ESAOTE

THE IMAGE OF INNOVATION™

E-SCAN XQ

DEDICATED MRI

MR

Service Manual
Site Planning Guide

Replaces: VER.C

English
Doc.Gen.: Nov/2005

8300096028 VER.D DGT NE

Document revision level
The document corresponds to the version/revision level effective at the time of system delivery. Revisions to hardcopy documentation are not automatically distributed.
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Part 0 Table of Contents

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Part 1 Introduction

General

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This planning guide provides a description of the items to be considered when planning the installation of the system in order to assure its safe operation.

Like other MR systems, the system is sensitive to RF interference. Therefore, a modular optional pavilion is used to shield the system from external RF noise. If already in place, a standard RF cabin can be used instead.

As the system has an open architecture it is also more sensitive to low frequency magnetic field fluctuations than a closed system. Up to a certain limit, the system's EFI unit can compensate for these fluctuations.

To ensure that the external RF noise and the magnetic field fluctuation do not exceed the specified limits, site survey measurement has to be performed (see also RF and Magnetic Field Interference and Annex 2, Preliminary Site Survey).

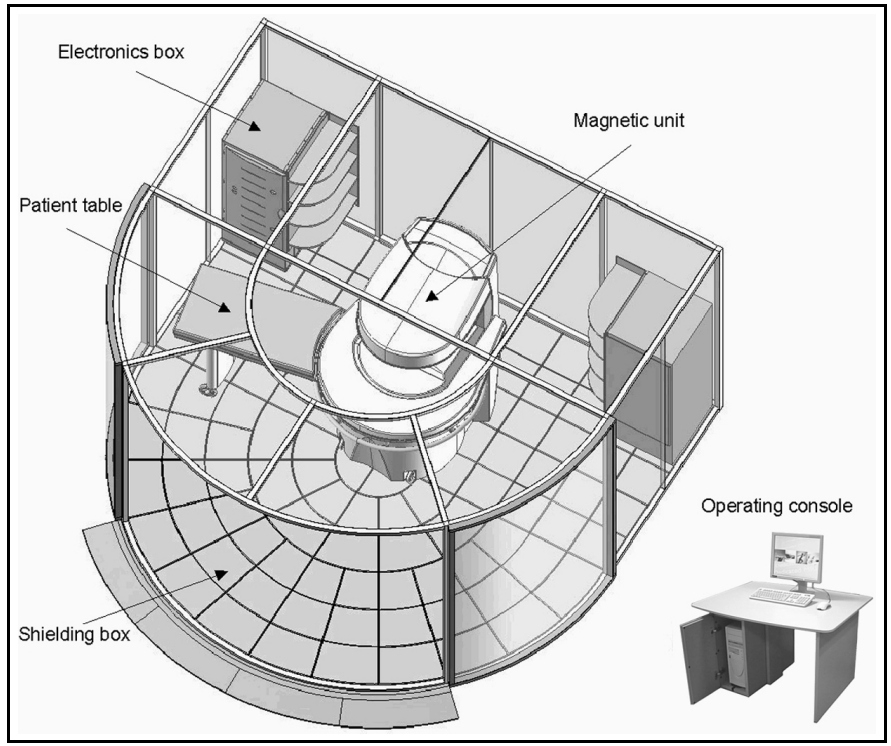
Refer to Annex 1 for an overview of actions to be taken while planning a system installation.

System Components

Refer also to the next figure:

- Magnet unit, including a vertical magnetic field type permanent magnet
- Patient table
- Operator console, including Computer Unit, monitor, keyboard and mouse
- Modular shielding pavilion (optional)
- Electronic box (can be placed left or right Pavilion corner)
- Phone outlet for modem and Network (from the Computer Unit)
- Cable duct (only three cables from the Electronic Box to the Computer Unit)
- EFI unit to compensate for magnetic field fluctuations (not shown in figure)
- Coil rack (optional, shown in figure in the right Pavilion corner)

Fig. 1: System Components



Optional Modular Shielding Pavilion

The optional modular shielding pavilion protects the System from external RF noise. The attenuation of the pavilion is at least 70 dB at a frequency of 7.8 MHz.

The pavilion has been designed in such a way that it can be installed with minimal effects on the room infrastructure.

The Pavilion is not provided with the system: it has to be ordered.

The pavilion is composed of modular elements made of perforated steel panels that are attached to steel support frames. This construction allows the pavilion to use the same lighting and ventilation supplied to the room. It eliminates the need for a dedicated air conditioning system and possibly even internal lighting as well.

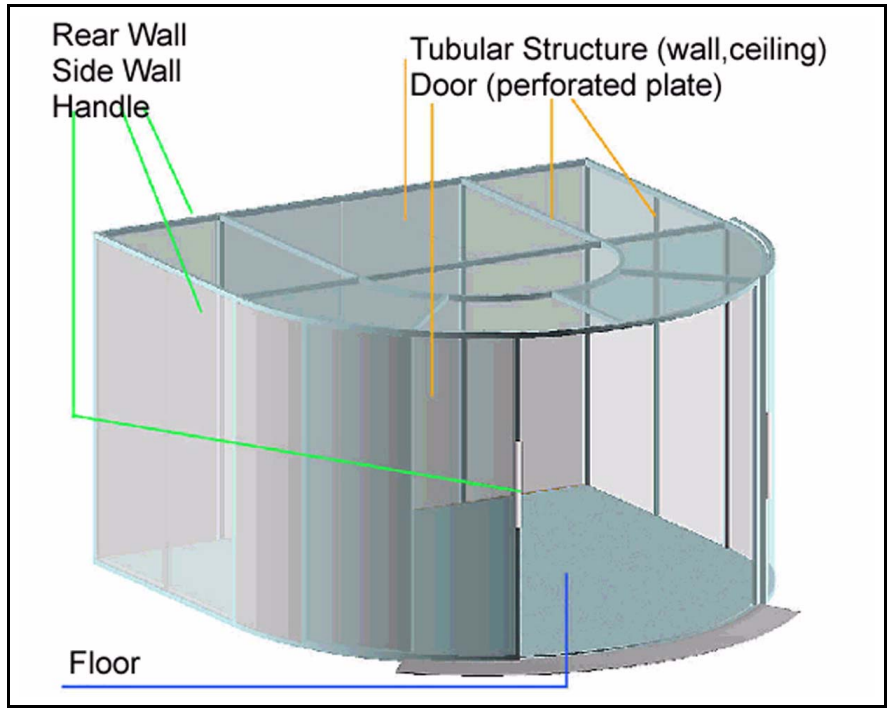
There are two sliding doors available for access. For better adaptation to the room layout, the doors can be mounted either centrally or half-left or half-right with regard to the center position.

All the parts are assembled with hardware that makes it easy to disassemble and reinstall the pavilion. The size and weight of the modules make handling easy.

The pavilion can be completely mounted from inside. Therefore, the pavilion can even be installed in corners, partitioned-off rooms or rooms slightly larger than the pavilion itself.

NOTICE	Ensure that a craftsman is available for covering the floor of the pavilion with linoleum (supplied) after siting the magnet unit

Fig. 2: Pavilion 3D view



The doors can be installed on the right side and on the lateral side, instead of the central position, as is shown in the follow picture.

For the Pavilion dimension refer to the Dimension of System Components paragraph of the Part3: Technical Data.

Fig. 3: Pavilion layout right door

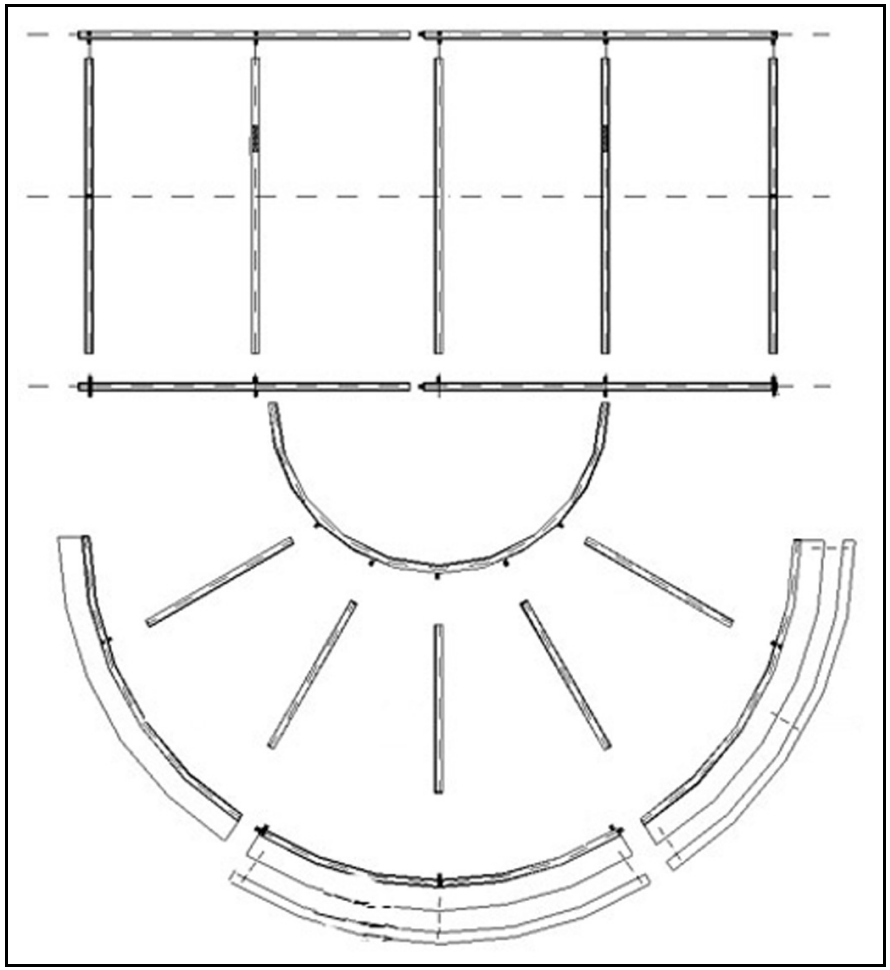
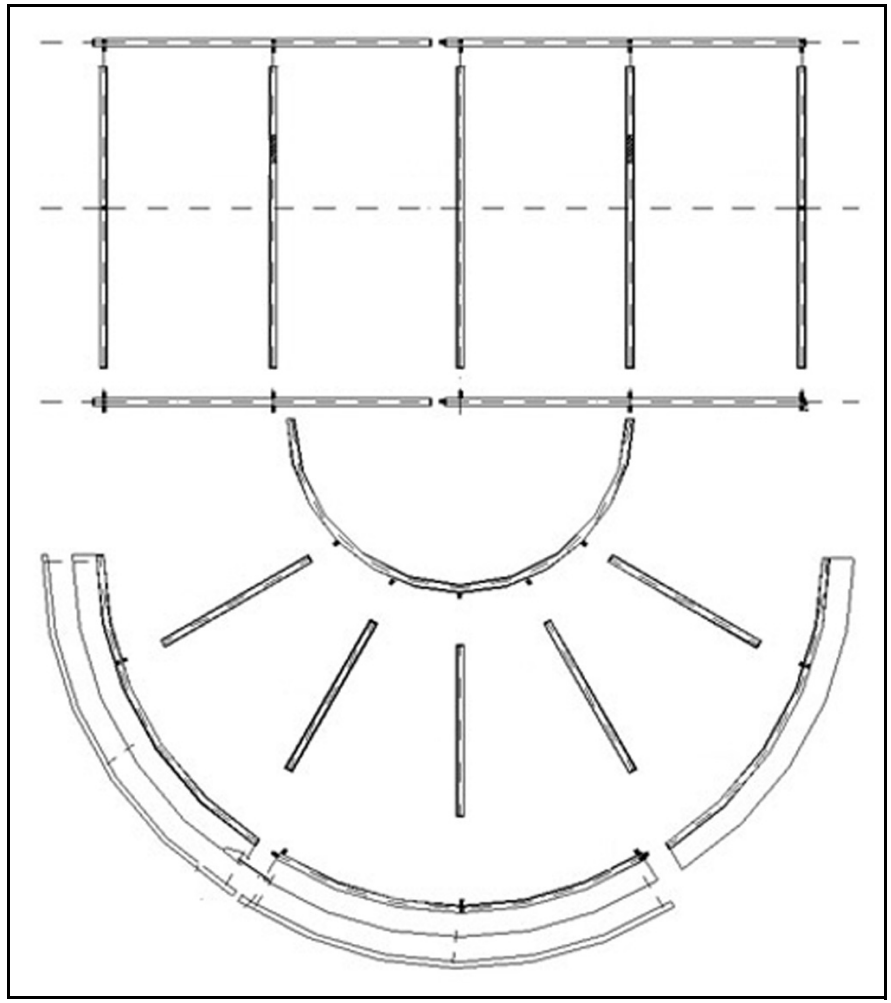


Fig. 4: Pavilion layout left door



Patient Routine Monitoring

To guarantee acoustic and visual contact between the physician and the patient during examination, the system has been equipped with a semi-transparent Shielding Box.

The acoustic contact feature is achieved through the use of perforated metallic panels for the Box mechanical structure, while appropriate Shielding Box inside and outside lighting achieves visual contact.

NOTICE	The Pavilion is an option

If the system is installed inside a traditional shielding cabin the following restrictions should be kept in mind:

- The cabin should be equipped with a window with a grid to enable acoustic contact between the physician and the patient. As on alternative an intercom system has to be used to ensure a possible communication between the patient and the operator. The intercom has to be ordered locally (not available from ESAOTE). It must not create interference to the MR system
- The pavilion inside and outside lighting should be properly set for visual contact; moreover the system installation position should be frontal to the window in order to enable the physician to check the patient through the magnet C shaped opening during the examination

Safety Notes

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The magnet installed in the scan room is always under field and attracts magnetic material. The apparatus and instruments to be carried into the pavilion should be non-magnetic. Gurneys, stretchers or other large metallic objects, which may possibly be attracted to the magnet, can be dangerous. It could be useful to differentiate these objects from the standard furnishings through the use of color-coding.

Items must not be brought into the pavilion unless they are made of non-magnetic material.

In general, people must be prohibited from entering the scan room. Local regulations require that warning signs be posted with respect to possible malfunctioning of instruments or pacemakers due to the fringe magnetic field. Preventive measures must be taken with regard to this.

A warning sign calling the attention of the hospital workers and patients entering the scan room must be posted (refer also to next figure). Carrying a watch, credit card, etc., into the pavilion may cause them to malfunction.

