BioSpec/PharmaScan

System Owner Manual

Version 003 for AVANCE NEO

Innovation with Integrity

Preclinical Imaging

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Contents

Contents

1 About This Manual

This System Owner Manual is part of the accompanying documents of the BioSpec MR instrument. The accompanying documents are:

The instrument is delivered with a System Owner binder that contains a USB stick with:

1. All relevant User Documentation such as for example instructions for use, safety, maintenance at the user level, contact etc.
2. This is complemented by the System Owner Manual with instructions and information for the System Owner (responsible body) to assist in fulfilling her/his responsibility for a safe operation of the instrument within the laboratory environment.
3. Also, Site Planning Information is provided that addresses persons who plan and prepare the instrument site. Such persons may include the System Owner as responsible person, but possibly also external planning agencies and engineers who are involved in the layout of the site and the realization of required site preparations.
4. In addition, a separate section MRI RF Coils is provided with RF coil specific information.

The System Owner binder also provides folders to file the different documents originating during the lifetime of the instrument. These are for example installation protocols such as the Magnet Field Acceptance, the installation Acceptance Protocol, training records, or service reports.

Before starting any work, personnel must read the manuals thoroughly and understand their contents. Compliance with all specified safety and operating instructions, as well as local work safety regulations, are vital to ensure safe operation.

The figures shown in the documentation are designed to be general and informative and may not represent the specific Bruker model, component or software/firmware version you are working with. Options and accessories may or may not be illustrated in each figure.

In addition, Bruker may provide the following listed documents that are not part of the accompanying documentation. These documents are designed for advanced users or special applications, and contain in-depth information beyond standard operation:

- **Software Manual**: Contains detailed information on the *ParaVision* user software for experienced operators, see the *ParaVision* Online Help.
- **Application Manual**: Contains detailed information and workflows for in vivo applications performed by experienced operators using the MR or PET/MR instrument with *ParaVision* software, see the *ParaVision* Online Help.
- **Programming and Administration Manual**: Contains detailed information on the application-specific programming of the MR or PET/MR instrument as well as hardware requirements for the workplaces and the scanner electronic. Information for workplace configurations, workplace networking and maintenance procedures are also provided. The document is addressed to method programmers and the instrument administrator, see *ParaVision* Online Help.

Service Documentation is not part of the delivery. Please contact Bruker Service & Life Cycle Support.

1.1 Symbols and Conventions

Safety instructions in this manual and labels of devices are marked with symbols.

The safety instructions are introduced using indicative words which express the extent of the hazard.

In order to avoid accidents, personal injury or damage to property, always observe safety instructions and proceed with care.

⚠ DANGER

DANGER: Indicates a hazardous situation that, if not avoided, will result in death or serious injury. This signal word is limited to the most extreme situations.

This is the consequence of not following the warning.

1. This is the safety condition.

▶ This is the safety instruction.

⚠ WARNING

WARNING: Indicates a hazardous situation that, if not avoided, could result in death or serious injury.

This is the consequence of not following the warning.

1. This is the safety condition.

▶ This is the safety instruction.

⚠ CAUTION

CAUTION: Indicates a hazardous situation that, if not avoided, could result in minor or moderate injury.

This is the consequence of not following the warning.

1. This is the safety condition.

▶ This is the safety instruction.

NOTICE

NOTICE: Indicates information considered important, but not hazard-related (e.g. messages relating to property damage).

This is the consequence of not following the notice.

1. This is a safety condition.

▶ This is a safety instruction.

SAFETY INSTRUCTIONS

SAFETY INSTRUCTIONS are used for control flow and shutdowns in the event of an error or emergency.

This is the consequence of not following the safety instructions.

1. This is a safety condition.

▶ This is a safety instruction.

This symbol highlights useful tips and recommendations as well as information designed to ensure efficient and smooth operation.

General Hazard

Sign indicating a general hazard.

Read the manual for safety instructions or action guidelines. Noncompliance with the information provided in the manual may result in hazards or incorrect operation.

Hazardous Electrical Voltage

Sign indicating hazardous electrical voltage.

Noncompliance with the safety instructions provided in the manual may result in serious hazards.

Radioactive Material or Ionizing Radiation

Sign indicating radioactive material or ionizing radiation.

Noncompliance with the safety instructions provided in the manual may result in serious hazards

Flammable

Sign indicating flammability.

Noncompliance with the safety instructions provided in the manual may result in serious hazards.

Biohazard

Sign indicating biohazard.

Noncompliance with the safety instructions provided in the manual may result in serious hazards.

1.2 Abbreviations

ACE	Animal Cell Extension
ATS	Animal Transport System
BMU	Bruker Magnet Monitoring Unit
CCM	Component Cabinet at the Magnet
DLHE	Dual Loop Heat Exchanger

EPU	Embedded Processing Unit
GC	Gradient Coil
GCTU	Gradient Control Temperature Unit
GTU	Gradient and Timing Unit
GPA	Gradient Power Amplifier
HMI Monitor	Human Machine Interface Monitor
LDU	Line (power) Distribution Unit
LPD	Line Power Distributor
RF	Radio Frequency
RFPA	Radio Frequency Power Amplifier
SPS	Shim Power Supply
TRX 1200	Transmit/Receive module broadband 1200 MHz
WAG	Waste Anesthetic Gas

Table 1.1: Abbreviations for AVANCE NEO based MR instruments.

2 Introduction

The BioSpec/PharmaScan MR instruments are Bruker's preclinical imaging instruments designed for various applications in the field of magnetic resonance imaging (MRI) and spectroscopy (MRS). The latest generation of the electronic platform for these MR instruments is called AVANCE *NEO*. Where indicated, the MR instruments can be extended to a combined instrument with a position emission tomography (PET) instrument (PET/MR).

2.1 Intended Use MR Instrument

Bruker MR instruments are research instruments for Magnetic Resonance Imaging or Magnetic Resonance Spectroscopy (MRI/MRS). The instruments are designed for in vivo investigations of laboratory animals and investigations of biological and non-biological samples.

The instruments are solely operated by trained users and under the control of the corresponding acquisition control and reconstruction software provided by Bruker.

The operation of MR instruments e.g. with strong magnetic fields are regulated by national laws of the country in which the instrument is operated. It is the responsibility of the system owner

- to follow these regulations.
- to assure that all users are well trained and familiar with all safety instructions before using the instrument.
- to assure safe working conditions for staff and any persons who might interact with the imaging device or with the regulated lab environment.

All Imaging experiments with laboratory animals must comply with the country-specific acts and regulations.

2.2 Contraindications

The use of the instrument is contraindicated for

- any examinations that are described by medical device regulations, e.g. MDD.
- any kind of in-vitro diagnostic (IVD) examinations that are described by IVD regulations, e.g. IVDD, IVDR.
- in-vivo examinations of humans or parts of the human body.

2.3 Normal Operating Conditions

For a safe operation of the instrument, it must be operated under Normal Operating Conditions.

This includes compliance with environmental conditions (see System Owner Manual *Environmental Conditions [▶ 63]*) as well as:

- The device is for indoor use only.

- Cooling water (and compressed air for PET option) provided and operational.
- Quench Pipe installed and operational (not required for cryogen free magnets).
- Magnet supervision installed and operational.
- All doors and covers of the instrument and the cabinets are closed.
- The door of the Faraday cage and/or of the CCM are closed.
- RF coils intended for use are connected and loaded either with a dedicated sample or phantom.
- The instrument is READY without indication of error messages.
- No electrical or protective grounding modifications of the instrument.
- No mechanical modifications of the instrument.

See also

Environmental Conditions [▶ 63]

2.4 Performance Environmental Conditions

In order to achieve the specified performance of the instrument, the enhanced performance environmental conditions in the different areas of the installation must be met, for example enhanced temperature stability conditions in the magnet and technical room are required beyond the environmental conditions for a safe operation. The full set of requirements for the performance environmental conditions are given in the Site Planning Information.

Operational Qualification within the specifications of the instrument can only be obtained when the performance environmental conditions are fulfilled.

2.5 Product Safety and Electromagnetic Compatibility

The device complies with the standards:

Product Safety

Adherence to Product Safety standards family 61010-1 and respective -2-parts (to IEC/EN/UL/CSA) – “Safety Requirements for Electrical Equipment for Measurement, Control, and Laboratory Use”.

Electromagnetic Compatibility

Adherence to Electromagnetic Compatibility standards family 61326-1 (to IEC/EN) – “Electrical equipment for measurement, control and laboratory use - EMC requirements“.

Note: This is a “class A” product. It is suitable for use in all establishments other than domestic, and those directly connected to a low voltage power supply network which supplies buildings for domestic purposes. In a domestic environment this product may cause radio interference in which case the System Owner may be required to take adequate measures.

Any modification of the product by the user voids the declaration of conformity.

2.6 National Standards Operating MR Instruments

Compliance with all national standards for operating MR instruments is in the responsibility of the System Owner (responsible body). The references to national standards listed in this document should not be regarded as complete or as generally valid.

Introduction

3 Safety

In this section of the System Owner Manual, safety aspects in the responsibility of the System Owner (responsible body) are listed. Operators are requested to see the Instructions for Use regarding safety and operating instructions of the MR or PET/MR instrument.

Bruker MR and PET/MR instruments are subject to the safety demands given by the Low Voltage Directive (LVD) 2014/35/EU of the European Parliament. Safety is proven by the application of the *Product Safety and Electromagnetic Compatibility [▷ 11]*.

In addition, safety aspects with regard to the magnetic field need to be considered. Thus, the System Owner is requested to establish and maintain a Controlled Access Area which in minimum extension is defined by the three dimensional region where the magnetic field exceeds 0.5 mT (see Magnetic Stray Field).

Furthermore, safety aspects related to the use of radioactive tracer (PET/MR), the infrastructure, anesthesia gases, maintenance and cleaning are mentioned in the following sections.

3.1 General System Owner's Responsibility

System Owner

The term *System Owner* refers to the person who himself operates the device for trade or commercial purposes, or who surrenders the device to a third party for use/application, and who bears the legal product liability for protecting the user, the personnel or third parties during the operation.

System Owner‘s Obligations

The device is used in the industrial sector, universities, and research laboratories. The System Owner of the device must therefore comply with statutory occupational safety requirements.

In addition to the safety instructions in this manual, the safety, accident prevention and environmental protection regulations governing the operating area of the device must be observed.

In this regard, the following requirements should be particularly observed:

- The System Owner must obtain information about the applicable occupational safety regulations, and - in the context of a risk assessment - must determine any additional dangers resulting from the specific working conditions at the usage location of the device. The System Owner must then implement this information in a set of operating instructions governing operation of the device.
- During the complete operating time of the device, the System Owner must assess whether the operating instructions issued comply with the current status of regulations, and must update the operating instructions if necessary.
- The System Owner must lay down and specify responsibilities with respect to operation, maintenance, and cleaning.
- The System Owner must specify, establish, and document the content and the execution of regular PET quality control test. Bruker Service needs to have access to these data for reference during Planned Maintenance.

- The System Owner must ensure that all personnel dealing with the device have read and understood the Instructions for Use. In addition, the System Owner must warrant that the device is operated by trained and authorized personnel and provide personnel with training and hazards information at regular intervals. Especially when dealing with radioactive tracers, the corresponding workflows and safety measures are of utmost importance.
- The System Owner must provide the personnel with the necessary protective equipment.
- All personnel who work with, or in the close proximity of the device, need to be informed of all safety issues and emergency procedures.
- The System Owner must ensure that new personnel are supervised by experienced personnel. It is highly recommended to implement a company training program for new personnel on all aspects of product safety and operation.
- The System Owner must ensure that personnel are regularly informed of the potential hazards within the laboratory. This is all personnel that work in the area, but in particular laboratory personnel and external personnel such as cleaning and service personnel.
- The System Owner is responsible for taking measures to avoid inherent risks in the handling of dangerous substances, preventing industrial disease, and providing medical first aid in emergencies.
- The System Owner is responsible for providing facilities according to the local regulations for the prevention of industrial accidents and generally accepted safety regulations according to the rules of occupational medicine.
- All substances needed for operating and cleaning the device samples, solvents, cleaning agents, gases, etc. have to be handled with care and disposed of appropriately. All hints and warnings on storage containers must be read and adhered to.
- The System Owner must ensure that the work area is sufficiently illuminated to avoid reading errors and faulty operation.

⚠ WARNING

Safety of personnel and significant instrument damage

Bruker recommends to install, to service and to maintain the instrument by Bruker Service & Life Cycle Support. In case you authorize staff or third party service engineers, it is entirely your responsibility to care for qualification. Unqualified manipulations on the instrument bear a high risk of injury and can lead to significant instrument damage.

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3.3 Controlled Access Area

The System Owner is requested to establish and maintain a Controlled Access Area which in minimum extension is defined by the three dimensional region where the magnetic field exceeds 0.5 mT (see Magnetic Stray Field). Several safety aspects arise that are listed below.

⚠ WARNING

Risk of personal injury or death due to effects originating from strong magnetic fields: Establish and maintain a Controlled Access Area.

Approaching a strong magnetic field bears various risks that can lead to serious injuries. It is the responsibility of the System Owner (responsible body) to establish and maintain a Controlled Access Area which is defined by the three dimensional region where the magnetic field exceeds 0.5 mT (5 Gauss). People with medical implants or pacemakers or people carrying magnetic parts must not enter the Controlled Access Area.

- ▶ Establish a Controlled Access Area with minimum size of the 0.5 mT region.
- ▶ Train and authorize all personnel that needs to enter the Controlled Access Area. Do not forget to inform facility management, cleaning personnel, or potentially local fire brigade.
- ▶ Check authorization regularly and refresh training on safety.
- ▶ Refuse and prevent actively people carrying medical implants entering the Controlled Access Area.
- ▶ Refuse and prevent actively non-authorized and or non-trained personnel entering the Controlled Access Area. Inform visitors on the potential risk originating from the high magnetic field. Do not leave visitors unattended.
- ▶ It is good practice to establish a standard procedure when entering the Controlled Access Area and depose all personal accessories outside that might be affected or become dangerous projectiles.

⚠ WARNING

Risk of personal injury or death by projectiles

Ferromagnetic objects introduced into the vicinity of the magnetic field become projectiles. Especially in front of the bore, such objects cannot be controlled and become life-threatening projectiles.

- ▶ No ferromagnetic material may be brought into the vicinity of a MR magnet. If it is unclear if a device contains ferromagnetic material, do not use in the vicinity of the magnet until compatibility has been proven. Always be aware of the strong and sudden attractive force on ferromagnetic materials mainly at the entrance of the magnet bore.
- ▶ Do not wear or carry ferromagnetic objects on your person or in your pockets, for example watches, pens, scissors, …
- ▶ Do not use gas tanks as for example oxygen, nitrogen, or helium tanks within the Controlled Access Area.
- ▶ Do not use ferromagnetic cleaning tools in the Controlled Access Area.
- ▶ Be especially cautious with sharp or massive objects, i.e. scissors, knives, needles, tools, or non MR compatible animal accessories.
- ▶ Never examine samples that contain ferromagnetic materials.

⚠ WARNING

Risk of personal injury or death

The magnetic field of the superconducting magnet remains on even when the MR instrument is powered off.

▶ All safety measures associated with the Controlled Access Area have to be observed even when the MR instrument is powered off.

⚠ CAUTION

Risk of injury and or severe damage of the magnet

Accidentally attracted ferromagnetic material stuck in the magnet may be only removed without risk of injury or damage to the system when discharging the magnet. Contact your local Bruker Service.

⚠ CAUTION

Hazard by untrained and unauthorized persons performing work at the magnet

Persons working at the magnet must be trained and authorized.

Thus, installation, initial commissioning, retrofitting, repairs, adjustments or dismantling of the magnet must only be carried out by Bruker Magnet Service. Note the difference between Bruker Service and Bruker Magnet Service team.

⚠ CAUTION

Dizziness when moving the head at the entrance of the magnet bore

Do not move your head at or close to the entrance of the magnet bore. A temporary feeling of drowsiness, dizziness, or metallic taste may result. These effects become stronger the faster the movements are.

⚠ CAUTION

Risk of Fire

Ensure a general prohibition of smoking or open fire in the area where the instrument is installed. For MR instruments, this applies to the Controlled Access Area and in the technical room.

▶ For MR instruments, only non-magnetic fire extinguishers equipped with carbon-dioxide are to be used in the Controlled Access Area.

NOTICE

Malfunction of laboratory equipment sensitive to magnetic fields

Within the Controlled Access Area, the MR instrument can

1. interfere with electronic devices so that they might not work as intended
2. be influenced by electronic devices so that image quality can be affected

▶ Always check accessories located in the Controlled Access Area for MR compatibility.

NOTICE

Potential damage of devices by strong magnetic field.

The magnetic field can

1. erase magnetic data media, e.g. disks, memory sticks, credit cards
2. destroy mechanically-sensitive components, e.g. watches, hearing aids, cameras

▶ Always check accessories that shall be used within the Controlled Access Area for compatibility with magnetic fields.

3.4 Magnet

The magnetic field of the magnet is permanently active. It is only to be de-energized in emergency situations by actively pressing the Magnet Emergency Quench Button (see instructions for use on the User Documentation DVD). The discharging process of the superconducting magnet is called a quench. An emergency applies whenever there is danger for a person to be injured due to the action of the magnetic forces, and there is no other solution than an emergency quench of the magnet. This might for example be the case when a person is squeezed and held against the magnet by a large ferromagnetic object. The force might be so high that it is impossible to remove the object and free the person without first de-energizing the magnet.

All personnel must be clearly instructed how to use the Magnet Emergency Quench Button and to use only in case of emergency (see instructions for use on the User Documentation DVD).

⚠ CAUTION

Risk of unwanted magnet quench.

If the red Magnet Quench button is pressed a magnet quench is triggered **immediately** without the option to undo.

1. The red Magnet Quench button must be pressed only in case of emergency.

▶ Read the Instructions for Use (System Manual) to understand the quench button function.

The magnet must be attached to a gas-exhaust line, called a quench tube. The quench tube is needed in the case of a quench of the magnet. Under normal operation conditions, the quench valve is blocked off towards the dewar of the magnet by the burst disk. In case of a quench, the burst disk brakes and the quench tube vents the quickly evaporating cryogen gases out of the magnet room. If a quench has occurred, immediately inform Bruker Service & Lifecycle Support to replace the broken burst disk to avoid condensation or re-sublimation inside the magnet dewar.

⚠ WARNING

Risk of personal injury or death

Operating a MR instrument without an intact quench line is prohibited and represents a high potential risk of injury in case of a quench of the magnet.

⚠ WARNING

Injuries by bursting magnet

As a protection of the outer vacuum case against internal overpressure a blind flange is installed as a drop off plate on the side of the outer vacuum case. It is held in position by the atmospheric pressure of the air outside the outer vacuum case and drops automatically in case of overpressure.

- ▶ The drop off plate needs to drop off freely and automatically in case of overpressure.
- ▶ Do not fix or clamp the drop off plate.

Severe damage of the magnet after a quench

After a quench, immediately inform Bruker Service & Lifecycle Support to replace the broken burst disk as soon as possible to prevent damage of the magnet.

3.5 Radioactive Tracer and Samples

By definition, the operation of the PET instrument requires the use of radioactive tracers. The usage of such materials is strictly regulated by the local occupational standards and permissions under the responsibility of the System Owner and/or the local radiation officer.

⚠ WARNING

Health hazard by ionizing radiation.

Radioactive sources are used during operation. Compliance with occupational safety and health regulations are in the responsibility of the System Owner (responsible body).

