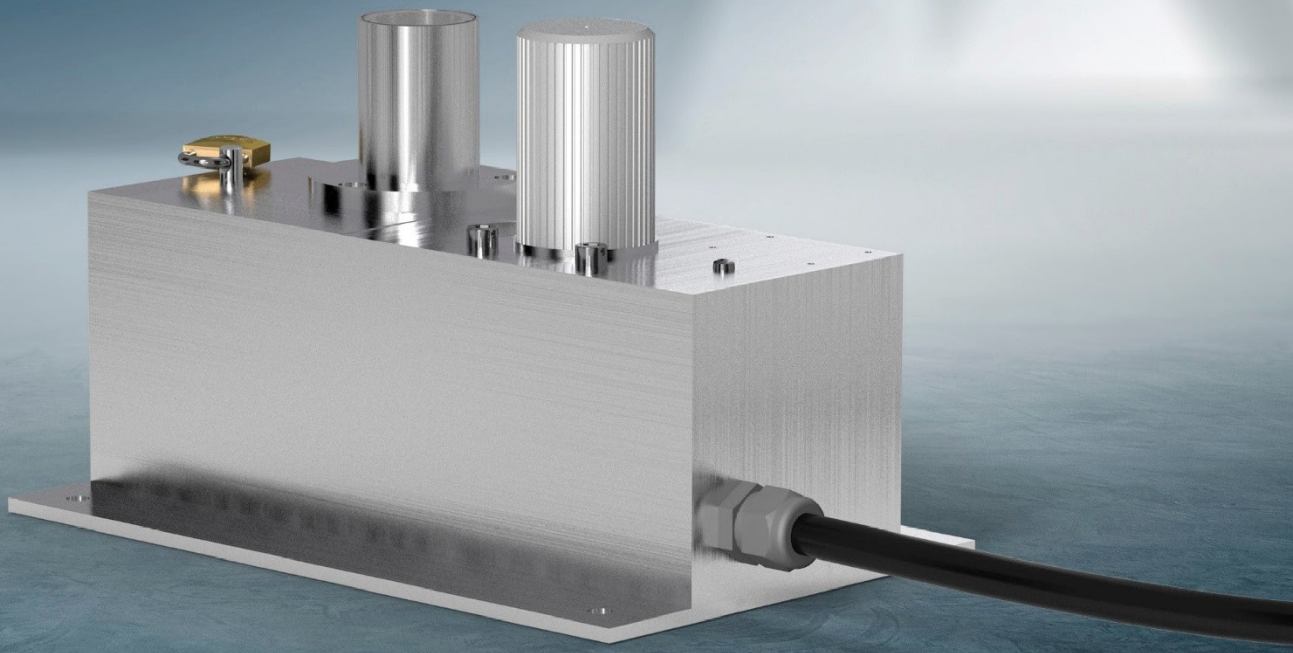
SHIELD WITH ELECTRICALLY OPERATED SHUTTER

LB 7488-1

Operating Manual



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1 About this operating manual

1.1 Applicable documents

- Technical Information, Id. Nr. 26150TI2

1.2 Some prior remarks

The product is handed over to you by the manufacturer BERTHOLD TECHNOLOGIES GmbH & Co. KG (designated as Berthold in the following) in a complete and functionally reliable condition.

This operating manual illustrates how to:

- set up/install the product
- operate the product
- carry out maintenance on the product
- dismount the product
- dispose of the product

Read these instructions thoroughly and completely before working with the product. We have tried to compile all the information for safe and proper operation for you.

However, should questions arise which are not answered in this manual, please contact Berthold.

Store the instructions where they are accessible for all users at all times.

1.3 Storage

This operating manual as well as all product-related documentation relevant to the respective application must be accessible at all times during the life cycle near the device.

1.4 Target group

The product may only be installed, operated, maintained and repaired by trained personnel.

This manual is directed at qualified specialist personnel who are familiar with handling radioactive sources and heavy system components.

Specialist personnel refers to those who can assess the work assigned to them and recognise possible dangers through their specialist training, knowledge and experience as well as knowledge of the relevant regulations.

1.5 Validity of the manual

The manual is valid from the delivery of the Berthold product to the user until its disposal. Version and release date of this operating manual can be found in the bottom of each page. An alteration service is not provided by the manufacturer Berthold.

The manufacturer reserves the right to make changes to this operating manual at any time without stating reasons.

NOTICE

The current revision of this operating manual replaces all previous versions.

1.6 Structure of the manual

This manual has been divided into chapters. The order of the chapters should help you to familiarise yourself quickly and properly with the operation.

1.7 Copyrights

This manual contains copyright-protected information. None of the chapters may be copied or reproduced in any other form without prior authorisation from the manufacturer.

1.8 Representation

Identifier	Meaning	Example
Round brackets	Image reference	Connect the plug (Fig. 1, item 1)
	Prohibited actions, procedures or processes within a figure.	
	Representation of the ionizing radiation within a figure.	

1.9 Symbols used

NOTICE

If this information is not observed, deterioration in the operation and/or property damage may occur.

IMPORTANT

Sections marked with this symbol point out important information on the product or on handling the product.

Tip

Provides tips on application and other useful information.

General warning symbol

Warning symbol danger of crushing

Warning symbol heavy loads

Warning symbol suspended load

Warning of radioactive substances

Wear protective helmet

Wear safety shoes

Do not touch the surface

1.10 Structure of warnings

⚠ Signal word

Source and consequence
Explanation, if required
- ▶ Measur

In case of emergency

- **Warning symbols:** (warning triangle) draws attention to the hazard.
- **Signal word:** states the severity of the hazard.
- **Source:** states the type and source of the hazard.
- **Consequence:** describes the consequences if warning is ignored.
- **Measure:** states how one can avoid the hazard.
- **In case of emergency:** states how to react in case of direct danger.

Warning levels used

In this manual, warning instructions in front of instructions for action refer to risks of injury or damage to property. The hazard-prevention measures described must be observed.

⚠ DANGER

Indicates an **imminent**, major hazard, which will certainly result in serious injuries or even death if the hazard is not avoided.

⚠ WARNING

Indicates a **potential** hazard, which can result in serious injuries or even death if the hazard is not avoided.

⚠ CAUTION

Refers to a **potentially dangerous** situation, which can result in medium or minor physical injuries or damages to property, if it is not avoided.

1.11 Symbols used on the device

Ionizing radiation
 The shield is equipped with a radioactive source. Please note the handling instructions. Please observe the transport instructions in this operating manual.

2 Safety

2.1 Product safety

The appliance has been designed, manufactured and tested in accordance with the current state of the art and in compliance with the generally recognized rules of technology. It was delivered in a technically safe and fault-free condition.

2.2 Proper use

The source with shield is used in connection with a detector and a suitable evaluation unit provided by Berthold to measure the radiation intensity occurring during a radiometric measurement.

The shield was developed as shield/protective container for radioactive sources and may be used exclusively for this purpose. The source container ensures effective shielding of ionizing radiation from the environment and only allows radiation to escape during measurement operation within the intended measurement application.

Usually, the shield contains a radioactive source. The notes on radiation protection contained in the present manual as well as any statutory requirements in this respect are to be strictly adhered to.

The following constitutes proper use

- Adhering strictly to the instructions and operation sequences and not undertaking any different, unauthorized practices which could put your safety and the operational reliability of the shield at risk.
- Observing the provided safety instructions.
- Carrying out the prescribed maintenance measures or having them carried out for you.

The following constitutes improper use and is to be avoided

• Any non-compliance with the present operating manual for the supplied products

• Applying conditions and requirements which do not conform to those stated in the technical documents, data sheets, operation and assembly instructions and other specific guidelines of the manufacturer.

