




			<div>Typical</div> <div>----</div> <div>----</div>				
A	10/Jul/2018	First issue drawing / Final study based on MRI-					
REV	DATE	MODIFICATIONS					
01 - C1 - Cover Sheet 02 - C2 - Disclaimer - Site Readiness 03 - A1 - General Notes 04 - A2 - Equipment Layout 05 - A3 - Section Views 06 - A4 - Acoustic - Proximity Limits 07 - A5 - RF shielding 08 - A6 - Equipment Details (1) 09 - A7 - Equipment Details (2) 10 - A8 - Delivery 11 - S1 - Structural Notes 12 - S2 - Structural Layout 13 - S3 - Structural Details 14 - M1 - Mechanical Layout 15 - M2 - HVAC-Venting		16 - M3 - Chilled Water 17 - M4 - Cryogenics (1) 18 - M5 - Cryogenics (2) 19 - E1 - Electrical Notes 20 - E2 - Electrical Layout 21 - E3 - Electrical Elevations 22 - E4 - Electrical Details 23 - E5 - Electrical Details (2) 24 - E6 - Power Requirements 25 - E7 - Interconnections			<div>GE Healthcare</div> <div>-----</div> <div>-----</div> <div>-----</div>		
<b>SIGNA ARTIST / OPTIMA MR450W FINAL STUDY</b>							
Drawn by		Verified by	Concession	S.O. (GON)	PIM Manual	Rev	
PMM		PMM	-	----	5670001	15	
Format	Scale	File Name			Date	Sheet	
A3	1/4"=1'-0"	EN-MRI-TYP-OPTIMA_MR450W-WEB.DWG			27/Sep/2021	01/25	
A mandatory component of this drawing set is the GE Healthcare Pre Installation manual. Failure to reference the Pre Installation manual will result in incomplete documentation required for site design and preparation. Pre Installation documents for GE Healthcare products can be accessed on the web at: <a href="http://www.gehealthcare.com/siteplanning">www.gehealthcare.com/siteplanning</a>							
GE does not take responsibility for any damages resulting from changes on drawings made by others. Errors may occur by not referring to the complete set of final issue drawing. GE cannot accept responsibility for any damage due to the partial use of GE final issue drawings, however caused. All dimensions are in millimeters unless otherwise specified. Do not scale from printed pdf files. GE accepts no responsibility or liability for defective work due to scaling from these drawings.							

DISCLAIMER

GENERAL SPECIFICATIONS

- GE is not responsible for the installation of developers and associated equipment, lighting, cassette trays and protective screens or derivatives not mentioned in the order.
- The final study contains recommendations for the location of GE equipment and associated devices, electrical wiring and room arrangements. When preparing the study, every effort has been made to consider every aspect of the actual equipment expected to be installed.
- The layout of the equipment offered by GE, the dimensions given for the premises, the details provided for the pre-installation work and electrical power supply are given according to the information noted during on-site study and the wishes expressed by the customer.
- The room dimensions used to create the equipment layout may originate from a previous layout and may not be accurate as they may not have been verified on site. GE cannot take any responsibility for errors due to lack of information.
- Dimensions apply to finished surfaces of the room.
- Actual configuration may differ from options presented in some typical views or tables.
- If this set of final drawings has been approved by the customer, any subsequent modification of the site must be subject to further investigation by GE about the feasibility of installing the equipment. Any reservations must be noted.
- The equipment layout indicates the placement and interconnection of the indicated equipment components. There may be local requirements that could impact the placement of these components. It remains the customer's responsibility to ensure that the site and final equipment placement complies with all applicable local requirements.
- All work required to install GE equipment must be carried out in compliance with the building regulations and the safety standards of legal force in the country concerned.
- These drawings are not to be used for actual construction purposes. The company cannot take responsibility for any damage resulting therefrom.

CUSTOMER RESPONSIBILITIES

- It is the responsibility of the customer to prepare the site in accordance with the specifications stated in the final study. A detailed site readiness checklist is provided by GE. It is the responsibility of the customer to ensure all requirements are fulfilled and that the site conforms to all specifications defined in the checklist and final study. The GE Project Manager of Installation (PMI) will work in cooperation with the customer to follow up and ensure that actions in the checklist are complete, and if necessary, will aid in the rescheduling of the delivery and installation date.
- Prior to installation, a structural engineer of record must ensure that the floor and ceiling is designed in such a way that the loads of the installed system can be securely borne and transferred. The layout of additional structural elements, dimensioning and the selection of appropriate installation methods are the sole responsibility of the structural engineer. Execution of load bearing structures supporting equipment on the ceiling, floor or walls are the customer's responsibility.

THE UNDERSIGNED, HEREBY CERTIFIES THAT I HAVE READ AND APPROVED THE PLANS IN THIS DOCUMENT.		
DATE	NAME	SIGNATURE

GLOBAL SITE READINESS CHECKLIST (DI)

DOC1809666 Rev. 7

Site Ready Checks at Installation
EHS Site Requirements
Overall access route to the scan room free from obstruction / high hazards.
Enough space to store tools, equipment, parts, install waste and the general area free from obstruction and trip hazards.
Enough necessary facilities for the GE employees available.
No 3rd parties working in the area that may affect the safety of the installation activity.
Area free from any chemical, gas, dust, welding fume exposure and has painting been completed and dry.
All emergency routes identified, signed and clear from obstruction.
Accessible single source lockable panel that LOTO can be applied to for GE equipment installation (MDP and/or PDU).
There are no other conditions or hazards that you have observed or have been made aware of by the customer or contractors on site.
Site Ready Checks for MR Magnet delivery if separate from system
Specific for MR Magnet Delivery
All permits, plans and permissions received for rigging and/or delivery.
Adequate delivery route from truck to final place of installation has been reviewed with all stakeholders, all communications/notifications have occurred, arrangements have been made for special handling (rigging, elevator, fork lift, etc.)
All floors along delivery route will support weight of the equipment, temporary reinforcements arranged if needed.
Chilled water supply for Water Cooled Compressor or Air Cooled Compressor is ready and meets GE specifications.
Water drain available in the equipment room, if applicable.
Power for MR compressor & Chiller is available.
Power is available for magnet monitoring.
Connectivity is available for magnet monitoring.
Ensure cryogen venting system is complete to outside the building & available for magnet connection.
Exhaust fan system is installed per GE requirements and VERIFIED operational by suction at intake.
Required for Mechanical Install start
Room dimensions, including ceiling height, for all Exam, Equipment/Technical & Control rooms meets GE specifications.
Ceiling support structure, if indicated on the GE drawing, is in the correct location and at the correct height according to the Original Equipment Manufacturer specifications.
Levelness and spacing has been measured, and is ready for the installation of any GE supplied components.
Finished ceiling is installed. If applicable ceiling tiles installed per PMI discretion.
Floor levelness/flatness is measured and within tolerance, and there are no visible defects per GEHC specifications.
Entry door threshold meets PIM requirement
Floor Strength and thickness have been discussed with customer/contractor and they have confirmed GE requirements are met.
Rooms that will contain equipment, including staging areas if applicable, are construction debris free. Precautions must be taken to prevent debris from entering rooms containing equipment.
Cable ways (floor/wall/ceiling/Access Flooring) are available for installation of GE cables are of correct length and diameter.
Overhead cable trays must be install exactly as shown in GE supplied installation draings to assure proper Gradient Cable length.
Cable ways routes per GE Final drawings and cable access openings areas installed at a time determined by GEHC PM. Surface floor duct can be installed at time of system installation.
Adequate room illumination installed and working.
Customer supplied countertops where GE equipment will be installed are in place.
RF Shield installed with possible exception of magnet entrance. RF Shield Effectivity and Ground Isolation Test needed. If GE responsible for supplying RF shield, the RF shield Effectivity and Ground Isolation Test data is a Mandatory attachment into MyProjects.
Required for Calibration start
HVAC systems Installed, and the site meets minimum environmental operational system requirements.
System power & grounding (PDB/MDP) is available as per GE specifications.
System power & grounding (PDB/MDP) is installed at point of final connection and ready to use. Lock Out Tag Out is available.
PMI to confirm all feeder wires and breaker are size appropriately. EPO installed if needed.
PMI to confirm with electrician all power and signal cables are well terminated ensuring there are no loose connections.
Network outlets installed.
Computer network available and working.

Note: The details shown here are only an extract from DOC1809666. For the complete document please contact your PMI.

CUSTOMER SITE READINESS REQUIREMENTS

- Any deviation from these drawings must be communicated in writing to and reviewed by your local GE healthcare installation project manager prior to making changes.
- Make arrangements for any rigging, special handling, or facility modifications that must be made to deliver the equipment to the installation site. If desired, your local GE healthcare installation project manager can supply a reference list of rigging contractors.
- New construction requires the following;
  - Secure area for equipment,
  - Power for drills and other test equipment,
  - Capability for image analysis,
  - Restrooms.
- Provide for refuse removal and disposal (e.g. crates, cartons, packing)
- For CT, MR, PET/CT, and SPECT systems it is required to minimize vibrations within the scan room. It is the customer's responsibility to contract a vibration consultant/engineer to implement site design modifications to meet the GE vibration specification. Refer to the system preinstallation manual for vibration specifications.

MRI SITE PLANNING REMINDERS

Please refer to pre-installation checklist in pre-installation manual listed on the cover sheet for items critical to image quality.

- The layout should be arranged so that the 5g line is contained to the magnet room. If not possible, a barrier is recommended to prevent entry to the 5g field area.
- The spaces around, above, and below the magnet must be reviewed for effects of the 5g, 3g, 1g, and .5g fields. Refer to the proximity limit chart in the MR pre-installation manual referenced on the cover sheet.
- For moving metal, the restriction lines typically extend outside of the MR space. Please confirm there are no moving metal concerns within these areas.
- For vibration, analysis to be completed as required per pre-installation manual.
- For EMI, review the site for the location of the main electrical feeders, AC devices, or distribution systems. An EMI study is recommended if large AC systems are nearby.
- Details of the floor below the magnet must be reviewed. The structural engineer must verify that the quantity of steel in the volume 10ft [3.1m] x 10ft [3.1m] x 1ft [.3m] deep (below the magnet) does not exceed the allowable steel content as given in the MR pre-installation manual referenced on the cover sheet.
- 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.

Responsibility for the coordination, design, engineering, and site preparation resides with the customer and their project architects and contractors. GE does not, by providing reviews and furnishing comments and assistance, accept any responsibility beyond its obligations as defined in the MR system, sale/purchase agreement.

IMAGE QUALITY CONSIDERATIONS

Broadband RF noise is a single transient or continuous series of transient disturbances caused by an electrical discharge. Low humidity environmental conditions will have higher probability of electrical discharge. The electrical discharge can occur due to electrical arcing (micro arcing) or merely static discharge. Some potential sources capable of producing electrical discharge include:

- Loose hardware/fasteners vibration or movement (electrical continuity must always be maintained)
- Flooring material including raised access flooring (panels & support hardware) and carpeting
- Electrical fixtures (i.e. Lighting fixtures, track lighting, emergency lighting, battery chargers, outlets)
- Ducting for HVAC and cable routing
- RF shield seals (walls, doors, windows etc.)

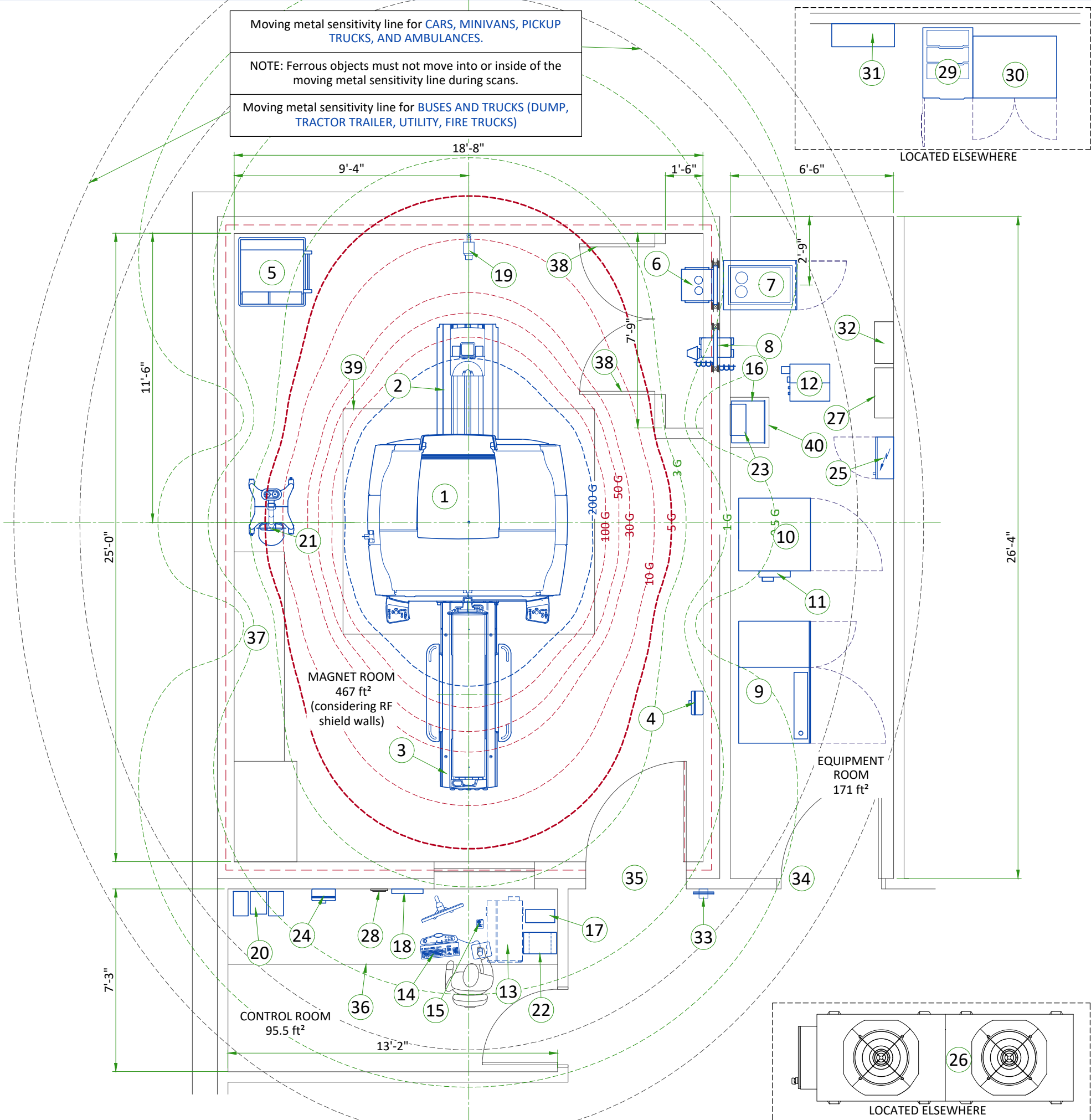
For additional information regarding image quality, refer to the pre-installation manual listed on the cover sheet.






MAGNETIC INTERFERENCE SPECIFICATIONS

- The customer must establish protocols to prevent persons with cardiac pacemakers, neurostimulators, and biostimulation devices from entering magnetic fields of greater than 5 gauss (exclusion zone).
- Main power transformers must remain outside the 3 gauss field. EMI < 20mg rms ac. EMI < 5.87mg dc.
- Potential exists under fault conditions that the 5 gauss line may expand radially to 9.35 ft. [2.85 m] and axially to 14.27 ft. [4.35 m] for 1 seconds or less. It should be noted that normal rampdowns or magnet rundown unit initiated quenches will not cause the magnetic field to expand.
- It is recommended every site consider the event of a quench and plan accordingly (such as placing 5 gauss warning signs at expanded locations).
- The ferrous metal objects listed below must not move into or inside of the moving metal sensitivity line during scans.

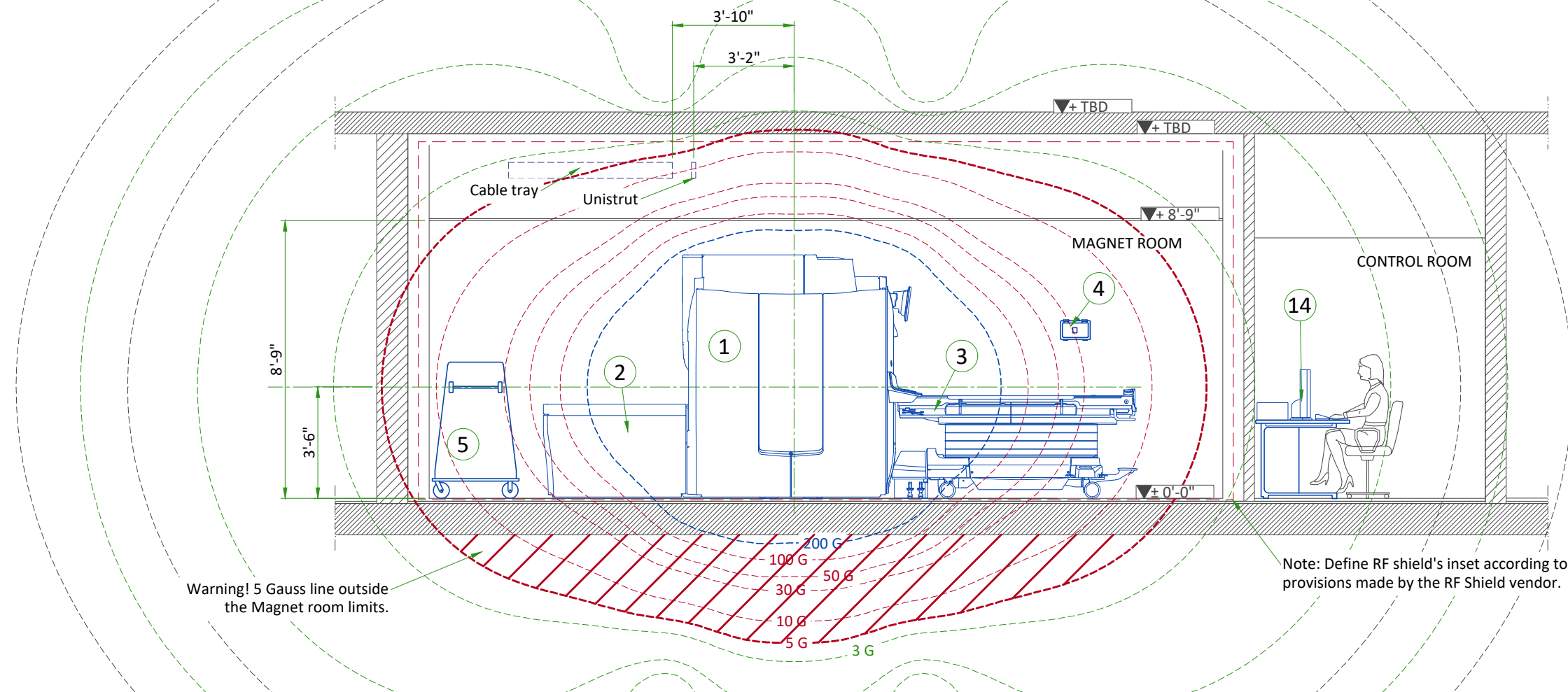
TYPICAL MOVING MAGNETIC MASS	DISTANCE RADIALLY		DISTANCE AXIALLY	
Carts, Gurneys 100-400 lbs [45-182 kg]	3 Gauss line		3 Gauss line	
Forklifts, small elevator, cars, minivans vans, pickup trucks, ambulances (objects greater than 400 lbs [182 kg])	15.5 FT	4.72 M	24.6 FT	7.5 M
Buses and trucks (dump, tractor trailer, utility, fire trucks)	18.1 FT	5.52 M	28.75 FT	8.76 M



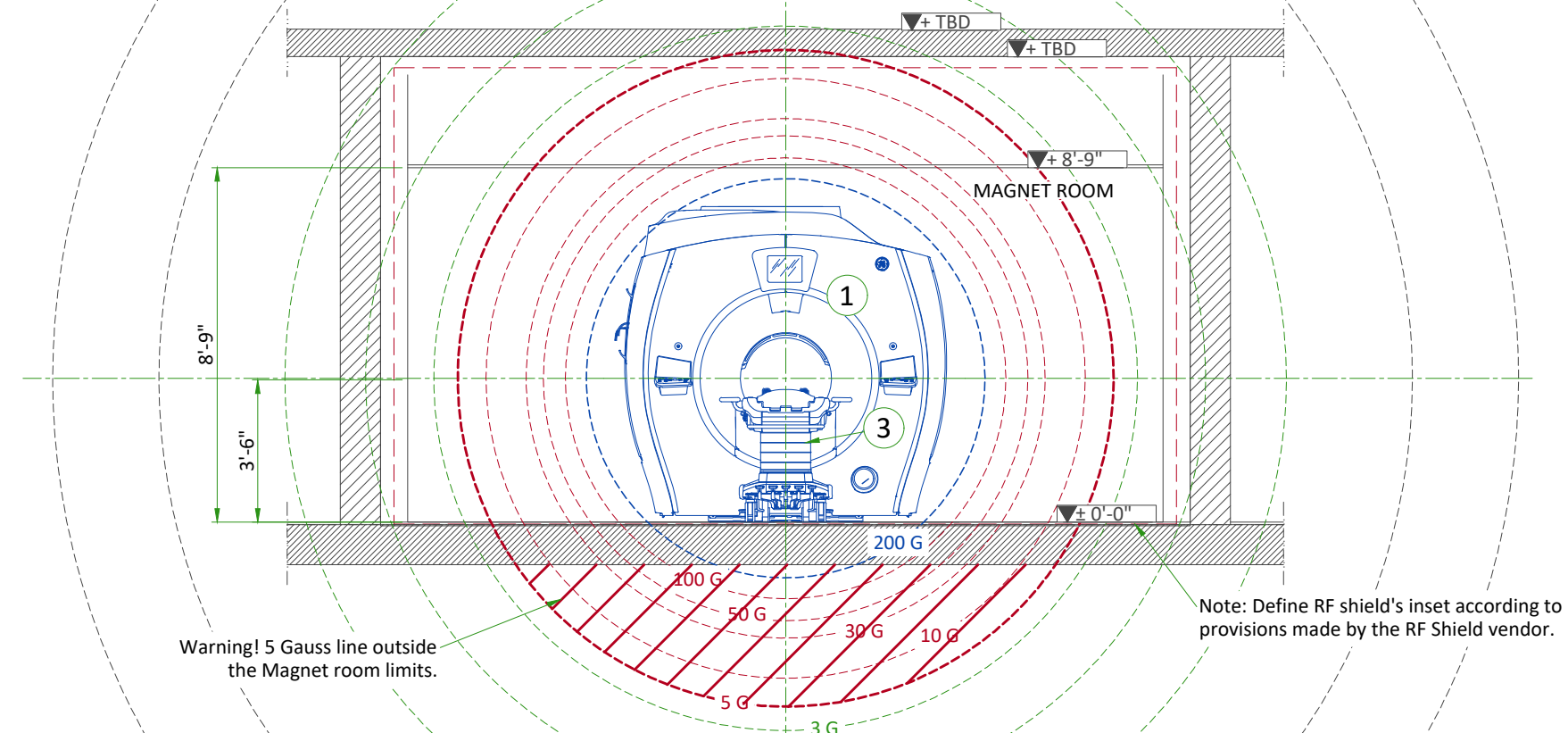


LEGEND						
A	GE Supplied		C	Customer/contractor supplied and installed		
B	GE Supplied/contractor installed		D	Available from GE		
	200 Gauss			5 Gauss		
	100, 50, 30, 10 Gauss			3, 1, 0.5 Gauss		
BY	ITEM	DESCRIPTION	MAX HEAT OUTPUT (btu)	WEIGHT (lbs)	MAX HEAT OUTPUT (W)	WEIGHT (kg)
A	1	1.5T Magnet	8189	9867	2400	4476
A	2	Rear pedestal	-	212	-	96
A	3	GEM Patient table	-	463	-	210
A	4	Magnet rundown unit	-	7	-	3.2
A	5	Phantom set storage cabinet	-	350	-	136
A	6	Blower box	1535	-	450	-
A	7	Penetration cabinet	1024/10697	639	300/3135	290
A	8	Secondary penetration wall	-	92	-	45
A	9	Power, gradient, RF cabinet	20940	3144	6137	1426
A	10	Heat exchanger cabinet	3412	1350	1000	612
A	11	Magnet monitor	819	10	240	4.5
A	12	Cryocooler compressor	1706	276	500	125
A	13	Operator console computer	4947	141.75	1450	64.3
A	14	Operator workspace	-	26	-	11.80
A	15	Pneumatic patient alert	-	0.5	-	0.2
D	16	MR Elastography	480	53.4	0.14	24.22
D	17	700 va partial UPS	-	26.5	-	11.5
D	18	CCTV Monitor	-	7.7	-	3.50
D	19	CCTV Camera	-	0.3	-	0.14
D	20	Music system	-	-	-	-
D	21	Injector on pedestal	-	94	-	43
D	22	Injector control	675	17	198	8
D	23	Injector power supply	660	6	193	3
D	24	Remote magnet rundown unit	-	7	-	3.20
B	25	Main disconnect panel	901	96	264	59
D	26	Dimplex chiller	168000	4300	49250	1951
D	27	Water filter	-	-	-	-
D	28	Remote graphic display	-	-	-	-
D	29	Full UPS 150 kW	23544	1206	6900	547
D	30	Full UPS Battery cabinet	-	3500	-	1588
D	31	Maintenance Bypass Panel (MBP)	-	125	-	57
D	32	Water bypass	-	-	-	-
D	33	Metal Detector (hand held)	-	-	-	-
C	34	Minimum opening for equipment delivery is 40 in. w x 82 in. h, contingent on a 72 in. corridor width				
C	35	Minimum opening for delivery is 43 in. w x 82 in. h, contingent on a 96 in. corridor width				
C	36	Counter top for equipment- provide grommets openings as required to route cables				
C	37	Base cabinet for storage of: surface coils, patient positioning pads, phantoms, etc.				
C	38	Louvered doors - refer to preinstall for requirements				
C	39	Magnet access 9'-0"x10'-0"				
C	40	Shelf				
	RF SHIELD - 100 dB ATTENUATION					
Exam room height						
Finished floor to slab height					TBD	
Recommended finished ceiling height					8'-9"	

