

Rod source shield LB 8110

**Operating Manual
36682BA2**

Rev. No.: 00, 07/2018

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1

About this operating manual

1.1 Some prior remarks

The product is handed over to you by the manufacturer BERTHOLD TECHNOLOGIES GmbH & Co. KG 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 TECHNOLOGIES GmbH & Co. KG.

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

1.2 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.

1.3 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.

1.4 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 TECHNOLOGIES GmbH & Co. KG.

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.

1.5 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.

1.6 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.

1.7 Representation

| Identifier | Meaning | Example |
|----------------|-----------------|--------------------------------------|
| Round brackets | Image reference | Connect the plug (fig. 1, item 1) |

1.8 Symbols Used

1.8.1 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.

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.

1.8.2 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 Proper use

The source with shield is used in connection with a detector provided by BERTHOLD TECHNOLOGIES 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 TECHNOLOGIES GmbH & Co. KG.
- 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 TECHNOLOGIES GmbH & Co. KG 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.

2.2 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 as regards the storage of radioactive substances.

Furthermore, the following prescribed ambient conditions are to be observed:

- The minimum admissible operating/storage temperature is -40°C. Below this temperature, the sealing rings of the shield may become brittle. In such case, the leakproofness of the shield can no longer be guaranteed.
- The maximum admissible operating/storage temperature is +100°C. Above this temperature, the sealing rings of the shield may be destroyed. In such case, the leakproofness of the shield can no longer be guaranteed.
- 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.

2.3 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 TECHNOLOGIES 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!

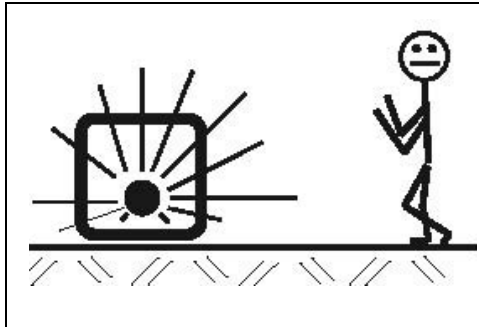
Radiation protection officers must have a specific training with certification.

2.4 Radiation Protection

2.4.1 Basic principles and regulations

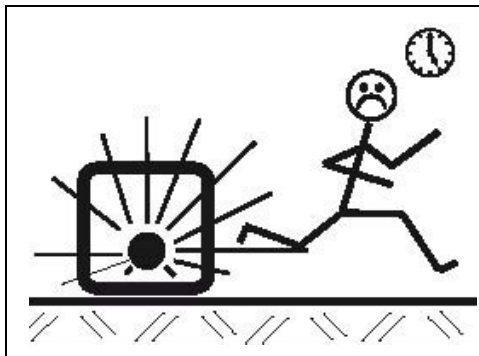
The amount of radiation absorbed by the body (exposure to radiation) is determined by three parameters from which the basic radiation protection regulations can be derived:

Distance



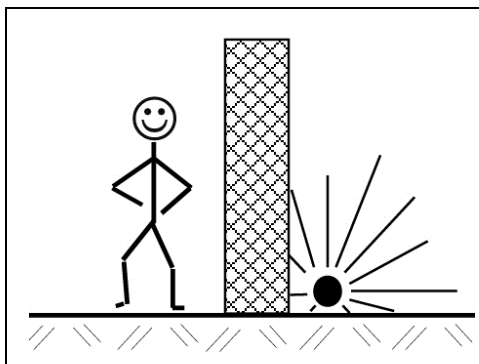
If work close to equipment containing radioactive substances is required, the largest distance possible is to be kept. In particular, this shall apply for employees which do not immediately participate in such work.

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.

2.4.2 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.

2.4.3 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 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.

2.4.4 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.



- ▶ In the case of fire, these measures limit the access to this area.
- ▶ Avoid the incorporation by keeping sufficient distance.
- ▶ Notify **BERTHOLD TECHNOLOGIES** of the situation; you will promptly receive information on immediate measures.