• Using the product after any repair carried out by employees who have not been authorized by Berthold.

• Using the product in a damaged or corroded condition.

• Dismounting the unit while the radiation beam outlet is in the open position (except for situations in which the locking mechanism is defective and the beam outlet can no longer be closed).

• Operation without the safety precautions provided by the manufacturer.

• Any modification to design and function, except for any activities provided for and described in the present manual.

• Restructuring or changing the system components.

• Manipulation or avoidance of existing safety equipment.

Berthold shall only accept liability for / guarantee the correspondence of the product to its publicised specifications.

If the product is used in a way which is not described in this manual, the product's protection is compromised and the warranty becomes void. Berthold accepts no liability for damage caused by improper use.

2.3 Ambient conditions during operation and storage

The shield is intended for indoor use only. When used outdoors, suitable protective measures must be taken to protect the shield from weather conditions such as rain or snow.

The compliance with the operating conditions specified contributes to guaranteeing the permanent functionality of the shield and the prevention of damage.

Shields containing radioactive substances and sources are to be stored in a lockable storage room complying with the national requirements for the storage of radioactive substances.

Storage temperature: 0°C to +70°C. Storage outside this range can lead to malfunctions, permanent damage to the device, safety risks and potential danger to persons.

Operating temperature: 0°C to +70°C. Operation outside this range can lead to malfunctions, permanent damage to the appliance, safety risks and potential danger to persons.

The higher the dust and dirt content of the environment, the more likely the rotational motion of the shutter mechanism can be impaired or entirely blocked. For this reason, the functional test intervals (see chapter 7) should be adjusted for the ambient conditions.

Highly combustible or explosive substances must not be kept in the vicinity of shields in order to prevent a fire from spreading to the radioactive substances. Furthermore, the ambient condition requirements in the document “Technical Information” are to be observed.

2.4 Qualification of the personnel

NOTICE

A minimum requirement for all work on or with the product would be employees with general knowledge who are instructed by an expert or authorised person.

At different parts in this manual, reference is made to personnel with certain qualifications who can be entrusted with different tasks during the installation, usage and maintenance.

The four groups this refers to are:

- Employees with general knowledge
- Experts
- Authorised persons
- Radiation Safety Officer

Employees with general knowledge

Employees with general knowledge are e.g. technicians or welders who can undertake different tasks during the transportation, assembly and installation of the product under the guidance of an authorised person. This may also refer to construction site personnel. The persons in question must have experience in handling the product.

NOTICE

Employees with general knowledge only must be under the supervision of at least one expert at all times. When dealing with radioactive substances, a radiation safety officer must also be consulted.

Experts

Experts are people who have sufficient knowledge in the required area due to their specialized training and who are familiar with the relevant national health and safety regulations, accident prevention regulations, guidelines and recognized technical rules.

Expert personnel must be capable of safely assessing the results of their work and they must be familiar with the content of this manual.

Authorised personnel

Authorised personnel are those who are either designated for the corresponding task due to legal regulations or those who have been authorised by Berthold for particular tasks. When dealing with radioactive materials, a radiation safety officer must also be consulted.

Radiation safety officer

In order to ensure proper handling and compliance with the statutory requirements, the company has to appoint a radiation safety officer in accordance with the applicable national law (in Germany: Strahlenschutzverordnung [German radiation protection regulation]). The radiation safety officer must implement the statutory radiation protection requirements in order to protect employees against damage to their health caused by handling radioactive materials.

NOTICE

Dangerous goods officers must not perform any activities as radiation protection officers, unless they underwent a special training as radiation safety officer!

Radiation safety officers must have a special training with attendance of an officially recognized course and appropriate professional experience.

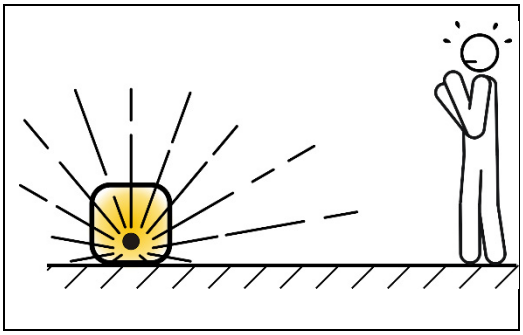
2.5 Radiation protection

2.5.1 Basic principles and regulations

The handling of radioactive radiation sources is regulated by law. The radiation protection regulations of the country in which the facility is operated are authoritative. In the Federal Republic of Germany, the current version of the Radiation Protection Act and the Radiation Protection Ordinance apply.

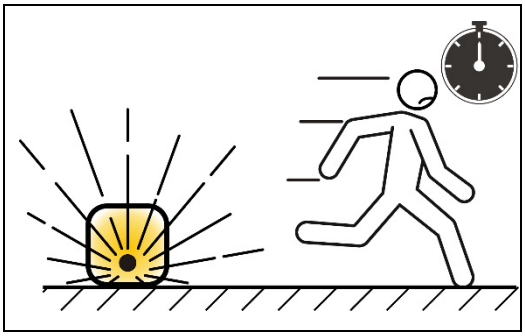
The amount of radiation absorbed by the body (exposure to radiation) is determined by three parameters from which the basic radiation protection regulations can be derived:

Distance



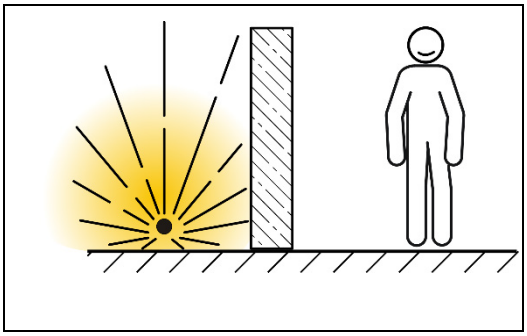
If work close to equipment containing radioactive substances is required, the largest distance possible is to be kept. In particular, this applies to employees not immediately required to work directly with the radioactive devices.

Time



Any work required in the vicinity of radiometric measuring systems is to be prepared for carefully and to be organised in a way that the work can be executed as quickly as possible. Here, providing the correct tools and aids is particularly important.

Shield



When mounting and dismounting the shield, it is to be ensured in advance that the radiation beam outlet is closed.

Exposure of employees to radiation

During installation, maintenance and decommissioning of the shield, employees may be exposed to radiation.

In order to keep such exposure as low as possible, the shield with the source may only be mounted and/or dismounted by authorized employees. Such authorised staff is to be instructed as regards all rules of behaviour when handling radioactive substances in advance.

It is to be ensured that the locking mechanism of the shield is closed and secured in order to prevent the emission of unshielded radiation. Modification or damage to the shield must be avoided at all times.

Work may only be executed according to the instructions and under the supervision of the radiation safety officer, who furthermore has to calculate or estimate the exposure of the employees to radiation in order to ensure that the statutory dose rate limits are not exceeded.

Theft protection

Radioactive substances or equipment containing radioactive substances must be secured in a way that they are protected against access by unauthorized persons. In the case of firmly installed equipment containing radioactive substances, the protection against unauthorized access is generally provided by the firmly attached installation.

Shields with radioactive sources which are decommissioned for a certain period of time must be dismounted and securely stored in a storage room complying with the national regulations for the storage of radioactive substances.

Portable measuring systems must never be left unsupervised. When this equipment is not in use, it is to be protected against access by unauthorised persons.

In the case of fire

The shielding material can melt and leak from the shield if exposed to very high temperatures for an extended period of time. During and after a fire, there is a risk of major long-time consequences for your health due to the incorporation of lead as well as a risk of increased radiation exposure.

