

MAGNETOM Espree

MR

Planning Guide

System

Planning Guide

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1	General	10
	Safety	10
	Regulatory affairs	11
	Pressure Equipment Directive	11
	Pressure device regulations	11
	Project Manager Information	13
	Project management	13
	Service and installation	13
	Environmental protection	14
	System component overview	15
	System configuration with SEP	15
	System configuration with dedicated KKT chiller and IFP	16
	System components	17
2	Room planning	19
	General	19
	Magnetic field effects on peripheral devices	20
	Flux density $B_{\max}$	20
	Magnet site requirements	21
	Minimum distances between magnets (Siemens only)	21
	Interferences	23
	Dynamic interference	23
	AC interferences	24
	Static interferences	25
	Iron room shielding	27
	Building vibration specifications	29
	Additional information	29
	Site measurement decision matrix	30
	Noise emission	31
	Terzband spectrum	31
	Regulations	32
	Noise emission values	33
	Noise cancellation	33
	Fringe field distribution	34
	Controlled access area	34
	Graphical fringe field distribution	37
	Fringe field distribution in table form	39
	Co-Siting	40
	General	40
	Magnet distances	40
	Co-siting prerequisites	40
	Field decay	41
	ACC distance for systems with the same operating frequency	42
	Magnet orientation	43
	Room configurations and sizes	45
	Room configuration example	46

Minimum technical finished room size	52
Magnet floor loading	54
RF filter plate installation	56
Recommended installation	57
Alternative installation	58
3 System components	62
Magnet OR122	62
Function	62
Technical data	62
Dimensions	62
Magnet positioning solutions	70
Seismic anchoring	72
Quench tube connection	76
Electronics cabinet (GPA/ACC cabinet)	86
Function	86
Technical data	86
Dimensions	87
Service area	88
RF filter plate	90
Function	90
Technical data	90
Dimensions	91
Console components	95
Siemens Color Display	95
Host PC MRC	95
Console components	97
Alarm box	98
Function	98
Technical data	98
Dimensions	99
Magnet stop button	100
Function	100
Technical data	100
Dimensions	101
SEP cabinet	103
Function	103
Technical data	103
Block diagram	104
Dimensions	104
KKT KCC 215 chiller	110
Function	110
Technical data	110
Block diagram	111
Dimensions	113
Options	116
KKT representations	117
IFP	123

	Function	123
	Technical data.....	123
	Block diagram	124
	Dimensions	124
	Helium compressor.....	126
	Function	126
	Technical data.....	127
	Dimensions	128
4	On-site electrical installation	130
	General.....	130
	Electromagnetic Compatibility (EMV)	130
	Equipotential bonding	131
	On-site power supply	132
	On-site power specifications	132
	Notes.....	132
	On-site power requirement	133
	Average power consumption	134
	Mains connection of the system	134
	On-site power distribution panel.....	136
	Block diagram	136
	Power distribution panel diagram example	138
	Line power on/off; EPO.....	140
	Grounding.....	142
	Grounding points.....	142
	Customer RF filter connection	143
	RF filter for customer use	143
	RF filter 6A/25A.....	144
	Alarm contact	145
	Connection details	145
	Additional information.....	146
	Vacuum Pump	146
	Room lighting	147
	Intensity of illumination	147
	Image screen workstations	147
	Planning	147
	Reflections, glare	147
	Examination room.....	148
	DC voltage	148
	AC voltage	148
	Recommendation	148
	Protective Conductor Test	149
5	On-site water supply	150
	General.....	150
	Water-cooled components	151
	On-site water supply.....	152
	Piping specifications	152

	Water quality specifications	154
	Primary chilled water supply specifications	155
	Primary chilled water supply	155
6	Air-conditioning	157
	General	157
	Air-conditioning requirements	157
	Climate conditions	159
	Climate specifications - Examination room	159
	Climate specifications - Equipment room	160
	Climate specifications - Operator room	161
	Climate specifications - Evaluation room	161
	Absolute humidity - Molier graph	163
7	System connections	164
	System connection lengths	164
	System cable connection	164
	System water hose connection	173
	System pressurized helium hose connection	180
	MRC Host PC and Imager PC environment	182
	MRSC Host PC and Imager PC environment	183
	Information for using Digital and/or Laser cameras	183
	Cabling top sheets	184
	Top sheet 1	184
	Top sheet 2	185
	Top sheet Magnet	186
		187
	Connectivity Concept	188
	Network	188
	Cable routing	189
	Bending radius for cables	189
	Cable separation	189
	Door switches at the RF room	191
8	RF Room	192
	RF room prerequisites	192
	RF room design	194
	Specifications for the RF room	194
	RF door opening	195
	RF room interior	196
	Quench tube	197
	Air conditioning	202
	Medical gases	203
	Used DIN norms	204
	Modular RF rooms	204
	RF room construction (example)	205
	RF filter plate cut-out	206
	Cu RF room RF filter panel cut-out	208

	Cu RF room floor (example)	209
	RF room isolation from on-site ground	210
	Definition	210
	Measurement devices	210
	Preferred method of measurement	210
	Checklist	211
	RF room manufacturers	212
	RF room manufacturer contacts	212
9	Quench Tube	215
	General	215
	Basis for design calculations	215
	Quench tube components checklist	216
	Sizing procedure	224
	Quench line elbows	225
	Diffuser	226
	Maximum permissible tube lengths	227
	Smooth pipe	227
	Flexible convoluted tube	227
	Effective length of bends	228
	Quench tube sizing example	229
	Galvanic separation	231
	Quench tube - RF room feed-through	233
	Quench tube sketch	234
	Horizontal	234
	Vertical	235
	90° bend and flexible tube	236
	90° bend	236
	Flexible tube	237
	Checklist	242
	Additional information	244
10	Cryogen supply	245
	General	245
	Structural requirements	246
	Transport methods for helium	247
	Dimensions of the dewars	248
	Delivery of magnet	249
	The magnet is shipped cold (standard case)	249
	Boil-off rate and helium level for the OR122 magnet	250
	Helium content	250
	Boil-off rate	250
11	Options	252
	General	252

MRSC / Leonardo workstation	253
Power requirements	253
In-room MRC	255
Functionality	255
Component	255
For planning purposes, the following are important:	258
Foot switch	259
Functionality	259
Components	259
Additional monitor	261
Patient supervision unit	262
Functionality	262
Components	262
Sensor docking station	268
Function	268
Technical data	268
Drawing	269
Console table and container	271
Table	271
Container for the Host PC	272
Surface coils	273
Patient table trolley	274
Function	274
Technical data	274
Drawing	275
Patient transport trolley 3	276
Application	276
Adaptation transformer for the SEP cabinet	277
Application	277
Ordering information	277
Dimensions	277
Power Distribution Panel	280
Application	280
Ordering information	280
Dimensions	280
UPS System for the Host PC	281
Function	281
Technical data	281
Ordering information	282
Scheme	282
Connection box for UPS PW 9125 3000i	283
UPS systems for the complete system	285
Notes	285
Power requirements if the on-site power is provided through a UPS system	285
UPS system configurations (examples)	286
Primary water filter system	289

12 Installation and service tools 290

Service tools	290
Dedicated service tools for MAGNETOM Espree	290
Standard service tools	291
Magnet transport device	292
MPS (Magnet Power Supply)	294
Application	294
Ordering information	294
Transport box dimensions	295
Array Shim Device	296
Application	296
Ordering information	296
Transport box dimensions	296
13 Information on transport	297
Transport and storage specifications	297
Mechanical conditions	297
Transport and storage specifications for the magnet	297
Transport and storage specifications for the system components	297
Transport route	298
Requirements for the transport route	298
Issuing the order	298
Transport dimension	299
Magnet	299
GPA/ACC cabinet	301
Component weight and dimension	302
14 Technical data	303
Technical data	303
General classification	303
Power requirements	303
Heating/air conditioning	304
Primary water specifications	304
RF shielding	305
Noise emission	305
15 Mobile-specific requirements	306
16 Changes to previous version	307

Safety

- ⇒ The safety notes are supplemented by specific descriptions in the documents supplied by us, e.g. product documents, ARTD (general guidelines) as well as by written instructions for specific cases. All safety instructions have to be observed when performing work activities and tests; in addition, compliance with prescribed country-specific requirements has to be ensured (e.g. occupational safety and accident prevention regulations).

NOTE

Read these pages carefully and comply with the safety information!

Read the documents “General Safety” and “MR-specific Safety”.

Regulatory affairs

Pressure Equipment Directive

NOTE

Local national laws, codes, regulations and procedures have to be maintained.

The magnet qualifies as pressure equipment. When starting up and during the operating of pressure equipment, national regulations have to be observed. In Europe, the Pressure Equipment Directive (97/23/EU) regulates the market introduction of pressure equipment. In Germany, the Pressure Equipment Directive as well as the "Betriebsicherheitsverordnung" (BetrSichV) (Industrial Safety Regulations) apply to system start-up and operation. The BetrSichV stipulates that prior to start-up, the user or others must perform a final acceptance test consisting of the inspection of the documentation, safety equipment, and installation. Periodic inspections of the cryostat are not required. However, periodic internal tests and periodic strength tests are mandatory, if the equipment is taken out of operation for maintenance or repair work.

Declaration of Conformity

- ⇒ The Declaration of Conformity is delivered together with the magnet documentation.

The CSE, ISE or factory installation member performing the initial installation of the system had to add the "Declaration of Conformity" to the "System Owner Manual", Register 6, Certificates.

The "Declaration of Conformity" is important for the customer in several countries for acceptance inspections by e.g. the government or any technical inspection authority.

Pressure device regulations

The magnet is a pressure device. Für die Inbetriebnahme und den Betrieb von Druckgeräten sind die nationalen Vorschriften zu beachten. In Europa regelt die Druckgeräterichtlinie (97/23/EG) [Pressure Equipment Directive] die Inverkehrbringung des Druckgerätes. In Deutschland gilt die Druckgeräateverordnung sowie die für die Inbetriebnahme und den Betrieb der Anlage relevante Betriebssicherheitsverordnung (BetrSichV). Die BetrSichV schreibt dem Betreiber u.a. eine Abnahmeprüfung vor. Inbetriebnahme vor, die aus einer Ordnungsprüfung, Prüfung der Sicherheitsausrüstung und Prüfung der Aufstellung besteht. Wiederkehrende Prüfungen des Kryostaten sind nicht vorgeschrieben. Bei Druckgeräten müssen jedoch wiederkehrende innere Prüfungen und wiederkehrende Festigkeitsprüfungen durchgeführt werden, wenn sie zu Instandsetzungsarbeiten ausser Betrieb genommen werden.

Declaration of Conformity

- ⇒ The declaration of Conformity is delivered together with the magnet documentation.

The CSE, ISE or factory installation member which is performing the initial installation of the system had to add the “Declaration of Conformity” to the “System Owner Manual”, Register 6, Certificates.

The “Declaration of Conformity” is important for the customer in several countries for acceptance inspections by e.g. the government or any technical inspection authority.

Project Manager Information

Project management

NOTE	The infrastructure for site preparation
NOTE	For each project the actual data/information and the Planning Guides have to be used! It is the responsibility of the Project Manager to check the Intranet for the latest version of the Planning Guide.

Service and installation

- ⇒ Information regarding service and installation tools can be found in the following chapter: ([Installation and service tools / p. 290](#))

Installation

NOTE	The transportation, mechanical installation and cabling of the system and system components have to be performed by trained personnel of our service providers (Hegele, UniData and RemeTronix) only! The system installation e.g tune-up and start-up will be performed by the US Installation team, the Erlangen Factory installation team or the HSC team Erlangen.
NOTE	High priority must be given to preparing the site for a trouble-free reading! This means ensuring that the system components can be installed and connected as soon as possible to achieve a customer- orientated installation time and to reduce the amount of liquid helium boil off during the installation process.
NOTE	All transport locking devices e.g., the red metal beams on top of the ACC cabinet or the aluminium mounting blocks for the magnet, have to be stored on-site. The reason for this is the possibility of future location changing or removing/transporting of the system.

Environmental protection

⇒ Refer to the latest version of the Disposal Instructions

NOTE

The transport packing materials, e.g. all port pallets, have to be taken back by the service provider!

All other packing materials, e.g. cardboard containers, can be disposed of as required by local codes.

System component overview

System configuration with SEP

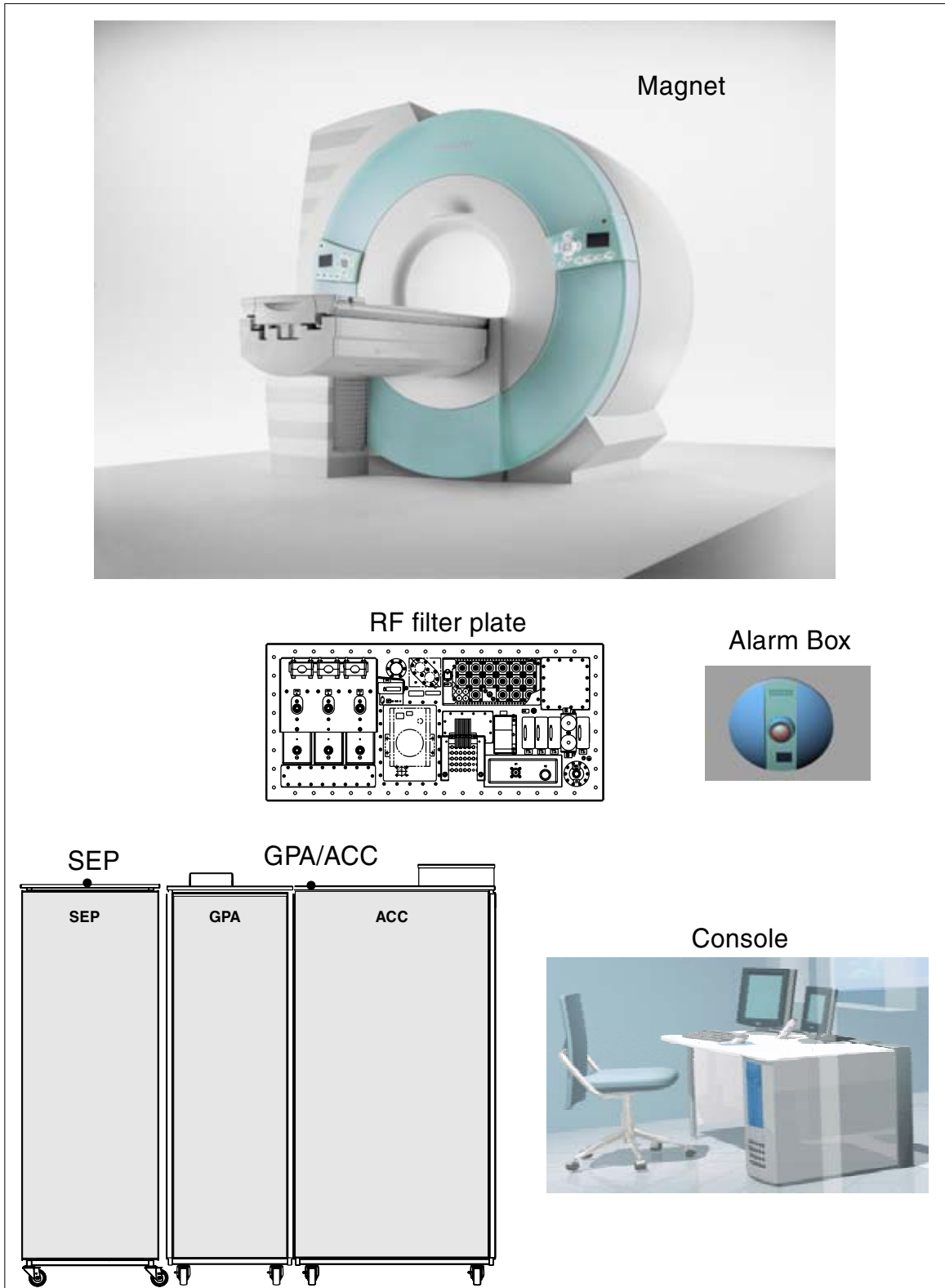


Fig. 1: MAGNETOM Espree system components with SEP

System configuration with dedicated KKT chiller and IFP

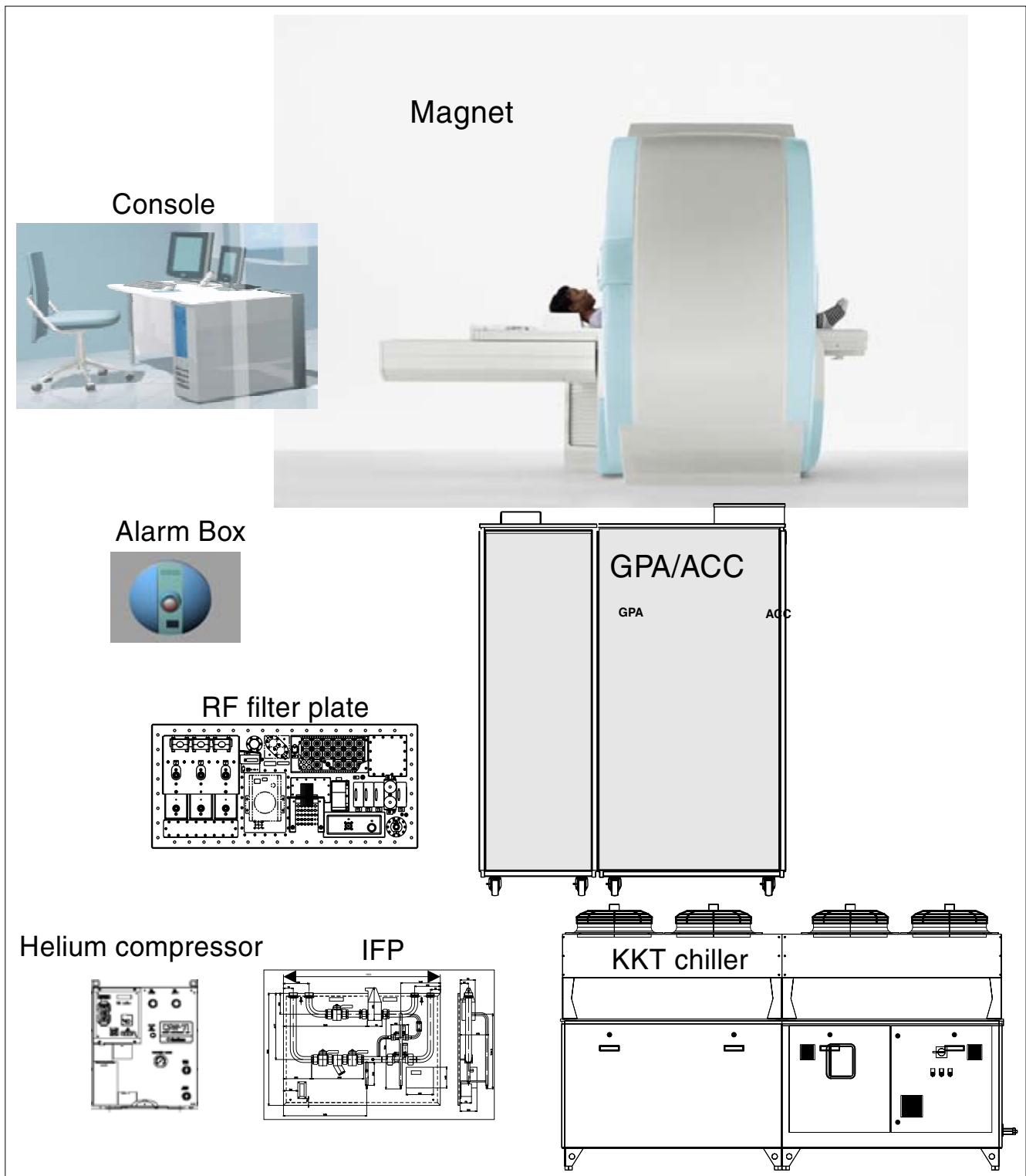


Fig. 2: MAGNETOM Espree component configuration with KKT chiller and IFP

System components

Magnet

(Function / p. 62)

System electronics cabinet (GPA/ACC)

(Function / p. 86)

RF filter plate

(Function / p. 90)

Alarm box

(Function / p. 98)

MRC console

The MRC console consists of the HOST PC, monitor, keyboard and mouse used to operate the MR system. In addition, an intercom is part of the console electronics.

SEP system configuration

(Function / p. 103) (Fig. 69 / p. 108)

KKT chiller system configuration

(Function / p. 110) (Fig. 71 / p. 111)

IFP

(Function / p. 123) (Fig. 78 / p. 124)

Integrated components

Whole-body gradient system

In addition to the basic magnetic field, the whole-body gradient system generates linear dynamic magnetic field gradients in the three room orientations. The whole-body gradient system includes the gradient amplifier and the gradient coil.

RF system

The RF system generates the RF fields and transmits them to the patient (transmit function). It also receives the MR signals emitted by the patient and provides them in digital format for image reconstruction (receive system).

RF coils

The system includes a whole-body coil for emitting RF to the patient and for receiving MR signals from the patient. The tune box which adjusts the resonator to the performance amplifier as a function of frequency and load as well as the connection cables to these units are part of the body coil. The support tube of the body coil also functions as the inner cover of the magnet tunnel.

RF local coils improve image quality when examining specific body regions.

RF coil dimensions can be found under the following chapter: ([Surface coils / p. 273](#))

Patient handling

Prior to the MR examination the patient is positioned on the table using the positioning accessories for additional comfort. During the examination, the patient is monitored accordingly, e.g. via video camera. The system handling function covers all requirements and includes the patient table, lighting, ventilation, and patient monitoring.

Since the patient is usually alone in the examination room during the measurements, patient and physician communicate via the intercom. The intercom includes the configurations necessary in the examination room and the operating console as well as the cabling.

Whenever required, the patient is monitored during the examination via a video camera. The setup consists of the camera, the monitor, as well as the cabling.

General

When planning the MR suite, the following circumstances can influence the suitability of the site:

- Interference generated by the magnet
- Interference affecting the magnet
- Site preparation
- Installation quality
- Noise emission
- Load capacity
- Minimum door height
- Minimum room height
- Cable routing

Magnetic field effects on peripheral devices

The fringe field may affect the functions of devices operated in the vicinity of the magnet. To prevent interference, the magnetic flux density at the location of these devices may not exceed certain values. The flux density acceptable for these devices depends on a number of different parameters. All pertinent information is available through the manufacturer.

NOTE

The fringe field of the MR system may make its location critical as specified in the planning documentation. Additional room shielding can be calculated and recommended by the ES PM PS planning department in Erlangen.

Flux density $B_{\max}$

Reference values for acceptable magnetic flux densities $B_{\max}$

$B_{\max}$ in mT ¹	distance ²		Note
	radial direction (X/Y) in m	axial direction (Z) in m	
20	1.41	1.91	Servo ventilator by Siemens
10	1.53	2.2	RF filter plate
5	1.72	2.5	MR electronics cabinet
3	1.88	2.8	Small motors, watches, cameras, magnetic data carriers
1	2.56	3.5	Processors, magnetic disk drives, oscilloscopes
0.5	2.5	4.1	Pacemakers, B/W monitors, X-ray tubes, magnetic data carriers, insulin pumps
0.3	2.76	4.6	Color monitor with active and passive shielding
0.2	3.0	5.1	CT systems by Siemens
0.15	3.2	5.5	Computer monitors (PC)
0.1	3.4	5.8	Linear accelerators by Siemens
0.05	3.6	7.2	X-ray image intensifiers, gamma cameras, linear accelerators from other manufacturers

1. 1mT = 10 Gauss

2. The distance is measured from the magnet isocenter

Magnet site requirements

- ⇒ The final location selected for the magnet has to ensure that the stability and homogeneity of the magnetic field are not adversely affected by extraneous fields. In addition, the magnetic fringe field should not impair the safety of personnel or the functions of other devices in the vicinity of the magnet.

NOTE

At present, a site survey measurement has to be performed.

Contact the ES PM PS department in Erlangen (Mr. Michael Schmitz) to arrange this measurement.

This will be valid until further notice.

Minimum distances between magnets (Siemens only)

NOTE

It is not possible to install side-by-side electronics components (GPA/ACC/SEP/) of MR systems with the same operating frequency! Refer to: [\(Co-Siting / p. 40\)](#)

The GPA/ACC cabinets have to be separated by 5 m. The magnetic field of one system has to be ramped to the upper frequency limit of tolerance, the other magnet field to the lower frequency limit of tolerance!

Shimming is only optimized with both magnets ramped up during the shimming procedure.

- ⇒ The following minimum distances between magnets are valid if:

- Both magnets are at field.
- Neither magnet is ramping while the other is running applications.
- If one magnet is switched off, the other magnet has to be re-shimmed.
- Contact the VR P PS department if you have non-Siemens products or older system types, or if you have to plan, e.g., two systems with the same operating frequency close to each other.

MAGNETOM Espree min. distance to system type:	Distance to the magnet isocenter in m
1.5T Avanto	5.0
1.0T Harmony	5.0
1.5T Symphony	5.0
1.5T Espree	5.0
1.5T Sonata	5.0
3.0T Allegra	7.0

MAGNETOM Espree min. distance to system type:	Distance to the magnet isocenter in m
3.0T Trio	7.0
1.0T Rhapsody	9.0
0.2T Concerto	6.0
0.2T Jazz	7.0
0.35T "C"	6.0

NOTE

Shimming is only optimized with both magnets ramped up! Neither magnet is ramping, while the other is running applications. If one magnet is switched off, the other magnet has to be re-shimmed.

Interferences

Effects on the magnetic field are divided into:

- **static interferences** caused by, e.g., ferromagnetic objects, especially those located underneath the magnet
- **dynamic interferences** caused by, e.g., moving ferromagnetic objects or low frequency magnetic fields
 - ⇒ In critical cases, either Siemens or a third party authorized by Siemens checks the suitability of the site. The tests are designed to detect electromagnetic and mechanical sources of interference.
 - ⇒ Siemens is not responsible for inspecting structural prerequisites, for example, the load capacity of floors or the heating and air conditioning system of the site. Similarly, Siemens is not responsible for executing or monitoring preliminary on-site installation steps. For these reasons, Siemens will not be held liable for the customer's failure to maintain specific operating conditions.

NOTE

Static effects can be compensated for by shimming.

Dynamic effects are compensated for by maintaining the maximum values indicated.

NOTE

A magnetic shielding is required, e.g., if minimum distances to static / moving iron masses or AC/DC sources cannot be kept.

Dynamic interference

Dynamic interference	min. distance ¹ in m		Notes
	radial direction (X/Y)	axial direction (Z)	
Iron object < 50 kg	4.9	5.8	With additional iron shielding, it is possible to reduce these distances by about 1 m! For objects that appear under an angle of 45° to 0° from the Z-axis, the axial values must be applied. The distances are measured from magnet center to the edge of the object!
Iron object < 200 kg	5.3	6.5	
Iron object < 900 kg	5.5	7.5	
Iron object < 4,500 kg	6.2	9.0	

Dynamic interference	min. distance ¹ in m		Notes
Wheelchair / Bed	4.9	5.8	With additional iron shielding, it is possible to reduce these distances by about 1 m! For objects that appear under an angle of 45° to 0° from the Z-axis, the axial values must be applied. The distances are measured from the magnet center to the edge of the object!
Car	5.5	7.5	
Truck	6.2	9.0	
Train	40.0	40.0	
Subway / Tram	40.0	40.0	

1. Distance from the magnet isocenter

AC interferences

AC interference	min. distance ¹ in m		Notes
	radial direction (X/Y)	axial direction (Z)	
AC Transformer < 100 kVA	12.0	8.0	The distances are measured from the magnet center to the edge of the object!
AC Transformer < 250 kVA	12.5	10.0	
AC Transformer < 650 kVA	13.0	12.0	
AC Transformer < 1,600 kVA	14.0	15.0	

AC interference	min. distance ¹ in m		Notes
	radial direction (X/Y)	axial direction (Z)	
AC Cables < 10 A	2.0	2.0	The distances are measured from the magnet center to the edge of the object!
AC Cables < 25 A	2.0	2.0	
AC Cables < 5 A	2.0	2.0	
AC Cables < 100 A	3.0	2.0	
AC Cables < 250 A	7.0	3.0	
AC Cables < 1000 A	12.0	5.0	

1. Distance from the magnet isocenter

Static interferences

Static interferences	min. distance ¹ in m		Notes
	radial direction (X/Y)	axial direction (Z)	
Water cooling unit	4.0	4.0	valid for MAGNETOM Espree

1. Distance from the magnet isocenter

For statical iron (reinforcements) observe the following limitations:

Iron mass	Max. allowed iron mass 1.25 m distance from magnet isocenter
allowable reinforcement steel in the floor	$\leq 100 \text{ kg / m}^2$
allowable iron beam mass in the floor	$\leq 100 \text{ kg / m}$

Iron mass e.g. existing additional iron shielding underneath the magnet	iron mass at 1.25m distance from magnet isocenter ¹ .
Contact Mr. Bernhard Heinrich ES PM PS; E-mail: bernhard.heinrich@siemens.com	

1. Contact VR P PS in these type of cases.

NOTE

According to our recent experience, the mass of the floor plate should be about 600 kg/m² (corresponding to a thickness of about min. 20 cm or 8") to achieve good vibration and structure-borne sound isolation

Iron room shielding

- ⇒ Additional iron shielding is required e.g. if the 0.5mT line has to be within the examination room walls, dynamic interferences are present, and public areas have to be protected against the 0.5mT fringe field.
- ⇒ For additional iron room shielding calculations (if required), contact the planning department of **ES PM PS**:
++49 (0) 9131-84-7624
++49 (0) 9131-84-7616

NOTE

Existing iron masses will effect the magnetic field and therefore the image quality of the system. The following information has to be taken into account.

NOTE

If an additional iron room shielding has to be installed, inform the responsible structural engineer regarding the additional weight load of the iron for the examination room.

Iron masses in the environment

NOTE: In these cases, the Sylomer/Sylodamp pad kit with part number 83 96 728 has to be ordered in advance!

E.g. existing/required additional iron shielding underneath the magnet

E.g. iron beams or reinforcement iron at 1.25m distance from the magnet isocenter .

Contact Mr. Bernhard Heinrich ES PM PS; E-mail: bernhard.heinrich@siemens.com

NOTE

The following table shows the required damping solution for local site conditions. It is very important to order the Sylomer/Sylodamp pad kit in advance and to communicate the local site conditions (iron shielding underneath the magnet or not) to e.g. the service provider or installation team performing the positioning and mechanical installation of the magnet.

They have to use the correct damping solution kit out of the two available ones (Stop-Choc spring kit which is the standard kit with magnet delivery or Sylomer/Sylodamp kit which has to be ordered separately).

Local iron mass conditions	Required damping solution kit
Standard site conditions (none of the below described circumstances takes place)	Stop-Chock spring damping solution kit has to be installed.
Additional iron shielding, calculated by ES PM PS, underneath the magnet position is required.	Sylomer/Sylodamp pad damping solution kit has to be installed Sylomer/Sylodamp pad kit part number: 83 96 728
Additional iron shielding underneath the magnet position is already present e.g. from a previous system.	Sylomer/Sylodamp pad damping solution kit has to be installed Sylomer/Sylodamp pad kit part number: 83 96 728

Building vibration specifications

- ⇒ External vibrations or shocks affecting the magnet may degrade image quality. The building must not exceed the following vibrational specifications in the three spatial orientations:

Tab. 1 Building vibration specifications

Acceleration	Building vibration specifications	in the frequency range
$a_{\max}$	-70dB (g)	from 0 to 70 Hz

- ⇒ The requirement for $a_{\max}$ is **-70 dB (g)** is measured as a maximum rms value per frequency component > 0.5Hz in the Fourier Transformation of the recorded signal (spectrum).

Additional information

- ⇒ The reference value is the acceleration of gravity ($g=9.81\text{m/s}$).
- ⇒ -70dB correspond to a factor of 1/10000
- ⇒ $a_{\max} = 1 \text{ mm/s}$

NOTE

According to our experience, the mass of the floor plate should be about 600 kg/m^2 (corresponding to a thickness of about min. 20cm or 8") to achieve good vibration and structure-borne sound isolation

NOTE

The fringe field of the MR system may make its location critical as specified in the planning documentation. Additional room shielding can be calculated and recommended by the ES PM PS planning department in Erlangen.

See also: ([Iron room shielding / p. 27](#))

Site measurement decision matrix

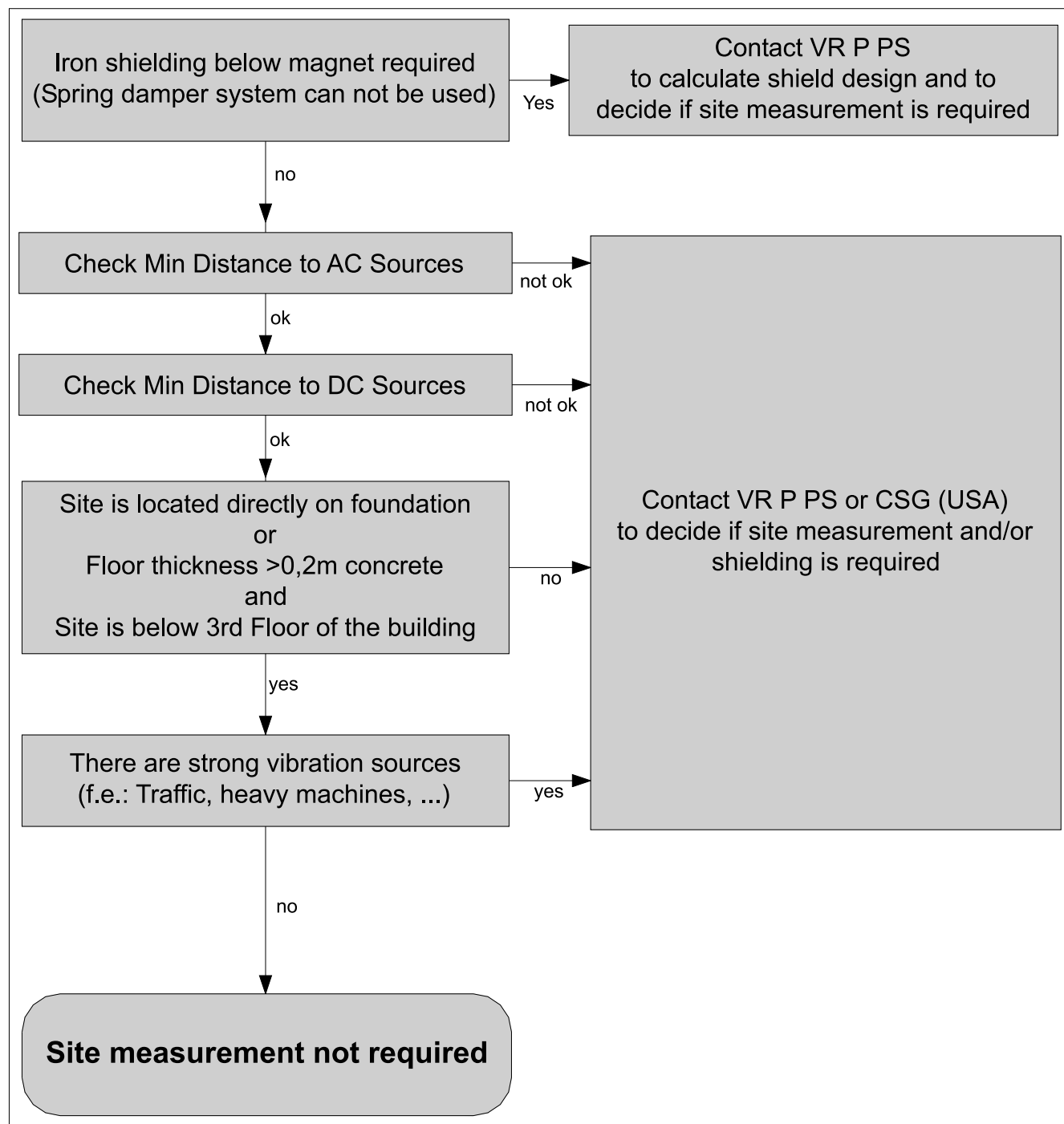


Fig. 3: Site measurement decision matrix

Noise emission

NOTE

The MAGNETOM Espree is equipped with a Stop-Choc spring kit or Sylomer/Sylodamp pad kit for reducing the structurally-borne noise.

In addition, the covers are equipped with passive noise cancellation for reducing airborne noise.

NOTE

The warning sign “Ear protection” has to be posted on all examination room entrance doors.



Fig. 4: Hearing protection sign

The physical characteristics of the MR system generate a certain amount of noise, emitted as contact or acoustic noise.

The table below provides you with the information to install the noise attenuation as required, e.g., by law. The attenuation usually incurs additional structural expenditures.

The noise level for the various systems averaged across different sequences is shown in the table below.

Terzband spectrum

NOTE

This spectrum shows the noise behaviour of the MAGNETOM Espree for the eight hour average value of 85.4 dB(A).

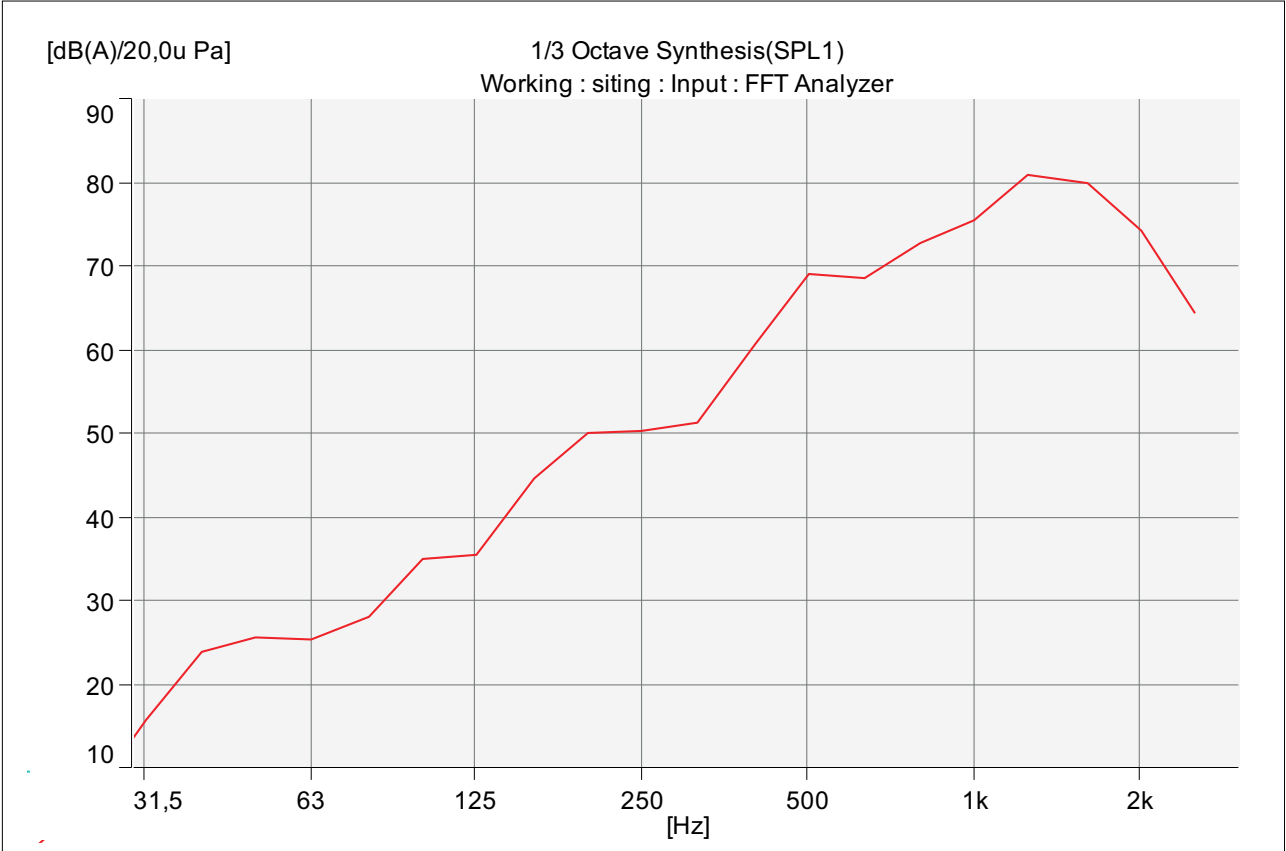


Fig. 5: Terzband spectrum

Regulations

Local regulations (e.g. VGB 121)

NOTE

Refer to local regulations for noise protection.

Allowable noise level for operating personnel ¹	Room	Level
Limiting value related to 20 Pa acoustic pressure	Operating room	</= 55db(A)
A-weighted average value across 8 hours		</= 55db(A)
A-weighted average value across a sequence		</= 65db(A)

1. The noise level is valid for the operating personnel working in the operating room based on VGB 121.

Allowable noise level for neighbors	Level
Limiting value related to 20 Pa acoustic pressure	</= 20/30db(A)
e.g., sick room, bedroom	

Allowable noise level for neighbors	Level
A-weighted average value across 8 hours	$\leq 20\text{dB(A)}$
A-weighted average value across a sequence	$\leq 30\text{dB(A)}$
e.g., external office	
A-weighted average value across 8 hours	$\leq 30\text{dB(A)}$
A-weighted average value across a sequence	$\leq 40\text{dB(A)}$

Noise emission values

Tab. 2 Noise value

Examination room	Equipment room	Control room
Acoustic noise emission		
$\leq 85.4\text{ dB(A)}^1$	$\leq 65\text{ dB(A)}$ (average value)	$\leq 55\text{ dB(A)}$ (average value)

1. Average value across 8 hours.

Noise cancellation

NOTE

If you expect noise problems, the RF room manufacturer you are using may be able to deliver noise reduction components with the RF room (e.g., interior; RF window; RF door, etc.)

Fringe field distribution

Controlled access area

NOTE

The project manager has to inform the customer to protect the controlled access area (0.5mT) with the delivered warning signs. All doors leading into the 0.5mT area must be identified/protected with a warning sign. The project manager provides the customer with the position of the 0.5mT line based on, e.g., a table from the planning guide that shows the distances or the customer site drawings that indicate the 0.5mT line. The warning sign “cardiac pacemaker” is, e.g., for identifying the 0.5mT line. The warning sign “strong magnetic field” is, e.g., for identifying the entrance doors into the examination room or the 0.5mT line.

⇒ The following warning signs are part of the delivery volume.



Fig. 6: Warning sign “Pacemaker”



Fig. 7: Warning sign

For MR EQUIPMENT that generates a stray field exceeding 0.5 mT outside its permanently attached cover and/or an electromagnetic interference level that does not comply with IEC 60601-1-2; 1993, the technical description

- will indicate the necessity to define and permanently install a CONTROLLED ACCESS AREA around the MR EQUIPMENT such that outside this area
 - the magnetic fringe field strength will not exceed 0.5 mT and
 - the electromagnetic interference level complies with IEC 60601-1-2: 1993;
- will give clear recommendations as to how this CONTROLLED ACCESS AREA will be delimited, e.g. by markings on the floor, barriers and/or other means to allow the responsible staff to adequately control access to this area by unauthorized persons; and
- The CONTROLLED ACCESS AREA must be labeled at all entries using the warning signs provided, including indication of the presence of magnetic fields and their force or torque on ferromagnetic materials.

When the MR EQUIPMENT is designed for installation in a room in which audio visual contact to the PATIENT is likely to be limited, the technical descriptions will specify provisions in the design of the room and in the EQUIPMENT to enable audio and visual contact with the PATIENT during the MR EXAMINATION. The audio visual contact will be sufficient not to hamper the possible need for MEDICAL SUPERVISION of the PATIENT.

When the installation of a CONTROLLED ACCESS AREA is required for the MR EQUIPMENT, the INSTRUCTIONS FOR USE

- will state clearly that it is the responsibility of the USER to follow local statutory requirements with respect to access to the CONTROLLED ACCESS AREA;

- will specify, preferably accompanied by a sketch, the size and shape of the CONTROLLED ACCESS AREA;
- will indicate the need to establish adequate rules for controlling access to the CONTROLLED ACCESS AREA in terms of the potential risk to PATIENTS and staff within the CONTROLLED ACCESS AREA from the attraction of objects containing iron or other magnetically active materials or from torque on such metallic materials and the potential risk to persons inadvertently entering the area who may be affected by the possible malfunction of medical implants such as pacemakers;

NOTE

For magnetic field strengths less than 0.5 mT, no administrative controls are required.

- will list EQUIPMENT and tools specified or recommended by the MANUFACTURER for use in the CONTROLLED ACCESS AREA. For all EQUIPMENT, ACCESSORIES or tools listed, a description should be given of special measures that are needed, if any, for its installation as well as special precautions, if any, for their use;
- will state clearly that peripheral equipment, including PATIENT monitoring, life supporting devices and emergency care equipment, which are not specified or recommended for use in the CONTROLLED ACCESS AREA, may be disturbed by the radio frequency field or the magnetic fringe field of the MR EQUIPMENT and that this peripheral equipment may also disturb the proper function of the MR EQUIPMENT.

Graphical fringe field distribution

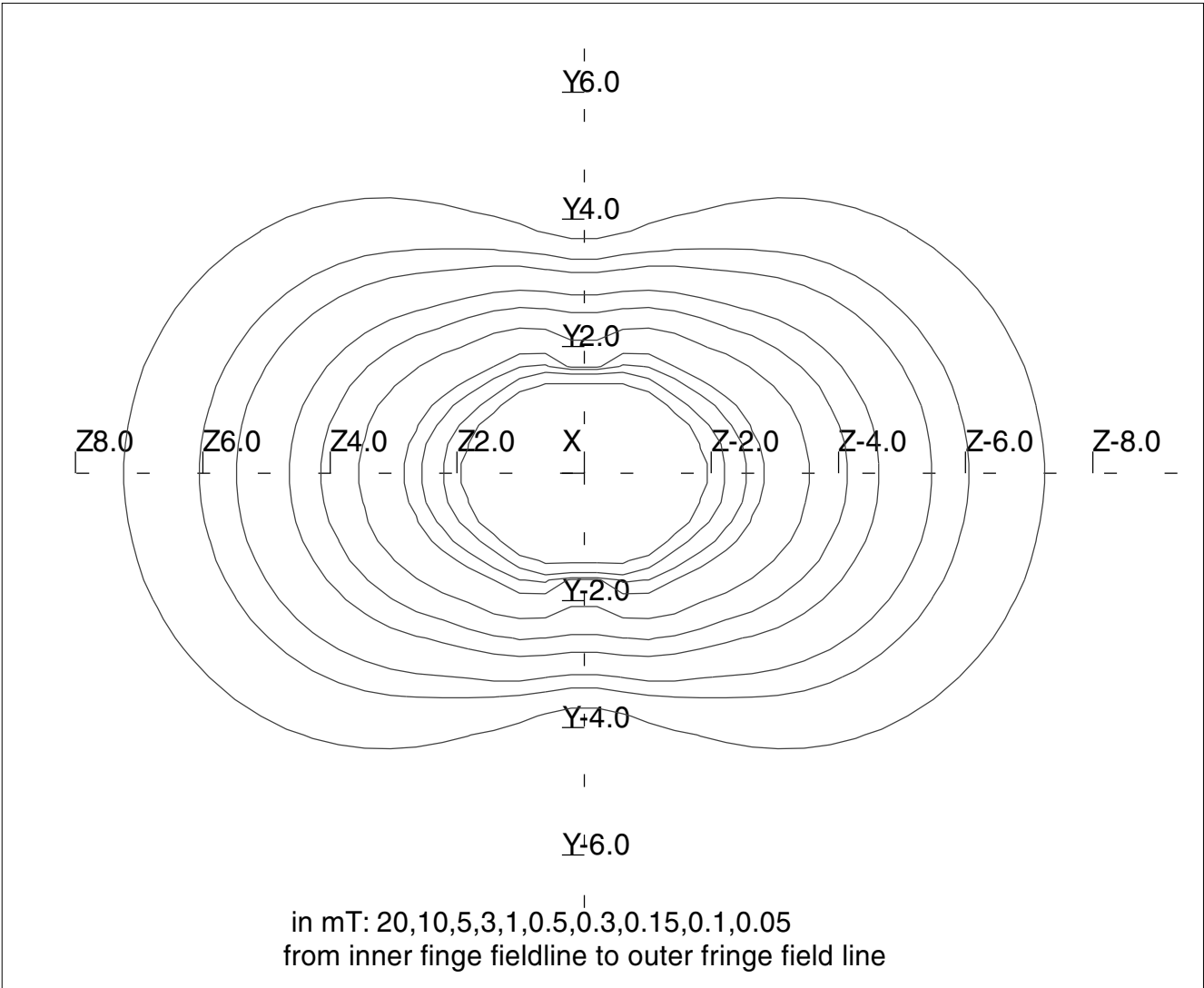


Fig. 8: Fringe field distribution chart (Y/Z)

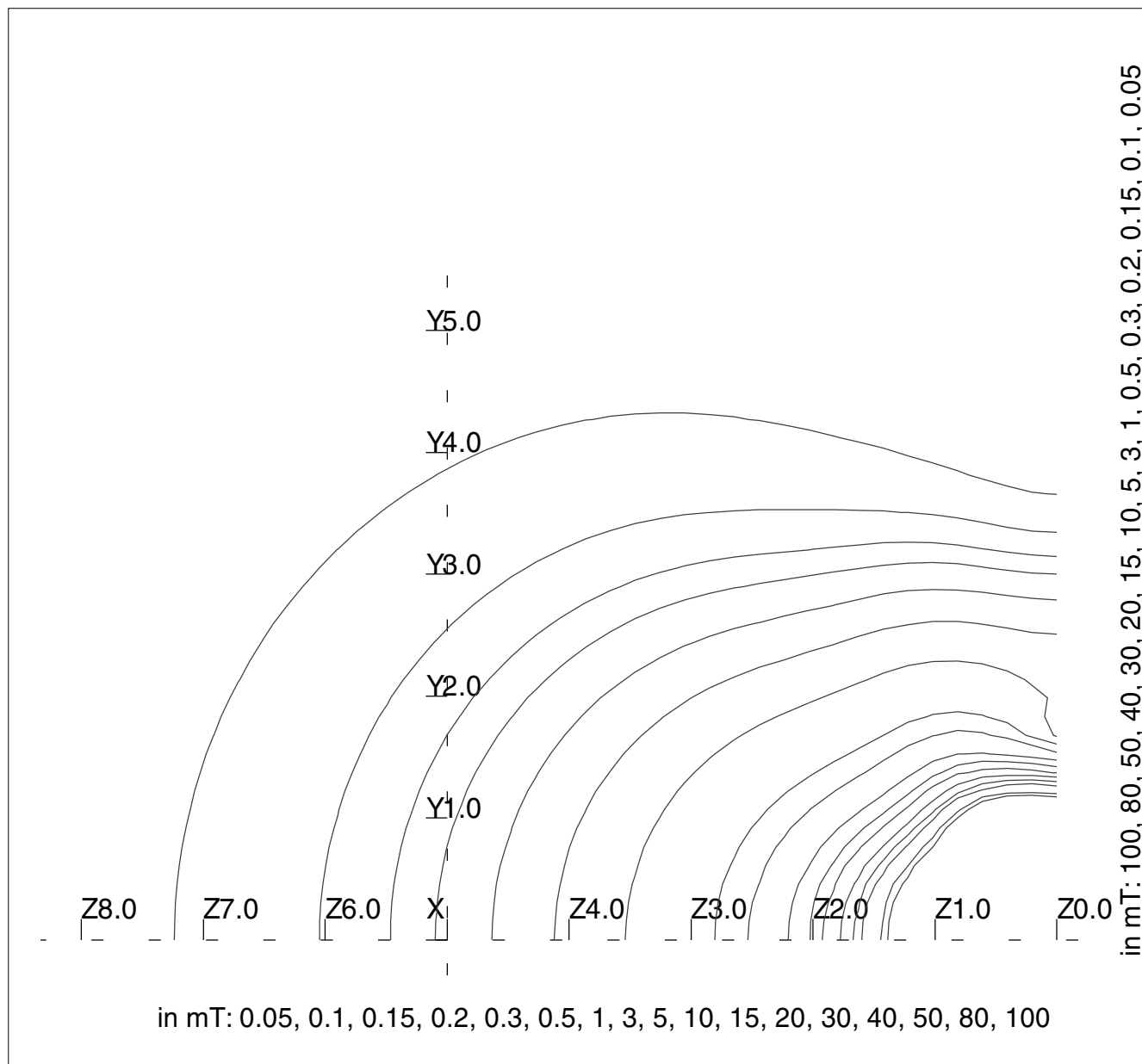


Fig. 9: Fringe field distribution chart (Z/Y)

Fringe field distribution in table form

Tab. 3 Fringe field distribution MAGNETOM Espree

Fringe field	Distance from the magnetic center in the direction of		
	the X-axis in m	the Y-axis in m	the Z-axis in m
200 mT	1.0	1.0	1.31
100 mT	1.19	1.19	1.4
80 mT	1.21	1.21	1.5
50 mT	1.28	1.28	1.6
40 mT	1.31	1.31	1.7
30 mT	1.34	1.34	1.76
20 mT	1.41	1.41	1.91
15 mT	1.47	1.47	2.02
10 mT	1.53	1.53	2.2
5 mT	1.72	1.72	2.5
3 mT	1.88	1.88	2.8
2 mT			
1 mT	2.56	2.56	3.5
0.5 mT	2.50	2.50	4.10
0.3 mT	2.76	2.76	4.6
0.2 mT	3.0	3.0	5.1
0.15 mT	3.2	3.2	5.5
0.1 mT	3.4	3.4	5.8
0.05 mT	3.6	3.6	7.2

⇒ The fringe field extends spatially in three dimensions around the magnet isocenter and can be reduced by additional iron shielding. The typical fringe field lines represent the ideal flux density distribution in air which may be distorted by steel reinforcements or other iron masses in buildings.

Co-Siting

General

- ⇒ Co-Siting describes the prerequisites for planning/installing two MR systems side-by-side at the same time and with the same operating frequency (field strength). **One other scenario could be:**
A customer already has a 1.5T system in operation and is getting a second 1.5T system to be located in close vicinity of the first one. In this case, the new system has to meet all requirements specified in this section. The already installed system should be modified where possible.

NOTE

It is not possible to install electronic components (GPA/ACC/SEP) side-by-side for systems with the same operating frequency. Additional prerequisites are mandatory!

The ACC cabinets have to be separated by 5.0 m (center to center). The magnetic field of one system has to be ramped, according to the ramping procedure, to the upper frequency limit of tolerance, the other magnet to the lower frequency limit of tolerance!

Shimming is only optimized with both magnets ramped up during the shimming procedure.

Magnet distances

Min. distance between magnets ¹				
	1.0T	1.5T	0.2T ²	3.0T
0.2T	5.0 m	6.0 m	10.0 m	10.0 m
0.35T	5.0 m	6.0 m	10.0 m	10.0 m
1.0T	4.5 m	5.0 m	5.0 m	7.0 m
1.5T	5.0 m	5.0 m	6.0 m	7.0 m
3.0T	7.0 m	7.0 m	10.0 m	10.0 m

1. Contact VR P PS for details if the on-site situation requires, e.g., additional iron shielding
2. With EFI unit, no ramping during measurement; additional iron shielding can reduce distance

Co-siting prerequisites

NOTE

The following prerequisites for Co-Siting are mandatory for both MR systems.

If two systems with the same operating frequency have to be planned (or one is already installed), take the following into account:

- The attenuation of the RF room must be 100 dB at the required operating frequency.
- For additional/optional wave guides, the following calculation applies:

$$L_{\min} = 4 \times d_i$$

$L_{\min}$ = wave guide length; d_i = inner tube diameter ($d_i = < 300\text{mm}$)

- The two RF rooms cannot be connected electrically.
- The openings of the RF rooms (e.g., door, window, wave guide) have to be **turned away** from each other. **Avoid** having the openings (e.g., door, window, wave guide) **facing** each other.
- The **ACC cabinet** must be installed at a min. **distance** of **5.0 m** from each other.
- The cable ducts (ACC side) of the two systems have to be installed separated by 5 m.
- The short cable set (**1.5 m**) is **not permitted** for use with systems in Co-Siting, even if the ACC cabinet is installed directly underneath the RF filter plate.
- **separate on-site power distribution panels for each system have to be installed as far away as possible from each other**
- The **RF filter plates** have to be positioned as far away as possible **from each other**
The minimum distance is 5.0 m.
- The connection of the RF filters (gradient and power) has to be performed as requested in the installation manual (e.g., torque).
- According to the ramp procedure, one of the MR systems has to be ramped to the **upper frequency limit** of, e.g., **63.7 MHz (1.5T)**, the other MR system has to be ramped to approx. **100 kHz lower** than the first one.

Field decay

- ⇒ The magnet marked "magnet 2" in the example has to be re-ramped first, because the normal magnetic field decay causes the lower operating frequency tolerance limit to be reached earlier.

NOTE

The special ramping procedure could require a different re-ramping time interval (to the operating frequency after the normal field decay) of the two systems!

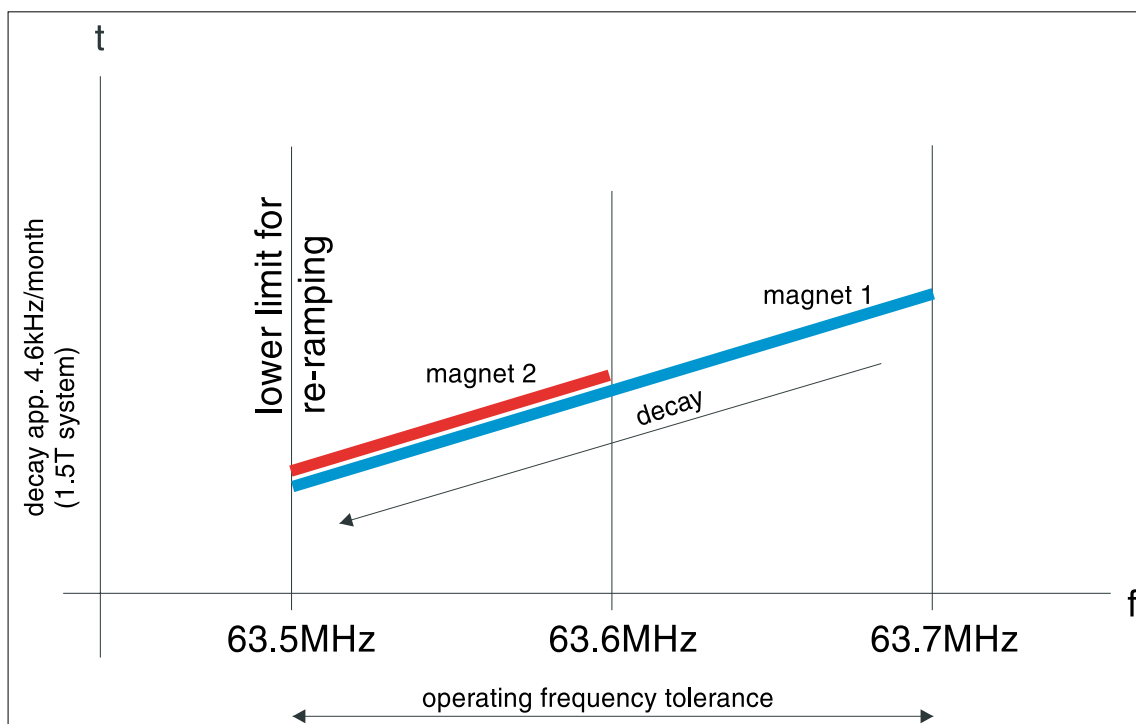


Fig. 10: Magnetic field decay

ACC distance for systems with the same operating frequency

NOTE

The distance from the isocenter of the electronics cabinet to each other must be min. 5.0m.

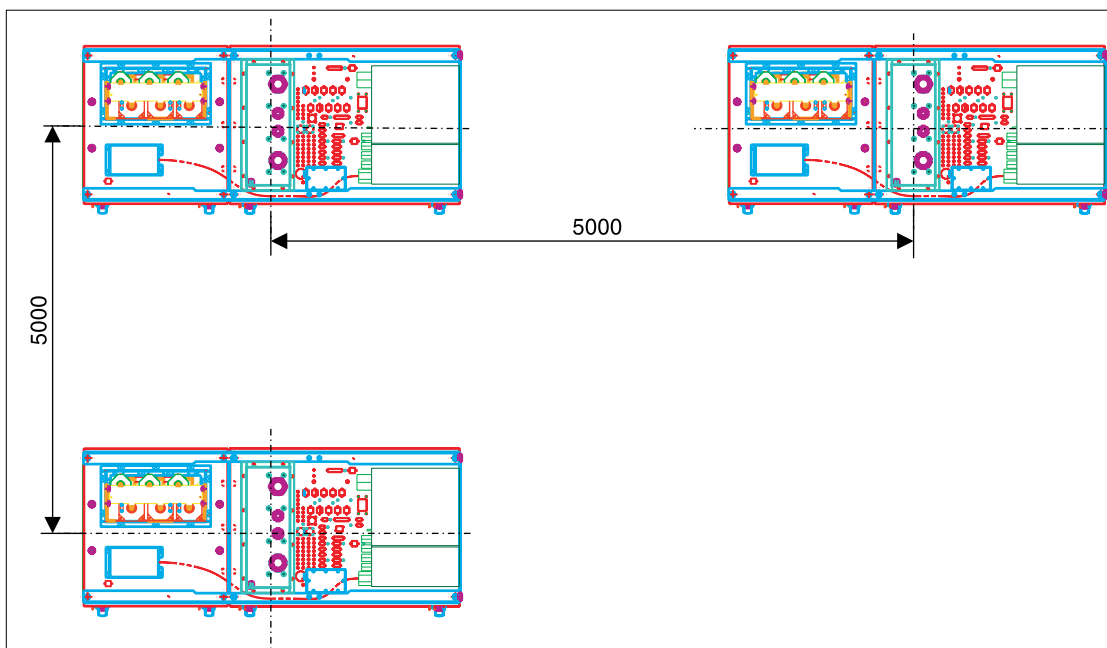


Fig. 11: ACC installation with two systems at the same operating frequency

Magnet orientation

NOTE

Two magnets with the same operating frequency positioned in "Z" direction should be avoided due to the required distances and increased RF coupling between the systems! Contact ES PM PS in this case.

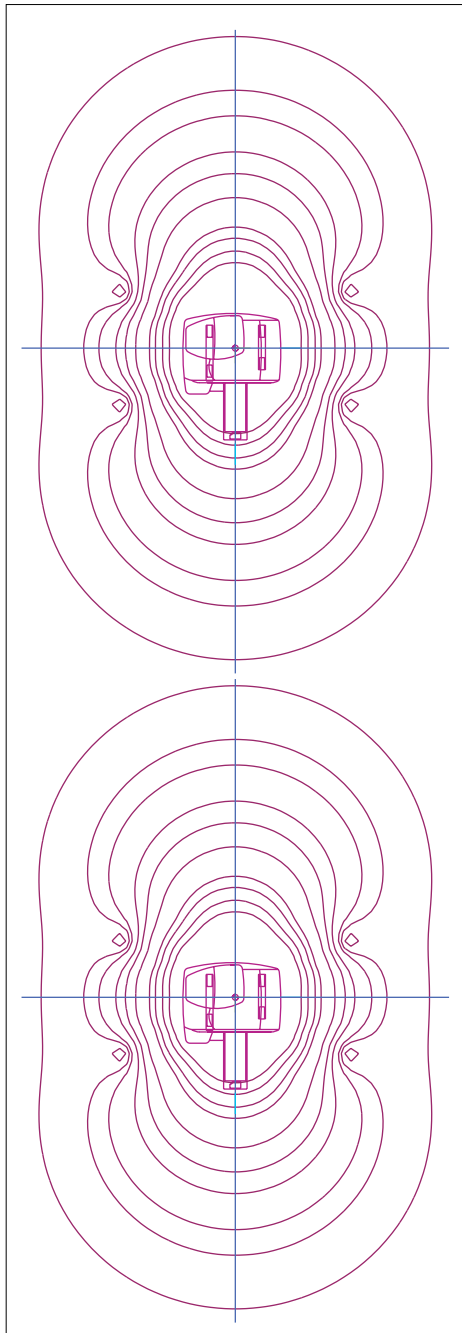


Fig. 12: 2 magnets line up in "Z" axis

NOTE

It is permitted to position two magnets with the same operating frequency in the "X" direction.

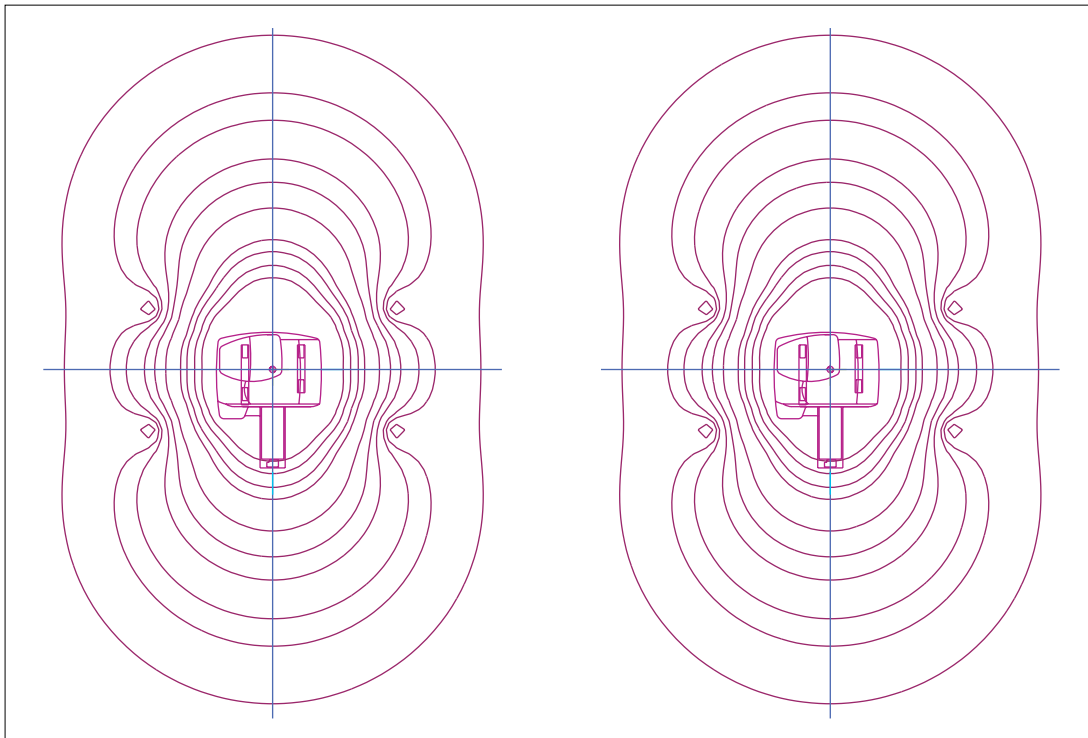


Fig. 13: Magnet parallel installation

NOTE

It is permitted to position two magnets with the same operating frequency at an angle to each other.

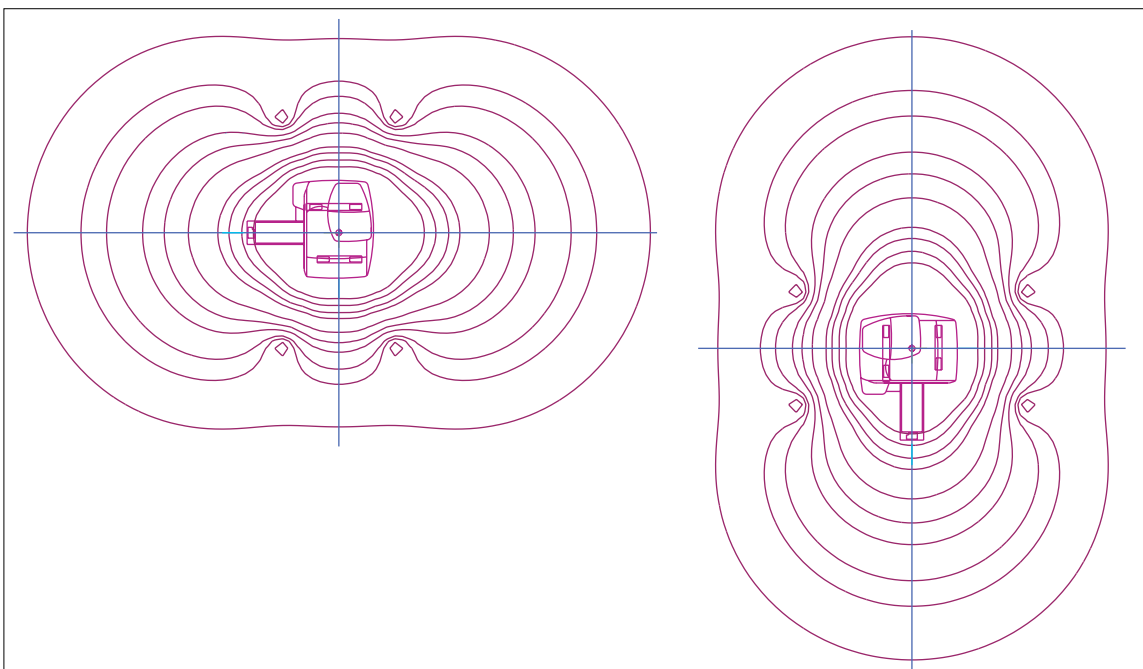


Fig. 14: 2 magnets 90° to each other

Room configurations and sizes



Fig. 15: Example of MAGNETOM Espree room layout

Room configuration example

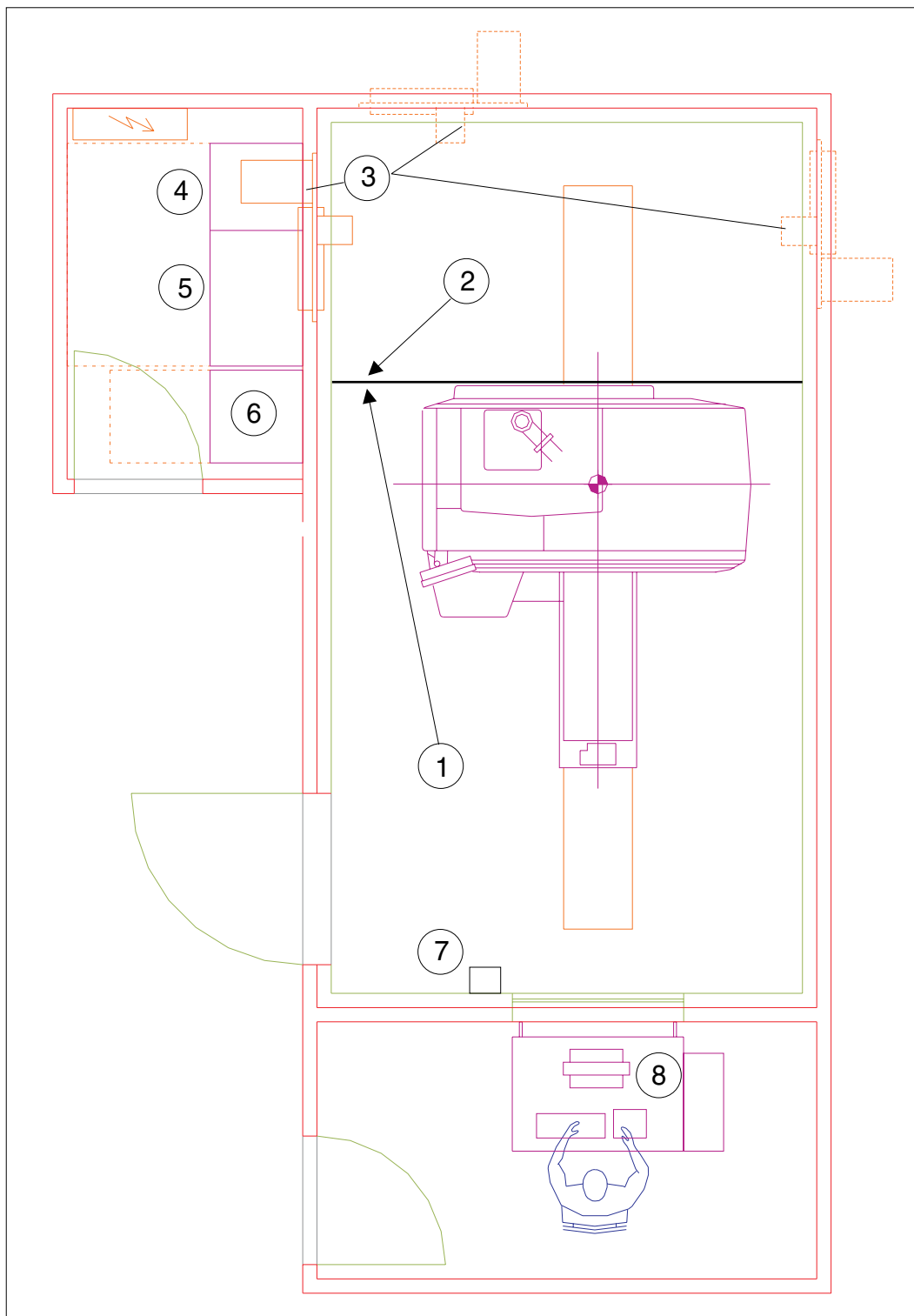


Fig. 16: Example of room layout

- Pos. 1 The RF filter panel should not be planned in the area lower than this line; Area 1.
- Pos. 2 In the area above this line should be the position of the RF filter panel; Area 2.
- Pos. 3 Recommended positioning examples of the RF filter panel.
- Pos. 4 **G**radient **P**ower **A**mplifier
- Pos. 5 **A**dvanced **C**ooling **C**abinet
- Pos. 6 **S**EParation cabinet
- Pos. 7 Possible location of the Patient Video Camera. The Patient Video Camera has to be installed at the finished wall.
- Pos. 8 Console components

NOTE

If the patient cannot be observed (visually) through an RF window because of restrictions in the room layout, the Patient Video option has to be included in the room planning. Audible contact with the patient is provided via the built-in intercom system (e.g. loud-speaker, pneumatic headphone).

NOTE

For installation and service (ramping the magnet), an area of approx. 1.0m² has to be provided for the MPS and cables in the equipment room.

NOTE

The possibility of refilling the magnet with liquid helium has to be guaranteed. As a result, space has to be provided for the helium dewars.

The min. distance between patient table and RF cabin wall has to be suitable for He- dewars.

NOTE

The RF room door has to be opened to the outside, if this is e.g. not possible due to building restrictions, refer to the register RF-room for details ([Alternatives for a pressure equalization opening / p. 196](#)).

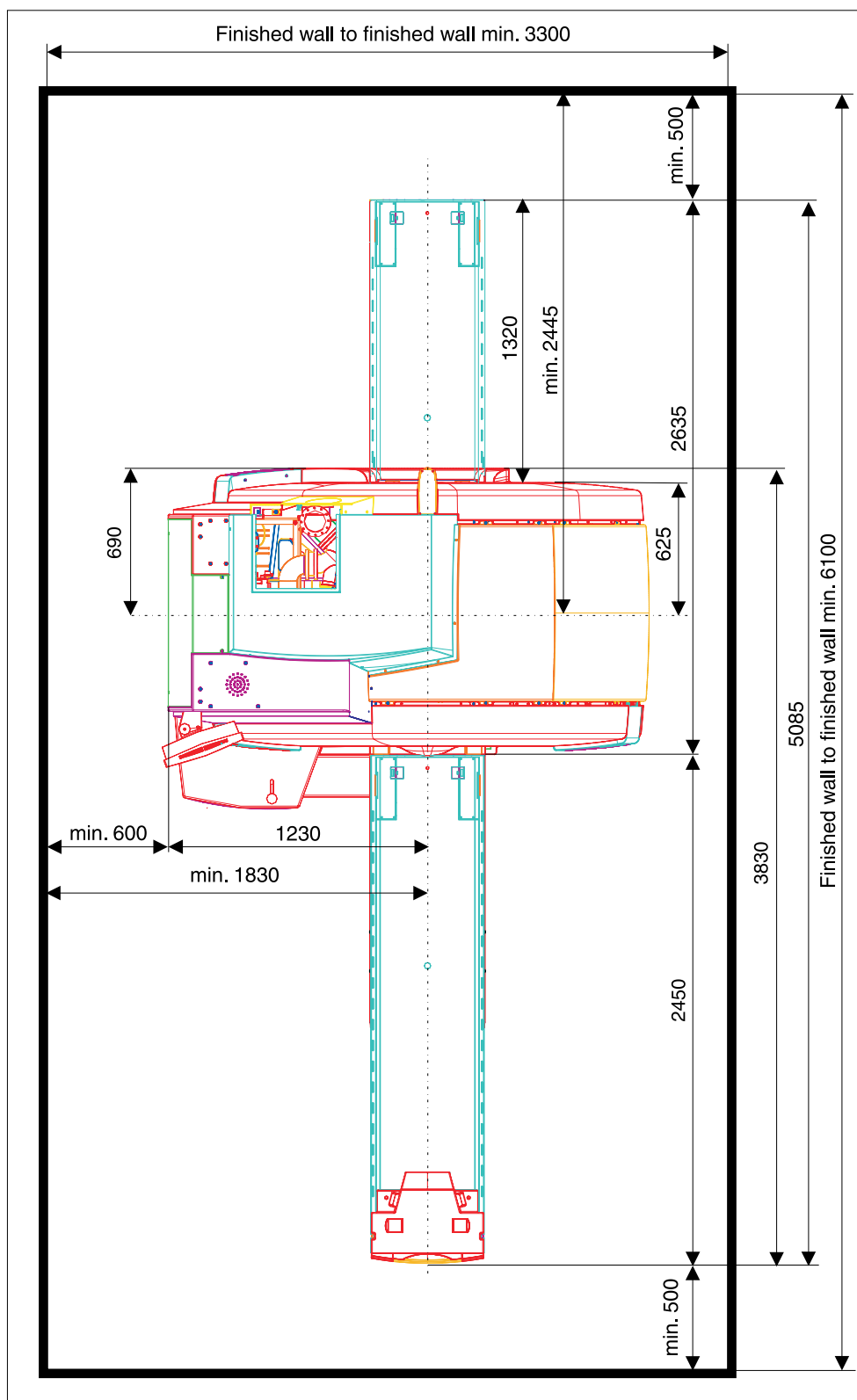


Fig. 17: Examination room; minimum technical room size from finished wall to finished wall

NOTE

Ensure that no cable ducts, light fittings, air conditioning ducts or any other component is installed above the cold head and the helium syphon port.

Keep those areas clear of components.

Distance of the magnet to the rear wall	
Maximum patient table travel distance in the longitudinal direction is 2530mm	
Maximum patient table excess length behind the magnet is 1320mm	
The distance from the back magnet cover to the back wall of 1820mm is recommended in any case and mandatory for the “whole-body suite” option. Minimum required distance from the back magnet cover to the back wall for service purposes (e.g. changing the patient tabletop) is 1500mm if the “whole-body suite option” is not present.	
The distance from the magnet isocenter to the back wall of 2445mm is recommended in any case and mandatory for the “whole-body suite” option. Minimum distance from the magnet isocenter to the back wall is 1925 mm if the “whole-body suite option” is not present.	
The distance from the magnet isocenter to the back wall of 2445mm is recommended in any case, and mandatory for the “whole-body suite” option. Minimum required distance from the magnet isocenter to the back wall is 2445mm if the “whole-body suite option” is present.	

Patient table travel	
Vertical patient table movement	470mm to 890mm
Longitudinal table movement	2530mm
Table excess length behind the magnet for whole-body suite	1320mm
Table excess length behind the magnet if wholebody suite is not present	800mm
Minimum required service distance from the back magnet cover to the wall (changing the patient table top)	1500mm
Minimum required service distance from the magnet isocenter to the wall	2125mm
Minimum required distance from the back magnet cover to the wall including 500mm safety distance.	1820mm
Minimum required distance from the magnet isocenter to the wall including 500mm safety distance.	2445mm

Patient table travel	
Minimum required distance in front of the magnet from the fully slided out patient table to the wall for using the option "Patient table trolley"	600mm
Recommended distance in front of the magnet from the fully slided out patient table to the wall for using the option "Patient table trolley"	750mm

NOTE

If the system is designated for using the 2nd tabletop with trolley, the distance of 500mm, in front of the patient table fully extended to the wall, has to be increased by 100mm to 600mm!

The distance of 600mm is a technical minimum distance. We recommend 750mm.

The distance of 750mm to the wall will guarantee easy use of the patient table trolley.

This will result in a finished room length of min. 6200mm with the option "patient table trolley".

The recommended finished room length is 6350mm!

NOTE

If the magnet is installed on an additional base frame the option "Patient table trolley" will not work.