2.5 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

2.6 Type plate of the source

| | | | |
|---|---|---|---------------------------------|
|  36867-00  | | | |
| 8 | Nr. no. <input type="text"/> | 1 | Datum date <input type="text"/> |
| | abgeschirmt/shielded | | |
| 6 | <input type="text"/> mm | 2 | MBq <input type="text"/> |
| 7 | Dosisleistung in 1m Abstand dose rate at 1m distance <input type="text"/> $\mu\text{Sv/h}$ | | |
| 5 | BERTHOLD TECHNOLOGIES GmbH & Co. KG D-75323 BAD WILDBAD, GERMANY | | |

| | |
|---|--|
| 1 | Date of manufacture of the source |
| 2 | Isotope |
| 3 | Activity [MBq] |
| 4 | Dose rate within 1 m distance [$\mu\text{Sv/h}$] |
| 5 | Supplier of the source |
| 6 | Shield thickness |
| 7 | Shield material |
| 8 | Source number |

Fig. 1 Type plate of the source

3

System Description

The LB 8110 shield is intended as shield/protective container for radioactive rod sources and may only be used for this purpose. The radioactive substance is contained in a leak-proof welded source capsule and installed in the LB 8110 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 subject of this operating manual. Please refer to the individual manuals of the respective system components.

The shield container consists of a robust stainless steel housing. The locking cylinder of the shield is pivoted. The provided lever rod can be used to turn the locking cylinder to the two end positions. The radiation beam outlet is thereby opened and closed.

The locking plate on the upper side of the shield ensures that the source cannot be removed by unauthorized persons. Operators can secure the locking plate by installing a padlock at the right-hand and the left-hand side.

The locking cylinder can be locked in both rotational positions (radiation beam outlet open, radiation beam outlet closed) using fixing screws or a padlock.

