ambulances	Distance from isocenter measured to center of driving or parking lane radial x axial	7.31 x 7.80 (23.98 x 25.6) See Note 2 below
Bus, Trucks (Utility, Dump, Semi)	Distance from isocenter measured to center of driving or parking lane radial x axial	8.54 x 9.11 (28.0 x 29.9)
Objects > 181.44 kg (400 lb.), Elevators, Trains, Subways	Place a directional probe (for example, flux gate sensor) at isocenter of proposed magnet location aligned along the Z-axis. Measure peak-to-peak magnetic field change (DC).	Z-axis EMI disturbances must not exceed 522 nanotesla (5.22 milligauss) peak-to-peak.

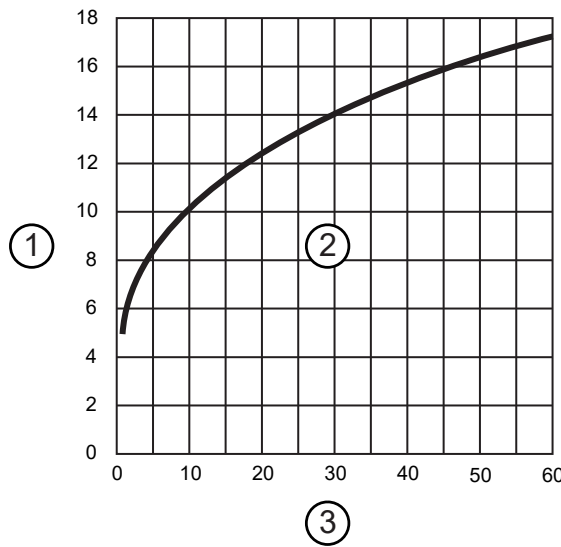
**Table 2-2 Magnet Moving Metal Requirements** (Table continued)

Metal Objects Category	Definition Of Distance Location	Magnet Minimum Distance Radial X Axial <sup>1</sup> m (ft.)
<p><b>Notes:</b></p> <ol style="list-style-type: none"> <li>1. Radial distances are magnet X and Y axis. Axial distances are magnet Z axis.</li> <li>2. Since the 3 gauss line will vary depending on the use of magnetic shielding, the sensitivity area for cars, pickups, vans, and ambulances is the area shown by Line 2, or the 3 gauss line (as indicated in <a href="#">Figure 2-6 Magnet Moving Metal Sensitivity Line Plot (Side View)</a> on page 25 and <a href="#">Figure 2-7 Magnet Moving Metal Sensitivity Line Plot (Top View)</a> on page 26), whichever is furthest from the magnet in any direction.</li> </ol>		

## 2.6.3 Electrical Current

1. Electrical current in high voltage power lines, transformers, motors, or generators near the magnet may affect magnetic field homogeneity.
2. Magnetic field interference at 50 or 60 Hz must not exceed 1.695  $\mu\text{T}$  (16.95 mG) or 1.790  $\mu\text{T}$  (17.90 mG) RMS respectively at the magnet location (see [Figure 2-8 Magnet Allowable Milligauss vs. Line Frequency for AC Equipment on page 28](#)).
3. The following equation can be used as a general guide in determining allowable current in feeder lines at a given distance from the magnet isocenter:
  - 3.1. For 7T Magnet:  $I = (8.95X^2)/S$ , where:
    - 3.2. I = Maximum allowable RMS single phase current (in amps) or maximum allowable RMS line current (in amps) in three phase feeder lines
    - 3.3. S = Separation (in meters) between single phase conductors or greatest separation between three phase conductors
    - 3.4. X = Minimum distance (in meters) from the feeder lines to isocenter of the magnet

**Figure 2-8 Magnet Allowable Milligauss vs. Line Frequency for AC Equipment**



Item	Description	Item	Description
1	Milligauss	3	Excitation Frequency (Hz)
2	No Impact on Imaging		

Refer to [Sample Calculation AC Power Equipment Minimum Distance on page 126](#) for additional examples.

## 2.6.4 Non-MR System Equipment Sensitivity to Magnetic Fields

Site plans must include consideration for magnetic field interaction with all customer equipment.

This section lists equipment known to be sensitive to high magnetic fields.

Use the table for reference only. The Tesla (Gauss) limits in the table are approximate for that type of equipment. Refer to OEM manuals for the equipment at your site to determine the actual Tesla (Gauss) limits.

**Table 2-3 Magnetic Proximity Limits (For Reference Only)**

<b>mT (Gauss) Limit</b>	<b>Equipment</b>	
0.05mT (0.5 G)	Nuclear camera	
0.1mT (1 G)	Positron Emission Tomography scanner	Video display (tube)
	Linear Accelerator	CT scanner
	Cyclotrons	Ultrasound
	Accurate measuring scale	Lithotripter
	Analog image intensifiers	Electron microscope
	Bone Densitometers	
0.3mT (3 G)	Power transformers	Main electrical distribution transformers
0.5mT (5 G)	Cardiac pacemakers	Biostimulation devices
	Neurostimulators	
1mT (10 G)	Magnetic computer media	Telephone switching stations
	Hard copy imagers	Water cooling equipment
	Line printers	HVAC equipment
	Video Cassette Recorder (VCR)	Major mechanical equipment room
	Film processor	Credit cards, watches, and clocks
	X-ray tubes	
	Large steel equipment, including:	
	Emergency generators	Air conditioning equipment
	Commercial laundry equipment	Fuel storage tanks
	Food preparation area	Motors greater than 5 horsepower
5mT (50 G)	Metal detector for screening	Telephones
	LCD panels	
No Limit	Digital Detectors	

## 2.7 Multiple MR System Requirements



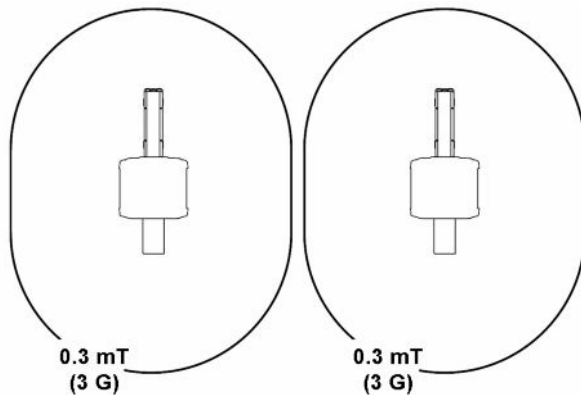
(Applies to all subsections within this section)

### 2.7.1 Multiple Magnets

When installing multiple magnets, the 0.3 mT (3 G) lines must not intersect or the magnets will be interactive. Contact the GE HealthCare Project Manager of Installation (PMI) for any questions regarding magnetic field interaction.

Magnet Rooms cannot share walls.

**Figure 2-9 Two Magnet Installation (No Interaction)**

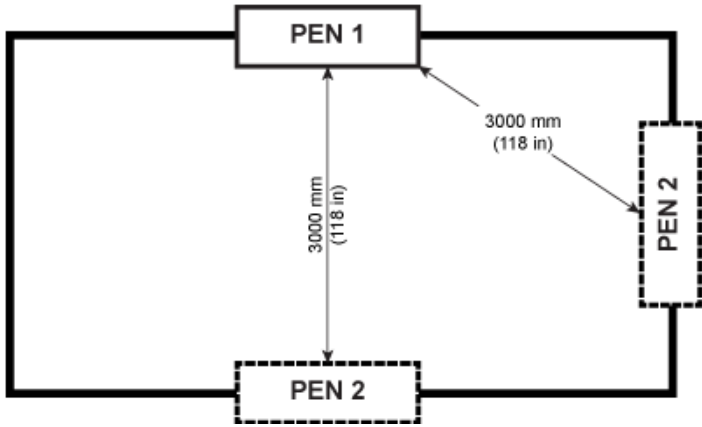


### 2.7.2 Shared Equipment Rooms

When installing multiple MR Systems in a shared Equipment Room, of the same field strength, the following conditions must be met:

1. The penetration panel of the other system must be separated from the penetration wall of the ISC by at least 3000 mm (118 in.).
2. Cables from different MR Systems must not be routed together.
3. Two systems cannot share common power or ground feeds.

**Figure 2-10 Panel Separations in Shared Equipment Room (Top View)**



## 2.8 MR Suite Temperature and Humidity



(Applies to all subsections within this section)

This section provides temperature and humidity requirements for the MR suite.



**NOTE**

Make sure the HVAC system has the correct capacity for the room size, equipment heat output, and environmental conditions to maintain correct temperature and humidity for the protection of the patient.

Specific construction requirements for each room can be found in the following chapters:

- Magnet Room
- Equipment Room
- Control Room

### 2.8.1 Temperature and Humidity Requirements

1. The customer is responsible for HVAC system design, purchase, and installation.
2. The temperature and humidity requirements must not be exceeded at any point during the day (both working or non-working hours).
3. A separate thermostat must be provided for the Magnet Room.

**Table 2-4 Room Temperature and Humidity Requirements**

Room	Temperature		Humidity	
	Range °C (°F)	Change °C/Hr (°F/Hr) <sup>1</sup>	Range %RH	Change %RH/Hr <sup>2</sup>
Equipment Room (at Inlet to Equipment)	15-32 (59-89.6) <sup>3</sup>	3 (5)	30-75	5
Magnet Room	15-21 (59-69.8)	3 (5)	30-60	5
Operator Room	15-32 (59-89.6)	3 (5)	30-75	5
<b>Notes:</b>				
1. Operating temperature gradient limits shall be between -3°C/Hr (-5°F/Hr) and 3°C/Hr (5°F/Hr), when averaged over 1 hour.				
2. Operating humidity gradient limits shall be between -5% RH/hour and 5% RH/hour, when averaged over 1 hour.				
3. Maximum ambient temperature is derated by 1°C per 175 m above 950 m (not to exceed 2600 m).				

## 2.8.2 Equipment Heat Output Specifications

This section details the heat output for specific components. These heat outputs define the minimum, maximum and an assumed average condition over a 12-hour period. Actual heat output and room temperature may vary due to environmental factors, room insulation, clinical usage, and any non-GE HealthCare equipment used in the MR suite. Also, due to large variations in heat loads, the HVAC system may require unloaders, hot gas bypass, and reheat to maintain humidity levels.

**Table 2-5 System Heat Output for Air Cooling**

Component	Magnet Room W (BTU/hr)			Equipment Room W (BTU/hr)			Control Room W (BTU/hr)		
	Maximum	Average	Idle	Maximum	Average	Idle	Maximum	Average	Idle
Magnet (MAG) and Patient Transport Table (PT)	2720 (9289)	1650 (5627)	561 (1913)						
Penetration Panel (PP)	0	0	0	0	0	0			
Secondary Penetration Wall (SPW)	300 (1023)	150 (512)	0	300 (1023)	150 (512)	0			
Main Disconnect Panel (MDP)				285 (972)	132 (450)	132 (450)			
Integrated System Cabinet (ISC)				11500 (39215)	5500 (18755)	2950 (10060)			
Integrated Cooling Cabinet (ICC)				1000 (3410)	600 (2046)	250 (853)			
Cryocooler Compressor (CRY)				500 (1706) x2	500 (1706) x2	500 (1706) x2			
Magnet Monitor (MON)				60 (205) x2	60 (205) x2	60 (205) x2			
RF Cabinet				6200 (21156)	1000 (3413)	1000 (3413)			
HOS Cabinet				1624 (5541)	612 (2088)	612 (2088)			
Operator Workspace equipment (OW)							1450 (4945)	1450 (4945)	1450 (4945)

## 2.9 Facility Coolant Requirements



(Applies to all subsections within this section)



### IMPORTANT

Equipment Failure. A continuous supply of facility liquid coolant is required at all times for correct system operation. Failure to provide liquid coolant with the requirements listed in this section may cause equipment failure.

The facility must provide a coolant source for the Integrated Cooling Cabinet (ICC), and each of the two Cryocooler Compressors. This can be achieved with a single coolant source or multiple sources, provided the requirements in [2.9.1 Integrated Cooling Cabinet \(ICC\) Coolant Requirements on page 34](#) and [2.9.2 Cryocooler Compressor Coolant Requirements on page 38](#) are met. The total cooling capacity required is 94.6 kW.

### 2.9.1 Integrated Cooling Cabinet (ICC) Coolant Requirements

1. The facility must provide pipe/hose, filter, and connectors to the ICC.
2. The vertical distance between the coolant connection points of the ICC and the Gradient Coil must be less than  $\pm 5$  meters ( $\pm 196.8$  in.).
3. The customer must provide and install an in-line flow meter on either the supply or return facility coolant hose. The flow meter must be capable of visually displaying volumetric flow between 76 and 189 L/min (20 and 50 GPM) and configured for the properties of the cooling fluid in use within the ICC coolant circuit.

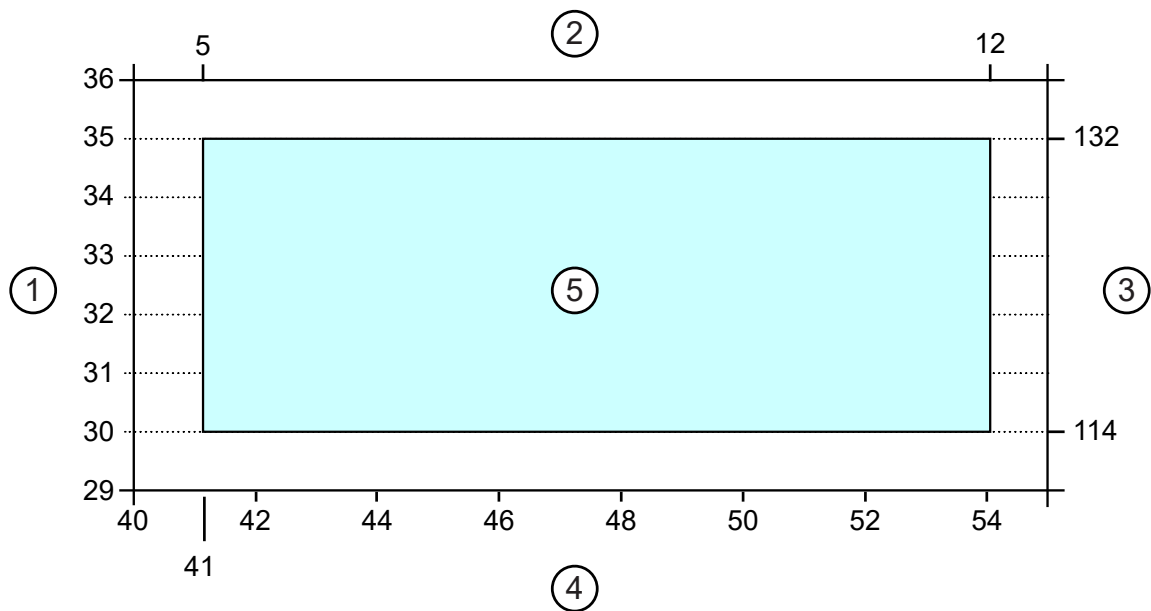
**Table 2-6 Facility Liquid Coolant Requirements for the ICC**

Parameter	Requirements
Availability	Continuous
Antifreeze or treated process water	No more than 50% propylene glycol-water (PGW) or ethylene glycol-water (EGW)
Minimum Flow	114 L/min (30 GPM)
Maximum Flow	132 L/min (35 GPM)
Maximum Pressure Drop in ICC at Minimum Flow	2.7 bar (39.5 psi) with 50% propylene glycol-water; 1060 kg/m <sup>3</sup> density 2.2 bar (31.6 psi) with pure water; 994 kg/m <sup>3</sup> density
Maximum Pressure Drop in ICC at Maximum Flow	3.7 bar (53.4 psi) with 50% propylene glycol-water; 1060 kg/m <sup>3</sup> density 2.9 bar (42.7 psi) with pure water; 994 kg/m <sup>3</sup> density
Temperature rise at Minimum Flow	11.7°C (21.1°F) with 50% propylene glycol-water; 3346 J/(kg K) specific heat; 1060 kg/m <sup>3</sup> density; 79 kW heat
Temperature rise at Maximum Flow	10.1°C (18.2°F) with 50% propylene glycol-water; 3346 J/(kg K) specific heat; 1060 kg/m <sup>3</sup> density; 79 kW heat
Maximum Inlet Pressure to ICC	6 bar (87 psi)
Chiller Size	79 kW

**Table 2-6 Facility Liquid Coolant Requirements for the ICC (Table continued)**

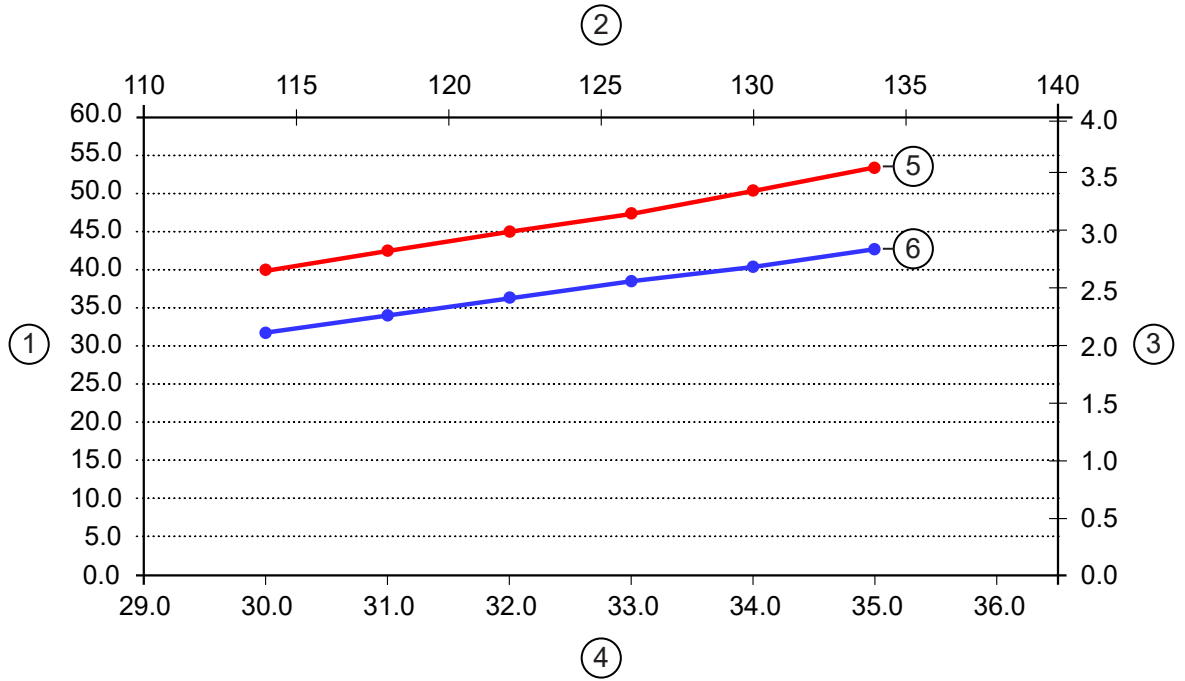
Parameter	Requirements
Condensation Protection	Facility Plumbing to the ICC must be properly routed and insulated to prevent equipment damage or safety hazards
Minimum Continuous Heat Load	1 kW in stand-by state 0 kW in off mode state
Inlet Temperature	5 to 12°C (41 to 54°F) measured at the inlet to the ICC
Customer supplied feeder hose (from main water supply to ICC)	38.1 mm (1.5 in.) minimum hose inside diameter
Hose connections to the ICC	38.1 mm (1.5 in.) male NPT

**Figure 2-11 Allowable Facility Water Temperature and Flow**



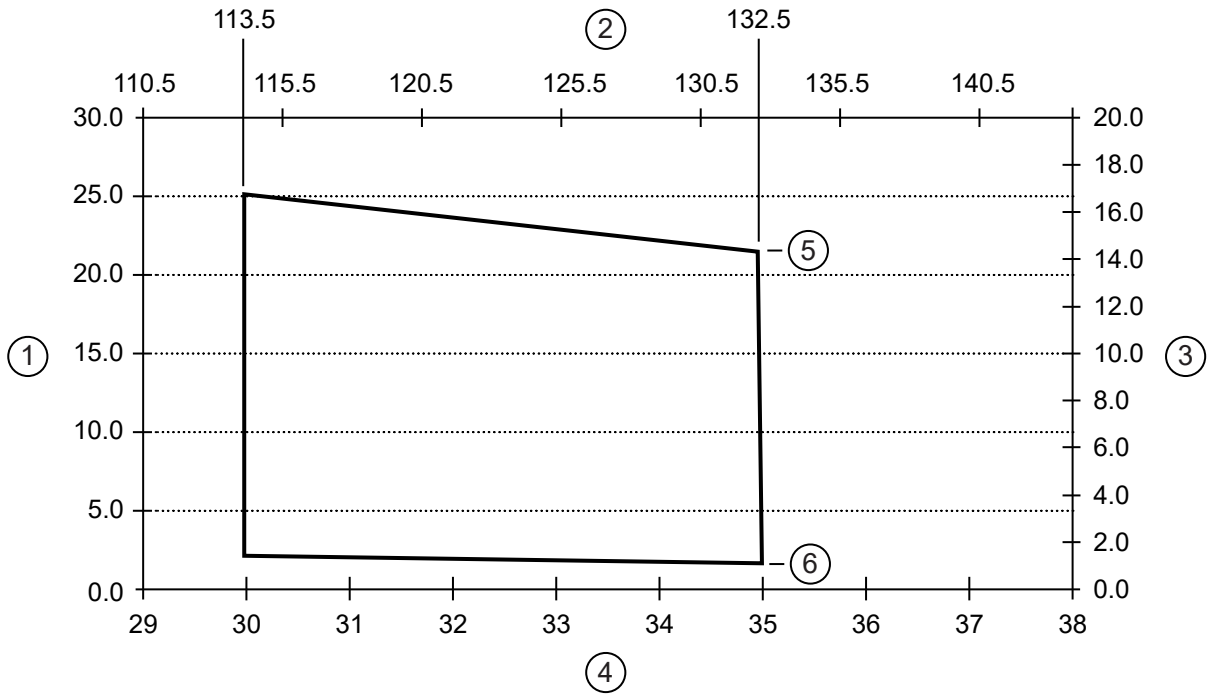
Item	Description	Item	Description
1	Flow [gpm]	4	Temperature [°F]
2	Temperature [°C]	5	0-50% Propylene or Ethylene Glycol
3	Flow [L/min]		

**Figure 2-12 Pressure Drop through ICC**



Item	Description	Item	Description
1	Pressure [psig]	4	Flowrate [gpm]
2	Flowrate [L/min]	5	50% PGW, 1060 kg/m <sup>3</sup>
3	Pressure [bar]	6	Water

**Figure 2-13 Temperature Rise through ICC (50% PGW, 3346 J/kg-K, 1060 kg/m<sup>3</sup>)**



Item	Description	Item	Description
1	Temperature Rise [°F]	4	Flowrate [gpm]
2	Flowrate [L/min]	5	Max Heat Load: 94kW
3	Temperature Rise [°C]	6	Min Heat Load: 7.5kW

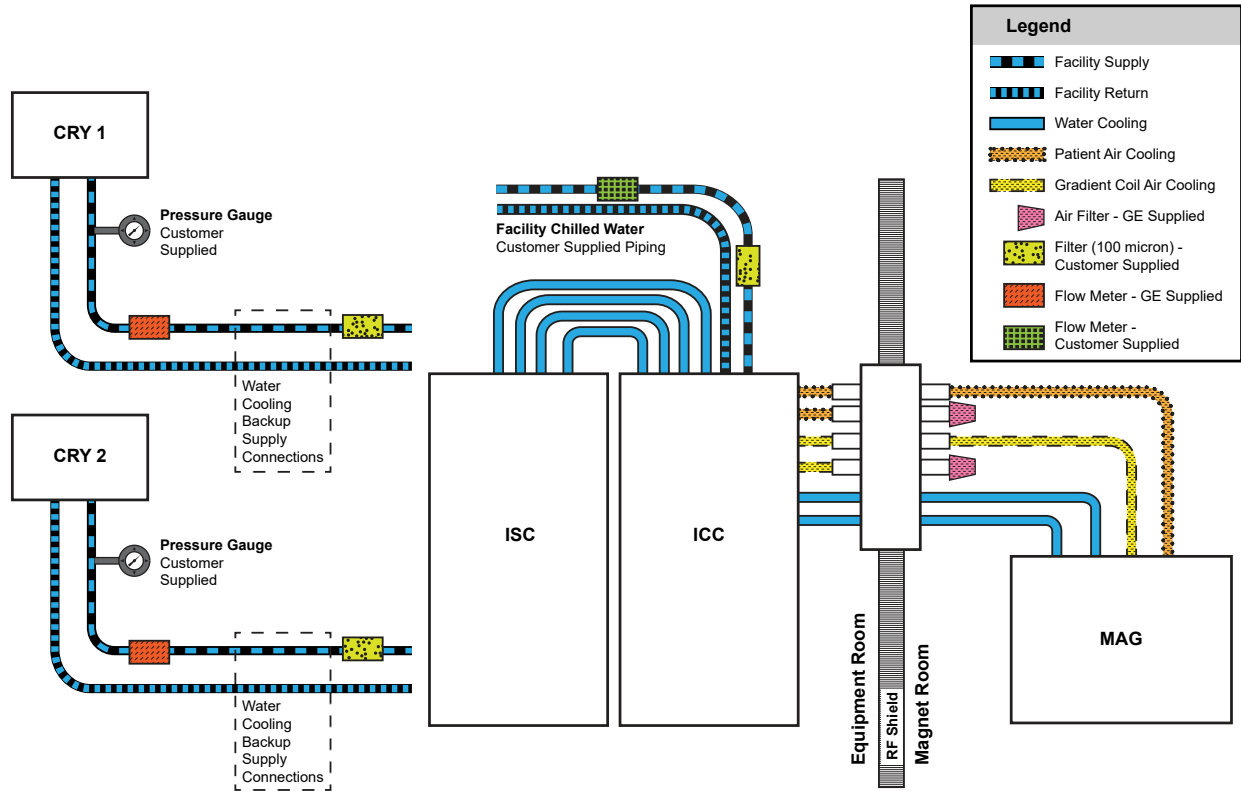
**Table 2-7 Facility Water Quality Requirements**

Parameter	Requirement
pH Value	6.5 to 8.2 at 25 °C (77 °F)
Electrical Conductivity	< 0.8 mmho/cm
Chloride Ion	< 200 ppm
Sulfate Ion	< 200 ppm
M-Alkalinity	< 100 ppm
Total Hardness	< 200 ppm
Calcium Hardness	< 150 ppm
Ionic Silica	< 50 ppm
Iron	< 1.0 ppm
Copper	< 0.3 ppm
Sulfide Ion	None, not detectable
Ammonium Ion	< 1.0 ppm
Residual Chlorine	< 0.3 ppm
Free Carbon Dioxide	< 4.0 ppm

**Table 2-7 Facility Water Quality Requirements** (Table continued)

Parameter	Requirement
Stability Index	6.0 to 7.0
Suspended Matter	< 10 ppm
Particle Size	< 100 micron (with field changeable filter)

**Figure 2-14 MR System Water Cooling Block Diagram**



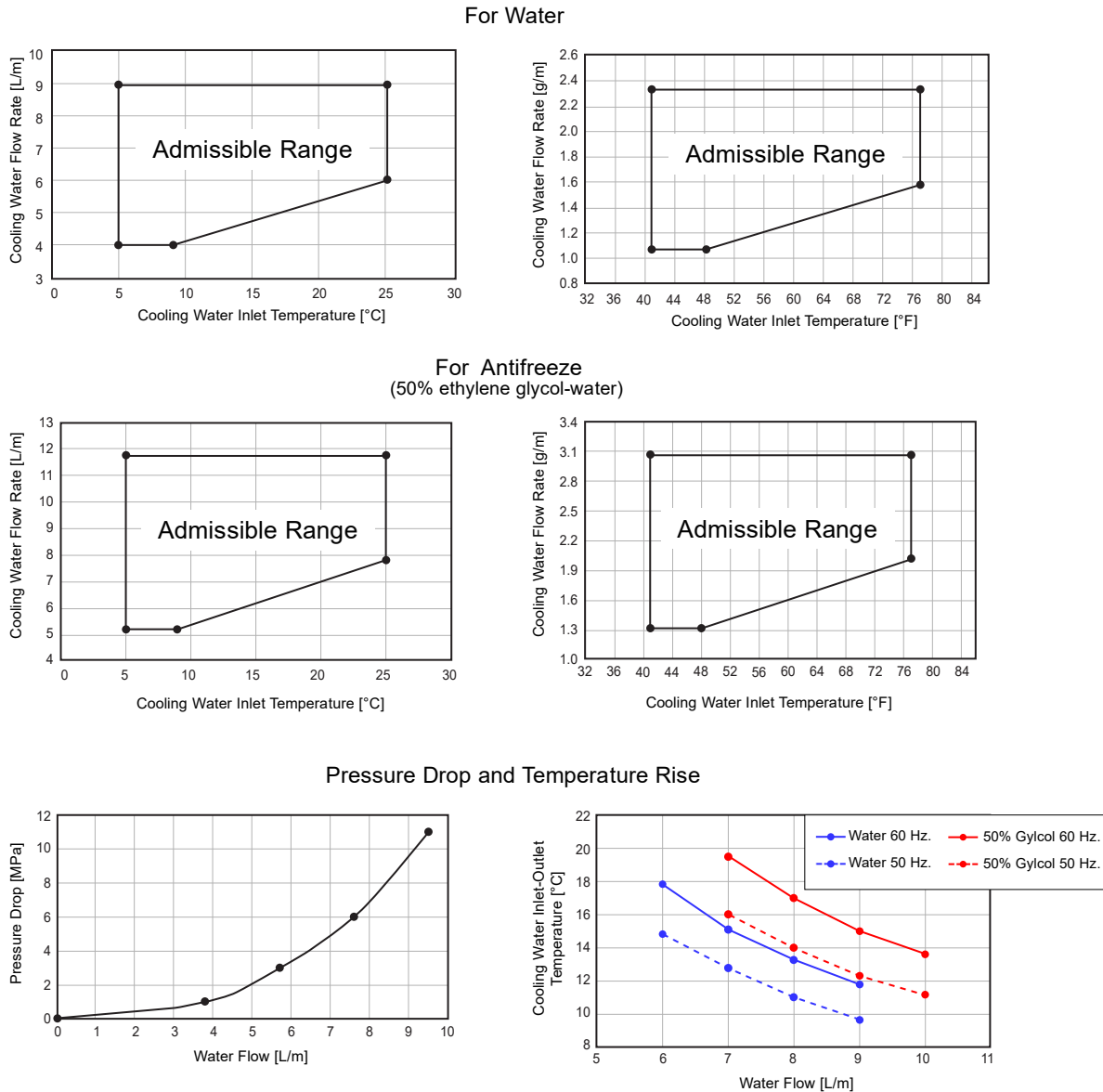
## 2.9.2 Cryocooler Compressor Coolant Requirements

1. The facility is responsible for coolant, pipe/hose, filters, and connectors to supply the coolant to the Cryocooler Compressors.
2. The customer must provide and install a pressure gauge at the supply (or supplies) to the Cryocooler Compressors. GE HealthCare provides in-line flow meters, which the customer must install on the supply coolant hose, as shown in [Figure 2-14 MR System Water Cooling Block Diagram on page 38](#).
3. The facility must provide an uninterrupted supply of liquid coolant to the Cryocooler Compressors.
4. Coolant must meet water quality requirements listed in [Table 2-7 Facility Water Quality Requirements on page 37](#).

