# OPERATING MANUAL

## Magnetically Shielded Room

### Series Ak3B

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Edition 10/2008
Original operating manual

**Translation**

The operating manual must be translated into the language of the user country for delivery to countries of the European Trade Area. If there are any irregularities in the translated text, the original operating manual (German) should be consulted for clarification or the manufacturer contacted.

# 1 Contents

## 1.1 Contents

## 1.2 List of figures

## 1.3 Declaration of conformity

# Declaration of conformity

In line with
- **the EC directive governing low potential voltage 73/23/EWG, Appendix III (Status 2002)**
- **the EC directive EMV 89/336/EWG, Appendix I and II (Status 2002)**
- **the EC directive for machines 98/37/EG, Appendix II A (Status 2002)**
- **the EC directive for medical products 93/42/EG (Status 2003)**

We hereby declare that the design and construction of

**Name:** **Magnetically Shielded Room**

**VAC- No.:** **530-11 13 02-13**

in the state of delivery complies with the directives listed above and the following DIN EN standards:

Harmonised standards in accordance with the guidelines:

| Directive/ standard | Title | Edition | Remarks |
|---|---|---|---|
| DIN EN 62079 | Creation of instructions, structure, content and presentation | 2001 | Harmonised standard |
| | | | |
| **73/23/EG** | **EC Guideline Low potential voltage directive** | **1973** | **Status 06. 2002** |
| DIN EN 60204-1 | Safety of machines; Electrical equipment of machines; Part 1: General requirements | 1998 | Harmonised standard |
| | | | |
| **89/336/EG** | **EC guideline: EMV** | **1989** | **Status 06. 2002** |
| DIN EN 61000-6-3 | Electromagnetic compatibility; Basic technical standard, spurious emission; trade | 2001 | Harmonised standard |
| DIN EN 61000-6-2 | Electromagnetic compatibility; Basic technical standard interference immunity; industry | 2001 | Harmonised standard |
| | | | |
| **93/42/EG** | **EU directive: Medical products** | **1993** | **Status Feb. 2003** |
| Appendix I | General requirements | | |
| Appendix VII | EC Declaration of conformity | | |
| Appendix IX | Classification criteria | | |

| 98/37/EG | EC directive: Machine | 1998 | Status 06. 2002 |
|---|---|---|---|
| DIN EN 292-1 | Safety of machines;<br>Fundamental terms; general design principles; Part 1: fundamental terminology, methodology | 1991 | Harmonised standard |
| DIN EN 292-2 with Appendix 1 | Safety of machines – Fundamental terms, general design principles – Part 2: Technical principals and specifications | 1995 | Harmonised standard |
| DIN EN 418 | Safety of machines; EMERGENCY OFF devices | 1993 | Harmonised standard |
| DIN EN 614-1 | Safety of machines – Ergonomic design principles – Part 1: Terms and general principles | 1995 | Harmonised standard |
| DIN EN 953 | Safety of machines – Protective separating equipment – General requirements on design and construction of stationary and mobile protective separating equipment | 1997 | Harmonised standard |
| DIN EN 1037 | Safety of machines;<br>Avoidance of unexpected start-up | 1996 | Harmonised standard |
| DIN EN 1050 | Safety of machines – Principals for risk assessment | 1997 | Harmonised standard |
| DIN EN 1088 | Safety of machines;<br>Locking equipment in conjunction with protective separating equipment | 1996 | Harmonised standard |

This explanation becomes invalid following changes to the machine which have not been approved by us.

# 2 Overview and use for the intended purpose

## 2.1 Overview

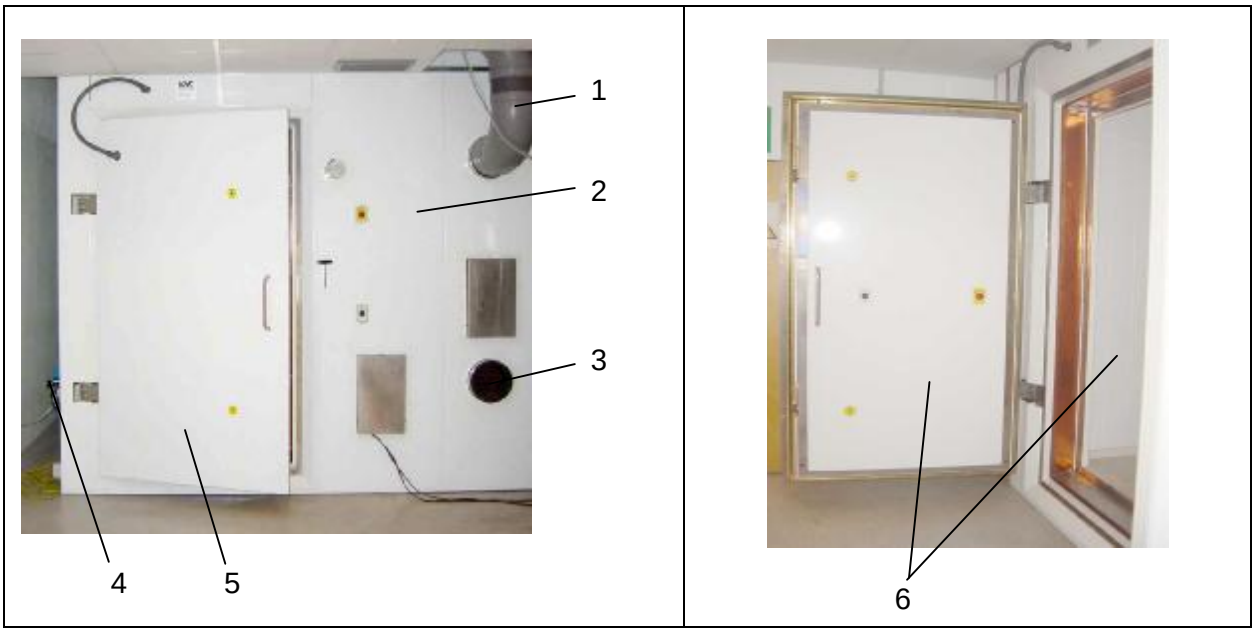



*Fig. 2-1 Overview*

**The Magnetically Shielded Room is made up of the following main components:**

1 Fresh air inlet
2 Cabin frame with aluminium shell and shield walls made from MUMETAL/VACOPERM 70, insulation and exterior cladding
3 Extracted air outlet
4 Pneumatic connection
5 Access door with pneumatic locking/unlocking
6 Interior cladding
7 Lighting (not shown in the picture)
8 Electrical installation and control/emergency equipment for lighting and door (not shown in the picture)

## 2.2 Use for the intended purpose

In the Magnetically Shielded Room, low magnetic fields are measured for medical diagnosis, which are typically induced by the flow of nerve currents. In this way, the Magnetically Shielded Room eliminates the majority of disturbance influences caused by other magnetic or electromagnetic fields, which could impair the measurement result. The Magnetically Shielded Room is classed as a machine in accordance with the machine directive and was developed, designed and built exclusively for medical and commercial use.


*This machine was intended exclusively for this use. A different use or alteration of the machine without written approval from the manufacturer does not conform with the intended use. The manufacturer will not be liable for any damage resulting from this. The owner bears the sole risk.*

Use for the intended purpose also includes observing the manufacturer's instructions for operation, maintenance and repair.