Fig. 5: Warning Sign

Part 2 Planning

Room

Room Size

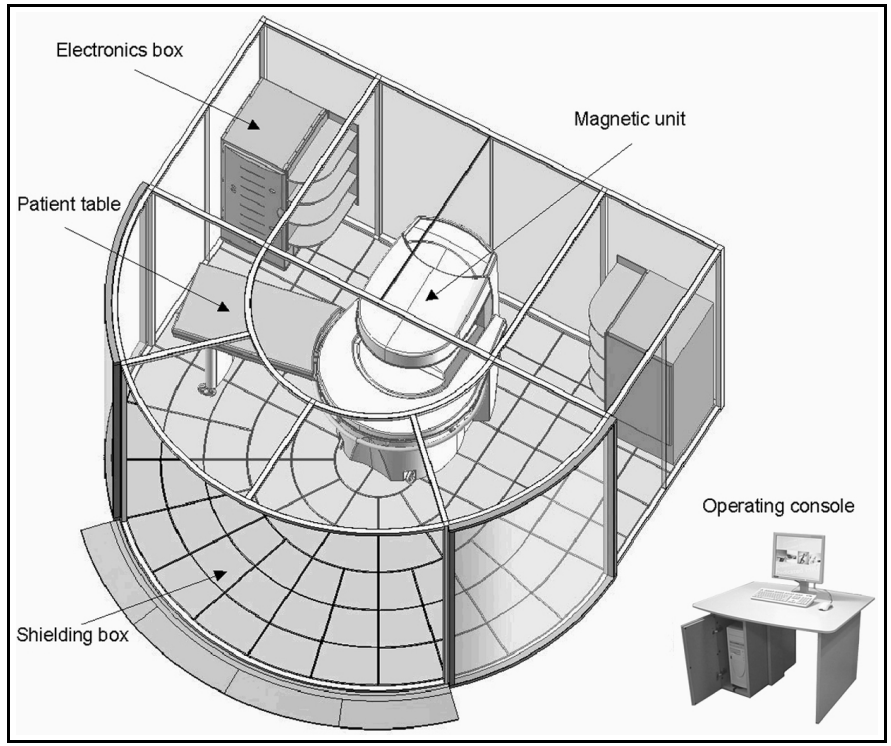
Only one room is required to install the system.

The minimum space required for the installation of the system, including the pavilion, is 4.0 m x 4.5 m x 2.4 m.

Tab. 1: Minimum Space Requirements

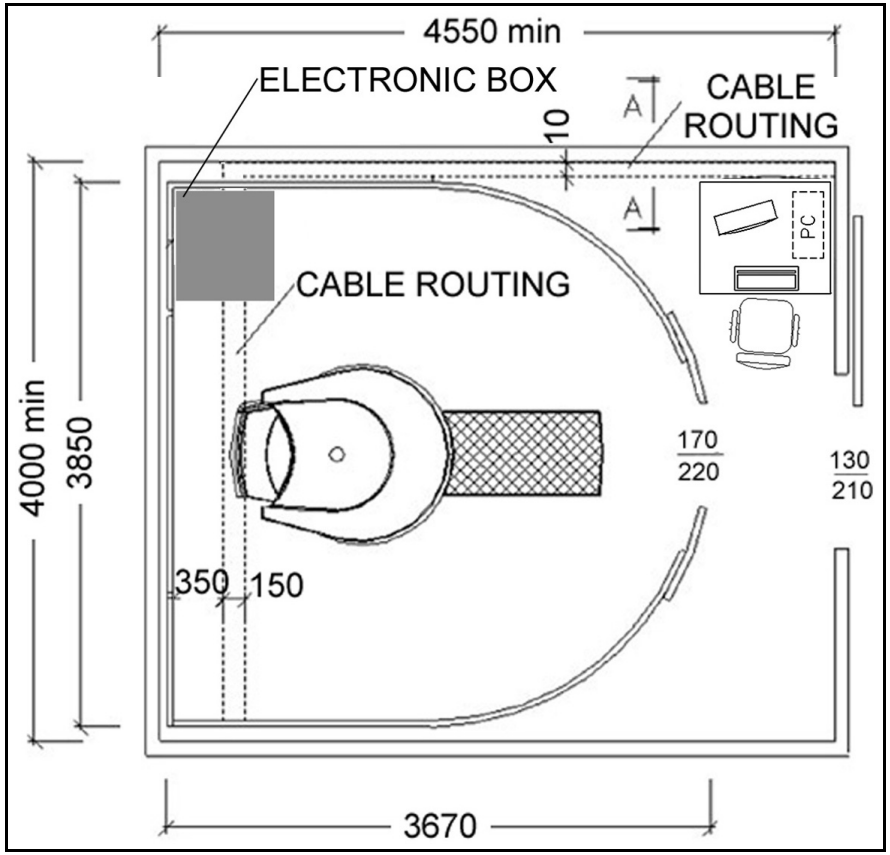
Minimum Space Requirements
4.0 m x 4.5 m x 2.4 m

Fig. 6: Magnet and Pavilion View



Recommended Room Configuration

Fig. 7: Recommended Room Configuration



Floor

Floor Load

The floor must be able to support the weight of the magnet unit (2100 kg), pavilion (1300 kg), operating console (50 kg) and three people (250 kg). Therefore, the floor may have to be reinforced to sustain a total load of 3800 kg.

Tab. 2: Floor Load Requirements

Floor Load Requirements
3800 kg

Floor Leveling

In order to allow the pavilion to be installed directly on the floor, the floor must be leveled to within 5 mm / 3 m.

Tab. 3: Floor Leveling Requirements

Floor Leveling Requirements
5 mm / 3 m

NOTICE	The floor leveling must be maintained very carefully after system installation

Iron plates in floor

Tab. 4: Iron plates in floor (static interference)

Iron plates in floor (static interference)
<30kg/m^2

RF & Magnetic Field Interference

The surroundings of any MR-site must be examined very carefully. In the case of System sites, it is imperative to check for external magnetic and RF interference (EMI and EFI) at an early stage of the project. This check is called a “site survey” and consists of a set of measurements that must be performed by a site survey specialist. These results are then compared to the corresponding specifications (refer also to table 5 and to table 6).

The first step is to complete the Preliminary Site Survey Report (refer to Annex 2) during the sales phase of the project, and to return it to your site survey specialist. This information is needed in order to estimate installation costs, the costs associated with the measurement, and to determine whether or not a system can be installed at that particular location. However, the final decision on the suitability of the site depends on the results of site measurements, and not on the Preliminary Site Survey Report.

NOTICE	Both RF noise and magnetic field fluctuations are determined during the site survey using specially designed measuring equipment (SMD, Site Measurement Device).

RF Noise

Because the optional Shielding Box has limited shielding capabilities (≥70 dB at a frequency of 7.8 MHz), the external RF noise must be no more than 40 dB μV/m in at least 95% of the measurements.

Tab. 5: Maximum RF Noise

Maximum RF Noise
40 dB μV/m

NOTICE	IF THIS THRESHOLD IS EXCEEDED IN NO MORE THAN 5% OF MEASUREMENTS DURING THE USUAL WORK TIME FOR THAT MRI SYSTEM, THE INSTALLATION ROOM IS ALSO TO BE CONSIDERED SUITABLE

Magnetic Field Fluctuation

The need for EFI compensation and the shielding method must be determined according to the quasi-static (DC, < 5 Hz) and slow-changing magnetic field fluctuation (AC, 16-20 Hz; AC, 50-60 Hz), All the values below refer to peak/peak fluctuation in the proposed position of the magnet center.

The DC values, measured by SMD, to be considered are the peak/peak variations within a window of ten minutes. When measuring Ac fluctuation you must consider if RMS of peak/peak values have been recorded.

Tab. 6: Maximum Values without EFI

Maximum Values without EFI	
DC (< 5 Hz)	30 nT pkpk (0.3 mG)
AC (16.7 Hz)	6 nT pkpk (0.06 mG)
AC (50-60 Hz)	20 nT pkpk (0.2 mG)

Tab. 7: Maximum Values with EFI

Maximum Values with EFI	
DC (< 5 Hz)	3000 nT pkpk (30 mG)
AC (16.7 Hz)	600 nT pkpk (6 mG)
AC (50-60 Hz)	1000 nT pkpk (10 mG)

In order to keep these values valid, no more than one source must be present within the limit shown in the Maximum Values without EFI table. Particular restrictions apply for moving iron masses (see the next table). Moved iron masses must be further than the distance from the magnet center as defined in the following table.

Tab. 8: Iron Masses Weight

Weight	Moving Direction	
	X (Front-Back), Y (Vertical)	Z (Lateral)
50 kg	5 m	4 m
200 kg	7 m	5 m
900 kg	9 m	6 m
4500 kg	15 m	10 m
20000 kg	25 m	20 m

Regarding AC sources, no cables must run in the ceiling or in the floor of the installation room, especially if their path is not fixed and stable.

Particular Situations

In some cases, it is possible to install the system with even higher magnetic field fluctuation and particularly as reported below:

Tab. 9: Maximum Values for DC with EFI

Maximum Values for DC with EFI	
Underground lines or trams further than 100 m	1500 nT (15 mG)

In this case the transversal component must always be checked and the values must be lower than the Maximum Values with EFI.

Tab. 10: Maximum Values for AC with EFI

Maximum Values for AC with EFI	
Single confined sources, transformers and motors	2000 nT (20 mG)

A very important parameter to take into consideration is the time stability of AC disturbance. The more stable the level of the disturbance, the simpler a good compensation will be.

NOTICE	If MRI equipment is installed near the system, the gradient fringe fields must also be considered and treated as any other external magnetic field fluctuations. For this reason refer to the table Maximum Values without EFI in the previous page

Static Magnetic Field Generated by Other Sources

The Static Magnetic Field generated by other sources (e.g. MRI systems) can influence the System performances. For this reason the fringe field of the external MRI equipment must be at maximum **0.1 mT (1G)** on the external boundaries of the Pavilion.

Tab. 11: Static Magnetic Field

Fringe Magnetic Field of External MRI Equipment
0.1 mT line (at maximum) on the external boundaries of the Pavilion

NOTICE	If this situation occurs, in some cases, the system could require some tuning operations

Minimum Distance to Sources of Interference

If the system needs to be equipped with an EFI unit, the following minimum distances between the corresponding source of interference and the EFI must be observed:

Tab. 12: Minimum Distance to Sources of Interference

Sources of Interference	Minimum Distance
a) AC 50 Hz or 60 Hz	>10 m
b) AC 50 Hz or 60 Hz: Transformers, fans	>10 m
c) AC 16.6 Hz or other train frequencies	>400 m
d) Moving iron (dynamic interference)	
– <50 kg: Wheel chair, etc.	Refer to Tab.8
– 200 kg: Patient bed, etc.	Refer to Tab.8
– 900 kg: Car, small elevator, etc.	Refer to Tab.8
– >4500 kg: Truck, large elevator, etc.	Refer to Tab.8
– >20000 kg: big Truck, Excavator, etc.	Refer to Tab.8
e) DC cables from trams or subway	>50 m
f) Iron plates in floor (static interference)	<30 kg/m^2

Environment

To achieve optimum performance from the installed system, it is important to provide patients and operators with a comfortable environment, as well as to meet the temperature, humidity and other environmental conditions that each system component requires.

Tab. 13: Environmental Requirements

Environmental Requirements	
Temperature range	20 - 26 °C / 68 - 78.8 °F
Temperature stability	3 °C/h / 5.4 °F/h
Humidity range	45 - 80%

Fahrenheit = (1.8 x Centigrade) + 32

Centigrade = 0.56 x (Fahrenheit - 32)

Building Vibrations

Building vibrations or shocks affecting the magnet may degrade image quality. Vibrational acceleration a_{max} transferred through building vibrations to the magnet must not exceed the value of

-70 dB(g) for all three spatial orientations in the frequency range from 0 to 100 Hz.

NOTICE	a_{max} is the maximum rms value measured in the Fourier transformation of the recorded signal spectrum

Tab. 14: Building Vibration Requirements

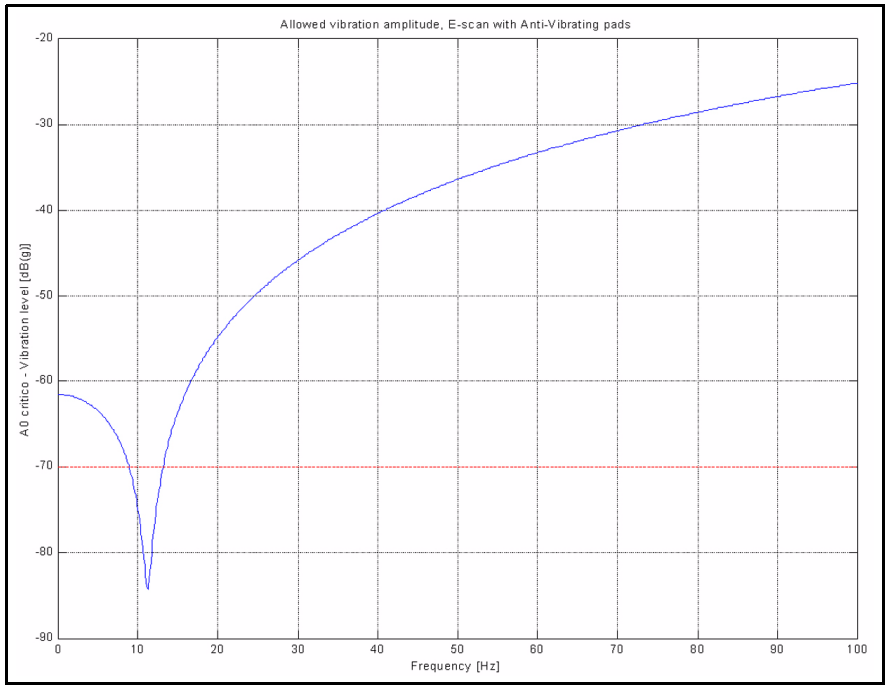
Building Vibration Requirements	
a_{max}	-70 dB(g)

NOTICE	The building vibration measurement must be performed during the site survey acquisition

NOTICE	The presence of other equipment (e.g. MRI systems) in the building, can determine the maximum level of vibrations; therefore vibration measurements must be performed during working hours

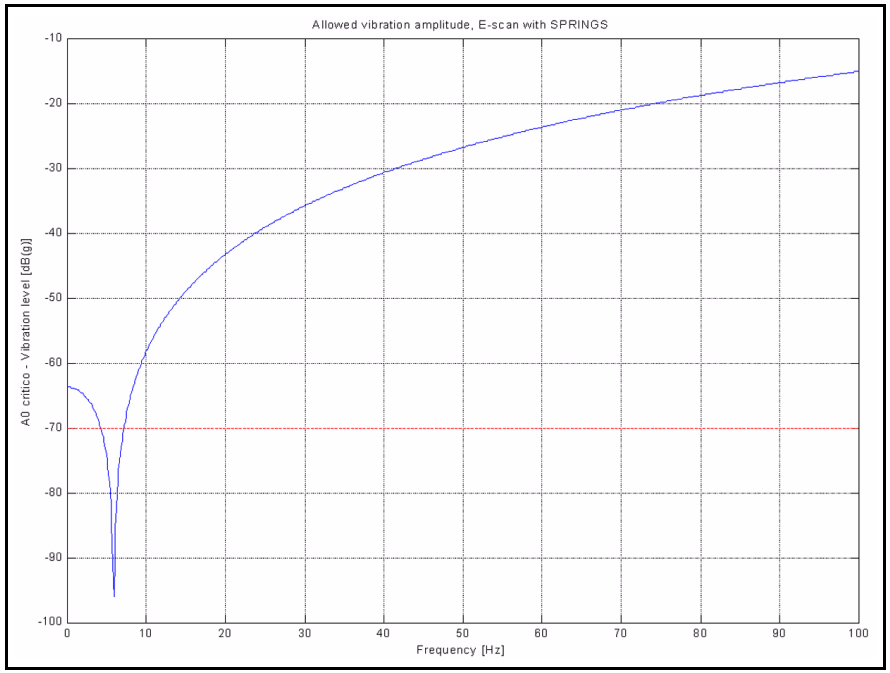
The normal threshold for these feet is fixed to -70 dB(g) from 0 to 100 Hz but we advised a small range of frequencies (from 9 to13 Hz) where the threshold is much more restrictive and equal to -83 dB(g). These frequencies are related to the Foot Resonance Frequency of ≈11 Hz, like shown in the next figure.