When planning the use of radiometric measuring systems, constructional measures ensuring fire prevention are to be provided.

- In the case of fire, these measures limit the access to this area.
- Avoid the incorporation, contamination and exposure by keeping sufficient distance.
- Notify Berthold of the situation; you will promptly receive information on immediate measures.

2.6 Emergency procedure

2.6.1 Shutter cannot be closed

The locking device can no longer be moved to the OFF position due to mechanical damage.

1. Leave the affected area immediately
2. Inform the radiation protection officer
3. Radiation protection officer initiates appropriate measures and coordinates further action with Berthold.
4. If the necessary specialist knowledge is available, dismantle the radiation protection container and direct the radiation outlet channel e.g. against a thick wall, floor or steel plate.

2.6.2 Handling major operational disruptions

In case of serious operational trouble, such as fire or explosion, which could adversely affect the radiometric device, it cannot be ruled out that the function of the shielding lock, the shielding efficiency or the stability of the source capsule have been compromised. In this case, it is possible that people in the vicinity of the shield have been exposed to higher levels of radiation.

If you suspect such a severe malfunction, the Radiation Safety Officer must be informed immediately, who will then check the situation on site and take all further measures to prevent further damage and any unnecessary exposure of the operating personnel to radiation. The responsible supervisory authority must be informed immediately of the incident with all the necessary information. Further measures will then be taken in consultation with the competent supervisory authority.

The radiation protection officer must prohibit any further use of the measuring device. If necessary, the manufacturer or supplier of the device must be consulted to ensure that all further actions are carried out under expert guidance. If the necessary expertise is available and suitable equipment is at hand, it may be possible to carry out immediate measures. In this case, the following procedure is recommended:

1. Locate the shielding.
2. Check the function of the shielding.
3. Check the efficiency of the shielding by measuring the dose rate.
4. Secure and label radiation protection areas.
5. Secure the shielding with source.
6. Document the event and estimate the possible radiation level to which the people involved were exposed.

If you suspect any damage to the source capsule, the following points have to be observed as well:

1. Leave the affected area immediately.
2. Persons in the danger zone could be contaminated. Immediately initiate protective measures for these persons! Take measures to prevent further spread of the contamination.
3. Cordon off the suspected danger area over a wide area (e.g. with marking tape). Also take into account areas above and below. As soon as it is possible

to measure radiation, determine the endangered area precisely by measuring it.

4. Ensure that no persons enter the suspected danger zone.
5. If you have the necessary specialist knowledge, grasp the source with tools (e.g. pliers or tweezers) and wrap both (source and tools) in a plastic bag and secure behind an auxiliary shield (concrete wall, steel or lead plate).
6. Check that the environment is free of contamination if suitable measuring equipment is available.
7. Make sure the radioactive waste is secured and disposed of in compliance with the pertinent regulations.

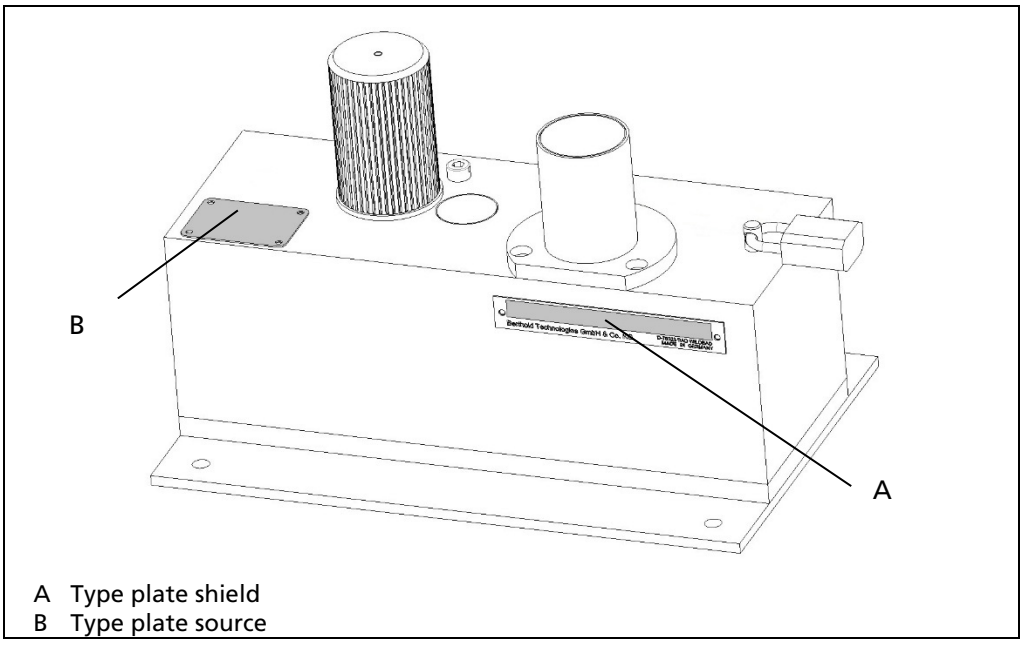
2.7 Operator's obligations

The operator of the product must regularly train his personnel in the following topics:

- Observation and use of the operating manual and the legal provisions.
- Proper use of the product.
- Observation of the plant security instructions and the operating instructions of the operator.

2.8 Type plates

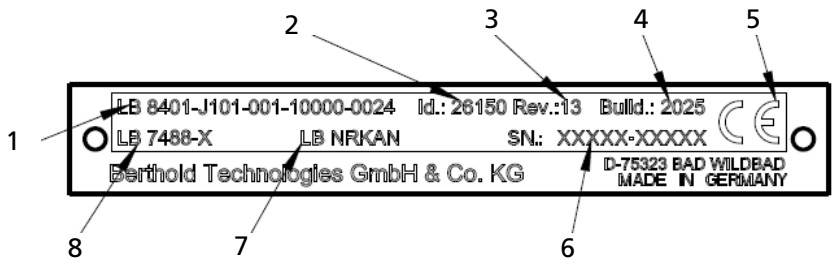
Type plates contain the most important information about the shield and the radioactive source installed in it.



A Type plate shield
B Type plate source

Fig. 1 Type plates, Position on the shield

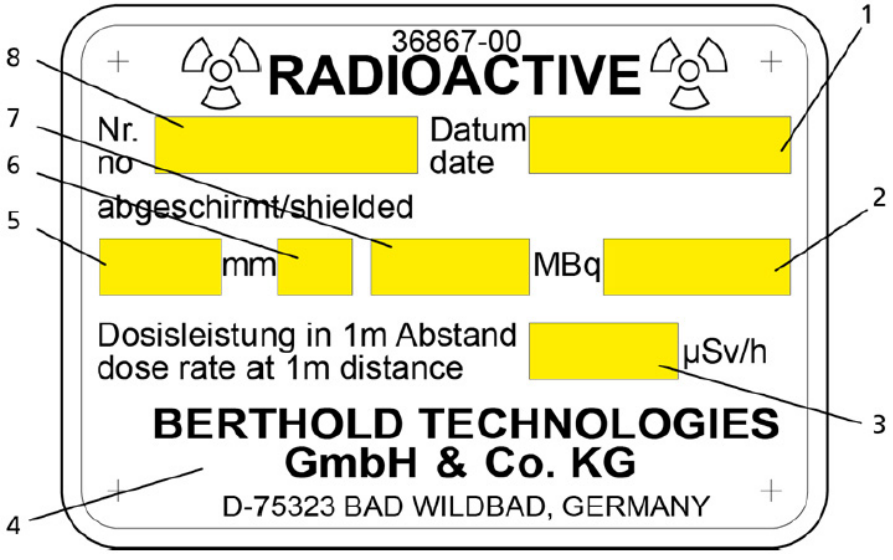
2.8.1 Shield, type plate



1 Shield LB number (unique identification of the shield)
2 Order number
3 Bill of materials version
4 Year of manufacture
5 CE marking (only if a CE declaration is available for the shield)
6 Serial number
7 LB number Canada (if available)
8 LB number USA (if available)

Fig. 2 Shield, type plate

2.8.2 Source type plate



1 Date of manufacture of the source
2 Isotop
3 Dose rate in 1 m distance[µSv/h]
4 Supplier of the source
5 Effective shielding thickness
6 Shielding material
7 Activity [MBq]
8 Source number

Fig. 3 Standard Type plate of the source

3 System description

The shield LB 7488 is intended as shield/protective container for radioactive point sources. The radioactive substance is contained in a leak-proof welded source capsule and installed in the LB 7488 shield. Apart from source and shield, additional system components such as detectors and evaluation units are required for a complete measuring system. Usage of these system components is not the subject of this operating manual. Please refer to the individual manuals of the respective system components.