## SIDE VIEW WITH MAGNETIC FIELD



## FRONT VIEW WITH MAGNETIC FIELD



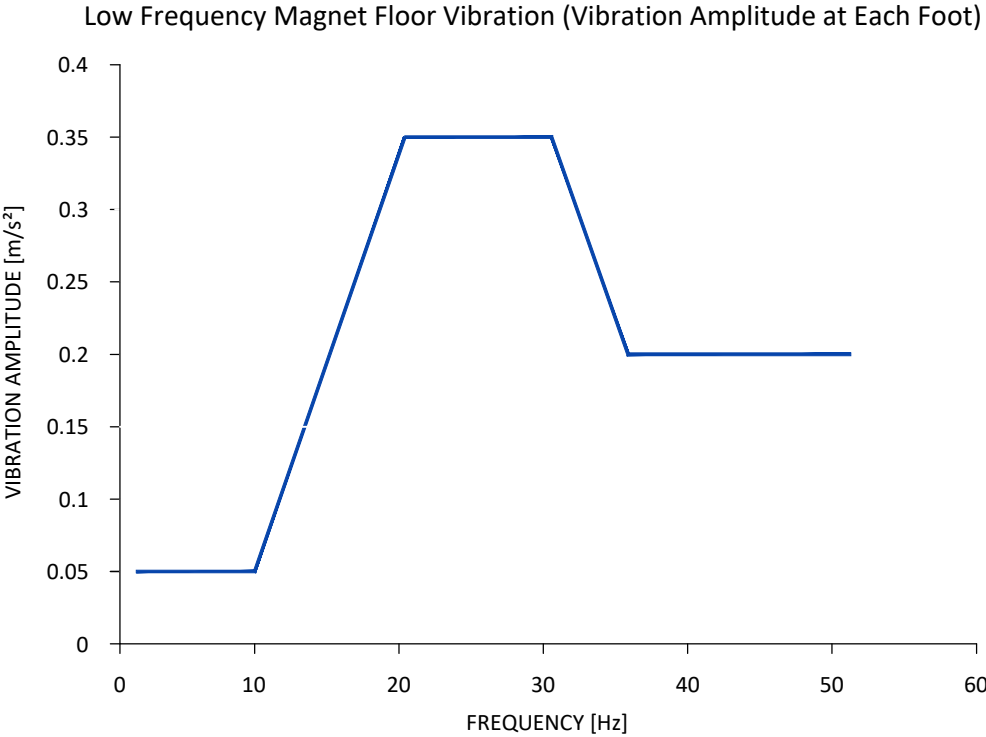
ACOUSTICS SPECIFICATIONS

Acoustic and vibroacoustic information is provided for site planning and architectural design activities. It is the customer's responsibility to hire a qualified acoustic engineer for solutions to further attenuate this transmitted noise and vibration, if required. The actual room noise level may vary based on room design, optional equipment, and usage:

Control Room: 62 dBA  
Equipment Room: 80 dBA  
Magnet Room: 127 dBA\*  
(maximum sound pressure level at magnet bore isocenter)

\* Frequency: 20 Hz to 20kHz

FREQUENCY (Hz)	AMPLITUDE (m/s²)
2	0.05
10	0.05
20	0.35
30	0.35
35	0.2
50	0.2

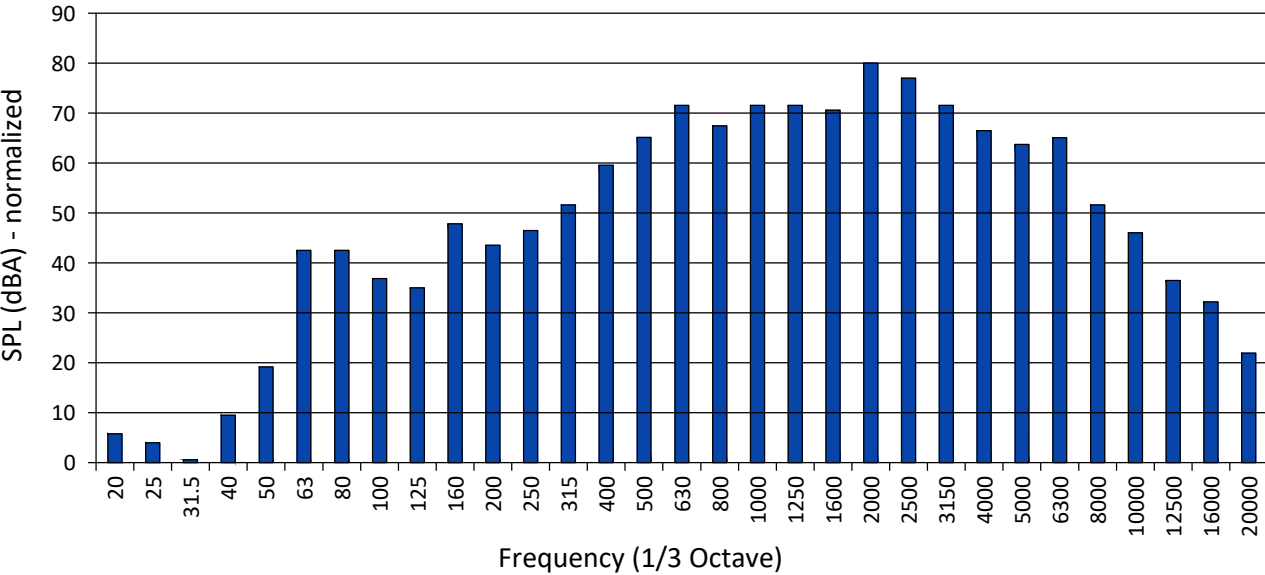


ISOGAUSS PLOTS

\* The isogauss contour plots depicted on this drawing represent magnetic fringe fields resulting from the normal operation of the magnet provided with the MR system. The actual magnetic field intensity at any point in the vicinity of the magnet when installed may vary from the contour plots due to factors such as the concentrating effects of nearby ferrous objects ambient magnetic fields, including the earth's magnetic field. Therefore, the contours shown are only approximations of actual field intensities found at a corresponding distance from the magnet's isocenter.

SOUND PRESSURE SPECTRAL DISTRIBUTION

1/3 Band Relative SPL



MAGNETIC PROXIMITY LIMITS

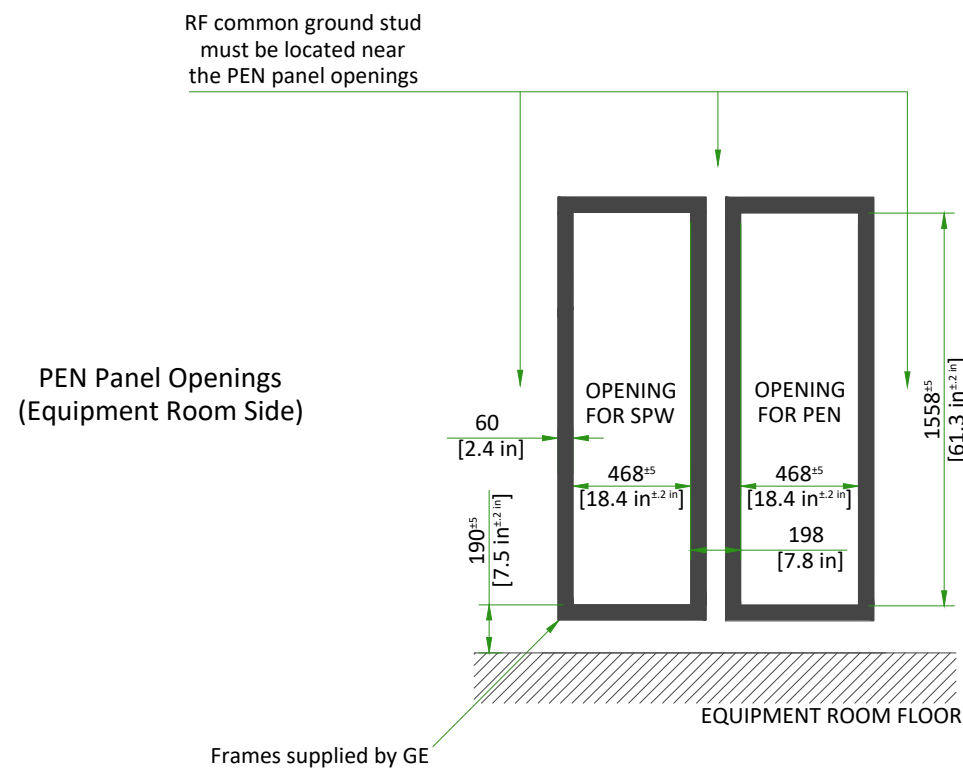
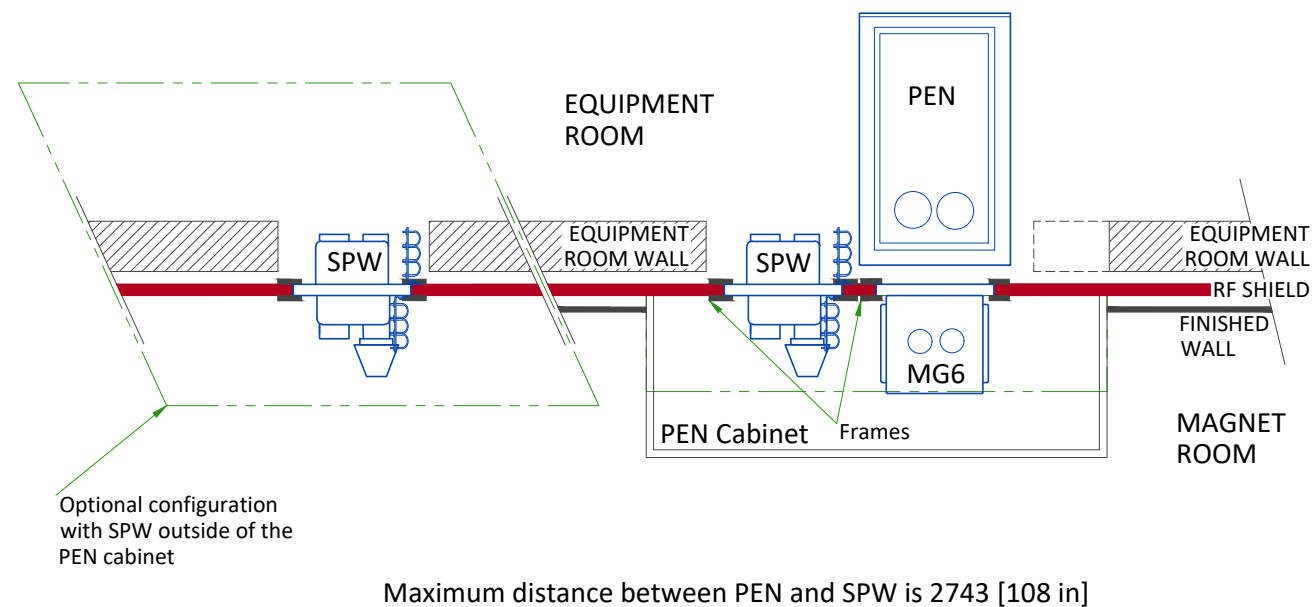
Gauss (mT) Limit	Equipment
0.5 gauss (0.05mT)	Nuclear camera
1 gauss (0.1mT)	Positron Emission Tomography scanner, Linear Accelerator, Cyclotrons, Accurate measuring scale, Image intensifiers, Bone Densitometers, Video display (tube), CT scanner, Ultrasound, Lithotripter, Electron microscope, Digital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

The customer must provide detail defining ferrous material below the magnet to the Project Manager so the GE Healthcare MR Siting and Shielding team can review for compliance.

STEEL MASS LIMITS TO MAGNET ISOCENTER (3x3 m [10x10 ft] AREA UNDER MAGNET)					
Limits Of Steel Mass		Distance From Magnet Isocenter		Distance Below Top Surface Of Floor	
kg/m²	lbs/ft²	mm	in	mm	in
0	0	0 - 1143	0-45	0 - 76	0-3
9.8	2	1143 - 1194	45-47	76 - 127	3-5
14.7	3	1194 - 1321	47-52	127 - 254	5-10
39.2	8	1321 - 1397	52-55	254 - 330	10-13
98.0	20	1397+	55+	330+	13+

The actual field strength can be affected by Magnetic shielding, Earth's magnetic field, other magnetic fields and stationary or moving metal. This information must be used to evaluate potential site interaction of GE Healthcare equipment with other non-GE Healthcare equipment. Magnetic shielding can be installed to prevent interaction between the magnet and nearby sensitive devices. The GE Healthcare Project Manager of Installation (PMI) can work with the customer to coordinate the magnetic shielding site evaluation. The customer is responsible for installation of all magnetic shielding.

## PENETRATION PANEL WITH SPW



SCALE 1:30

## PENETRATION PANEL CLOSET

An enclosure (i.e. closet) must be provided to restrict access to the PEN panels and for storage of excess interconnections.

- The PEN closet must have a mechanical locking mechanism to restrict access to the PEN panels
- The PEN closet must maintain the minimum service area outside the 200 Gauss in the magnet room.
- PEN closet must allow free air exchange of **400CFM (680 m<sup>3</sup>/hour)** between the Magnet room and PEN closet for MR system blowers. Airflow may be achieved through door louvers or other openings in the PEN closet that meet all other PEN closet requirements

A closet service hatch must be provided if the room does not allow the PEN panel blower box removal path to remain completely outside the 200 Gauss line.

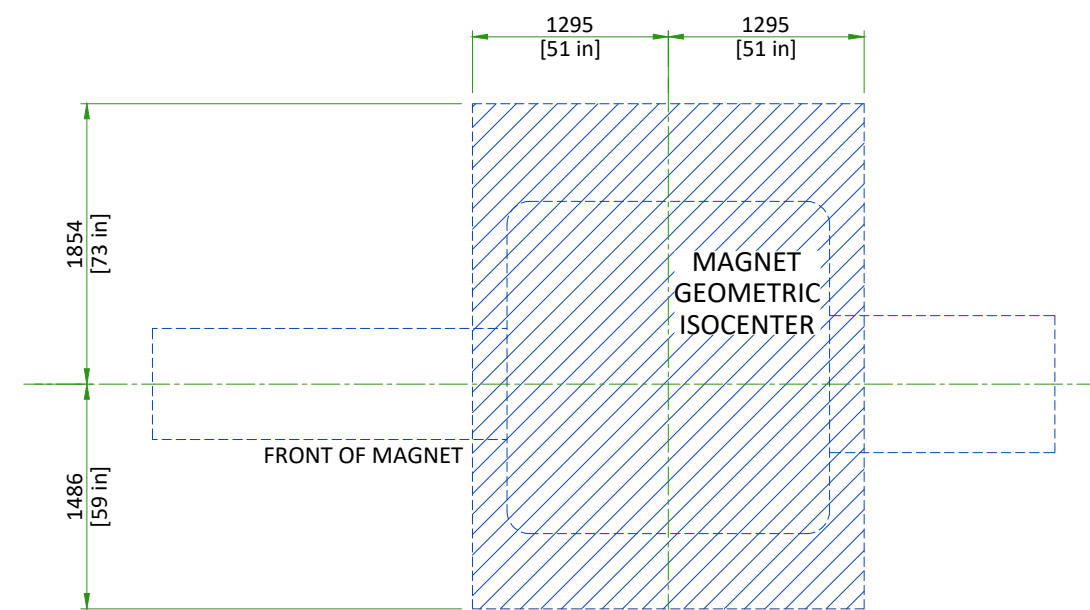
NOTE: If the room size is sufficiently large so the SPW blower box can be removed without entering the 200 Gauss line, a closet service hatch is not required.

The closet service hatch must meet the following requirements:

- Must be located within the PEN closet on the RF wall allowing access to the Equipment room
- May be located anywhere within the PEN closet (between 254 [10 in] and 1524 mm [60 in] with unobstructed pass-through)
- Must be minimum 508x508 mm [20x20 in]
- Must maintain RF shield integrity for all service access
- May use any design (quick disconnect RF panel, blanker panel, hinged door, etc.) as long as all other requirements are met
- The closet service hatch removal must take less than 15 minutes (replacement must also take less than 15 minutes)

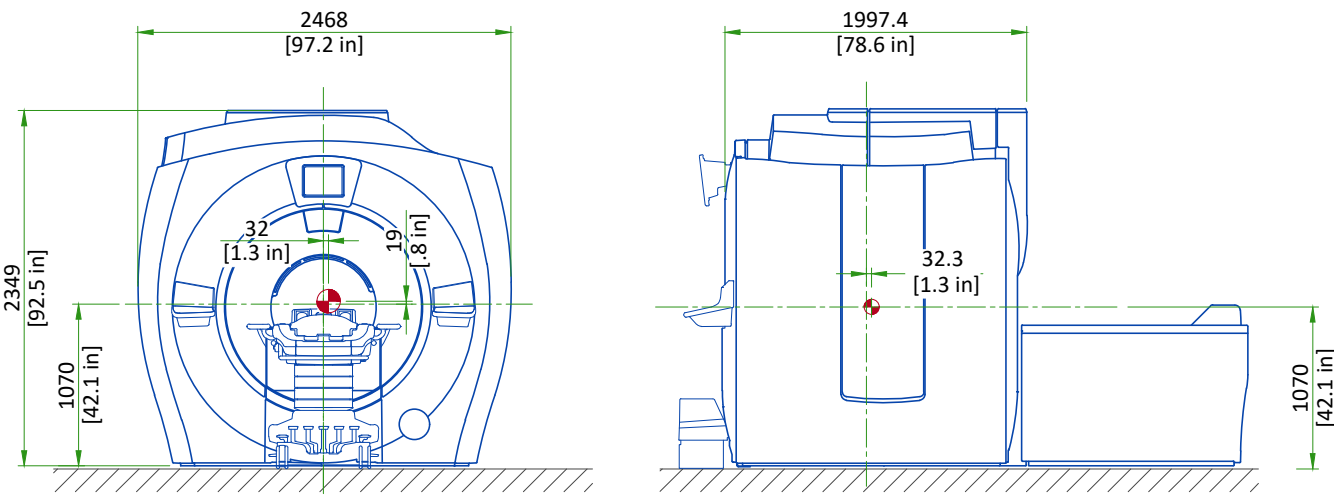
## MINIMUM MAGNET CEILING HEIGHT ( TOP VIEW )

Shaded area indicates floor to ceiling minimum height of 2500 mm [98.42 in]. Special service procedures are required if ceiling height is between 2500 mm [98.42 in] and 2667 mm [105 in].



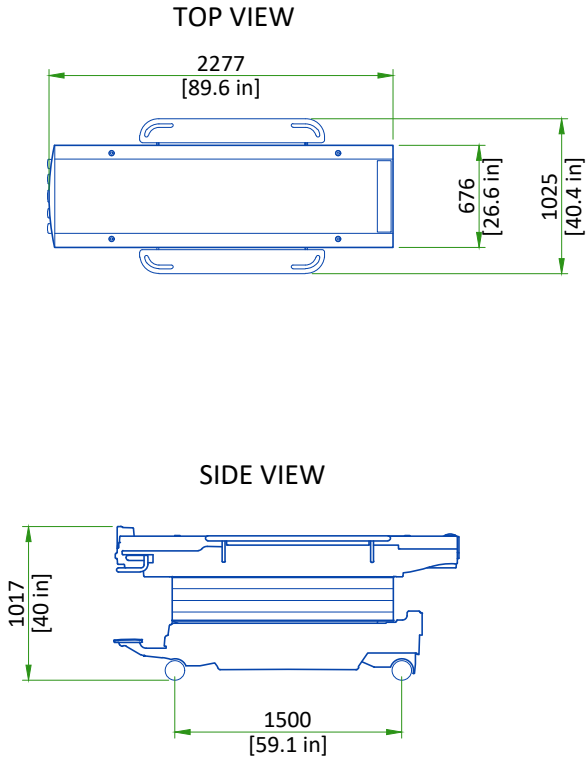


MAGNET ENCLOSURE

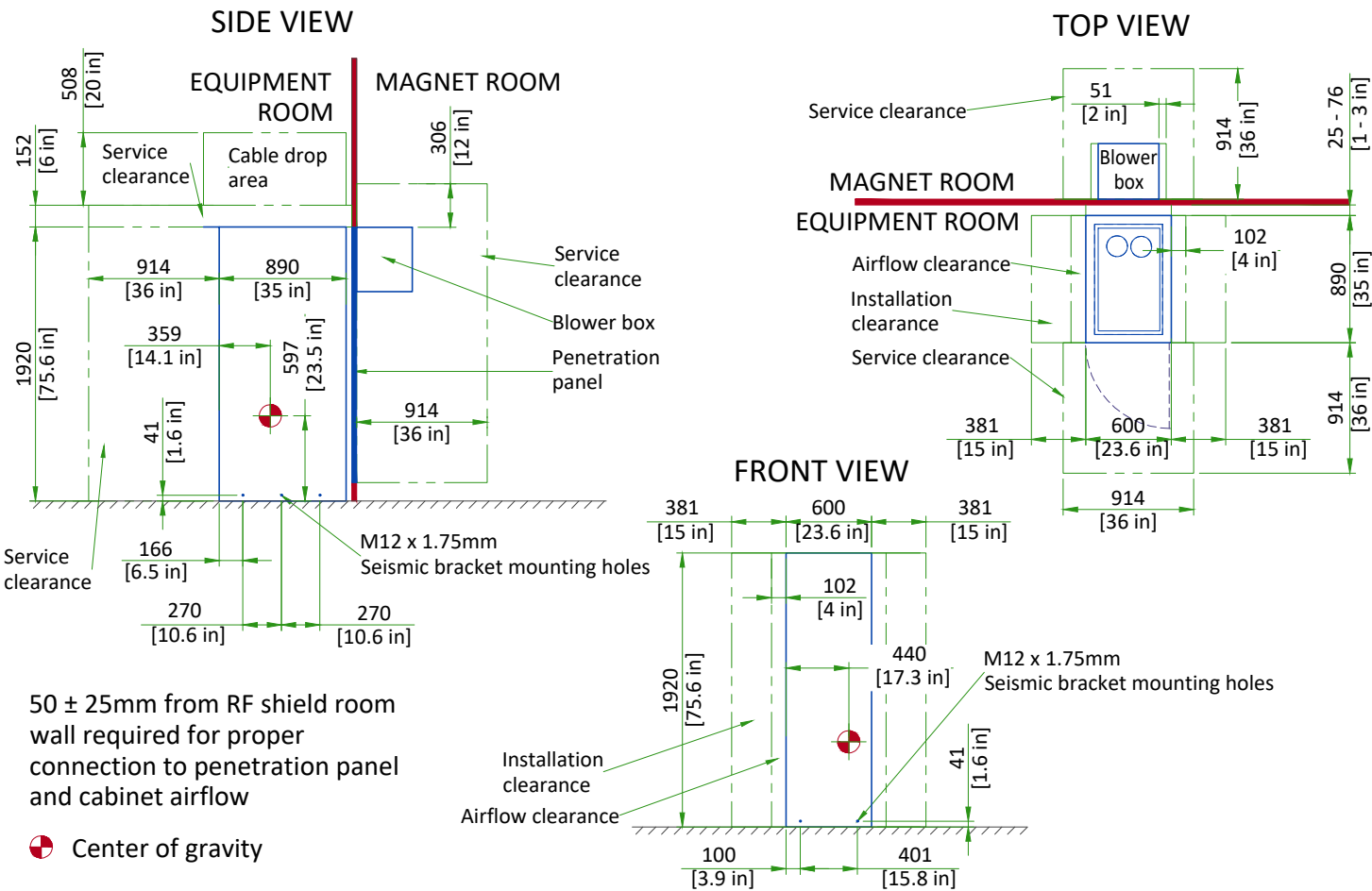


Note:  
Center of gravity is approximate and includes the GE Healthcare supplied VibroAcoustic Dampening Kit, but does not include cryogenes, gradient assembly, side mounted electronics, or enclosures.  
Enclosure dimensions are for reference only, NOT FOR SITE PLANNING USE.  
Center of gravity