Fig. 8: Nornal Anti-Vibrating Feet



The Resonance Frequency of these feet is equal to ≈5.9 Hz and the warning level is for 4 to 7 Hz. In this range the vibration threshold is fixed to -95 dB(g) while in all the other frequencies is fixed to -70 dB(g) like shown in the next figure.

Fig. 9: Anti-Vibrating Feet with Springs



Install the Anti-Vibration Feet with spring in case of vibration at the warning frequencies of the Normal Anti-Vibration Feet.

Tab. 15: Anti-Vibration Feet Warning Levels

Anti-Vibration Feet Warning Levels	
Normal Feet	from 9 to 13 Hz
Feet With Springs	from 4 to 7 Hz

Power and Grounding

Due to the sensitivity of the system to RF interference, great care should be taken when providing the power supply and when grounding the system.

To safely operate the installed system, dedicated power supplies must be provided for the MRI system and the air-conditioner, as well as any lighting equipment and convenience outlets.

A switch box should be provided on the wall of the room, with separate switches for each of the above power supplies to allow system maintenance and service. Simultaneous use of the power supply for the system with air-conditioning, lighting and other electrical equipment is not allowed.

The power requirements are listed in the following table.

Tab. 16: Power Requirements

Power Requirements	
Power requirements	AC 100/110/220/230/240 V ± 1%
Frequency	50/60 Hz ±1Hz
Power	1.3 kVA

Power supply cable

The power supply cable, provided with the system, is a three-wire, 10m long, shielded cable with a 1.5mm^2 section. See the next table for the characteristics of the power supply cable.

Tab. 17: Power Supply Cable Features

Power Supply Cable Features	
Section	1.5 mm^2
Length	10 m

System Grounding

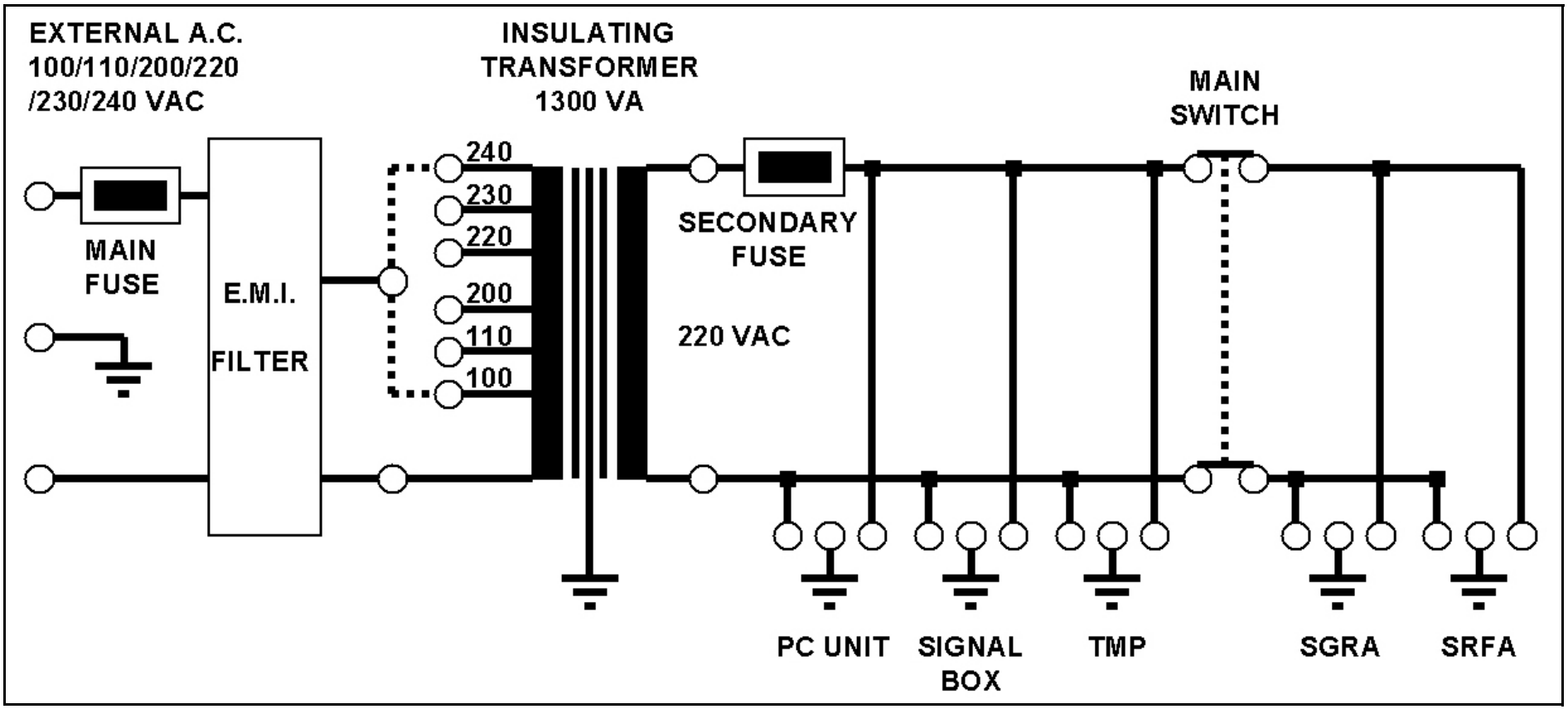
The grounding conductor must be insulated and must not be electrically connected to surrounding structures. To ensure that the system is grounded properly, the modular shielding pavilion is insulated from the floor via corresponding insulating sheeting.

System Main power distribution

Main power distribution

The main power distribution diagram is shown in the next figure.

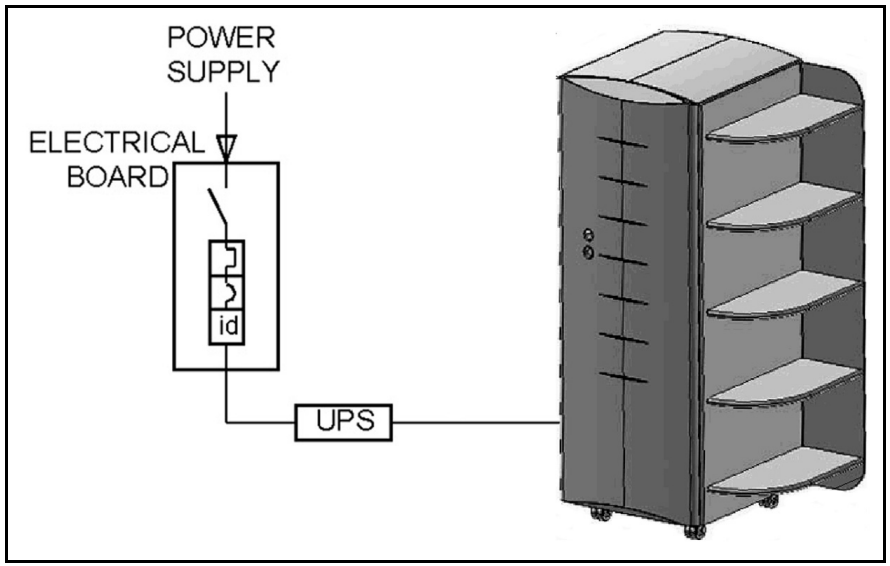
Fig. 10: Power distribution scheme



Main Power Distribution Scheme

The room's power distribution scheme is shown in the following picture. All the parts that the electrical circuits need are displayed in this scheme.

Fig. 11: Room Power Distribution Scheme



Uninterruptible Power Supply (UPS)

Line voltage stabilizers or UPS systems are required in countries with unreliable power supplies. As the magnet needs to be permanently heated to keep its temperature, it's highly recommended to use UPS in case the main power supply is not reliable.

One type of UPS has been tested and released for use with the system: ONEAC, model ON1300I-SN. It must be ordered from the UPS manufacturer.

Power Supply for Air-conditioning

The power supply for the room's air-conditioner of the room must be selected according to the environmental conditions specified in Tab. 13.

Power Supply for Lighting

Due to the special perforated steel sheet, external lighting may be sufficient. If it is not, internal lighting can be used. The filter panel provides dedicated filters for this purpose. Simultaneous use of the system's power supply with the lighting equipment is not allowed.

Lighting Equipment

Due to the special perforated steel sheet, external lighting may be sufficient. If it is not, internal lighting can be used (not delivered). The filter plate provides a dedicated filter for this purpose. Simultaneous use of the system's power supply with the lighting equipment is not allowed.

If internal room lighting is required, the following items must be considered:

Incandescent lamps must be used, and the luminance should be about 200 lux, similar to that of general examination rooms.

Spotlights must not be used for the room illumination due to interference pattern with would be created by the pavilion.

Lights must not be directed towards the magnet to avoid local heating of the iron yoke and changes in the shim of the magnet.

⚠WARNING Fluorescent lamps must not be used either internally or externally since they emit noise.

Light adjustments, if required, should be carried out by switching the number of lights required on or off.

⚠WARNING Light-adjusting devices or thyristor systems must not be used either internally or externally because they emit noise.

Internal Pavilion Lighting

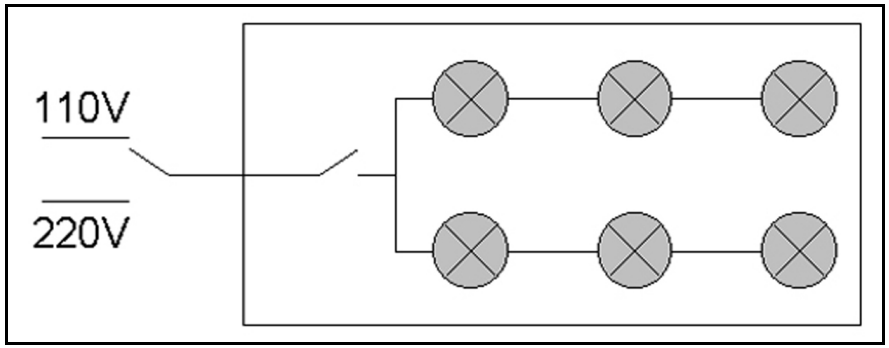
If internal room lighting is required, the following items must be considered. Wiring must be routed through the line filter or outlet line filter installed in a line filter box.

The line filter specifications are shown in Tab. 18:

Tab. 18: Line Filter Specification

Line Filter Specification	
Max. voltage	AC 250 V
Max. current	5 A

Fig. 12: Lighting Equipment Scheme



Convenience Outlets

Emergency Lamp and Smoke Sensor

An emergency lamp and smoke sensor must be shielded if installed inside the scan room. They must be powered through the Filter Panel using the auxiliary plug.

Medical Tubing

The locations of medical tubing (oxygen and vacuum suction) will be determined in accordance with customer requirements.

Electrically insulated tubing (nylon, polyethylene, Teflon, etc.) must be used for applications that are routed through the RF-shielded walls. Metal tubing should not be used for these types of applications since the tubing acts as a RF antenna by introducing external noise into the pavilion.

Insulate the primary-side tubing from the RF-shielded room. An insulated tube and a copper pipe must be connected using a joint that is appropriate to both materials.

For the oxygen the dimensions are 10 - 12 mm (diameter) and 100 mm (length).

Air-conditioning

Air-conditioning should be provided according to the environmental conditions of the room. (Refer to Tab. 13). No air-conditioning duct openings must be installed above the magnet or central control console.

⚠WARNING To prevent magnetic field drifts, the magnet must not be exposed to direct airflow from any of the air duct openings

Because the system has a small magnetic fringe field, standard air-conditioner items (galvanized sheet iron) may be used for the air-conditioning duct and accessories in the scan room.

The air-conditioner for the scan room must operate constantly. The temperature of the scan room must be maintained within a range from 20 °C to 26 °C and with a stability of at least 3 °C/h, even when the MRI system is not in operation. Otherwise, the system cannot be operated.

Connections

Maximum Distance Among System Components

The maximum distance between the PC Unit and the Electronic Box is 5m. For higher distance please order the 17m cable set.

Tab. 19: Maximum Distance PC Unit – Electronic Box

Maximum Distance PC Unit - Electronic Box
5 m (real cable length 8 m)

The cable ducts for the system wiring inside and outside the pavilion are part of the delivery.

The maximum distance between the Magnet and the Filter Panel present in the Electronic box is 1,5m.

Don’t place the Electronic Unit closer to the Magnet to avoid possible interferences.

Tab. 20: Maximum Distance Magnet – Electronic Box

Maximum distance Magnet – Electronic Box
1,5 m (real cable length 2,7 m)

Modem, Network and Camera

Modem

The system includes an external analog modem for Remote Diagnostics purposes. A direct analog phone line should be provided close to the console to connect the modem. The length of the modem cable is 2.15 m.

Tab. 21: Length of Modem Cable

Length of Modem Cable
2,15 m

Network

The system includes an internal network card for LAN connection. An appropriate outlet should be provided to connect to the LAN. The network connection cable is not provided with the system.

NOTICE	The network cable is not provided with the system

Camera

The system can be connected to laser cameras in three different ways: analog (cable), digital (cable and optical link) and DICOM (LAN). For detailed information, refer to the Installation Guide.

Please contact the customer to establish the type of camera connection.

NOTICE	The Camera cable (either analog or digital) is not provided with the system, it must be provided by the camera company/manufacturer

NOTICE	The network connection cable is not provided with the system

Analog Connection

The maximum length of RG 59 (75 Ω) cable for analog connection of the camera is 10 m, so you must provide the correct location for the camera when it is connected in this way.

The cable is not supplied with the system. Please contact the camera manufacturer for the required cable details.

Tab. 22: Maximum Cable Length for Analog Connection

Maximum Cable Length for Analog Connection
10 m

Digital Connection

The maximum length of cable for digital connection of the camera is 40 m. You must provide the correct location for the camera when it is connected in this way.

The cable is not supplied with the system. Please contact the camera manufacturer for the required cable details.