## 2.3 Technical data


*The materials/media to be used for the intended purpose of the machine are procured and applied by the machine owner. Proper handling of these materials/media and the associated dangers are the sole responsibility of the owner. Danger and disposal instructions must be provided by the owner. The safety data sheets of the material and media manufacturers must be observed.*

### 2.3.1 Dimensions and weight

**Magnetically Shielded Room (internal dimensions)**

| | | | |
|---|---|---|---|
| Length: | | 4,000 | mm |
| Width: | | 3,000 | mm |
| Height: | | 2,400 | mm |
| Total weight: | appr. | 7,200 | kg |

**Cabin door**

| | | | |
|---|---|---|---|
| Clear width: | | 1,000 | mm |
| Clear height: | | 2,000 | mm |

**Required space**

The requirements with regard to space are included in the layout plans. The floor must be level for the cabin to stand vertically.

| | | | |
|---|---|---|---|
| Approximate distance for assembly at a room wall: | | 50 | mm |
| Free space to a surrounding wall: | min. | 600 | mm |
| Room height for normal assembly (free standing): | min. | 3,100 | mm |
| Room height for assembly in a Corner or by a wall: | min. | 3,500 | mm |

In particular cases of tight room dimensions please contact VAC.

## 2.3.2 Electrical connections

**Plug for power supply unit lighting**

| | |
|---|---|
| Operating voltage (alternating current): | 1 AC 115 / 230 V, ± 10 % |
| Neutral conductor: | loadable N (in the machine) |
| PE conductor: | separate PE conductor (yellow-green) (in the machine) |
| Frequency: | 47 – 63 Hz |
| Power: | 500 W |
| Fuse: | 2 x 3.15 A delayed action |
| Degree of protection: | IP 40 |
| Installation specification: | designed in accordance with VDE |

**Cabin lighting (MAIN)**

| | |
|---|---|
| Voltage (direct current) adjustable: | 5 – 12 V |
| Continuous current: | 12.5 A |
| Max. current: | 20 A (appr. 5 min) |
| Power: | 150 W |

**Emergency lighting (EMERGENCY)**

| | |
|---|---|
| Voltage: | 12 V, ± 15 % |
| Current: | max. 5 A |
| Fuse: | 5 A, delayed action |
| Bridging: | approx. 5 h, at 1 A |
| Charging current: | approx. 650 mA |
| Charging voltage: | 13.8 – 14 V |
| Charging duration: | approx. 14 h (full charge) |

**Special accessories Demagnetisation unit (plug)**

| | |
|---|---|
| Operating voltage (alternating current): | 1 AC 115 / 230 V, ± 10 % |
| Neutral conductor: | loadable N (in the machine) |
| PE conductor: | separate PE conductor (yellow-green) (in the machine) |
| Frequency: | 47 – 63 Hz |
| Power: | 3 kW |
| Fuse: | 1 x 16 A delayed action |

| | |
|---|---|
| Degree of protection: | IP 40 |
| Installation specification: | designed in accordance with VDE |

**Helmholtz-Coils**

| | |
|---|---|
| Operating Voltage: | SELV (Safety Extra-Low Voltage) according to IEC 61140 |

### 2.3.3 Pneumatic connection

For operation of the door with reliable magnetic shielding, compressed air (dry, filtered) with a system pressure (manometer display) of **6 - 8 bar** is required.
The initial pressure must not exceed **14 bar**.
Door opening operation with button “open/close door” requires a minimum pressure of **4 bar**. Be aware that in case pressure is below 4 bar, the normal door operation is totally out of function. “Door open” operation is then only possible with “Emergency door release”.

### 2.3.4 General data

**Ambient temperature range for:**

| | |
|---|---|
| Lower limit temperature: | +5 °C |
| Upper limit temperature: | +35 °C |
| Switch cabinet/operator terminal: | max. ≤ 35 °C |

**Ambient conditions:**

| | |
|---|---|
| Noise level (hearing protection): | < 70 dB (A) |

*The ambient conditions must be designed so that the product is not negatively influenced by the processing, e.g. by air currents, dust or liquids from leaks, condensates or aerosols.*

# 3 Safety

## 3.1 Notes / explanations

***Operating manual binding***
*is framed and identified by a "book".*


***Warnings***
*are framed and identified by a "STOP" sign.*

***Danger notes***
*are framed and identified by a warning triangle.*

***Notes***
*are framed and identified by a "hand".*

***Dangers from electrical current***
*are framed and identified by the adjoining symbol.*

***Danger of crushing***
*are framed and identified by the adjoining symbol.*


***Protective earth connection***
*is identified by this symbol at the connecting terminals.*

### 3.1.1 Machine identification

The data in this operating manual only apply for this machine, the VAC No. of which is specified on the title sheet.
The rating plate with the VAC - No. is mounted above the door of the cabin.

This must be specified correctly for all inquiries:

- the machine identification
- the VAC - No.

Only then quick and perfect handling is possible.

## 3.2 Built-in safety systems

The built-in safety devices must be checked at regular intervals (**d** = daily, **w** = weekly, **m** = monthly, **y** = yearly). The applied test methods are: **V** = visual test, **F** = function test, **M** = measurement.

**Mains disconnection device (plug) for Cabin lighting and optional additional plug for special accessories Demagnetisation unit**

| Test | |
|---|---|
| **Interval** | **Method** |
| **y** | **F** |

The plugs connect or disconnect the machine to the power supply.
When carrying out cleaning, maintenance and repair work
the plugs must be removed from the power supply and placed in a position to prevent them from inadvertently being reconnected to the power supply.

The plug for the demagnetisation unit must be disconnected from the power supply after the demagnetisation has taken place.

**Emergency Door Release system**

| Test | |
|---|---|
| **Interval** | **Method** |
| **m** | **F** |

The machine is equipped with an emergency door release system. An emergency door release button is located on the inside and the outside of the cabin door.
When activated, the pneumatic locking system is deaerated and the door released. By pulling or turning to the left, the emergency door release button can be unlocked.

**Mechanical emergency release**

| Test | |
|---|---|
| **Interval** | **Method** |
| **m** | **F** |

If the locking mechanism leverage becomes blocked, the cabin door can be unlocked using the emergency release. To this end, an allen key is fastened on

the inside and outside which can be utilized to activate the emergency release.

**Emergency lighting**
The machine is equipped with emergency lighting to ensure continued sight during a power outage.

| Test | |
|---|---|
| **Interval** | **Method** |
| **m** | **F** |

**Electrics**
The electrics come equipped internally with a 3-conductor supply system (a phase, load compatible MP and separate earth return ) with GREEN/YELLOW cable cover.

| Test | |
|---|---|
| **Interval** | **Method** |
| **y** | **V, F, M** |

*The owner must ensure that no unauthorised persons (not operating or maintenance personnel) are allowed to enter the operating area.*

*The electrical cabinets can only be opened with a special key. The special key may only be issued to an authorised person. Please make sure that the door/hatches of the electrical cabinets are only opened by experts for maintenance work and troubleshooting and are otherwise kept locked!*

*This operating manual is part of the machine and must be available to operating personnel at all times.*

*The safety instructions herein must be observed.*

*It is strictly prohibited to deactivate the safety devices or to change their function in any way.*

## 3.3 Interfaces of the machine


*Fig. 3-1 Interfaces of the machine*

**The Magnetically Shielded Room has the following interfaces:**

1 Cabin door
2 Pneumatic connection
3 Extracted air outlet
4 Control cabinet (by the customer) with electrical plug for power supply unit lighting
5 Control elements on the outside of the Magnetically Shielded Room
6 Fresh air supply
7 Control elements on the inside of the Magnetically Shielded Room
(not shown in the picture)
8 Optional: Electrical plug for special accessories demagnetisation (not shown in the picture)

## 3.4 Safety measures (to be taken by the owner)

May we remind you that the owner is responsible for instructing operating and maintenance personnel:

- about the **machine's protective devices**,
- with regard to compliance with safety measures.
- The owner must ensure that unauthorised persons (not operating or maintenance personnel) are prevented from entering the danger area of the plant/machine.

This operating manual must be kept for future use. The frequency of inspection and control intervals must be observed.