PATIENT TRANSPORT TABLE (PT)

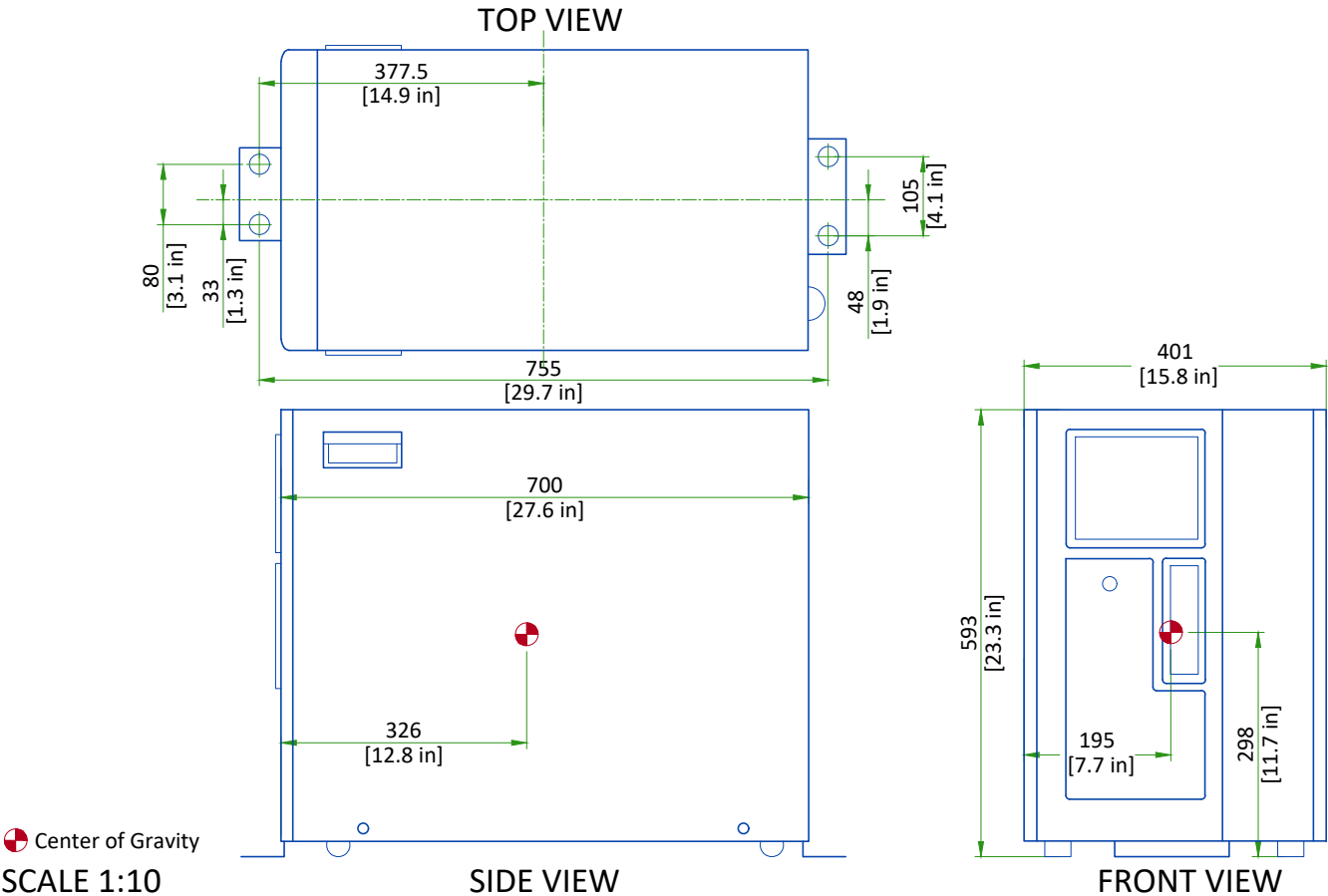


PENETRATION CABINET CLEARANCE



50 ± 25mm from RF shield room wall required for proper connection to penetration panel and cabinet airflow  
Center of gravity

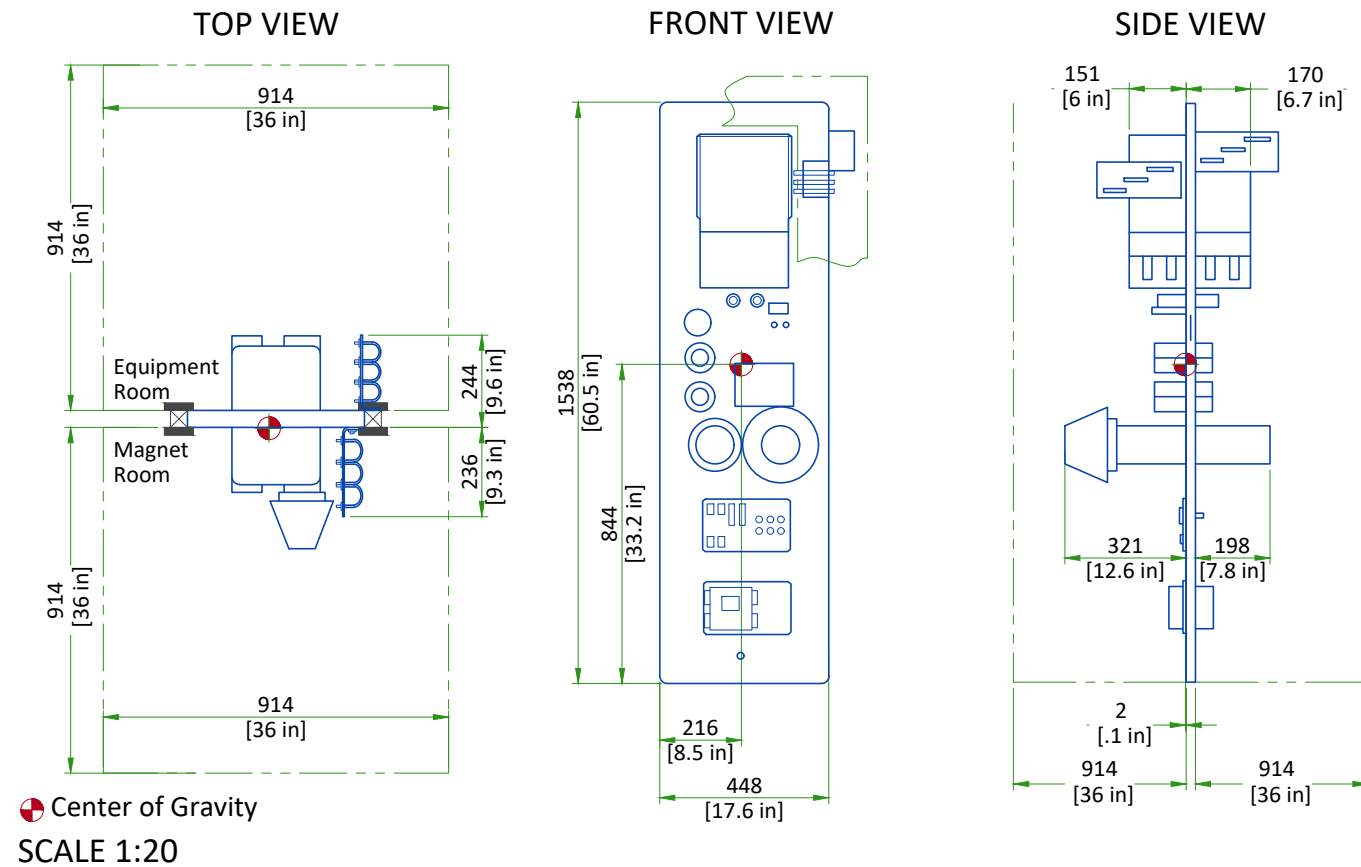
GLOBAL OPERATORS CABINET (GOC)



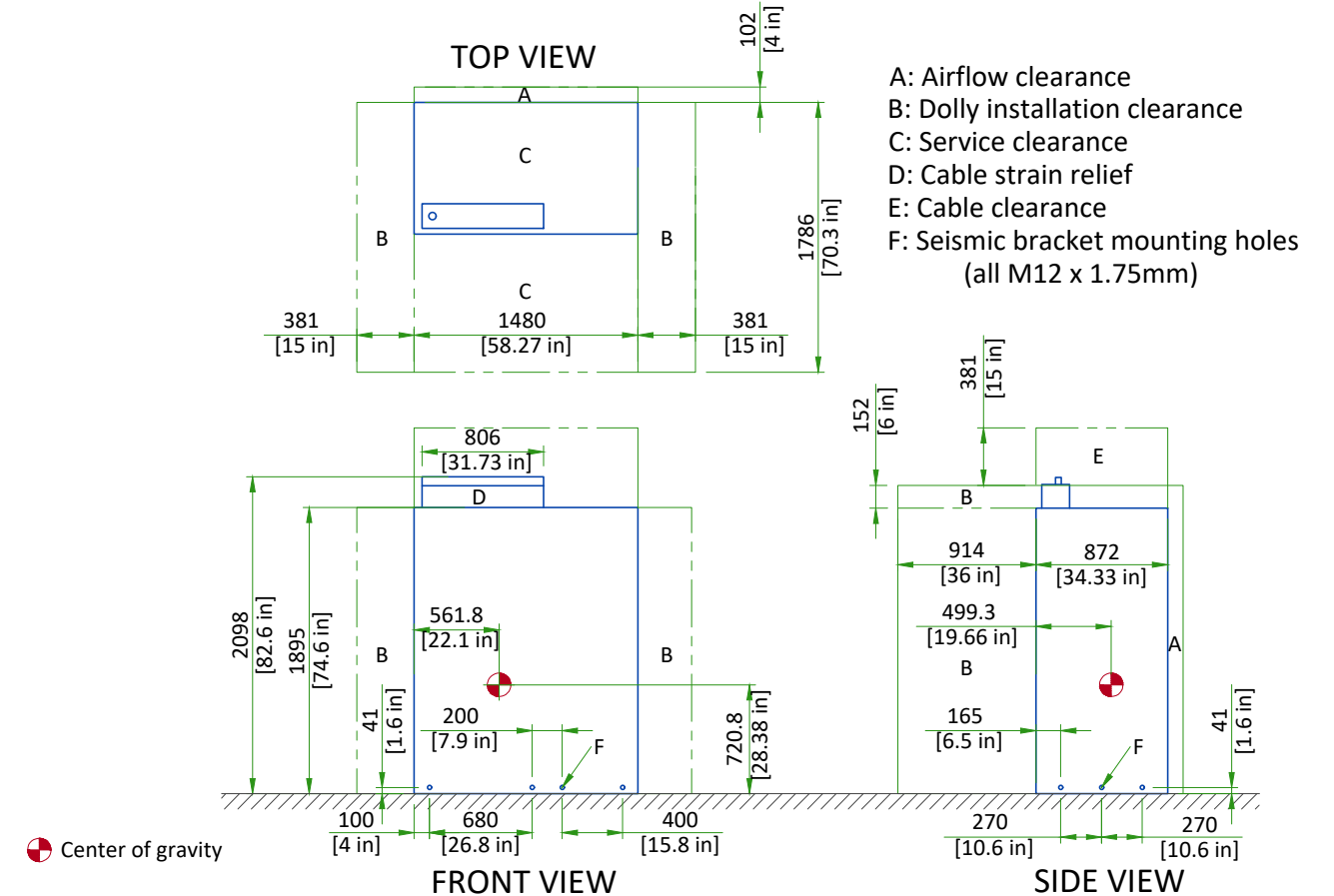
Center of Gravity  
SCALE 1:10



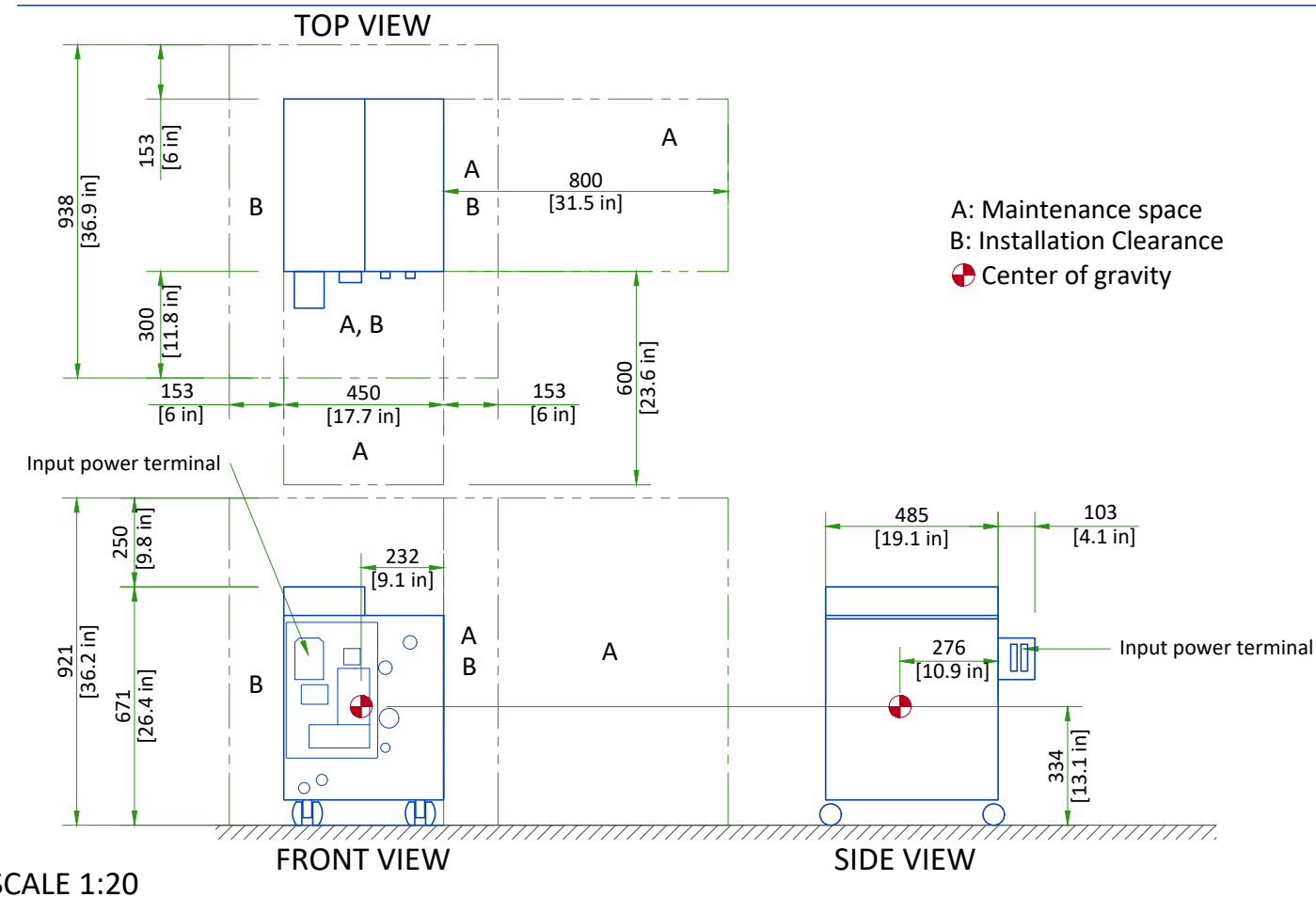
## SECONDARY PENETRATION WALL (SPW)



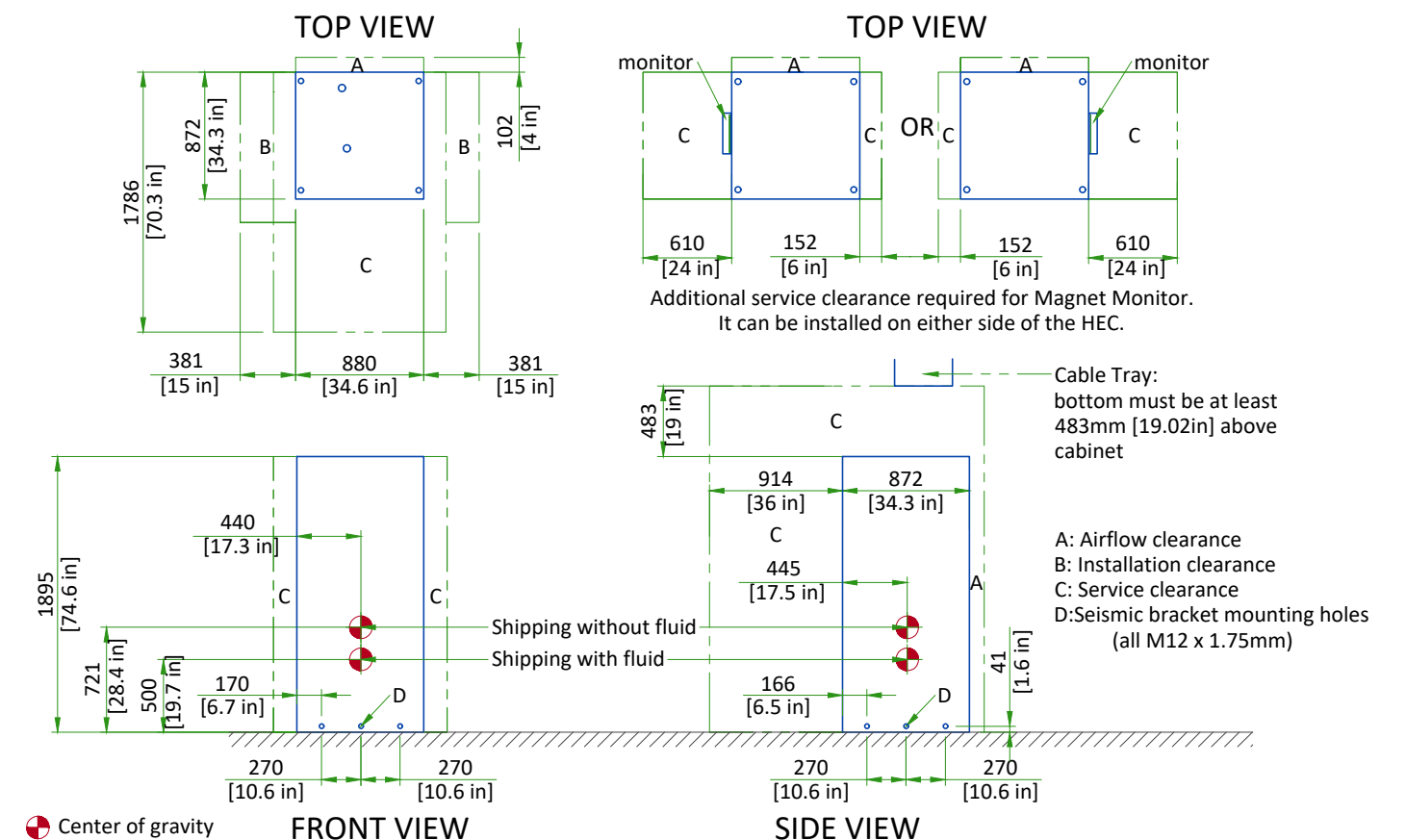
## POWER, GRADIENT, RF CABINET (PGR)



## CRYOCOOLER COMPRESSOR ( CRY )



## HEAT EXCHANGER CABINET ( HEC )



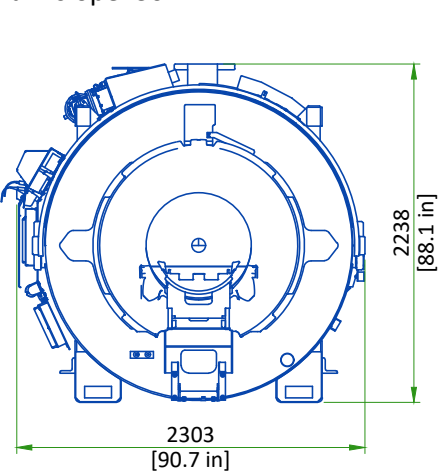
DELIVERY

ROUTING

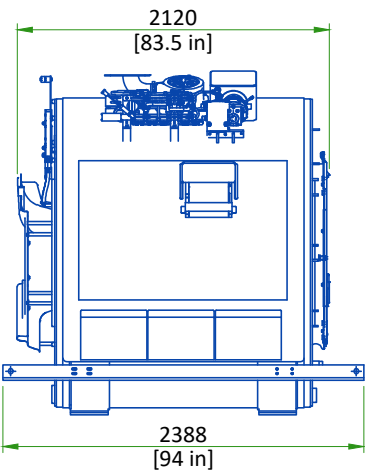
- The customer is solely liable for routing of components from dock to final site.
- GE must be able to move system components in or out with no need to uncrate or disassemble any of the components. The entire passageway must be cleared, adequately lighted and free from dust.
- The floor and it surfacing must be able to withstand the live load of components and handling equipment.
- Floor surfacing must be continuous.
- The customer must protect any fragile flooring surfaces.

SPECIFICATIONS FOR MAGNET ROUTING

- Floor must be able to withstand a moving load of 4823kg [10632 lb]
- Recommended opening height: 2.5m [98.5in], width: 2.5m [98.5in]. If recommended dimensions cannot be met refer to pre-installation manual for detailed specifications.
- Maximum slope: 30°

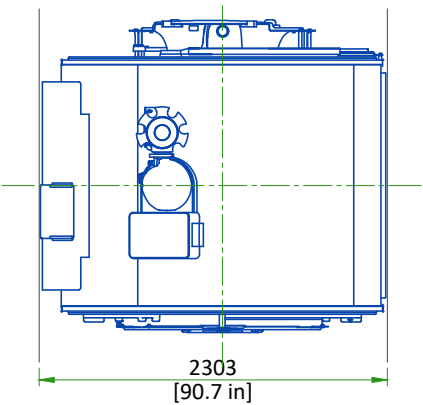


FRONT VIEW OF MAGNET

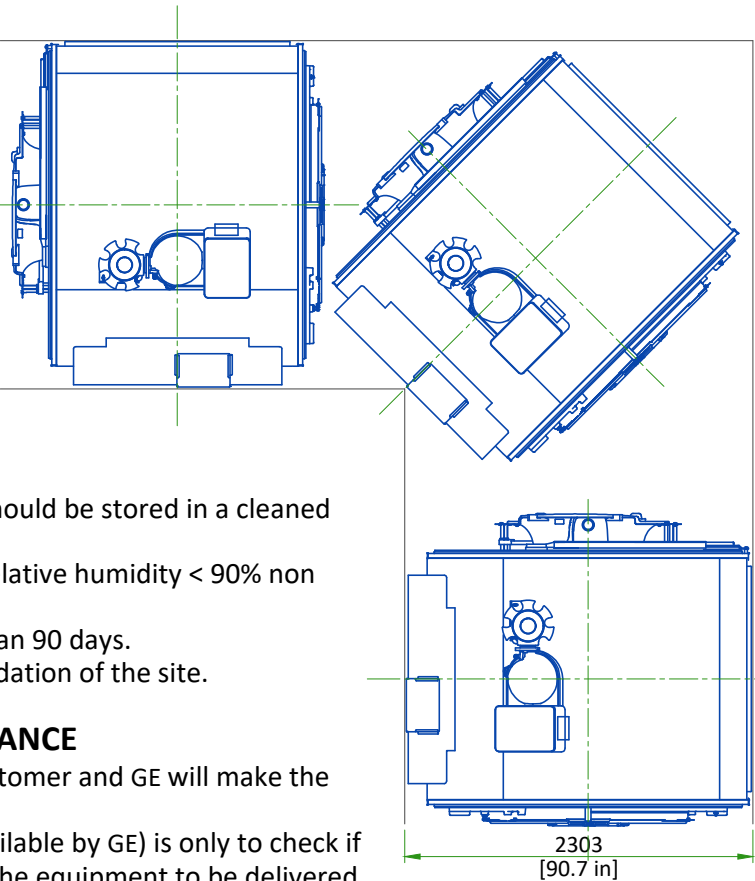


SIDE VIEW OF MAGNET

STRAIGHT PATH  
(Rigging wheels required)



PATH WITH 90 DEGREE TURN



STORAGE CONDITIONS

- System components except the magnet should be stored in a cleaned room:
- Temperature = -30 to 60°C [-22 to 140], relative humidity < 90% non condensing.
- Material should not be stored for more than 90 days.
- The magnet will be delivered after GE validation of the site.

