POINT SOURCE SHIELDS
LB 8030 / 8040

Operating Manual



56160BA2 Rev.00 07/2026

BERTHOLD

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Table of Contents

1 About this operating manual 5
1.1 Applicable documents 5
1.2 Some prior remarks 5
1.3 Storage 5
1.4 Target group 5
1.5 Validity of the manual 6
1.6 Structure of the manual 6
1.7 Copyrights 6
1.8 Representation 6
1.9 Symbols used 7
1.10 Structure of warnings 8
1.11 Definition of Terms 8
1.12 Symbols used on the device 9

2 Safety 10
2.1 Product safety 10
2.2 Proper use 10
2.3 Ambient conditions during operation and storage 11
2.4 Qualification of the personnel 11
2.5 Radiation Protection 13
2.5.1 Basic principles and regulations 13
2.6 Emergency procedure 15
2.6.1 Shutter cannot be closed 15
2.6.2 Handling major operational disruptions 15
2.7 Operator's obligations 16
2.8 Type plates 16
2.8.1 Type plate shield 17
2.8.2 Type plate source 17

3 System description 18
3.1 View 19

4 Transport 20
4.1 Safety Instructions 20
4.2 Packaging 21
4.3 Temporary storage of the source 21
4.4 Scope of delivery 21
4.5 Check delivery 21
4.6 Transport to operation site 21

5 Installation 22
5.1 Safety instructions 22
5.2 Ambient conditions during installation 23
5.3 Temporary storage of the source 23
5.4 Preparing the Installation 23
5.5 Checking the delivery 24
5.6 Installation of the shield 25
5.7 Marking 28

6 Usage 29
6.1 Safety instructions 29
6.2 Opening and closing the locking mechanism 29

7 Maintenance and Repair 32
7.1 Safety instructions 32
7.2 Visual inspection 33

7.3 Leak test ... 34
7.4 Shutter check procedure ... 36
7.5 Removing and installing the source ... 37
7.5.1 Removing the source ... 38
7.5.2 Installing the source ... 40
7.6 Source replacement ... 42
7.6.1 Replacing the source ... 42

8 Uninstallation ... 43
8.1 Safety instructions ... 43
8.2 Dismounting the shield ... 44
8.3 Disposal of radioactive substances ... 45
8.4 Shipment of radioactive substances ... 45

9 Appendices ... 47
9.1 Check lists for tests ... 47

1 About this operating manual

1.1 Applicable documents

- Technical Information, Mat. No. 56160TI2

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
- carry out maintenance on the product
- disassemble 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.

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 ionising radiation within a figure.	

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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
- ▶ Measure

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 Definition of Terms

Source
Sealed radioactive sources.

Ionizing radiation
Radiation from a radioactive substance.

Emergency
Event that immediately or later leads to a serious danger or to high property damage.

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1.12 Symbols used on the device

Ionising 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.

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, unauthorised 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.
- The usage 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 open.
- 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.

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2.3 Ambient conditions during operation and storage

The shield was specifically designed for use in rough ambient conditions. The compliance with the operating conditions specified below 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: -20°C to +60°C. Storage outside this range can lead to malfunctions, permanent damage to the device, safety risks and potential danger to persons.

Operating temperature: -30°C to +100°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 9.1) 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

NOTICE

Employees with general knowledge must always be guided by one expert at the very least. When dealing with radioactive substances, a radiation safety officer must also be consulted.

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.

Experts

Experts are persons who have sufficient knowledge in the required area due to their specialist training and who are familiar with the relevant national health and safety regulations, accident prevention regulations, guidelines and recognised 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 persons

Authorised persons 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. 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 safety 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.

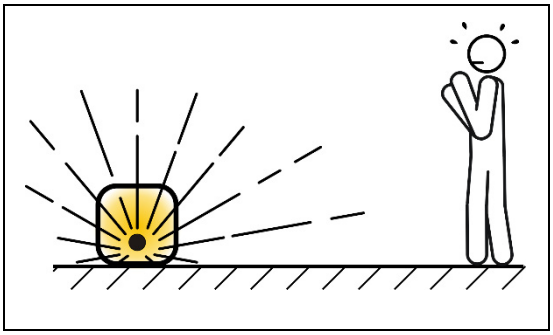
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2.5 Radiation Protection

2.5.1 Basic principles and regulations

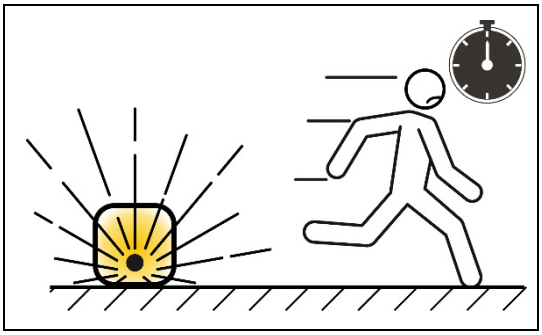
The amount of radiation absorbed by the body (exposure to radiation) is determined by three parameters from which the basic radiation protection regulations can be derived:

Distance



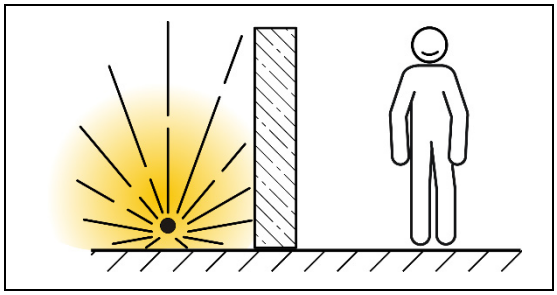
If work close to equipment containing radioactive substances is required, the largest distance possible is to be kept. In particular, this applies to employees not immediately required to work directly with the radioactive devices.

Time



Any work required in the vicinity of radiometric measuring system is to be prepared 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 radiation beam outlet 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.

Any 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 unauthorised persons. In the case of firmly installed equipment containing radioactive substances, the protection against unauthorised 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 as regards the storage of radioactive substances.

Portable measuring systems must never be left unsupervised. When this equipment is out of use, it is to be protected against access by unauthorised persons.

In the case of fire

The shield 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 tungsten 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.

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

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2.6 Emergency procedure

2.6.1 Shutter cannot be closed

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

1. Leave the affected area immediately
2. Inform the radiation safety officer
3. Radiation safety 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 shield 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 has to be notified immediately. He will then investigate the situation immediately and take all necessary actions to prevent further damage and to avoid more exposure of the operating staff to radiation.

The Radiation safety officer has to make sure that the measuring system is no longer in operation and then take appropriate steps. The competent authority must be notified immediately. If necessary, the manufacturer or supplier of the measuring equipment may also be consulted to clarify further questions and obtain additional information.

All further measures must be coordinated with the authority.