The work described in this operating manual is described in such a way that it can be understood

- in the Operation and Operating Modes chapter of the operating manual by an **instructed person**,
- by an **expert** in the chapters Transport, Installation and Assembly, Maintenance, Fault/Cause/Remedy

.

The **Transport, Installation and Assembly, Maintenance, Fault/Cause/Remedy chapters are intended for experts only**. Work described in these chapters may only be performed by expert.

**Instructed person**
A person who has been instructed by an expert in the assigned tasks and informed of the possible risks in the event of improper handling and trained and instructed as to the necessary safety devices and safety measures if necessary.

**Expert**
A person who is able, on account of his/her technical training, knowledge and experience and familiarity with the pertinent standards,
to evaluate the entrusted tasks and recognise the possible dangers.
**In the definition based on EN 60204-1.**

## 3.5 Owner's obligations

*In the European Trade Area the national implementation of the basic directive (89/391/EEC) and the corresponding individual directives and especially the directive (89/655/EEC) governing the minimum specifications for safety and health for the use of operating equipment by employees, in the respective valid version, must be observed and complied with.*
*In Germany the Operational Safety Directive of October 2002 must be observed (implementation of the above directive in German law).*

The operator must obtain the local **operating permit** and observe the associated restrictions.

In addition he must observe the local legal provisions for
- safety of personnel (rules for accident prevention)
- safety of equipment (safety equipment and maintenance)
- product disposal (waste disposal act)
- material disposal (waste disposal act)
- cleaning (cleaning agents and disposal)
- environmental restrictions.

**Connections:**
Before operating the machine the owner must ensure that the local regulations,
for example for the electrical connection, are observed during installation and commissioning.

## 3.6 Safety inspections

carried out by the manufacturer at the factory.

1. Airborne noise measurement
   - according to the machine directive, Appendix 1 (Item 1.7.4/f)

2. Testing and inspection according to DIN EN 60204-1 (Edition of Nov. 98)
   - Check that the electrical equipment corresponds to the technical documentation. (chap. 19.1)

   - Unbroken connection of the protective earth conductor system (chap. 19.2)

   - Insulation resistance tests (chap. 19.3)

   - Voltage tests (chap. 19.4)

   - Protection against residual voltages (chap. 19.5)

   - Function tests (chap. 19.6)
     The functions of the electrical equipment, especially that relating to safety and protection measures, have been tested.

# 4 General danger notes

## 4.1 Dangers

The safety systems and instructions described in this manual must be observed.

The machine is controlled by the control cabinet during operation.

Ensure that the area around the machine and the inside of the cabin are kept free from obstructions to enable access at any time.

*Pay attention to the **dangers from electrical current** during set-up, maintenance and repair work! **Disconnect the power supply!***

The plug for the optional demagnetisation unit may only be connected to the power supply during the demagnetisation process and must be disconnected again when the process is finished.

*If people are present in the cabin, the optional demagnetisation unit may not be used under any circumstances! **The plug must not be connected to the power supply!***

*Please note that no electromagnetic disturbances can occur outside the cabin during the demagnetisation process.*

## 4.2 Danger areas in the machine

The owner can access the entire area in and around the Magnetically Shielded Room.
Operation takes place through the actuation of the control elements on the control cabinet, on the outside and inside the Magnetically Shielded Room and on the compressed air feed.
The danger area is located in the door area during maintenance and repair work.

*The **danger area** during maintenance and repair work or cleaning covers 1 m around the machine. The swing area of the opening cabinet doors must be taken into account.*

*Pay attention to the dangers from **electrical current** when handling the machine.*

*The switch-off procedures (see chap.4.5 ) must be performed before cleaning, maintenance and repair work!*

## 4.3 Operating and maintenance personnel

Operating and maintenance personnel are persons responsible for transport,
assembly, installation, operation, set-up and cleaning of the machine and for troubleshooting.

1. The machine may only be operated by trained and authorised persons.

2. The responsibilities for operation of the machine must be clearly defined and observed so that there are no unclear competencies under the aspect of safety.

3. For all work (operation, maintenance, repair etc.) the switch-off procedures specified in the operating manual must be observed.

4. The operator must refrain from working in any manner which could impair the safety of the machine.

5. The operator must ensure that only authorised persons work on the machine.

6. The operator is obliged to report any changes to the machine which could impair the safety to the owner immediately.

7. The owner is obliged to always operate the machine in perfect working condition only.

8. The owner must equip the operating personnel with the appropriate safety equipment in accordance with the legal provisions and the material to be processed.

## 4.4 Installation of spare parts and wearable parts

May we remind you that spare parts and accessories not delivered by us have not been tested and released by us. The installation and/or use of such products may therefore have a negative effect on the constructionally specified properties of your machine.
For damage caused by the use of non-original parts and non-original accessories
Vacuumschmelze GmbH & Co. KG will be excluded from all liability.
Standard parts can be ordered through the trade.

## 4.5 Switch-off procedures


*The following switch-off procedure must be observed before performing cleaning, maintenance or repair work (only by experts):*

1. *Switch off power to machine.*

   - ü *Disconnect the power supply*
   - ü *disconnect any additional plugs connected to the power supply from the optional demagnetisation unit.*
   - ü *Place the plug in a position to ensure that it cannot be reconnected to the power supply inadnvertently.*
   - ü *Ensure that there is no voltage.*
   - ü *Short-out and earth the machine.*
   - ü *Cover and shield any parts supplied with power in the immediate vicinity.*

2. *Cut off pneumatics.*

   - ü *Close stop valve.*
   - ü *Check that the pneumatic system is free of pressure.*
   - ü *Ensure that the stop valve can not be reopened.*

*Close the open electric cabinets when cleaning so that no water or dust can get in.*
*Failure to do so can result in danger to the life and limb of personnel!*

# 5 Installation

## 5.1 Scope of delivery

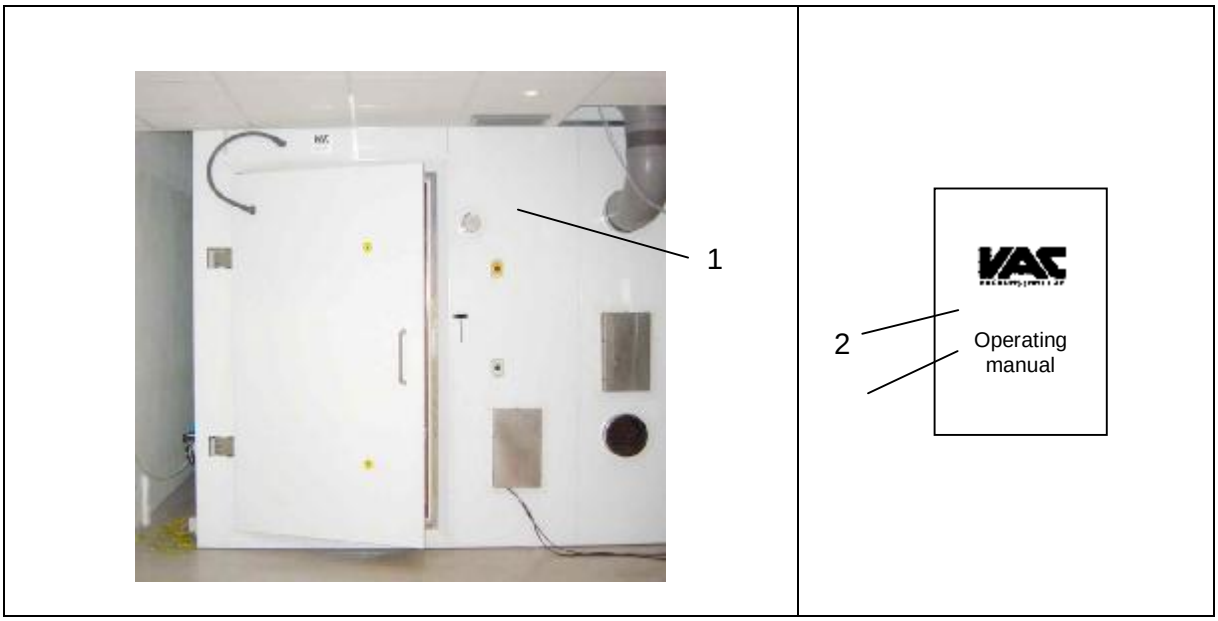



*Fig. 5-1 Scope of delivery*

**The scope of delivery includes:**

1 Magnetically Shielded Room with accessories (demagnetisation unit optional)

2 Operating manual

*A detailed scope of delivery can be found in the order confirmation.*

## 5.2 Transport and packing

VAC plants and machines are tested and packed carefully prior to delivery, nevertheless damage cannot be ruled out completely.