**Table 2-8 Facility Liquid Coolant Requirements for each Cryocooler Compressor**

Parameter	Requirements for <u>each</u> Cryocooler Compressor
Availability	Continuous
Antifreeze or treated process water	No more than 50% propylene glycol-water (PGW) or ethylene glycol-water (EGW)
Minimum Flow	7.8 L/min (2.1 GPM) with 50% ethylene glycol-water; 1064 kg/m <sup>3</sup> density 6 L/min (1.6 GPM) with pure water; 994 kg/m <sup>3</sup> density
Maximum Flow	11.7 L/min (3.1 GPM) with 50% ethylene glycol-water; 1064 kg/m <sup>3</sup> density 9 L/min (2.4 GPM) with pure water; 994 kg/m <sup>3</sup> density
Maximum Pressure Drop at 8 L/min (2.1 GPM) Flow	0.48 bar (7 psi)
Temperature rise at Minimum or Maximum Flow	<a href="#">Figure 2-15 Cryocooler Water Cooling Requirements on page 40</a>
Maximum Inlet Pressure	8 bar (116 psi)
Chiller Size	7.8 kW
Condensation Protection	Facility Plumbing to the Cryocooler Compressor(s) must be properly routed and insulated to prevent equipment damage or safety hazards
Heat Load (Continuous)	7.8 kW
Inlet Temperature	5 to 25°C (41 to 77°F)
Hose connections to the Cryocooler compressors (supply and return)	12.5 mm (0.5 in.) onto hose barb and clamp
Hose connections to the GE HealthCare supplied in-line flow meters	12.5 mm (0.5 in.) onto hose barb and clamp

**Figure 2-15 Cryocooler Water Cooling Requirements**



## 2.9.3 Requirements for Emergency Backup Facility Coolant (Optional)

The customer must balance the cost of cryogenics and local controls with the cost of emergency backup facility coolant. There are two options for emergency backup, either total System backup or Cryocooler Compressor backup.

The facility may provide an optional emergency backup coolant supply in one of the following configurations:

1. Total System backup:
  - 1.1. The facility is responsible for the connection of all hoses of a backup system.
  - 1.2. Coolant must meet all other coolant requirements listed in [2.9.1 Integrated Cooling Cabinet \(ICC\) Coolant Requirements on page 34](#).

2. Cryocooler Compressor backup only:  
Coolant may be routed directly to the Cryocooler compressors at the locations indicated in [Figure 2-14 MR System Water Cooling Block Diagram on page 38](#) with the following requirements:
  - 2.1. Coolant must meet all other coolant requirements listed in [2.9.2 Cryocooler Compressor Coolant Requirements on page 38](#).
  - 2.2. The facility is also responsible for coolant, 12.5 mm (0.5 in.) pipe/hose, and connectors to supply the coolant to each of the separate dedicated Cryocooler Compressor emergency supply feeds.

## 2.10 MR Suite Electrical Requirements



(Applies to all subsections within this section)

### 2.10.1 General Electrical Requirements

1. Customer is required to install a Main Disconnect Panel (MDP): See [2.10.2 GE HealthCare Supplied Main Disconnect Panel \(MDP\) Specifications for M7700MA and M7700MB on page 44.](#)
2. At least one remote Emergency Off push-button shall be installed in a location that is visible and accessible to the device operator (Control Room or Magnet Room). The push-button shall be normally closed and require operator action to release after activation (for example, twist and pull). GE HealthCare recommends installing two remote Emergency Off push buttons, installed in the Control Room and Magnet Room.
3. The facility must provide system power to the MDP.
4. All associated transformers and cables must be correctly sized for system power requirements.
5. The facility must provide cabling from the MDP to the two PDUs in the Integrated System Cabinet (ISC).
6. Runs E0009, E0009B, E3030 and M3030 are supplied by GE HealthCare. All other wiring shown in [Figure 2-16 GE HealthCare supplied Main Disconnect Panel \(MDP\) Setup for M7700MA and M7700MB on page 45](#) must be customer-supplied and installed. A customer-supplied substitute for E0009 and E0009B can be used if the supplied run is shorter than required.
7. All feeder circuits require dedicated ground wires.

**Table 2-9 Facility Power Requirements**

Component	Parameter	Requirements	
At Main Disconnect Panel (MDP)	Voltage / Frequency	480 VAC	60 ±3 Hz
		415 VAC	50 ±3 Hz, 60 ±3 Hz
		400 VAC	50 ±3 Hz, 60 ±3 Hz
		380 VAC	50 ±3 Hz, 60 ±3 Hz
	Daily Voltage Variation	Customer to provide +10% / -10% from nominal at MDP input under all line and load conditions. This includes variation of power source and transmission losses up to the MDP.	
Phase	Input power to the MDP may use one of the following configurations: <ul style="list-style-type: none"> <li>• A 3 phase solidly grounded WYE with Ground (3 Wire + Ground) A neutral conductor is not required for MR System operation. If a neutral conductor is present, it can be terminated on the neutral bus provided in the GE HealthCare-supplied MDP.</li> <li>• A 3 phase floating DELTA with Ground (3 Wire + Ground). Do not connect a corner grounded DELTA source.</li> </ul> Note: Some UPS options may require a neutral (refer to manufacturer documentation for requirements).		

**Table 2-9 Facility Power Requirements**

Component	Parameter	Requirements	
	Phase Balance	Difference between the highest phase line-to-line voltage and the lowest phase line-to-line voltage must not exceed 2%	
	Power Quality	Recommended THD-V of less than 2.5%	
	Facility Zero Voltage Reference Ground	<ul style="list-style-type: none"> <li>The facility ground for the MR System must originate at the system power source (that is, transformer or first access point of power into the facility) and be continuous to the MR System Main Disconnect Panel (MDP) in the room.</li> <li>Main facility ground conductor to Main Disconnect Panel (MDP) must be appropriately sized insulated copper wire.</li> <li>The main facility ground to the Main Disconnect Panel (MDP) must meet local codes.</li> </ul>	
	Power Availability	Continuous, facility power is required at all times for operation of the two Cryocoolers (CRY1 and CRY2) to minimize cryogen consumption.	
Service receptacle in Magnet Room	Voltage / Frequency	100-120 VAC 60 Hz (North America) 200-240 VAC 50/60 Hz (International)	Receptacle required for small power tools. Local voltage and portable transformers for voltage values.
	Phase	1	
	Maximum Current	20A (North America) 16A (International)	
Pneumatic Patient Alert	Voltage / Frequency	100-120 VAC 60 Hz (North America) 200-240 VAC 50/60 Hz (International)	The Control Box must be mounted within reach of the operator and within 1.5 m (5 ft.) of an electrical outlet.
	Phase	1	
	Maximum Current	20A (North America) 16A (International)	
Magnet Rundown Unit (MRU)	Voltage / Frequency	100-120 VAC 60 Hz (North America) 200-240 VAC 50/60 Hz (International)	Connection type: Hardwired or permanently wired directly to facility power, no plugs or connectors allowed. 25 mm (1 in.) PVC Schedule 40 Conduit recommended  Availability: Continuous  Circuit Breaker: Dedicated AC disconnect required for both live and neutral connections
	Phase	1	
	Maximum Current	1A	
Magnet Monitor (MON) x 2	Voltage / Frequency	100-120 VAC 60 Hz (North America) 200-240 VAC 50/60 Hz (International)	Power at the 2 outlets must be continuously available.
	Phase	1	
	Maximum Current	3A	
Oxygen Monitor (OXY)	Voltage / Frequency	100-120 VAC 60 Hz (North America) 200-240 VAC 50/60 Hz (International)	Connection type: Hardwired in unit

**Table 2-9 Facility Power Requirements** (Table continued)

Component	Parameter	Requirements	
	Phase	1	
	Maximum Current	0.9A	

**Table 2-10 System Power Demand**

Equipment	Power Draw (kVA)
Cryocooler Compressor Continuous Power	18 (2 compressors)
Total System 50 Millisecond Power	291
Total System 15 minute Power	190
Total System Continuous Power	153

## 2.10.2 GE HealthCare Supplied Main Disconnect Panel (MDP) Specifications for M7700MA and M7700MB

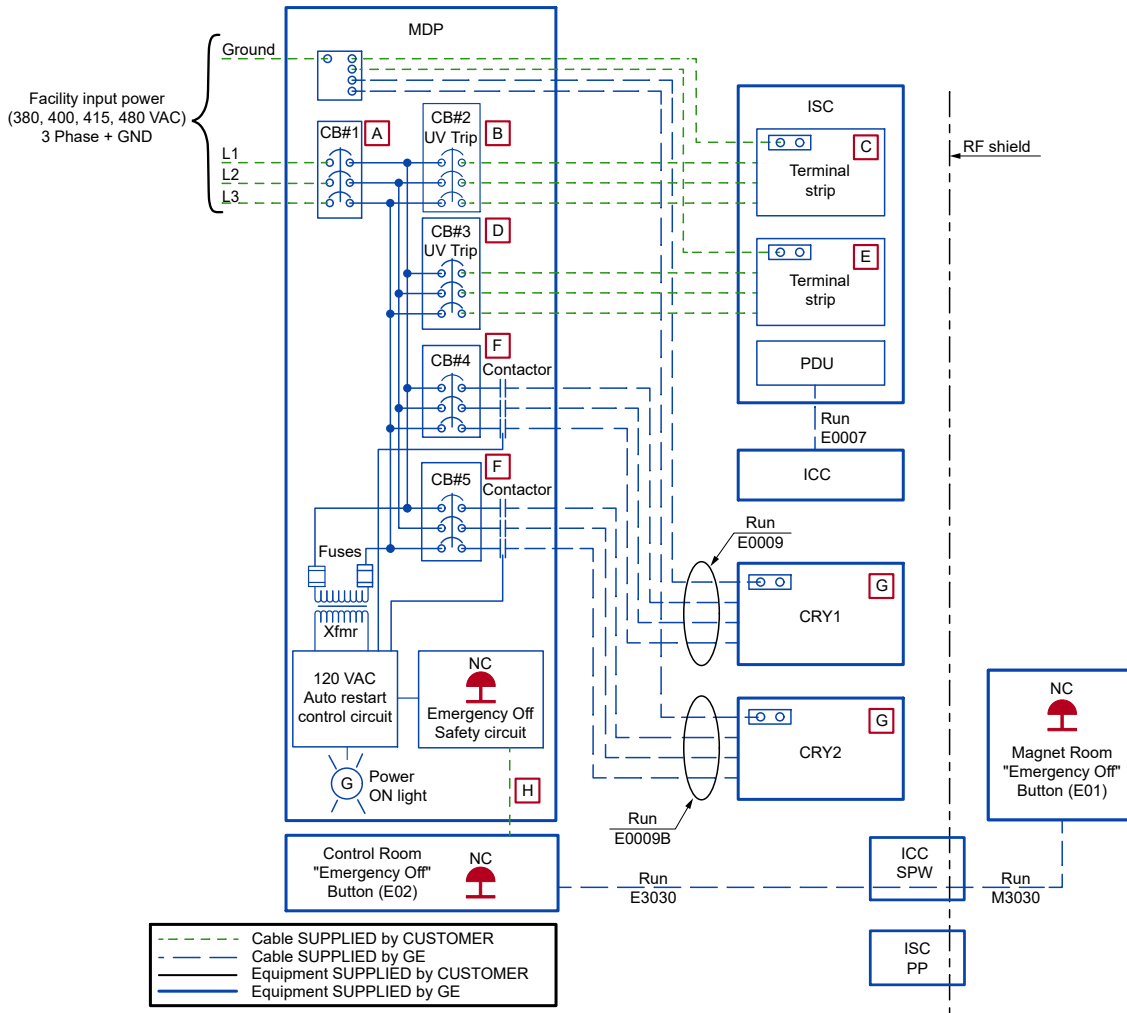
The customer is responsible for determining the suitability of the GE HealthCare supplied MDP with respect to governing electrical codes.

The GE HealthCare MDP consists of the following:

- A 3-pole main circuit breaker rated for the total current of all the sub-breaker circuits.
- A 3-pole circuit breaker rated for the current of the Gradient PDU circuit.
- A 3-pole circuit breaker rated for the current of the System PDU circuit.
- Two 3-pole circuit breakers rated for the current of the Cryocooler Compressor (CRY).
- All circuit breakers have a short circuit current interrupting rating of 25000 Amps at 480V (M7700MA) or 415V (M7700MB).
- Auto restart on the Cryocooler circuits following loss and restoration of power.
- Two remote Emergency Off Buttons to be installed external to the MDP. Emergency Off removes power from all outputs when activated. MDP supports maximum E-off cable length of 100 meters when remote EPO push buttons are installed in the field.
- Terminal blocks that can accept wire sizes for M7700MA are listed in [Table 2-12 GE HealthCare supplied MDP - Range of Standard Stranded Conductors Accepted for M7700MA on page 46](#).
- Terminal blocks that can accept wire sizes for M7700MB are listed in [Table 2-13 GE HealthCare supplied MDP - Range of Standard Stranded Conductors Accepted for M7700MB on page 46](#).
- Provision for terminating facility incoming neutral wire on the neutral terminal block.
- Multiple ground terminal blocks as required by panel design.
- GE HealthCare MDP M7700MA is listed and labeled by Nationally Recognized Testing Lab (NRTL) in accordance with UL 508A and bears UL mark. This MDP is certified as per “UL 508A” standard.
- GE HealthCare MDP M7700MB bears manufacturer’s CE mark and is certified as per “IEC 61439-2” standards.
- Power on indicator for main breaker output power.

- Two isolated, normally open contact pairs that open when e-OFF is pressed, or the included System On/Off selector switch is off, or facility power is interrupted for use with optional accessories.
- Capability for single point lock-out/tag-out for the entire system (Mains Disconnect / Input Breaker) and a means to lock-out/tag-out each output breaker independently. All LOTO points support a standard sized hasp for lock-out.

**Figure 2-16 GE HealthCare supplied Main Disconnect Panel (MDP) Setup for M7700MA and M7700MB**



**Table 2-11 GE HealthCare supplied MDP - Breaker Sizes for M7700MA and M7700MB**

Catalog Number	M7700MA	M7700MB
Description	MDP 480V 60Hz	MDP 380V, 400V, 415V, 50/60Hz with RCD
Mains Input Breaker, CB1	280A	340A
Gradient PDU Breaker, CB2	200A	250A
System PDU Breaker, CB3	60A	80A
Cryo Compressor #1 Breaker, CB4	25A	25A
Cryo Compressor #2 Breaker, CB5	25A	25A

The labeled connections shown in [Figure 2-16 GE HealthCare supplied Main Disconnect Panel \(MDP\) Setup for M7700MA and M7700MB on page 45](#) can accept the range of standard stranded conductors shown in the tables below. All wire types, color, and sizing are to be selected in accordance with governing electrical codes.

**Table 2-12 GE HealthCare supplied MDP - Range of Standard Stranded Conductors Accepted for M7700MA**

Item	Phase		Ground	
	sq mm	AWG/kcmil	sq mm	AWG/kcmil
A	(2) 70-240	(2) 2/0-500	(2) 35-240	(2) 2-500
B	6-120	10-250	16-150	6-300
C	16-120	6-250	16-185	6-350
D	2.5-50	14-1/0	16-150	6-300
E	6-35	10-2	4-35	12-2
F	2.5-10	14-8	2.5-6	14-10
G	2.5-6	14-10	2.5-6	14-10
H	0.34-6	22-10		

**Table 2-13 GE HealthCare supplied MDP - Range of Standard Stranded Conductors Accepted for M7700MB**

Item	Phase		Ground	
	sq mm	AWG/kcmil	sq mm	AWG/kcmil
A	(2) 70-240	(2) 2/0-500	(2) 35-240	(2) 2-500
B	25-150	4-300	16-150	6-300
C	16-120	6-250	16-185	6-350
D	2.5-50	14-1/0	16-150	6-300
E	6-35	10-2	4-35	12-2
F	2.5-10	14-8	2.5-6	14-10
G	2.5-6	14-10	2.5-6	14-10
H	0.34-6	22-10		

### 2.10.3 Emergency Power Backup Specifications (Optional)

The following facility backup power is recommended for continuous operation of the cryocooler compressors and Magnet Monitors:




**NOTE**

If the compressors must operate on emergency backup power, they still require chilled water defined in the [2.9.3 Requirements for Emergency Backup Facility Coolant \(Optional\) on page 40](#).

- Dedicated power supply to the two compressors.
- Magnet Monitor emergency power (110V / 220V, 3A) for each Magnet Monitor. Refer to [Magnet Monitor \(MON\) Requirements and Specifications on page 91](#).

- Emergency Off Circuit (E-Off) for the emergency backup to the compressors. LOTO is required for the power source between the generator and compressor.
- A transfer switch to remove the primary power source from the compressors when in emergency backup power mode.

**Table 2-14 Specifications for Emergency Power to Cryocooler Compressor (for each Compressor)**

Parameter	Requirements
Power Line Voltage	AC 380, 400, 415V ( $\pm 10\%$ ) / 50 Hz, 3 phase (3 Wire + Ground) AC 480V ( $\pm 10\%$ ) / 60 Hz, 3 phase (3 Wire + Ground) Commercial Power Source  <div style="text-align: center;"> <p><b>WARNING</b></p>  <p>Do not use an inverter for the main power source.</p> </div>
Operating Current	Max. 13A (Both 50 and 60 Hz)
Starting current	75A (Both 50 and 60 Hz)
Maximum Fuse or Circuit Breaker Size	30A
Power Requirement	Minimum 9 kVA
Power Consumption	Max. 9.0 kW / Steady State 7.8 kW at 60 Hz Max. 8.5 kW / Steady State 6.9 kW at 50 Hz

## 2.11 MR System Shipping and Receiving



(Applies to all subsections within this section)



### IMPORTANT

All shipping dimensions and weights are approximate and may vary based on ship-to location, required rigging, or other requirements. Some shipping or access routes may have requirements in addition to those listed in this section. Contact the GE HealthCare Project Manager of Installation (PMI) to verify magnet shipping, rigging, and access.

### 2.11.1 Receiving Requirements

1. The customer must provide an area for unloading system components from the truck and delivering to the MR suite



### NOTE

Contact GE HealthCare project manager for magnet handling document to be used by rigging companies.

2. The customer is responsible for ensuring:
  - 2.1. All floors along the route will support the weight of the magnet (GE HealthCare recommends a structural analysis)
  - 2.2. Doors or other openings are sufficiently wide to allow passage
  - 2.3. Sufficient room is provided for any required rigging tools

### 2.11.2 Facility Delivery Route Requirements

The following table lists the delivery dimensions of system components. Upon delivery, verify the component dimensions and weight. The delivery route must be planned to accommodate the dimensions listed.

**Table 2-15 Delivery Route Requirements**

Component	Width		Depth		Height		Weight		Notes
	mm	in.	mm	in.	mm	in.	kg	lb.	
Magnet	See <a href="#">Table 2-16 MR System Component Shipping Specifications on page 49</a> .								
Cryogen	Dimensions vary depending on dewar type used. Verify with cryogen supplier.								
ISC 1	602 With dolly: 1212	23.7 With dolly: 47.7	978	38.5	2001	78.8	1034 With dolly: 1116	2275 With dolly: 2455	Cabinets must be raised to remove the pallet but may be lowered almost to floor level while moving. For moving a short distance (for example, from outside the equipment
ISC 2	1362 With dolly: 1972	53.6 With dolly: 77.6	878 With dolly: 986	34.6 With dolly: 38.8	2001	78.8	1023 With dolly: 1105	2250 With dolly: 2430	

**Table 2-15 Delivery Route Requirements** (Table continued)

Component	Width		Depth		Height		Weight		Notes
	mm	in.	mm	in.	mm	in.	kg	lb.	
ICC	1100 With dolly: 1710	43.3 With dolly: 67.3	842	33.1	1970	77.6	560 With dolly: 642	1235 With dolly: 1415	room across the door to the inside), the equipment can be moved on its casters.
RF Amplifier Cabinet	635	25	1067	42	2070	81.5	634	1397	The equipment can be moved on its casters.
HOS Power Supply Cabinet	600	23.62	1016	40	1941	76.4	410	904	

## 2.11.3 MR System Component Shipping Specifications

MR System component shipping dimensions and weight are listed below:

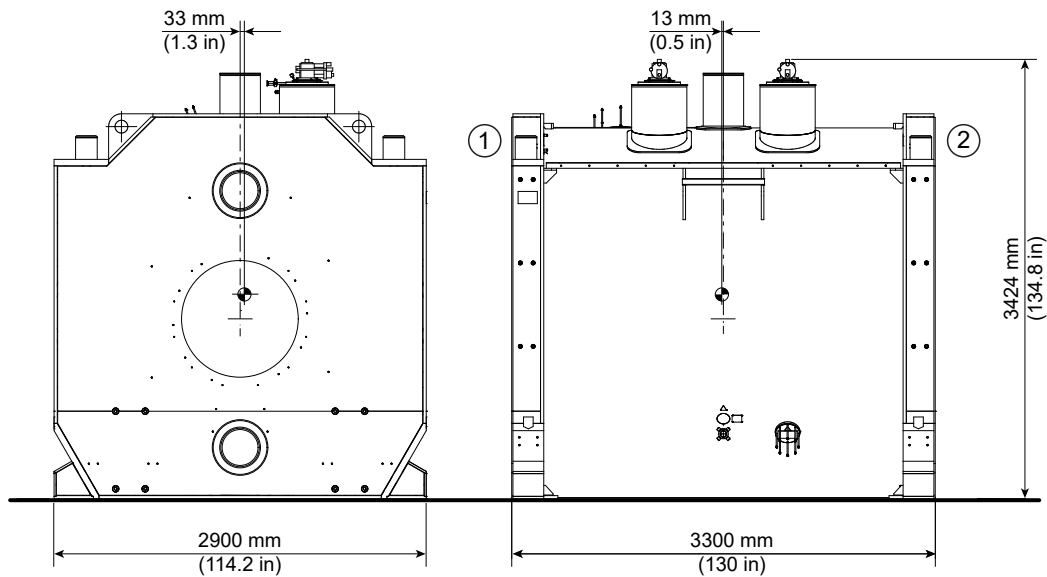
**Table 2-16 MR System Component Shipping Specifications**

Component	W x D x H		Weight		Notes
	mm	in.	kg	lb.	
Magnet (in normal rigging height configuration for scan room delivery)	2900 x 3300 x 3424	114 x 130 x 135	45000	99208	Normal rigging height: Cryo-vent and coldheads are installed on the top of the magnet.
Magnet (in minimum rigging height configuration for scan room delivery)	2900 x 3300 x 3316	114 x 130 x 131	45000	99208	Minimum rigging height: Cryo-vent and coldheads are temporarily removed.
Cryocooler Compressor (x2)	838 x 838 x 914	33 x 33 x 36	140	309	Pallet with box cover
Front End Bell	1142 x 408 x 1142	45 x 16 x 45	19	40	
Rear End Bell	1142 x 583 x 1054	45 x 23 x 41	19	40	
Patient Table	2650 x 960 x 880	104 x 38 x 35	406	895	Pallet
ISC 1 Gradient PDU	840 x 1090 x 2265	35 x 44 x 90	1200	2630	Pallet plus crate
ISC 2 System PDU	1538 x 970 x 2295	61 x 40 x 91	1240	2725	Pallet plus crate
Integrated Cooling Cabinet (ICC)	1338 x 952 x 2180	53 x 38 x 86	716	1575	Crate
ISC PP	533 x 610 x 1626	21 x 24 x 64	24	45	Pallet
ICC PW	533 x 610 x 1626	21 x 24 x 64	46	101	Pallet with cardboard cover
SPT Phantom Set	864 x 826 x 1524	34 x 32.5 x 60	159	350	On cart casters with box cover
RF Amplifier Cabinet	965 x 1219 x 2210	38 x 48 x 87	768	1694	Crate with ramp
Bridge	842 x 3908 x 515	33 x 154 x 20	100	220	Box on Pallet
Patient Tube	933 x 3025 x 1064	37 x 119 x 42	200	440	Box on Pallet
LH Architectural Panel	1794 x 391 x 2956	71 x 15 x 116	236	520	Box on Pallet
RH Architectural Panel	1778 x 391 x 2956	70 x 15 x 116	254	560	Box on Pallet

**Table 2-16 MR System Component Shipping Specifications** (Table continued)

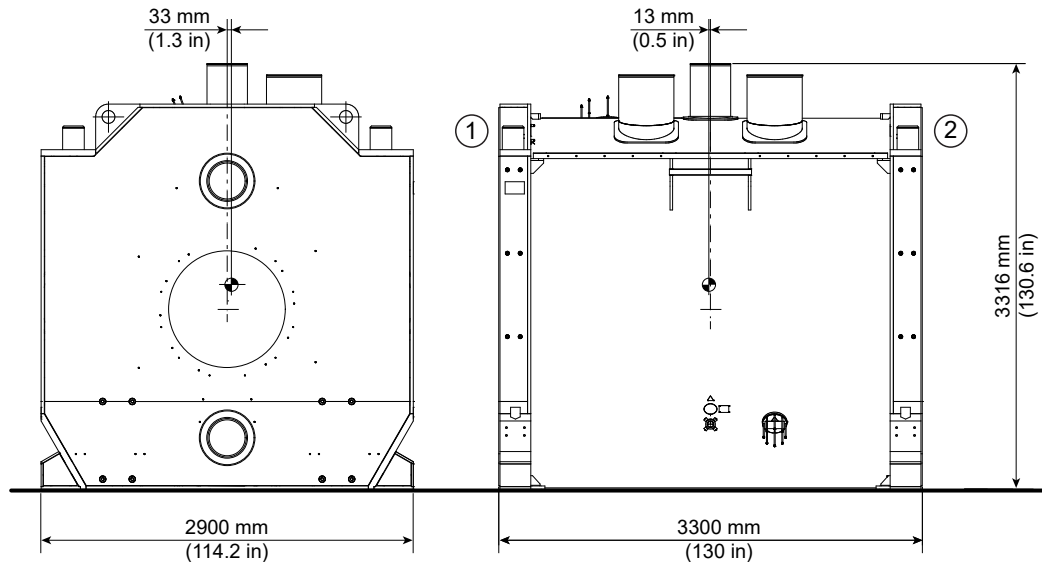
Component	W x D x H		Weight		Notes
	mm	in.	kg	lb.	
Rear Pedestal	842 x 1803 x 1315	33 x 71 x 52	103	227	Box on Pallet
Operator Workspace Cabinet	610 x 889 x 787	24 x 35 x 31	110	243	Wood pallet with cardboard cover
Operator Workspace Display	686 x 838 x 686	27 x 33 x 27	9	19	Box
Operator Workspace equipment	813 x 813 x 584	32 x 32 x 23	45	100	Box
Operator Workspace Table	1041 x 1372 x 381	41 x 54 x 15	75	165	Box
HOS Power Supply Cabinet	880 x 1330 x 2100	34.6 x 52.4 x 82.7	550	1212	Crate with ramp

**Figure 2-17 Magnet Dimensions (as Shipped) with normal rigging height configuration**



Item	Description	Item	Description
1	Service End	2	Patient End


**Figure 2-18 Magnet Dimensions (as Shipped) with minimum rigging height configuration**



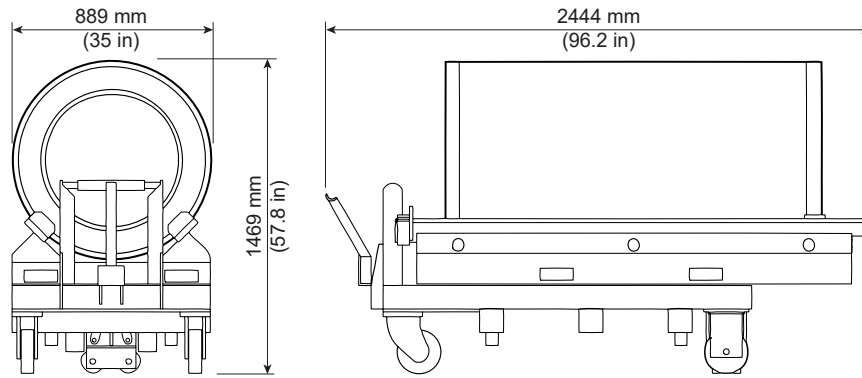
Item	Description	Item	Description
1	Service End	2	Patient End

**Table 2-17 MR System Component Replacement Shipping Specifications**

Component	Component Location	W x D x H		Weight	
		mm	in.	kg	lb.
Replacement HRMb Gradient Coil Assembly on a Shipping Cradle/Cart	Magnet Room	889 x 2444 x 1469	35 x 96.2 x 57.8	1407	3100
Gradient Power Supply	Equipment room (front of ISC)	750 x 1026 x 437	29.5 x 40.4 x 17.2	85	179
Gradient Cooling Unit (GCU)	Equipment room (front of ICC)	920 x 605 x 1445	36.2 x 23.8 x 56.9	145	319
Cabinet Cooling Unit (CCU)	Equipment room (front of ICC)	920 x 705 x 1550	36.2 x 27.8 x 61.0	196	431
HOS Power Amplifier	Equipment room (front of HOS Power Supply Cabinet)	597 x 813 x 470	23.5 x 32 x 18.5	80	176
RF Amplifier Power Supply	Equipment room (front of RF Amplifier Cabinet)	1022 x 686 x 608	40.3 x 27 x 24	67	147
Gradient Coil Replacement Tool Kit Crate	At site near magnet room	900 x 1250 x 880	35.4 x 49.2 x 34.6	340	750

**NOTE**  The dimensions and weights listed for the components in [Table 2-17 MR System Component Replacement Shipping Specifications on page 51](#) include packaging.

**Figure 2-19 Gradient Coil Cart**



## 2.11.4 Temperature and Humidity Storage Requirements

MR systems and components must be stored within the environmental requirements listed below.



### NOTE

Some equipment is liquid-cooled. After coolant is added, the equipment must be kept from freezing. Phantoms and the coolant itself must also be kept from freezing.