Tab. 23: Maximum Cable Length for Digital Connection

Maximum Cable Length for Digital Connection
40 m

Optical Link Connection

The maximum length of cable for optical link connection of the camera is 100 m. The Optical Link transmitter is connected to the digital output of the Print board.

Tab. 24: Maximum Cable Length for Optical Link Connection

Maximum Cable Length for Optical Link Connection
100 m

DICOM Connection

The system uses the internal network card for DICOM connection.

An appropriate outlet should be provided to connect to the LAN.

NOTICE	The network connection cable is not provided with the system

Cameras

The following models are tested and compatible with the system. For more technical details (e.g.: installation and setup) refer to the Installation Guide, Peripherals chapter.

Kodak

Direct Connection

- DryView 8800/8700 Dual
- DryView 8700 Plus
- DryView 8700 Standard
- DryView 8800/8500 Dual
- DryView 8500 Plus
- DryView 8500 Standard
- DryView 8800/8300 Dual
- DryView 8300 Standard
- M969 HQ
- M969 HQT
- M959 XL
- DryView 8100

Dicom Connection

- DryView 8300 Standard
- 9410/DryView 8700 Plus (also 8700 Dual, HQ)
- 9410/DryView 8100

Fuji

Dicom Connection

- Fuji Film FM-DPL
- Fuji Film Dry Pix 1000 - 3000
- Fuji Film Dry Pix 5000 - 7000

Peripheral Devices

In case you want to install other equipment such as a personal computer inside the room, a minimum safety distance from the pavilion must be at least 3 m according to the CE rules.

Tab. 25: Minimum Distance of External Equipment (PC) from the Pavilion.

Minimum Distance of External Equipment from the Pavilion
3 m

Effects of the Magnetic Field on Peripheral Devices

The fringe field (refer to the “Fringe field distribution” table) may effect the function of devices operated close to the magnet. To prevent interference, the magnetic flux density measured at the location of these devices must not exceed the values in the following table.

Tab. 26: Reference Values for Acceptable Magnetic Flux Densities Bmax

Device	B_{max} (mT)
Small motors, watches, cameras, magnetic data carriers (short-term exposure)	3
Processor, magnetic disk drives, oscilloscope	1
B/W monitors, X RAY tubes, magnetic data carriers during storage, pacemakers, insulin pumps, etc.	0.5
Color monitors with active and passive shielding	0.3
CT systems	0.2
Colors monitor	0.15
X RAY image intensifier, gamma cameras	0.05

Part 3 Technical Data

System Components

Dimensions and Weights

Tab. 27: Dimension of system components

Dimension of system components				
Part	Width (mm)	Length (mm)	Height (mm)	Weight (kg)
Magnet and Patient Table	1244	2495	1564	2100
Electronic Box	526*	632	1467	210
Operating Table Standard	1080	800	740	30
Operating Table High	1100	900	800	35
TFT Monitor 18"	399	404	404-504	8
PC Unit	260	440	430	15
Pavilion (aluminum)	4000	3650	2350	500

* 793 mm considering also the lateral holders

Dimensions of Magnet & Patient Table

Tab. 28: Magnet Dimension without the Base

Magnet Dimensions (without Base) and Weight
650 mm (W) x 850 mm (L) x 790 mm (H) 1800 kg

Fig. 13: Dimension of Magnet Unit and Patient Table

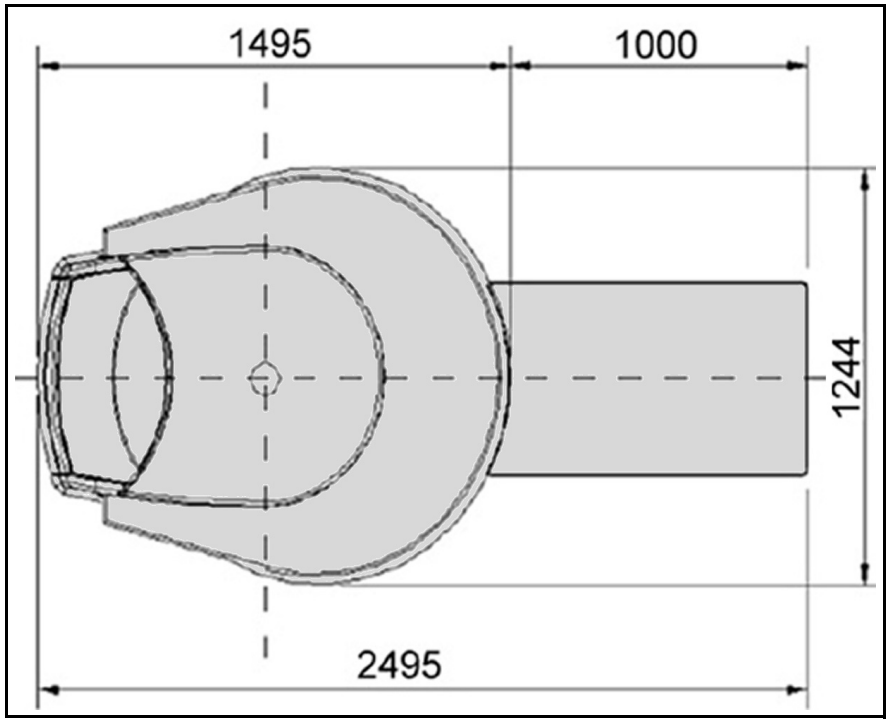
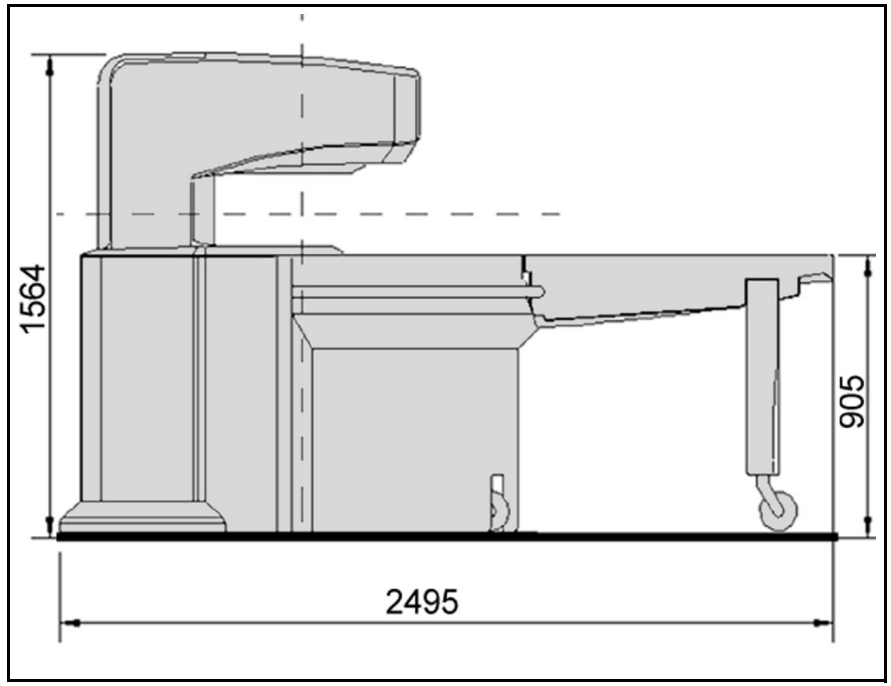


Fig. 14: Dimension of Magnet Unit and Patient Table



Magnet Fringe Field

Fig. 15: Magnet Fringe Field Distribution

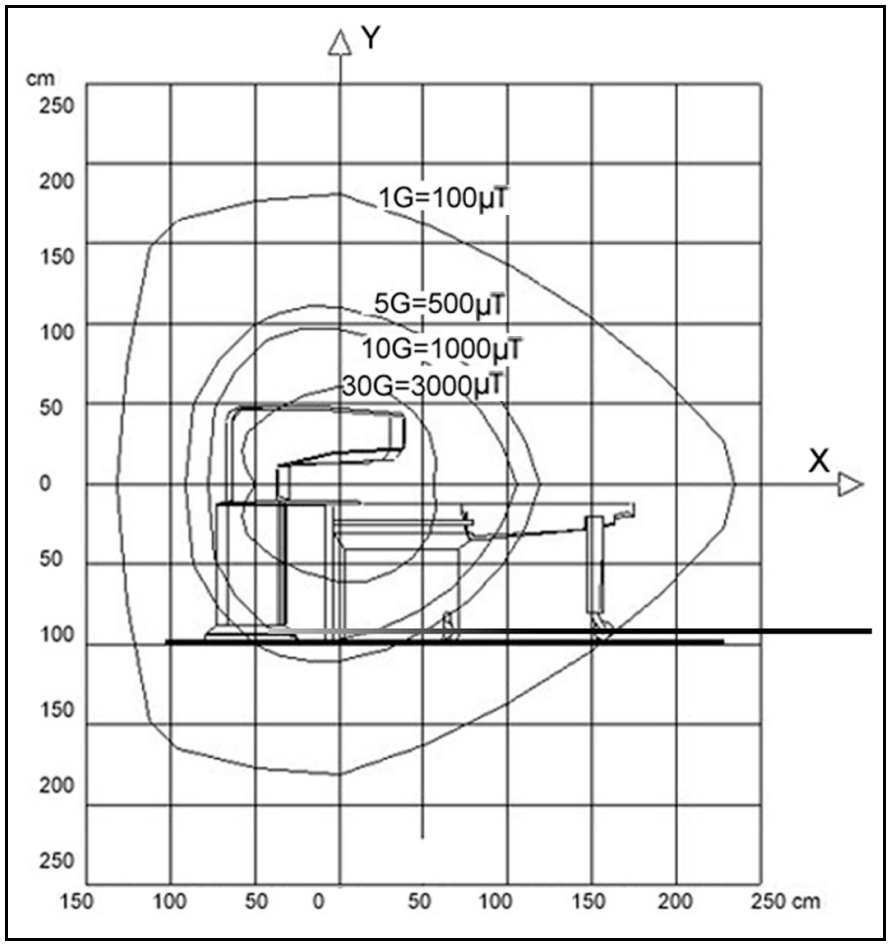
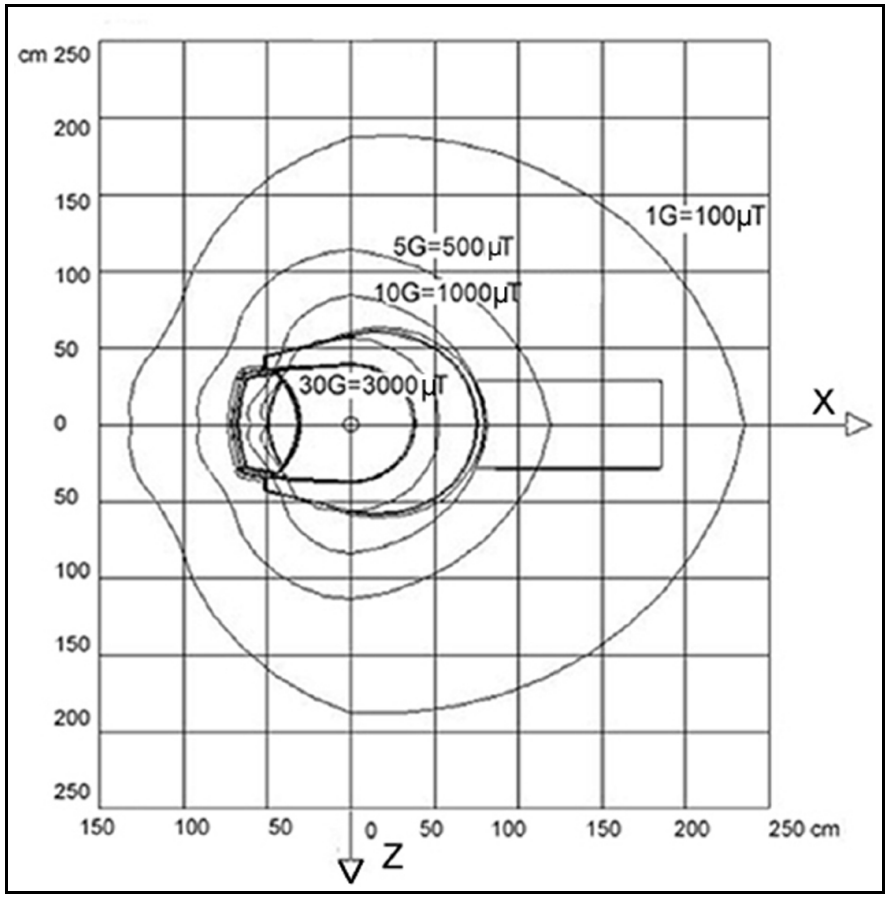


Fig. 16: Magnet Fringe Field Distribution



Tab. 29: Fringe Field Distribution

Fringe Field		Distance from the Magnetic Center in Direction of		
Gauss	**mTesla**	**X axis (m)**	**Y axis (m)**	**Z axis (m)**
30	3	0.5	0.6	0.6
10	1	0.8	1	0.8
5	0.5	1.2	1.1	1.2
1	0.1	2.3	1.7	1.8

