

MAGNETOM Terra, 7 Tesla

Basic Planning Information

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Legend

- Motion area / Swivelling range / Minimal room size / Safety distance
- Service area
- Additional equipment
- Ceiling mounted
- Wall mounted
- Floor mounted
- New construction
- Demolition

Dimensioning

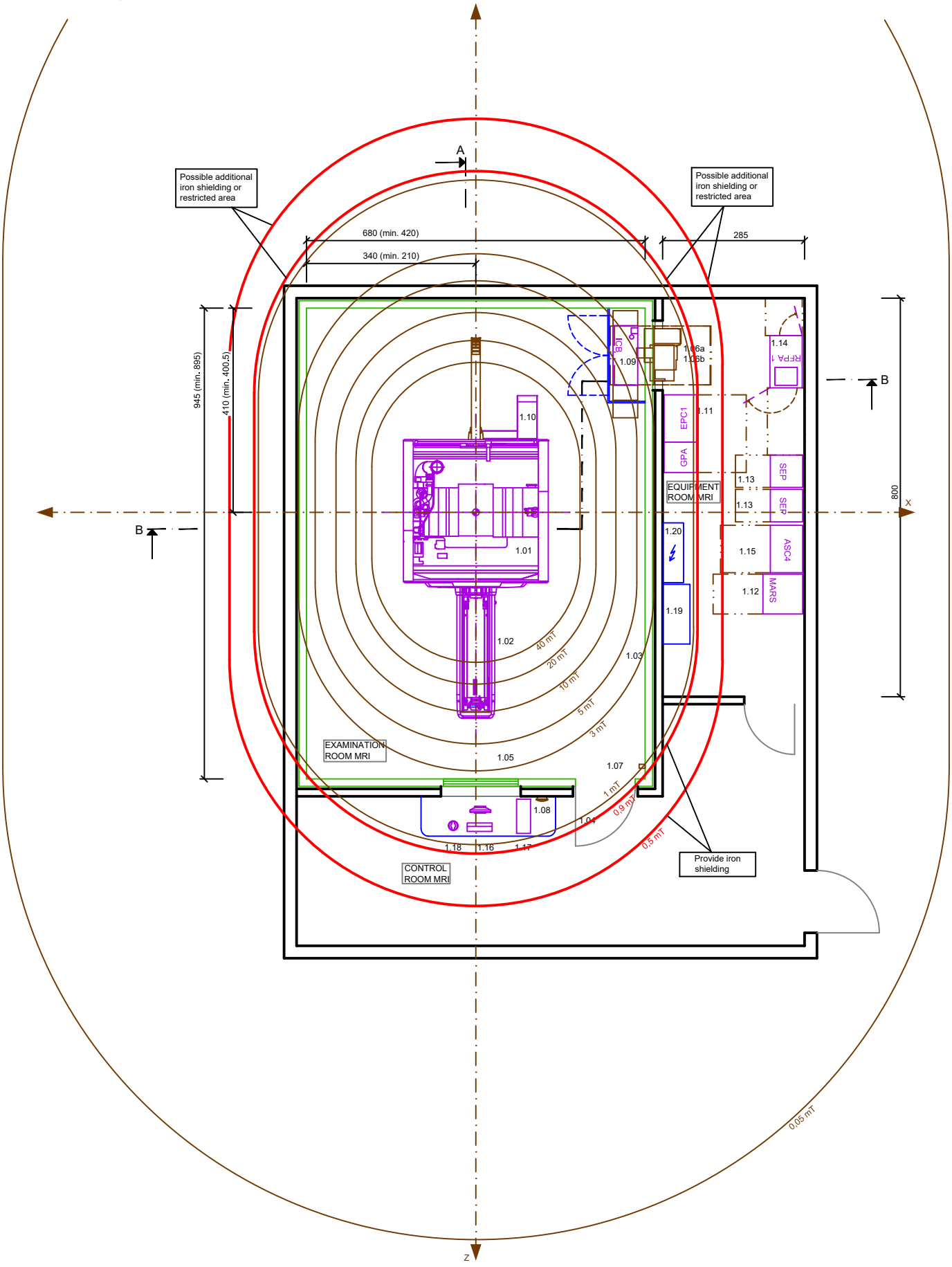
All installation measurements apply to finished wall/floor/ceiling and are to be checked prior to assembling the unit.