Room	Temperature		Humidity	
	Range °C (°F)	Change °C/Hr (°F/Hr)	Relative % (Non-condensing)	Change %/Hr
Electronic Cabinets and Equipment	-30 — 60 (-22 — 140)	20 (68)	10 — 80	30
Magnet Assembly	-30 — 60 (-22 — 140)	20 (68)	10 — 80	30
Surface Coil	-30 — 50 (-22 — 122)	20 (68)	10 — 95	30

## 3 Magnet Room

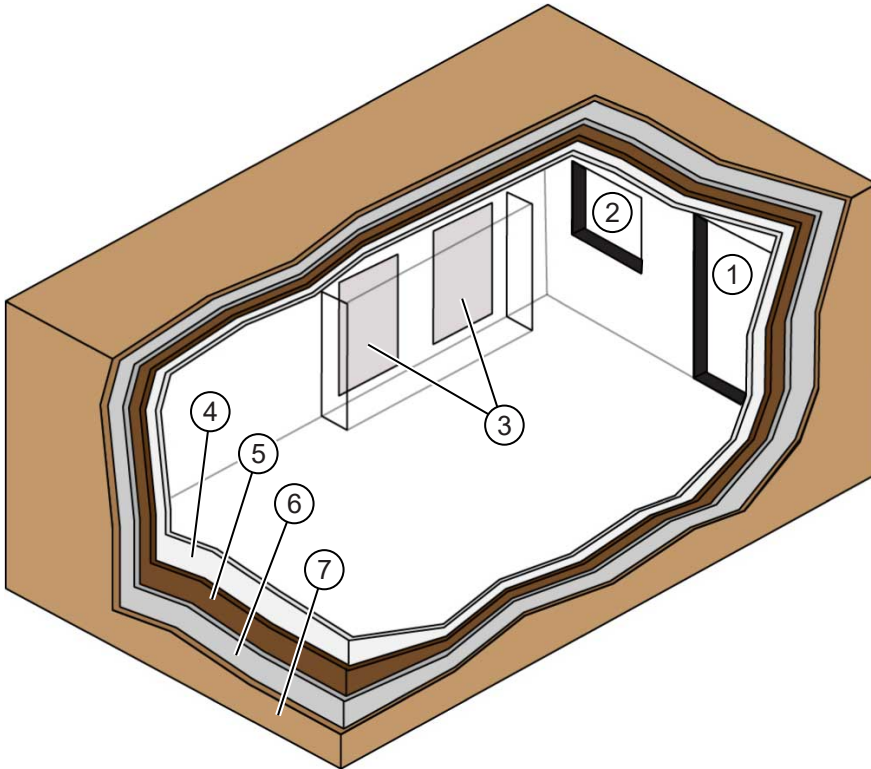
### 3.1 Magnet Room Introduction



The Magnet Room is best understood as a series of layers, or “rooms within a room.” Each of these rooms has a specific function and associated requirements. All requirements in this chapter must be followed to ensure safe and correct operation of the MR System.

1. The Magnetic shielded room contains the MR Magnet fringe field within a confined space. A site survey is required to determine magnet shield requirements (not all sites require magnetic shielding). Because of the added cost of magnetic shielding, room location should be carefully considered.
2. The Acoustic room is a layer used to help attenuate the noise produced during a scan. An acoustic engineer is strongly recommended to assess the environment.
3. The RF shielded room is critical to the correct MR System operation. RF shielding prevents interaction of external RF radiation with MR System operation and it also prevents MR System RF radiation from interfering with external systems, such as aircraft control. Special care must be used when installing all fixtures penetrating the RF shield (for example, vents, electrical conduit, penetration panels) to ensure the integrity of the RF shield is maintained. Refer to *RF Shielded Room Requirements*, 5850260-1EN.
4. The Finished room includes the wall coverings, ceiling tile, ceiling grid, other fixtures, Magnet (MAG) and Patient Table (PT). When planning the finished room, ensure the following:
  - 4.1. All building codes are met (such as maintaining egress routes).
  - 4.2. Items which may generate or create RF interference (including fluorescent lighting) are not allowed for installation within the Magnet Room.
  - 4.3. Customer is responsible for the selection and installation of all locally required safety devices (for example, smoke detectors, oxygen monitors, and so on).
  - 4.4. Smoke detectors should be located outside of the Magnet Room (for example, within the return air duct) whenever possible. If code does not allow this, use only simple two wire non-addressable smoke detectors in the Magnet Room.
  - 4.5. Ferrous or metallic items which could become projectiles when the magnet is installed (including wall coverings, ceiling tile, ceiling grid, or other fixtures) are not used or are correctly secured.

**Figure 3-1 Magnet Room Layers**



Item	Description	Item	Description
1	Door	2	Window
3	Penetration wall(s)	4	Finished room
5	RF shielding	6	Acoustic barrier
7	Magnetic shielding	-	-



**NOTE**

The sequence of the room layers can vary based on siting needs.

## 3.2 Magnet Room Structural Requirements



This section lists the structural requirements that must be considered when performing site evaluation and planning of the Magnet Room.

### 3.2.1 Overview



1. When preparing a building plan or evaluating a potential site for an MR System, take care to ensure the MR suite will not interact with the surrounding environment (that is, magnetic, acoustic, environmental steel, and vibration).
2. The customer is responsible for vibration testing required to verify suitability of a proposed site. All test results and any questions regarding testing, results, or analysis must be forwarded to the GE HealthCare Project Manager of Installation (PMI).

### 3.2.2 Environmental Steel Limits



A static magnetic field extends in a three-dimensional space around the magnet isocenter. Environmental steel within the static magnetic field affects the uniformity (or homogeneity) of the field. Field uniformity is critical to both image quality and chemical shift analysis (spectroscopy). An analysis of the environmental steel is required within a 2.5 m (8.2 ft.) spherical radius of the magnet isocenter. Environmental steel includes ferrous pipes, beams, concrete rebar, or any other structural steel in the floors, walls, or ceiling.

The following floor items must be limited per [Table 3-1 Steel Mass Limits to Magnet Isocenter \(3.3 x 3.3 m \(10.8 x 10.8 ft.\) Area Under Magnet\) on page 57](#).

1. Non-movable steel construction material such as rebar and metal decking
2. Existing or proposed RF/magnetic shielding or shim plates
3. [Table 3-1 Steel Mass Limits to Magnet Isocenter \(3.3 x 3.3 m \(10.8 x 10.8 ft.\) Area Under Magnet\) on page 57](#) defines the limits of use as a guideline to help the customer understand allowable amounts of ferrous rebar, steel decking, or other components as they design the MR suite and Magnet Room floor structure.
4. The customer must provide detail defining ferrous material below the magnet to the Project Manager so the GE HealthCare MR Siting and Shielding (MRSS) team can review for compliance.

**Table 3-1 Steel Mass Limits to Magnet Isocenter (3.3 x 3.3 m (10.8 x 10.8 ft.) Area Under Magnet)**

Limits Of Steel Mass kg/m <sup>2</sup> (lb./ft <sup>2</sup> )	Distance Below Top Surface Of Recessed Floor mm (in.)
0 (0)	0-50 (0-2)
32 (6.6)	50-100 (2-4)
38 (7.8)	100-150 (4-6)
46 (9.4)	150-200 (6-8)
54 (11.1)	200-250 (8-10)
64 (13.1)	250-300 (10-12)
76 (15.6)	300-350 (12-14)
95 (19.5)	350-400 (14-16)
117 (24.0)	400-450 (16-18)
166 (34.0)	450-500 (18-20)
264 (54.1)	500+ (20+)

### 3.2.3 Vibration Requirements



Excessive vibration can affect MR image quality. Vibration testing must be performed early in the site planning process to ensure vibration is minimized. Both steady state vibration (exhaust fans, air conditioners, pumps, and so on) and transient vibrations (traffic, pedestrians, door slamming, and so on) must be assessed (see [Table 3-2 Acceptable Vibration Levels on page 57](#)). Specific requirements for vibration mitigation, include:

1. The Magnet (MAG) cannot be directly isolated from vibration. Any vibration issue must be resolved at the source.
2. MR Suite HVAC must have vibration isolation.
3. A vibration analysis must be performed at the proposed site with the results (and any mitigation) forwarded to the GE HealthCare Project Manager of Installation (PMI). See the [8.2 MR Site Vibration Test Guidelines on page 122](#).
4. A transient vibration test must only be performed after a steady-state test has been performed and all steady-state sources of vibration have been mitigated.
5. Transient vibration levels above the specified limits in the [8.2 MR Site Vibration Test Guidelines on page 122](#) must be given to the PMI for review.
6. Any transient vibration that causes vibration to exceed the steady-state level must be mitigated.
7. The vibration test consultant must account for non-mechanically induced signals such as test equipment instabilities, thermal drift or RF interference.

**Table 3-2 Acceptable Vibration Levels**

Vibration State	Vibration Level	Vibration Frequency
Steady State	10 micro g (1 x 10 <sup>-4</sup> m/s <sup>2</sup> )	0.5 to 45 Hz

**Table 3-2 Acceptable Vibration Levels** (Table continued)

Vibration State	Vibration Level	Vibration Frequency
Transient	500 micro g (0.005 m/s <sup>2</sup> )	N/A

### 3.3 Magnetic Shielded Room Requirements



Magnetic shielding prevents interaction between the magnet and nearby sensitive devices. Because of the added cost of magnetic shielding, room location should be carefully considered. All sites, including upgrade sites, must be evaluated for magnetic shielding requirements. Existing magnetic shielding at an upgrade site may not be sufficient for the new system. Contact the GE HealthCare Project Manager of Installation (PMI) to request a site evaluation.

See [MR Suite Magnetic Field Specifications on page 22](#) for detailed magnetic proximity limit information.

1. The GE HealthCare Project Manager of Installation (PMI) works with the customer to coordinate the magnetic shielding site evaluation.
2. The customer is responsible for installation of all magnetic shielding.
3. If rear wall magnetic shield or steel RF wall is closer than 2500mm (98.4 in.) from isocenter, it should be verified by GE HealthCare PMI.

### 3.4 Penetration Panel Wall Opening Requirements



1. The Equipment Room and the Magnet Room must share at least one common wall to mount the ISC and ICC panels.
2. The penetration panel opening requirements are shown in [Figure 3-2 Penetration Wall Openings on page 59](#).
3. Two GE HealthCare-supplied penetration panel adaptor plates are used to connect the ISC and ICC panels to the wall openings. Connection details are shown in [Figure 3-2 Penetration Wall Openings on page 59](#).
4. The RF vendor must supply 168 fasteners for hole size of Ø8.8 mm (0.35 in) (total quantity for both panels) and install each penetration panel adaptor plate to the wall through the outer ring of holes in the plate.

**NOTE**

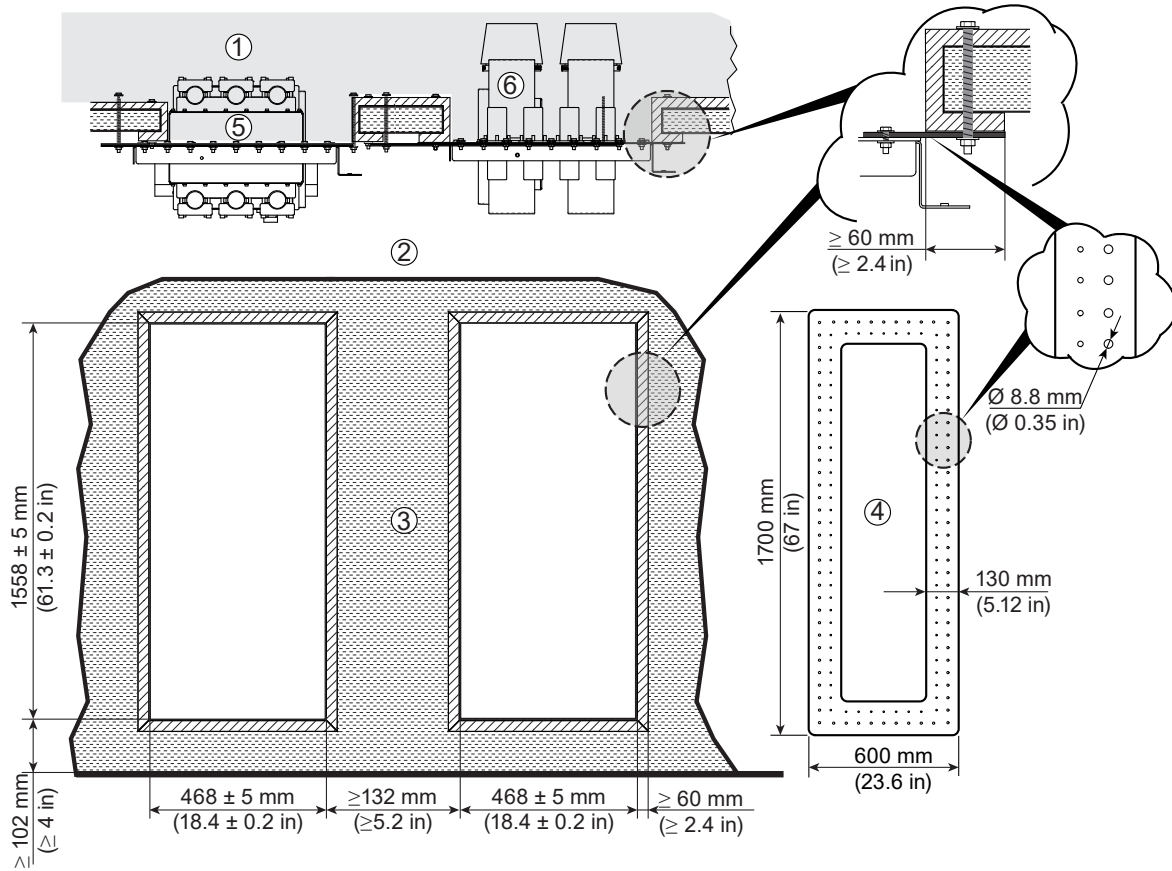
The length of the fasteners should be based on the thickness of the RF Wall.

**NOTE**

GE HealthCare-supplied bolts connect the penetration panels to each adaptor plate through the inner ring of holes in the plate.

5. RF shielding in the Magnet Room walls must completely wrap around all edges of the penetration wall openings and continue through the openings to the inside of the Equipment Room to provide full shielding continuity with the adaptor plate. The minimum overlay in the Equipment Room is 60 mm (2.4 in.).
6. A minimum of 102 mm (4 in.) is required between the floor and the bottom of the penetration panel opening to provide clearance for the adaptor plate.
7. The maximum distance between the penetration panels is determined by the available length of the cables between the RF common ground stud and pen panels. Refer to [7.1.2 Available Cable Lengths on page 103](#).

**Figure 3-2 Penetration Wall Openings**



Item	Description	Item	Description
1	Magnet Room	4	RF Shield
2	Equipment Room	5	ISC PP
3	Wall	6	ICC PEN Wall

## 3.5 Finished Room Requirements

### 3.5.1 Ferrous Materials in the Magnet Room



1. Non-ferrous (non-metallic) materials or components should be used in the Magnet Room.
2. Ferrous components or material in the Magnet Room that could be removed for servicing, cleaning, or replacement must be secured to prevent the ferrous material from becoming a projectile (ferrous components or material must also be identified as ferrous to prevent untrained personnel from working on the ferrous material while the magnet is energized).

### 3.5.2 Walls



Refer to *Acoustic Room Details*, 5850262-1EN. Hard, bare wall surfaces may create a harsh Magnet Room acoustic environment due to reflection of sound waves. Finished walls with acoustic properties can reduce reflected noise.

1. GE HealthCare recommends finished walls to protect the RF shielding.
2. Walls and any millwork, cabinets, storage areas, acoustic coverings, and so on, must remain outside the minimum service area.
3. A metallic electrical conduit inside walls and ceilings may be used. Conduit for receptacles must be metallic.

### 3.5.3 Magnet Preinstallation Markings



For correct cryogen venting, the magnet vent adaptor must align correctly with the ceiling vent when the magnet is installed.

1. The magnet isocenter position must be clearly marked, and the marking must be identifiable throughout construction.



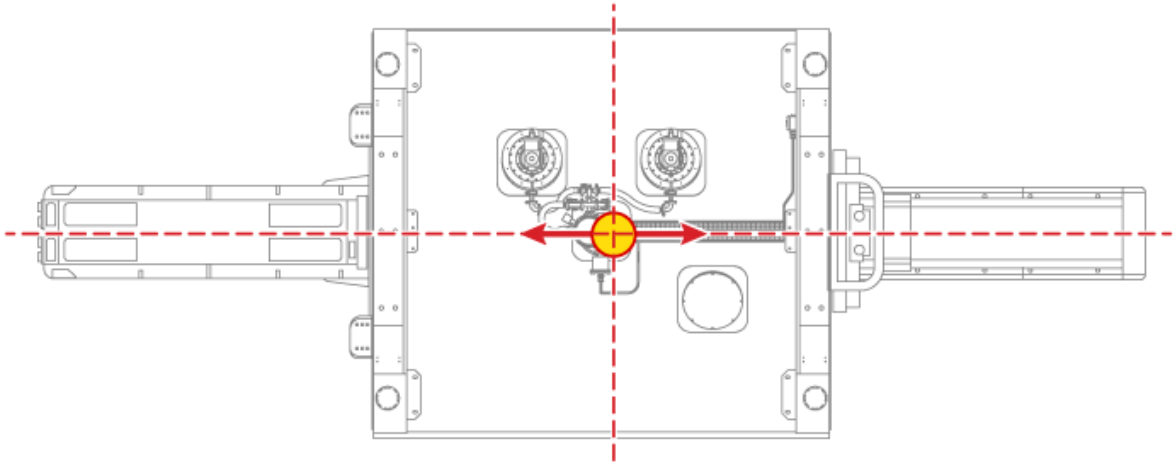
#### NOTE

If there is no ceiling grid in the room, we recommend to also mark the magnet isocenter location on the ceiling. This can serve as a reference for positioning a new vent pipe, or can be used to reproduce the floor markings if they become lost during construction.

Refer to *Magnet Room Venting Requirements*, 5850263-1EN for the location of the magnet vent.

2. The location of the magnet isocenter and magnet z-axis orientation must be marked on the Magnet Room floor as shown below.

**Figure 3-3 Marking the Magnet Isocenter and the Z-Axis Orientation on the Floor**



## 3.5.4 Penetration Panel Closet



1. An enclosure (that is, the penetration panel closet) must be provided to restrict access to the penetration panel(s) and for storage of excess interconnections.
  - 1.1. The penetration panel closet must meet the minimum penetration panel closet outline as shown in [3.5.5 Penetration Panel Closet Specifications on page 63](#).
  - 1.2. The penetration panel closet must have a mechanical locking mechanism to restrict access to the penetration panels.
  - 1.3. The penetration panel closet may be expanded to provide an area for excess cable storage with the following requirements:
    - 1.3.1. Excess cable must not be stored within the minimum closet service area.
    - 1.3.2. Excess cable must not interfere with access or servicing of the ISC or ICC penetration walls .
    - 1.3.3. The area within the penetration panel closet to store the cable should be sized to accept a 300 mm (11.8 in.) cable loop.
    - 1.3.4. Refer to [7.1.4 Storage Requirements for Excess Gradient Cable on page 106](#) for additional excess cable storage requirements.
  - 1.4. The penetration panel closet must allow free air exchange of 680 m<sup>3</sup>/hour (400 cfm) between the Magnet Room and penetration panel closet for MR System blowers. Airflow may be achieved through door louvers or other openings in the penetration panel closet that meet all other penetration panel closet requirements.
  - 1.5. The primary source of airflow must be from the Magnet Room. Openings into the area above a false ceiling or other storage areas should be minimized.
  - 1.6. The penetration walls may be enclosed by separate closets with the following requirements:
    - 1.6.1. The maximum distance between the penetration panels is determined by the available length of the cables between the RF common ground stud and pen panels. Refer to [7.1.2 Available Cable Lengths on page 103](#).
    - 1.6.2. The separate closets must meet all other service area requirements for each penetration panel.
    - 1.6.3. Airflow as listed above must be provided for both closets.
    - 1.6.4. Both closets must have mechanical locks.

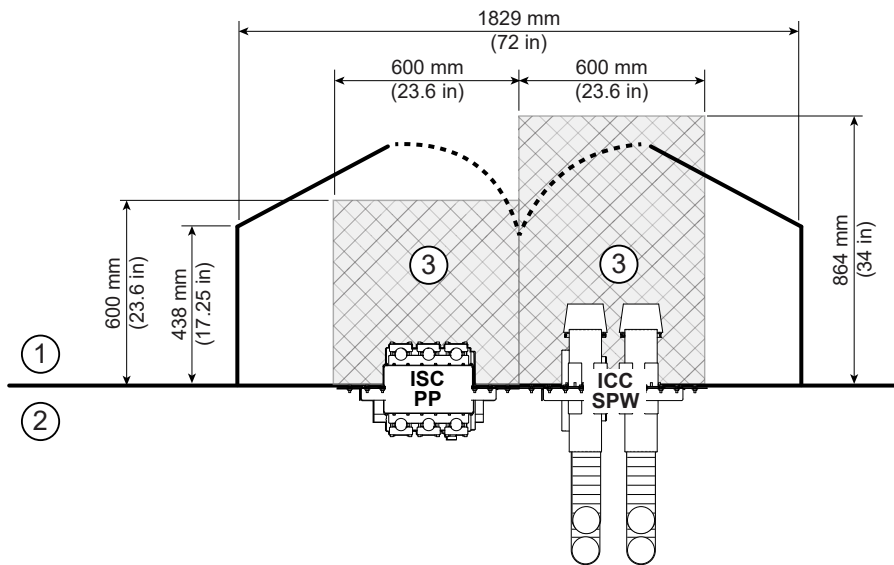
### 3.5.5 Penetration Panel Closet Specifications

- Minimum Closet Depth: 438 mm (17.25 in.)
- Minimum Closet Width: 1829 mm (72 in.)
- Minimum Closet Height: 2007 mm (79 in.)

**NOTE**  
 If the closet depth is less than 600 mm (23.6 in.), the closet must have a door for each panel to clear the service area for each panel.

**NOTE**  
 Minimum closet specifications do not account for storage space for excess gradient cable. Refer to [7.1.4 Storage Requirements for Excess Gradient Cable on page 106](#) for additional excess cable storage requirements.

**Figure 3-4 Minimum dimensions of closet in the Magnet Room**



Item	Description		
1	Magnet Room	3	Service area
2	Equipment Room	-	-

## 3.5.6 Doors, Magnet Access Openings, and Patient Viewing Windows



1. The finished opening of the Magnet Room main door must be at least 1092 mm (43 in.) wide to allow for helium dewars and patient tables.
2. Threshold height must not exceed 15 mm (0.6 in.) on both sides of the door with a maximum 10-degree threshold inclination.
3. IEC requires the patient, while in the bore, be in full view of the operator.



### NOTE

- GE HealthCare recommends using a window, although other means (for example, camera and video display) may be used as long as all IEC requirements are met.
  - The recommended dimensions for the patient viewing windows are 1219 mm wide x 762 mm high (48 in. wide x 30 in. high).
  - The recommended distance from the bottom edge of the patient viewing window to the finished floor is 1067 mm (42 in.).
4. The magnet delivery requires an opening into the room to allow access for the magnet delivery, rigging, and personnel access.

## 3.5.7 Finished Ceiling



1. The customer is responsible for the finished ceiling.
2. The finished ceiling grid must be non-ferrous.
3. Ceiling preparation should be completed prior to magnet delivery.



### NOTE

- No special frames are necessary for the system.
- The space above the magnet must be clear of any obstructions, up to a height of 3700 mm (146 in.) from the finished floor, for cables to be routed to the magnet. Refer to [7.2.5 Cable Tray Requirements and Examples on page 112](#) for height requirements for the trays that route cables through this opening.

## 3.5.8 Magnet Room Floors



1. Both the recessed floor and the finished raised floor must support the weight of all components throughout operation and service life. This includes the magnet (recessed floor only), patient table, and gradient coil replacement cart.



### NOTE

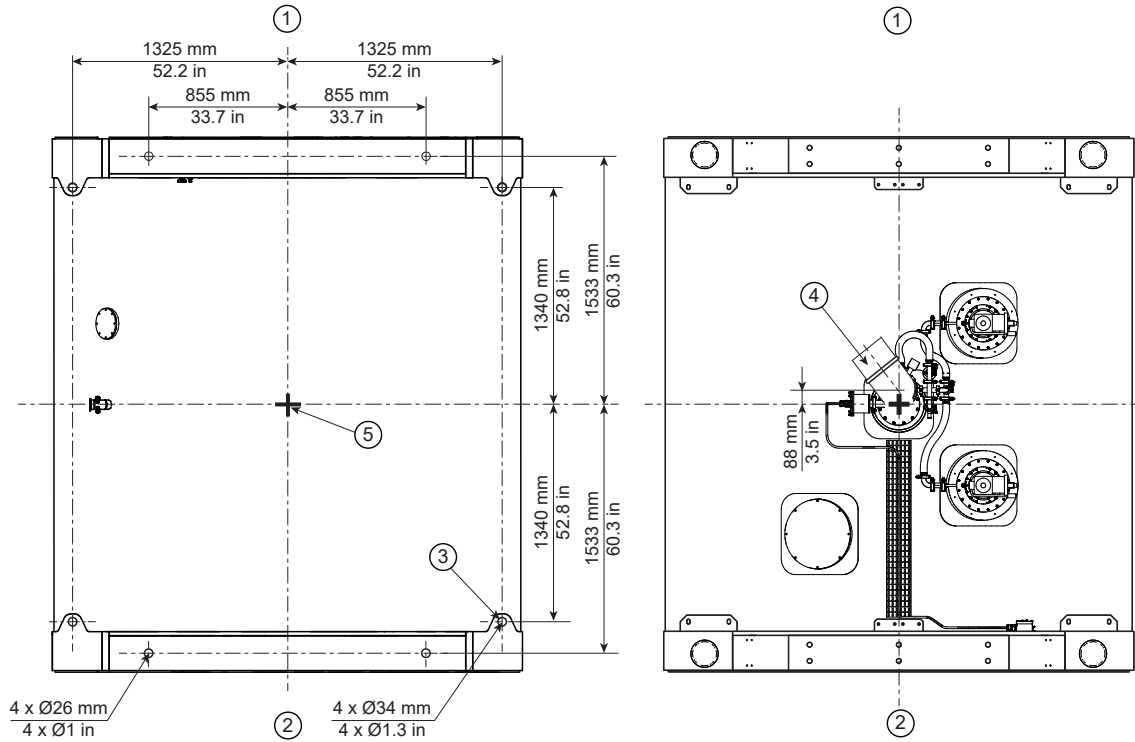
For gradient coil replacement, field engineers remove the patient table from the Magnet Room before they move the gradient coil replacement cart into the Magnet Room.

2. The recessed floor must be water resistant to protect the subfloor and shielding from water damage.
3. The customer is responsible for providing flooring to prevent ESD (Electrostatic Discharge) buildup to 8 kV for protection of the sensitive MR equipment.
4. The Magnet is mounted directly to the recessed floor as shown in [Figure 3-5 Magnet Mounting Detail \(left is bottom view, right is top view\) on page 66](#).

The recessed flooring for the magnet footprint should be flat and level to 3 mm (0.125 in.) across the footprint area of 3300 mm long x 2900 mm wide (130 in. long x 114 in. wide).

Anchor points are provided if the magnet will be anchored to the floor in areas with seismic activity.

**Figure 3-5 Magnet Mounting Detail (left is bottom view, right is top view)**



Item	Description	Item	Description
1	Patient end	4	Center of vent pipe
2	Service end	5	Center of magnet
3	Anchor hole (x4)	-	-

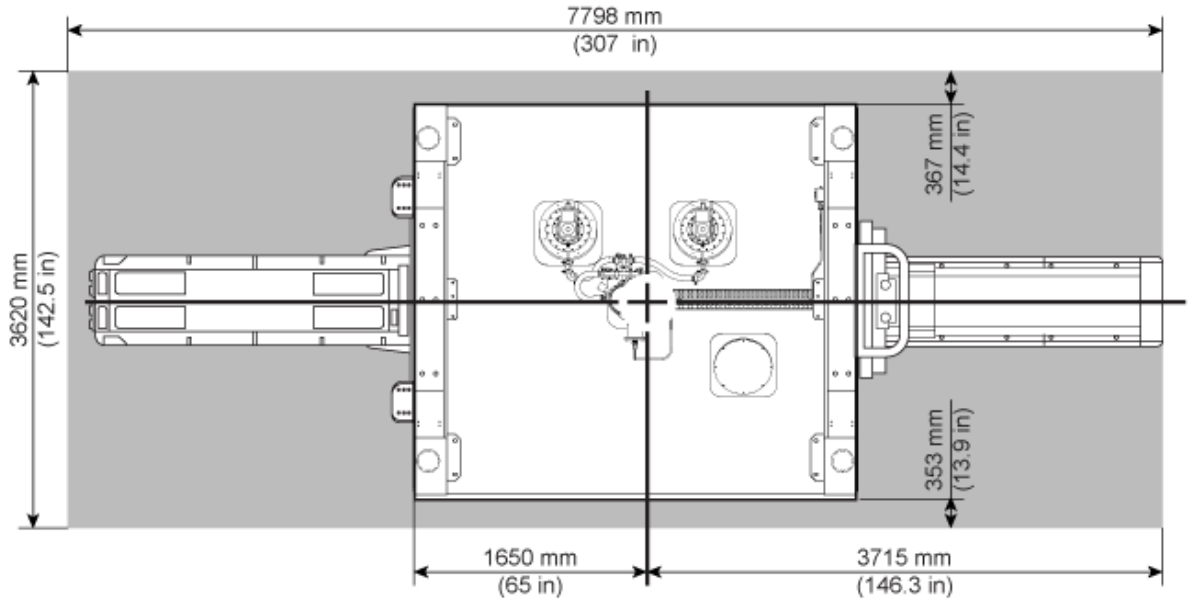
- After the magnet is mounted on the recessed floor, a raised finished floor must be built around the magnet with a height of 1000 mm ± 5 mm (39.4 in. ± 0.2 in.) below the isocenter of the magnet, which is approximately 400 mm (15.8 in.) above the recessed floor surface where the magnet is mounted on. The raised finished floor must extend to the walls of the Magnet Room.
- The raised floor must be flat and level within 3 mm (0.125 in.) in the shaded area (patient table, rear pedestal, and area around the magnet). On the sides of the magnet, the floor must not extend beyond the feet of the magnet, to allow space for electronics to be placed underneath the magnet.



**NOTE**

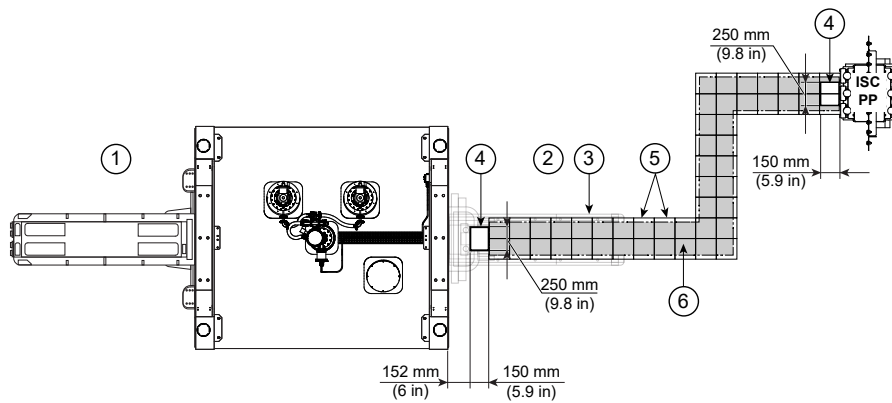
Floor may extend beyond the end of the rear pedestal, but floor levelness must be maintained in the shaded area shown in [Figure 3-6 Magnet Room Floor Levelness Area on page 67](#).