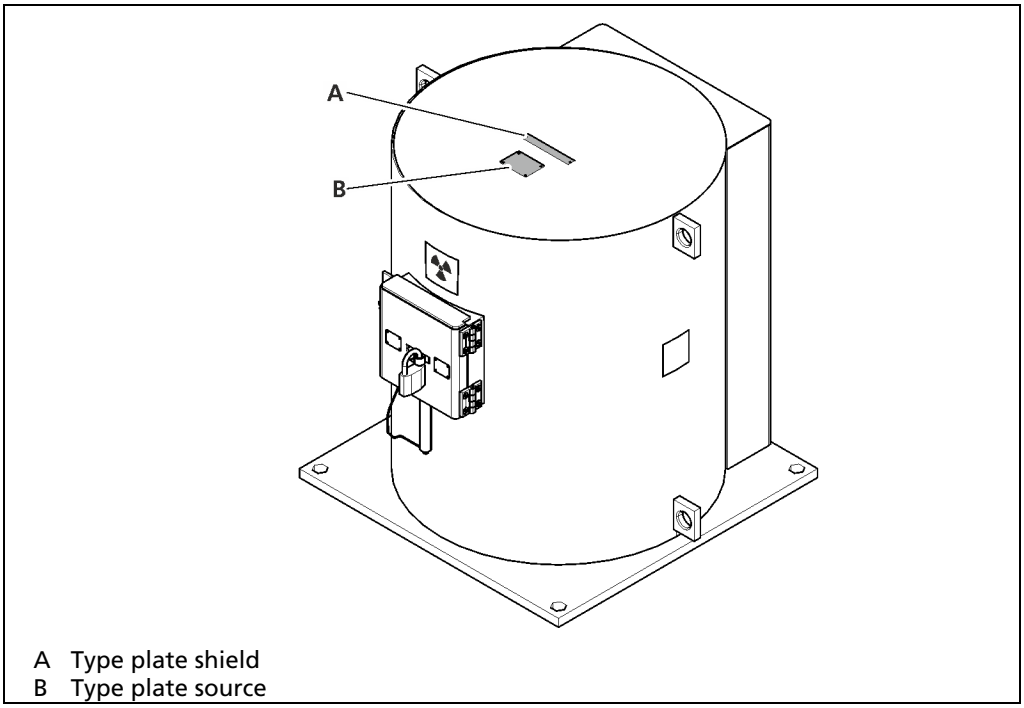
2.7 Operator's obligations

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 regarding the shield and the radioactive source installed within it.

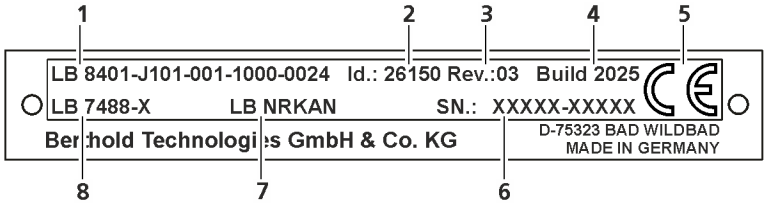


A Type plate shield
B Type plate source

Fig. 1 Typ plates

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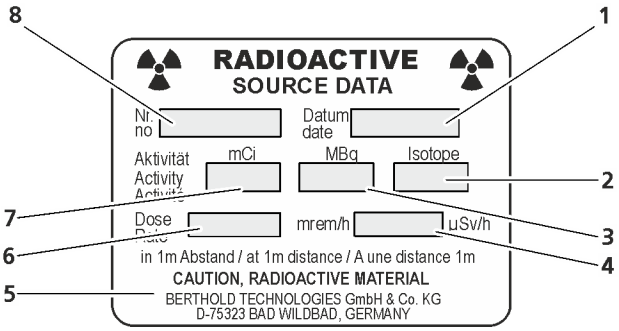
2.8.1 Type plate shield



1 LB number shield (Unique identification of the shield)
2 Order number (Mat. No.)
3 Bill of materials version
4 Year of construction (only if a CE declaration is available for the shield)
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 Type plate of the shield

2.8.2 Type plate source



1 Date of manufacture of the source
2 Isotope
3 Activity [MBq]
4 Dose rate at 1m distance [µSv/h]
5 Supplier of the source
6 Dose rate at 1m distance [mrem/h]
7 Activity [mCi]
8 Source number

Fig. 3 Type plate of the source

3 System description

The point source shield is intended as shield/protective container for radioactive sources. The radioactive substance is contained in a leak-proof welded source capsule and installed in the point source 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 consists of a sturdy stainless-steel housing filled with lead/tungsten holding a rotatable locking cylinder. The rotatable locking cylinder is made of steel with a tungsten insert and holds the radioactive source capsule.

Using the lever rod provided, the rotatable locking cylinder can be rotated between the two end positions. In the *CLOSED* position, the radiation exit channel points into the lead/tungsten-filled steel housing, thereby preventing the escape of ionising radiation. In the *OPEN* position, the radiation exit channel points toward the container and the detector.

The cover is used to secure the adjusted source position. Attach the cover using the provided mounting screw.

When closed and during transport, the shield can be secured with a padlock to protect the source against unauthorised removal.

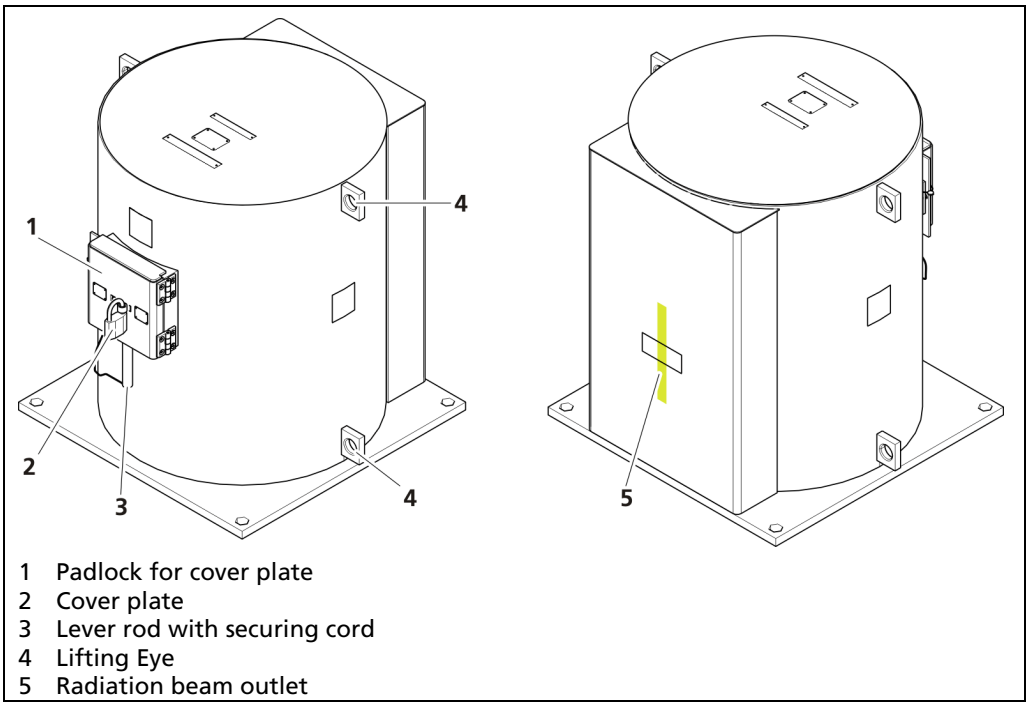
The shield is equipped with a flange for mounting.