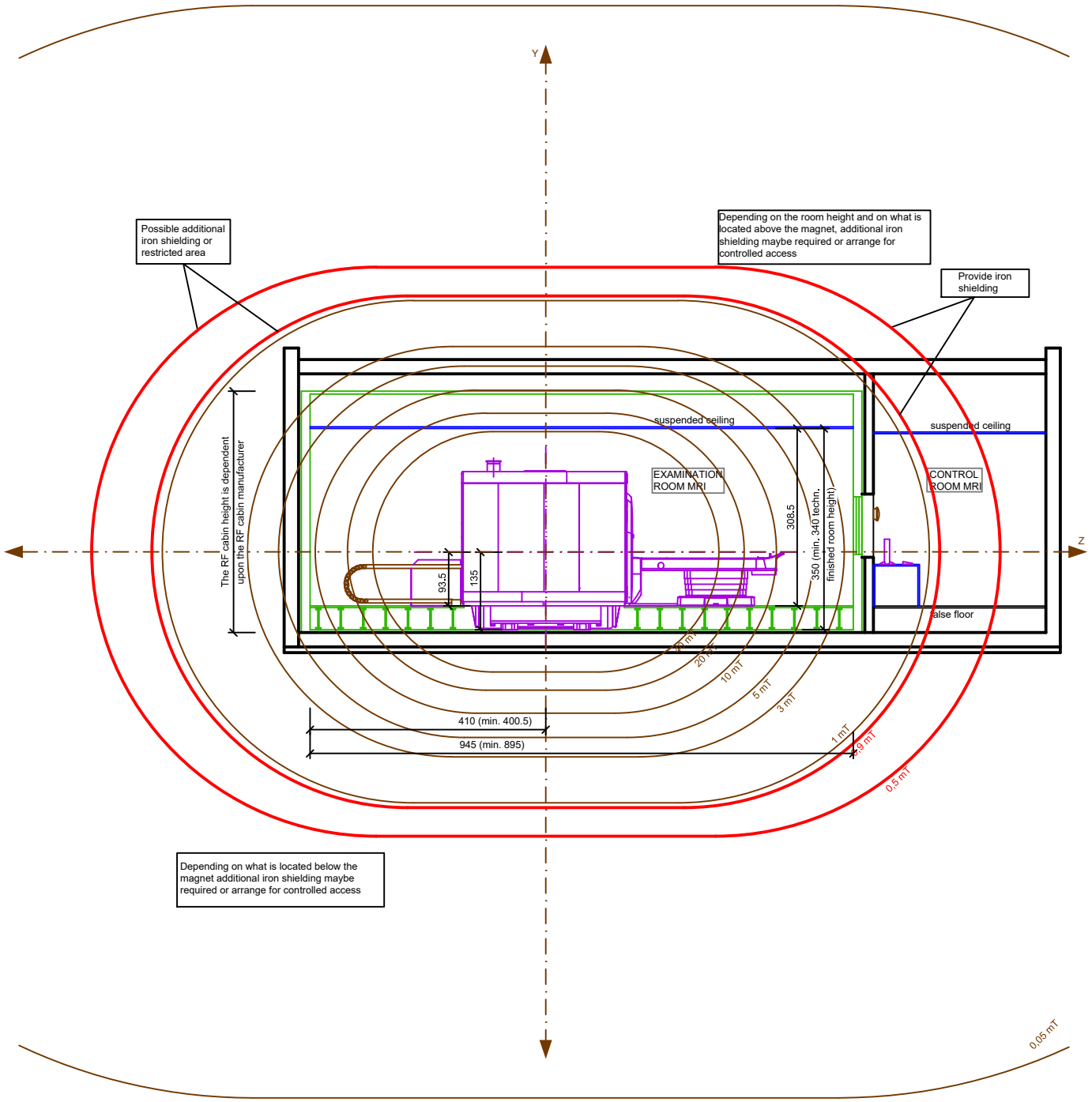
Orientation point = reference point of the Siemens Healthineers unit for planning and installation

Please note: The drawing parts in this document are not to scale!