Fig. 17: Magnet Fringe Field Distribution

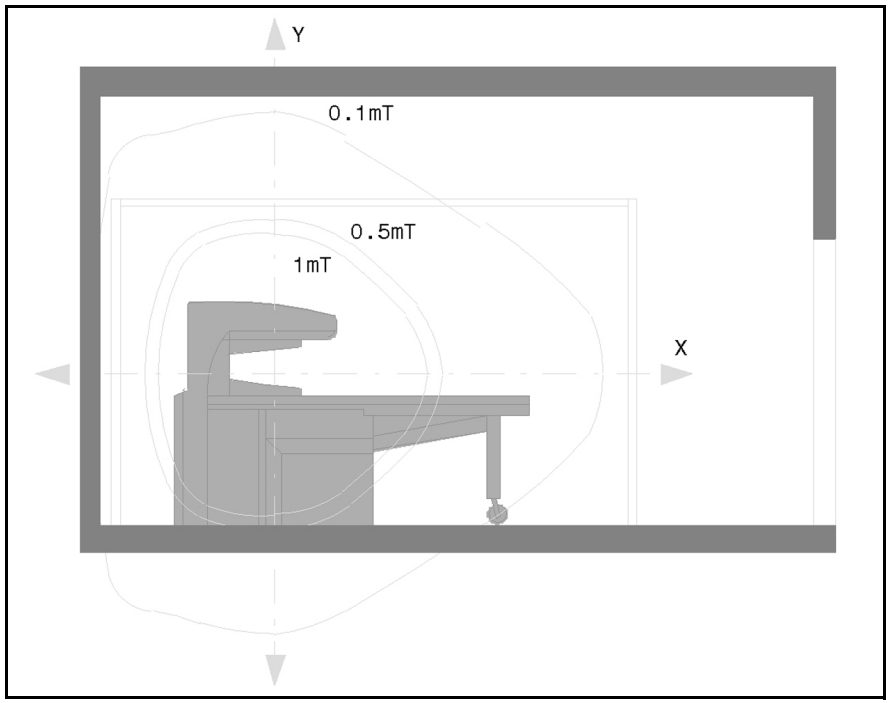
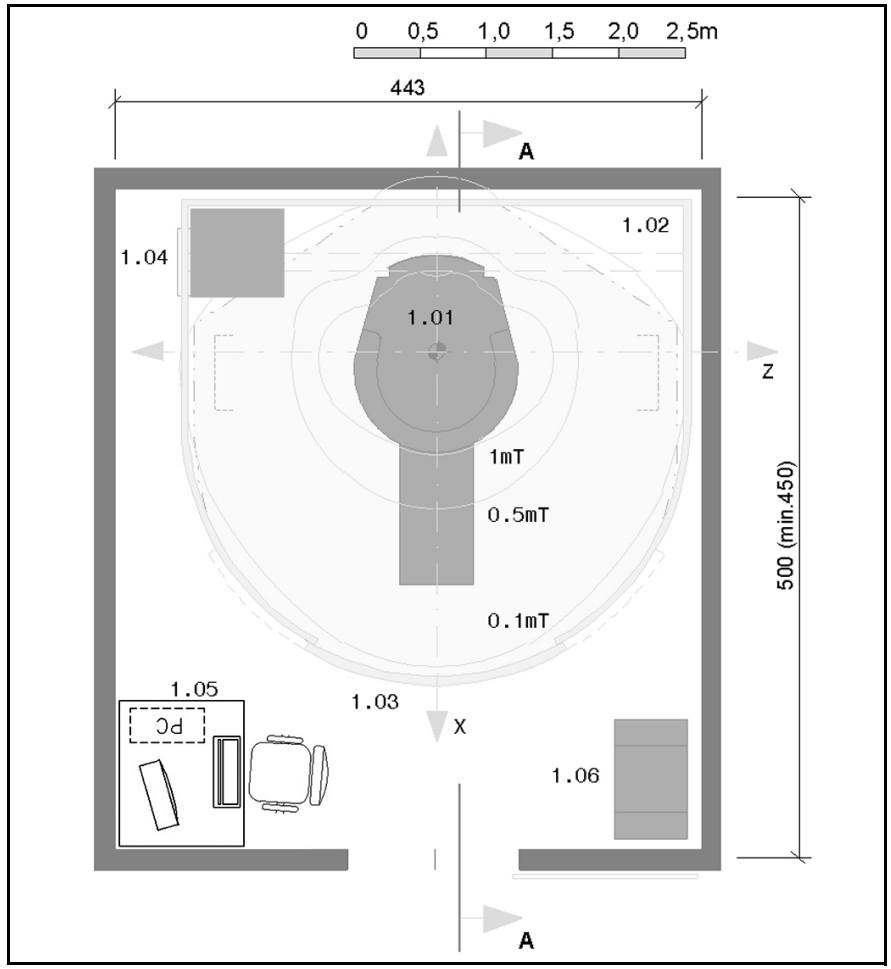
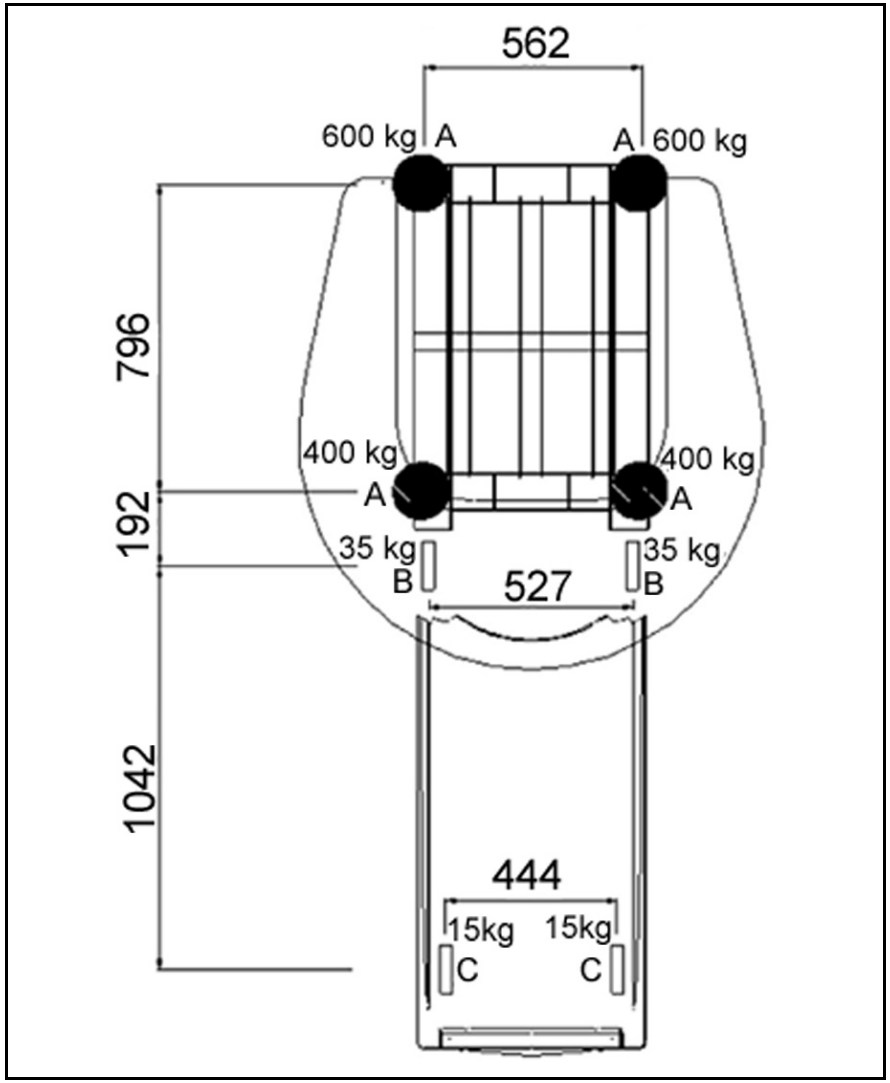


Fig. 18: Magnet Fringe Field Distribution



Load Distribution

Fig. 19: Load Distribution



Electronic Unit Dimensions

Fig. 20: Electronic Unit Dimension

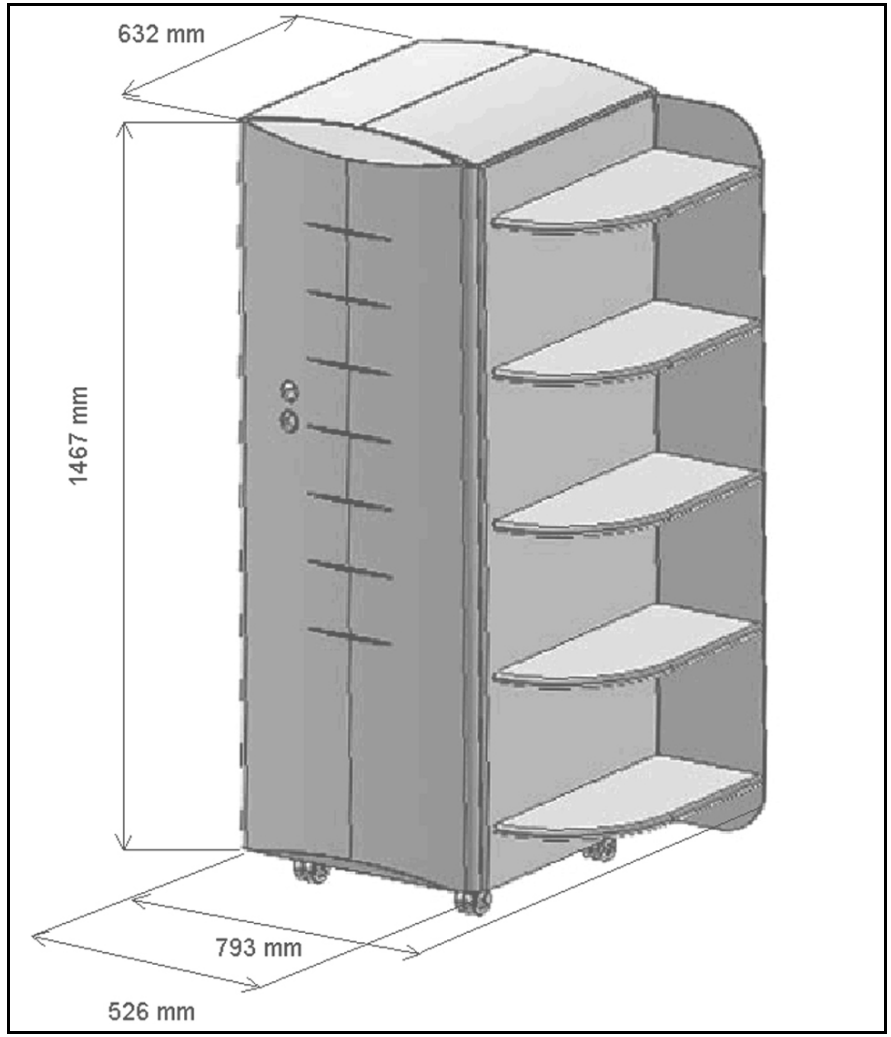
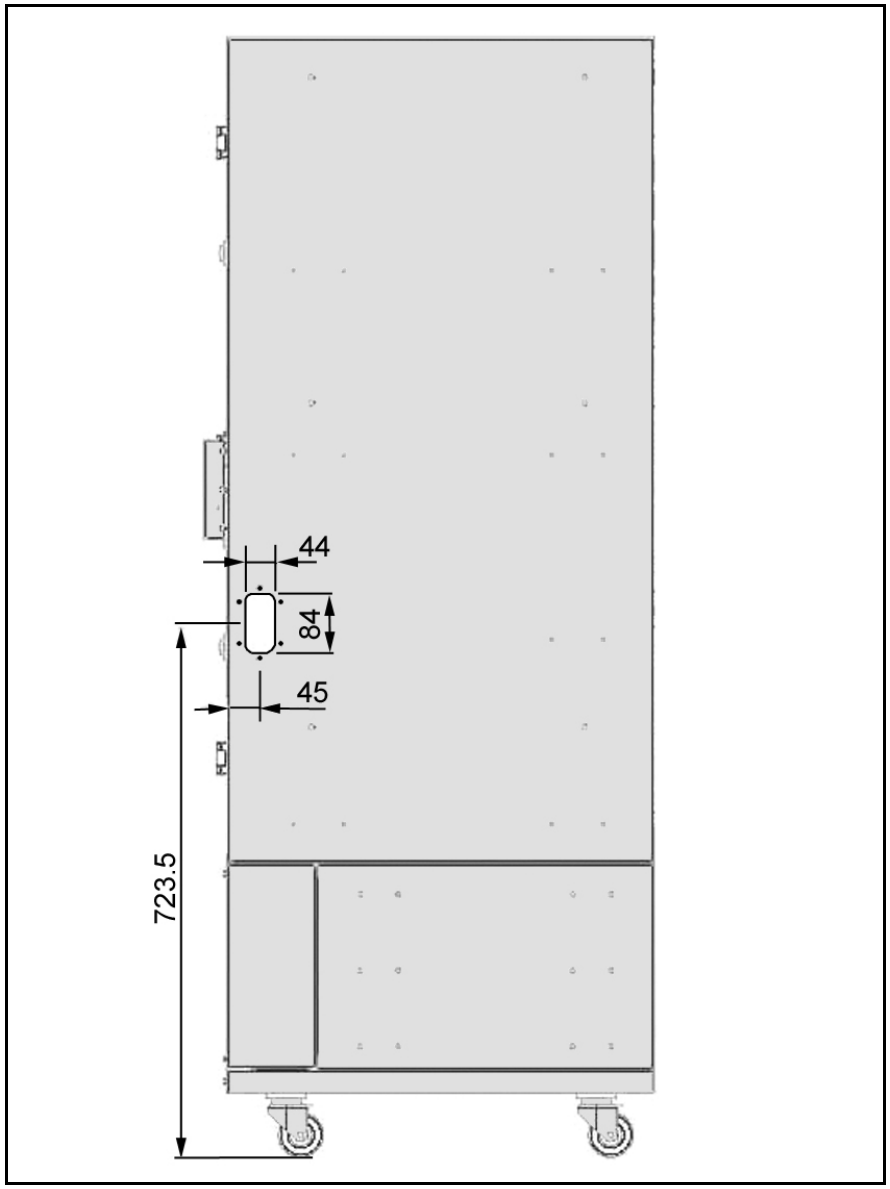


Fig. 21: Position of the Cable Passing Hole (lateral view)



Wave Guide Dimensions

The length of the Wave Guide is 10 cm.

Refer to the Electronic Unit cable passing hole and to the Wave Guide dimensions in case of not ESAOTE Pavilion installation.