**Figure 3-6 Magnet Room Floor Levelness Area**



7. A maximum gap of 71 mm (3 in.) can be present between the raised floor and the patient end of the magnet.
8. The raised floor underneath the rear pedestal must be tiled (computer room) to allow for cable routing underneath. The minimum width of the duct or raceway under the tiled floor is 330 mm (13 in.) to accommodate the cables. The minimum width of the tiled floor access panels that cover the duct or raceway is 305 mm (12 in.). The tiled floor area begins underneath the rear pedestal and must extend to the Penetration Panel Closet. At both ends of this tiled cable duct, a 150 mm x 250 mm (5.9 in. x 9.5") hole must be present to allow the cables to penetrate the floor.

**Figure 3-7 Tiled Floor Area for Cable Routing**



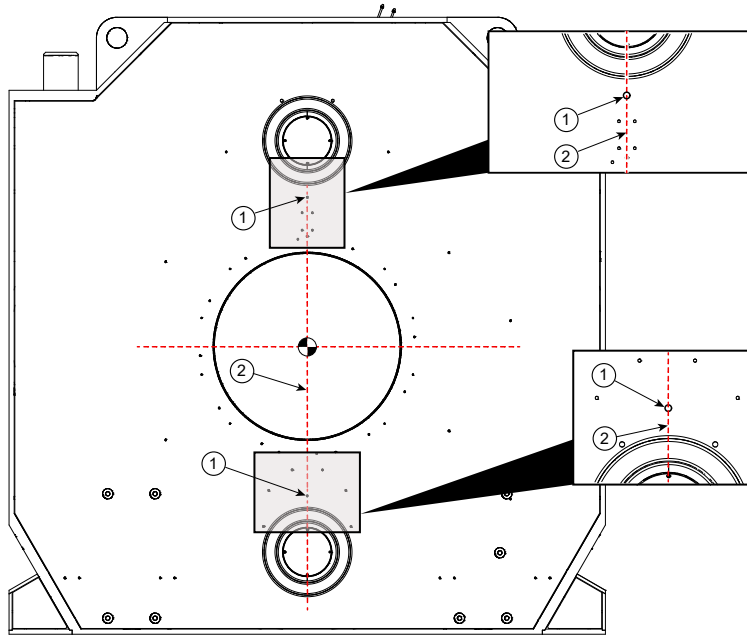
Item	Description	Item	Description
1	Patient End	4	150 mm x 250 mm (5.9 in. x 9.8") hole
2	Service End	5	Computer Tile
3	Rear Pedestal	6	Cable Duct

### 3.5.9 Raised Floor Calculation

The raised floor must be within the nominal height of 551 mm ± 2.5 mm (21.7 in. ± 0.1 in.) from the bottom of the bore.

1. Use a self leveling laser to cast a vertical line that is centered on hole “A” .

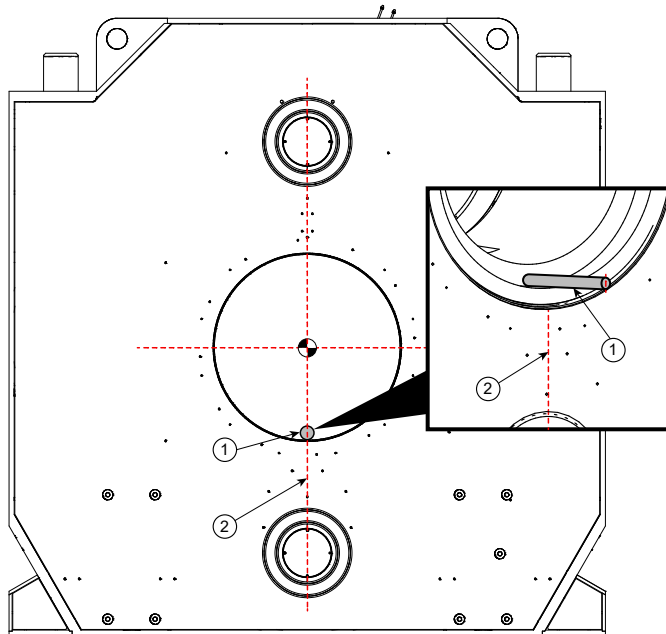
**Figure 3-8 Vertical laser line**



Item	Description	Item	Description
1	Hole A	2	Laser line

2. Place a rod in the bore and position its center so that it aligns with the vertical laser line.

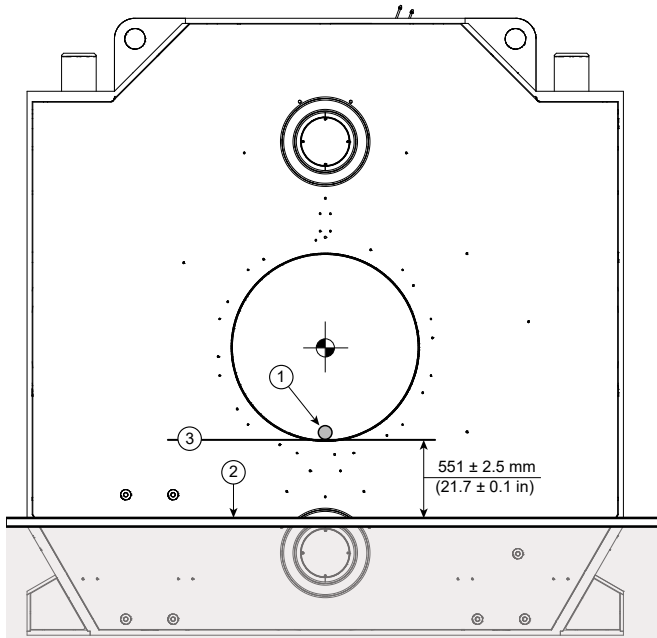
**Figure 3-9 Rod position**



Item	Description	Item	Description
1	Rod	2	Laser line

- Measuring down from the bottom of the rod, the top surface of the finished floor shall be placed at 551 mm ± 2.5 mm (21.7 in. ± 0.1 in.).

**Figure 3-10 Finished floor measurement**



Item	Description	Item	Description
1	Rod	3	Rod
2	Raised Finished Floor		

## 3.5.10 Storage Cabinets



### NOTE

GE HealthCare no longer provides a storage solution for system phantoms.

1. The customer shall provide storage for phantoms in the magnet room (for example, a cart, shelving unit or cabinet). Storage needs to be large enough to accommodate system phantoms listed in Table 1-1 of *Customer Site Storage Requirements*, 5182674 (available in the Customer Documentation Portal).
2. The storage solution can not interfere with the magnet room minimum service area.

# 3.6 Magnet Room Equipment Specifications

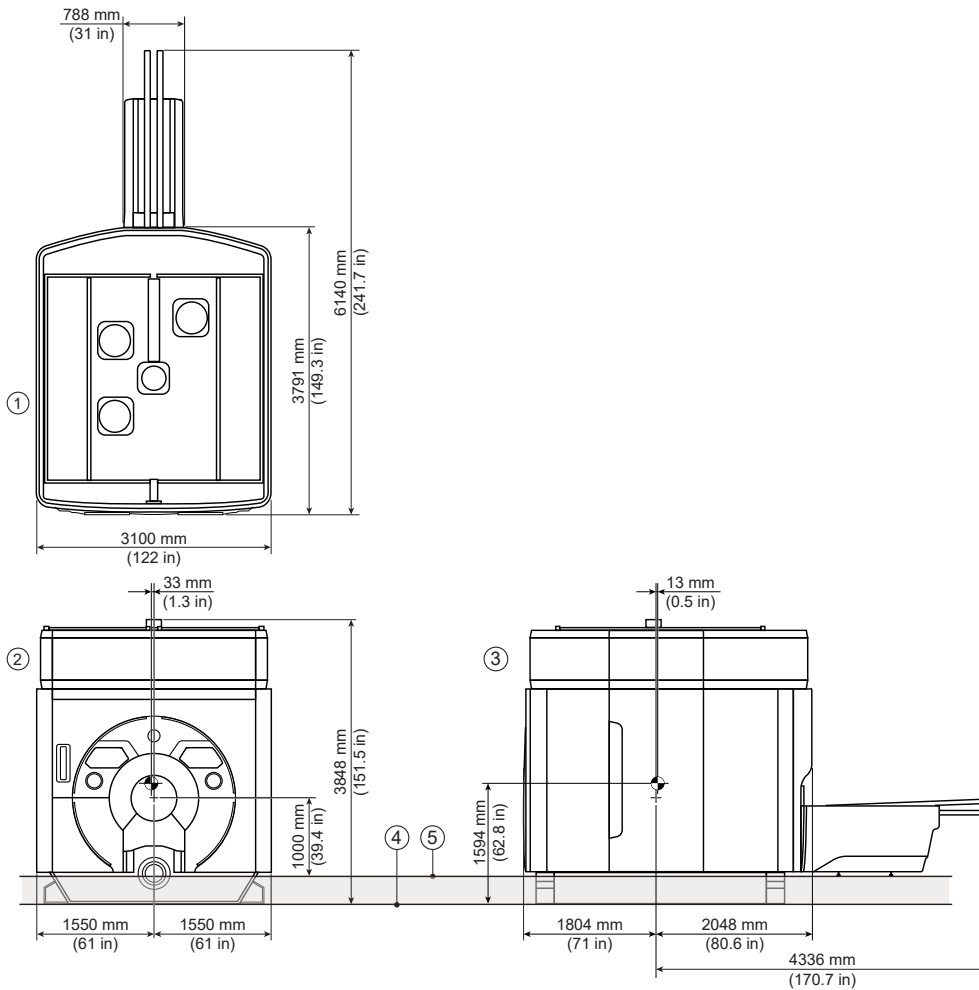


(Applies to all subsections within this section)

## 3.6.1 Magnet (MAG) Assembly Specifications

1. Magnet weight, with cryogenics at maximum capacity: 46324 kg (102126 lb.)

**Figure 3-11 Magnet (MAG) Dimensions and Rear Pedestal**

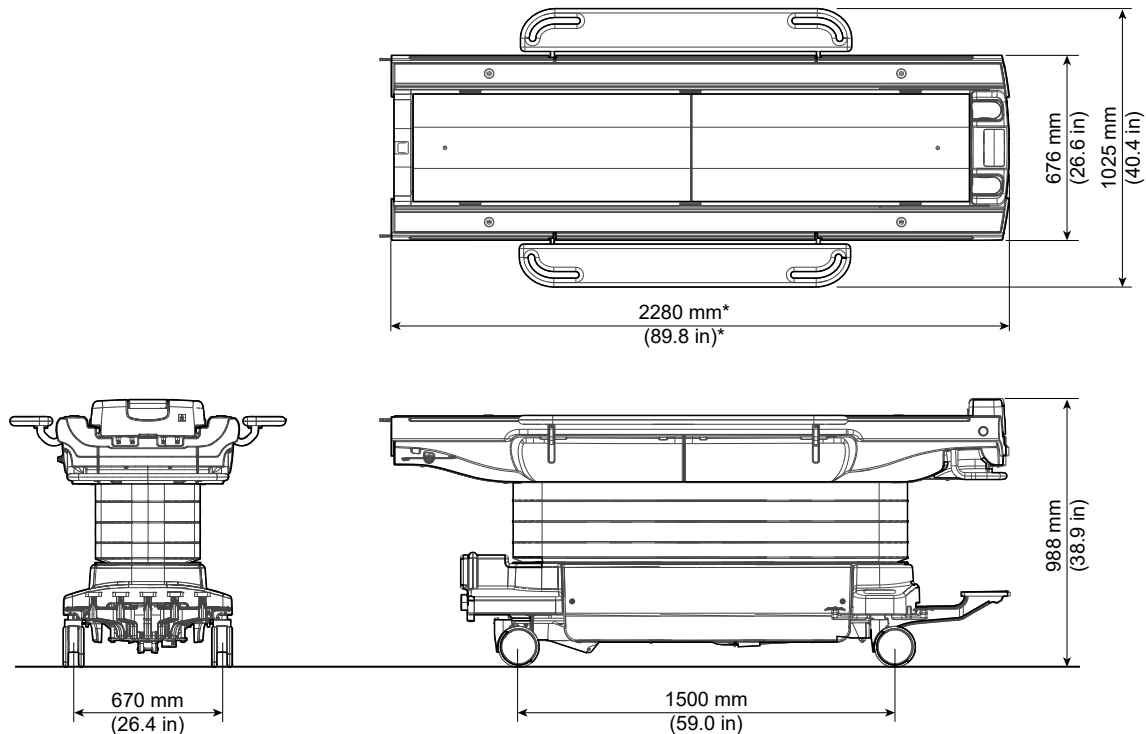


Item	Description	Item	Description
1	Top view	3	Side view
2	Front view	4	Recessed Floor
5	Finished Floor		

### 3.6.2 Patient Table (PT) Specifications

1. Table weight, empty: 190 kg (418 lb.)
2. Table weight, including maximum patient weight of 159 kg (349 lb.): 349 kg (768 lb.)

**Figure 3-12 Patient Table (PT)**



\* When the table handle is rotated into its extended position, the length of the table is 2370 mm (93.3 in.)

### 3.6.3 Magnet Rundown Unit (MRU) Specifications and Requirements

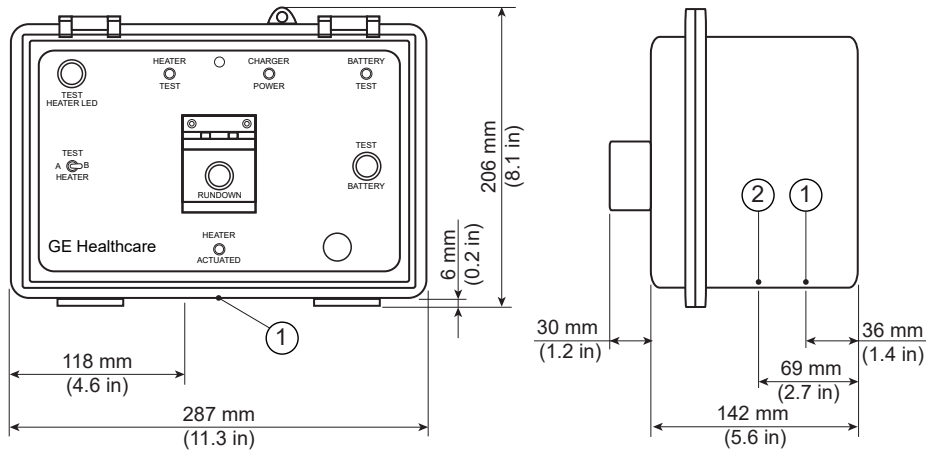
1. Location: The bottom edge of the MRU must be mounted  $1524 \pm 25$  mm ( $60 \pm 1$  in.) above the finished Magnet Room floor near the front of the magnet enclosure.
2. Weight: 3.2 kg (7 lb.)
3. Magnetic Field Limit: 20 mT (200 G)
4. The MRU is installed by the facility contractor.



**NOTE**

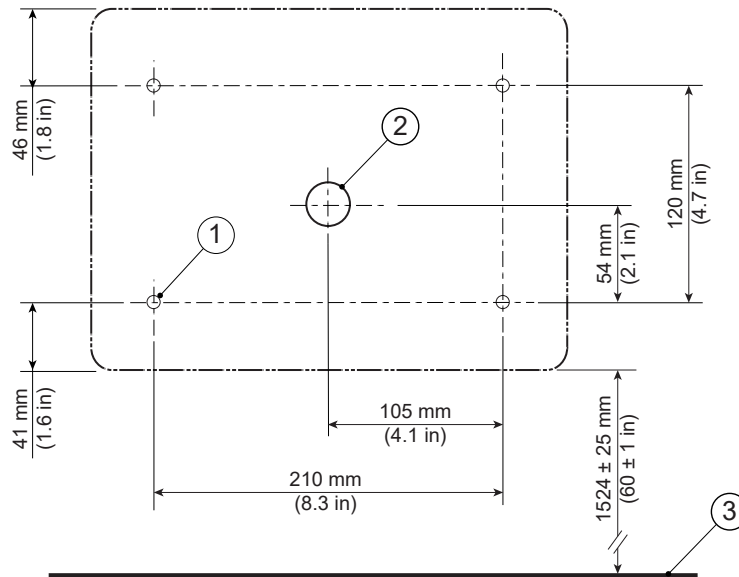
An optional remote MRU may be installed outside the Magnet Room. The remote MRU does not require facility power. For more information, refer to MRU vendor manual.

**Figure 3-13 Magnet Rundown Unit (MRU)**



Item	Description
1	Cable access
2	Power access

**Figure 3-14 MRU Mounting Pattern**



Item	Description	Item	Description
1	7 mm (0.275 in.) diameter mounting hole	3	Finished floor
2	26 mm (1.025 in.) diameter cable access	-	-

### 3.6.4 Oxygen Monitor Sensor Specifications

See [Oxygen Monitor \(OXY\) Option](#) on page 100.

## 3.7 Magnet Room Lighting Requirements



1. All lighting fixtures and associated components must meet all RF shielded room and RF grounding requirements (for example, track lighting is not recommended due to possible RF noise).
2. All removable lighting fixtures and associated components must be non-magnetic.
3. All lighting must use direct current (the DC must have less than 5% ripple).
4. At least 300 lux must be provided at the front of the magnet for patient access and above the magnet for servicing.
5. Fluorescent lighting must not be used in the Magnet Room.
6. Lighting must be adjusted using a discrete switch or a variable DC lighting controller.
7. SCR dimmers or rheostats must not be used.
8. DC LED lighting may be used if the DC power converter and RF sources are all located outside the Magnet Room RF Shield.



### NOTE

LED lighting could cause image quality issues due to RF interference. Make sure a MR-compatible LED lighting solution is chosen.

9. Battery chargers (for example, used for emergency lighting) must be located outside the Magnet Room.
10. LED Lighting or short filament length incandescent bulbs are recommended.
11. Linear lamps are not recommended due to the high burnout rate.

## 4 Equipment Room

### 4.1 Equipment Room Overview



(Applies to all sections within this chapter)

1. The vertical distance between the coolant connection points of the ICC and the Gradient Coil must be less than 5 meters (196.8 in.).
2. The ICC, ISC, and cryo compressors must be located on the same floor.

The following illustration shows minimum equipment room service clearances. Refer to [MR Suite Minimum Room Size Requirements on page 17](#) for a list of considerations not included in the minimum area dimensions.



#### NOTE

Colored areas indicate service/installation areas. These areas can overlap as necessary as shown below. See individual component descriptions and room requirements for service area details. Magnet Monitors (MON) can be mounted on the side of the wall near the ICC. Optional equipment is not shown; additional space may be required for options.



#### NOTE

The following illustrations show equipment layouts based on the assumption that cryocooler compressors must be re-positioned during some service activities.



#### NOTE

Refer to [Table 2-17 MR System Component Replacement Shipping Specifications on page 51](#) for the dimensions of the replacement parts. The parts must be able to be positioned in front of the noted cabinet for replacement procedures after the system has been installed.



## 4.2 Main Disconnect Panel (MDP) Requirements and Specifications

### 4.2.1 Requirements

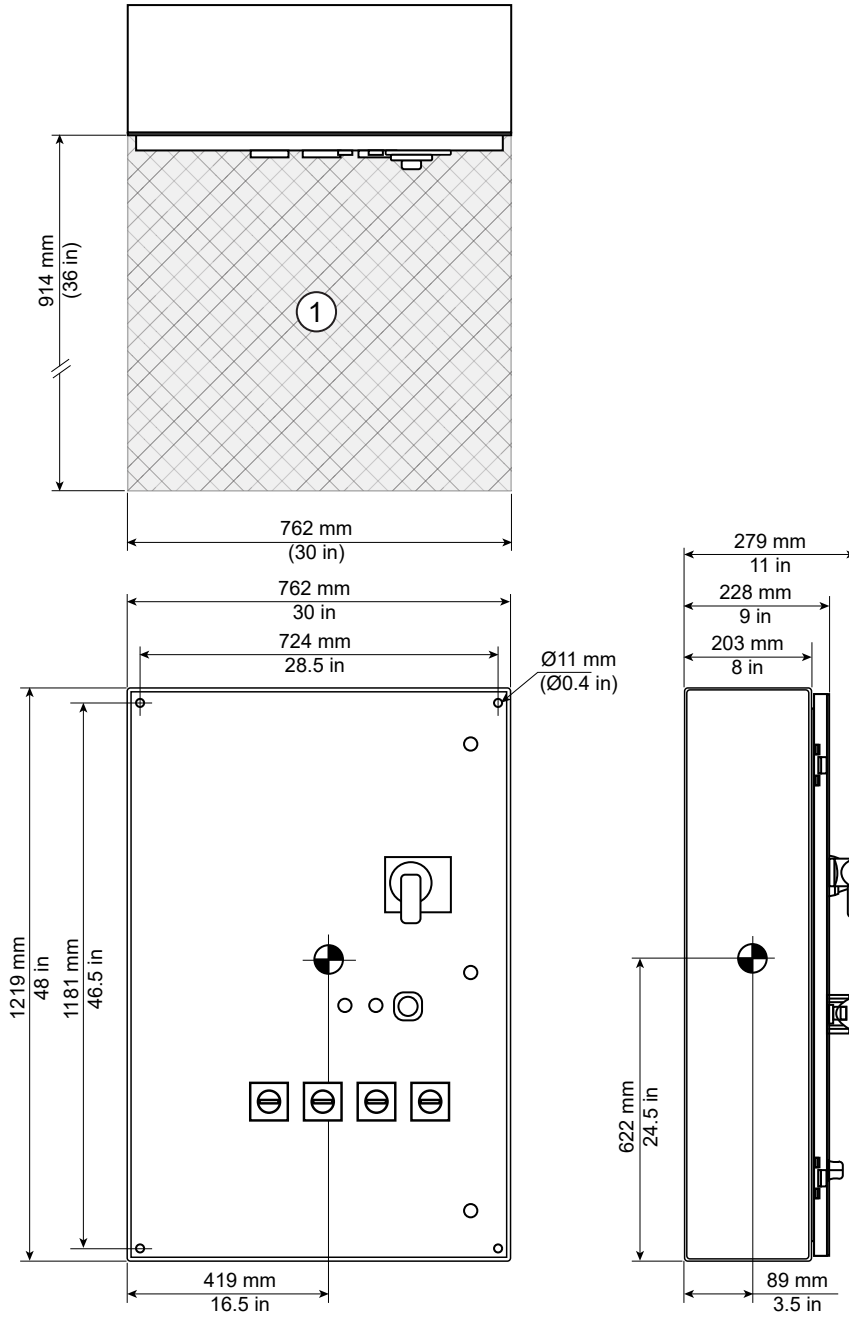
1. It is recommended to install the following items to support a power monitor:
  - 1.1. A T100 network connection with RJ45 connector near the MDP
  - 1.2. An electrical outlet
2. The cable must be Cat 5 or better.
3. The network connection must not be routed through the Ethernet switch in the Global Operator Cabinet (GOC).

### 4.2.2 Specifications

A GE HealthCare Main Disconnect Panel (MDP) is supplied with the following specifications.

1. 480V **M7700MA**, Weight: 90.7 kg (200 lb.)
2. 380-415V **M7700MB**, Weight: 91.6 kg (202 lb.)
3. Magnetic Field Limit: 5 mT (50 G)

**Figure 4-2 GE HealthCare supplied Main Disconnect Panel (MDP) M7700MA and M7700MB**

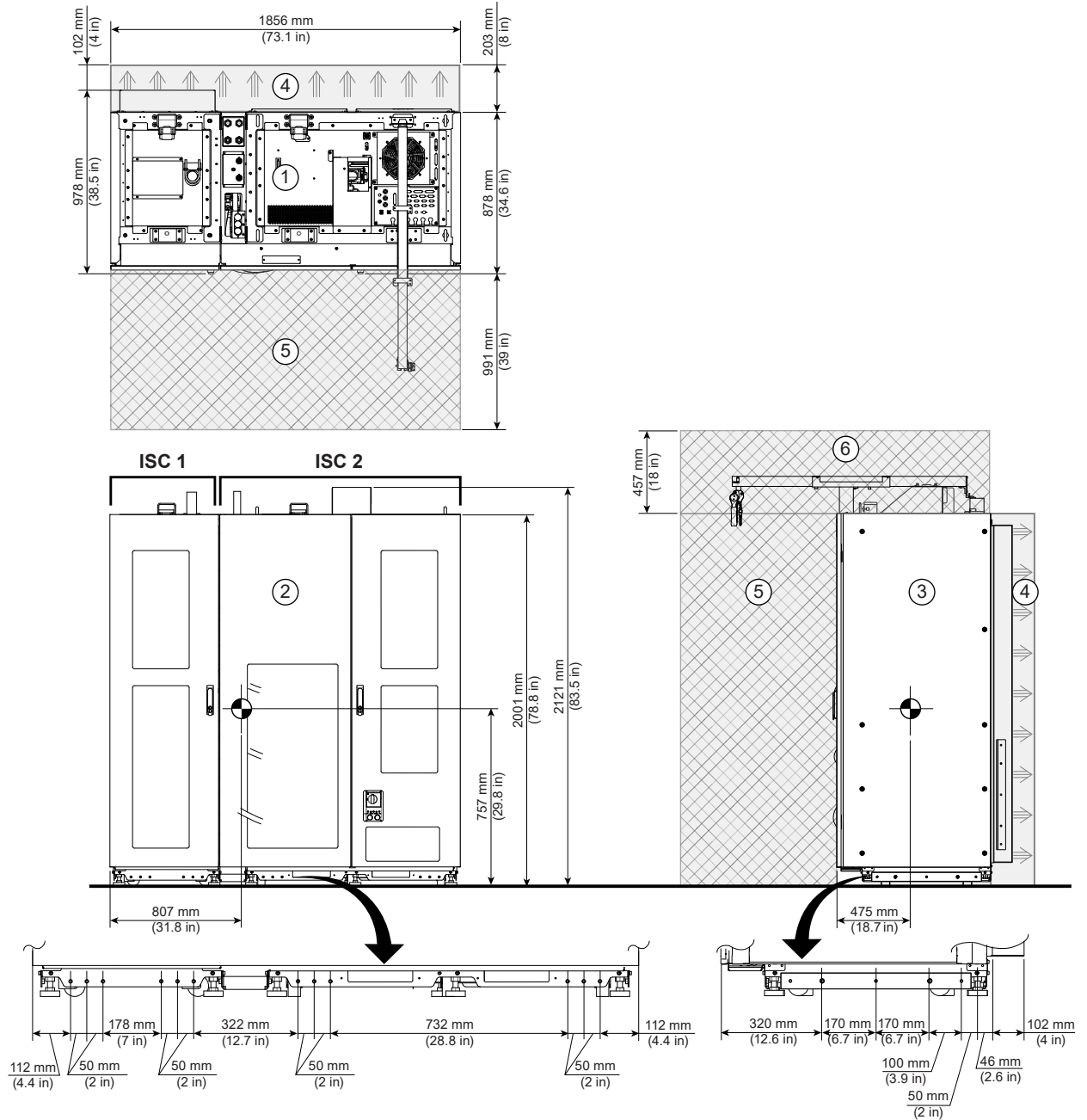


Item	Description
1	Service Clearance

## 4.3 Integrated System Cabinet (ISC) Specifications

1. Weight, ISC 1: 1034 kg (2279 lb.)
2. Weight, ISC 2: 1025 kg (2260 lb.)
3. Total Weight: 2059 kg (4539 lb.)
4. Maximum weight per caster: 272 kg (600 lb.)
5. Magnetic Field Limit: 5 mT (50 G) (Penetration Panel side)
6. The threaded seismic anchor mounting holes accommodate M8 bolts.
7. For seismic areas, the customer's contractor must provide and install brackets that secure the ISC cabinet to the wall and to the floor. See [Figure 4-3 Integrated System Cabinet \(ISC\) on page 81](#) for the location details for the mounting holes that the contractor will use to anchor the cabinet to the floor. Accommodations for floor mounting are available on the front and the sides of the cabinet. Accommodations for wall mounting are available on the top rear of the cabinet. Refer to [Figure 4-5 ISC wall brackets specifications \(short bracket\) on page 83](#) and [Figure 4-6 ISC wall brackets specifications \(long bracket\) on page 83](#).