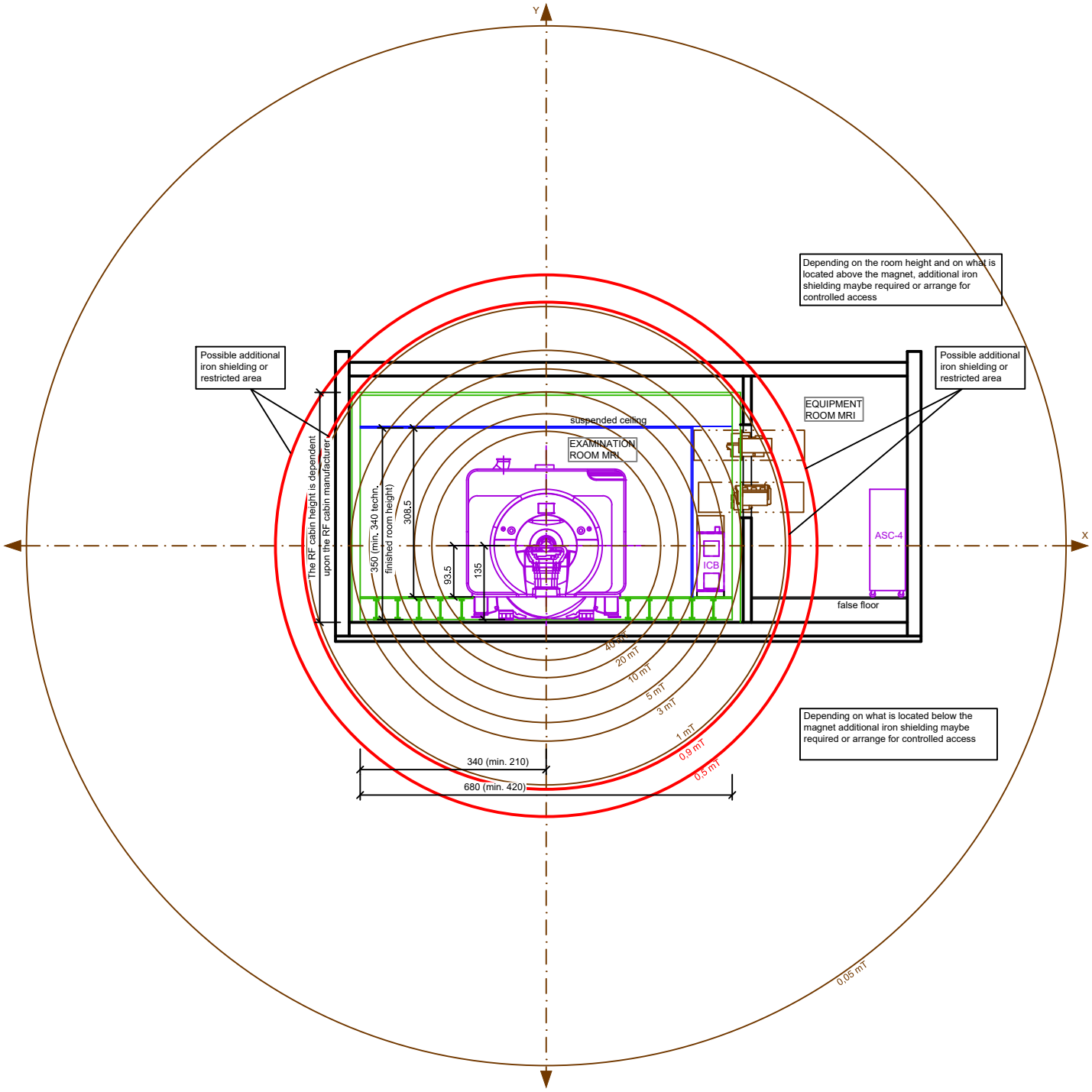
Planning Example



Section A-A


Y
Z
Possible additional iron shielding or restricted area
Depending on the room height and on what is located above the magnet, additional iron shielding maybe required or arrange for controlled access
Provide iron shielding
suspended ceiling
suspended ceiling
EXAMINATION ROOM MRI
CONTROL ROOM MRI
The RF cabin height is dependent upon the RF cabin manufacturer
93.5
135
308.5
350 (min. 340 techn. finished room height)
false floor
20 mT
10 mT
5 mT
3 mT
1 mT
0,5 mT
0,05 mT
410 (min. 400.5)
945 (min. 895)
Depending on what is located below the magnet additional iron shielding maybe required or arrange for controlled access

Section B-B


Y
X
Depending on the room height and on what is located above the magnet, additional iron shielding maybe required or arrange for controlled access
Possible additional iron shielding or restricted area
Possible additional iron shielding or restricted area
suspended ceiling
EXAMINATION ROOM MRI
EQUIPMENT ROOM MRI
ASC-4
ICB
false floor
The RF cabin height is dependent upon the RF cabin manufacturer
350 (min. 340 techn. finished room height)
308,5
93,5
135
40 mT
20 mT
10 mT
5 mT
3 mT
1 mT
0,9 mT
0,5 mT
0,05 mT
340 (min. 210)
680 (min. 420)
Depending on what is located below the magnet additional iron shielding maybe required or arrange for controlled access

MAGNETOM Terra - Equipment Legend

		Weight (kg), Heat dissipation to the air (W)		
Pos.	Description	kg	W	Remark
1.01	Magnet	~20000		#1/#2
1.02	Fixed patient table	240		
1.03	RF-cabin			
1.04	RF-door			
1.05	RF-window			
1.06a	RF-System filter plate 1	110	250	#5
1.06b	RF-System filter plate 2	80	250	#5
1.07	Magnet stop			
1.08	Alarm Box			
1.09	ICB infrastructure box			
1.10	RF-Unit			
1.11	Electronics cabinet GPA/EPC1	1250		#1/#3
1.12	MARS	300	1000	
1.13a	SEP cabinet 1	318		#2/#3
1.13b	SEP cabinet 2	318		#2/#3
1.14	RFPA 1 cabinet	435	≤ 2000	
1.15	ASC4 cabinet	288	1500	
1.16	Control unit MR AWP	20	200	optional
1.17	Host PC MR AWP	22	700	max. magnetic field strength 1mT
1.18	Intercom System			
1.19	Air condition unit			by customer
1.20	Power distributor			by customer
	#1 Heat dissipation depending on measuring #2 Additional water cooling system necessary #3 Typical heat dissipation of both components to the environment in the Technical-Room ≤ 5 kW #5 Installation of non-SIEMENS components prohibited			

Room Dimensioning

Technical minimum finished room height
Examination room min. 340cm (base to suspended ceiling), technique room min. 300cm, computer room min. 210cm.