The shield has the following functions:

- Shield radiation to a level that is non-hazardous for the operating personnel
- Locking the radiation beam outlet channel for transport and during installation
- Protecting the integrated source capsule from mechanical damage and environmental impact

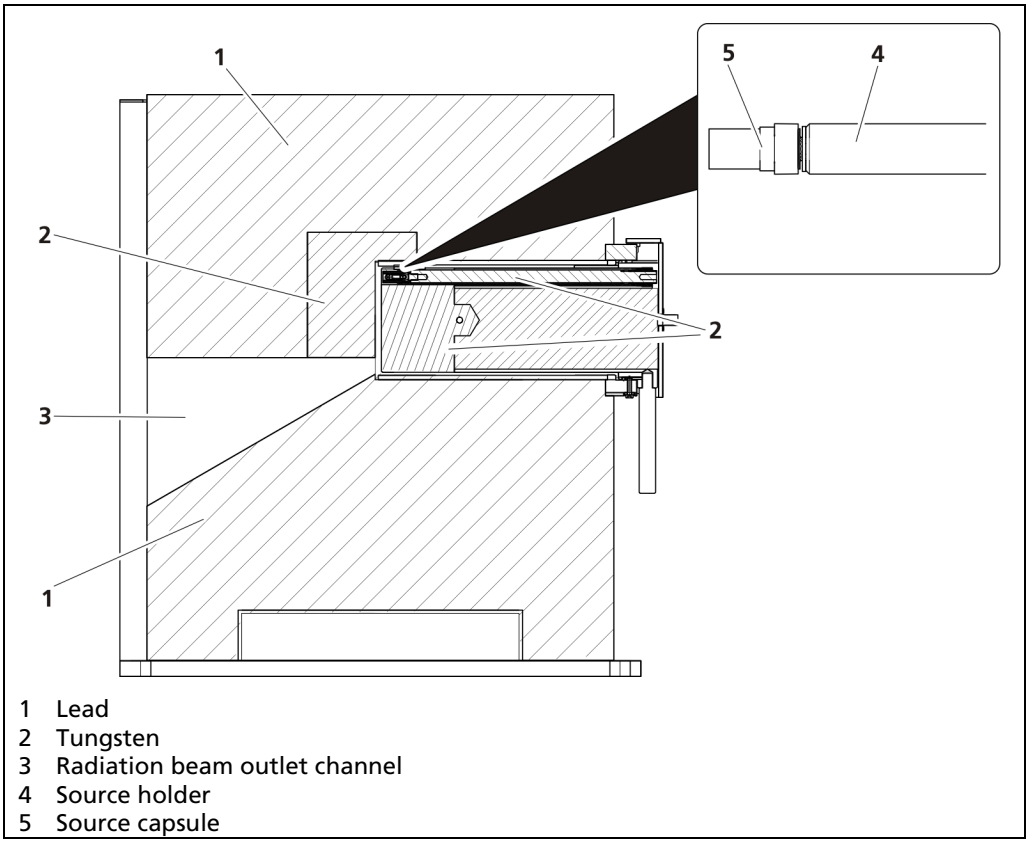
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3.1 View



1 Padlock for cover plate
2 Cover plate
3 Lever rod with securing cord
4 Lifting Eye
5 Radiation beam outlet

Fig. 4 Basic layout



1 Lead
2 Tungsten
3 Radiation beam outlet channel
4 Source holder
5 Source capsule

Fig. 5 Sectional representation

4 Transport

The shield may only be handled and transported by competent people (see chapter 2.4 Qualification of the personnel).

4.1 Safety Instructions

⚠ WARNING!



Danger of injury by falling loads!

Shields have built-in lead components increasing the weight.

- Only use the lifting eye nuts provided on the shield to attach the lifting gear.
- Never stand underneath a lifted or suspended load, keep at a safe distance.
- Wear head protection and safety shoes.

⚠ WARNING



Danger of injury caused by heavy and bulky system components

- Heavy and bulky system components should only be handled using aids and by at least 2 persons.
- Observe the guidelines for safe handling of heavy loads.
- Ensure stability and use the provided fixing options.

⚠ CAUTION



Danger caused by ionising 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 *CLOSED* position and secured during transport and mounting of the shield.

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.

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4.2 Packaging

The shield containing the radioactive source is delivered in packaging that complies with applicable regulations for the transport of radioactive materials. Upon delivery, the shield is in the *CLOSED* position and secured with a lock. At the operator's request, the shield and the source may be delivered separately; in this case, the source is supplied subsequently in a dedicated transport shield.

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 for completeness (material parts) and integrity. In the case of damage, immediately notify the forwarding agent and the manufacturer.

4.5 Check delivery

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

4.6 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 authorized person. If the shields contain a radioactive source, the radiation safety 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 2.4 Qualification of the personnel). Possibly the radiation safety officer is to be consulted, as well.

5.1 Safety instructions

⚠ WARNING!



Danger of injury by falling loads!

- Only use the lifting eyes provided on the shield to attach the lifting gear.
- Never stand underneath a lifted or suspended load, keep at a safe distance.
- Only use tested sling gear components appropriate for the transport weight.
- Observe the marking for the centre of gravity on the outer packaging, if applicable.
- Wear head protection and safety shoes.

⚠ WARNING!



Danger of injury caused by heavy and bulky system components!

- Heavy and bulky system components should only be handled using aids and by at least 2 persons.
- Observe the guidelines for safe handling of heavy loads.
- Ensure stability and use the provided fixing options.

⚠ CAUTION!



Danger caused by ionising 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 ***CLOSED*** position and secured during transport and mounting of the shield.

IMPORTANT



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

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5.2 Ambient conditions during installation

Mount shield using the lifting eyes (Fig. 7, item 2). The minimum permissible temperature during installation is -20 °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 *CLOSED* position during transport and installation of the shield.

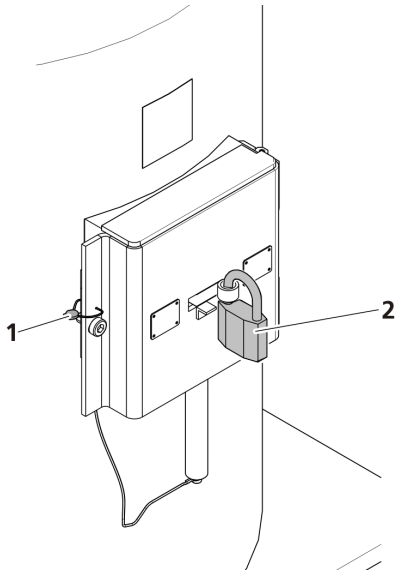
IMPORTANT

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 (incl. 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 Seal wire
2 Padlock for cover plate

Fig. 6 Checking the delivery

1. Check the delivery for completeness using the packing list.
2. Check padlock (Fig. 6, item 2) is installed, closed and undamaged.
   - In the case of damage, immediately notify the forwarding agent and the manufacturer.
3. Check the integrity of the lead seal and the seal wire (Fig. 6, item 1).
   - In the case of damage, immediately notify the forwarding agent and the manufacturer.
4. Clean the parts, if required.
5. Check the shield for damage.
   - In the case of damage, immediately notify the forwarding agent and the manufacturer.

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5.6 Installation of the shield

⚠ WARNING!



Risk of injury due to tilting shield!

There is a risk of injury to people when working on non-fixed shields.

- Always secure upright shields against falling by fasten securing straps to the eyelets.

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.