Figure 4-3 Integrated System Cabinet (ISC)



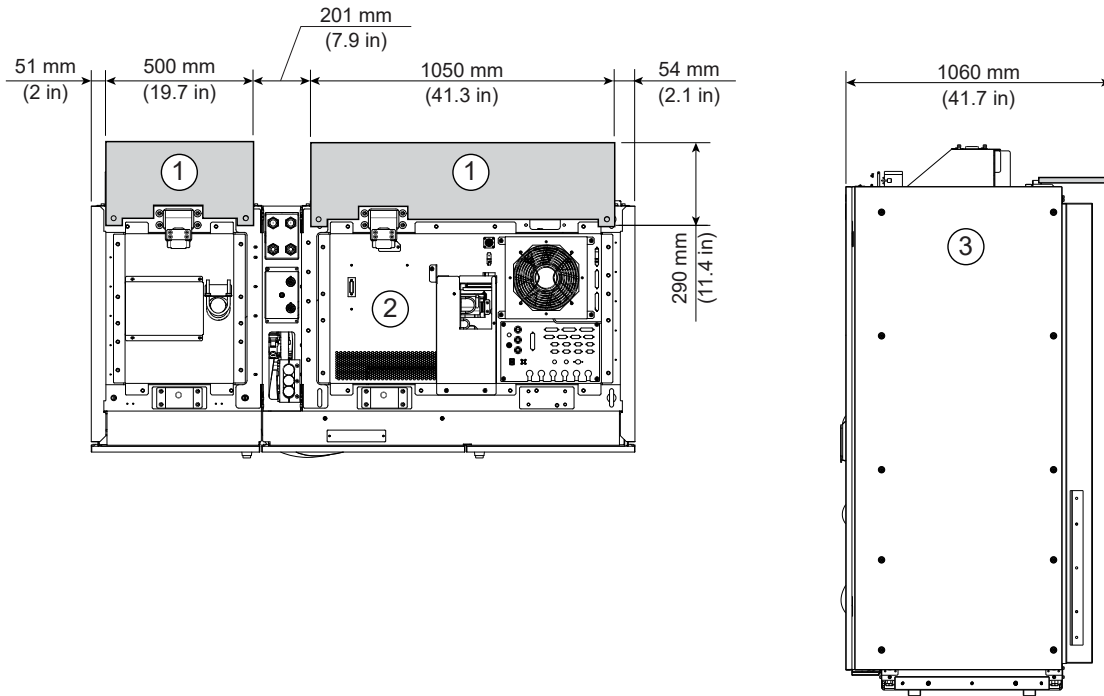
Item	Description	Item	Description
1	Top View	4	Air Flow between ISC and Wall
2	Front View	5	Service area
3	Side View	6	Minimum Space between Cabinet Top and Cable Tray



**NOTE**

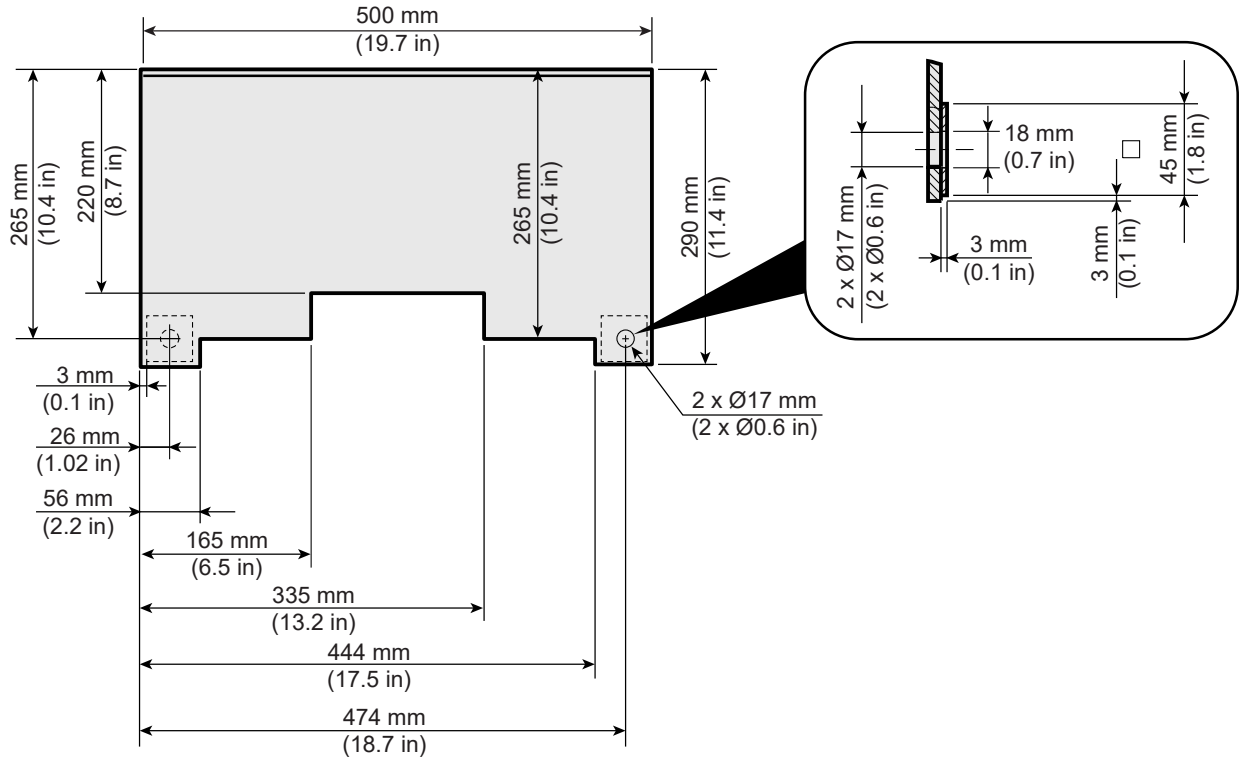
The left side and the right side of the ISC floor anchor bracket locations are symmetrical.

**Figure 4-4 ISC Anchor Bracket Location For Seismic Mounting**

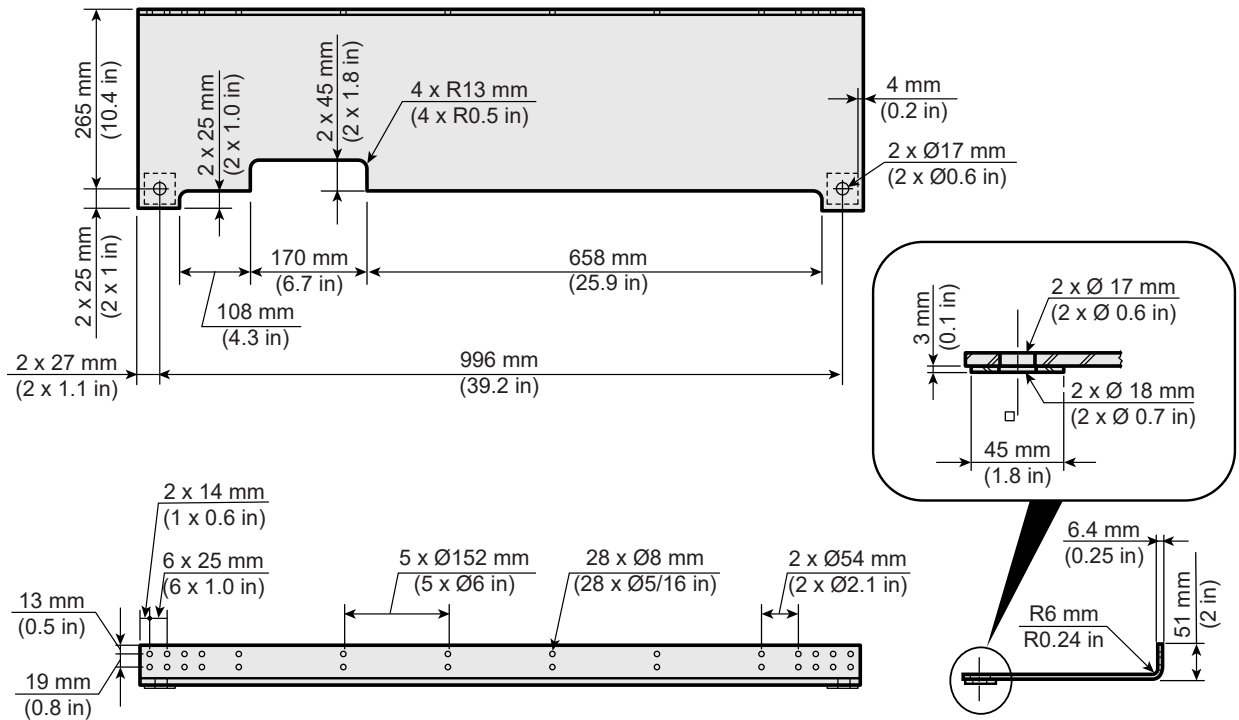


Item	Description	Item	Description
1	Bracket Locations	3	Side View
2	Top View	-	-

**Figure 4-5 ISC wall brackets specifications (short bracket)**



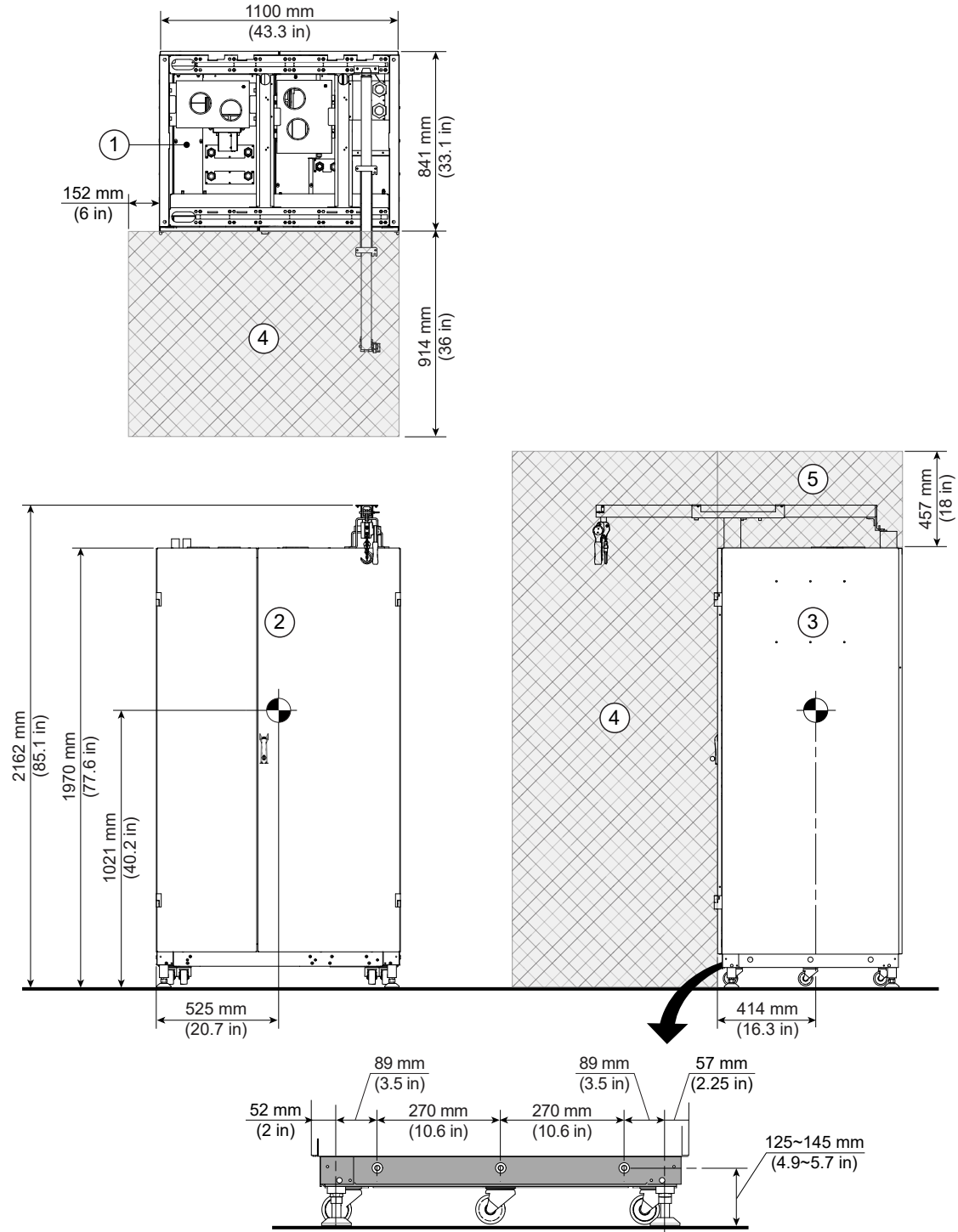
**Figure 4-6 ISC wall brackets specifications (long bracket)**



## 4.4 Integrated Cooling Cabinet (ICC) Specifications

1. ICC Weight with coolant: 615 kg (1353 lb.)
2. Magnetic Field Limit: 5 mT (50 G) (Penetration Panel side)
3. The threaded seismic anchor mounting holes accommodate M12 bolts.
4. Seismic mounting of the ICC must be performed at the sides of the cabinet.

**Figure 4-7 Integrated Cooling Cabinet (ICC)**



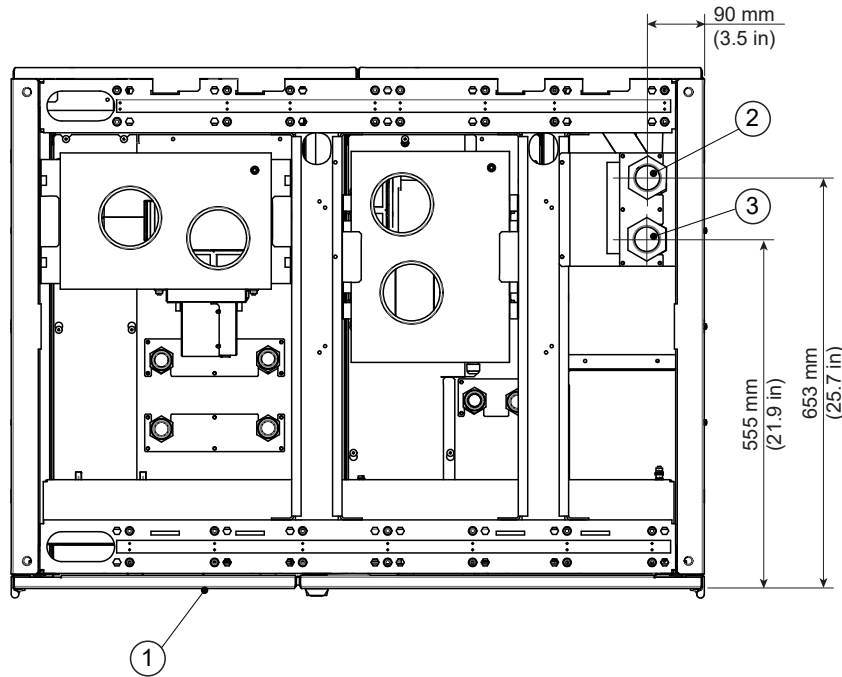
Item	Description	Item	Description
1	Top View	4	Service Area
2	Front View	5	Air Flow and Cables
3	Side View	-	-



**NOTE**

The left side and the right side of the ICC anchor bracket locations are symmetrical.

**Figure 4-8 ICC Facility Water Supply and Return Connections Location**



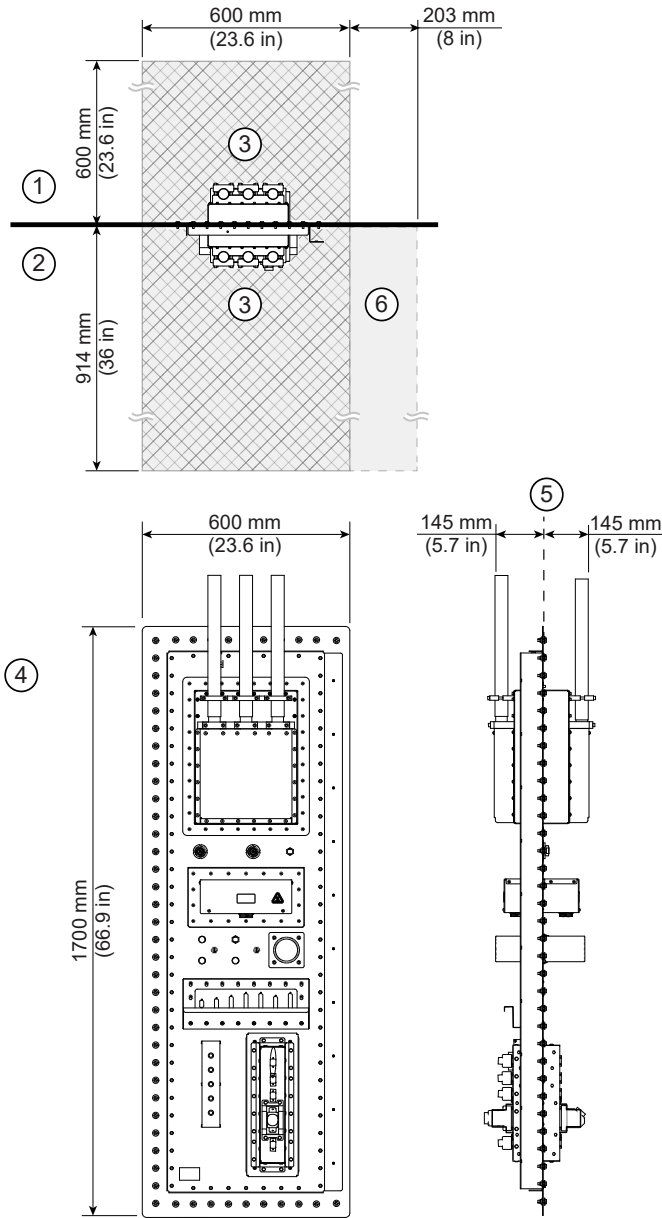
Item	Description	Item	Description
1	Cabinet Front	3	Facility Supply
2	Facility Return	-	-

## 4.5 Integrated System Cabinet (ISC) Penetration Panel (PP) Specifications

The Integrated System Cabinet (ISC) penetration panel (PP) provides interconnects from the Equipment Room through the Magnet Room RF Shield.

1. Magnetic Field Limit: 20 mT (200 G)
2. Refer to [3.4 Penetration Panel Wall Opening Requirements on page 58](#) for PEN panel mounting and location requirements.

**Figure 4-9 Integrated System Cabinet (ISC) Penetration Panel (PP)**



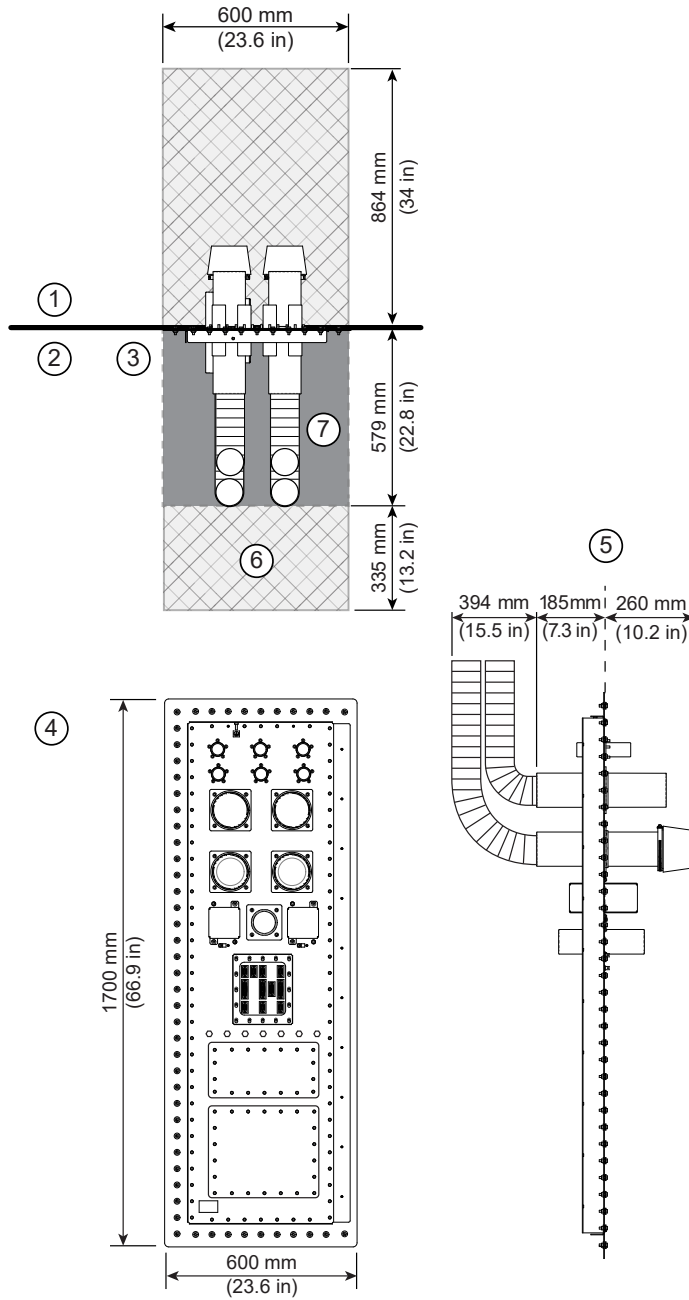
Item	Description	Item	Description
1	Magnet Room	4	Front View
2	Equipment Room	5	Side View
3	Service Area	6	Additional service clearance is needed if the ISC PEN is located away from ICC PEN. The additional clearance can be on either side of the ISC PEN.

## 4.6 Integrated Cooling Cabinet (ICC) Secondary Penetration Wall (SPW) Specifications

The Integrated Cooling Cabinet (ICC) secondary penetration wall (SPW) provides interconnects from the Equipment Room through the Magnet Room RF Shield.

1. Magnetic Field Limit: 20 mT (200 G)
2. Refer to [3.4 Penetration Panel Wall Opening Requirements on page 58](#) for PEN panel mounting and location requirements.

**Figure 4-10 Integrated Cooling Cabinet (ICC) Secondary Penetration Wall (SPW)**



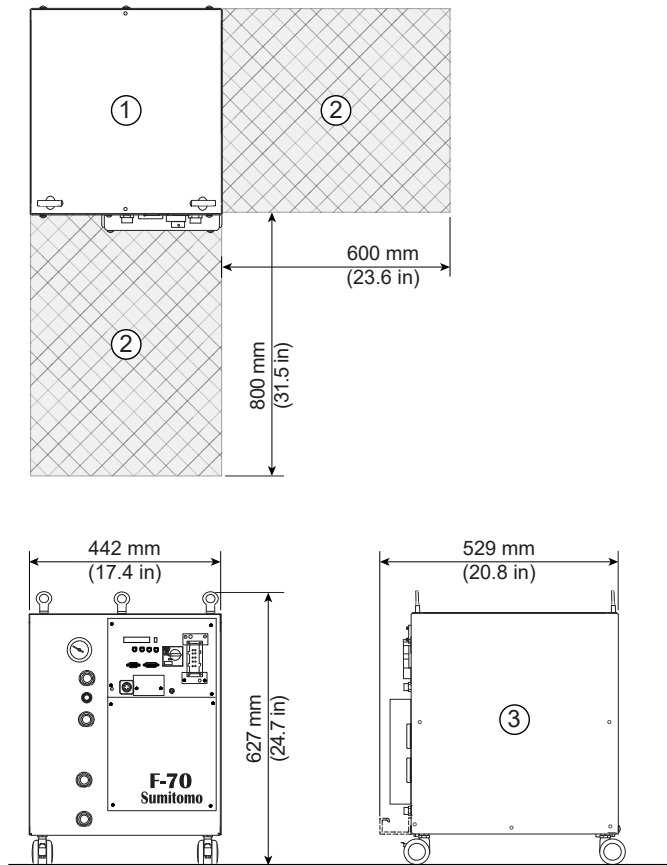
Item	Description	Item	Description
1	Magnet Room	5	Side View
2	Equipment Room	6	Service Area
3	Top View	7	Space for Hoses
4	Front View	-	-

## 4.7 Cryocooler Compressor (CRY) Specifications

The system includes two F-70 Cryocooler Compressors (CRY). Water cooling for the compressors is provided by the facility.

1. Weight: 100 kg (220 lb.) each
2. Magnetic Field Limit: 5 mT (50 G)

**Figure 4-11 F70 Cryocooler Compressor**



Item	Description	Item	Description
1	Top view	3	Side view
2	Service area		

# 4.8 Magnet Monitor (MON) Requirements and Specifications

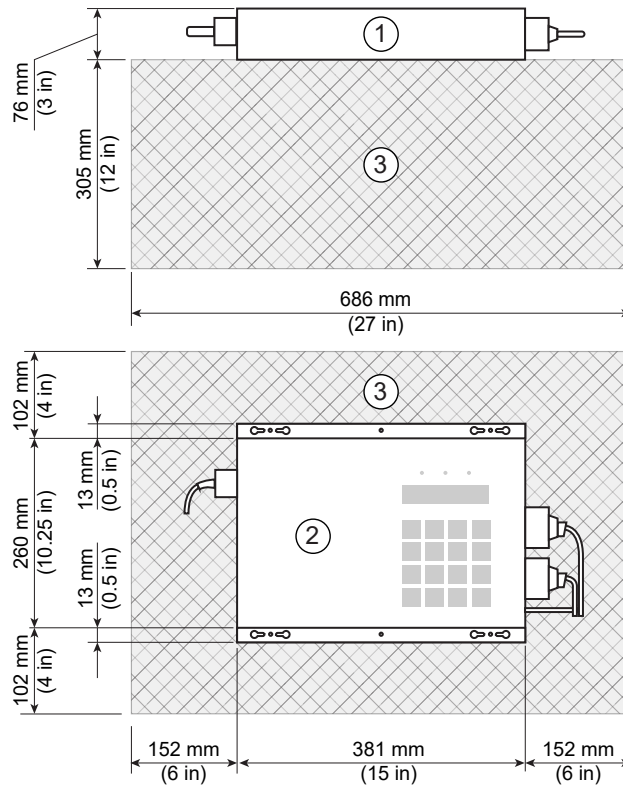
## 4.8.1 Requirements

1. Customer must supply T100 network connection with RJ45 connector to each of the two Magnet Monitors (MON). Network connectivity must be active prior to magnet delivery.
2. The cable must be Cat 5 or better.
3. The network connection must not be routed through the Ethernet switch in the Global Operator Cabinet (GOC).

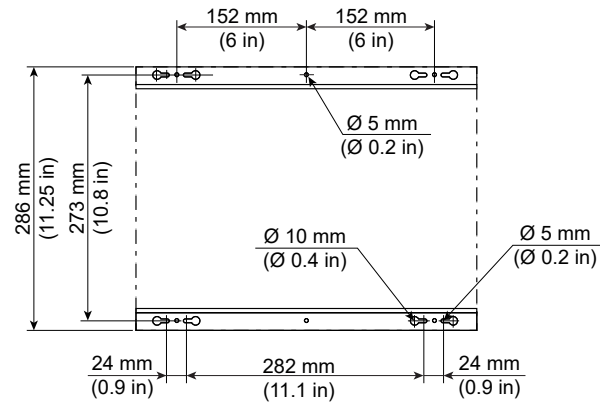
## 4.8.2 Specifications

1. Mounting location: On the wall or on either side of the ICC
2. Weight: 3.6 kg (8 lb.)
3. Magnetic Field Limit: 20 mT (200 gauss)
4. Power cord length: 1829 mm (72 in.)

Figure 4-12 Magnet Monitor (MON)



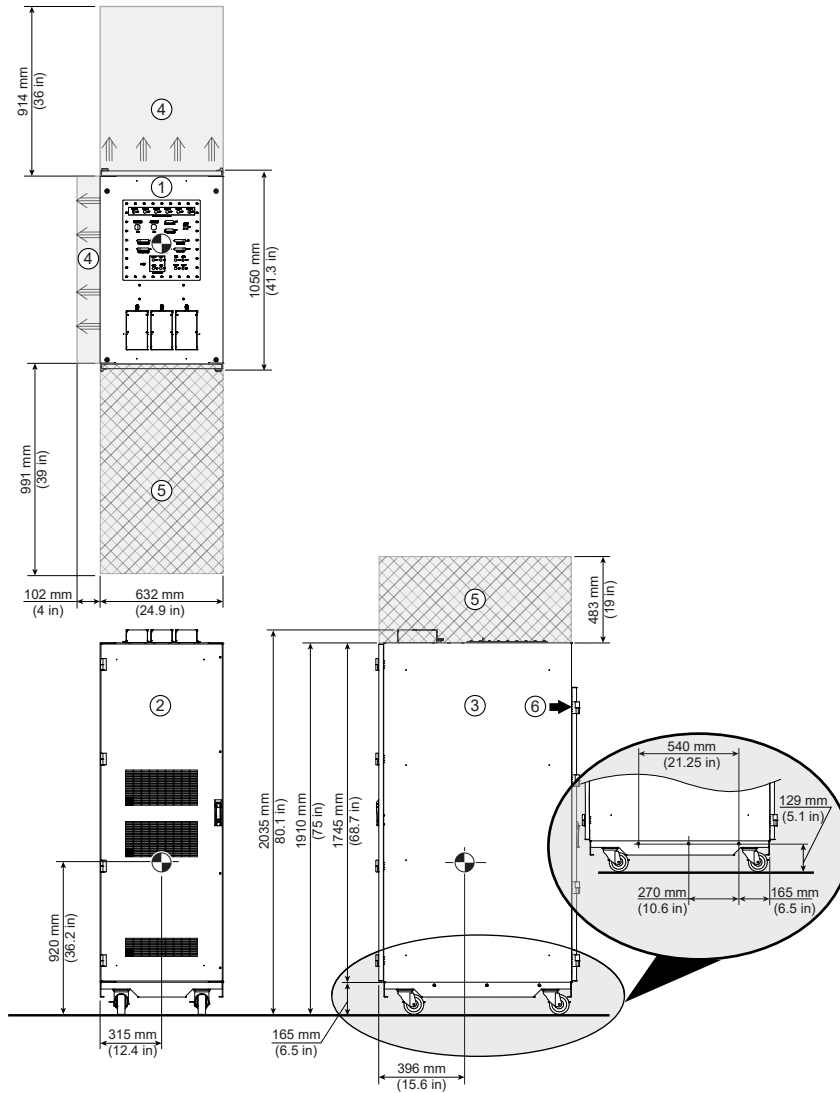
Item	Description	Item	Description
1	Top View	3	Service area
2	Front View	-	-

**Figure 4-13 Magnet Monitor (MON) Mounting Patterns**

## 4.9 RF Amplifier Cabinet Specifications

1. Weight: 634 kg (1397 lb.)
2. Magnetic Field Limit: 20 mT (200 G)
3. The threaded seismic anchor mounting holes accommodate M12 bolts.
4. Seismic mounting of the RF Amplifier Cabinet must be performed at the sides of the cabinet.

**Figure 4-14 RF Amplifier Cabinet**

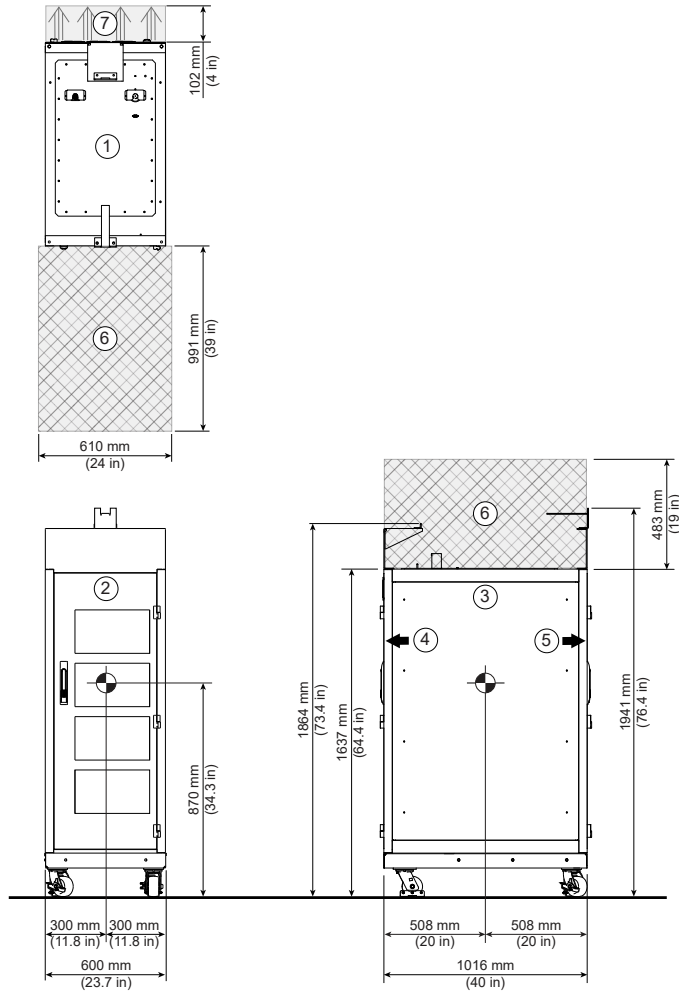


Item	Description	Item	Description
1	Top View	4	Airflow Clearance
2	Front View	5	Service Clearance
3	Side View	6	Front Cover

## 4.10 High Order Shim (HOS) Power Supply Cabinet Specifications

1. Weight: 410 kg (904 lb.)
2. Magnetic Field Limit: 20 mT (200 G)
3. The threaded seismic anchor mounting holes accommodate M10 bolts.
4. Seismic mounting of the HOS must be performed at the sides of the cabinet.