Technical minimum finished room length and width
Minimum finished room Examination room length / width: 895 cm / 420 cm

Statics and Transport

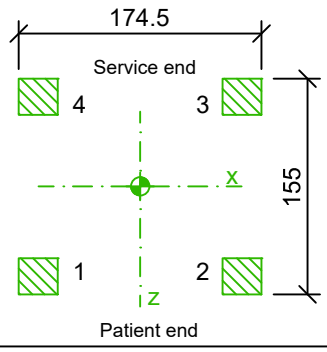
Statics

not to scale

Support feet and floor load with sylomer pads

Transport weight of the magnet: ~ 17.000 kg
Installation weight of the magnet: ~ 20.000 kg
4 support feet each 28 cm x 26 cm (728 cm²)

Pos. 1 = 5.000 kg
Pos. 2 = 5.000 kg
Pos. 3 = 5.000 kg
Pos. 4 = 5.000 kg



You have to consider the additional weights of the RF cabin and the possible iron shielding for the static calculation. It is only possible to position the magnet on Spring Solution (Stop-Chocs) if it is installed in a non-magnetic RF cabin and if there is no iron shielding below the magnet.
Standard configuration is an installation on Sylomer Solution.

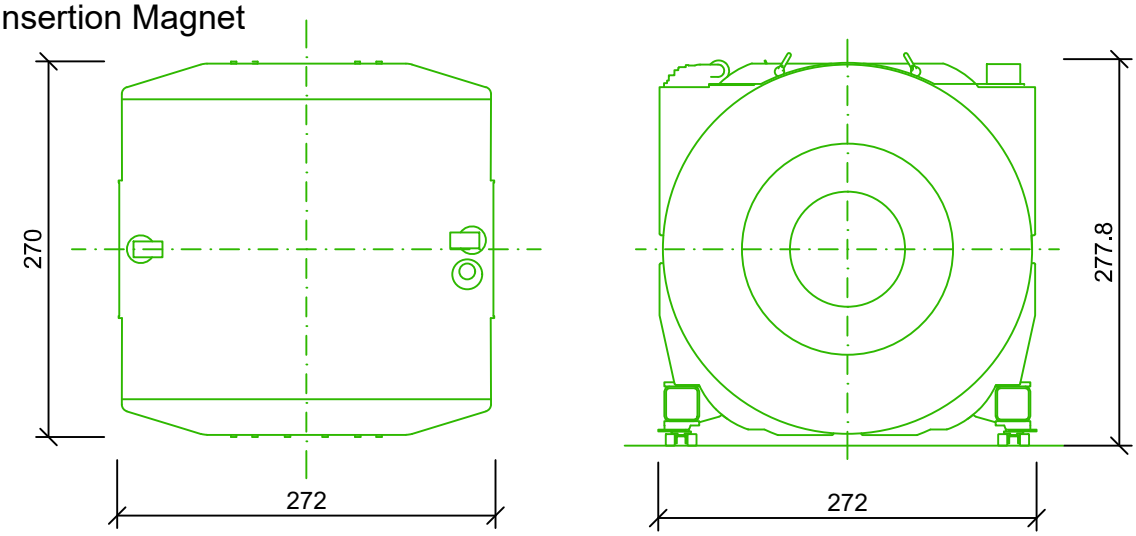
Building vibrations

External vibrations or shocks affecting the magnet may degrade image quality. In the three spatial orientations the building vibration must not exeed the following specification:
Building vibration specification:
a_{max} = -83 dB(g) in the frequency range from 0 to 70 Hz
The requirement for a_{max} is depending on the frequency.

Transport

not to scale

Insertion Magnet



Min. transport opening in the wall: W = 300 cm / H = 300 cm
Min. transport opening in the ceiling: L = 300 cm / W = 300 cm

The maximum load and the width of doors and openings must be considered for the delivery of system parts and the later delivery of cryogens.