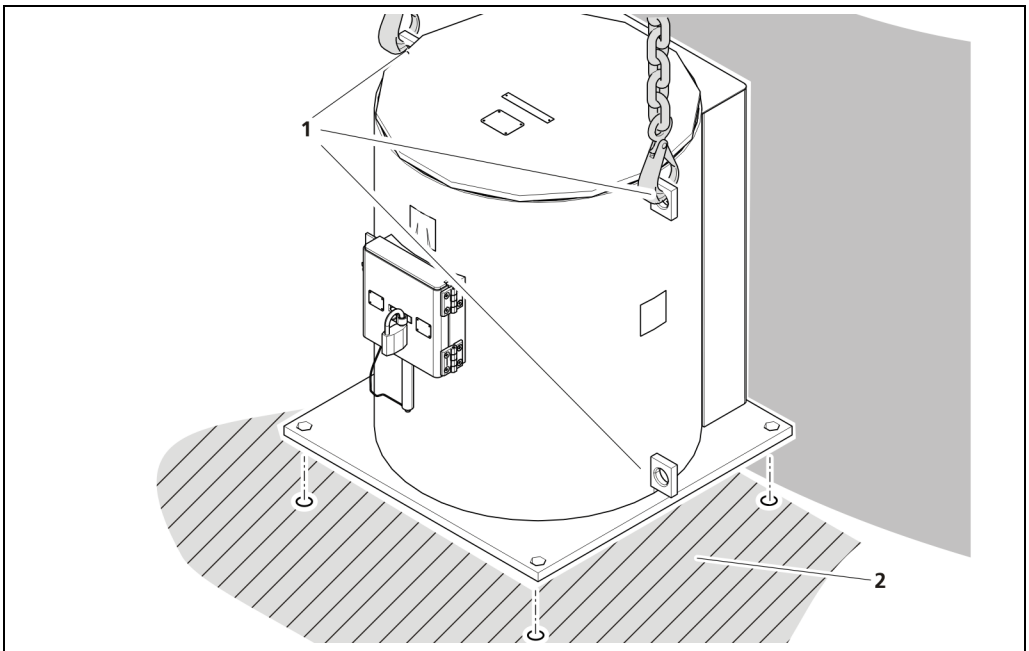
- Also note the information in the document "Technical Information" (see 1.1 Applicable documents).

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.

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 Eyelet
2 Mounting base / ground

Fig. 7 Position the shield

1. Ensure that the shield has been closed and secured
   - the locking cylinder is set to the CLOSED position
   - the transport securing device and, if applicable, the padlock is installed

⚠ WARNING!



Danger of injury by falling loads!
Falling loads can endanger people.
- Never stand underneath a lifted or suspended load, keep at a safe distance.
- Cordon off the danger zone with barrier tape.

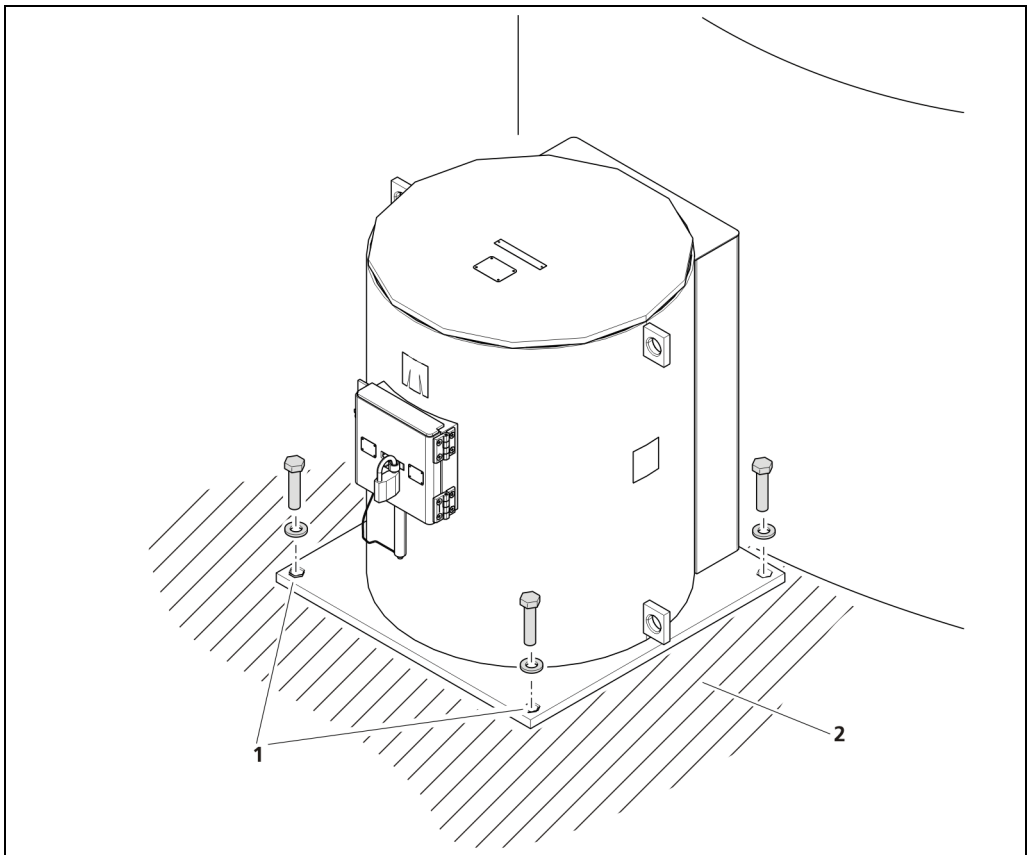
⚠ WARNING!



Danger of crushing by moving the shields!
Due to the high weight of the shield, there is a risk of injury.
- Heavy and bulky system components should only be handled using aids and by at least 2 people.
- Do not reach between the shield and the container or mounting base.

2. Fasten the shield with sufficiently dimensioned lifting straps at the eyelets (Fig. 7, item 1).
3. Raise the shield and place it in the mounting position.
4. Carefully place the shield on the ground or mounting base (Fig. 7, item 2).

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1 Screw connection
2 Ground / mounting base

Fig. 8 Installation at measuring point

⚠ WARNING!

Incorrect assembly may result in accidents!

Incorrect selection of the fastening elements endangers the stability of the shield.

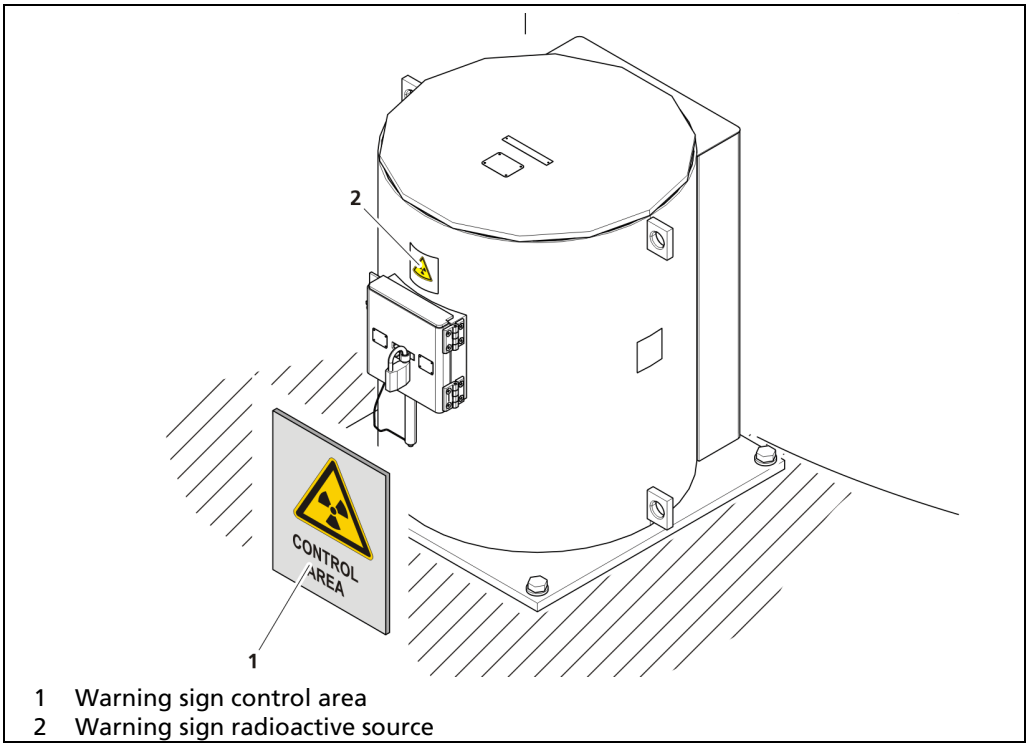
- Use correctly sized and approved mounting elements (mounting base, anti-tilt, nuts and bolts, screw lock).