### 5.2.1 Delivery (also for spare and replacement parts)

**Incoming inspection:**

- Check the completeness against the bill of delivery!

**In case of damages**

- **Check the delivery for damage** (visual inspection)!

**In case of damages**

If the delivery has been damaged during transport:

- Contact the last shipping agent immediately!
- Keep the packing (for possible inspection by shipping agent or for sending back).

**Packing for return**

Use the original packing and original packing material if possible. If both are no longer available:

- Contract a packing company with specialist personnel.
- Place the transport units on a pallet (This must be designed to take the weight).
- If you have any questions about packing and transport security please contact Vacuumschmelze GmbH & Co. KG.

**Packing for transport by truck**

For transport by truck the transport units of the machine are placed on the appropriate transport pallets, screwed and secured.

### 5.2.2 Intermediate storage

The freight packing of the machine and of the spare and replacement parts is designed for a storage time of 3 months after delivery.

*Place desiccants in the electrical and operating cabinets.*

**Storage conditions**
Closed and dry room with a room temperature of min 5 °C – max. 30 °C.

*Never clean the machine or parts thereof with a high-pressure water jet, steam jet or splash water. Dirt and water can get into the machine and cause serious damage.*

## 5.3 Transport to the installation site (by the customer)

*Transport may only be performed by experts according to local conditions.*

The transport units are transported to the installation site by the customer on transport pallets.

*Pay attention to the **weights** of the **transport units** during transport (see technical data). The transport units may tip over during transport. Pay attention to the **centres of gravity**. Secure the transport units before transport with the appropriate **lashings if necessary.***

**Transport by crane**

The crane must be designed to take the weight of the transport units.

- The operator must be authorised to operate the crane.
- Secure the transport unit to the crane with the appropriate lashings
  (e.g. traverse, strap, multipoint harness, ropes) at the lashing points provided.
- Use the available transport eyes for transporting the electrical equipment.

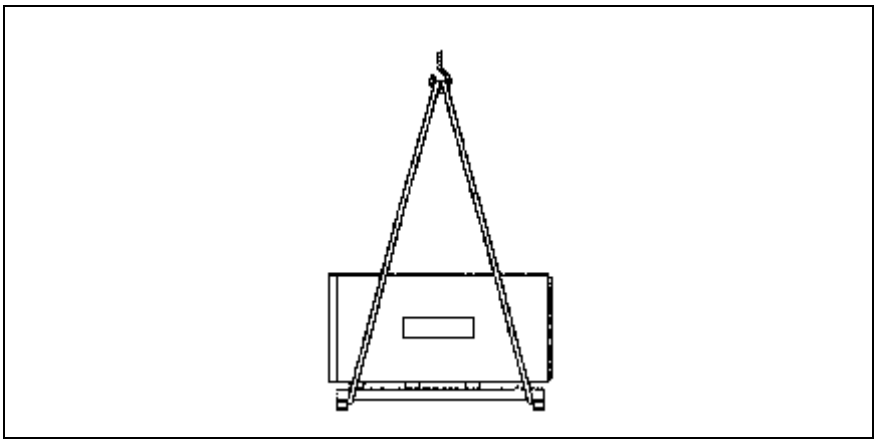


*Fig. 5-2 Transport by crane*

**Transport by forklift truck**

- The forklift truck must be set to suit the weight of the transport units and the driver must be authorized to drive the vehicle.
- Drive the forks of the forklift truck between or under the blocks of the transport pallet or transport unit. Make sure that you drive the forks in far enough (the forks must protrude from the opposite side).
- Lift the transport unit and transport it.

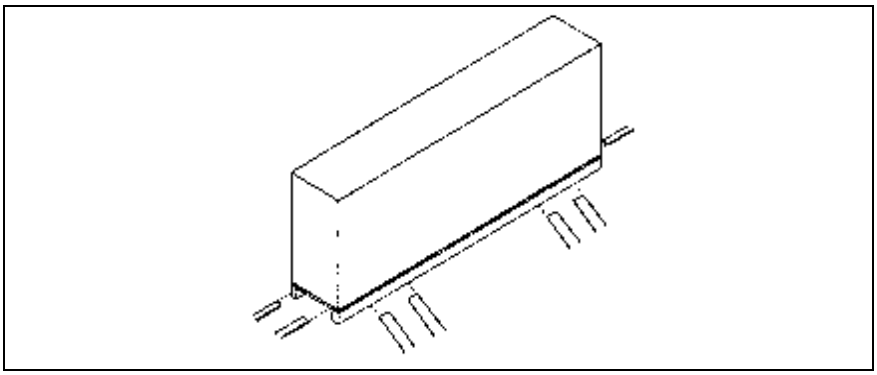


*Fig. 5-3 Transport by forklift truck*

| Module | Weight | Centre of gravity | Lashing points | Conduct |
|---|---|---|---|---|
| Door element | approx. 280 kg | centre | Is assembled and disassembled in individual parts | By VAC specialist personnel |
| Floor, wall ceiling elements | 50 kg per element | centre | Is assembled and disassembled in individual parts | By VAC specialist personnel |
| Control cabinet for demagnetisation unit | 20 kg | centre | Wall assembly | By VAC specialist personnel |
| Lighting power supply | 10 kg | centre | Wall assembly | By VAC specialist personnel |

Assembly only following checks on the building statics in accordance with the floor load plan

## 5.4 Installation, assembly and commissioning

The installation and assembly of the machine must be performed by experts of Vacuumschmelze GmbH & Co.

- Check whether the statics of the building are suitable to take the load of the machine.
  The overall load of the cabin is 7.2 t.
  The base surface of the cabin has 39 pressure points, whereas it should be expected that the support frame will react mechanically flexible. Therefore, a cross beam in the wall, which leads vertically to the floor is responsible for ensuring that it carries both the surface proportion of the wall and half of the surface proportion of the ceiling as load.
- Set up the base frame in the intended location in accordance with the location plan and assemble using relevant measuring equipment
  (e.g. spirit level).
- Assemble the further cabin components based on the assembly diagrams and any separate manufacturer operating manuals.
- Connect the pneumatic connections to the compressed air supply.
- Check that suitable plugs are present in accordance with chapter 2.3.2.
- Start up the machine under consideration of the information in chapter 7.