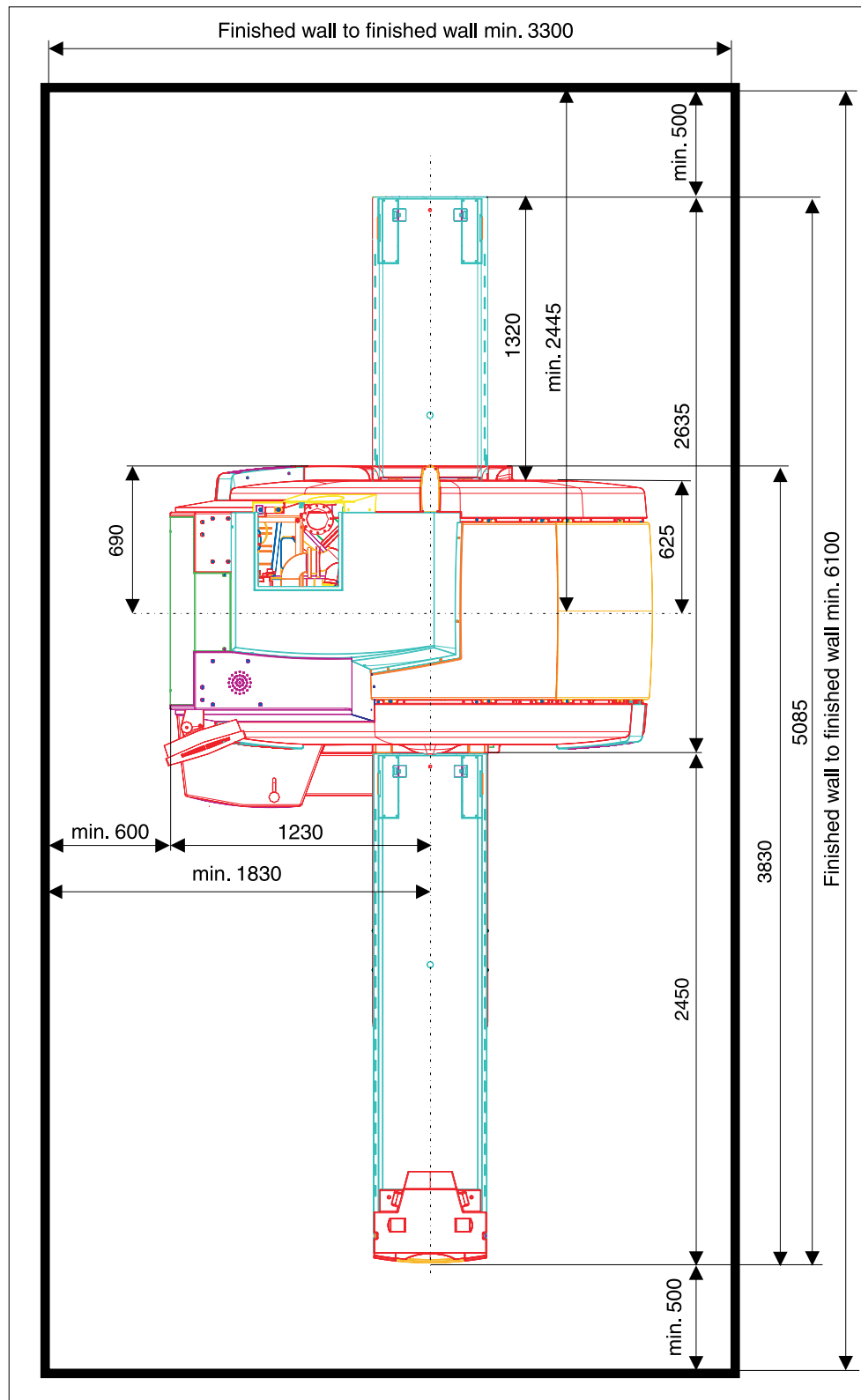


Fig. 18: Examination room; minimum technical room size from finished wall to finished wall

Minimum technical finished room size

Minimum distances

Room planning for MR systems must be based on the minimum technical distances specified for safety and installation-related reasons.

NOTE

If the system is designated for using the 2nd tabletop with trolley, the distance of 500mm, in front of the patient table fully extended to the wall, has to be increased by 100mm to 600mm!

The distance of 600mm is a technical minimum distance. We recommend 750mm.

The distance of 750mm to the wall will guarantee easy use of the patient table trolley.

This will result in a finished room length of min. 6200mm with the option "patient table trolley".

The recommended finished room length is 6350mm!

NOTE

The minimum distance from the back magnet cover to the back wall has to be 1500mm in any case. This is needed because of service requirements.

NOTE

The minimum finished room height measures from the finished floor to the finished (e.g., suspended) ceiling.

⇒ To service the magnet (e.g., cold head, current probe, etc.), the minimum finished room height must be guaranteed.

Minimum technical room height

NOTE

The minimum dimensions provided present the minimum technical requirements.

It is the decision of the customer to increase these dimensions.

NOTE

The system is delivered with a built-in set of Stop-Choc elements for structurally-borne sound reduction.

NOTE

If, e.g., additional iron room shielding or noise damping has to be built into the RF room, take the size of the noise damping into consideration to achieve the min. finished room sizes!

Minimum technical finished room height ¹		Minimum technical finished room size ² in l x w
Examination room	2400 mm	3300 mm/6100 ³ mm
Control room	2100 mm	3300 mm/2000 mm
Equipment room	2200 mm	2900 mm/1650 mm

1. The finished room height is the distance from the finished floor (e.g., anti-static linoleum floor) to the finished ceiling (e.g., suspended ceiling). These values are technical measures.
2. The minimum finished room size is measured from the finished wall to finished wall.
3. It is required to plan min. 6200mm for using the option Patient table trolley. Nevertheless it is recommended to use 6350mm finished room length with the option patient table trolley because of a better workflow.

NOTE

To cover various room heights, a turret cover, cut to height, is part of the delivery volume.

The turret cover can be cut to cover a height from 2350mm to 2700mm finished ceiling height.

Magnet floor loading

Magnet floor loading	
Total magnet weight	5100kg
Stop-Choc springs (standard configuration)	4 support feet each 150 mm X 250 mm (each 375cm)
Sylomer/Sylodamp	4 support feet each 120 mm X 280 mm (each 336cm)
Total floor loading	~ 50.03kN
Foot position 1	14.40 kN
Foot position 2	12.20 kN
Foot position 3	10.75 kN
Foot position 4	12.00 kN

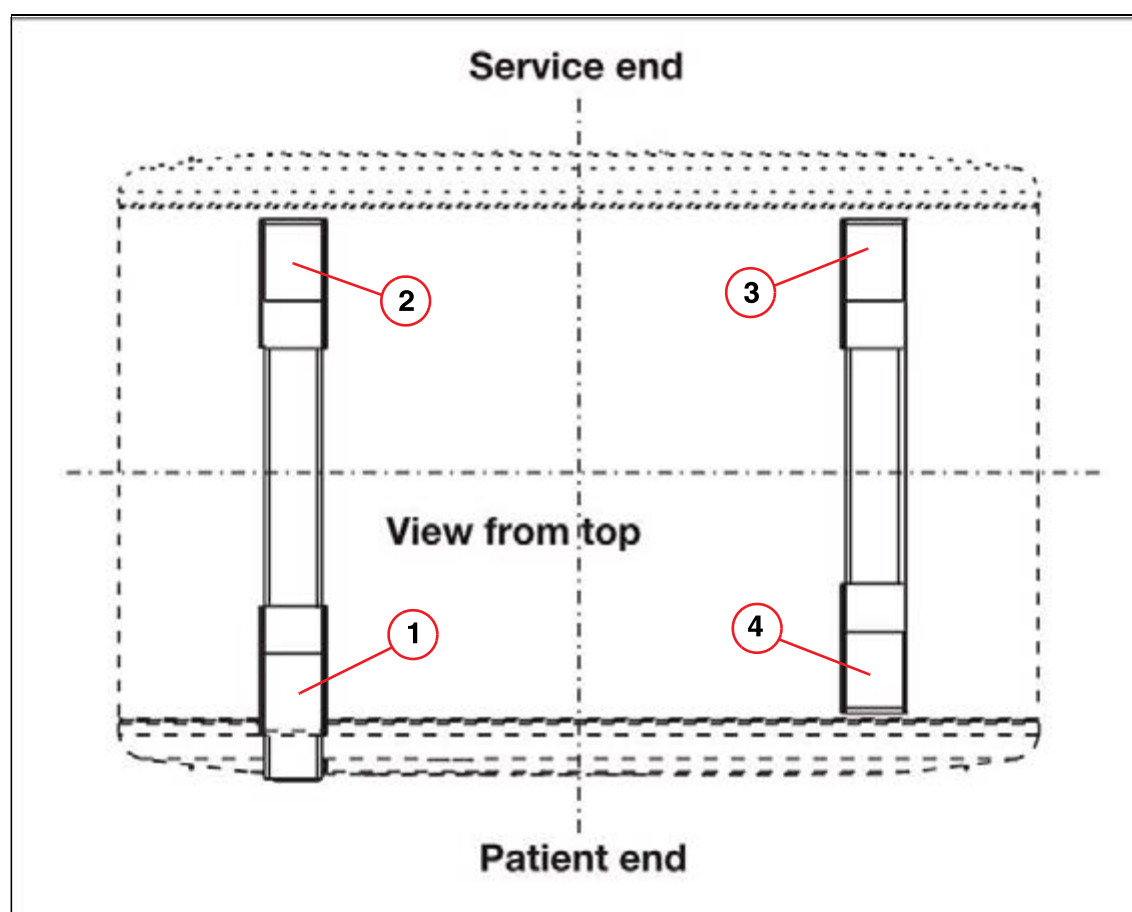


Fig. 19: Footprint for Stop-Choc configuration

Pos. 1	Stop-Choc no. 311-4633
Pos. 2	Stop-Choc no. 311-4631
Pos. 3	Stop-Choc no. 311-4630
Pos. 4	Stop-Choc no. 311-4632

NOTE

The floor in the vicinity of the magnet (2.2 m x 4.5 m) must be leveled within max. +/-2.0 mm.

RF filter plate installation

NOTE

The position of the RF filter panel should be located in the area behind the magnet center.

Recommended installation

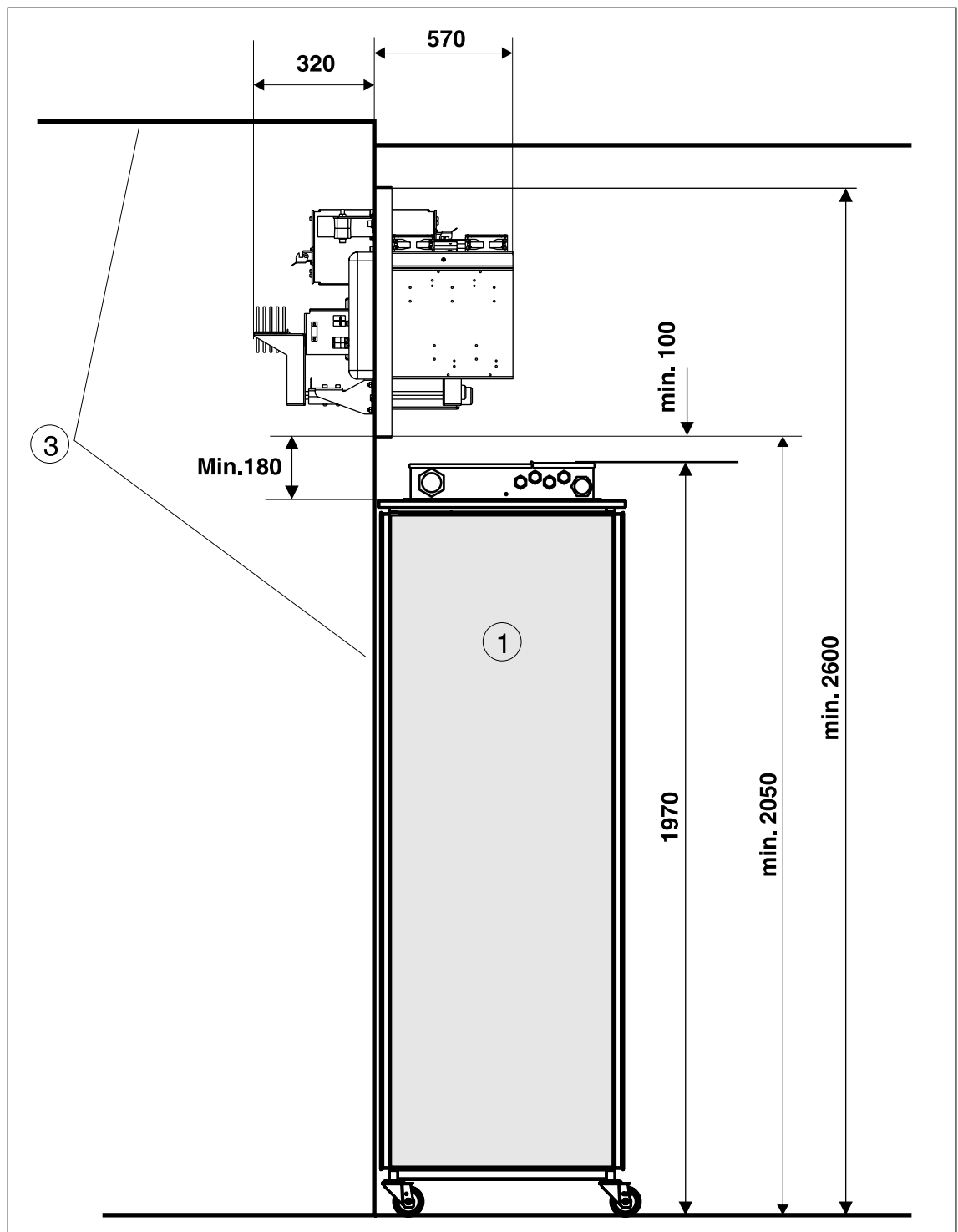


Fig. 20: ACC/GPA position in relation to the RF filter plate

Pos. 1 ACC/GPA

Pos. 3 RF room

Alternative installation

Due to the building requirements or other circumstances, it may be necessary to install the RF filter plate in other positions.

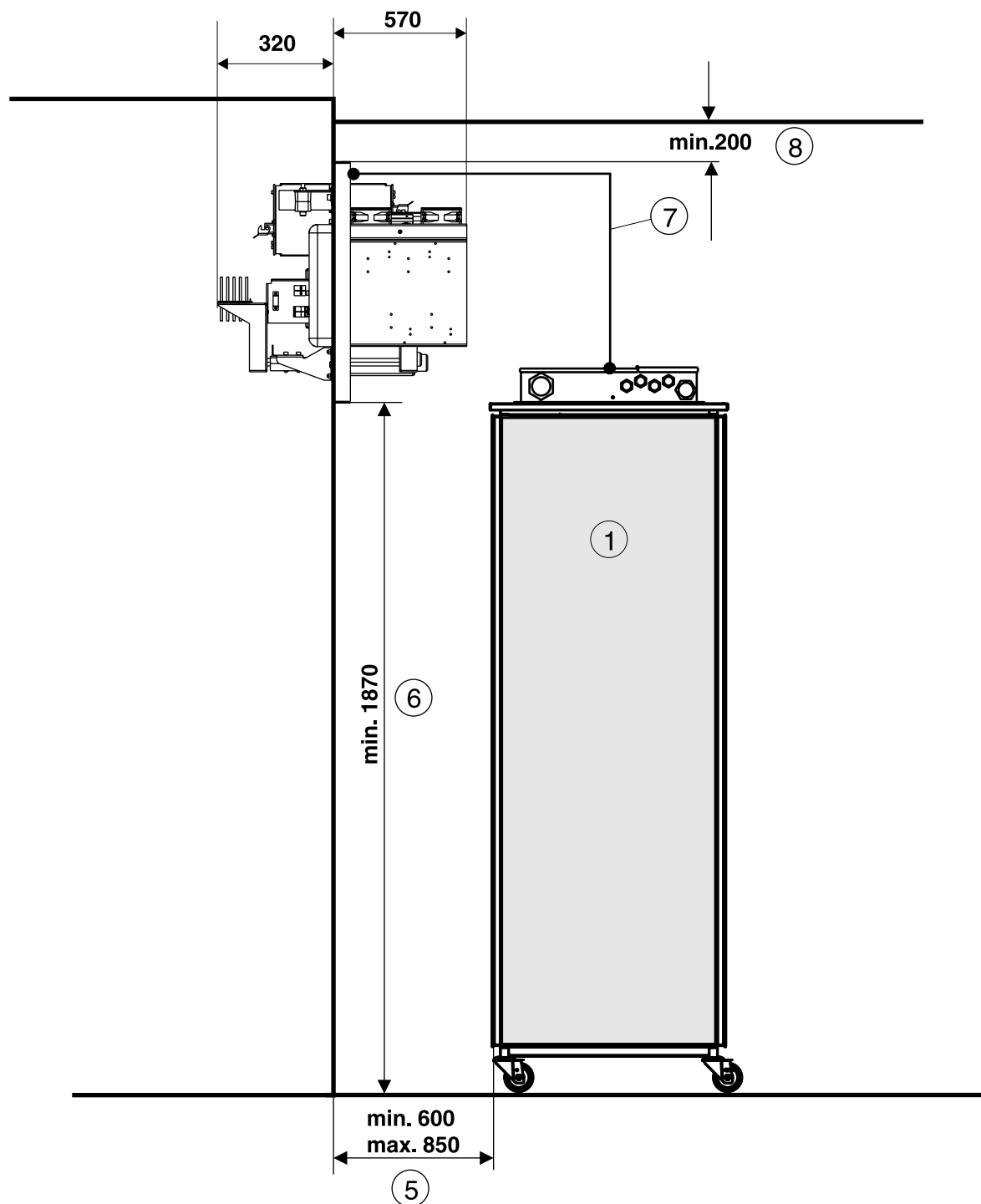


Fig. 21: RF filter plate at ACC/GPA height

- Pos. 1 ACC/GPA
- Pos. 5 Minimum distance of ACC/GPA to RF room if (6) is 1,870 mm or lower
- Pos. 6 RF filter plate height example
- Pos. 7 The 1.5 m cable set will cover this configuration. If the distance (5) is more than 850 mm, the next longer cable set has to be used.
- Pos. 8 The minimum distance of 200 mm to the ceiling is to achieve the bending radius of the gradient cables.

NOTE

The electronic cabinet could also be positioned either to the left or right side of the filter plate. A longer cable set has to be ordered for this configuration.

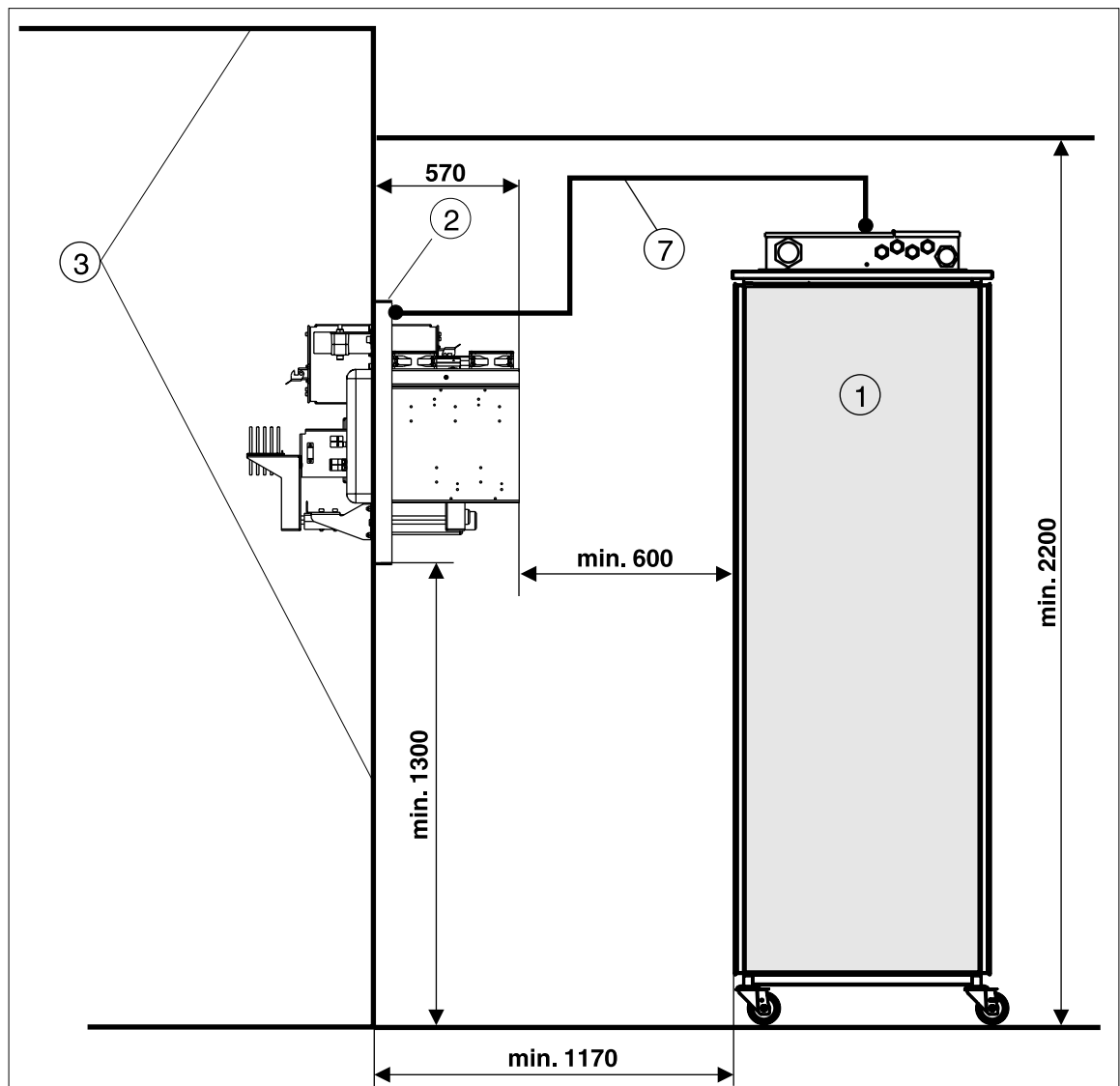


Fig. 22: Low RF filter plate installation

- Pos. 1 GPA/ACC cabinet
- Pos. 2 RF filter plate
- Pos. 3 RF room (RF shielding)
- Pos. 7 Cable set > 1.5 m

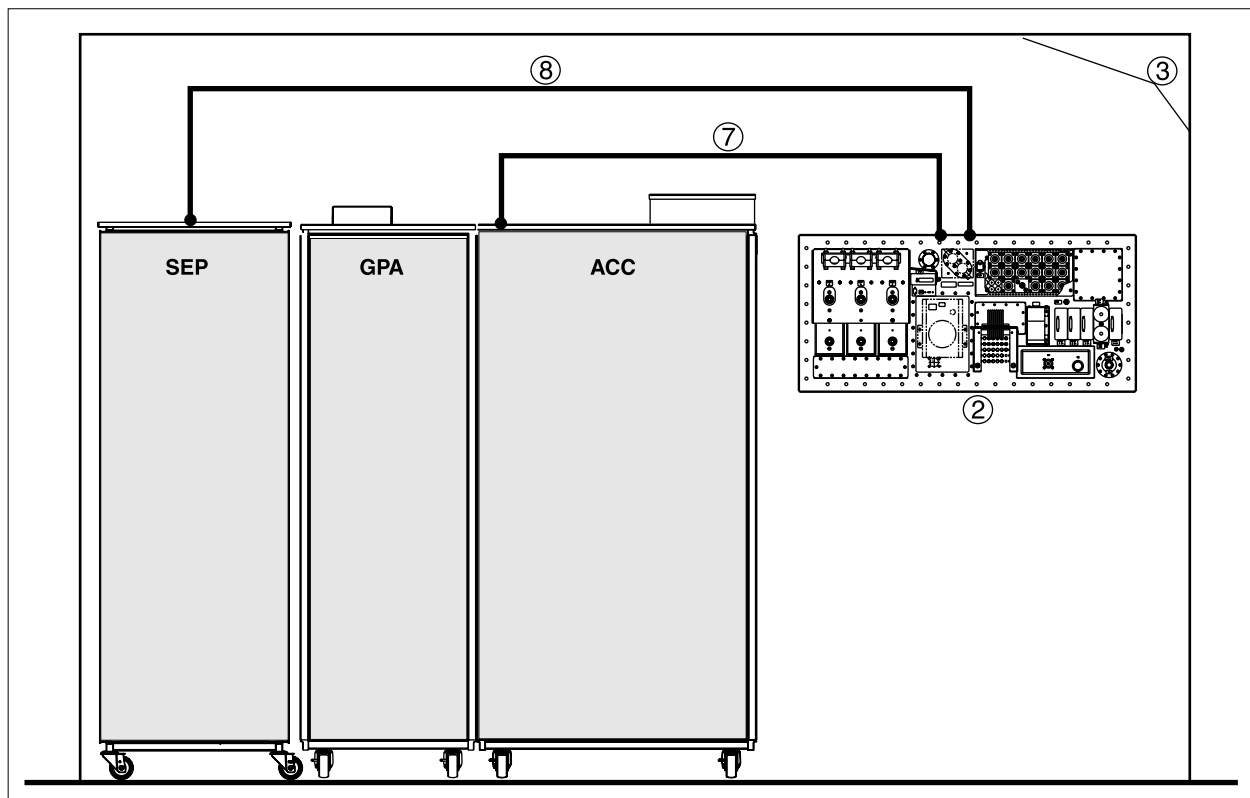


Fig. 23: RF filter plate right of ACC

Pos. 2 RF filter plate

Pos. 3 RF room

Pos. 7 Cable set >1.5 m outside the RF room (equipment room) is required for this configuration.

Pos. 8 Pay attention to the length of the helium low and high pressure line from the SEP / helium compressor via the RF filter plate to the coldhead.

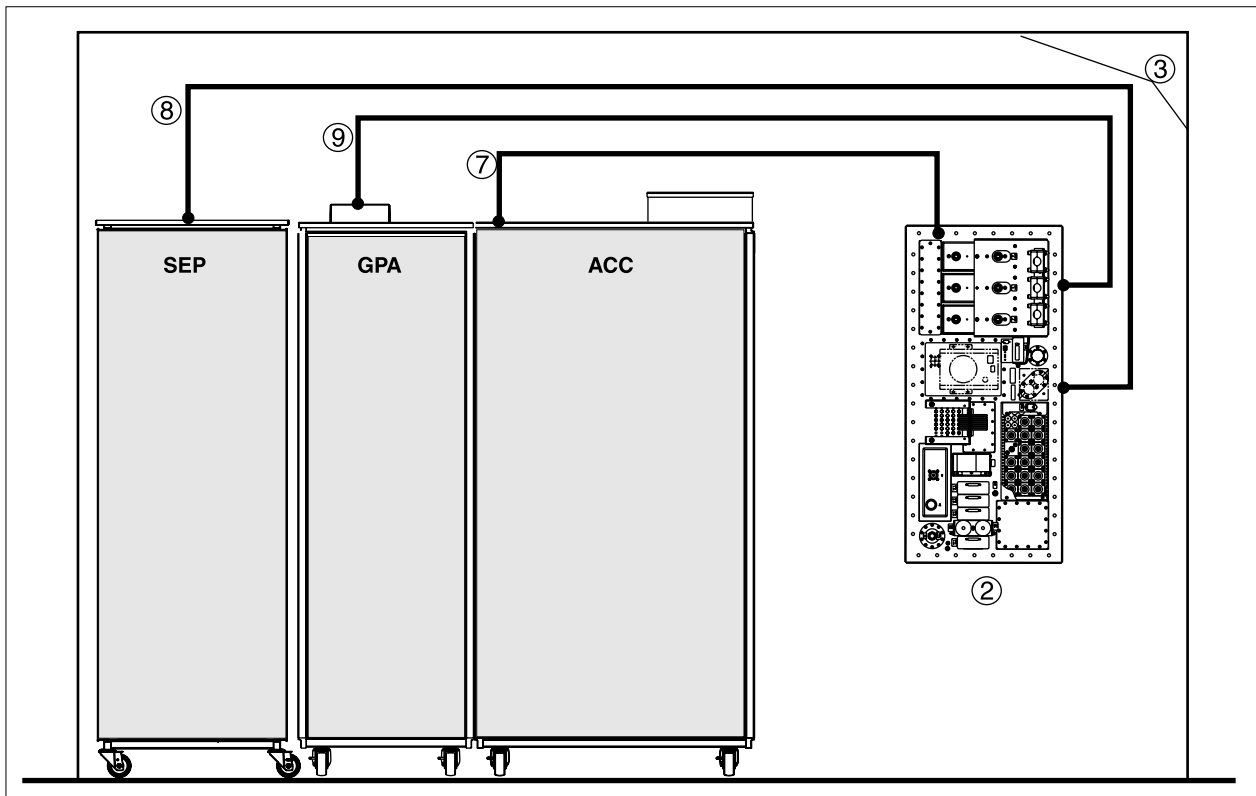


Fig. 24: RF filter plate, vertical, installed on the right side of the ACC

- Pos. 2 RF filter plate. If the filter plate is mounted vertically, the gradient filters have to be on top
- Pos. 3 RF room
- Pos. 7 A cable set >1.5 m in the examination room has to be used for this configuration.
- Pos. 8 Pay attention to the length of the high and low pressure lines between the SEP / helium compressor via the RF filter plate to the coldhead.
- Pos. 9 Pay attention to the length of the gradient cables. In this case, the connection point of the gradient cables is on the right side of the RF filter plate.

Magnet OR122

Function

The magnet system generates the basic magnetic field. The electrical and mechanical shim are integrated in the gradient coil. The magnet comprises the superconducting magnet including the system for cooling (interface for helium fill/refill, cold head), energizing (current probe) and monitoring the magnet during operation. In addition, it includes the cabling up to the point where the external lines are connected.

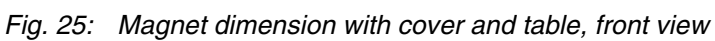
Technical data

Tab. 4 Magnet and component weight

Magnet type	OR122
Magnet with 70% of helium	~3800 kg
Gradient coil	~750 kg
RF electronic	~50 kg
Patient table	~350 kg
Covers	~150 kg
Total weight	approx. 5100 kg

Dimensions

Magnet dimension with cover and patient table



MAGNETOM Espree

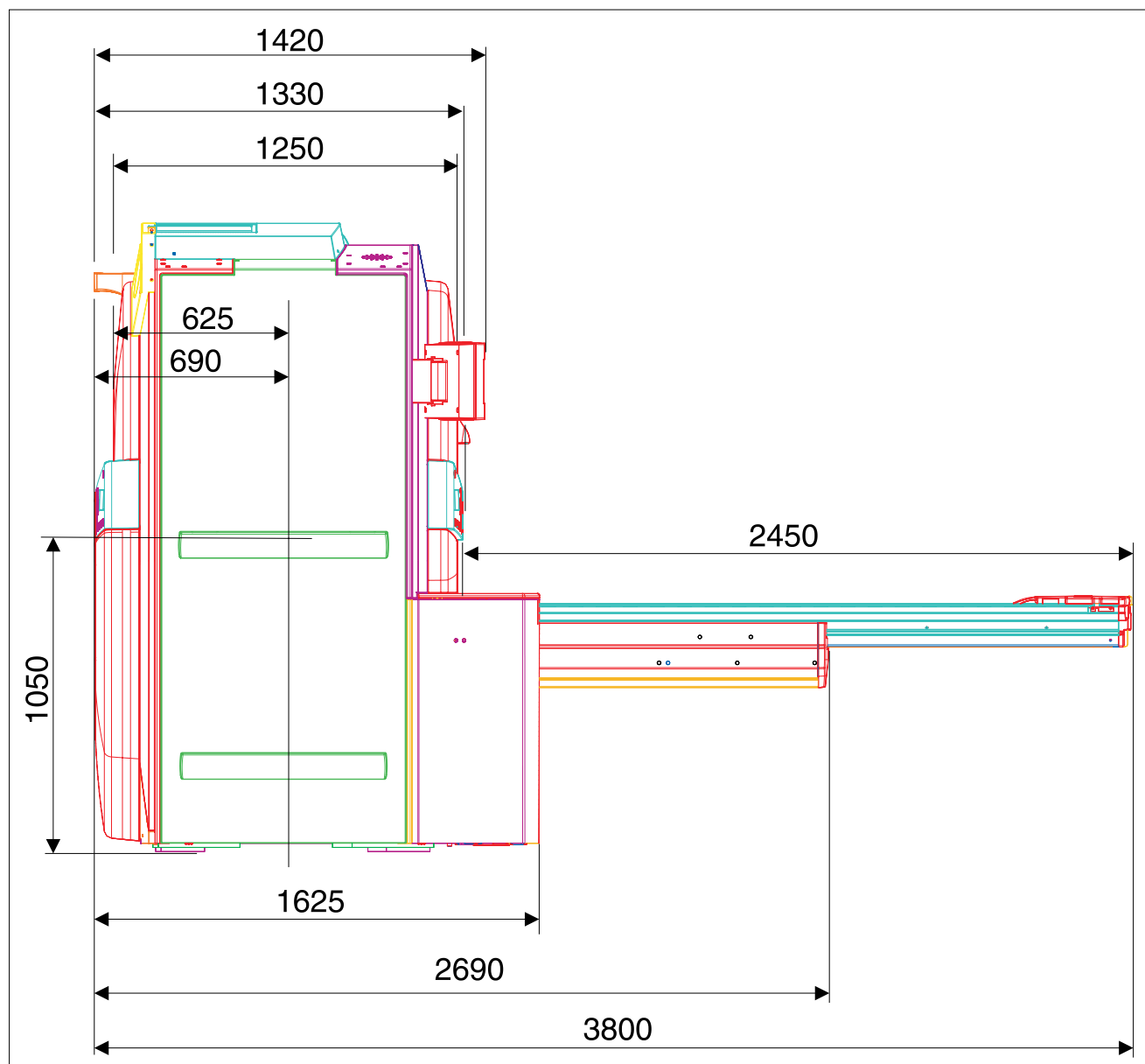


Fig. 26: Magnet dimension with cover and table, side view

Patient table details	
Vertical patient table movement	470mm to 890mm
Longitudinal table movement	2530mm
Maximum speed for longitudinal travel	200mm/s
Maximum speed for vertical travel	100mm/s
Scan range with "Tim Whole-Body Suite" option	2050mm
Maximum patient weight	200kg
Required distance in front of the fully slided out patient table to the wall for using the option "patient table trolley"	600mm

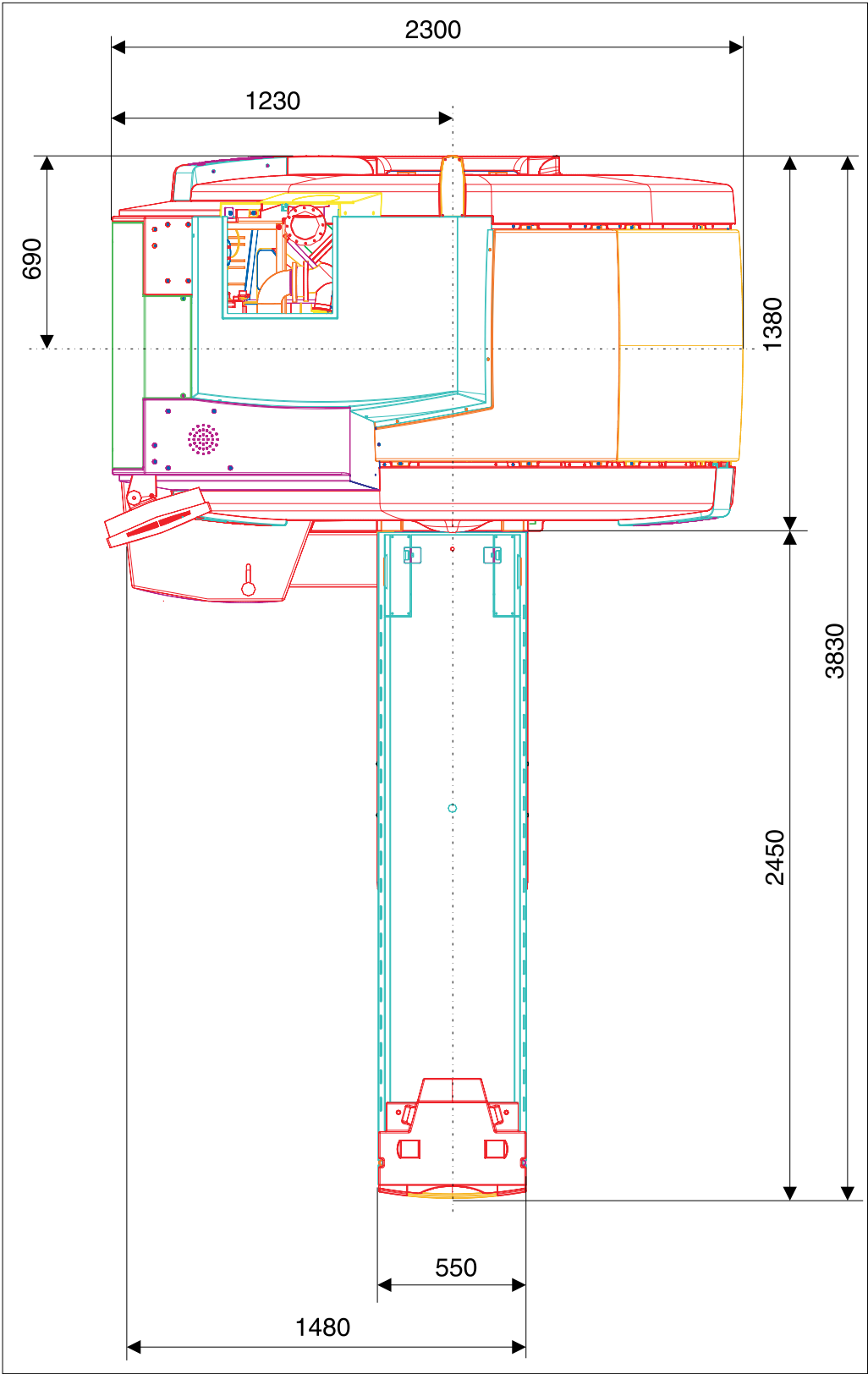


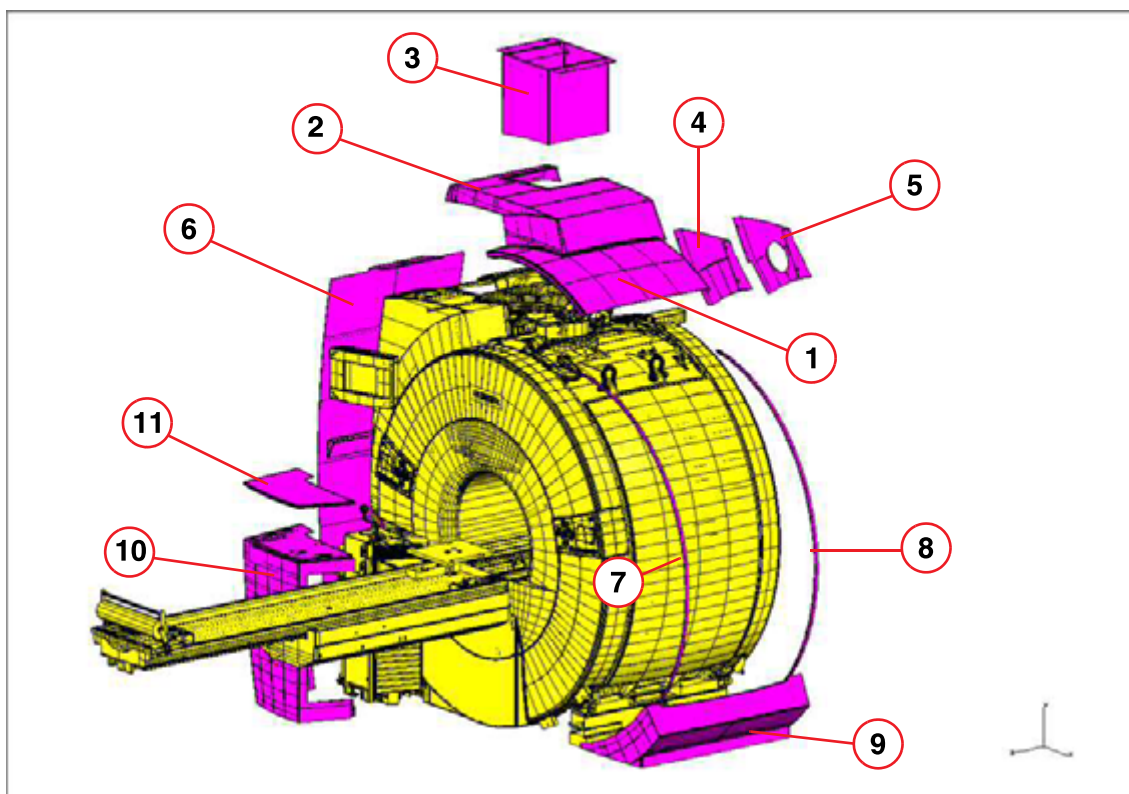
Fig. 27: Magnet dimension with cover and table, top view

Tab. 5 Magnet dimensions with patient table and cover

Height	2300 mm
Length	2690 mm
Width	2300 mm

NOTE

The min. finished ceiling height for removal of cold head and He syphon is 2400 mm.

Magnet covers*Fig. 28: Enlarged view, cover, patient end*

- Pos. 1 Top right side cover
- Pos. 2 Turret cover
- Pos. 3 Turret extension
- Pos. 4 Quench tube outlet cover
- Pos. 5 Quench tube outlet cover horizontal
- Pos. 6 Service access cover
- Pos. 7 Front ring segment
- Pos. 8 Rear ring segment
- Pos. 9 Lower right cover
- Pos. 10 Lifting column cover
- Pos. 11 Lifting column covering

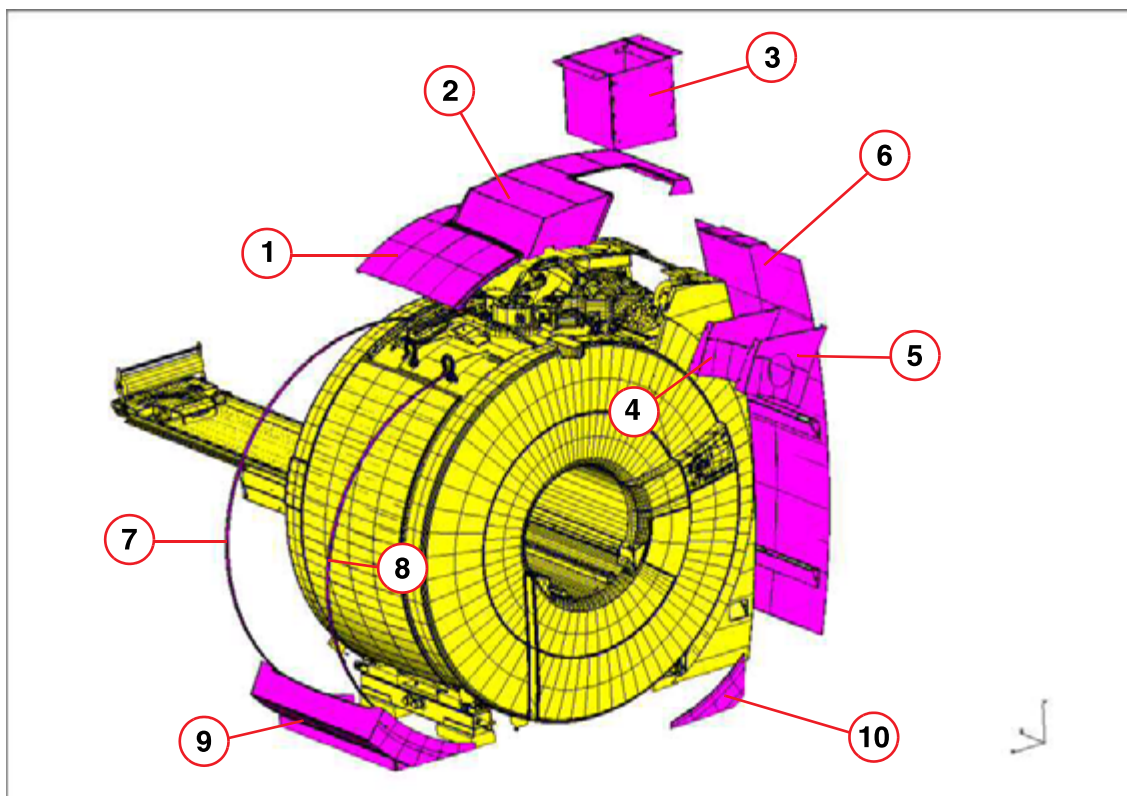


Fig. 29: Enlarged view, cover, service end

- Pos. 1 Top right side cover
- Pos. 2 Turret cover
- Pos. 3 Turret extension
- Pos. 4 Quench tube outlet cover
- Pos. 5 Quench tube outlet cover horizontal
- Pos. 6 Service access cover
- Pos. 7 Front ring segment
- Pos. 8 Rear ring segment
- Pos. 9 Lower right cover
- Pos. 10 Lower left rear cover

Magnet without patient table and cover

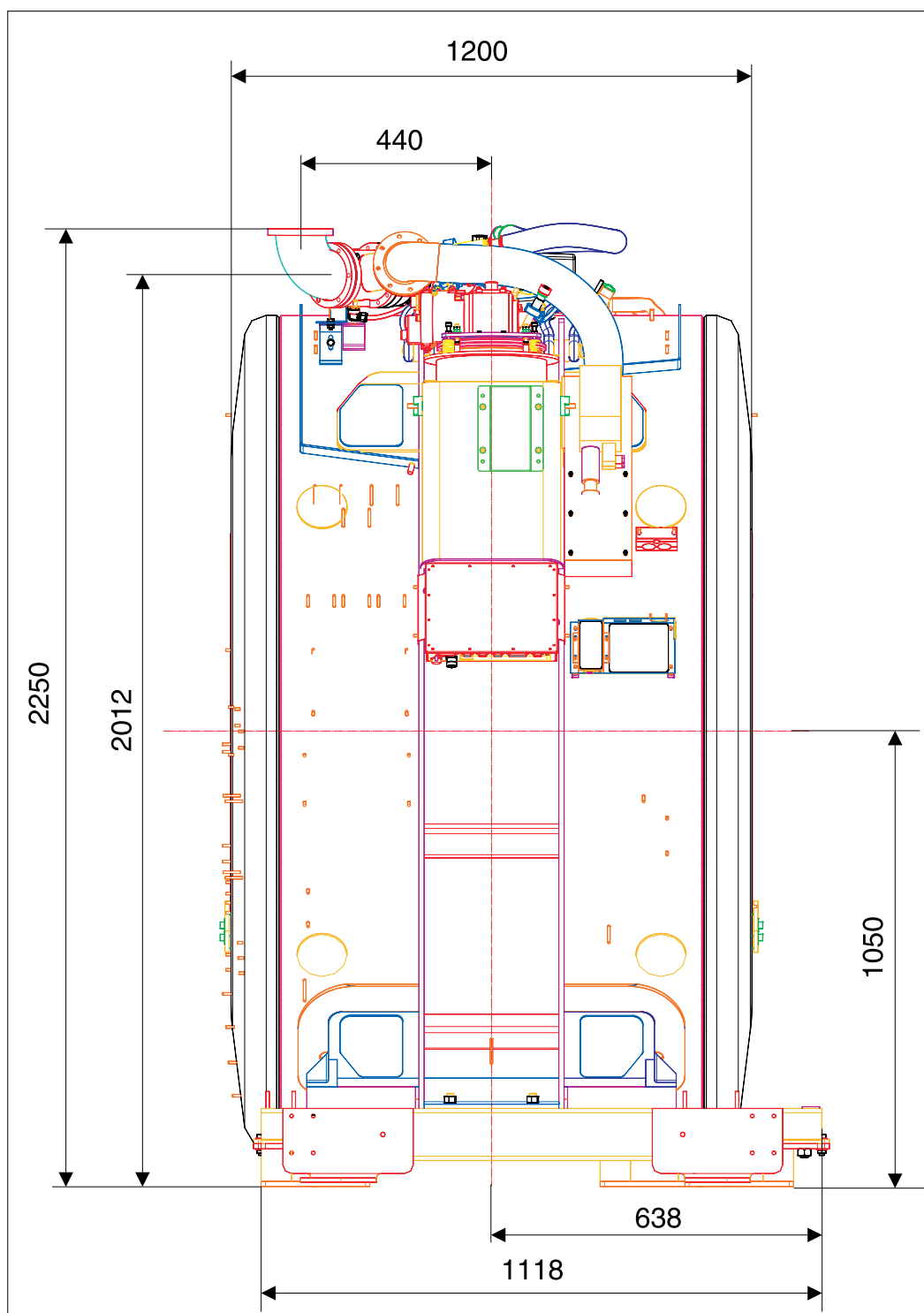


Fig. 30: Magnet quench vent position, side view

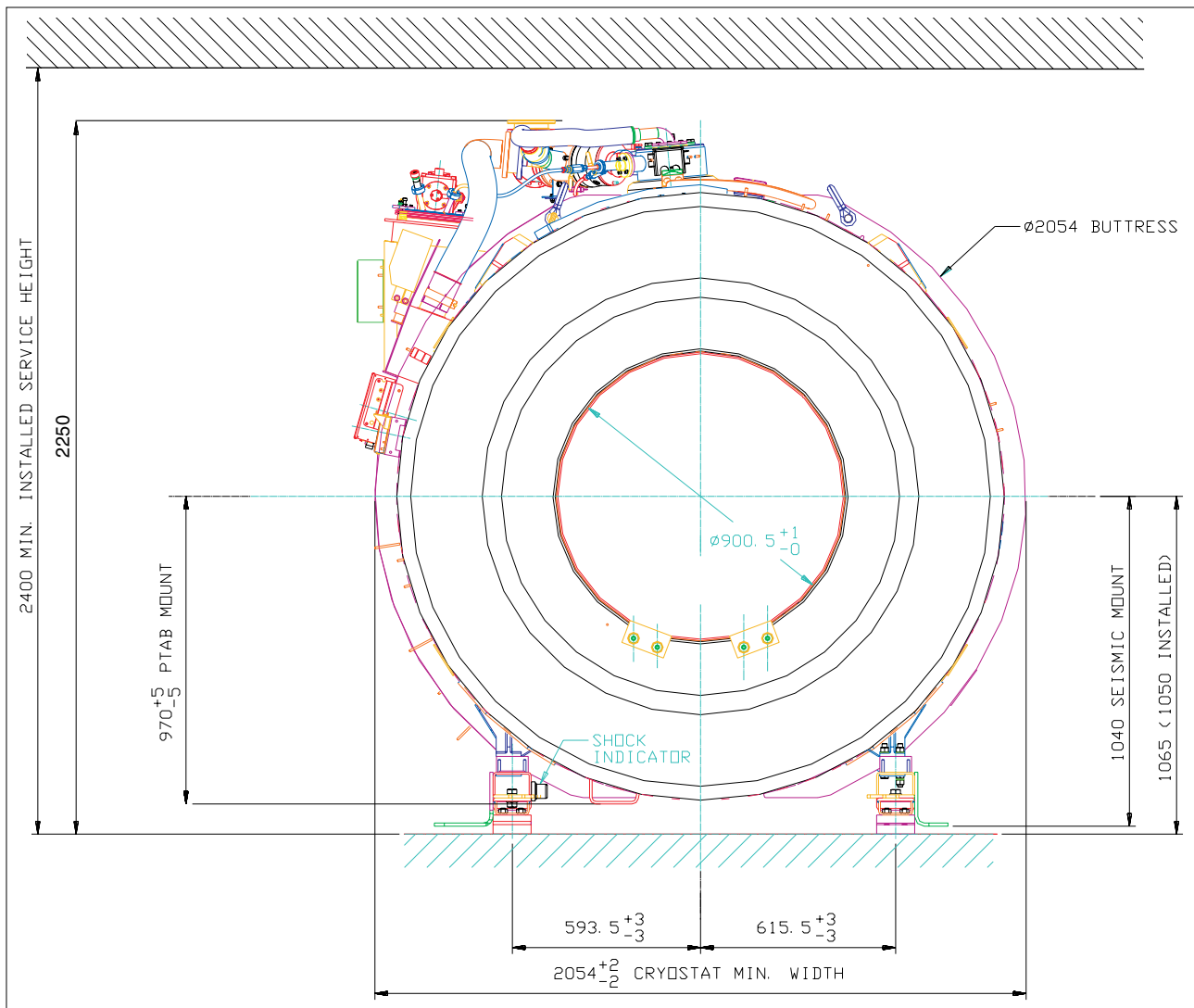


Fig. 31: Magnet front view without cover and patient table

Tab. 6 Magnet dimensions

Height	2230 mm
Height with 90° elbow	2250 mm
Length	1290 mm
Width	2054 mm
Minimum installed service height	2400 mm ¹

1. 2400mm represents the minimum finished room height from the finished floor to the finished ceiling (e.g. suspended or false ceiling).

NOTE

The min. finished ceiling height for removal of cold head and He syphon is 2400 mm.

Magnet positioning solutions

- ⇒ The magnet positioning solution depends on the local iron mass condition underneath the magnet.

Local iron mass condition underneath the magnet.	Required damping solution kit
Standard site conditions (none of the below described circumstances takes place)	Stop-Chock spring damping solution kit has to be installed.
Additional iron shielding, calculated by ES PM PS, is required underneath the magnet position.	Sylomer/Sylodamp pad damping solution kit has to be installed
Additional iron shielding underneath the magnet position is already present from a previous system.	Sylomer/Sylodamp pad damping solution kit has to be installed

Stop-Chock spring configuration

- ⇒ The Stop-Chock spring configuration is considered to be the standard positioning solution. The Sylomer/Sylodamp pad configuration has to be used only if the iron masses underneath the magnet are higher than specified.

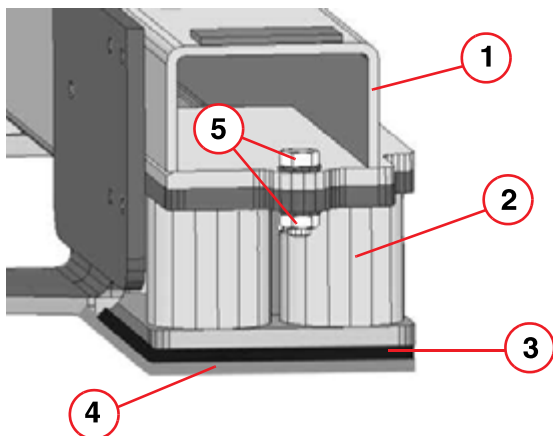


Fig. 32: Configuration with Stop-Choc

- Pos. 1 Box section
 Pos. 2 Stop-Choc
 Pos. 3 Sylomer / Sylodamp plates
 Pos. 4 Aluminum floor plates
 Pos. 5 M10x50 screw, Nordlock washers, nut



Fig. 33: Stop-Choc element

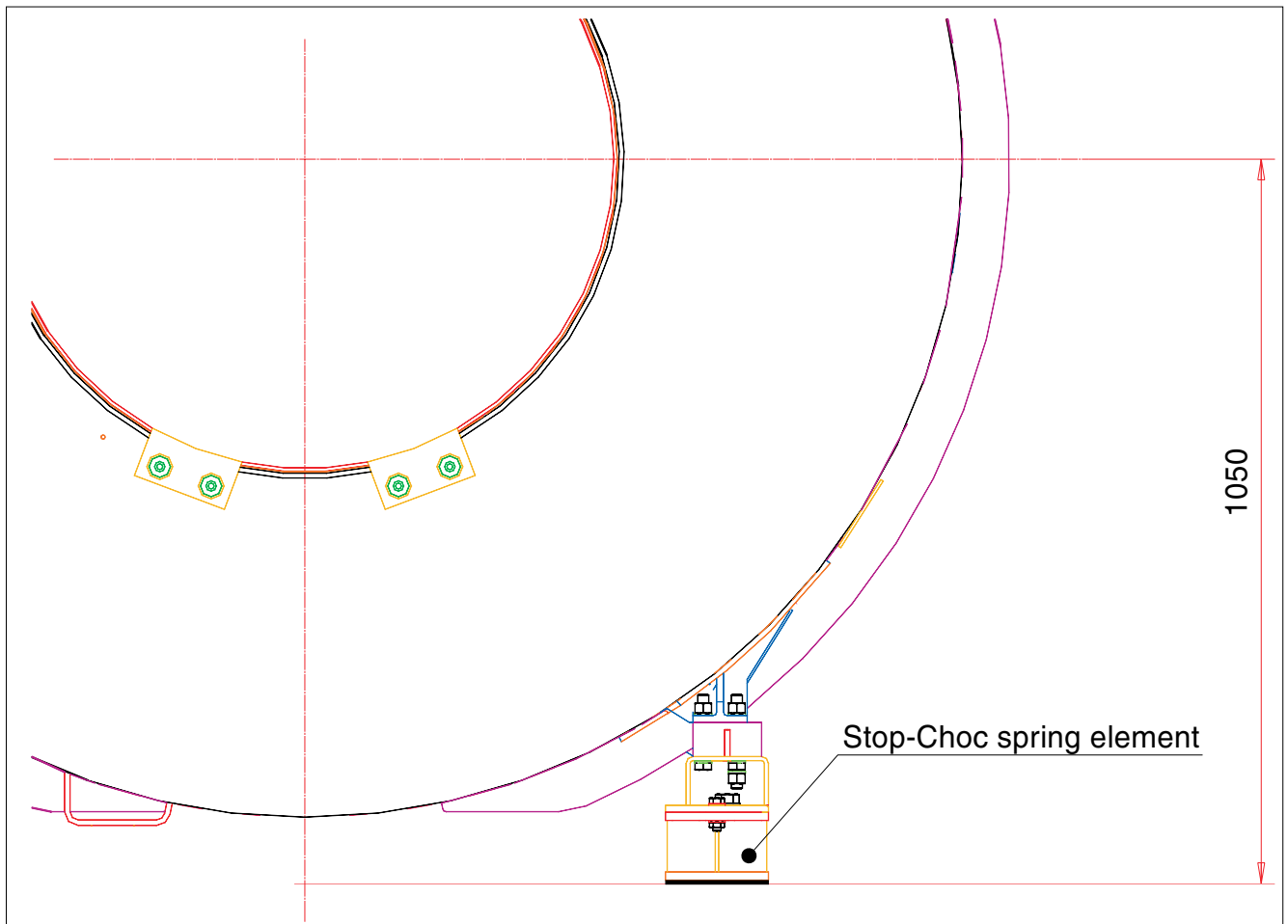


Fig. 34: Magnet center height with Stop-Choc springs

Sylomer/Sylodamp pad configuration

NOTE

The Sylomer/Sylodamp pad configuration is used only in special cases. See also (Fig. 3 / p. 30).

The position of the Sylomer/Sylodamp pads underneath the box sections is identical to the Stop-Choc spring position.

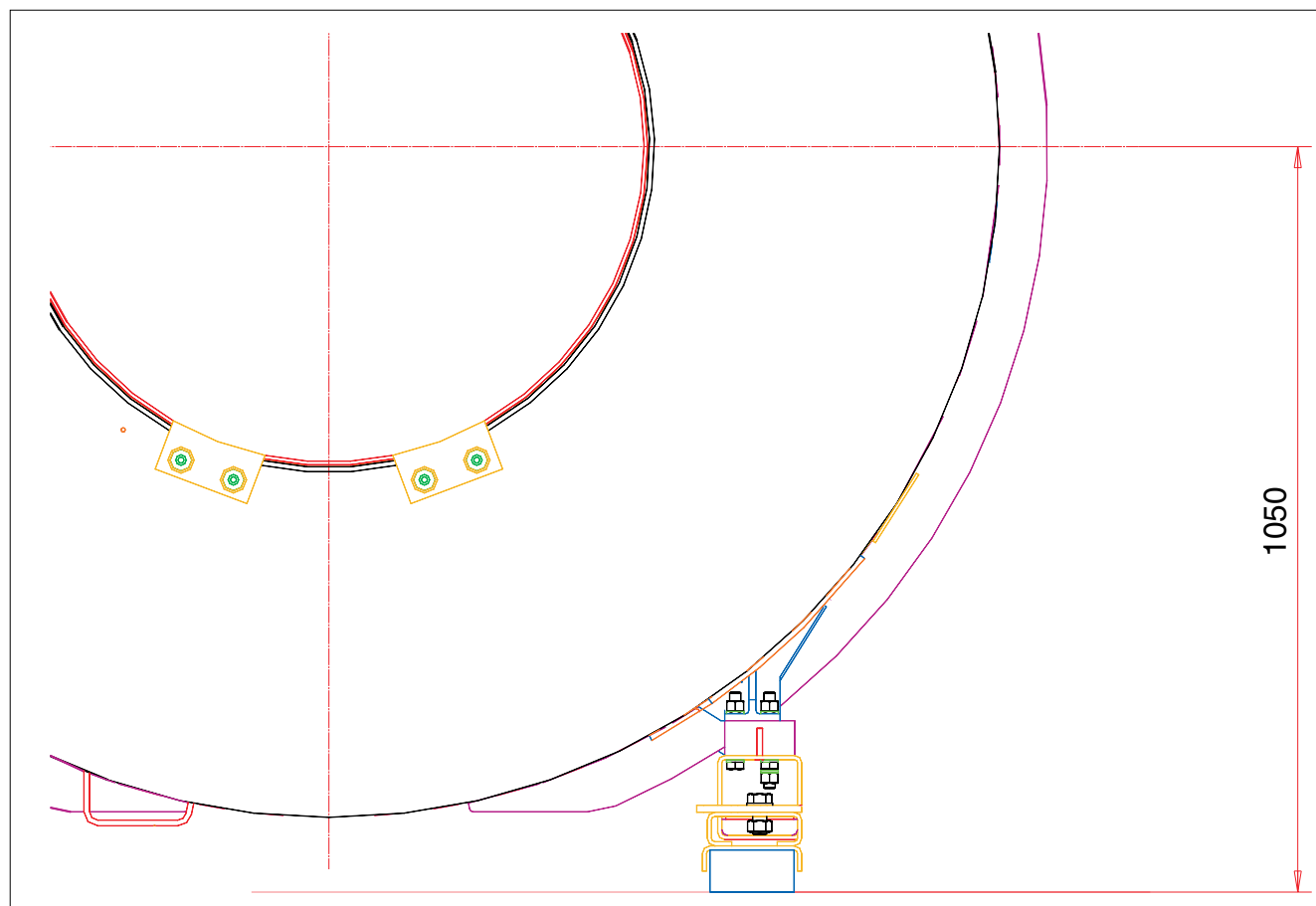


Fig. 35: Magnet center height with the Sylomer/Sylodamp kit

Seismic anchoring

- ⇒ Seismic anchoring is valid for the Stop-Chock spring configuration **and** for the Sylomer/Sylodamp pad configuration.

NOTE

The seismic brackets are permanently mounted to the magnet box sections. Mounting hardware, e.g. anchors, is not part of the delivery volume.

Seismic anchoring is related to local/national regulations, guidelines or codes.

Local regulations have to be met on site.

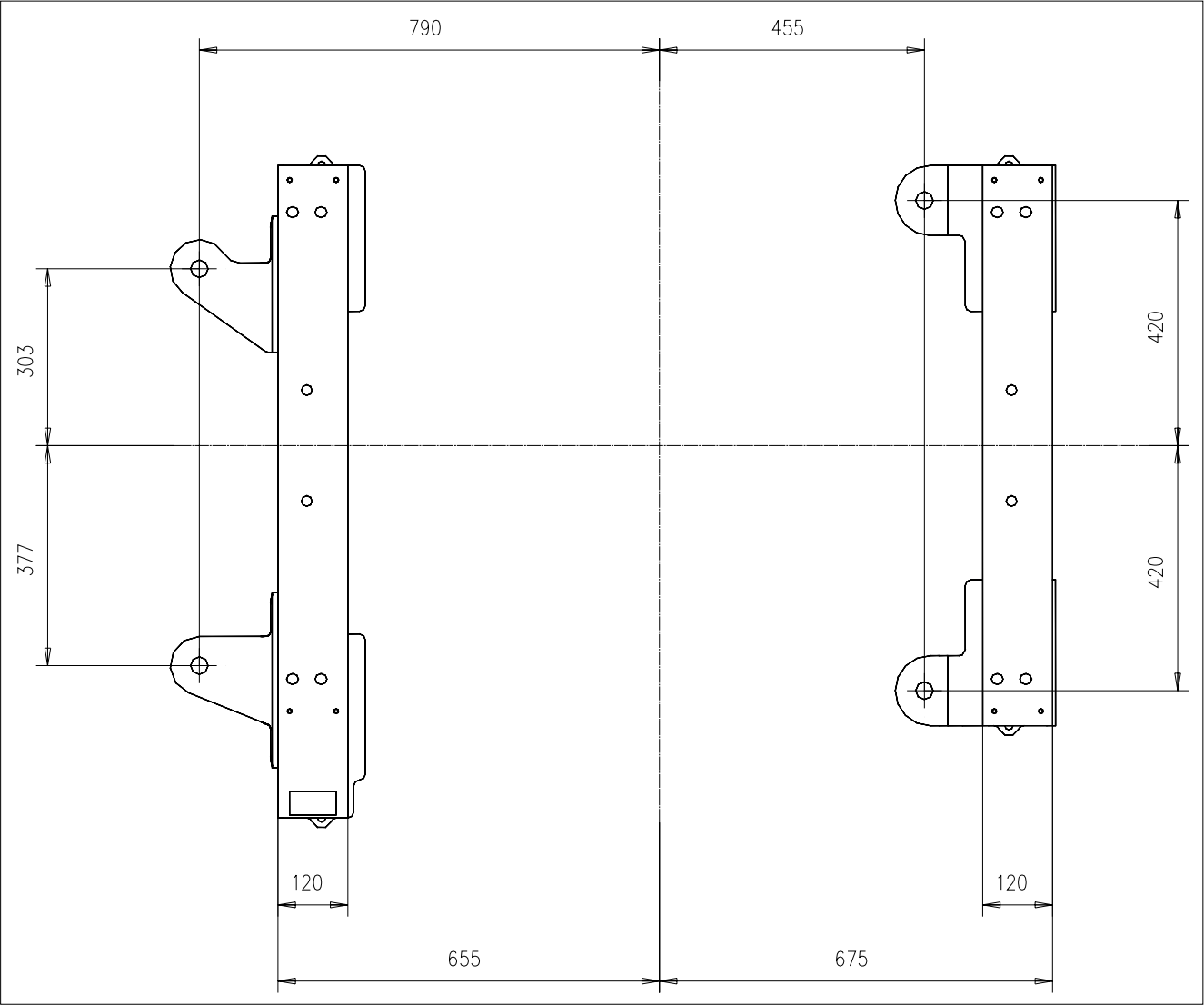


Fig. 36: Seismic anchor positions

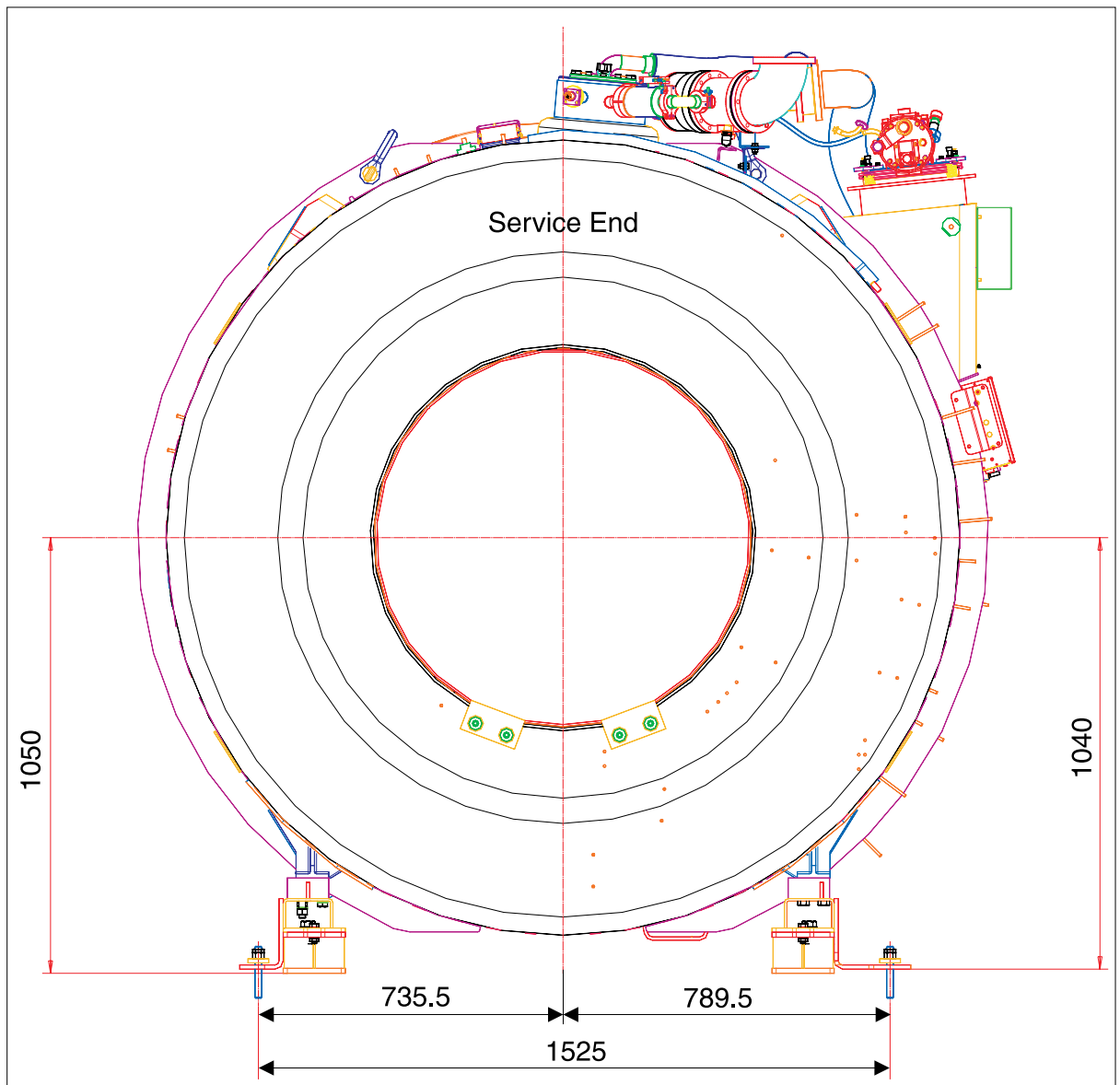


Fig. 37: Seismic bracket position, service end view

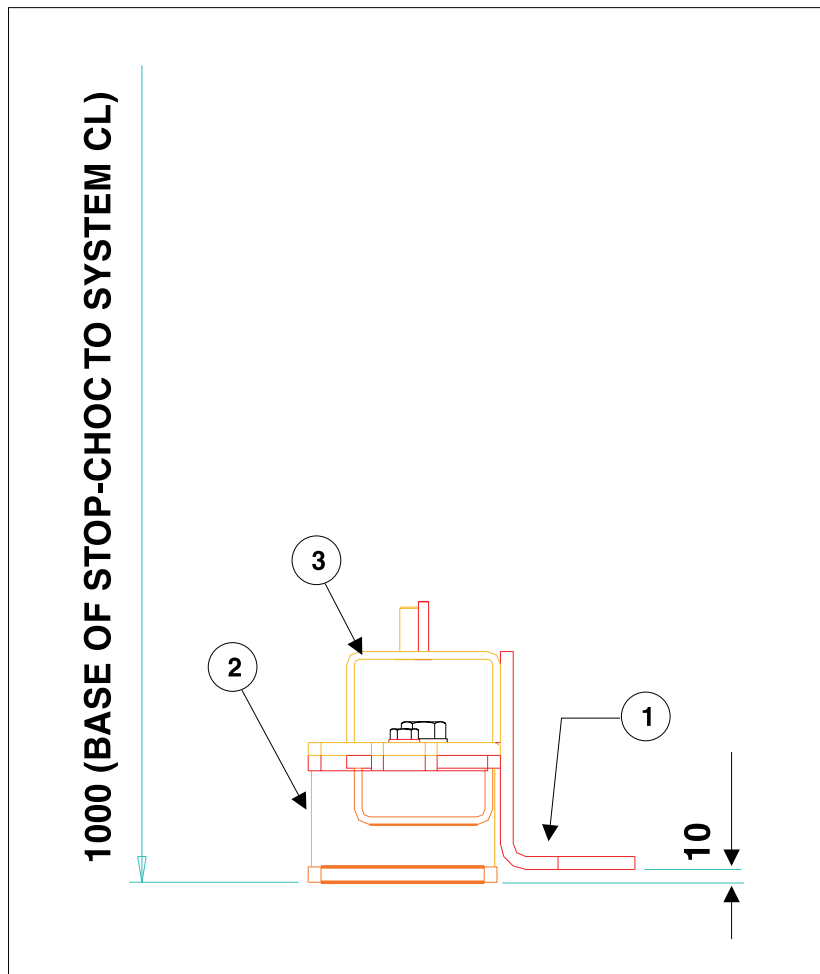


Fig. 38: Seismic bracket

- Pos. 1 Seismic bracket
- Pos. 2 Stop-Choc element
- Pos. 3 Magnet box section

NOTE

The bolt used at the left front side (patient end) cannot protrude more than 25.0mm above the bracket.

If this bolt is longer, mechanical collision with the patient table will occur.

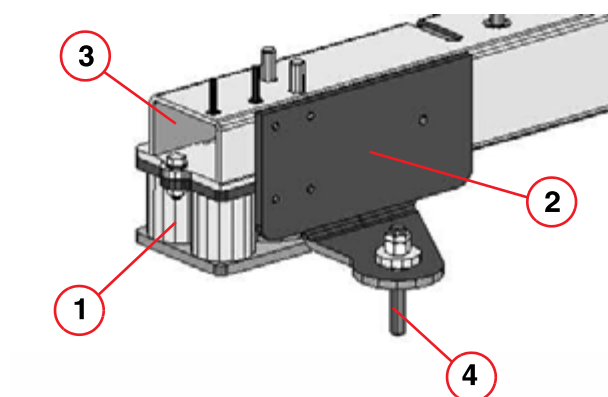


Fig. 39: Seismic bracket

Pos. 1	Stop-Choc
Pos. 2	Seismic bracket
Pos. 3	Box section
Pos. 4	Anchor

Quench tube connection

The on-site quench tube can be connected horizontally or vertically to the magnet.

Vertical quench vent connection

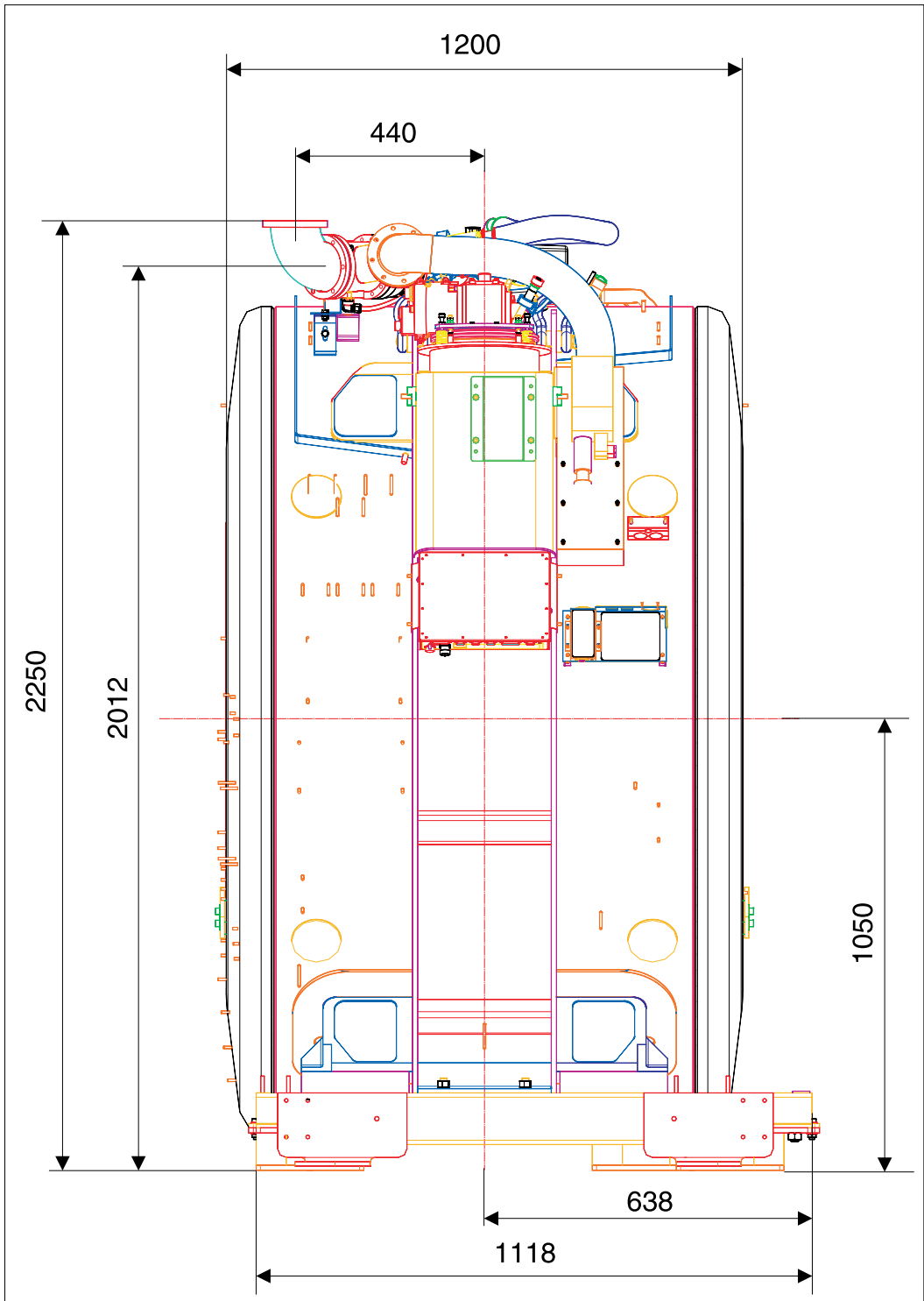


Fig. 40: Magnet quench vent position, side view

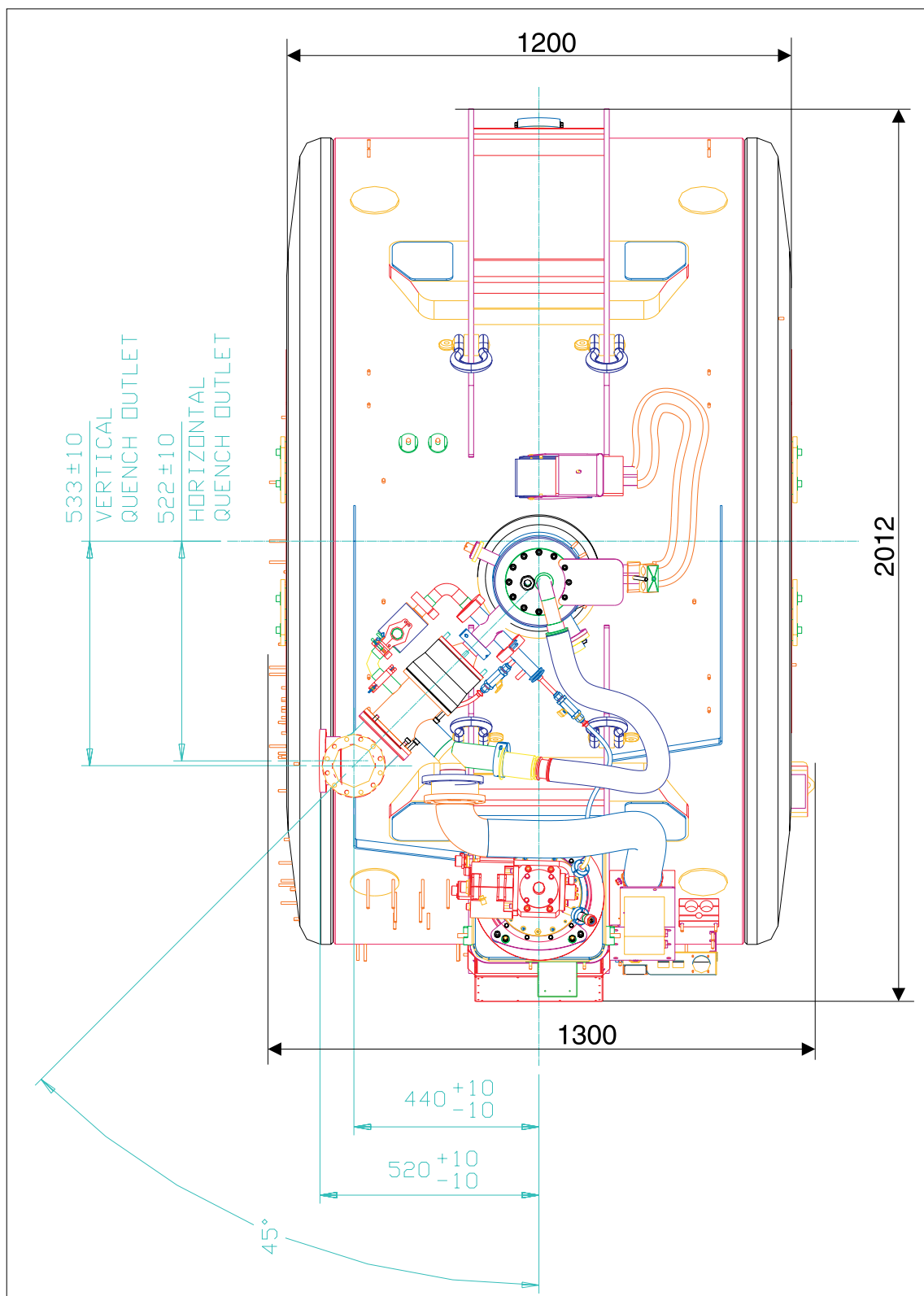


Fig. 41: Magnet dimension, quench vent position, top view

90° Elbow

The 90° elbow is part of the delivery volume. The two flanges are identical. The twelve 10.2 mm holes (separated by 30°) allow you to turn the elbow by 30°, if necessary.