Figure 4-15 High Order Shim (HOS)



Item	Description	Item	Description
1	Top View	5	Front Cover
2	Front View	6	Service Clearance
3	Side View	7	Airflow Clearance
4	Rear Cover	-	-

## 5 Control Room

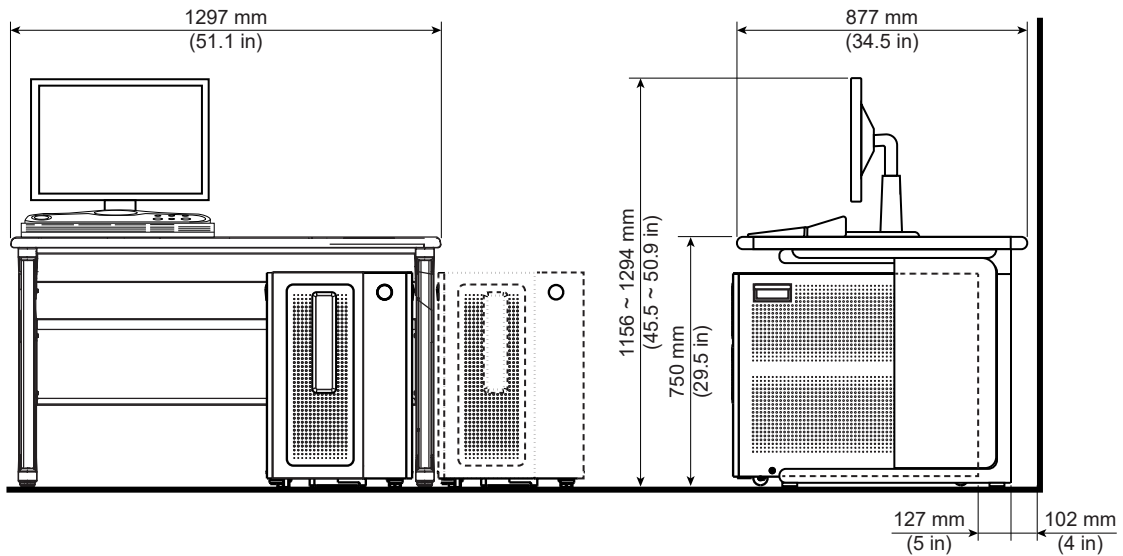
### 5.1 Operator Workspace Equipment Specifications



(Applies to all sections within this chapter)

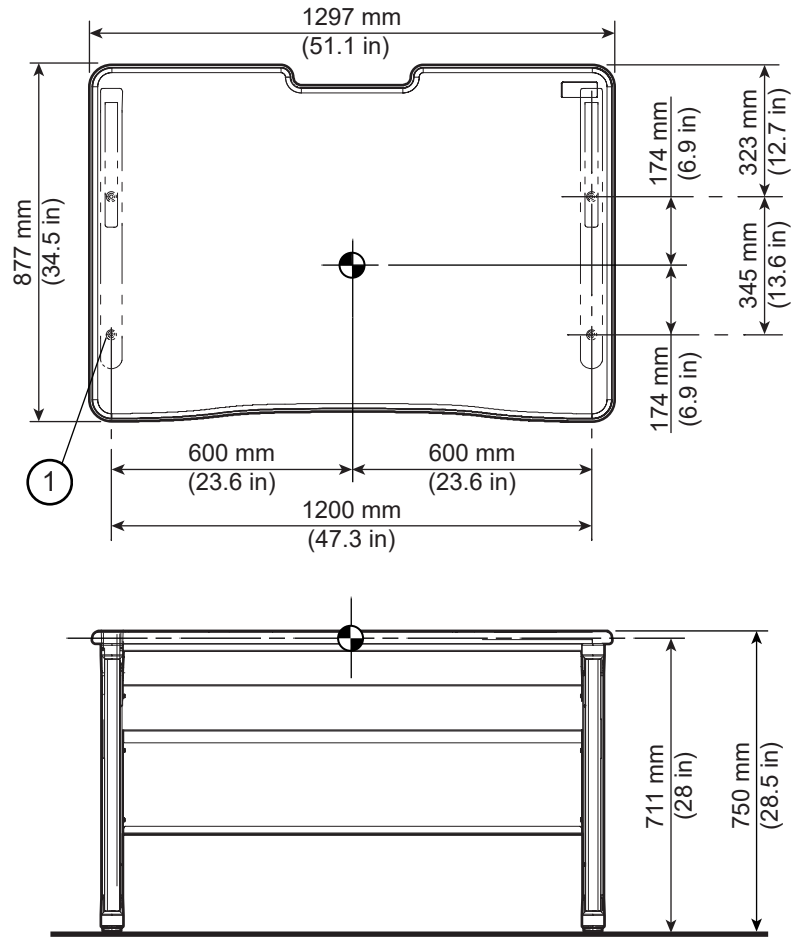
#### 5.1.1 Operator Workspace Assembly

Figure 5-1 Operator Workspace Assembly



## 5.1.2 Operator Workspace (OW) (Optional Equipment)

Figure 5-2 Operator Workspace (OW) Table (Top and Front View)

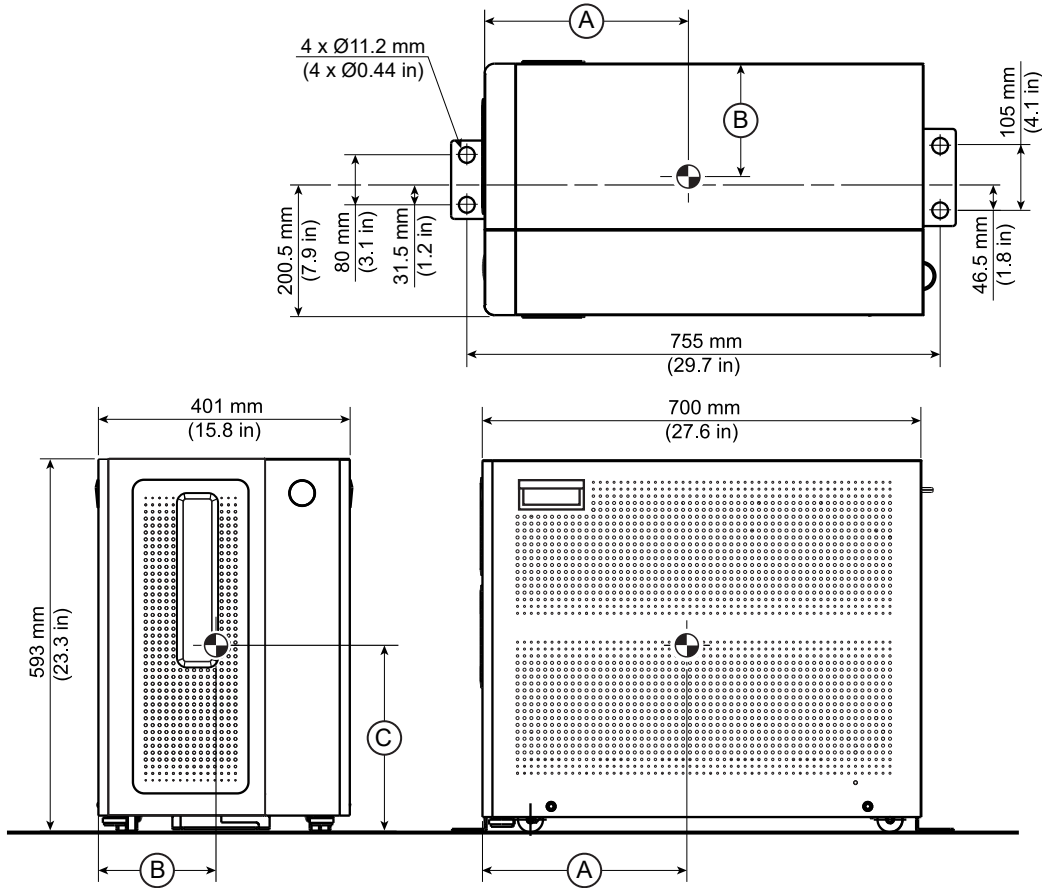


Item	Description
1	Four (4) 15.9 mm (5/8 in.) thru mounting holes for 9.5 mm (3/8 in.) seismic anchors

### 5.1.3 Global Operator Cabinet (GOC)

1. Weight:
  - For Dell T5820:** 59.3 kg (130.7 lb.)
  - For HP Z4G5:** 54.7 kg (120.6 lb.)
2. Magnetic Field Limit: 5 mT (50 G)
3. Anchor size: M10 (3/8 in.)

Figure 5-3 Global Operator Cabinet (GOC)



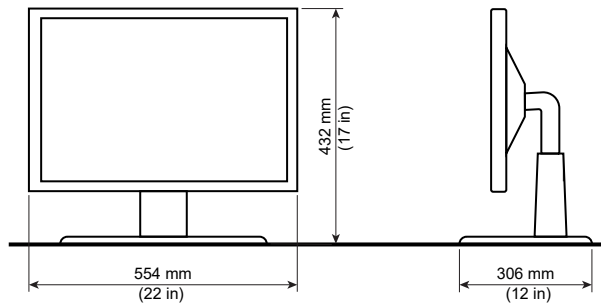
	A	B	C
Dell T5820	333 mm (13.1 in.)	187 mm (7.4 in.)	273 mm (10.7 in.)
HP Z4G5	375 mm (14.8 in.)	205 mm (8.1 in.)	330 mm (13 in.)

## 5.1.4 Host Display

Weight and dimensions for the Host Display are approximate and might vary depending on the display model.

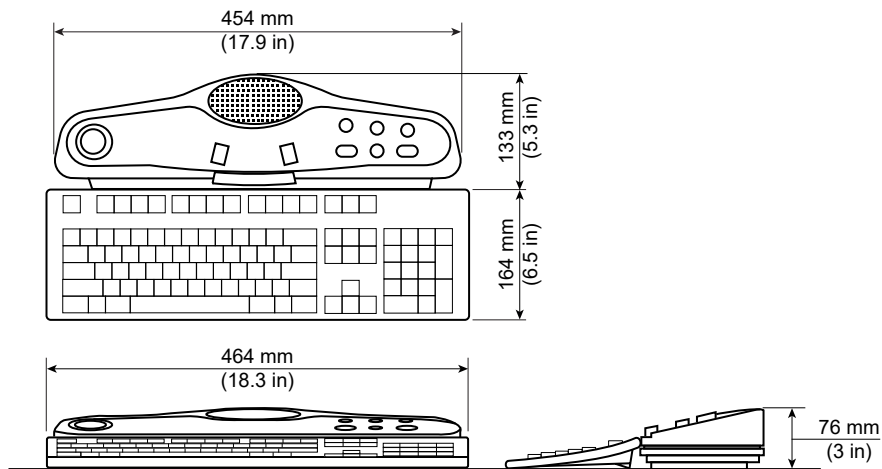
1. Weight: 6.7kg (14.8 lb.)
2. Magnetic Field Limit: 5 mT (50 G)

**Figure 5-4 Host Display**



## 5.1.5 Host Keyboard

**Figure 5-5 Host Keyboard**

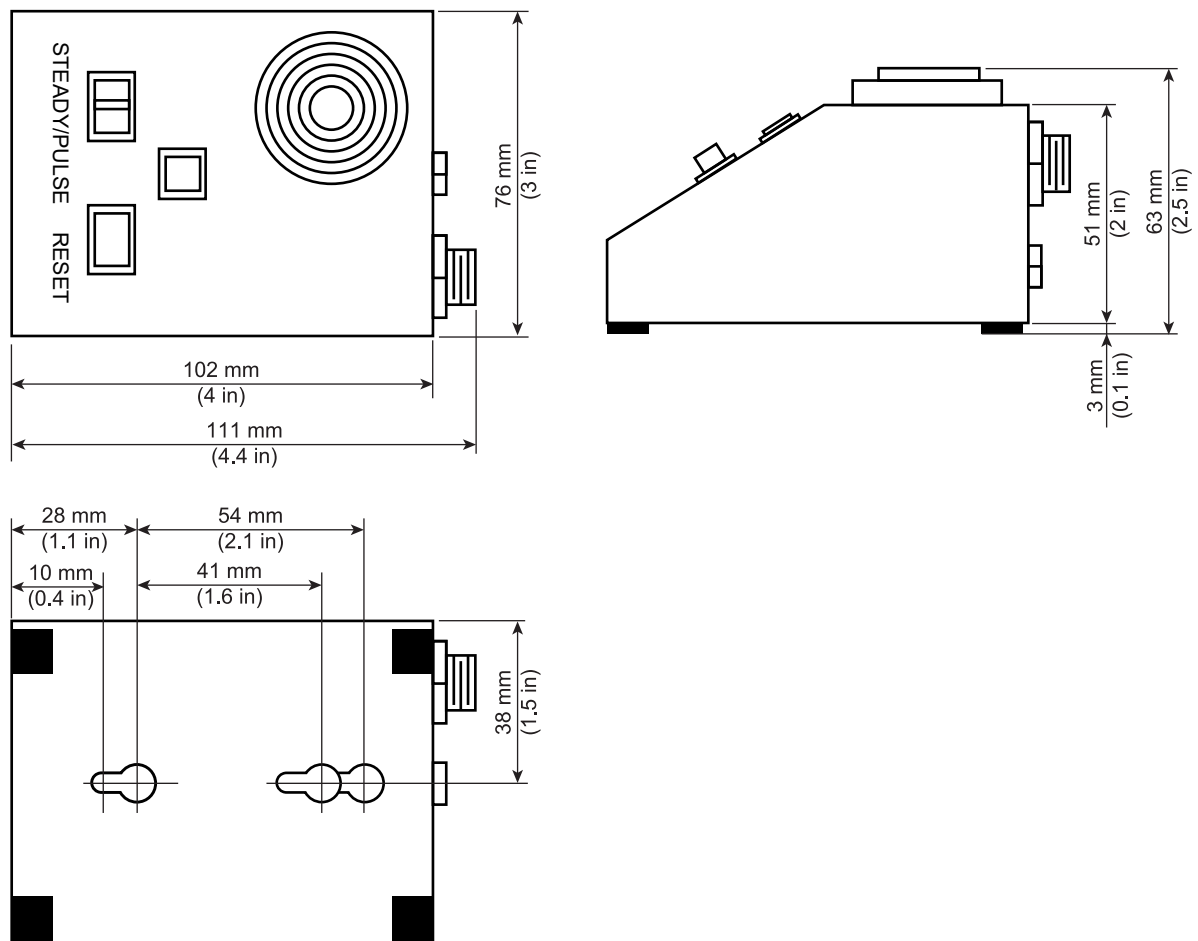


## 5.1.6 Pneumatic Patient Alert

The Pneumatic Patient Alert system allows the patient to contact the operator. 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.

1. Weight 0.2 kg (0.5 lb.)
2. Magnetic Field Limit: 5 mT (50 G)
3. The Control Box must be placed or mounted within reach of the operator and within 1.5 m (5 ft.) of an electrical outlet.

**Figure 5-6 Pneumatic Patient Alert (PA) with Mounting Pattern**

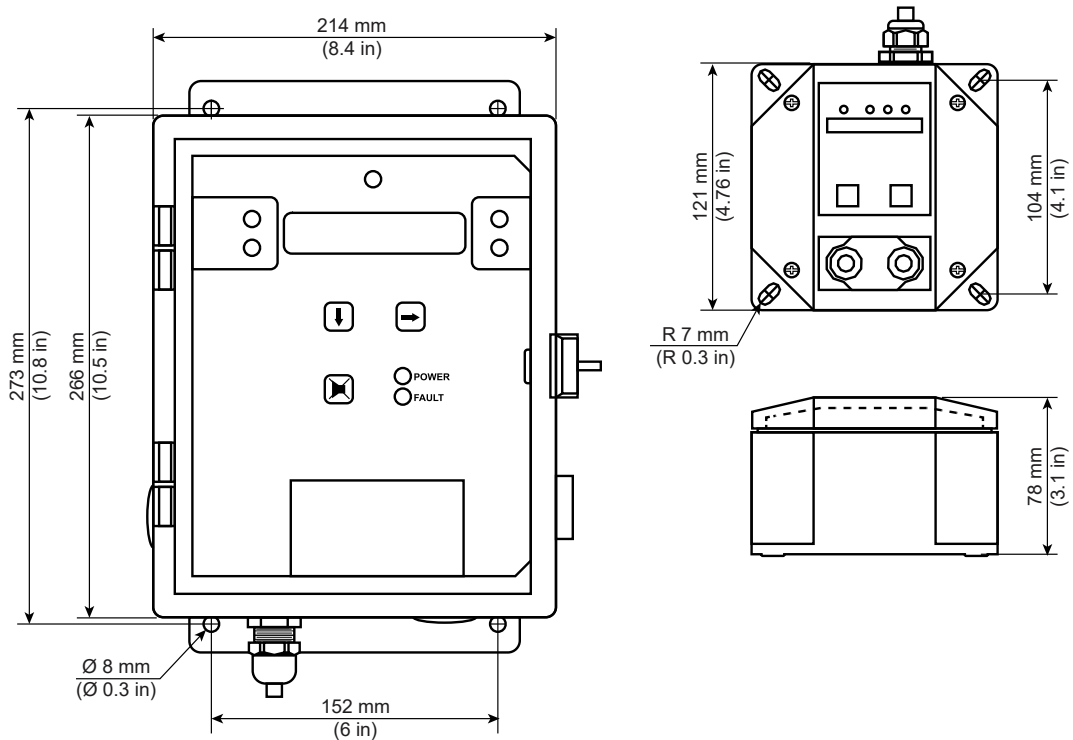


## 5.2 Oxygen Monitor (OXY) Specifications (Optional Equipment)

The optional Oxygen Monitor system consists of the Oxygen Monitor, the Remote Oxygen Sensor Module, and interconnects through the Penetration Panel. The Oxygen Monitor alarm is located near the Operator Workspace and is activated by the Remote Oxygen Sensor Module in the Magnet Room.

1. Oxygen Monitor Weight: 3.6 kg (8 lb.)
2. Oxygen Sensor Module Weight: 0.9 kg (2 lb.)
3. Magnetic Field Limit: 5 mT (50 G)

**Figure 5-7 Oxygen Monitor and Remote Sensor**



# 6 Digital Service and Connectivity Requirements

## 6.1 InSite RSvP (Remote Service Platform) Requirements



(Applies to all sections within this chapter)

### 6.1.1 InSite RSvP Connectivity Requirements

Following are the requirements for InSite RSvP connectivity:

1. The customer shall provide a physical connection or a route to an existing enterprise LAN.
2. The cable must be Cat 5 or better.
3. The customer shall provide outbound internet access for the device using HTTPS protocol over port 443.
4. The customer's network administrators shall provide DNS IP Address or Proxy IP address and authentication information (if applicable for the proxy server).
5. The customer's network administrators shall whitelist the following URLs:
  - Enterprise production:
    - `https://insite.gehealthcare.com:443`
    - `https://as1-insite.gehealthcare.com`
    - `https://as2-insite.gehealthcare.com`
  - Flexera URL: `https://gehealthcare-ns.flexnetoperations.com`
  - Flexera Software Download URL: `https://download.flexnetoperations.com`
  - For EU regions, whitelist the following:
    - `https://as1-insite-eu.gehealthcare.com`
    - `https://insite-eu.gehealthcare.com`

## 7 MR System Interconnects

### 7.1 MR System Interconnects Specifications



(Applies to all subsections within this section)

#### 7.1.1 Component Designator Definitions

GE HealthCare uses Component Designators to identify system components. All subsystem cabinets and other components are referred to by their component designators in the Interconnect Data diagrams and tables.

**Table 7-1 MR System Component Designators**

Component Designator	Description
CRY1, CRY2	Cryocooler Compressor 1 and 2
DS, DS1	Door Switch
E01, E02, and so on	Emergency-Off (E-Off) Buttons
HOS PS	High Order Shim Power Supply Cabinet
ICC	Integrated Cooling Cabinet
ISC	Integrated System Cabinet
MAG	Magnet and Enclosure (all magnet enclosure components in Magnet Room)
MDP	Main Disconnect Panel
MON1, MON2	Magnet Monitor 1 and 2
MRU	Magnet Rundown Unit
OW	Operator Workstation
PA1	Pneumatic Patient Alert Control Box
PDU	Power Distribution Unit (PDU) is a module in the ISC cabinet
PED	Magnet Rear Pedestal
PP	Penetration Panel
PT	Patient Transport Table
RF	RF Cabinet

**Table 7-2 MR System Options Component Designators**

Component Designator	Description
OXY	Oxygen Monitor

## 7.1.2 Available Cable Lengths

Cable lengths for the system are defined in the following table. Cabinets and equipment at the site must be positioned within the distances shown. This maximum distance between cabinets must accommodate the cable length from the top of the equipment, through the cable tray, and to the top of the other equipment, with the exception of the RF Transmit cables, which are routed beneath the finished floor.

**Table 7-3 Available Cable and Hose Lengths**

Length Identifier (shown in the figure below)	Point A	Point B	Cable Length mm (in.)
<b>Equipment Room</b>			
L1 (This length is for all cables and hoses <b>except</b> for gradient cables. For gradient cable available lengths, refer to <a href="#">Table 7-4 Available Cable Lengths for Gradient Cable (Equipment Room, PP I/O Panel to Top of ISC)</a> on page 104.)	ISC, top panel	ISC PP, top	8500 (334.6)
L2	ISC, top panel	ICC SPW, top	9000 (354.3)
L3	ISC, top panel	ICC, top panel	8000 (315.0)
L4	ISC, top panel	OW, back	27000 (1063.0)
L5	ISC, top panel	Magnet Room door switch	24400 (960.6)
L6	ICC, top panel	ICC SPW, top	12000 (472.44094)
Not shown	ICC, top panel	E-Off switch, Control Room or Equipment Room	16800 (661.4)
Not shown	Top of ISC PP and ICC SPW	RF Common ground stud	2800 (110.2)
L7	MDP	Top of CRY	8500 (334.6)
L12	OW, back	ICC SPW, top	27000 (1063.0)
L15	MON	ICC SPW	15000 (590.6)
L17	RF, top panel	ISC, top panel	6000 (236.2)
L18	RF, top panel	ISC PP, top	7000 (275.6)
L19	HOS, top panel	ISC, top panel	10000 (393.7)
L20	HOS, top panel	ICC SPW, top panel	8000 (315.0)
L21	MON	ISC, top panel	18200 (720)
L22	MON	CRY, front	10000 (394)
Not shown	MON	Hospital ethernet switch	30000 (1181.1)
<b>Magnet Room</b>			
L8	MAG, top	ISC, top panel	17000 (669.3)

**Table 7-3 Available Cable and Hose Lengths** (Table continued)

Length Identifier (shown in the figure below)	Point A	Point B	Cable Length mm (in.)
L9	MAG, top	ICC SPW, top	10600 (417.3)
L10 (This length is for all cables and hoses <b>except</b> for gradient cables. For gradient cable available lengths, refer to <a href="#">Table 7-4 Available Cable Lengths for Gradient Cable (Equipment Room, PP I/O Panel to Top of ISC)</a> on page 104.)	MAG, top	ISC PP, top	9960 (392.1)
L11	MAG, top	OW, back	45000 (1771.7)
L14	MAG, top	CRY, front	20000 (787.4)
L16	MAG, top	MRU	24700 (972.4)
L23	ISC PP, bottom	PED (RF Transmit cables route underneath the floor)	12200 (480.3)

**Table 7-4 Available Cable Lengths for Gradient Cable (Equipment Room, PP I/O Panel to Top of ISC)**

Length Identifier (shown in the figure below)	Available lengths mm (in.)
L1	4600 (181)
	6600 (260)
	8600 (339)
	10600 (417)
	12600 (496)
	14600 (575)

**Table 7-5 Available Cable Lengths for Gradient Cable (Magnet Room, Magnet Gradient Cable Strain Relief Plate to Top of SPW I/O Panel)**

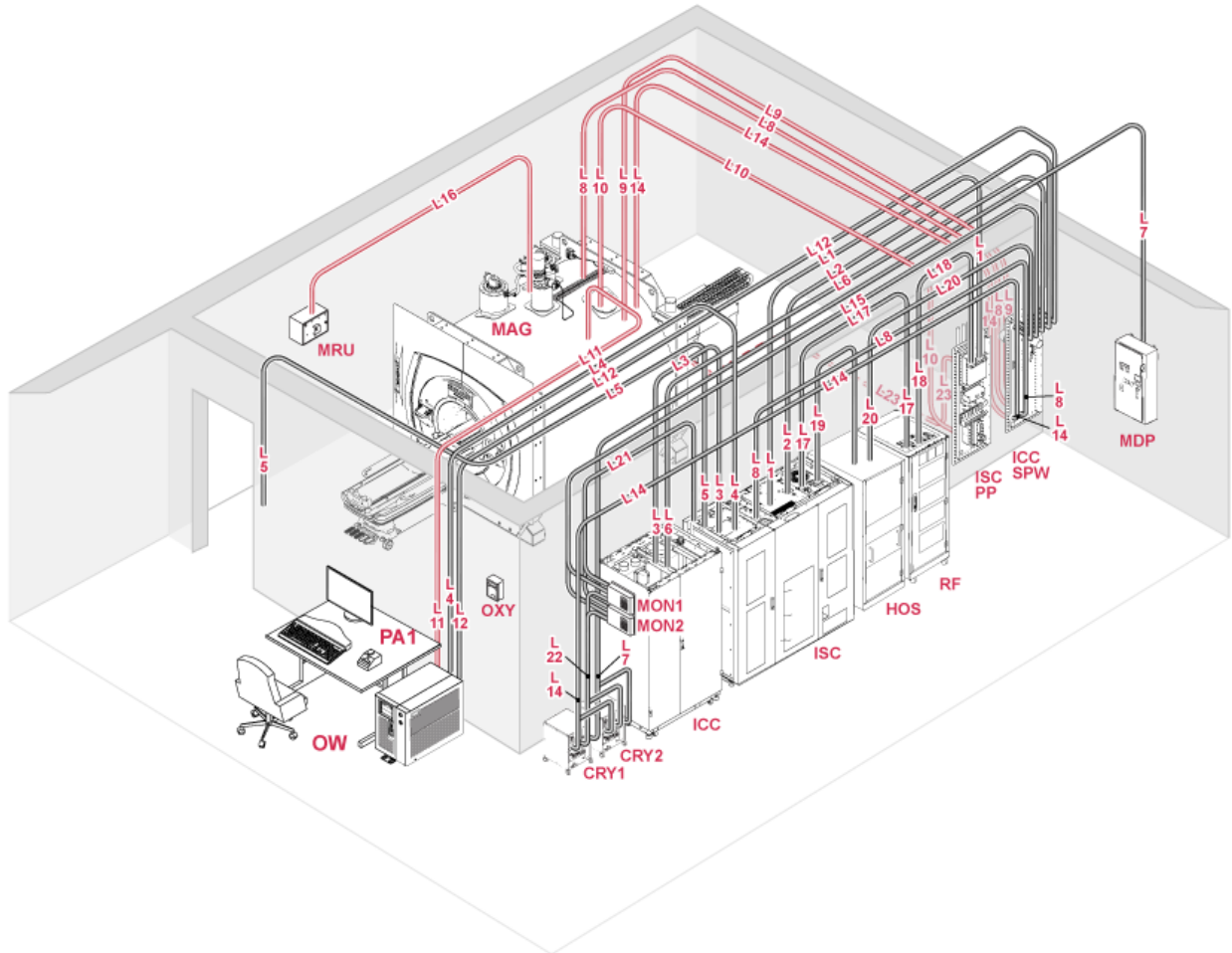
Length Identifier (shown in the figure below)	Available lengths mm (in.)
L12	4600 (181)
	6600 (260)
	8600 (339)
	10600 (417)
	12600 (496)
	14600 (575)



**NOTE**

Figure 7-1 Available Cable/Hose Lengths on page 105 does not show cable trays. This figure is for reference only, to show available cable lengths and not to be used to design cable routing.

**Figure 7-1 Available Cable/Hose Lengths**



**NOTE**

OXY shown above is an optional component of the system.



**NOTE**

For simplicity only cables to Cryocooler Compressor Cabinet (CRY 1) are shown in the above figure. The same cables will connect to the second Cryocooler Compressor Cabinet (CRY 2).

### 7.1.3 BrainWave Option

**Table 7-6 BrainWave Option Usable Cable Lengths**

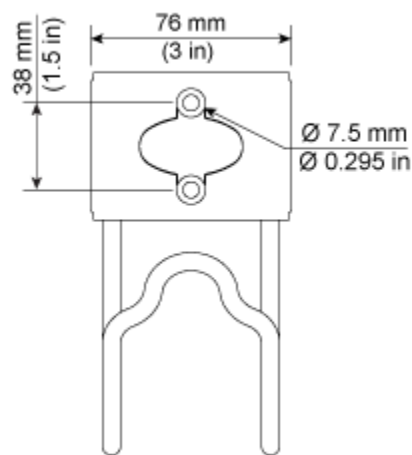
Cable	From	To	Cable Length mm (in.)
9-pin D-sub to JF-50	ICC SPW, top edge	Top of GOC	34187 (1346)
9-pin D-sub to BNC	ISC, top edge	Top of GOC	27432 (1080)

**Table 7-6 BrainWave Option Usable Cable Lengths** (Table continued)

Cable	From	To	Cable Length mm (in.)
9-pin D-sub to Coax	ICC SPW, top edge	MAG, gradient cable clamp block	11327 (446)

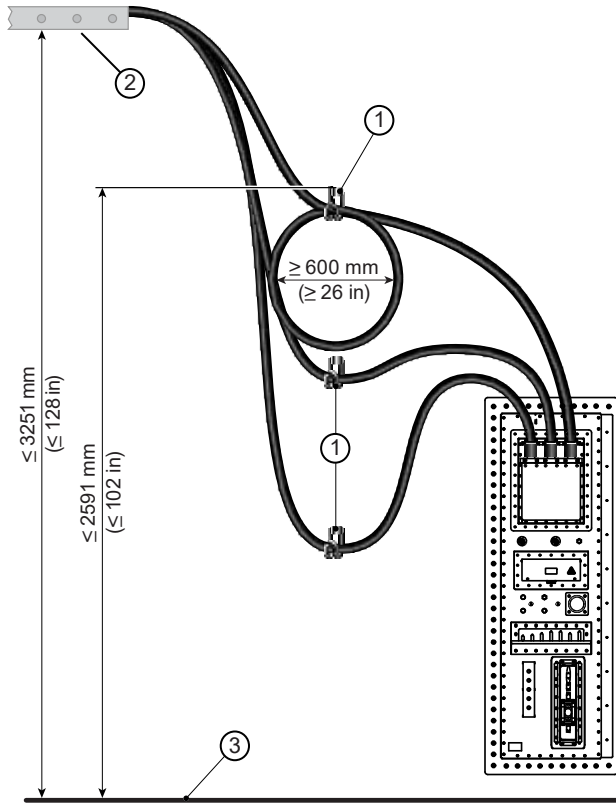
## 7.1.4 Storage Requirements for Excess Gradient Cable

1. Excess gradient cable must be stored on a wall hook inside the penetration panel closet in the Magnet Room and on a hook anchored into the Equipment Room wall. GE HealthCare supplies one hook per cable.
2. Supports and anchorage must be able to hold up to 22.7 kg (50 lb.) of weight per cable.
3. Excess gradient cable can be stored in a single loop (no more than one loop per cable) with a minimum bend radius of 330 mm (13 in.).
4. Supports shall be anchored no more than 2591 mm (102 in.) above the floor.