*Check that all the components in the electrical and operating cabinets fit tightly. Tighten all screws and terminals (electrical cabinet/control panel, motors etc.). The interfaces are shown in chapter 3.3 of this operating manual.*

***Caution**: Before first usage of the MSR, door contacts need to be greased properly, as described in chapter 8.1.2. This is not part of VAC's Installing service.*

# 6 Function

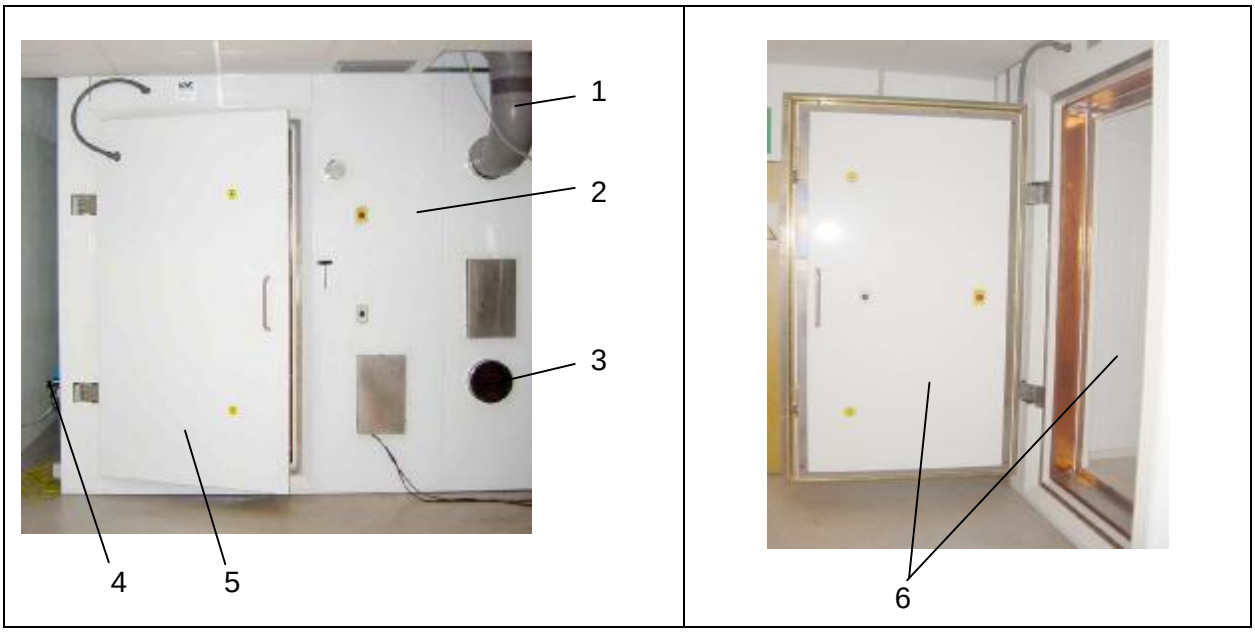



**Fig. 6-1 Overview**

**The Magnetically Shielded Room is made up of the following main components:**

1 Connection for fresh air inlet (by customer)
2 Cabin frame with aluminium shell and shield walls made from MUMETAL/VACOPERM 70, insulation and exterior cladding
3 Connection for extracted air outlet (by customer)
4 Pneumatic connection
5 Access door with pneumatic locking/unlocking
6 Interior cladding
7 Lighting (not shown in the picture)
8 Electrical installation and control/emergency equipment for lighting and door (not shown in the picture)

**Composition and function**

In the Magnetically Shielded Room, low magnetic fields are measured for medical diagnosis, which are typically induced by the flow of nerve currents.
In this way, the Magnetically Shielded Room eliminates the majority of disturbance influences caused by other magnetic or electromagnetic fields, which could impair the measurement result.
If the patient is able to walk, he will be alone in the cabin during the measuring process. For disabled patients, an additional person can also be in the cabin during the process.

- The Magnetically Shielded Room is made up of a cabin frame with aluminium shell and shield walls made from MUMETAL/VACOPERM 70, insulation and exterior cladding and integrated measuring technology.
  The cladding has two functions:
  - to protect the MUMETAL/VACOPERM 70 against mechanical damage which could impair the shielding effect as well as
  - achieving an optical finish.

- The individual cabin components and elements are assembled to the whole cabin at the location of use and the cabin door (clear width 1m, clear height 2 m) with the closing and opening mechanisms mounted and installed. An access ramp is placed in front of the cabin door, so that patients in a wheelchair or hospital bed can be transported into the Magnetically Shielded Room.

- The air supply is provided by fresh air from the central air conditioning system via a supply pipe into the Magnetically Shielded Room and is removed through an extracted air outlet with a filter. Low excess pressure is ensured by the filter function. The air stream should be set so that the air in the cabin is changed at least between 2 and 3 times every hour.

- The Magnetically Shielded Room comes equipped with interior lighting,
  emergency light and an emergency opening system for the cabin door.

## 6.1 Shielding

- The magnetic field can be compensated both passively (purely magnetic shielding from MUMETAL/VACOPERM 70) and actively (feeding electricity to a coil system).
- For active compensation, the control unit MK 3 is used. It is made up of a coil system, which is coiled along the edge of the cabin, and a Fluxgate- Sensor, which is positioned outside the cabin in a corner at the top.
- The device measures the interfering field outside and couples opposite phased fields into the Magnetically Shielded Room, in order to compensate the interfering field. With the system sensor, homogeneous, inhomogeneous or extremely quick changing field parts are compensated. This applies to a range of up to 10 Hz; higher frequencies are not taken into consideration.
  The measurement area itself ranges from 0 Hz to 100 Hz, with the highest level of disturbance lying between 0 -10 Hz.
- The magnetic shielding with MUMETAL/VACOPERM 70 works better in areas above 10 Hz rather than in the lower fields. To raise the lower area and bring it up to an even level, the opposing coupling is carried out. This comprises 3 axes ( x, y and z) with 6 coils in all walls incl. the floor. The power cables are located in the edge area in designated profile. In this case a low potential voltage of approx. 30 mVA per axis is used to avoid any dangers. LED´s show when disturbances are reached in the individual fields. The BNC sockets and RS 232 for the interfering field compensation are located at the front.
- Added to this is a permanent demagnetisation fixture, which is also made up of 6 coils along the inner edge of the MUMETAL/VACOPERM 70, designed so that the MUMETAL/VACOPERM 70 shell is surrounded by each coil. In this case there are 4 coils mounted in z-form (along the floor, positioned high on the side and along the same route back).

These coils join at one point (at the terminal box) and are then fed to the outside to the measuring device.

- The coils are powered with a voltage of 220 V and protected through insulation and cable channel. The connection consists of 5 x 2.5 $^2$ - Cu-cable, joined with insulated AMP – closed-end connectors.
- Magnetised objects brought into the cabin can magnetise the cabin or increase the magnetic effect. This state can be identified with a magnetometer, the planned medical measurements can be impaired in this state. To prevent the measurements from being impaired, the demagnetisation unit needs to be activated by connecting the respective plug to the power supply.
  Demagnetisation must not be carried out while a person is in the cabin. The responsible party must check that no one is in the cabin before demagnetisation is started. The plug must be disconnected from the power supply after demagnetisation. The effect of the demagnetisation process should be tested again with an external measuring device.
- The cabin is free at all ends. The transformer is located behind the cabin. The transformer is equipped with an off-switch, an amperemeter and a potentiometer for turning up the current.

*Do not bring any ferromagnetic components into the cabin following demagnetisation as the demagnetisation process may then have to be repeated.*
*Assemble additional parts so that the MUMETAL/VACOPERM 70 is not put under magnetic stress.*
*Electrically insulate conductive components to the aluminium shell with insulation sockets to avoid an antenna effect.*

## 6.2 Pneumatic circuits

- The pneumatic circuit is designed so the door is released automatically in case of a pressure drop or internal pressure interruption and can be unlocked following the emergency door release procedure. In addition to the pneumatic release, the door is also equipped with a mechanical emergency release enabling exit if the locking mechanism leverage becomes blocked.