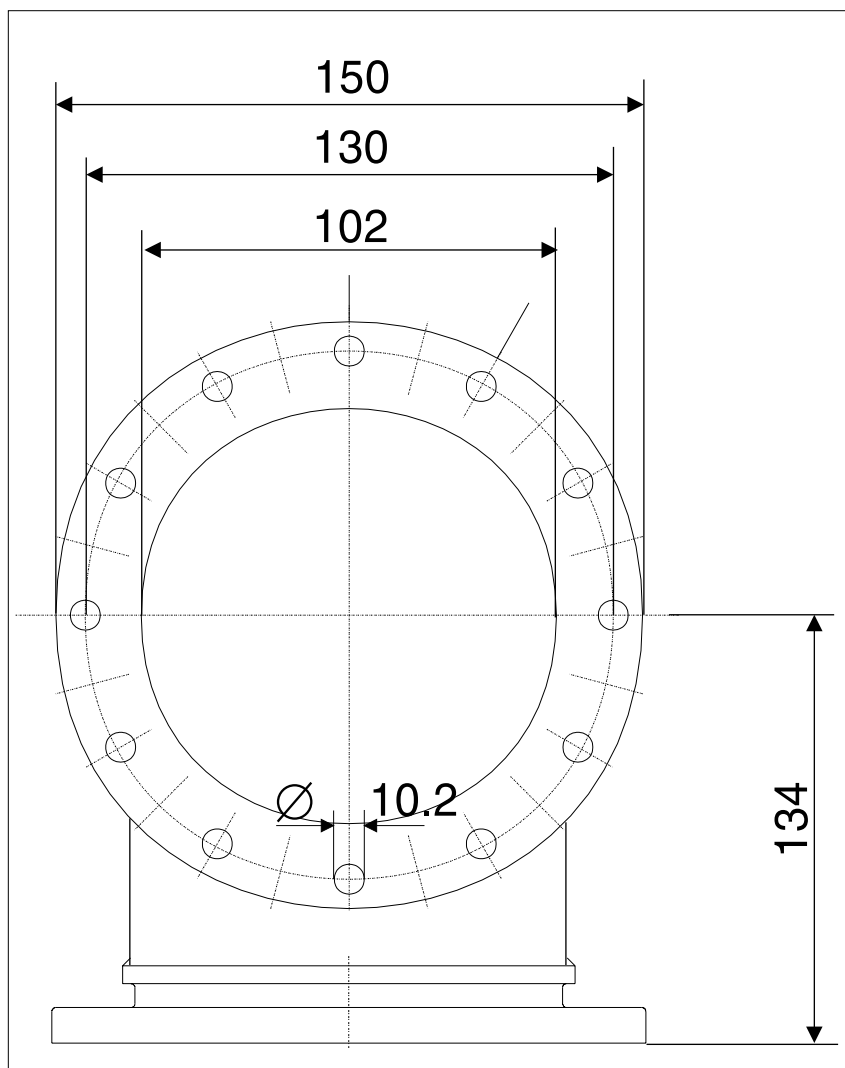


Fig. 42: 90° elbow

Flexible bellow

The flexible bellow is part of the magnet delivery and has to be installed.



Fig. 43: Bellows

NOTE

The total length of the bellow is 372.0mm.

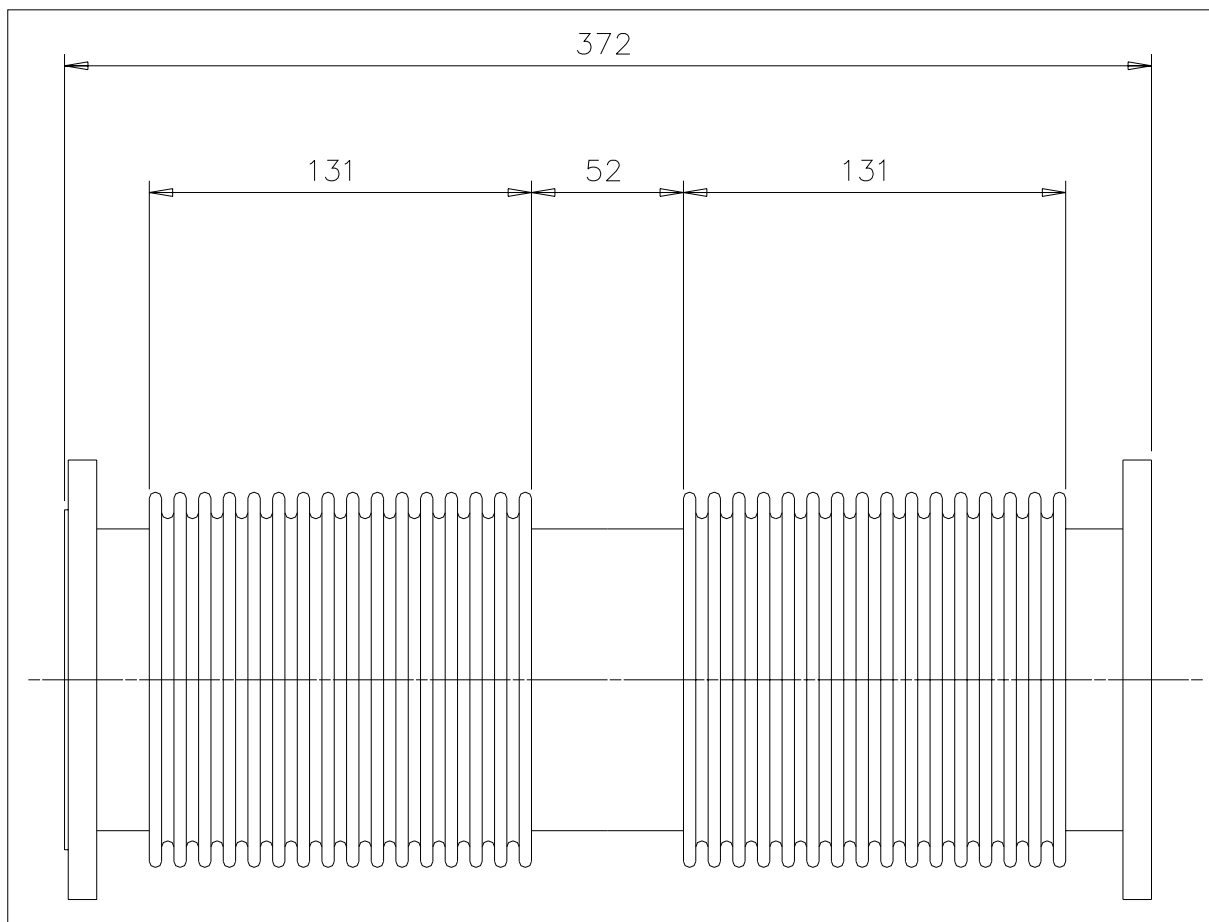


Fig. 44: Compensator_2

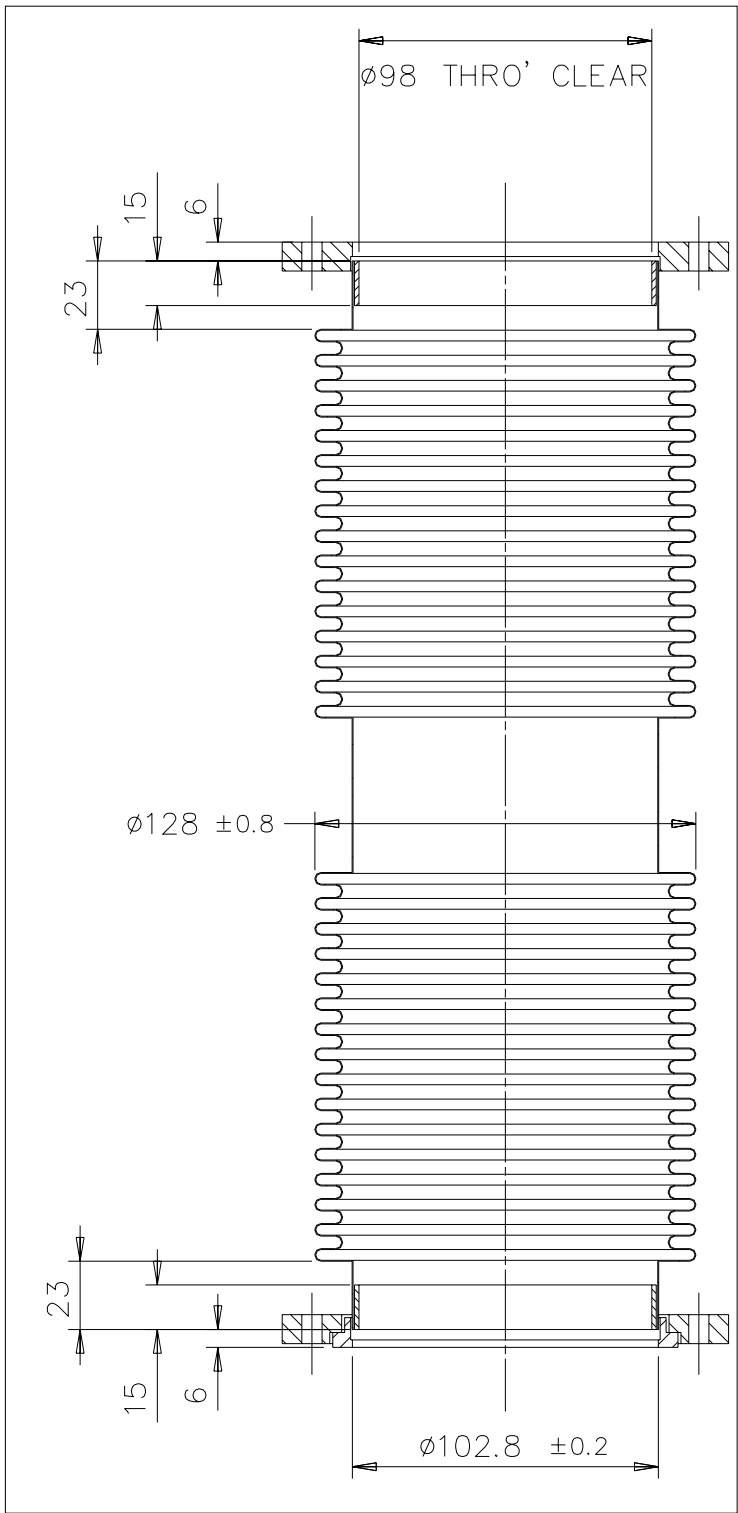


Fig. 45: Acoustic decoupler

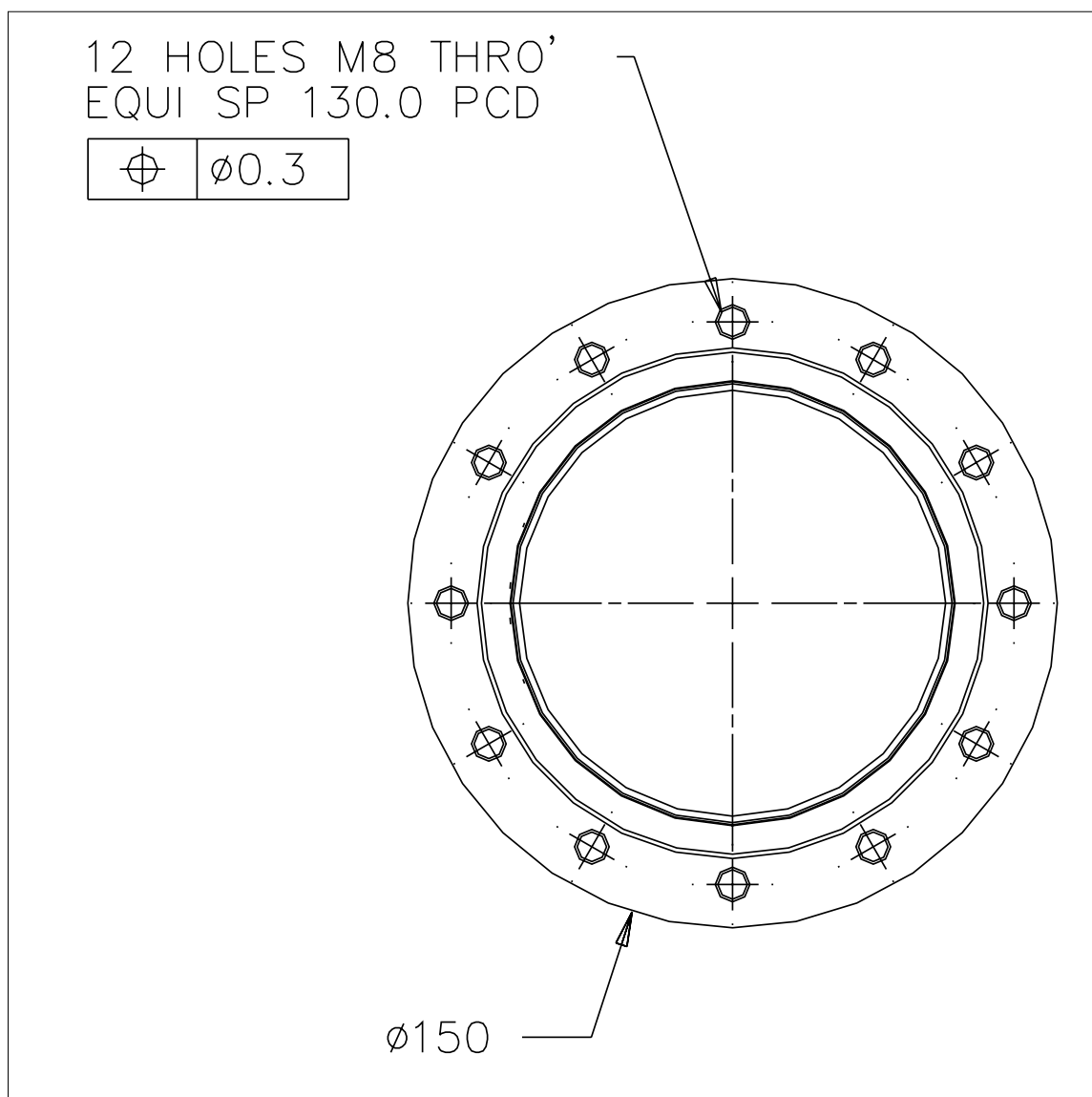
Quench vent flange

Fig. 46: Quench Vent connection side flange

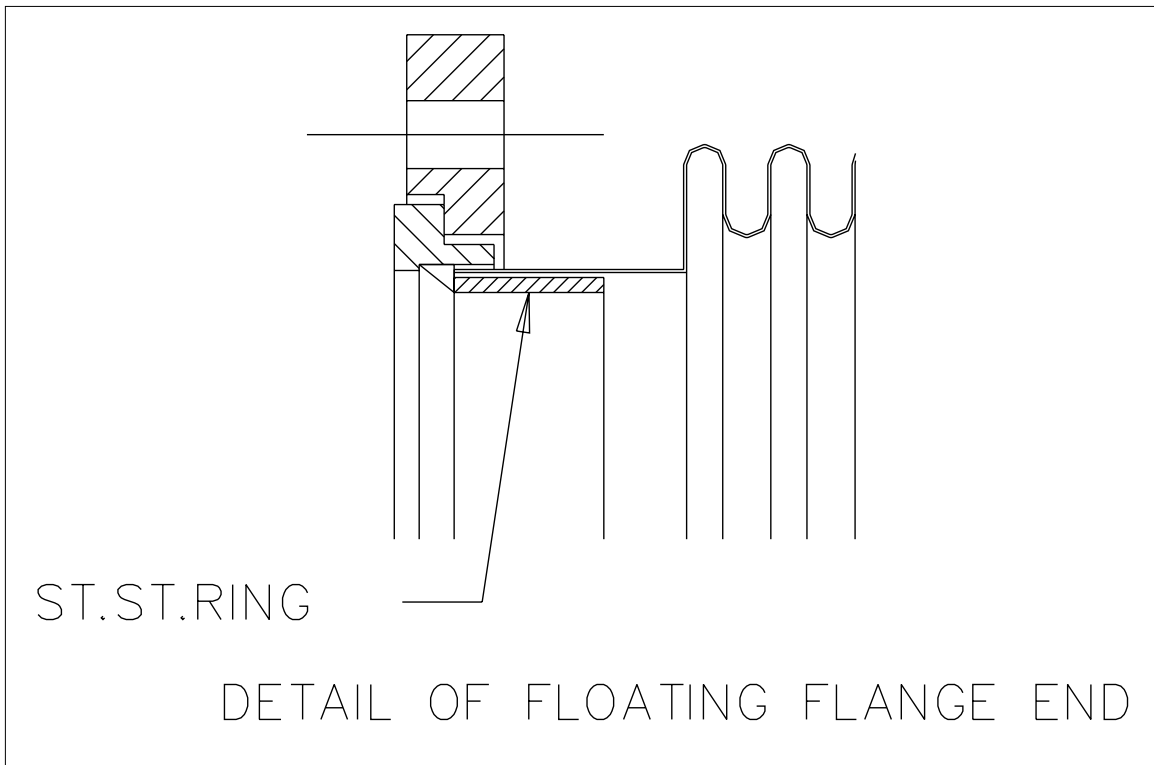
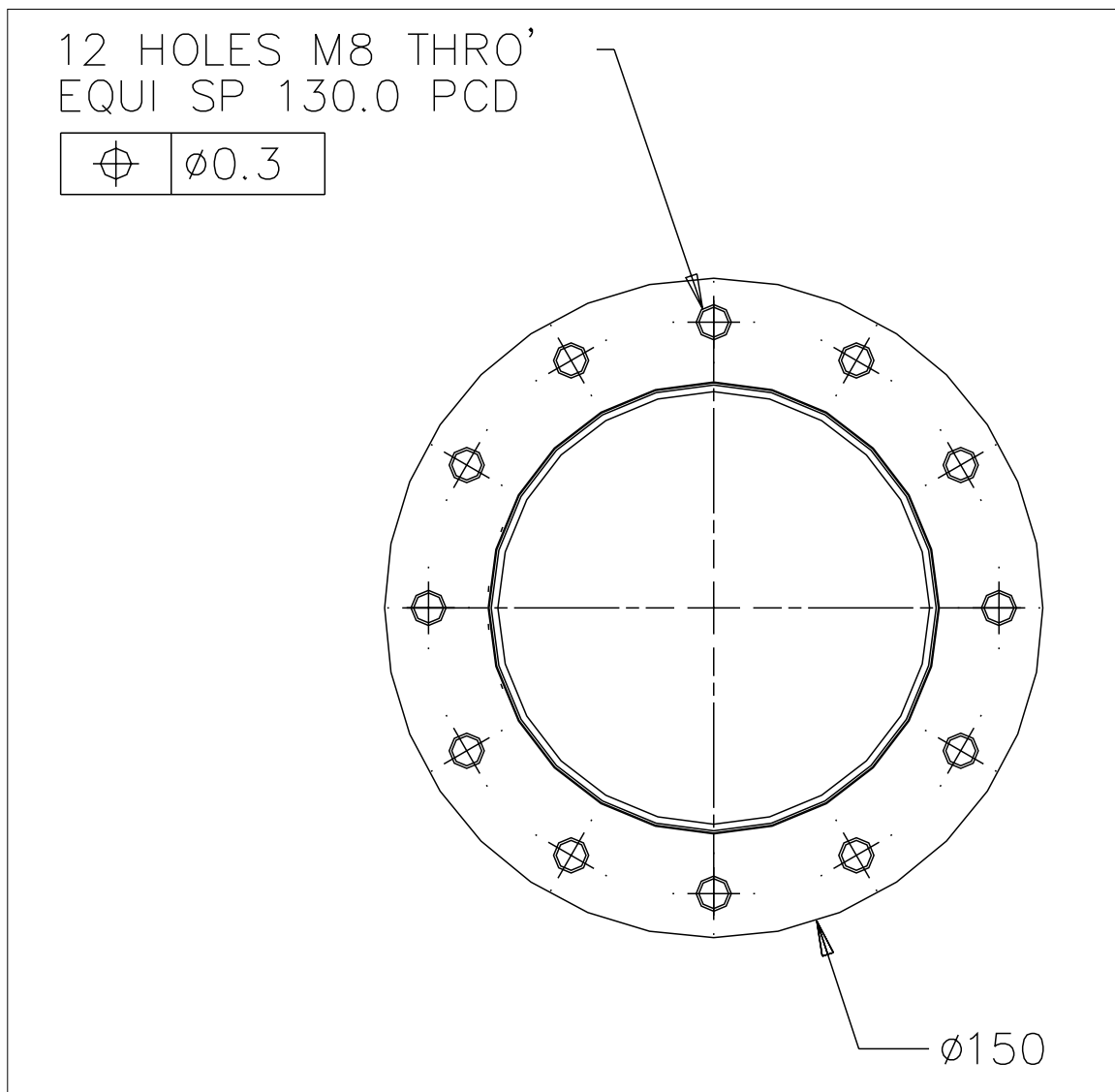


Fig. 47: Detail of Quench Vent connection side

90° elbow; 45° knee connection flange*Fig. 48: 90° Elbow; 45° knee connection flange*

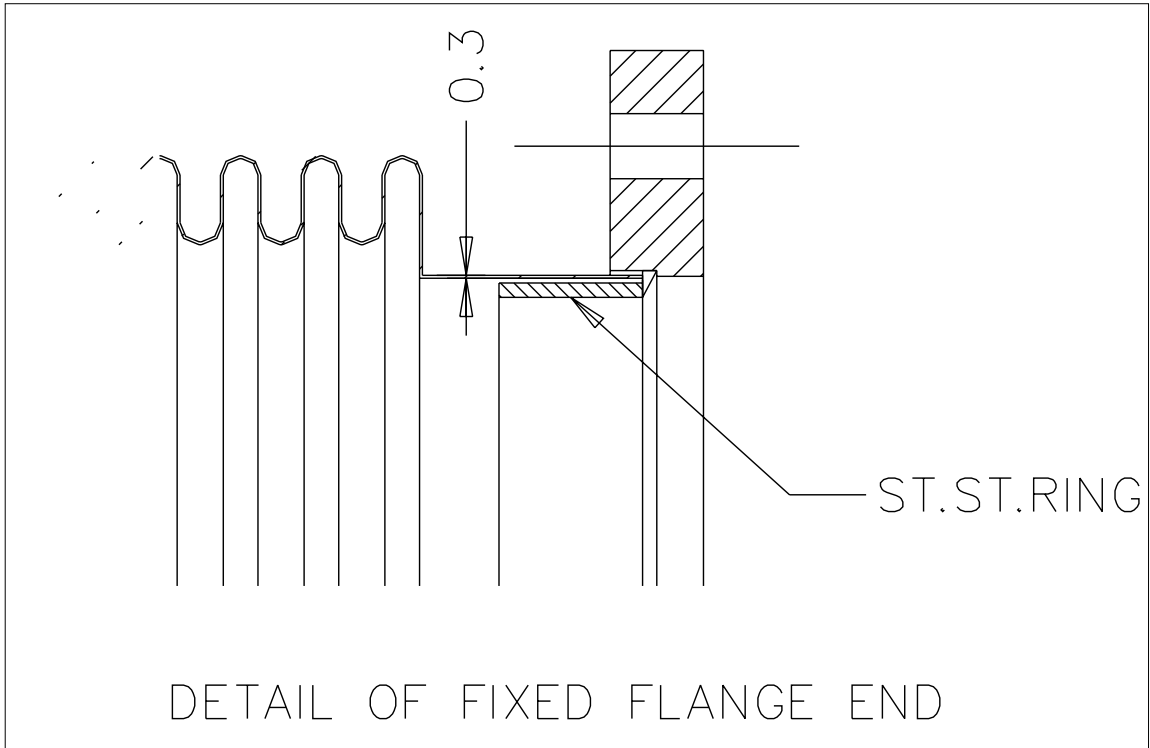


Fig. 49: 90° Elbow; 45° knee connection flange

Electronics cabinet (GPA/ACC cabinet)

Function

The electronics cabinet consists of the GPA cabinet and the ACC cabinet.

GPA = Gradient Power Amplifier; ACC = Advanced Control Cabinet; ACS = Advanced cooling system

The system electronics cabinet includes the power distribution component, RFPA, GPA, imager, magnet monitoring, RF electronics, and ACS.

The system electronics cabinet plus the SEP cabinet or IFP (if available) can be installed one floor above or one floor below the magnet room level. In this case it is important to install the SEP cabinet or the IFP panel in close vicinity of the GPA/ACC electronics cabinet.

Technical data

Tab. 7 GPA/ACC technical data

	GPA	ACC	Total¹
Weight	580 kg	670 kg	1250 kg
Height	1970 mm		
Width	610 mm	950 mm	1560 mm
Depth	650 mm		
Limit value of magnetic flux density ²	5.0 mT		
Heat dissipation to air tot.			4.0 kW

1. The GPA and ACC are mechanically combined into a single cabinet.
2. The value of 5.0 mT applies to the surrounding housing of the cabinet.

Dimensions

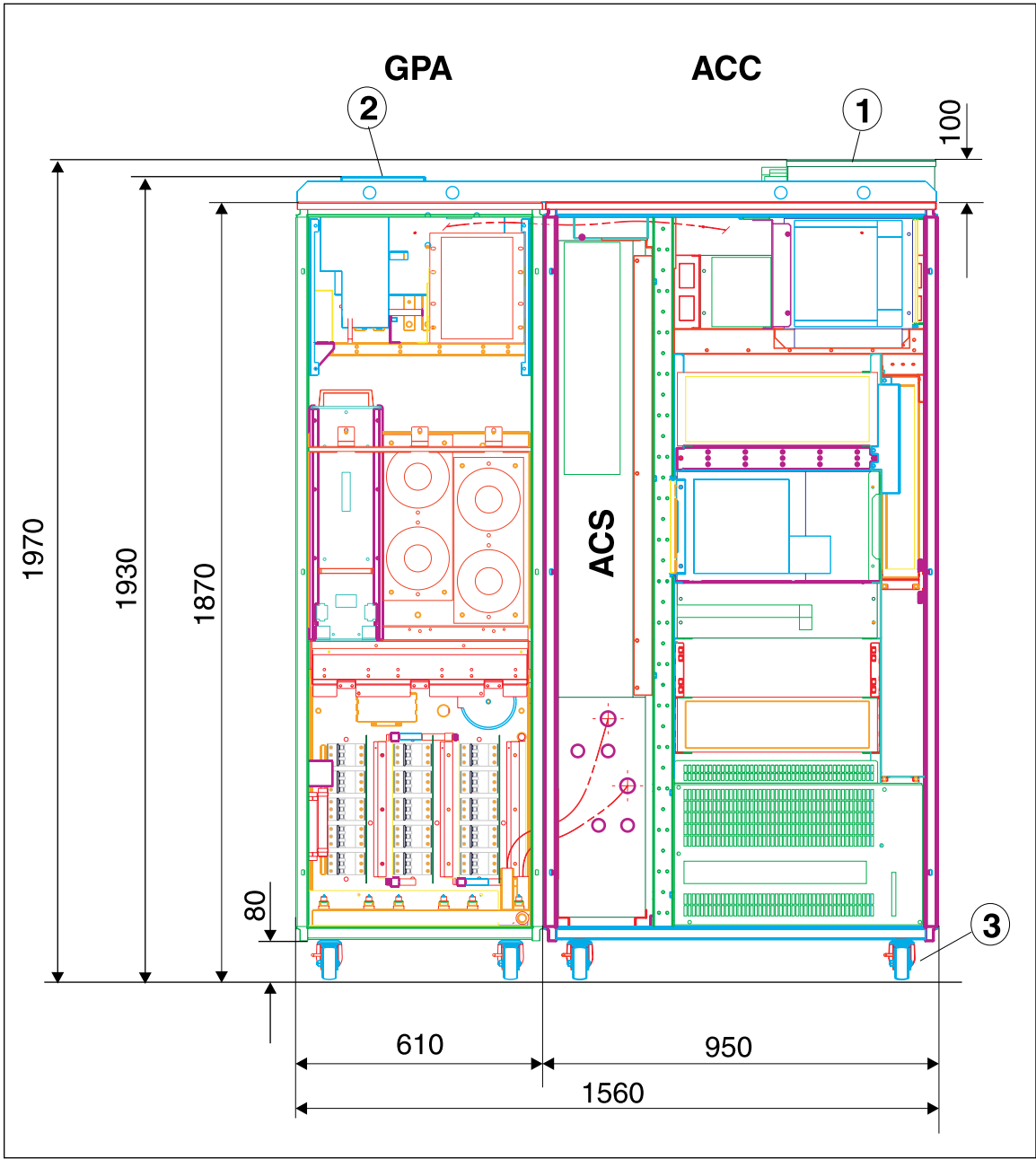


Fig. 50: GPA ACC dimensions

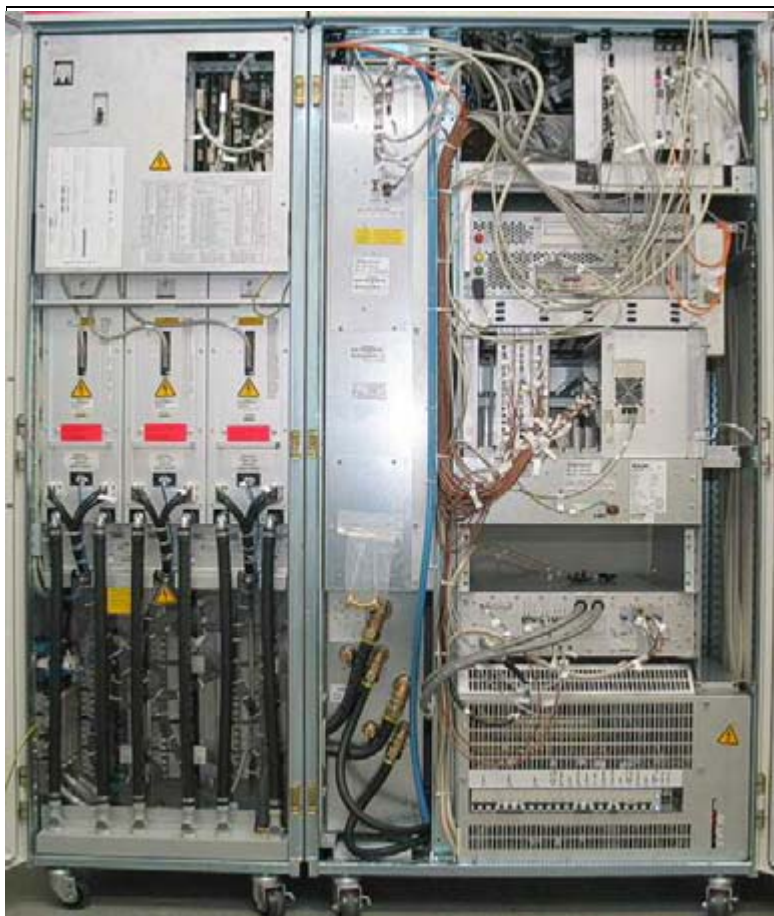


Fig. 51: GPA/ACC

Service area

To facilitate service, ensure that the following service area is provided.

Space required for GPA/ACC cabinet including service area is **2.6 m²**.

NOTE

The doors of the cabinets can be removed with less mechanical expenditure.

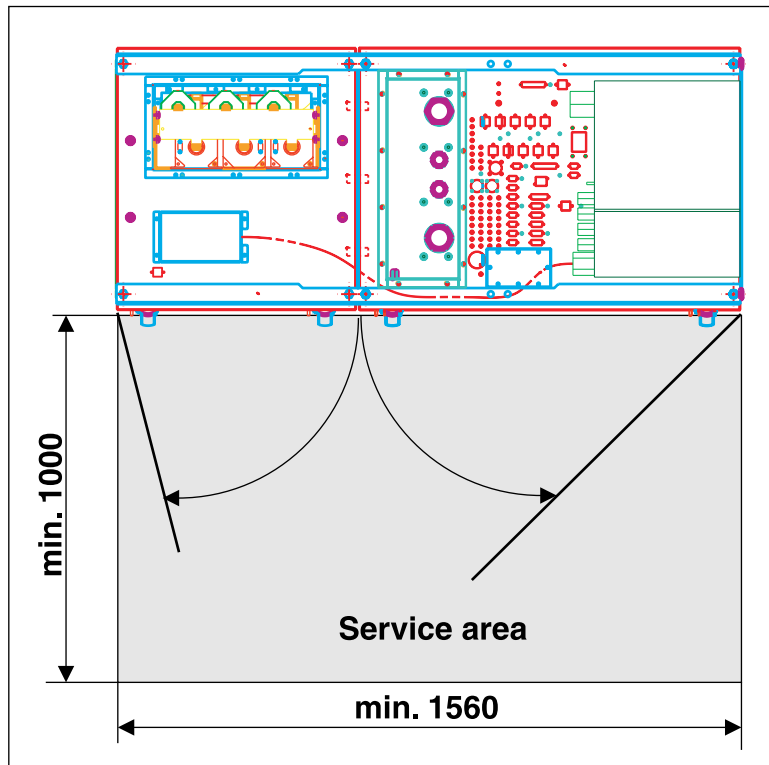


Fig. 52: ACC/GPA service area

Seismic anchoring

NOTE

If you need seismic anchoring for your site, you have to order the "Seismic Kit" for the cabinets separately under part number 57 63 367!

Seismic anchoring is related to local regulations or guidelines.

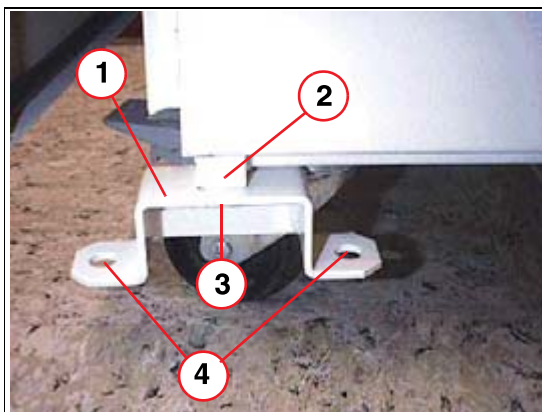


Fig. 53: Seismic anchoring of the cabinets

- Pos. 1 Seismic bracket
- Pos. 2 Cabinet frame with thread
- Pos. 3 Screw connection
- Pos. 4 Holes for seismic anchors (not part of the delivery)

RF filter plate

Function

The RF filter plate is the interface from the electronics cabinet / equipment room to the RF room. All electrical signals must be filtered to prevent interferences.

For customer-specific options, separate RF filters have to be installed.

The RF filter panel is only equipped with additional filters (two each) for:

- EPO button (emergency power-off)
- RF room lights
- Spare

NOTE

The RF filter panel is for Siemens components/options only!

If additional components, e.g. customer components, need to be connected through an Rf filter, an additional locally supplied (e.g. by the RF room manufacturer) small RF filter panel has to be installed. Specifications for the filter are located under the following link: [\(Customer RF filter connection / p. 143\)](#)

Technical data

Tab. 8 Technical data RF filter panel

Weight	130 kg
Height	550 mm
Depth	890 mm
Length	1179 mm
Heat dissipation to air	250 W
Limit value for magnetic flux density for operating safety	10 mT
Installation position	vertical ¹ or horizontal.

1. If the RF filter plate will be installed in the vertical position, the gradient filters have to be located on top

Dimensions

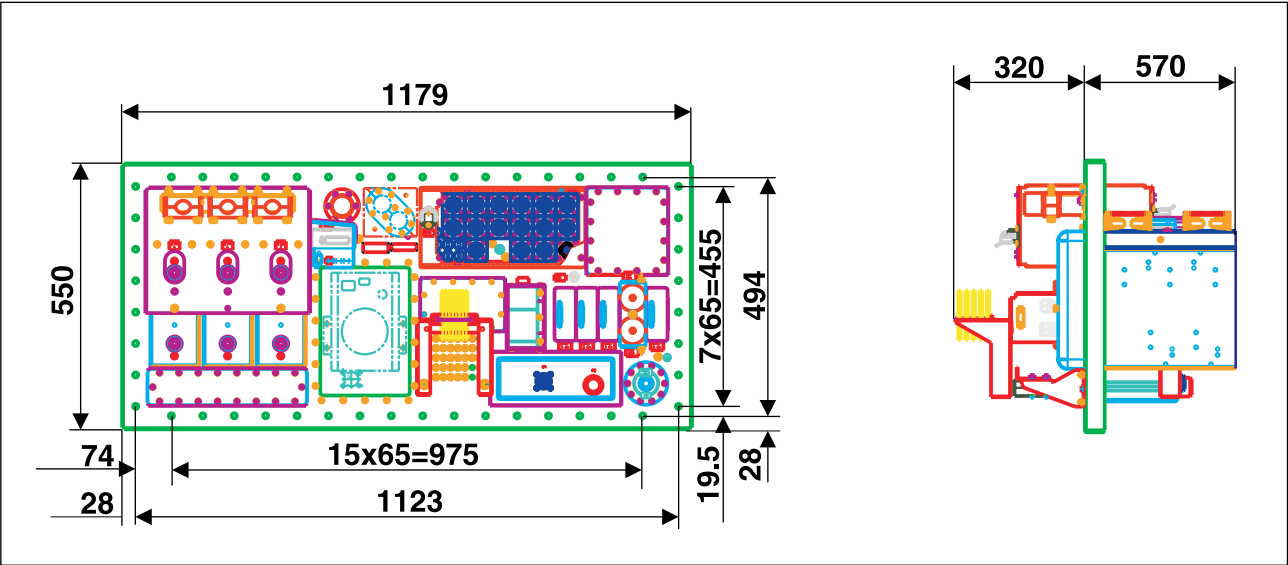


Fig. 54: RF filter plate dimensions

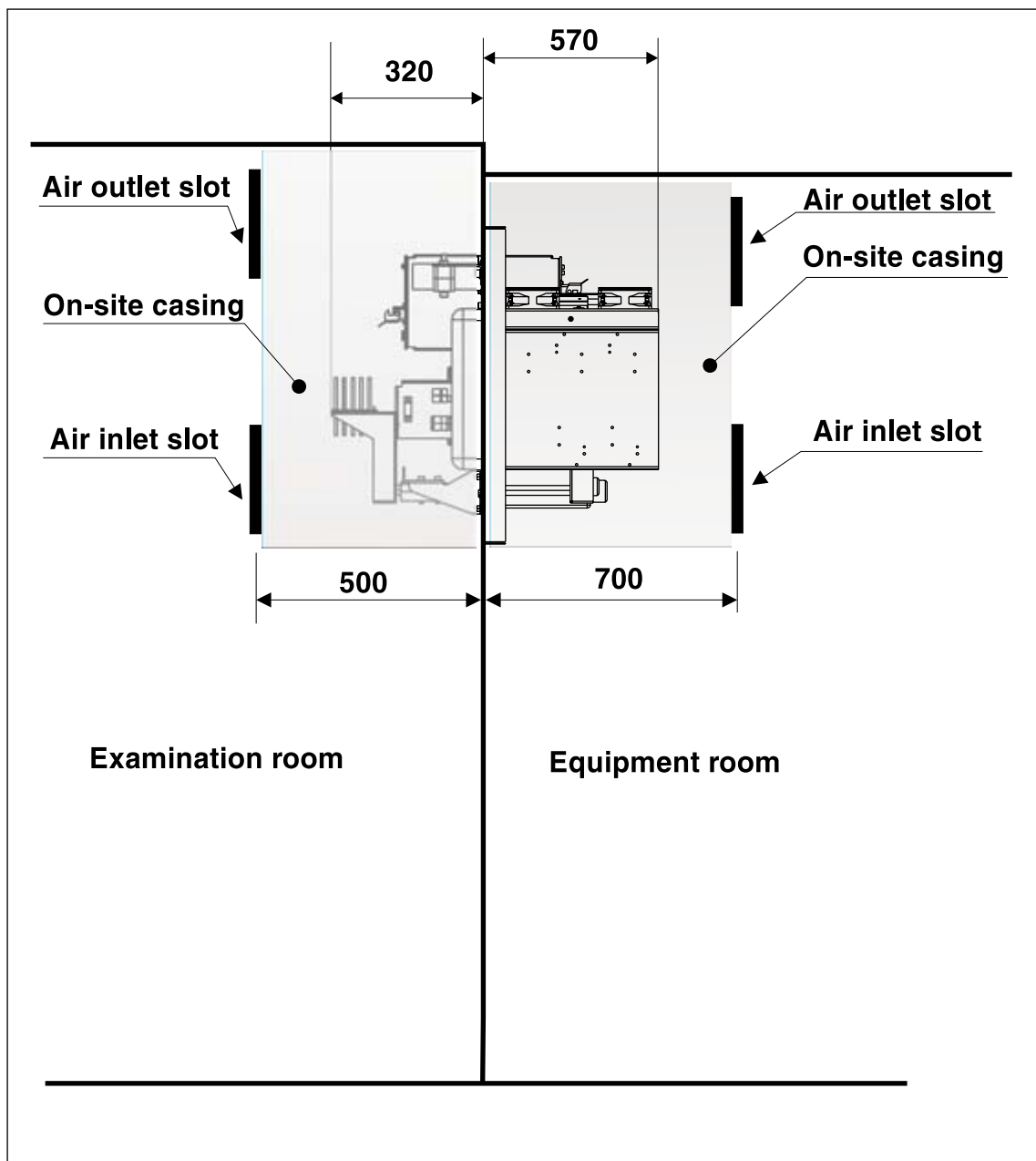


Fig. 55: RF filter panel on-site casing

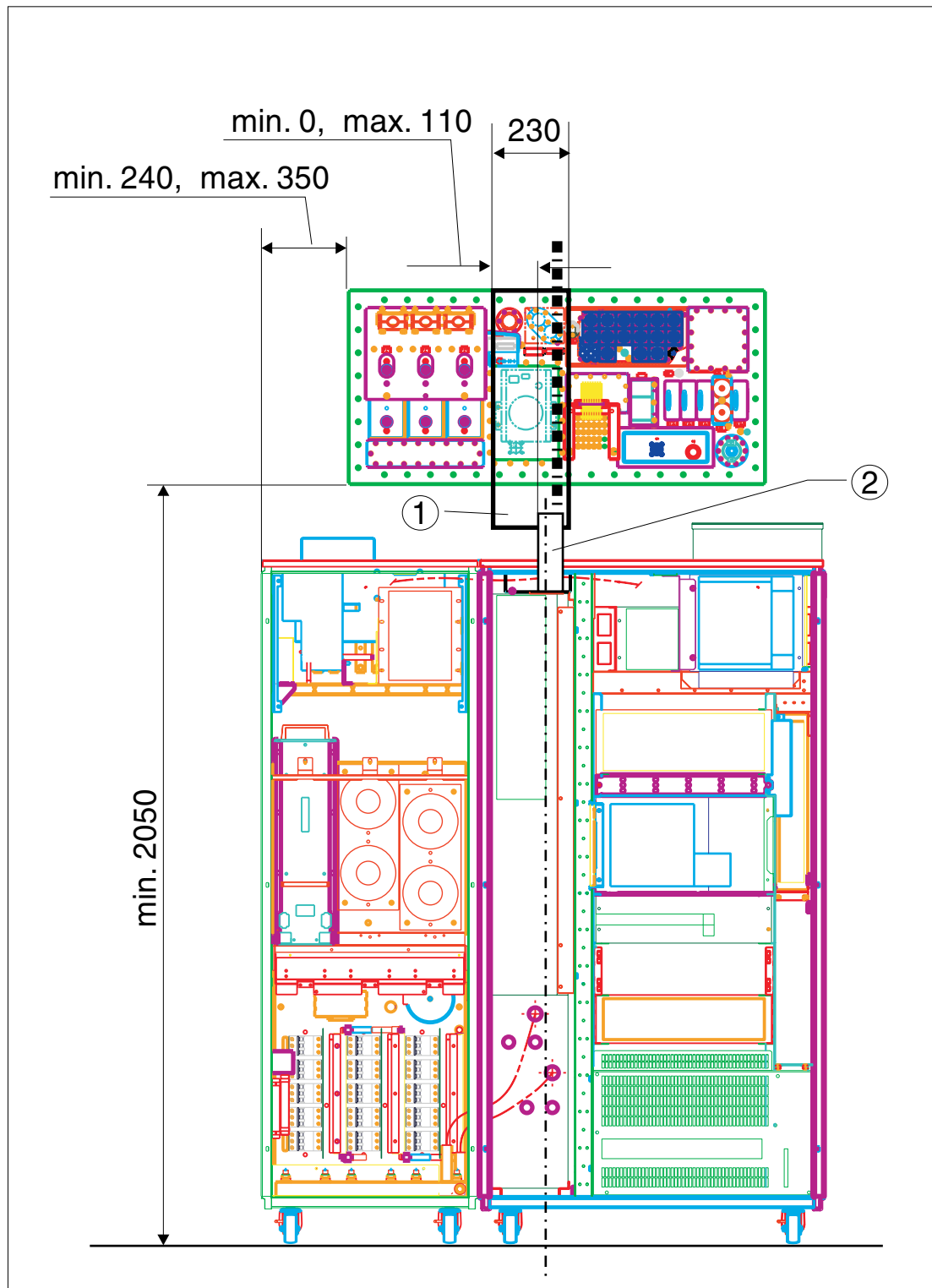


Fig. 56: RF filter panel in reference to the ACC cabinet

- Pos. 1 Space of 230 mm for position No. 2 (Water supply from IFP or SEP)
- Pos. 2 Water supply hoses from IFP or SEP

NOTE

If you want to install a cover inside the examination room (not part of the delivery) around the RF filter panel, observe a minimum distance of 500 mm to allow for proper cabling.

Recommended is 1300mm in width and 600mm in depth.

NOTE

Materials (e.g., screws, nuts and bolts) for mounting the RF filter plate to the RF room have to be purchased locally.

NOTE

Additional RF filters, e.g. for smoke detectors in the examination room, have to be provided locally on an extra RF filter panel, if required.

Console components

Siemens Color Display

Technical data			
Weight	10 kg	Line voltage	100V...230V AC +/-10V
Height	465 mm	Monitor foot	240 mm
Width	430 mm		
Depth	20 mm		
Heat dissipation		Frequency	47Hz/0.65 Hz
Audible noise	< 35 dB(A)	Power consumption	75 W

NOTE

There is no measurable effect of the magnetic field on the monitor outside the RF room.

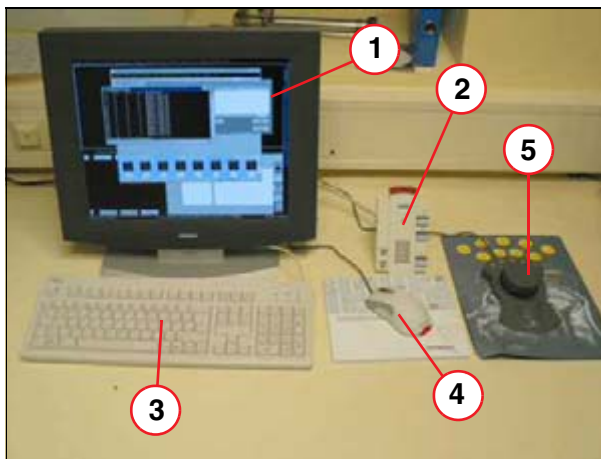


Fig. 57: Console components

- Pos. 1 Color screen
- Pos. 2 Intercom
- Pos. 3 Keyboard
- Pos. 4 Computer mouse
- Pos. 5 Space mouse (optional)

Host PC MRC

Technical data	
Weight	≤ 22 kg
Heat dissipation to air	≤ 700 W

Technical data	
Power consumption	654 VA
Limit value for magnetic flux density for operating safety	max. 1.0 mT
Height	460 mm
Width	280 mm
Depth	685 mm



Fig. 58: Computer R610, front

NOTE

The Host computer has to be positioned at the MRC console.

The free cable length between Host PC and ACC cabinet is 23.0 m.

The connection for the modem is located in back of the Host PC, as is the network connection.

Console components

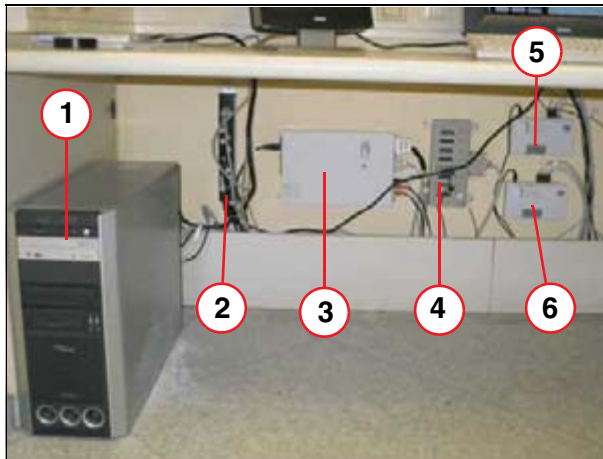


Fig. 59: Console components 1

- Pos. 1 Host PC
- Pos. 2 Power distributor
- Pos. 3 ICU
- Pos. 4 Ser_Distribution
- Pos. 5 MRC switch
- Pos. 6 MRSC switch (optional)

Item no.	Component name	Size (L x W x H) in mm
1	Host PC	280 x 685 x 460
2	Line distribution	330 x 45 x 50
3	Intercom	320 x 210 x 55
4	Serial distribution	250 x 160 x 40
5	Switch (1)	210 x 120 x 40
6	Switch (2; only if option MRSC is available)	210 x 120 x 40

NOTE

If the console table is not part of the delivery, the components (item 1 to 5) have to be installed, e.g. on the wall, in close vicinity to the Host PC (item 6).

The cabling of the components has to be routed to prevent cables from becoming loose/disconnected by e.g. the feet of the operator.

Alarm box

Function

The alarm box used in conjunction with the OR 105 magnet supervisory unit is designed to indicate the general condition of the MRI magnet system. Operation of the red emergency stop button while connected to the supervisory unit will cause the Emergency Run-down Unit to apply power to the switch and quench heaters. The fringe field may affect the functions of devices operated in the vicinity of the magnet.

The following features are provided:

- Emergency Stop button.
 - System control with "lockout" keyswitch.
 - Acoustic and visual alarm indication with alarm silence push-button.
- ⇒ For MAGNETOM systems containing superconductive magnets or resistive magnets, the technical descriptions provide decay characteristics for the magnet in case of a QUENCH or an emergency field shutdown to enable the USER to implement adequate life support and other safety procedures. These characteristics indicate the time starting when the EMERGENCY FIELD SHUTDOWN UNIT is activated to the moment the field strength in the magnet isocenter has dropped to 20 mT (typical value: 20s).

Technical data

Tab. 9 Technical data - Alarm box

Weight	0.6 kg
Size	230 mm diameter
Depth	100 mm
Heat dissipation to air	n.a.
Limit value for magnetic flux density for operating safety	5.0 mT

Dimensions

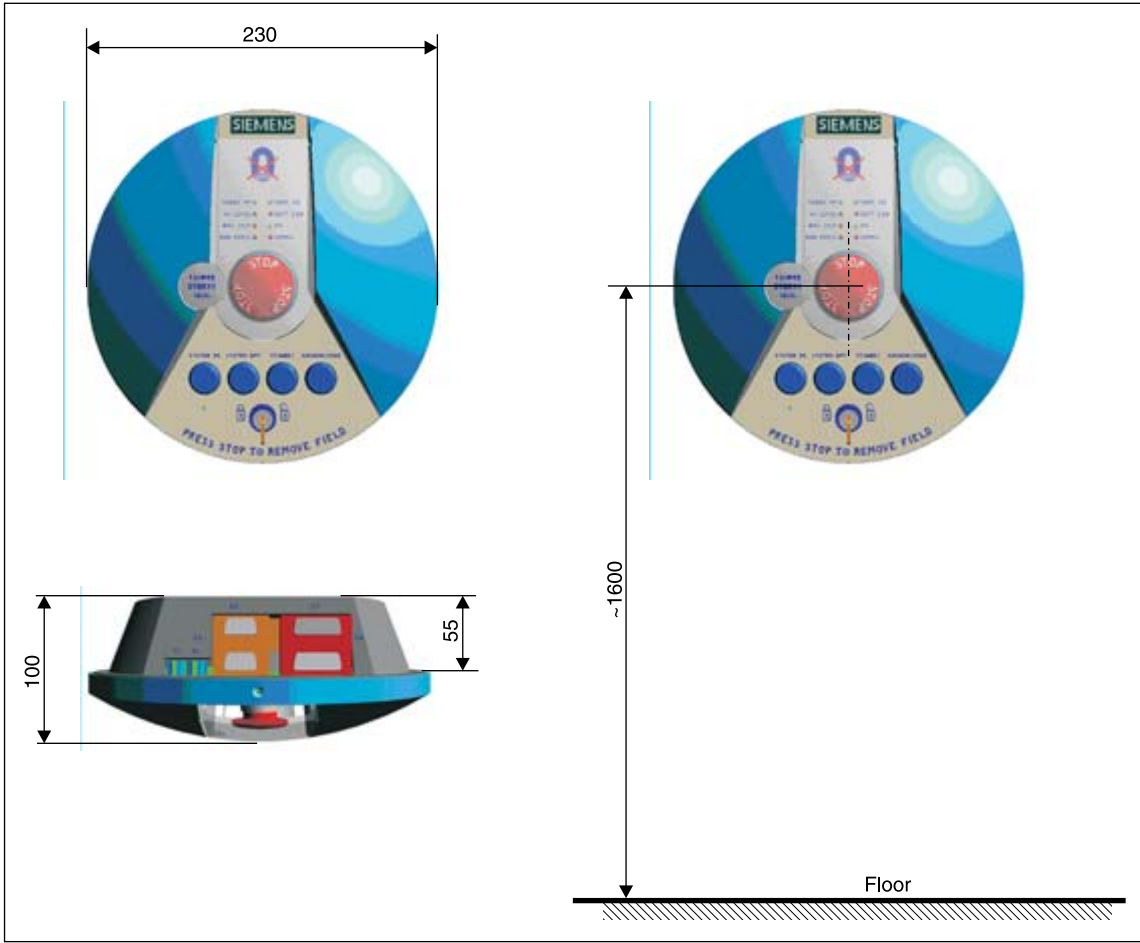


Fig. 60: Alarm box

Magnet stop button

Function

The function of the remote magnet stop button is to switch off the magnetic field in case of emergency or hazardous conditions to persons. Operation of the red emergency stop button while connected to the supervisory unit will cause the Emergency Rundown Unit to apply power to the switch and quench heaters. The fringe field may affect the functions of devices operated in the vicinity of the magnet.

The standard delivery of the system consists of three magnet stop buttons:

1. One button is part of the alarm box.
2. One remote magnet stop button is installed inside the examination room.
3. One remote magnet stop button is installed inside the equipment room.

Technical data

Weight	0.2 kg
Height	80 mm
Width	80 mm
Length	120 mm

Dimensions

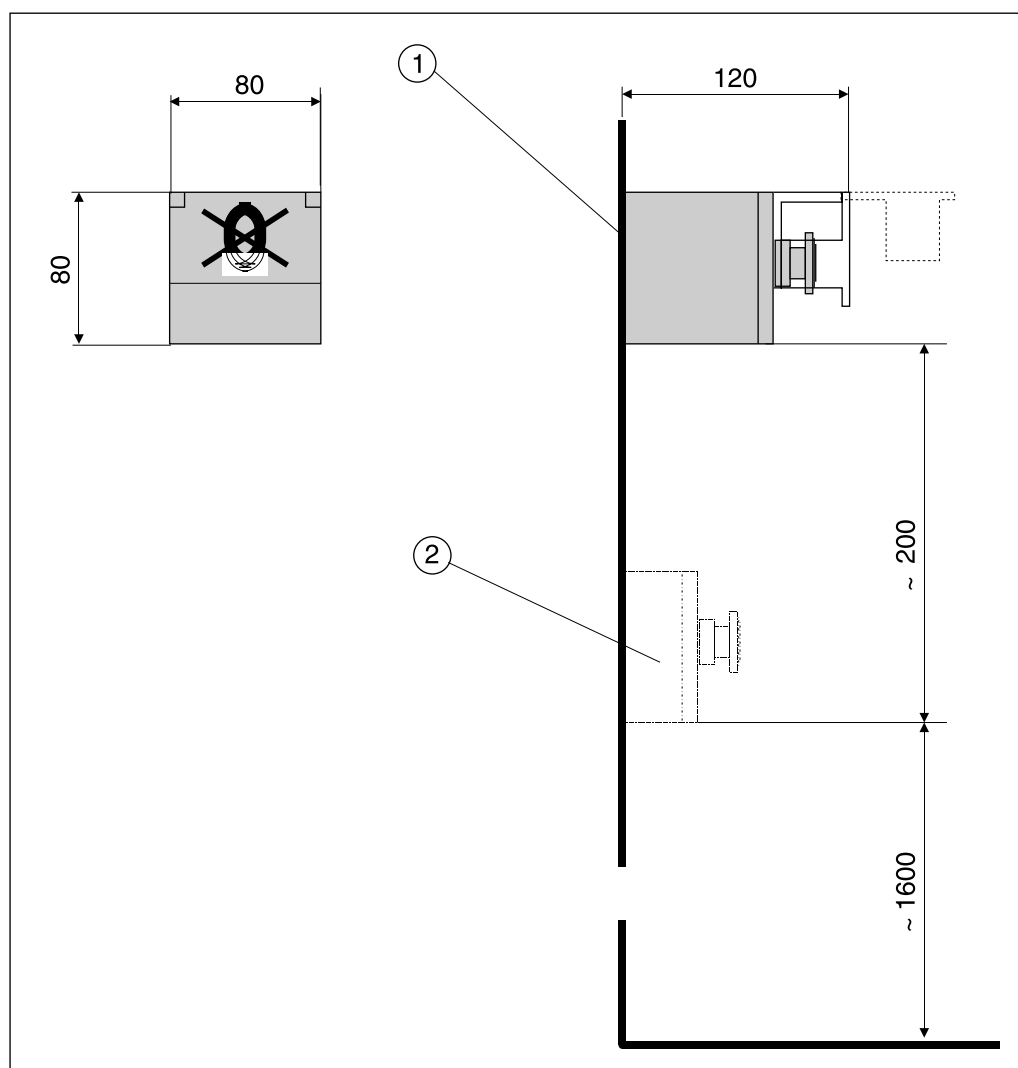


Fig. 61: Remote magnet stop button

Pos. 1 Remote magnet stop button

Pos. 2 EPO (emergency power off)



Fig. 62: Remote Magnet Stop button

SEP cabinet

Function

The SEP (separation cabinet) has to be used if a central hospital chilled water supply is available or if a chiller of any brand/type is already available. The SEP is the interface between the on-site water chiller (of any brand/type) or the interface to the central hospital chilled water supply. For the above-mentioned cases, the SEP cabinet is mandatory! The cold head compressor is part of the SEP cabinet and is connected internally. The position of the SEP has to be in close vicinity of the ACC cabinet. Two 5.0 m hoses (forward and return) to connect the SEP to the ACC, and two 2.0 m hoses (forward and return) for connecting the SEP to the local water supply system are part of the delivery volume.

The SEP cabinet is not part of the standard delivery. The SEP cabinet is used, if the dedicated KKT chiller is not used, for delivering the primary chilled water.

SEP = separation cabinet (separates the primary from the secondary water circuit)

Technical data

Tab. 10 Technical data SEP

Weight	340 kg
Height	1870 mm
Width	650 mm
Length	650 mm
Heat dissipation to air	1.0 kW
Limit value for magnetic flux density	5.0 mT

Block diagram

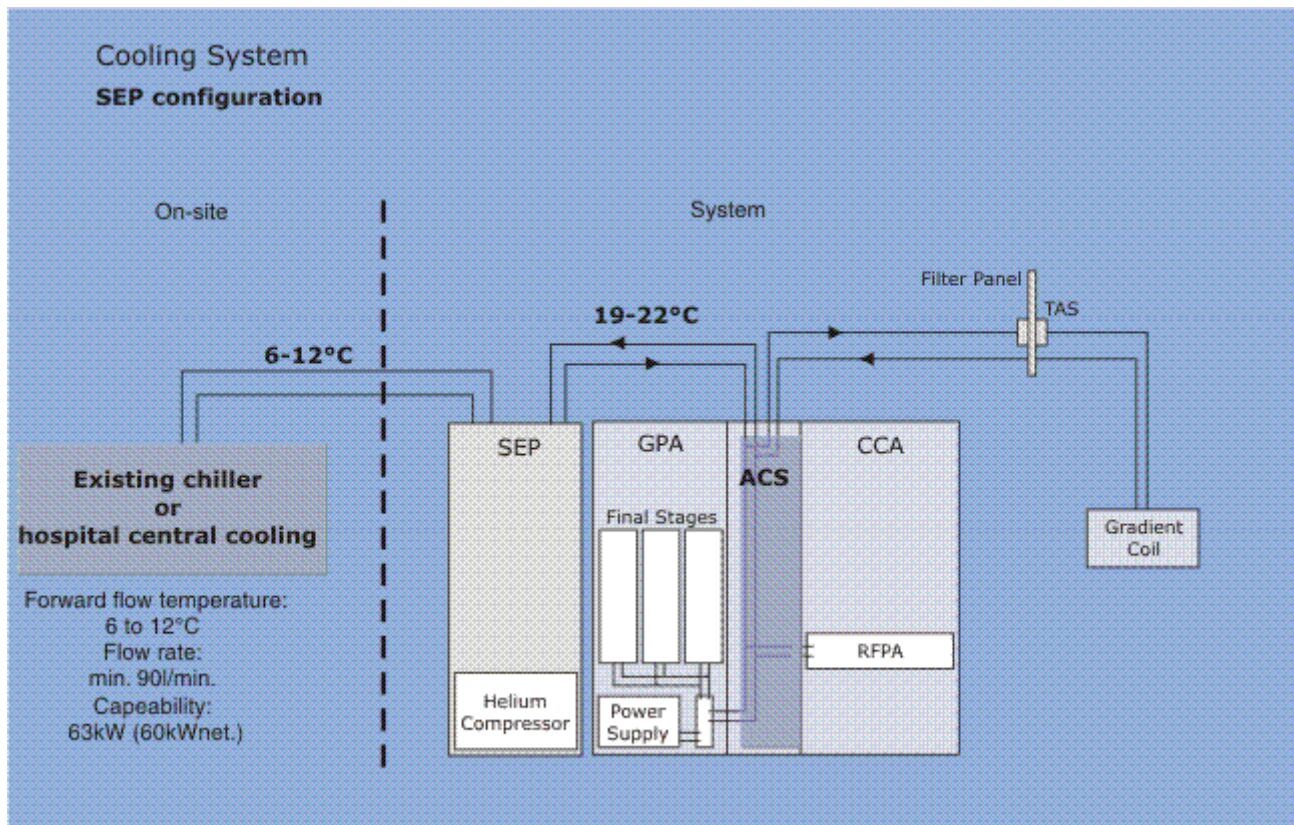


Fig. 63: SEP configuration

Dimensions

NOTE

The SEP cabinet has to be installed next to the GPA/ACC cabinet. However, be sure to allow for the hose/cable lengths between the SEP and GPA/ACC cabinet.

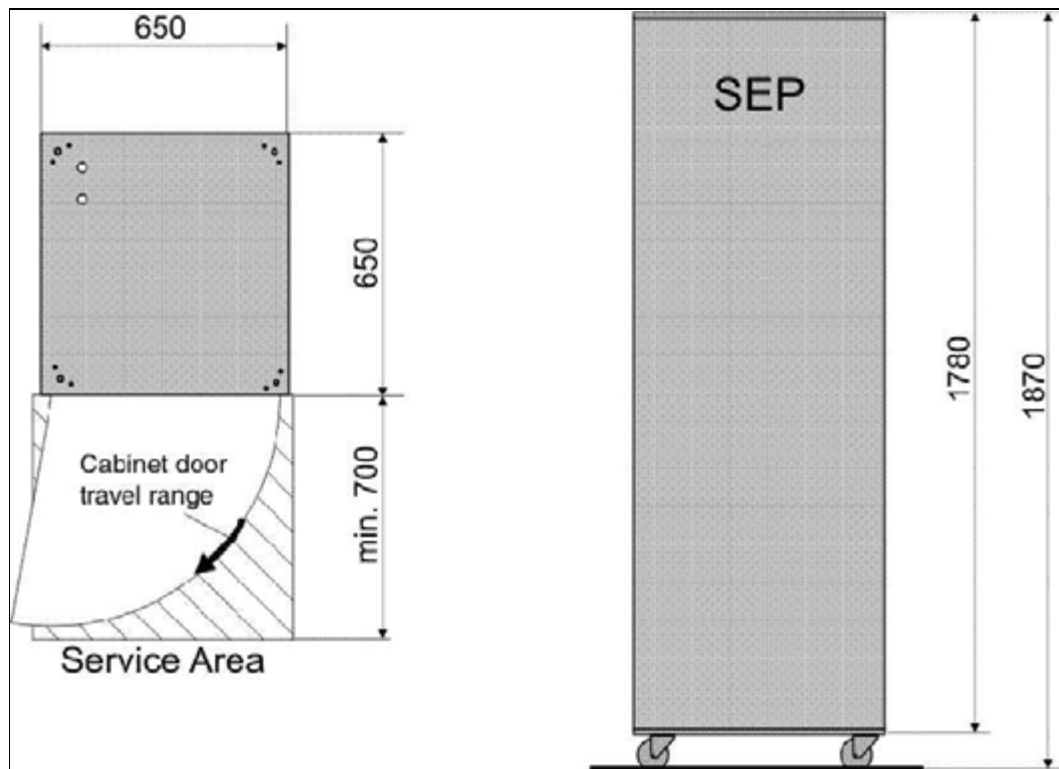


Fig. 64: SEP service area

Connection interface

NOTE

The on-site water preparation has to be 2" NPT female threaded connectors for for "supply" and "return".

The following picture is showing the two delivered primary water connection possibilities.

Possibility 1

Pos. 2 (Fig. 41) can be inserted in the on-site prepared 2" female pipe connection if the assembled water hose can not be installed easily e.g. at mobiles.

Poa.1 is for connecting the delivered hose.

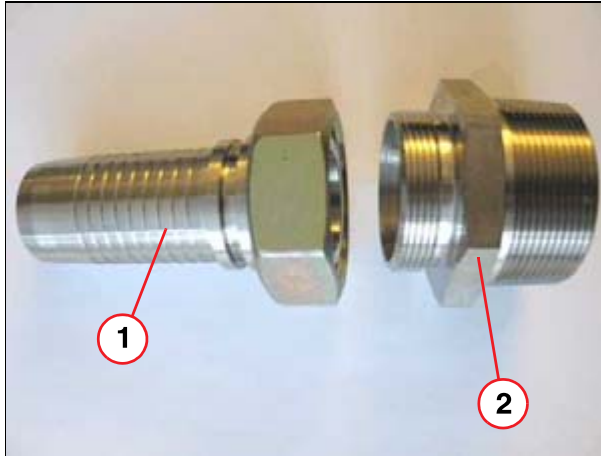


Fig. 65: On-site primary water supply connection for SEP

Pos. 1 Hose Cutting connection

Pos. 2 Adapter (2" male thread to Cutting connection)

Possibility 2

Pos. 1 (Fig 42) can be used for with a 2" NPT female pipe thread on-site water supply if the assembled water hose connections can be installed easily.

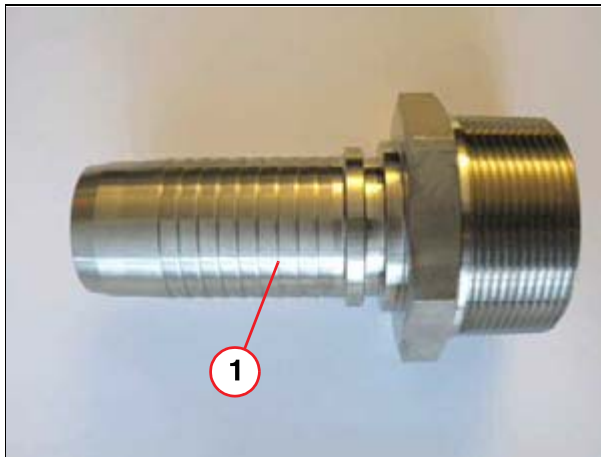


Fig. 66: On-site primary water supply connection for SEP

Pos. 1 Hose Cutting connection



Fig. 67: SEP

NOTE

With the SEP configuration, the helium compressor is built into the SEP cabinet.

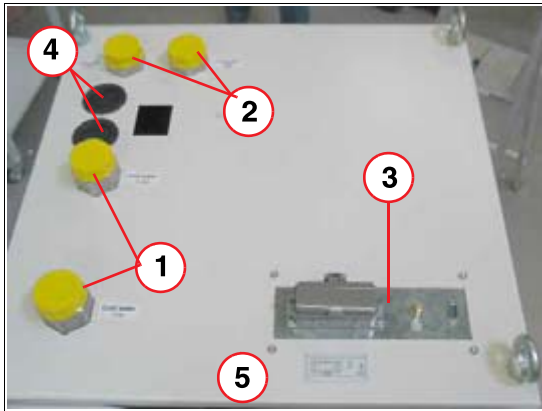


Fig. 68: SEP top interface

- Pos. 1 2" male thread for the delivered 5.0 m connection hoses to the ACS
- Pos. 2 2" male thread for the delivered 2.0 m connection hoses to the on-site primary water supply
- Pos. 3 Electrical connection panel
- Pos. 4 Feed-through for the high/low helium pressure lines
- Pos. 5 Front side of the SEP

Hydraulic diagram

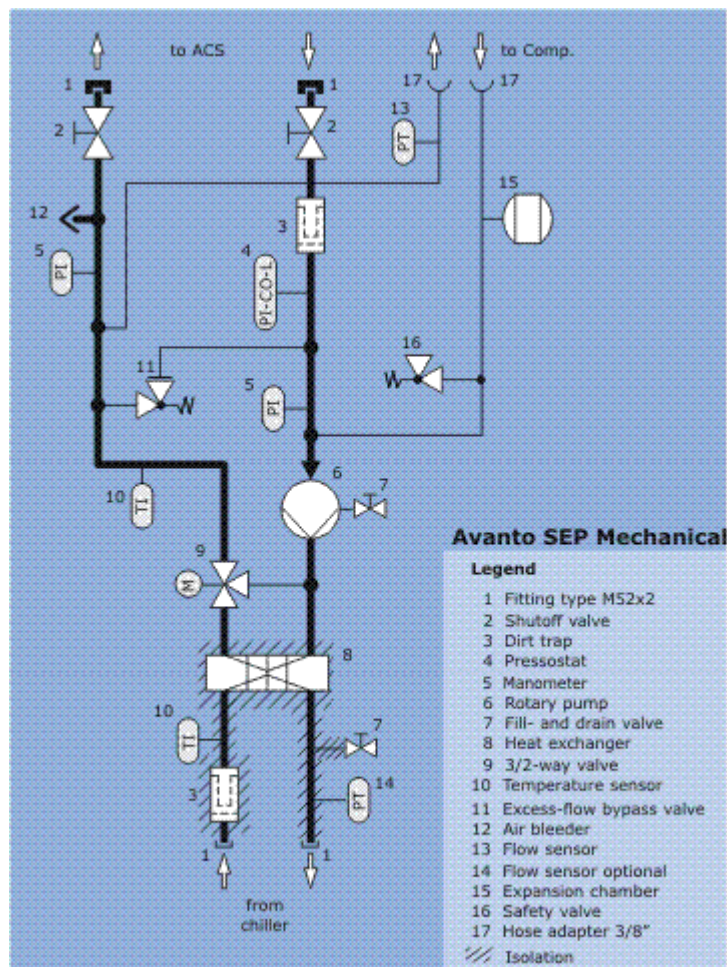


Fig. 69: SEP block diagram

Seismic anchoring

For seismic anchoring of the SEP cabinet, the “Seismic anchoring kit” has to be ordered.

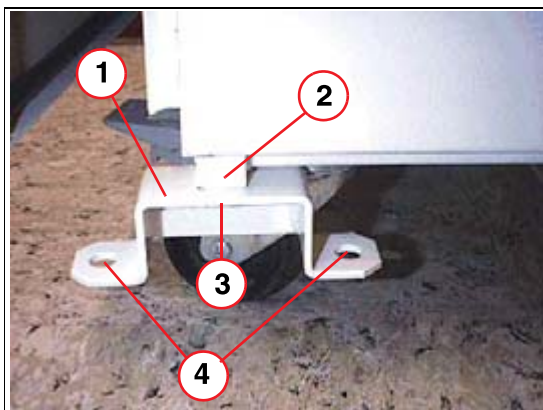


Fig. 70: Seismic anchoring of the cabinets

- Pos. 1 Seismic bracket
- Pos. 2 Cabinet frame with thread
- Pos. 3 Screw connection
- Pos. 4 Holes for seismic anchors (not part of the delivery)

KKT KCC 215 chiller

NOTE

The local project manager is responsible for coordinating the site preparation and installation of the KKT KCC 215 Chiller and IFP panel. Part of this coordination is e.g. the foundation for the chiller and the water pipe installation between the KKT chiller and the IFP panel.

Function

The KKT chiller is not part of the standard delivery. If the KKT chiller is not part of the delivery volume, a SEP will be delivered

The KKT KCC 215 is a dedicated MAGNETOM Espree 20°C chiller. The chiller has to be used in combination with the IFP. The chiller supplies dedicated primary chilled water in cases where no chilled water supply is available on-site. The cooling capacity of the chiller is 60 kW, the chilled water temperature is 20°C, the water flow between chiller and IFP is 130 l/min.

A data cable (50 m) is connected from the chiller to the ACC cabinet for reading error messages (An extension cable of 50m is available see next page).

Technical data

Power specifications

Connection value	48 kVA
Voltage	380V to 480V 50/60Hz
Fuse rate	63 A
Power consumption	55.0A (50Hz)/ 58.5A (60Hz)
Nominal cooling capacity	60.0 kW

Installation specifications

Weight	1100 kg
Max. admissible pressure at ACS	6.0 bar
Installation above the MR system	max. 10 m
Installation below the MR system	max. 25.0m
Distances between KKT chiller and IFP ¹	
<= 25.0 m	with 2" pipes
>= 25.0 m; <= 45.0 m	with 2 1/2" pipes

$\geq 45.0 \text{ m}^2$	contact KKT (KKT representations / p. 117)
Installation altitude ³	0.0 m to 2000.0 m above sea level
Ambient temperature conditions	- 20.0°C to + 48.0°C
Noise level in 10.0 m distance at outside temperatures of:	
21° C	50 dB(A)
32° C	55 dB(A)
48° C	61 dB(A)

1. The distance between IFP and ACS is max. 5 m.
2. For distances > than 25 m ,you need to order the extended data cable under part number 81 16 274.
3. If the installation altitude is higher than 2000.0 m, the MR system has to be operated with an SEP unit!

Block diagram

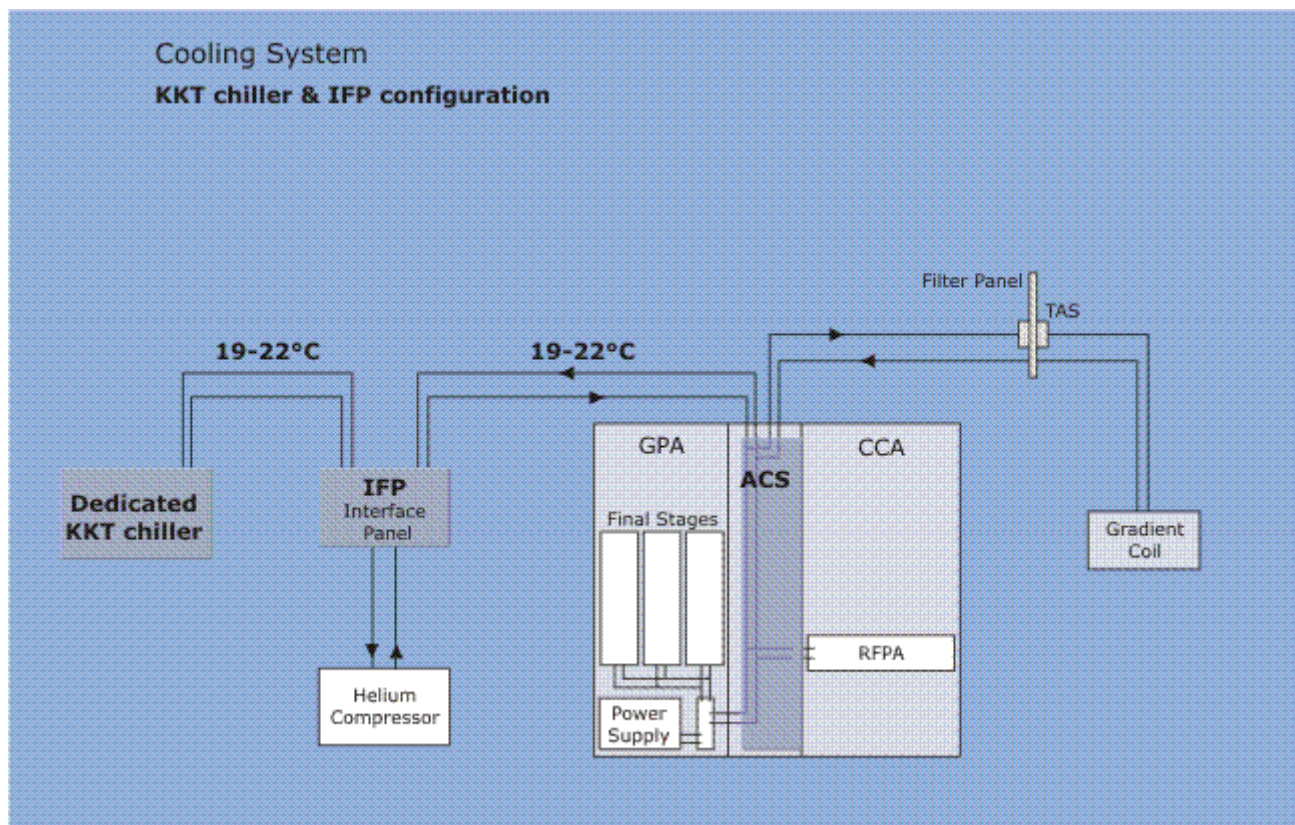


Fig. 71: KKT & IFP configuration

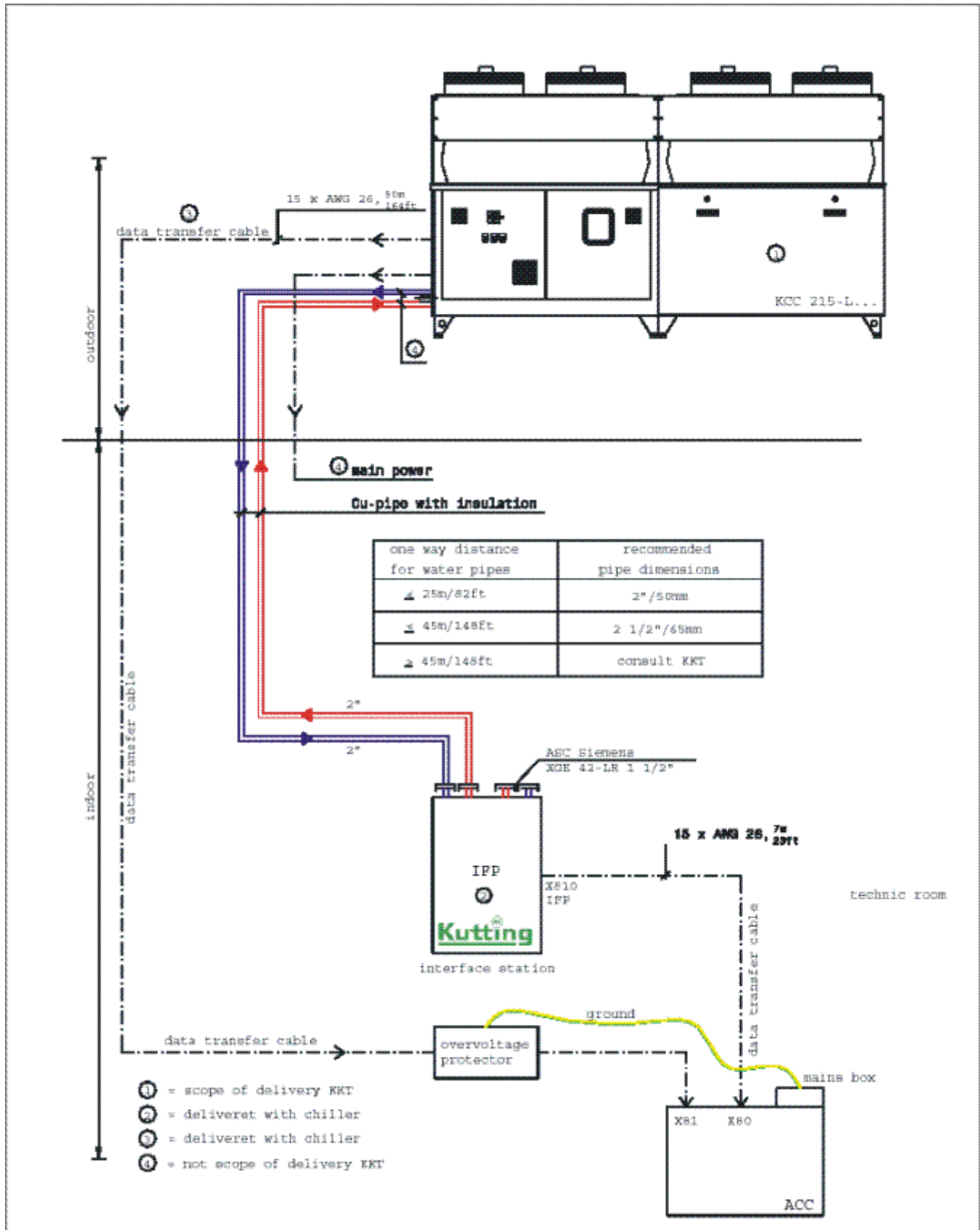


Fig. 72: KKT chiller system connections

NOTE

The cable W401 from ACC X81 to the KKT chiller does require a 32mm diameter conduit, if a conduit will be installed.