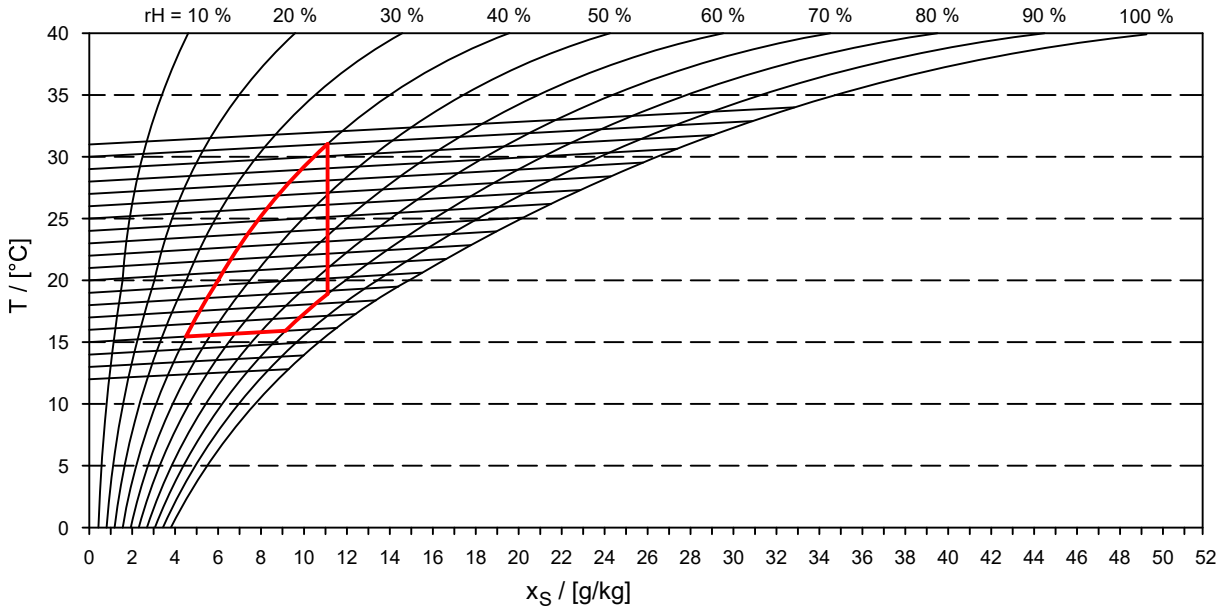
Largest Parts	Length	Width	Height	Weight
Magnet without cover	270 cm	272 cm	277.8 cm	16880 kg
Fixed Table	247 cm	76 cm	105 cm	240 kg
Cabinet GPA/EPC	156 cm	65 cm	197 cm	1500 kg
Cabinet SEP	65 cm	65 cm	187 cm	318 kg
Cabinet ASC4	100 cm	65 cm	195 cm	288 kg
RFPA	105 cm	65 cm	195 cm	435 kg
MARS	80 cm	100 cm	189 cm	300 kg
Cryogene dewar with siphon (example)	max. Ø 115 cm		204 cm	500 kg
Dimensions without safety loading.				

Cooling Water Installation

Cooling water (SEP cabinets)		
Central cooling water supply (e.g.in Hospitals) is alredy avaliable or local chiller is available.		
Water quality Primary water Recommendation	pH-value Hardness Chlorine portion Sulfate portion Filtration Water / antifreeze	: 6 to 8 : < 250 ppm $CaCO_3$, < 14 °dH : < 200 ppm : < 200 ppm : 500 µm : depending on the primary water supply
Water quality Secondary water	Water to be used Filtration Water / antifreeze Additive for secondary chilled water circuit	: De-ionized water : 700 µm : n.a. : $NaHCO_3$
SEP 1 - Cabinet	Heat dissipation to water Water flow rate Primary water temperature Primary water pressure Pressure loss across SEP	: 60 kW : 100 l/min +/- 10 l/min : 6 to 12 °C : < 6 bar : < 1 bar (at 90 l / min) typically 0.8 bar
SEP 2 - Cabinet	Heat dissipation to water Water flow rate Primary water temperature Primary water pressure Pressure loss across SEP	: 30 kW : 50 l/min +/- 10 l/min : 6 to 12 °C : < 6 bar : < 1 bar (at 90 l / min) typically 0.8 bar

Environmental conditions

Environmental conditions		
In the MR-area must be ensure following conditions (system during operation)		
Examination room	Room temperature Relative humidity Absolute humidity Air exchange rate	18 to 22 °C 40 to 60 % < 11.0 g/kg min. 6 times / h (recommended 10 times / h)
Technique room	Room temperature Relative humidity Temperature gradient Absolute humidity	18 to 24 °C 40 to 80 % 1 K / 5 min < 11.0 g/kg
Control / Evaluation room	Room temperature Relative humidity Absolute humidity	15 to 30 °C 40 to 80 % < 11.0 g/kg
The operating values should be set within these limits and ventilation must conform to local standards and regulations.		
Air filtering	In the equipment area: filter classification EU 4 (ISO 16890-2 / part 2) to filter out dust particles > 10 µm. For the MR examination room observe the local regulations.	
Typical heat dissipation of the MR-components to the environment during an operation.	Examination room Control room Technique room	≤ 3,0 kW ≤ 2,0 kW ≤ 10,0 kW



Electrical Installation

Power requirements			
Mains: TN-S		3/N/PE AC 50/60 Hz ± 1 Hz	Connection value: EPC1 105 kVA EPC1/EPC2 120 kVA EPC1/EPC2/GPA 152 kVA (future expansion stage)
Line voltage:		400 V ± 10 %	
Line to line unbalanced:		max. 2 %	
EPC1	Line impedance:	≤ 95 mΩ	
EPC1/EPC2	Line impedance:	≤ 95 mΩ	
EPC1/EPC2/GPA	Line impedance:	≤ 80 mΩ	
			Only copper cables are allowed.
The size of the terminals in the EPC are designed for 70 mm². For future expansion stage EPC1/EPC2/GPA: The size of the terminals in the EPC are designed for 50 mm², in the GPA for 70 mm².			
Cable cross section is to be determined by national regulation and calculation.			