Fig. 22: Wave Guide

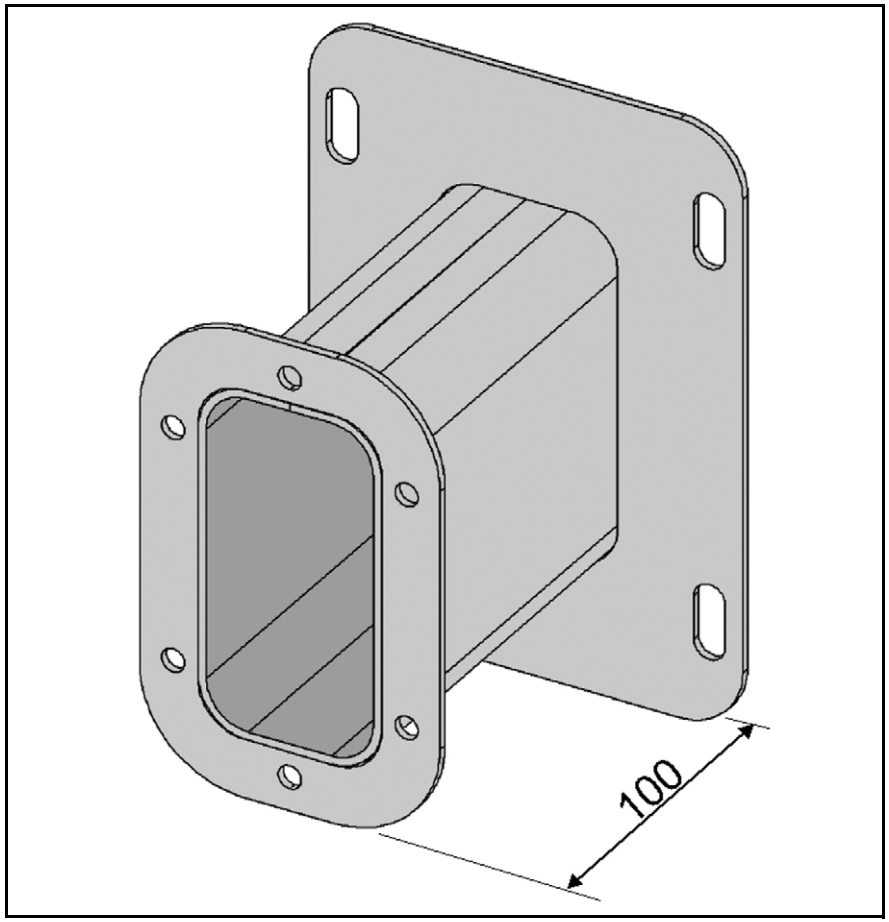


Fig. 23: Wave Guide Electronic Unit Side

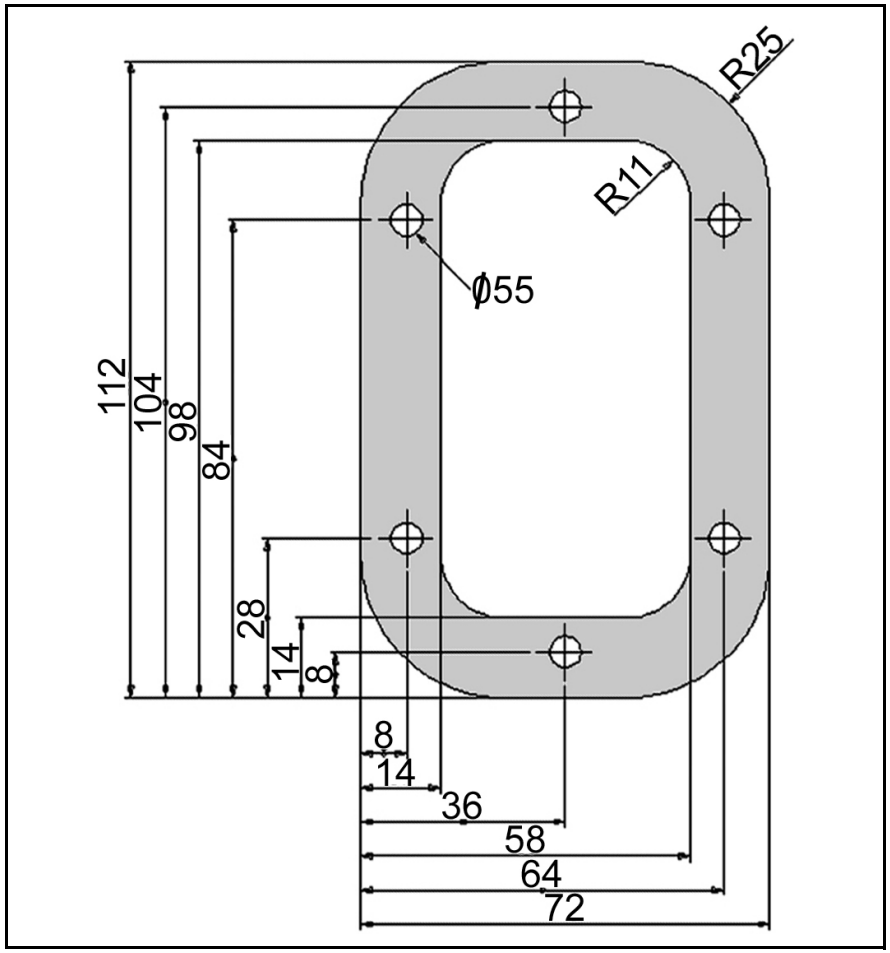
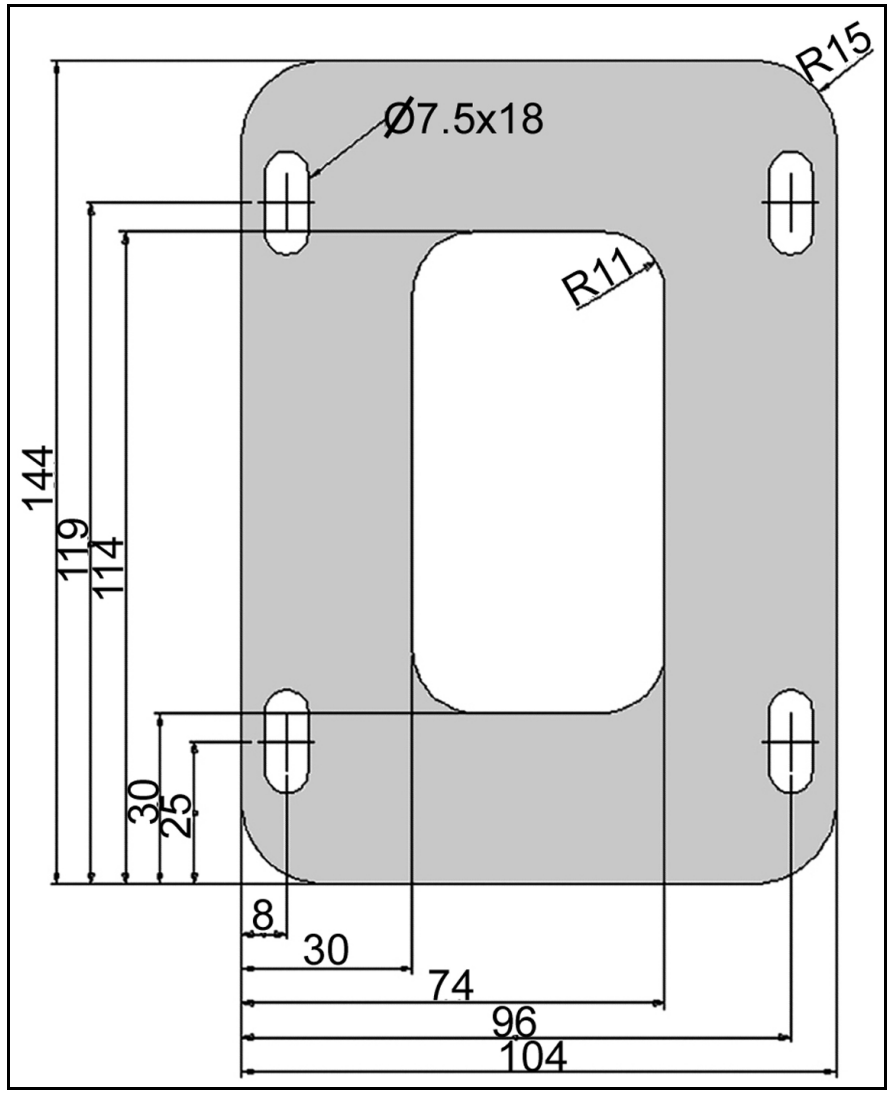


Fig. 24: Wave Guide RF Cage Side



Heat Dissipation

The system (without the laser camera or any other equipment) produces a maximum heat of 400 W.

Tab. 30: Heat Dissipation of System Components

Heat Dissipation of System Components	
Magnet unit and console	400 W

Acoustic Noise

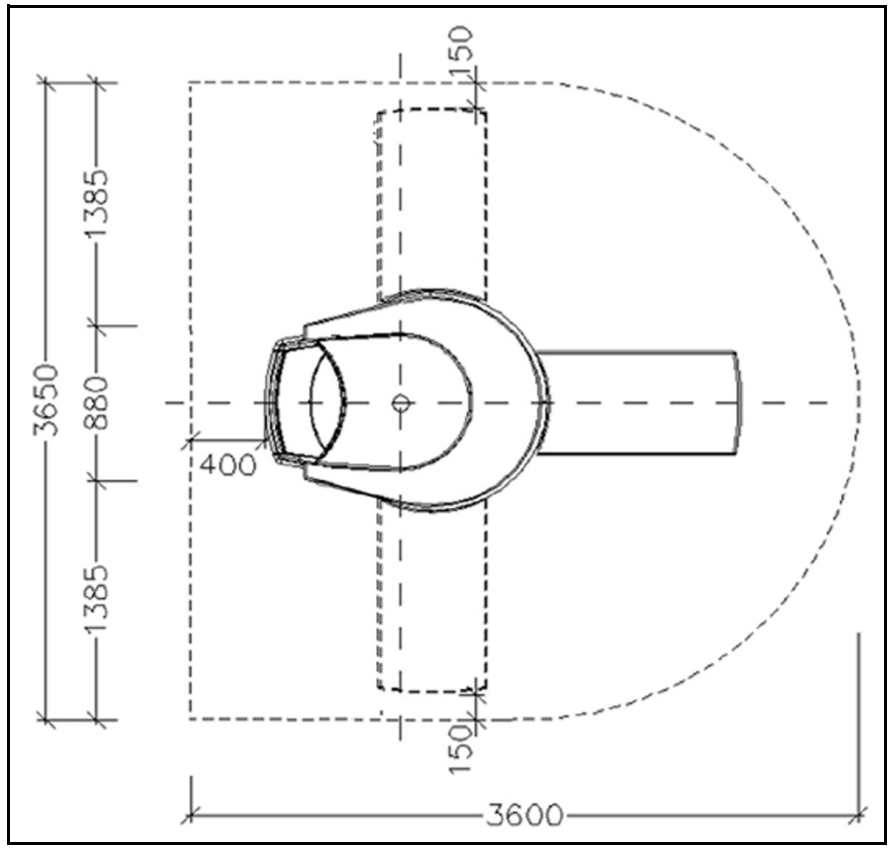
The system console generates a noise of 55 dB (A) measured in the operator position; in other words, in front of the monitor.

Tab. 31: Acoustic Noise

Acoustic Noise
55 dB (A)

Service Area

Fig. 25: Minimum Required Service Area



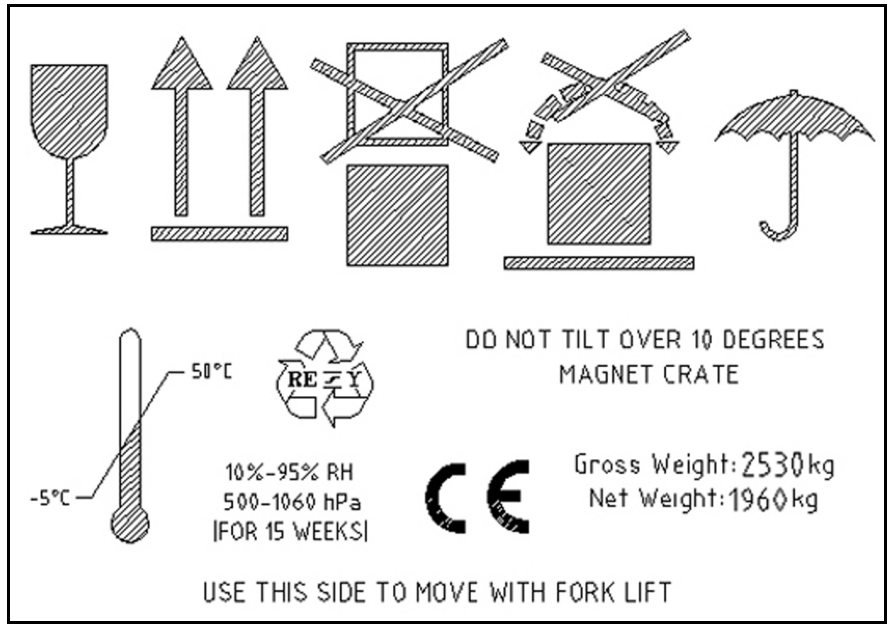
Part 4 Transport & Storage

Crates Dimensions

Tab. 32: Crates Dimensions

Content	Crate weight	Content weight	Size (LxWxH)
Magnet unit	570 kg	1960 kg	171 x 186 x 182 cm
Covers	127 kg	60 kg	140 x 90 x 185 cm
Electronic Box	110 kg	130 kg	126 x 92 x 190 cm
Bed and Monitor	95 kg	128 kg	147 x 76 x 125 cm

Fig. 26: Magnet Crate Label



Transport Conditions

Temperature

When transporting and storing the magnet unit, never exceed the temperature range specified in the following table. Otherwise, the magnet will be damaged.

Tab. 33: Temperature Range during Transport and Storage of the Magnet

Temperature Range During Transportation and Storage	
Minimum temperature	-5 °C
Maximum temperature	50 °C

Humidity

When transporting and storing the magnet unit, never exceed the humidity range specified in the following table. Otherwise, the magnet will be damaged.

Tab. 34: Humidity Range during Transport and Storage of the Magnet

Humidity Range During Transportation and Storage	
Humidity range	10 ÷ 95%

Pressure

When transporting and storing the magnet unit, never exceed the pressure range specified in the following table. Otherwise, the magnet will be damaged.

Tab. 35: Pressure Range during Transport and Storage of the Magnet

Pressure Range During Transportation and Storage	
Minimum pressure	500 hPa
Maximum pressure	1060 hPa

Maximum Tilt

If you have to use a ramp when transporting and storing the magnet unit, never exceed a maximum tilt of 10%. Otherwise, the magnet will be damaged.

Tab. 36: Maximum Tilt during Transport and Storage of the Magnet

Maximum Tilt During Transportation and Storage	
Maximum tilt	10%

Storage

If the upper part of the Magnet crate is removed for storage or transport the following specification illustrated by pictures must be meet.