- ▶ Care for regulatory clearance prior to the installation and operation of the instrument.
- ▶ Ensure compliance with regulatory.
- ▶ Ensure that the correct warning signs are clearly visible at all entrances to the regulated areas and access is controlled.
- ▶ Handling of radioactive samples by trained persons only.

The standard for the protection of laboratory staff against radiation exposure are commonly stated “As Low as Reasonably Achievable (ALARA) . ALARA can be achieved in part by considering concepts of time (decay), distance, probability of exposure and shielding. In order to implement these principles in laboratory workflow, it is essential to include all steps of handling radioactive tracer material, starting from the delivery of radioactive materials, its transport pathways and usage up to the final disposal of radioactive waste, materials and tools as well as the probability of persons being exposed to radiation.

⚠ WARNING

Health and environmental hazard by contamination with radiological substances.

When detecting contamination (for example spilled fluids) and decontaminating radiological substances, follow the decontamination instructions of the substance supplier and your institutional safety protocols for decontaminating and handling/disposal of radioactive waste. Occupational safety, health, and disposal regulations are in the responsibility of the System Owner (responsible body).

- ▶ Classify radioactive composition and state of the sample.
- ▶ Be familiar with the required radioactive protection measures of the sample fluid.
- ▶ Ensure compliance with regulatory while cleaning and disposing contaminations.
- ▶ Depending on the radioactive status of the sample, prevent unauthorized access to the instrument for the required duration.

After any direct contact of a person with a radioactive sample, it is mandatory to consult immediately a physician and the radioactive safety officer of the lab.

3.6 Infrastructure

In order to operate the instrument safely, the laboratory environment has to fulfill certain conditions which have to be fulfilled initially at the time of installation (see Site Planning Information) but need also to be maintained over time. These are for example

- the air ventilation and air conditioning in the magnet room.
- the emergency lights in the magnet room.
- the granted access to the Line Power Distributor to disconnect the instrument from mains.

⚠ WARNING

Emergency Access.

In case of emergency, access to the Line Power Distributor (LPD) must be granted. The components of the MR instrument are to be disconnected from mains at the LPD.

▶ Position the LPD such that access is always granted in case of emergency.

In addition, application of anesthesia gases adds requirements to the laboratory environment.

⚠ CAUTION

Health hazard by anesthesia gas above regulatory limits (worker protection)

Compliance with occupational safety and health regulations are in the responsibility of the System Owner (responsible body). Acute exposure to Isoflurane as well as chronic exposure can cause health hazard.

1. Anesthesia gas delivered into the instrument can escape.

▶ Use corresponding air suction in the surrounding enclosure where applicable.

▶ Use Waste Anesthetic Gas suction from the anesthesia mask where applicable.

▶ Operate instrument in a room with sufficient air exchange rate.

▶ To ensure safe and adequate handling of anesthesia, only trained and authorized users may work with anesthesia gas. Repeat training on a regular base.

▶ Check residual anesthesia gas concentration to stay within worker protection regulatory limits (for example using regularly gas personal monitors suitable for Isoflurane detection).

⚠ CAUTION

Risk of Fire

Anesthesia gases may be flammable.

▶ Use non-flammable gases (e.g. isoflurane).

3.7 Third Party Products

Any usage of e.g. accessories, RF Coils, line power cables that are not verified and released by Bruker for compatibility with the instrument offends against its declaration of conformity and bears a potential risk.

⚠ WARNING

Danger of injury from electrical shock.

1. Defective devices or devices having insufficient safety standard bear the risk of electrical hazard.

- ▶ Use only devices and line power cables with approval by nationally recognized testing laboratories (NRTL).
- ▶ Do not use defective devices or cables or devices showing safety relevant signs of wear and tear.
- ▶ Check the water hoses and connections before using them in the imaging instrument (where applicable).
- ▶ Do not use leaking devices in the imaging instruments.

Trade Product: Bruker delivers this/these item/s as Trade Product/s.

Product Liability is with the manufacturer of the trade product (*).

Product Warranty is within the manufacturer of the trade product (*).

These items are excluded from the acceptance of the Bruker instrument.

These items are excluded from Bruker extended warranty.

It is in the responsibility of the System Owner (responsible body) to follow the product instructions provided by the Trade Product supplier.

(*) only with European Manufacturers (or with authorized representative within the European Union), otherwise via Bruker – see trade product label information.

3.8 Anesthesia

Many in vivo experiment are performed with narcotic gases. Narcotic gases can have a negative impact on the operator. Read the Safety Data Sheets of the different narcotic gases and follow the instructions therein.

Different animal containments can be use during measurements. Depending on the type of the animal cradle, Waste Anesthetic Gas (WAG) can be removed from the cradle and/or the anesthesia mask. Nevertheless, the chamber or mask cannot be considered as fully air tight. Thus, a portion of anesthesia gas can escape.

In any case, follow the warnings given below.

⚠ CAUTION

Health hazard by anesthesia gas above regulatory limits (worker protection)

Compliance with occupational safety and health regulations are in the responsibility of the System Owner (responsible body). Acute exposure to Isoflurane as well as chronic exposure can cause health hazard.

1. Anesthesia gas delivered into the instrument can escape.

▶ Use corresponding air suction in the surrounding enclosure where applicable.

▶ Use Waste Anesthetic Gas suction from the anesthesia mask where applicable.

▶ Operate instrument in a room with sufficient air exchange rate.

▶ To ensure safe and adequate handling of anesthesia, only trained and authorized users may work with anesthesia gas. Repeat training on a regular base.

▶ Check residual anesthesia gas concentration to stay within worker protection regulatory limits (for example using regularly gas personal monitors suitable for Isoflurane detection).

⚠ CAUTION

Risk of Fire

Anesthesia gases may be flammable.

▶ Use non-flammable gases (e.g. isoflurane).

NOTICE

Death of or harm to the animal

1. The Bruker instrument is often used in combination with anesthesia devices (Trade Products) that deliver anesthesia gas. Overdose of anesthesia gas might cause the death of the animal. It is in the operators responsibility to monitor vital signs of the animal.

▶ We recommend to use an animal monitoring system to monitor vital signs (for example heart rate, respiratory rate, body temperature, …).

▶ Follow the instructions for use of all device suppliers such as for example the anesthesia device or animal monitoring trade product supplier.

▶ Ensure operation of vital signs when preparing the experimental setup. For example check ECG wires and hoses of respiratory air pressure pad for blockade.

3.9 Emergency Plan

The System Owner is responsible for the definition and the implementation of procedures which followed in the case of an emergency situation. Such a procedure is called an Emergency Plan and should comprehend the following major steps:

1. Define and establish the emergency plan including the definition of responsibilities.
2. Introduction of the emergency plan and regular training for all users.
3. Introduction of the emergency plan and regular training for service, security and cleaning personnel.
4. Introduction of the emergency plan and regular training for the local fire brigade.
5. Conduct in the event of fire.
6. Medical emergencies.
7. Ensure that all users are familiar with the operation of the electronic emergency switches and in case of a MR or PET/MR instrument, the safety aspects related to the magnetic field.
8. Ensure that all persons involved in the emergency plan are familiar with any special procedures arising from the use of radioactive materials (PET/MR) or X-rays (PET/CT).

It is necessary to inform all people who are involved in the emergency plan about the potential risks. All people who potentially have access to the instrument must be introduced to the emergency plan and to all risks associated with the instrument. Beside the laboratory staff, this includes the local fire brigade, security staff, first aid and medical assistance personnel.

It is recommended to organize an informal visit of these people in order to discuss conduct during a fire or any other emergency situation on site.

3.10 Maintenance and Cleaning

The System Owner is responsible for ensuring that the device is always in a technically faultless condition. Therefore, the following applies:

- The System Owner must ensure that the tasks and maintenance intervals for the instrument described in this manual in section *Maintenance [▷ 49]* are fulfilled.
- The System Owner must ensure that all safety devices are regularly checked to ensure full functionality and completeness.
- Last no least, cleaning or disinfection and decontamination (PET/MR or PET/CT) needs to be addressed and taken care of appropriately by the System Owner.

⚠ CAUTION

Health hazard while cleaning the device (worker protection)

Compliance with occupational safety and health regulations are in the responsibility of the System Owner (responsible body).

- ▶ Before starting to clean the instrument, make sure that radioactivity is completely removed from the instrument and correct decay times have been applied (PET/MR and PET/CT instruments).
- ▶ Wear appropriate protective gear. As gloves, impervious gloves, e.g., latex or nitrile are recommended.
- ▶ When handling or using any cleaner, consult the manufacturer's Material Safety Data Sheet (MSDS) for additional information prior to use.

3.11 Transport and Dismantling

Contact Bruker Service and Lifecycle Support when planning to relocate the instrument within a building or when planning to transport.

⚠ WARNING

Personal injury and/or risk of severe damage of the MR instrument

- ▶ A MR instrument may only be moved by qualified personnel.
- ▶ The magnet must not be moved when it is on magnetic field or without having the transport safety devices installed.
- ▶ Transport of the instrument bears the potential risk of damage to the instrument and/or the structure of the building.
- ▶ Storage and transport of the magnet in a cold state without connection to the refrigerator has to be limited to magnet specific holding times.
- ▶ Storage and transport of the magnet in a cold state without a quench pipe must comply with the regulations for the storage of cryogen containers. Make sure that the ventilation is sufficient during the entire storage and transportation process (this does not apply for cryogen free magnets).
- ▶ Increased residual magnetization in the building's ferromagnetic structure may remain after an MR instrument has been moved.

⚠ WARNING

Danger of injury from electrical shock.

A life threatening shock may result when the service access housing is opened and work performed while connected to the line power.

Only electrically qualified personnel should open the housing and carry out work.

- ▶ Disconnect from line power.
- ▶ Prevent reconnection.
- ▶ Test for absence of harmful voltages.

⚠ CAUTION

Heavy load.

Some Service actions require handling of heavy loads.

- ▶ Ensure compliance with worker protection regulatory limits.
- ▶ Potentially handle with at least 2 persons where applicable.
- ▶ Potentially, hire professional staff trained in handling heavy loads.

4 Magnetic Stray Field

Most MR instruments are equipped with superconducting magnets designed in ultra-shielded magnet technology to minimize the magnetic flux density of the static magnetic field around the magnet (stray field). Nevertheless, in the vicinity of the magnet, a remaining stray field exists which decreases with increasing distance to the magnet center.

The contours of the magnetic flux density of the static magnetic field around the magnet (stray field) are shown in the diagrams below. According to the Directive 2013/35/EU of the European Parliament on the minimum health and safety requirements regarding the exposure of workers to the risks arising from physical agents (electromagnetic fields), the following two Action levels (ALs) are outlined:

- 0.5 mT: Interference with active implanted devices, e.g. cardiac pacemakers
- 3 mT: Attraction and projectile risk in the fringe field of high field strength

The risks arising from this magnetic field and the establishment of a controlled access area are discussed in the chapters Safety of the User Documentation and System Owner Manual.

The following figures provide contours of equal field strength (magnetic flux density expressed in Tesla and Gauss) of the magnetic stray field surrounding the magnet and the operation area. These data can be used to

1. Define the controlled access area around the MR instrument
2. Define operation procedures that are consistent with the regulations given by occupational standards
3. Evaluate the MR compatibility of non-Bruker MR products with the MR instrument. The system owner has to ensure that the use of non-Bruker MR products in the vicinity of the magnet does not conflict with the functions of the MR instrument and vice versa.

In principle MR instruments may be used only together with MR-compatible equipment. MR compatible[1)] equipment is MR safe[2)] and has additionally no significant influence on the quality of information of the MR instrument. Furthermore the characteristics of the MR compatible equipment are not affected by the MR instrument.

The MR instrument or equipment should not be used adjacent to other equipment. If adjacent or beside use is required, the equipment or the MR instrument should be observed to verify normal operation in the configuration in which it will be used.

Especially at very high magnetic fields, occupational standards might restrict the to enter the magnet bore with extremities of the human body.

1) The MR conditions under which the equipment was tested must be specified. Since a equipment which is specified to be MR safe or MR compatible under one set of MR-conditions, eventually may not be so under a more extreme MR condition.

2) An MR safe equipment in use does not generates an additional risk in the MR environment neither for the user nor for the sample under investigation. However, it may affect the quality of the data from MR instrument

4.1 Magnet 47/16 US

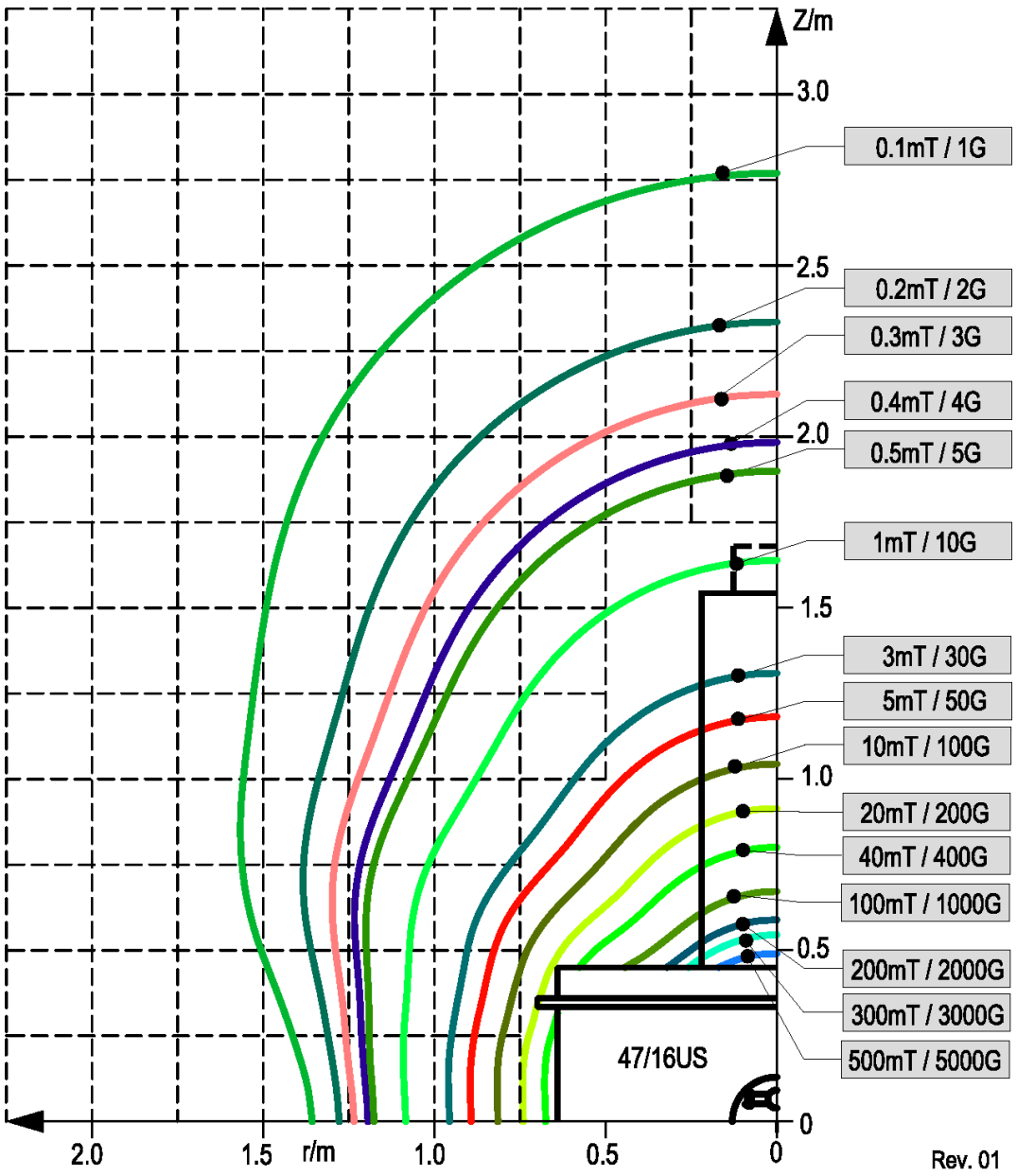

Figure 4.1: Contours of given magnetic field strengths of the stray field outside and inside the magnet bore. The stray field is rotation-symmetric to the z-axis. The origin of the diagram is referenced to the magnet iso-center.

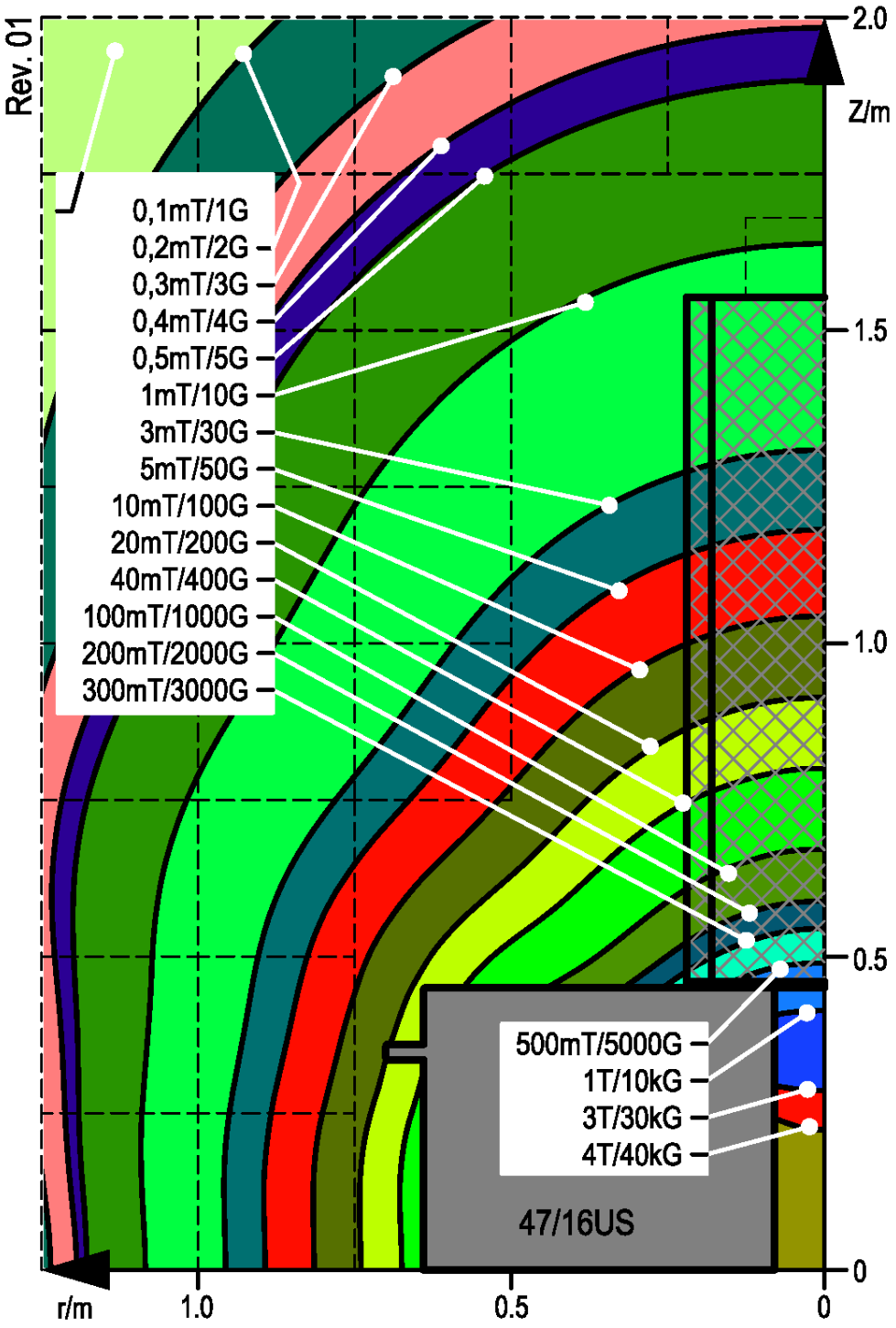

Figure 4.2: Contours of given magnetic field strengths of the stray field close to the magnet and inside the magnet bore. The stray field is rotation-symmetric to the z-axis. The origin of the diagram is referenced to the magnet iso-center.