INSTALLATION AND DELIVERY ACCEPTANCE

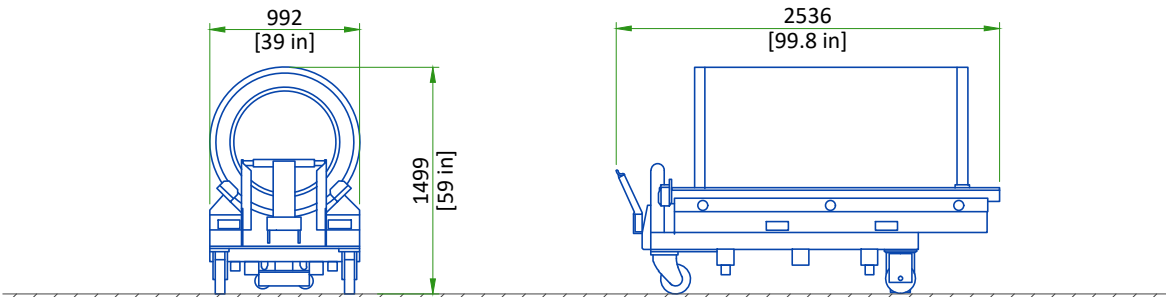
- A survey of the site established by the customer and GE will make the decision for the delivery time.
- This survey of the site (a form is made available by GE) is only to check if the apparent conditions of the site allow the equipment to be delivered.
- If the site is not ready, GE can delay the delivery time.

CRITICAL ITEMS FOR MAGNET DELIVERY

- 24/7 chilled water and 480v power for shield/cryo cooler
- 24/7 120v power for the magnet monitor
- Phone lines for magnet monitoring and emergency use
- Magnet room exhaust fan
- Cryogen venting (if roof hatch, completed within 24 hrs)

This is only a partial list of items required for delivery of the magnet. For a complete checklist refer to the pre-installation manual referenced on cover sheet.

GRADIENT COIL REPLACEMENT



Front view of the BRM Gradient

Side view of the BRM Gradient

EQUIPMENT	DIMENSIONS LxWxH		WEIGHT		NOTE
	mm	in	kg	lbs	
Replacement BRM gradient coil assembly on a shipping cradle/cart	991x2536x1499	39x99.84x59	1449	3194	Initial gradient coil assembly is shipped installed in the magnet. Shipping/installation cart is used to install re-placement coil assembly only.

The weight bearing structure of the site should support any additional weight of the main replacement parts occurring during maintenance of the magnet, throughout the whole lifecycle of the MR.

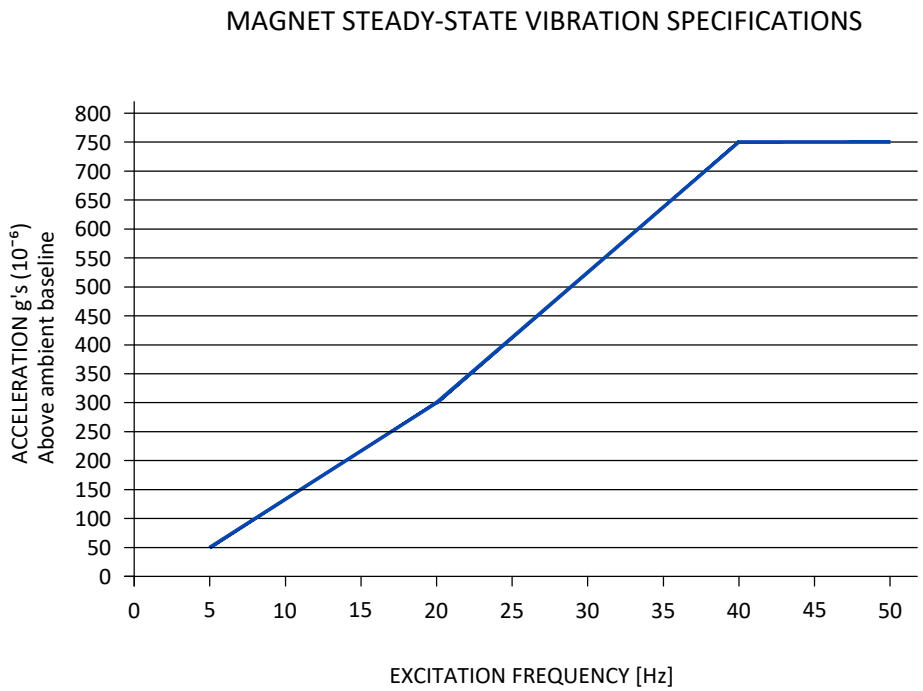
STRUCTURAL NOTES

- All units that are wall mounted or wall supported are to be provided with supports where necessary. Wall supports are to be supplied and installed by the customer or his contractors.
- Dimensions are to finished surfaces of room.
- Certain MR procedures require an extremely stable environment to achieve high resolution image quality. Vibration is known to introduce field instabilities into the imaging system. The vibration effects on image quality can be minimized during the initial site planning of the mr suite by minimizing the vibration environment. See [PROXIMITY LIMITS](#), [PATIENT TABLE DOCK ANCHOR MOUNTING REQUIREMENTS AND VIBROACOUSTIC DAMPENING KIT](#) details for additional information.
- Standard steel studs, nails, screws, conduit, piping, drains and other hardware are acceptable if properly secured. Any loose steel objects can be violently accelerated into the bore of the magnet. Careful thought should be given to the selection of light fixtures, cabinets, wall decorations, etc. To minimize this potential hazard. For safety, all removable items within the magnet room such as faucet handles, drain covers, switch box cover plates, light fixture components, mounting screws, etc. must be non-magnetic. If you have a specific question about material, bring it to the attention of your GE project manager of installations.
- Floor levelness refer to [MAGNET ROOM FLOOR SPECIFICATIONS DETAIL](#), this floor levelness requirement is important for accurate patient table docking.
- Non-movable steel such as wall studs or hvac components will produce negligible effect on the active shield magnet.
- Customers contractor must provide all penetrations in post tension floors.
- Customers contractor must provide and install any non-standard anchoring. Documents for standard anchoring methods are included with GE equipment drawings for geographic areas that require such documentation.
- Customers contractor must provide and install hardware for "through the floor" anchoring and/or any bracing under access floors. This contractor must also provide floor drilling that cannot be completed because of an obstruction encountered while drilling by the GE installer such as rebar etc.
- Customers contractor to provide and install appropriate supports for the storage of excess cables.
- It is the customer's responsibility to perform any floor or wall penetrations that may be required. The customer is also responsible for ensuring that no subsurface utilities (e.g., electrical or any other form of wiring, conduits, piping, duct work or structural supports (i.e. post tension cables or rebar)) will interfere or come in contact with subsurface penetration operations (e.g. drilling and installation of anchors/screws) performed during the installation process. To ensure worker safety, GE installers will perform surface penetration operations only after the customer's validation and completion of the "GE surface penetration permit"

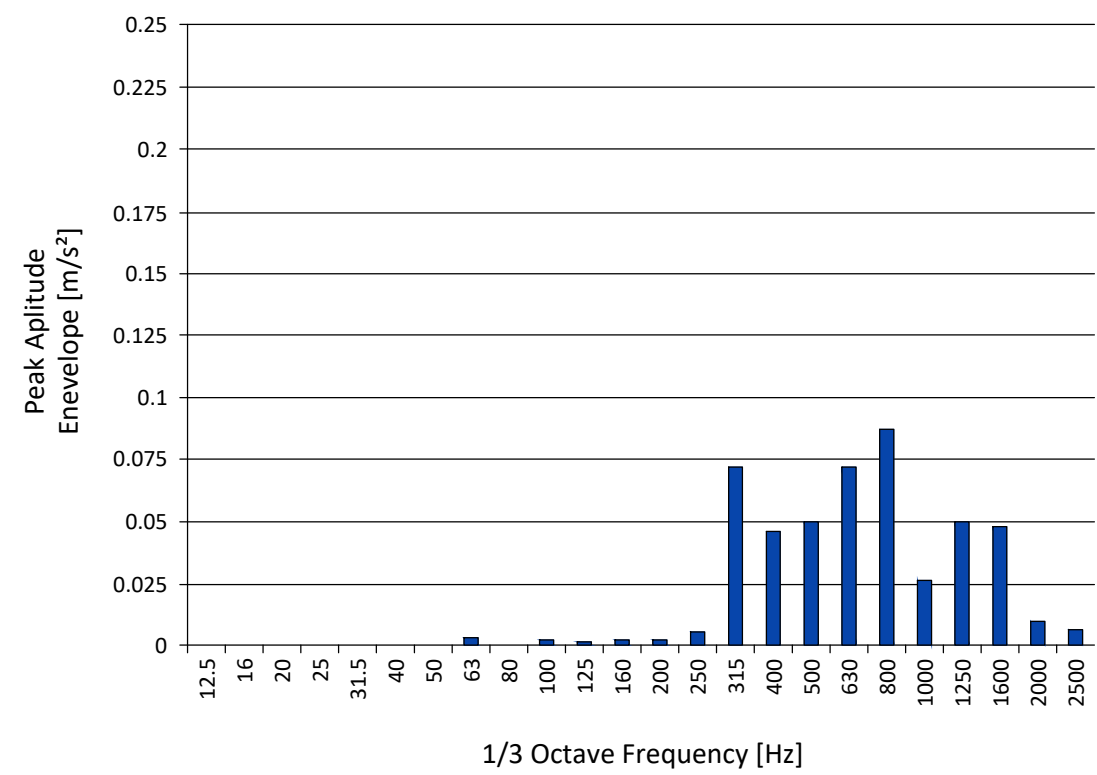
VIBRATION SPECIFICATIONS

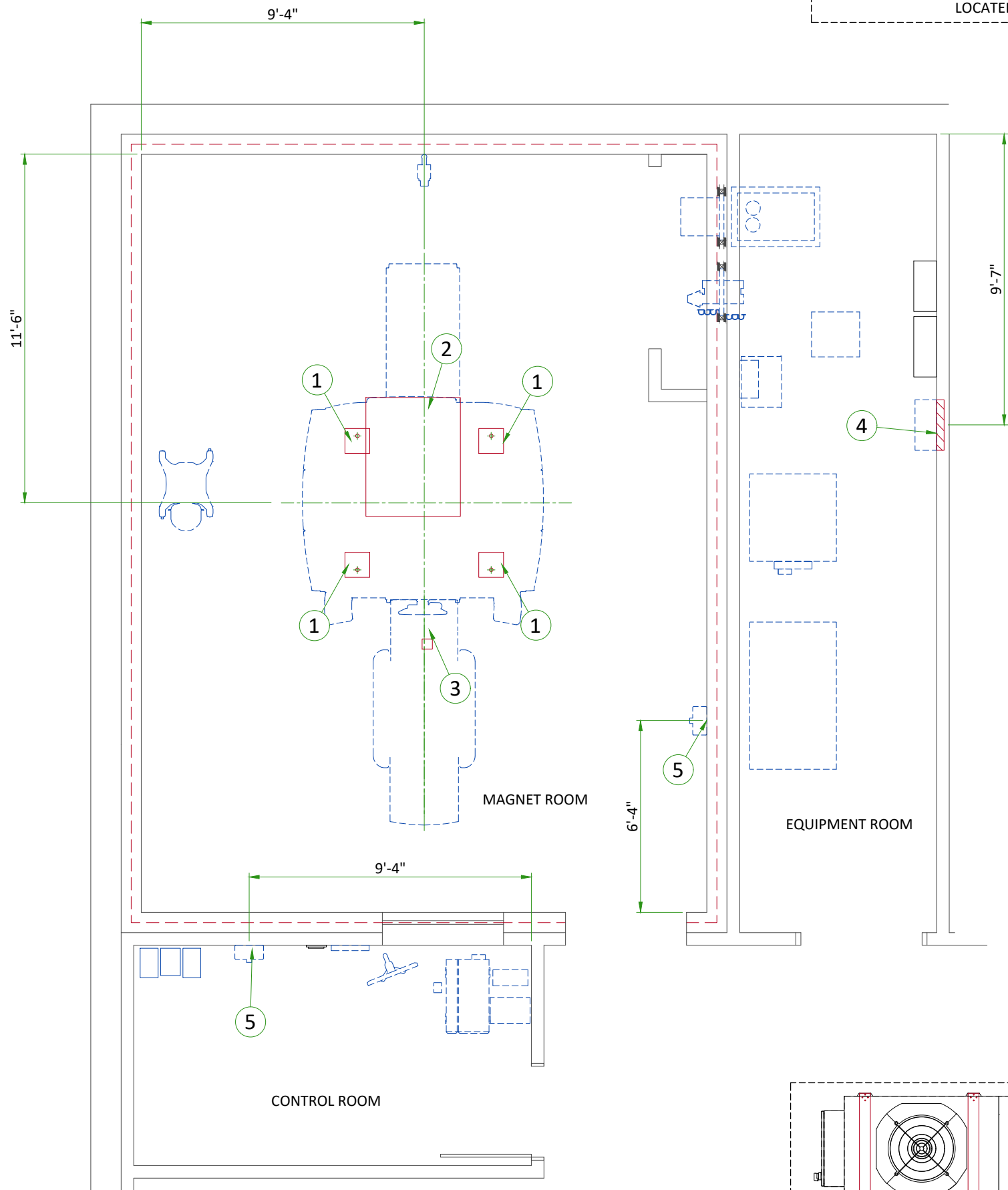
Excessive vibration can affect MR image quality. Vibration testing must be performed early in the site planning process to ensure vibration is minimized. Both steady state vibration (exhaust fans, air conditioners, pumps, etc.) and transient vibrations (traffic, pedestrians, door slamming, etc.) must be assessed. The Magnet cannot be directly isolated from vibration. Any vibration issue must be resolved at the source.

Transient vibration levels above the specified limits in the MR Site Vibration Test Guidelines must be analyzed. Any transient vibration that causes vibration to exceed the steady-state level must be mitigated.



VIBRATION TRANSMITTED THROUGH VIBROACOUSTIC MAT

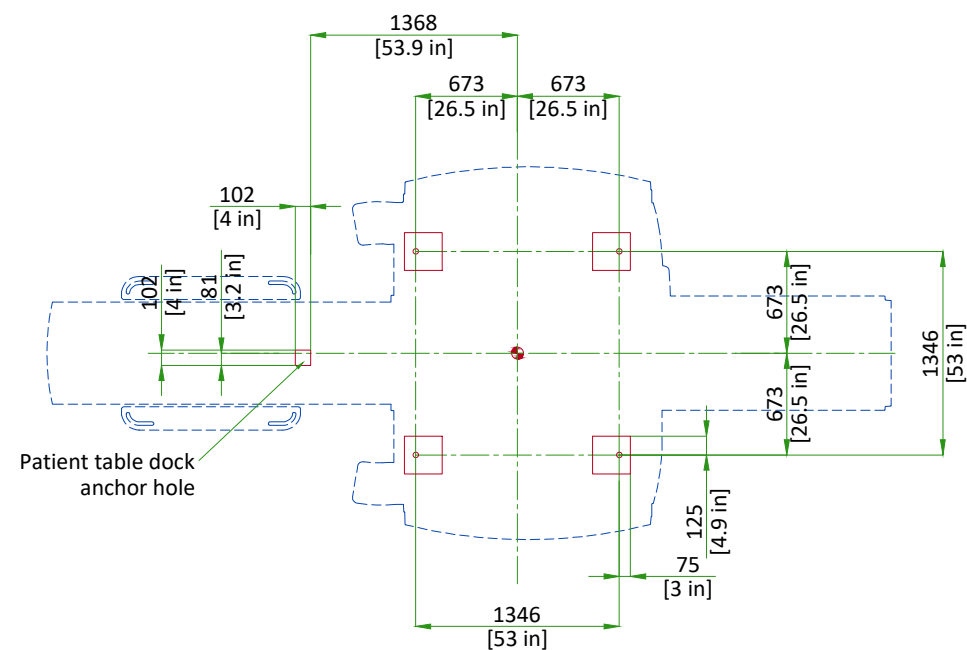




ITEM	DESCRIPTION
(GE SUPPLIED / CONTRACTOR INSTALLED)	
1	Vibroacoustic dampening kit (see floor structural detail)
2	Magnet curtain kit
(CONTRACTOR SUPPLIED & INSTALLED)	
3	Patient table dock anchoring
4	Structural wall backing for Main Disconnect Panel
5	Structural wall backing for Magnet Rundown Unit
6	Structural wall backing for Main Bypass Panel



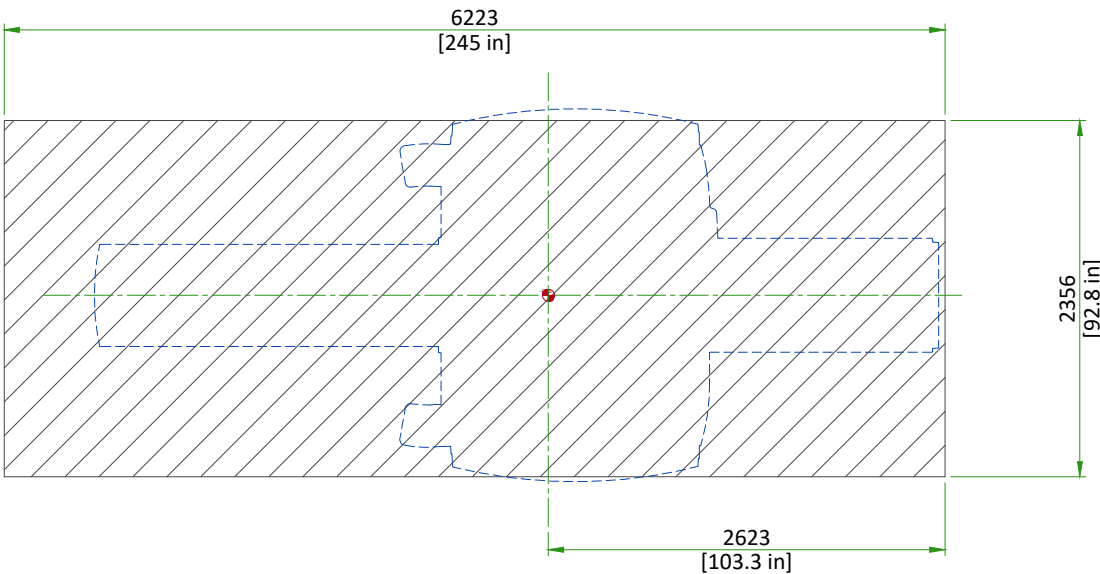
MAGNET ON VIBROACOUSTIC DAMPENING KIT "VIBROMAT"



NOT TO SCALE

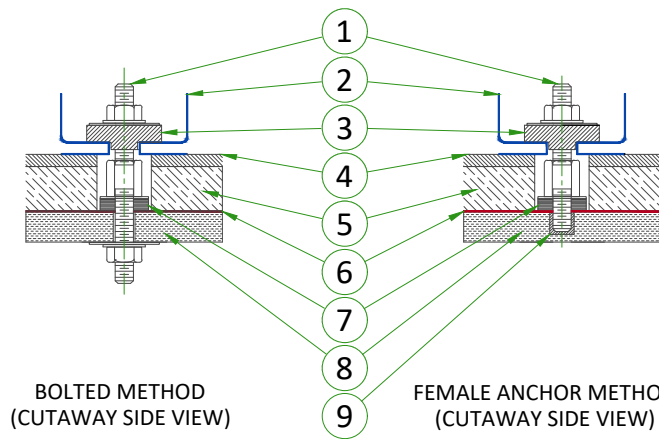
MAGNET ROOM FLOOR SPECIFICATIONS

Floor levelness must be 3 mm between high and low spots in the rectangular area shown.



The finished floor must support the weight of all components (e.g., patient table, gradient coil replacement cart) throughout operation and service life.

PATIENT TABLE DOCK ANCHOR MOUNTING REQUIREMENTS



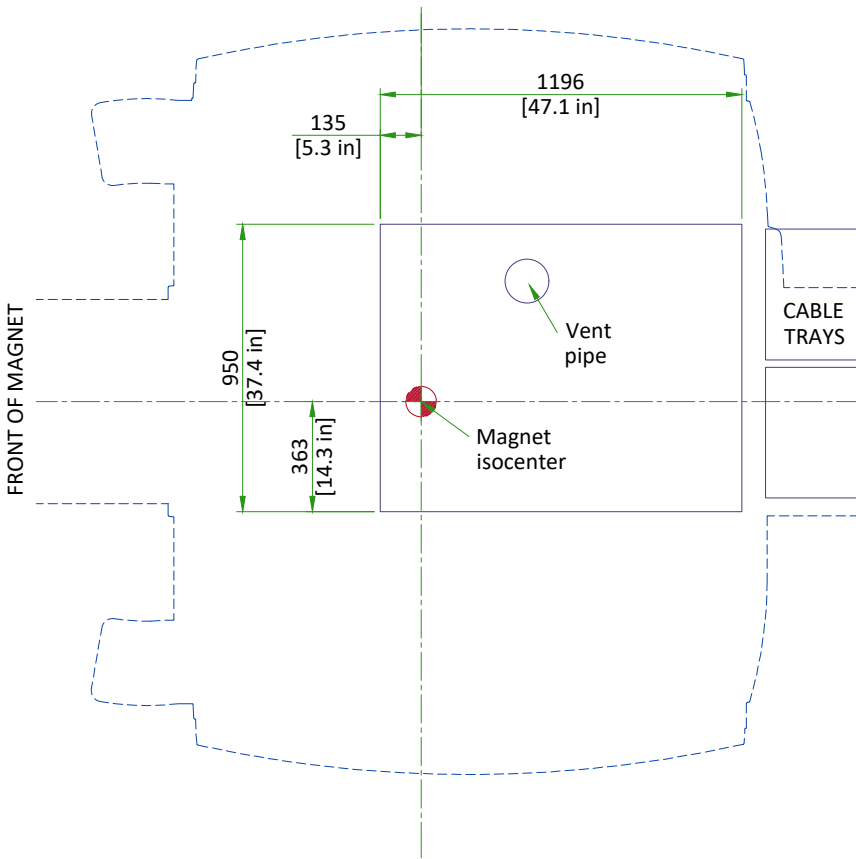
- 1 Removable Anchor Rod (Male insert)
- 2 Dock
- 3 Clamp bracket
- 4 Finished floor
- 5 Filler Board or Grout
- 6 RF Shield
- 7 Conductive Fibrous Washer (RF seal)
- 8 Concrete
- 9 Female Anchor Insert

- The RF Shield vendor must design and install the dock anchor bolt
- The dock anchor hole must be drilled **after** the Magnet is installed
- The dock anchor must not contact floor rebar or other structural steel
- The dock anchor must electrically contact the RF shield at point of entry
- The RF shield vendor must perform a pull test on the anchor (equal to the clamping force).