The shield container consists of a robust brass housing. The LB 7488 shield is designed to be loaded with a radioactive source and to ensure safe operation. For this purpose, the shielding is equipped with an electrical shutter that can open or shield the radiation outlet channel. This allows the source to be placed in a safe position when not in use.

The locking mechanism of the shield is based on the principle of an electromagnetic induction coil. When the supply voltage is applied, the coil is activated, which unlocks the mechanical shutter and releases the beam exit channel.

As soon as the supply voltage is interrupted or fails, the shutter is automatically returned to the closed position by an integrated return spring. This mechanical return ensures that the radiation source remains reliably shielded in the event of a power failure or switch-off.

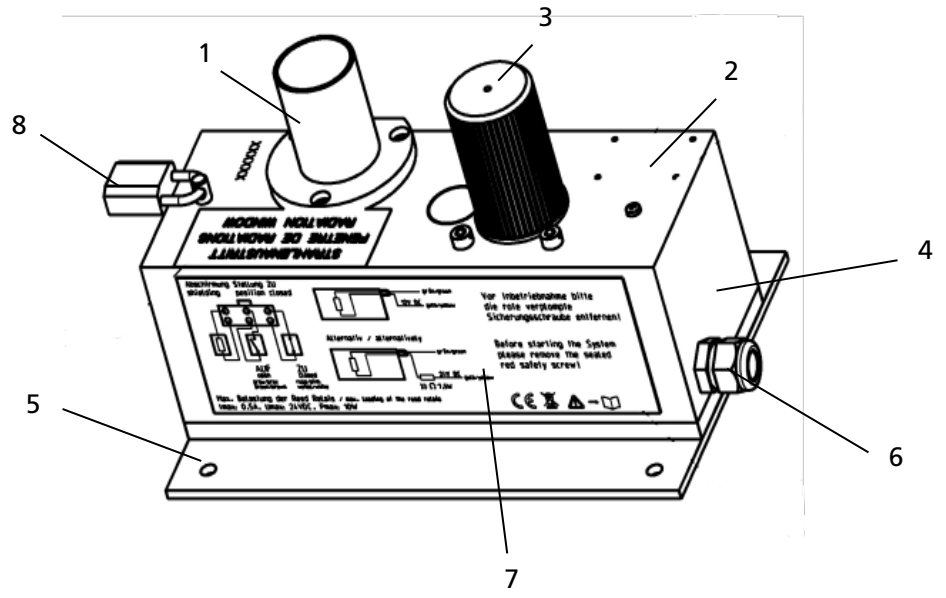
The shield uses lead as an absorber. The source activity is selected according to the requirements of the measurement task.

Only the lower mounting plate is permitted for mounting the shield.

The Shield has the following functions:

- shield the radiation to a level that is non-hazardous for operating personnel
- Locking the radiation beam path in the CLOSED position for transport and during installation
- Protecting the integrated source capsule from mechanical damage and the effects of the environment

3.1 View



1 Collimator (optional)
2 Source type plate
3 Key protection cap
4 Housing
5 Mounting plate
6 Control cable / strain relief
7 Wiring diagram
8 Padlock

Fig. 4 Basic layout

4 Transport

4.1 Safety instructions

⚠ Caution!

Danger caused by ionizing radiation!

Shields usually contain radioactive sources. An increased exposure to radiation may lead to damage to health.

- Consult the radiation safety officer responsible for your company.
- Transport the source exclusively inside the closed and secured shield.
- The locking mechanism must be in the OFF position and secured during transport and mounting of the shield.

NOTICE

The device may only be transported by competent people (see 2.4 Qualification of the personnel).

The applicable national regulations of the country of use have to be observed. Observe the marking for the center of gravity on the outer packaging, if applicable.

4.2 Packaging

Shields with the radioactive source is delivered in a packaging which complies with the regulations for the transport of radioactive material (Type A packaging).

4.3 Temporary storage of the source

If the source must be temporarily stored at the site of use between delivery and installation, please observe the following notes:

- Store the source exclusively inside a closed and secured shield.
- Store the shield in a lockable and properly marked room. The storage room must comply with the national requirements regarding the storage of radioactive substances.
- Accessible areas of increased radiation exposure must be marked and closed off, if required.

4.4 Scope of delivery

Check the delivery immediately to ensure that it is complete as ordered (bill of materials) and undamaged. In the event of damage, notify the forwarding agent and the manufacturer immediately.

Check delivery

Document any visible transport damage with photos on delivery. In case of damage contact the transport company and the manufacturer immediately.

4.5 Transport to operation site

The transportation may only be executed by construction site personnel experienced in handling heavy components. The construction site personnel is to be instructed by at least by one authorised person. If the shields contains a radioactive source, the radiation protection officer is to be consulted, as well!.

For lifting packages or shields weighing more than 25 kg, suitable aids (e.g. forklift truck) are to be used. If shields are lifted without transport packaging (wooden box or pallet), the provided lifting eyes are to be used exclusively for attaching the sling gear.

Please observe the radiation protection regulations for the transportation of radioactive substances.

5 Installation

The shield may only be installed and mounted by competent people (see chapter 2.44 Qualification of the personnel). Possibly the radiation protection officer is to be consulted, as well.

5.1 Safety instructions

⚠ Caution!

Danger caused by ionizing radiation!

Shields usually contain radioactive sources. An increased exposure to radiation may lead to damage to health.

- Consult the radiation safety officer responsible for your company.
- Transport the source exclusively inside the closed and secured shield.
- The locking mechanism must be in the OFF position and secured during transport and mounting of the shield.

IMPORTANT

The applicable national regulations of the country of use have to be observed.

5.2 Ambient conditions during installation

The minimum permissible temperature during installation is **0°C**.

5.3 Temporary storage of the source

If the source must be temporarily stored at the site of use between delivery and installation, please observe the following notes:

- Store the source exclusively inside a closed and secured shield.
- Store the shield in a lockable and properly marked room. The storage room must comply with the national requirements regarding the storage of radioactive substances.
- Accessible areas of increased radiation exposure must be marked and closed off, if required.

5.4 Preparing the installation

NOTE

The shutter must be turned and secured in the *OFF* position during transport and installation of the shield.

IMPORTANT

Size and position of the applicable measuring range are specified in the project planning phase and determined by means of drawings, sketches or written notes. During installation, these specifications must be strictly observed since deviations may lead to malfunction of the measuring system.