Dimensions

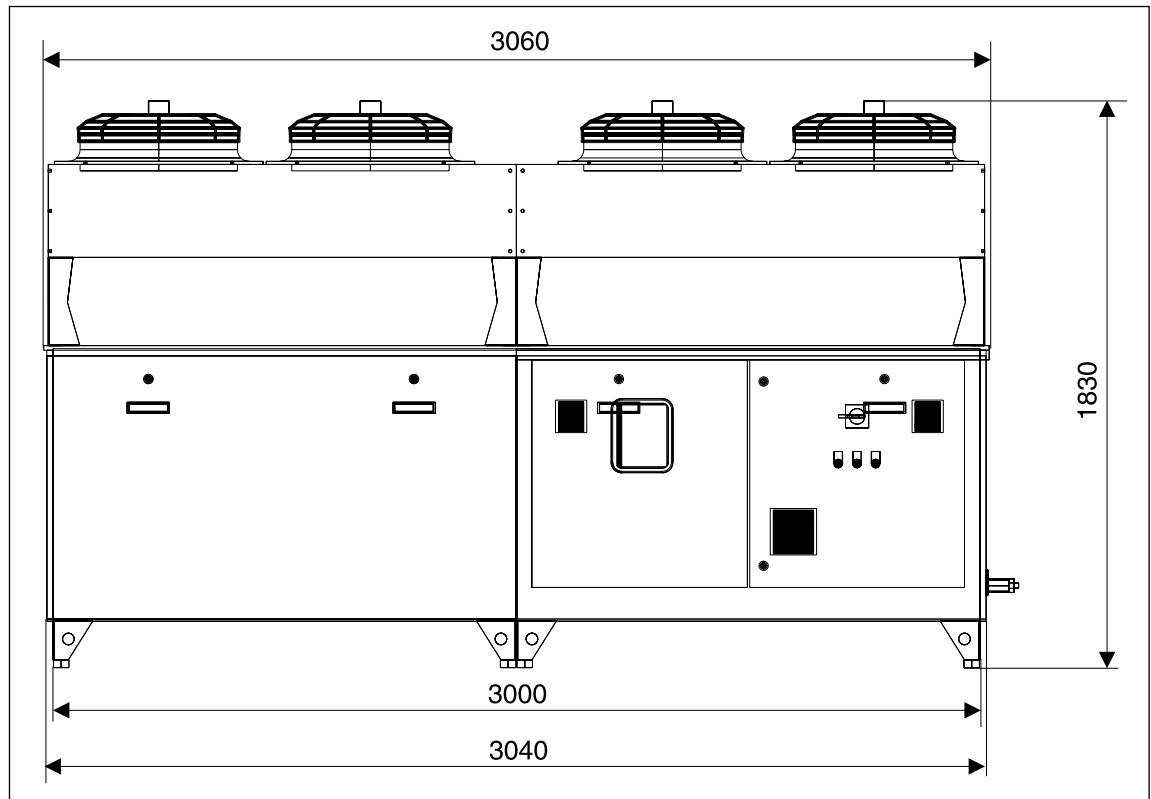


Fig. 73: KKT chiller, front view

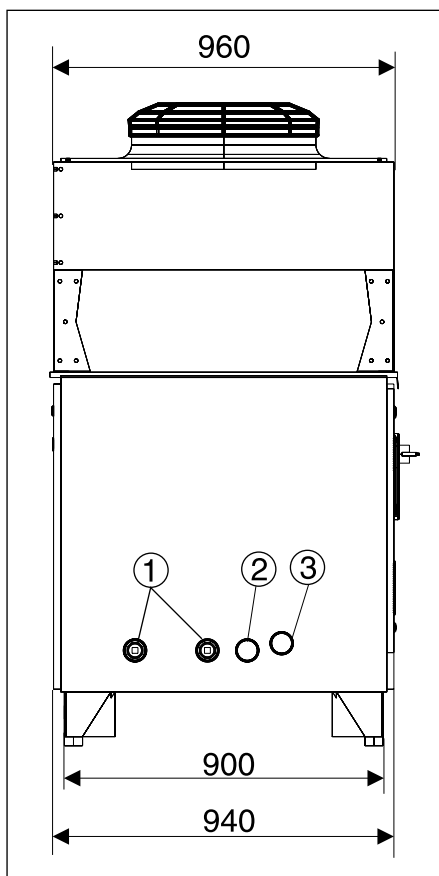


Fig. 74: KKT chiller, side view

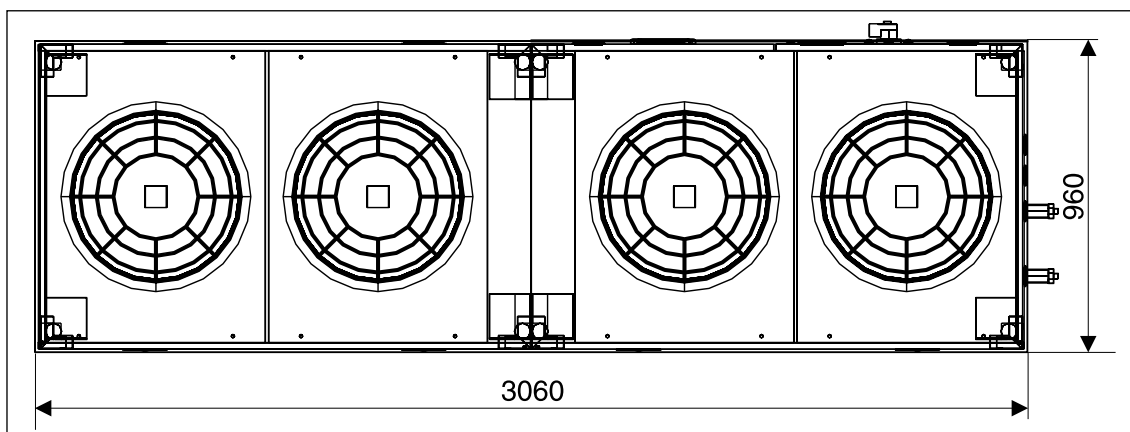


Fig. 75: KKT chiller, top view

NOTE

The KKT chiller requires a 1.0m service area in each direction.

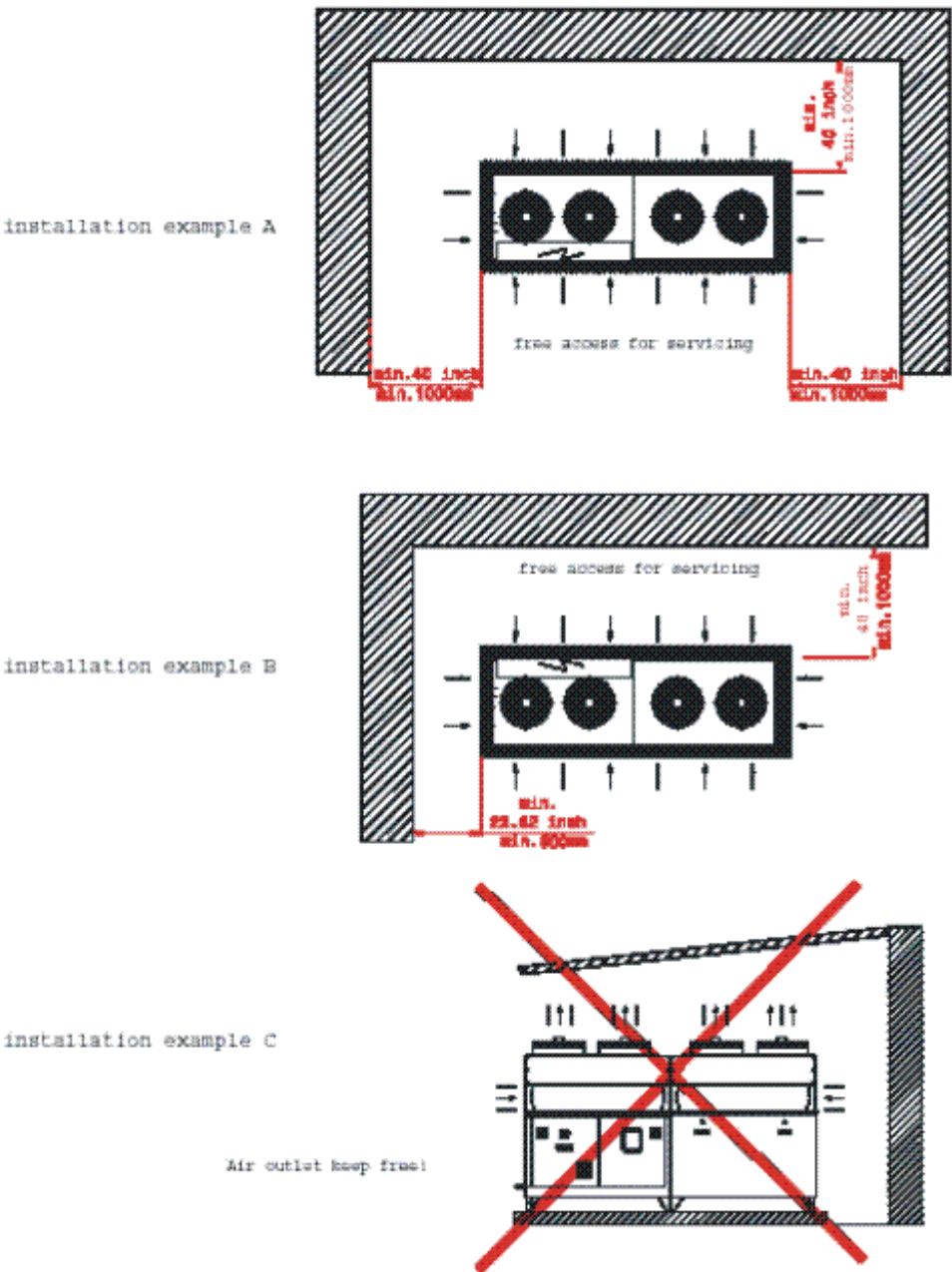


Fig. 76: Installation requirement

Connection interface

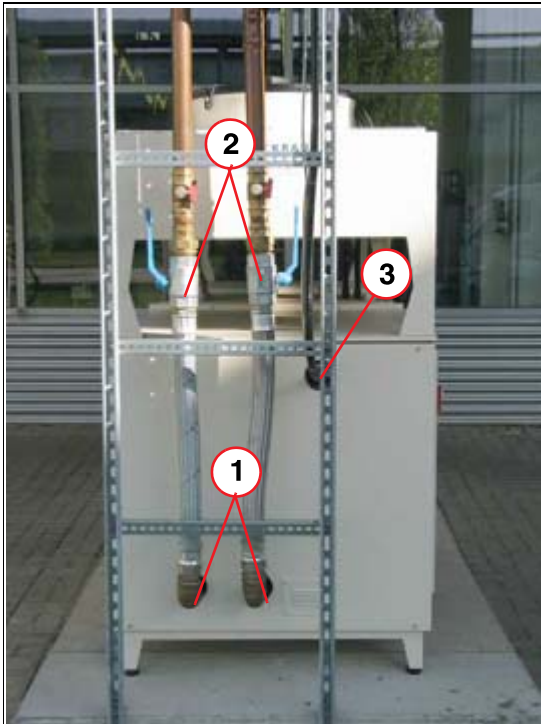


Fig. 77: KKT chiller

- Pos. 1 2" female thread (Chiller side)
- Pos. 2 Shut-off valves to be installed on-site
- Pos. 3 Electrical connections

NOTE

All water pipes (e.g. from the KKT chiller to the IFP) to outside buildings have to be insulated.

Options

The following options can be ordered for the KKT chiller.

Electrical installation package

The kit consists of a 25 m connection cable to the on-site power supply panel, including a cable tray and mechanical mounting kit. The data cable length is 50.0m

NOTE

The KKT chiller is not connected electrically to the ACC cabinet.

Hydraulic installation package

The kit consists of pipes (DN54), insulation material, elbows and mounting materials to cover the 25 m distance from the chiller to the IFP.

NOTE

Follow the specifications for the pipe materials as specified in: [\(Piping specifications / p. 152\)](#).

Soft-start option

If the KKT chiller will be operated with a UPS system, it has to be ordered with the soft-start option.

Inrush current of KKT chiller with soft-start option
< 2.5 X I _N (nominal current) for less than 1.0 s (second)
< 2.0 X I _N (nominal current) for less than 5.0 s (seconds)

KKT representations

Country	Address
Austria	Axima Gebäudetechnik GmbH Leberstr. 120 1110 Vienna Telephone: FAX: +43 1 74036140
Bulgaria	Aero-Technika GmbH Vladajska Street 10 1606 Sophia Telephone: +359 2 8528952 FAX: +359 2 8560859 e-mail: aerotech@techno-link.com
China	Krüger Intersales Beijing 53 Dong An Men Str., East. Dist. PRC 100006 Beijing Telephone: 008610/65237-0 FAX: 008610/65237653

Czech Republic	Klima Technik Zlatniky 61 25241 Praha - západ Telephone: +420 2 41931783 FAX: +420 2 41931783 e-mail: klimatechnik@volny.cz
Denmark	Svedan Industri Koeleanlaeg A-S Haanovaerkerbyen 8 2670 Greve Telephone: +45 43907111 FAX: +45 43907133 e-mail: sg@svedan.com
France	KKT France 10, rue du Rhone 68100 Mulhouse Telephone: 00333/89660697 FAX: 00333/89660697
Greece	Taircon LTD. Mitsopoulou 26 114 74 Athens Telephone: +30 2106431609 FAX: +30 2106457231 e-mail: taircon@taircon.gr
Hungary	Klimatrade KFT Fehèrvàri út 108-112 1116 Budapest Telephone: +36 12036004 FAX: +36 12036246 e-mail: klimatrade@klimatrade.hu
India	Padmaja Enterprises Natwar Nagar, Road no 1, Jogeshwari (East) 400060 Mumbai Bombay / India Telephone: +91 2228381577 FAX: +91 2233981409 e-mail: rivulet_chiller@indiatimes.com

Indonesia	PT. Buanaprima Kharisma Jaya Jin Let Jen Suprpto No 160 Blok A15 10640 Jakarta Telephone: +62 214211483-4 FAX: +62 214211486 e-mail: tuwaidan@cbn.net.id
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Croatia	EL&TA d.o.o. Ivana Pergocida 10 10090 Zagreb - Hrvatska Telephone: +385 1 3645930 FAX: +385 1 3645929 e-mail: elta@zg.htnet.hr
Lithuania / Letland / Estland	SK Impex Service Center Mildos Str. 6 2055 Vilnius / Lithuania Telephone: +370 5 2105885 FAX: +370 5 2105880 e-mail: service.skimpex@aiva.lt
Malaysia	JT & T Electrical Engineering SDN. BHD. Taman Mayang Jaya 47301 Pataling Jaya, Selangor D.E. Telephone: +603 78038812 FAX: +603 78039912 e-mail: juanc33@streamyx.com
Pakistan	Captive Air (Pvt) Ltd Telephone: +92 42 6675170 FAX: +92 42 6675171 e-mail: aire136@shoa.net

Poland	Kaltrav Sp.zo.o. ul. Wernyhory 4/2 02-729 Warsaw, ul Rolna 179/181 Telephone: +48 22 8433330 FAX: +48 22 8433330
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Romania	S.C. Ascensorul S.A. 10 George Georgescu St. 70506 Bukarest 3 Telephone: +40 21 3368239 FAX: +40 21 3370109 e-mail: ascensor@kappa.ro
Oman; U.A.E	TMTEC Trad. & Technical Services LLC P.O. Box 455 Al-Ghubrah North PC 116 Sultanate of Oman Telephone: +968 595848 FAX: +968 594838 e-mail: talalmaskri@hotmail.com
Singapore	Data Sphere (S) Pte. Ltd. 415945 Singapore Telephone: +65 67412233 FAX: +65 68412233 e-mail: cliff@datasphere.com.sg
Sweden	KKT Svenska Gullvivevägen 11 51292 Falköping Telephone: +46 515 728312 FAX: +46 515 728312

Switzerland	HIPAG Service GmbH Bundtstrasse 34b 8127 Forch Telephone: +41 1 8877515 FAX: +41 1 8877516
Slovenia	Elektroklima Rázusova 14 90201 Pezinok Telephone: +421 7046402928 FAX: +421 7046402928 e-mail: dujka.elektroklima@nextra.sk
Slovenia	Klima-Petek d.o.o. Kraljevica Marka ul. 14 2000 Maribor Telephone: +386 2 2909120 FAX: +386 2 2522550
Taiwan	Protec Co. Ltd. Chung Ho City Taipei Hsien, R.o.C. Telephone: +886 2 32340355 Fax: +886 2 323 40 200 e-mail: printex@ms22.hinet.net
Thailand	Carrier Limited Nation Tower 46/63-74 Bangna-Trad Rd. 10260 Bangna, Bangkok Telephone: +66 27514777 Fax: +66 27514743 e-mail: chaiyuth.jongsiri@carrier.utc.com
United Kingdom	H&C Contracts Ltd. The Kilns Frith End Road, Hold Barnes BP, Unit 3 GU35 OQP Bordon Hampshire Telephone: +44 1420488281 Fax: +44 1420489950 e-mail: colin@hccontracts.co.uk

Ukraine	MKM Telekom Ukrainian-Russian-German Joint Venture 07300 Vyshgorod Kiev RegionUkraineTelephone: 0038044/4607570FAX: 0038044/4607501
USA	The Waldinger Corporation 2601 Bell Avenue IA 50306 Des Moines, Iowa Telephone: +1 515 3235139 FAX: +1 515 3235168 e-mail: cbeard@waldinger.com
Vietnam	REE Corporation Hanoi Branch Huan Kiem, Hanoi / Vietnam Telephone: +84 4 8252300 FAX: +84 4 9350229 e-mail: neehn@jpt.vn

IFP

Function

The IFP (Interface Panel) is to be used only in combination with the KKT Chiller KCC215. This applies if no chilled water supply is available on-site. The IFP is the interface between the KKT chiller and the ACC cabinet as well as the water supply for the cold head compressor which is connected directly to the IFP. Additional devices such as built-in flow meters and a strainer are to guarantee an accurately functioning cooling water circuit, especially for the cold head compressor. The connection between KKT chiller and IFP has to be established locally with 2" pipes. Two 5 m hoses (forward and return) to connect the IFP to the ACC are part of the delivery volume.

Technical data

Power specifications

Connected to	ACC
---------------------	-----

Installation specifications

Weight	40.0 kg
Height	800.0 mm
Depth	200.0 mm
Length	1,050.0 mm
Hose length to ACC	max. 5.0 m
Pipe length to KKT chiller	max. 25.0 m
Hose length to helium compressor	max. 1.8 m
Heat dissipation to air (IFP+Helium compressor)	1.0kW

Block diagram

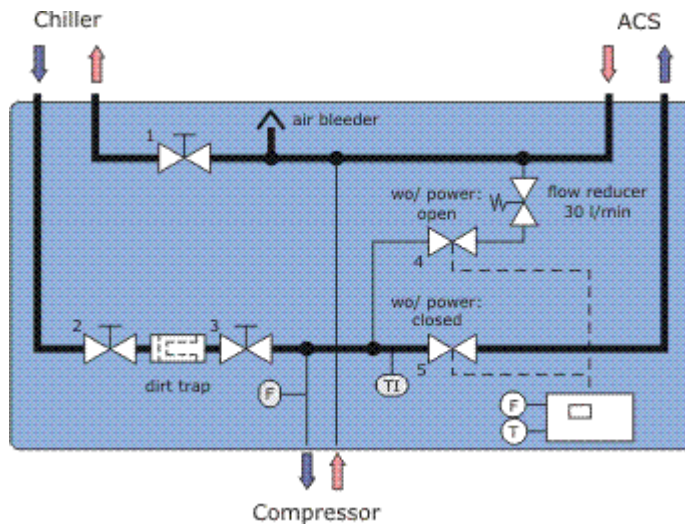


Fig. 78: IFP block diagram

Dimensions

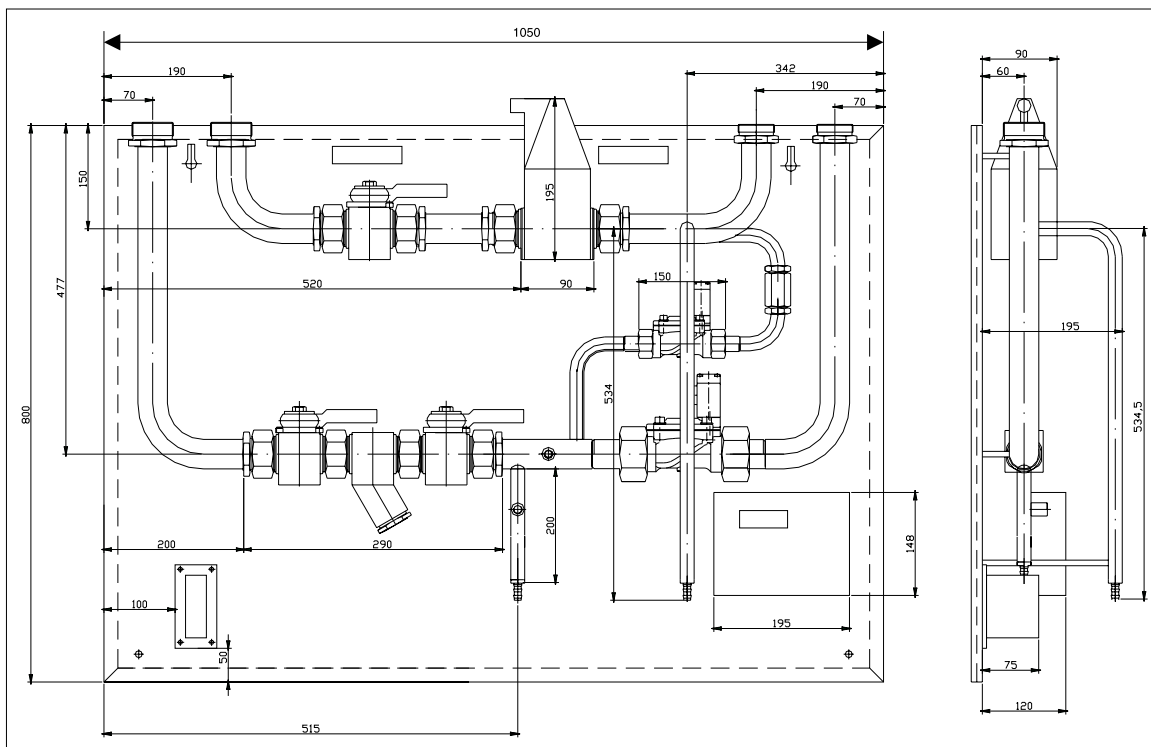


Fig. 79: IFP dimensions

Connection interface

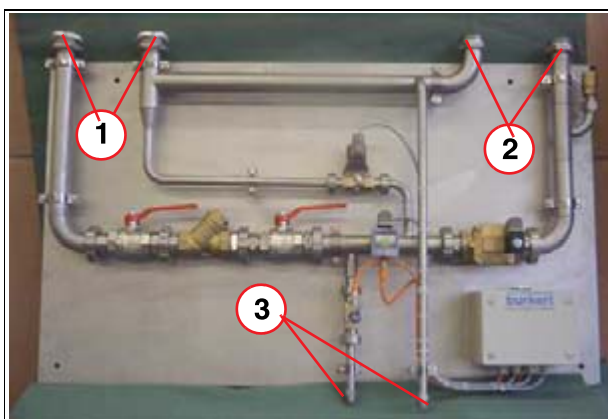


Fig. 80: IFP water connections

- Pos. 1 2" male NPT pipe thread (primary water from/to KKT chiller)
- Pos. 2 2" male thread for the delivered 5 m Kutting hoses (to ACS)
- Pos. 3 Helium compressor water connection

Helium compressor

Function

The 90 elbow is part of the delivery volume. If the KKT chiller is part of the delivery volume, the helium compressor is delivered as a separate component. If the KKT chiller is part of the delivery volume, the helium compressor is delivered as a separate component.

The SC-10 or SC-10L Shield Cooler is a two-stage refrigeration system that cools the warm (77 K) and cold (20 K) radiation shields of the MRI Cryostat conductively, maintaining the shields at cryogenic temperatures and reducing the loss of liquid helium.

The SC-10 Shield Cooler connects with the cryostat interface flange and shields provided by the magnet manufacturer.

The system consists of a helium compressor (either HC-10 or HC-10L), interconnecting gas lines, cables and the shield cooler. The helium compressor uses high purity helium gas for its refrigerant. There is no co-mixing of the helium refrigerant with the helium in the cryostat. The equipment is designed for continuous operation. Electricity and cooling water for the compressor are the only utilities required.

Pressures are stated as gauge, not absolute. Pressure units are bar and pounds per square inch (psig). For reference:

1 bar = 14.5 psig

1 MPa = 10 bar

NOTE

KKTchiller and IFP configuration:

The power supply of the helium compressor is connected to the mains box via the IFP. The helium compressor will not be switched off with “System off” or “System stand-by”.

The helium compressor will be “off” when the on-site EPO switch is pressed and/or the complete MR system is disconnected from the on-site power supply.

SEP configuration:

The power supply of the helium compressor is connected to the mains box via the SEP cabinet. The helium compressor will not be switched off with “System off” or “System stand-by”.

The helium compressor will be “off” when the on-site EPO switch is pressed and/or the complete MR system is disconnected from the on site power supply.

For all configurations:

As soon as the power is back to the ACC mains box connection, the helium compressor will restart automatically.

Technical data

Dimensions	Width	450 mm
	Length	485 mm
	Height	529 mm
Weight		120 kg
Hose length to IFP		1.8 m
Power requirements		Connected to ACC ¹
Ambient conditions		Equipment room

-
1. AC 380, 400, 415 V/50HzAC 460, 480 V/50Hz. If you do not meet these power/frequency combinations, an additional transformer has to be installed.

Dimensions

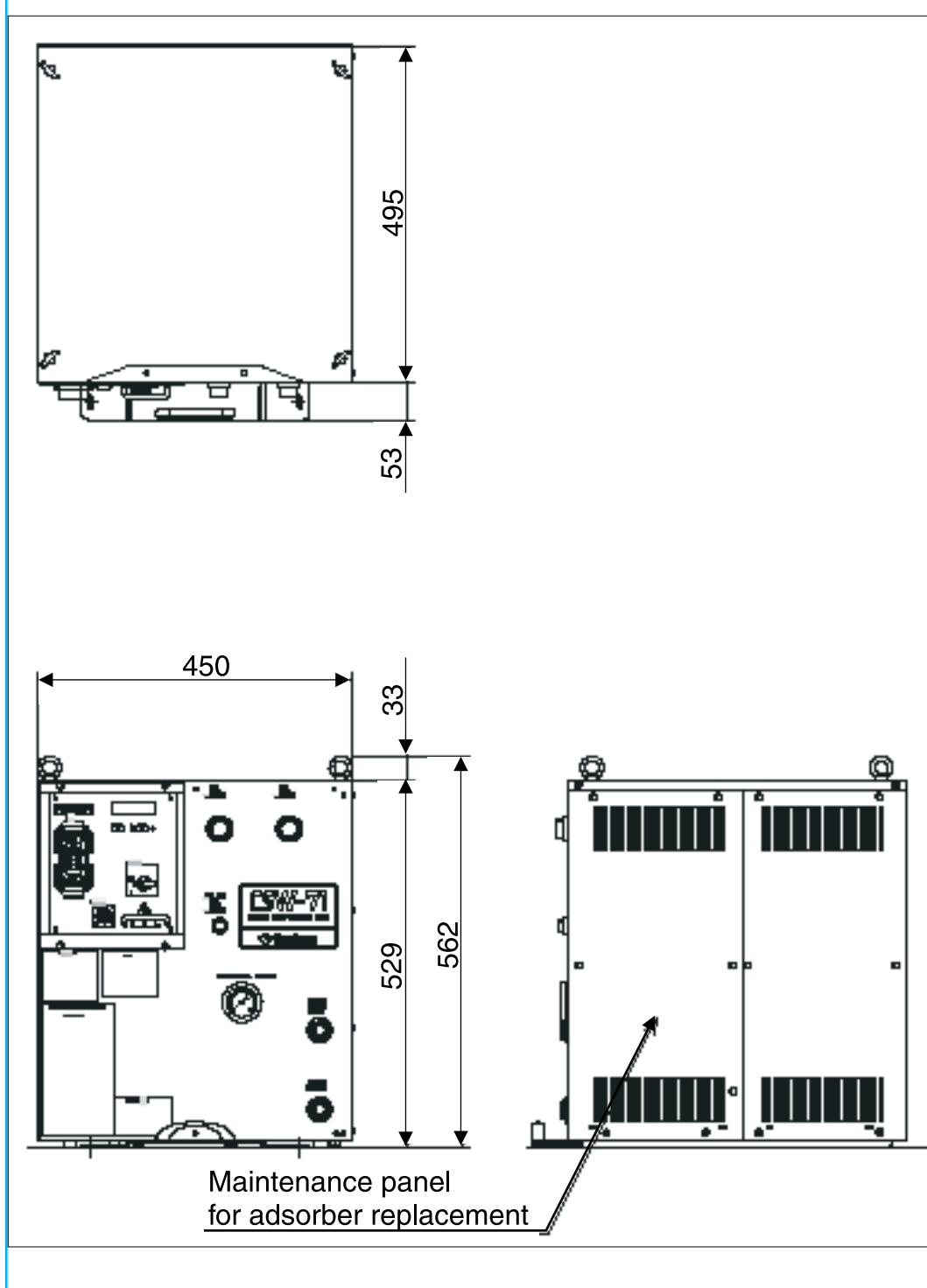


Fig. 81: Compressor unit dimension

Seismic fixation

NOTE

The seismic fixation of the helium compressor can be fitted to the corresponding holes in the housing.

General

To minimize interference on line voltage cables for the MAGNETOM, non-MAGNETOM components (e.g., heating and air conditioning unit, pumps, light sources) should not be connected after the service line.

As a rule, heating and air conditioning units have to be equipped with line filters.

The examination room installation has to be completed according to DIN VDE 0107, and if necessary, connected to an emergency power supply.

Room lighting should not be affected when the MR system is switched off or shut down via the Emergency SHUTDOWN button.

To avoid extraneous electrical fields in the examination room, the following should not be installed or used:

- Telephone connections
- Extensions for in-house intercom systems
- Fluorescent lights
- Energy-saving light bulbs

NOTE

The system and the system components are designed to operate safely, and within the ITIC requirements, during power interferences.

Electromagnetic Compatibility (EMV)

All information regarding electromagnetic compatibility is based on IEC 60601-1-2:1993 and EN 60601-1-2:1994 standards.

Emitted interference	
Radiated interference	Class B
Conducted interference	Class B

Interference immunity	
Electrostatic discharge (ESD)	
Contact discharge	+/- 6 kV
Airborne discharge	+/- 8 kV
RF radiation	
ISM bands	3 V/m
Quick, transient disturbances (bursts)	
AC supply lines	+/- 2 kV

Interference immunity	
Other connecting lines	+/- 1 kV
Surges	
AC supply lines	+/- 2 kV

To minimize interference on line voltage cables for the MAGNETOM, non-MAGNETOM components (e.g., heating and air conditioning unit, pumps, light sources) should not be connected after the service line. As a rule, heating and air conditioning units have to be equipped with line filters.

Equipotential bonding

Equipotential bonding of main and additional voltage has to conform to DIN VDE 57100 (Parts 410 and 540) and DIN VDE 0107, so that allowable leakage current values as outlined in DIN VDE 0750 part 1 and part 1-1 are not exceeded.

The above standards are identical to IEC 601-1 and IEC 601-1-1 (international) and EN 60 601 as well as EN 60601-1-1 for Europe.

On-site power supply

On-site power specifications

	Nominal value	Tolerance ¹
Voltage range	380, 400, 420, 440, 460, 480 V 3-phase and ground	+10% / -10%
Line to line unbalanced	--	max. 2%
Frequency	50/60 Hz	+/- 1 Hz

1. For all line conditions (e.g., power supply under voltage from the power plant) including maximum voltage drop according to the connection value.

NOTE

In terms of the allowable voltage and frequency fluctuations, the requirements of EN60601-1 are valid! If EN60601-1 does not apply, refer to local regulations.

NOTE

The power connection for the MRSC cannot be connected to the MRC line distribution or the ACC cabinet.

The power supply for the MRSC and other customer related peripheral devices (e.g printer, video etc.) has to be provided on-site. It is not possible to connect the above mentioned devices to our built-in power distribution.

NOTE

If the Helium compressor is supplied with power again, e.g. after a power failure, the Helium compressor will start automatically.

To achieve this function the on-site power distribution panel should not contain any relais that trips with a power failure and does not come up again automatically when the mains power comes back again.

Due to local guidelines and regulations there are cases, e.g. EPO circuit, which require relais. In those cases the main relais has to be activated actively with a "switch-on" button after the power is back on again.

To prevent Helium boil-off the available potential free alarm contact (if used) will give an indication of the absence of power.

Notes

IT IS THE CUSTOMER'S RESPONSIBILITY TO COMPLY WITH THE POWER QUALITY REQUIREMENTS FOR SIEMENS MEDICAL SOLUTIONS EQUIPMENT.

The electrical feeder to the Siemens Medical Solutions equipment must feed only the imaging system and be kept separate from electrical feeders to HV-AC, motors, pumps, compressors, elevators and other potential sources of electrical interference.

The electrical feeder to the imaging system must be run directly to a main facility distribution panel or to the facility's service entrance, with no other loads powered from this feeder.

On-site power requirement

Gradient type	Recommended fuse rate	Connection value	Momentary power	Internal line impedance
Z-engine	125 A (NH-Type)	85 kVA	100 kVA	< 95 mOhm

Recommended fuse rate

The conductor size of the main connection line should be selected to ensure that the maximum voltage drop is less than 4%, including the source impedance, feeders, and any transformers. Fuse rating to be selected in order to protect the mains connection line conductors and to supply the momentary current. This is valid for the on-site power installation (e.g., hospital).

Connection value

Connection value during measurement sequences (< 5 min.) at nominal voltage.

Momentary power

Momentary power during measurement sequences (< 5 sec.), relevant for maximum voltage drop calculation over the mains connection line and UPS size selection.

Recommended FI (country related)

FI = residual current operated protective device

Recommended FI				
	Manufacturer	Type	Nominal current	Nominal residual current
Z-engine	DOEPKE	DFS 8; 4-poles (for surge current)	125 A	0.03 A

Circuit breaker

Circuit breaker		
Z-engine	Nominal current	125 A

NOTE

If as an alternative or in addition (country related) to the EPO circuit a power switch is installed, the power switch must not trip at currents lower than 500A peak.

Average power consumption

Estimated average power consumption	Value measured at 400 V / 50 Hz
	Z-engine
System off ¹	8.2 kW / 12.0 kVA
Stand-by	8.4 kW / 12.2 kVA
Ready for measurement	13.5 kW 17.7 kVA
Typical measurement	30.0 kW
Highest average power	37.0 kVA
System duty cycle	56.0 kVA

1. The helium compressor and cold head is operational 24 h/day.

NOTE

The average power consumption of the systems differs based on the type of sequences, parameters and applications used.

Mains connection of the system

Requirements			
Cable size ¹	Type	Wires	Comments
70 mm ²	shielded	4 (3 phase/ground)	From on-site power supplies to the ACC
AWG 2/0 (for 480 V)	shielded, metal conduit	4 (3 phase/ground)	From on-site power supplies to the ACC

-
1. For an Espree installation with a Q-Engine gradient, an existing MR suite 50 mm cable size can be used. For new installations always use a 70mm cable size.

NOTE

A shielded power cable is required for connecting the MR system to the mains. (From the on-site power distribution panel to the mains connection terminal of the MR system.)

If a UPS system is connected to the MR system, a shielded power cable is required between the UPS and the MR system.

Service line

The permissible magnetic flux density B (magnetic induction) for the AC and three-phase power meters is:

$B \leq 2 \text{ mT}$

Magnetic shielding has to be provided at higher magnetic flux densities, because they impair the functions of the AC and three-phase power meters.

On-site power distribution panel

Block diagram

NOTE

The MR system uses only a supply line L1, L2, L3 and ground (PE). Neutral is not required. In some countries, neutral is used (due to country-specific regulations) in the on-site power distribution panel (e.g., for FI installation). The neutral cannot be connected to our system (mains box)! The example shown is for European country-specific regulations only and not mandatory.

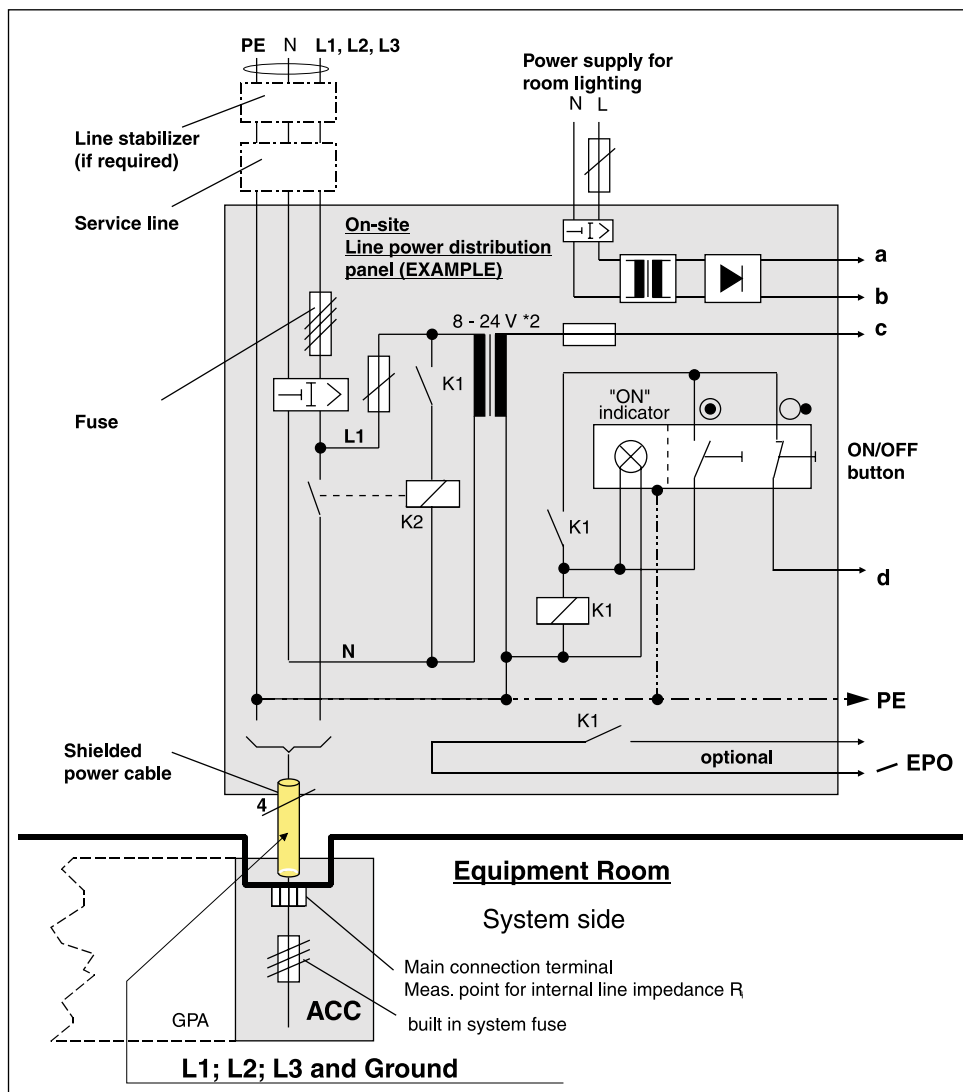


Fig. 82: Example of on-site power distribution panel, part 1

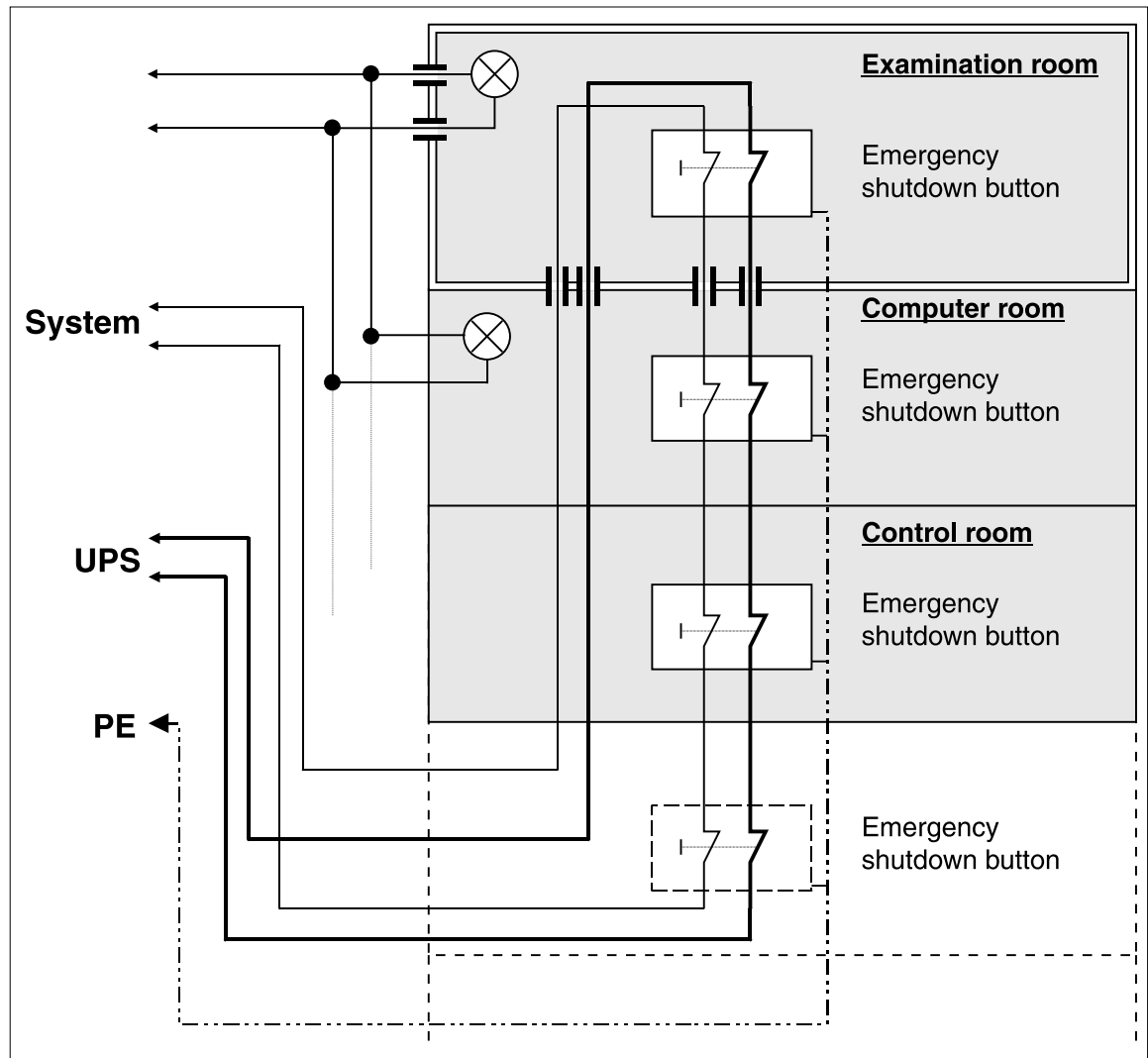


Fig. 83: Example of on-site power distribution, part 2

NOTE

If a UPS is supplying the incoming main line voltage to the system, it also has to be shut off via the emergency shutdown buttons. This applies to the small MRC UPS as well.

Power distribution panel diagram example

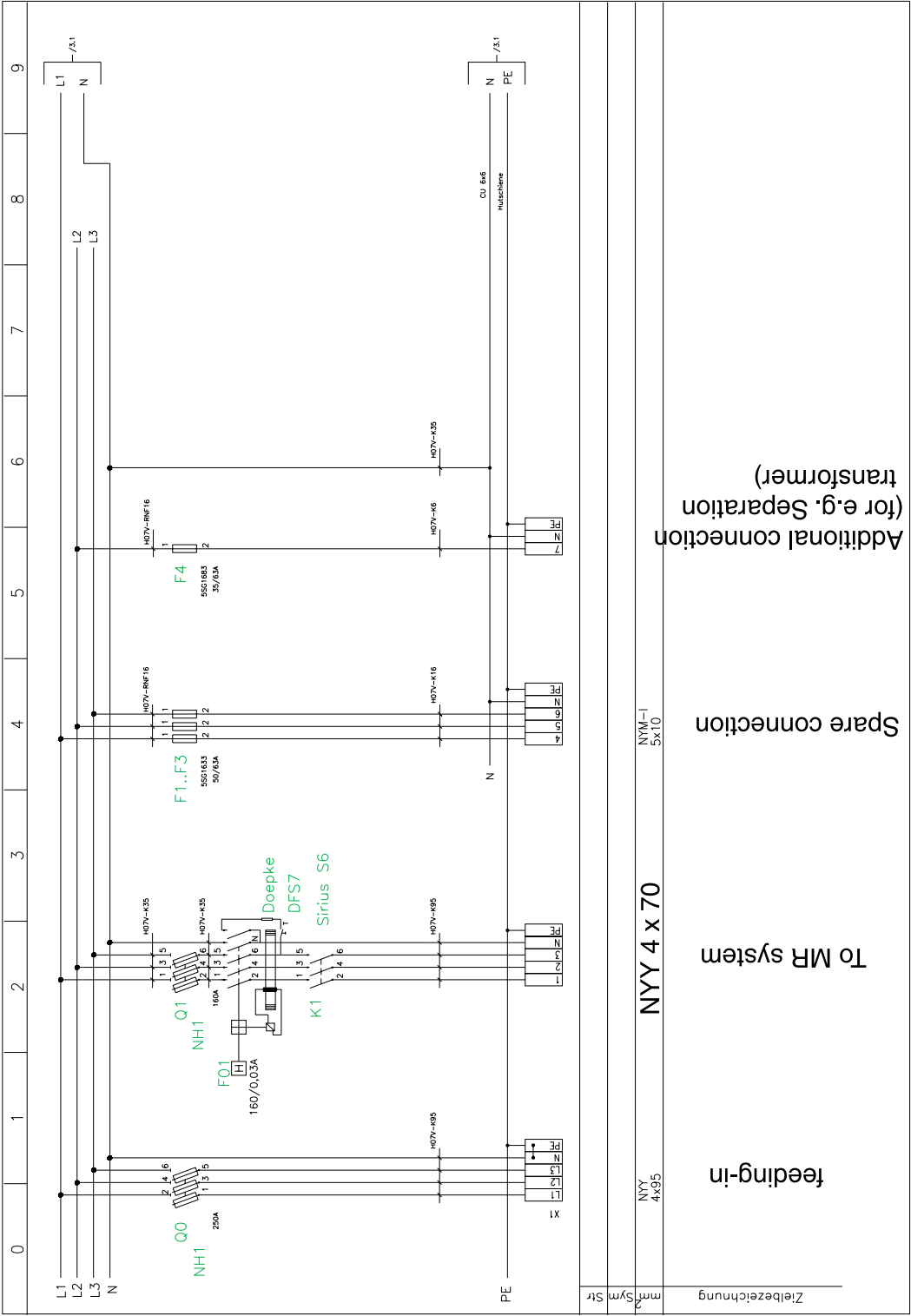


Fig. 84: Example of on-site power distribution panel, part 1

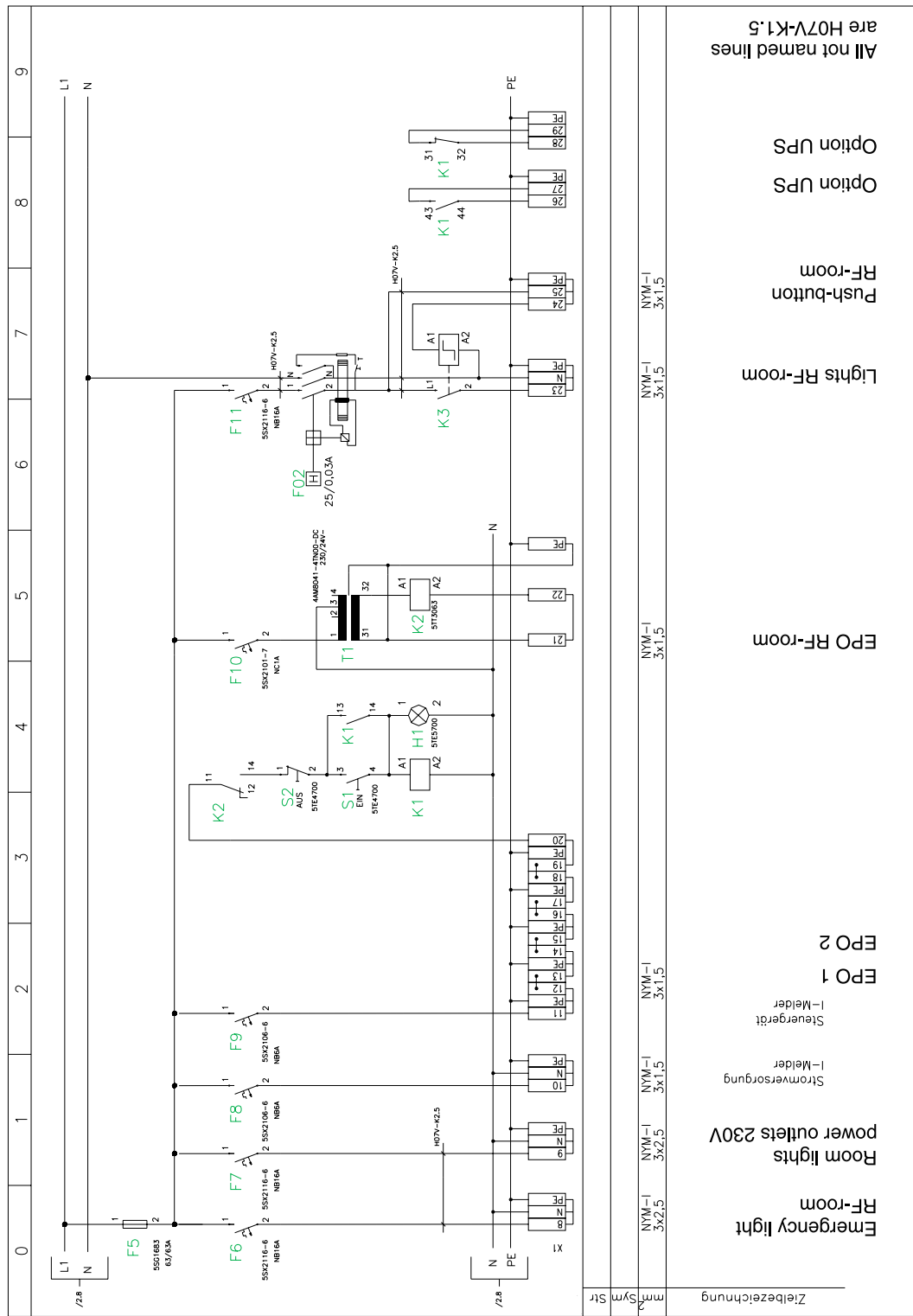


Fig. 85: Example of on-site power distribution panel, part 2

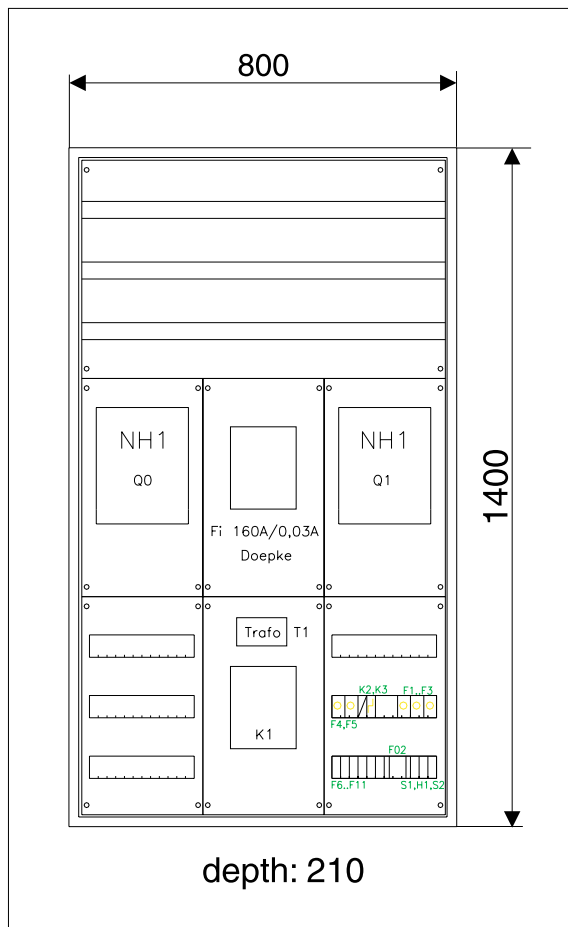


Fig. 86: On-site power distribution panel example (optional)

Line power on/off; EPO

The on-site power supply has to be switched on or off via the ON/OFF button which should be located on the line power distribution panel.

NOTE

The MR system is switched on or off via the button on the alarm box supplied with the system.

Install the EMERGENCY SHUTDOWN buttons (EPO) in the MR suite in accordance with the project plans. The EPO buttons are recommended. In some countries, they are not required. Follow local regulations and guidelines. If no EPO button is installed, a main circuit breaker has to be installed at the on-site power distribution panel.

The MR system should be shut down via the shutdown circuitry (Emergency SHUTDOWN button) in emergencies only. The refrigerator is switched off in emergency cases, which means that the helium boil-off rate increases considerably.

NOTE

If a UPS is connected to the system, it has to be shut off via the emergency shutdown buttons as well.

NOTE

If as an alternative or in addition (country related) to the EPO circuit, a power switch is installed, the power switch must not trip at currents lower than 500A peak. The circuit breaker must be suitable for 125A.

NOTE

Ensure that the MR system cannot be switched on accidentally after, e.g., the Emergency shutdown button (EPO) has been unlocked/reactivated.

NOTE

All emergency stop buttons should be mounted in such a manner as to be easily accessible. Locations should be chosen that will prevent accidental shutdown of the system. All buttons should have "Guards" installed to prevent accidental depression of the button(s).

Grounding

Siemens Medical Solutions products are sophisticated electronic systems that require attention to grounding to ensure optimal equipment performance and reliability.

Equipment grounds to Siemens equipment are specified to be "isolated" types as permitted in NEC 250-96(b) for the reduction of electrical noise.

In order to maintain the integrity of the RF-shielded examination room, the ground must originate at the Siemens electronics cabinet ground bus (ACC cabinet), and should be connected at both ends under Siemens supervision.

Non-current carrying conductive surfaces have to be grounded via a #6 a.w.g. insulated green copper conductor installed in the metal raceway that contains the branch-circuit conductors supplying the equipment.

A neutral conductor, if present, is not used for the line voltage connection to the Siemens equipment. If the neutral conductor is provided, it should not be electrically connected at any point in the power distribution to Siemens equipment, unless specifically required. Unintentional neutral-to-ground bonds may violate local and national electrical codes and result in grounding problems.

The grounding of the system, especially the facility ground provided, should be prepared in compliance with local regulations.

The internal grounding of the MR system must be set up with minimum ground loops in order to prevent noise currents and general disturbances from flowing through the grounding path.

Grounding points

To achieve such a grounding, three major grounding points should be used:

1. The facility ground provided in the distribution panel.
2. The main grounding point at the ACC cabinet (should be directly connected to (1)).
3. The RF room common grounding point at the RF filter panel (should be directly connected to (1)).
4. An optional UPS system should be connected as well to (1).

To check for possible ground loops, the ground resistance between the RF cabin (3) and the facility ground (1) should be checked prior to switching on the system. The minimum resistance between (1) and (3) without connected ground wire should be at least 100 Ohm. After having measured that all ground wires should be connected, the maximum resistance between any two points on the grounding system should not exceed 200 mOhm.

Additional electrical equipment installed inside the RF cabin should use RF filters mounted on the filter panel. These additional filters should be grounded as well to the RF room common ground.

Any modifications or non-MR equipment grounds added to the MR ground system must be approved by Siemens representative to guarantee system safety and performance.

Customer RF filter connection

RF filter for customer use

NOTE

It is recommended to install a separate RF filter panel for the on site filtering, e.g for room light. RF room manufacturers are able to supply special made filtering panels.

The blind plates implemented in the RF filter panel are for Siemens use, e.g. future options, only.

Usage	Filter
EPO circuit ¹	Z 19
EPO circuit	Z 20
Examination room light	Z 21
Examination room light	Z 22
Customer AC supply ²	Z 23
Customer AC supply	Z 24

1. Follow local regulations for installing the EPO button. In some countries, the EPO button is not mandatory. The EPO button is recommended in any case.
2. Refer to the use of the power outlet in the examination room and follow local regulations. An isolation transformer with a leakage current detector may be required (AG1; AG2).

NOTE

Hazardous conditions are created by the magnetic field when connecting devices made from magnetizable material to the receptacles installed in the examination room.

In addition, the functionality of electrical devices, e.g., servo ventilators, may be affected by the magnetic field if the devices are not suitable for this type of operation.

The user is responsible for the installation and use of receptacles in the examination room as well as damage resulting from said use.

In addition, the on-site electrical system has to conform to Application group 2 (VDE 0107) when life supporting systems are used in the examination room.

NOTE

Power outlets inside the examination room have to be connected through extra RF-filters, an insulation transformer and a leakage current detector if DIN VDE 0107 Application group 2 applies.

Local requirements have to be fulfilled.

RF filter 6A/25A

RF filters have to be installed, for example if a fire alarm or other electrical devices will be installed in the examination room.

NOTE

It is not recommended that you install additional RF filters on the RF filter panel. This will conflict with the upgradability.

Ordering information

Part number	Max. voltage	Max. current
46 84 866	250 V	6 A
77 54 158	250 V	25 A

Specifications 25 A

25 A filter specifications	
U _{rated} (rated voltage)	250 V AC
I _{rated} (rated current)	25 A
Capacitance against ground	0.2 F
Longitudinal inductivity	n.a.
Insertion loss	105 dB

Specifications 6A

6A filter specifications	
U _{rated} (rated voltage)	250 V AC
I _{rated} (rated current)	6 A
Capacitance against ground	1.0 F
Longitudinal inductivity	60.0 H
Insertion loss	105 dB

Alarm contact

- ⇒ The ACC cabinet is equipped with one potential-free alarm contact X119.
- The contact (X119) is for remote alarm of the following malfunctions:
 - Helium level warning and alarm
 - Shield temperature
 - Magnet pressure (high/low)
 - He- compressor stop

Connection details

Specifications for X119	
Connector type	HAN 3A
Load	230 V
	10 A
not protected by a fuse	

Configuration X119 (HAN 3A)			
Status	Pin	Pin	Contact
normal	1	3 ¹	closed
	2	3	open
alarm	1	3	open
	2	3	closed

1. Pin 3 is common.

Additional information

Vacuum Pump

If a Vacuum pump is installed at the RF filter panel in some cases the customers need to switch the vacuum pum “off”. There is no possibility implemented in the pump to do so.

If the customer wants to switch “off” his vacuum pump an adequate switch has to be installed on site.

This can be done locally without any problem. The switch has to be installed in the power supply cable from the RF filter panel to the vacuum pump. The switch has to be outside of the RF room.

Room lighting

Intensity of illumination

The most important factors with respect to good lighting are the brightness level and light density which should result in reflection-free presentation and uniformity. Those parameters must be adjustable.

The room lighting fixtures should be divided into groups so that they can be adjusted to daylight conditions.

NOTE

The planning of the illumination and position of, e.g., monitors should be performed in reference to DIN 6868-57.

In reference to DIN 6868-57, the illumination in rooms equipped with, e.g., monitors for diagnoses has to fulfill the following requirements:

- adjustable
- non-dazzling
- reproducible adjustment of the illumination density
- no reflections from windows, lamps, display cabinets in the normal operation position, e.g., of the monitor.

Image screen workstations

The special requirements to be met by the human eye when working with image screen workstations are, for example, rapid image or text displays. An expert in room lighting should be consulted when determining the physical location of the MR monitors and the seating arrangement for the operator. Of special importance is the location of windows (daylight) and illumination with respect to the screen.

Planning

Reflections from light sources or daylight (windows) lead to completely false contrast and brightness settings on the MR monitor. Since the images and texts displayed on-screen are the basis for photographic documentation, the quality of images from this source will be negatively influenced. Equally important for optimal image quality on the MR monitor and thus for the most fatigue-free working conditions are such factors as reflection and glare, light density, and adequate illumination strength.

Reflections, glare

Glare considerably impairs the work performed on-screen. Direct glare due to lamps or illumination as well as various kinds of reflected glare should be prevented. Appropriate planning is therefore highly important.

Examination room

NOTE

The magnetic field adversely affects the operating life of light bulbs located in the immediate vicinity of the magnet. The filament in the light bulb oscillates with the frequency of the power supply.

NOTE

AC-lights and DC-lights can be installed in the examination room. Fluorescent lighting cannot be installed inside the examination room.

DC voltage

It is recommended, but not mandatory that you connect light fixtures in the vicinity of the magnet to a DC voltage supply. If room lighting is supplied with DC voltage, correct polarity of the sockets should be ensured during their installation.

Residual DC ripple should be $\leq 5\%$.

AC voltage

AC lights can be used as well. Only lamps **without phase angle** control should be used.

Recommendation

Light sources should be installed as follows:

- The groups of lamps in the examination room are switched on/off with the main switch in the control room.
- The set of lamps above the patient table is controlled via a switch in the examination room.
- The set of lamps next to the patient table is controlled via a second switch in the examination room.

Protective Conductor Test

NOTE

Before performing the protective conductor test, read the operator's manual of your measurement device!

For some measurement devices, the resistance of the measurement leads have to be subtracted from the results measured.

NOTE

Prior to performing this test, the entire grounding cabling has to be installed.

NOTE

The protective conductor test also has to be performed from the on-site power distribution panel to the connection (mains box) of the ACC cabinet. This is to ensure the presence of the ground connection at the connection terminal of the ACC cabinet.

⇒ Use the **protective conductor meter** and measure the **ohmic resistance** between the protective conductor connection on top of the ACC cabinet and an uncoated metallic part of the:

- SEP
- ACC
- KKT chiller
- IFP
- Helium compressor
- MRC Host computer
- MRC console components
- RF room
- RF filter plate
- Magnet
- Patient table
- Monitor
- Options (if available)

NOTE

Should the resistance exceed 200 mΩ in one instance, test the protective conductor in question for satisfactory galvanic connection.

NOTE

If this is not successful for devices with inlet-connectors (for non-heating appliances), an additional 16 mm² protective conductor should be connected to the respective housing. Do not disconnect the protective conductor in the line voltage cable.

General

An on-site water supply (e.g., chiller, central chilled water supply) is required for operating the MR system. To guarantee failure-free operation of the water cooling circuit, and the water-cooled components listed in the table, the primary chilled water supply has to comply with the specifications listed in this document ([Water-cooled components / p. 151](#)).

Three solutions for the on-site water supply are feasible:

1. Central chilled water supply (e.g., in hospitals) is already available.
2. A local chiller of a different brand is already available (has to meet our specifications).
3. Chilled water supply is not available and has to be built up with the dedicated KKT MR chiller, type KCC 215.

NOTE

In Germany, DIN 1988 "Technical guideline for tap water installations" should be part of the planning phase.

Local/country specific regulations/codes will apply in all other countries.

Tab. 11 Water cooling solutions

Available solutions	Required system components
Central hospital chilled water supply available ¹	SEP ²
Local chiller is available ³	SEP
No chilled water is available	KKT chiller ⁴ and IFP ^{5 6}

1. Refer to specifications for the cooling water supply.
2. SEP = system separator (includes the helium compressor).
3. See specifications for the chilled water supply.
4. See KKT chiller specifications for details; this KKT chiller is mandatory in this case.
5. IFP = interface panel
6. If the IFP will be installed, the helium compressor is separate and will be connected directly to the IFP.

CAUTION

The pipe/hose dimension between the MR chiller and IFP or central water supply and SEP has to be min. 2 inches. If other diameters are used, the function of the water cooling circuit will be affected.

⇒ **Check the use of the correct pipe/hose size during the planning/installation phase.**

NOTE

Only the KKT chiller type KCC 215 with the IFP panel is used as the dedicated MAGNETOM Espree chiller.

For all other chiller types or brands, the SEP cabinet has to be installed.

NOTE

The helium compressor requires chilled water 24 hours a day, 7 days a week.

NOTE

The delivered water hoses for the primary circuit are equipped with shut-off valves for the forward and return pipes. This is to be able to change the SEP cabinet and maintain the primary strainer, if required. The supplied forward hose is equipped with a strainer.

Water-cooled components

NOTE

With the SEP configuration, all water cooled Siemens system components are connected to the secondary water circuit only.

With the KKT chiller/IFP configuration, the primary chilled water flowing through the KKT chiller is also flowing through all water-cooled system components.

The following components are connected to the water cooling circuit.

Tab. 12 Water-cooled components

Component	Volume flow (SEP / KKT chiller with IFP)	Refrigerating capacity
Gradient coil / Tas-C	25 l/min / 30 l/min	< 30.0 kW
GPA	55 l/min / 60 l/min	< 20.0 kW
ACS	25 l/min	< 5.0 kW
RFPA	10 l/min	< 2.0 kW
Refrigerator	10 l/min	< 8.0 kW

NOTE

If the system is switched off (i.e., water pump is not running), a static overpressure of 1.0 to 1.5 bar is present in the secondary water circuit.

On-site water supply

Piping specifications

NOTE

Pay attention to the use/or not of the materials listed in the table (Tab. 13 / p. 152) for the pipework.

NOTE

The water circuit between the KKT chiller and IFP or the central water supply and SEP has to be flushed before connecting it.

The chilled water used has to meet our specifications.

Tab. 13 Piping material

To be used	Not to be used ¹
Stainless steel (V2A; V4A)	Aluminum
Non-ferrous metal (e.g., copper, brass)	Iron, carbon steel
Synthetic materials, plastics	Zinc-plated steel
Brazing solder, hard solder	Zinc
Fitting solder, types 3 and 4	Standard steel pipes

1. Do not use any of these materials! These materials will cause damage to the water-cooled system components.

CAUTION

The pipe/hose dimension between the KKT chiller and IFP or central water supply and SEP must be min. 2" in size. If other diameters are used, the function of the water cooling circuit will be affected.

⇒ Check the use of the correct pipe/hose size during the planning/installation phase.

NOTE

The 2" water pipes are required for new system installation with SEP configuration.

If the existing water pipes comply with our water requirement specifications, they do not have to be modified.

The on-site water supply (forward and return) must be equipped with a 2" female NPT pipe thread.

NOTE

All pipes for the primary water supply have to be identified with labels. The flow direction of the cooling media has to be identified as well. Local requirements have to be met.

On-site primary water pipe preparation

NOTE

The on-site water preparation has to be 2" NPT female threaded connectors for for "supply" and "return".

The following pictures are showing the two delivered primary water connection possibilities.

Possibility 1

Pos. 2 (Fig.1) can be inserted in a 2" female threaded on-site pipe connection as an adaptation part if the hoses can not be connected easily when assembled e.g. at mobiles.

Poa.1 is for connecting the delivered hose.

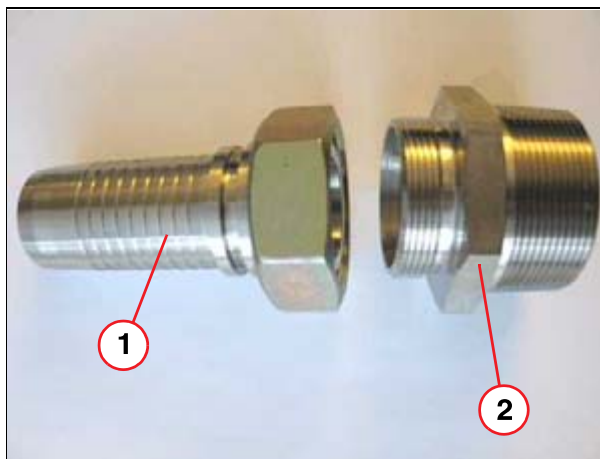


Fig. 87: On-site primary water supply connection for SEP

Pos. 1 Hose Kutting connection

Pos. 2 Adapter (2" male thread to Kutting connection)

Possibility 2

Pos. 1 (Fig. 2) can be used with a 2" female pipe thread on-site water supply when the assembled hose can be installed easily.

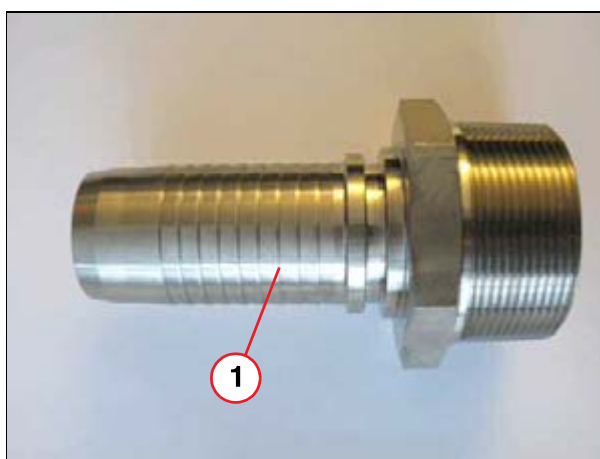


Fig. 88: On-site primary water supply connection for SEP

Pos. 1 Hose Kutting connection

Water quality specifications

NOTE

The following specifications are valid for all chilled water circuits.

Tab. 14 Water quality specifications

	KKT Chiller KCC 215 / IFP ¹	Central water supply / SEP Local chiller /SEP
pH value	6 - 8	6 - 8
Hardness	< 250 ppm CaCO ₃ (calcium carbonate) < 14° dH (deutsche Härte)	< 250 ppm CaCO ₃ (calcium carbonate) < 14° dH (deutsche Härte)
Water to be used ²	tap water for initial filling	tap water for initial filling
Chlorine gas concentration	chlorine portion < 200 ppm	chlorine portion < 200 ppm
Filtration	500 µm ³	500 µm ⁴
Water pressure	max. 6 bar	max. 6 bar
Pressure loss	n.a.	across SEP < 1.0 bar
Water / anti freeze	62% water 38% ethylene glycol	See footnote ⁵

1. Water/ethylene glycol compound combination is mandatory!
2. Standard tap water will suffice for filling the water circuit!
3. The installed strainer does apply to this value.
4. The installed strainer does apply to this value.
5. No ethylene glycol/antifrogen are required if the chiller used (other than the KKT) or the connected central water supply does not require ethylene glycol/antifrogen. Due to national/local regulations, different antifreezing compounds may be used.

NOTE

System with dedicated MAGNETOM Espree KKT KCC 215 Chiller:
The water circuit must be filled with 38% of ethylene glycol.
Never use propylene glycol or automobile anti-freeze!

Primary chilled water supply specifications

Primary chilled water supply

The system separator (SEP) is used in building environments where an existing central water cooling unit or a chiller with the required specifications is already available. The System Separator is the interface unit between the on-site water supply and the MR system.

NOTE

If the KKT chiller is not part of your system configuration, a SEP cabinet has to be used.

Only two possibilities can be selected for the system cooling configuration:

1: SEP cabinet or

2: KKT KCC 215 chiller plus IFP

The IFP (Interface and filter panel) is part of the MR system if the local building environment does not supply central chilled water. A dedicated KKT MR chiller has to be used in this case. This KKT MR chiller (KKT type KCC 215) is mandatory for this type of chilled water supply.

	Primary chilled water solution	
	2	1
	Dedicated Espree chiller (fixed KKT KCC 215 chiller values, cannot be changed!)	Hospital central cooling Local chiller (to be prepared on-site)
Required components	KKT KCC 215 MR chiller, IFP	SEP
Heat dissipation to water	60 kW	48 kW ¹
Water flow rate	130 l/min. ²	≥ 90 l/min. ³ max. 110l/min.
Water supply temperature	19-22°C ⁴	6-12°C ⁵
Water temperature gradient	≤ 2 K/5min. ⁶	≤ 4 K/5min. ⁷
Pressure loss	n.a.	across SEP < 1.0 bar ⁸ typically 0.8 bar
Primary water pressure	n.a.	max. 6.0 bar

1. The value of 48kW includes the heat dissipation (3kW) of the built-in pump.
2. Flow rate between KKT chiller and IFP/ACC; cannot be changed.
3. Flow rate between on-site chilled water supply and SEP.

4. The supply temperature from the dedicated KKT chiller; cannot be changed.
5. The difference in temperature from the primary water inlet temperature (into the SEP) to the primary water outlet (out of the SEP) is approx. 10K (e.g. primary water inlet is 10°C the primary outlet will be approx. 20°C). This is valid at maximum heat dissipation to water.
6. This specification is valid for all load change conditions with a floating integration time of 30 s.; cannot be changed.
7. This specification is valid for all load change conditions with a floating integration time of 30 s.
8. Typically 0.8 bar.

Heat dissipation to water		
Z-engine	48 kW	with SEP configuration
Z-engine	60 kW	with dedicated KKT chiller

NOTE

A tab water connection within 20.0m distance to the SEP, IFP, ACC cabinet has to be available.

This is for filling up the secondary water circuit.

General

The capacity of the air-conditioning system is based on the:

- heat dissipation from the MR system
- heat dissipation from the room lights of the examination room
- heat generated by adjacent rooms or sun light

The air conditioning system selected should be designed to permit future expansion. In addition, the system should be equipped with sensors that automatically switch off the air conditioning in case of errors. The temperature and humidity values should be recorded by a thermo-hydrograph to ensure that the data required are available for troubleshooting.

The MR system is cooled most effectively when the system components are installed at the prescribed distances from the walls or ceiling.

If the input draws upon air from outside the building, we recommend installing an on-site filter of EU filter class 4 (DIN 24185/part 2) to remove dust particles > 10 µm.

Air-conditioning requirements

NOTE

The air-conditioning unit has to be configured according to local/country/hospital-specific regulations/codes, e.g. DIN 1946 (Germany).

NOTE

The specifications for the air-conditioning system have to be achieved. If the specifications are not kept condensation will occur and could cause damages to system components.

A remote display for indicating the temperature and humidity for the examination and equipment room should be part of the air conditioning system!

- maximum room temperature deviations should be less than 3°C.
- air current speed in locations used by personnel should be less than 0.2 m/second.

NOTE

A minimum fresh air exchange rate, related to the examination room volume, of six (6) times per hour is mandatory.

Higher fresh air exchange rates may be required due to local regulations or system usage.

It is mandatory to install fresh air systems (100% fresh air intake).

NOTE

It is important for fresh air intake systems to deflect the exhaust air of the examination room directly out of the building. The exhaust air of the examination room cannot be deflected into another room!

NOTE

The off-take opening (exhaust) in the examination room of the air conditioning system cannot be installed lower than 2000mm.

NOTE

The air intake of the air conditioning system must not be located in close vicinity of the quench vent outlet.

In the event of a quench, this prevents helium gas from being sucked into the air conditioning system.

NOTE

It may be required to have an air off-take and intake connection within the suspended ceiling as well. The reason for this is the heat dissipation of the magnet electronics components into the suspended ceiling via the adjustable magnet tower cover.

Climate conditions

The MR system environment is divided into four areas:

1. Examination room
2. Equipment room
3. Operator's room
4. Evaluation room

NOTE

It is recommended that you install an air conditioning system for the examination room separately from all other rooms. This air conditioning unit should have direct vent access to the outside of the building.

NOTE

A minimum fresh air exchange rate, related to the examination room volume of six (6) times per hour, is recommended.

Higher fresh air exchange rates may be required due to local regulations or system usage.

It is recommended that you install fresh air systems (100% fresh air intake).

NOTE

If the values for temperature or humidity are exceeded, condensation will be created.

Climate specifications - Examination room

Room climate specifications

Tab. 15 Climate specifications - Examination room

Air temperature	+18°C to +24°C
Temperature gradient	
Relative humidity	40% - 60%
Absolute humidity	< 11.0 g/kg

Heat dissipation to air of components

Tab. 16 Heat dissipation to air

Component	Heat emission
-----------	---------------

Magnet	
Patient table	
RF electronics	
RF filter panel	
Total value	3.0 kW

NOTE

To calculate the total heat load of the examination room, you need to add additional emission values, e.g., for room lighting, to the system component heat emission.

Climate specifications - Equipment room

Room climate specifications

Tab. 17 Climatic specifications - Equipment room

Air temperature	+15°C to +30°C
Temperature gradient	$\leq 1.0 \text{ K/5 min.}$
Relative humidity	40% - 80%
Absolute humidity	11.5 g/kg

Heat dissipation of components to air

Tab. 18 Heat dissipation to air

Component	Heat emission
ACC/GPA	
SEP	
Helium compressor	
RF filter panel	
Total value	5.0 kW

NOTE

To calculate the total heat load of the examination room, you need to add additional emission values, e.g., for room lighting, to the system component heat emission.

Climate specifications - Operator room

Room climate specifications

Tab. 19 Climate specifications - Operator room

Air temperature	+15°C to +30°C
Temperature gradient	n.a.
Relative humidity	40% - 80%
Absolute humidity	11.5 g/kg

Heat dissipation of components to air

Tab. 20 Heat dissipation to air

Component	Heat emission
Host computer	
Monitor	
Console components	
Intercom	
Total value	2.0 kW

NOTE

To calculate the total heat load of the examination room, you need to add additional emission values, e.g., for room lighting, to the system component heat emission.