5. Screw the shield to the ground or mounting base (Fig. 8, item 2). The plant operator is responsible for selecting the connection elements (Fig. 8, item 2), the screw locking and the tightening torque.

5.7 Marking

The warning sign (Fig. 9, 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. 9, item 2) already applied to the shield is sufficient. Fig. 9 shows an exemplary identification of the control area according to German law. Please observe the local legislation of the country of employment.



1 Warning sign control area
2 Warning sign radioactive source

Fig. 9 Example marking

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6 Usage

The shield may only be operate by competent personnel (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 nuclear radiation!

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

- ▶ Ensure that the shield does not show any signs of damage or functional limitations.

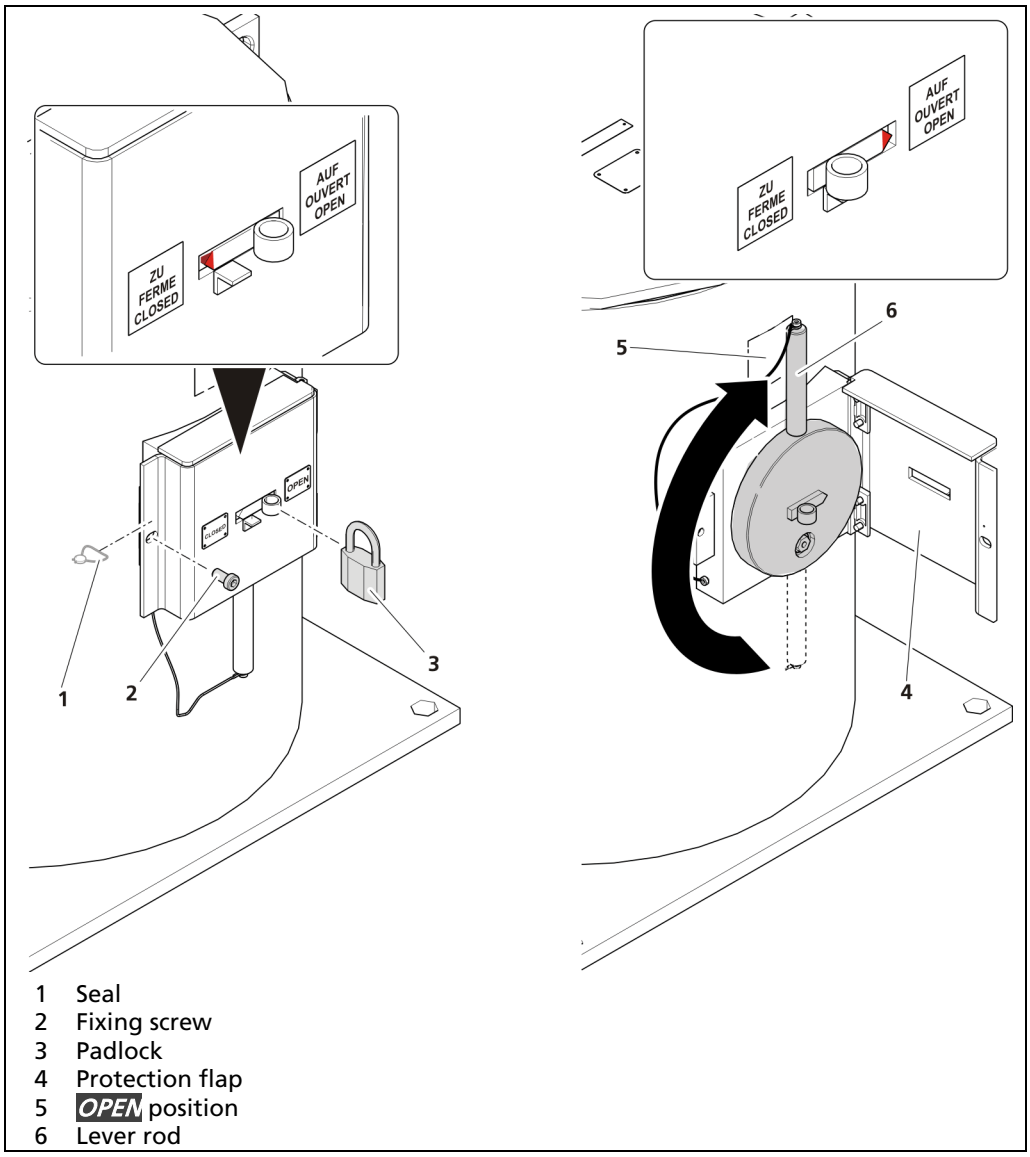
6.2 Opening and closing the locking mechanism

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

NOTICE

During transport and installation of the shield, the rotary cylinder must be set to *CLOSED* and be secured.

Opening the locking mechanism

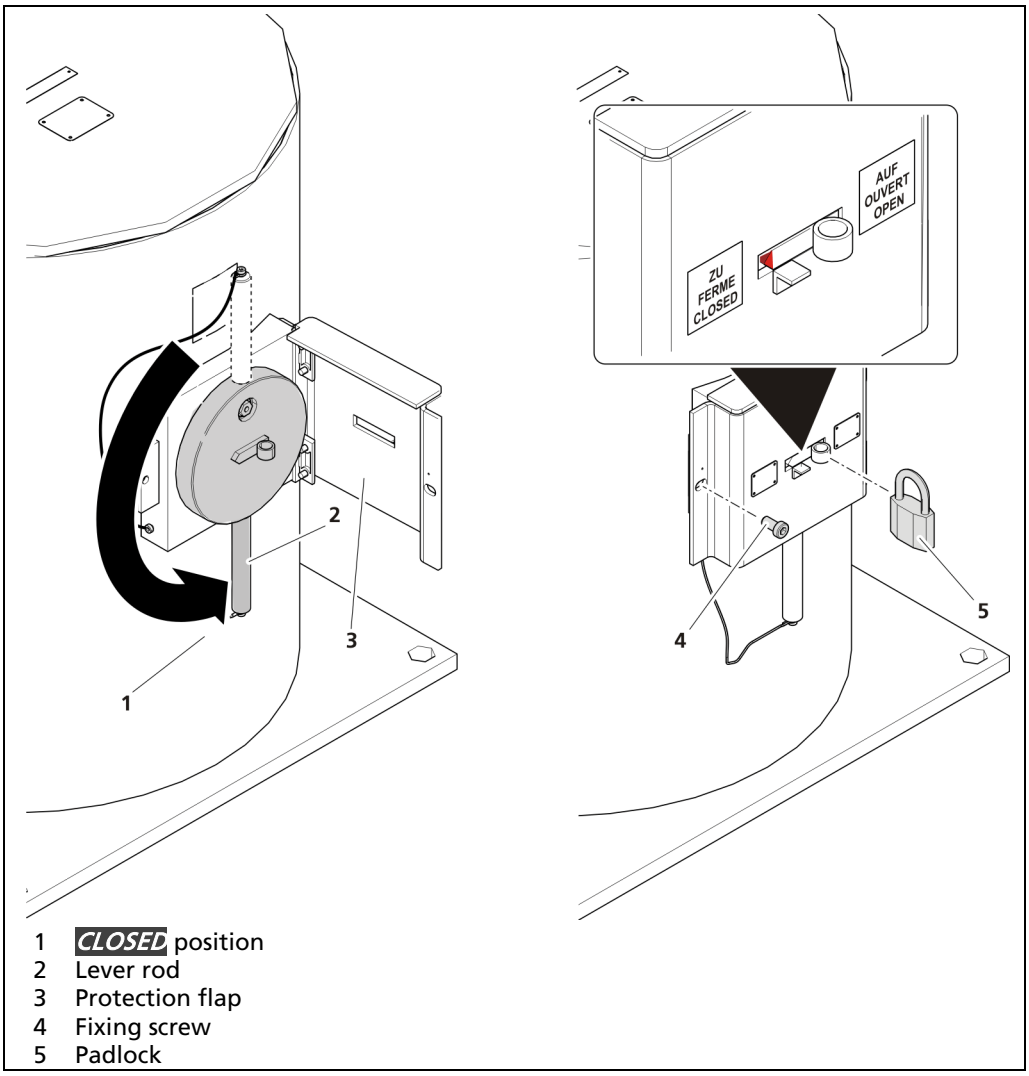


1 Seal
2 Fixing screw
3 Padlock
4 Protection flap
5 OPEN position
6 Lever rod

Fig. 10 Shield open (OPEN position)