To avoid an unnecessary exposure to radiation, the handling period of the source (even if it is shielded) must be kept as short as possible during installation. It is therefore recommended to perform the following steps prior to delivery of the source:

- Installation planning (including estimation of radiation exposure)
- Instruction of the employees
- Organising and cleaning the installation site
- Preparing the required tools and hoisting devices
- Removing all obstacles which might hinder the installation of the shield or the source

5.5 Checking the delivery

1. Check the delivery for completeness using the packing list.
2. Clean the parts, if required.
3. In the case of damage, immediately notify the forwarding agent and the manufacturer.

5.6 Installation of the shield

NOTE

Malfunctions and / or damage to the shield due to impermissible ambient conditions!

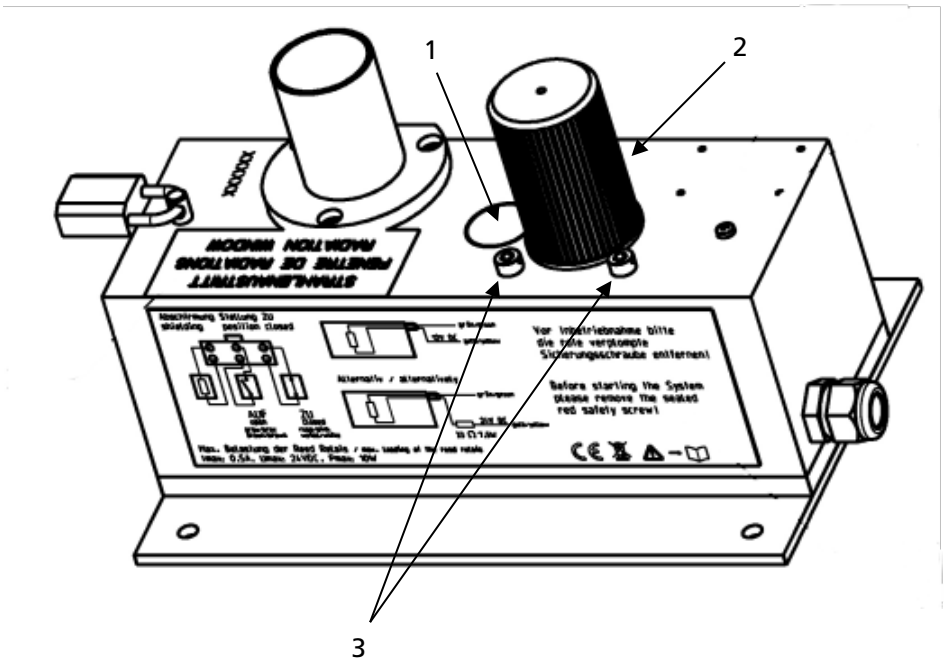
The mounting location and mounting position are determined during the project planning and defined by drawings, sketches or written instructions. These instructions must be observed strictly during assembly.

- Also note the information in the document "Technical Information".

To avoid unnecessary exposure to radiation, install the shield as final system component. The shield is placed on a mounting base at the measuring point and fixed. The mounted shield is secured against tilting by means of tipping protection.

Tip

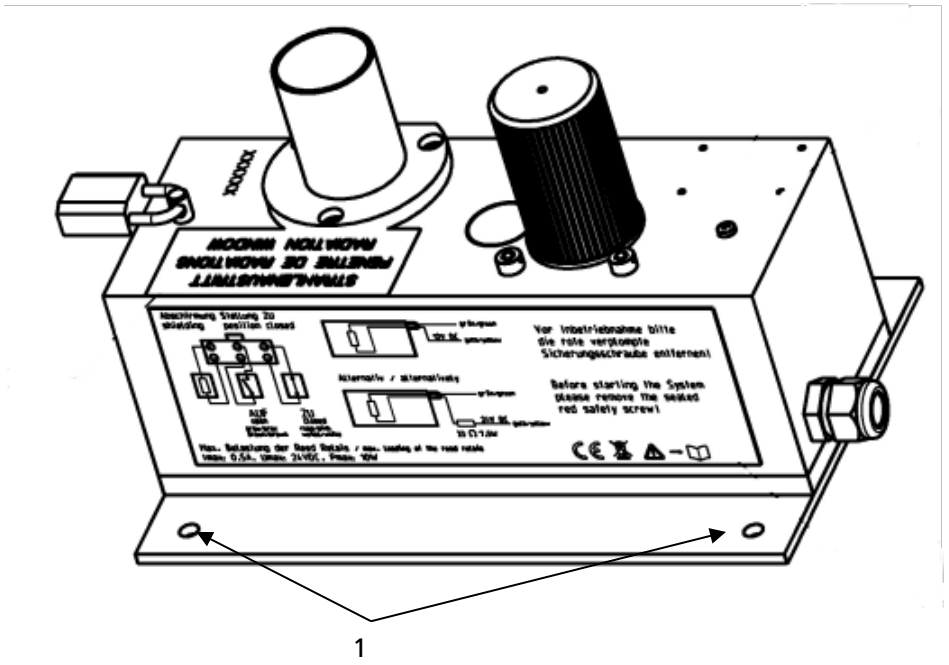
If the shield contains a radioactive source, the measurement of the background count rate of the detector should take place before the shield is installed.



1 Position OFF (Viewing window)
2 Locking bolt with key
3 Transport securing screws

Fig. 5 Shield closed (Position OFF)

1. Check that the shield is closed and secured.
   - the shutter is located in position OFF (Display viewing window).
   - the locking bolt has been locked with the key.
   - the transport securing screws are correctly fitted.



1 Screw connection with M6 (4pcs.)

Fig. 6 Mounting on a base

2. Carefully place the shield on the mounting base.

⚠ WARNING!

Incorrect assembly may result in accidents!

Use correctly sized and approved mounting elements (mounting base, nuts and bolts, screw lock).

- Use correctly sized and approved mounting elements (mounting base, anti-tilt, nuts and bolts, screw lock).

3. Screw the shield to the mounting base. The plant operator is responsible for selecting the connection elements, the screw locking and the tightening torque.

- The installation is complete.

5.7 Electrical connection of the shield

⚠ DANGER

Danger to life due to electric shock!

- Installation may only be carried out by a qualified electrician.
- Observe the relevant safety regulations. Electrical installations must be carried out in accordance with the applicable national and international regulations and the recognized rules of technology. Improper connection can lead to serious material damage, electric shock or fire.
- Only carry out installation/maintenance when the appliance is de-energized.
- In the event of an electric shock, carry out the necessary initial measures and contact the emergency services immediately.