4.2 Magnet 47/40 USR V2

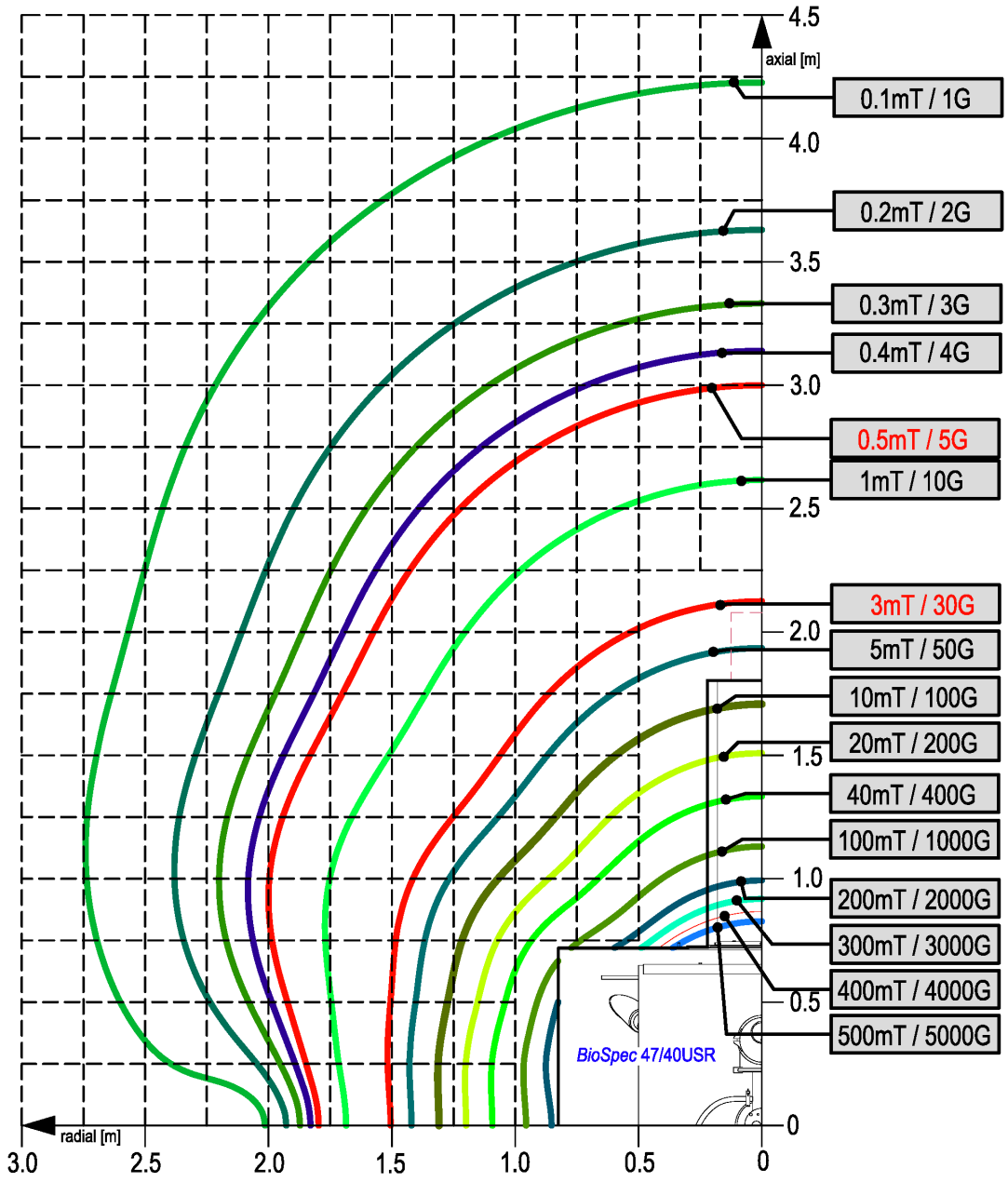

Figure 4.3: Magnet 47/40 USR V2. Contours of the magnetic field strengths of the stray field outside the magnet bore. The stray field is rotation-symmetric to the z-axis. The origin of the diagram is referenced to the magnet iso-center.

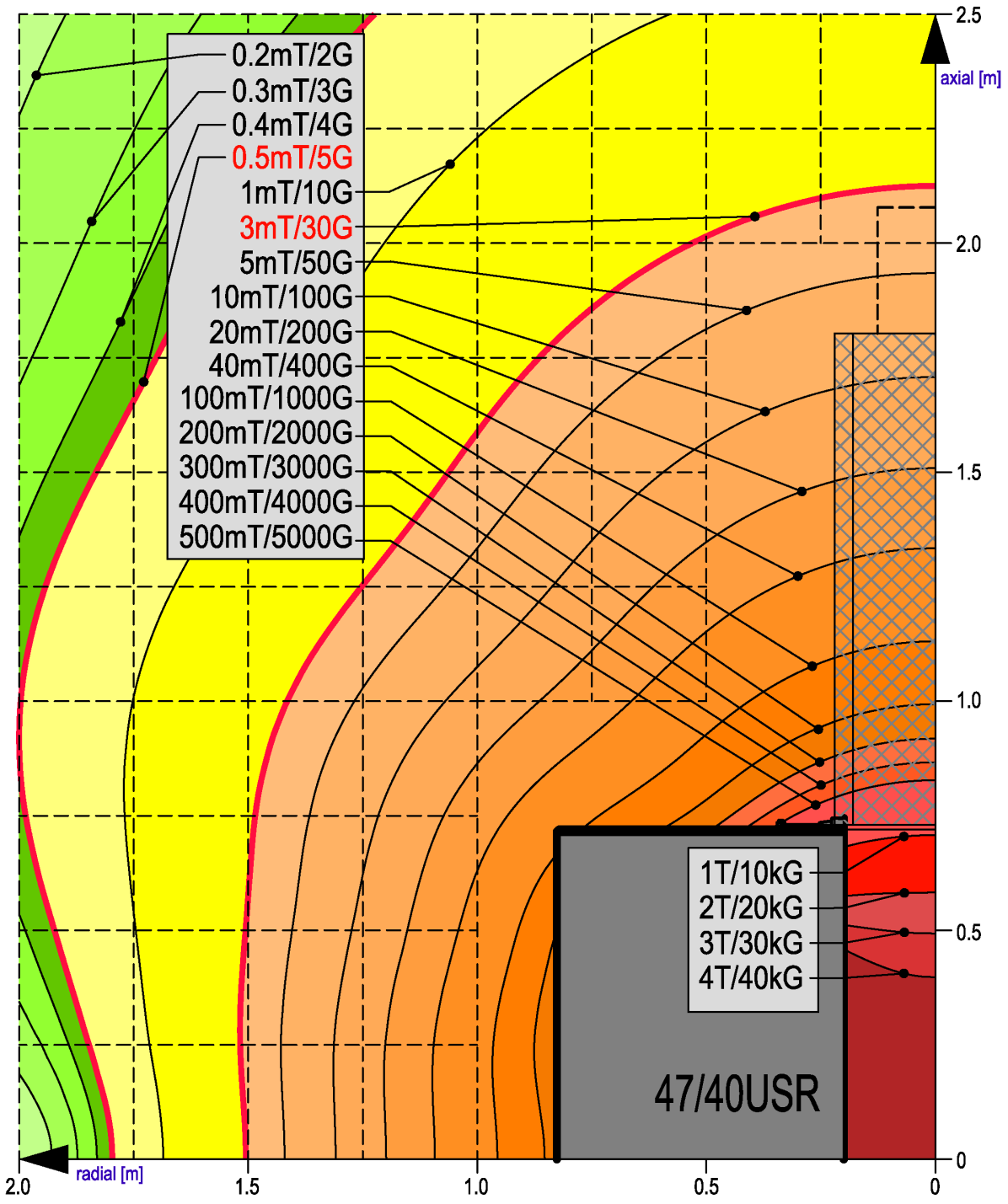

Figure 4.4: Magnet 47/40 USR V2. Contours of the magnetic field strengths of the stray field close to the magnet and inside the magnet bore. The stray field is rotation-symmetric to the z-axis. The origin of the diagram is referenced to the magnet iso-center.

4.3 Magnet 70/16 US

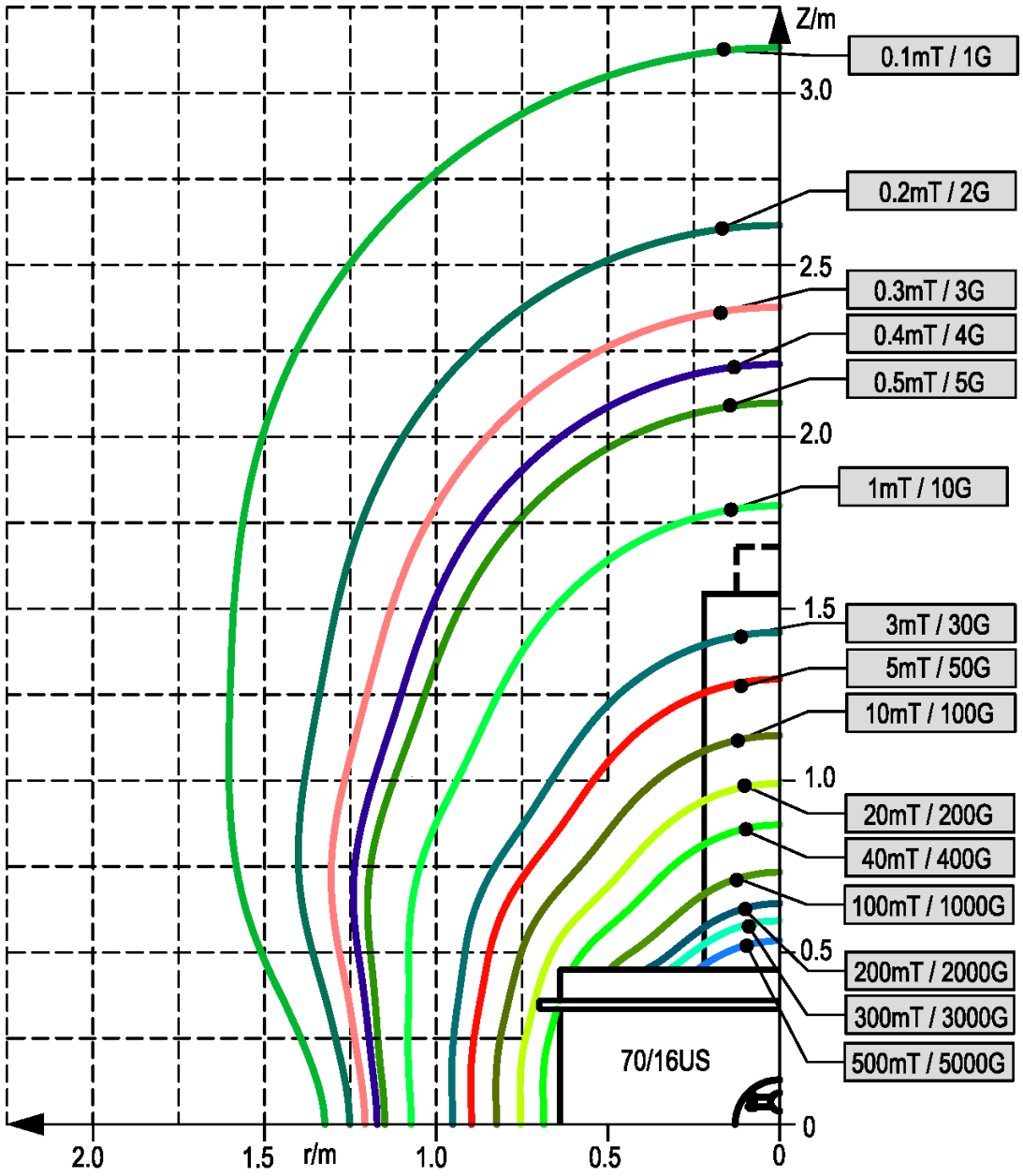

Figure 4.5: Contours of given magnetic field strengths of the stray field outside and inside the magnet bore. The stray field is rotation-symmetric to the z-axis. The origin of the diagram is referenced to the magnet iso-center.

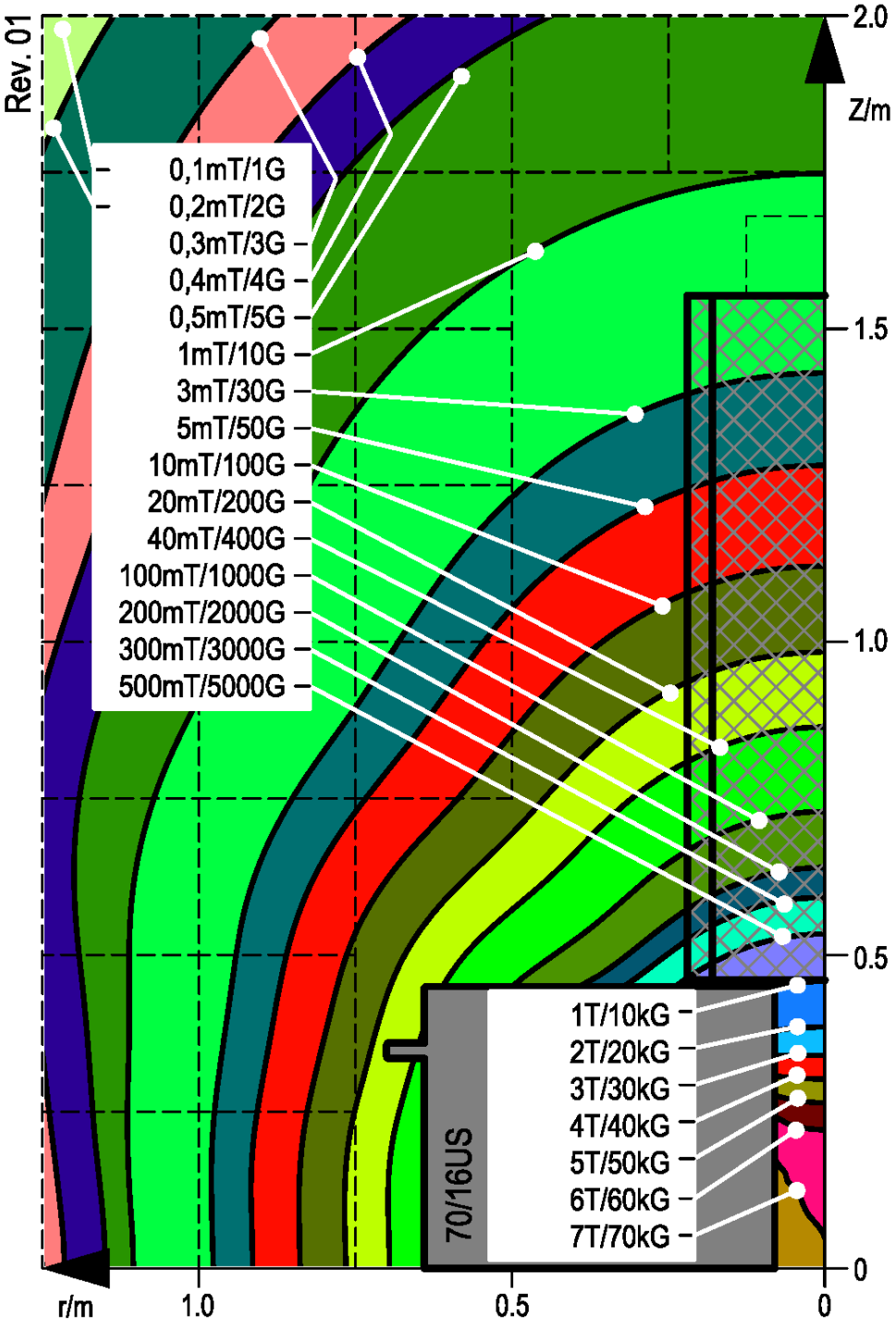

Figure 4.6: Contours of given magnetic field strengths of the stray field close to the magnet and inside the magnet bore. The stray field is rotation-symmetric to the z-axis. The origin of the diagram is referenced to the magnet iso-center.

4.4 Magnet 70/20 USR

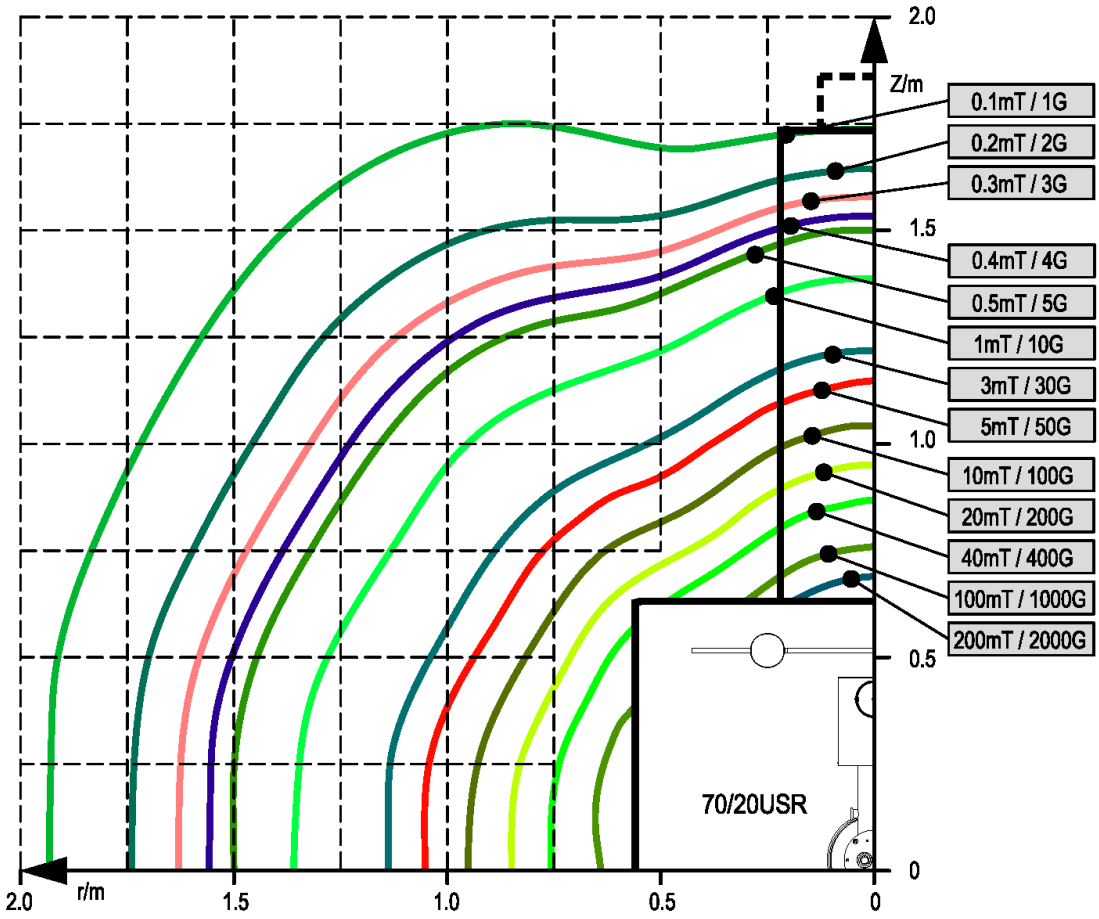

Figure 4.7: Contours of given magnetic field strengths of the stray field outside the magnet bore. The stray field is rotation-symmetric to the z-axis. The origin of the diagram is referenced to the magnet iso-center.