- The initial pressure must not exceed 14 bar as it could otherwise cause damage to the pressure reducer. The system pressure must be set in an area between 6 and 8 bar (manometer display on the pressure reducer). In case the system pressure decreases below 4 bar, a normal door operation is not possible.

- The door is opened and closed manually. Pneumatics are only used to lock and unlock the door.

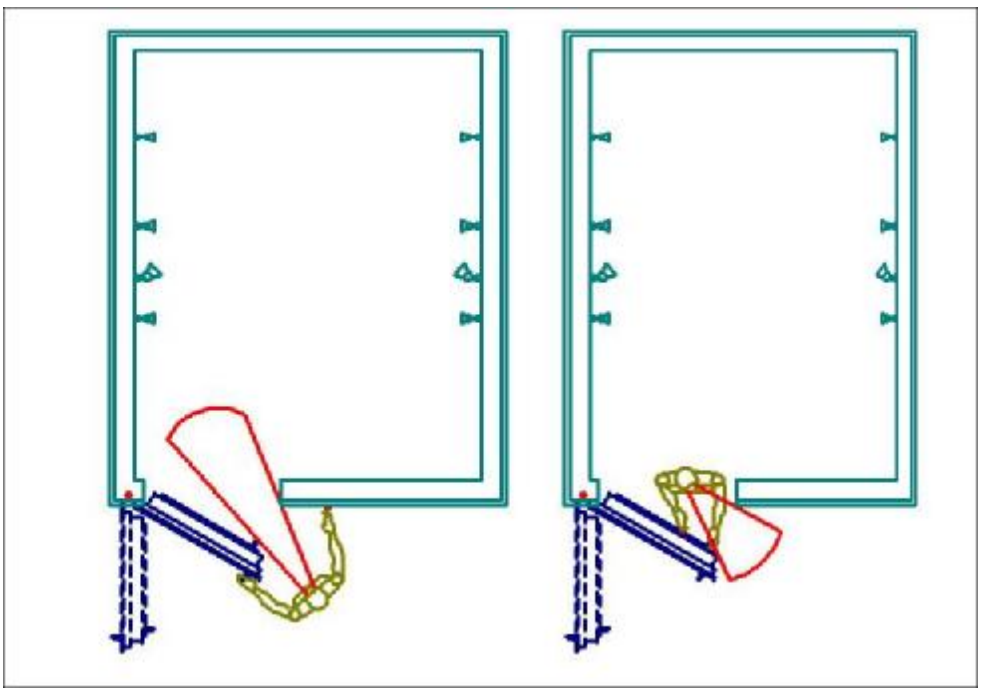
# 7 Operation

*The Magnetically Shielded Room may only be operated by qualified and trained experts.*

## 7.1 Opening and closing the door

- Inside and outside the cabin buttons are installed labelled "Door open" and "Door close". The pneumatic locking procedure begins when the position sensor on the door is activated from the switch cam and one of the above-mentioned buttons are pressed at the same time. As soon as the closing procedure is started, the "Door close" button can be released. Depending on the status of the pneumatic switch, it can be necessary to press the above-mentioned button two times to start the locking procedure.

- The switch method forces the operator to keep both hands outside the danger area of the door. The buttons are positioned so the operator has a view into the door gap and can therefore prevent any risk of danger to third parties.



- The normal opening procedure is started by pressing one of the two buttons again. The compressed air is directed in such a way that the door unlocks and opens approx. 50 mm. Further opening to the open angle of up to 90 ° is then carried out manually.

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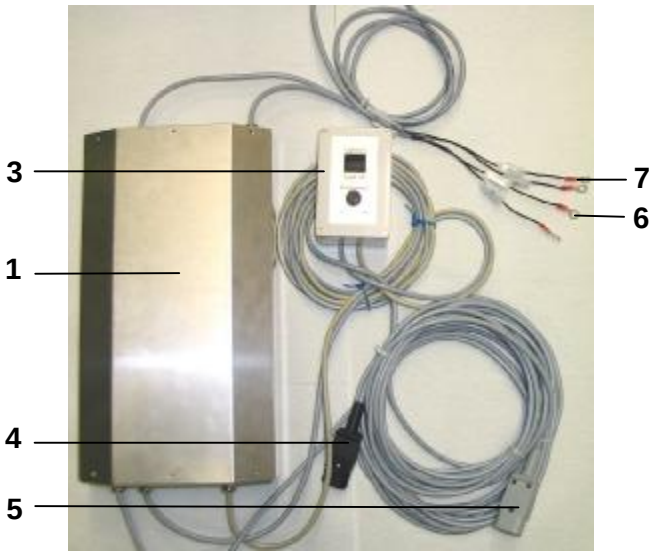
## 7.2 Lighting

The Magnetically Shielded Room is equipped with a dimmable external power supply. This operates a total of six low potential voltage halogen lamps, three installed on each side wall of the cabin. In the event of a power cut, the energy supply is switched over into emergency lighting mode. This effect can also be simulated by disconnecting the power supply (disconnecting the plug from the power supply) when the lamps are switched on.

*Never leave the lighting system running in emergency operation for longer than 2 hours, as otherwise the built-in battery can be drained and destroyed.*





*Power supply in test assembly with USB*

*Fig. 7-1 Power supply / test assembly*

**The cabin lighting is divided in:**

1 **Power supply.**

2 **Uninterruptible power supplies (UPS)**
In the event of a break in the energy supply, the UPS for the emergency lighting switches automatically to the emergency battery supply.

3 **Control element**
- **With toggle switch On / Off**
  When activated, the lighting is switched on or off.
- **Brightness (potentiometer)**
  By activating the potentiometer, the brightness of the lighting can be increased or decreased stepless.

4 **Power cable -3X1 (plug black)**
This connection is used to connect the power cable to the UPS. (USV socket -3X1 black)

5 **Power cable -3X4 (plug grey)**
This connection is used to connect the power cable to the UPS. (USP socket -3X4 white)

6 **Connecting cable for the main cabin lighting (MAIN)**
This cable connects the main cabin light.

7 **Connecting cable for the emergency lighting (EMERGENCY)**
This cable connects the emergency lighting. This connector supplies halogen lamps both as main lighting and as emergency lighting in the event of breaks in the power supply.

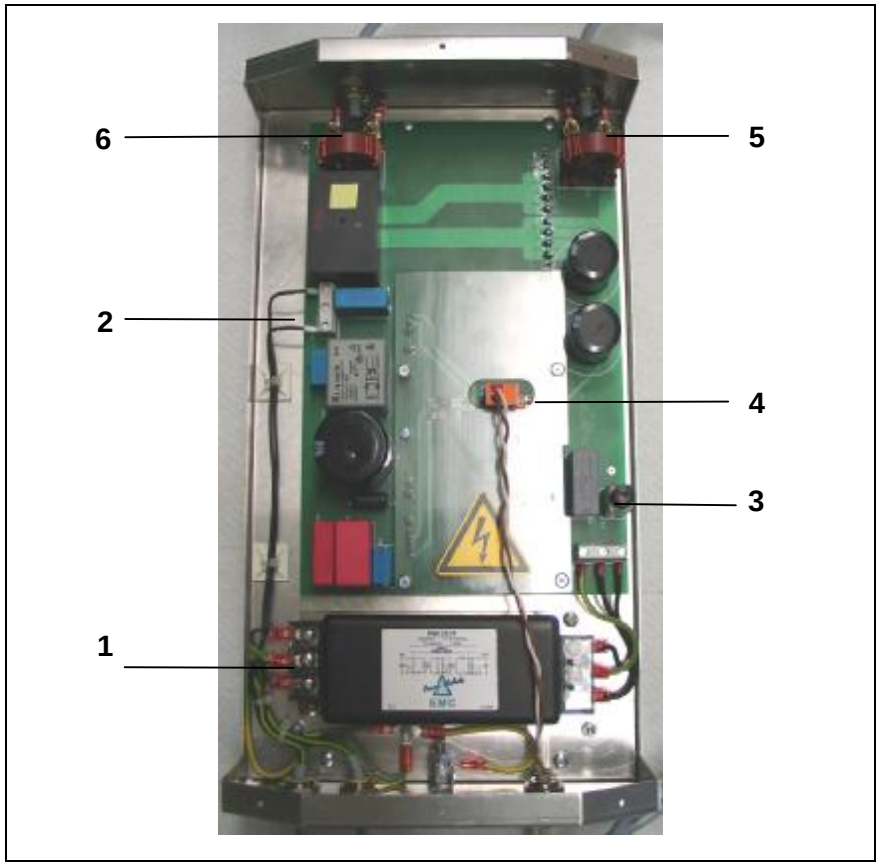



*Fig. 7-2 Power supply open*

**The following interfaces are to be found in the power supply:**

1 **Power cable** (plug black)

2 **Power cable** (plug grey)
**Attention!** When changing the mains type to 120V, the cable must be connected to terminals N and 120V.