**Figure 7-2 Gradient Cable Mounting Hook Mounting Detail****NOTE**

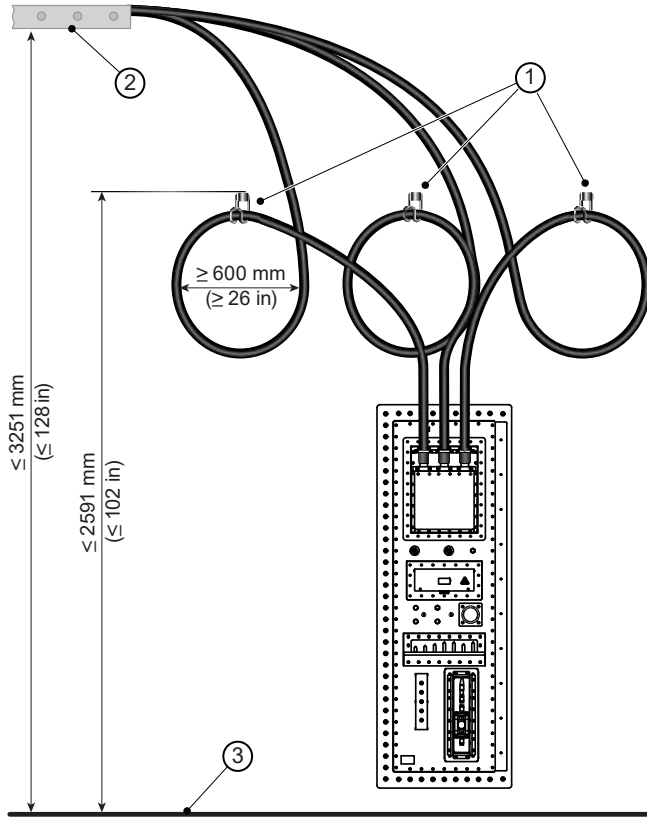
The examples below are representative of possible cable layout or configuration. Layout may vary depending on size, shape and configuration of the penetration panel closet. Configure cables to best suit the install configuration without violating the requirements above.

**Figure 7-3 Gradient Cable Storage Vertical Layout (Example)**



Item	Description	Item	Description
1	GE HealthCare-supplied gradient cable mounting hooks	3	Finished floor
2	Cable tray		

**Figure 7-4 Gradient Cable Storage Horizontal Layout (Example)**



Item	Description	Item	Description
1	GE HealthCare-supplied gradient cable mounting hooks	3	Finished floor
2	Cable tray		

## 7.2 MR System Interconnects Routing Requirements



(Applies to all subsections within this section)

### 7.2.1 General Requirements

1. The customer is responsible for the purchase and installation of all cable support mechanisms.
2. Any type of nonferrous cable support can be used, such as a commercially available ladder or wire rack style cable trays, if the cable trays meet all MR System requirements.
3. The distance between cable supports must be less than 305 mm (12 in.). For example, the distance between rungs on a ladder tray, or the distance from the end of a cable tray to a final nonferrous cable support must be 305 mm (12 in.) or less.
4. The cable supports must have the minimum cable bend radius per MR System Cable Specifications. For example, the vertical and horizontal bends of the gradient cables must have a bend radius of 330 mm (13 in.).
5. Cable supports can be stacked or side-to-side.
6. If trays are stacked, the air, water, and cryogen lines must be run in the lower support (see [Figure 7-6 Cable Groupings on page 111](#)).
7. Each cable tray must support a weight of at least 74.8 kg/m (50 lb./ft.).



#### NOTE

If stacked, each cable tray must support the weight of both cable trays: that is 149.6 kg/m (100 lb./ft.).

8. Cables must be accessible on at least one side of the cable support and require a minimum of 254 mm (10 in.) from the top of the tray. (For example, see [Figure 7-7 Cable Tray Requirements Example \(Side-By-Side\) on page 113](#) or [Figure 7-8 Cable Tray Requirements Example \(Stacked\) on page 114](#).) If this is not possible due to obstructions, see the exceptions below.
9. All individual cable supports (for example, rungs) require lateral support to maintain the positions specified in the illustrations both during installation and after installation of the interconnects (for example, cables).

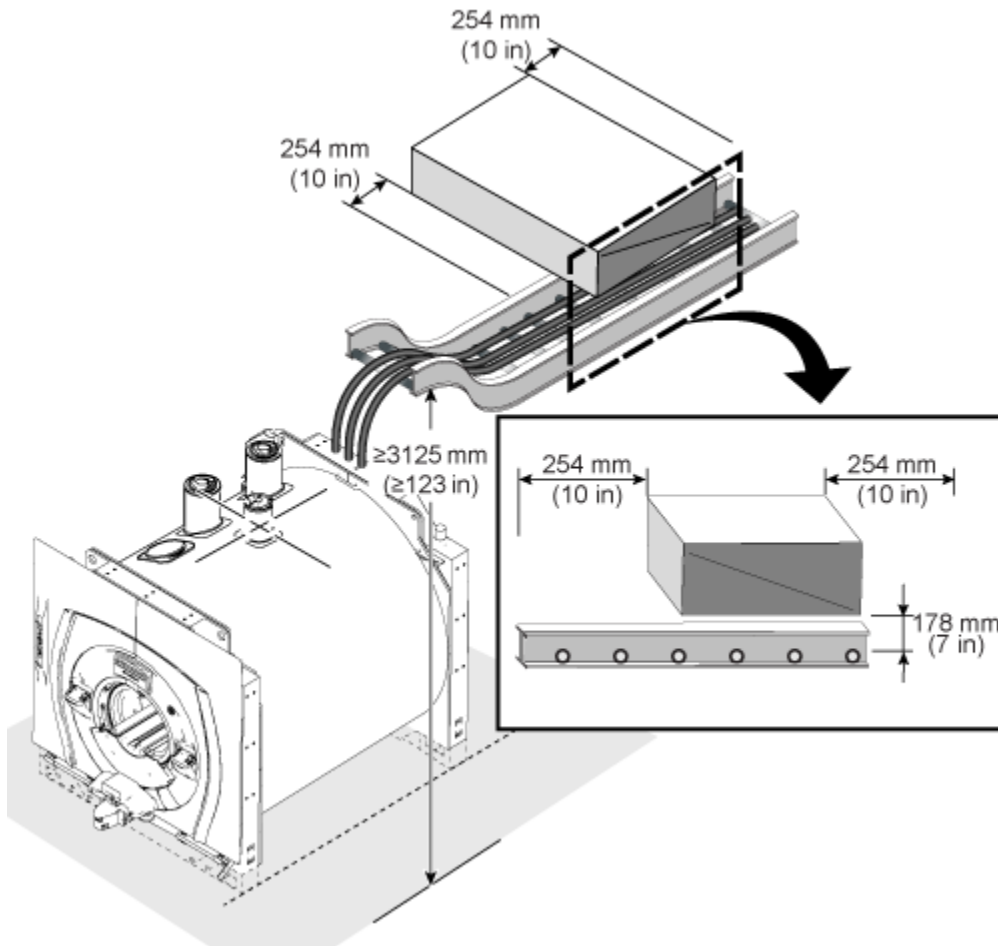
#### Exceptions for Obstructions:

1. The top of the cable tray must not touch an obstruction. A minimum of 254 mm (10 in.) of clearance is required on either side of the obstruction. See [Figure 7-5 Obstruction Example on page 110](#).
2. A minimum of 178 mm (7 in.) of clearance is required from the top of the tray rung to the lowest point of any obstruction.

**NOTE**

The illustration below shows how to route cable trays around HVAC ducts, light fixtures, medical gases, structural beams, and other obstructions. If local code permits, a tray with a bend can route the cables underneath an obstruction. At the rear of the magnet, the cable tray must be installed at the minimum height. The part of the cable tray that is under the obstruction can be installed at a lower height. The tray bend must provide the minimum cable bend radius.

**Figure 7-5 Obstruction Example**



## 7.2.2 Magnet Room Requirements

1. Two cable trays must be used, each at least 450 mm or 18 in. wide.
2. Installation and routing of cable trays must be coordinated with the RF shield vendor.
3. Side-to-side trays in the Magnet Room must not touch to prevent RF broadband noise caused by metal-to-metal sidewall contact.
4. Ceiling grid work, medical gas lines, lighting fixtures, and so on, must not touch MR System cabling or cable supports.
5. Excess cable length in the Magnet Room must be stored in either:
  - 5.1. Penetration Panel closet. If utilizing the Penetration Panel Closet for cable storage, the supports and anchors must be able to hold up to 22.7 kg (50 lb.).

- 5.2. Magnet Room cable trays (excess cable must be at least 915 mm (36 in.) from the magnet end of the tray).

### 7.2.3 Recommended Cable Groupings

We recommend the grouping order shown below. The cable groups must not touch. Local code may require dividers, channeling, bundling, and so on.



#### NOTE

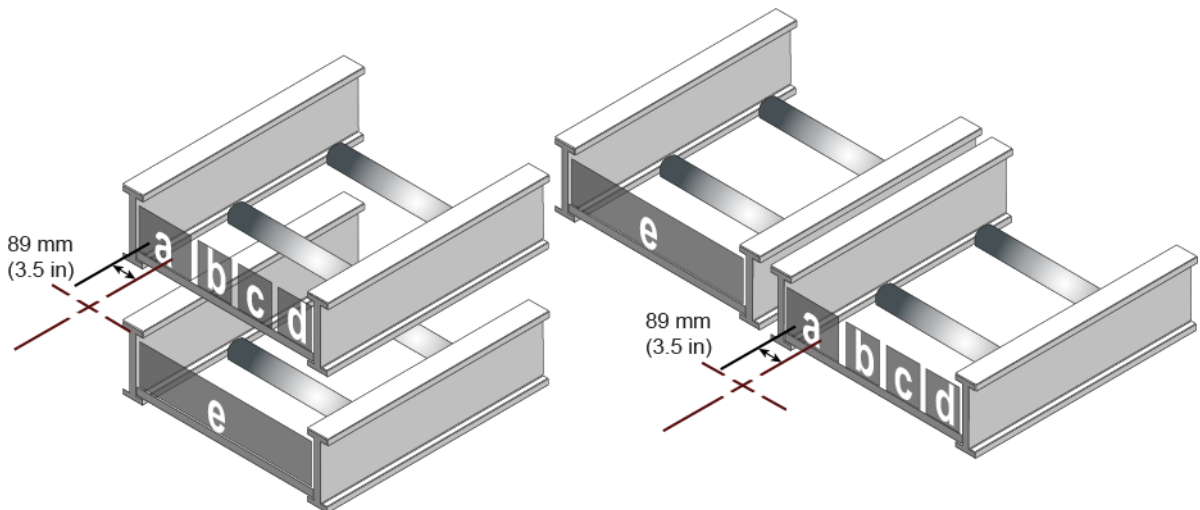
RF TX cables must be routed below the raised finished floor in the Magnet Room. See [7.2.4 Cabling Requirements for Floor Routed Cables on page 111](#).

- Group a — Gradient and RF common ground cables

In the Magnet Room, the gradient cable group must be laid in a single layer. The center of cable group “a” is 89 mm (3.5 in.) from the inside edge of the tray, in line with the magnet center. See [Figure 7-6 Cable Groupings on page 111](#).

- Group b — Coax, RF, and AC power cables with jacket rating of 600V and above
- Group c — Data and fiber optic and 300V coax or RF clock cables
- Group d — 300V signal, 300V power, and 300V power and signal cables
- Group e — Air, water, and cryogen lines

**Figure 7-6 Cable Groupings**



### 7.2.4 Cabling Requirements for Floor Routed Cables

1. The customer is responsible for the purchase and installation of all cable support mechanisms.
2. Any Magnet Room duct must attach to the RF Shield Room and the installation and routing of the duct or pit must be coordinated with the RF shield vendor.
3. Any type of nonferrous duct, such as composites or aluminum, may be used provided it meets all MR System requirements and any local and national codes.
4. Cables must be accessible for maintenance at all points along the route.
5. The duct or pit must accommodate a minimum cable bend radius of 152 mm (6 in.).

6. All electrical and mechanical connections and fasteners must be tightened and secured to supplier specifications to prevent broadband interference.
7. Excess cable length in the Magnet Room must be stored in the pit or duct.

## 7.2.5 Cable Tray Requirements and Examples

1. The gradient cable support must end at the back of the magnet  $2030 \pm 12$  mm ( $80 \pm 0.5$  in.) from the geometric isocenter. See [Figure 7-7 Cable Tray Requirements Example \(Side-By-Side\) on page 113](#), [Figure 7-8 Cable Tray Requirements Example \(Stacked\) on page 114](#), and [Figure 7-9 Cable Tray Requirements Example \(90° Magnet Interface\) on page 115](#).
2. Supports for all other cables and hoses must end at the back of the magnet  $1650 \pm 12$  mm ( $65 \pm 0.5$  in.) from the geometric isocenter.
3. Cable supports must have a minimum height of 3125 mm (123 in.) at the back of the magnet measured from the recessed floor. See [Figure 7-7 Cable Tray Requirements Example \(Side-By-Side\) on page 113](#).

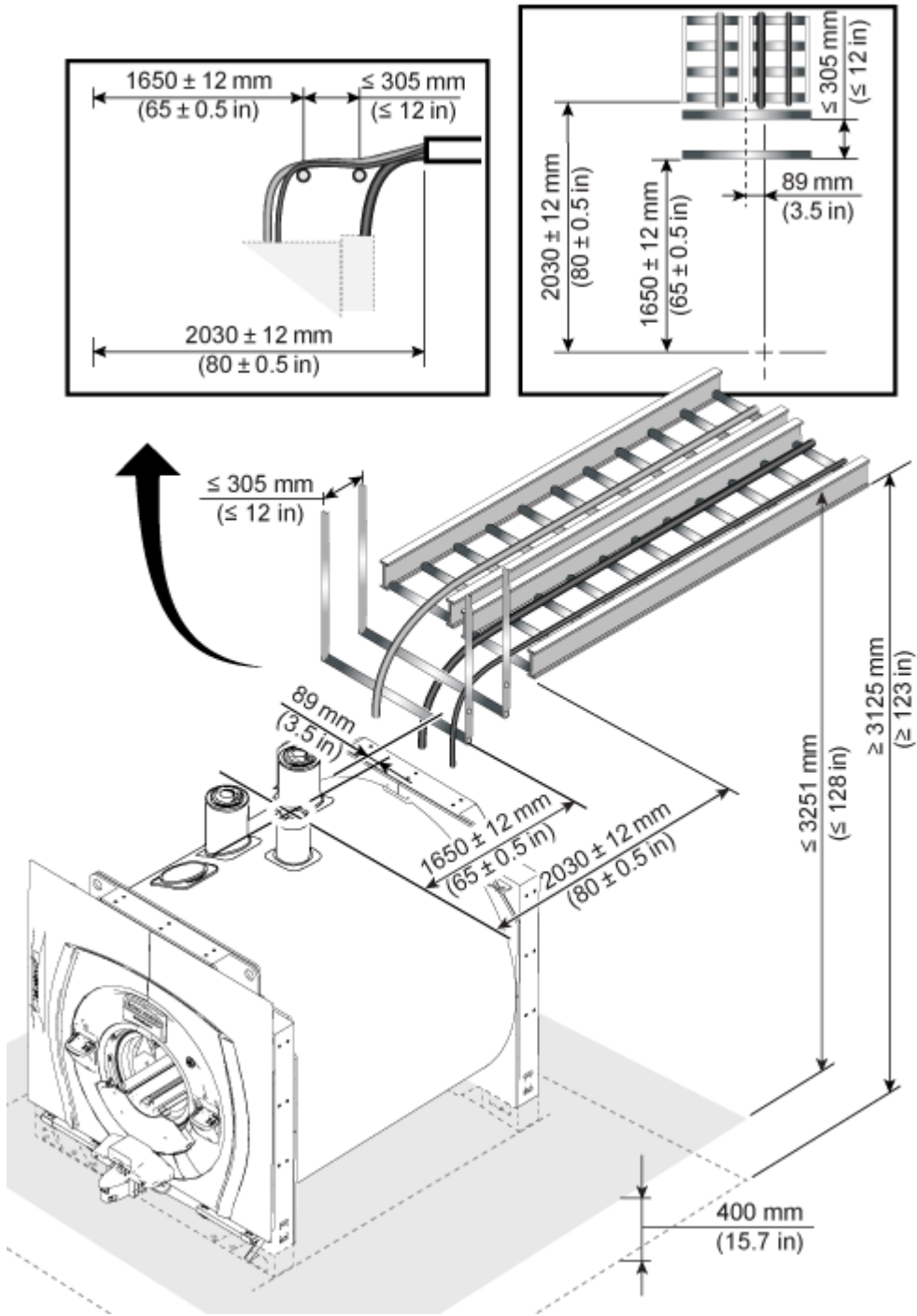


### NOTE

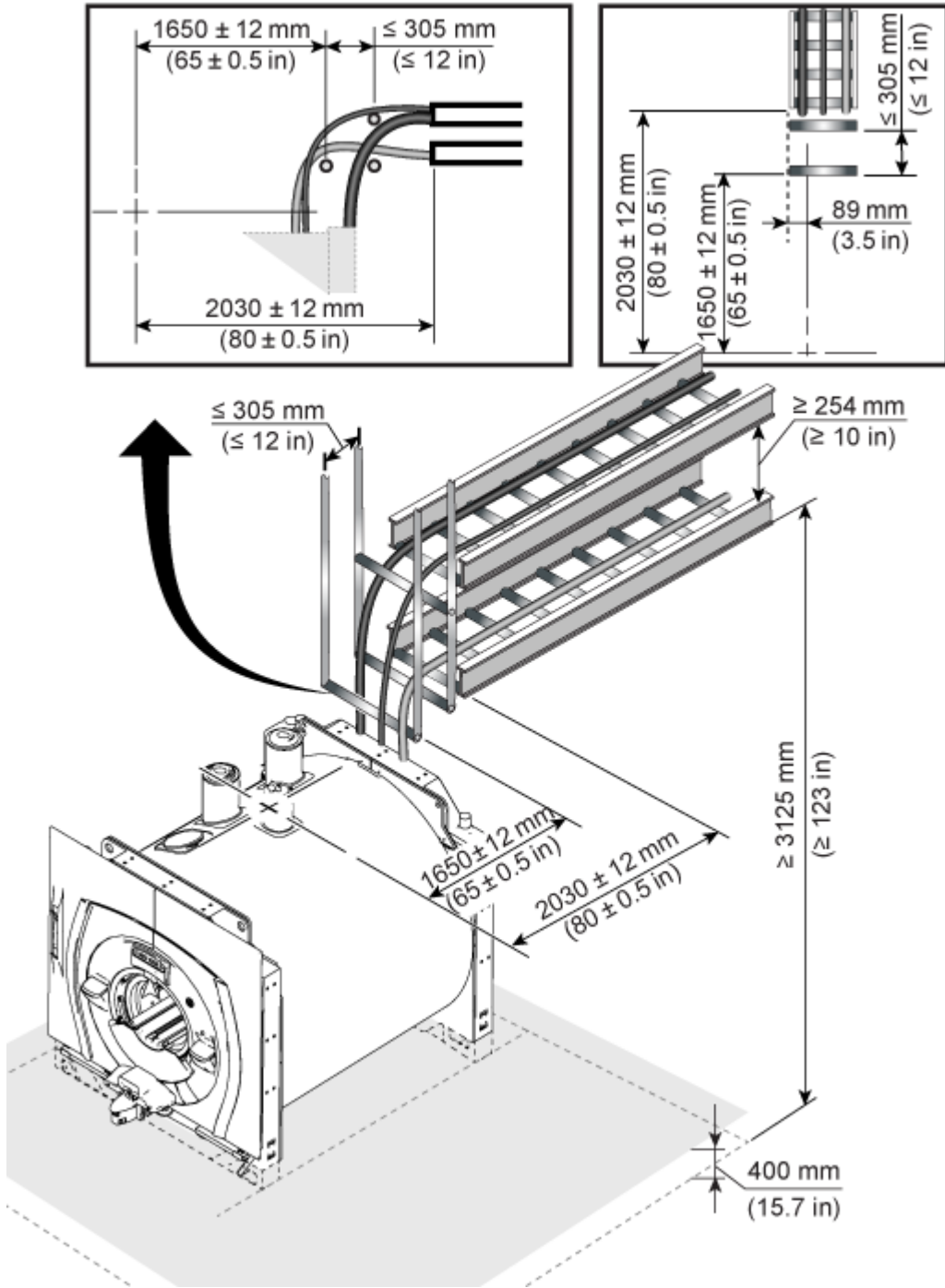
Supports may be lower at other points along the route to clear obstructions as long as all other requirements are met.

4. The top of the cable tray must be less than 3251 mm (128 in.) above the finished floor. See [Figure 7-7 Cable Tray Requirements Example \(Side-By-Side\) on page 113](#).

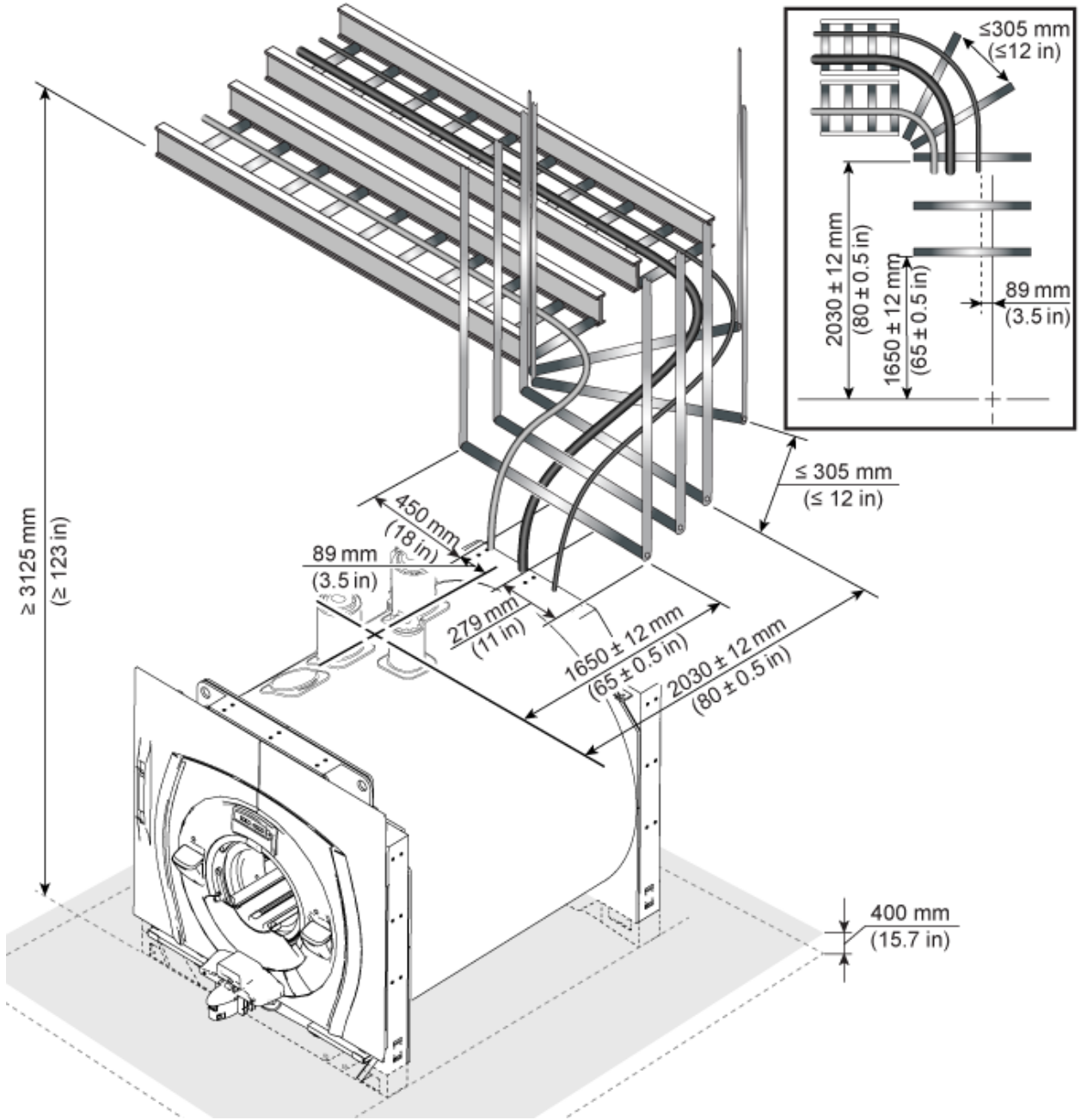
Figure 7-7 Cable Tray Requirements Example (Side-By-Side)



**Figure 7-8 Cable Tray Requirements Example (Stacked)**



**Figure 7-9 Cable Tray Requirements Example (90° Magnet Interface)**



### 7.2.6 Penetration Panel Closet Requirements

1. The cable support must be positioned to prevent cables from resting on the top of the Penetration Panel Closet.
2. The gradient cable support height and distance from the must support a minimum cable bend radius of 330 mm (13 in.) to accommodate gradient cables.

## 7.2.7 Equipment Room Requirements

1. All equipment interconnects must route overhead.
2. Cables or hoses must drop through the bottom or off the end of the cable support directly to the top of the cabinets (see individual components in Chapter 4 for height requirements).
3. Cable supports do not have minimum height restrictions except above Equipment Room components. Refer to [Figure 4-3 Integrated System Cabinet \(ISC\) on page 81](#), [Figure 4-7 Integrated Cooling Cabinet \(ICC\) on page 85](#), [Figure 4-14 RF Amplifier Cabinet on page 93](#) and [Figure 4-15 High Order Shim \(HOS\) on page 94](#) for the service restrictions above the cabinets.
4. Excess cable length must be stored in the Equipment Room.
5. For multiple MR System installations, cables from different MR Systems must not share the same cable support.
6. The table below lists the minimum width for cable trays between Equipment Room (and Operator Workspace) components.

**Table 7-7 Minimum Cable Tray Width**

	ISC		ICC		OW	RF	HOS PS	CRY (2)
	Electrical	Air and Water	Electrical	Air and Water	Electrical	Electrical	Electrical	Electrical
ICC	76 mm (3 in.)	102 mm (4 in.)	N/A	N/A	N/A	N/A	N/A	76 mm (3 in.) each
ISC	N/A	N/A	N/A	N/A	N/A	300 mm (12 in.)	76 mm (3 in.)	N/A
OW	76 mm (3 in.)	N/A	76 mm (3 in.)	N/A	N/A	N/A	N/A	N/A
ISC PP	450 mm (18 in.)	N/A	N/A	N/A	N/A	300 mm (12 in.)	76 mm (3 in.)	N/A
ICC SPW	76 mm (3 in.)	N/A	76 mm (3 in.)	300 mm (12 in.)	76 mm (3 in.)	N/A	N/A	76 mm (3 in.) each

# 7.3 Facility-Supplied System Interconnects Specifications



On installation sites in China, make sure that the power cables and ground cables provided by customers have China Compulsory Certification (CCC). This information is supplied to the customer in China Power Cable Requirements, 5159493. (Go to the Customer Documentation Portal or contact the PMI.)

The following table lists the required facility-supplied system interconnects. Refer to [Figure 7-10 Facility-Supplied System Interconnects](#) on page 118 for additional information.

**Table 7-8 Facility-Supplied System Interconnects**

Group	Between Units		Comments	Requirements
	From	To		
C01	Facility Power	MDP	Facility Power and Ground	<a href="#">MR Suite Electrical Requirements on page 42</a>
C02	MDP	CRY1	Cryocooler Compressor Power (GE HealthCare supplied)	
	MDP	CRY2	Cryocooler Compressor Power (GE HealthCare supplied)	
C03	MDP	ISC	PDU1 Power	
	MDP	ISC	PDU2 Power	
	Facility Cooling Water	ICC	Cooling Water Supply	<a href="#">MR System Facility Water Requirements on page 34</a>
	Facility Cooling Water	ICC	Cooling Water Return	
	Facility Cooling Water	CRY1	Cooling Water Return	
	Facility Cooling Water	CRY1	Cooling Water Return	
	Facility Cooling Water	CRY2	Cooling Water Return	
	Facility Cooling Water	CRY2	Cooling Water Return	
C04	Facility Network	MON1	Facility must provide separate network access for both Magnet Monitors (MON) and Global Operator Cabinet (GOC). The MON connections must be available at all times.	<a href="#">Magnet Monitor (MON) Requirements and Specifications on page 91</a>
	Facility Network	MON2		
	Facility Network	GOC		
	Facility Network	Receptacle near MDP		
C05	MDP	E-Off Switch	Facility must supply cable from the MDP to the E-Off Switch in the Equipment Room.	<a href="#">MR Suite Electrical Requirements on page 42</a>

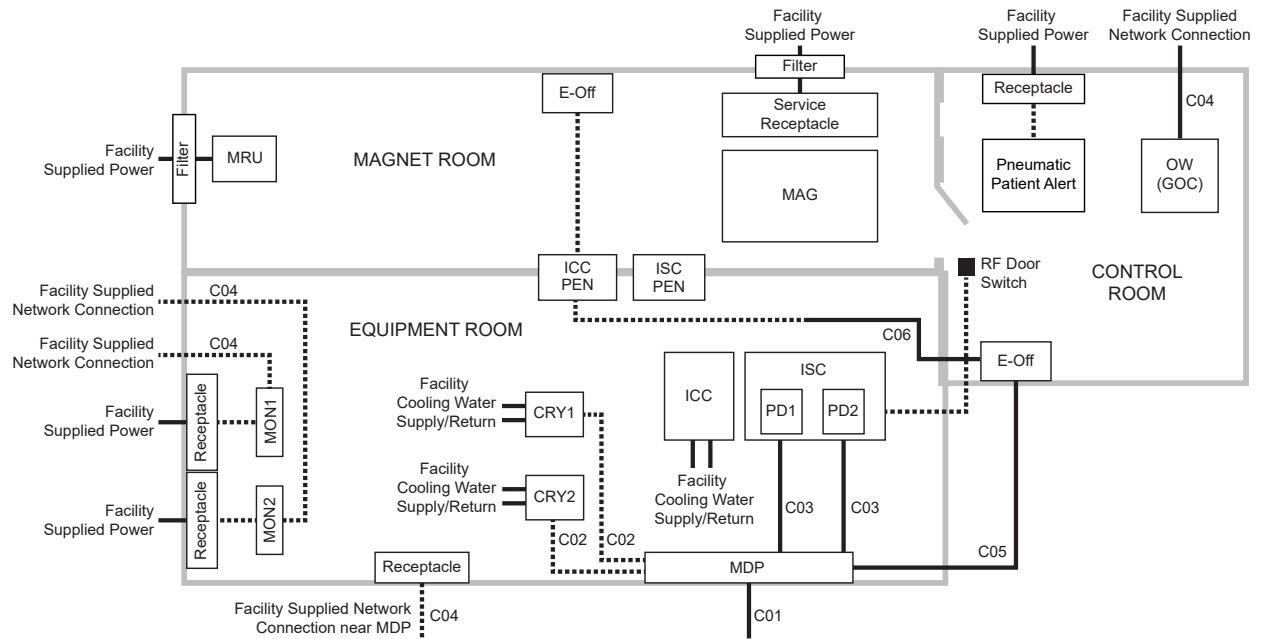
**Table 7-8 Facility-Supplied System Interconnects (Table continued)**

Group	Between Units		Comments	Requirements
	From	To		
	Facility Power	Outlet near MON1	Facility outlets for MON power	Magnet Monitor (MON) Requirements and Specifications on page 91
	Facility Power	Outlet near MON2		
C06	ISC PEN	E-Off Switch in Control Room or Equipment Room	Facility must supply additional wiring between the GE HealthCare supplied cable and the E-Off switch if the length needed is greater than the available length listed in MR System Interconnects Specifications on page 102.	MR Suite Electrical Requirements on page 42
	Facility Power	MRU	Facility power to MRU	Magnet Room Equipment Specifications on page 72
	Facility Power	Service Receptacle	Receptacle to be installed in Magnet Room, using appropriate filter.	MR Suite Electrical Requirements on page 42
	Facility Power	Pneumatic Patient Alert	Facility Power to Pneumatic Patient Alert	MR Suite Electrical Requirements on page 42

**Table 7-9 Optional Facility-Supplied System Interconnects**

Group	Between Units	Comments	Requirements
C01	Facility Power	Control room	Hardwired connection for OXY power (optional, not shown) 2.10 MR Suite Electrical Requirements on page 42

**Figure 7-10 Facility-Supplied System Interconnects**



Legend	
	Facility supplied interconnect
	GE HealthCare supplied interconnect

**NOTE**

- GE HealthCare recommends installing the RF Door switch on the outside wall of the Magnet Room.
- The illustration is not to scale and component positioning/interconnect runs are typical.
- Only GE HealthCare equipment interconnects are shown. Additional facility interconnects are required for non-GE HealthCare equipment (for example, Magnet Room DC Lighting).
- The E-Off button placement and cable routing shown indicates one possible configuration. Final E-Off button placement and cable routing is the responsibility of the customer. Refer to [2.10.1 General Electrical Requirements on page 42](#) for requirements for E-Off button placement.