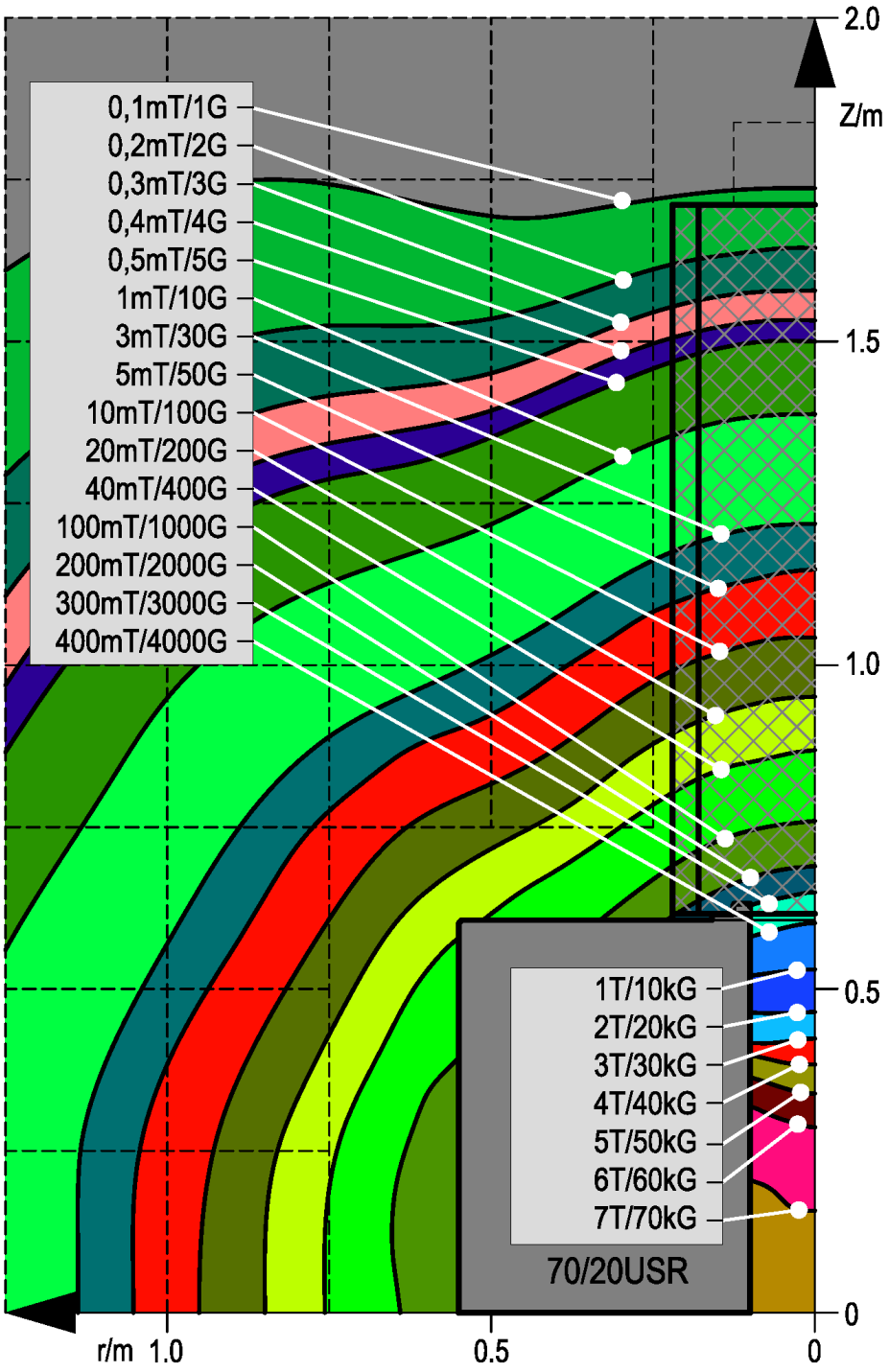

Figure 4.8: Contours of given magnetic field strengths of the stray field close to the magnet and inside the magnet bore. The stray field is rotation-symmetric to the z-axis. The origin of the diagram is referenced to the magnet iso-center.

4.5 Magnet 70/30 USR V2

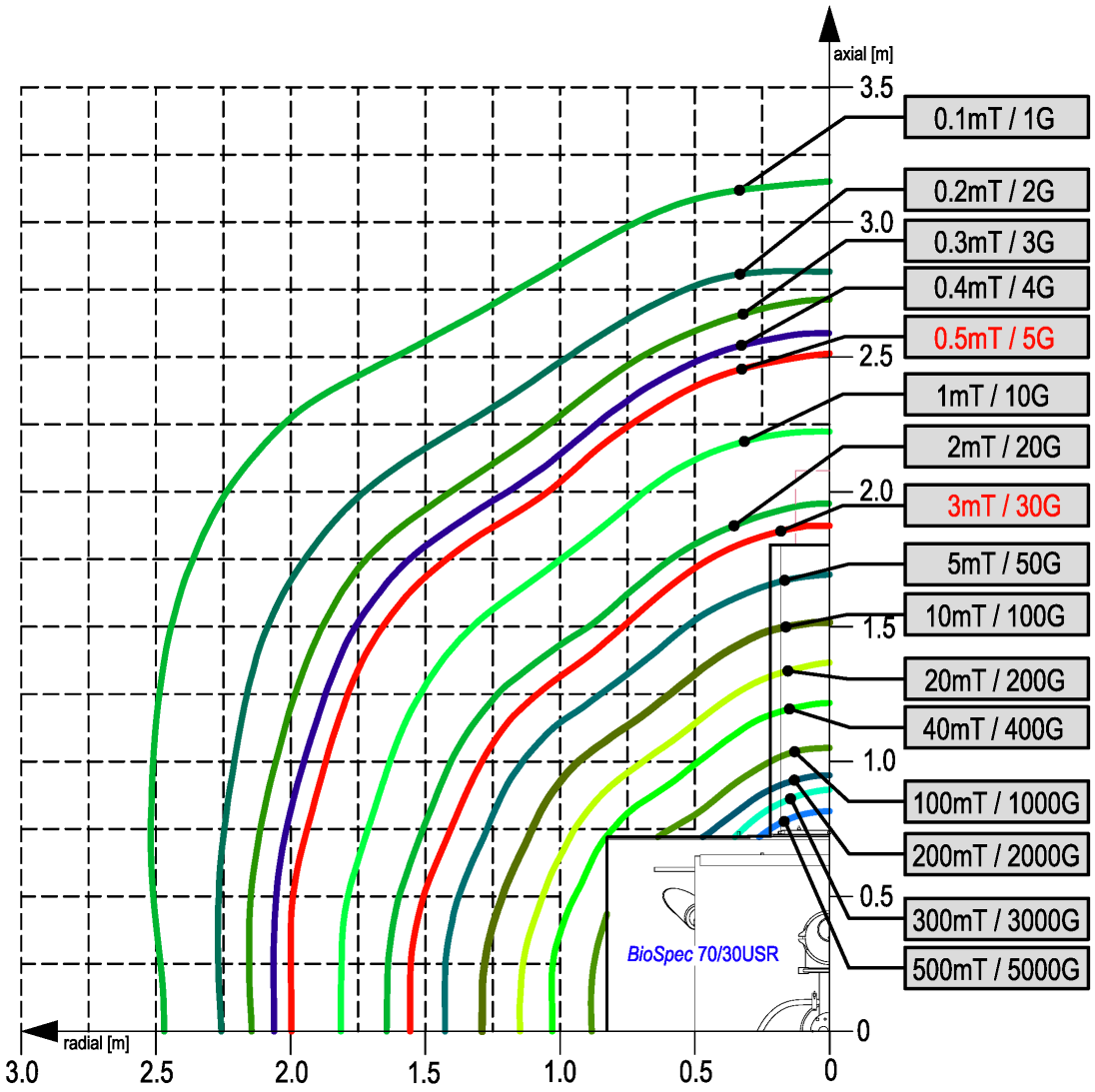

Figure 4.9: Magnet 70/30 USR V2. Contours of the magnetic field strengths of the stray field outside the magnet bore. The stray field is rotation-symmetric to the z-axis. The origin of the diagram is referenced to the magnet iso-center.

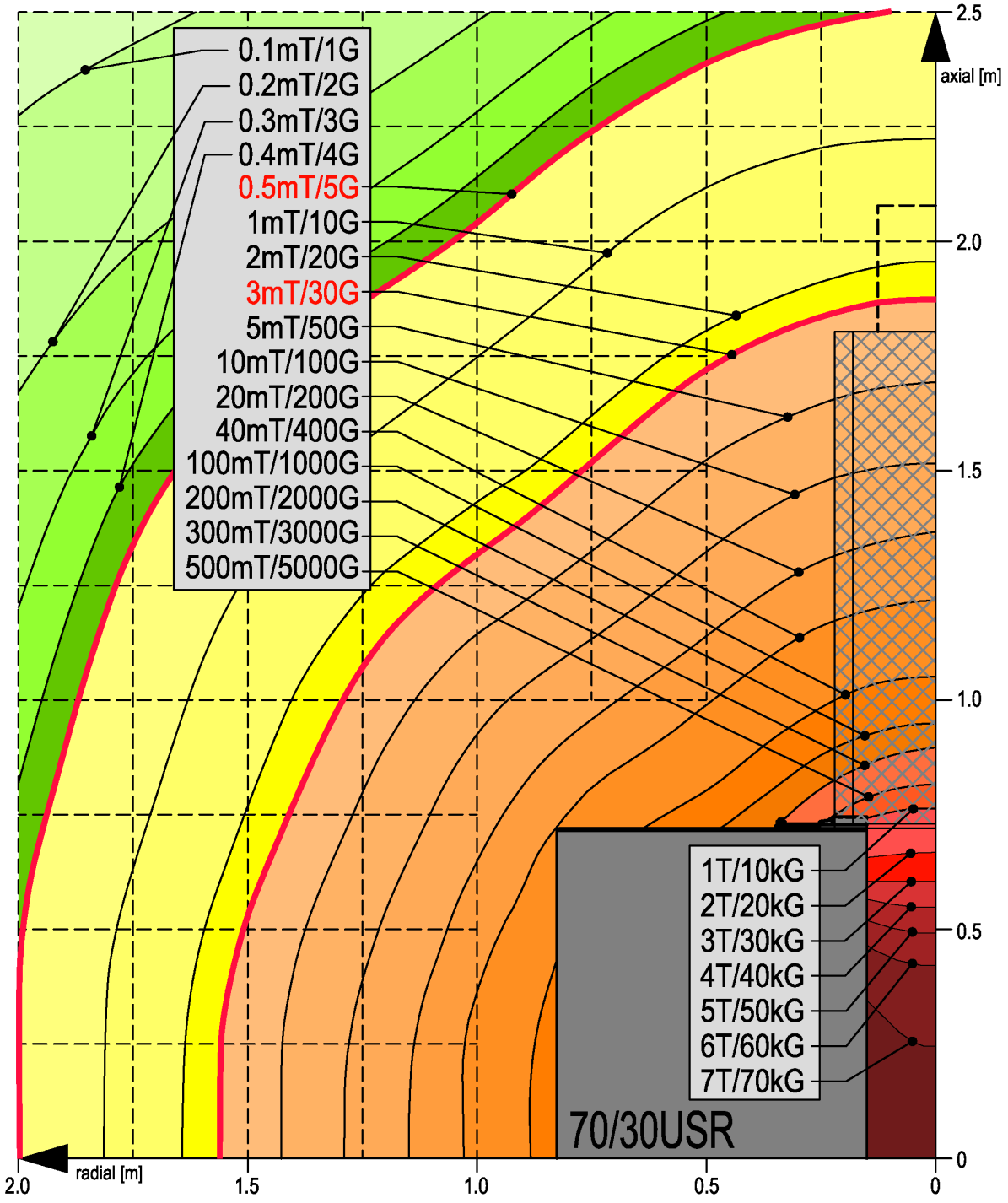

Figure 4.10: Magnet 70/30 USR V2. Contours of the magnetic field strengths of the stray field close to the magnet and inside the magnet bore. The stray field is rotation-symmetric to the z-axis. The origin of the diagram is referenced to the magnet iso-center.

4.6 Magnet 94/20 USR

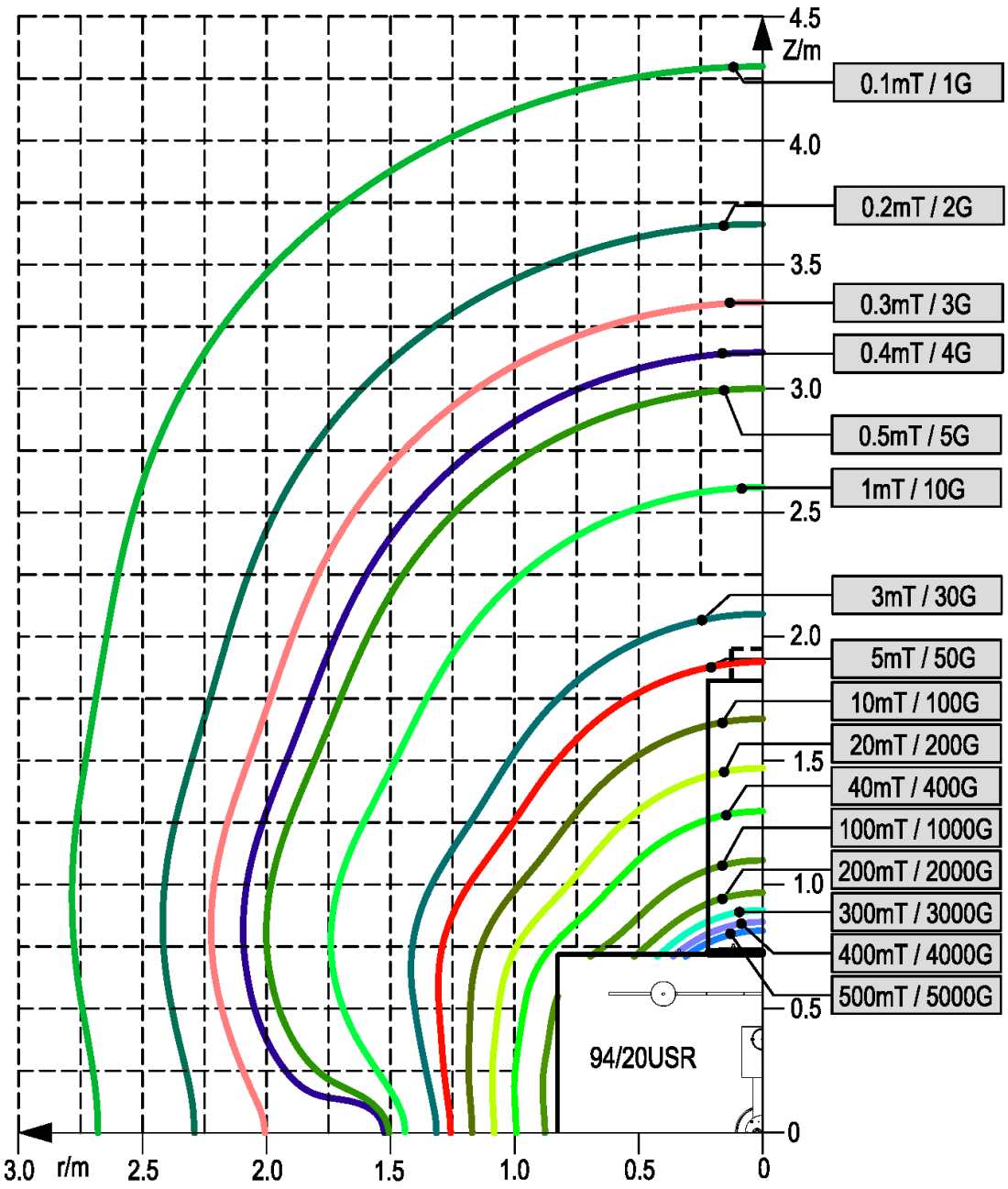

Figure 4.11: Contours of given magnetic field strengths of the stray field outside the magnet bore. The stray field is rotation-symmetric to the z-axis. The origin of the diagram is referenced to the magnet iso-center.

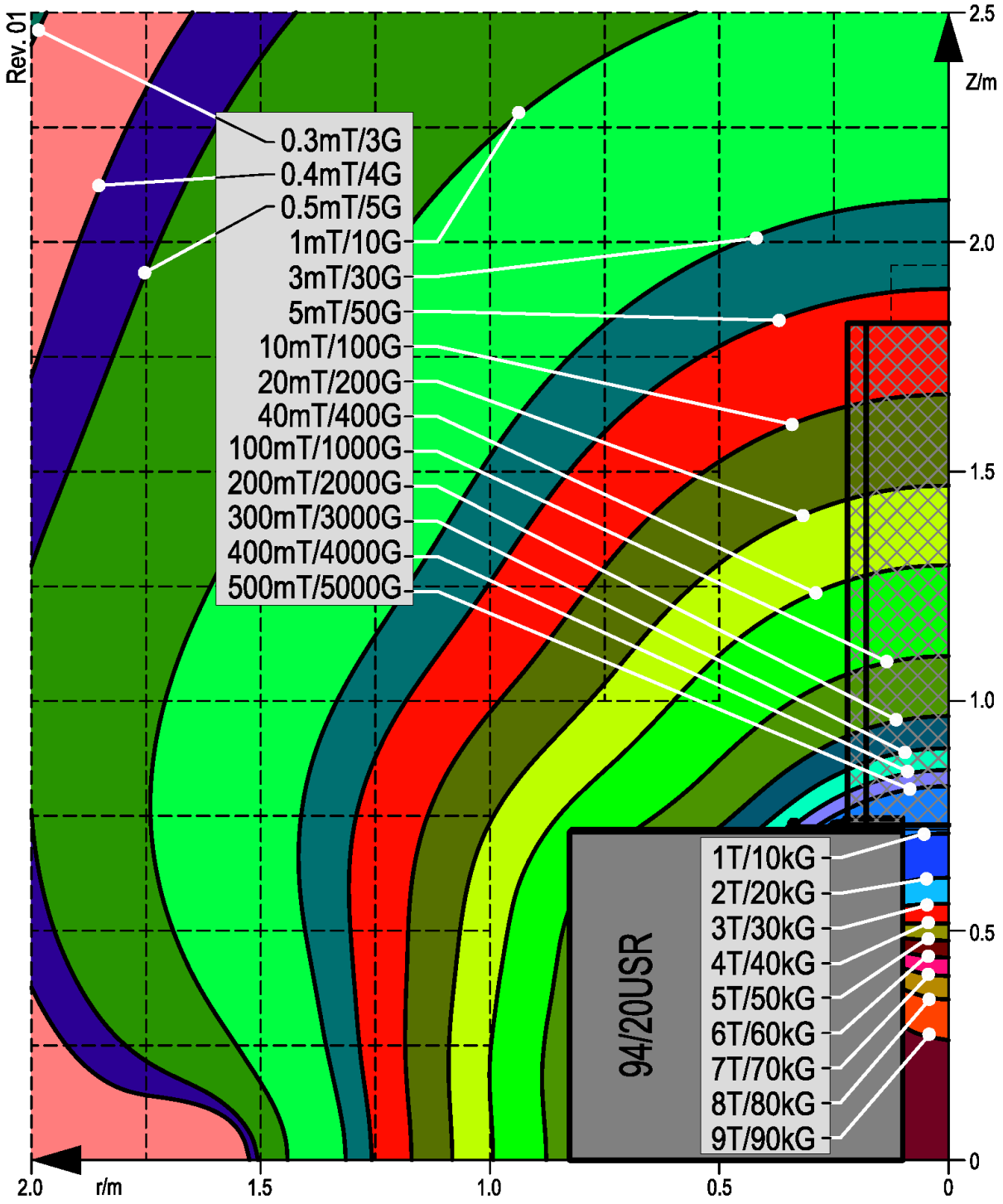

Figure 4.12: Contours of given magnetic field strengths of the stray field close to the magnet and inside the magnet bore. The stray field is rotation-symmetric to the z-axis. The origin of the diagram is referenced to the magnet iso-center.