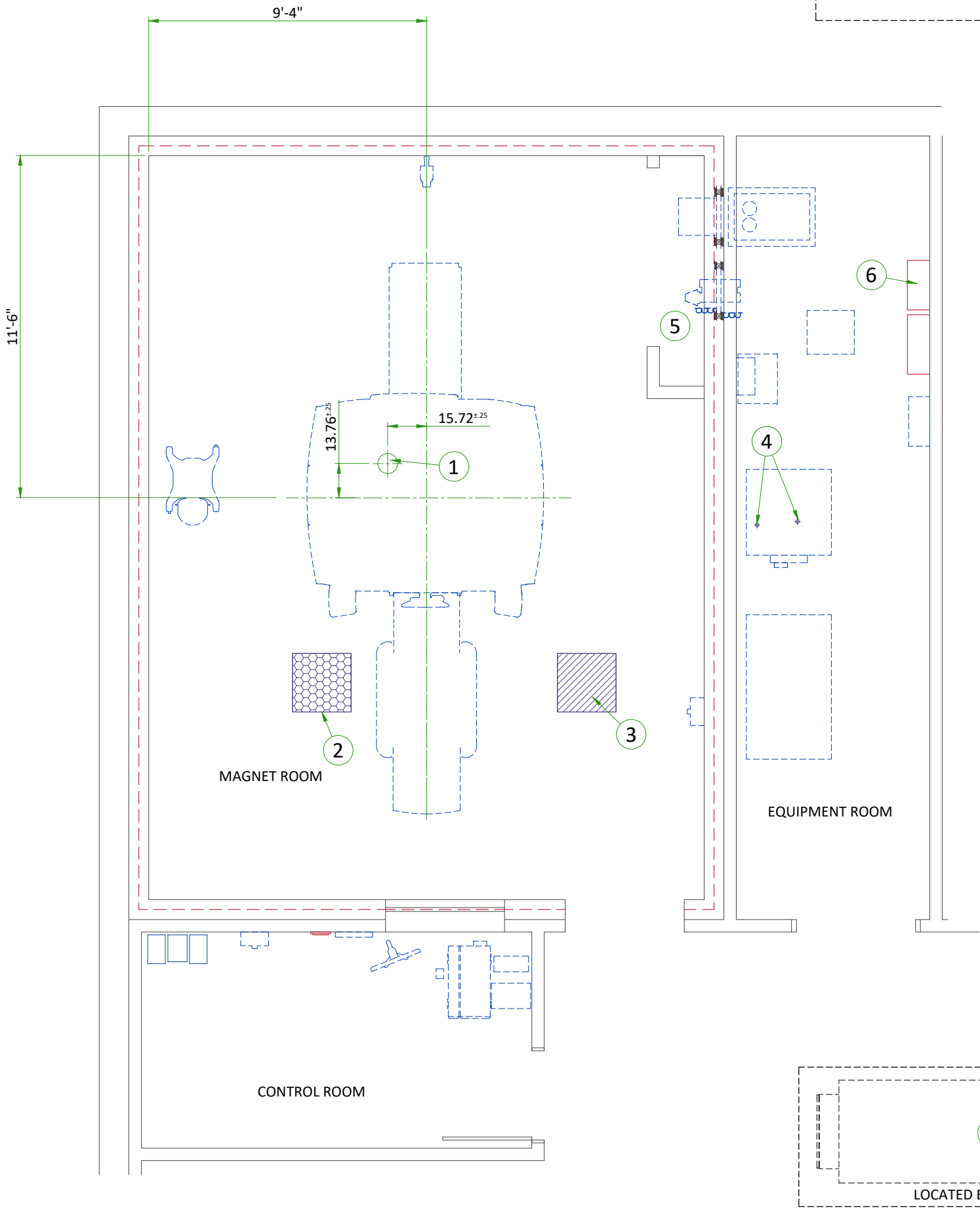
- The dock anchor properties must comply with the following requirements:
- a. Anchors must be two-part assembly (male/female)
  - b. Female side must be expansion- or epoxy-type
  - c. Male side must be a bolt or threaded rod with appropriate-sized nut (bolt or rod must be removable - not epoxied or cemented in place)
  - d. Anchors must be electrically conductive
  - e. Anchors must be non-magnetic
  - f. Anchors must not induce galvanic corrosion with the RF shield
  - g. Anchors must be commercially procured
  - h. The anchor rod hole clearance in the table frame anchor base is 11mm [0.43 in]. The anchor rod diameter must be sized appropriately.
  - i. Anchors must meet the following clamping force: 2,669 N [600 lb]
  - j. The anchor rod must extend 60 mm ± 13 mm [2.25 in ± 0.5 in] above the finished floor
  - k. The anchor rod must be less tha 152 mm [6 in] in total length (length above the floor plus embedded length)
  - l. If underside of deck is metallic, then insulating bushing must be added to through bolt hardware to prevent grounding of shield at this point.

NOT TO SCALE

CABLE CONCEALMENT



SCALE 1:25



ITEM	DESCRIPTION
1	Cryogen vent (200mm [8"] O.D.)
2	Emergency exhaust vent - refer to magnet room vent requirements (position to be defined)
3	Pressure equalization vent - refer to magnet room vent requirements (position in ceiling to be defined)
4	38mm [1.5"] NPT Male connectors, at 2.1m [82.67"] above floor, (2) 38mm [1.5"] copper lines (insulated) and (2) shut off valves. refer to chilled water block diagram
5	Closet must allow free air exchange of 400 CFM between magnet room and closet
6	Provide as needed - low pressure rubber multipurpose hose, inside dia. 1/2" working pressure range: 250 to 499 PSI - refer to the manual city water back-up system detail
7	(2) 50mm [2"] I.D. High pressure hoses and (2) 50mm [2"] to 38mm [1.5"] Reducers

MECHANICAL/PLUMBING NOTES

- All piping, fittings, supports, hoses, clamps, ventilation systems, etc. are to be supplied and installed by the customer or his contractors.
- For complete design and requirements, specifications and guidelines refer to the pre-installation manual: system cooling, cryogen venting, waveguides and exhaust venting.
- An emergency water cooling back-up supply is recommended for continuous cryogen compressor operation. if using an open loop back-up design, ensure a drain is provided. please refer to the pre-install manual for optional back-up coolant supply requirements

TEMPERATURE AND HUMIDITY SPECIFICATIONS

IN-USE CONDITIONS

	MAGNET ROOM			CONTROL ROOM			EQUIPMENT ROOM		
Temperature	Range			Range			Range		
	15 to 21°C			15 to 32°C			15 to 32°C		
	59 to 69.8°F			59 to 89.6°F			59 to 89.6°F		
Temperature gradient	± 3°C/h			± 3°C/h			± 3°C/h		
	± 5°F/h			± 5°F/h			± 5°F/h		
Relative humidity (1)	30% to 60%			30% to 70%			30% to 70%		
Humidity gradient	≤ 5%/h			≤ 5%/h			≤ 5%/h		
System heat dissipation	Stand by	Average	Max	Stand by	Average	Max	Stand by	Average	Max
	1.01kW	1.8kW	3.15kW	1.46kW			5.79kW	6.87kW	13.05kW
	3450 btu	6142 btu	10748 btu	4947 btu			19769 btu	23225 btu	44523 btu

NOTE  
Maximum ambient temperature for the Equipment room at inlet is derated by 1°C per 300 m (984 ft) above 2000 m (6562 ft) (not to exceed 2600 m [8530 ft]).

AIR EXCHANGE

According to local standards.

NOTE  
In case of using air conditioning systems or chilled water piping that have a risk of water leakage it is recommended not to install it above electric equipment or to take measures to protect the equipment from dropping water.

HEAT DISSIPATION DETAILS

DESCRIPTION	ROOM	IDLE		AVERAGE		MAX	
		W	btu	W	btu	W	btu
Magnet (MAG) and Patient Table (PT)	Magnet	561	1915	1200	4095	2400	8189
Blower Box (MG6)	Magnet	450	1535	450	1535	450	1535
Penetration Panel Cabinet (PEN)	Magnet	0	0	150	512	300	1024
Penetration Panel Cabinet (PEN)	Equipment	1568	5349	1568	5349	3135	10697
Secondary Penetration Wall (SPW)	Magnet/Equipment	0					
Main Disconnect Panel (MDP)	Equipment	132	450	132	450	264	901
Power, Gradient, RF Cabinet (PGR)	Equipment	2500	8530	3068	10470	6137	20940
Cryocooler Compressor (CRY)	Equipment	500	1706	500	1706	500	1706
Heat Exchanger Cabinet (HEC)	Equipment	500	1706	500	1706	1000	3412
Magnet Monitor (MON)	Equipment	240	819	240	819	240	819
Operator Workspace equipment (OW)	Control	1450	4947	1450	4947	1450	4947

MAGNET ROOM VENTING REQUIREMENTS

HVAC VENT REQUIREMENTS

- HVAC vendor must comply with Magnet room temperature and humidity specifications and RF shielding specifications.
- RF Shield vendor must install open pipe or honeycomb HVAC waveguides.
- All serviceable parts in the Magnet room (e.g.: diffusers) must be non-magnetic.
- Waveguides must be nonmagnetic and electrically isolated.
- Incoming air must contain at least **5% air** from outside the Magnet room (inside or outside the facility) to displace residual helium.

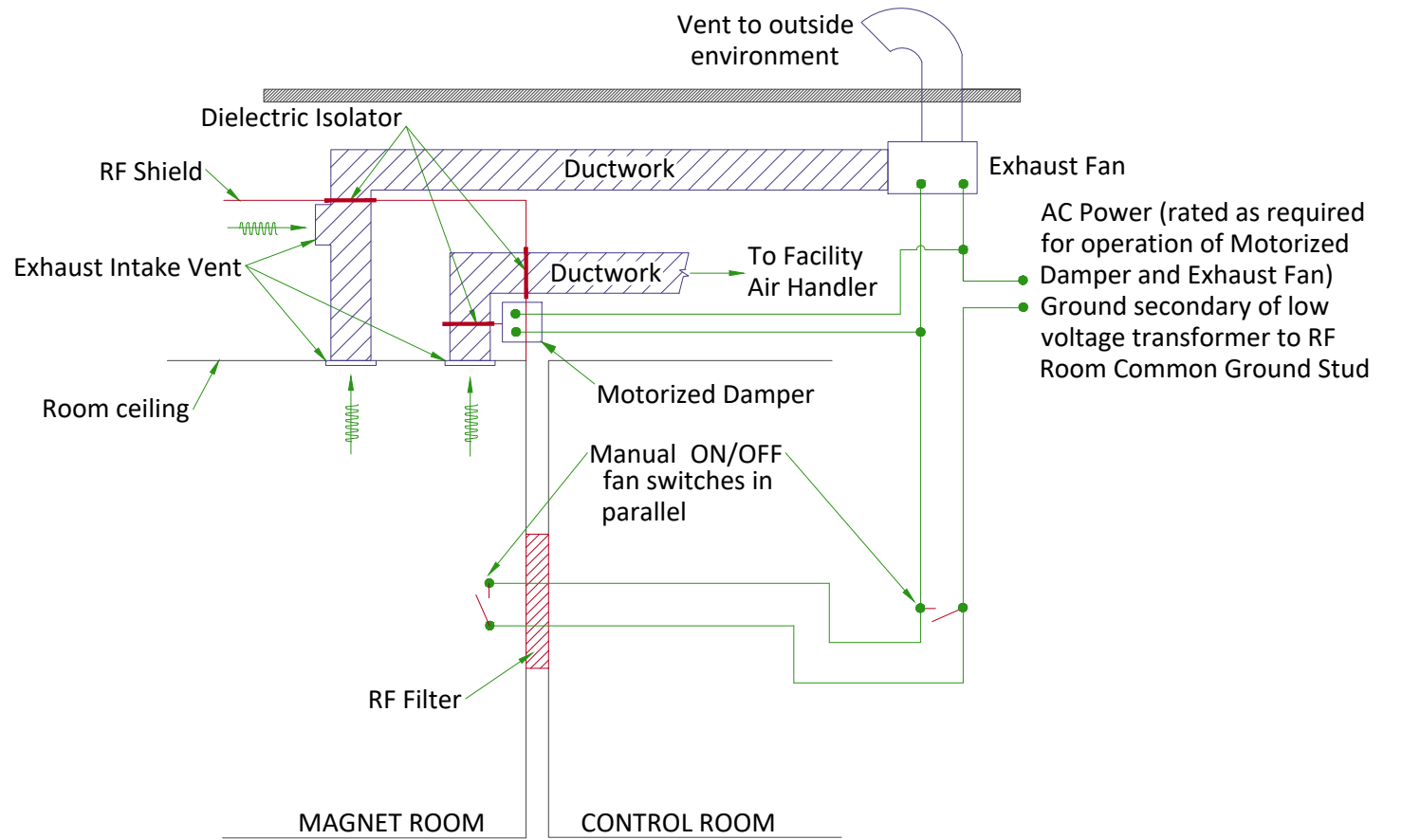
EMERGENCY VENT REQUIREMENT

- Exhaust vent system is supplied by the customer.
- All items within the RF enclosure must be non-magnetic.
- The exhaust vent system must be tested and operational before the magnet is installed.
- The exhaust intake vent must be located near the magnet cryogenic vent at the highest point on the finished or drop ceiling.
- The Magnet room exhaust fan and exhaust intake vent must have a capacity of at least **1200 CFM (34 m³/min)** with a minimum of **12 room air exchanges per hour**.
- The exhaust fan must be placed above RF shielding located outside 10 gauss (1mT) and with appropriate waveguide.
- The system must have a manual exhaust fan switch near the Operator Workspace and in the Magnet room near the door (the switches must be connected in parallel).
- All system components must be accessible for customer inspection, cleaning and maintenance

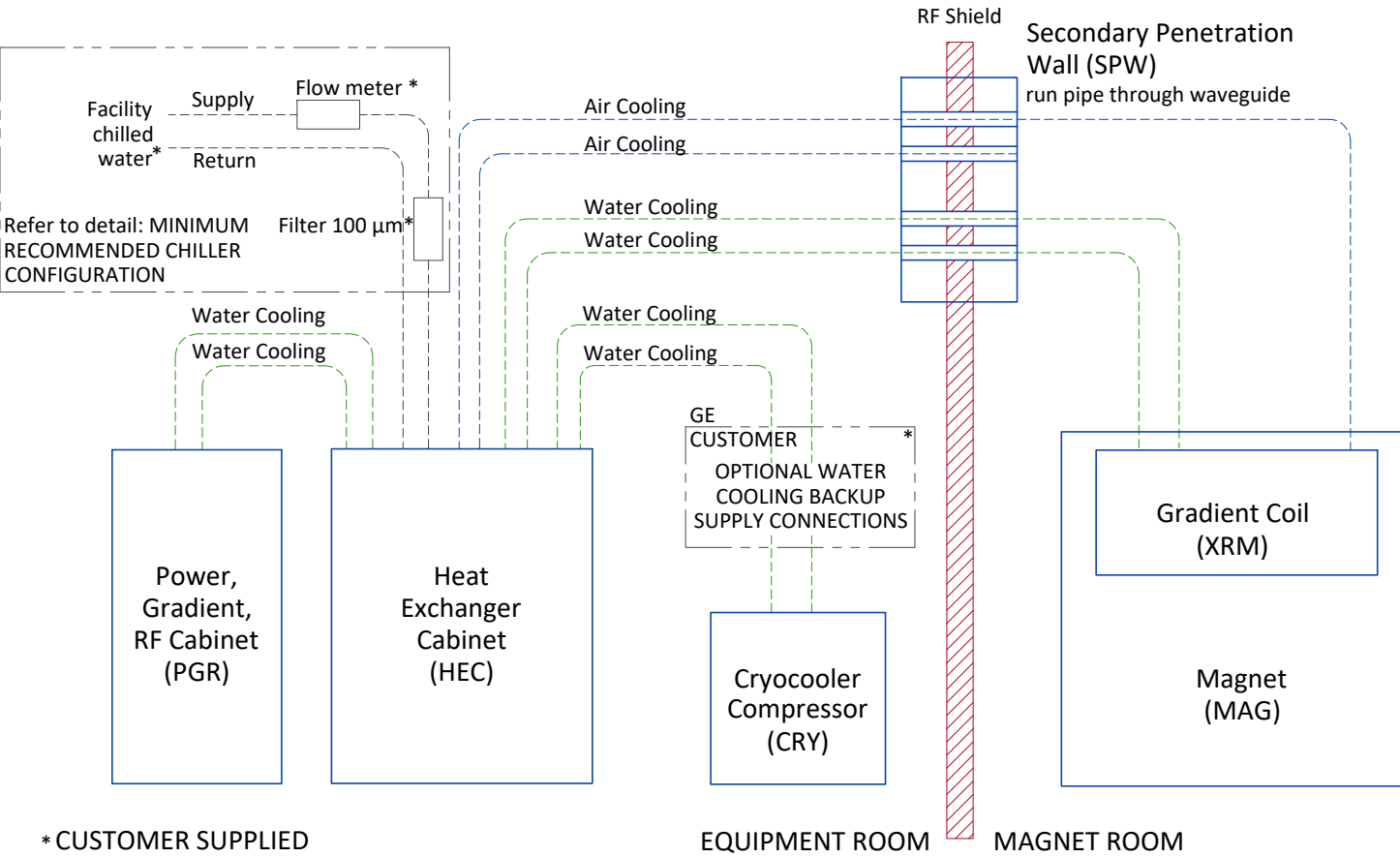
PRESSURE VENT REQUIREMENT

- A **pressure equalizing vent is required** in the magnet room ceiling or in the wall, at the highest point possible.
  - The **vent minimum size** must be **(610 mm x 610 mm [24 in x 24 in])** or equivalent.
  - The pressure equalization vent must be located so any Helium gas is not vented into occupied areas.
- Note: Location may affect acoustic noise transmission into occupied spaces.

MAGNET ROOM EXHAUST FAN SCHEMATIC



CHILLED WATER BLOCK DIAGRAM

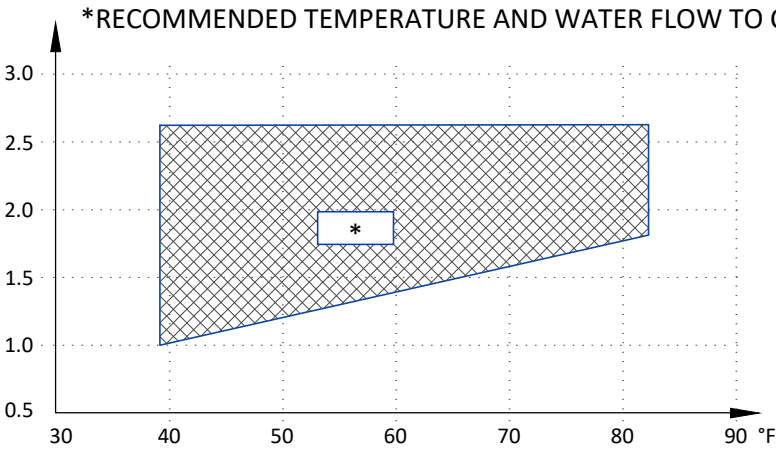


CHILLED WATER SPECIFICATIONS

PARAMETER		REQUIREMENTS	
Chiller size		Minimum 49 kW	
Inlet temperature		6 to 12°C [42.8 to 53.6°F] measured at the inlet to the HEC	
Hose connections to the HEC (supplied by customer)		1.5 inch (38.1 mm) male NPT	
		MINIMUM FLOW 114 l/min [30 gpm]	MAXIMUM FLOW 132 l/min [35 gpm]
PRESSURE DROP IN HEC CABINET	40% propylene glycol	2.4 bars [34.8 psi]	3.3 bars [47.8 psi]
Availability		Continuous	
Antifreeze		no more than 40% propylene glycol	
Temperature rise at minimum flow		6.8°C [12.2°F] with 40% propylene glycol-water 3730J/(kgK) specific heat, 1021kg/m³ density, 49kW heat	
Temperature rise at maximum flow		5.8°C [10.4°F] with 40% propylene glycol-water 3730J/(kgK) specific heat, 1021kg/m³ density, 49kW heat	
Maximum inlet pressure to HEC		6 bar [87 psi]	
Minimum continuous heat load		7.5 kW	
Hoses to be provided by customer		38.1 mm [1.5 in] minimum hose inside diameter	
Condensation protection		Facility plumbing to the HEC must be properly routed and insulated to prevent equipment damage or safety hazards	
Water quality		Refer to pre-installation manual for detailed specifications	

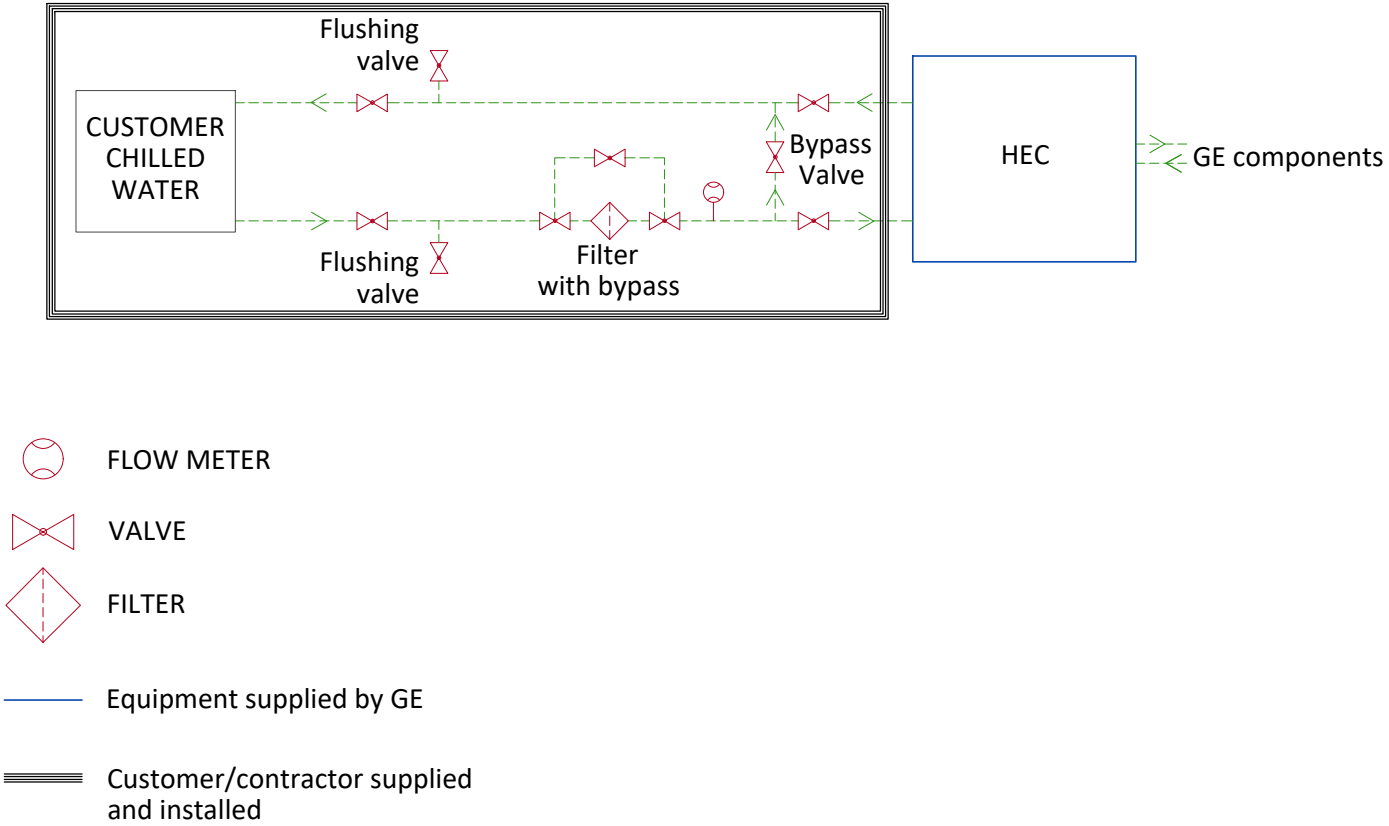
CITY WATER BACKUP SPECIFICATIONS FOR COMPRESSOR

INLET WATER FLOW/TEMPERATURE FOR CRYOCOOLER COMPRESSOR



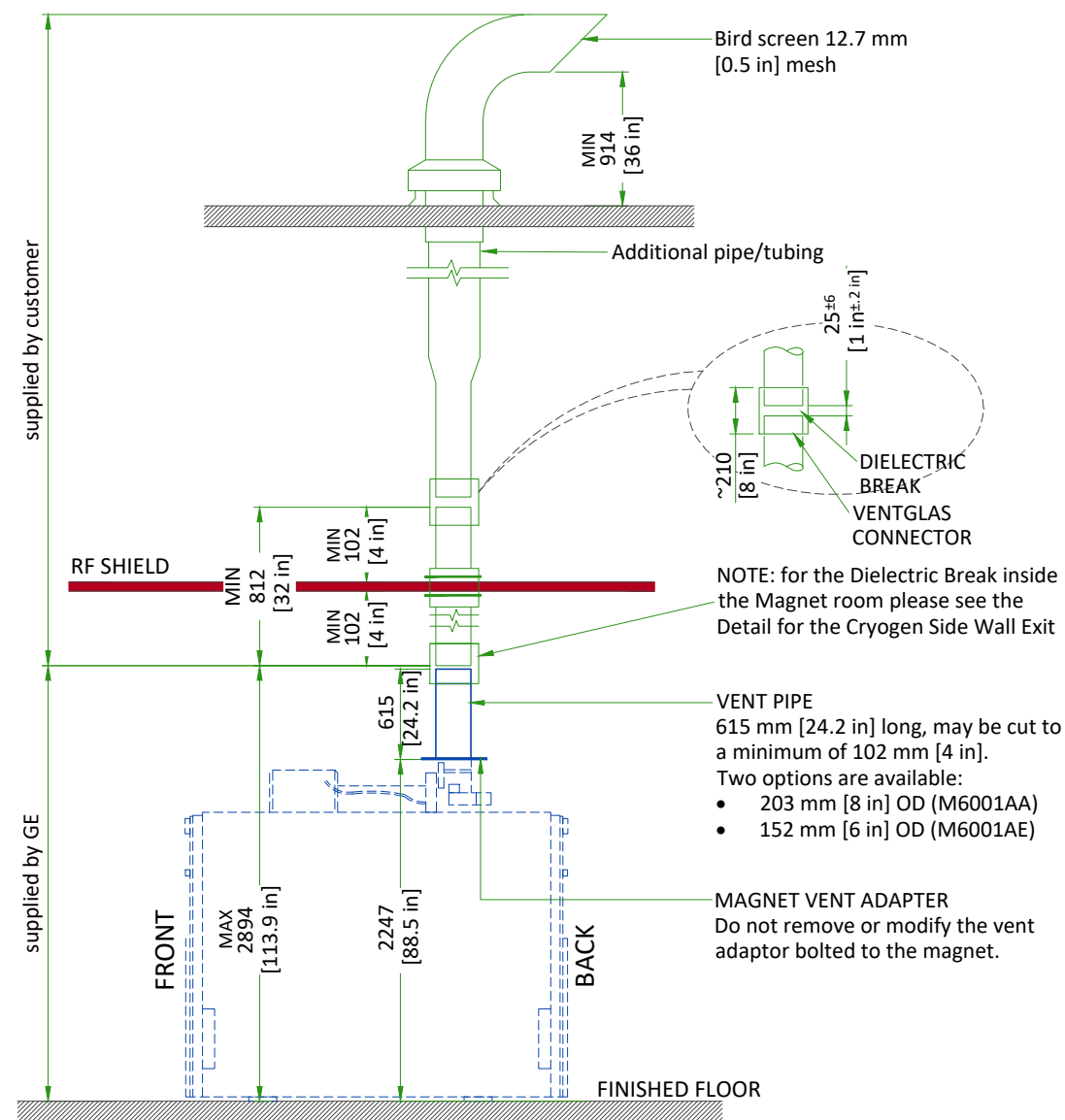
	MIN	MAX
INLET TEMP	39.2°F (4°C)	82.4°F (28°C)
INLET FLOW	1.0 gpm (4 l/min)	2.6 gpm (10 l/min)
TEMP RISE	89.6°F at 1.0 gpm (32°C at 4 l/min flow)	53.6°F at 2.6 gpm (12°C at 10 l/min flow)
HEAT DISSIPATION (kW)	7.2 kW	
PRESSURE DROP	8.7 psi at 2.1 gpm flow (60 kPa at 8 l/min flow)	