1. If applicable, remove seal (Fig. 10, item1) and padlock (Fig. 10, item 3).
2. Remove hex socket screw (Fig. 10, item 2).
3. Open the protection flap (Fig. 10, item 4)
4. Turn the locking cylinder to the OPEN position (Fig. 10, item 5) with the help of the lever rod (Fig. 10, item 6).
   - ▶ The radiation beam outlet is now open.
5. Unscrew the lever rod (Fig. 10, item 6).
6. Close the protection flap (Fig. 10, item 4) and secure with fixing screw (Fig. 10, item 2).

Closing the locking mechanism



1 CLOSED position
2 Lever rod
3 Protection flap
4 Fixing screw
5 Padlock

Fig. 11 Shield closed (CLOSED position)

1. Remove the fixing screw (Fig. 11, item 4) and the padlock (Fig. 11, item 5).
2. Open the protection flap (Fig. 11, item 3).
3. Screw lever rod (Fig. 11, item 2) into the cylinder.
4. Turn the cylinder to the CLOSED position (Fig. 11, item 1) using the lever rod.
   - ▶ The radiation beam outlet channel is now closed.
5. Close the protection flap (Fig. 11, item 3) and secure with fixing screw (Fig. 11, item 4).
6. Attach and close the padlock (Fig. 11, item 3).

7 Maintenance and Repair

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

7.1 Safety instructions

⚠ CAUTION!



Danger caused by nuclear 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.

IMPORTANT

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.

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7.2 Visual inspection

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

- 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 dispatch: Check if the shield is in *CLOSED* position and if the padlock as well as the transport securing device 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 the manufacturer.

NOTICE



If deviations are detected during the periodic inspection, which can impair the safety of the shield, measures to rectify them must be taken immediately. In particular, corrosion must be rectified promptly.

NOTICE



Please inform Berthold about negative experiences and deviations that you notice during the period of use.

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.

NOTICE

A leak test is not only required as a routine inspection measure but must also be performed after any incident that could compromise the source's containment. In such cases, the leak test must be ordered by the responsible radiation safety officers in accordance with all applicable regulations and must cover not only the shield but also all other affected parts of the vessel. The leak test must be performed immediately after the incident.

The leak test described below is intended for the following purposes:

- For periodic inspections during ongoing operation
- During prolonged storage of the shield
- When the shield is to be returned to service after storage

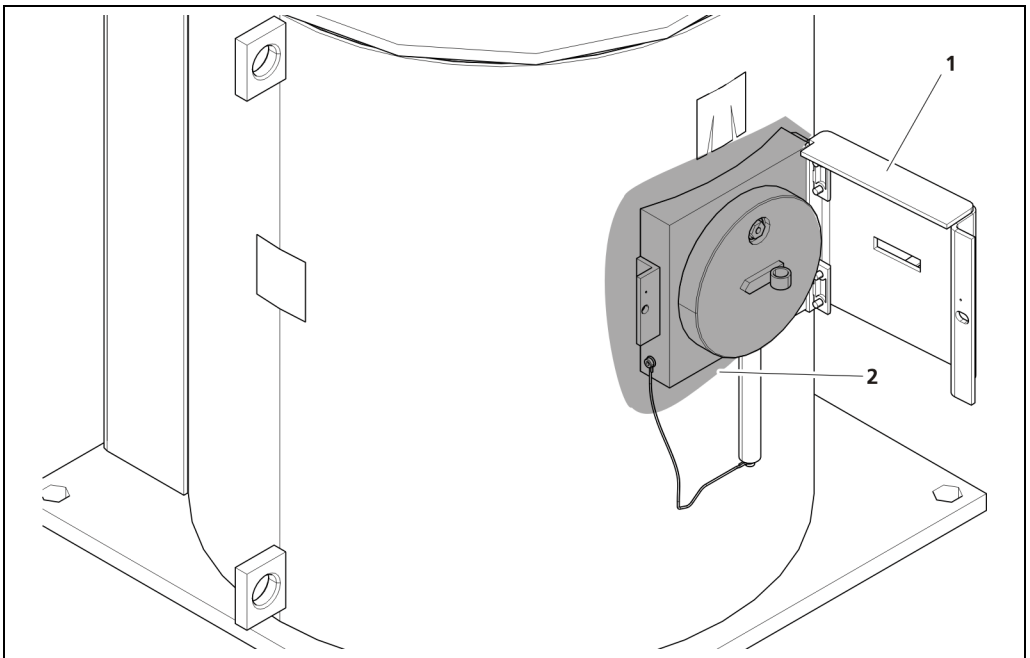
Required documents

- 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.

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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 Protection flap
2 Nearest accessible surface

Fig. 12 Nearest accessible surface for leak test (the area marked in grey)

⚠ WARNING

The source may be leaking!

- Notify the radiation safety officer immediately and follow his or her instructions.
- Take appropriate measures to prevent contamination of the surrounding area by the source. Secure the source.
- Notify the competent authority immediately that a potentially leaking source has been detected.
- Comply with national regulations

The following instruction should be used:

1. Open the Protection flap (Fig. 12, item 1).
2. Swab the area highlighted in Fig. 12, item 2.
   - The leak test is complete.

7.4 Shutter check procedure

The functional test of the locking mechanism must be carried out by a person who is at least an employee with general knowledge. We recommend conducting the test of the locking 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 shield works properly if the measured value approximately corresponds to the maximum value when the locking mechanism is closed (*CLOSED* position).

Tip



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

3. Return the rotatable cylinder to its starting position (*OPEN* position or *CLOSED* position).
4. If applicable, reinstall the fixing screws and/or the cylinder padlock.
5. Immediately report any malfunction or stiffness of the rotating mechanism to the competent radiation safety officer.

   ▶ The shutter check is completed.

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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 comprises handling unshielded sources.