4.7 Magnet 94/30 USR

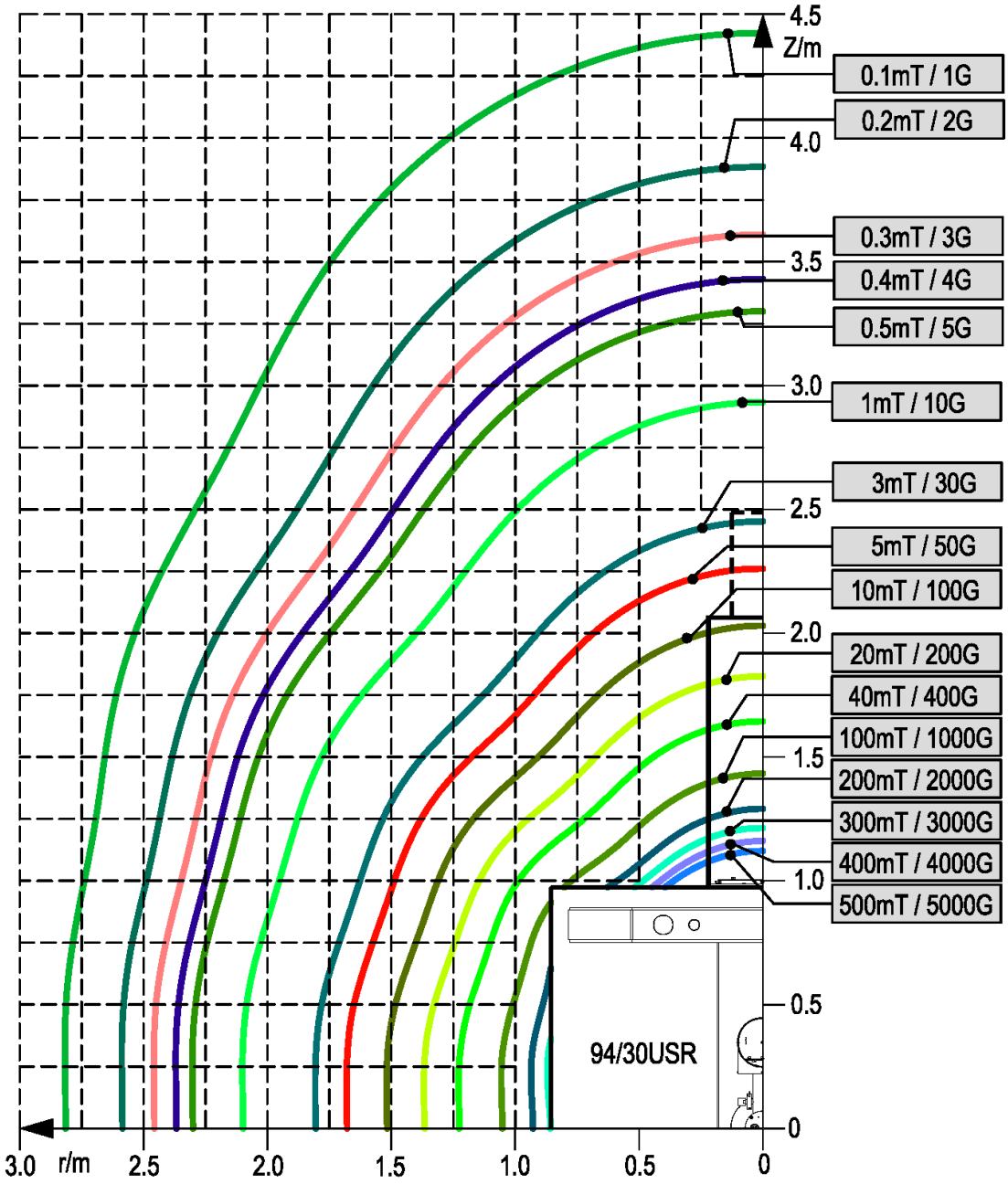

Figure 4.13: Contours of given magnetic field strengths of the stray field outside the magnet bore. The stray field is rotation-symmetric to the z-axis. The origin of the diagram is referenced to the magnet iso-center.

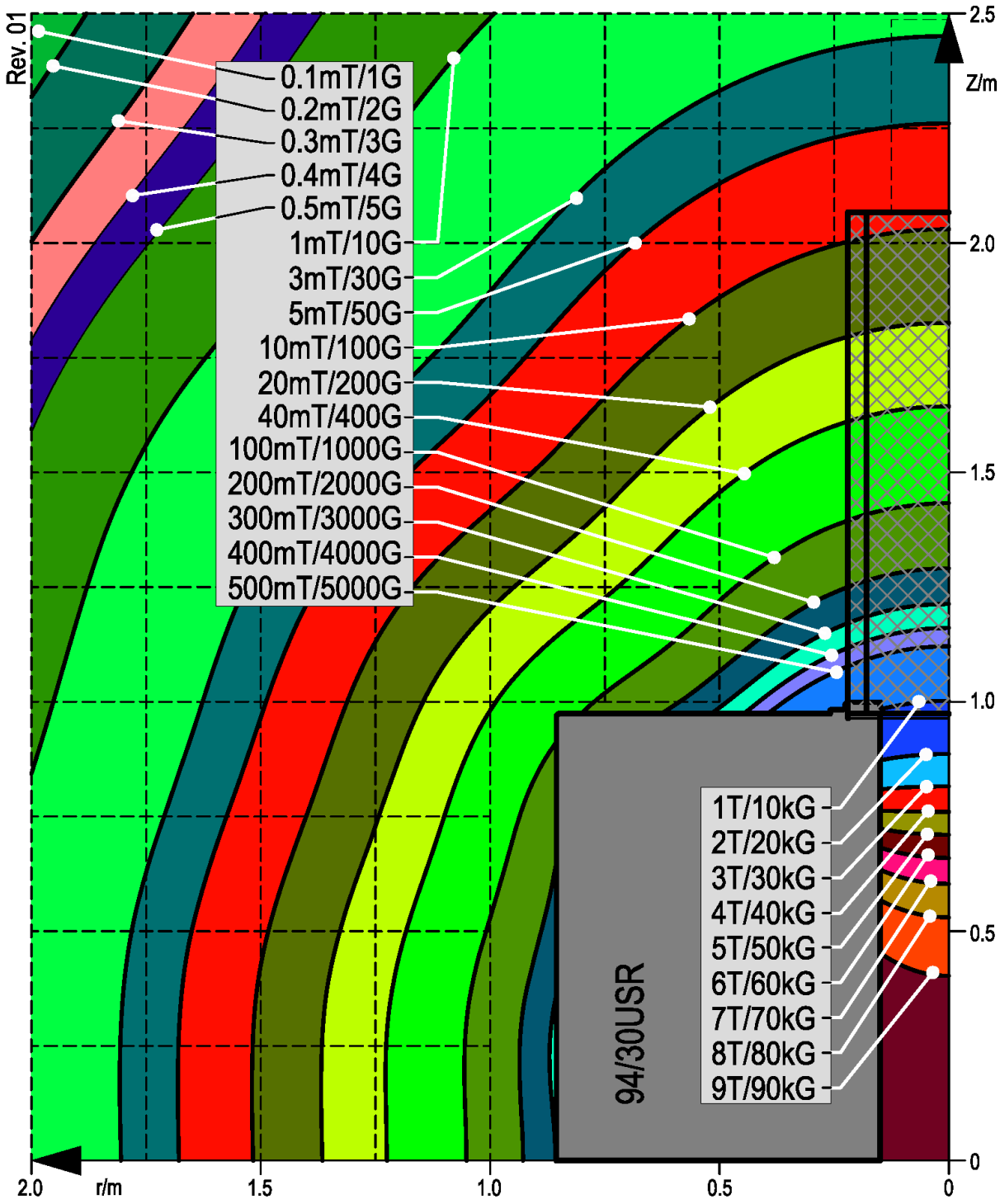

Figure 4.14: Figure 16: Magnet 94/30 USR. Contours of given magnetic field strengths of the stray field close to the magnet and inside the magnet bore. The stray field is rotation-symmetric to the z-axis. The origin of the diagram is referenced to the magnet iso-center.

4.8 Magnet 117/11 US/R

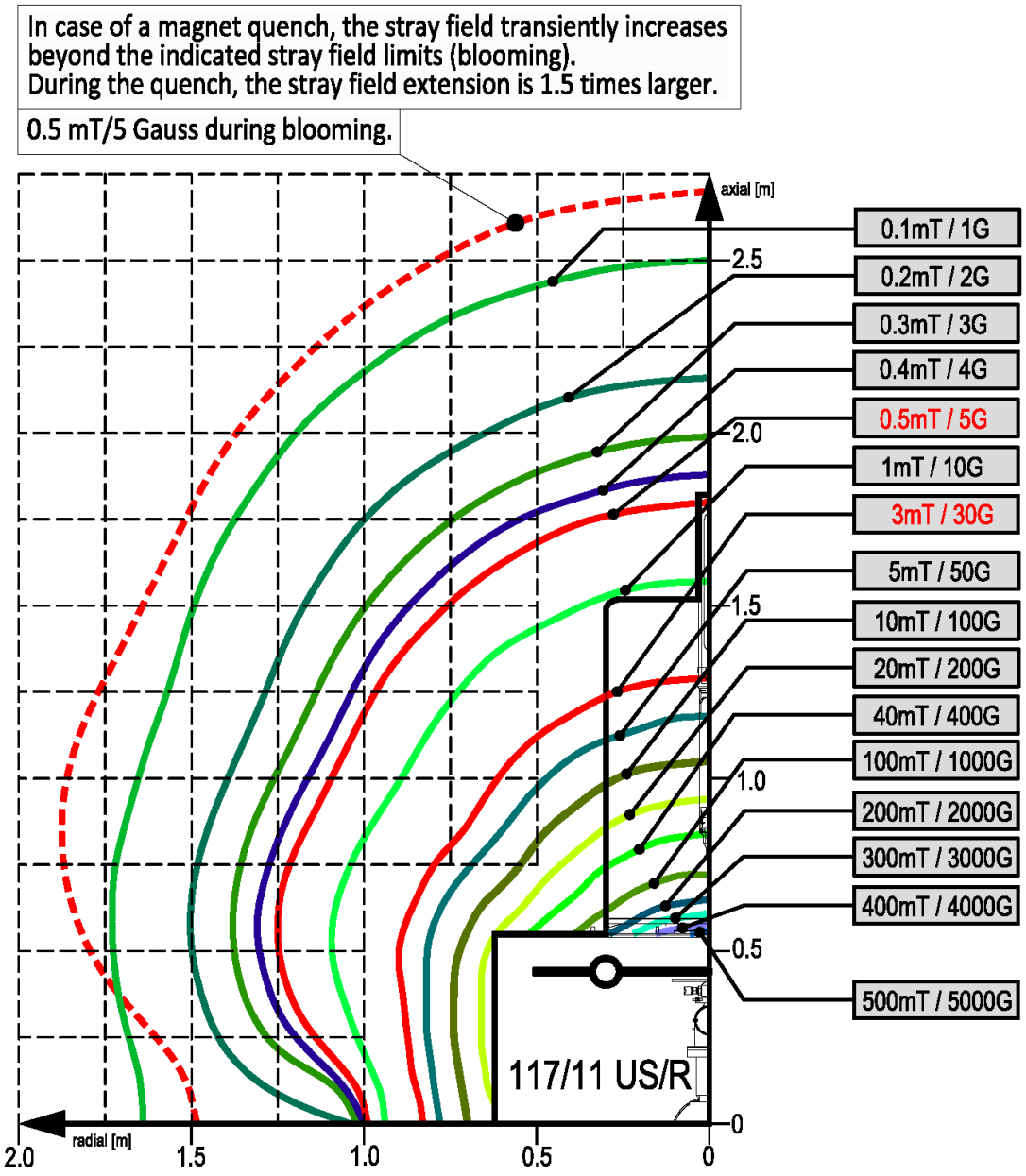

Figure 4.15: Contours of given magnetic field strengths of the stray field outside the magnet bore. The stray field is rotation-symmetric to the z-axis. The origin of the diagram is referenced to the magnet iso-center.

In case of a magnet quench the stray field may momentarily bloom beyond the indicated stray field limits for normal operation: Axial and radial 5 Gauss burst field limit < 1.5 x specified distances for normal operation.

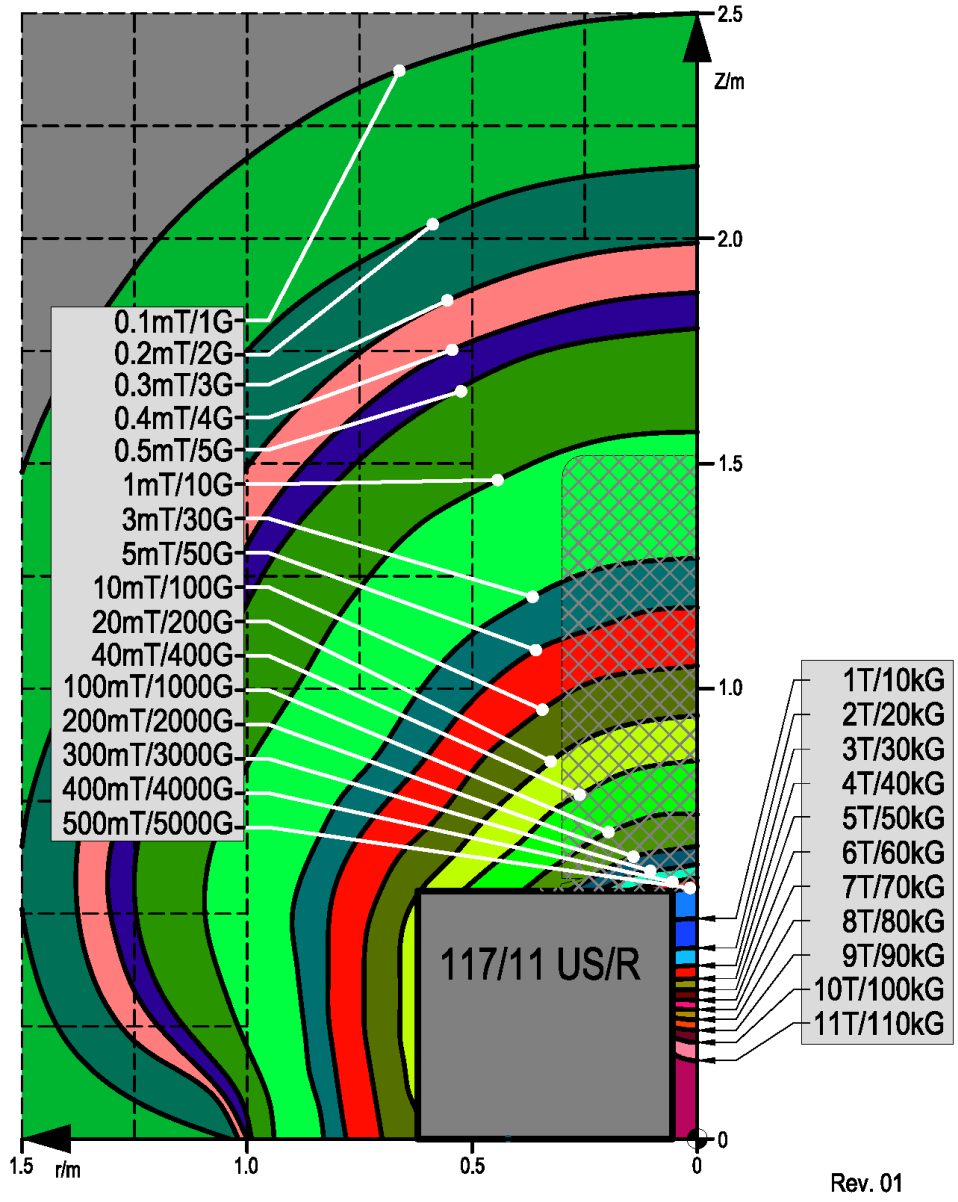

Figure 4.16: Contours of given magnetic field strengths of the stray field close to the magnet and inside the magnet bore. The stray field is rotation-symmetric to the z-axis. The origin of the diagram is referenced to the magnet iso-center.

4.9 Magnet 117/16 USR

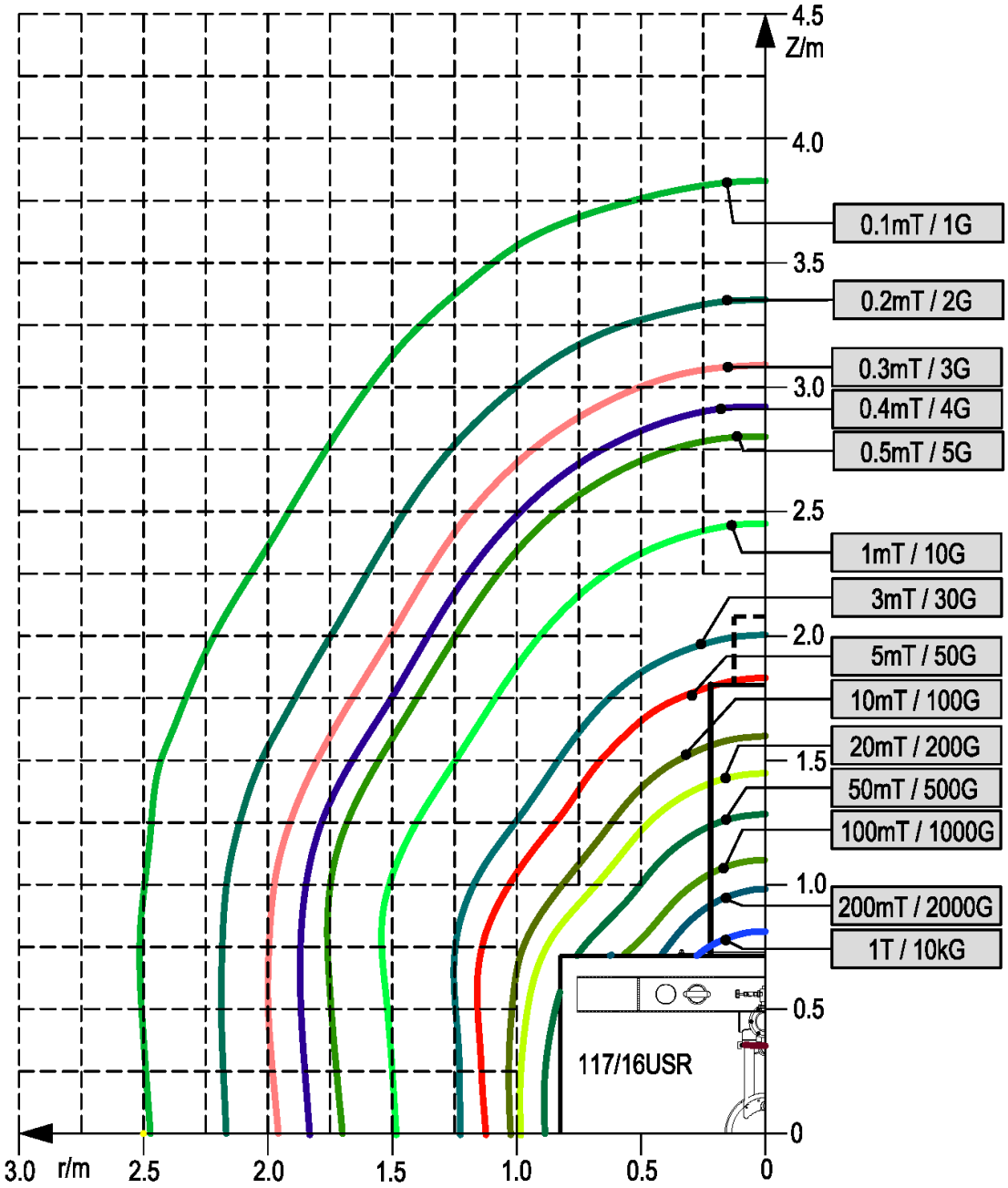

Figure 4.17: Contours of given magnetic field strengths of the stray field outside the magnet bore. The stray field is rotation-symmetric to the z-axis. The origin of the diagram is referenced to the magnet iso-center.