Room lighting
Ambient lighting in rooms with diagnostics or with workstations must comply with the respective local and national regulations. General requirements like the needed intensity of illumination - adjustable, reproducible, flicker-free or a limitation of dazzlings and reflections etc. have to be observed (EN 12464-1, DIN 5035-7).

Noise Emission Values

Noise emission values			
If required, noise reduction should be realized based on the noise emission values as specified.			
Average values across 8 hours	Examination room	Control room	Technique room
	102.2 dB(A)	≤ 60 dB(A)	≤ 68 dB(A)

Fringe Field

Requirement for magn. field level warning signs in the control zone ≥ 0.5 mT/ 0.9 mT
Limit for persons with cardiac pacemaker. If the magnetic flux density in a given area exceeds 0.5 mT or 0.9 mT, it is necessary to display warning signs and restrict access in accordance with local regulations.

Fringe field distribution MAGNETOM Terra		
Fringe field	Distance in m from the magnetic center in direction of	
	X/Y axis (radial)	Z axis (axial)
40 mT	2,09	3,01
20 mT	2,41	3,45
10 mT	2,81	4,01
5 mT	3,23	4,65
3 mT	3,57	5,19
1 mT	4,37	6,67
0,9 mT	4,45	6,85
0,5 mT	4,95	7,90
0,05 mT	9,50	14,60

Siting Requirements

Siting requirements for the magnet

The siting of the magnet must be such that during operation neither external influences affect the homogenity of the magnetic field nor the safety of persons and/or the functioning of sensitive equipment can be affected by the stray magnetic field.

Disturbing influences on the magnetic field

Static
E.g. steel beams, reinforcements, especially beneath the magnet. Partially correctable by shimming of the magnet and/or compliance with minimum clearances/maximum weights.
Dynamic
E.g. moving ferromagnetic objects, electrical wiring, transformers. Avoidable when minimum clearances are observed. Minimum distance depend on moving direction and magnet orientation. If distances are not kept please contact the Siemens Healthineers Planning Department.

	Object	Minimum clearance		Max. weight
		radial (X/Y)	axial (Z)	
Guidelines for minimum clearances and maximum weights	Water cooling system	4.0 m	6.0 m	
	Wheelchairs, beds, Angiography systems	7.0 m	8.0 m	
	Carts up to approx. 200 kg	8.0 m	10.0 m	
	Transformers < 1600 kVA	7.0 m	7.0 m	
	AC cables < 1000A	6.0 m	6.0 m	
	Cars up to approx. 900 kg, CT	10.0 m	12.0 m	
	Trucks up to approx. 4500 kg, Lifts	12.0 m	15.0 m	
	Cyclotron	20.0 m	20.0 m	
	Street cars, trains	40.0 m	40.0 m	#1
	Angiography systems with magnetic navigation	30.0 m	30.0 m	
	Reinforcement distributed in thickness of floor slab	please contact Siemens Healthineers Planning department		
	Iron beam mass in the floor			

#1 The DC disturbances must not exceed a peak-peak value of 1250 nT (axial) and 2500 nT (radial). Occasionally these values might be exceeded although the minimum distances to DC sources are kept as stated in the planning guide. Please contact the planning department of Siemens Healthineers if the distances to trains, tramways or subways are smaller than 100 m.

Minimum distances magnet - magnet (Siemens Healthineers)

	0.2 T	0.35 T	1.0 T	1.5 T	3.0 T
0.2 T	10 m	10 m	5 m	6 m	10 m
0.35 T	10 m	10 m	5 m	6 m	10 m
1.0 T	5 m	5 m	4.5 m	5 m	6 m
1.5 T	6 m	6 m	5 m	5 m	6 m
3.0 T	10 m	10 m	6 m	6 m	6 m
7.0 T	10 m				

No magnet is ramping during the other runs applications! Shim is only optimized with both magnets ramped up during the shimming procedure.

Guidelines for max.Permissible Magnetic Flux Density (mT)

mT	Radial (X/Y)	Axial (Z)	
40	2.09 m	3.01 m	Servoventilator
20	2.41 m	3.45 m	Defibrillator
10	2.81 m	4.01 m	RF-filter plate
5	3.23 m	4.65 m	MR electronics cabinet (SIEMENS Healthineers) GPA/EPC, SEP, ASC4
3	3.57 m	5.19 m	Small motors, watches, cameras
1	4.37 m	6.67 m	Computers, oscilloscopes, MR electronics cabinet (SIEMENS Healthineers) RFPA, MARS
0,9	4,45 m	6,85 m	Pacemakers, limit for public access
0,5	4,95 m	7,90 m	Pacemakers, limit for public access
0,05	9,50 m	14,60 m	Gamma cameras, linear accelerators

The magnetic stray field is present in all three dimensions around the magnet and can be reduced by a magnetic shielding. Typical lines of constant magnetic flux density are shown in the drawing. This represents the ideal field distribution in air, which can be distorted by the presence of steel in the building.
Magnetic field specification depends on manufacturer.