Climate specifications - Evaluation room

Room climate specifications

Tab. 21 Climate specifications - Evaluation room

Air temperature	15°C - 30°C
Temperature gradient	n.a.
Relative humidity	40% - 80%
Absolute humidity	11.5 g/kg

Heat dissipation of components to air

Tab. 22 Heat dissipation to air

Component	Heat emission
Host computer	
Monitor	
Console components	
Total value	2.0 kW

NOTE

To calculate the total heat load of the examination room, you need to add additional emission values, e.g., for room lighting, to the system component heat emission.

Absolute humidity - Molier graph

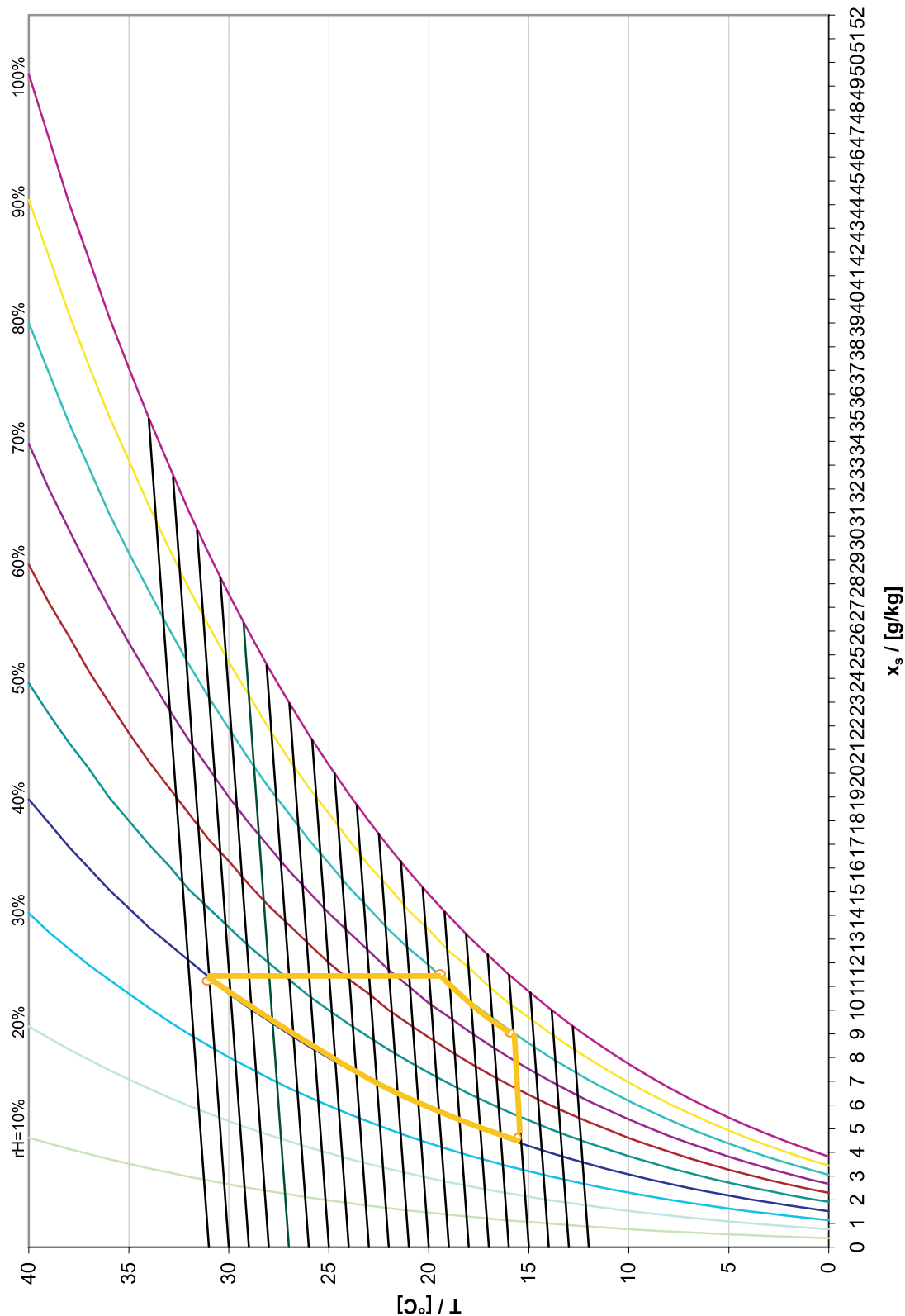


Fig. 89: Molier diagram

System connection lengths

System cable connection

NOTE

The cables cannot exceed a total length of 20.0 m (outside RF room + inside RF room) due to technical restrictions.

The available cable sets do not allow this.

Available cable sets				
Set no.	inside RF room		outside RF room	
	Cable length		“free cable length”	
	System cable length	Gradient cable length ¹	From the magnet to the RF filter panel	From the RF filter panel to the ACC cabinet
1	8.0 m	6.2 m	4.6 m	1.5 m
2	8.0 m	6.2 m	4.6 m	10.0 m
3	8.0 m	6.2 m	4.6 m	12.0 m
4	11.0 m	9.2 m	7.6 m	1.5 m
5	11.0 m	9.2 m	7.6 m	9.0 m
6	16.0 m	14.2 m	12.6 m	4.0 m
Water hose length valid for all cable sets				
from	to			
ACC	Filter plate			15.0 m ²
Filter plate	Magnet	15.0 m ³		
SEP	ACC			5.0 m ⁴
IFP	ACC			5.0 m ⁵
Helium compressor	IFP			1.8 m ⁶
On-site water supply	SEP			2.0 m ⁷
Pressurized helium line length valid for all cable sets ⁸				
Helium compressor	Cold head	20.0 m		

1. The gradient cables inside the examination room are 1.8m shorter than the other system cables.
2. Can be cut to length.

3. Can be cut to length.
4. Fixed length.
5. Fixed length.
6. Fixed length.
7. Can be cut to length.
8. The total length of the pressurized helium line is 20.0 m.

NOTE

The gradient cable's physical length inside the examination room is 1.8 m shorter than the physical length of the other system cables.

Due to the position of the RF filter panel in relation to the magnet and the type of cable feeding, the length of the selected cable set may not be correct!

With all cable sets, the following is valid:

Due to the physical connection point at the magnet, the gradient cables are 0.4m longer than the other cables exiting the magnet.

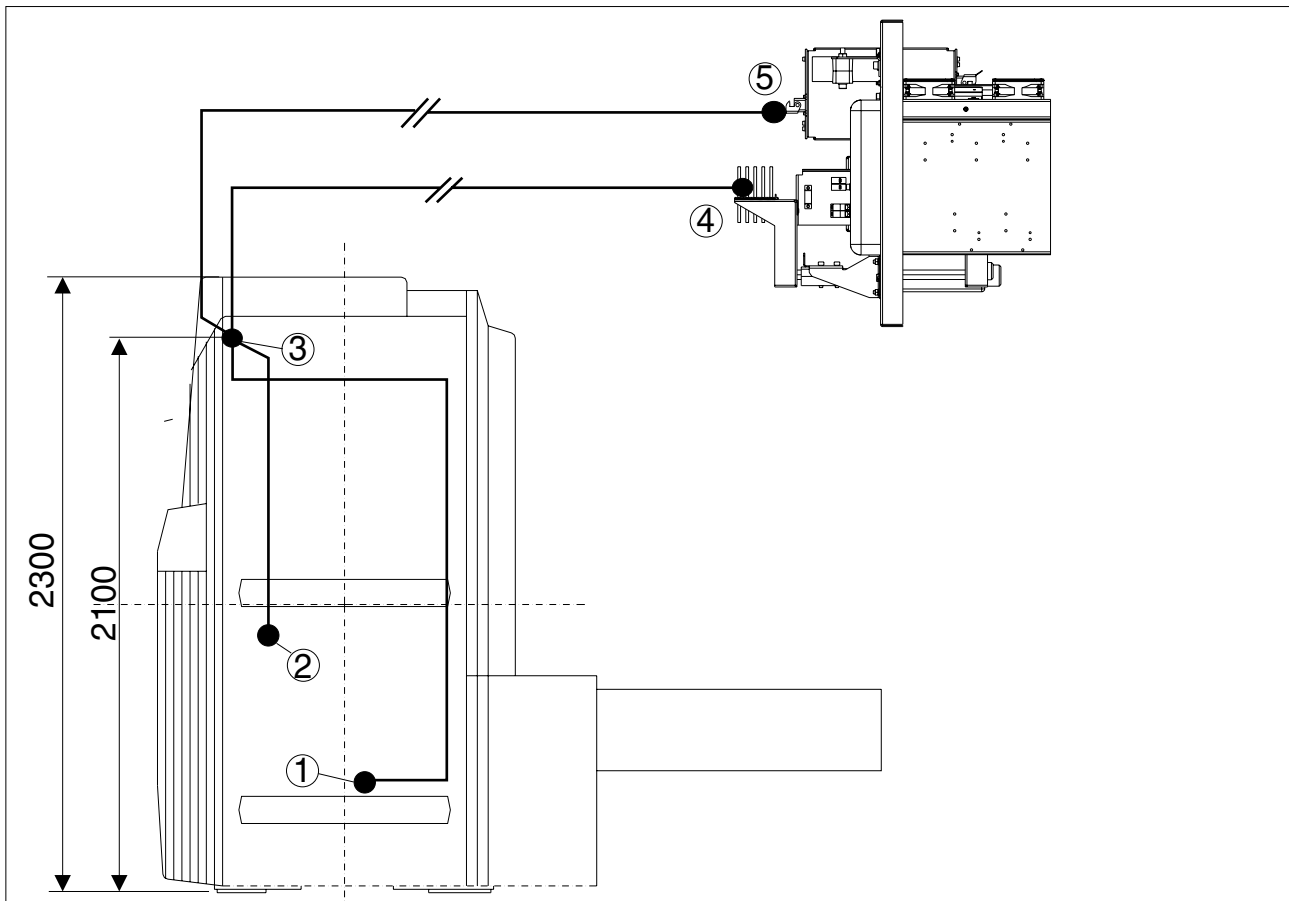


Fig. 90: Free cable length between magnet and RF filter panel

- | | |
|--------|--|
| Pos. 1 | RF receive cable connection point |
| Pos. 2 | Gradient cable connection point |
| Pos. 3 | Measuring point of the magnet side cables |
| Pos. 4 | RF receive cables connection point RF filter panel |
| Pos. 5 | Gradient cable connection point RF filter panel |

Free cable length inside the examination room			
	from point	to point	RF receive cable length
RF receive cable length inside the cover	1	3	3.4m
RF receive cable length outside the cover ¹	3	4	4.6m/7.6m/12.6m ²
Total RF receive cable length	1	4	8.0m/11.0m/16.0m ³
Gradient cable length inside the cover	2	3	1.2m
Gradient cable length outside the cover	3	5	5.0m/8.0m/13.0m ⁴
Total gradient cable length	2	5	6.2m/9.2m/14.2m ⁵

1. This length interpretes the “free cable length” between the magnet and the RF filter panel.
2. Relatet to the cable set used
3. Relatet to the cable set used
4. Relatet to the cable set used
5. Relatet to the cable set used

NOTE

The “free cable length” between the magnet and the RF filter panel is selected by the RF receive cables (4.6m/7.6m/12.6m).

Pay attention during the planning phase:

The “free cable length” of the MAGNETOM Espree inside the examination (magnet to RF filter panel) room is approx. 1 meter shorter than at the MAGNETOM Avanto!

NOTE

For the cable sets 8/10m, 8/12m and 11/9m, an additional ramp cable set of 5m length, part number 8395662 ,should be ordered separately for ramping the magnet system up or down.

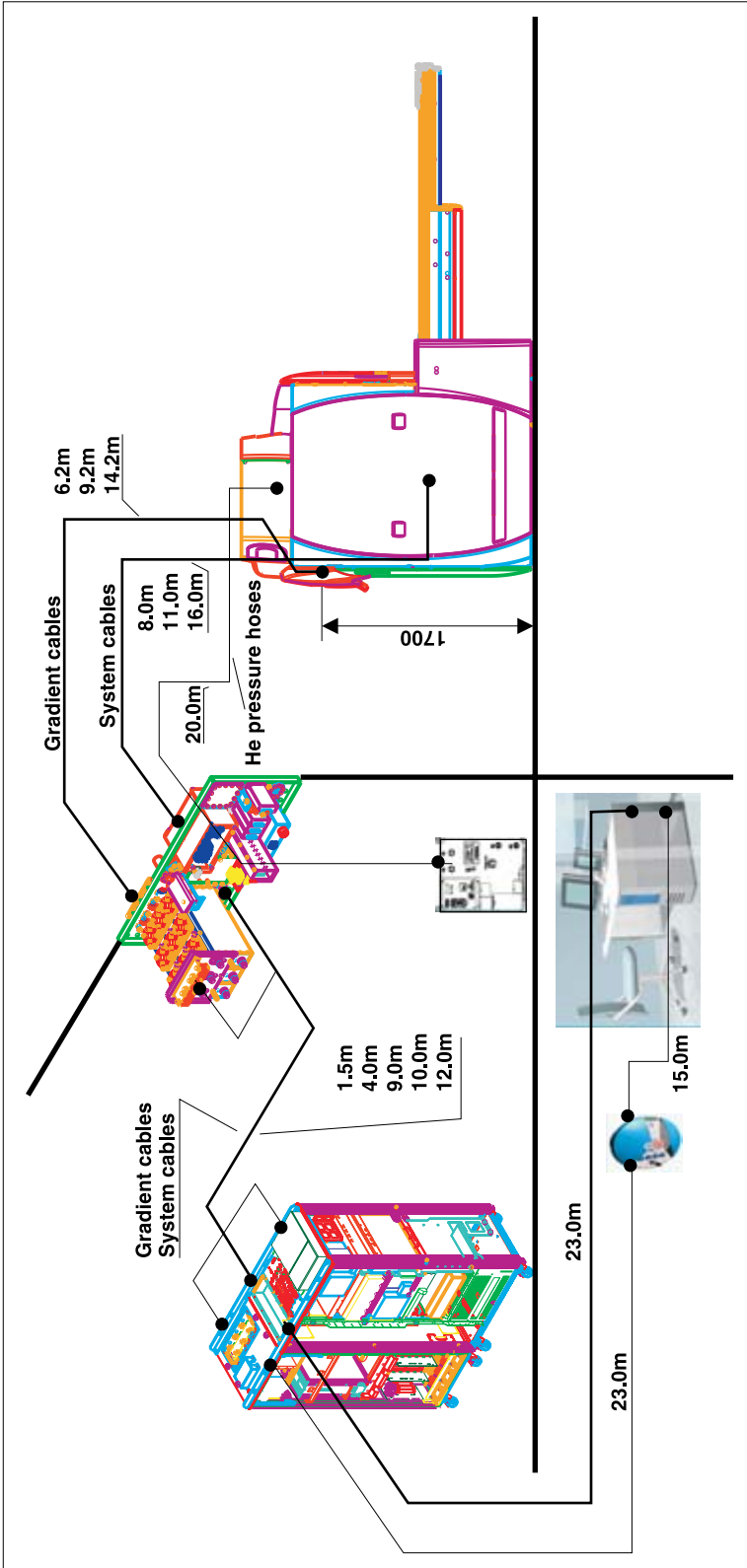


Fig. 91: System cabling

NOTE

The cable set length identifies the "free cable length" as from connection point to connection point! The cable length is not the distance between the components! You have to consider the cable feeding!

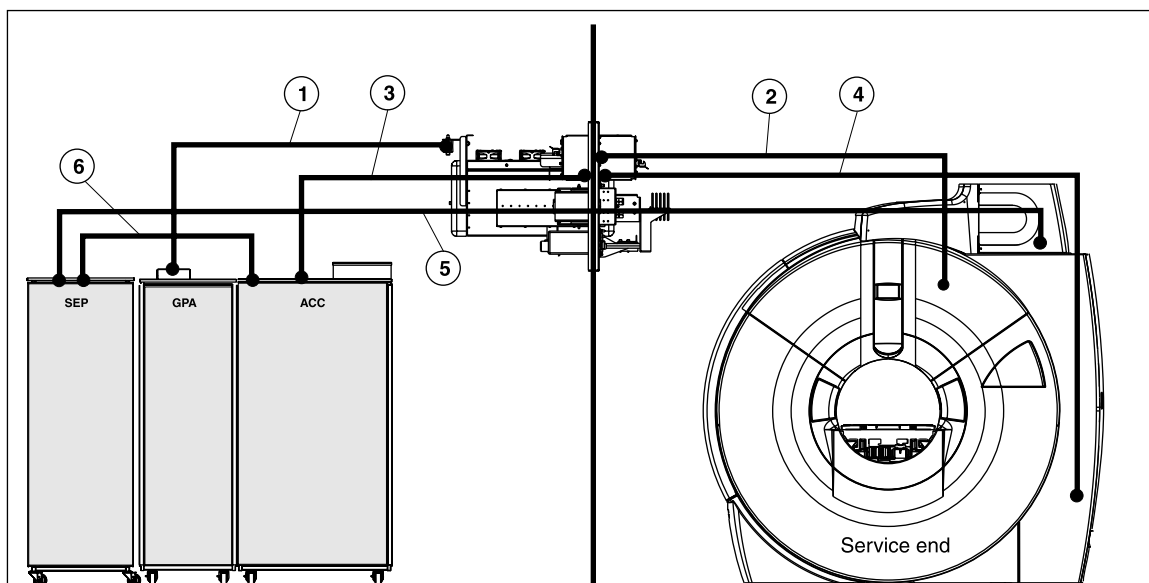


Fig. 92: System connection, part 1, electrical connections

Cable length		
No.	Cable type	cable length ¹
1	gradient cable outside the RF room	1.7m / 4.0m / 10.0m / 12.0m
2	gradient cable inside RF room ²	6.2m / 9.2m / 14.2m
3	system cables outside the RF room	1.5m / 9.0m / 10.0m / 12.0m / 4.0m ³
4	system cables inside the RF room	8.0m / 11.0m / 16.0m ⁴
5 ⁵	pressurized hoses SEP > cold head	20.0 m
6 ⁶	ACC > SEP cables	7.0 m

1. Depending on the cable set combination used.
2. The gradient cable length inside the examination room is 1.8 m shorter than the other system cables
3. This cable set , 16/4m, cable for the site! This cable set has to be manufactured separately and has to be ordered way in advance.
4. This cable set , 16/4m, is not a standard cable set and should be ordered only if one of the standard sets will not be suitable for the site! This cable set has to be manufactured separately and has to be ordered way in advance.
5. The total length of the pressurized helium hoses is 20.0 m for all cable sets.
6. The position of the SEP must be in close vicinity to the ACC.

Cable sets as per Price book		
Cable set No.	Inside the examination room ¹	outside the examination room
1 ²	8.0m	12.0m
2 ³	8.0m	10.0m
3 ⁴	8.0m	1.5m
4 ⁵	11.0m	1.5m
5 ⁶	11.0m	9.0m
6 ⁷	16.0m	4.0m

1. The gradient cable length inside the examination room is 1.8 m shorter than the other system cables.
2. Filter plate on the left side of the magnet
3. Filter plate on the left side of the magnet
4. Filter plate on the left side of the magnet
5. Filter plate on the right side of the magnet
6. Filter plate on the right side of the magnet
7. This cable set ,16/4m, is not a standard cable set and should be ordered only if one of the standard cable sets will not be suitable for the site, or complex construction work can be by-passed using this cable set! This cable set has to be manufactured separately and has to be ordered way in advance.

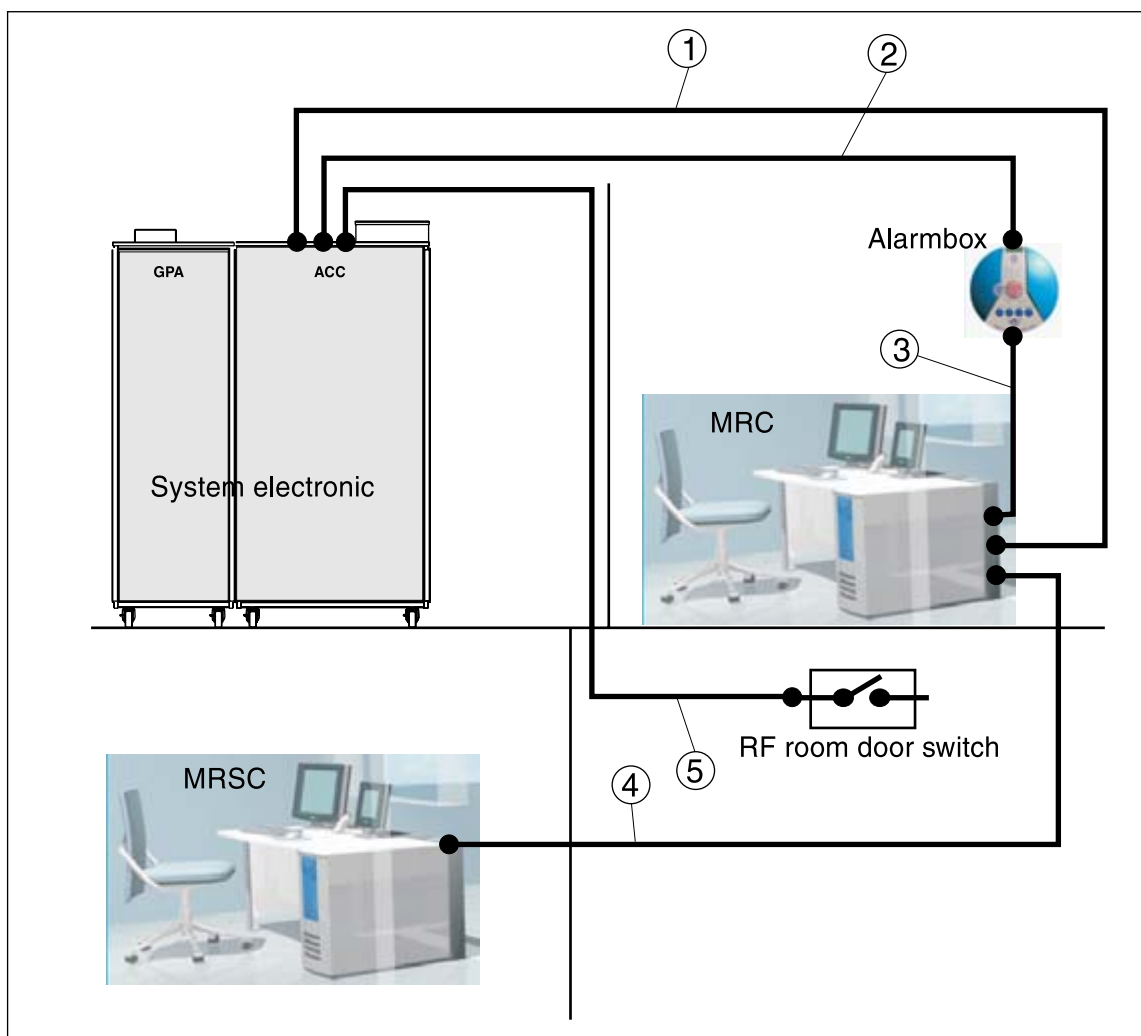


Fig. 93: System cabling, part 2, MRC, MRSC

Cable length		
No.	Connection type	cable length
1	ACC > console components	23.0 m
2	ACC > alarm box	23.0 m
3	Alarm box > serial distribution (console)	15.0 m
4	Ethernet	90.0 m
5	ACC > RF room door switch	23.0 m

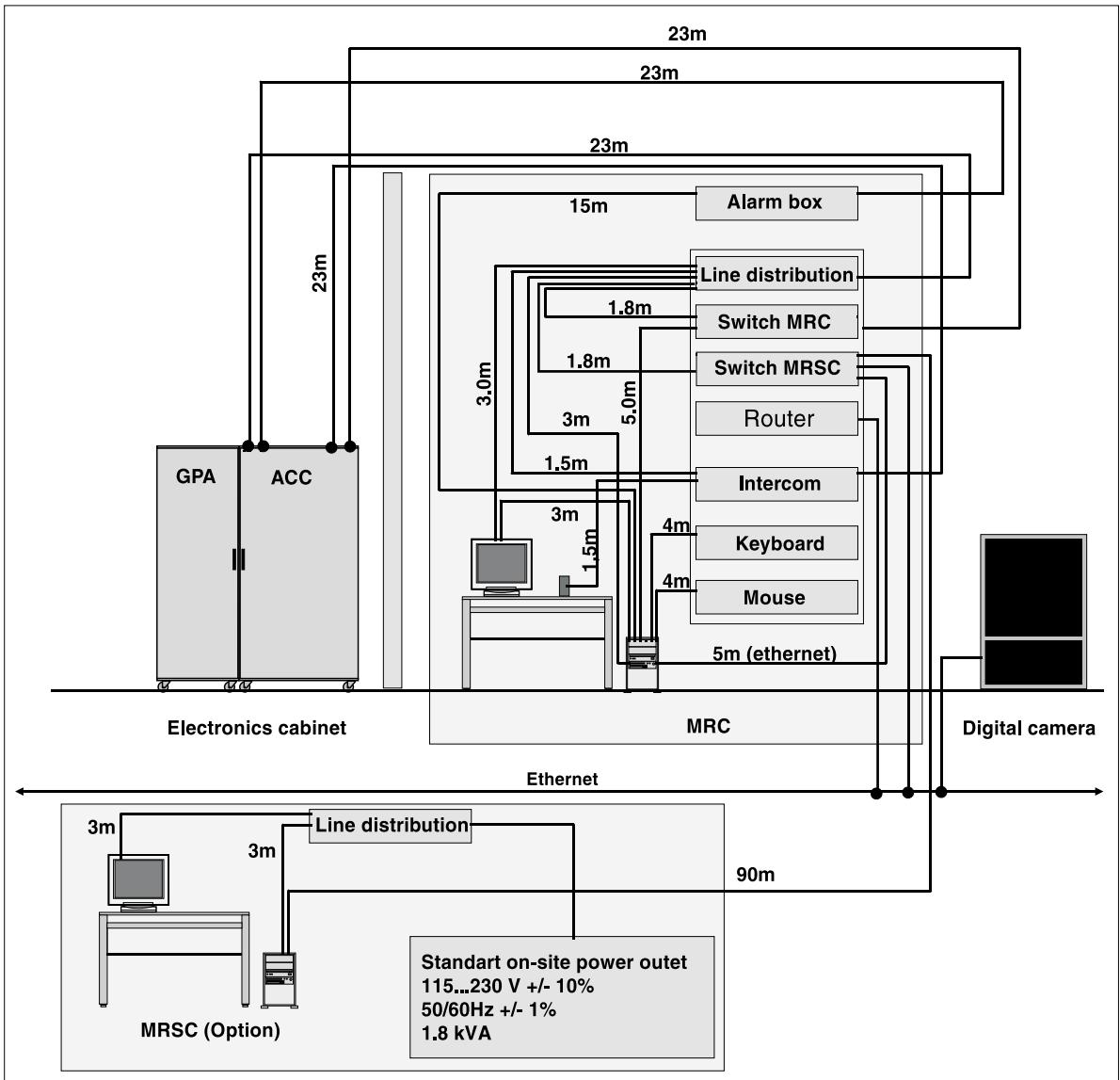


Fig. 94: MRC console component cabling

Cable length		
from:	to:	cable length
ACC	Console MRC	23.0 m
Console MRC	Console MRSC	90.0 m
ACC	Alarm box	23.0 m
Alarm box	Serial distribution	15.0 m

KKT chiller and IFP connection

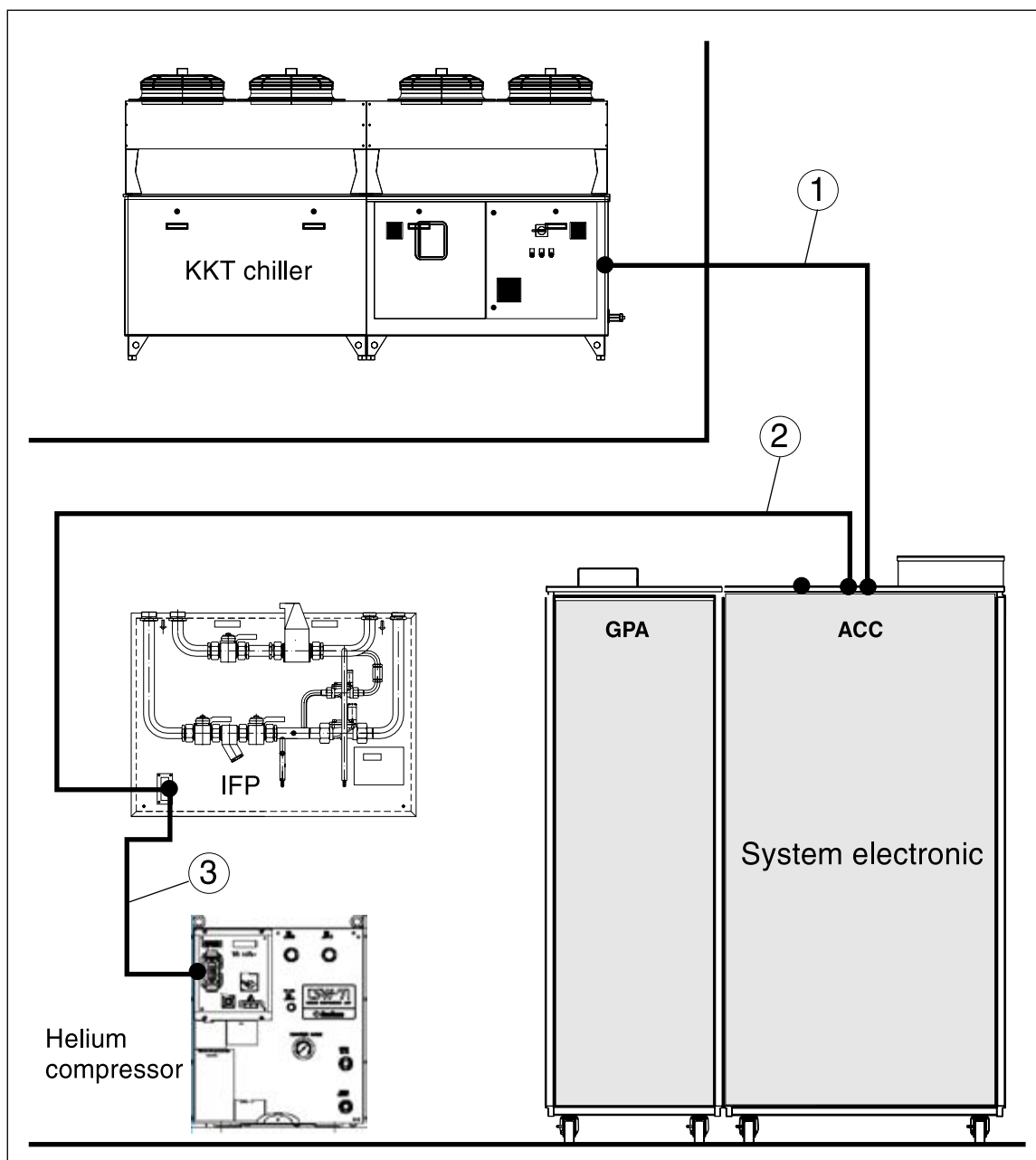


Fig. 95: ACC, KKT chiller, IFP and helium compressor cable connection

Cable length		
No.	Connection type	cable length
1	ACC > KKT chiller (data)	50.0 m
2	ACC > IFP	7.0 m
3 ¹	IFP > helium compressor	1.8 m

1. The positions of the IFP and helium compressor have to be in close vicinity to the ACC cabinet.

System water hose connection

The water hose set is part of the cable set! All couplings are part of the delivery volume.

NOTE

For the initial filling of the secondary water circuit, a standard tap water connection has to be located within 20.0 m from the SEP cabinet or IFP panel.



Fig. 96: Water filling

Configuration with SEP

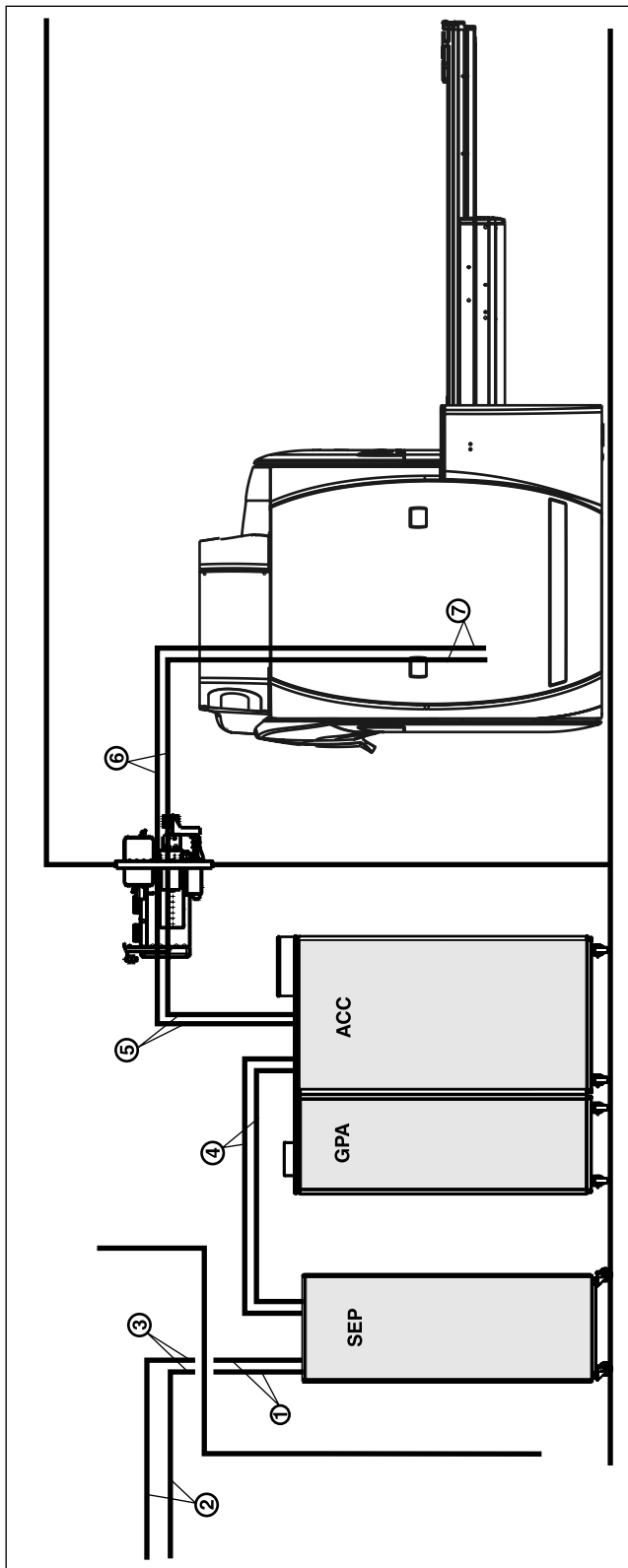


Fig. 97: SEP hose configuration

- Pos. 1 2" hoses, 2.0 m long, configured with couplings. At one side of the hose is a coupling with a 2" NPT female pipe thread for the on-site water connection (Pos. 3).
- Pos. 2 2" on-site water supply and return equipped with shut-off valves and 2" female NPT pipe thread.

- Pos. 3 2" female NPT pipe threads.
- Pos. 4 Two DN40 hoses, 5.0 m long, from the SEP to the ACC. Couplings already configured.
- Pos. 5 Two 15.0 m long DN19 hoses from the ACC to the filter plate. One end is already configured with a coupling, the other coupling is part of the delivery volume. The hoses can be cut to length.
- Pos. 6 Two 15.0 m long DN19 hoses from the filter plate to the magnet. One end is already configured with a coupling, the other coupling is part of the delivery volume. The hoses can be cut to length.
- Pos. 7 Magnet side quick connect couplings for the gradient coil.

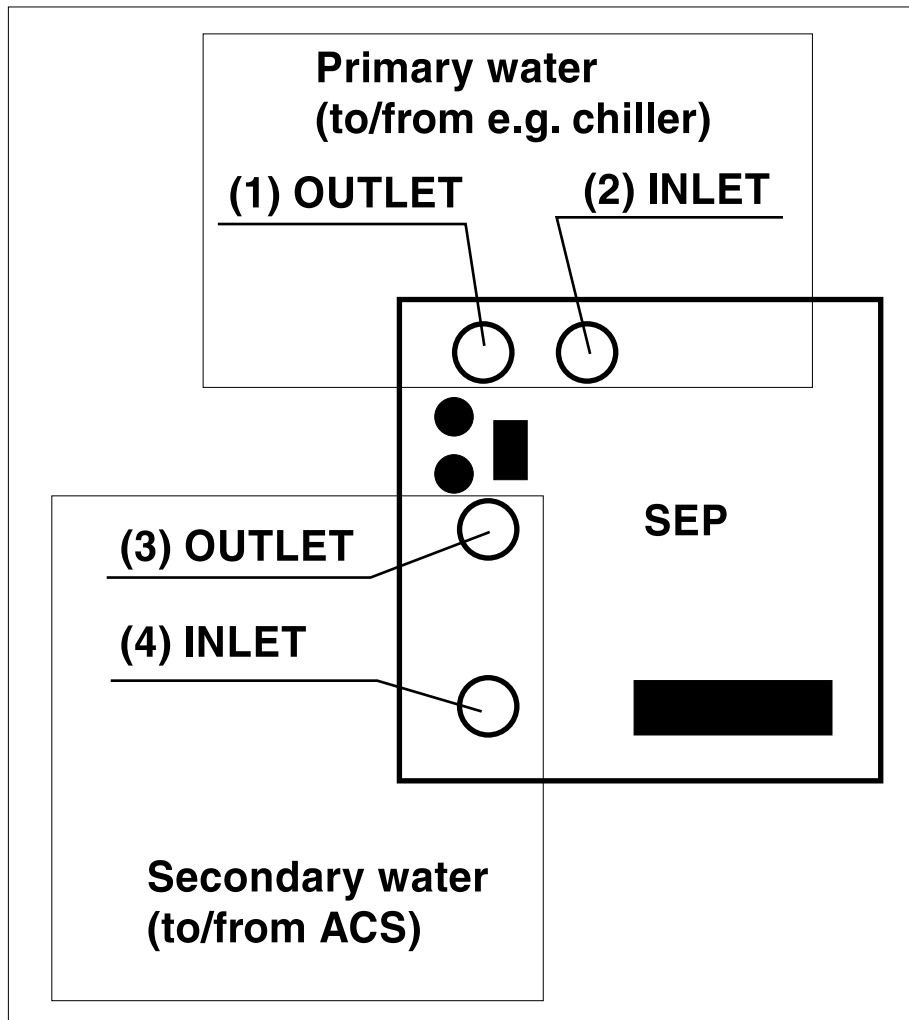


Fig. 98: SEP top hose configuration

Tab. 23

SEP hose configuration		
Pos.	Label	feeding
1	OUTLET primary circuit to chiller	from SEP to chiller
2	INLET primary circuit from chiller	from chiller to SEP
3	OUTLET to ACS	from SEP to ACS
4	INLET from ACS	from ACS to SEP

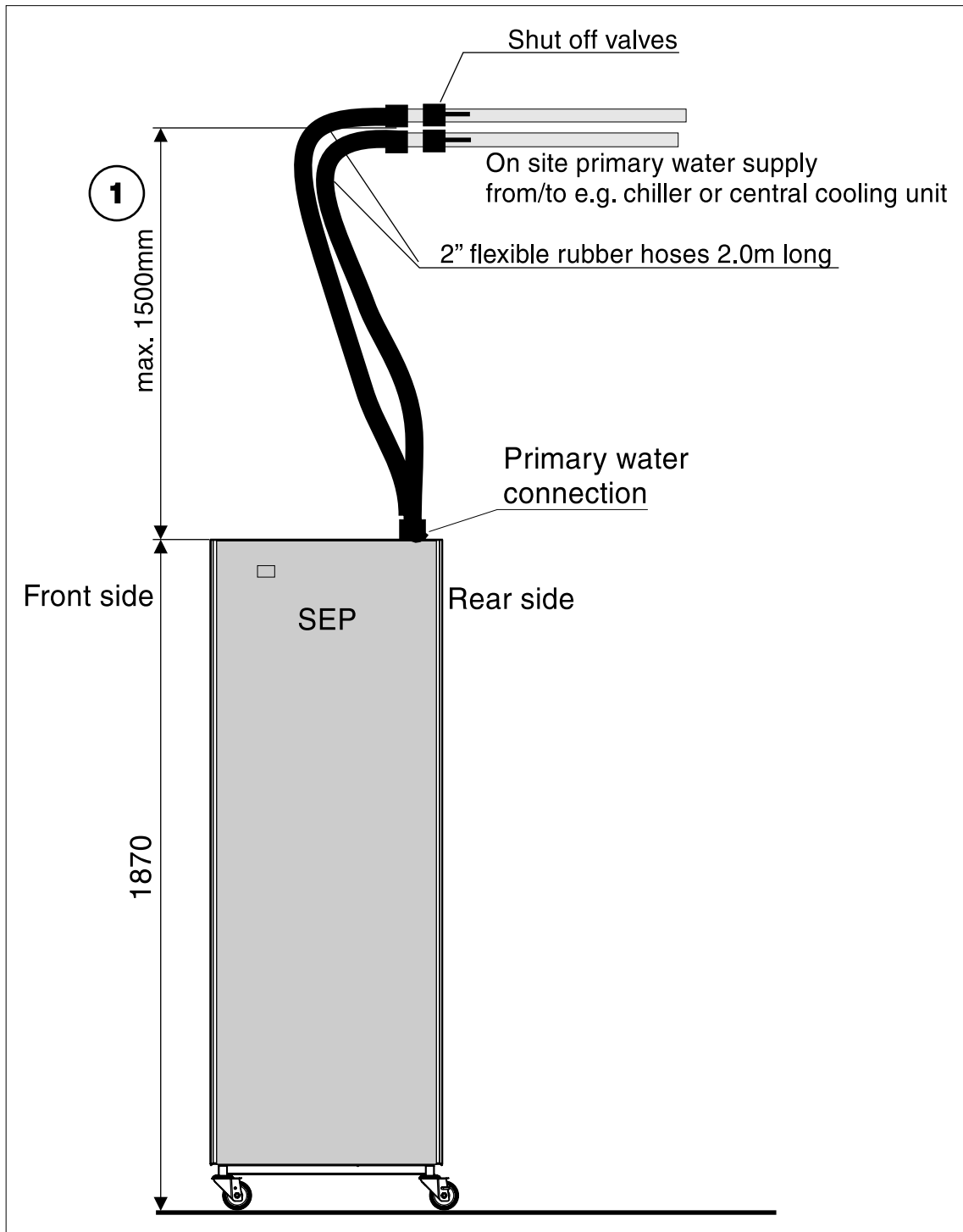


Fig. 99: SEP primary water connection

Pos. 1 The distance of the on-site primary water connection to the SEP primary water connection is given by the delivered 2.0 m, 2" water hoses. These hoses cannot be cut. The bending radius is approx. 500 mm.

NOTE

The on-site 2" primary water forward and return water pipe has to be equipped with 2" female NPT pipe threads.

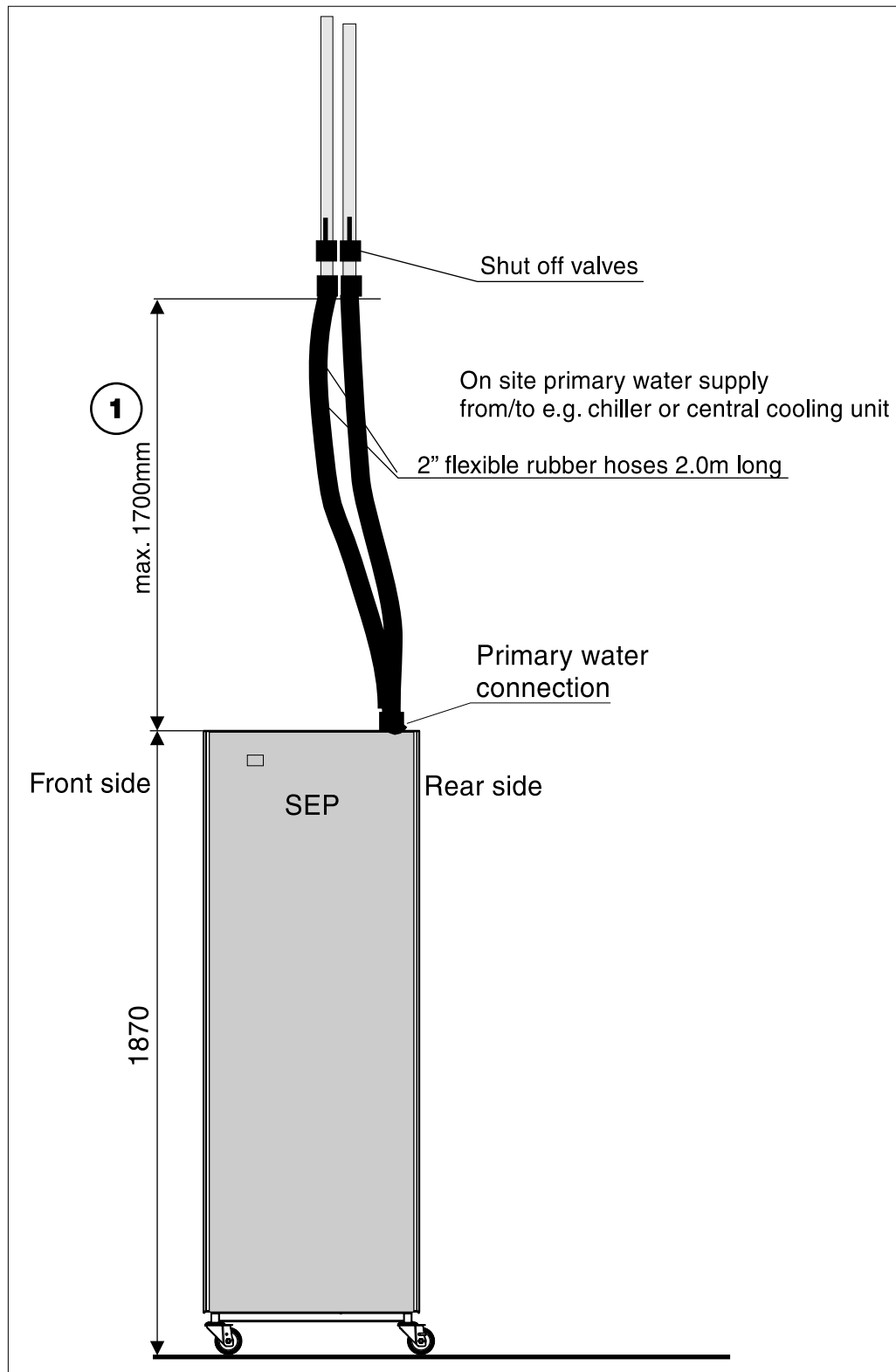


Fig. 100: SEP primary water connection, vertical

- Pos. 1 The distance from the on-site primary water connection to the SEP is given by the delivered 2 inch, 2.0 m water hoses. NOTE: if the distance becomes less than 1,700 mm a buckling of the hoses might occur due to the stiffness of the hoses. The bending radius is 500 mm.

NOTE

The hose length between the SEP and the ACC is 5.0 m. The hose length between the SEP and the on-site pipe connection is 2.0 m.

NOTE

Shut-off valves have to be installed at the on-site water supply pipes (forward and return). This is for servicing the SEP cabinet. The pipe thread at the on-site water supply pipes has to be a 2" NPT female thread.

NOTE

The forward and return pipe between the local chilled water supply and the SEP have to be identified with labels. At a minimum, the labels have to be present at the connection points of the chiller, IFP and refilling connections. The contents of the labels have to comply with local regulations and have to contain the following information: flow direction and medium (e.g., water/glycol ethylene)

Configuration with KKT chiller and IFP

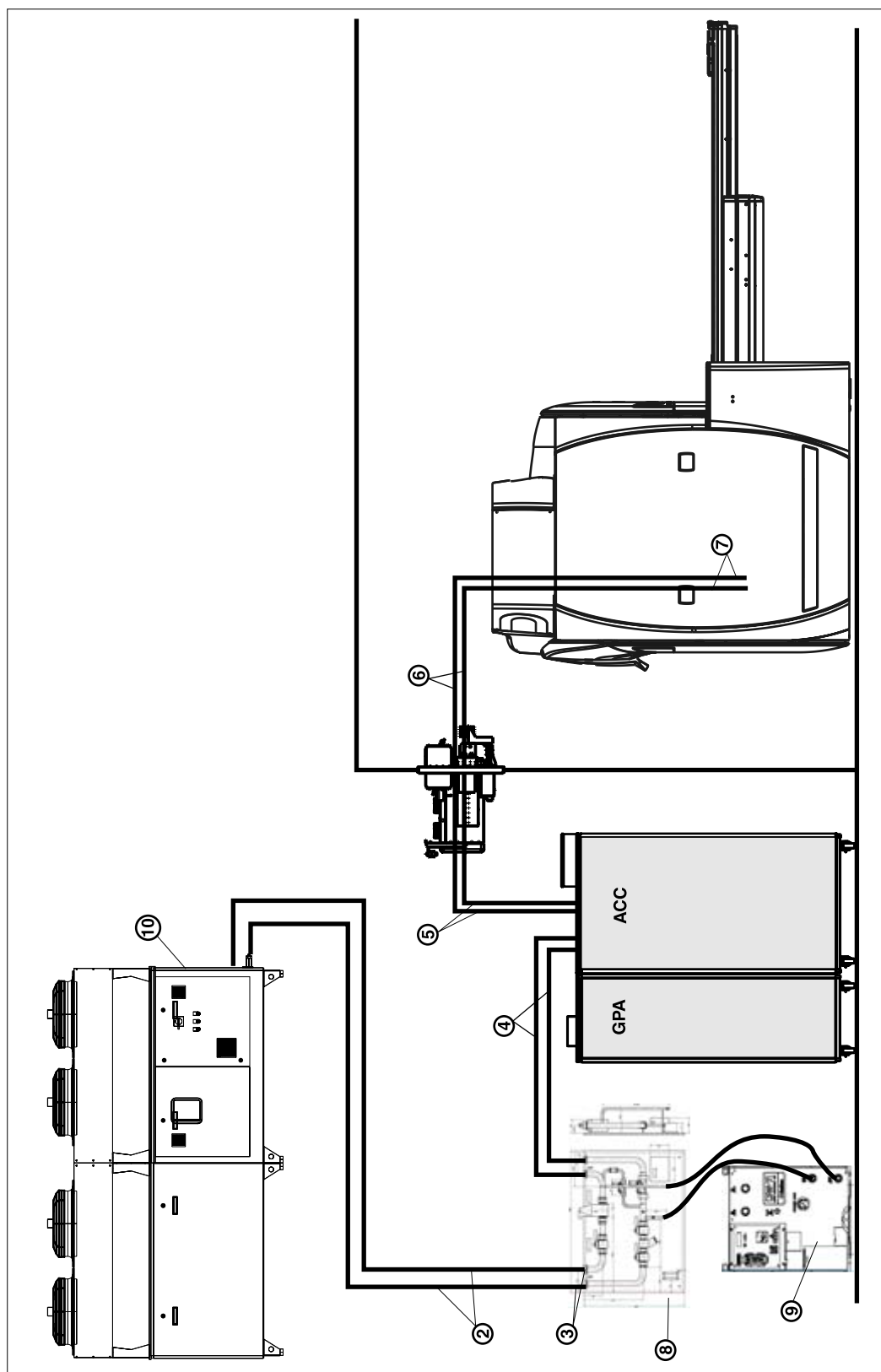


Fig. 101: KKT chiller, IFP and helium compressor

- Pos. 2 Hydraulic installation kit or on-site preparation Maximum 25 m distance to IFP
 Pos. 3 2" female pipe thread. The IFP is equipped with 2" male pipe threads.

- Pos. 4 Two 5 m DN40 connection hoses from IFP to ACC; couplings already configured.
- Pos. 5 Two 15 m DN19 connection hoses from ACC to the filter plate. One end is already configured with a coupling. The hoses can be cut to the required length.
- Pos. 6 Two 15 m DN19 connection hoses from the filter plate to the magnet. One end is already configured with a coupling. The hoses can be cut to the required length.
- Pos. 7 Magnet side, quick connect couplings.
- Pos. 8 IFP The IFP should be installed in the close vicinity to the ACC cabinet.
- Pos. 9 Helium compressor unit The entire grounding cabling must be installed before attempting this test.
- Pos. 10 KKT chiller, dedicated chiller for the MAGNETOM Avanto/Espree. Maximum distance to the IFP 25 m.

NOTE

The hose length from the IFP to the ACC is 5.0 m. The helium compressor has to be installed underneath the IFP. The pipe length from the KKT chiller to the IFP is max. 25.0 m

NOTE

A deaeration device has to be installed at the highest point of the water pipe installation between the KKT chiller and the IFP. This applies for the forward flow. The deaeration device is not part of the delivery volume and has to be purchased locally.

NOTE

The forward and return pipe between the KKT chiller and the IFP have to be identified with labels. At a minimum, the labels have to be present at the connection points of the chiller, IFP and refilling connections. The contents of the labels have to comply with local regulations and have to contain the following information: flow direction and medium (e.g., water/glycol ethylene)

System pressurized helium hose connection

NOTE

The pressurized hoses (from helium compressor to cold head) delivered with the system are 20.0 m long, this applies to each available cable set!

The diagram illustrates the HC-10 system components and their interconnections. The components are labeled with numbers 1 through 7:

- 1:** A vertical assembly, likely a pump or filter, connected to the main unit via a line labeled 5.
- 2:** The main control unit, featuring a digital display, various buttons, and a 'Gradient Filter' section.
- 3:** A control panel with a pressure gauge, a 'PRESSURE' switch, and a 'CONTROL PRESSURE' switch.
- 4:** A line connecting the main unit to the control panel.
- 5:** A line connecting the vertical assembly to the main unit.
- 6:** A line connecting the vertical assembly to the control panel.
- 7:** A line connecting the main unit to the control panel.

The main unit (2) includes a 'Gradient Filter' section with three buttons, a 'Switch & Option' section, and a 'RESERVE/INTERVIEW' section. The control panel (3) includes a 'PRESSURE' switch, a 'CONTROL PRESSURE' switch, and a 'MAINTENANCE' button.

Cable length		
No.	Component	Length
1	Cold head	
2	RF filter plate	
3	Helium compressor	
4	high/low pressure lines	20.0 m total
5	high/low pressure lines	
6	Cold head power, RF filter plate > cold head	15.0 m
7	Cold head power, cold head > RF filter plate	15.0 m

[illegible]

Cable length		
No.	Component	Length
1	Cold head	
2	RF filter plate	
3	helium compressor (inside SEP cabinet)	
4	high/low pressure lines	20.0 m total
5	high/low pressure lines	
6	power line inside exam. room	15.0 m
7	power line inside exam. room	15.0 m

Siemens AG
Medical Solutions

MRSC Host PC and Imager PC environment

NOTE

If the control room is used as a patient preparation room and the MRSC is located in this room, for safety reasons it should not be possible for the patient or other personnel, who are not members of the operator team, to reach the MRSC console within 1.5 m.

Information for using Digital and/or Laser cameras

The digital camera for syngo MR has to be equipped with a DICOM interface.

- ➞ Information regarding cameras released for MR by Siemens Medical Systems is located under the following URL:
[http://cs.med.siemens.de/For Service/Product Information/Cameras/MR](http://cs.med.siemens.de/For%20Service/Product%20Information/Cameras/MR)

NOTE

Older digital camera models without DICOM interface will not work with syngo MR!

A special interface has to be installed between the Host PC and the digital camera.

NOTE

Consult the installation manual of the laser/digital camera manufacturer for details regarding fringe field sensitivity!

Top sheet 1



Top sheet 2

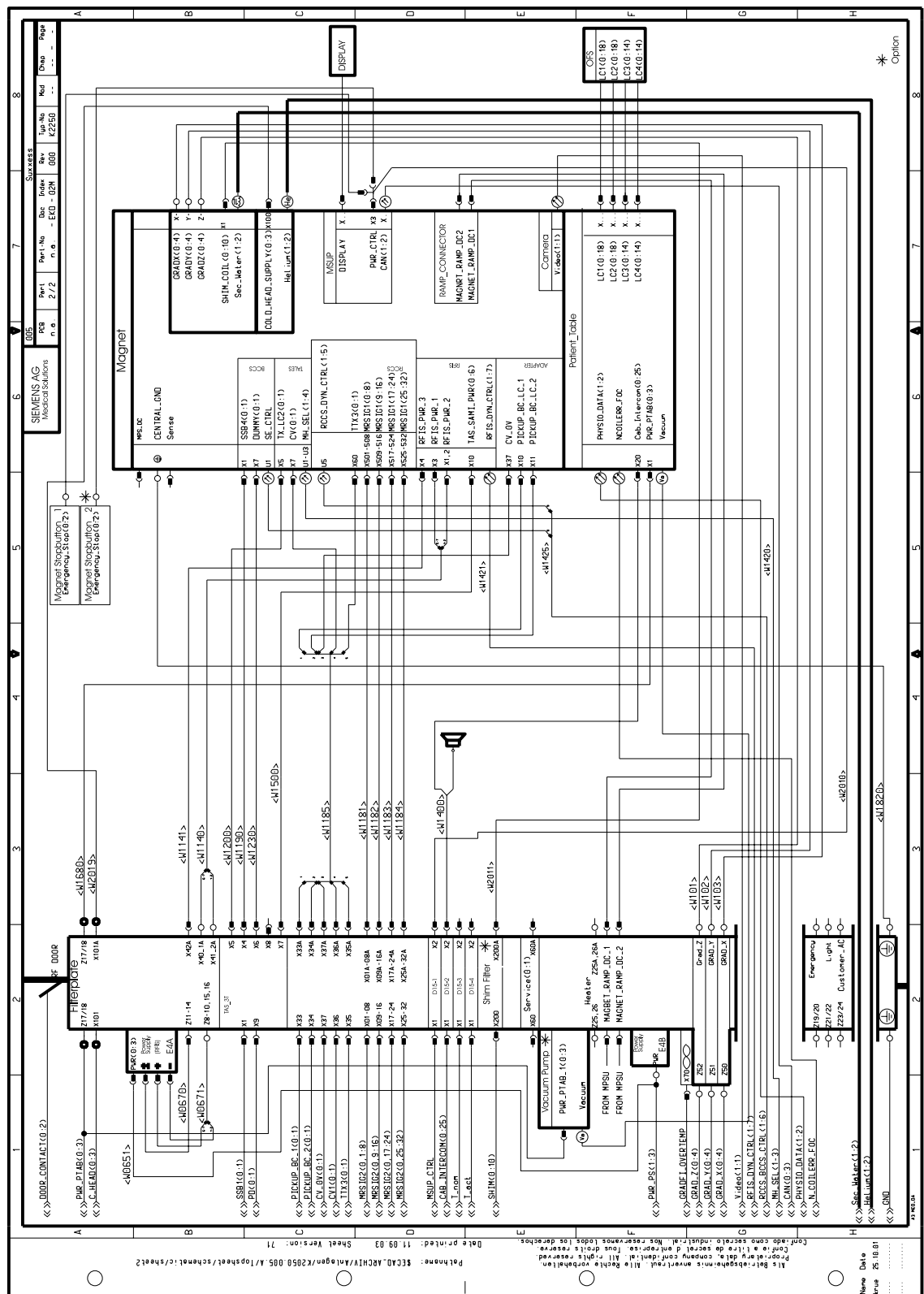


Fig. 105: System cabling, top sheet, part 2

Fig. 106: System cabling, top sheet magnet



Connectivity Concept

NOTE

Refer to the SRS Planning Guide.

It is absolutely essential to prepare the site for remote services. This will save time during installation and service.

Explanation of the diagram:

It is necessary to have a router that can be left with the customer at no extra charge during the warranty period. Beyond this time it should be available via a service agreement. The router remains the property of Siemens AG.

- ⇒ The router will be installed in a central location (e.g., hospital computer room to avoid physical access to the router for security reasons).
- ⇒ The router can be connected to either the ISDN or an analog connection.

Remote diagnostics and "Pro-active Event Management" require remote LAN access to our systems. A router is required for this. We provide this router to our customers during the warranty period free of charge. Beyond this period, the router is available if a service contract has been concluded.

The router remains the property of Siemens AG. The required telephone connection (preferably ISDN) and the power supply have to be provided on site. Even if several Siemens systems are connected to the same data net, only a single central router is required.

Of course, we observe the confidentiality of patient data within the framework of remote diagnostics and have provided security against accessing them. For further information on the topic of data security, pls. refer to system-specific publications.

NOTE

For detailed information about SIEMENS Remote Services (SRS), see PG TD00-000.891.01...

Network

The image system is equipped with a network card for Fast Ethernet (100 BaseT).

Cable routing

NOTE

Proper cable routing is absolutely essential for obtaining good image quality!

The total cable length consists of the cable length required between the components.

The free cable length is the length between the exit points for the cables at the components.

NOTE

When planning the final location of the system components, do not exceed the maximum distance as determined by the cable length. Take into consideration the required additional length for routing the cables, e.g., through a cable tray at the ceiling.

NOTE

Adjust the openings (i.e., wall, ceiling) to the size of the cable connectors

Bending radius for cables

Tab. 24 Bending radius RB

Cable type	Bending radius RB	Comment
Gradient cable	≥ 135 mm	
Transmitter RF cable	≥ 120 mm	when bent once
Transmitter RF cable	≥ 360 mm	when bent several times
Fiber optic cable	≥ 150 mm	
Fiber optic cable for patient supervision	≥ 45 mm	

Cable separation

- The cables are routed via cable trays or ducts. Install the cable tray to maintain a distance of 300 mm between the different cable types (refer to table below).
- In general, the cables are routed from the top of the cabinet. The cables can be routed in cable ducts to the top part of the cabinet.
- The minimum bending radius for gradient cables, RF cables and fiber optic cables has to be maintained.

Cable separation				
		Gradient cables	RF transmit cables, RF receive cables	Fiber optic cables, power cables, signal cables
1	Gradient cables	-	300 mm	300 mm
2	RF transmit and receive cables	300 mm	-	300 mm
3	Fiber optic cables, power cables, signal cables	300 mm	300 mm	-
4	Water hoses, pres- sure hoses	300 mm	-	-

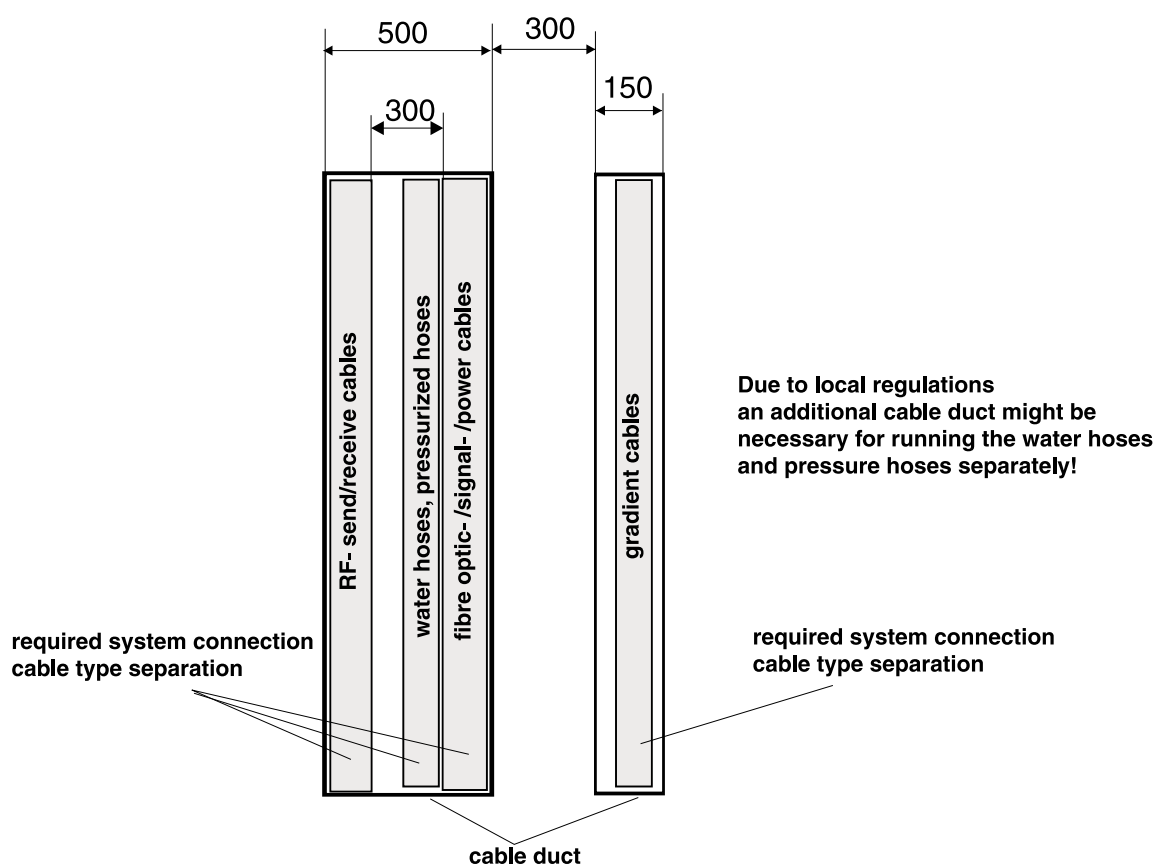


Fig. 108: Cable duct configuration, example

NOTE

Separate the three different cable types from each other. The cable duct may not be installed across the magnet area (false ceiling). If necessary, install additional cable trays! **DO NOT COMBINE ALL CABLES TOGETHER!**

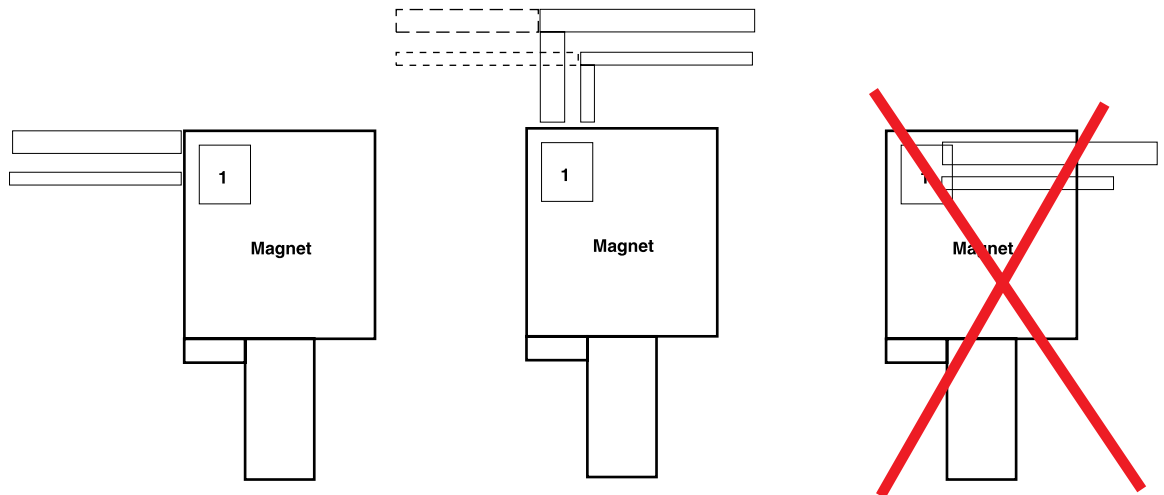
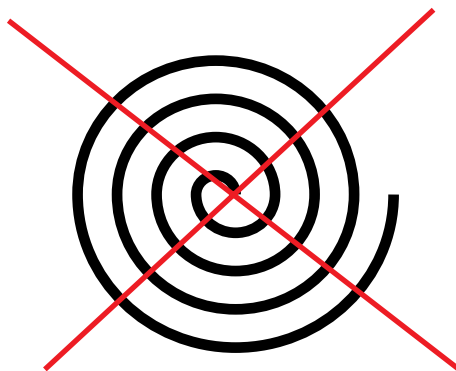


Fig. 109: Cable tray position

NOTE

The left over cable length must not be rolled into loops at any time. Use a "meandering" technique for the remaining cable length. Never store remaining cable length at the magnet!

NO



YES

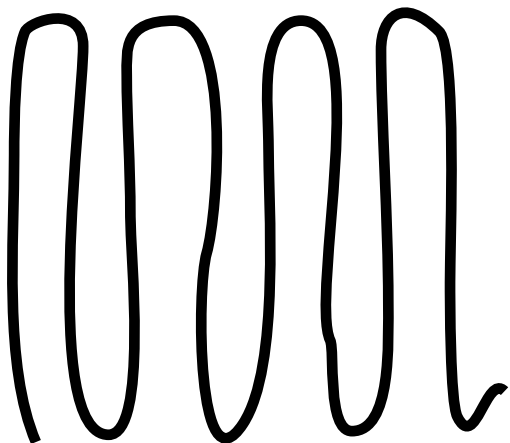


Fig. 110: Cable layout

Door switches at the RF room

NOTE

All doors of the RF room have to be equipped with a door switch. (In the case of several doors, the switches have to be connected in series.)

RF room prerequisites

- RF shielding is required in the examination room, because
 - all international and/or national RF guidelines for the prevention of RF interference caused by MR system operation have to be observed
 - interference-free operation of the MR system despite RF interference in the operating frequency range of the installation has to be ensured. Route all electrical lines in the RF room via RF filters.
- Equip doors leading to the RF room with a limit switch.
- To prevent extraneous electrical fields in the examination room, the following should not be installed or used:
 - Telephone connections
 - Extensions for in-house intercom systems
 - Fluorescent lights
 - Energy-saving light bulbs
- The RF integrity has to be tested and the filter plate has to be installed after completion of the RF room. Requirements regarding RF-shielding

NOTE

By using a suitable design as well as maintenance plan, the manufacturer of the RFcabin has to ensure that the following operate without fail:

the door locking, especially the door handle and locking mechanism so as to secure continuous access to the patient in the examination room for emergency care and evacuation.

NOTE

The opening direction of the RF door has to be to the outside of the RF room. As an alternative other appropriate means have to be provided to ensure that pressure built up during a quench, when the venting fails to work adequately, will not prevent the RF door of the examination room from being opened.

If, e.g., due to constructional reasons, the RF door opening direction is to the inside of the RF room, a flap measuring 600 mm x 600 mm has to be integrated into the RF room door!

NOTE

If required, the RF manufacturer has to perform a separate/additional RF attenuation measurement after the complete installation of the RF room (magnet is positioned; RF filter plate is installed).

NOTE

To operate the MR system, the RF room has to be grounded at the points specified in the installation instructions. All other ground connections are unacceptable.

NOTE

The RF attenuation in the RF room must be min. 90 dB in the 15-128 MHz frequency range. The measured value (after installation of the RF room on-site) has to be stated in the handover protocol of the RF room manufacturer. A copy of this protocol has to be inserted into the system owners manual.

NOTE

All components of the RF room and the interior fittings/accessories of the examination room have to be made from non-magnetizable material. Follow manufacturer's specifications and instructions.

NOTE

The floor in the vicinity of the magnet (2.2 m x 4.5 m) has to be leveled within max. +/-2.0 mm.

RF room design

Specifications for the RF room

RF room specifications ¹	
RF room attenuation	> 90.0 dB
RF room attenuation for Co-Siting	> 100.0 dB
Frequency range in steps	15 MHz to 128 MHz
Floor evenness ²	+/-2.0 mm
RF room isolation	isolated from the on-site ground
Resistance between the RF room and the central protective ground of the system	> 100 Ohm

1. The specification of the RF room attenuation has to be maintained across the RF room and its life-time. If required, measures have to be taken to meet this requirement (e.g. refer to the manufacturer's maintenance instructions)
2. This applies in the area of the magnet position (2.4 m x 4.5 m).

RF room frequency specifications	
Element	Frequency
min. frequency	15.0 MHz
17 O	
13 C	16.0 MHz
23 Na	16.8 MHz
129 Xe	17.6 MHz
7 Li	24.7 MHz
31 P	25.7 MHz
3 He	48.4 MHz
19 F	59.8 MHz
1 H	63.6 MHz
max. frequency	128.0 MHz

RF door opening

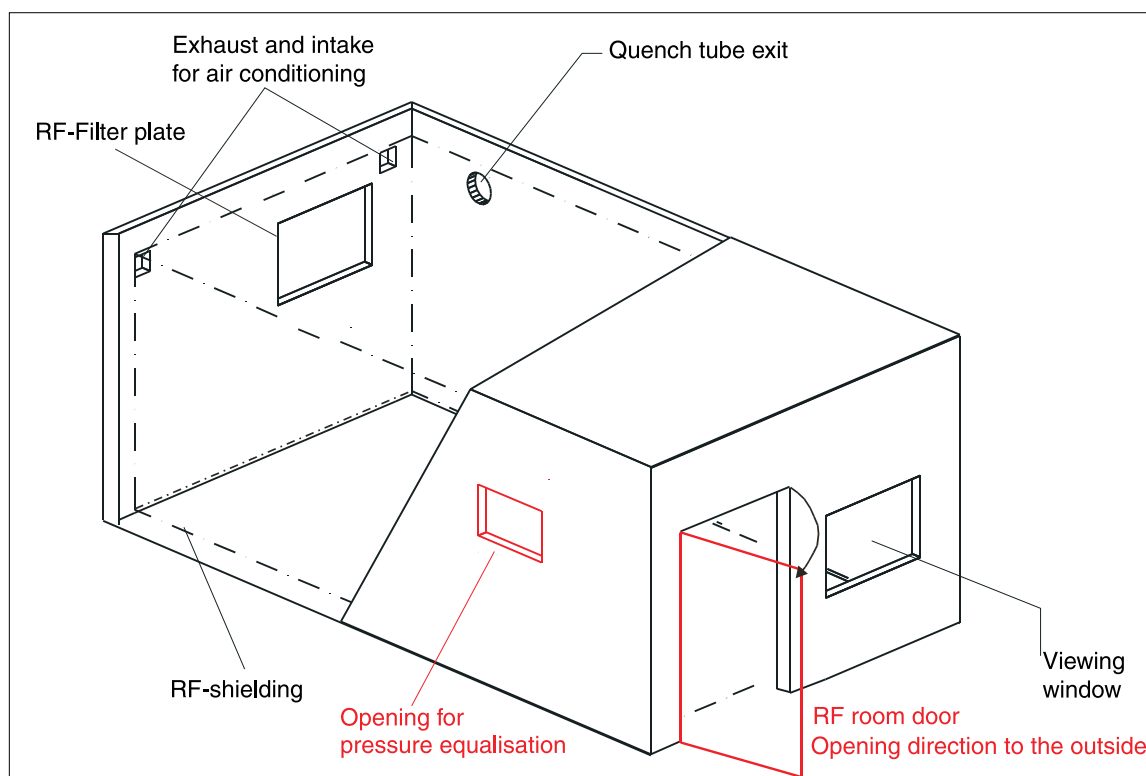


Fig. 111: RF room, example

NOTE

The opening direction of the RF door has to be to the outside of the RF room. As an alternative, other appropriate means have to be provided to ensure that pressure built up during a quench, if the venting fails to work adequately, will not prevent the RF door of the examination room from being opened.

An opening in the RF room of 600 mm x 600 mm has to be installed, if the RF door opens to the inside of the examination room! This is mandatory!

The opening of 600 mm x 600 mm is recommended, even if the door opens to the outside.

NOTE

By using a suitable design as well as maintenance plan, the manufacturer of the RF cabin has to ensure that the following operate without fail:

the door locking, especially the door handle and locking mechanism so as to secure continuous access to the patient in the examination room for emergency care and evacuation.

- ⇒ If your RF room door opens to the inside, your RF room manufacturer may be able to provide you with subsequent improvements. For new systems, the following are considered standard safety measures. We recommend that you upgrade older systems to these standards.

Alternatives for a pressure equalization opening

- The door is reconfigured so that it opens to the outside and into the control room.
- The door is replaced with an RF-sealed sliding door. It should be ensured that the door closes in a way that allows it to move away from the frame in case of overpressure, that is, it facilitates opening the door.
- The stationary observation window is replaced by a window opening into the control room.
- An opening in the RF room measuring 600 mm x 600 mm has to be installed, if the RF door opens to the inside of the examination room! These panels require an RF-sealed installation. After opening the panel, the outlet should measure at least 600 x 600 mm². When using rectangular panels, the shorter side should measure a minimum of 600 mm in length. To ensure unobstructed venting, this opening cannot be subdivided. This means that, e.g., RF-sealed honeycomb grids are not permitted. Also, easy removal of the panel by a person has to be ensured. In addition, a minimum distance of 1 meter to the next wall needs to be observed. The panel should be installed as far as possible toward the top to allow escape of the low-density helium.
- If your RF room door opens to the inside, your RF room manufacturer may be able to provide you with subsequent improvements. However, these openings are also conduits for noise generated outside the RF room. The panel should be installed as far as possible toward the top to allow escape of low-density helium. To maintain unobstructed flow through a pipe, the diameter of a 10 m long line has to measure at least 0.7 m. It is not permitted to use honeycomb grids in this line.
 - ⇒ For doors moved via auxiliary drives (e.g. electrical or pneumatic), manual operation has to be ensured as well. An outside window should be in the vicinity to allow venting exhausted gas to the outside. After completing the remodeling, the integrity of the RF shielding has to be tested again. If included in the installation, the observation window may be pushed in. The window usually includes wiring for the RF shielding that needs to be worked through as well. However, rescue personnel may be injured by the resulting glass splinters. Depending on the construction and the thickness of the window, the operator has to provide suitable tools for breaking the window.

RF room interior

- ⇒ The following information is important for a faultless operation of the imaging system!
 - Only non-magnetic materials are to be used and installed in the RF room.
 - A suspended ceiling must be statically suspended, i.e., not suspended with movable clamps, springs, etc.
 - Corrugated rods in suspended ceilings have to be attached securely (galvanic contact between the corrugated rods has to be guaranteed, the can't just lie on top of one another. A wire jumper between the rods may be useful).
 - Electrical wiring, e.g., for lights, cannot rest unsecured on the suspended ceiling.

NOTE

If you expect noise problems, the RF room manufacturer you are using may be able to deliver noise reduction components with the RF room (e.g., interior; RF window; RF door, etc.).

NOTE

Adhere to the manufacturers guidelines, specifications and/or installation manuals.

Be sure to include the weight of the RF room and/or external iron shielding and/or noise reduction material in your static calculations!

NOTE

Special devices such as medical gas feed-throughs or RF filters for, e.g., room lights could possibly be ordered from your RF room supplier/manufacturer.

Quench tube

The material of the quench tube contracts after a quench. To allow for subsequent material expansion, include an expansion margin for the RF-sealed wave trap of the quench tube.

- ⇒ The RF room feed-through needs to conform to certain geometric constraints to guarantee the RF integrity of the RF room.
- ⇒ As a function of the inner pipe diameter d_i the following applies to the minimum pipe length $L_{\min}$ for frequencies up to 128 MHz and 110 dB attenuation.

NOTE

$L_{\min} = 4.0 \times d_i$, whereby: $d_i \leq 300 \text{ mm}$

- Bolts are placed at a maximum of 30 mm distance to ensure RF shielding.
- Depending on RF room designs, RF seals may be required between the mounting flange and the RF room.