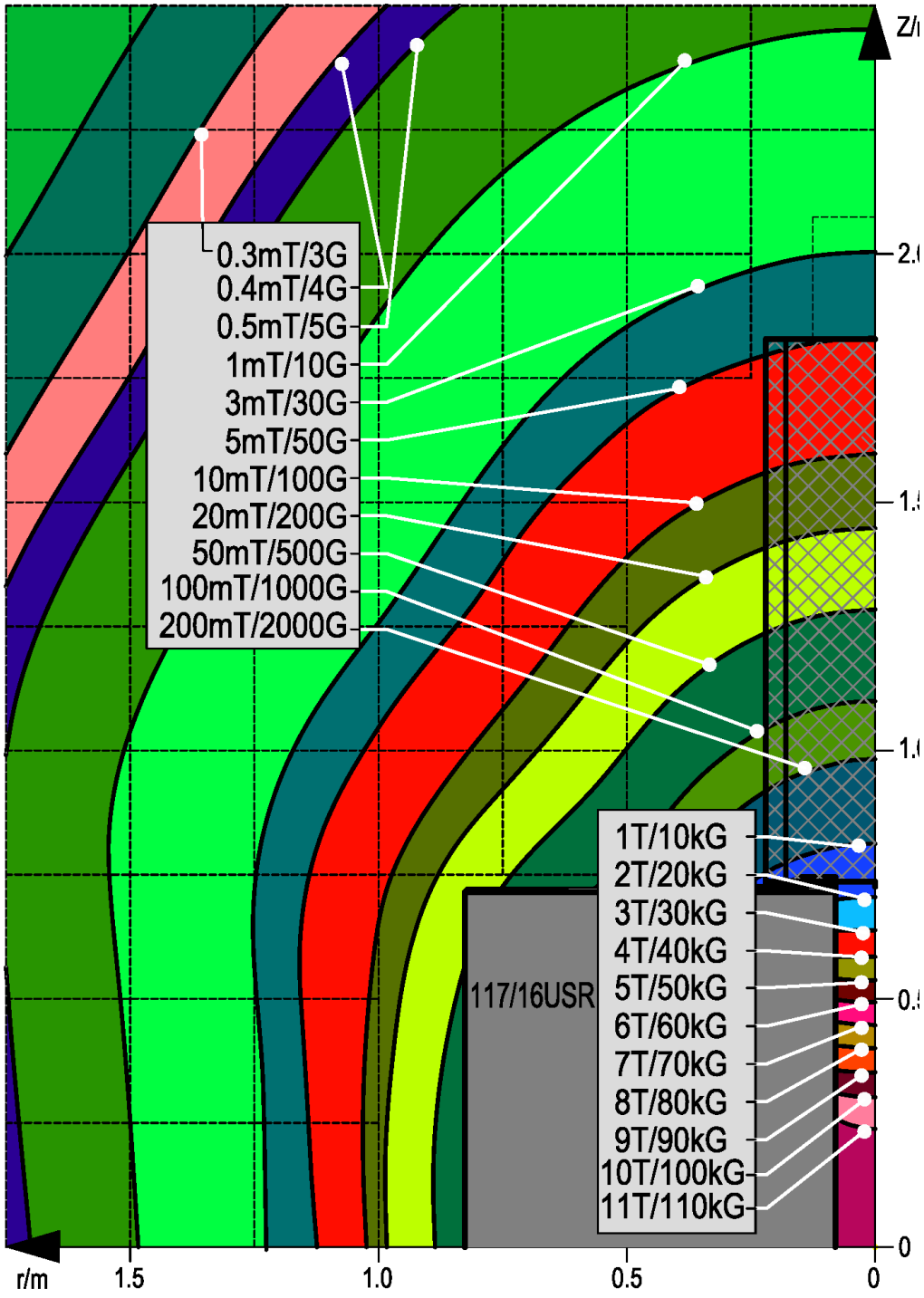

Figure 4.18: Contours of given magnetic field strengths of the stray field close to the magnet and inside the magnet bore. The stray field is rotation-symmetric to the z-axis. The origin of the diagram is referenced to the magnet iso-center.

4.10 Magnet 152/11 US/R

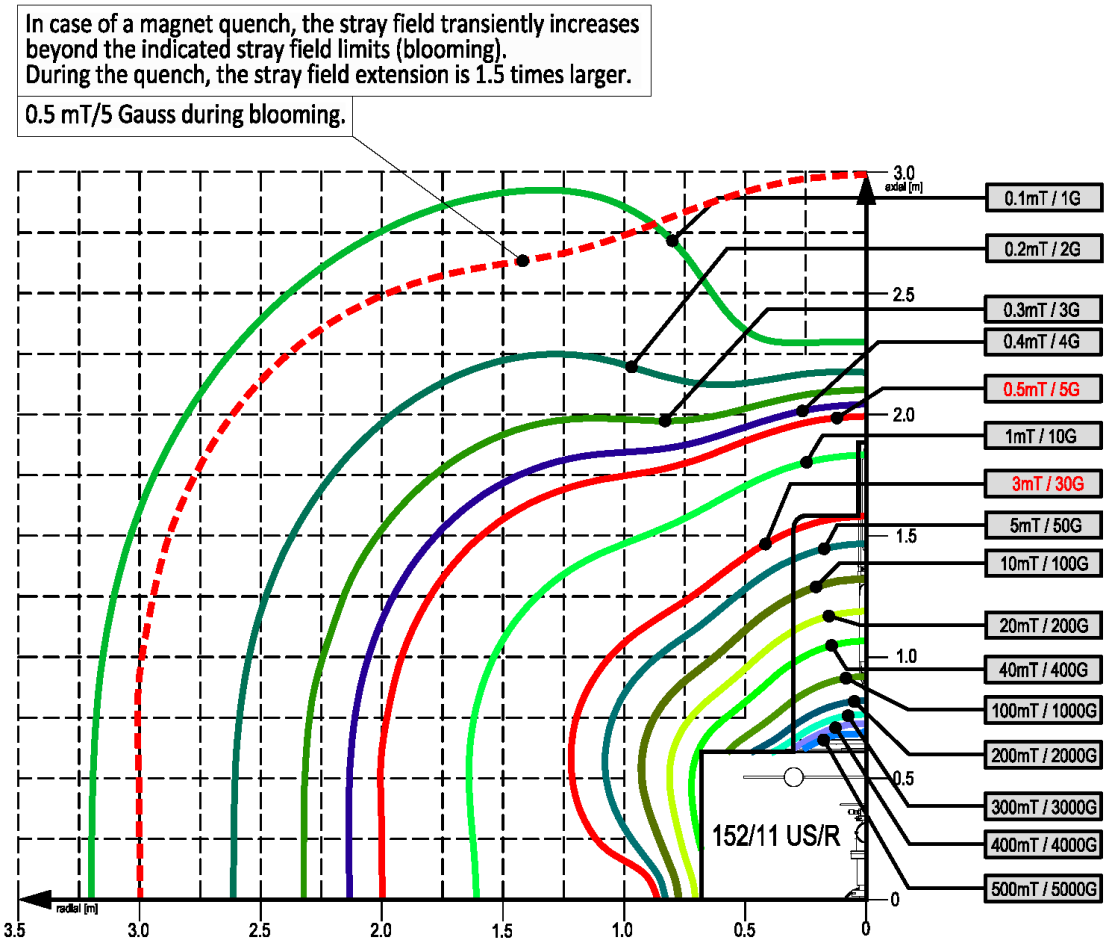

Figure 4.19: Contours of given magnetic field strengths of the stray field outside the magnet bore. The stray field is rotation-symmetric to the z-axis. The origin of the diagram is referenced to the magnet iso-center.

In case of a magnet quench the stray field may momentarily bloom beyond the indicated stray field limits for normal operation: Axial and radial 5 Gauss burst field limit < 1.5 x specified distances for normal operation.

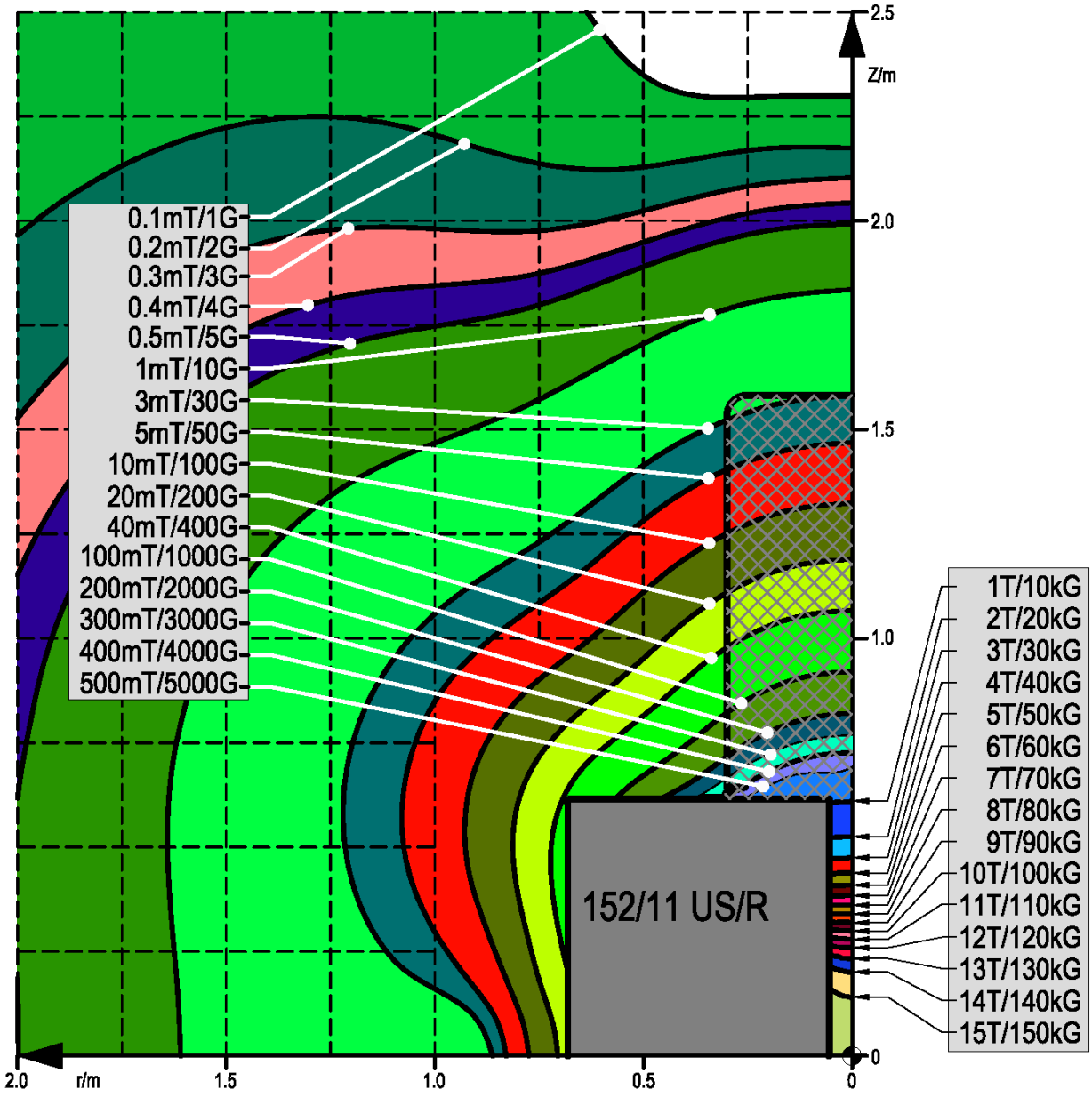

Figure 4.20: Contours of given magnetic field strengths of the stray field close to the magnet and inside the magnet bore. The stray field is rotation-symmetric to the z-axis. The origin of the diagram is referenced to the magnet iso-center.

Magnetic Stray Field

5 Maintenance

5.1 Introduction

Bruker instruments are designed and produced to offer continuously reproducible high-level performance. For this, regular maintenance is required. It is the responsibility of the System Owner to care for regular checks and planned maintenance to ensure safe and qualified operation of the instrument. In some countries, proof of these activities is required by the local authorities.

The following sections distinguish maintenance actions that

- can and are to be performed by the users: Cleaning and Disinfection and Regular Checks.
- are to be performed by Bruker Service: Safety Checks, Reliability Checks and Tasks, and Operational Qualification.
- are to be performed by an even more specialized team called Bruker Magnet Service: Magnet Service (MR instruments).

It is recommended that the System Owner designates a staff member to be responsible to perform and document the Regular Checks.

Bruker Service tasks have to be performed by qualified[1)] and authorized[2)] service engineers only. Service may be ordered at Bruker Service & Life Cycle Support that offers a complete range of service packages related to maintenance and repair of your instrument. For details, please contact your local Bruker sales office.

1) Qualified means, that the engineer has been trained accordingly.

2) Authorized means, that the engineers have been authorized by the System Owner or his designated staff member to perform maintenance work.

⚠ WARNING

Safety of personnel and significant instrument damage

Bruker recommends to install, to service and to maintain the instrument by Bruker Service & Life Cycle Support. In case you authorize staff or third party service engineers, it is entirely your responsibility to care for qualification. Unqualified manipulations on the instrument bear a high risk of injury and can lead to significant instrument damage.

Maintenance Plan

The following sections outline the activities that are to be performed.

5.2 Cleaning and Disinfection

⚠ CAUTION

Health hazard while cleaning the device (worker protection)

Compliance with occupational safety and health regulations are in the responsibility of the System Owner (responsible body).

- ▶ Before starting to clean the instrument, make sure that radioactivity is completely removed from the instrument and correct decay times have been applied (PET/MR and PET/CT instruments).
- ▶ Wear appropriate protective gear. As gloves, impervious gloves, e.g., latex or nitrile are recommended.
- ▶ When handling or using any cleaner, consult the manufacturer's Material Safety Data Sheet (MSDS) for additional information prior to use.

Cleaning

Use dry cleaning whenever possible or dampen a soft, lint-free cloth with water or a diluted cleaning solution of an all-purpose cleaner and wipe the surface carefully. Do not immerse.

Disinfection

We recommend to use surface disinfection using for example Microbac® forte.

Disinfection with VHP, a vapor form of hydrogen peroxide (H_2O_2), is possible, however, the product lines have not been specifically designed to withstand repeated VHP disinfection procedures under long-term conditions. VHP exposure may lead to surface blistering and corrosion of electrical contacts. It is important that the VHP manufacturer's instructions are read and followed in detail to strictly avoid H_2O_2 condensation; and the VHP exposure interval must be kept as short as reasonably possible.

NOTICE

Material damage of the device

Cleaning of the device with the following chemicals will damage the device.

- ▶ Do not use acetone, ketones, hexanes, acids and alkalis.
- ▶ Do not use alcohols such as for example ethanol, propanol, or isopropyl alcohol (isopropanol) or products, containing alcohols such as Bacillol®.
- ▶ Do not use volatile cleaners like thinner or benzine.

5.3 Regular Tasks and Checks

Bruker recommends to perform the Regular Tasks and Checks at least in the intervals given.

Object or Function	What is checked	Interval
Water Cooling (primary water)	• The correct operation of the primary water supplying the Dual Loop Heat Exchanger (DLHE) with cooling water is a prerequisite for cooling of the MR instrument. Thus, it is recommended for System Owners to check regularly and to maintain the primary cooling water supply as specified.	Continuously
Water Cooling (secondary water)	• Check filling state: The secondary water circuits are supported by a water tank in the Dual Loop Heat Exchanger (DLHE). The filling status is supervised by the DLHE. When the threshold is reached, an acoustic alarm as well as a red LED “Refill Tank” is provided at the DLHE. If the filling level drops below a second threshold, LED “Low Level” is turned on and the gradient pump is disabled. Refill water, see *Filling Secondary Water Tank [▷ 58]*. • Check outgoing water tubes for flow (no bending). • Check for leakage / spilling of cooling water.	Monthly Monthly Continuously
Software	• Archive acquired data. • Check disk space. • Remove non-active user accounts. • Clean up the personal data, protocols, methods, coil configurations, etc.	Continuously
BMU He level (BioSpec)	• Recording the BMU He level (Hlv) is recommended as regular check. If He level approaches 50%, contact your Bruker SLS office for refill.	Continuously
BMU Heater Power (BioSpec)	• The BMU Heater power (Hpw) is an indication for correct operation of the refrigerator cold head. Recording is recommended as regular check. If < 10 %, contact your Bruker SLS office.	Continuously
BMU Batteries	• Press the BMU battery check button shortly and activate the menu with F1 followed by F9: Batteries are OK as long as no “battery alarm” occurs and the voltage displayed is > 20V. • Replace batteries, if the check fails, the voltage approaches 20V, or the batteries have not been replaced for 6 months. See *Replacing BMU Batteries [▷ 58]*.	Check monthly and replace latest every 6 months.
QA Phantoms	• Check filling state.	monthly

Object or Function	What is checked	Interval
	• Refill with original sample fluids. • Replace liquid and gel phantoms according to expiration date.	

5.4 Safety Checks

The following checks are intended to maintain the safe operation of the instrument. Where appropriate, preventive measures have to be adopted or repairs need to be performed. The points to be checked are generally regulated by laws and standards.

The specified checks and intervals correspond to the minimum requirements. Compliance with the stricter national legislation may be necessary and needs to be checked by the System Owner.

Safe operation of the instrument

To keep the instrument safe for operation, the System Owner is responsible to perform the safety checks listed below.