Disturbances caused by the stray magnetic field

All equipment and systems whose functions could be influenced by external magnetic field must be taken into consideration. The maximum permissible magnetic flux density depends on the sensitivity of each system component and must be clarified if necessary with equipment manufacturer.
Stray magnetic field distribution in air
mT = Millitesla
1 Millitesla = 10 Gauss

Site inspection

In critical cases the site must be inspected on customer's expense by Siemens Healthineers or one of Siemens Healthineers appointed representatives to ensure basic suitability on the site.
This inspection is exclusively concerned with the measurement of the magnetic and radio frequency interference and building vibrations.
This inspection of other construction requirements, in particular the static and air conditioning and also the performance and supervision of on-site installation preparations and the later compliance with the basic operating requirements is not our responsibility.

RF-Shielding

RF-shielding

An RF-shielding (faraday cage) is required for the MR-examination room. This shielding protects the environment from RF interference and conversely protects the MR system from external interference. Required attenuation: >90 dB over the frequency range 40 to 300 MHz (>100 dB at Co-Siting). These values must be certified by measuring before the MR system is installed. RF-shielding components (doors, windows, interfaces) and complete modular RF-cabins can be supplied on request by Siemens Healthineers.

RF-Door

All RF-doors leading into the examination room have to be equipped with a door switch for indicating the closed / open position of the RF-door! It must be possible to lock the RF-doors from the outside. In addition to that it must always be possible to open the RF-door without key or additional devices in any cases from the inside!
The opening direction of the RF-door has to be to the outside of the RF-room.
Doors that open inwards is a safety risk due to room overpressure. For these rooms a pressure relief panel 600 mm x 600 mm (minimum size) must be installed into the RF cabin.
The RF-door is an important component for a good image quality and also for safety aspects. The customer/user of the MR system has to be informed to maintain the maintenance intervals given by the RF-room enclosure manufacturer. This will guarantee a correct function of the RF-door.