MINIMUM RECOMMENDED CHILLER CONFIGURATION





## TYPICAL CRYOGENIC VENT PIPE DETAIL



Waveguide is contractor supplied. Minimum 812 mm [32 in.]. Must extend at least 100 mm [4 in.] on magnet room side of the wall/ceiling and 25±6 mm [1±0.25 in.] from the GE supplied pipe below isolation joint.

1. The 203 mm [8 in] OD vent material must be one of the following materials with the wall thickness indicated:
  - a. SS 304: Minimum 0.89 mm [0.035 in]; Maximum 3.18 mm [0.125 in]
  - b. AL 6061-T6: Minimum 2.11 mm [0.083 in]; Maximum 3.18 mm [0.125 in]
  - c. CU DWV, M or L: Minimum 2.11 mm [0.083 in]; Maximum 3.56 mm [0.140 in]
2. Either tubes or pipes may be used and must be seamless or have welded seams

NOTE

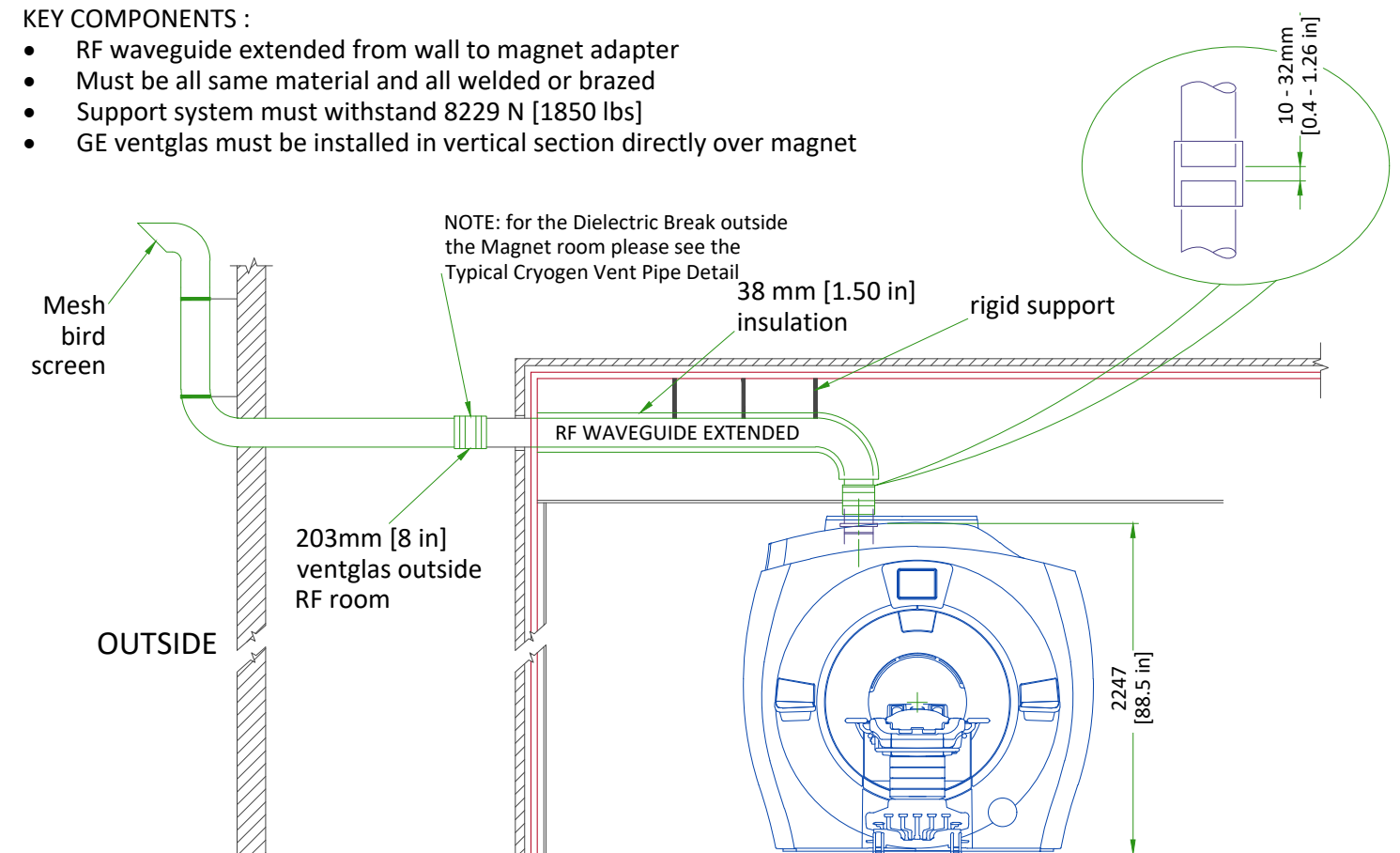
All welds on the pipe must be ground down to a smooth 203 mm [ 8 in] diameter so that it can be clamped to the Ventglas with enough force.

3. Corrugated pipe or spiral duct must not be used
4. If required, bellows pipe less than 300 mm [12 in] in length may be used as a thermal expansion joint
5. The vent pipe must withstand the maximum pressure listed in the Pre-Installation Manual
6. Waveguide vent material must match the outside diameter of the magnet flanged vent adapter

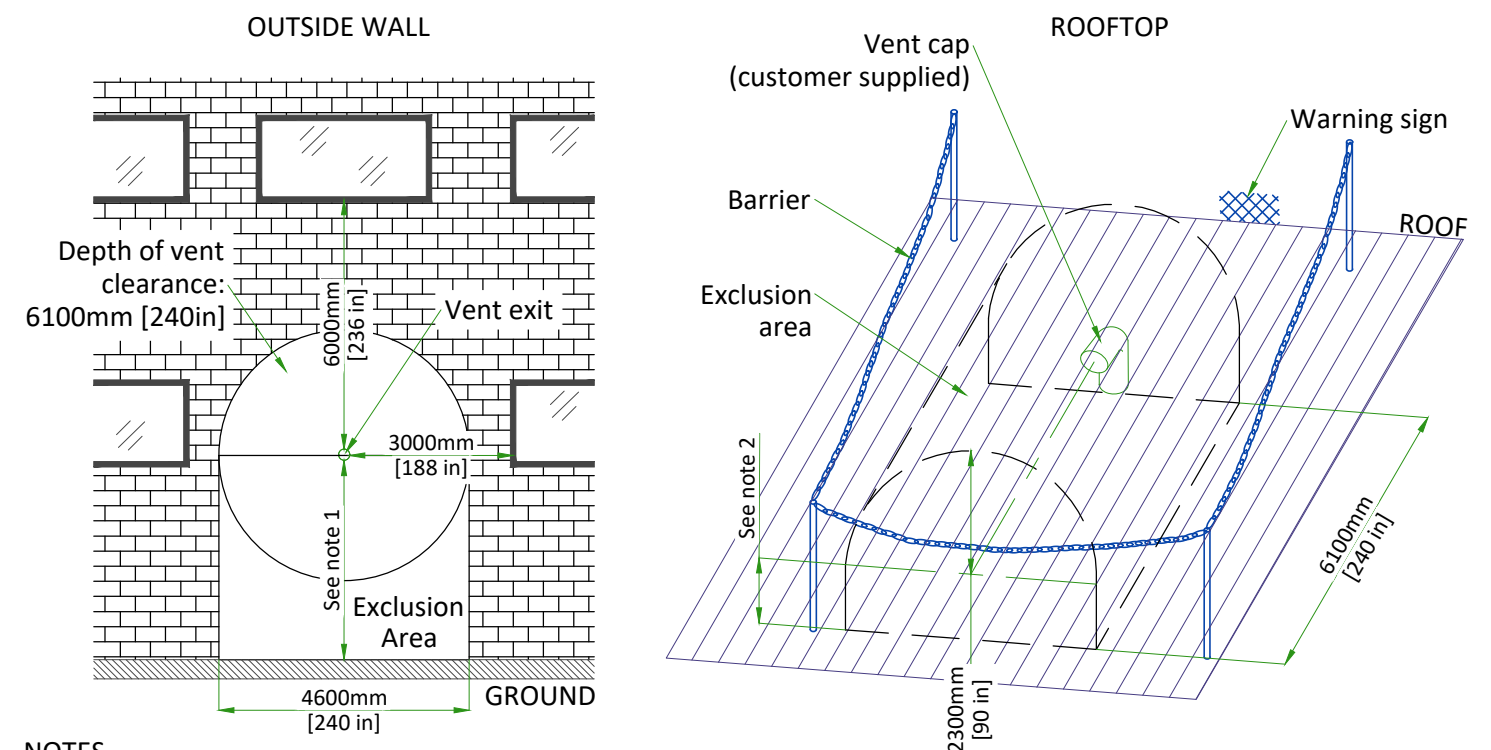
## TYPICAL CRYOGEN SIDE WALL EXIT WITH LONG SWEEP ELBOW

### KEY COMPONENTS :

- RF waveguide extended from wall to magnet adapter
- Must be all same material and all welded or brazed
- Support system must withstand 8229 N [1850 lbs]
- GE ventglas must be installed in vertical section directly over magnet



## CRYOGENIC VENTING ( EXTERIOR )



## NOTES

- (1) Restricted area: minimum distance between vent pipe and ground is 3660mm [144 in]. Barriers are required. Public area: barriers are not required if height is > 5000mm [197 in].
- (2) The bottom of the 90° elbow must be at least 914mm [36 in] above the roof deck (or higher if at risk of being blocked by drifting snow, sand, or other potential obstructions.)

NOT TO SCALE

MAGNET CRYOGENIC VENT SYSTEM PRESSURE DROP MATRIX

Outer dia. of pipe (D)	Distance of vent system component t from magnet		Pressure drop for straight pipe		Std sweep 45° elbow		Long sweep 45° elbow		Std sweep 90° elbow		Long sweep 90° elbow		90° miter	
	ft	m	psi/ft	kPa/m	psi	kPa	psi	kPa	psi	kPa	psi	kPa	psi	kPa
6 in. (Inside dia. ≥144mm)	10	3.048	0.146	3.311	0.804	5.544	0.536	3.696	1.507	10.394	1.005	6.93	3.014	20.789
	20	6.096	0.253	5.715	1.356	9.355	0.904	6.237	2.543	17.54	1.696	11.694	5.087	35.081
	30	9.144	0.374	8.451	1.845	12.727	1.23	8.485	3.46	23.864	2.307	15.909	6.92	47.727
	40	12.192	0.473	10.699	2.278	15.708	1.518	10.472	4.271	29.453	2.847	19.635	8.541	58.906
	50	15.24	0.554	12.534	2.66	18.342	1.773	12.228	4.987	34.392	3.325	22.928	9.974	68.783
	60	18.288	0.62	14.019	2.997	20.668	1.998	13.779	5.619	38.753	3.746	25.835	11.238	77.506
8 in. (Inside dia. ≥195mm)	10	3.048	0.025	0.564	0.188	1.294	0.125	0.862	0.352	2.426	0.234	1.617	0.703	4.851
	20	6.096	0.043	0.97	0.313	2.158	0.209	1.439	0.587	4.046	0.391	2.697	1.173	8.092
	30	9.144	0.064	1.45	0.427	2.944	0.285	1.963	0.8	5.52	0.534	3.68	1.601	11.04
	40	12.192	0.082	1.862	0.53	3.658	0.354	2.439	0.995	6.859	0.663	4.573	1.989	13.718
	50	15.24	0.098	2.215	0.624	4.307	0.416	2.871	1.171	8.075	0.781	5.383	2.342	16.15
	60	18.288	0.111	2.516	0.71	4.895	0.473	3.263	1.331	9.179	0.887	6.119	2.662	18.357
	80	24.384	0.132	2.987	0.857	5.914	0.572	3.942	1.608	11.088	1.072	7.392	3.216	22.176
	100	30.48	0.147	3.318	0.979	6.752	0.653	4.501	1.836	12.659	1.224	8.439	3.671	25.318
	120	36.576	0.157	3.545	1.079	7.44	0.719	4.96	2.023	13.95	1.3490	9.3	4.046	27.901
	140	42.672	0.163	3.693	1.161	8.006	0.774	5.338	2.177	15.012	1.451	10.008	4.353	30.024
10 in. (Inside dia. ≥247mm)	160	48.768	0.167	3.784	1.228	8.471	0.819	5.648	2.303	15.884	1.535	10.589	4.606	31.768
	180	54.864	0.169	3.833	1.2840	8.853	0.856	5.902	2.407	16.6	1.605	11.067	4.814	33.2
	20	6.096	0.011	0.241	0.099	0.683	0.066	0.455	0.186	1.28	0.124	0.854	0.371	2.561
	40	12.192	0.021	0.468	0.168	1.16	0.112	0.773	0.315	2.175	0.21	1.45	0.631	4.351
	60	18.288	0.029	0.645	0.227	1.568	0.152	1.045	0.426	2.94	0.284	1.96	0.853	5.88
	80	24.384	0.035	0.781	0.278	1.916	0.185	1.277	0.521	3.592	0.347	2.395	1.042	7.184
	100	30.48	0.039	0.884	0.321	2.212	0.214	1.474	0.601	4.147	0.401	2.765	1.203	8.294
	120	36.576	0.042	0.96	0.357	2.464	0.238	1.642	0.67	4.619	0.447	3.08	1.34	9.239
	140	42.672	0.045	1.016	0.388	2.678	0.259	1.785	0.728	5.021	0.485	3.348	1.456	10.043
	160	48.768	0.047	1.056	0.415	2.86	0.276	1.907	0.778	5.363	0.518	3.575	1.555	10.726
12 in. (Inside dia. ≥298mm)	180	54.864	0.048	1.083	0.437	3.015	0.291	2.01	0.82	5.653	0.547	3.769	1.64	11.307
	200	60.99	0.049	1.101	0.456	3.147	0.304	2.098	0.856	5.9	0.57	3.934	1.711	11.801
	20	6.096	0.004	0.08	0.04	0.277	0.027	0.184	0.075	0.519	0.05	0.346	0.15	1.037
	40	12.192	0.007	0.157	0.068	0.47	0.045	0.313	0.128	0.88	0.085	0.587	0.255	1.761
	60	18.288	0.01	0.22	0.093	0.638	0.062	0.425	0.174	1.197	0.116	0.798	0.347	2.393
	80	24.384	0.012	0.269	0.114	0.786	0.076	0.524	0.214	1.473	0.142	0.982	0.427	2.946
	100	30.48	0.014	0.309	0.133	0.914	0.088	0.609	0.248	1.714	0.166	1.142	0.497	3.427
	120	36.576	0.015	0.34	0.149	1.026	0.099	0.684	0.279	1.923	0.186	1.282	0.558	3.847
	140	42.672	0.016	0.364	0.163	1.123	0.109	0.749	0.305	2.106	0.204	1.404	0.611	4.212
	160	48.768	0.017	0.382	0.175	1.208	0.117	0.805	0.328	2.265	0.219	1.51	0.657	4.529
	180	54.864	0.018	0.396	0.186	1.282	0.124	0.854	0.348	2.403	0.232	1.602	0.697	4.806
	200	60.96	0.018	0.406	0.195	1.346	0.13	0.897	0.366	2.523	0.244	1.682	0.732	5.046

Outer dia. of pipe (D)	Distance of vent system component t from magnet		Pressure drop for straight pipe		Std sweep 45° elbow		Long sweep 45° elbow		Std sweep 90° elbow		Long sweep 90° elbow		90° miter	
	ft	m	psi/ft	kPa/m	psi	kPa	psi	kPa	psi	kPa	psi	kPa	psi	kPa
14 in. (Inside dia. ≥348mm)	20	6.096	0.001	0.032	0.019	0.13	0.013	0.086	0.035	0.243	0.024	0.162	0.071	0.486
	40	12.192	0.003	0.063	0.032	0.219	0.021	0.146	0.06	0.411	0.04	0.274	0.119	0.823
	60	18.288	0.004	0.088	0.043	0.299	0.029	0.2	0.081	0.561	0.054	0.374	0.163	1.122
	80	24.384	0.005	0.11	0.054	0.37	0.036	0.247	0.101	0.694	0.067	0.463	0.201	1.389
	100	30.48	0.006	0.127	0.063	0.433	0.042	0.289	0.118	0.812	0.079	0.542	0.236	1.625
	120	36.576	0.006	0.141	0.071	0.489	0.047	0.326	0.133	0.917	0.089	0.611	0.266	1.834
	140	42.672	0.007	0.152	0.078	0.539	0.052	0.359	0.146	1.01	0.098	0.673	0.293	2.02
	160	48.768	0.007	0.161	0.084	0.582	0.056	0.388	0.158	1.092	0.106	0.728	0.317	2.184
	180	54.864	0.007	0.169	0.090	0.621	0.06	0.414	0.169	1.164	0.113	0.776	0.338	2.329
	200	60.96	0.008	0.174	0.095	0.655	0.063	0.437	0.178	1.229	0.119	0.819	0.356	2.457
16 in. (Inside dia. ≥399mm)	20	6.096	0.001	0.014	0.01	0.068	0.007	0.045	0.018	0.127	0.012	0.084	0.037	0.253
	40	12.192	0.001	0.028	0.017	0.114	0.011	0.076	0.0310	0.2130	0.021	0.142	0.062	0.427
	60	18.288	0.002	0.04	0.023	0.156	0.015	0.104	0.042	0.292	0.028	0.195	0.085	0.584
	80	24.384	0.002	0.05	0.028	0.193	0.019	0.129	0.053	0.362	0.035	0.242	0.105	0.725
	100	30.48	0.003	0.059	0.033	0.227	0.022	0.151	0.062	0.426	0.041	0.284	0.124	0.852
	120	36.576	0.003	0.066	0.037	0.258	0.025	0.172	0.07	0.483	0.047	0.322	0.14	0.966
	140	42.6720	0.003	0.072	0.041	0.285	0.028	0.19	0.077	0.534	0.052	0.356	0.155	1.069
	160	48.768	0.003	0.076	0.045	0.309	0.03	0.206	0.084	0.58	0.056	0.387	0.168	1.16
	180	54.864	0.004	0.08	0.048	0.331	0.032	0.221	0.09	0.621	0.06	0.414	0.18	1.243
	200	60.96	0.004	0.083	0.051	0.351	0.034	0.234	0.095	0.658	0.064	0.439	0.191	1.316

- Notes
- Elbows with angles greater than 90 deg must not be used
  - Data in Table is based on the following facts and assumptions:
    - Initial flow conditions at magnet interface
    - EM energy (13MJ) is dumped to He during quench and rises He temperature to 10 Kelvin
    - Gas temperature starting at 10 Kelvin and increase with length determined by thermal energy balance
    - 90% He is assumed to be evacuated within 30 sec. None left after quench.
    - Absolute roughness is assumed to be 0.25 mm.
    - R/D = 1.0 for standard sweep elbows, R/D = 1.5 for long sweep elbows where D = outer diameter of pipe; R = radius of bend
  - The total pressure drop of the entire cryogenic vent system must be less than 20 psi (137.9 kPa). The calculation starts at the magnet vent interface and ends at the termination point outside the building.

LIGHTING REQUIREMENTS

- All lighting fixtures and associated components must meet all RF shielded room and RF grounding requirements (e.g., track lighting is not recommended due to possible RF noise).
- All removable lighting fixtures and associated components must be non-magnetic.
- All lighting must use direct current (the DC must have less than 5% ripple).
- 300 lux must be provided at the front of the magnet for patient access and above the magnet for servicing.
- Fluorescent lighting must not be used in the magnet room.
- Lighting must be adjusted using a discrete switch or a variable DC lighting controller.
- SCR dimmers or rheostats must not be used.
- 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.

- Battery chargers (e.g., used for emergency lighting) must be located outside the magnet room.
- Short filament length bulbs are recommended.
- Linear lamps are not recommended due to the high burnout rate.