MR Instrument		
Object or Function	**What is checked**	**Interval**
Entire installation and accessories	• Visual inspection of the instrument integrity.	Annually
Connections to protective earth	• All protective earth ground connections are correctly established. • The resistance of the ground connections is verified according to the local standards (1)	Annually / according to local regulations and after every decontamination e.g. with vaporized hydrogen peroxide
Accessible cabling, cabinets and protective covers	• Visual inspection of cables, cable routing and correct installation of all protective covers	Annually
Ventilation (required when anesthesia gas is used and for cryogenic magnets)	• Visual inspection of correct function of the ventilation /air conditioning system. • Installation and specifications of the systems have to comply with local laws	Annually
O2 supervision if installed (not required for cryogen free magnets)	• Functional inspection of the O2 supervising system. • Replace O2 sensors according to the service interval given by the manufacturer.	see manual of the installed device
Emergency lights in magnet room, technical room and operating area	• Check function of emergency lights. • Replace lights if required.	Annually
Fire extinguishers	• Check according to local regulations • Check for usage of non-magnetic models	Annually

MR Instrument		
Object or Function	**What is checked**	**Interval**
Controlled Access Area	• The Controlled Access Area is clearly visible marked. • The magnet room is identified with the warning sign “strong magnetic fields”. • Access to the Controlled Access Area is controlled in an adequate way.	Annually
Electronic ON/OFF switch	• Check functionality of electronic ON/OFF switch: The electronic system shuts down. • Check free access of the electronic ON/ OFF switch. **Do NOT test the Magnet Emergency Quench Button!**	Annually
Mains Disconnect	• Check that access to the Line Power Distributor is granted to disconnect the instrument from mains in case of emergency.	Annually
Magnet Emergency Quench Button and Magnet Monitoring Unit	• Check general status of the monitoring unit. • Check batteries of the monitoring unit and replace if necessary. • Check connection to Magnet Emergency Quench Button. • Check free access of the Magnet Emergency Quench Button. • Magnet drop-off plate free? **Do NOT test the Magnet Emergency Quench Button!**	Annually, battery check monthly during regular checks, replacement latest every 6 months.
Magnet Emergency Quench Button	• Check Magnet Emergency Quench Button, in magnet room and at the magnet monitoring unit.  To be checked by Bruker Magnet Service only, special tools required! Please contact Bruker for this safety check.	Every 2 years during cold head service.
ATS Emergency Stop	• Check drive stop function of the ATS Emergency Stop.	Monthly
ATS Spindles	• The spindles of the ATS are Teflon coated to avoid adherence. Check coating visually and potentially clean spindle(s) gently in case of dirt.	Annually
Accessories	• Visual inspection of all accessories. • Electrical safety of all accessories.	Annually,

MR Instrument		
Object or Function	**What is checked**	**Interval**
	• Remove all magnetic tools from the Controlled Access Area.	see service instructions of the installed device,
Instructions for Use	• User Documentation DVD present and legible. • Every operator is familiar with the operating and safety instructions?	Annually. New members before first operation.
Training	• Instruct new staff and operators on safety aspects as described in the Instructions for Use. • Instruct and train non staff members that have access to the Controlled Access Area, i.e. cleaning personnel or • Instruct and train fire brigade and medical assistance	Annually. New members before first operation.
RF Coils	• Check integrity of housing (inner/outer). • Check integrity of cables and connectors. • Check for pollution. • Check for liquids.	Monthly. After every decontamination.
Gradient Coil	• Check gradient cables for damage of isolation. Avoid sharp edges (gradient cables may move on sharp edges during gradient switching).	Annually.

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(1) Instructions for measuring equipment leakage current:

National regulations have to be observed, e.g. in Germany the DIN VDE 0701-1. According to DIN VDE 0701-1, the equipment leakage current does not have to be measured:

- if a protective conductor is permanently connected and
- if the on-site protective standards for indirect contact can be shown. In such cases, the user has to comply with DIN VDE 100-710.

It is not necessary to measure leakage current at the RF Coils since:

- applied part has non-conducting surface
- live parts are separated from applied part double insulated through power supply
- applied part does not have dangerous voltages.

5.5 Reliability Checks

The reliability checks are to reduce unforeseen failures to a minimum. If conducted regularly, there is a high probability to detect any defects of the MR instrument in an early phase.

Different operating conditions (e. g. different temperature, size of dust particles, humidity, gases, and vapor) may require shortening the suggested time intervals.

Object or Function	What is checked	Interval
Primary water for Heat exchanger (DLHE)	• Check primary water inflow, pressure, and water quality.	Monthly
Heat exchanger (DLHE)	• Refill water, potentially clean tank. • Check temperature setting 18 ± 1 °C. • Check secondary water flow to gradient coil > 2 l/min (B-GA 6S-100), > 7 l/min (B-GA9S HP), > 7 l/min (B-GA105S HP), > 17 l/min (B-GA12S HP), > 19 l/min (B-GA20S HP), potentially clean gradient cooling water filter.	Monthly
Air filters in cabinet doors and instrument cover where applicable.	• Replace air filters.	Annually
Ventilators in electronics (RF power supply, gradient power supply, …)	• Check functionality and operating noise of ventilators.	Annually
Magnet	• Visual check of integrity of refrigerator lines, compressor, cold head for condensate or ice formation.	Monthly
CCM / ATS	• Check the RF sealing and replace if broken or missing. • Clean surfaces contacting the RF sealing.	Monthly
ATS	• Visual check of the wire and mechanics of the ATS cover.	every 3 years
Software / Workstation	• Check disc space. • Save and archive configuration. • Create and archive backup software image.	usage dependent

5.6 Operational Qualification

Wear and tear or defects may disrupt operational qualification. Regular checks avoid reduced image quality or acquiring corrupt data. It is useful to log the results of the qualification checks over time to detect trends.

MR Instrument		
Object or Function	**What is checked**	**Interval**
Gradient performance	• Verify gradient amplifier matching. • Verify gradient and preemphasis performance.	Every year
Shim performance	• Verify functionality and map shim calibration.	Every year
RF amplifier (transmitter) performance	• Verify transmitter output power. • Verify transmitter linearity.	Every year
Receiver performance	• Verify receive channel sensitivity and phase adjustment between multiple receiver.	Every year
Signal-to-Noise / RF coil performance	• Check RF Coils for visual damage. • Perform QA SNR Coil Checks as described in the RF coil documentation using the corresponding setup, procedure, and QA phantom.	Monthly, recommended every week
Imaging and spectroscopy performance	• Perform image and spectroscopy quality checks as given in the acceptance procedure.	Every year, recommended every month
Image Orientation	• Check image orientation	After every service action on the gradient amplifier or gradient coil.

5.7 Magnet Service

Planned Magnet Service enables safe and reliable operation of the magnet.

⚠ CAUTION

Hazard by untrained and unauthorized persons performing work at the magnet

Persons working at the magnet must be trained and authorized.

Thus, installation, initial commissioning, retrofitting, repairs, adjustments or dismantling of the magnet must only be carried out by Bruker Magnet Service. Note the difference between Bruker Service and Bruker Magnet Service team.

5.7.1 Planned Magnet Maintenance

Planned Maintenance has to be initiated and ordered by the System Owner.

Planned Maintenance actions to be performed by Bruker Service at the magnet are:

Object or Function	What is checked	Interval
Cooling Water	• Check Dual Loop Heat Exchanger (DLHE) for cold water supply.	Yearly
Magnet He level	• Check / refill He.	Yearly (more often in case refrigerator operation was interrupted)

Planned Maintenance actions to be performed by Bruker Magnet Service are:

Object or Function	What is checked	Interval
Compressor Adsorber	• Compressor Adsorber needs refurbishment (including He refill).	2 years
Magnet Cold Head	• Cold head needs refurbishment (including He refill).	4 years
Emergency Magnet Quench	• Check of Magnet Emergency Quench button.	2 years
Magnet Supervision	• Check BMU and logfiles.	2 years

5.8 User Maintenance Actions

5.8.1 Replacing BMU Batteries

Procedure

- Unlock drawers containing the batteries and remove batteries.
- Insert the new batteries as indicated by the polarity symbols (+ and -) marked.
- Push the batteries drawer in the compartment.
- Press the BMU battery check button shortly and activate the menu with F1 followed by F9: Batteries are OK as long as no “battery alarm” occurs and the voltage displayed is > 20V.

Batteries replacement cases for BMU 4.x:

- The 16 batteries must be changed every six months in case of a normal use (BMU has always been connected to the mains).
- If the BMU has been disconnected from mains and the batteries have not been removed during that time, you must replace the 16 batteries.
- “Battery alarm” occurs and the voltage displayed is < 20V (see last step above).

5.8.2 Filling Secondary Water Tank

1. Open the tank lid.
2. Fill in tap water up to **FULL** level mark.
3. Close tank lid.

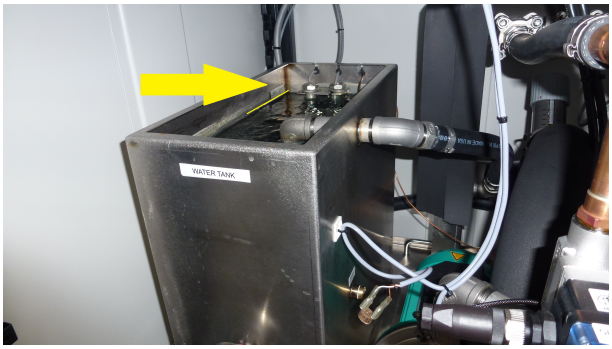


Figure 5.1: Fill water tank up to the maximum marking.

5.8.2.1 Secondary water requirements

Secondary water is the term used for the two water circuits that cool the magnet helium compressor and the gradient coil. The DLHE is the heat exchanger between primary and secondary water.

Water quality	filtered, drinking quality tap water
Conductivity	> 20 µS
Hardness	< 15 °d
pH	7.0 – 8.0
Water reservoir capacity	~ 30 liter
Water amount for installation:	~ 50 to 100 liter, depending on the length of the gradient water hoses

5.8.3 Cleaning the Gradient Water Strainer

Figure 5.2: Water "Y" strainer

Cleaning or replacement of the strainer needs to be done in the following steps:

1. Stop the gradient pump by turning the MR instrument to **OFF.**
2. Close the shut-off valve of the gradient cooling circuit.
3. Drain the water reservoir or collect the remaining water between shut-off valve and strainer in a small bucket. Avoid dripping water into the pump below.

Figure 5.3: Cover with strainer

1. Unscrew the cover and pull out the strainer.
2. Clean the strainer.
3. Insert and tighten the strainer again.
4. Fill the reservoir up to **FULL** level mark.
5. Open the shut-off valve of the gradient cooling circuit.

6. Switch **ON** the MR instrument.

5.8.4 Switching ON the GCTU

For instruments equipped with GCTU (if unknown, please ask your Bruker SLS office), the unit needs to be permanently switched on to stabilize temperature changes and to reduce magnetic field drifts by heating and stabilizing the temperature of the shim system. However, after a power outage, it is not automatically switched on again. Therefore, the user might need to switch it on.

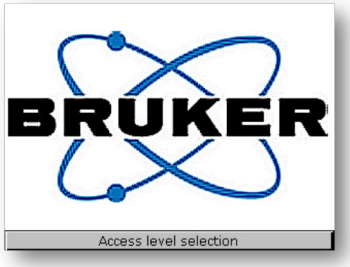
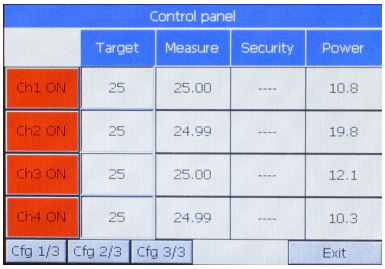


Figure 5.4: Start screen of the GCTU 2.

In case the start screen is shown in the display, proceed as follows:

- Press Access Level selection and select the Access Level 1 followed by the password “full”. It is best to use a pen for keyboard selections on the tiny touch screen.
- The control panel displayed in level 1 allows the user to switch **ON/OFF** all the shim heaters. Most other parameters are inaccessible.
- The control panel appears.
- In case the channels are not ON, press Ch1 ON to switch ON channel 1.
- Continue to switch ON the remaining channels, correspondingly.



- Control Panel Information

Ch1-4 ON/OFF	Indicates the current status of the shim heater channel. Can only be switched in Access Level 1.
Target	Temperature set point. Cannot be modified in this menu.
Measure	Current shim zone temperature.
Security	not used (temperature of safety sensor of 70/82 magnet only)
Power	Current heating power in %
Exit	Return to main screen

6 Replacement of Parts

Contact Bruker Service and Lifecycle Support for replacement of parts.

7 Technical Data

The following tables provide a short summary of the basic technical specifications of the corresponding AVANCE Neo hardware based MR instruments. Relevant for the acceptance of the MR instrument are technical data signed-off in the quote.

Please contact the local Bruker offices for new options to extend or upgrade the MR instrument, especially for new or customer defined RF coils.

7.1 Identification of the MR Instrument

The identification label (product label) of the instruments is attached at the outside of the front door of the main electronic cabinet. Please refer to Type, Model No., and Serial No. (equals internal order number) when contacting Bruker.

Figure 7.1: Identification label (product label) at the front of the main electronic cabinet: In this example, the type is BioSpec 94/20 USR (AVANCE NEO) with Model No. BAP94/20 and Serial No. 404597.

7.2 Environmental Conditions

Compliance with the environmental conditions allows a safe operation of the MR, PET/MR or PET/CT instrument. In addition, *Normal Operating Conditions [▶ 9]* and *Performance Environmental Conditions [▶ 10]* apply for operational qualification.

Data	Value	Unit
Temperature	5 - 40	°C
Maximum relative humidity	80 for temperatures up to 31 °C decreasing linearly to maximum 50 relative humidity at 40 °C.	%
Operating altitude	Up to 2000	m
Use	Indoor use	-
Degree of pollution	II	-

Table 7.1: Environmental Conditions.

7.3 Technical Data PharmaScan 47/16 US

STANDARD CONFIGURATION	
Magnet type	Ultra Shielded
1H resonance frequency	200.3 MHz
Diameter of magnet bore	155 mm
Max. gradient strength	570 mT/m @ 150 A
Max. linear slew rate	5130 T/m/s
Shim set	X, Y, Z, Z2, ZX, ZY, X2-Y2, 2XY, Z3
Transmit/receive (T/R) channel	Two 1H parallel transmit / receive channels.
Transmitter power	1000 W (2x 500 W)
Standard RF coil	transceiver volume coil, ID = 72 mm

OPTIONS	
Broadband T/R channel	Additional broadband transmit / receive channel.
Parallel receiver	4, 8, 16
Parallel transmitter	no
High power gradient upgrade	760 mT/m @ 200 A with 6840 T/m/s
High power transmitter upgrade	not available
Gradient inserts	no
RF Coils	Volume and Surface Coils, Phased Array Coils, X-Nuclei Volume and Surface Coils, MRI CryoProbe ™

INSTALLATION	
Rating	400/230 VAC, 3W+N+PE, 50/60 Hz, 80 A Overvoltage category: II Degree of pollution: 2 IP Classification: 20
Heat dissipation (*)	into air (technical room): ~ 7.5 kW (standard) plus ~ 1.2 kW MRI CryoProbe (option) into air (MR system in magnet room): ~ 0.5 kW into air (operating room): ~ 0.5 kW
Acoustic sound pressure	Technical room: typically 70 dB(A) Magnet room / examination: up to 100 dB(A)

(*) The power consumption and the heat dissipation depend on the actual system configuration and on the operation state of the MR instrument. For site planning purpose, see details in the instrument specific Site Planning Information.

7.4 Technical Data BioSpec 47/40 USR

STANDARD CONFIGURATION	
Magnet type	Ultra Shielded & Refrigerated (USR)
1H resonance frequency	200.3 MHz
Diameter of magnet bore	403 mm
Max. gradient strength	155 mT/m @ 200 A
Max. linear slew rate	280 T/m/s
Shim set	X, Y, Z, Z2, ZX, ZY, X2-Y2, 2XY, Z3
Transmit/receive (T/R) channel	Two 1H parallel transmit / receive channels.
Transmitter power	1000 W (2x 500 W)
Standard RF coil	transceiver volume coil, ID = 197 mm

OPTIONS	
Broadband T/R channel	Additional broadband transmit / receive channel.
Parallel receiver	4, 8, 16
Parallel transmitter	up to 8 parallel transmitter
High power gradient upgrade	230 mT/m, 650 T/m/s @ 300 A
High power transmitter upgrade	up to 2000 W (2x 1000W)
Gradient inserts	BGA 12S HP, BGA 6S-100
RF Coils	Volume and Surface Coils, Phased Array Coils, X-Nuclei Volume and Surface Coils, MRI CryoProbe ™

INSTALLATION	
Rating	400/230 VAC, 3W+N+PE, 50/60 Hz, 80 A Overvoltage category: II Degree of pollution: 2 IP Classification: 20
Heat dissipation (*)	into air (technical room): ~ 7.5 kW (standard) plus ~ 7 kW High Power Gradient Amplifier (option) ~ 1.2 kW MRI CryoProbe (option) ~ 2.0 kW Parallel Transmit Cabinet (option) into air (MR system in magnet room): ~ 0.5 kW into air (operating room): ~ 0.5 kW into facility cold water supply: ~ 11.5 kW
Acoustic sound pressure	Technical room: typically 70 dB(A) Magnet room / examination: up to 100 dB(A)

(*) The power consumption and the heat dissipation depend on the actual system configuration and on the operation state of the MR instrument. For site planning purpose, see details in the instrument specific Site Planning Information.

7.5 Technical Data PharmaScan 70/16 US

STANDARD CONFIGURATION	
Magnet type	Ultra Shielded
1H resonance frequency	300.3 MHz
Diameter of magnet bore	155 mm
Max. gradient strength	380 mT/m @ 100 A
Max. linear slew rate	5130 T/m/s
Shim set	X, Y, Z, Z2, ZX, ZY, X2-Y2, 2XY, Z3
Transmit/receive (T/R) channel	Two 1H parallel transmit / receive channels.
Transmitter power	1000 W (2x 500 W)
Standard RF coil	transceiver volume coil, ID = 72 mm

OPTIONS	
Broadband T/R channel	Additional broadband transmit / receive channel.
Parallel receiver	4, 8, 16
Parallel transmitter	no
High power gradient upgrade	760 mT/m @ 200 A with 6840 T/m/s
High power transmitter upgrade	not available
Gradient inserts	no
RF Coils	Volume and Surface Coils, Phased Array Coils, X-Nuclei Volume and Surface Coils, MRI CryoProbe ™

INSTALLATION	
Rating	400/230 VAC, 3W+N+PE, 50/60 Hz, 80 A Overvoltage category: II Degree of pollution: 2 IP Classification: 20
Heat dissipation (*)	into air (technical room): ~ 7.5 kW (standard) plus ~ 1.2 kW MRI CryoProbe (option) into air (MR system in magnet room): ~ 0.5 kW into air (operating room): ~ 0.5 kW
Acoustic sound pressure	Technical room: typically 70 dB(A) Magnet room / examination: up to 100 dB(A)

(*) The power consumption and the heat dissipation depend on the actual system configuration and on the operation state of the MR instrument. For site planning purpose, see details in the instrument specific Site Planning Information.