In any case, the source may only be installed/removed by authorised persons. The competent 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

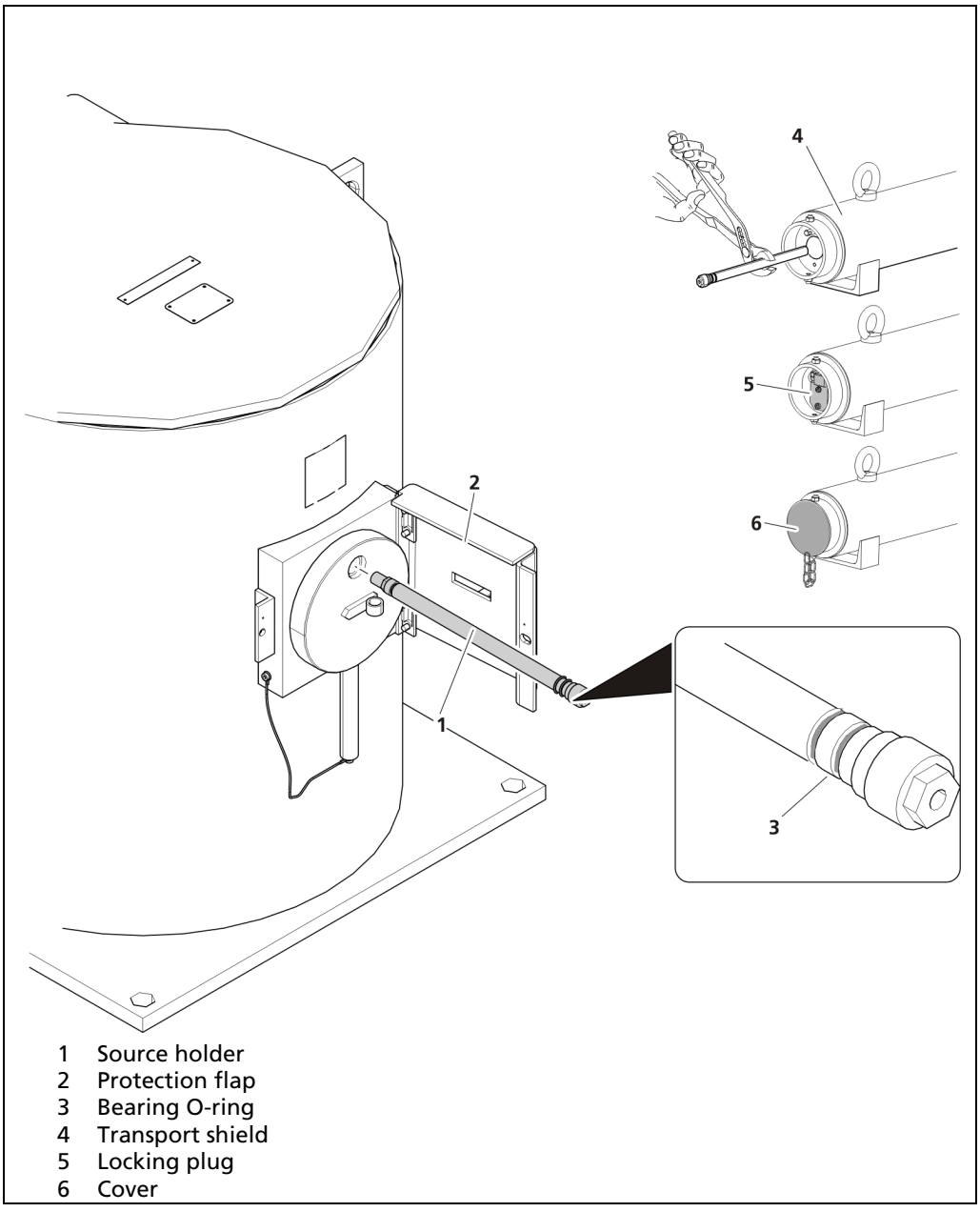
Only remove / install the source in areas with closed floors. Any apertures which are larger than the external diameter of the source (7 mm) are to be covered before commencing any work.

7.5.1 Removing the source

To remove the source, the following tools are required:

- pliers to securely grip the source
- 12 mm hexagon wrench to unscrew the source holder

1. Prepare the transport shield (Fig. 13, item 4) for the source, remove the cover (Fig. 13, item 6) and the locking plug (Fig. 13, item 5).



1 Source holder
2 Protection flap
3 Bearing O-ring
4 Transport shield
5 Locking plug
6 Cover

Fig. 13 Remove source out of shield

2. Open the padlock and remove the fixing screw.
3. Open the Protection flap (Fig. 13, item 2).
   ▶ You can now see the screwed sealing plug of the source holder.
4. Loosen the source holder (Fig. 13, item 1).
5. Take the source out of the shield using the pliers.

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6. Check whether the rings (Fig. 13, item 3) are attached to the holder.

⚠ CAUTION!



Danger caused by ionising radiation!

When the source is removed, the unshielded source must be handled as quickly as possible. An increased exposure to radiation may lead to damage to health.

- Hold the source only with pliers.
- Keep the source far from the body.
- Ensure that no people are in the field of radiation during the work.

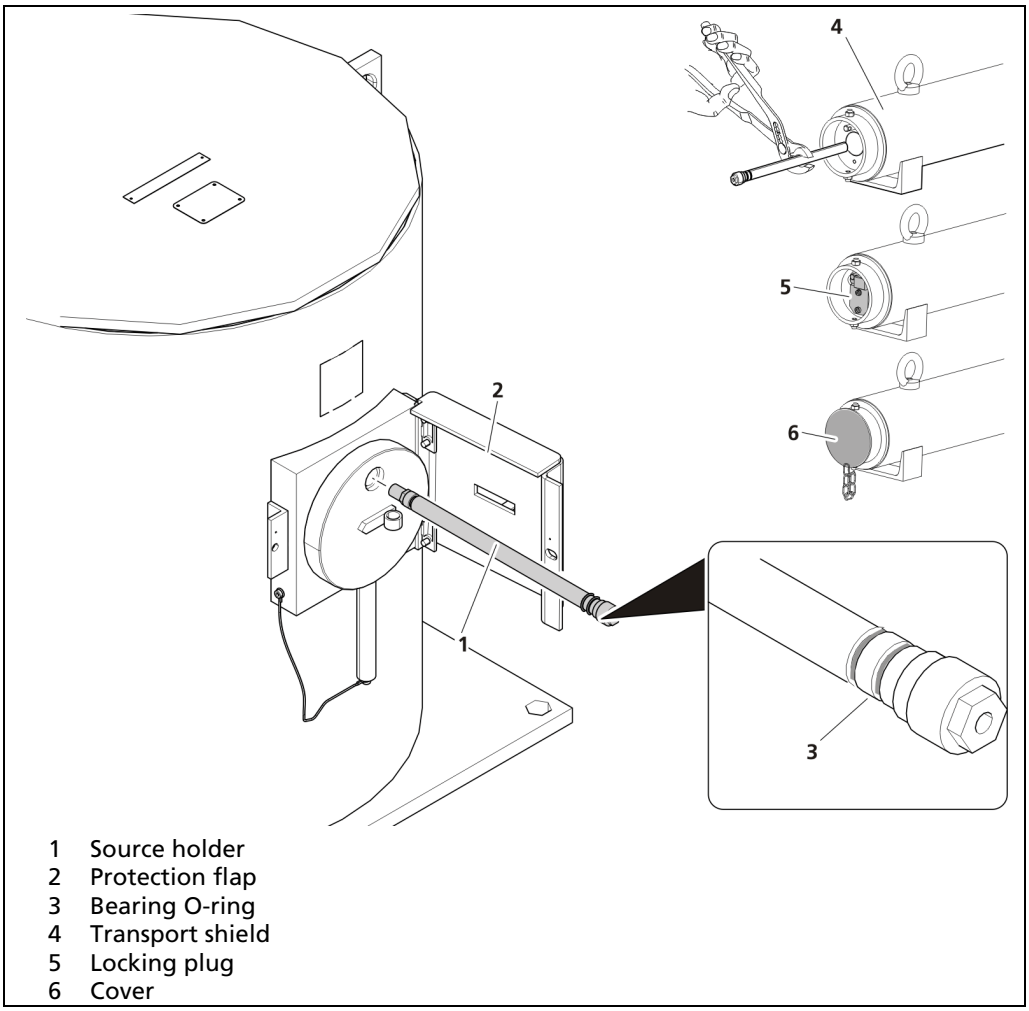
7. Pull the source out of the shield. Hold the source holder (Fig. 13, item 1) with pliers.
8. Insert the source as quickly as possible into the provided and opened transport shield (Fig. 13, item.4) and close the locking plug (Fig. 13, item 5) and the cover (Fig. 13, item 6).