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

3.1 View

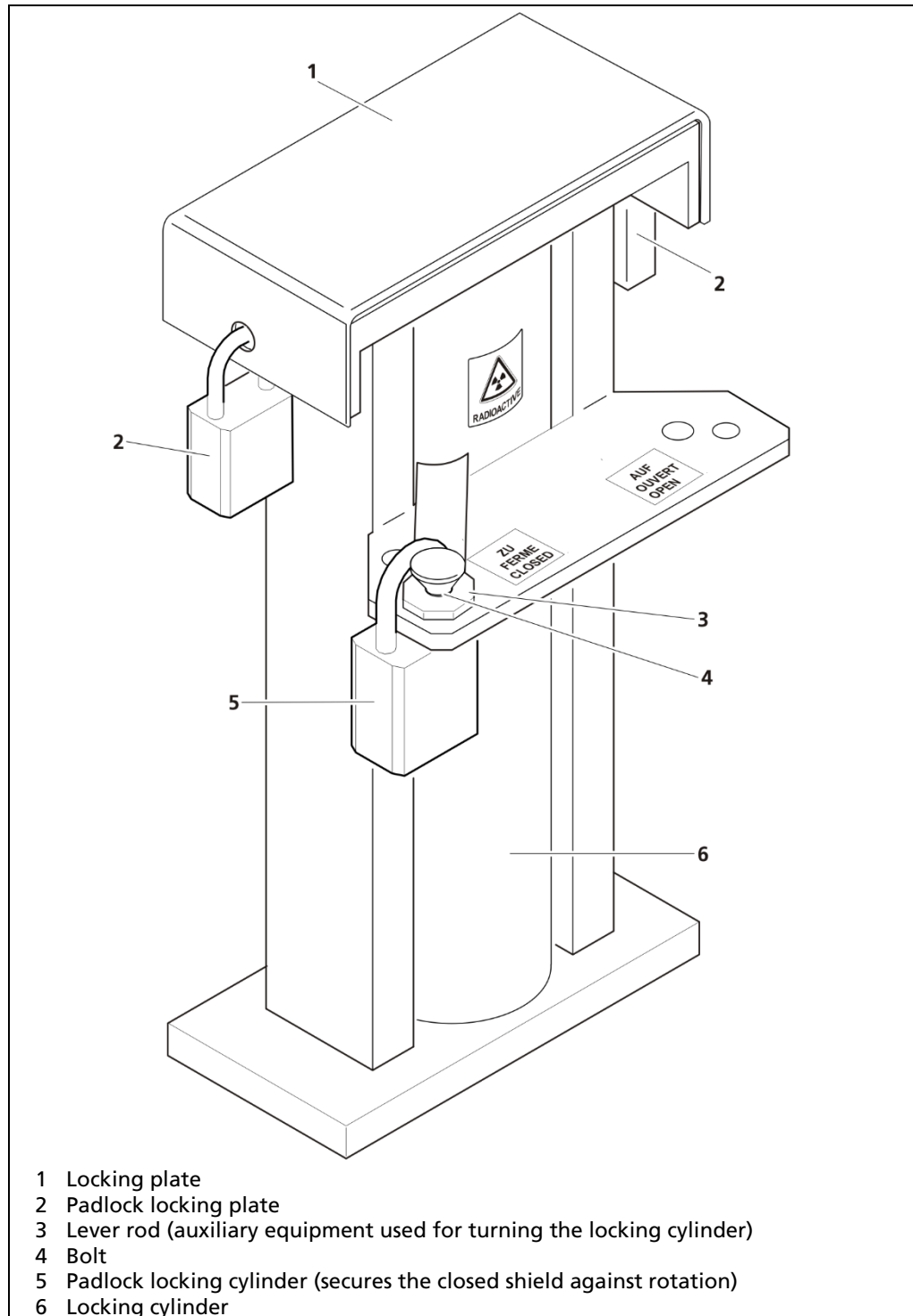


Fig. 2 Design

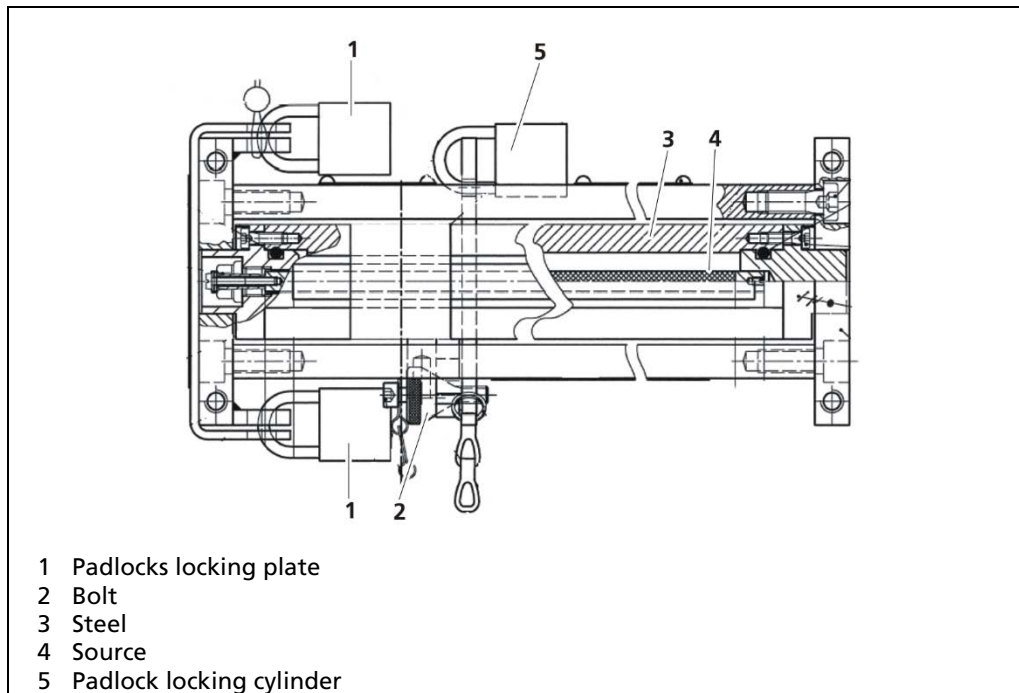


Fig. 3 Sectional representation

4 Installation

4.1 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.



- ▶ Exclusively use the provided fixing possibilities (lifting brackets) for attaching the sling gear.



- ▶ 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

- ▶ Despite their small size, the shield and the transport cap have a high weight.
- ▶ When handling and installing heavy and unwieldy system components, work with at least 2 persons.
- ▶ Observe the guidelines for safe handling of heavy loads.

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.

IMPORTANT



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

4.2 Packaging

The shield with radioactive source fulfils the regulations for the transport of radioactive substances UN 2910 – excepted package – with a maximum activity of < 10 GBq Am-241 acc. IAEA SSR-6.

4.3 Intermediate storage of the source

If the source must be intermediately 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 Preparing the Installation

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

4.5 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.

4.6 Installation of the shield

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 shield on the container is secured against tilting by means of a 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. Ensure that the shield has been closed and secured
 - ▶ the locking cylinder is set to the CLOSED position
 - ▶ the padlocks are 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 persons.
- ▶ Do not reach between the shield and the container or mounting base.