The RF Shielded Room Vendor is responsible for installing the RF door switches. Refer to *RF Shielded Room Requirements, 5850260-1EN*.

## 8 Appendix

### 8.1 Glossary



#### Cryogen

A substance for producing low temperatures. Liquid helium is the cryogen used to cool the magnet to approximately 4 K (-269°C or -452°F).

#### Dewar

A container with an evacuated space between two highly reflective walls used to keep low temperature substances at near-constant temperatures. Liquid helium is usually stored and shipped in dewars.

#### 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 = 10000 G and 1 millitesla = 10 G).

#### High Order Shim

The use of software and embedded superconducting shim coils within the magnet to correct higher orders of inhomogeneity in the magnetic field.

#### 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

A line on a field plot connecting identical magnetic field strength points.

#### Magnetic Field

A condition in a region of space established by the presence of a magnet and characterized by the presence of a detectable magnetic force at every point in the region. A magnetic field exists in the

space around a magnet (or current carrying conductor) and 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 (for example, steel) to redistribute a magnetic field, usually to reduce fringe fields.

### **Quench**

Condition when a superconducting magnet becomes resistive thus rapidly boiling off liquid helium. The magnetic field reduces rapidly after a quench.

### **Radio Frequency (RF)**

Frequency intermediate between audio frequency and infrared frequencies. Used in magnetic resonance systems to excite nuclei.

### **Radio Frequency Shielding**

Using material (for example, copper, aluminum, or steel) to reduce interference from external radio frequencies. A radio frequency shielded room usually encloses the entire Magnet Room.

### **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.

### **Shimming**

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

### **Superconducting Magnet**

A magnet whose magnetic field originates from current flowing through a superconductor. Such a magnet is enclosed in a cryostat.

### **Superconductor**

A substance whose electrical resistance essentially disappears at temperatures near zero Kelvin. A commonly used superconductor in magnetic resonance imaging system magnets is niobium-titanium embedded in a copper matrix.

### **Tesla**

The internationally accepted unit of magnetic flux density. One tesla is equal to 10000 Gauss. One millitesla is equal to 10 Gauss.

### Waveguide

A hollow linear structure used in components such as the penetration wall to route cables and hoses, while limiting and controlling electromagnetic waves from entering the Magnet Room.

## 8.2 MR Site Vibration Test Guidelines



(Applies to all subsections within this section)

### 8.2.1 Test Measurements

1. Vibration measurements must be in the range of  $10^{-6}$  g. Test equipment must have the required sensitivity to these levels.
2. Instrumentation must have a low tolerance to temperature effects since many times the low frequency thermal drift may influence the measurements.
3. All measured data must be acquired real time. Recording of vibration data will not allow for a correct site survey, specifically when studying transient vibration and when searching for specific vibration sources.
4. All analyses must be narrow-band Fast Fourier Transforms (FFT) over the frequency bands listed in [Table 8-1 Frequency Bands for FFT on page 122](#).
5. Time histories of the vibration must be recorded as acceleration levels vs. time. The resolution of the time history must be adjusted to clearly capture the transient event. The analyzer set-up will be site dependent and, in special cases, vibration response dependent. It is the responsibility of the vibration consultant to study the transient environment, capture data to confirm that transient activity exceeds the trigger level, then expand the time history data to exhibit the structural response.

**Table 8-1 Frequency Bands for FFT**

Frequency Band	Frequency Resolution
0.2 to 50 Hz	$\Delta f = 0.125$ Hz

### 8.2.2 Equipment (Spectral Analyzer) Set-Up

1. Frequency average should be a minimum of 20 linear averages (Do not use peak hold or 1/3 octave analysis).
2. Average and store should be a minimum of 20 plots steady state and 20 plots transient to support the consistency of the site vibrations.
3. Hanning windows must be applied to the entire spectra.
4. Spectrum analyzers capable of these measurements are readily available for purchase or rental. Models, such as the HP 3560A, Nicolet Phaszer, B&K Pulse, and HP 35670, are all capable of making the site vibration measurements. Accelerometers must have the capability to measure from 0.2 Hz beyond 50 Hz. Time histories can be recorded using any of the analyzers listed above.

**NOTE**

The equipment mentioned is for example only. It is the responsibility of the Engineering Test Firm to provide equipment that will allow measurements compliant with this guideline.

## 8.2.3 Data Collection

### 8.2.3.1 Ambient Baseline Condition

1. All of the measurements listed above must be made in a “quiet” environment—that is, areas where excessive traffic, subway trains, and so on, do not 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.
2. The source of any steady state vibration, whose level exceeds the magnet specifications found in [Magnet Room Structural Requirements on page 56](#), must be identified. A second measurement should be made with all of the identified contributors powered down if possible. In situations where it is not possible to power down equipment, vibration data must be collected to identify the specific source of the vibration concern. The majority of steady state vibration problems can be negated by isolating the vibration source.

### 8.2.3.2 Normal Condition

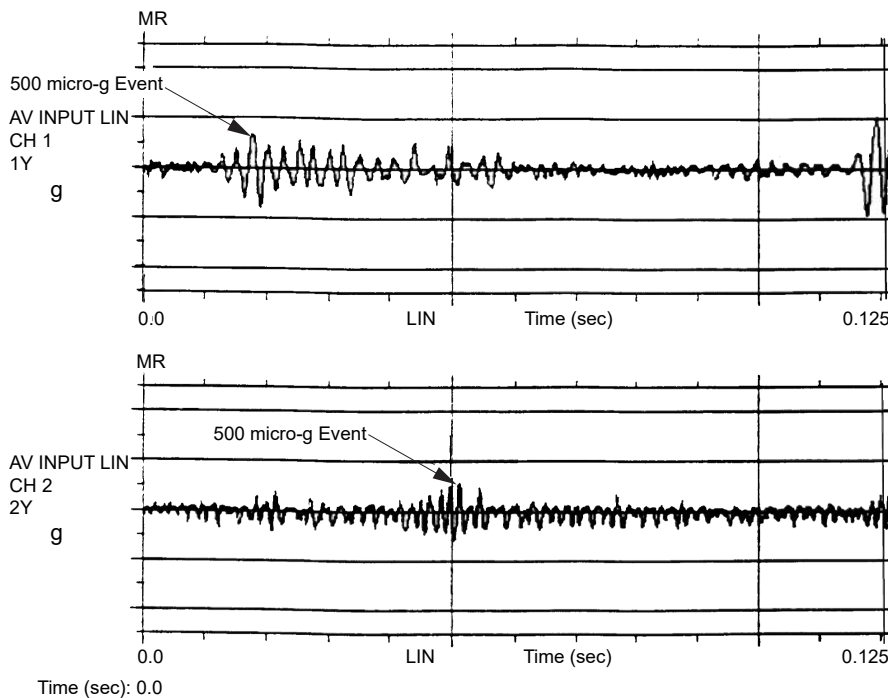
1. All of the vibration measurements listed above must be repeated during periods of “normal” environmental conditions, including the Fast Fourier Transforms (FFTs) and time histories. The transient measurements must be provided to define the dynamic disturbances the MR System may be exposed to. Transient analysis is required for a true assessment of the site.
2. Special attention must be paid to the site assessment during the entire analysis. Since transient vibration is not easily addressed once the MR suite is fully constructed, the test consultant must fully understand the needs for this analysis. The source of any transient vibration must be identified and supported with vibration plots. If the source of any transient vibration is not locatable, it is recommended that the customer have an alternate location identified and the vibration studied.
3. Transient vibration can be difficult to assess if the details are not understood. The **0.0005 g, zero-to-peak trigger level** is a starting point to understanding the vibration stability. The transient vibration peak amplitude, structural (time variant) response, decay rate and an estimate of the number of events per unit of time would constitute a complete transient analysis. All transient failures must be supported by time history plots. The plots must clearly show the structural response, the frequency of the signature and the decay rate. From this data, GE HealthCare can help determine compliance with the vibration guidelines.
4. The test consultant must provide site data to show the design recommendations for all sites/building structures meet the magnet specifications found in [Magnet Room Structural Requirements on page 56](#).

## 8.2.4 Presentation/Interpretation of Results

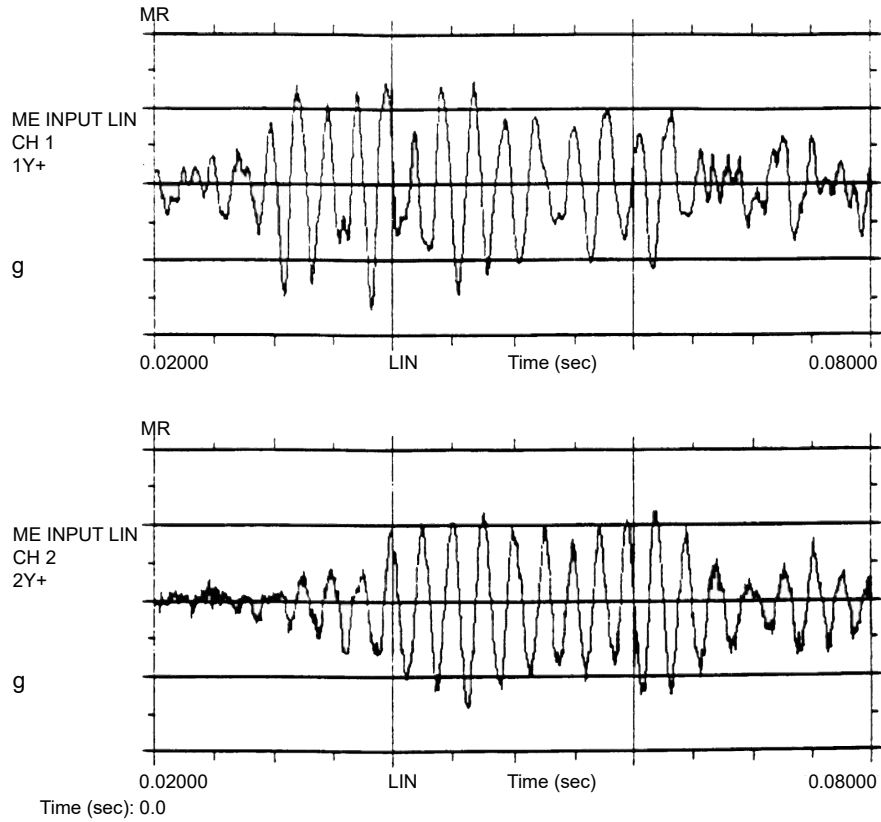
1. The recommended format for site vibration data collection, presentation, and analysis is demonstrated in the examples in [8.2.4 Presentation/Interpretation of Results on page 123](#), [Figure 8-1 Acceleration Time History on page 124](#), and [Figure 8-2 Acceleration Time History \(Zoomed In on Transient Event\) on page 125](#). Presentation of the data in any other format (linear units

- only) may result in incorrect interpretation and diagnosis of the site. Additional data collection or presentation methods are at the option of the vibration testing service.
2. All plots must be properly annotated with:
    - 2.1. Instrumentation setup including number of averages, frequency resolution, and so on
    - 2.2. Test location
    - 2.3. Test conditions:
      - 2.3.1. Steady state
      - 2.3.2. Transient
      - 2.3.3. Heel drop
      - 2.3.4. Normal environment
      - 2.3.5. Typical traffic
      - 2.3.6. Any other conditions necessary to demonstrate understanding of potential sources of vibration
  3. The customer's vibration testing service is responsible for interpreting the results and determining if that site meets GE HealthCare specifications.
  4. If the vibration levels are too high, additional data acquisition may be necessary to:
    - 4.1. Determine the source of the vibration
    - 4.2. Propose a solution to the problem
    - 4.3. Find an alternate site location
  5. Any questions regarding test equipment requirements, test parameters, or general questions should be discussed with the GE HealthCare Project Manager of Installation (PMI).

**Figure 8-1 Acceleration Time History**



**Figure 8-2 Acceleration Time History (Zoomed In on Transient Event)**



# 8.3 Sample Calculation AC Power Equipment Minimum Distance



This is a sample calculation to determine minimum distance from a feeder, transformer, or other AC electrical source, using the formula found in 2.6.3 Electrical Current on page 28 to determine minimum distance from a feeder, transformer, or other AC electrical source.

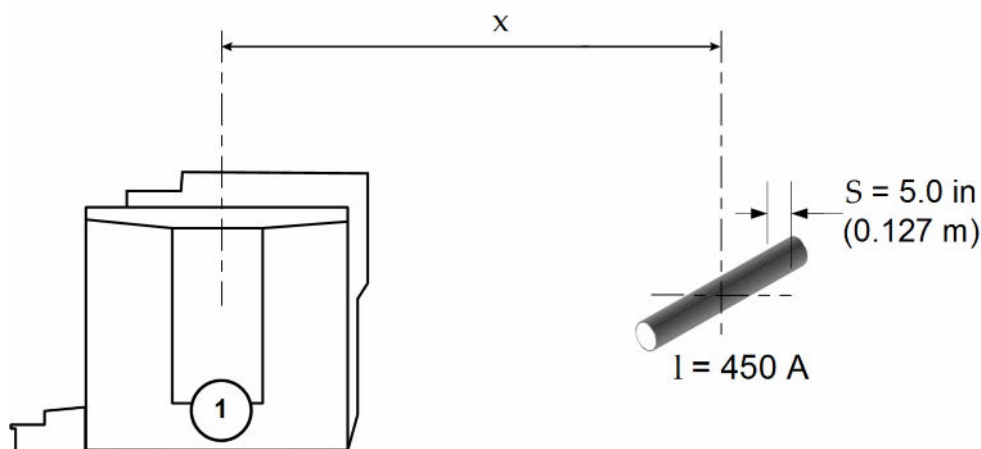
Note that the formula has three variables. If you have two of them, you can calculate the third. In this example, we calculate the minimum distance **x** from the source—in this case, a main electrical feeder carrying 450 amps of current in a 127 mm (5 in.) conduit.

Rearranging:	$x^2 = \frac{I \times S}{8.55}$ $x = \sqrt{\frac{I \times S}{8.55}}$
--------------	----------------------------------------------------------------------

where:	
x	Minimum distance (in meters) from the feeder lines to isocenter of the magnet
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

The separation **S** is the spacing between the conductors, and when all 3 conductors are run in a single conduit, **S** is simply the diameter of the conduit.

$S = 5 \text{ inches} = 0.127 \text{ meters}$



Item	Description
1	Magnet

In other situations, the spacing **S** may be the spacing between HV feeders, the distance between transformer lugs, or the spacing between conduits when the phase conductors are run in separate conduits.

**What if it is too close?**

If this is an existing condition, you should request an *EMI study* to quantify the magnitude and direction of the AC disturbances. The calculation is worst-case and does not take into account the vector direction of the AC interference. The magnet is only sensitive to AC disturbances that are directed horizontally (magnet z-axis). Also, the calculation does not account for any magnetic shielding effect of steel conduit.

## 8.4 Selecting Anchor Size



The following is an example to illustrate the selection of correct anchors to install a magnet in a building with 13.8 MPa (2000 psi) concrete. For this example the area is not under seismic requirements.

1. Determine the magnet clamping force (for the Magnet: 11100 N + 900 N = 12000 N (2500 lb. + 200 lb. = 2700 lb.)).
2. Refer to the examples of anchor vendor catalogs below to select the anchor diameter and embedment that meets the clamping force (tension) determined in Step 1.

Diameter :  $\geq 15.875$  mm (0.625 in.)  $\leq 31.75$  mm (1.25 in.)

For 203 mm (8 in.) embedment select 19 mm (0.75 in.) diameter

For 114.3 mm (4.5 in.) embedment select 25.4 mm (1 in.) diameter

or

Diameter : Min. M16 Max. M32

For 130 mm embedment select M20 diameter

For 114 mm embedment select M24 diameter


3. The vendor instructions and torque to the maximum recommended level for the anchor selected in Step 2 must be provided to the RF shielded room vendor for correct installation of the anchor and equipment.

**Table 8-2 Allowable Anchor Loads in Concrete (English Units)**

Anchor Diameter mm (in.)	Embedment Depth mm (in.)	13.8 MPa (2000 psi)		20.7 MPa (3000 psi)		27.6 MPa (4000 psi)		41.4 MPa (6000 psi)	
		Tension kN (lb.)	Shear kN (lb.)	Tension kN (lb.)	Shear kN (lb.)	Tension kN (lb.)	Shear kN (lb.)	Tension kN (lb.)	Shear kN (lb.)
15.9 (5/8)	70 (2 3/4)	<b>5.6</b> <b>(1250)</b>	<b>12.5</b> <b>(2800)</b>	<b>7.1</b> <b>(1600)</b>	<b>13.7</b> <b>(3070)</b>	<b>8.1</b> <b>(1810)</b>	<b>14.8</b> <b>(3300)</b>	<b>8.5</b> <b>(1920)</b>	<b>12.5</b> <b>(3330)</b>
	102 (4)	<b>8.3</b> <b>(1870)</b>	<b>14.8</b> <b>(3330)</b>	<b>10.7</b> <b>(2400)</b>	<b>14.8</b> <b>(3330)</b>	13.0 (2930)	14.8 (3330)	14.2 (3200)	12.5 (3330)
	178 (7)	<b>11.2</b> <b>(2500)</b>	<b>14.8</b> <b>(3330)</b>	13.4 (3010)	14.8 (3330)	16.2 (3650)	14.8 (3330)	16.2 (3650)	12.5 (3330)
19.1 (3/4)	83 (3 1/4)	<b>6.9</b> <b>(1550)</b>	<b>12.8</b> <b>(2880)</b>	<b>8.7</b> <b>(1950)</b>	<b>14.7</b> <b>(3310)</b>	<b>10.5</b> <b>(2350)</b>	<b>16.6</b> <b>(3730)</b>	<b>11.6</b> <b>(2610)</b>	<b>21.4</b> <b>(4800)</b>
	121 (4 3/4)	<b>11.2</b> <b>(2510)</b>	<b>20.1</b> <b>(4510)</b>	14.5 (3250)	20.7 (4650)	17.2 (3870)	21.4 (4800)	20.8 (4670)	21.4 (4800)
	203 (8)	13.0 (2930)	21.4 (4800)	17.2 (3870)	21.4 (4800)	20.2 (4530)	21.4 (4800)	22.8 (5120)	21.4 (4800)


**Table 8-2 Allowable Anchor Loads in Concrete (English Units)** (Table continued)

Anchor Diameter mm (in.)	Embedment Depth mm (in.)	13.8 MPa (2000 psi)		20.7 MPa (3000 psi)		27.6 MPa (4000 psi)		41.4 MPa (6000 psi)	
		Tension kN (lb.)	Shear kN (lb.)	Tension kN (lb.)	Shear kN (lb.)	Tension kN (lb.)	Shear kN (lb.)	Tension kN (lb.)	Shear kN (lb.)
25.4 (1)	114 (4 1/2)	13.9 (3120)	27.0 (6080)	17.2 (3870)	30.1 (6770)	20.5 (4610)	33.2 (7470)	21.4 (4800)	33.2 (7470)
	152 (6)	19.6 (4400)	33.2 (7470)	28.5 (6400)	33.2 (7470)	32.0 (7200)	33.2 (7470)	32.6 (7330)	33.2 (7470)
	229 (9)	24.9 (5600)	33.2 (7470)	35.59 (8000)	33.2 (7470)	41.77 (9390)	33.2 (7470)	41.8 (9390)	33.2 (7470)

**NOTE**  
 All bolded values in this table fail to meet the clamping force (tension), and are therefore not acceptable anchors.

**Table 8-3 Allowable Anchor Loads in Concrete (Metric Units)**

Anchor Diameter	Embedment Depth mm (in.)	13.8 MPa (2000 psi)		20.7 MPa (3000 psi)		27.6 MPa (4000 psi)		41.4 MPa (6000 psi)	
		Tension kN (lb.)	Shear kN (lb.)	Tension kN (lb.)	Shear kN (lb.)	Tension kN (lb.)	Shear kN (lb.)	Tension kN (lb.)	Shear kN (lb.)
M16	105 (4 1/8)	<b>11.2</b> <b>(2500)</b>	<b>25.1</b> <b>(5650)</b>	20.9 (4705)	39.9 (8965)	24.2 (5450)	45.0 (10125)	30.7 (6900)	46.9 (10550)
M20	130 (5 1/8)	25.1 (5650)	52.9 (11900)	30.7 (6910)	58.7 (13195)	36.4 (8175)	64.5 (14490)	44.5 (10005)	64.5 (14490)
M24	155 (6 1/8)	30.0 (6735)	61.2 (13760)	36.9 (8300)	70.5 (15855)	43.9 (9860)	29.8 (17950)	57.7 (12980)	95.6 (21490)

**NOTE**  
 All bolded values in this table fail to meet the clamping force (tension), and are therefore not acceptable anchors.

# Revision History

Rev	Date	Description
<b>English Document review and approval per DOC2161728</b>		
2	May 2025	<p><b>Throughout manual:</b> Removed content related to pICC</p> <ul style="list-style-type: none"> <li>• Section 2.2.2: Added MON2</li> <li>• Figure 2-1: Added MON2</li> <li>• Table 2-5: Changed values for MON</li> <li>• Table 2-6: Updated values for Maximum Pressure Drop at Minimum Flow and Maximum Flow for pure water</li> <li>• Table 2-9: Added x2 to values for MON</li> <li>• Section 2.10.3: Added "for each Magnet Monitor"</li> <li>• Section 2.11.4: Replaced "Resonance Module" with "Magnet Assembly"</li> <li>• Figure 3-4: Removed service areas shown on Equipment Room side</li> <li>• Figure 3-11: Updated dimensions</li> <li>• Figure 4-1: Swapped location of ICC and ISC</li> <li>• Figure 4-3: Added service area and hoist</li> <li>• Figure 4-7: Added height dimension 2162 mm (85.1 in.)</li> <li>• Figure 4-8: Added new figure "ICC Facility Water Supply and Return Connections Location"</li> <li>• Section 4.8.2: Changed weight</li> <li>• Figure 4-12: Updated dimensions</li> <li>• Section 5.1.3: Added weight for HP Z4G5</li> <li>• Figure 5-3: Added callouts and callout table</li> <li>• Figure 5-5: Updated dimensions</li> <li>• Table 7-1: Added MON2</li> <li>• Table 7-3: Added L7</li> <li>• Figure 7-1: Added L7 and MON2</li> <li>• Table 7-8: Added MON2</li> <li>• Figure 7-10: Added filter to MRU, added MON2</li> </ul>
1	May 2023	<p><b>Rev 1 of 5809186-1EN based on DOC2161728 Rev 8</b></p> <p>Major content re-organization throughout the manual, and some content was moved to separate documents. See the Related Documents section in this manual for document numbers.</p>
<b>Initial Release of 5809186-1EN</b>		

Rev	Date	Description
<b>English Document review and approval per DOC2161728</b>		
DOC2161728 Rev 7	February 2021	<ul style="list-style-type: none"> <li>• <b>All sections</b> - Content from a PIM redesign will appear in this document. Icons, new introduction material, etc. This will be inconsistent, as there is a separate dataset for the new PIM design, and not all content is shared. A new revision for this document created from the new design will be released at the next revision.</li> <li>• <b>2.3</b> - Update to dimension in image Minimum Magnet Ceiling Height</li> <li>• <b>2.7.2</b> - Updates to Magnet moving metal image and field specifications.</li> <li>• <b>2.7.3</b> - Update to Electrical current field interference specification.</li> <li>• <b>2.11.3</b> - Update to Terminal Wire Block Sizes specification table.</li> <li>• <b>2.12.3</b> - Updates to MR System Component Shipping Specifications table.</li> <li>• <b>3.6.6</b> - Add bottom view of magnet with dimensions for anchor points. Add verbiage for anchor points in areas with seismic activity. Update magnet in Floor levelness image.</li> <li>• <b>3.8.7.3</b> - Update magnet image in Cryogenic vent location view.</li> <li>• <b>3.8.6.2</b> - Update max pressure for vent pipe. Previous value was incorrect.</li> <li>• <b>6.2.4</b> - Update cable tray images to match other systems.</li> </ul>
DOC2161728 Rev 6	August 2020	<ul style="list-style-type: none"> <li>• <b>2.7.1 Magnetic Fringe field</b> - Add instruction on evaluating isogauss plots for future upgrade sites.</li> </ul>
DOC2161728 Rev 5	June 2020	<ul style="list-style-type: none"> <li>• Removed front cover number 5809186 and replaced with DOC2161728. PN 5809186 is not yet released.</li> <li>• 2.3 Update Minimum service area requirements, both the table and image.</li> <li>• 4.1 Update Equipment Room overview image, change clearance DIMs for the cryo-cooler.</li> <li>• Add cryocooler specifications section.</li> <li>• 4.8 Add ICC specifications.</li> </ul>
DOC2161728 Rev 4	February 2020	<ul style="list-style-type: none"> <li>• 2.10.1 Change to step 6, add cryocooler compressor.</li> <li>• 2.3 Update Minimum service area requirements, both the table and image.</li> <li>• 2.4 Change to Table 5 Guidance And Manufacturer's Declaration – Electromagnetic Immunity.</li> </ul>
DOC2161728 Rev 3	February 2020	<ul style="list-style-type: none"> <li>• 2.3 Update Minimum Room Size diagram, new DIM for Rear Ped to back of room.</li> <li>• 2.11.1 Update System Power Demand table.</li> <li>• 2.11.3 Update terminal block wire sizes table.</li> <li>• 2.12.3 Update shipping weight for Replacement HRMB Gradient Coil Assembly in the table.</li> <li>• 3.5.5 Update anchor mounting graphic and requirements.</li> <li>• General update to graphics, remove text from graphics, add numbers and reference chart.</li> <li>• General Update - change dimensions to metric/us for consistency.</li> </ul>

Rev	Date	Description
<b>English Document review and approval per DOC2161728</b>		
DOC2161728 Rev 2	May 2019	<ul style="list-style-type: none"> <li>• 2.25 System Overview: Updated System overview illustration.</li> <li>• 2.3 Table 2, Room Dimensions to Satisfy Minimum Service Area Requirements: Updated minimum MR room ceiling height .</li> <li>• 2.4 IEC EMC Compliance: Added section.</li> <li>• 2.5 MR System Seismic Requirements: Added section</li> <li>• 2.8.2 Shared Equipment Rooms: Corrected spelling error.</li> <li>• 2.9.2 Table 11 System Heat Output for Air Cooling: Added RF and HOS heating values.</li> <li>• 2.10 Facility Coolant Requirements: Added section</li> <li>• 2.11.1 Table 15 System Power Demand: Updated specifications.</li> <li>• 2.11.3 Table 16 GE HealthCare MDP Features: Added part number 5792781-1 information.</li> <li>• 2.12.2 Table 19, Delivery Route Requirements: Corrected link to point to Table 20, MR System Component Shipping Specifications. Updated HOS information.</li> <li>• 2.12.3 Table 20, MR System Component Shipping Specifications: Updated to include the 3 magnet shipping configurations. Deleted Bridge (rear) row. Added Patient Table Dock information. Updated HOS information.</li> <li>• 2.12.3 Deleted Table: MR System Service Component Shipping Specifications.</li> <li>• 3.5.5 Dock Anchor Mounting Requirements: Updated Figure 21, Dock Anchor Mounting Options. Removed a step.</li> <li>• 3.6.6 Magnet Room Floors: Step 5, Changed raised floor height from 401 to 400 mm.</li> <li>• 3.6.6 Magnet Room Floors: Added a step to address the finished floor panels.</li> <li>• 3.7.1 Figure 25, Magnet (MAG) Dimensions: Updated magnet iso center height value.</li> <li>• 3.7.1 Figure 26, Magnet (MAG) and Rear Pedestal: Added illustration.</li> <li>• 3.7.1 Table 24, Magnet Component Weight Table: Updated table title.</li> <li>• 4.1 Equipment Room Overview: Added Equipment Room overview section.</li> <li>• 4.2 Main Disconnect Panel (MDP) Specifications: Added part number 5792781-1 information. Updated</li> <li>• 4.3 RF Cabinet specifications: #2, Updated Magnetic Field Limit specification. Figure 39, Added a service clearance dimension. Table 29, Added service clearance.</li> <li>• 4.4 High Order Shim (HOS) Power Supply Specifications: Added specifications.</li> <li>• 4.9 Penetration Panel Closet Specifications: Added section.</li> <li>• 6.2 MR System Interconnects Routing Requirements: Figure 58, Figure 60, Figure 61, Figure 62, Updated illustrations. To show raised and finished floors.</li> <li>• 6.3 MR System Cable Specifications: Table 37, Deleted Description column. Updated Table 38, Coolant and Air Hoses Specifications</li> </ul>
DOC2161728 Rev 1	August 2018	Initial release (DOC2161728).



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