3 **Fuse for power supply** ( 2A delayed action)

4 **Plug contact for potentiometer** (brightness)

5 **Connection for cabin main lighting**

6 **Connection for emergency lighting**

## 7.3 Setting up the machine

*When setting up the machine, the appropriate instructions in the manufacturer operating manuals for devices and equipment, which are being employed, must be observed.*

Follow the following procedure when setting up the Magnetically Shielded Room:

- Establish the electrical connection between the cabin safety lighting and the Magnetically Shielded Room.
- Check that the batteries of the emergency lighting are read for operation.
- Open the compressed air connection and perform a test of the door locking mechanism.
- If necessary, position the access ramp to the cabin door.

# 8 Emergency

## In Case the door does not open:

1) Check system air pressure (pressure gauge located at the front side of the MSR close to the host wall): Min 4 bar for door unlocking mechanism is required. If the pressure gauge shows more than 4 bar, press button “Door open/close”.

2) If the pressure gauge shows less than 4 bar or the door still does not open by following step (1), press the **Emergency door release button** on the inside or outside of the Magnetically Shielded Room.

a) normally, the door unlocks and opens a gap length, and the door can be fully opened manually.

b) in case the door opens not visibly, it may nevertheless have unlocked and can be opened by applying more force. This could be due to non-greased door contacts, causing friction (insufficient maintenance).

3) In case the door cannot be opened this way, please use the mechanical emergency release by utilizing the allen keys.

- The mechanical emergency release is meant for use when the locking mechanism leverage in the door becomes blocked.

- Two allen keys are attached to the cabin for the mechanical emergency release (one on the inside and one on the outside).
- To mechanically unlock, one of the two allen keys must be inserted into the,two holes, located in the cladding on both the inside and the outside with the label "Mechanical emergency release". In addition, it may be necessary to push the "Emergency door release" button.
- The door is now unlocked and can be opened manually. The pull-open-procedure requires slightly more force , as the friction between the contact surfaces must be overcome.

*If this type of error occurs, the door must be repaired before reuse in consultation with*
*Vacuumschmelze GmbH & Co. KG.*

# 9 Maintenance / cleaning

*The **chapter maintenance/cleaning** is intended for experts only. Maintenance, cleaning and repair work may only be performed by experts.*

**Expert**
An expert is a person who on account of his/her technical training, knowledge, experience and familiarity with the pertinent standards is able to evaluate the tasks entrusted to him/her and recognise possible dangers.
**In the definition based on EN 60204-1.**

*The contents and structure of these maintenance instructions have been based on DIN 31 052 "Maintenance".*

To enable trouble-free operation of the machine, it is absolutely essential to clean and service the machine at regular intervals.

The locking mechanism of the door is subject to irregular vibrations during operation, which could lead to loosening of the screw and clamp connections. To prevent damage, check the locking mechanism at
regular intervals (recommended interval for single shift operation 6 months) for loose connection.

*During maintenance and repair work pay attention to **danger of crushing!***

*Observe the maintenance instructions for the component modules in the separate manufacturer operating manuals for performing maintenance work.*

*Pay attention to the **dangers from electrical current** during maintenance**!***


*The following switch-off procedures must be performed before carrying out cleaning, maintenance or repair work (only by experts):*

1. *Switch off power to machine.*
   - ü *Disconnect the power supply*
   - ü *disconnect any additional plugs connected to the power supply from the optional demagnetisation unit.*
   - ü *Place the plug in a position to ensure that it cannot be reconnected to the power supply inadvertently.*
   - ü *Ensure that there is no voltage.*
   - ü *Short-out and earth the machine.*
   - ü *Cover and shield any parts supplied with power in the immediate vicinity.*
2. *Cut off pneumatics.*
   - ü *Close stop valve.*
   - ü *Check that the pneumatic system is free of pressure.*
   - ü *Ensure that the stop valve can not be reopened.*

*Close the open electric cabinets when cleaning so that no water or dust can get in.*
*Failure to do so can result in danger to the life and limb of personnel!*

## 9.1 Maintenance

The Magnetically Shielded Room itself is for the most part maintenance free.
The following additional maintenance is required:

### 9.1.1 Maintenance of the conductive PVC special cover

See Appendix 1 "Maintenance instructions: Derby SPL"

### 9.1.2 Door area

Interval: before first usage and subsequently every 3 months
Component: Door contacts
Maintenance: Clean with solvent and grease
with Vaseline.

Since the installation of the Magnetically Shielded Room usually takes place in fabric environment, VAC does not grease the door contacts initially. Before first usage of the Magnetically Shielded Room, the door contacts therefore need to be greased appropriately.

*Through frequent activation of the door or external influences (e.g. earthquake) subsidence can take place in the door plate.*

Subsidence in the door can normally be identified when the locking pressure of 6 - 8 bar is no longer sufficient to completely lock the door. A further indication can be excessive local abrasion of the copper layer on the contact blade (light marks from the springs on the blade are normal, particularly if the Vaseline layer has been renewed).

*If signs are present that subsidence has occurred in the door, we strongly recommend that the door position be checked, as in severe cases a fault can appear in the door. Excessive abrasion of the copper layer can also result in an HF-leakage. Please contact Fa. Vacuumschmelze GmbH & Co KG immediately. in such cases so that the door can be readjusted and damage avoided.*

### 9.1.3 Air outlet

The filter in the air outlet opening of the Magnetically Shielded Room must be cleaned regularly (in accordance with internal regulations and taking into account the number of operating hours) or checked for cleanliness.

### 9.1.4 Pneumatic connection

The compressed air supply must be checked for leaks regularly. It is important to check that the screws are fastened tightly. The filters in the machine must be cleaned or replaced regularly. Check the compressed air pressure on the manometer of the maintenance unit and readjust if necessary.

## 9.2 Cleaning

To ensure that the Magnetically Shielded Room works with no disturbances, it must be cleaned regularly and thoroughly.

*When selecting the cleaning agents and carrying out the cleaning work, current hygiene regulations for cleaning medical equipment must be observed.*
*These regulations must be included in internal cleaning plans.*

*Ensure that following cleaning work no cleaning material or similar is left in the Magnetically Shielded Room.*

## 9.3 Inspections

1. Carry out visual tests in and around the Magnetically Shielded Room, including any connections.

   Pay particular attention to:
   - the wiring for kinks, chafing or charring,
   - the covers and insulation for damage.