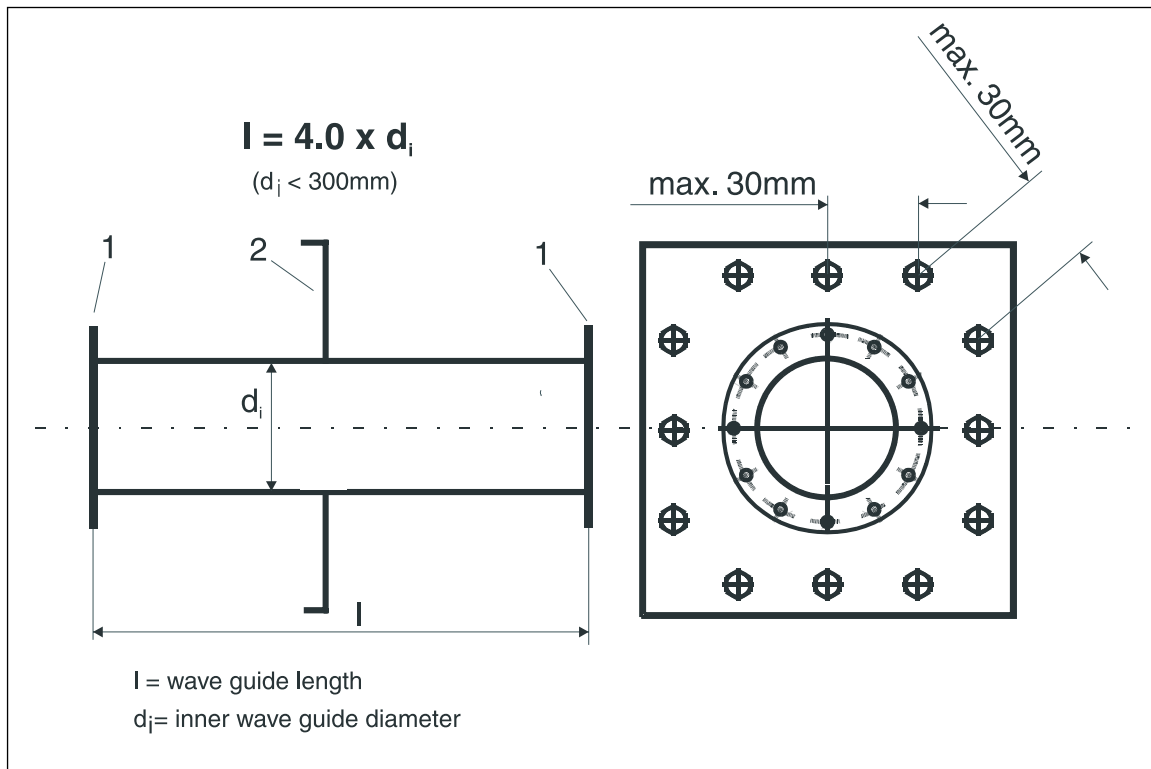


Fig. 112: Quench tube RF feed-through

Pos. 1 Quench tube connection flanges

Pos. 2 Connection flange for mounting the feed-through to the RF room

Galvanic separation

Galvanic separation has to be installed to avoid electrical noise being picked up by loops between the magnet, the quench tube, the RF room, and the building.

It is necessary to have one galvanic separation of the quench tube inside and one outside the RF room.

The sketch below shows the installation parts to be used for galvanic separation.

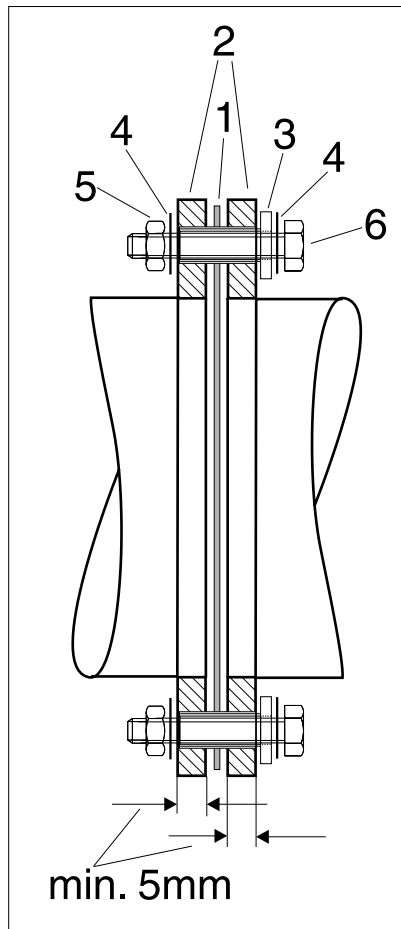


Fig. 113: Galvanic separation

- Pos. 1 Gasket
- Pos. 2 Stainless steel flange
- Pos. 3 UHWPE bushing
- Pos. 4 Stainless steel spring washer
- Pos. 5 Stainless steel locking nut
- Pos. 6 Stainless steel screw

Quench tube sketch

Horizontal

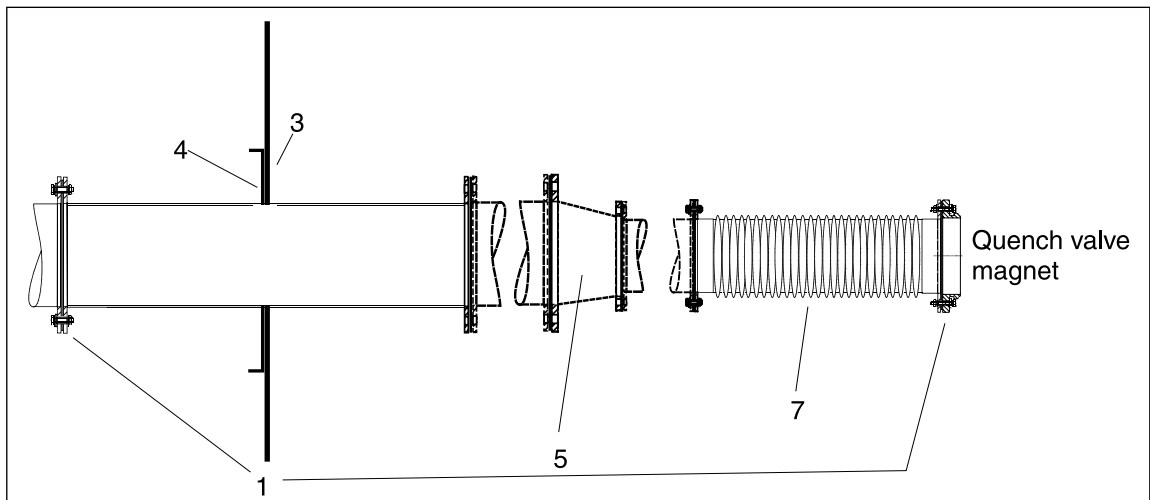


Fig. 114: Quench tube horizontal

- Pos. 1 Galvanic separation
- Pos. 2 RF feed through
- Pos. 3 RF room
- Pos. 4 Connection to RF room
- Pos. 5 Diffuser (Optional)
- Pos. 6 Flange (e.g. welded, screw connection)
- Pos. 7 Bellows

Vertical

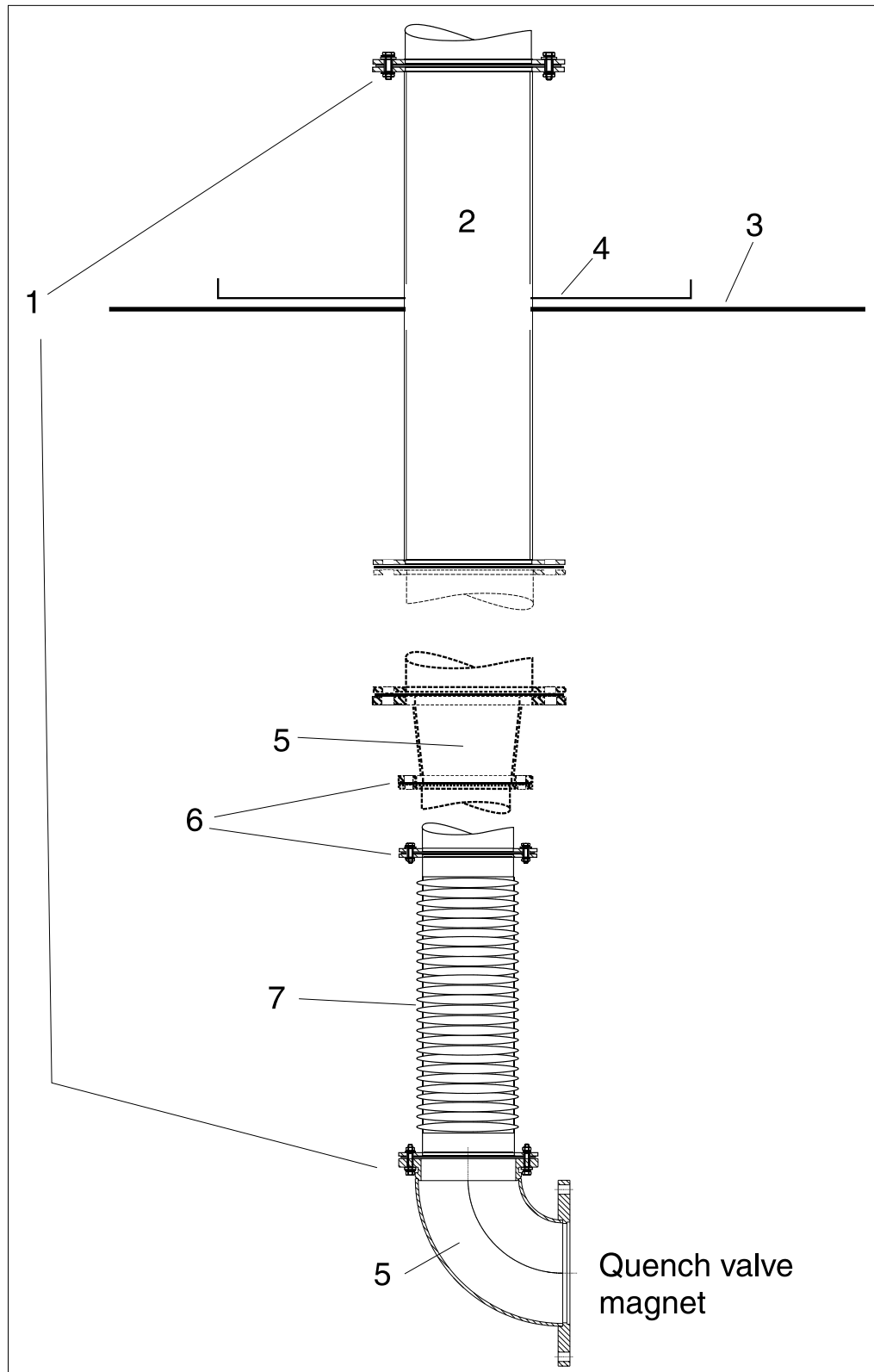


Fig. 115: Quench tube, vertical

- Pos. 1 Galvanic separation
- Pos. 2 RF feed-through
- Pos. 3 RF room

Pos. 4	RF room connection
Pos. 5	Diffuser (optional)
Pos. 6	Flange (e.g., welded, screw connection)
Pos. 7	Bellows

Air conditioning

Feed-through

Honeycomb wave guides consist of a large number of small hollow wave guides. Depending on their dimensions, the honeycomb wave guides block certain frequencies. The honeycomb wave guides are used as RF-sealed feed-throughs for e.g. the air intake and exhaust ducts of the air conditioning unit. Refer to the data sheets of the manufacturer for additional details.

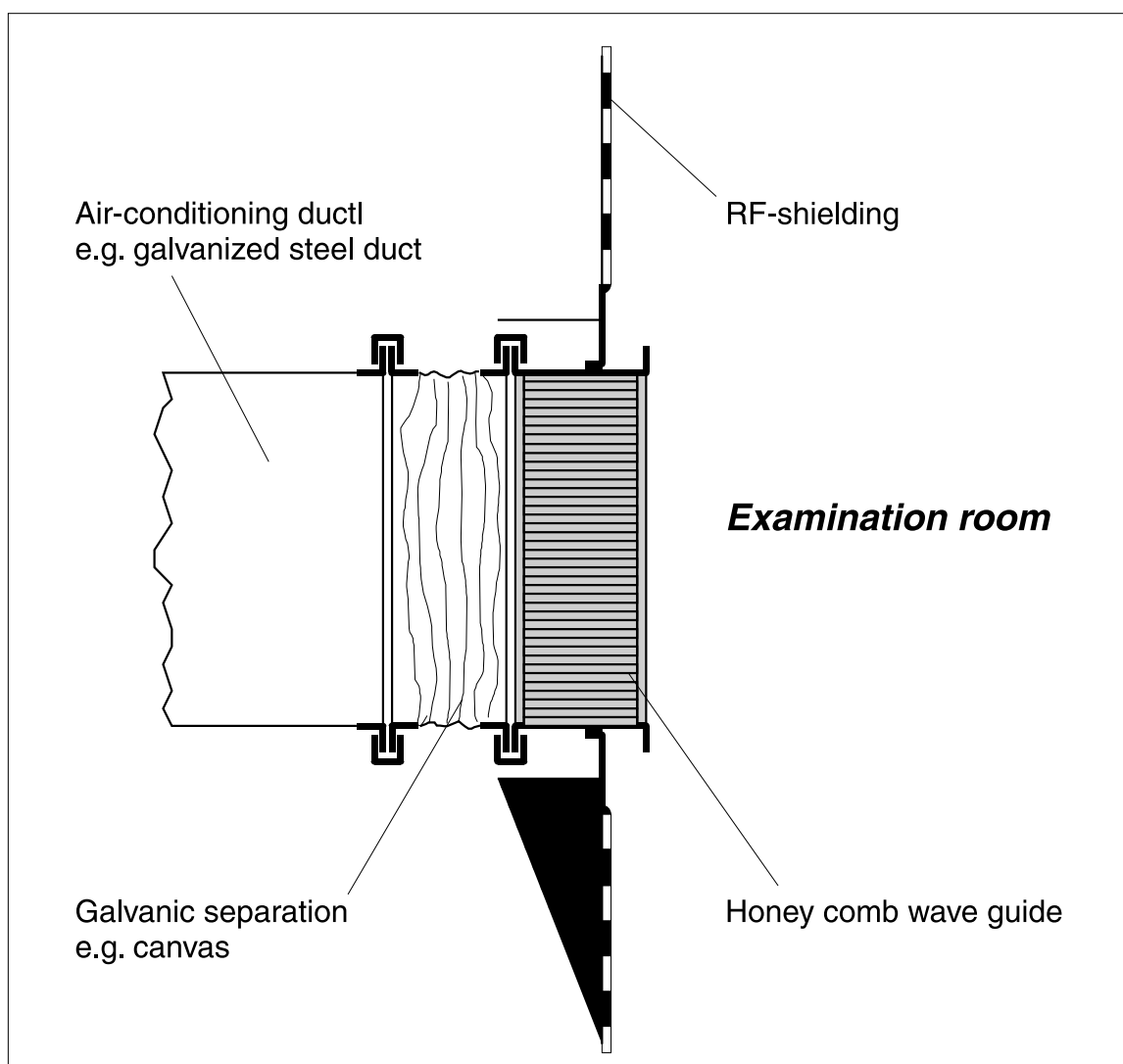


Fig. 116: Air-conditioning feed-through

Medical gases

Medical gases feed-through

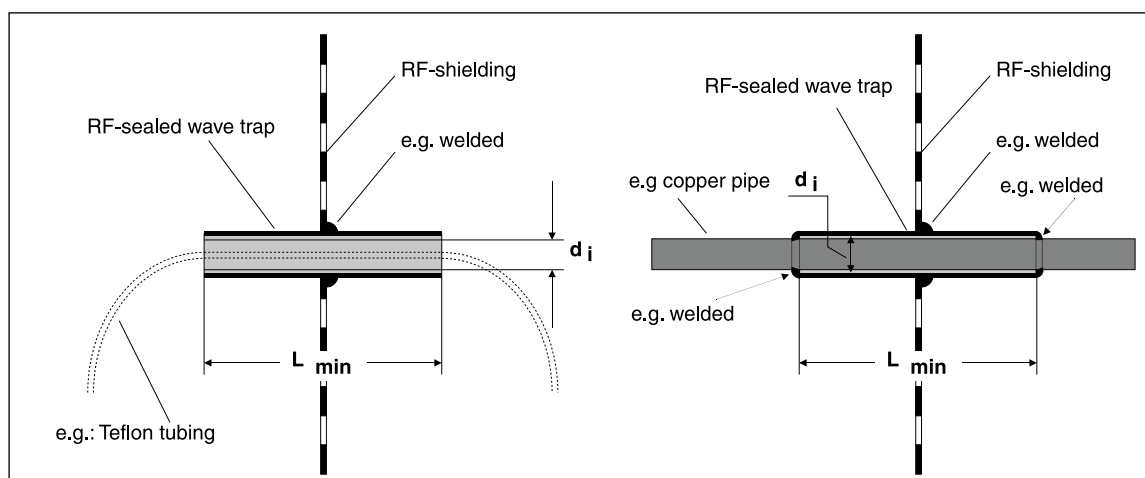


Fig. 117: Medical gases feed-through, example

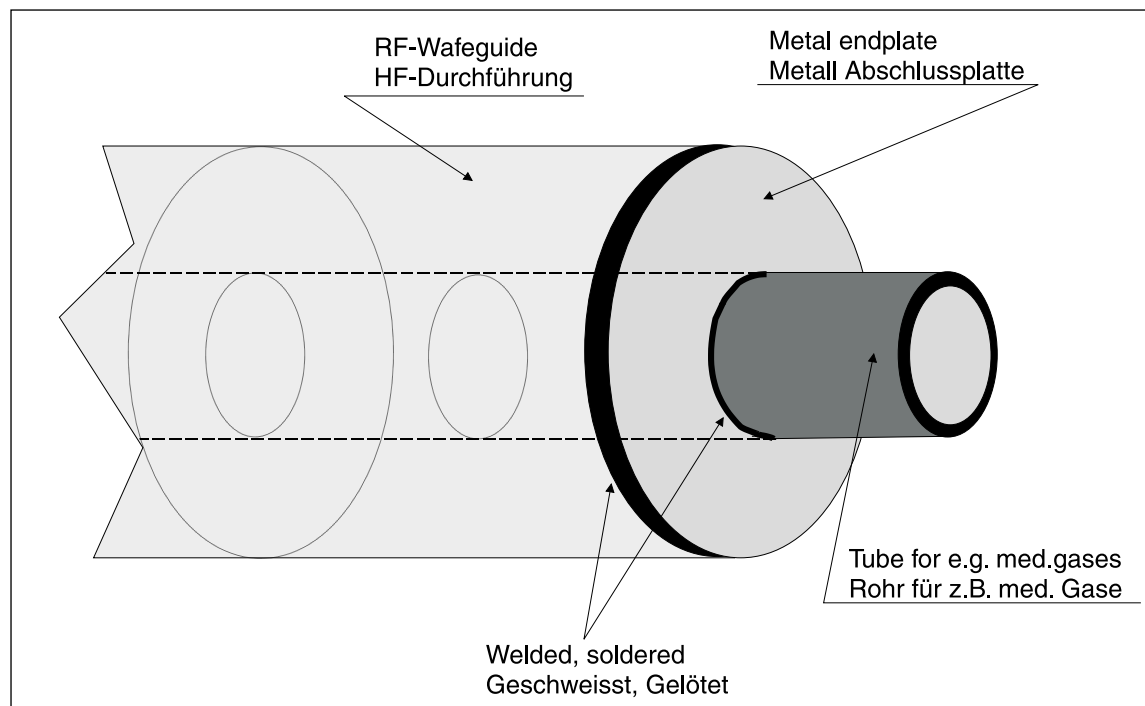


Fig. 118: Medical gases feed-through, example

Information on medical gases

Our information on medical gases is as follows:

Only licensed firms (e.g., Dräger) are permitted to perform installations.

Up to now there were actually three ways of routing medical gas lines:

- Pipes were comprised solely of plastic tubing and were introduced into the RF room through a 76 mm feed-through. This is actually the simplest solution from a technical standpoint.

- Complete line voltage supply in copper tubing within the hospital. Copper tubing also installed inside the RF room. The RF feed-through from the outside to the inside was established using the 76 mm feed-through and synthetic tubing. In the area of the feed-throughs inside and outside the RF room, inspection ports are required inside the suspended ceiling.

Dräger performed the installation of the copper tubing and the transition with plastic tubing.

- Introducing the copper tubing directly into the RF room via an RF-sealed copper tube had been planned several times, but was never implemented. A type of mounting plate was planned upon which the necessary number of copper tubes of the appropriate diameter would be located. In the majority of cases, diameters of 8, 10, 12, and 14 mm are required for the gases, while diameters of 20 or 25 mm are required for suction. RF integrity can be calculated precisely using the diameter and length of the tubing.

The tubing could be connected directly to the mounting plate via the respective fittings. The only problem with this solution is the galvanic separation of the RF room from the rest of the building.

All electrically non-conductive supply lines for

- oxygen, anesthetics or
- fiber optic cables, etc.

routed from the outside into the RF room must be fed through electrically conductive pipes also known as RF-sealed wave guides. They must be either welded to the RF shielding or attached via screws. The RF-sealed wave guides function as hollow wave guides that block certain frequencies.

Metal pipes (e.g., technical/medical gases, water, etc.) have to be grounded at the RF wave guide. All international/national RF regulations and ordinances have to be followed. Accurate and interference-free operation of the MAGNETOM system has to be guaranteed.

Used DIN norms

Shielding attenuation measurements are normally performed in compliance with the following standards:

- EN 50147-1 (European standard)
- NSA 65-6 (American standard)
- MIL STD 285 (American standard)
- IEEE 299 (1997)

The various methods for measuring are established and described within the standard. It is, therefore, common for us to determine certification measurements with the respective customer as early as the quotation and planning phase.

Modular RF rooms

The shell of the examination room has to have been completed prior to assembling and installing the RF room. The wall openings for, e.g., RF room door, view window, air intake and exhaust ducts, etc., have been made.

The modular RF room consists of individual sections (modules) made from non-magnetizable material.

- No special structural requirements are needed for the ceiling and the walls.
- If sections of the completed modular RF room have to be disassembled for installation-related reasons, new contact springs have to be used when re-assembling the sections.
- The modules have to be disassembled in groups from floor to ceiling or up to the respective corner of the RF room. The same applies to the ceiling panels.

RF room construction (example)

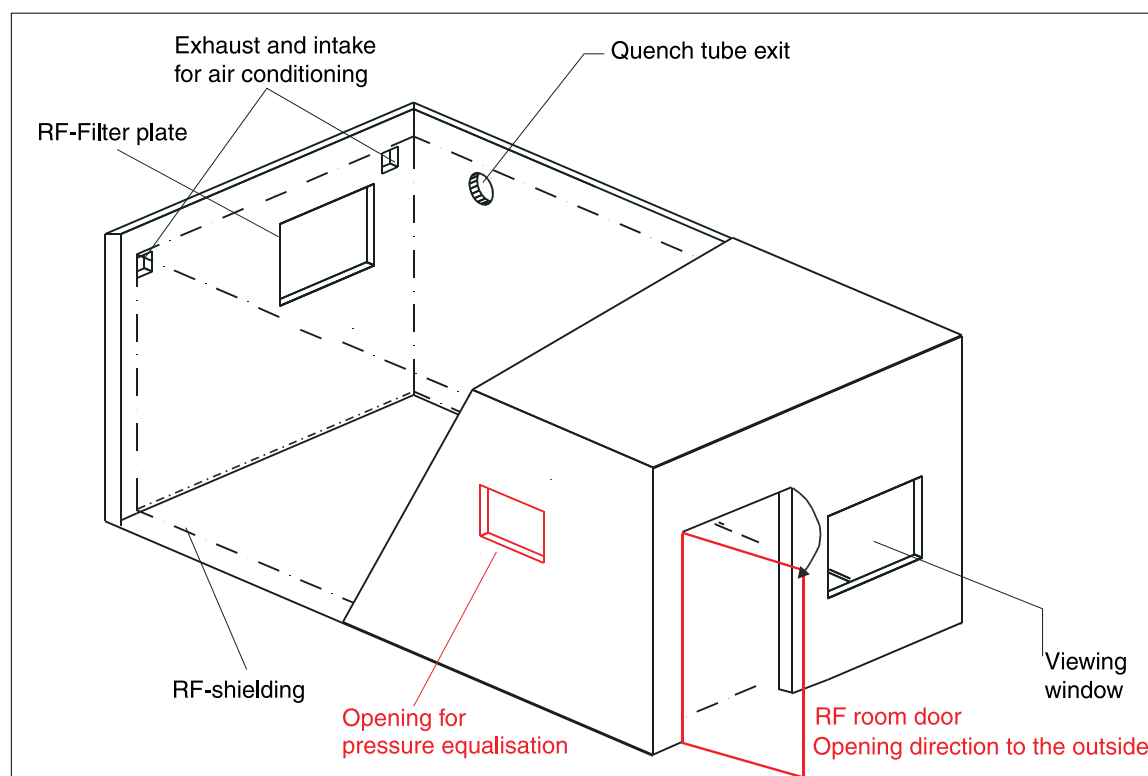


Fig. 119: RF room, example

NOTE

The floor in the vicinity of the magnet (2.2 m x 4.5 m) has to be level within maximum +/- 2.0 mm

NOTE

Use antistatic floor covering in any case!

If particle board is used/installed to be sure to meet the specifications of V100 E1 (density 620...800 kg/m³; DIN 52361).

NOTE

Additional information regarding the shielding for RF rooms may be obtained from the manufacturer.

RF filter plate cut-out

The RF filter plate can be installed in the vertical or horizontal position.

NOTE

If the RF filter plate will be installed vertically, the gradient filter position has to be on top.

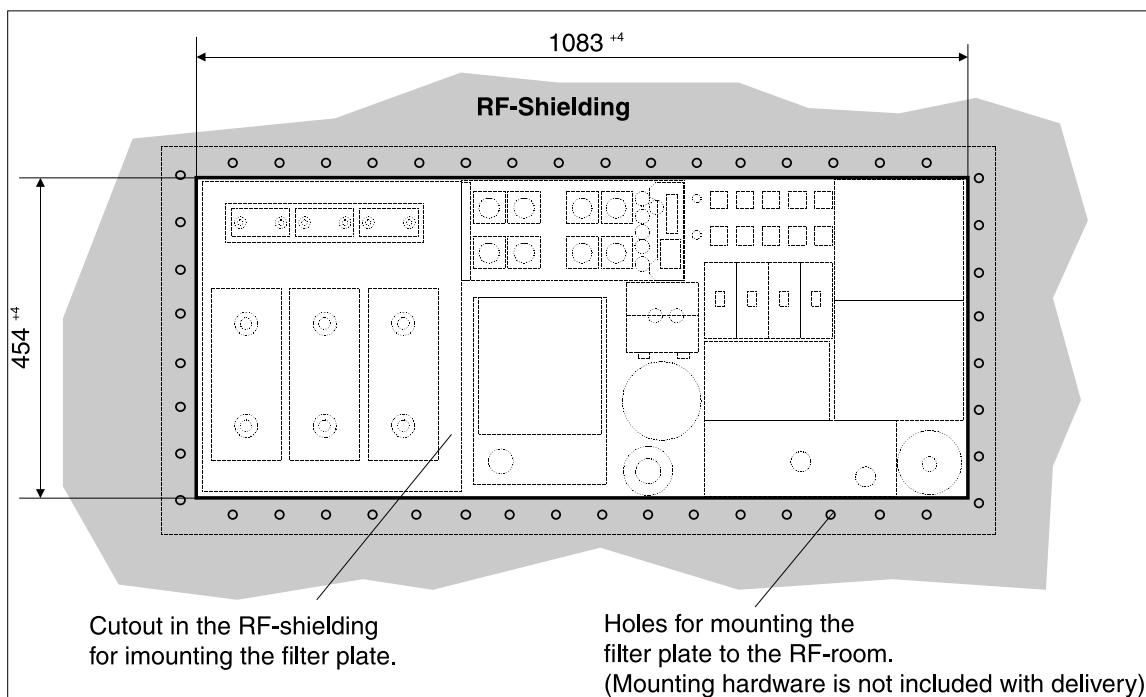


Fig. 120: RF filter plate cut-out

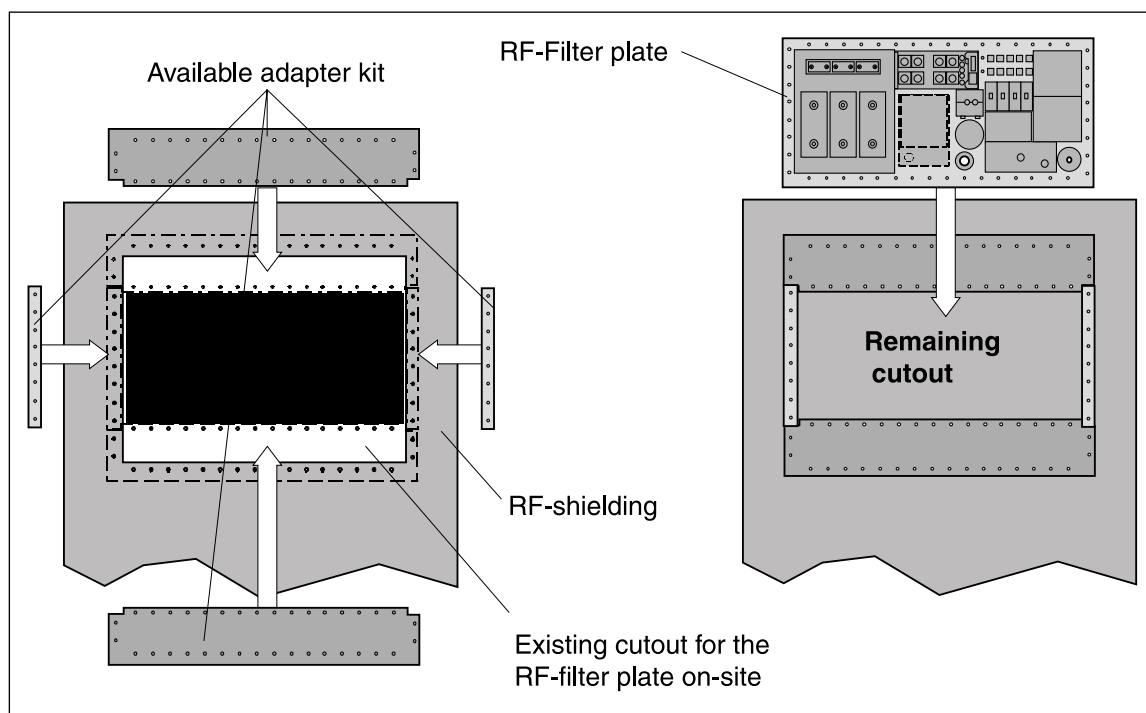


Fig. 121: RF filter plate adapter

NOTE

There is an adapter kit available for mounting the Espree filter plate into already existing RF that used to house older SIEMENS MR systems. The part number is: 56 41 316.

Cu RF room RF filter panel cut-out

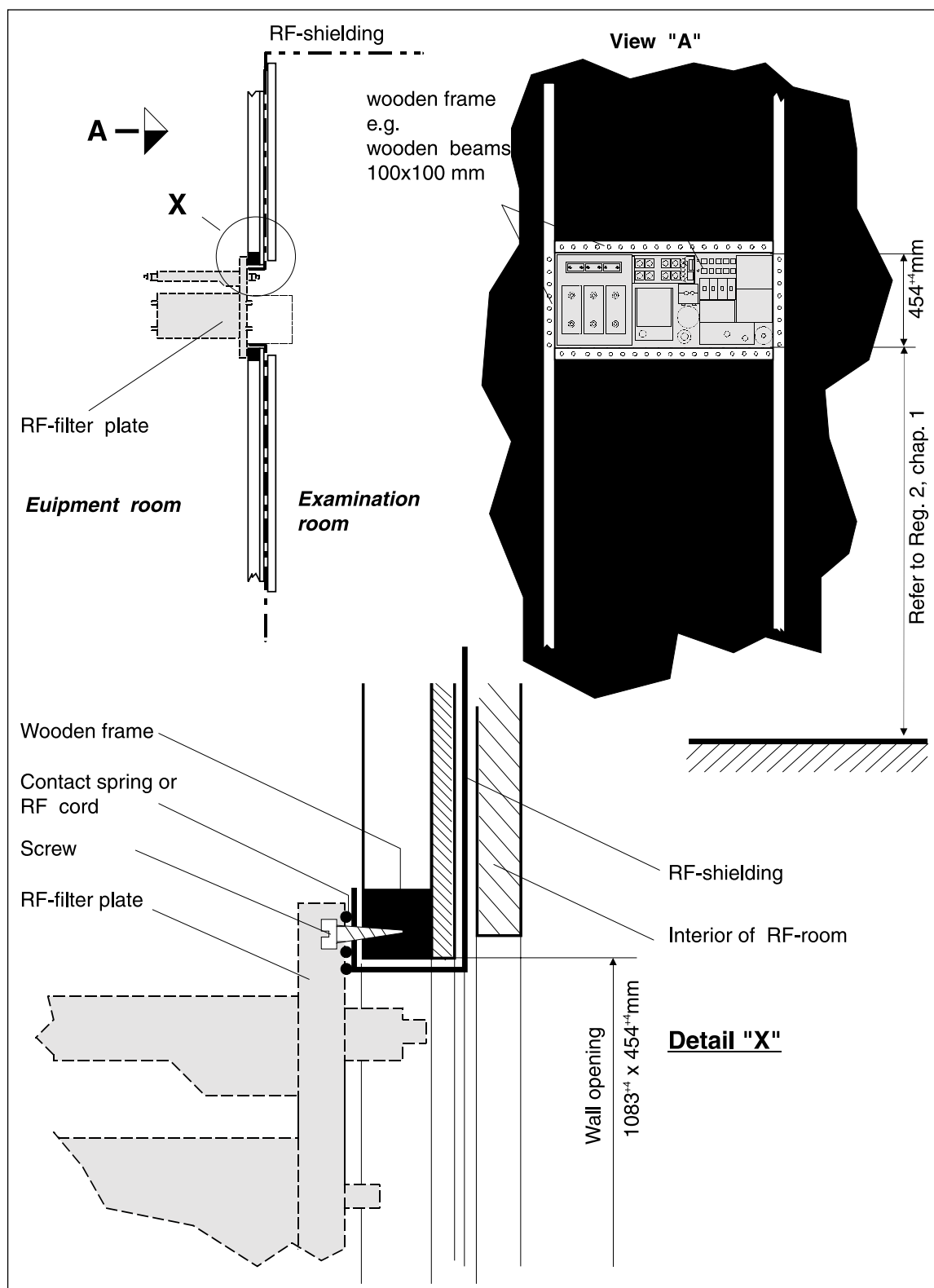


Fig. 122: RF filter plate installation in a Cu-RF room

Cu RF room floor (example)

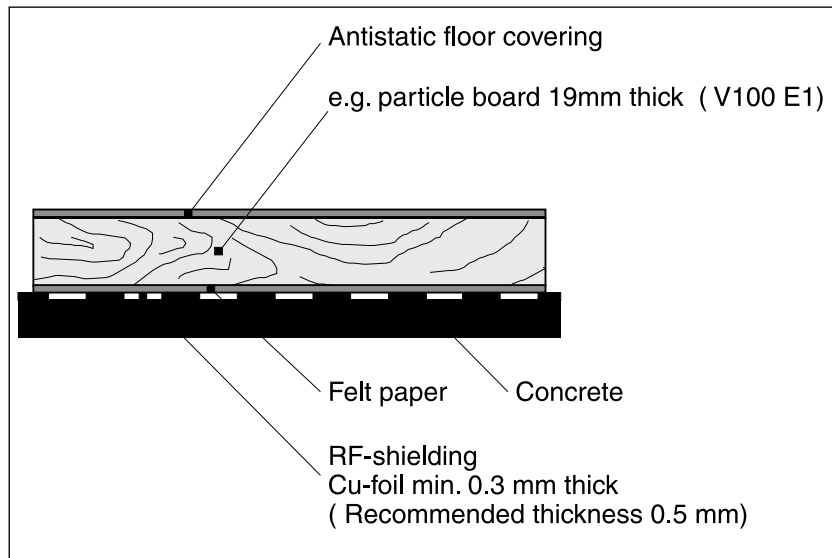


Fig. 123: RF room floor example for a CU RF room

RF room isolation from on-site ground

Definition

The RF room is isolated from on-site ground, if the resistance between any of the points in the RF room and the central protective conductor of the system is greater than or equal to 100 Ohms.

Measurement devices

Protective conductor meter.

Preferred method of measurement

- Construct the RF room and measure the resistance between the RF room and the central protective conductor of the system.
 - Measure the resistance between the RF room and the central protective conductor of the system each time an anchor is set into the floor.
 - After completion of the RF room, the resistance between the RF room and the central protective conductor of the system has to exceed 100 Ohms.
 - The RF room cannot be connected to the on-site ground.
 - Final measurements with the protective ground meter
 - Remove all protective conductor connections to the RF room.
 - Measure the resistance between the RF room and the on-site ground with the protective ground meter.
- ⇒ The resistance must be >100 Ohms.

Checklist

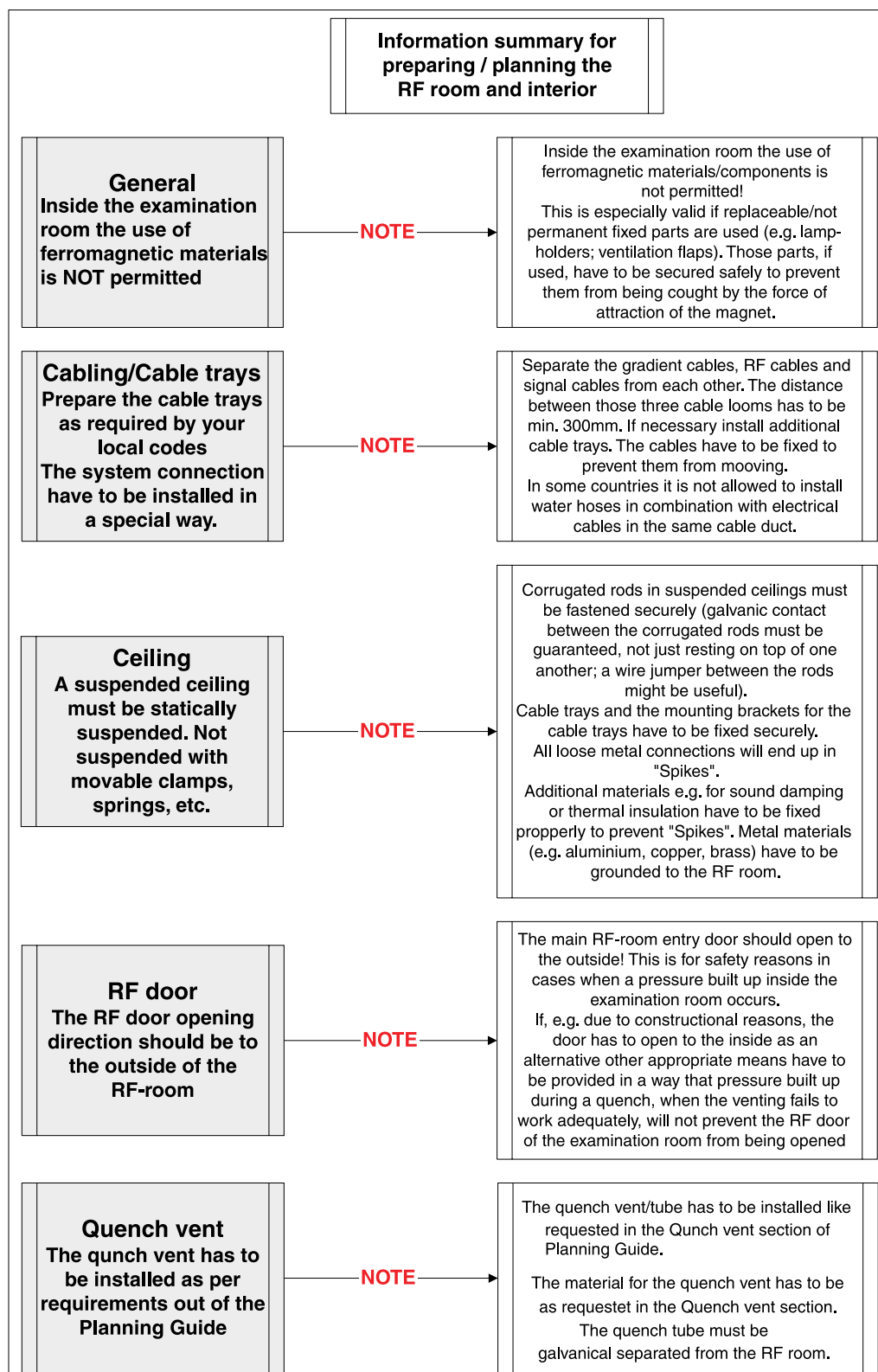


Fig. 124: RF room checklist

RF room manufacturers

RF room manufacturer contacts

RF room manufacturers	
Siemens AG Medical Solutions Department MRL A2 Allee am Röthelheimpark 2 91052 Erlangen phone: +49 (0) 9131/84-7747 fax: +49 (0) 9131/84-3910	Albatross Projects GmbH Daimlerstrasse 17 89564 Nattheim / Germany phone: +49 (0) 7321 / 730-543 fax.: +49 (0) 7321 / 730-590
ETS Lindgren-Rayproof Ltd (Europe) Boulten Road, Pin Green Industrial Area Stevenage, Hertfordshire SG1 4th England phone: +44 1438-730-700 fax: +44 1438-730-750 Internet: www.ETS-lindgren.com	ETS Lindgren RF Enclosures, Inc. (Rest of World) 400 High Grove Blvd. Glendale Heights IL 60139 U.S.A. phone: 001 630-307-7200 fax: 001 630-307-7571 Internet: www.ETS-lindgren.com

RF room manufacturers	
IMEDCO AG Medical RF and Magnetic Shielding Specialists Industriestrasse West 14 4614 Hägendorf Switzerland phone.: +41 62-20940-20 fax.: +41 62-20940-29 e-mail: imedco@imedco.ch Internet: www.imedco.ch	SCHWARZ GmbH & Co. KG Abschirmtechnik Löhestrasse 49 D-53773 Hennef phone: +49 (0) 2242 96978-0 fax: +49 (0) 2242 96978-79 e-mail: schwarz@schwarz-elektroanlagen.de
HAMACO GmbH Elektro Magnetische Komponenten Rombrocker Strasse 15 D-58640 Iserlohn phone: +49 (0) 2371 9761-5 fax: +49 (0) 2371 9761-60 e-mail: info@hamaco.de Internet: www.hamaco.de	MR-Schutztechnik Kabinenbaugesellschaft mbH Dammweg 13 D-64807 Dieburg phone: +49 (0) 6071 985710 fax: +49 (0) 6071 985711 e-mail: MR-Schutztechnik@t-online.de Internet: www.MR-Schutztechnik.de

- ⇒ Upon request some of the RF room manufacturers will install the quench tube, air conditioning and the interior of the RF room. Fringe field measurement and RF measurements after the complete installation can be ordered from some of the RF room manufacturers as well.

NOTE

The RF room manufacturers ensure compliance with the specifications, e.g., 90 dB attenuation from 15 to 128 MHz of the installed RF shielding (depending on the system operating frequency). The RF shielding will be tested by the manufacturer of the RF room using special measurement devices after the RF room is installed. The test will be confirmed via a protocol which has to be filed in the customer's "System Owner Manual".

Quench tube support	
	Witzenmann GmbH Kevin East Sales Manager Witzenmann UK Limited tel: +44 (079006) 05594 mobileTel: +44 (0)1924 89 44 55 Fax: +44 (0)1924 89 39 E-mail: 45kevineastwuk@aol.com

General

NOTE

The installation of the quench tube has to be performed by competent personnel.

In the event of a quench, the thermal energy dissipated causes the liquid helium to boil off extremely rapidly. The system has to be capable of venting the large volume of gas generated at the approximate expansion ratio of 1:700 from liquid at 4.2 K to room temperature gas. The exhaust system is critical for the safe operation of the magnet. Please follow the guidelines for this section. Since helium vented in a quench is an asphyxiant and an extremely cold gas, the quench tube has to end at a point where access by people is not possible. This is similar to venting dangerous gases in chimneys.

Planning and installation of quench tubes must be conducted by qualified personnel. Note that components used for other tubing, e.g., in air conditioning or room venting, are generally not suitable for quench tube construction.

It is the responsibility of the operator of the equipment to ensure that the quench tube pipe is maintained in an operable state.

NOTE

The quench tube design has to comply with the requirements specified in this document. It is the responsibility of the Project Manager to ensure that the installation of the quench tube is completed before the magnet is connected!

NOTE

The quench tube outlet, as well as the quench tube, have to be easily accessible for visual inspection!

NOTE

The quench tube has to be identified with a marker tape across the complete length of the quench tube.

The content could be, e.g.: "Do not cut, quench tube exhaust pipe."

Basis for design calculations

Calculating the pressure drop along the quench tube during a quench is complex due to the compressibility of gas and the heat inputs along the length of the tube, which affect the gas density.

The sizing procedure relies on tabulated data used in simple arithmetic calculations. The tables are based on empirical data derived from quench test pressure loss measurement.

An example of the sizing process is contained in the following section:

Quench tube components checklist

The following specific design rules apply to the components making up the quench tube:

1. The quench tube will comprise straight, hydraulically smooth tube sections, bends (up to 90°) and a diffuser if required (Fig. 8). The end of the tube has to be terminated in a way to prevent ingress of rain, snow, and foreign objects (Fig. 1; Fig. 2). Flexible sections are used to either connect to the magnet or as expansion joints ("Principle layout of a quench tube example 1," on page 9 - 15). If a quench line is very short and straight, a flexible tube may be used for the whole of the quench line. Note, however, that due to the high pressure drop, the maximum permissible length of flexible tubes is very short as compared to straight tubes.
2. The quench tube **has to be made from non-magnetic material. Only stainless steel** grades AISI 304, 309, 316, and 321 [EN 1.4301, 1.4828, 1.4401, and 1.4878] may be used.
3. Consideration has to be given to thermal contraction (**up to 3 mm/meter for stainless steel**). Stainless steel bellows sections have to be used to allow for adequate contraction. Bellows are to be fitted **at a minimum of every 10 m**. The movement of the bellows has to be limited so that the pipe does not expand excessively under internal pressure.

NOTE

**Flexible tubes and bellows may only be made of stainless steel.
(For material grades see paragraph 2.)**

The length of the bellows sections in total may **not exceed 2%** of the allowed maximum pipe length to ensure that the drop in pipe pressure does not increase excessively.

The weight of the tube against the building has to be supported. To ensure that the line suspension is not overstressed due to thermal contraction, the suspension needs to be flexible enough to accommodate the movements. Also, the wall exit in general should not be fixed hard to the wall.

The maximum internal pressure of the pipe is **0.1 bar** in the design calculations. However, the maximum **permissible pressure needs to be 0.45 bar**.

The quench line has to be constructed in accordance with sound engineering practices.

4. There has to be a flexible section at the quench valve to reduce noise transmission, ease the fitting of the quench tube, and to avoid that the quench valve carries any load from the weight of the quench tube.

The flexible section at the quench tube should be about 0.3 m to 0.5 m in length, the internal diameter has to be at least 0.102 m (4").

It is to be made of stainless steel, and has to be able to withstand a **maximum permissible pressure of 0.45 bar** over atmosphere.

The flexible section has to be installed nominally straight, i.e., to allow for minor misalignment. It cannot be bent in a way to replace an elbow. The length of this section should be accounted for according to table 2.

5. Joints may be made only by welding (by welders qualified to handle stainless steel), or by using bolted flanges. Rotary flanges are permitted to facilitate the installation process. V-clamped flanges may not be used. Gaskets used to seal section joints have to

be made of either UHMW-PE [Cestilene HD1000, Hostalen GC579, or Hostalen GUR812], PTFE [BS EN 13000-1:1998, BS EN 13000-2:1998], or fiber [ASTM F36, BS 7531, DIN 3754P]. **No other materials are permitted.**

6. The end of the quench pipe has to be protected from outside elements such as rain or snow. It will be fitted with a wire mesh. **The mesh size has to be $10 + 2 / - 1$ mm with 1.0 ± 0.3 mm round wires**, to prevent ingress of foreign bodies [e.g., birds and rodents]. The area of the **mesh has to be at least 2.5 times the cross-section** of the quench tube (Fig. 2).

NOTE

The area of the mesh has to be at least 2.5 times the cross-section of the quench tube (Fig. 2).

7. Where the quench tube exits through a flat roof, the outlet has to be above the level where water could enter in case the roof drains get blocked. Wherever the quench tube exits vertically, a rain shield has to be installed (Fig. 1).

To prevent helium from re-entering the building, a deflector plate has to be welded to the tube where it exits the roof. (Fig. 1). The deflector plate has to have at least the same diameter as the rain guard. It has to be located at least two pipe diameters above the roof, and two diameters below the bottom of the rain guard.

In the case of a horizontal exit through a wall, the outlet has to be turned down by not less than the pipe diameter to prevent rain ingress (Fig. 1). The exit has to be situated where it cannot be blocked by drifting snow.

NOTE

Only the examples of pipe exits as shown in this guide may be used.

8. To avoid the risk of injury from cold burns and asphyxiation, access to the quench tube has to be **restricted by 3 m** at each side and below, and warning signs have to be affixed **vertically 6 m above the exit** (Fig. 1). The exit cannot be situated where, in case of a quench, helium gas may be drawn into an air inlet, or where gas may enter open windows. Note that helium is lighter than air, even when very cold. The cold gas must not be allowed to blow directly onto a window.

NOTE

Windows located within the restricted access area have to be sealed and permanently closed. Means of opening the windows have to be removed.

9. All bends have to be smooth walled and have a centerline radius to internal pipe diameter ratio in the range **1.5 to 5.0**. Where a one-piece bend is not readily available, a fabricated bend using straight sections is permissible (Fig. 6).
10. Mitred elbows (Fig. 7) may be used. However, please be aware that the greater equivalent length does not make them very suitable for this purpose.
11. Expansion from a small to a large tube diameter is accomplished by using a diffuser. Diffusers will conform to the geometric parameters shown in Fig. 8.

Never reduce the diameter of a line in the downstream direction.

12. The pipe is to be insulated along its full length. In this way, condensation of liquid air in case of a quench, as well as water condensation on the inside is avoided in case of humid weather conditions. A double-walled structure is allowed. Mineral fiber insulation (brands such as Rockwool Ductwrap or other) cannot be less than 25 mm thick. The insulation has to conform to local regulations for fibrous insulation materials.

Within the RF room, the pipe is to be insulated with one layer of 25 mm thick mineral fiber insulation with vapor barrier, covered by one layer of 25 mm thick Class O Armaflex [Armacell]. To avoid RF interferences with the imaging system, ensure that vapor barriers do not make electrical contact between the magnet pipework and the wave guide. The outside may be covered with an aesthetic finish.

Outdoor pipes have to be covered if access at the pipe or below cannot be excluded (dripping liquid air in case of a quench). Outside insulation has to be weatherproof [e.g., Armafinish FR paint, or Arma-Chek insulation].

13. The pipe has to be marked along its length with a warning tape stating its function, e.g.,
"WARNING: Vent pipe for extremely cold helium gas - work to be performed by authorized personnel only."
14. To ensure galvanic separation between the imaging system, the RF room (cabin), and the building, two galvanic separations are required. Separation at the magnet has to be provided at the magnet exhaust flange, using stainless steel bolts, insulating bushes and locking nuts.

The same principle is to be used outside the cabin.

NOTE

For safety reasons, no other designs are permitted.

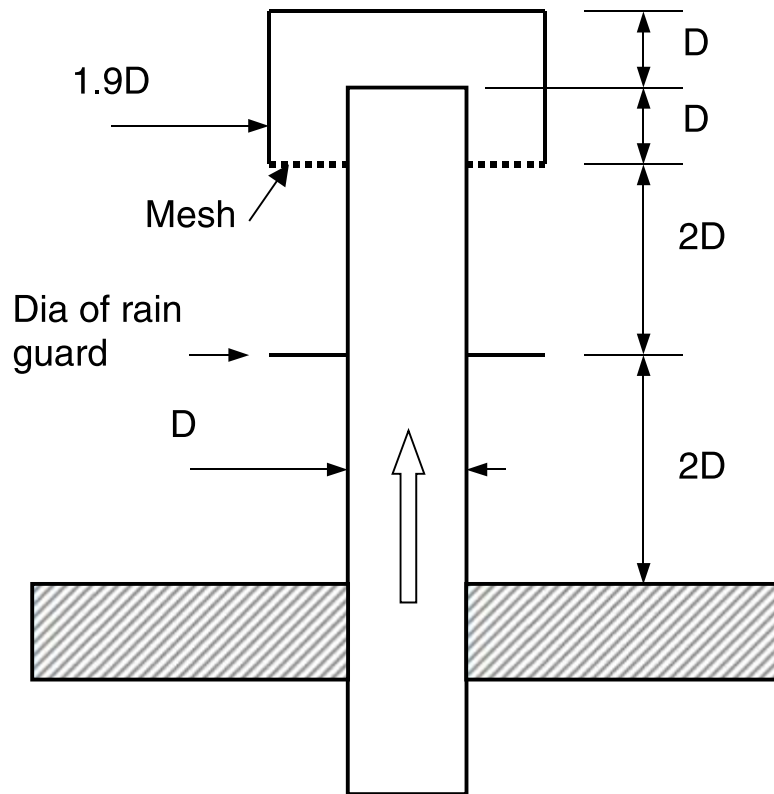
15. The quench tube design has to comply with the requirements specified in this document. It is the responsibility of the Project Manager to accept the installation of the quench tube before the magnet is connected!

16. Documentation:

NOTE

The design and construction of the quench pipe needs to be documented in drawings and calculations, and kept with the installation documents.

Quench Tube Outlet to Atmosphere - Vertical.



Quench Tube Outlet to Atmosphere - Horizontal.

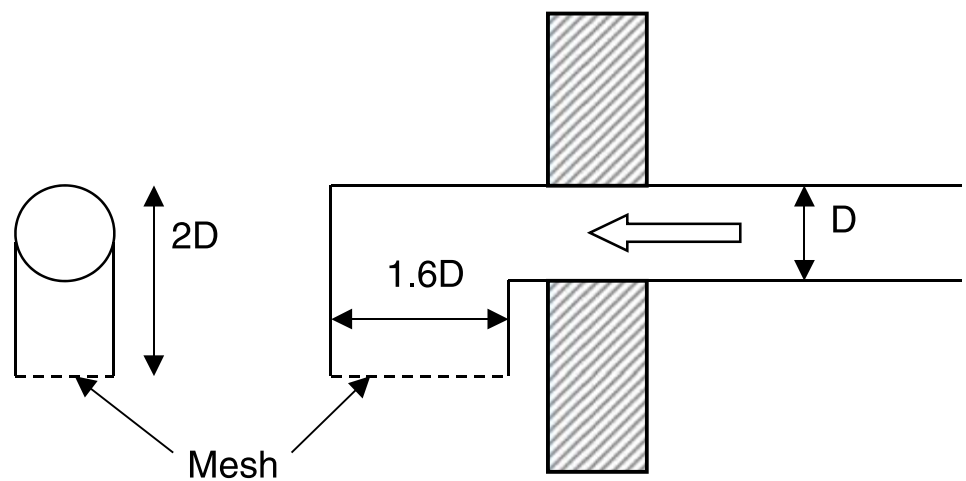


Fig. 125: Example of a vertical quench tube exhaust

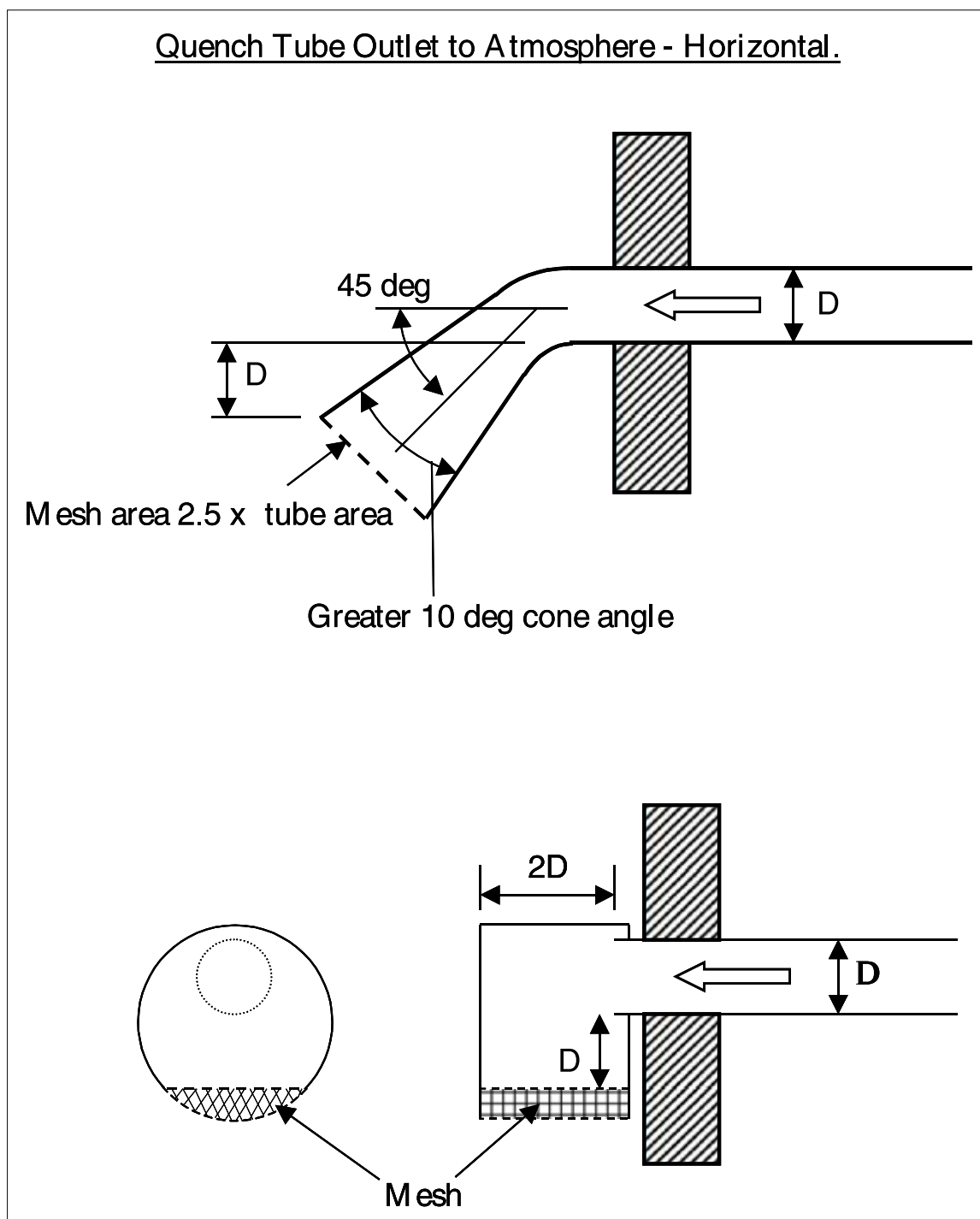


Fig. 126: Example of a horizontal quench tube exhaust

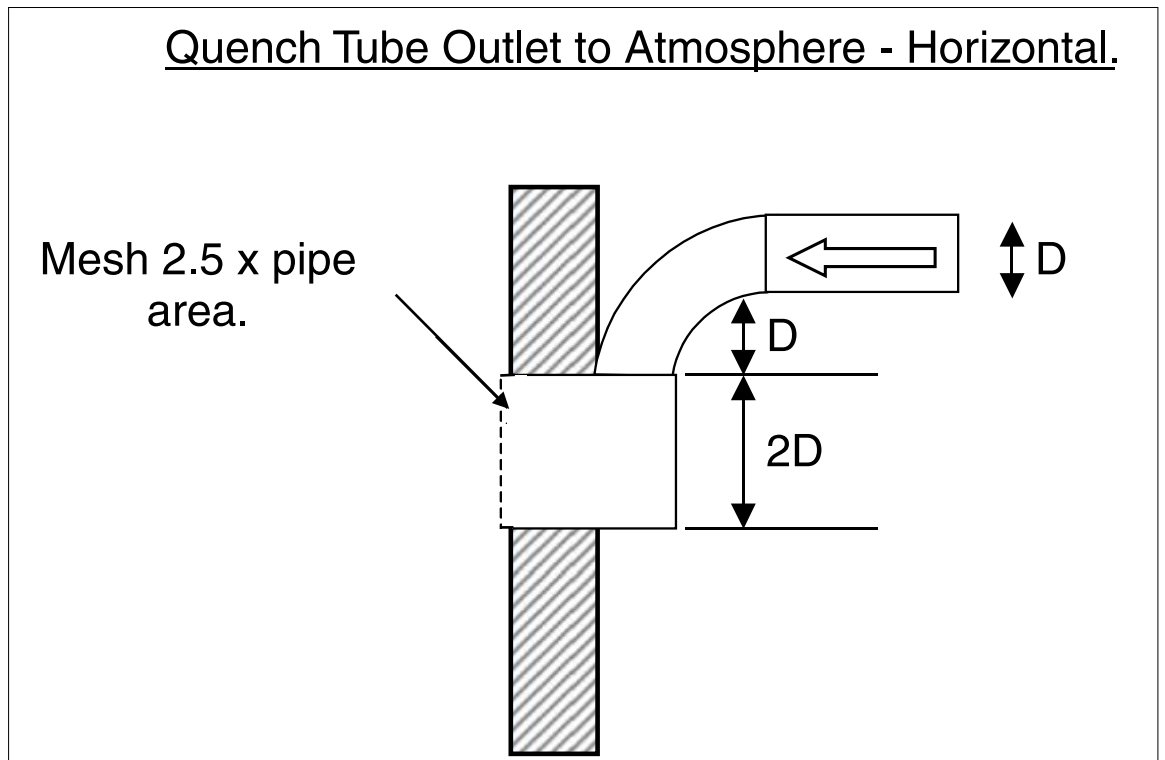


Fig. 127: Example of horizontal quench tube venting to the outside, flush with wall

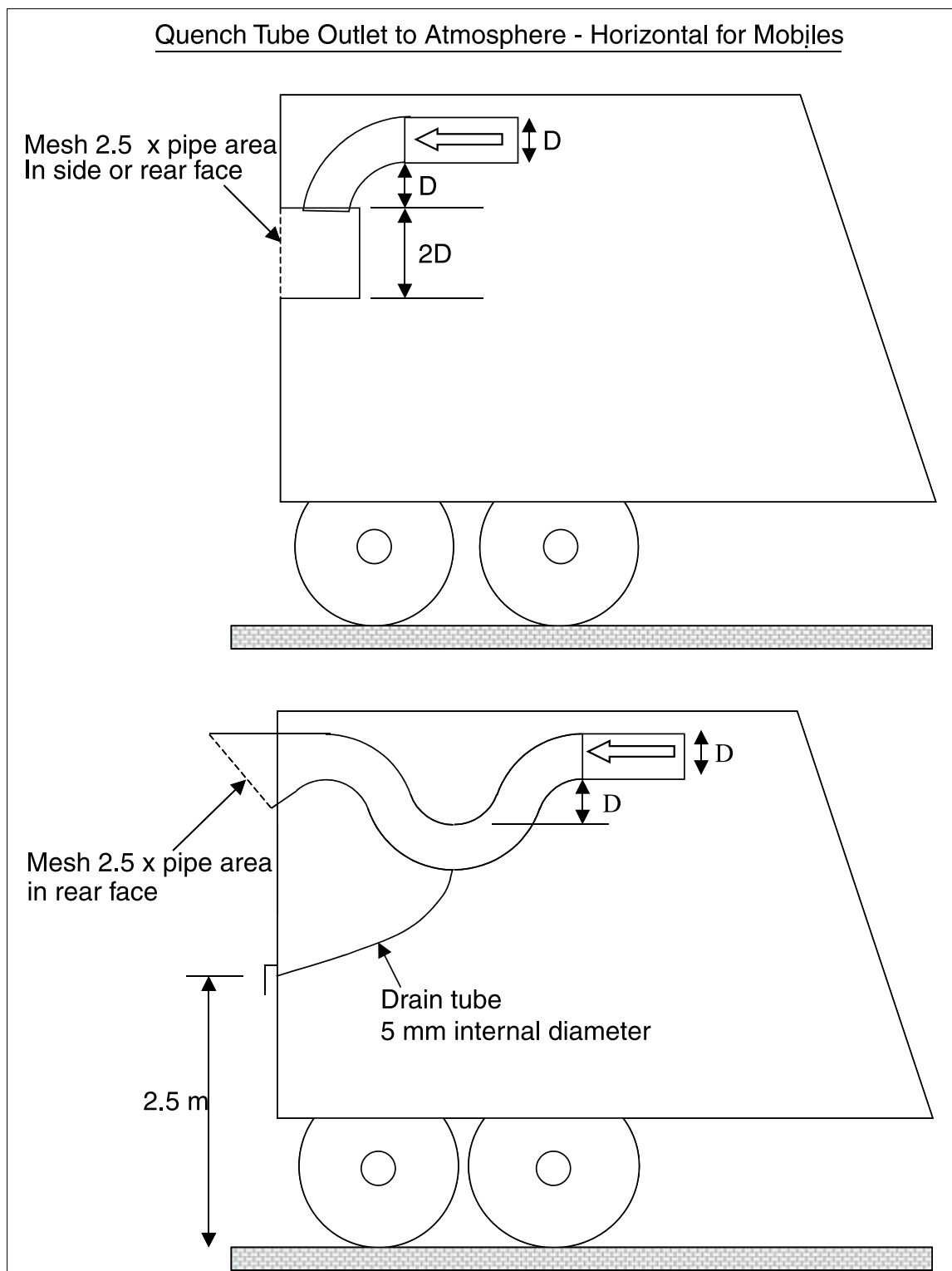


Fig. 128: Example of a mobile quench tube exhaust

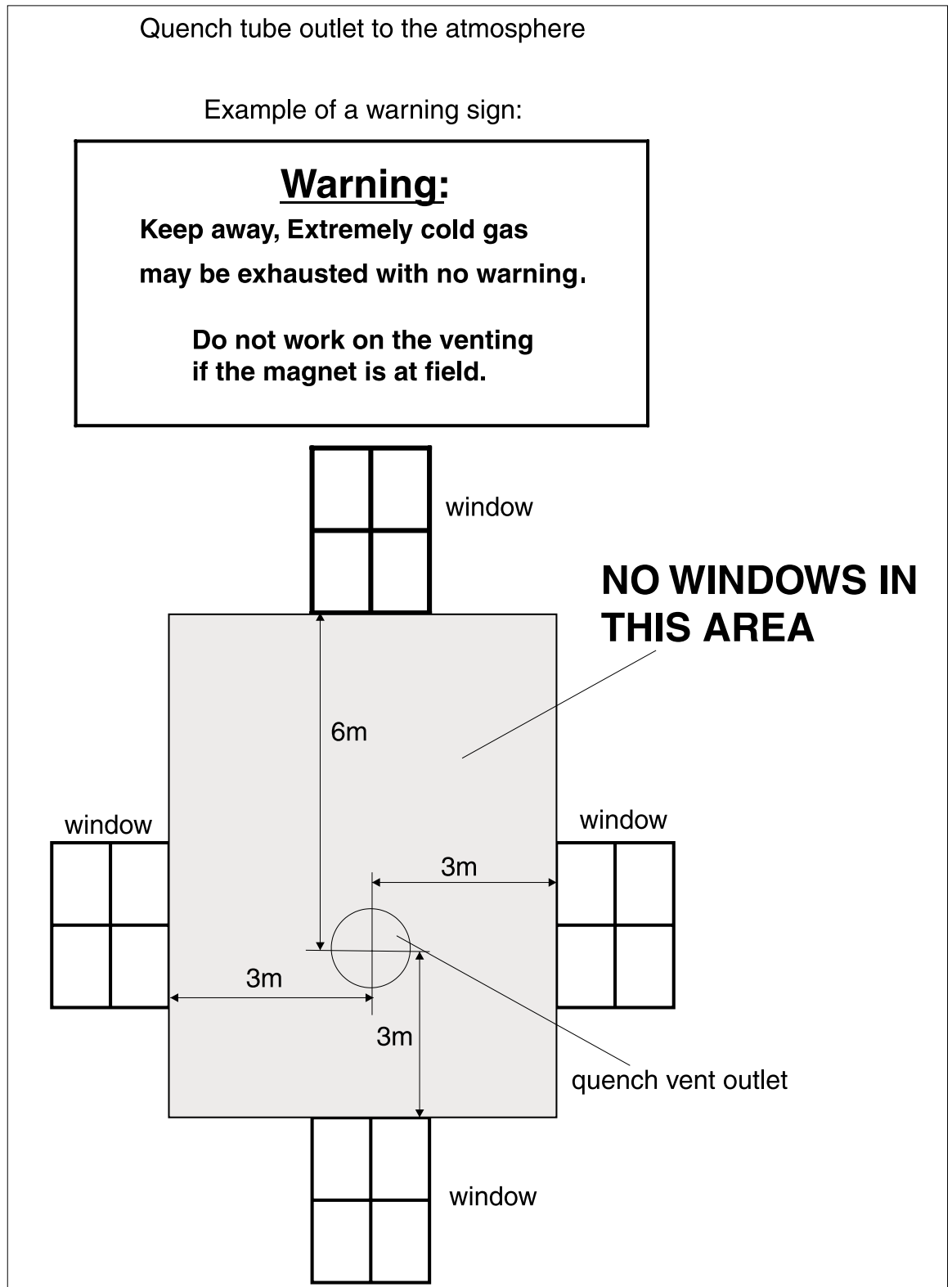


Fig. 129: Example of quench tube venting to the outside

Sizing procedure

The sizing procedure for the quench tube has to follow the steps outlined below.

1. Define the length of the flexible tube to be used (typically 0.5 m). Calculate the share of the maximum permissible length used by the flexible tube.
2. Determine the approximate length of tube required to reach from the flexible tube to the end of the quench tube, where it exits to atmosphere. In terms of the pressure loss along the tube during a quench, the apparent length of the tube is longer due to the extra frictional losses around the bends. As a first approximation, pick a diameter from the table.
3. Lay out line with bend elbows. Check bend radius to diameter ratio for all elbows (Fig. 6, Fig. 7)
4. The apparent length (L_A) is calculated as $L_A = L_1 + L_2 + \dots + L_m + E_1 + E_2 + \dots + E_n$, where $L_{1..m}$ are the straight lengths and $E_{1..n}$ are the effective bend loss lengths from table xxx.
5. Check whether the resulting L_A is within the limit allowed in xxx. If the line is longer than allowed, go to a larger diameter and repeat steps 2, 3 and 4.
6. Determine the correct length for a diffuser, if required.
7. Determine the required size for the protective rain guard.
8. If there is a need to use more than one diameter for the line, use the table and calculate the percentages of the maximum permissible tube lengths for each diameter. The sum of all percentages, including the flexible section at the magnet has to remain **below 100%**.

Quench line elbows

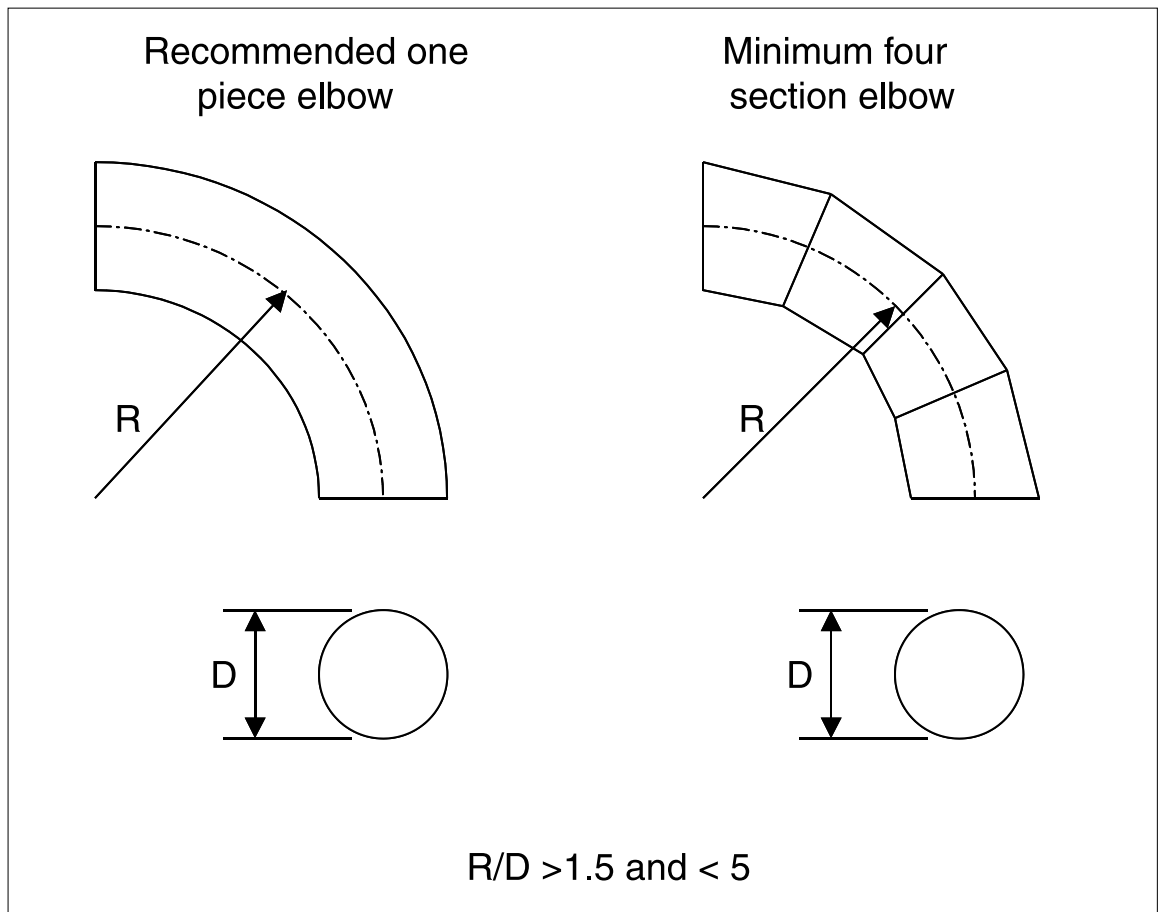


Fig. 130: Quench line elbow types

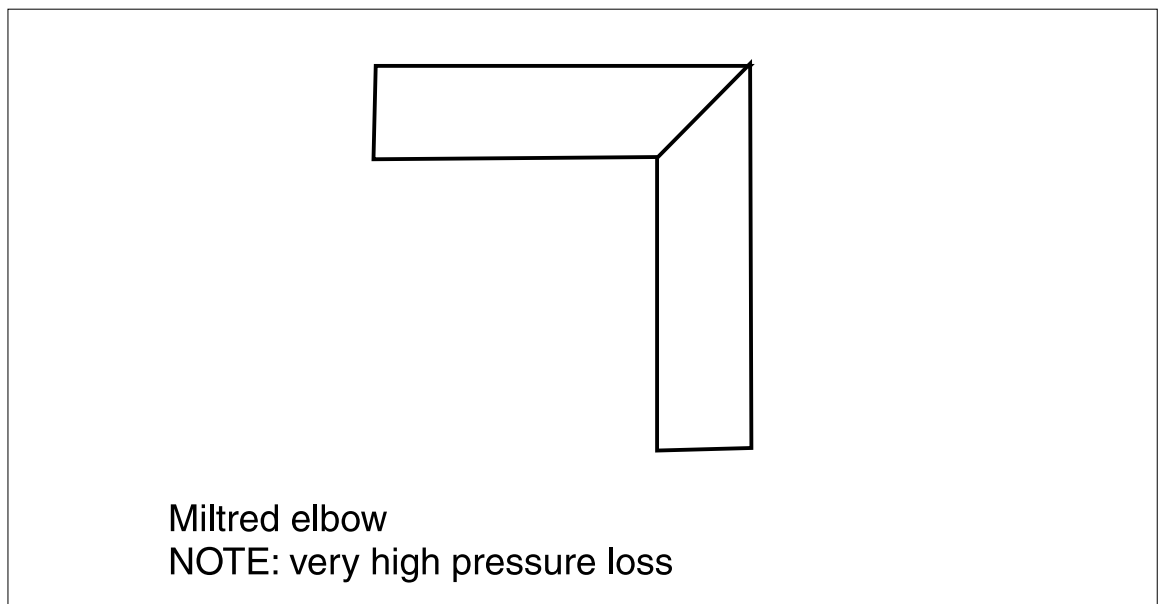
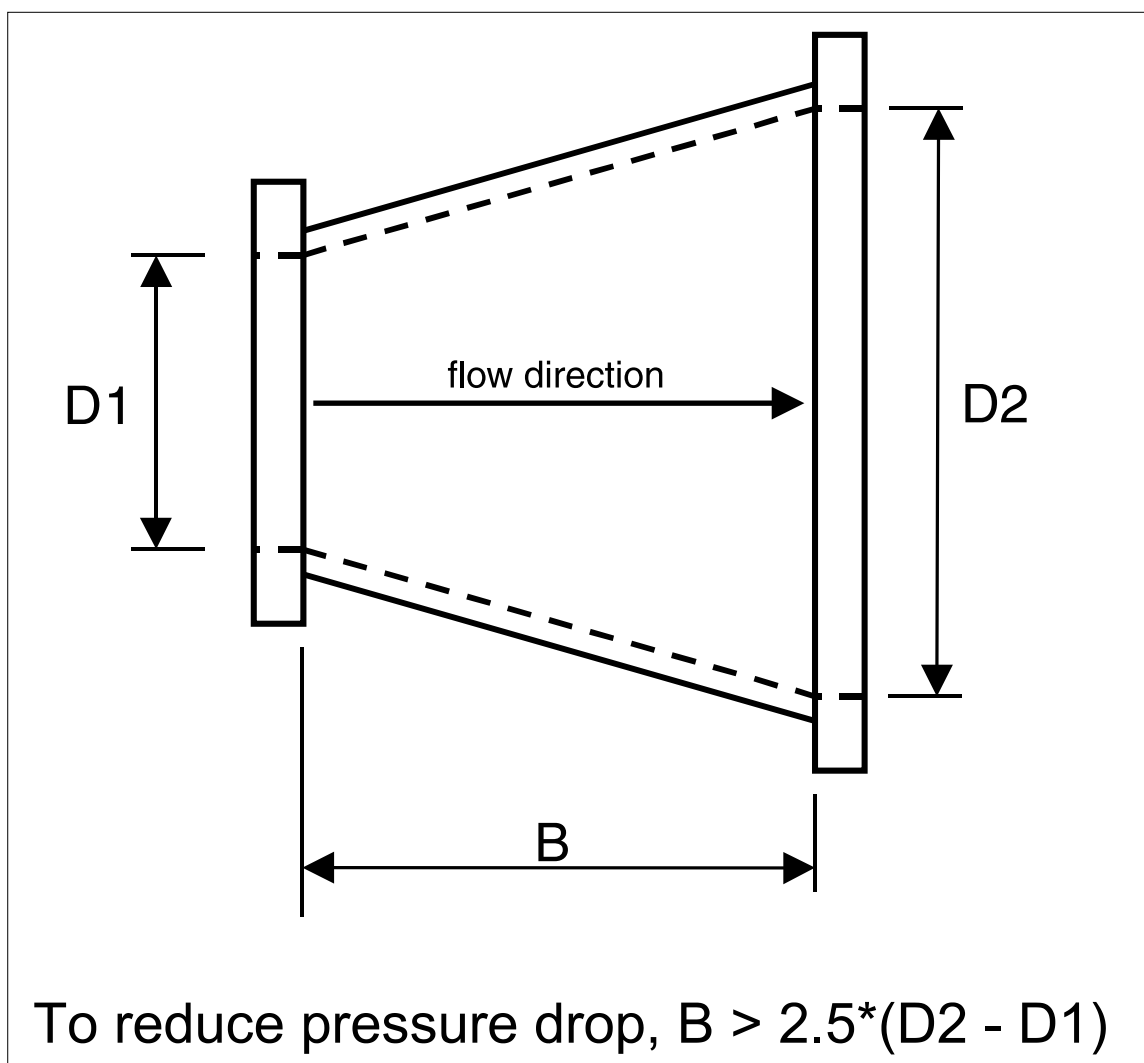


Fig. 131: Mitred elbow

Diffuser

*Fig. 132: Diffuser*

Maximum permissible tube lengths

Smooth pipe

Tab. 25 Maximum permitted tube lengths, smooth pipe

Smooth pipe			
Diameter of pipe		Length of pipe	
m	inches	m	feet
0.102	4	6.72	22
0.127	5	14.4	47
0.152	6	28.0	92
0.178	7	48.9	160
0.203	8	82.2	270
0.229	9	135.9	446
0.254	10	218.5	717

Flexible convoluted tube

Tab. 26 Maximum permitted tube lengths - flexible convoluted tube

Flexible convoluted tube			
Diameter of pipe		Length of pipe	
m	inches	m	feet
0.102	4	1.92	6
0.127	5	4.0	13
0.152	6	7.9	26
0.178	7	15.0	49
0.203	8	27.1	89

Effective length of bends

Tab. 27 Effective length of bends (total frictional loss of board)

EFFECTIVE LENGTH PER ELBOW, meters (m)						
Pipe diameter		90°	45°	90°	45°	90°
meters	inches	smooth	smooth	segmented	segmented	Mitred
0.102	4	1.15	0.75	2.0	1.3	6.7
0.127	5	1.44	0.94	2.5	1.65	8.4
0.152	6	1.73	1.12	3.0	2.0	10.1
0.178	7	2.07	1.35	3.6	2.3	11.8
0.203	8	2.42	1.57	4.2	2.73	13.4
0.229	9	2.65	1.73	4.6	3.0	15.4
0.254	10	2.94	1.91	5.1	3.32	16.9

NOTE

Interpolate for values between 0° - 45° and 45° - 90°.