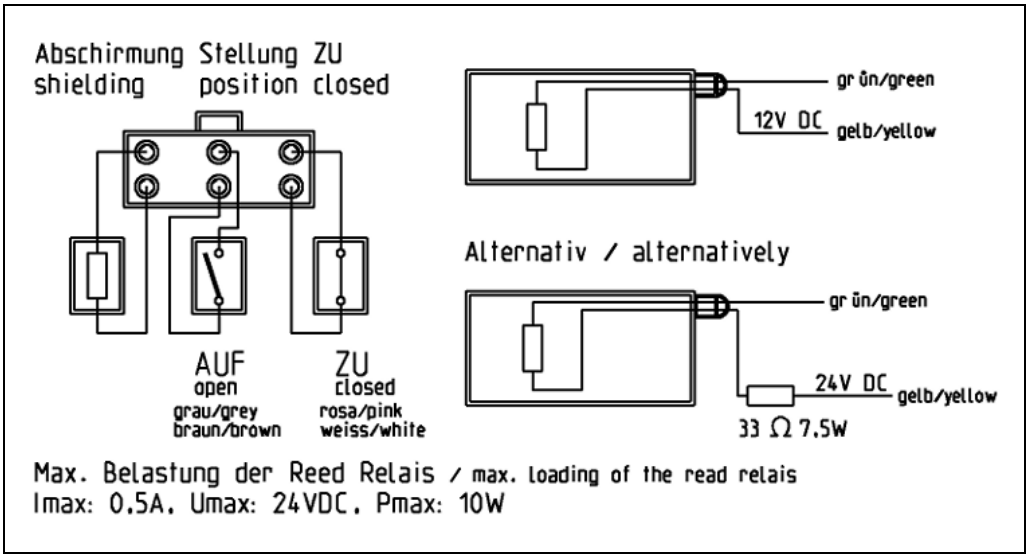
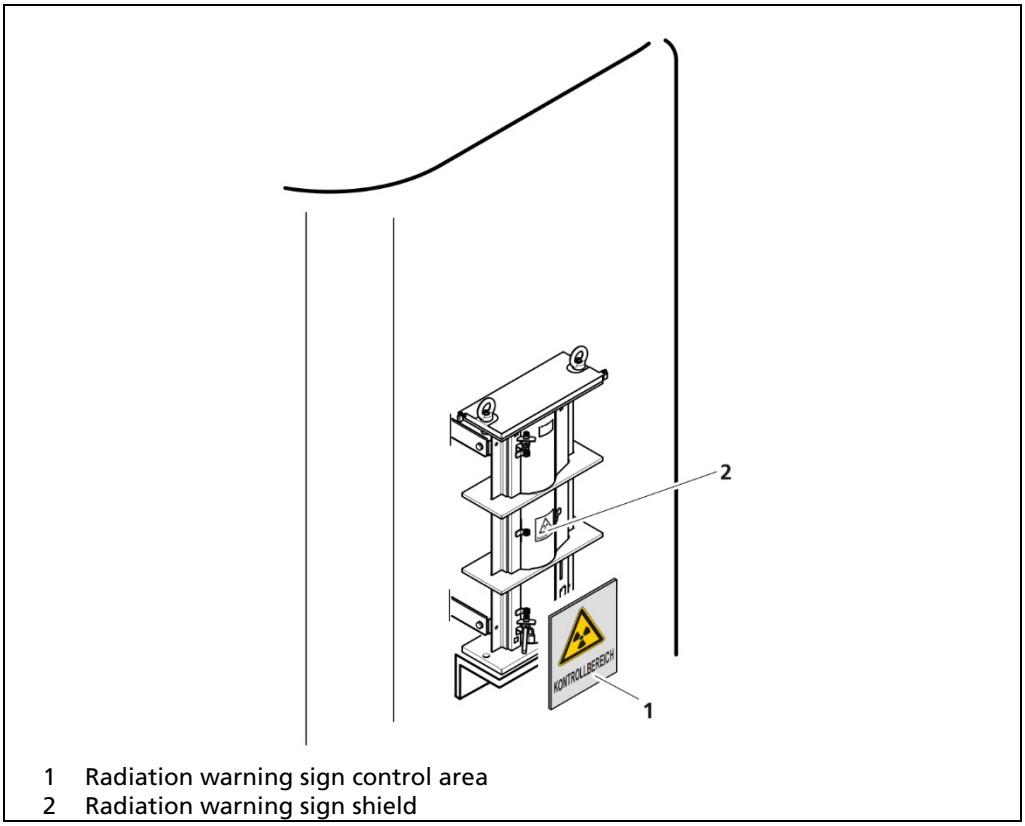


Fig. 7 Connection diagram

5.8 Marking control area

The radiation warning sign (Fig. 8, item 1) indicates the beginning of the control area as long as the control area is outside the shield.

If the control area is within the shield, then the radiation warning sign (Fig. 8, item 2) already applied to the shield is sufficient. Fig. 8 shows an exemplary identification of the control area according to German law. Please observe the local legislation of the country of install.



1 Radiation warning sign control area
2 Radiation warning sign shield

Fig. 8 Exemplary labeling

6 Usage

The shield may only operate by competent people (see 2.4 Qualification of the personnel). When operating the shield, unexpected changes at the process control system can occur. Before opening the locking mechanism, the guidelines of the system operator must be observed.

6.1 Safety instructions

⚠ CAUTION!

Danger caused by ionizing radiation!

Shields usually contain radioactive sources. An increased exposure to radiation may lead to damage to health.

- Consult the radiation safety officer responsible for your company.
- Make sure that the shield is not damaged or restricted in its function.
- Follow the instructions for regular maintenance.

6.2 Opening and closing the locking mechanism

The locking mechanism is used for opening and closing the beam outlet channel.

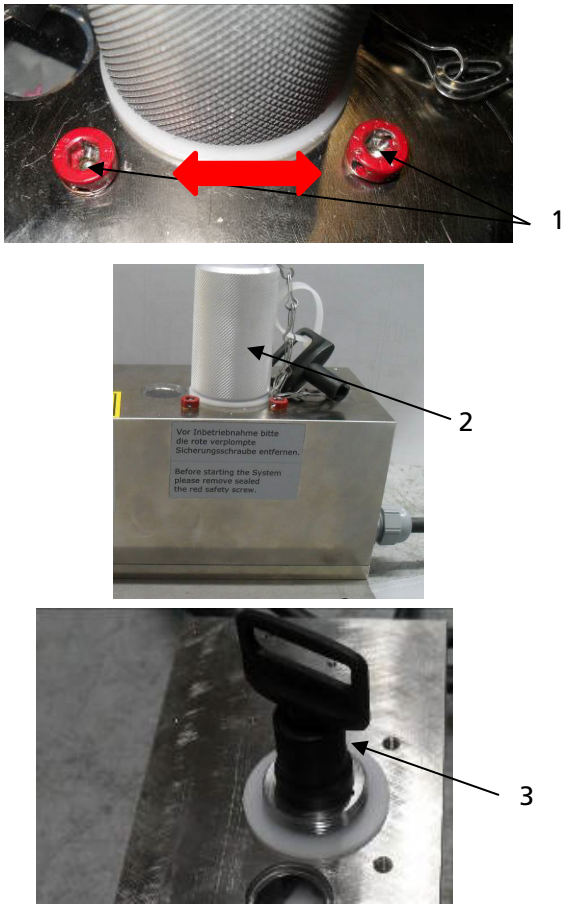
NOTICE

The locking mechanism must be in the OFF position and secured during transport and mounting of the shield.

IMPORTANT

The locking mechanism may be operated by at least employees with general knowledge who are instructed by a expert or authorized personnel. If the shield contains a radioactive source, the responsible radiation safety officer must be consulted (see chapter 2.4 Qualification of the personnel).

Opening the locking mechanism



1 Securing screws
2 Key protection cap
3 Key

Fig. 9 Shield open (Position ON)

1. Unscrew the two locking screws of different lengths (Fig. 6, Pos.1) and screw them back in, in the exchanged position.
2. Unscrew the key protection cap (Fig. 6, pos. 2). Open the locking bolt with the key (Fig. 6, pos. 3) and screw the key protection cap back on.
3. The shield can now be moved to the ON position by applying the supply voltage to the rotary solenoid.

- The beam exit channel is now open.

Closing the locking mechanism:

1. Switching off the supply voltage switches the shielding to the OFF position. The further steps 2 and 3 only need to be carried out if the shielding is to be additionally secured when closed.
2. Unscrew the key protection cap (Fig. 9, pos. 2). Close the locking bolt with the key (Fig. 9, pos. 3) and screw the key protection cap back on.
3. Unscrew the two locking screws of different lengths (Fig. 9, pos. 1) and screw them back in in the exchanged position.

- The beam exit channel is now closed and secured if necessary.

7 Maintenance and repair

The maintenance may only be carried out by competent people (see 2.4 Qualification of the personnel), which is supervised by experts or authorized persons. For repair work the radiation protection officer is to be consulted.