2. Carry out function tests on the cabin lighting and the door locking mechanism.

3. If all functions are perfect, the machine is **handed over** to the **operator**.

# 10 Fault, cause, remedy


*The facts and notes on "Fault, cause. remedy" described in this manual are written so that they can be understood by persons with technical training (see definition Chap. 3.4 "Safety measures") in*

- *electrical/electronic engineering*
- *mechanical engineering/maintenance*

*.*

*This personnel must be provided with the appropriate tools and test equipment.*

*The switch-off procedures (see chapter 4.5) must be carried out before all maintenance and repair work.*

| Fault | Cause | Remedy |
|---|---|---|
| Door does not lock. | Emergency door release button inside or outside activated. | Establish cause and rectify, unlock emergency door release button. |
| | No compressed air present. | Check external compressed air supply and re-establish the supply. |
| | Misadjustment of the release valve on the top side of the door. | Check the position of the switch cam at the contact blade and the height level of the roller follower. |
| Door locks and unlocks in intervals. | Misadjustment of the release valve on the top side of the door. | Check the position of the switch cam at the contact blade and the height levelof the roller follower. |
| | Leakage in one of the control valves. | Localize the leaking valve (hissing). Unscrew the base of the valve from the base plate. Unscrew the lid of the |

| | | |
|---|---|---|
| | | control side. Clean the seals and remount the valve. If this procedure does not solve the leakage problem, replace the valve completely. |
| Door unlocks of its own accord. | Misadjustment of the release valve on the top side of the door.<br><br>Leakage in one of the control valves. | Check the position of the switch cam on the contact blade and the height of the roller follower.<br><br>See above. |
| Lamps do not light up. | Light not switched on.<br><br>Power supply has no current.<br><br>Main fuse faulty | Switch on the UPS on the main fuse (LED lights up red)<br><br>Check that the power supply connections on the back of the UPS are fitting correctly.<br><br>Replace the fuses. |
| Only the two front lights light up and the UPS is making a beeping sound. | Power failure. Control running in emergency operation. | Reconnect the power supply to the UPS. |
| Door does not unlock | | See Chapter 8 “Emergency” |

# 11 Disassembly / disposal

**Disassembly**

The disassembly may only be performed by experts.
Make sure the switch-off procedures are performed before starting disassembly.

**Disposal**

The Magnetically Shielded Room is made up of approx. 3.8 t MUMETAL/VACOPERM 70 as
nickel-iron base alloy, approx. 2.5 t aluminium in various purity grades ($AlMg_3$ as extruded profile, Al 99.9 as pure aluminium for the copper-plated aluminium plates), conductive components from pure copper, small amounts of plastic in pipe ducts or pipe duct lining, wood parts e.g. MDF boards on the walls and the floor inside the cabin, approx. 12 $m^2$ PVC, 4 mm thick, as conductive floor covering, approx. 3 $m^3$ styrofoam from the walls, as well as a number of screws and door hinges made from stainless steel.

Solvents and cleaning agents must be disposed of in accordance with local regulations and following the instructions outlined in the safety information provided by the manufacturer.

Contaminated cleaning tools (brushes, cloths etc.) must also be disposed of according to manufacturer specifications.

# 12 Appendix 1: Cleaning notes floor cover Derby AL

for conductive / deflective PVC floorings in the commercial sector provided with a PUR factory finish

Flooring type: ***Derby AL***

**1. Preventive Measures**

A large part of the dirt usually carried into a building can be avoided by fitting dirt traps in front of the entrances to buildings and dirt-trapping flooring in the entrance areas and by incorporating these areas into routine cleaning procedures.

**2. Cleaning of Newly Laid Flooring**

After completion of work, the newly-laid flooring must be cleaned and treated prior to use in order to remove all residues and dirt that have been deposited on it during building and floor laying operations. *PU Cleaner* diluted in a ratio of 1:10 with water is used for this purpose. Where building dirt is slight, the concentration can be reduced accordingly. Distribute the cleaning solution over the floor and allow it to stand for around 10 minutes before the floor is scrubbed using a *Monodisc SRP appliance* fitted with scrubbing brush or red pad. Remove the dirt using a *Spray Extractor appliance* fitted with hard floor adapter or the *Premium F2* and neutralize the flooring using clear water until all traces of cleaning agent have been removed completely.

**3. Routine Cleaning and Care**

3.1 *Dust Removal:* Loose dust and dirt are removed by wiping over the floor with a slightly damp mop.

3.2 *Manual or Mechanical Wet Cleaning*: To remove stubborn dirt, dilute *PU Cleaner* in a ratio of 1:200 and damp mop the floor with a suitable mop (e.g., the *Quick-Step*) or machine clean it (e.g., using the *Premium F2*). Areas which have to be disinfectant cleaned on a regular basis are treated with *Disinfectant Cleaner Concentrate* (tested according to the current German guidelines on health).

3.3 *Intermediate Cleaning:* If it no longer proves possible to remove stubborn dirt by damp mopping, it is recommendable to perform an intermediate cleaning operation using *PU Cleaner* diluted with the appropriate amount of water to treat the degree of dirt in question (e.g., between 1:50 and 1:100). The floor is cleaned with a scrubbing brush/automatic cleaning appliance or using a *Monodisc SRP appliance* with red pad. Regular polishing of the floor after cleaning with the *Monodisc SRP2+S appliance* and a white pad is recommended to ensure the ideal conservation of floor quality.

**4. Removal of Stains and Rubber Heel Marks**

Stubborn stains and rubber heel marks can be removed using *PU Cleaner* undiluted together with a cloth or non-abrasive white pad and subsequently mopping over with clear water. Remove stains immediately if possible since certain types of stains settle into the flooring as they age and can then only be removed with difficulty or are impossible to remove completely.

### 5. Basic Cleaning

Protective films and other residues that impair the appearance of the floor surface and which cannot be eliminated using routine cleaning methods are removed by performing a basic cleaning operation. For basic cleaning, apply *Clean and Strip* in a dilution of up to 1:5 with water and allow to stand for 10-15 minutes before scrubbing the floor using a *Monodisc SRP appliance* fitted with a scrubbing brush or a red pad. Only use a green pad for particularly stubborn residues. Once the dirt has been removed completely using a *Spray Extractor* fitted with a hard floor adapter or the *Premium F2*, neutralize the floor with clear water, warm if possible until all traces of dirt and cleaning agent residues have been removed (the rinsing water no longer shows any sign of foam!).

These Instructions for Cleaning and Care have been compiled in collaboration with the manufacturer of the floor covering in question. The quality, ecological compatibility and fields of application of the CC cleaning and care products mentioned have been confirmed by expertises from independent test institutes. **By passing on these Instructions for Cleaning and Care to his client, the party laying the new flooring has fulfilled his obligations as laid down under Regulation DIN 18 365**.

If you have any further questions on the cleaning and care of elastic floor coverings or are interested in instructions for the cleaning and care of textile floor coverings, please contact our CC Technical Advisory Service. Our staff will be pleased to give you any assistance you require.

**CC-Dr. Schutz GmbH**
Holbeinstr. 17
53175 Bonn
Tel. (0228) 95352-0
www.dr-schutz.com

| Manufacturer | Deep cleaner | Cleaning solution with wiping agent |
|---|---|---|
| Henkel Hygiene GmbH | BENDUROL FORTE; SIGOFIX ULTRA; | INDUR SIGLA; WIT PLUS; |
| CC-Dr. Schutz GmbH | Deep Cleaner R; Professional Deep Cleaner | Floor Cleaner R 1000 |
| Tana Chemie GmbH | GR S; GR 10; LINAX plus | FR 66; TAWIP, AR 80; SR 13 |
| BUZIL-Werk | G 424; G 426 S 710 CORRIDOR wetex | G240; HC 20; HC 24 |
| Dreiturm GmbH | D 1 NEU | GOLDREIF-Klarwisch-Pflege; D3 SPEZIAL |
| Johnson Diversey GmbH | TASKI radical TASKI R20 plus | TASI tensol |