CONNECTIVITY REQUIREMENTS

Broadband Connections are necessary during the installation process and going forward to ensure full support from the Engineering Teams for the customers system. Maximum performance and availability for the customers system is maintained and closely monitored during the lifetime of the system. Proactive and reactive maintenance is available utilising the wide range of digital tools using the connectivity solutions listed below:

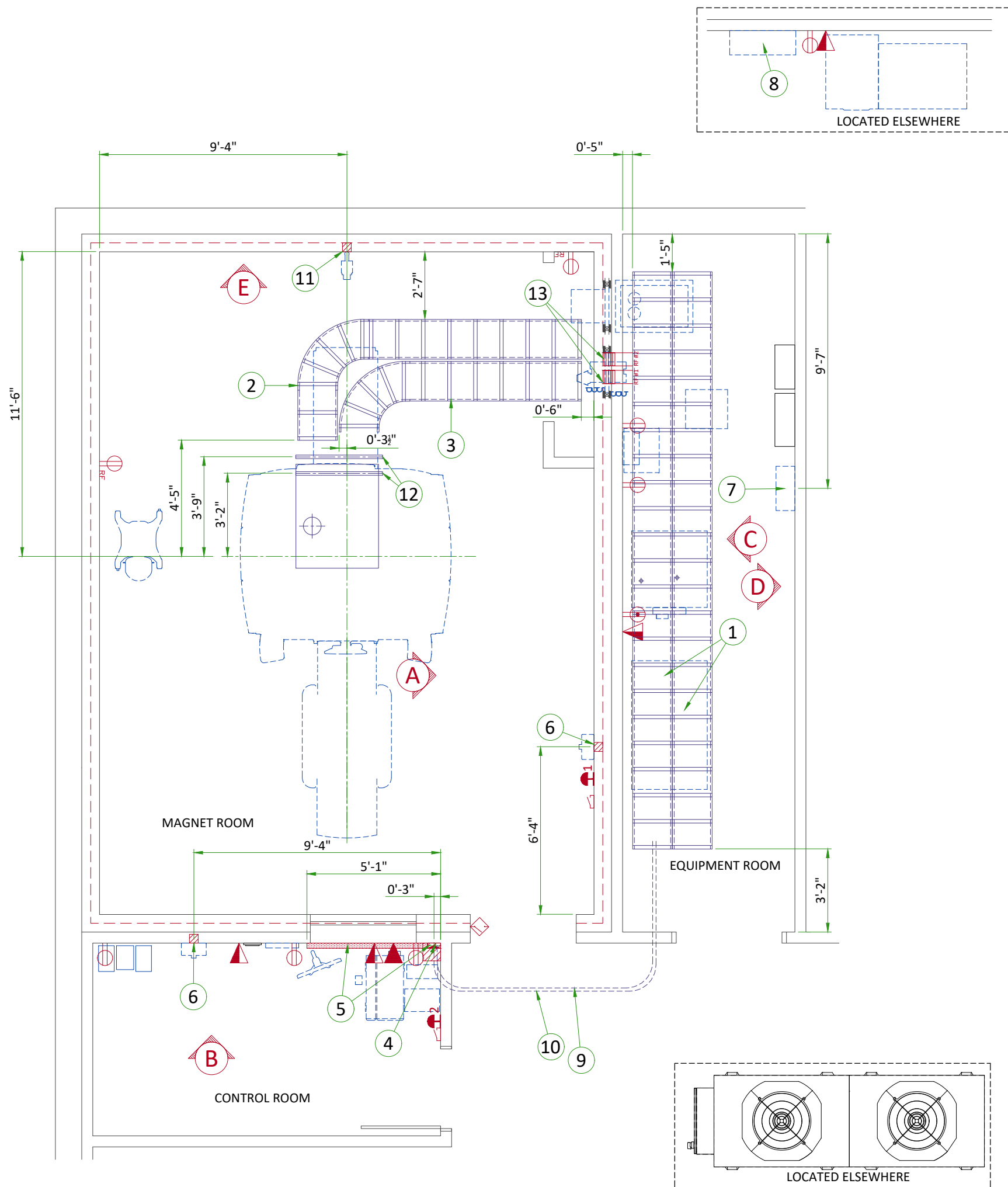
- Site-to-Site VPN/GE Solution
- Site-to-Site VPN/Customer Solution
- Connection through Dedicated Service Network
- Internet Access - connectivity for InSite 2.0

The requirements for these connectivity solutions are explained in the broadband solutions catalogue (separate document).

ELECTRICAL NOTES

1. All wires specified shall be copper stranded, flexible, thermo-plastic, color coded, cut 10 foot long at outlet boxes, duct termination points or stubbed conduit ends. All conductors, power, signal and ground, must be run in a conduit or duct system. Electrical contractor shall ring out and tag all wires at both ends. Wire runs must be continuous copper stranded and free from splices.
  - 1.1. Aluminum or solid wires are not allowed.
2. Wire sizes given are for use of equipment. Larger sizes may be required by local codes.
3. It is recommended that all wires be color coded, as required in accordance with national and local electrical codes.
4. Conduit sizes shall be verified by the architect, electrical engineer or contractor, in accordance with local or national codes.
5. Convenience outlets are not illustrated. Their number and location are to be specified by others. Locate at least one convenience outlet close to the system control, the power distribution unit and one on each wall of the procedure room. Use hospital approved outlet or equivalent.
6. General room illumination is not illustrated. Caution should be taken to avoid excessive heat from overhead spotlights. Damage can occur to ceiling mounting components and wiring if high wattage bulbs are used. Recommend low wattage bulbs no higher than 75 watts and use dimmer controls (except MR). Do not mount lights directly above areas where ceiling mounted accessories will be parked.
7. Routing of cable ductwork, conduits, etc., must run direct as possible otherwise may result in the need for greater than standard cable lengths (refer to the interconnection diagram for maximum usable lengths point to point).
8. Conduit turns to have large, sweeping bends with minimum radius in accordance with national and local electrical codes.
9. A special grounding system is required in all procedure rooms by some national and local codes. It is recommended in areas where patients might be examined or treated under present, future, or emergency conditions. Consult the governing electrical code and confer with appropriate customer administrative personnel to determine the areas requiring this type of grounding system.
10. The maximum point to point distances illustrated on this drawing must not be exceeded.
11. Physical connection of primary power to GE equipment is to be made by customers electrical contractor with the supervision of a GE representative. The GE representative would be required to identify the physical connection location, and insure proper handling of GE equipment.
12. GEHC conducts power audits to verify quality of power being delivered to the system. The customer's electrical contractor is required to be available to support this activity.

- All junction boxes, conduit, duct, duct dividers, switches, circuit breakers, cable tray, etc., are to be supplied and installed by customers electrical contractor.
- Conduit and duct runs shall have sweep radius bends
- Conduits and duct above ceiling or below finished floor must be installed as near to ceiling or floor as possible to reduce run length.
- Ceiling mounted junction boxes illustrated on this plan must be installed flush with finished ceiling.
- All ductwork must meet the following requirements:
  - 1.Ductwork shall be metal with dividers and have removable, accessible covers.
  - 2.Ductwork shall be certified/rated for electrical power purposes.
  - 3.Ductwork shall be electrically and mechanically bonded together in an approved manner.
  - 4.PVC as a substitute must be used in accordance with all local and national codes.
- All openings in raceway and access flooring are to be cut out and finished off with grommet material by the customers contractor.
- General contractor to insert pull cords for all cable run conduits between the equipment room and the operators control room.
- 10 foot pigtails at all junction points.
- Grounding is critical to equipment function and patient safety. Site must conform to wiring specifications shown on this plan.

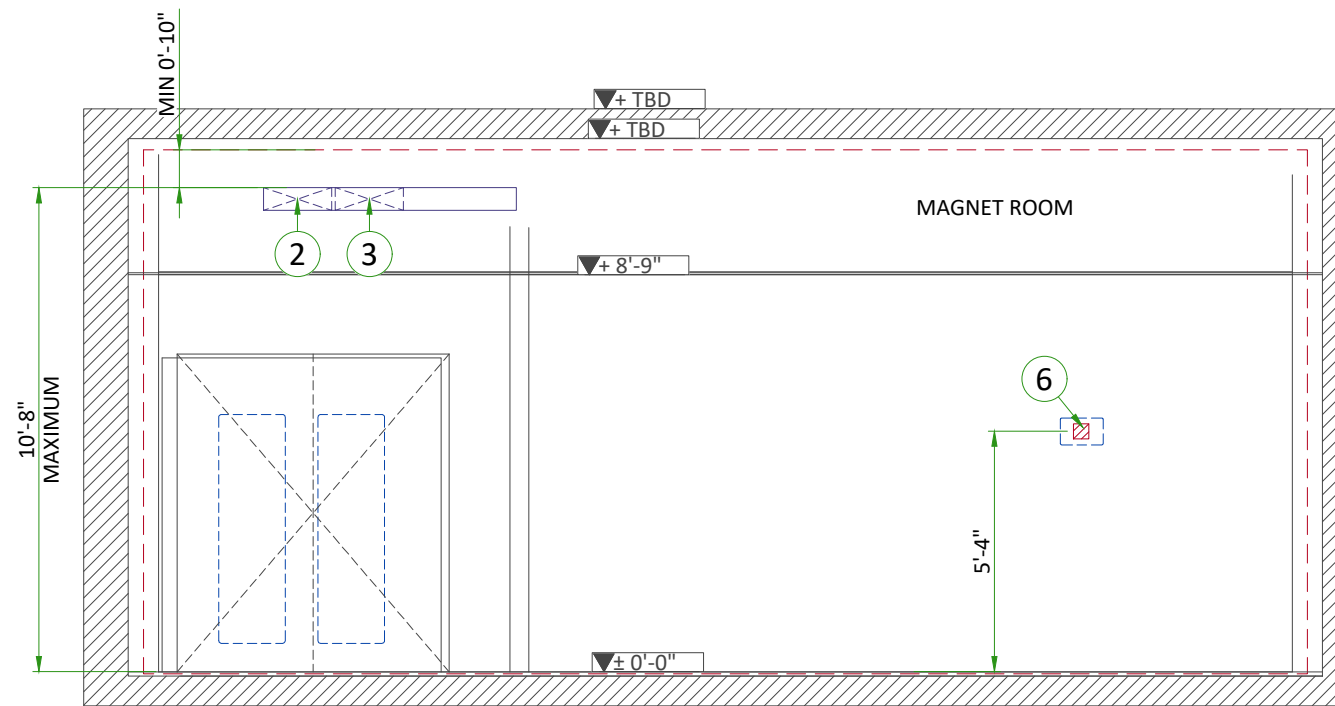


ITEM	Electrical Layout Item List
1	Cable ladder 18" x 6" [450 x 150]
2	Non-ferrous cable ladder 18" x 6" [450 x 150]
3	Non-ferrous cable ladder for gradient cables 18" x 6" [450 x 150]
4	Box above ceiling size per local code
5	Surface wall duct with minimum 2 dividers 6' x 3 1/2" [150 x 100]
6	Box in wall 4" x 4" x 2" [100 x 100 x 50]
7	Main disconnect panel
8	Maintenance bypass panel
9	Conduit above RF screen 2" [50]
10	Conduit above RF screen 3" [75]
11	Box in wall 4" x 4" x 4" [100 x 100 x 100]
12	Non-ferrous unistrut cable support
13	RF Filters - grounded to RF shield at Common Ground Stud

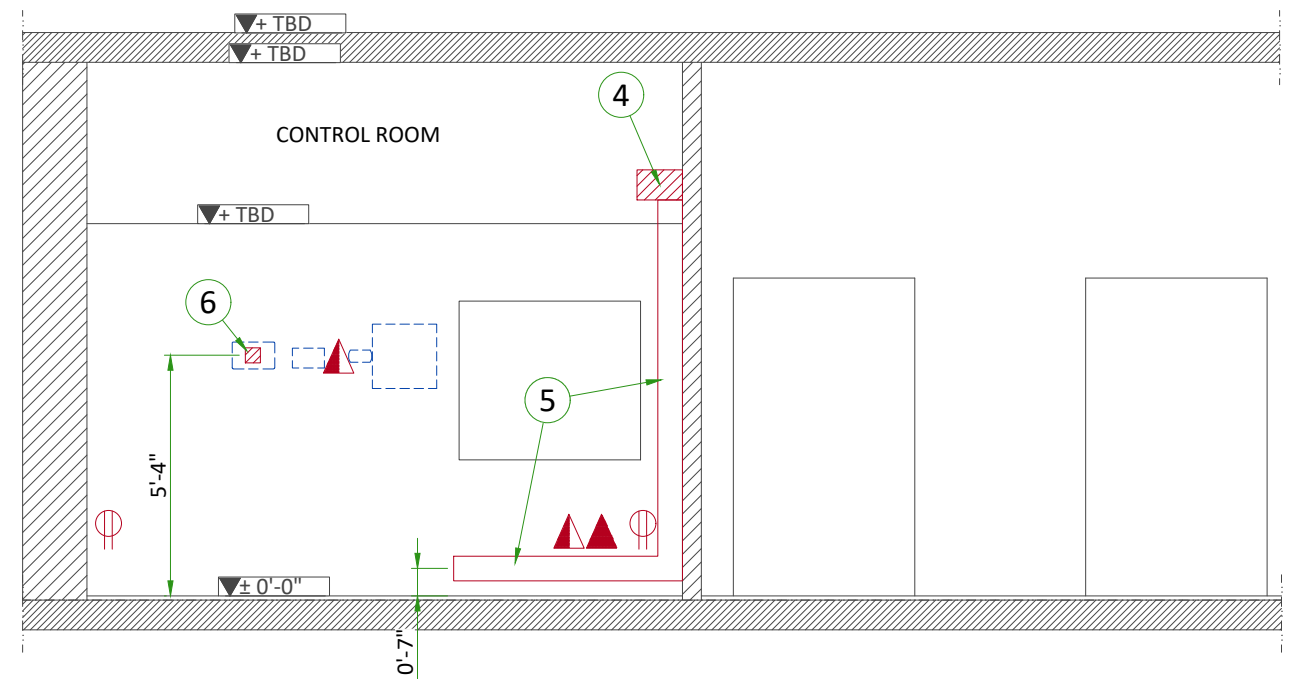
ITEM	QTY	Outlet Legend for GE Equipment
		System emergency off (EO1-2), (recommended height 1.2m [48"] above floor)
		Door interlock switch
		Emergency exhaust fan switch 1.2m [48"] height recommended)
		Duplex hospital grade, dedicated wall outlet 120-v, single phase power
		Network outlet
		Dedicated telephone lines/network connection
		Duplex hospital grade, dedicated outlet 120-v emergency, single phase power, 15a
		Duplex hospital grade, dedicated outlet 120-v, single phase outlet routed through RF filter

Additional Conduit Runs (Contractor Supplied and Installed)				
From (Bubble # / Item)	To (Bubble # / Item)	Qty	Size	
			In.	mm
7 Main Disconnect Panel	Power, Gradient, RF cabinet	1	As req'd	As req'd
	Heat Exchange Cabinet	1	As req'd	As req'd
	System emergency off 2	1	1/2	16
System emergency off 2	Secondary Penetration Wall	1	1/2	16
Door switch	Power, Gradient, RF cabinet	1	3/4	20
System emergency off 1	Secondary Penetration Wall	1	3/4	20
6 Magnet Rundown Unit	Magnet	1	1	25
	RF filter #1	1	As req'd	As req'd
RF filter #1	120-V 1Ø Power	1	As req'd	As req'd
Room Light	RF filter #2	1	As req'd	As req'd
RF filter #2	Facility emergency power	1	As req'd	As req'd
11 TV Camera	Waveguide or RF filter	1	1	25
4 TV Monitor		1	1	25
Injector control unit	Waveguide or RF filter	1	2 1/2	70
Injector head		1	As req'd	As req'd
Integrated battery charging unit		1	As req'd	As req'd
Dimplex Chiller	4 Remote Graphic Display	1	3/4	20
	Facility Power	1	as Req'd	
8 Maintenance Bypass Panel	7 Main Disconnect Panel	1	As req'd	As req'd
	Full UPS	2	As req'd	As req'd
	Facility Power		As req'd	As req'd
Full UPS	Battery Cabinet		As req'd	As req'd