Tab. 37: Pallet Dimensions

Platform Size
L 143 x W 102 x H 16.5 cm

Fig. 27: Transport and Storage specifications (Magnet and Pallet top view)

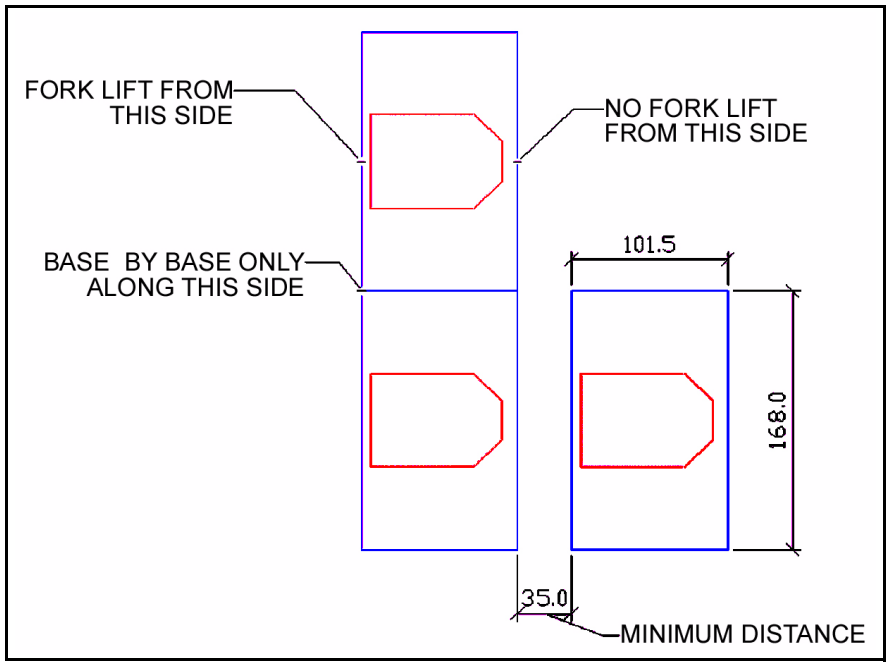
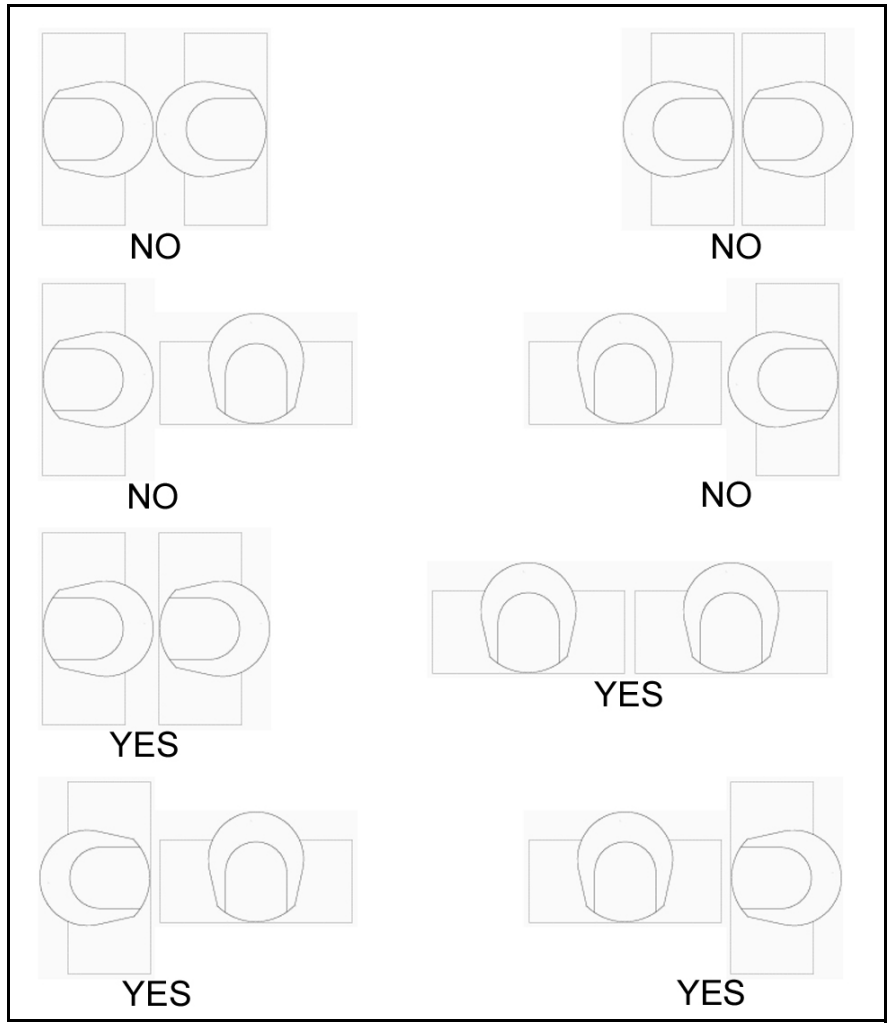


Fig. 28: Transport and Storage permitted and not permitted layouts (Magnet and Pallet top view)



Installation device

A specially designed transportation device is used to site the magnet (for more details refer to the Installation Guide).

Fig. 29: Part of the Transportation Device used to drive the Magnet

Tab. 38: Carriage Device Weight

Carriage Device Weight
25.5 kg (main driving part) + 50 kg (two metallic structure) + 30 kg (four wheels) + 6 kg (hydraulic pump)

Fig. 30: Magnet Transportation Device

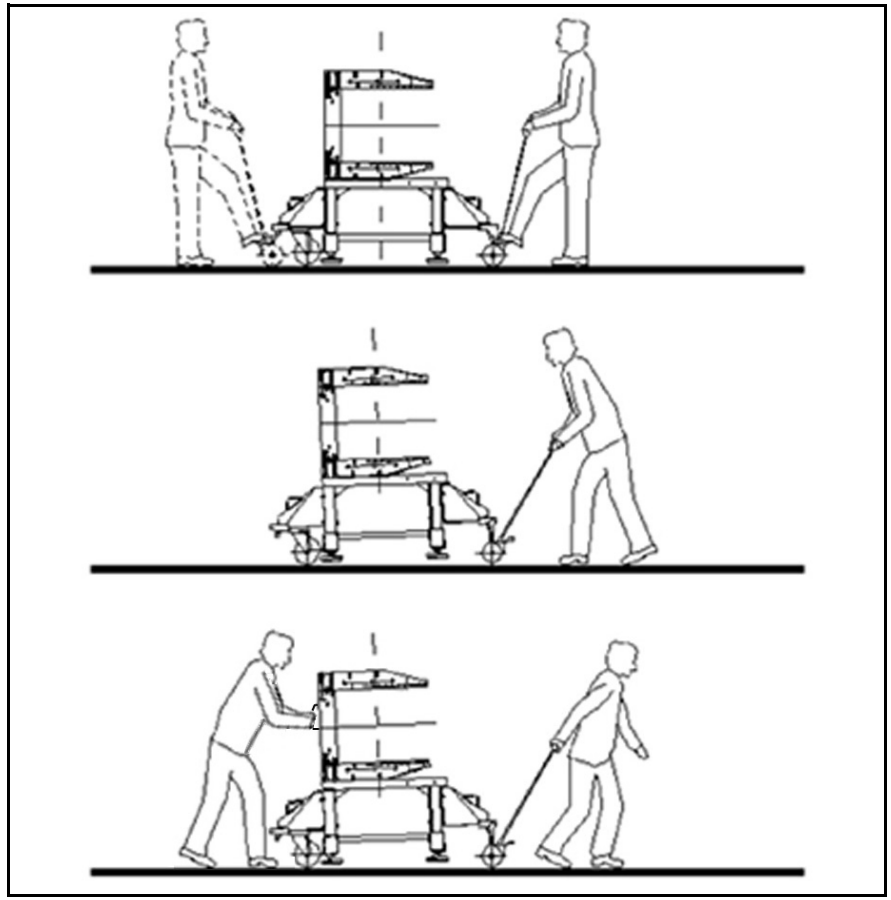


Fig. 31: Magnet with the Installation Kit placed

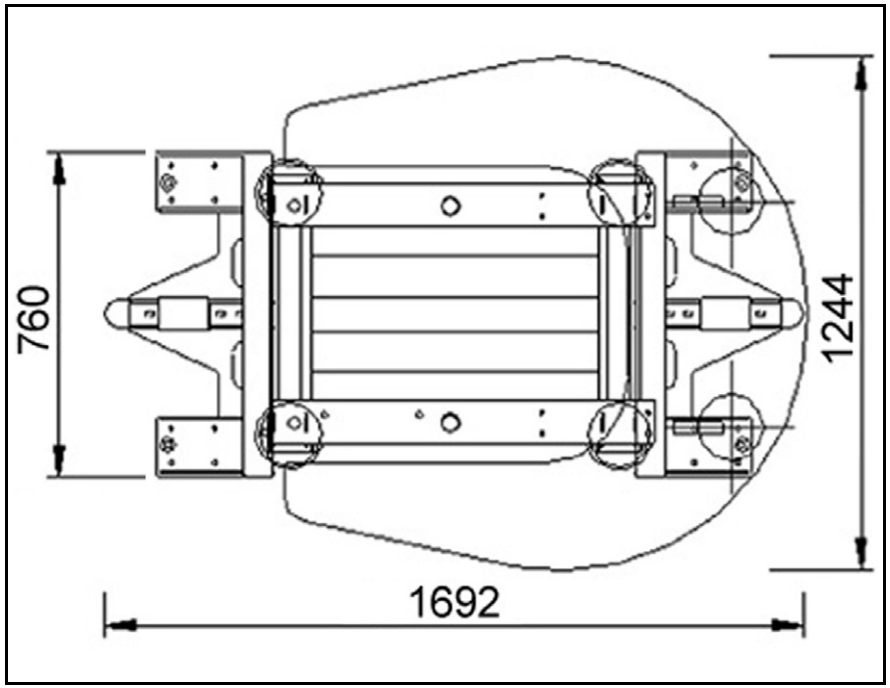
⚠WARNING The above picture is just an example: for safety reason two front wheels must be installed as well with the guide

Fig. 32: How to correctly lift the Magnet using a crane

Passage Dimensions

The standard passage dimension is 1300mm.

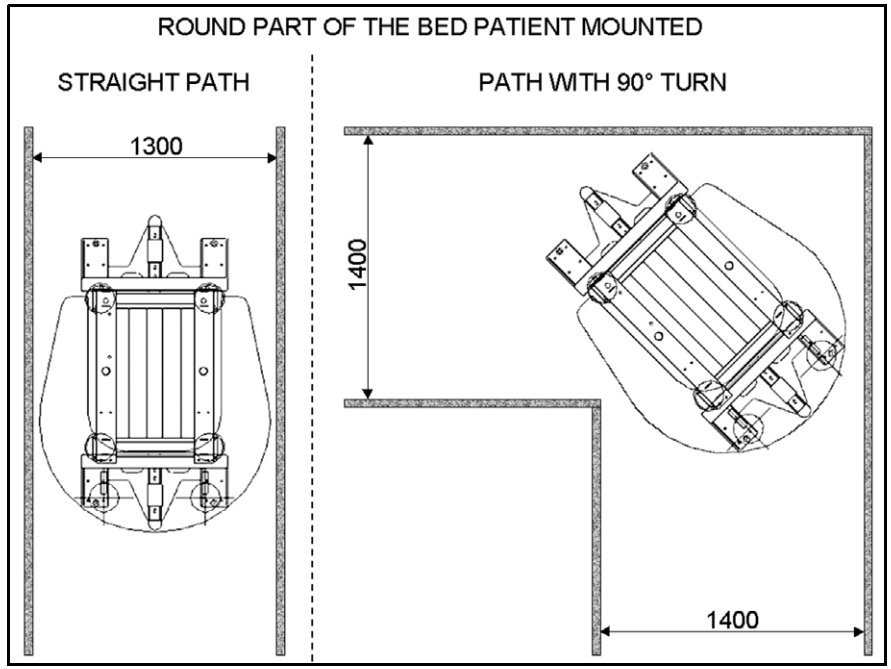
Fig. 33: Magnet and Installation Tools dimensions



Tab. 1: Minimum Passage Dimension

Straight Standard Passage Dimensions	
Standard Passage Dimension	1300 mm

Fig. 34: Width requirement



Minimum Passage Dimensions

In order to reduce the Magnet passage dimension to the minimum the semi-circular patient table can be removed together with the Magnet brackets. In this case the minimum passage dimension decreases to 850mm.

Removing also the Bracket plates you can reduce the minimum passage dimension to 800mm. If you do this you must mark the Bracket Plates positions in order to mount them back exactly in the same position as they were.

In both cases (removing the patient table or even the Brackets plates) if to enter in the Installation room you have to steer the Magnet you must take care that the corridor width has to permit the steering. In the worst case with a door opening of 800mm you need a corridor width of 1700mm.

Fig. 35: Right Bracket Plate

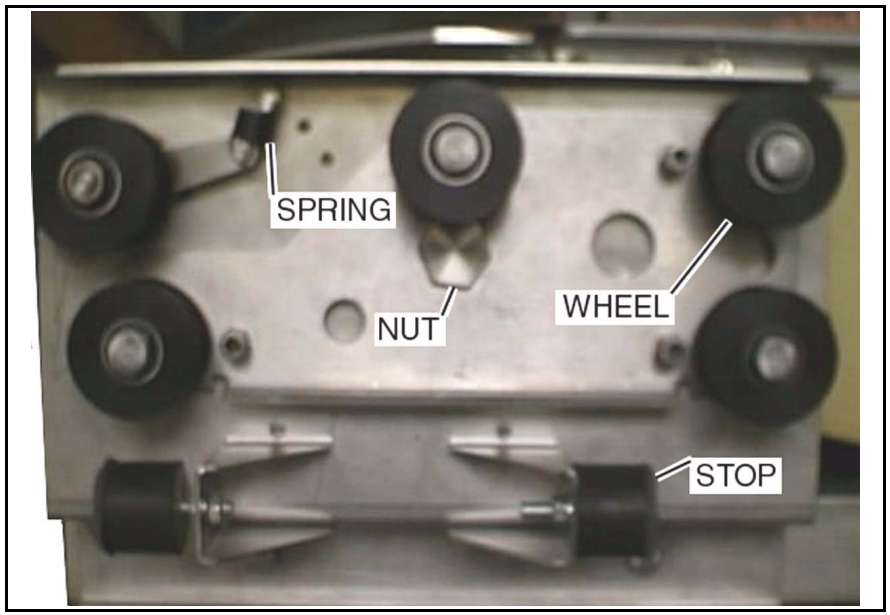
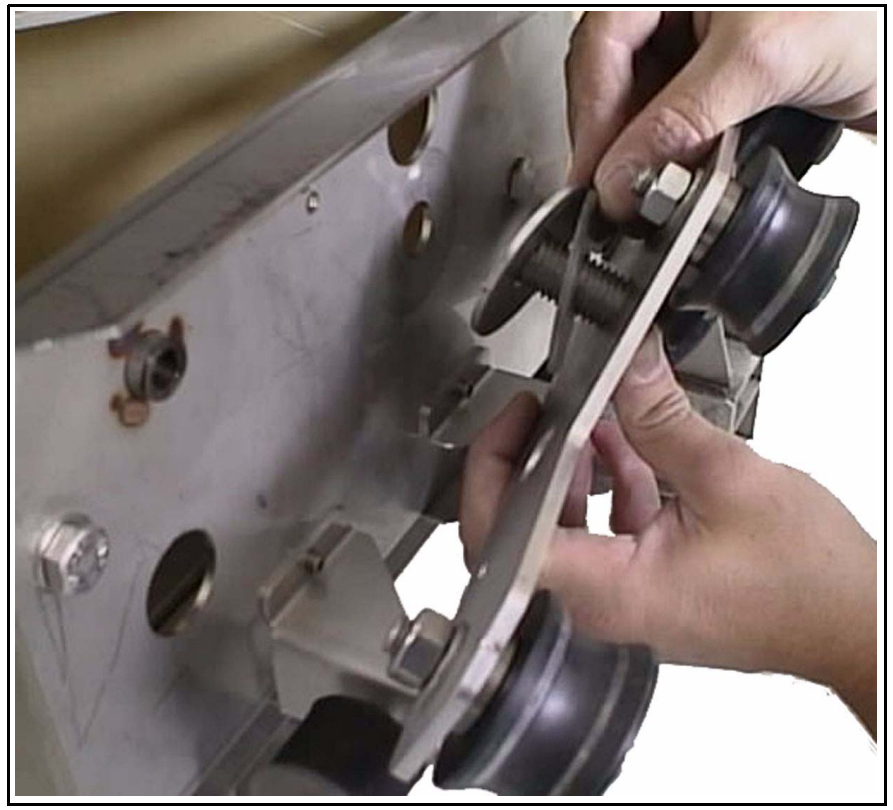


Fig. 36: Right Bracket Plate Removed

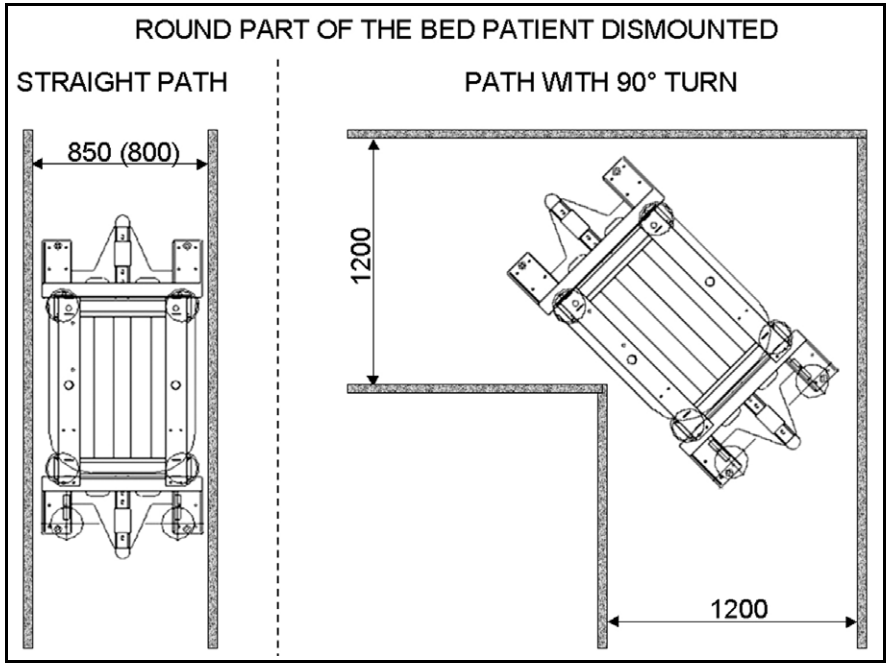


⚠WARNING If the bracket plates are mounted back in different position then they were, the Gantry centre won't be any more in the Magnet centre!