7.1 Safety instructions

⚠ CAUTION!

Danger caused by ionizing radiation!

Shields usually contain radioactive sources. An increased exposure to radiation may lead to damage to health.

- Consult the radiation safety officer responsible for your company.
- Ensure that no one is in the radiation beam during operation.
- Longer repair and maintenance work on shields must not be carried out with the source installed. If a removal of the source is not possible, please contact the manufacturer.

IMPORTANT

The applicable national regulations of the country of use have to be observed.

Document the results of the tests you conducted using the check list in the appendix. This documentation as well as the seal test certificates must be kept during the entire life cycle of the shield.

NOTICE

Adjust the intervals of the visual inspection and the functional check to the ambient conditions. If the ambient conditions are especially rough, the atmosphere is corrosive and / or there is a serious threat of contamination, the intervals should be shortened accordingly.

NOTICE

If damage affecting the secure function of the shield is detected during handling, maintenance or regular checks, the damage must be repaired after consultation with Berthold before the system is used again. Only spare parts specified by Berthold may be used and required repair work may be carried out exclusively by authorized persons.

7.2 Visual inspection

The visual inspection must be carried out by people who are at least employees with general knowledge at the following intervals:

- v before initial commissioning
- with every repair that may be required
- regularly at least every six months
- before shipping

When determining the intervals for the visual inspection, the following conditions are to be considered:

- ambient conditions (outdoors, rain, sunlight, wind)
- operating conditions (degree of utilisation of the plant, misuse)

Performing the Visual Inspection:

1. Check the shield for obvious damage (dents, cracks, holes etc.) and corrosion.
2. Only before shipping: Check if the shield is in closed position and if the cylinder padlock as well as the fixing screws are installed.

Tip

If there is any doubt regarding the actual position of the beam path: Check the dose rate at the shield using a dose rate measuring device. If the shield is closed, the dose rate in the direction of the beam may not be significantly higher than at other parts of the shield.

3. If any defects are identified during visual inspection, inform the radiation safety officer who will initiate the measures required for repairing the defects.

For further information, please contact Berthold.

7.3 Leak test

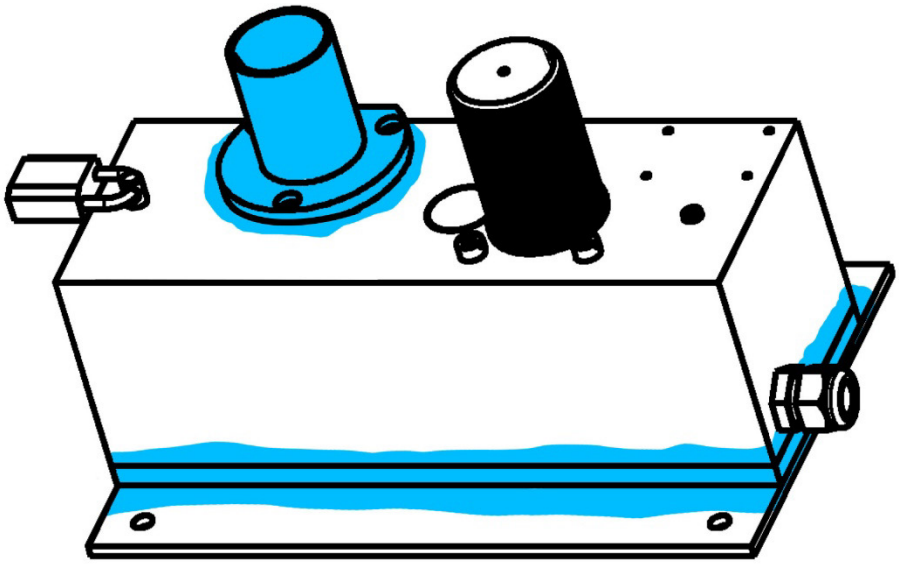
Depending on the supervisory authority responsible for the area where the source is used, regular leak tests must be carried out according to ISO 9978. These tests are to be carried out at the discretion of the competent supervisory authority either by an authorized expert or by the manufacturer. For this test, the corresponding source documentation must be made available.

Required documents

- Inventory list of the sources to be tested including indication of previous leak tests.
- **Source certificate containing the following information:** Nuclide, activity, procurement date, physical/chemical form, description of the enclosure and type of sealing, resistance against mechanical and thermal influences or classification of the source design. The source certificate is provided together with the source.
- Information on the location, application as well as on the maximum customary mechanical and thermal strains.
- If the source is installed in a device, a drawing is to be provided. In the drawing, the position of the source and of all parts intended to protect the source against external influences must be clearly indicated. Recommendations regarding the most appropriate test method should be given, e.g. by indicating alternative test areas. If required, recommendations should be given on how the necessary test can be conducted without affecting the functionality of the system or device.

Nearest accessible surface

The nearest accessible surface is defined as the area, which is most likely to be contaminated if a source is leaking. This area should be used primarily for performing the leak test.



1 Nearest accessible surface in the area of the beam exit (illustration with collimator)
2 Nearest accessible surface in the area of the housing connection, all-round

Fig. 10 Nearest accessible surface for leak test

The following Nearest accessible surface is available at the shield:

- the area marked in Fig. 10.

1. Carry out the contamination test on the marked test area in Fig. 10.

7.4 Shutter check procedure

The functional test of the shutter mechanism must be carried out by a person who is at least an employee with general knowledge. We recommend conducting the test of the shutter mechanism at the same intervals as the visual inspection if the operating condition of the system allows.

1. Ensure that no employees are present in the direction of the radiation beam outlet. Otherwise, these persons will be exposed to the radiation beam when the locking mechanism is opened.
2. Open and close the shield several times (see chapter 6) while observing the measuring signal of the corresponding measurement system.
   The shutter works properly if the measured value approximately corresponds to the maximum value when the locking mechanism is closed (OFF position).

   When opening and closing the shutter mechanism, the signals of the respective limit switch signals can also be observed. These must clearly indicate the respective locking position. Please note that this test is not a reliable confirmation of the proper functioning of the shutter.
   Only the dose rate check is a valid test.

Tip

Alternatively, you can measure the dose rate in the beam path. In this case, the dose rate in the OFF position must be clearly lower than in the ON position. At the same time, the dose rate in the OFF position n may not be significantly higher than at other parts of the shield.

3. Immediately report any malfunction or stiffness of the shutter mechanism to the competent radiation safety officer.

   ▶ The shutter check is completed.

7.5 Removing and installing the source

Before conducting extended maintenance work at the shield, you have to remove the source. After the maintenance work is finished, you can reinstall the source. This does require the direct handling of the unshielded source.

You must clarify with the responsible supervisory authority in advance whether your license for handling radioactive substances includes handling unshielded sources.

In any case, the source may only be installed/removed by authorised people. The radiation safety officer is responsible for planning and monitoring the work.

NOTICE

In order to keep the exposure to radiation during the removal / installation of the source as low as possible, all people involved should familiarise themselves with the exact procedure in advance.

NOTICE

Only remove / install the source in areas with closed floors. Any apertures which are larger than the external diameter of the source (7 mm) are to be covered before commencing any work.

7.5.1 Removing the source

⚠ CAUTION!

Danger caused by ionizing radiation!

- The sources used may only be replaced/removed at the main factory by authorized specialist personnel

7.5.2 Installing the source

⚠ CAUTION!

Danger caused by ionizing radiation!

- The sources used may only be replaced/removed at the main factory by authorized specialist personnel

7.6 Source replacement

When to replace the source

The radioactive source used complies with the requirements of ISO 2919 and ISO 9978

We recommend replacing the source if the statistical fluctuations of the output signal are inadmissibly large and by increasing the time constant is no longer possible, e.g. for control technical reasons, or if the recommended working life of the source has been exceeded.