Data to be used only for bends where R/D is in the range 1.5 to 5.0, except for right angle mitred joints.

One quench valve elbow (the 90° bend delivered as part of the magnet) could be used and is accounted for in these calculations. Note that a second quench valve elbow would take 25% of the maximum permissible length.

Quench tube sizing example

It has been determined that the quench tube needs to be approximately **12 meters** in length. The tube includes two elbows. A 0.102 m (4") flexible tube of length $L_f = 0.5$ m connects the quench tube to the outlet of the quench valve (Fig. 9).

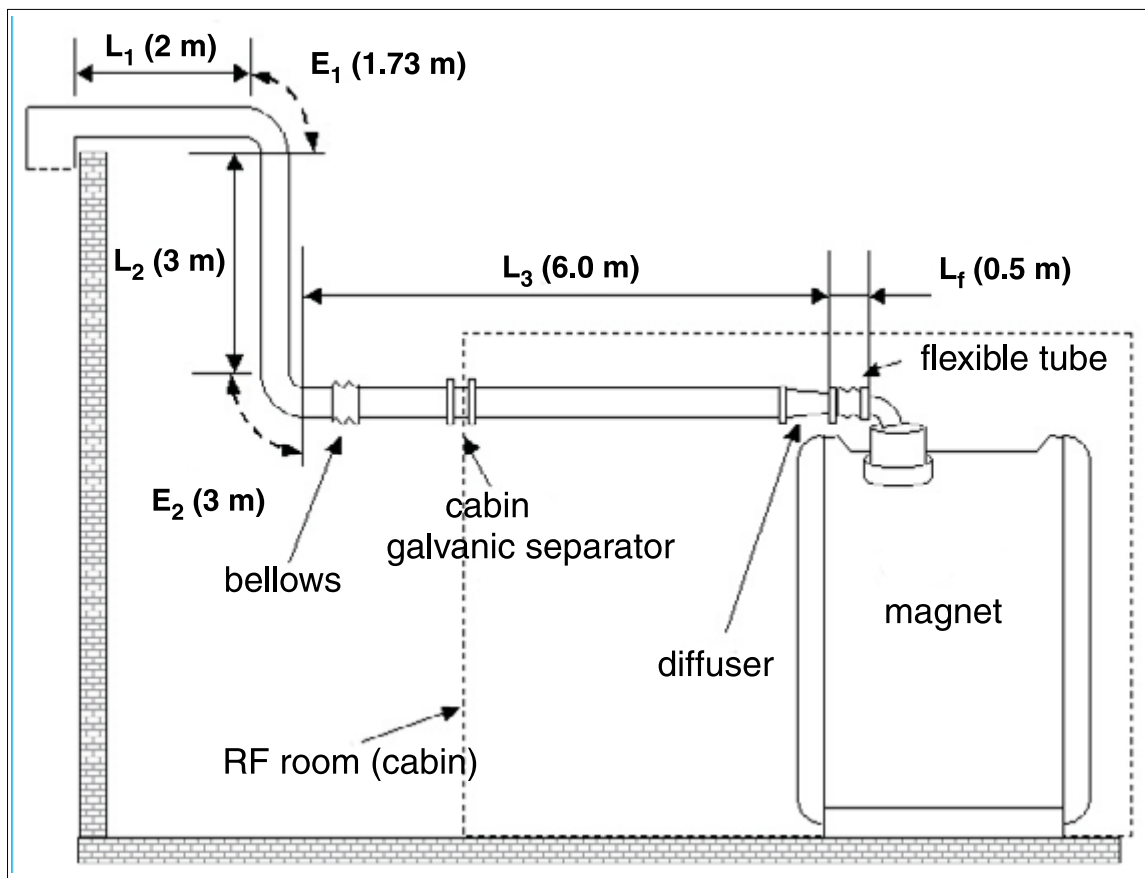


Fig. 133: Principle layout of a quench tube, example 1

DEFINITIONS:

$L_1 \dots L_m$	Straight section length
$E_1 \dots E_n$	Effective length per elbow

1. Considering a permissible length of 0.102 m (4"), the flexible tube is 1.92 m.
A 0.5 m long tube accounts for $0.5\text{m}/1.92\text{m} = 26\%$ of the total permissible length.
2. The required 12 meters of the quench tube should not exceed the remaining 74% of the total permissible length. Take $12\text{ m} * 100\% / 74\% = 16.2\text{ m}$. From select a diameter for the tube that will contain the length required. In this case 0.52 m (6") results in a maximum permissible length of 28 meters.

3. Check if the bend radius to diameter ratio is larger than 1.5 (Fig. 6).

A commercially available smooth-walled elbow has an R/D ratio of 2.

It can be used for bend 1. It is necessary to use a tighter elbow for bend 2.

Since a one-piece pipe is not available, it is decided to use a 5 segment fabricated pipe where R/D = 1.5. The effective lengths are taken from xxx.

Section	Effective length in m
1	2.00
2	3.00
3	6.00
Elbow 1	1.73
Elbow 2	3.00
Total	15.73

4. Determine apparent length L_A .

$$L_A = L_1 + E_1 + L_2 + E_2 + L_3 =$$

$$= 2 + 1.73 + 3 + 3 + 6 =$$

$$= 15.73 \text{ m}$$

(* : taken from)

5. The apparent length of 15.73 m should take less than 74% of the permissible length. Take $15.73 \text{ m} \times 100\% / 74\% = 21.26 \text{ m}$. This is less than the maximum permissible length of 28 m. The pipe size selected is acceptable.
6. A diffuser is required to connect the 0.102 m outlet on the quench valve to the 0.152 m ID pipe. From Fig. 8 the length of the diffuser is 0.128 m min. The longer the diffuser the better in this instance. Since space permits, a 1 meter long diffuser is used. It is acceptable to count the diffuser length to the straight length.
7. A horizontal outlet is chosen. For dimensions, refer to Fig. 10

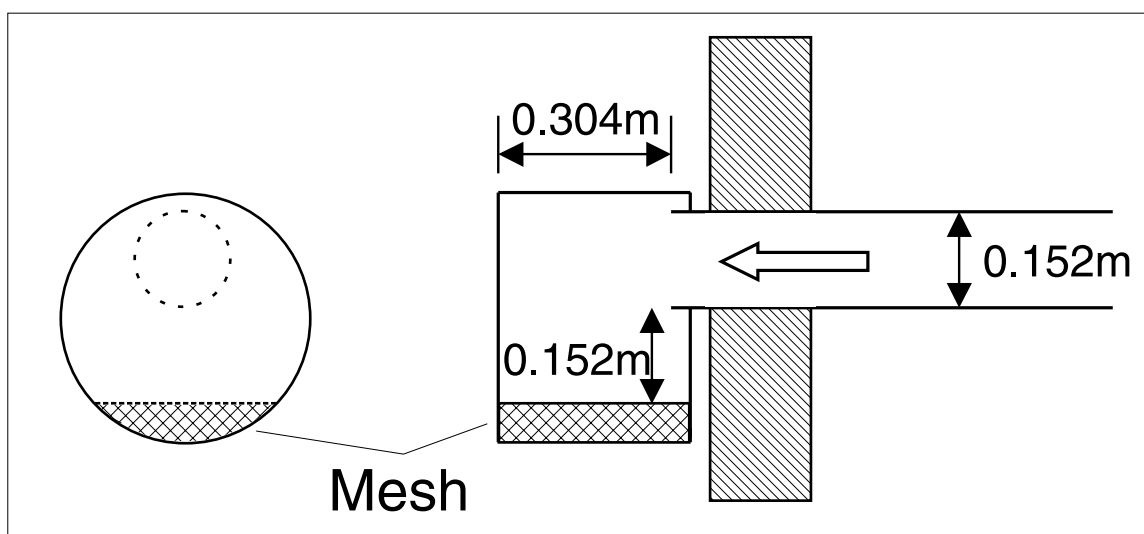


Fig. 134: Principle layout of a quench tube outlet

8. The total percentage used so far is $15.73\text{m}/28\text{m} + 0.5\text{m}/1.92\text{m} = 56\% + 26\% = 82\%$.
Any additional length tubing may use only the remaining 18% of its permissible length.

Galvanic separation

Galvanic separation has to be installed to avoid electrical noise being picked up by loops between the magnet, the quench tube, the RF room, and the building.

It is necessary to have one galvanic separation of the quench tube inside and one outside of the RF room.

The sketch below (Fig. 11) shows the installation parts to be used for galvanic separation.

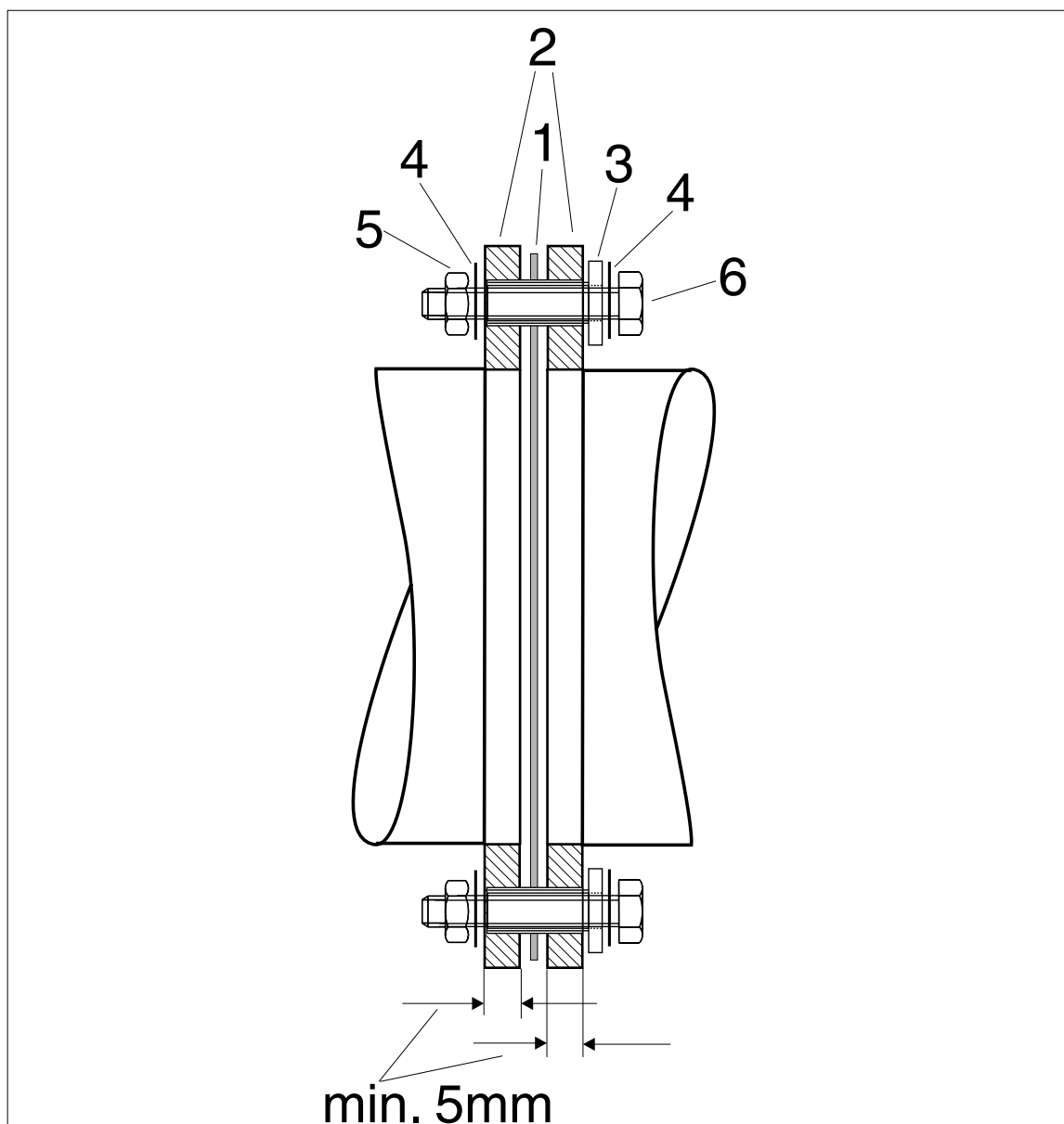


Fig. 135: Galvanic separation

1. Gasket	4. Stainless steel spring washer
-----------	----------------------------------

2. Stainless steel flange	5. Stainless steel locking nut
3. UHWPE bushing	6. Stainless steel screw

Quench tube - RF room feed-through

- ⇒ To guarantee RF integrity, the RF room feed-through needs to conform to certain geometric constraints.
- ⇒ As a function of the inner pipe diameter d_i the following applies to the minimum pipe length L_{min} for frequencies up to 128 MHz and 110 dB attenuation:

$$L_{min} = 4.0 \times d_i$$

Fig. 136:

whereby: $d_i \leq 300 \text{ mm}$

- Bolts are placed at a maximum distance of 30 mm to ensure RF shielding.
- Depending on RF room designs, RF seals may be required between the mounting flange and the RF room.

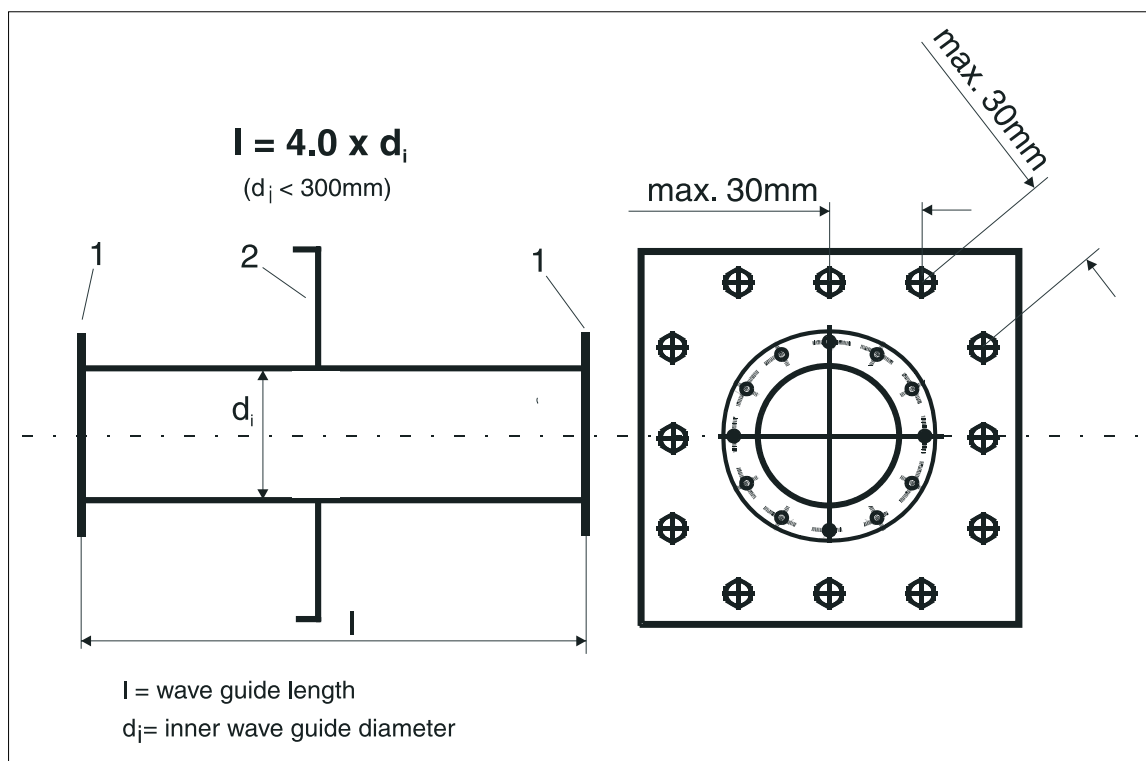


Fig. 137: RF wave guide

1. Connection flange	2. Connection plate to the RF room
----------------------	------------------------------------

Quench tube sketch

Horizontal

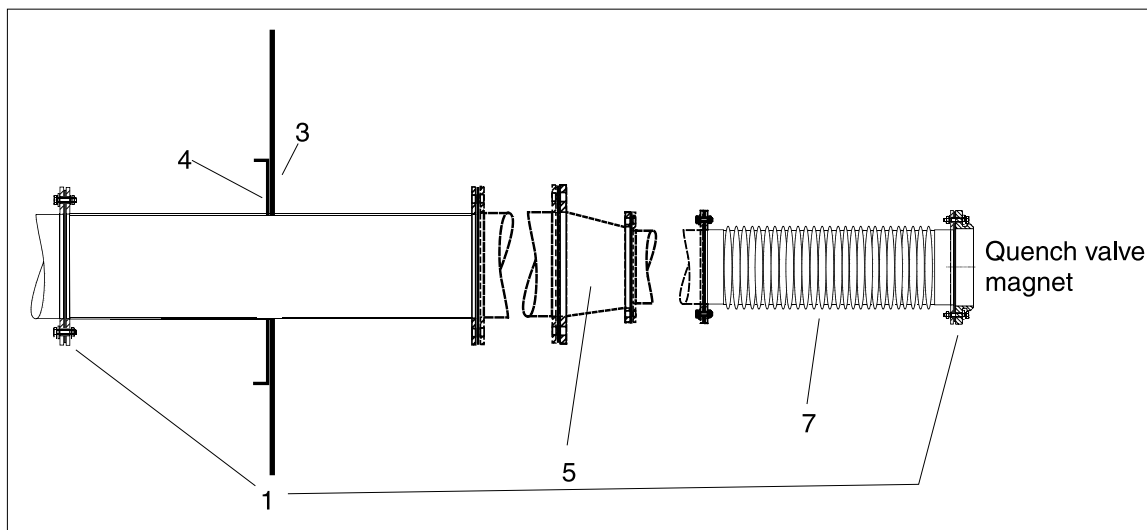


Fig. 138: Quench tube, example of horizontal bellows and cabin feed-through

1. Galvanic separation	5. Diffuser (optional)
2. RF feed-through	6. Flange (e.g., welded, screw connection)
3. RF room	7. Flexible tube
4. Connection to RF room	

Vertical

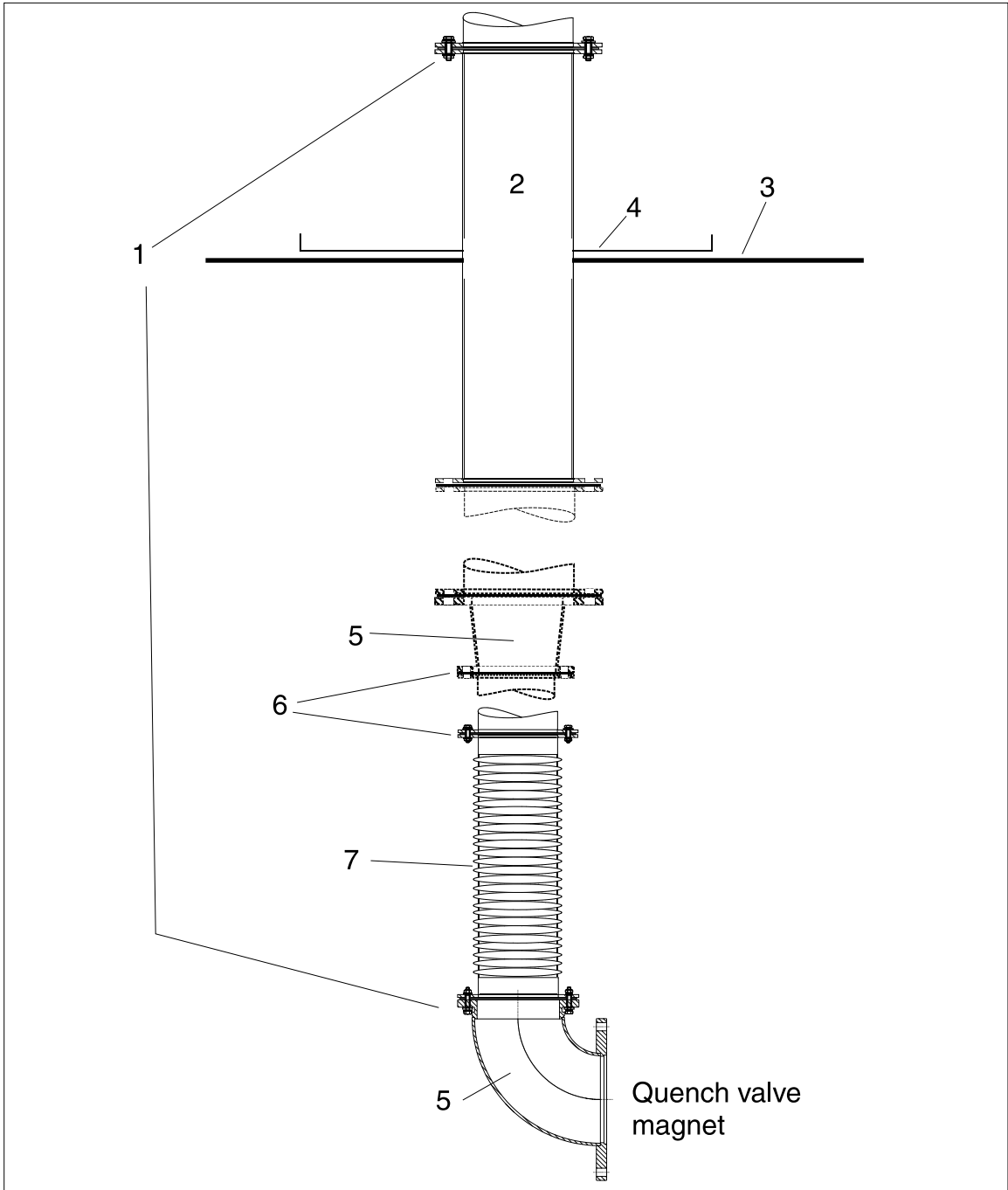


Fig. 139: Quench tube, example of vertical bellows and cabin feed-through

1. Galvanic separation	6. Flange (e.g., welded, screw connection)
2. RF feed-through	7. Flexible tube
3. RF room	
4. Connection to RF room	
5. Diffuser (optional)	

90° bend and flexible tube

The 90° bend and the flexible tube are part of the magnet delivery.

90° bend

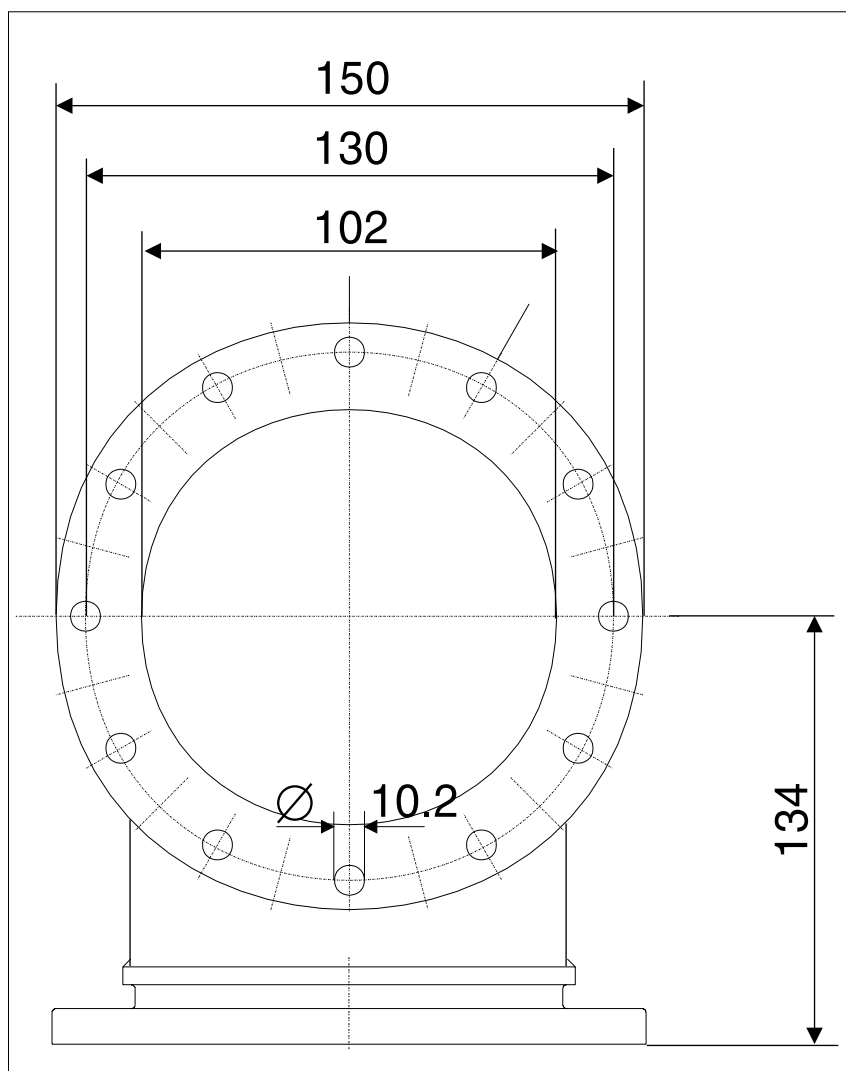


Fig. 140: 90° elbow

Flexible tube

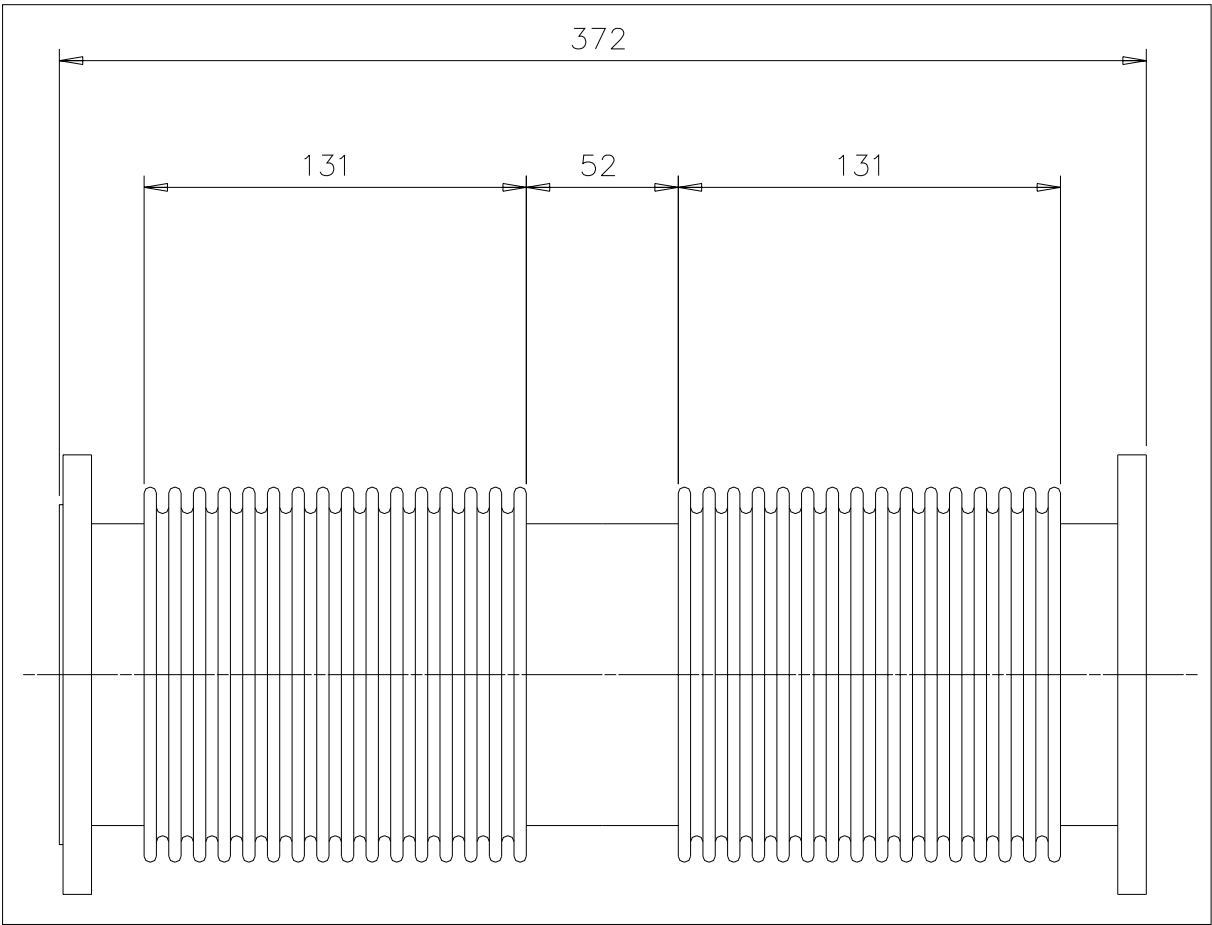


Fig. 141: Compensator_2

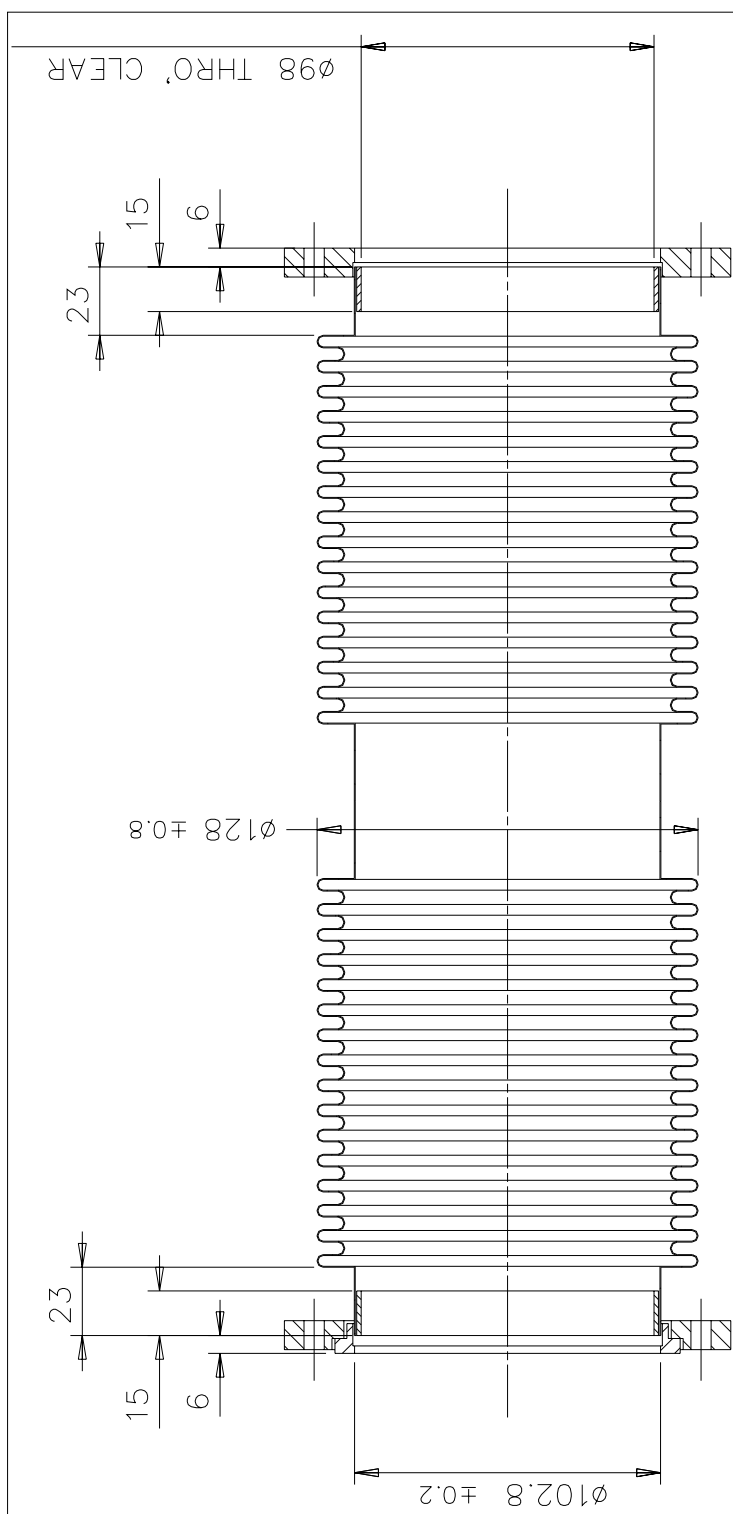


Fig. 142: Compensator_1

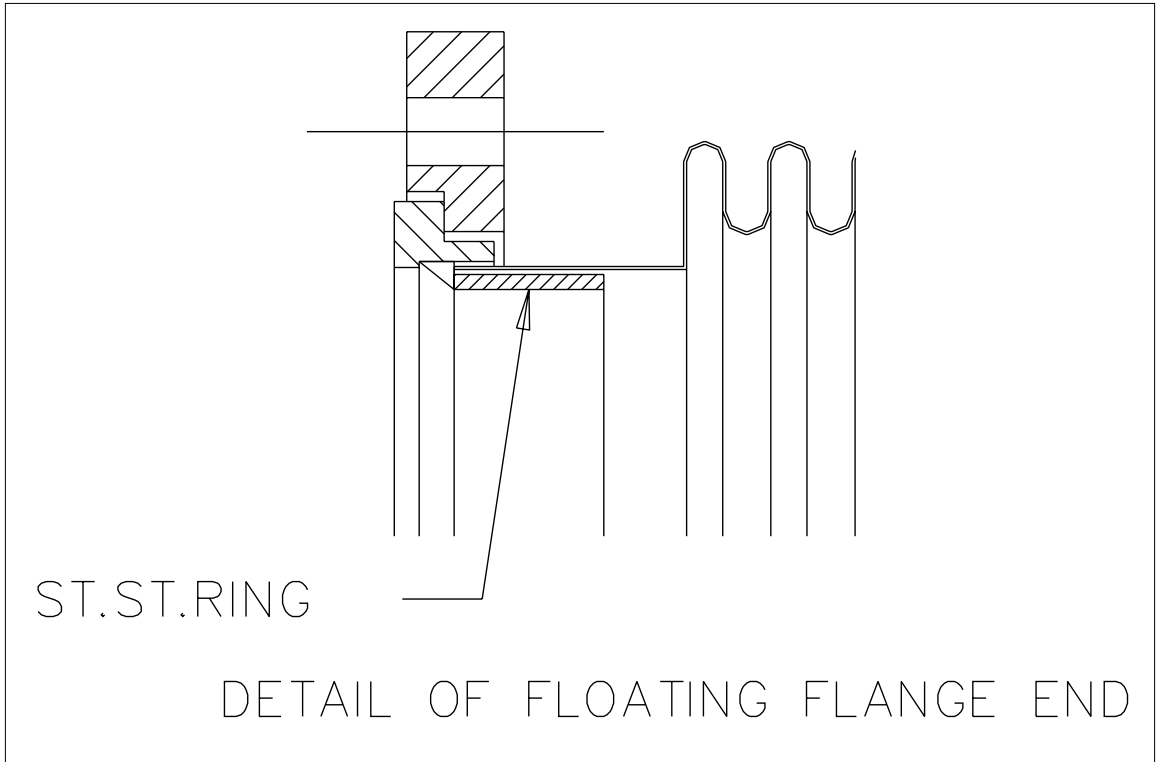


Fig. 143: Detail of Quench Vent connection side

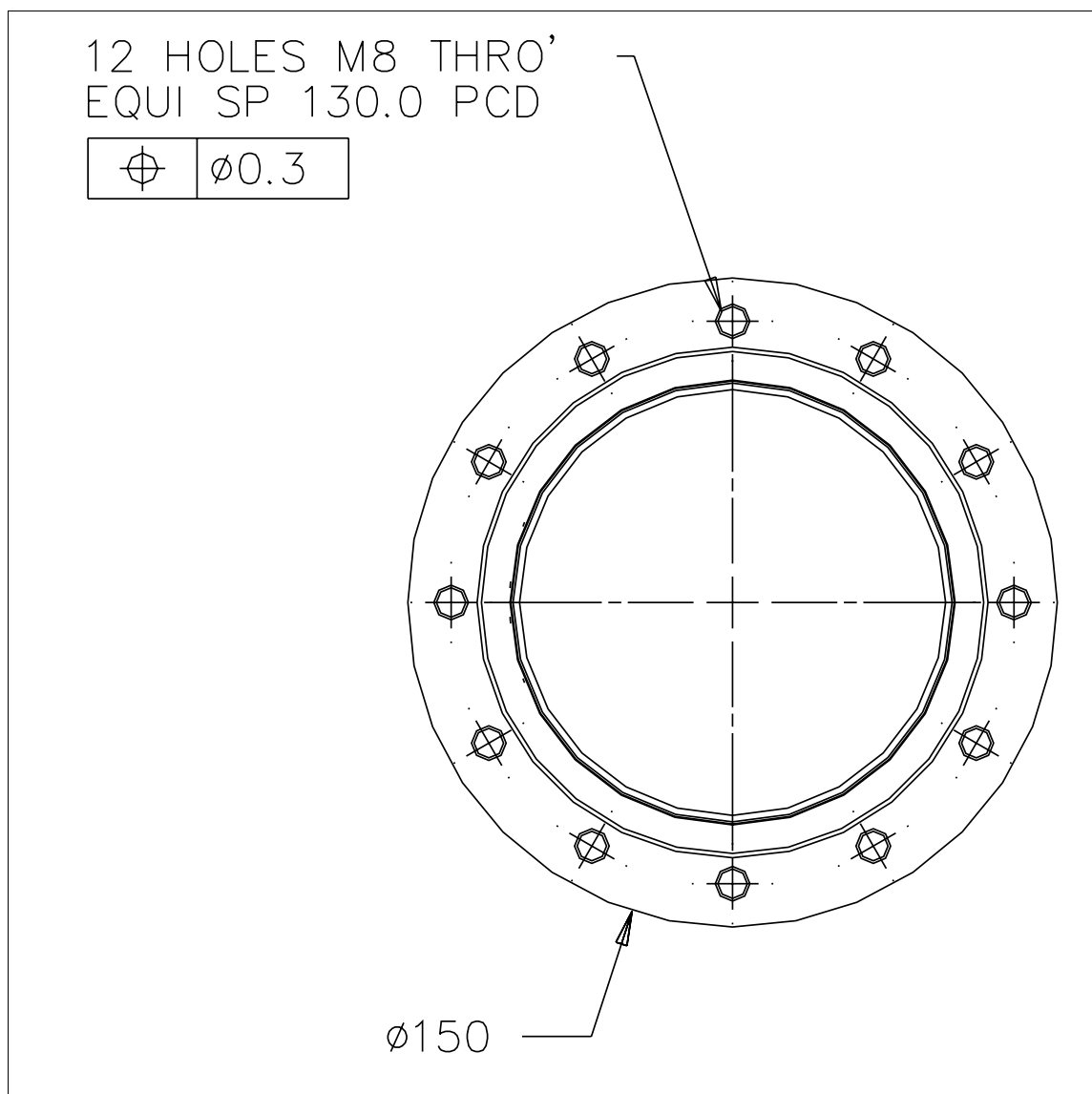


Fig. 144: Quench Vent connection side flange

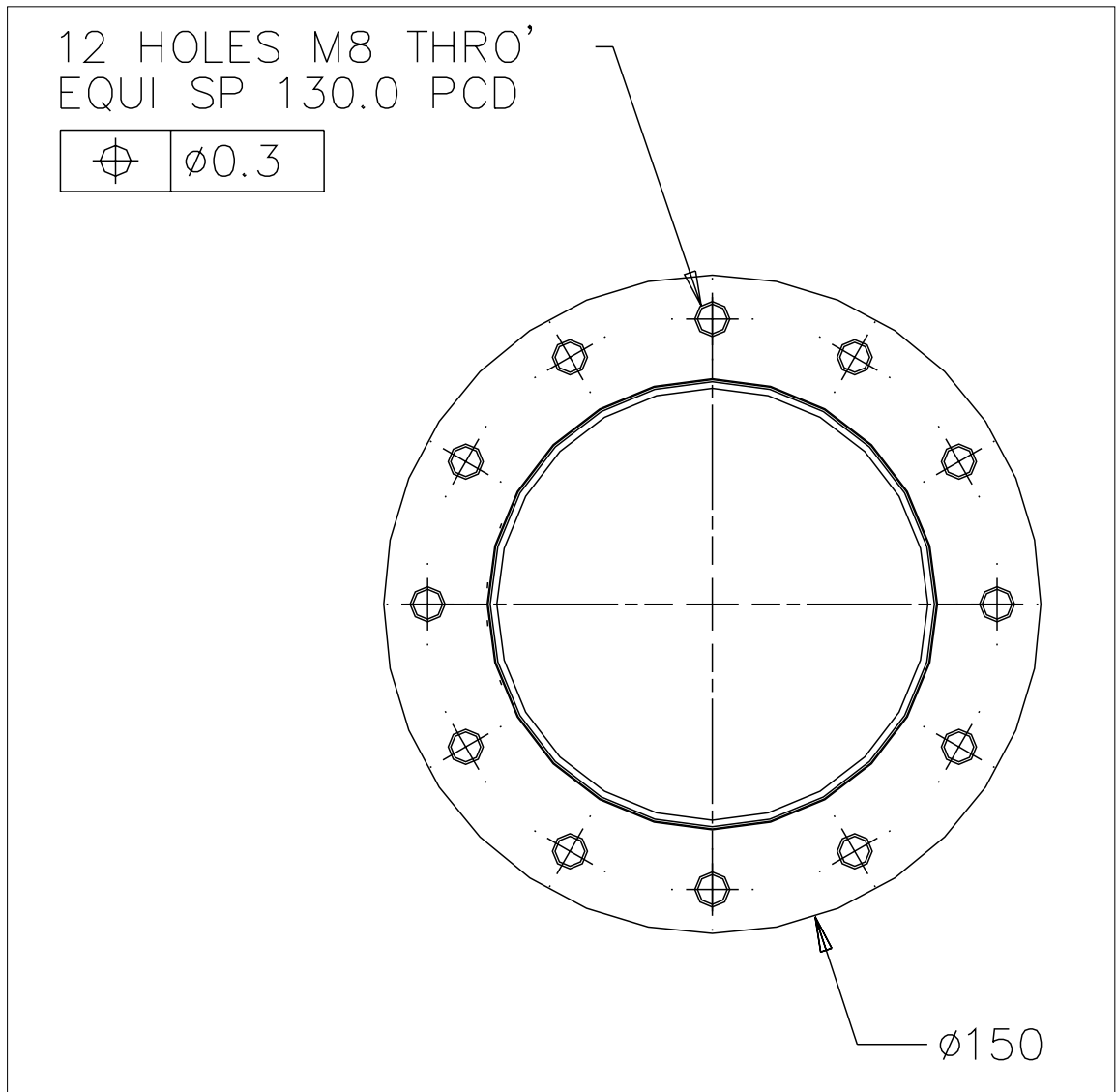


Fig. 145: 90° Elbow; 45° knee connection flange

Checklist

Fill out this checklist as required.

This checklist is the acceptance protocol for the mechanical installation of the quench tube.

NOTE

A copy of this checklist has to be filed in the “System Owner manual” and project-related customer documentation.

Customer-related information		
Customer / hospital Name:		
Street:		
City:		
Country:		
System-related information		
System type		
Magnet serial no.:		
System serial no.:		
Installation date:		
RF room manufacturer:		
Quench tube manufacturer:		
Checklist		
The following components of the quench tube installation apply to the guidelines:	o.k.	not o.k.
Used quench tube connections (welded or screw flange)		
Material used as required		
Quench tube diameter ¹		
Quench tube length ²		
Rain guard installed		
Quench tube exit surface is 2.5 times of the last quench tube diameter		
Mesh size as required		

Warning sign installed		
Thermal insulation of the quench tube installed		
Comments		
Project manager		
Print name	Signature	Date
	Quench tube manufacturer	
The quench tube is installed as per quench tube installation required.		
Print name	Signature	Date

1. The quench tube diameter in reference to the quench tube length.
2. The quench tube length in regard to the elbows and quench tube length used.

Additional information

NOTE

The quench vent insulation used in the area of the magnet top cover must not touch the cover. The diameter of the insulation used has to fit the magnet top cover area without touching the cover.

General

For satisfactory operation of the MR system, liquid as well as gaseous helium is required.

Based on the physical characteristics and the price of liquid helium, the cryogen has to be handled according to the special instructions provided in the subsequent pages.

As early as in the planning phase, the structural and logistic aspects of gas supply for the MR system have to be established.

The liquid helium is transported in containers especially designed for this purpose (dewars).

NOTE

High priority must be given to preparing the site for a trouble-free reading!

This means ensuring that the system components can be installed and connected as soon as possible to reduce the amount of liquid helium boil-off during the installation process.

NOTE

Every reputable supplier provides liquid helium dewars of non-magnetizable material. However, cylinders for gaseous helium are usually made from magnetic material. These cylinders must remain outside the vicinity of the magnet when it is energized.

Structural requirements

Since the vessel dimensions for liquid and gaseous helium must meet certain specifications, the following issues have to be clarified with the supplier prior to delivery:

1. Access routes
2. Width of doors
3. Size of elevators
4. Height of rooms and hallways
5. Temporary and permanent storage area for gas cylinders
6. Load capacity and condition of transport routes

NOTE

To move the helium dewars into the MR suite, evaluate the height and width of all access routes and doorways during the planning phase.

Transport methods for helium

Liquid helium is transported from the supplier to the magnet in dewars holding between 100 to 450 liters of liquid helium. The dewars are transported in special trucks equipped with an elevator platform. Special containers are available for air-freighting liquid helium.

Dimensions of the dewars

After the transport routes have been determined, the dewars and the refill equipment required have to be established.

The following items require clarification:

1. Dimension and fill capacity of dewars?
2. Pressurized or non-pressurized dewar?
3. Supplier provides a full set of refill equipment?
4. The syphon attaches to the magnet?

The following suppliers provide a full set of refill equipment:

- Linde AG
- Messergriesheim GmbH
- Air Products GmbH

Delivery of magnet

The magnet is shipped cold (standard case).

NOTE

Magnets that are shipped cold leave the factory with a fill level of approx. 78%. This will allow for approx. 23 days from shipping the system ex-factory to the next required LHe refill.

To keep helium boil-off to a minimum, the refrigerator (cold head) should be put in operation as soon as the magnet arrives at the site.

Boil-off rate and helium level for the OR122 magnet

Before the magnet is installed or energized, the helium level is measured with the helium service level meter.

Helium content

Helium content		
Magnet type	liters at 100%	liters at 30%
OR 122	980 l	327 l

Liquid helium weight			
1 liter lHe	at -269°C	at 1.013 bar	= 125g/l (125kg/m ³)
980 l lHe			= 122.5kg

Boil-off rate

NOTE

The helium content for shipment is typically app. 78%.
This gives a time to dry of app. 23 days!

Time to dry (35K heating):	
Liquid helium content in	time to dry in days
95%	26.5
78%	23

Helium loss without cold head running		
Shipping loss rate	~ 6.3% / 24h	~ 63l
On site loss rate	~ 4.6% / 24h	~ 46l

- With cold head in operation, approx. 0.0%
- Without cold head approx. 4.6% / day
- 1% lHe level equals approx. 10 liter lHe

Helium boil-off		
Magnet type	Refill interval (typical)	Boil off rate (typical)
1.5T OR 122	10 years ¹	0.01 l/h ²

1. For typical clinical use, depending on sequences and operating time.
2. For typical clinical use, depending on sequences and operating time.

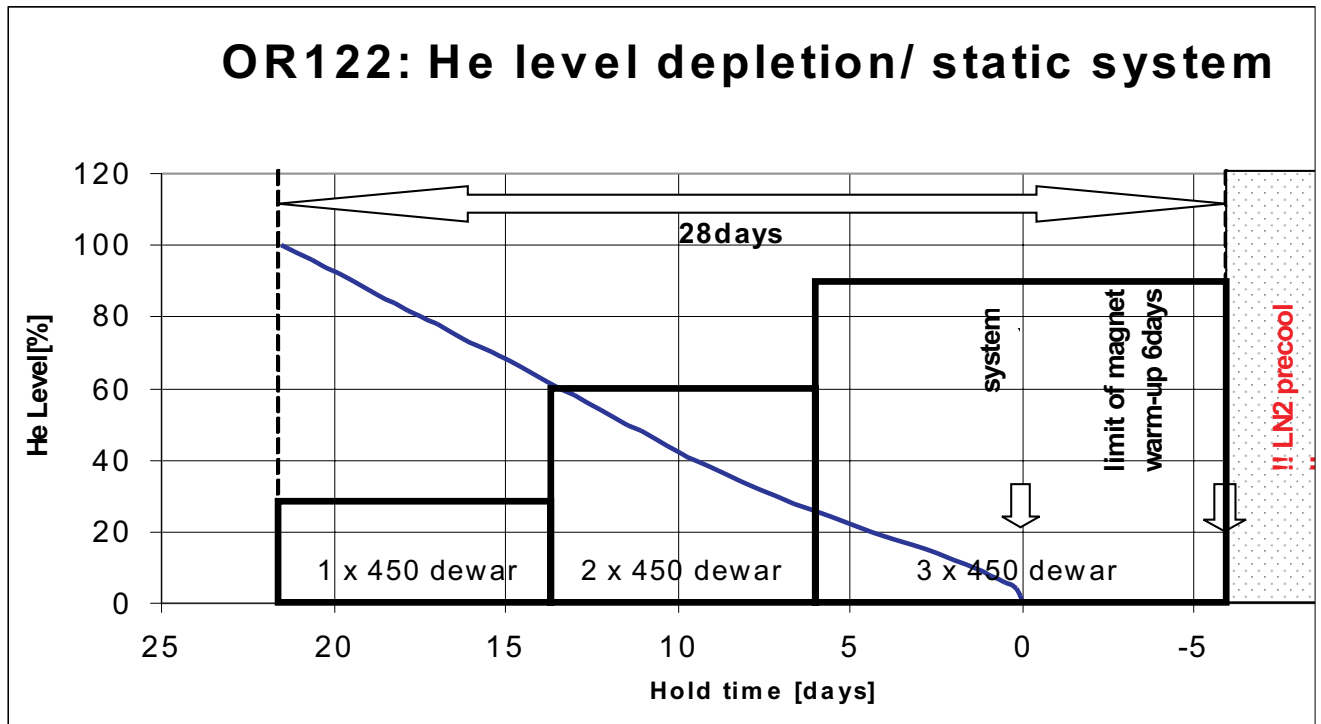


Fig. 146: Liquid Helium Hold Time

General

NOTE

**All available options are published in the Price Book.
Refer to the Price Book for detailed order informations.**

MRSC / Leonardo workstation

NOTE

For the option MRSC or Leonardo Workstation, an on-site power outlet has to be provided in the close vicinity of the final location of the MRSC console. See also [\(On-site electrical installation / p. 130\)](#).

NOTE

If the control room is used as a patient preparation room and the MRSC is located in this room, for safety reasons it should not be possible for the patient or other personnel, who are not members of the operator team, to reach the MRSC console within 1.5 m.

NOTE

The free cable length between MRC and MRSC is 90.0 m. (Ethernet connection)

Power requirements

- ⇒ For customer options use the same specifications as for the MRSC console. The power connections for the MRSC console components are to be provided on-site.

MRSC power outlet specifications (on-site)		
	Nominal value	Tolerance
Voltage	115/230 V	+10% / -14% (for all line and load conditions)
Line to line unbalanced	--	max. 2%
Frequency	50/60 Hz	+/-1 Hz
Power consumption	1.8 kVA	

NOTE

The power connection for the MRSC cannot be connected to the MRC line distribution or the ACC cabinet.

The power supply for the MRSC and other customer related devices have to be provided on-site. It is not possible to connect the above mentioned devices to our built-in power distribution for the MRC console.

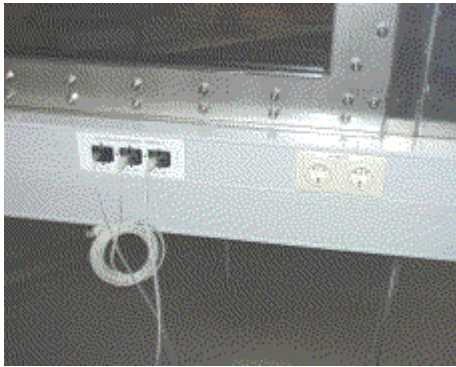


Fig. 147: Power outlet

In-room MRC

Functionality

Trackball-only driven operation and evaluation console, placed in the examination room close to the patient. Operates in parallel to the MR main console

The In-Room MRC provides the same NUMARIS operating user interface as the main-MRC and runs parallel to it. The removeable trolley allows the In-Room MRC to be freely-positioned in the examination room. It is used in MR guided interventional procedures and for MR guided biopsies. The In-Room MRC enables visualisation of the user interface (measurement parameters), images with the biopsy needle next to the patient and allows control of start of measurment without the need to get out of the examination room. All necessary display and measurement functions are started via the In-Room MRC mouse. The video signal from the graphic board is split via the video distributor on the Inroom LCD Display and th MRC Flatscreen. Both monitors have the same resolution and simultaneously display the same image.

Component

Technical data	
Weight	≤ 63 kg
Height	
Width	
Depth	

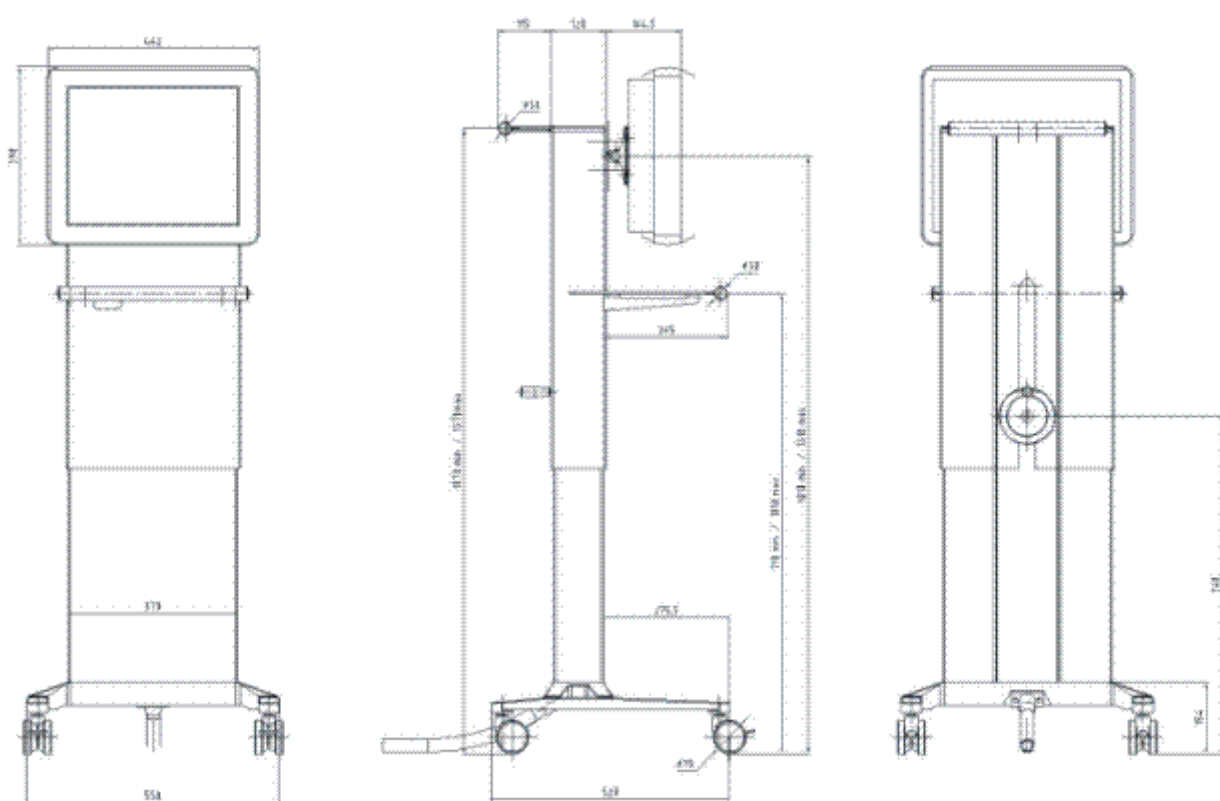


Fig. 148: In-Room MRC

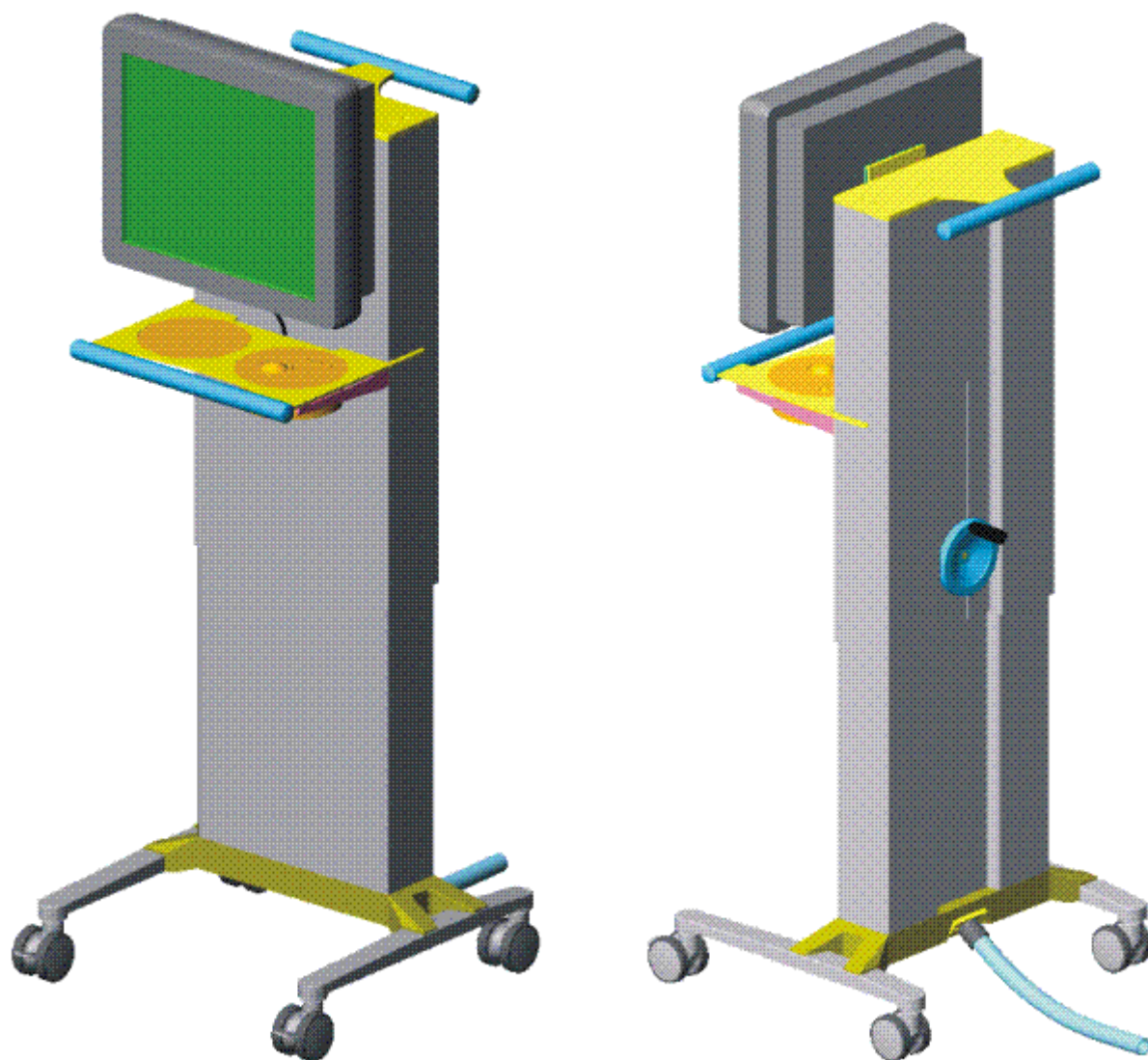


Fig. 149: In-Room MRC view

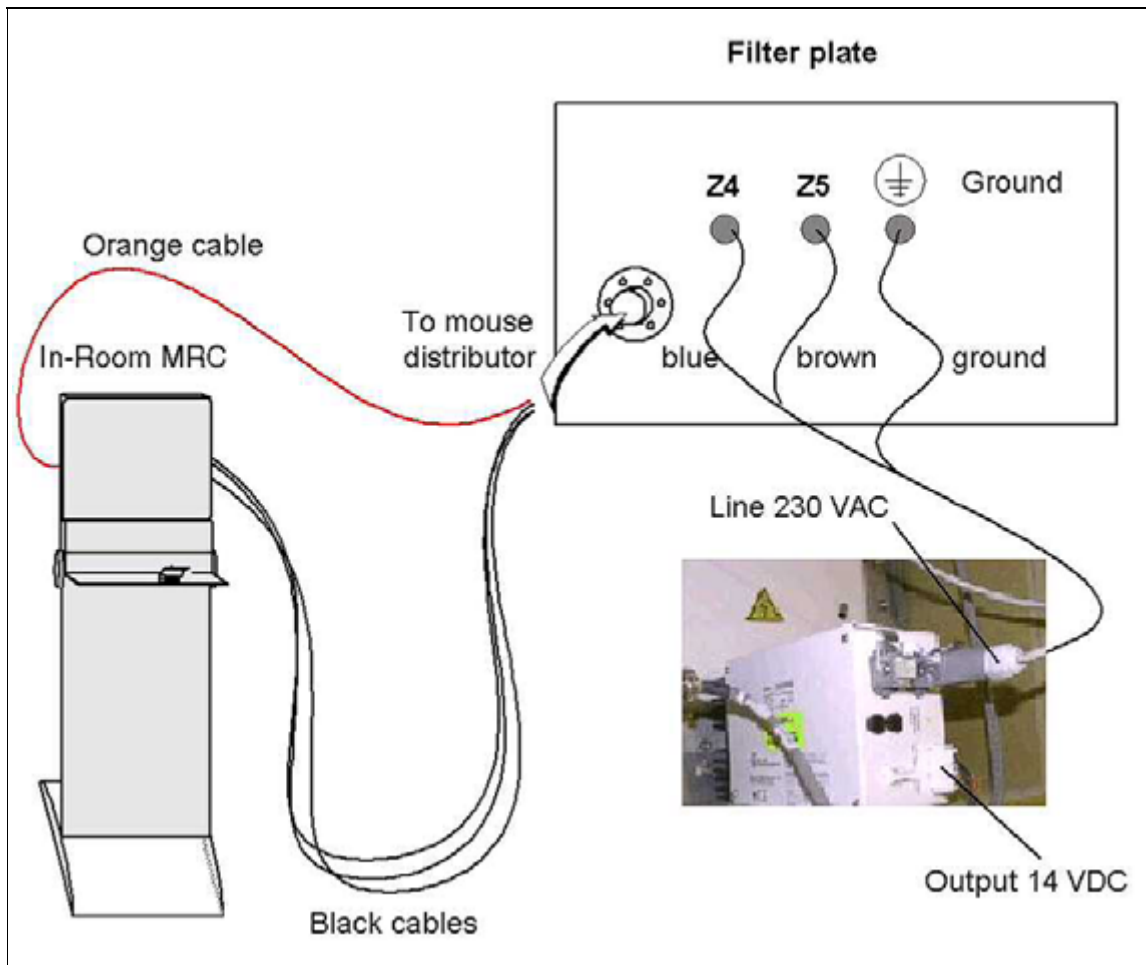


Fig. 150: Connecting the cables at the filter plate

For planning purposes, the following are important:

If the In-room MRC is installed, install the transformer at the RF filter plate inside the examination room. A special position is prepared at the RF filter plate. The RF filter plate already includes the necessary bolts. The RF filter to be used are Z30/Z31.

If for any reasons (e.g., sound reduction, thick wall), the cut-out in the wall/sound reduction construction for the filter plate is exactly the same dimensions as the outer dimensions of the filter plate, do not mount the transformer to the filter plate!

In this case, the transformer has to be mounted in close vicinity of the RF filter of the filter plate. The cable length is 700 mm.

- RF filter plate
- Sound reduction and/or wall
- Transformer
- Power cable

Foot switch

Functionality

Used to start and stop preprogrammed sequences directly at the patient table. Suited for sequence control during intra-operative MR examinations.

The push-button does not contain any electronics. It transmits signals to a converter via air pressure.

Components

The footswitch consists of two components:

- Footswitch (kneeling chair, optional)

The footswitch is located in the RF room. It has two buttons: "Start" and "Stop". The signals are transmitted pneumatically to the converter via two air hoses.

- Signal converter

The converter is located in back of the MR operating console. It converts the pneumatic signals of the footswitch or kneeling chair into electrical signals that are transmitted to the host computer via a RS232 interface and the adapter card.

Contents of the kit

- Footswitch (kneeling chair optional)
- Signal converter
- Hose assembly, 35 m
- RS232 interface cable
- Accessories (mounting material, power cable, connector, feed-through plate)

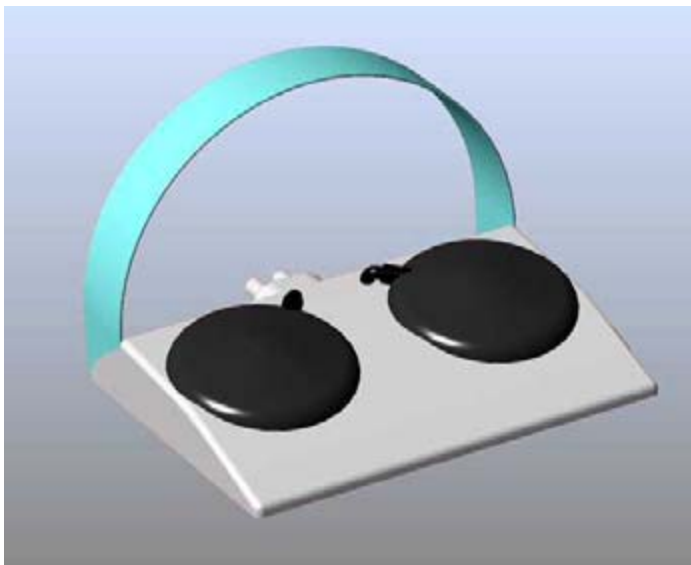


Fig. 151: Footswitch

The footswitch is located inside the examination room.

The connections of the footswitch are fed through the filter plate. The required adapter is part of the delivery volume.



Fig. 152: Converter

The signal convertor has to be mounted in close vicinity of the electronics components of the console.



Fig. 153: Feed-through plate

The feed-through has to be mounted to the filter plate. Therefore, a blind plate has to be removed.

Additional monitor

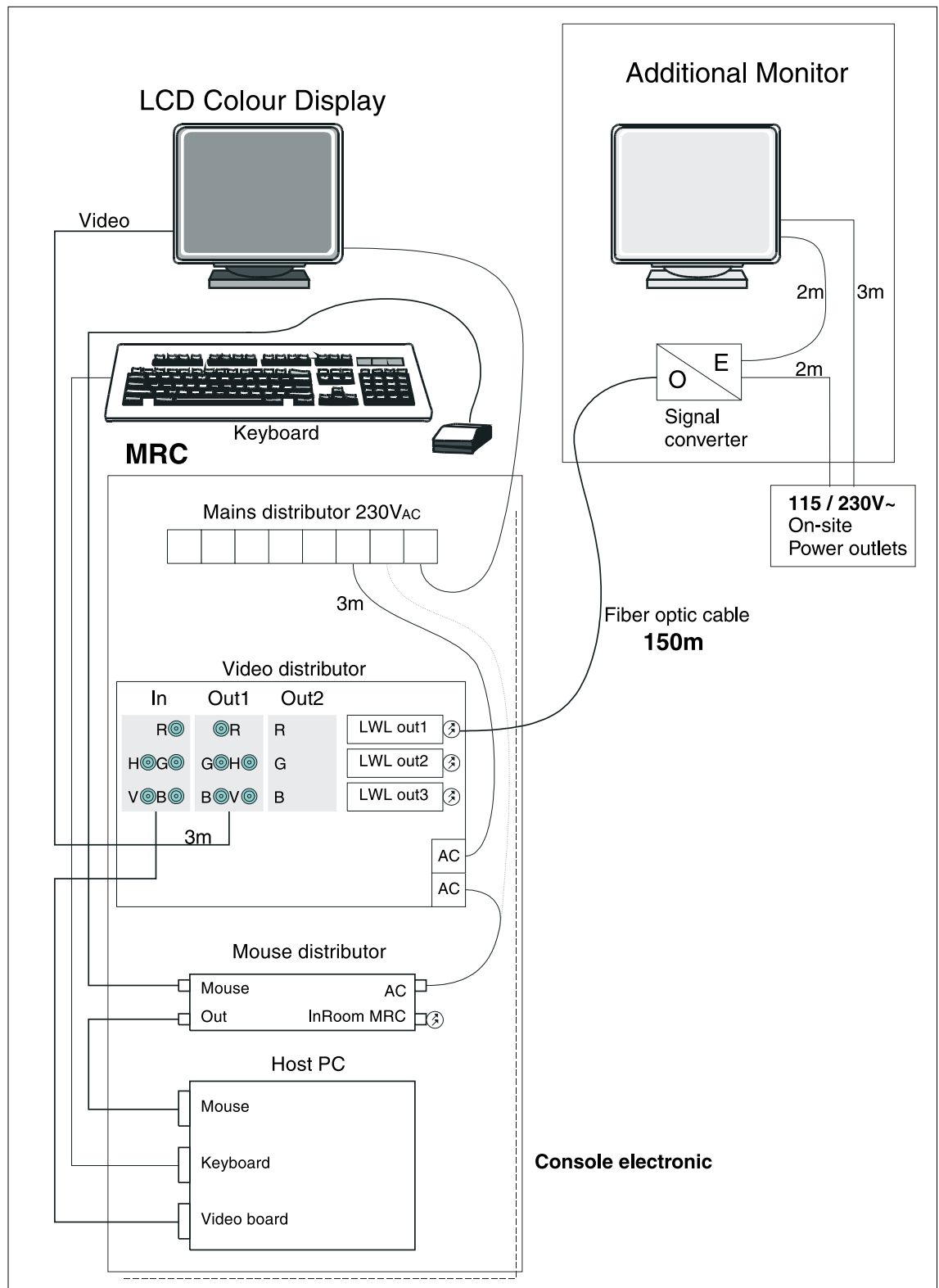


Fig. 154: Additional monitor

Patient supervision unit

Functionality

Patient video monitoring is required during the MR examination, if operating personnel cannot visually monitor the patient through the RF room window in a suitable manner. In principle, the video camera should be installed on the front wall of the RF room (as seen from the magnet). Installation on the back wall is possible, but results in a more limited viewing area due to the shorter distance between the magnet and the wall.

Due to the extensive travel range of the patient table toward the back wall of the RF room, ensure there is sufficient light behind the magnet (e.g., spot light or similar) to enable proper visual patient monitoring.

Components

Camera wall holder

The patient video camera has to be installed at the finished wall inside the examination room. The location can either be in front or in back of the magnet. Nevertheless the preferred location is at the patient end wall.

The camera wall holder is part of the delivery volume. You have to locally procure the appropriate screws and dowels required for the finished wall system you are using on site.

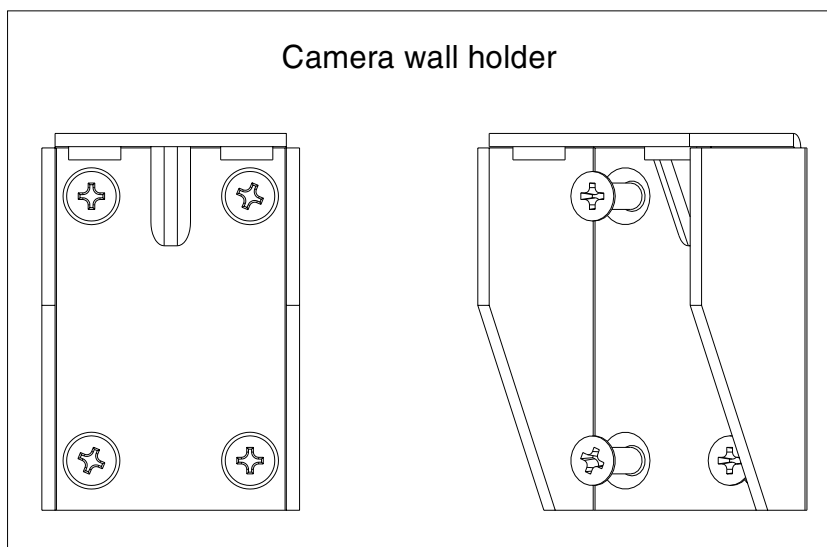


Fig. 155: Patient camera, wall holder

Camera

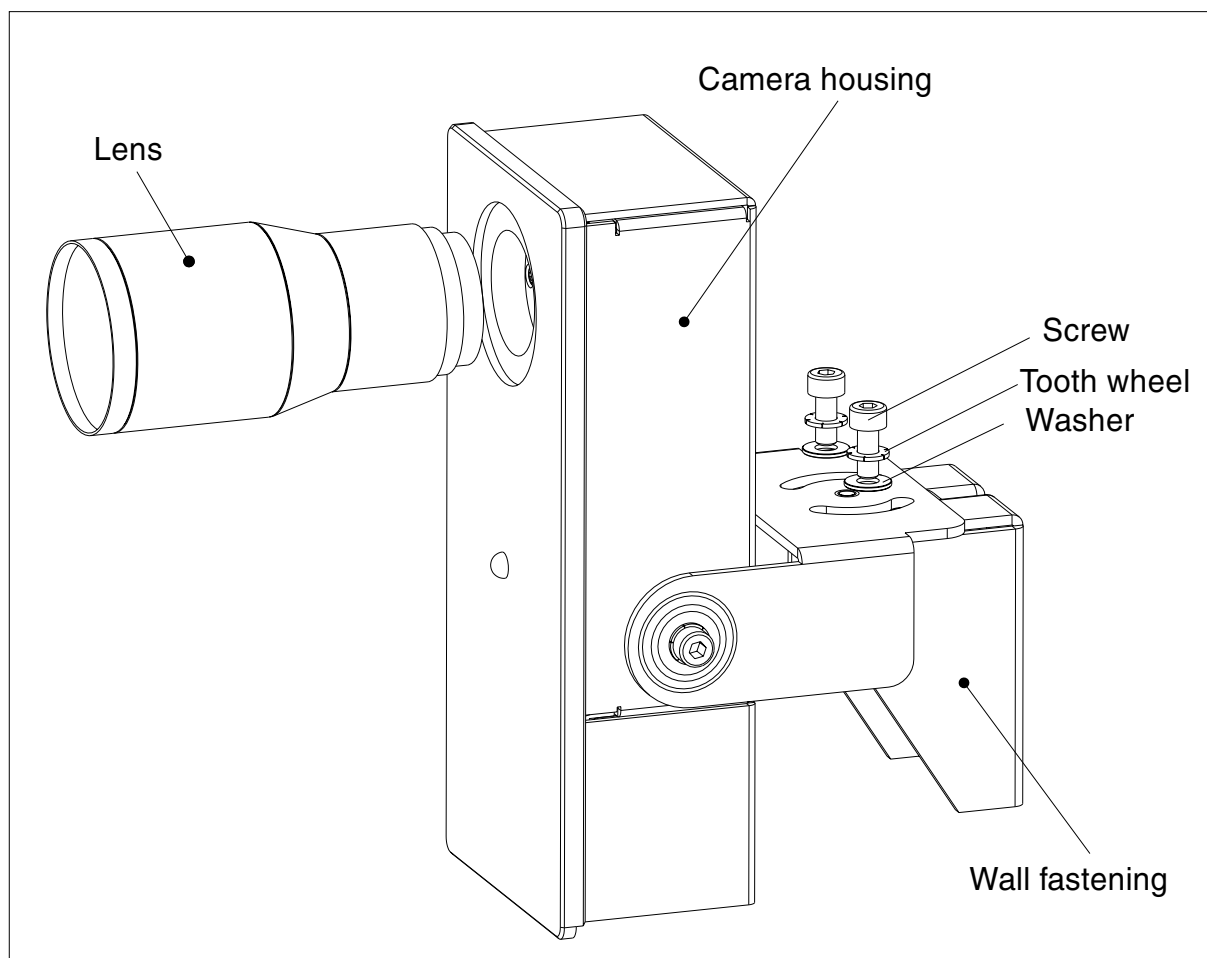


Fig. 156: Patient video camera

Camera installation

The camera is attached to the finished wall of the RF room using the wall-mounted bracket for holding the camera.

As a rule, the video camera should be mounted to the patient end wall. Installation at the service end wall is possible, however, the short distance to the magnet bore may lead into a limited field of view.

The most optimal camera position is:

- Positioning in the horizontal orientation:
Extension of the longitudinal table axis (at the center of the table) to the finished wall.
- Positioning in the vertical orientation:
Using the diagram (Fig. 157 / p. 264)

The bracket is provided in the delivery volume. The mounting bracket enables the camera to be positioned in the horizontal or vertical direction. The varying distances from the camera to the magnet may be compensated for by using the Vario lens. Refer to table (Fig. 157 / p. 264) and (Fig. 158 / p. 265).

- The display has an adjustable base for positioning it on the table near the MR console.

- Do not allow the bending radius of the fiber optic cable to fall below the 60 mm tolerance
- The plug for the power supply to the camera is 18mm in diameter. For installation behind the finished wall, provide a cable conduit measuring approximately 25mm in diameter.