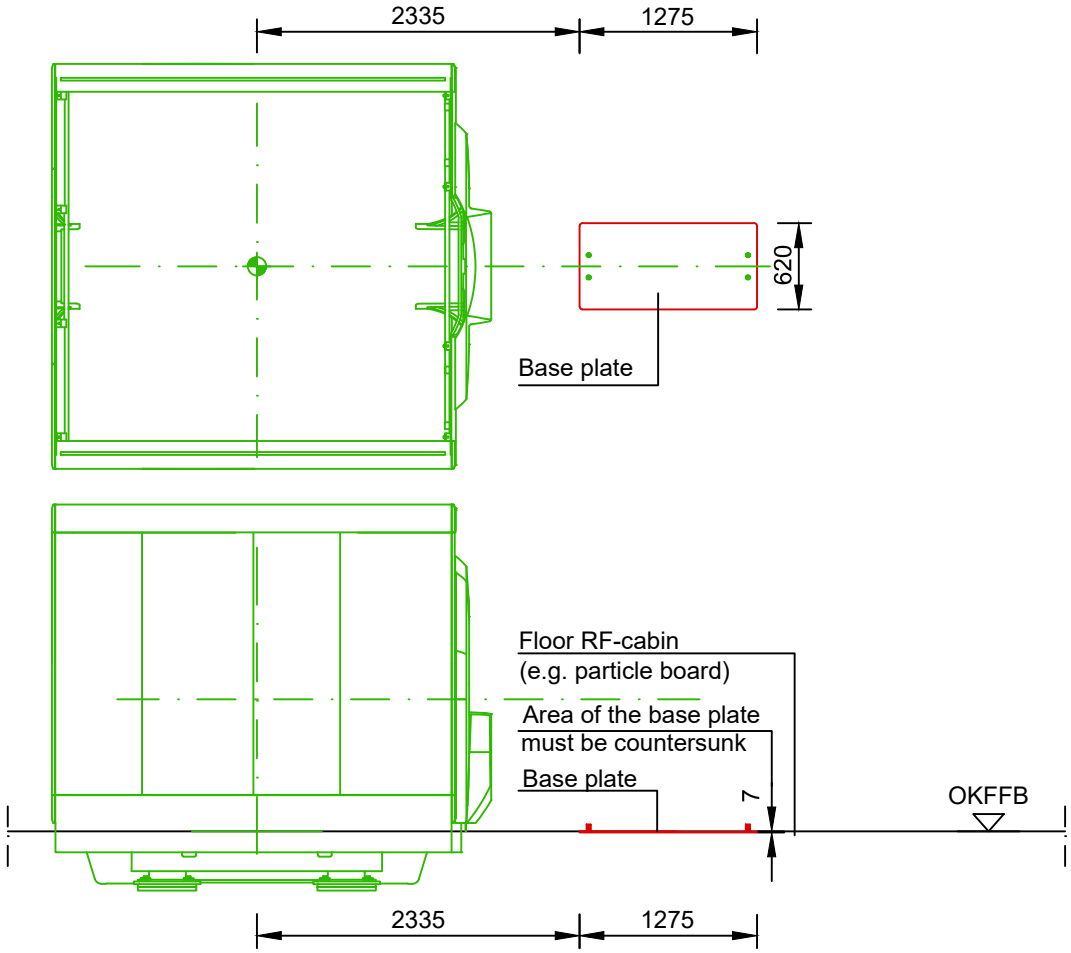
Flooring

An antistatic floor covering is necessary. The floor in the vicinity of the magnet and patient table (3.0 x 7.0 m) must be levelled to within max. ± 1.5 mm . The loading capacity of the flooring must be designed with the weight of the respective system components in mind.

Area of base plate in the RF-cabin

not to scale

Detail base plate fixed patient table



Note: The particle board and the base plate will be covered by the floor covering

Quench Pipe

Quench pipe

A thermally insulated tube (quench pipe) made of non-magnetic metal must be fitted from the super-conducting magnet to the outside of the building in order to vent the vaporizing helium gas. Exact design information must be obtained from Siemens Healthineers Project Manager.

Cryogens

Liquid helium (He) and also helium gas are required for operation of the superconducting magnet. The transport of these liquid gases to the examination room requires the use of special vessels. The size and weight of the vessels should be checked with the local cryogen supplier.
If the magnet can not be filled from the left service side, a long helium transfer line has to be ordered for the refilling process!

General Information

Display screen workstations

For setting up display screen workstations, take account of the guidelines in the Display Screen Workstation directive as well as any national regulations (e.g. EN ISO 9241-5).

Smart Remote Services (SRS)

Smart Remote Services (SRS) is used for remote diagnostics as well as remote service to provide highest system availability. Requirements:
- Broadband connection (minimum 10 Mbit/s down- and upstream, optimum 50 Mbit/s down- and upstream) without time or volume limitations
- The computer hosting of the Teamplay Receiver requires access to the hospital intranet and the internet. It should have a at least 6 Mbits/s upstream to the internet and at least 100 Mbits/s downstream from the internet.
- Router (for exclusive use with SRS)

Data protection and security is defined in the Smart Remote Services security concept.

Network Integration

The Siemens Healthineers components are using TCP/IP Protocol, a 100/1000 Mbit/s switched Ethernet network and static IP addresses.
The required network cabling (min. CAT 5 TP) has to be provided on site. Media converters, which are needed for using fibre optic cabling, are not in scope of delivery.
To prepare the implementation of the new system into the existing network environment, the availability of the needed network data at least two weeks before starting the installation is mandatory.
This is the only way to ensure a seamless integration of the new system into the workflow of the department.

Safety distances

Distances from moving parts of the medical device to walls, furniture and other equipment have to be kept to avoid injuries by crushing in compliance with local regulations, e.g. a minimum distance of 50 cm according to EN ISO 13854.

It is the customer's responsibility to ensure the above requirements are followed. This is to avoid the risk of injury.



If safety distances are not maintained appropriate on-site safety measures have to be put in place. Clear visible markings according to national guidelines, e.g. crushing warning signs, hazard warning tape, hazard area cordon, safety mats, may be required.

Site readiness guidelines

The following general conditions are necessary to have the status of "Ready site":

1) Proper power available at Siemens Healthineers Equipment Power Cabinet location and all power outlets functioning
2) Air conditioning / humidification systems complete, tested and functioning properly according to Siemens Healthineers specifications.
3) RF enclosure, infrastructure of the examination room complete.
4) The quench line must be available for immediate use to allow suitable venting for the magnet during installation.
5) Plumbing complete except for any final connections to Siemens Healthineers equipment.
6) All cable trays, ducts, conduits correctly sized, located and installed according to the Siemens Healthineers drawings
7) Room for equipment installation and immediate vicinity is dust-free and is to remain so for the duration of the installation.
8) Customer approval for Siemens Healthineers Remote Service (SRS) connection and customers IT. Contact information and IP adress established.

Notes on preparations for installation

Contracts for performing and supervising on-site installation preparations should be concluded with technically competent companies by the customer. The customer is responsible for timely and proper completion and supervision of all preparations for installation at the construction site in observance of all applicable legal regulations (e.g. X-ray regulations, radiation protection regulations) and all applicable general recognized rules of technology (e.g. VDE regulations, DIN standards).
Execution and supervision of installation preparations at the construction site and later observance of the standard operating conditions are not included in our duties. The customer is responsible for checking the static calculations and, where applicable, the air conditioning in the building to be equipped.

Siting requirements for the magnet

The siting of the magnet must be such that during operation neither external influences affect the homogenity of the magnetic field nor the safety of persons and/or the functioning of sensitive equipment can be affected by the stray magnetic field.

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