Tab. 1: Minimum Passage Dimension

Straight Minimum Passage Dimensions	
Without Patient table & Brackets	850 mm
Without Bracket Plates	800 mm

Fig. 37: Width requirement



Part 5 Annex

Annex 1

Recommended Planning Actions

This is a list of recommended actions to be taken while planning a system installation:

1. Check the room size against the minimum space required for siting a system
2. Check whether the floor has to be reinforced to sustain the total load of a system
3. Make sure that the building vibration requirements are met.
4. Check whether the fringe field of the magnet requires an external room shielding
5. Ensure that the minimum passage dimension required for carrying in the system as well as the minimum weight of the system components do not represent a problem for doors, floors, elevator, etc.
6. Fill in the Preliminary Site Survey Report and send it to your site survey specialist
7. Arrange for a site measurement with your site survey specialist.
8. Check whether the floor leveling requirements are met
9. Check whether the air-conditioning system fulfills the room temperature requirements
10. Check whether the power, grounding and lighting requirements are met
11. Make sure that modem, network and camera connections are available
12. Find out whether convenience outlets (emergency lamp, smoke sensor, medical tubing) are to be installed
13. Define the room layout (position of modular shielding pavilion, doors and console). Allow at least 0.2 m distance against the wall for the filter panel and remember that the console must be placed within a distance range of 6 m from the filter panel

Annex 2

Preliminary Site Survey

Preliminary Site Survey Report must be filled in during the sales phase of the project and then returned to your site survey specialist.

Situation Report

The Situation Report is a brief description of the location of the proposed site. Check the rooms surrounding the location with respect to all six directions and enter the results into the Tab: Distance check: - Where are...?.

Sources of Interference

The Distance Check is a systematic analysis of existing sources of magnetic interference and the distance between these sources and the center of the magnet. Sources of magnetic interference may be associated with one or more of the following:

a) AC 50 Hz or 60 Hz: high current cables, etc.

b) AC 50 Hz or 60 Hz: transformers, motors, etc.

c) AC 16.6 Hz or 25 Hz: power cables used for trains

d) Moving iron objects: cars, trucks, elevators, patient beds, equipment, etc.

e) Switched DC: tram, subway, other MR-systems

f) RF noise: antennas, fans (even not magnetic), monitors, engines, transformers, ups, phone switch boards, medical systems, etc.

NOTICE	Fans can create AC noise even if they are not magnetic.

In addition, place a check in the corresponding box to indicate the distance range for any sources of interference. The mark(s) in the column with the lowest class number will determine the preliminary site status:

- Class 1: Very critical site, installation probably impossible
- Class 2: Critical site, installation probably possible but additional shielding required
- Class 3: Normal site, installation possible but additional shielding may be required
- Class 4: Uncritical site, installation probably possible, additional shielding not required

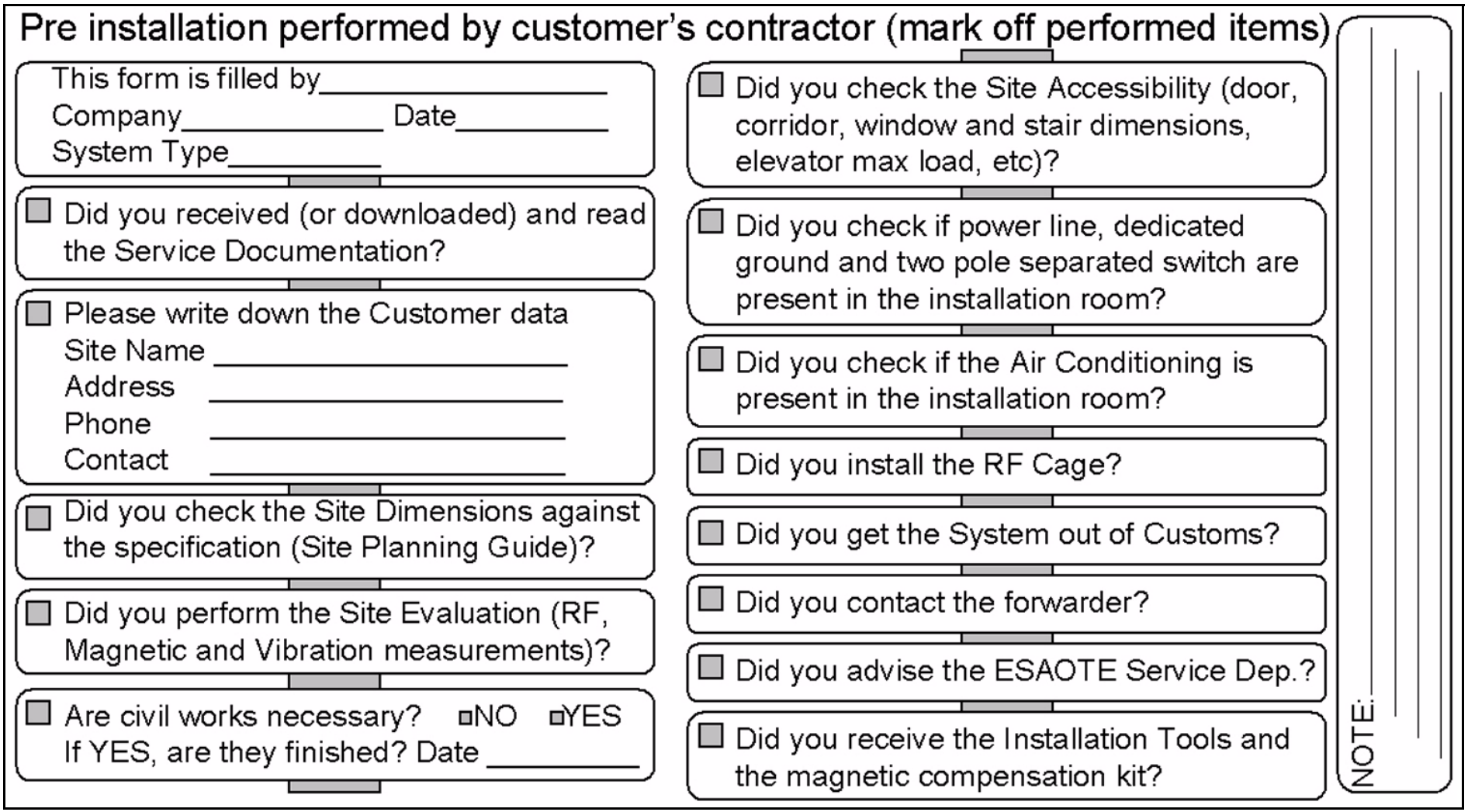
Remarks

Use this section to enter any comments you consider important regarding installing the system at that location.

Checks and Actions

PLEASE COMPLETE THE FOLLOWING FORM MARKING OFF ALL THE PERFORMED ITEMS AND E-MAIL/FAX BACK TO ESAOTE.

Fig. 38: Check and Actions flowcharts



General Information

Tab. 2: General Information

Sales representative:			
Project manager:			
Sales status:	sold: ❑	probable: ❑	possible: ❑
Customer name:			
City:			
Report issued by:			
Date and signature:			

Situation Report

Tab. 3: Situation Report - What is located where...?

Behind the magnet	+X	
In front of the magnet	-X	
Above the magnet	+Y	
Below the magnet	-Y	
Right of the magnet	+Z	
Left of the magnet	-Z	

Distance Check

Tab. 4: Distance check: - Where are...?

Sources of interference	Class 1		Class 2		Class 3		Class 4		X	Y	Z
a) AC 50 Hz or 60 Hz: High current cables	<1 m	❑	1 to 5 m	❑	5 to 10 m	❑	>10 m	❑	❑	❑	❑
b) AC 50 Hz or 60 Hz: Transformers	<4 m	❑	4 to 7 m	❑	7 to 10 m	❑	>10 m	❑	❑	❑	❑
c) AC 16.6 Hz or other train frequencies	<20 m	❑	20 to 100 m	❑	100 to 250 m	❑	>250 m	❑	❑	❑	❑
d) Moving iron (dynamic interference)											
– <50 kg: Wheel chair, etc.	<2 m	❑	2 to 4 m	❑	4 to 5 m	❑	>5 m	❑	❑	❑	❑
– 200 kg: Patient bed, etc.	<3 m	❑	3 to 6 m	❑	6 to 8 m	❑	>8 m	❑	❑	❑	❑
– 900 kg: Car, small elevator, etc.	<5 m	❑	5 to 9 m	❑	9 to 12 m	❑	>12 m	❑	❑	❑	❑
– >4500 kg: Truck, large elevator, etc.	<6 m	❑	6 to 11 m	❑	11 to 17 m	❑	>17 m	❑	❑	❑	❑
e) DC cables from tram or subway	<15 m	❑	15 to 40 m	❑	40 to 250 m	❑	>250 m	❑	❑	❑	❑
f) Iron plates in floor	>30 kg/m^2	❑									

Remarks

Tab. 5: Remarks

Annex 3

Planning summary

Minimum space requirements
4.0 m x 4.5 m x 2.4 m

Floor load requirements
3880 kg

Floor leveling requirements
5 mm / 3 m

Maximum RF noise requirements
40 dBµV/m

Maximum values without EFI	
DC (<5 Hz)	30 nT pkpk (0.3 mG)
AC (16-20 Hz)	6 nT pkpk (0.06 mG)
AC (50-60 Hz)	20 nT pkpk (0.2 mG)

Maximum values with EFI	
DC (<5 Hz)	3000 nT pkpk (30 mG)
AC (16-20 Hz)	600 nT pkpk (6 mG)
AC (50-60 Hz)	1000 nT pkpk (10 mG)

Sources of interference	Minimum Distance
a) AC 50 Hz or 60 Hz	>10 m
b) AC 50 Hz or 60 Hz: Transformers	>10 m
c) AC 16.6 Hz or other train frequencies	>400 m
d) Moving iron	
– <50 kg: Wheel chair, etc.	– Refer to Tab.8
– 200 kg: Patient bed, etc.	– Refer to Tab.8
– 900 kg: Car, small elevator, etc.	– Refer to Tab.8
– >4500 kg: Truck, large elevator, etc.	– Refer to Tab.8
– >20000 kg: big Truck, Excavator, etc.	– Refer to Tab.8
e) DC cables from trams or subway	>50 m
f) Iron plates in floor	>30 kg/m^2

Environmental requirements	
Temperature range	20-26 °C / 68-78.8 °F
Temperature stability	3 °C/h / 5.4 °F/h
Humidity range	45 - 80%

Building vibration requirements	
a_{max}	-70 dB(g)

Minimum Passage Dimensions	
Standard Passage	1300 mm
Minimum Passage without Patient Table	850 mm
Minimum Passage without Bracket Plates	800 mm

Anti-Vibration Feet Warning Levels	
Normal Feet	from 9 to 13 Hz
Feet With Springs	from 4 to 7 Hz

Power Supply Cable Features	
Section	1.5 mm^2
Length	10 m

Maximum Distance PC Unit - Electronic Box
5 m (real cable length 8 m)

Maximum distance Magnet – Electronic Box
1,5 m (real cable length 4 m)

Maximum length of modem cable
2.15 m

Maximum cable length for analog connection
10 m

Maximum cable length for digital connection
40 m

Maximum cable length for optical link connection
100 m

Reference value for mag flux densities	B_{max}/mT
Small motors, watches, cameras, magnetic data carriers (short-term exposure)	3
Processor, magnetic disk drives, oscilloscope	1
B/W monitors, X RAY tubes, magnetic data carriers during storage, pacemakers, insulin pumps, etc.	0,5
Color monitors with active and passive shielding	0,3
CT systems	0,2
Colors monitor	0,15
X RAY image intensifier, gamma cameras	0,05

Minimum Door Dimensions	
Minimum Door Dimension	850 mm
Minimum Door Dimension without bracket plates	800 mm

Power requirements	
Power requirements	AC 100/110/220/230/240 V
Frequency	50/60 Hz
Power	1.3 kVA

Line filter specification	
Max. voltage	AC 250 V
Max. current	5 A

Transport summary

Temperature range during transport and storage	
Minimum temperature	- 5 °C
Maximum temperature	50 °C

Crates Dimensions

Content	Crate weight	Content weight	Size mm(LxWxH)
Magnet unit	570 kg	1960 kg	1710x1860x1820
Covers	127 kg	60 kg	1400x900x1850
Electronic Box	110 kg	130 kg	1260x920x1900
Bed and Monitor	95 kg	128 kg	1470x760x1250

Technical Data summary

Dimension of system components				
Part	Width (mm)	Length (mm)	Height (mm)	Weight (kg)
Magnet and Patient Table	1244	2495	1564	2100
Electronic Box	526*	632	1467	210
Operating Table Standard	1080	800	740	30
Operating Table High	1100	900	800	35
TFT Monitor 18"	399	404	404-504	8
PC Unit	260	440	430	7
Pavilion (aluminum)	4000	3650	2350	500

* 793mm considering also the lateral holders

Heat dissipation of system components	
System	400 W

Part 6 Index