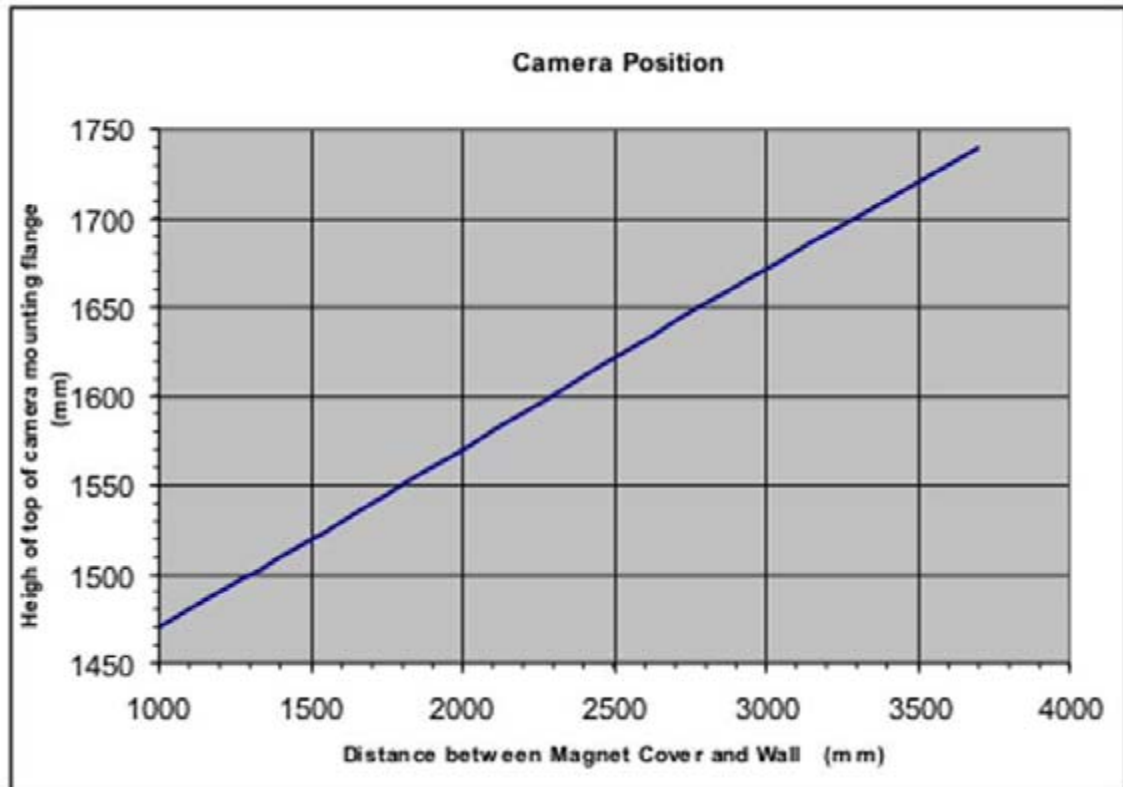


Fig. 157: Camera position

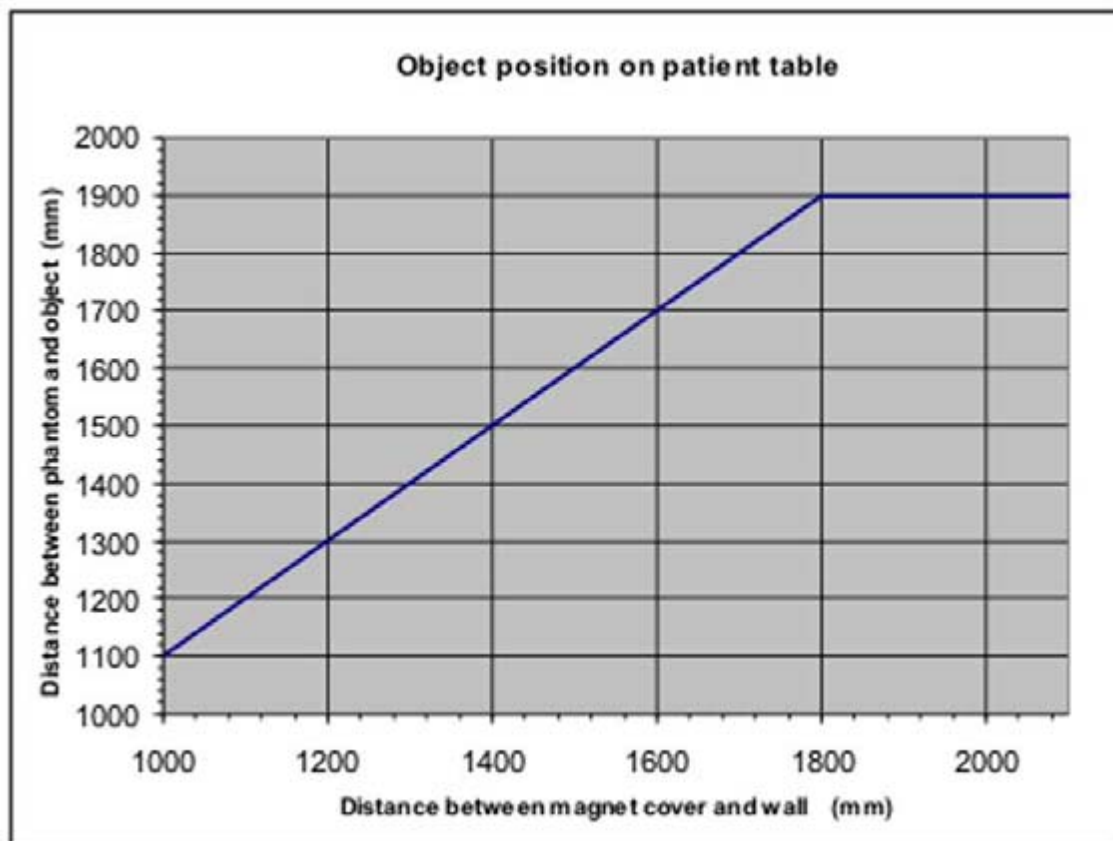


Fig. 158: Object position on patient table

Color LCD monitor

- ⇒ Special video camera to be mounted separately to either the front or back wall of the examination room for observing the patient. The color LCD monitor may be positioned at the operator's console or at a convenient wall location.

Technical data	
Weight	≤ 4.5 kg
Cooling	convection
Power consumption	20 W max.
Operating temp.	+15°C - +30°C
Humidity (below the dew point)	40% - 80%
Power supply	115/230 VAC +/- 10% automatic selection
Size (height X width X depth) in mm	314 x 312 x 94.6 / 180 at pedestal

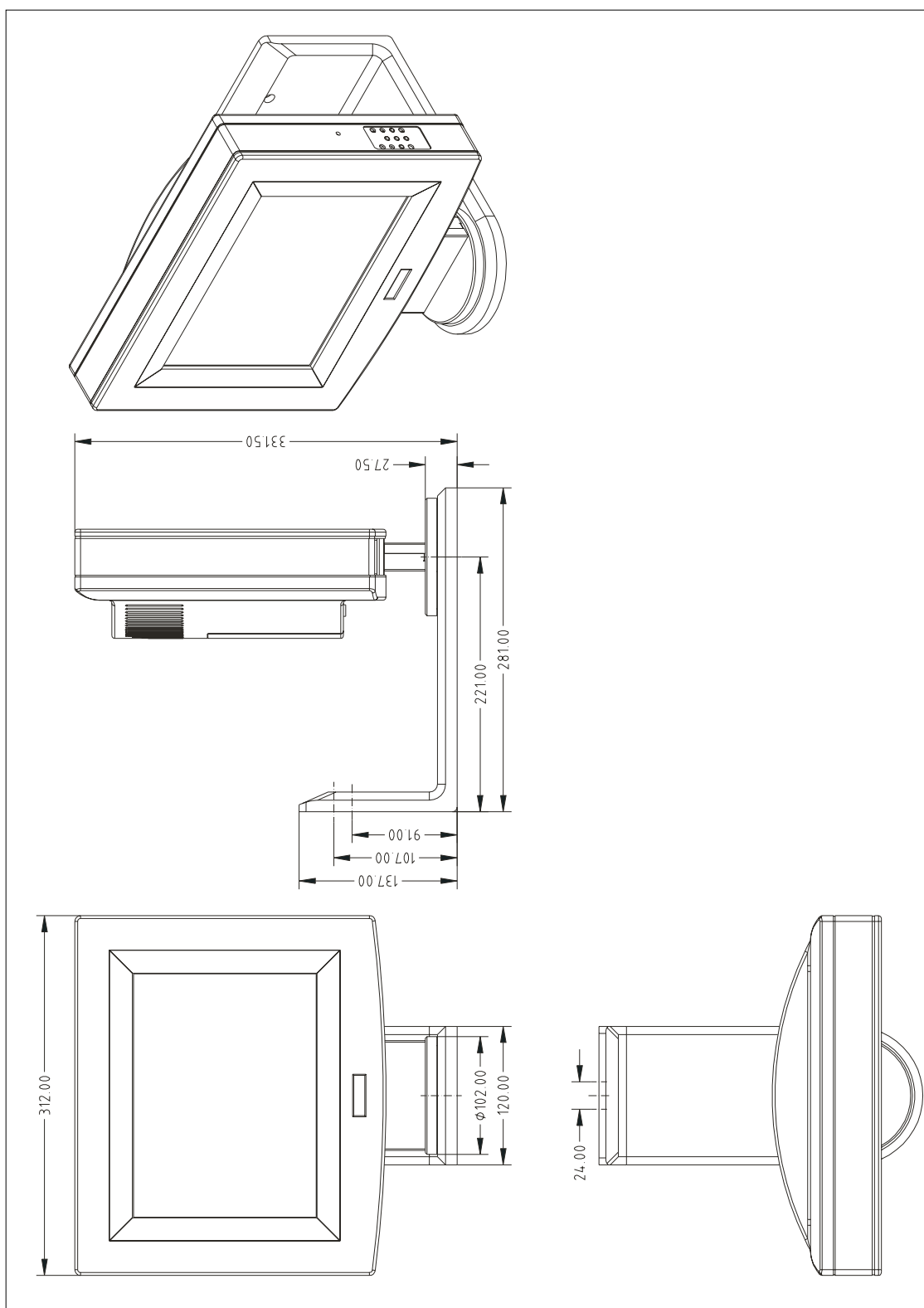


Fig. 159: Patient supervision monitor, part 1

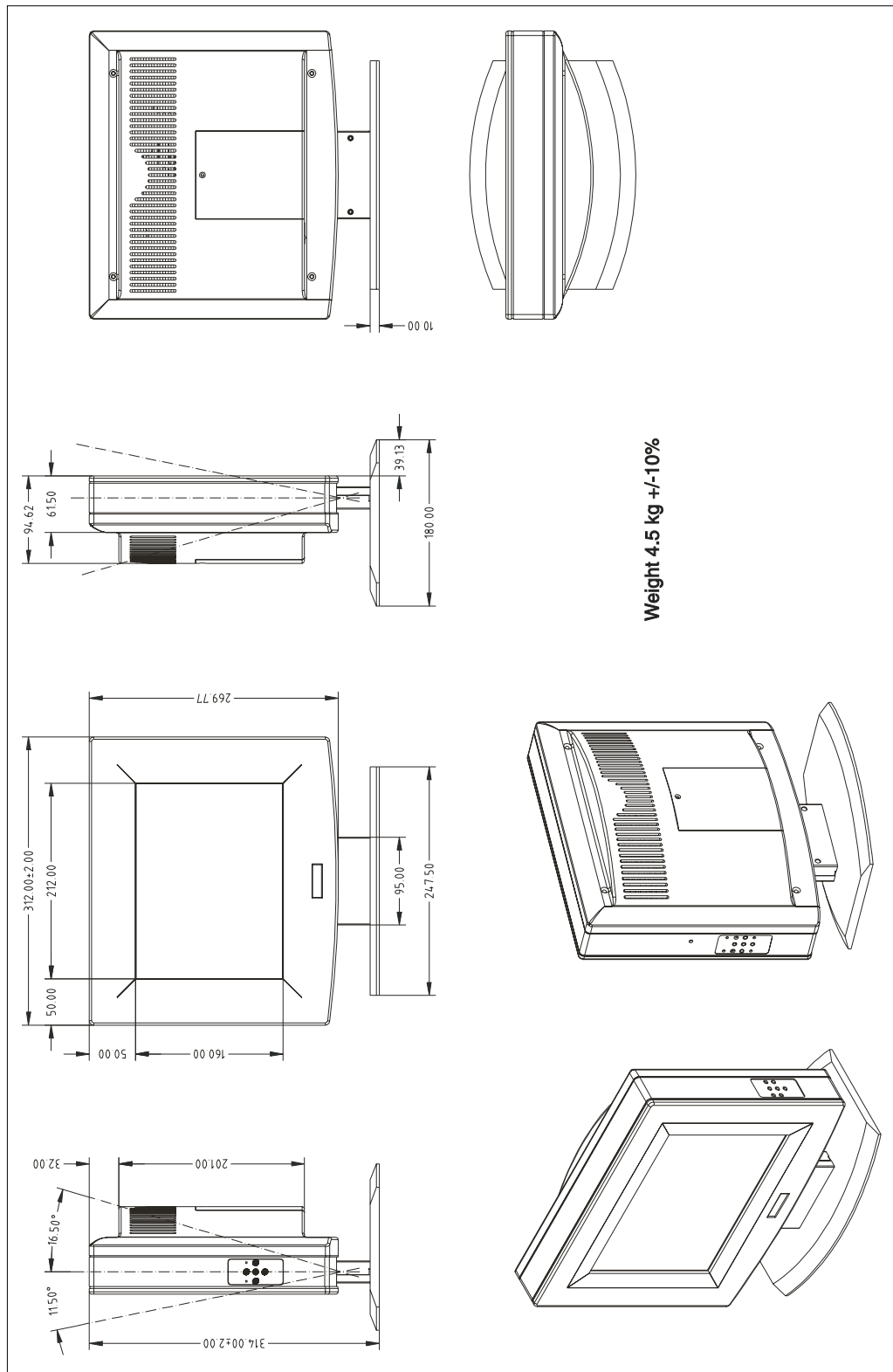


Fig. 160: Patient supervision monitor, part 2

Sensor docking station

Function

The sensor docking station is used for charging the lithium-polymer accumulator of the pulse sensor.

The location of the sensor docking station has to be in close vicinity of the main MR console.

Two components can be stored in the docking station:

- PPU = peripheral pulse unit
- PERU = physiologic ECG and respiratory unit

The docking station can be mounted to the wall with three screws (part of delivery volume).

The PPU is transmitting the data acquired to the PDAU which is mounted to the magnet electronics components.

Technical data

Mounting position	Close vicinity of MRC console (wall mounting) Range within 5.0m distance to the Host PC	
Height	80 mm	
Width	60mm	
Depth	80 mm	
lithium polymer accumulator	3.8V	300mAh
charging time of accumulator	<3h	
operating time, accumulator	>= 12h	
cable length to Host PC USB port	5.0m	

NOTE

A drilling template for the mounting holes is part of the delivery.

Drawing

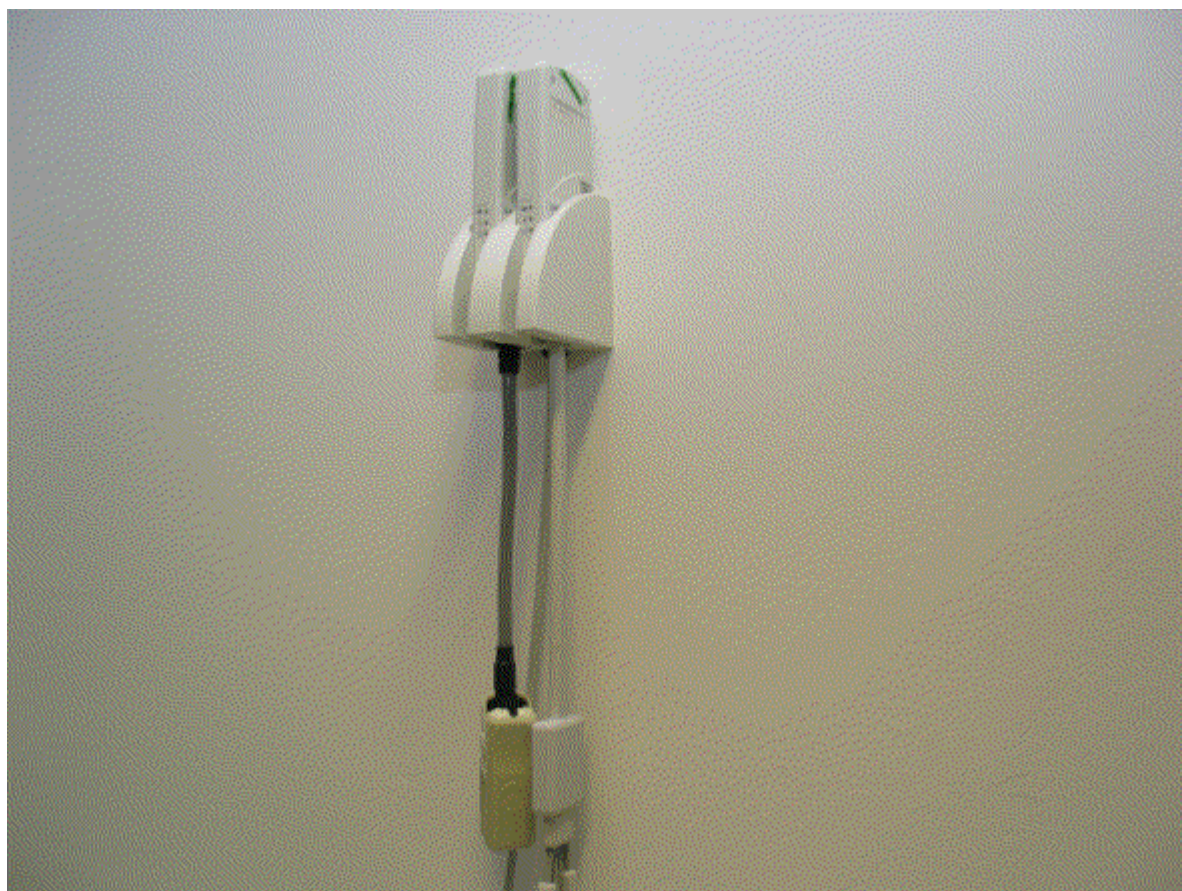


Fig. 161: Docking station with equipment

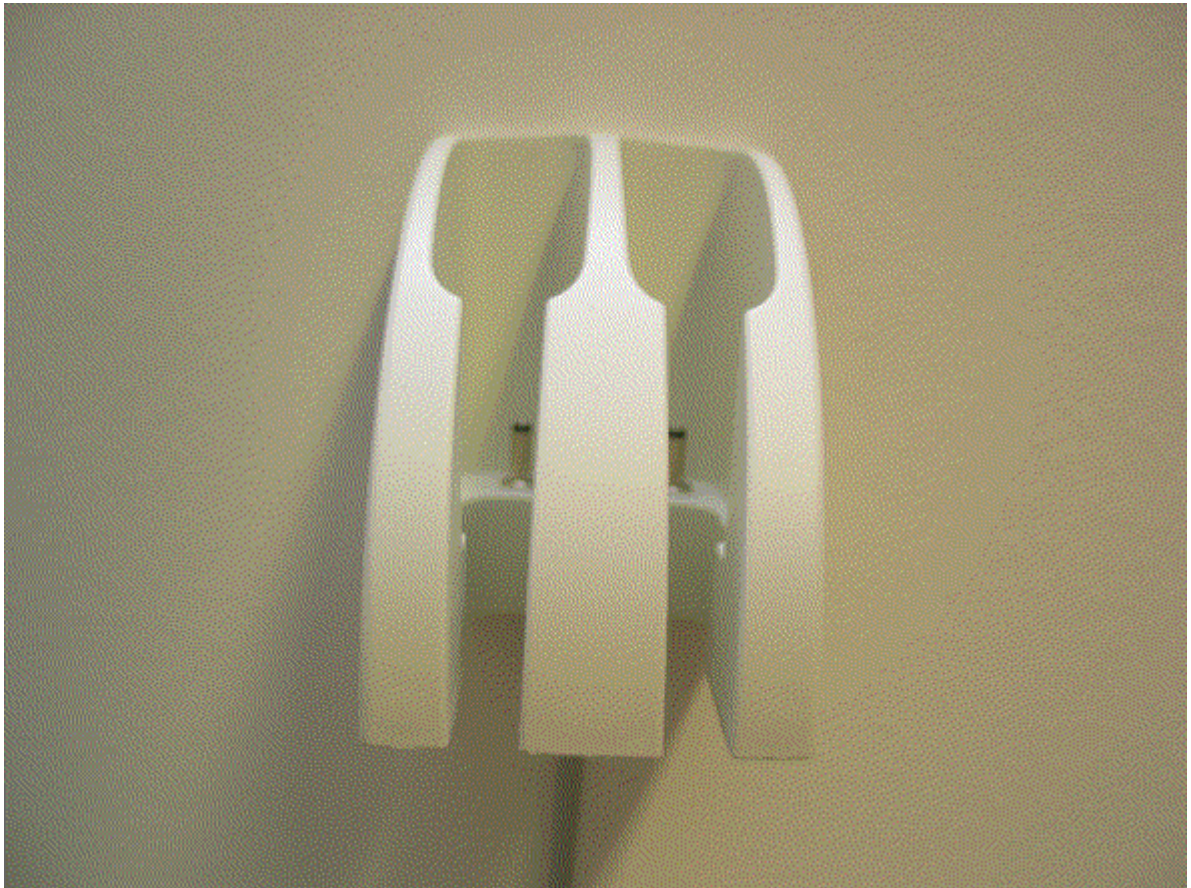


Fig. 162: Docking station

Console table and container

- ⇒ For details, refer to SI M 9-060
Additional components for the console table are available.



Fig. 163: Console furniture

Table

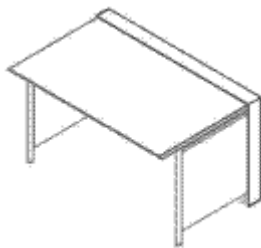


Fig. 164: Table

Technical data	
Height (variable)	710mm (adjustable by 30mm)
Width	1200mm
Depth	800mm

Container for the Host PC

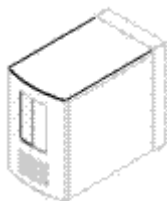


Fig. 165: Container small

Technical data container 450mm	
Height (variable)	710mm (adjustable by 30mm)
Width	450mm
Depth	800mm

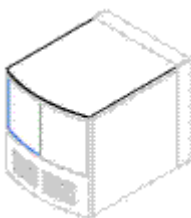


Fig. 166: Container large

Technical data container 600mm	
Height (variable)	710mm (adjustable by 30mm)
Width	600mm
Depth	800mm

Surface coils

⇒ The following table gives an overview of the surface coil size.

Coil name	length in mm	width in mm	height in mm	weight in kg	
Matrix Coils					
Head Matrix Coil	300	300	280	5.0kg	-
Neck Matrix Coil	190	330	332	2.6kg	-
Spine Matrix Coil	1185	485	33	11.0	-
Body Matrix Coil	300	300	280	0.95	-
PA Matrix Coil	970	300-600	270	5.75	-
Flex Coils					Diameter in mm
Flex Coil Interface	210	520	-	0.4	-
CP Flex Coil, small	170	360	-	0.3	-
Loop Flex Coil, large	-	-	-	0.4	190
Loop Flex Coil, small	-	-	-	0.1	40
Endorectal Coil Interface	-	-	-	0.2	-
Dedicated Coils					
CP Breast Array	500	530	145	7.1	-
Shoulder Array Coil					Opening in mm
Base Plate	445	490	-	5.0	-
Large Shoulder Array Coil	-	-	-	1.6	200
Small Shoulder Array	-	-	-	1.3	165
CP Extremity Coil	405	270	290	6.5	-
Double Loop Array Coil	82	135	82	1.1	-
Special Head Coils					-
CP Head Array	480	330	-	5.7	-
Quadrature Tx/Rx Head Coil	400	360	360	7.0	-

Patient table trolley

NOTE

If the system is designated for using the 2nd tabletop with trolley, the distance of 500mm, in front of the patient table fully extended to the wall, has to be increased by 100mm to 600mm!

The distance of 600mm is a technical minimum distance. We recommend 750mm.

The distance of 750mm to the wall will guarantee easy use of the patient table trolley.

This will result in a finished room length of min. 6200mm with the option “patient table trolley”.

The recommended finished room length is 6350mm!

NOTE

If the magnet is installed on an additional base frame the option “Patient table trolley” will not work.

Function

The option “Patient table trolley” is used together with changeable table tops.

One patient can be prepared while an other one is scanned. The patient table top including the patient can be removed using the patient table trolley. There is no need to walk for patient which are not able to do so.

Technical data

Patient table trolley			
Weight	132kg		
Size	height	width	length
	1000mm	670mm	1810mm
Overall length including patient table top	2445mm		

Drawing

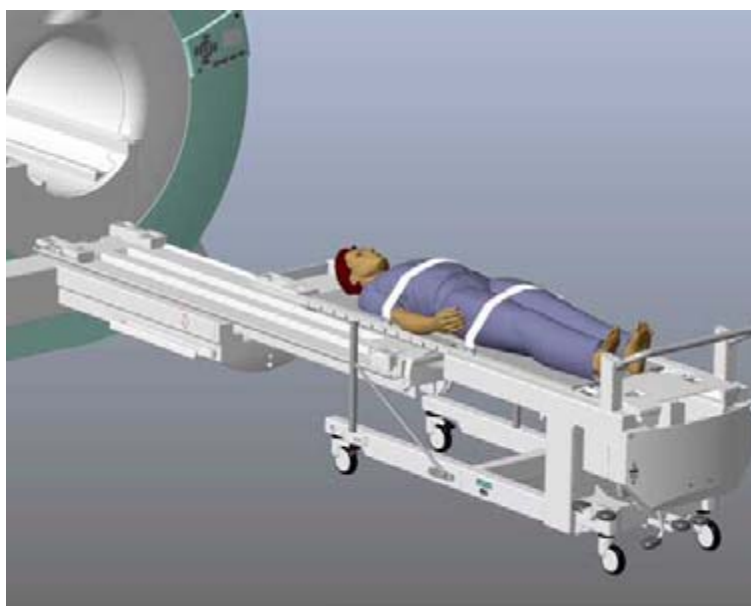


Fig. 167: Patient table trolley

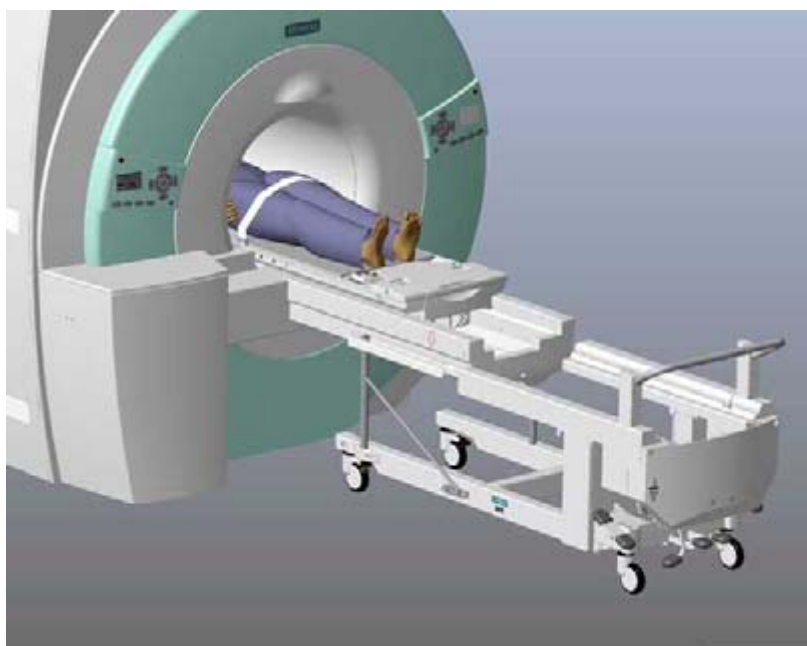


Fig. 168: Patient table trolley 2

Patient transport trolley 3

Technical data	
Weight	≤ 130kg
Max. patient weight	≤ 160 kg
Max. load at head end	≤ 60 kg
Height (variable)	655 mm to 965 mm
Width	639 mm
Length	2,154 mm

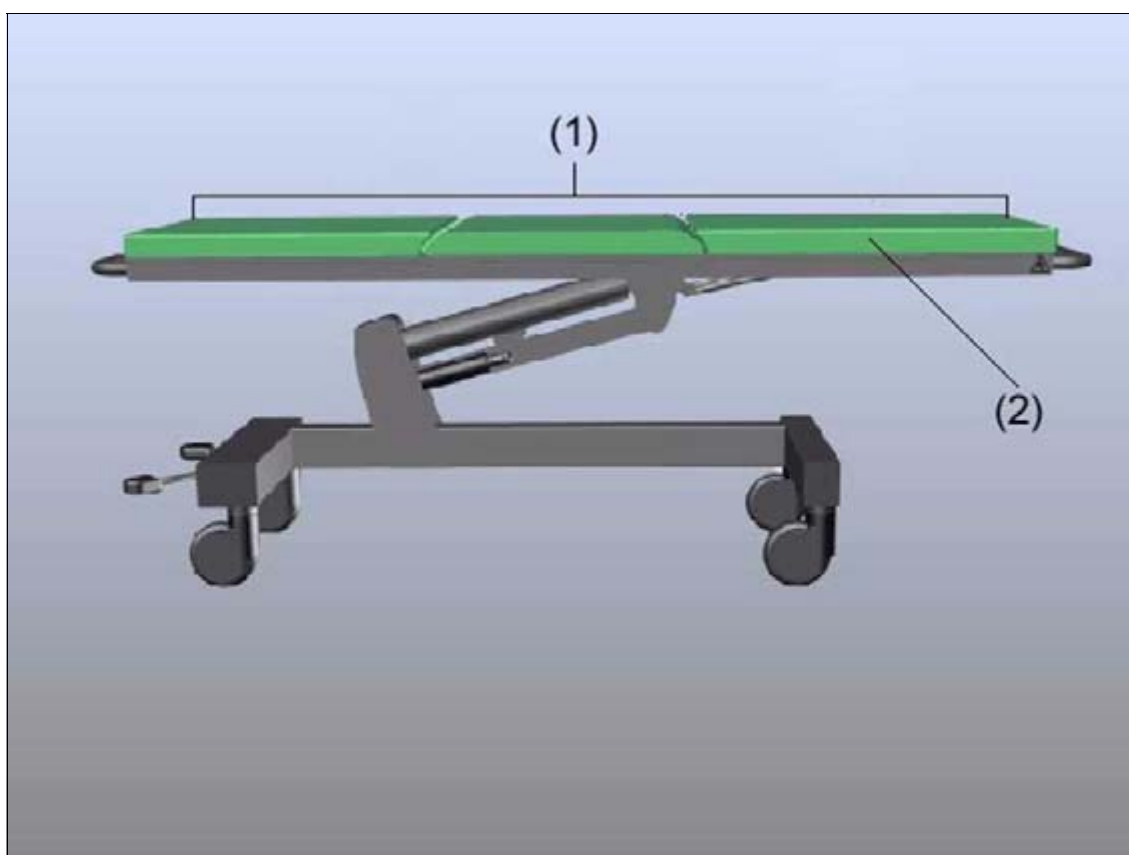


Fig. 169: Patient transport trolley

Application

Height-adjustable patient transport trolley specially designed for use in examination rooms containing MAGNETOM systems. It permits the transport of non-ambulatory patients into the examination room.

The head end may be tilted up to approximately 75°.

Adaptation transformer for the SEP cabinet

Application

The adaptation transformer has to be used in countries where the line power cannot be adapted to the voltage / frequency combination, 400V/50Hz and 480V/60Hz (e.g., Brazil, South Korea).

The adaption transformer is necessary, for the above mentioned reason, for the configuration SEP cabinet with the built-in helium compressor, and the configuration KKT chiller with the IFP where the helium compressor is connected directly to the IFP

The helium compressor is the component which requires in any case the above mentioned voltage / frequency combinations and therefore the adaption transformer.

Ordering information

Ordering information		Ordering address
Type	Article number	Siemens AG Medical Solutions Department MRL A
Adaptation transformer (incl. connection cable)	56 72 378	

Dimensions

Item	Size L x W x H in mm	Weight in kg
Adaptation transformer	360 x 330 x 570	55

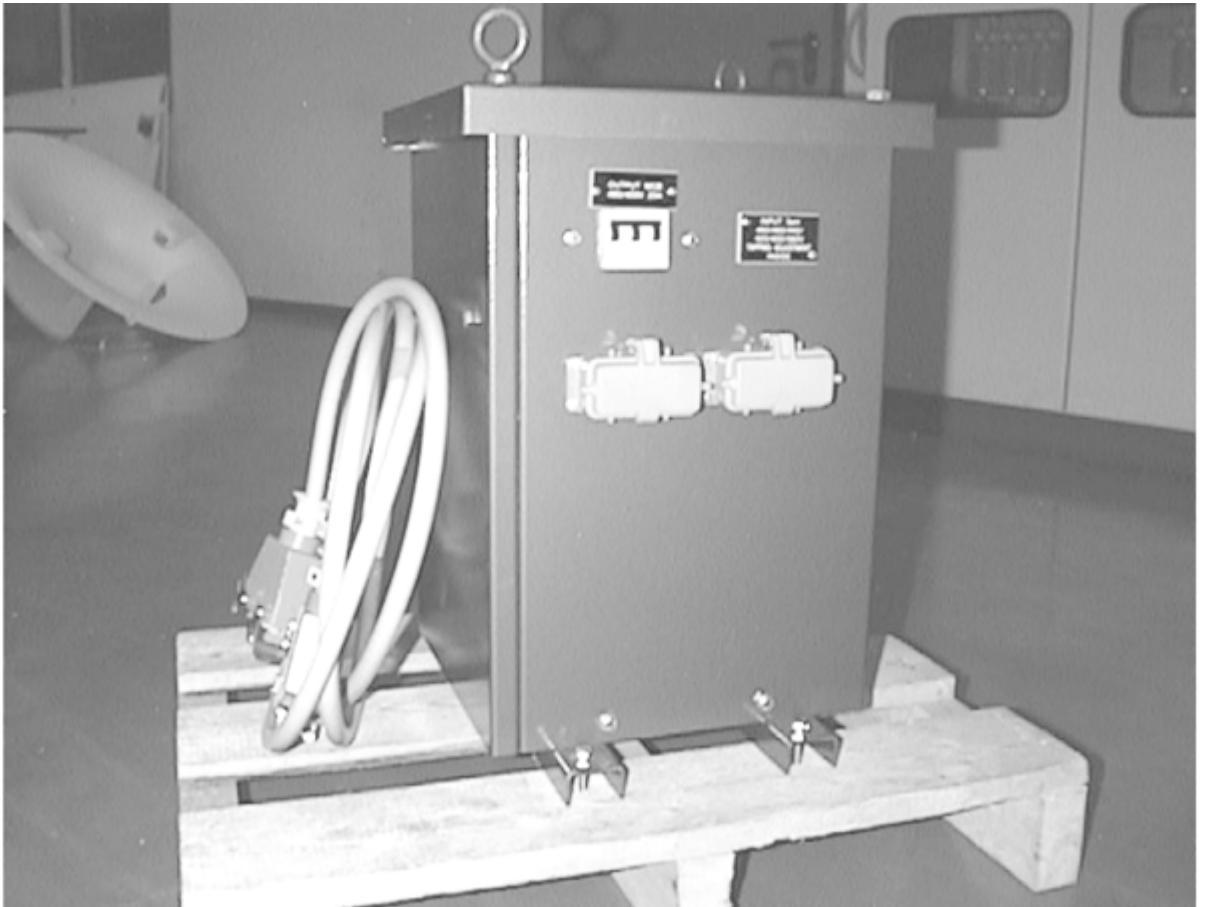


Fig. 170: Adaption transformer

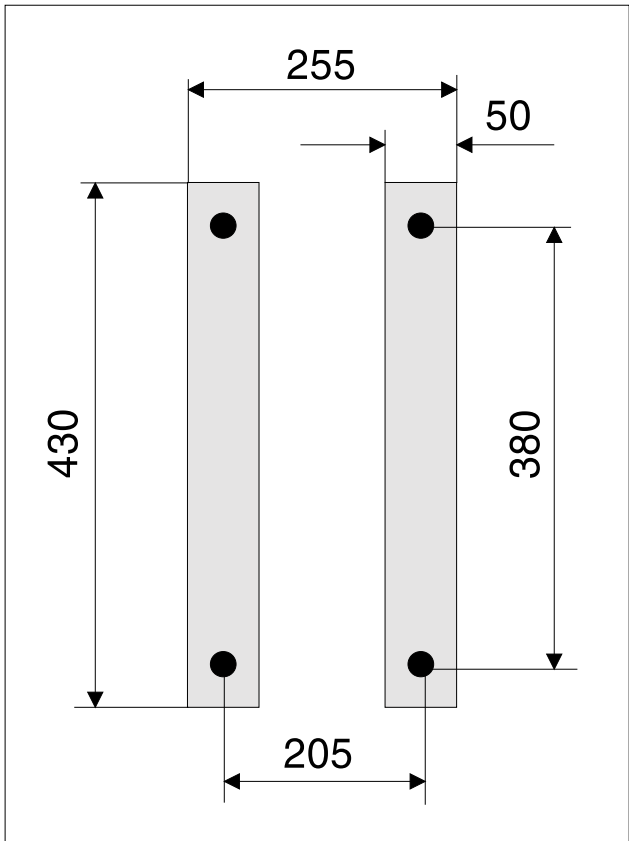


Fig. 171: Footprint Transformer

Power Distribution Panel

Application

The Power Distribution Panel can be used to distribute power within a MAGNETOM Espree environment. It is possible to connect not only the MAGNETOM system. In addition, you could also connect, e.g., a laser camera.

Ordering information

NOTE

The article numbers and descriptions of the PM are valid!

Ordering information		Ordering details
Type	Article number	Consult the Price Book
Power Distribution Panel, small without connection for a chiller.	81 14 154	
Power Distribution Panel, large with connection for a chiller.	81 14 162	

Dimensions

Item	Size L x W x H in mm	Weight in kg
Power Distribution Panel	800 x 220 x 800	52

UPS System for the Host PC

NOTE

If an MRSC console has been installed, the Powerware PW 9125 3000i® UPS will not supply the MRSC PC! A standard PC UPS or an additional Powerware PW 9125-3000i® UPS (without cable set) can be installed to supply the MRSC PC or a Leonardo workstation.

Powerware PW 9125-3000i® UPS for the MRC Host computer.

Function

With a static UPS (Uninterruptible Power Supply), the system computer can be protected against all types of line disturbances.

In most cases, the local power supply is sufficiently reliable for satisfactory operation. Modern processor-controlled devices, however, require highly reliable sources of power. The Powerware PW 9125 3000i® satisfies this requirement. The Powerware PW 9125 3000i® is the standard UPS for backing up **the MRC Host PC and Imager PC only.**

NOTE

The PW 9125-3000i® with the Siemens Cable set is supporting the Host PC and the Imager PC only.

For other options, e.g. MRSC, you have to purchase an additional UPS system, preferable also a PW 9125-3000i®.

Technical data

Technical Data Powerware 9125 3000i		
Weight in kg		37
Dimensions of the cabinets H x W x D in mm		89 x 432 x 610
Output in kVA		3.0
Backup time in min.	at max. load 5 min. with built-in batteries	at 50% load 16 min. with built-in batteries
Heat dissipation		280 W
Temperature		+0°C...+40°C
Relative humidity		5%...95% (before the dew point)
Audible noise		< 50 dB ¹

1. At 1.0m distance

Ordering information

NOTE

The article numbers and descriptions of the PM are valid!

Ordering information		Ordering details
Type	Article number	Consult the Price Book
Powerware 9125 3000i	88 57 810	
Siemens cable set (comes with connection box)	88 57 828	

NOTE

The connection box for the Powerware 9125 3000i® is part of the delivery volume "Cable set".

Scheme

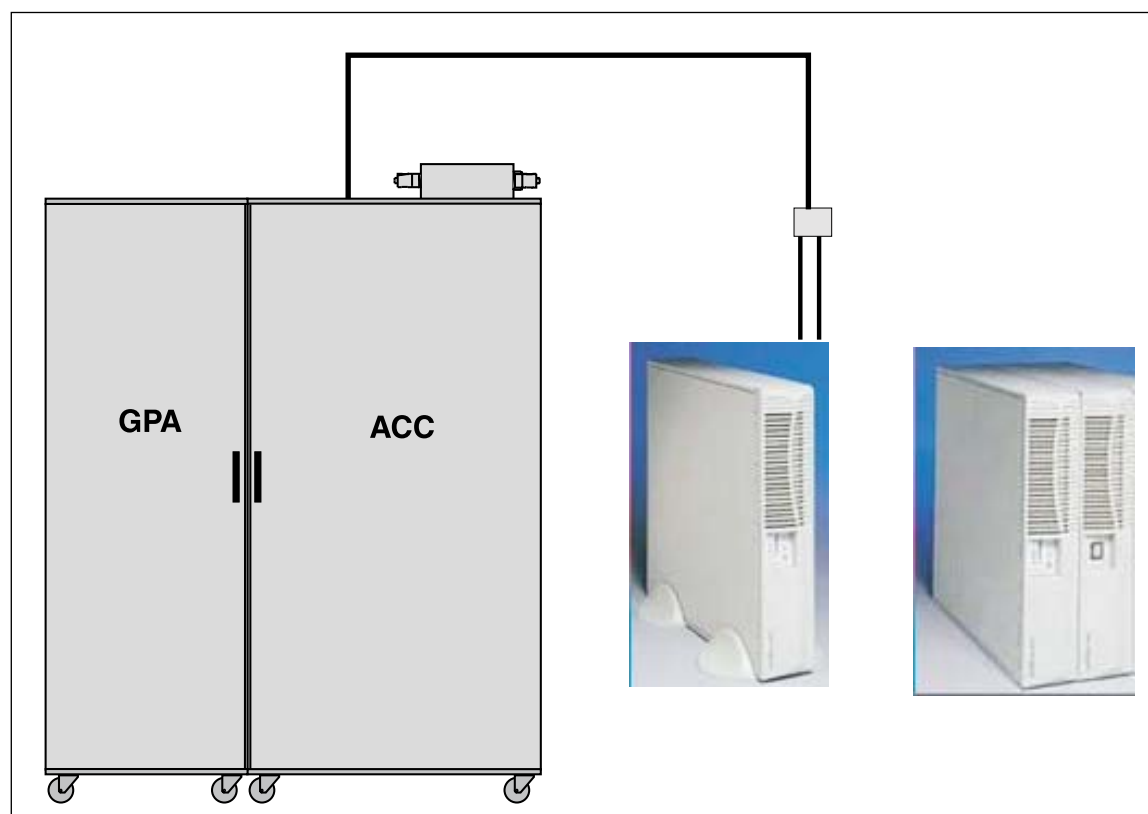


Fig. 172: UPS configuration for the host computer

Connection box for UPS PW 9125 3000i

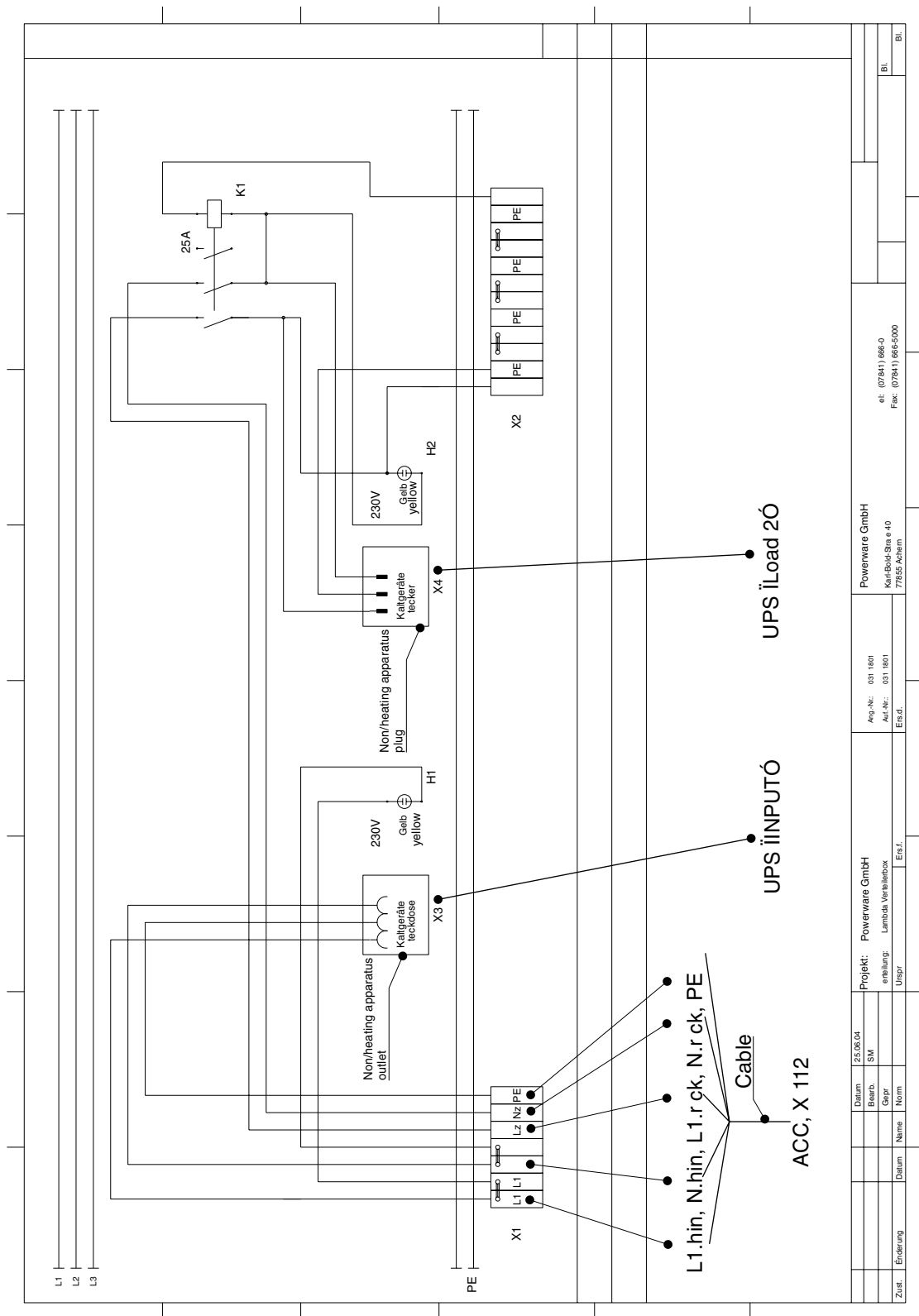


Fig. 173: UPS connection diagram

Tab. 28 Terminal block connection

Cable labeling	Disribution box labeling terminal block X1
L1.hin	L1
N.hin	N
L1.rück	Lz
N.rück	Nz
PE	PE

Tab. 29 Junction box

Use the provided cables for connecting:	
Junction box	UPS
X3	“INPUT”
X4	“LOAD2”

UPS systems for the complete system

Notes

POWER CONDITIONING DEVICES NOT APPROVED BY Siemens Medical Solutions MAY NOT BE COMPATIBLE WITH THE MAGNETOM SYSTEM. SUCH DEVICES ARE INSTALLED AND APPLIED AT THE CUSTOMER'S RISK.

In countries where the power supply is not reliable, UPS systems are used to supply the required power to the MR system, and in special cases to the chiller, in case of power interruptions or power failures. When there is a power failure, the UPS backup allows the MR system to be shut down normally or supplies power to the MR system during the time required to transfer to an emergency power supply. This allows you to complete measurements that have already been started. The UPS offers the additional advantage of reducing system downtime due to hardware and software errors.

Power requirements if the on-site power is provided through a UPS system

- ⇒ The following table lists values to be used when selecting a suitable UPS system. As a prerequisite, the water chiller is not connected to the UPS. If the water chiller should be connected to the same UPS, the required values power/current (the maximum possible value, e.g., switch-on current) for the chiller should be added to the values given below. In this case, the chiller has to be equipped with soft-start compressors.

Voltage	Momentary power ¹	Recommended min. power of UPS ²	Recommended UPS systems
480 V+ 10% (=528V) /60 Hz	100 kVA	> 120% of momentary power value	t.b.d.

1. Momentary power during measurement sequences < 5 sec.

2. The factor in this column is defined according to experiments with specific UPS model series. The factor may vary according to manufacturer and model series. The min. factor applied should be > 1.2.

NOTE

During the switch-on procedure, high current pulse amplitudes are possible. During this pulse, the UPS may switch into by-pass mode.

The switching time between battery mode and by-pass mode should be less than 1 ms. The UPS should meet local regulations in addition to the above listed requirements.

NOTE

If chiller connection to the UPS system is planned, the output of the UPS has to be correspondingly larger.

In this case, the chiller has to be equipped with a soft-start compressors.

NOTE

The Masterguard SIII (160kVA) is a recommendation. All other UPS system meeting our system requirements can be used.

UPS system configurations (examples)

UPS system for the MR system only

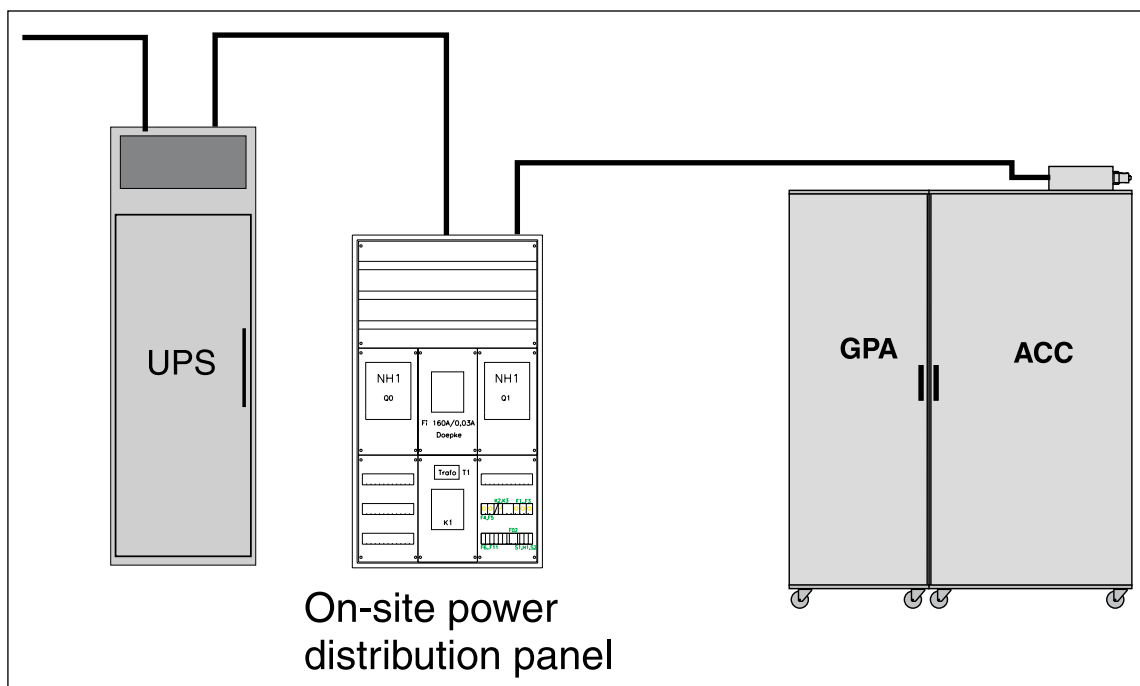


Fig. 174: UPS configuration for the system only

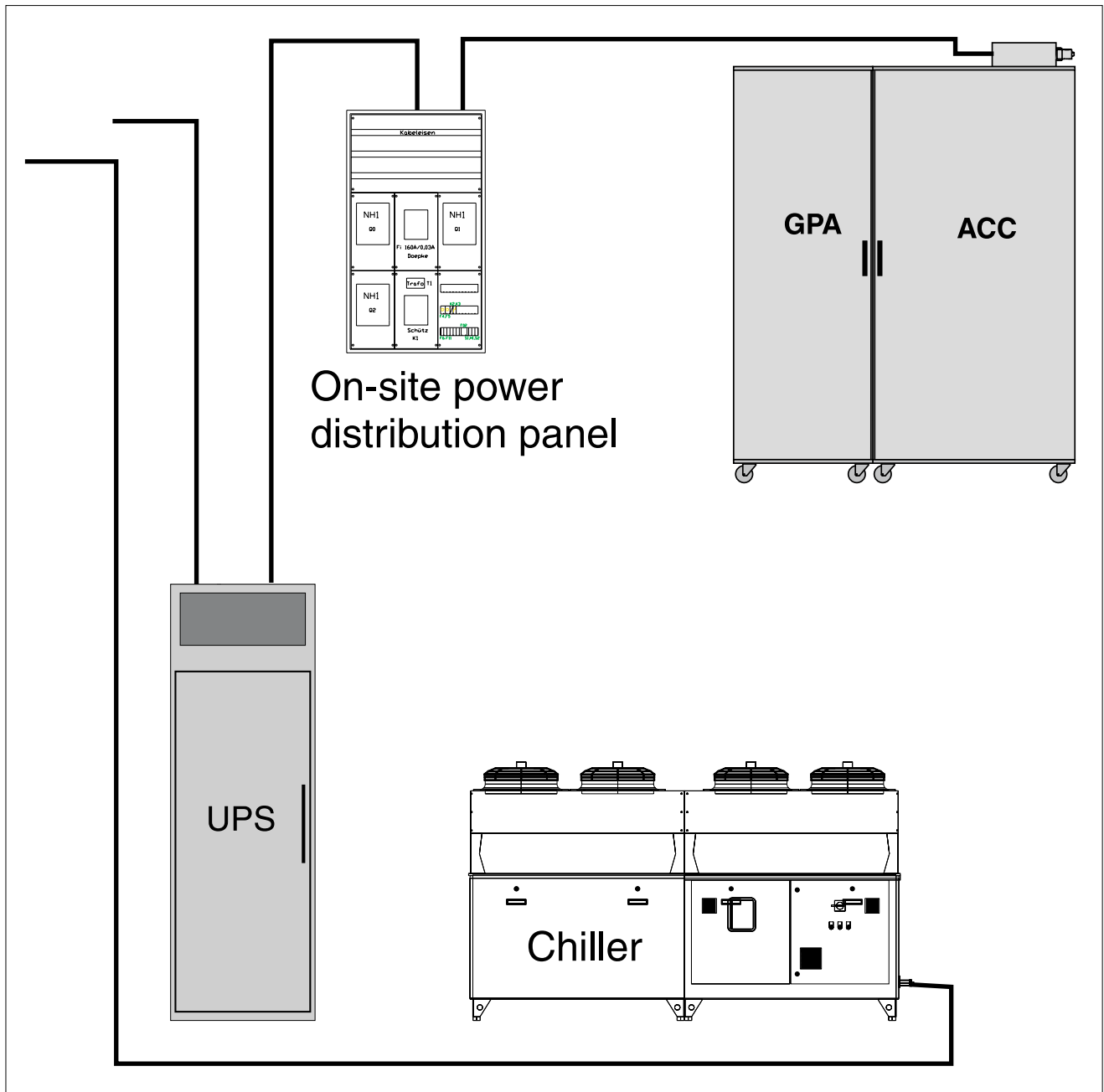


Fig. 175: UPS configuration for the system without chiller

UPS system for the MR system and a chiller

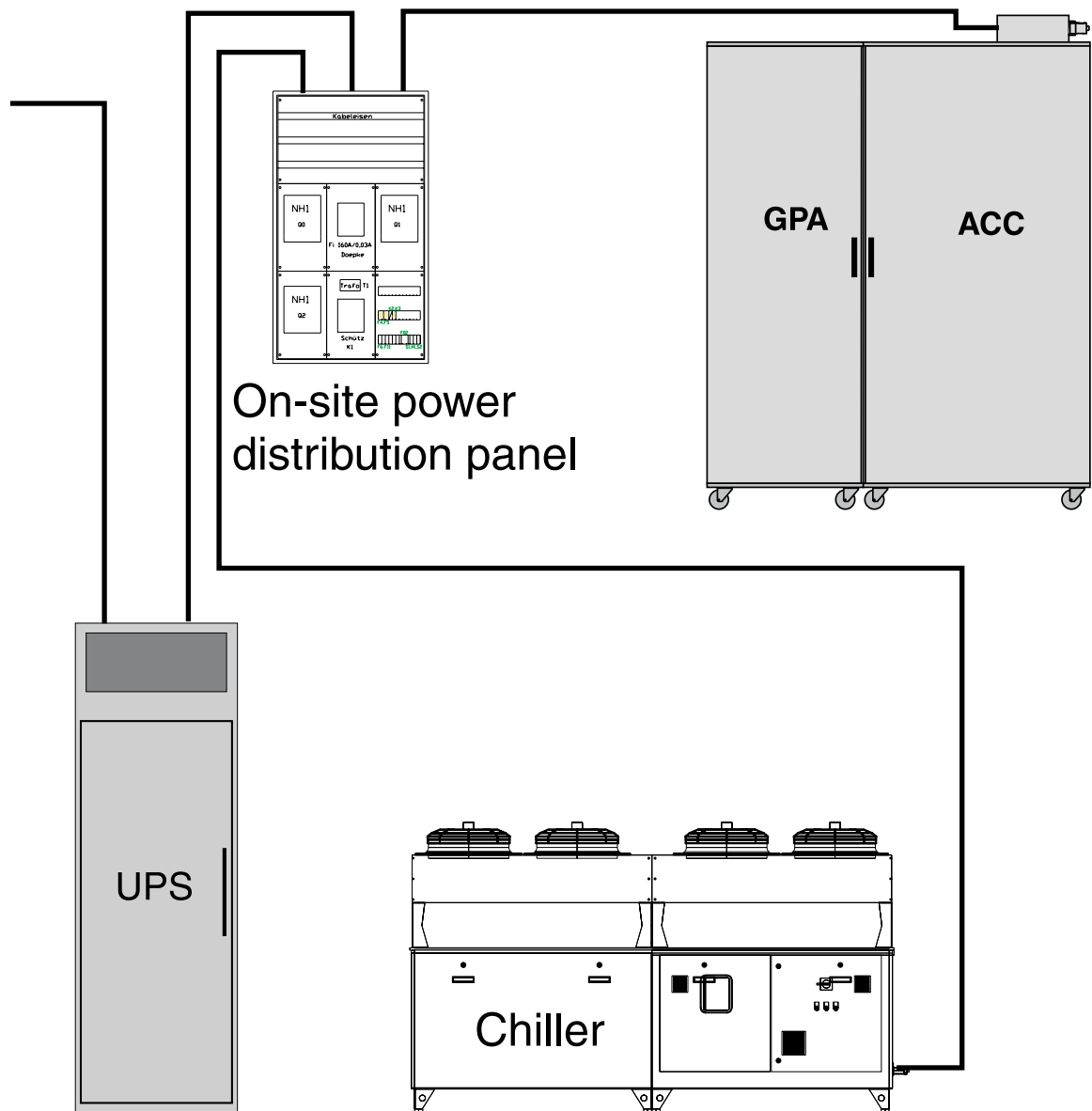


Fig. 176: UPS configuration with system and chiller connected

Primary water filter system

NOTE

To prevent pollution inside the primary water circuit, an external water filter is required, if the local water quality does not meet Siemens specifications.

A specially constructed set with water filter and water hoses can be ordered from:

Company name	Siemens AG
Country	Germany
Department	CS ML

Item	Part number
filter system (complete) filtration: 5 µm	7121366
consisting of:	
housing with three filter elements 1 adapter (Kutting connection) 2 hoses, 5 m with insulation 2 shut-off valves	

The set consists of:

Filter elements can be ordered as consumables:

Item	Part number
consumables	7121374
consisting of:	
three filter elements	

Service tools

NOTE

Only Siemens Medical Solutions equipment or equipment recommended by Siemens Medical Solutions may be used.

Dedicated service tools for MAGNETOM Espree

Service tools required				
Service tool	Part number	Returnable with discount	Required for	
			Installation Start-up	Service Maintenance
External power supply for MSUP	83 96 371	-	-	-
Magnet transport device (Magnet transport device / p. 292)	83 95 936	X	X	-
Patient table transport device	81 13 008	X	X	X
Remote display for MSUP	77 58 522	-	X	X
Magnet power supply (MPS)	83 95 613	X	X	X
Array shim device	83 66 978	X	X	X
Service plug Espree	77 15 720	-	X	X
Helium syphon, magnet side	83 96 363	-	X	X
ERDU test load	83 96 173	-	X	X
Torque wrench 20-50Nm	83 95 803	-	X	X
Torque wrench 5-20Nm	83 95 829	-	X	X
Torque wrench kit	83 96 116	-	X	X
Torx insert kit ¹		-	X	X

1. For MAGNETOM Espree, Torx screws are used in place of some of the screws used in the system cabinet. Since it is not practical to offer a standard set of tools as service tools, it is recommended to purchase these Torx inserts locally. It should contain the following sizes: TX 8, 9, 10, 15, 20, 25, 27 and TX30.

Standard service tools

Service tools required				
Service tool	Part number	Returnable with discount	Required for	
			Installation Start-up	Service Maintenance
Helium syphon, dewar side	11 94 344	-	X	X
Protective conductor meter ¹		-	X	X
Tool kit ²		-		
(Gradient coil lifting device / p. 292)		X	-	X
Helium leak tester	99 00 978	-	X	X
Fluke Scopemeter 199CM	73 92 074	-	-	X
Fluke 187 Digital Multimeter	99 94 831	-	X	X
Line impedance meter	84 28 104	-	X	X
Fiber optic cable tester	96 60 812	-	-	X
Fiber optic repair set	96 60 770	-	-	X
Spotmeter SMFit Act	77 52 848	-	-	X
Ventilator and heating attachment 230V	97 02 937	-	X	X
Ventilator and heating attachment 110V	97 023 945	-	X	X
(Protective clothes / p. 292)		-	X	X
Oxygen monitor	70 14 983	-	X	X
Laptop PC	n.a.	-	X	X
Service printer	n.a.	-	X	X

1. The recommended device is the SECUTEST S3 from Gossen-Metrawatt. If local requirements require a different measurement device, purchase an appropriate one.
2. The service suitcase contains all service tools necessary for installation, service, as well as maintenance. The same service suitcase as for MAGNETOM Harmony/Symphony/Sonata/Concerto/Trio/Allegra is used. The non-magnetic tool set is new, and does not contain any titanium tools. The set was replaced by non-magnetic steel tools. The old set can still be used. The screwdriver for body coil decoupling is already a part of the service tool kit and does not have to be ordered separately. In general, the tools should be available already in the local office.

Gradient coil lifting device

Gradient coil lifting device				
Service tool	Part number	Returnable with discount	Required for	
			Installation Start-up	Service Maintenance
Gradient coil lifting device	70 14 678	X	-	X
Short beam (4.0m)	11 41 725	X	-	X
Coil support	47 65 926	X	X	X

Protective clothes

Protective clothes				
Service tool	Part number	Returnable with discount	Required for	
			Installation Start-up	Service Maintenance
Protective clothes	97 02 978	-	X	X
Shield face for helmet	97 02 531	-	X	X
Coat	97 02 549	-	X	X
Protective helmet	97 02 994	-	X	X
Protective shoes	97 02 960	-	X	X

Magnet transport device**NOTE**

Only Siemens Medical Solutions equipment or equipment recommended by Siemens Medical Solutions may be used.

If a service provider (e.g. Remetronix; UNI DATA; HEGELE) is contracted to bring in the system, the service provider has to use the corresponding tools and special equipment required. Make sure they will have access to the required tools.

If the system is brought in by the local field office, they should ensure that the corresponding tools and special equipment (see tables above) are ordered and available as required.

Magnet transport device (Swan-necks)

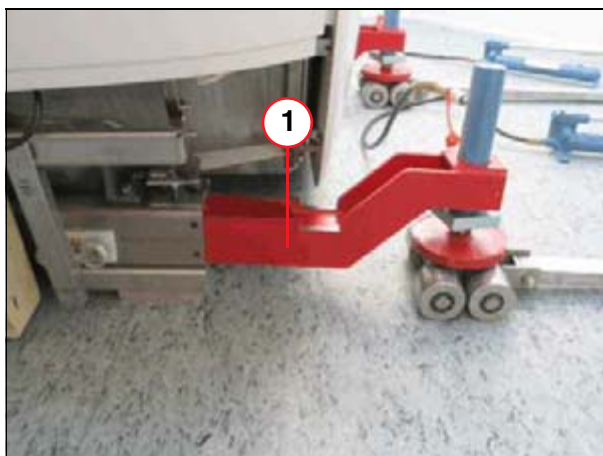


Fig. 177: Transport device

Pos. 1 Lifting element

The picture shows the swanneck device, the hydraulic lifter, and the transport roller.

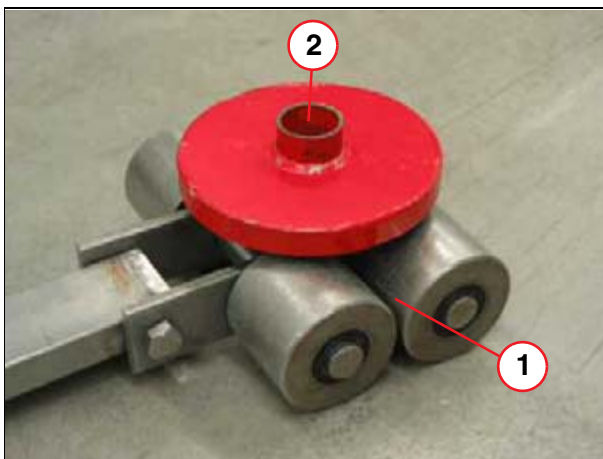


Fig. 178: Roller with overlay plate

Pos. 1 Rollers

Pos. 2 Overlay plate

MPS (Magnet Power Supply)

Application

The **M**agnet **P**ower **S**upply **U**nit consists of the unit which energizes/deenergizes the magnet, including the charge cable to the magnet, the cabling for the voltage supply and the magnet supervision. As a service tool, the MPS is brought on-site only as required.

Ordering information

Ordering information		Ordering address
Type	Article number	Siemens AG Medical Solutions Department CS ML (as a normal spare part)
MPS	83 95 613	



Fig. 179: MPSU
Pos. 1 MPSU LID

Transport box dimensions

Box no.	Size L x W x H in mm	Weight in kg / lb
1	920 x 730 x 1210	196 / 432

Array Shim Device

Application

The Array Shim Device is a service and installation tool for magnet shimming. It consists of mechanical supports, MR probes, preamplifier, multiplexer, etc. required to measure the magnetic field via the shim plot. The Array Shim Device is brought to the site by Customer Service and is not part of the delivery volume of the MR-system.

The Array Shim Device is shipped in its own crate together with the additional passive Shim Kit.

Ordering information

Ordering information		Ordering address
Type	Article number	Siemens AG Medical Solutions Department CS ML (as a normal spare part)
Array shim device	83 66 978	

Transport box dimensions

Size L x W x H in mm	Weight in kg / lb

Transport and storage specifications

Mechanical conditions

During transport, the components are subject to mechanical stress. The recommended reference values for various mechanical environmental parameters are specified in IEC 721-3-2 (Transport) and IEC 721-3-5 (Load in Road Vehicles).

However, these reference values significantly exceed the acceleration rates measured on loaded trucks with an air suspension system. According to experts who routinely perform vibration experiments in test labs, the guidelines of IEC 721 cannot be practically applied to components with mass ratios such as those found in MR systems.

With respect to impact loads, the maximum acceleration duration on loaded trucks with an impact duration of 20 ms is 1.4 g on the tractor and 4.7 g on the trailer. Our current specification for the magnet is 2 g horizontally (x, y) and 5 g vertically (z).

NOTE

Magnet mishandling during transport must be avoided. Refer to the transportation and storage conditions.

Transport and storage specifications for the magnet

Transport and storage specifications - Magnet	
Acceleration amplitude	2 m/s ² (2-100Hz)
Peak acceleration	5 g vertical, 2 g horizontal (20 ms time period)
Temperature range (Climate category N)	-40°C to +70°C
Rel. humidity (Climate category N)	10% to 100%
Barometric pressure (Climate category N)	50 kPa to 106 kPa

Transport and storage specifications for the system components

Transport and storage specifications for the system components	
Acceleration amplitude	2 m/s ² (2-100Hz)
Peak acceleration	5 g vertical, 2 g horizontal (20 ms time period)
Temperature range (Climate category N)	-25°C to +60°C
Rel. humidities (Climate category N)	10% to 95%
Barometric pressure (Climate category N)	70 kPa to 105 kPa

Transport route

NOTE

All transport activities including delivery of the magnet and the system components to the MR suite may be performed by a licensed carrier only.

Requirements for the transport route

- Prior to requesting the services of a licensed carrier, the project manager and the architect/construction engineer have to determine the floor loading of the transport routes and the temporary storage areas.
- The architect/construction engineer has to confirm in writing that the floor loading of the transport routes/storage areas selected will suffice for moving the magnet and the system components.
- It is the responsibility of the carrier to obtain information concerning the various transport routes before the actual transport.

Issuing the order

- The order for transport has to be issued in writing to the licensed carrier selected and has to contain the following data and documentation (in addition to such general information as a list of the components to be shipped):
 - Copies of the transport routes/storage areas selected
 - A copy of the certificate attesting to the weight capacity of the floor
 - Final destination of transport (to give the carrier enough time to obtain information regarding methods of transport and transport routes)
 - The weight and dimensions of the components to be transported
- Actual transport
 - The project manager is responsible for the availability of the transport equipment to be used
 - The carrier is responsible for the type of transportation and auxiliary tools used

Transport dimension

Magnet

The following illustrations and examples indicate the minimum distances for transporting the magnet.

NOTE

To change transport dimensions, the patient table can be removed.

Transport dimensions of the magnet		
	Magnet with patient table ¹	Magnet without patient table (removed on-site) including the transport devices underneath the boxsection for across transport (carry-in of the magnet turned by 90°).
Height	2230mm ²	2350mm ³
Width	2300mm	2300mm
Length	2690mm	1330mm

1. The dimensions given do not include the transport devices and safety distance as delivered from the factory.
2. 2230mm min. transport height is only possible with the Siemens transport devices (swan necks) and without the 90° elbow mounted.
3. The transport height of approx. 2350mm is valid if the transport rollers of the Siemens tool kit are being used. 2350mm is the min. required transport height for the across transport.

Roof hatch size

NOTE

The roof hatch/opening size should be min. 100 mm larger than the transport dimension.

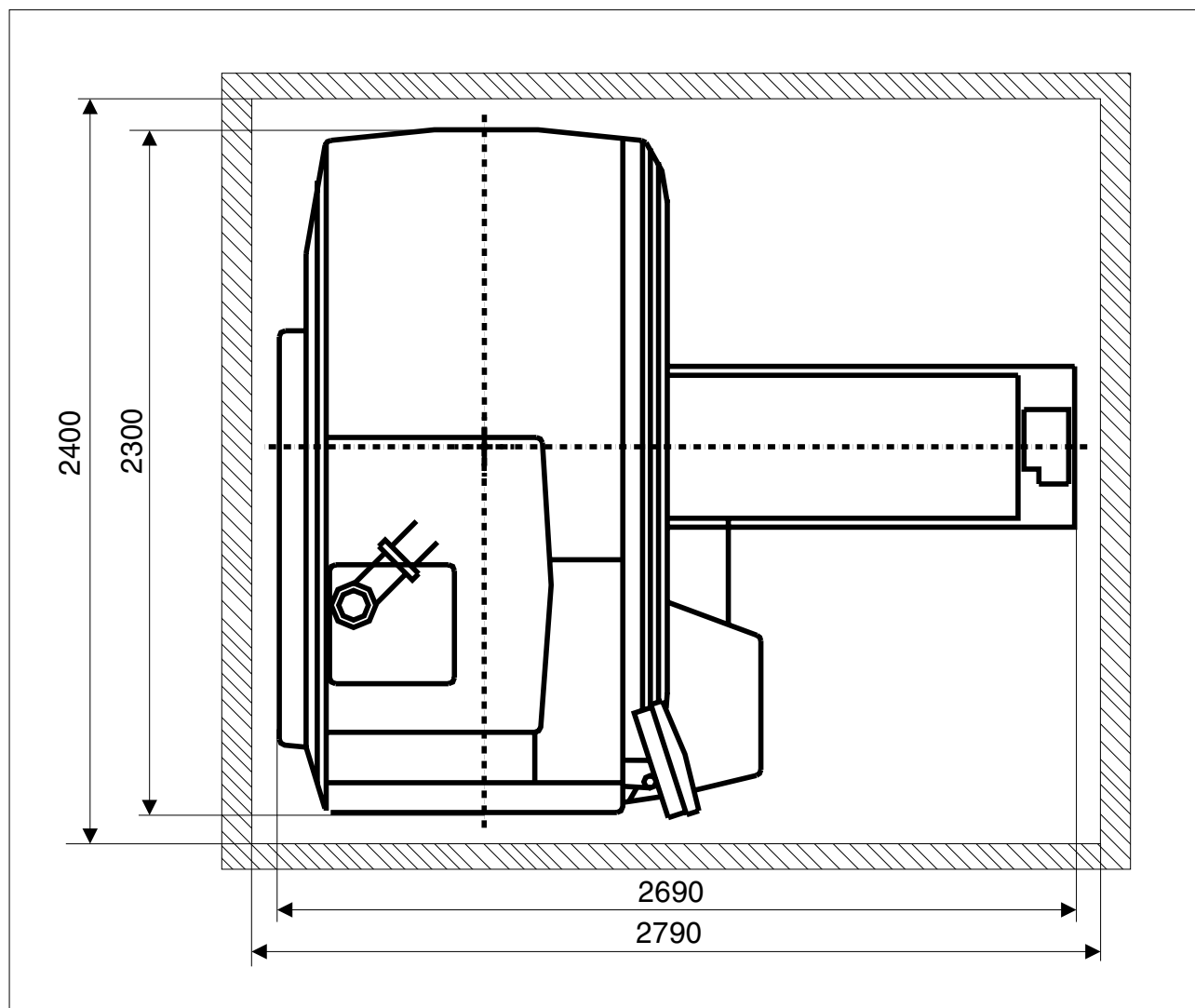


Fig. 180: Roof hatch opening for the magnet with patient table

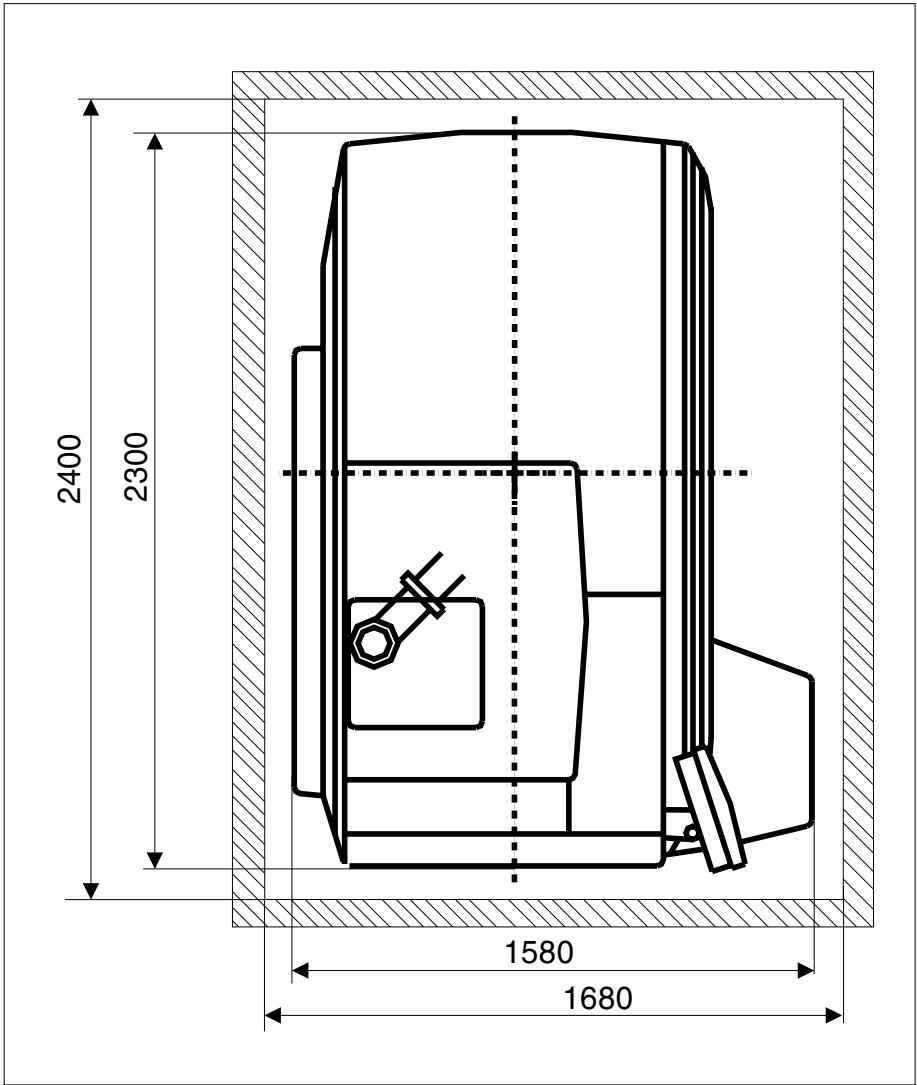


Fig. 181: Roof hatch size for the magnet without patient table

GPA/ACC cabinet

To transport the GPA/ACC cabinet, the minimum finished room height must be **1970 mm**.

Transport dimensions of the GPA/ACC			
	GPA/AC as delivered from the factory.	GPA/ACC removed wheels	GPA/ACC removed wheels and mains box
Height	1,970mm	1,890m	1,850mm
Depth	650mm		
Length	1,560mm		

NOTE

The transport dimensions are without transport devices.

Component weight and dimension

System components	Outside dimensions of crate/ L x W x H mm	Gross weight/ net weight
Magnet OR 122		
GPA/ACC cabinet		
SEP cabinet		
Filter plate	1110 x 1450 x 780	140/70 kg
Patient trolley	2200 x 800 x 1200	255/110 kg
Removable tabletop	2550 x 650 x 240	50kg/30 kg
SEP accessories		
Cable set		
Monitor	730 x 640 x 720	60/45 kg
Accessories	2120 x 1000 x 1140	264/199 kg
System components	1250 x 770 x 1020	104/78 kg

Options		
In-room MRC	1440 x 730 x 840	(net 63 kg)
Patient transport trolley 3	2340 x 900 x 900	130 kg

Technical data

General classification

Protection class 1	
Application parts, protection class	Type B
Patient table	Type B
Local coils	Type BF
ECG electrodes	
IP protection class according to IEC 60529	IP XO
Explosion protection	The MR system is not intended for operation in areas prone to explosion (e.g., highly flammable mixtures of anaesthesia gases with air or oxygen or nitrous oxide).
Operating mode	Continuous operation duty-type
Sterilization method (receptors)	Gas sterilization
Disinfection receptors / system components	Disinfectants without alcohol, ether

Power requirements

For detailed information refer to: [\(On-site electrical installation / p. 130\)](#)

	Nominal value	Tolerance ¹
Voltage range	380, 400, 420, 440, 460, 480V 3-phase and ground	+10% / -10%
Line to line unbalanced	--	max. 2%
Frequency	50/60 Hz	+/- 1 Hz

1. For all line conditions (e.g., power supply under voltage from the power plant) including maximum voltage drop according to the connection value.

Recom- mended fuse rate	Connection value	Momentary power	Internal line impedance
125A (NH-Type)	85 kVA	kVA	< 95 mOhm

Heating/air conditioning

For detailed information refer to: [\(Air-conditioning / p. 157\)](#)

Tab. 30 Climate specifications - Examination room

Examination room	
Air temperature	+18°C to +24°C
Temperature gradient	
Relative humidity	40% - 60%
Absolute humidity	< 11.0 g/kg
Heat dissipation to air	3.0 kW

Tab. 31 Climatic specifications - Equipment room

Equipment room	
Air temperature	+15°C to +30°C
Temperature gradient	</= 3K/5 min.
Relative humidity	40% - 80%
Absolute humidity	11.5 g/kg
Heat dissipation to air	5.0 kW

Tab. 32 Climate specifications - Operator room

Operator room	
Air temperature	+15°C to +30°C
Temperature gradient	n.a.
Relative humidity	40% - 80%
Absolute humidity	11.5 g/kg
Heat dissipation to air	2.0 kW

Primary water specifications

For detailed information refer to: [\(On-site water supply / p. 150\)](#)

Tab. 33 Water quality specifications

	KKT Chiller/IFP ¹	Central water supply / SEP ² Local chiller / SEP ³
pH value	6 - 8	6 - 8

Hardness	< 250 ppm CaCO ₃ (calcium carbonate) < 14° dH (deutsche Härte)	< 250 ppm CaCO ₃ (calcium carbonate) < 14° dH (deutsche Härte)
Water to be used / Filtration	tap water ⁴ for initial filling, chlorine portion < 200 ppm	tap water ⁵ for initial filling, chlorine portion < 200 ppm
Water pressure	max. 6 bar	max. 6 bar
Water / antifreeze	62% water 38% ethylene glycol ⁶	See footnote ⁷

1. Water / anti-freezing compound combination is mandatory!
2. There is no glycol/antifrogen required if the used chiller (other than KKT) or the connected central water supply does not require glycol/antifrogen. Due to national/local regulations different antifreezing compounds may be used.
3. There is no glycol/antifrogen required if the chiller used (other than KKT) or the connected central water supply does not require glycol/antifrogen. Due to national/local regulations, different antifreezing compounds may be used.
4. Standard tap water can be used to fill the water circuit!
5. Standard tap water can be used to fill the water circuit!
6. Due to national/local regulations different antifreezing compounds may be used.
7. There is no glycol/antifrogen required if the chiller used (other than KKT) or the connected central water supply does not require glycol/antifrogen. Due to national/local regulations, different antifreezing compounds may be used.

RF shielding

RF shielding		
RF room attenuation ¹	at 15-128 MHz	> 90 dB
for Co-Siting		>100 dB

1. The specifications of the RF room attenuation has to be maintained across the RF room and its life-time.

Noise emission

Tab. 34 Noise value

Examination room	Equipment room	Control room
Acoustic noise emission		
<= 85 dB(A) ¹	<= 65 dB(A)	<= 55 dB(A)

1. Average value across 8 hours.

NOTE

Mobile information is not available at present for MAGNETOM Espree until further notification.

The following changes have been made to this document.

Click on the Link (marked blue) to switch over to the location where the changes are implemented.

The following chart has been implemented ([Fig. 146 / p. 251](#))

Information added for using the option "Patient table Trolley" ([Room configurations and sizes / p. 45](#))

The following option has been added ([Patient table trolley / p. 274](#))

Connector changed from HAN Q5 to HAN 3A ([Alarm contact / p. 145](#))

Information for switching "off" the vacuum pump ([Vacuum Pump / p. 146](#))

Two possibilities of the on-site primary water connection (SEP) implemented ([On-site primary water pipe preparation / p. 153](#))

Two possibilities of the on-site primary water connection (SEP) implemented ([Connection interface / p. 105](#))