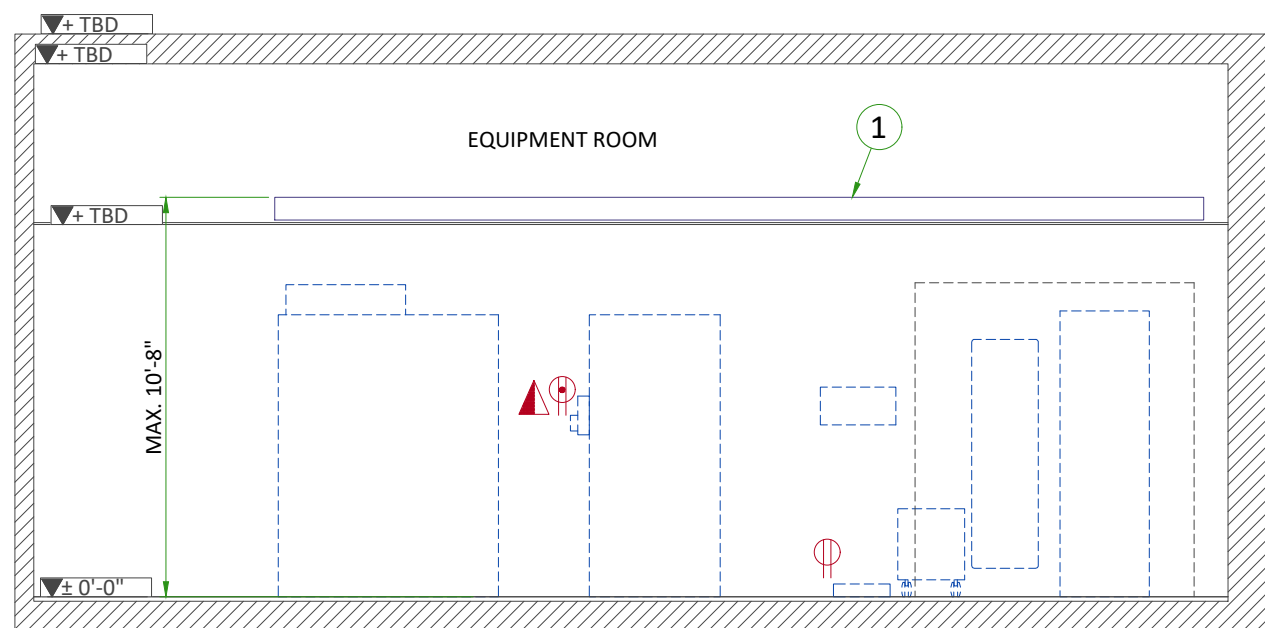




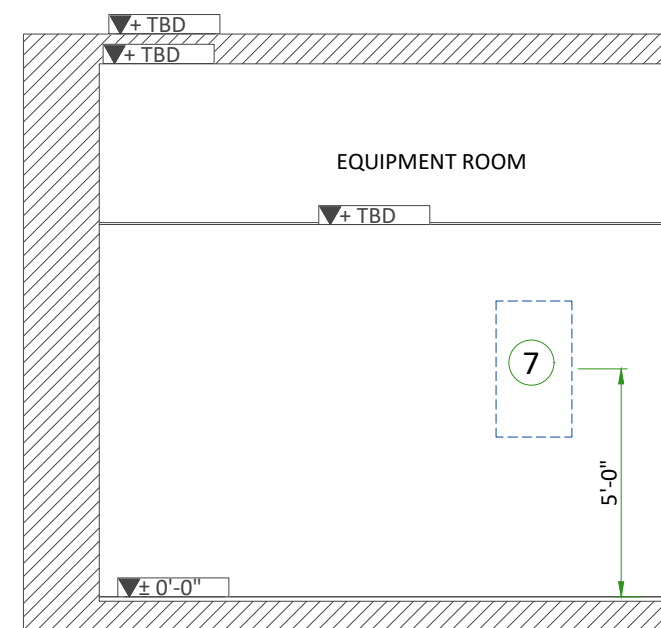
A



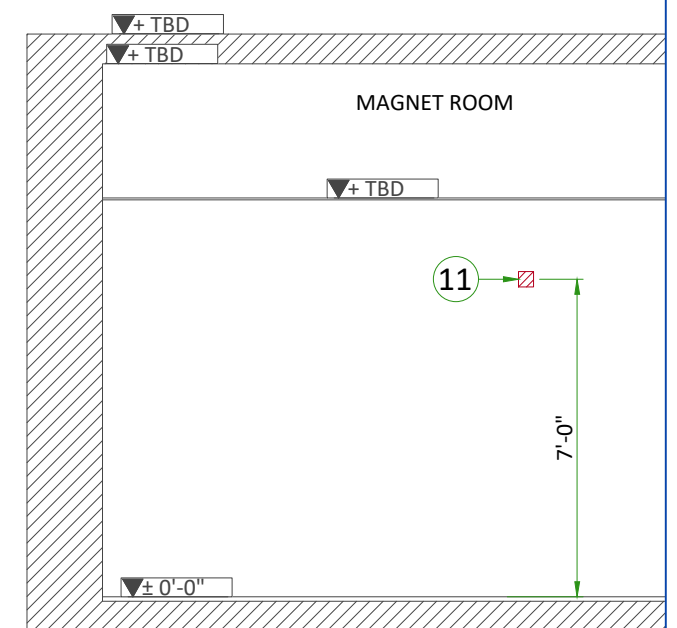
B



C

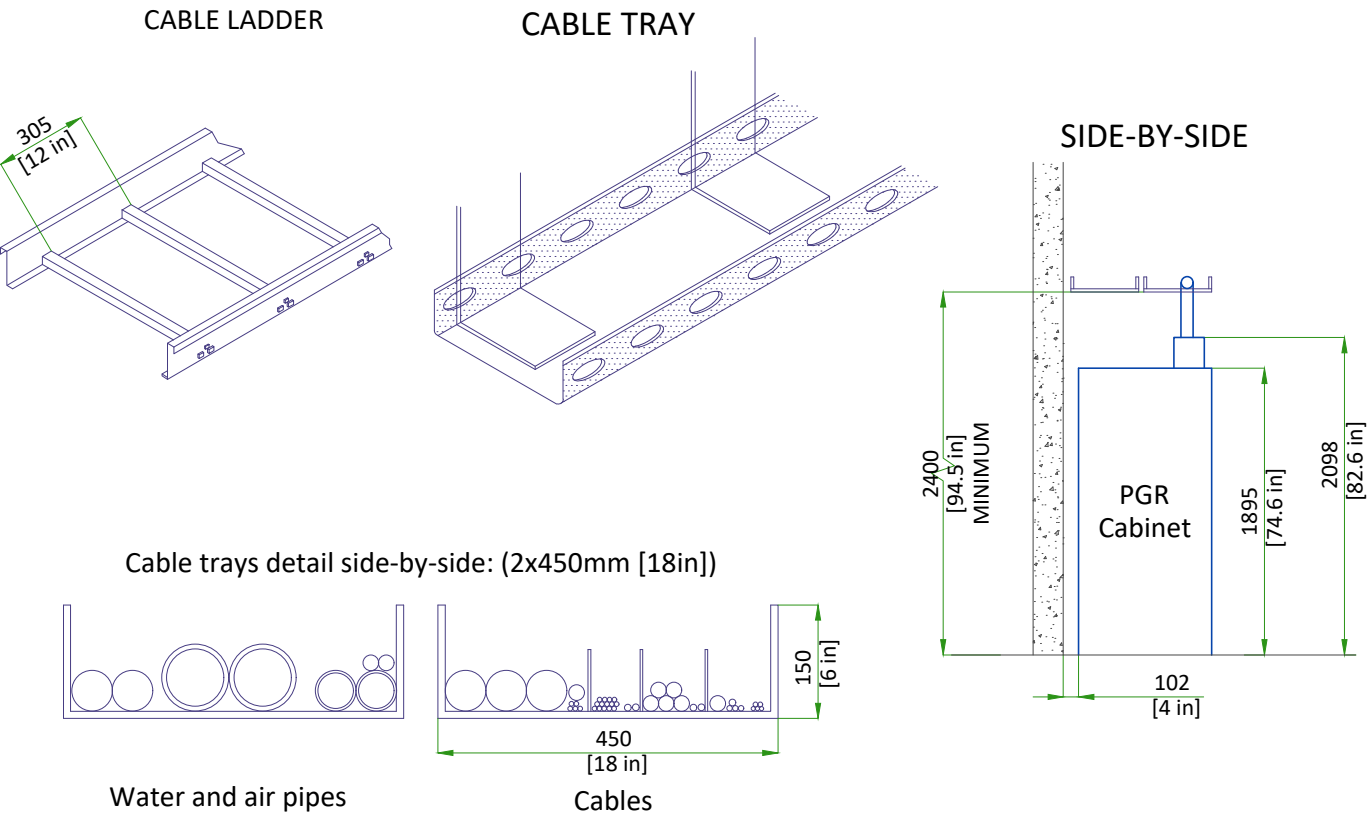


D

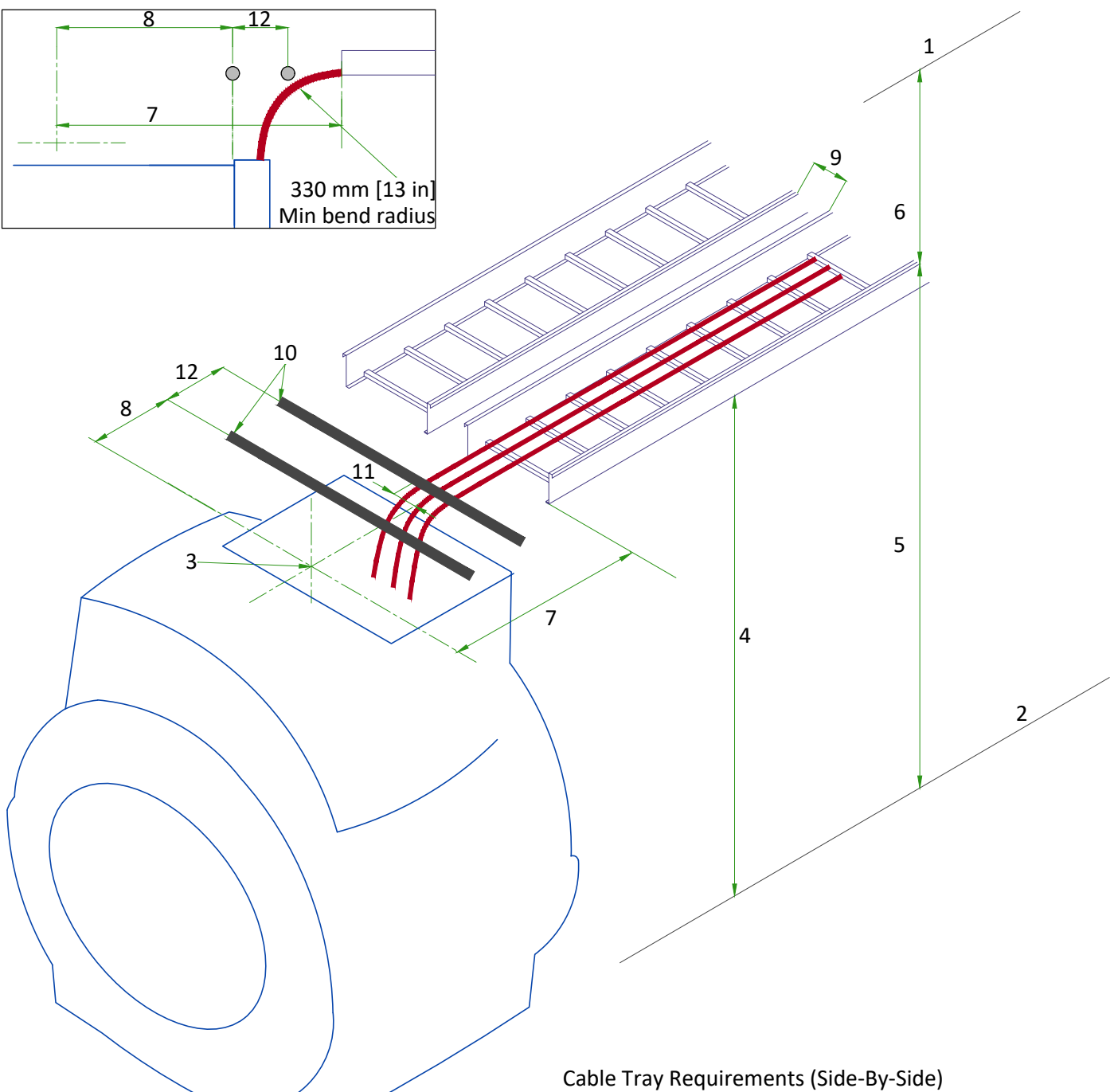


E

CABLE WAYS IN EQUIPMENT ROOM



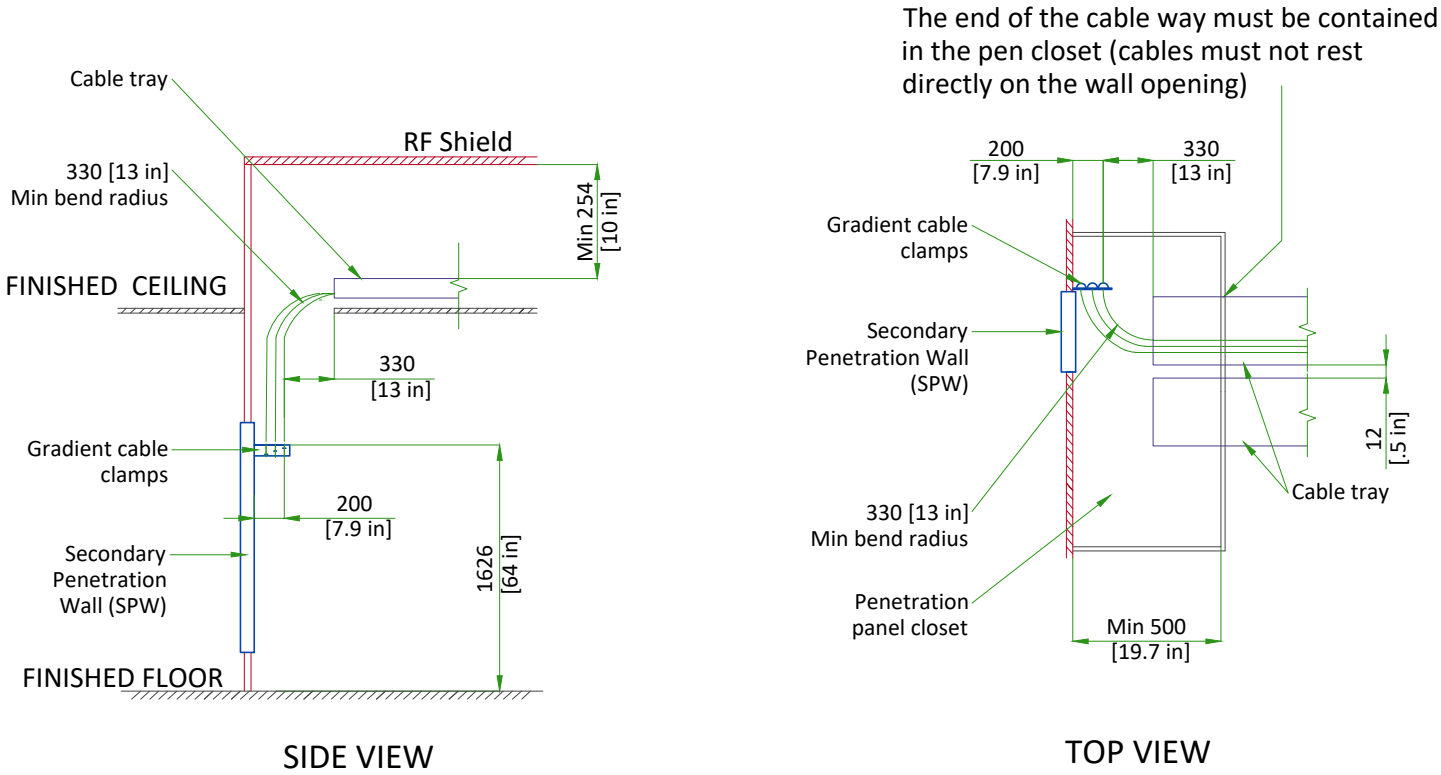
CABLE TRAYS REQUIREMENTS IN MAGNET ROOM



- 1 - Ceiling
- 2 - Finished Floor
- 3 - Magnet isocenter. Gradient cables must be centered on magnet isocenter.
- 4 - Minimum cable tray height required at back of Magnet: 2578 mm [101.5 in].  
Tray height may be lower at other points to avoid obstructions.
- 5 - Maximum height from floor to top of tray (anywhere in Magnet room): 3251 mm [128 in].
- 6 - Minimum distance from top of cable tray to ceiling or other obstruction: 254 mm [10 in].
- 7 - Tray end to isocenter: 1099 ±12 mm [43.25 ±0.5 in] (HM series) or 1336 ±12 mm [52.60 ±0.5 in] (IPM series).
- 8 - Other cable termination to isocenter: 718 ±12mm [28.25 ±0.5 in] (HM series) or 955 ±12 mm [37.60 ±0.5 in] (IPM series).
- 9 - Minimum distance between trays: 12 mm [0.5 in].
- 10 - Non-ferrous cable support
- 11 - The center of the gradient cable group is 89 mm [3.5 in] from magnet center.
- 12 - Distance between non-ferrous cable support: at least 305 mm [12 in].

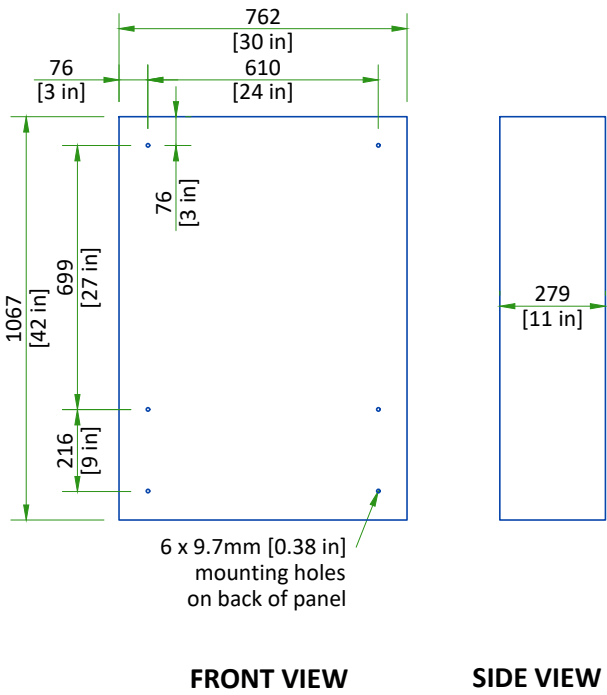
CABLE WAY TO PENETRATION PANEL

CABLE TRAY TO PENETRATION PANEL REQUIREMENTS IN THE EXAM ROOM



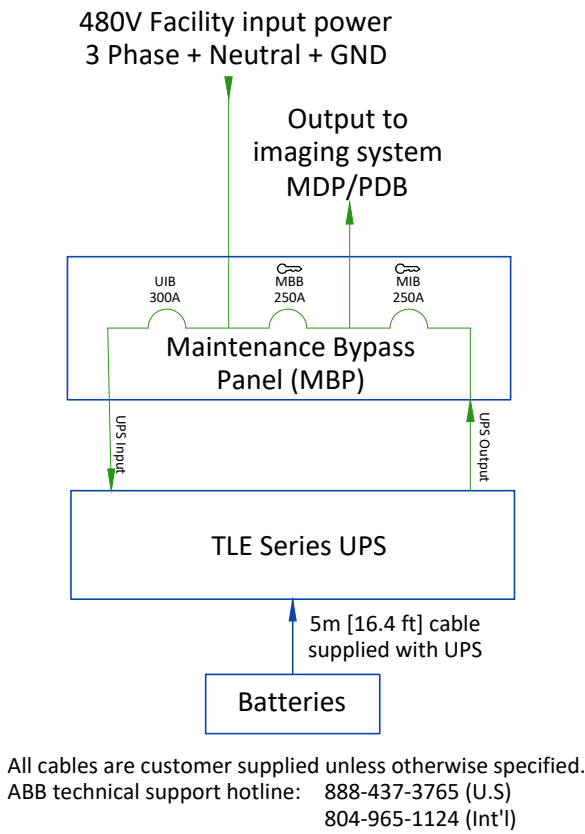
FULL SYSTEM UPS INTERCONNECT AND BYPASS PANEL

MAINTENANCE BYPASS PANEL (MBP) ELEVATIONS



SCALE 1:20

TYPICAL UPS SYSTEM CONNECTION METHOD



POWER REQUIREMENTS

SPECIFICATIONS OF MAIN POWER INPUT

POWER SUPPLY	380/400/415/480V ±10%, 3 PHASE + NEUTRAL + GND
FREQUENCIES	50/60Hz ± 3Hz
POWER FACTOR	0.9
MAXIMUM INPUT POWER (5 sec MAX)	123kVA
INSTALLED LOAD	99kVA
STAND-BY POWER	< 17kVA

- Power input must be separated from any others which may generate transients (elevators, air conditioning, radiology rooms equipped with high speed film changers...).
- If a neutral conductor is present, it can be terminated on the neutral bus provided in the GE-supplied MDP.
- Total harmonic distortion less than 2.5%. Phase imbalance must not exceed 2%.
- Lock-out/Tag-out: The Main Disconnect Panel (MDP) shall provide an external single point lock-out/tag-out feature for the entire system and a means to externally lock-out/tag-out each output breaker independently. Each lock-out/tag-out feature shall accommodate a standard sized lock hasp.

SPECIFICATIONS OF BACK-UP POWER SUPPLY

MAGNET MONITOR REQUIRES A 110/220 VAC, 50/60 HZ, 2.0 A FACILITY SUPPLIED OUTLET. POWER AT THE OUTLET MUST BE CONTINUOUSLY AVAILABLE.
--

FOR CRYOCOOLER COMPRESSOR

POWER INPUT	380/400/415/480V, THREE-PHASE + G
POWER REQUIREMENT	MIN 9kVA
POWER CONSUMPTION	MAX 7.2kW / STEADY STATE 6.5kW at 50Hz MAX 8.3kW / STEADY STATE 7.5kW at 60Hz
FREQUENCY	50/60Hz ± 3Hz
Power to Cryocooler Compressor must be removed when emergency off circuit is actuated.	

CABLES

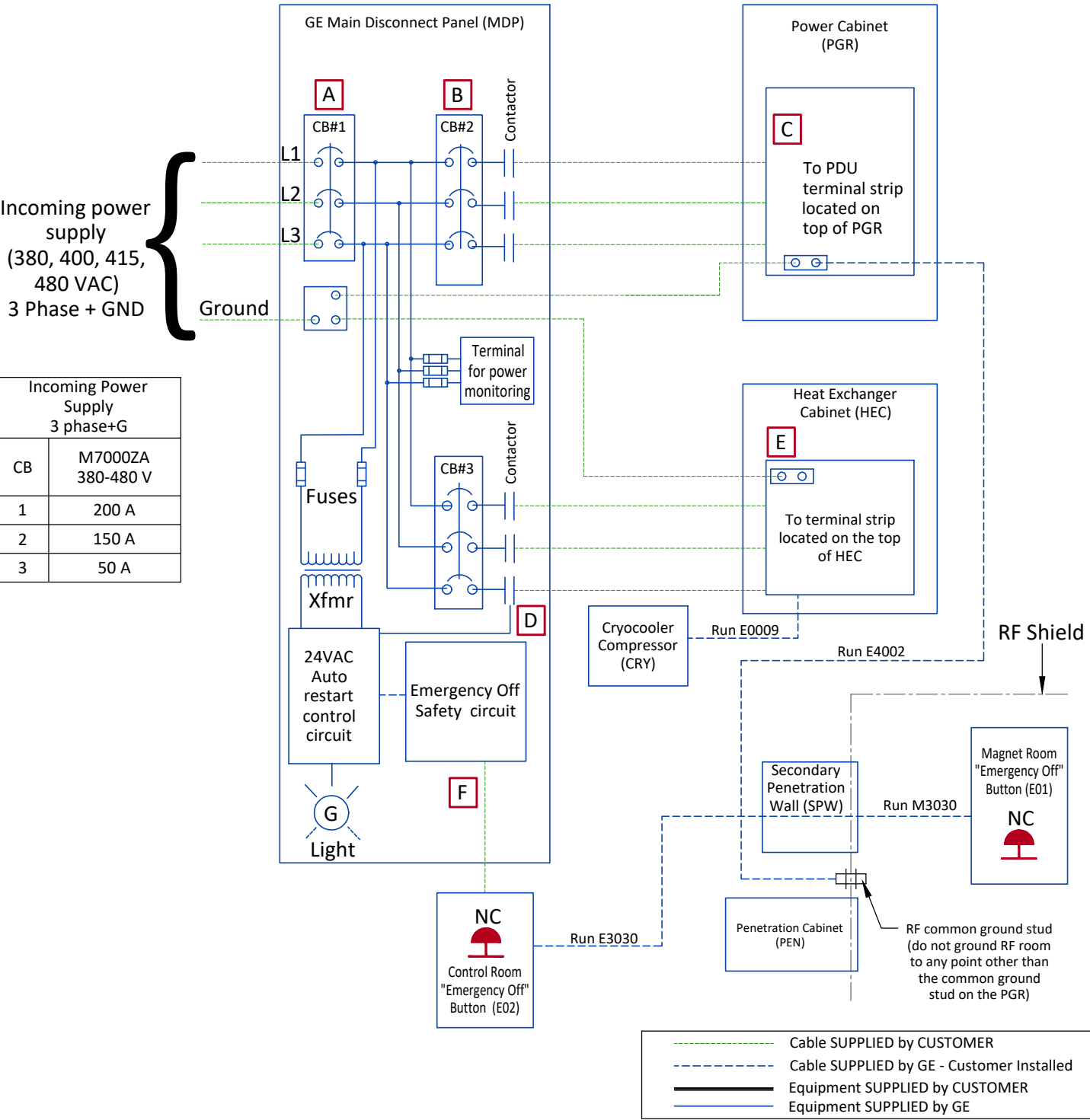
- Power and cable installation must comply with the distribution diagram.
- Size of the Main power input cable is determined by the customer, taking its length and admissible voltage drops into consideration.
- All cables must be isolated and flexible, cable color codes must comply with standards for electrical installation.
- The cables from signaling and remote control (Y, Emergency Off Buttons, L...) will go to Main Panel with a pigtail length of 1.5m [60in], and will be connected during installation.
- Each conductor will be identified and isolated (screw connector).

GROUND SYSTEM

- The equipotential link will be by means of an equipotential bar.
- The grounding point of MDP is directly connected to the building's ground by an isolated copper cable.
- The impedance of the earth bar should be less than or equal to 2 ohms.

GUIDANCE ON SLECTION OF FEEDER AND TRANSFORMER FOR MR SYSTEM			
	Direct feed from facility to MR system	MR system fed by dedicated facility distribution transformer	
Prerequisite Conditions			
MR System Incoming Voltage	480V 3-phase		
Minimum Source short-circuit kVA	7,900 kVA (at source of feeder to MDP)	8,325 kVA (at input to distribution transformer)	
Minimum No-Load Voltage	460V	475V (transformer secondary tapped accordingly)	
Feeder and Transformer Recommendations			
Dedicated Distribution Transformer Recommendations	N/A	Size: 225 kVA Impedance (Z): ≤5% K-Factor: ≥ K=20 200A overcurrent protection on secondary*	Size: 225 kVA Impedance (Z): ≤4% K-Factor: ≥ K=20 200A overcurrent protection on secondary*
Maximum Feeder Length*	280 ft	150 ft	240 ft
Feeder Size - 3-phase power conductors*	3/0 AWG Cu	3/0 AWG Cu	
Feeder Size - Ground (USA)*	6 AWG Cu (equipment grounding conductor)	4 AWG Cu (supply side bonding jumper) 6 AWG Cu (equipment grounding conductor)	
Feeder Size - Ground (Canada)*	6 AWG Cu (bonding conductor)	6 AWG Cu (bonding conductor)	
* NOTE: Recommendations shown apply only to cases defined exactly as shown in this table and when not in conflict with local electrical codes . For all other cases, refer to the local codes and the System Voltage Regulation Calculator located on the GE Healthcare Site Planning Website			

POWER DISTRIBUTION

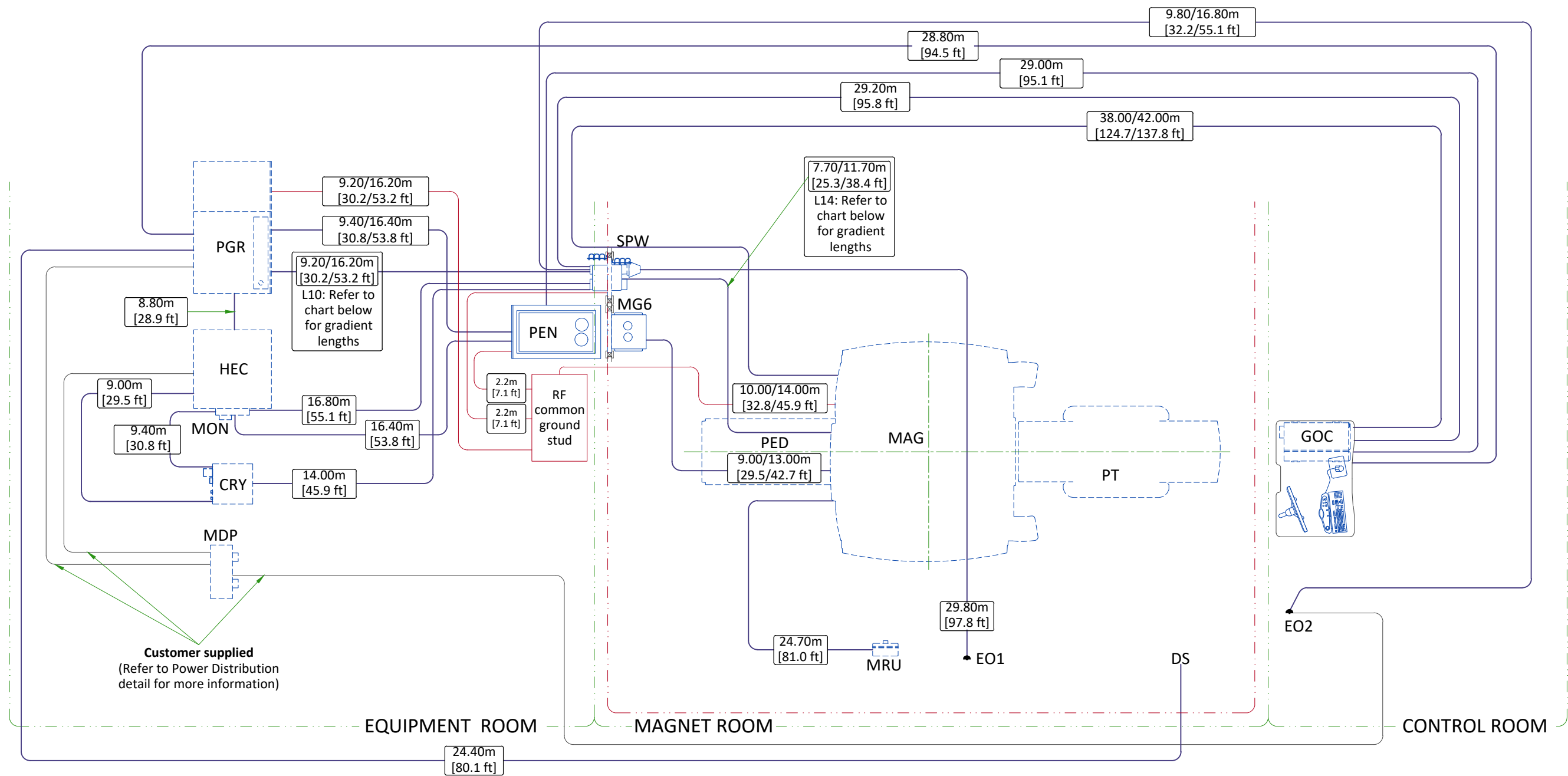


NOTES:

- Cryocooler Compressor (CRY) must operate 24 hours per day, 7 days per week.
- Runs E0009, E3030 and M3030 are GE supplied cables. All other wiring is customer supplied and installed.
- Two remote Emergency Off Maintained Buttons are supplied with the MDP. Emergency Off removes power from all outputs when activated.
- All MDP output circuits drop out on loss of power. the Cryocooler (CRY) circuit will automatically restart upon restoration of power.
- All feeder circuits require dedicated ground wires.



INTERCONNECTIONS



GRADIENT CABLE LENGTH OPTIONS	
Length Identifier	Available lengths m (ft)
L10	3.7 (12.9)
	5.7 (18.7)
	7.7 (25.3)
	9.7 (31.8)
	11.7 (38.4)
	13.7 (45.0)
L14	15.7 (51.5)
	4 (13.1)
	6 (19.7)
	8 (26.3)
	10 (32.8)
	12 (39.4)

CABLE ROUTING FOR ACCESSORIES			
OPTION	FROM	TO	CABLE LENGTH m (ft)
Magnetic Resonance Elastography (MRE)	MRE	Magnet (Isocenter)	Nominal: 7.31 (24) Maximum: 10.06 (33) Extra long: 11.90 (39)
	MRE	PEN cabinet	15.24 (50)
	MRE	Ethernet Hub in PGR	15.24 (50)
	MRE	Customer Supplied Outlet	60Hz: 6.10 (20) 50Hz: 7.62 (25)
Multi-Nuclear Spectroscopy (MNS)	MNS	PGR	9.85 (32.3)
	MNS	PGR	7.85 (25.7)/14 (45.9)
	SPW	PGR	8.2 (26.9)/14.35 (47)
Brainwave (BW)	BW	PEN cabinet	18.3 (60)

Order Configuration Options		
Configuration	Equipment Room - site option	Magnet Room - site option
A	Short	Short
B	Long	Short
C	Short	Long