7.6 Technical Data BioSpec 70/20 USR

STANDARD CONFIGURATION	
Magnet type	Ultra Shielded & Refrigerated (USR)
1H resonance frequency	300.3 MHz
Diameter of magnet bore	201 mm
Max. gradient strength	440 mT/m @ 200 A
Max. linear slew rate	3440 T/m/s
Shim set	X, Y, Z, Z2, ZX, ZY, X2-Y2, 2XY, Z3
Transmit/receive (T/R) channel	Two 1H parallel transmit / receive channels.
Transmitter power	1000 W (2x 500 W)
Standard RF coil	transceiver volume coil, ID = 86 mm

OPTIONS	
Broadband T/R channel	Additional broadband transmit / receive channel.
Parallel receiver	4, 8, 16
Parallel transmitter	up to 8 parallel transmitter
High power gradient upgrade	660 mT/m , 4570 T/m/s @ 300 A
High power transmitter upgrade	up to 2000 W (2x 1000W)
Gradient inserts	BGA 6S-100
RF Coils	Volume and Surface Coils, Phased Array Coils, X-Nuclei Volume and Surface Coils, MRI CryoProbe ™

INSTALLATION	
Rating	400/230 VAC, 3W+N+PE, 50/60 Hz, 80 A Overvoltage category: II Degree of pollution: 2 IP Classification: 20
Heat dissipation (*)	into air (technical room): ~ 7.5 kW (standard) plus ~ 7 kW High Power Gradient Amplifier (option) ~ 1.2 kW MRI CryoProbe (option) ~ 2.0 kW Parallel Transmit Cabinet (option) into air (MR system in magnet room): ~ 0.5 kW into air (operating room): ~ 0.5 kW into facility cold water supply: ~ 11.5 kW
Acoustic sound pressure	Technical room: typically 70 dB(A) Magnet room / examination: up to 100 dB(A)

(*) The power consumption and the heat dissipation depend on the actual system configuration and on the operation state of the MR instrument. For site planning purpose, see details in the instrument specific Site Planning Information.

7.7 Technical Data BioSpec 70/30 USR

STANDARD CONFIGURATION	
Magnet type	Ultra Shielded & Refrigerated (USR)
1H resonance frequency	300.3 MHz
Diameter of magnet bore	306 mm
Max. gradient strength	200 mT/m @ 200 A
Max. linear slew rate	640 T/m/s
Shim set	X, Y, Z, Z2, ZX, ZY, X2-Y2, 2XY, Z3
Transmit/receive (T/R) channel	Two 1H parallel transmit / receive channels.
Transmitter power	1000 W (2x 500 W)
Standard RF coil	transceiver volume coil, ID = 154 mm

OPTIONS	
Broadband T/R channel	Additional broadband transmit / receive channel.
Parallel receiver	4, 8, 16
Parallel transmitter	up to 8 parallel transmitter
High power gradient upgrade	300 mT/m , 1040 T/m/s @ 300 A
High power transmitter upgrade	up to 2000 W (2x 1000W)
Gradient inserts	BAG 12S HP, BGA 6S-100
RF Coils	Volume and Surface Coils, Phased Array Coils, X-Nuclei Volume and Surface Coils, MRI CryoProbe ™

INSTALLATION	
Rating	400/230 VAC, 3W+N+PE, 50/60 Hz, 80 A Overvoltage category: II Degree of pollution: 2 IP Classification: 20
Heat dissipation (*)	into air (technical room): ~ 7.5 kW (standard) plus ~ 7 kW High Power Gradient Amplifier (option) ~ 1.2 kW MRI CryoProbe (option) ~ 2.0 kW Parallel Transmit Cabinet (option) into air (MR system in magnet room): ~ 0.5 kW into air (operating room): ~ 0.5 kW into facility cold water supply: ~ 11.5 kW
Acoustic sound pressure	Technical room: typically 70 dB(A) Magnet room / examination: up to 100 dB(A)

(*) The power consumption and the heat dissipation depend on the actual system configuration and on the operation state of the MR instrument. For site planning purpose, see details in the instrument specific Site Planning Information.

7.8 Technical Data BioSpec 94/20 USR

STANDARD CONFIGURATION	
Magnet type	Ultra Shielded & Refrigerated (USR)
1H resonance frequency	400.3 MHz
Diameter of magnet bore	210 mm
Max. gradient strength	440 mT/m @ 200 A
Max. linear slew rate	3440 T/m/s
Shim set	X, Y, Z, Z2, ZX, ZY, X2-Y2, 2XY, Z3
Transmit/receive (T/R) channel	Two 1H parallel transmit / receive channels.
Transmitter power	1000 W (2x 500 W)
Standard RF coil	transceiver volume coil, ID = 86 mm

OPTIONS	
Broadband T/R channel	Additional broadband transmit / receive channel.
Parallel receiver	4, 8, 16
Parallel transmitter	up to 8 parallel transmitter
High power gradient upgrade	660 mT/m , 4570 T/m/s @ 300 A
High power transmitter upgrade	up to 2000 W (2x 1000W)
Gradient inserts	BGA 6S-100
RF Coils	Volume and Surface Coils, Phased Array Coils, X-Nuclei Volume and Surface Coils, MRI CryoProbe ™

INSTALLATION	
Rating	400/230 VAC, 3W+N+PE, 50/60 Hz, 80 A Overvoltage category: II Degree of pollution: 2 IP Classification: 20
Heat dissipation (*)	into air (technical room): ~ 7.5 kW (standard) plus ~ 7 kW High Power Gradient Amplifier (option) ~ 1.2 kW MRI CryoProbe (option) ~ 2.0 kW Parallel Transmit Cabinet (option) into air (MR system in magnet room): ~ 0.5 kW into air (operating room): ~ 0.5 kW into facility cold water supply: ~ 11.5 kW
Acoustic sound pressure	Technical room: typically 70 dB(A) Magnet room / examination: up to 100 dB(A)

(*) The power consumption and the heat dissipation depend on the actual system configuration and on the operation state of the MR instrument. For site planning purpose, see details in the instrument specific Site Planning Information.

7.9 Technical Data BioSpec 94/30 USR

STANDARD CONFIGURATION	
Magnet type	Ultra Shielded & Refrigerated (USR)
1H resonance frequency	400.3 MHz
Diameter of magnet bore	306 mm
Max. gradient strength	200 mT/m @ 200 A
Max. linear slew rate	640 T/m/s
Shim set	X, Y, Z, Z2, ZX, ZY, X2-Y2, 2XY, Z3
Transmit/receive (T/R) channel	Two 1H parallel transmit / receive channels.
Transmitter power	1000 W (2x 500 W)
Standard RF coil	transceiver volume coil, ID = 154 mm

OPTIONS	
Broadband T/R channel	Additional broadband transmit / receive channel.
Parallel receiver	4, 8, 16
Parallel transmitter	up to 8 parallel transmitter
High power gradient upgrade	300 mT/m , 1040 T/m/s @ 300 A
High power transmitter upgrade	up to 2000 W (2x 1000W)
Gradient inserts	BAG 12S HP, BGA 6S-100
RF Coils	Volume and Surface Coils, Phased Array Coils, X-Nuclei Volume and Surface Coils, MRI CryoProbe ™

INSTALLATION	
Rating	400/230 VAC, 3W+N+PE, 50/60 Hz, 80 A Overvoltage category: II Degree of pollution: 2 IP Classification: 20
Heat dissipation (*)	into air (technical room): ~ 7.5 kW (standard) plus ~ 7 kW High Power Gradient Amplifier (option) ~ 1.2 kW MRI CryoProbe (option) ~ 2.0 kW Parallel Transmit Cabinet (option) into air (MR system in magnet room): ~ 0.5 kW into air (operating room): ~ 0.5 kW into facility cold water supply: ~ 11.5 kW
Acoustic sound pressure	Technical room: typically 70 dB(A) Magnet room / examination: up to 100 dB(A)

(*) The power consumption and the heat dissipation depend on the actual system configuration and on the operation state of the MR instrument. For site planning purpose, see details in the instrument specific Site Planning Information.

7.10 Technical Data BioSpec 117/11 USR

STANDARD CONFIGURATION	
Magnet type	Ultra Shielded & Refrigerated (USR)
1H resonance frequency	500.3 MHz
Diameter of magnet bore	105 mm
Max. gradient strength	740 mT/m @ 100 A
Max. linear slew rate	9000 T/m/s
Shim set	X, Y, Z, Z2, ZX, ZY, X2-Y2, 2XY, Z3
Transmit/receive (T/R) channel	Two 1H parallel transmit / receive channels.
Transmitter power	1000 W (2x 500 W)
Standard RF coil	transceiver volume coil, ID = 35 mm

OPTIONS	
Broadband T/R channel	Additional broadband transmit / receive channel.
Parallel receiver	4, 8, 16
Parallel transmitter	up to 8 parallel transmitter
High power gradient upgrade	1000 mT/m @ 135 A, 9000 T/m/s
High power transmitter upgrade	up to 2000 W (2x 1000W)
Gradient inserts	none
RF Coils	Volume and Surface Coils, Phased Array Coils, X-Nuclei Volume and Surface Coils, MRI CryoProbe ™

INSTALLATION	
Rating	400/230 VAC, 3W+N+PE, 50/60 Hz, 80 A Overvoltage category: II Degree of pollution: 2 IP Classification: 20
Heat dissipation (*)	into air (technical room): ~ 7.5 kW (standard) plus ~ 7 kW High Power Gradient Amplifier (option) ~ 1.2 kW MRI CryoProbe (option) ~ 2.0 kW Parallel Transmit Cabinet (option) into air (MR system in magnet room): ~ 0.5 kW into air (operating room): ~ 0.5 kW into facility cold water supply: ~ 11.5 kW
Acoustic sound pressure	Technical room: typically 70 dB(A) Magnet room / examination: up to 100 dB(A)

(*) The power consumption and the heat dissipation depend on the actual system configuration and on the operation state of the MR instrument. For site planning purpose, see details in the instrument specific Site Planning Information.

7.11 Technical Data BioSpec 117/16 USR

STANDARD CONFIGURATION	
Magnet type	Ultra Shielded & Refrigerated (USR)
1H resonance frequency	500.3 MHz
Diameter of magnet bore	154 mm
Max. gradient strength	570 mT/m @ 150 A
Max. linear slew rate	5130 T/m/s
Shim set	X, Y, Z, Z2, ZX, ZY, X2-Y2, 2XY, Z3
Transmit/receive (T/R) channel	Two 1H parallel transmit / receive channels.
Transmitter power	1000 W (2x 500 W)
Standard RF coil	transceiver volume coil, ID = 72 mm

OPTIONS	
Broadband T/R channel	Additional broadband transmit / receive channel.
Parallel receiver	4, 8, 16
Parallel transmitter	up to 8 parallel transmitter
High power gradient upgrade	760 mT/m, 6840 T/m/s @ 200 A
High power transmitter upgrade	up to 2000 W (2x 1000W)
Gradient inserts	none
RF Coils	Volume and Surface Coils, Phased Array Coils, X-Nuclei Volume and Surface Coils, MRI CryoProbe ™

INSTALLATION	
Rating	400/230 VAC, 3W+N+PE, 50/60 Hz, 80 A Overvoltage category: II Degree of pollution: 2 IP Classification: 20
Heat dissipation (*)	into air (technical room): ~ 7.5 kW (standard) plus ~ 7 kW High Power Gradient Amplifier (option) ~ 1.2 kW MRI CryoProbe (option) ~ 2.0 kW Parallel Transmit Cabinet (option) into air (MR system in magnet room): ~ 0.5 kW into air (operating room): ~ 0.5 kW into facility cold water supply: ~ 11.5 kW
Acoustic sound pressure	Technical room: typically 70 dB(A) Magnet room / examination: up to 100 dB(A)

(*) The power consumption and the heat dissipation depend on the actual system configuration and on the operation state of the MR instrument. For site planning purpose, see details in the instrument specific Site Planning Information.

7.12 Technical Data BioSpec 152/11 USR

STANDARD CONFIGURATION	
Magnet type	Ultra Shielded & Refrigerated (USR)
1H resonance frequency	650.3 MHz
Diameter of magnet bore	105 mm
Max. gradient strength	740 mT/m @ 100 A
Max. linear slew rate	9000 T/m/s
Shim set	X, Y, Z, Z2, ZX, ZY, X2-Y2, 2XY, Z3
Transmit/receive (T/R) channel	Two 1H parallel transmit / receive channels.
Transmitter power	1000 W (2x 500 W)
Standard RF coil	transceiver volume coil, ID = 35 mm

OPTIONS	
Broadband T/R channel	Additional broadband transmit / receive channel.
Parallel receiver	4, 8, 16
Parallel transmitter	up to 8 parallel transmitter
High power gradient upgrade	1000 mT/m @ 135 A, 9000 T/m/s
High power transmitter upgrade	up to 2000 W (2x 1000W)
Gradient inserts	none
RF Coils	Volume and Surface Coils, Phased Array Coils, X-Nuclei Volume and Surface Coils, MRI CryoProbe ™

INSTALLATION	
Rating	400/230 VAC, 3W+N+PE, 50/60 Hz, 80 A Overvoltage category: II Degree of pollution: 2 IP Classification: 20
Heat dissipation (*)	into air (technical room): ~ 7.5 kW (standard) plus ~ 7 kW High Power Gradient Amplifier (option) ~ 1.2 kW MRI CryoProbe (option) ~ 2.0 kW Parallel Transmit Cabinet (option) into air (MR system in magnet room): ~ 0.5 kW into air (operating room): ~ 0.5 kW into facility cold water supply: ~ 11.5 kW
Acoustic sound pressure	Technical room: typically 70 dB(A) Magnet room / examination: up to 100 dB(A)

(*) The power consumption and the heat dissipation depend on the actual system configuration and on the operation state of the MR instrument. For site planning purpose, see details in the instrument specific Site Planning Information.

8 Transport, Dismantling and Disposal

⚠ WARNING

Risk of personal injury by explosion hazard

Unprofessional dismantling of the magnet may lead to the explosion of the dewar. Only trained, qualified, and authorized Bruker Magnet Service personnel is permitted to dismantle the superconducting magnet of the MR instrument.

- ▶ Always discharge the magnet before dismantling the magnet.
- ▶ Always warm up the magnet before dismantling the magnet.
- ▶ Always break the vacuum before dismantling the magnet.

8.1 Transport

Contact Bruker Service and Lifecycle Support when planning to relocate the MR instrument within a building or when planning to transport.

⚠ WARNING

Personal injury and/or risk of severe damage of the MR instrument

- ▶ A MR instrument may only be moved by qualified personnel.
- ▶ The magnet must not be moved when it is on magnetic field or without having the transport safety devices installed.
- ▶ Transport of the instrument bears the potential risk of damage to the instrument and/or the structure of the building.
- ▶ Storage and transport of the magnet in a cold state without connection to the refrigerator has to be limited to magnet specific holding times.
- ▶ Storage and transport of the magnet in a cold state without a quench pipe must comply with the regulations for the storage of cryogen containers. Make sure that the ventilation is sufficient during the entire storage and transportation process (this does not apply for cryogen free magnets).
- ▶ Increased residual magnetization in the building's ferromagnetic structure may remain after an MR instrument has been moved.

⚠ CAUTION

Heavy load.

Some Service actions require handling of heavy loads.

- ▶ Ensure compliance with worker protection regulatory limits.
- ▶ Potentially handle with at least 2 persons where applicable.
- ▶ Potentially, hire professional staff trained in handling heavy loads.

8.2 Dismantling

Following the end of its operational life, the device must be dismantled and disposed in accordance with the environmental regulations.

⚠ WARNING

Danger of injury from electrical shock.

A life threatening shock may result when the service access housing is opened and work performed while connected to the line power.

Only electrically qualified personnel should open the housing and carry out work.

- ▶ Disconnect from line power.
- ▶ Prevent reconnection.
- ▶ Test for absence of harmful voltages.

In preparation for dismantling, System Owner or persons in charge are requested to take the following actions:

1. Disconnect the MR instrument from the main power.
2. Remove consumables, auxiliary materials and other processing materials and dispose them in accordance with the environmental regulations.
3. Clean assemblies and parts properly in compliance with applicable local occupational safety and environmental protection regulations.
4. Contact Bruker Service and Lifecycle Support for discharging the magnet and preparing for disposal. These actions are to be performed by Bruker Magnet Service, only.

8.3 Disposal Europe

Environmental information for laboratory and industrial customers within the EU (European Union)

This laboratory product is developed and marketed for **Business-to-Business** (B2B), so does not fall under article 6 clause 3 of the German Act ElectroG. To meet the demands of the European Directive **2012/19/EU WEEE 2** (Waste of Electrical and Electronic Equipment) and the national Equipment Safety Act, electrical and electronic equipment that is marked with this symbol directly on or with the equipment and/or its packaging must not be disposed

of together with unsorted municipal waste or at local municipal waste collecting points. The symbol indicates that the equipment should be disposed of separately from regular industrial/ domestic waste.

Correct disposal and recycling will help prevent potential negative consequences for the environment and risk to personal health. It is your responsibility to dispose of this equipment using only legally prescribed methods of disposal and at collection points defined by government or local authorities in your area.

The WEEE register number can be found on the product label of the equipment. If you need further information on the disposal of equipment or collection and recovery programs available, contact your local Bruker BioSpin sales representative. Local authorities or professional waste management companies may also provide information on specific waste disposal services available in your area.

Disposal - End of Life (EoL) information: the common procedure as defined in the sales contract with Bruker BioSpin

After the lifespan of an electrical and electronic product, Bruker BioSpin takes responsibility for final disassembly and correct disposal in accordance with the European directive **2012/19/ EU** WEEE 2.

Bruker BioSpin offers to take back the equipment (only for deliveries after 23.03.2006) after termination of use at the customer site upon request by the customer. This request must be affirmed when the equipment is ordered from Bruker BioSpin. Additional costs for dismantling and transport service will apply!

Only 100% pre-decontaminated equipment can and will be accepted by Bruker BioSpin. A release document for decontamination can be inquired from your nearest Bruker BioSpin contact site, also to be used when repairs, going back to Bruker sites, are requested.

In compliance with WEEE II directive: **2012/19/EU**

8.4 Disposal for USA

Disposal of these materials may be regulated due to environmental considerations. For disposal or recycling information, please contact our local office or your local authorities, or in the U.S.A., contact the Electronics Industry Alliance web site at *www.eiae.org*.

9 Contact

Manufacturer

Bruker BioSpin MRI GmbH
Rudolf-Plank-Str. 23
D-76275 Ettlingen
Germany
Phone: +49 721-5161-6531
www.bruker.com / *preclinical imaging*
WEEE DE92533205

Hotlines

Service Hotline

Phone: +49 721-5161-6521
E-Mail MR: *mri-hardware-support@bruker.com*
E-Mail PET: *Support.NMI@bruker.com*

Application Hotline

Phone: +49 721-5161-6621
E-Mail: *mri-application-support@bruker.com*

Software Hotline

Phone: +49 721-5161-6588
E-Mail: *mri-software-support@bruker.com*

Service Centers

Service Centers or general *Service Helpdesk*.

Please refer to the product label located typically at the outside of the main electronic cabinet and report Type, Model No., Serial No. and Internal Order where different to Serial No.:

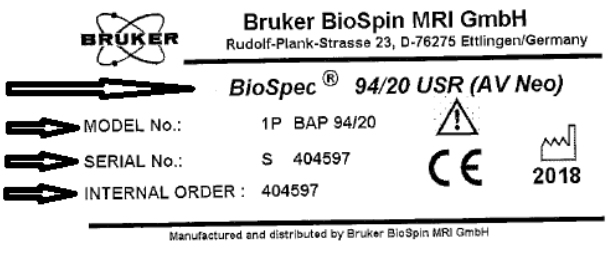
Product Label / Identification for Hotline		
	Type Model No. Serial No. Internal Order	

Table 9.1: Example showing BioSpec 94/20 USR (AVANCE NEO).

Contact

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Bruker Corporation

info@bruker.com
www.bruker.com

Order No: T168547