The recommended working life is 15 years.

Manufacturer's number for reordering

When reordering, always indicate the manufacturer's number of the source used since the new source must correspond to the original version.

The manufacturer's number can be found on the type plate of the shield as well as on the individual seal test certificate of each source.

8 Uninstallation

The shield may only be dismounted and put out of operation by employees with general knowledge (see 2.4 Qualification of the personnel). Possibly the radiation protection officer is to be consulted, as well.

8.1 Safety instructions

⚠ CAUTION!

Danger caused by ionizing radiation!

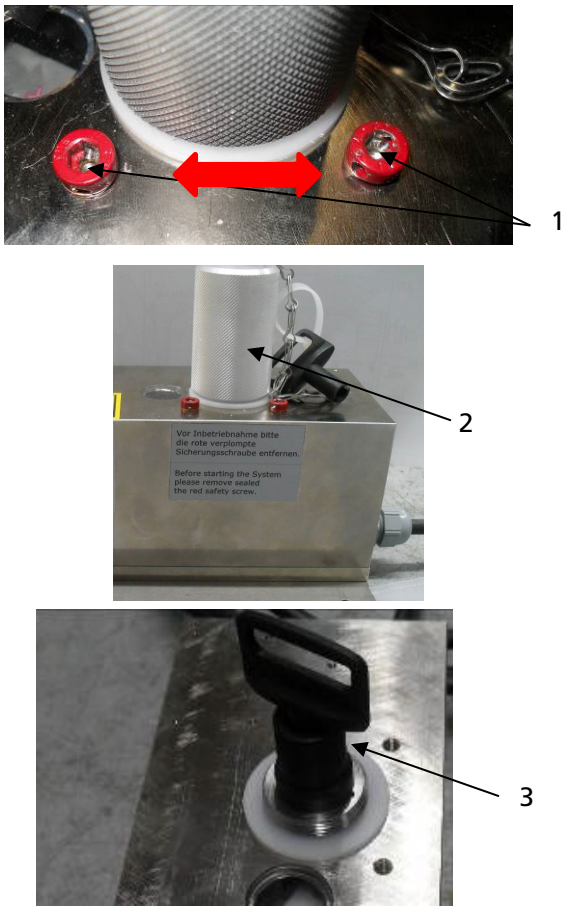
Shields usually contain radioactive sources. An increased exposure to radiation may lead to damage to health.

- Consult the radiation safety officer responsible for your company.
- Transport the source exclusively inside a closed and secured shield.

IMPORTANT

The applicable national regulations of the country of use must be obeyed.

8.2 Dismounting the shield



1 Securing screws
2 Key protection cap
3 Key

Fig. 11 Dismounting the shield

1. Check that the shield is closed and secured.

- The shutter is in OFF position (Display viewing window)
- The securing screws are mounted correctly. The long locking screw is fitted in the area of the viewing window, the short one in the area of the cable connection (Fig. 11, pos.1).
- Locking bolt (Fig. 11, pos. 3) is closed and the key protection cap is screwed back on.

2. Then check that the shutter no longer moves by opening and closing the shield several times.

- When operating the shielding, OFF must always be displayed in the viewing window.

3. The electrical connection of the shield can be professionally disconnected.

⚠ DANGER

Danger to life due to electric shock.

- Installation may only be carried out by a qualified electrician.
- Observe the relevant safety regulations. Electrical installations must be carried out in accordance with the applicable national and international regulations and the recognized rules of technology. Improper connection can lead to serious material damage, electric shock or fire.
- Only carry out installation/maintenance when the appliance is de-energized.
- In the event of an electric shock, carry out the necessary initial measures and contact the emergency services immediately.

4. The shield can be removed from the mounting base.

8.3 Disposal of radioactive substances

NOTICE

Should you have any questions regarding the transportation or disposal of radioactive substances, please contact the manufacturer.

Generally, each country has a depot where radioactive material is accepted and can be disposed of.

8.4 Shipment of radioactive substances

If you wish to ship radioactive material, you must observe the international regulations for the transport of dangerous goods and for radiation protection as well as any applicable national regulations. It is the full responsibility of the sender to comply with these regulations.

Please also note the following:

- Dose rate at the surface of the packaging must be lower than 2000 µSv/h.
- Dose rate at a distance of 1m from the surface of the packaging must be lower than 100 µSv/h.
- The packaging must be marked with a reference for dangerous goods in accordance with the applicable regulations with the UN number.
- Furthermore, transport documents with the correct description of the content as well as an accident procedures sheet according to the ADR regulations are required.
    - o With regard to transport by air, the IATA DGR.
    - o IAEA as the basis for all regulations.
- Packaging must comply with the current ADR regulations (for example European Agreement concerning the International Carriage of Dangerous Goods by Road).
- The cargo must be secured in the transport vehicle according to the applicable national and international regulations.

- Before dispatch, each shield containing a source must be subjected to a visual inspection by the user (chapter 7.2). The shields may only be dispatched if the test requirements are met.
- At the time of shipment, a valid leak test lab result for the source must be available.

Preconditions for returning shields to BERTHOLD TECHNOLOGIES GmbH & Co. KG:

- Radioactive substances and their shields must not be damaged in any way and a respective, valid leak test certificate must be provided. The leak test certificate issued before the arrival of the radioactive substances in Germany may not be older than 6 months.
- If radioactive sources with isotope Am-241 or Cm-244 are returned, the special form certificate must be attached.
- At all times, any radioactive material sent to us must be sufficiently labelled with your name and address. If we have sent you a quotation in advance, our quotation number must be indicated, as well.
- Radioactive substances may only be returned after the respective approval by Berthold. We are pleased to send you a quotation regarding the costs.
- Radioactive substances must be sent to Bad Wildbad, Germany, carriage paid. Berthold will not assume any costs for customs clearance or transportation.
- Berthold is to be informed about any return transport in advance. Berthold will reject any radioactive substances sent to Berthold without prior notice. Any storage costs accrued in such case shall be borne by the sender.
- A Before shipment of a radioactive source, a notification form with information about the source needs to be filled out and sent to Berthold. We will be pleased to send you the current version of the notification form.
- It is mandatory to attach a copy of the enclosed notification form and the valid leak test certificate to the shield. The original documents must be enclosed with the shipping documents. Before shipment, the documents must be sent to Berthold via e-mail.

NOTICE

Observe the applicable regulations when taking them out of operation and disposal.

9 Appendices

9.1 Check lists for tests

Visual inspection

Requirement	met	not met
The shield / connection cable must be free of damage.		
The type plates must be legible.		
If there is corrosion, it must not affect the function and stability of the shield.		
Only before shipment: The beam path must be closed.		
Only before shipping: The transport securing device(s)must be properly installed.		
Name of inspector:	Date:	Signature:

Checking the functions of the locking mechanism

Requirement	met	not met
It must be possible to move the locking mechanism completely back and forth between the two positions (ON / OFF). The respective limit switch signal must be present.		
The measuring signal of the measurement system must approximately correspond to the maximum value in the CLOSED position.		
If alternatively, a dose rate measurement device is used, the dose rate in the OFF position must be clearly lower than in the ON position.		
Only with manual actuation: It must be possible to turn the rotatable cylinder using one hand and the lever rod. It must be possible to turn the locking cylinder with one hand using any necessary tools (e.g. lever rod).		
Only with pneumatic actuation: The air pressure required for moving the locking mechanism may not exceed the maximum permissible air pressure for the pneumatic actuator (see technical data of the pneumatic actuators)		
Name of inspector:	Date:	Signature:

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