7.5.2 Installing the source

To install the source, the following tools are required:

- pliers to securely grip the source
- 12 mm hexagon wrench to unscrew the source holder

1. Prepare the transport shield with the source to be installed and remove the cover (Fig. 14, item 6) and the locking plug (Fig. 14, item 5) of the transport shield.
2. If necessary, remove the fixing screw and open the protection flap (Fig. 14, item 2).



1 Source holder
2 Protection flap
3 Bearing O-ring
4 Transport shield
5 Locking plug
6 Cover

Fig. 14 Installing the source in the shield

⚠ CAUTION



Danger caused by ionising radiation!

When the source is removed, the unshielded source must be handled as quickly and little as possible. An increased exposure to radiation may lead to damage to health.

- ▶ Hold the source only with pliers.
- ▶ Keep the source far from the body.
- ▶ Ensure that no people are in the field of radiation during the work.

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3. Grasp the source holder (Fig. 14, item 1) and pull out of the transport shield (Fig. 14, item 4) using the pliers.
4. Check the O-rings (Fig. 14, item 3) are undamaged and correctly positioned.
5. Insert the source as quickly as possible into the shield.
6. Screw the source holder in the shield (torque: 44 Nm).
7. Turn the locking cylinder to the starting position (position *OPEN* or position *CLOSED*).
8. Close the protection flap and secure with fixing screw and padlock.
   - ▶ The installation is complete.

7.6 Source replacement

When to replace the source

Generally, the radioactive source used enables a service life between 5 and 10 years. A replacement of the source is only required if the statistical fluctuations of the output signal are inadmissibly large and compensation by increasing the time constant is no longer possible, e.g. for control-technical reasons.

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.

7.6.1 Replacing the source

Replacing the source 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 comprises handling unshielded sources.

In any case, the source may only be installed/removed by authorised persons. The competent 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 persons 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.

To replace the source, the following tools are required:

- pliers to securely grip the source
- 12 mm hexagon wrench to unscrew the screwed sealing plug of the source holder

To replace the source, proceed as follows:

1. Prepare the transport shield and open it.
2. Remove the old source from the shield and insert the old source in the transport shield, see chapter 7.5.1.
3. Check the shield for damage and wear and repair it if required (see chapter 7.2).
4. Remove the type plate of the old source from the shield and rivet on the new type plate.
5. Install the new source in the shield, see chapter 7.5.2.

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8 Uninstallation

The shield may only be dismounted and put out of operation by competent people (see 2.4 Qualification of the personnel). Possibly the radiation safety officer is to be consulted, as well.

8.1 Safety instructions

⚠ WARNING!



Danger of injury by falling loads!

- Never stand underneath a lifted or suspended load, keep at a safe distance.



- Only use tested sling gear components appropriate for the transport weight.



- Observe the marking for the centre of gravity on the outer packaging, if applicable.



- Wear head protection and safety shoes.

⚠ WARNING!



Danger of injury caused by heavy and bulky system components!

- Heavy and bulky system components should only be handled using aids and by at least 2 persons.
- Observe the guidelines for safe handling of heavy loads.
- Ensure stability and use the provided fixing options.

⚠ CAUTION!



Danger caused by ionising 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 have to be obeyed.

8.2 Dismounting the shield

⚠ WARNING!



Danger of injury by falling loads!

Falling loads can endanger people.

- Never stand underneath a lifted or suspended load, keep at a safe distance.
- Cordon off the danger zone with barrier tape.

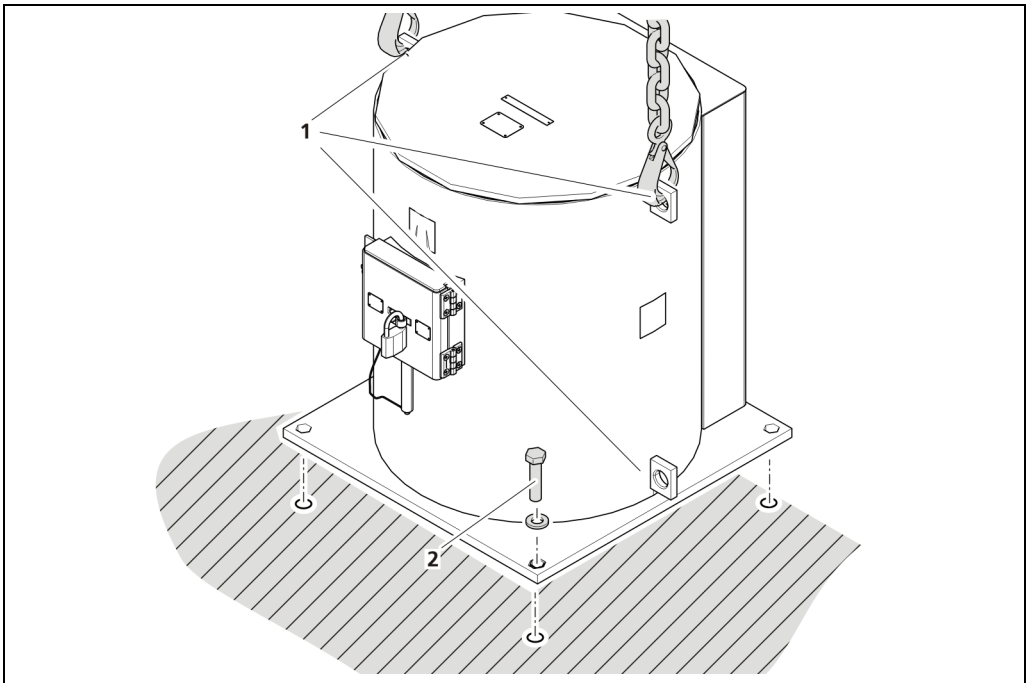
⚠ WARNING!



Danger of crushing by moving the shields!

Due to the high weight of the shield, there is a risk of injury.

- Heavy and bulky system components should only be handled using aids and by at least 2 persons.
- Do not reach between the shield and the container or mounting base.



1 Eyelet
2 Screw connection

Fig. 15 Disassemble the shield

1. Ensure that the shield has been closed and secured.
   - the locking cylinder is set to the CLOSED position
   - the transport securing device and, if applicable, the padlock is installed.
2. Fasten the shield with sufficiently dimensioned lifting straps at the ring bolts (Fig. 15, item 1).
3. Remove all screw connections (Fig. 15, item 2).
4. Raise and set down the shield vertically.

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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 dispatch 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 the UN number and a sign indicating dangerous goods.
- Furthermore, transport documents with the correct description of the content as well as an accident procedures sheet according to the ADR regulations are required.
    - With regard to transport by air, the IATA DGR.
    - IAEA SSR-6 as the basis for all regulations.
- Packaging must comply with the current ADR regulations (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 report 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.

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9 Appendices

9.1 Check lists for tests

Visual inspection

Requirement	met	not met
The shield must be free from 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 shipment: The protection flap must be mounted and secured.		
Only before shipment: The transport securing device must be 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 (*OPEN* / *CLOSED*).		
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 *CLOSED* position must be clearly lower than in the *OPEN* position.		
Only with manual actuation: It must be possible to turn the locking cylinder using one hand and the lever rod.		
Name of inspector:	Date:	Signature:

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