2. Fasten the shield with sufficiently dimensioned lifting straps.
3. Raise the shield and place it in the mounting position.
4. Screw the shield. The plant operator is responsible for selecting the connection elements, the screw locking and the tightening torque.

4.7 Marking

The warning sign 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 already applied to the shield is sufficient. Please observe the local legislation of the country of employment.

5 Usage

5.1 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 the shield does not show any signs of damage or functional limitations.
- ▶ Please observe the instructions on regular maintenance.

5.2 Opening and closing the locking mechanism

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

IMPORTANT



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

IMPORTANT



The locking mechanism may only be operated by persons who are at least employees with general knowledge and were instructed by an expert or authorized person. If the shield includes a radioactive source, the responsible radiation safety officer must be consulted.

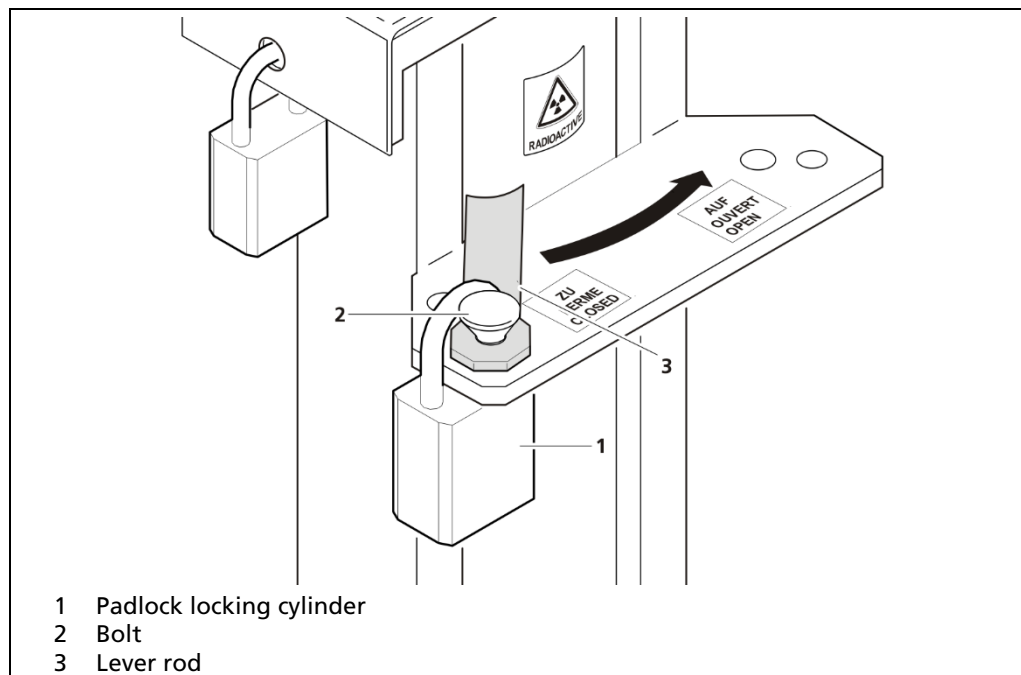


Fig. 4 Opening the locking mechanism

Opening the locking mechanism:

1. If applicable, remove the padlock (Fig. 4, item 1).
 2. Remove the bolt (Fig. 4, item 2).
 3. Turn the locking cylinder to the OPEN position using the lever rod (Fig. 4, item 3).
 4. Retain the locking cylinder in the new position using the bolt and the padlock.
- The radiation beam outlet is now open.

Closing the locking mechanism:

1. Remove the bolt (Fig. 4, item 2) and the padlock (Fig. 4, item 1).
 2. Turn the locking cylinder to the CLOSED position using the lever rod (Fig. 4, item 3).
 3. Retain the locking cylinder in the new position using the bolt and the padlock.
- The radiation beam outlet channel is now closed.

6

Maintenance and Repair

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.
- ▶ 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 TECHNOLOGIES GmbH & Co KG before the system is used again. Only spare parts specified by BERTHOLD TECHNOLOGIES GmbH & Co. KG may be used and required repair work may be carried out exclusively by authorized persons.

6.2 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 dispatch

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 locking mechanism: 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.

6.3 Leak test

Depending on the supervisory authority responsible for the area where the source is used, regular leak tests must be carried out. 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.

Alternative test areas:

Alternative test areas are areas (Grey marked area in Fig. 5) of a shield which will most likely be contaminated if a source is leaking.

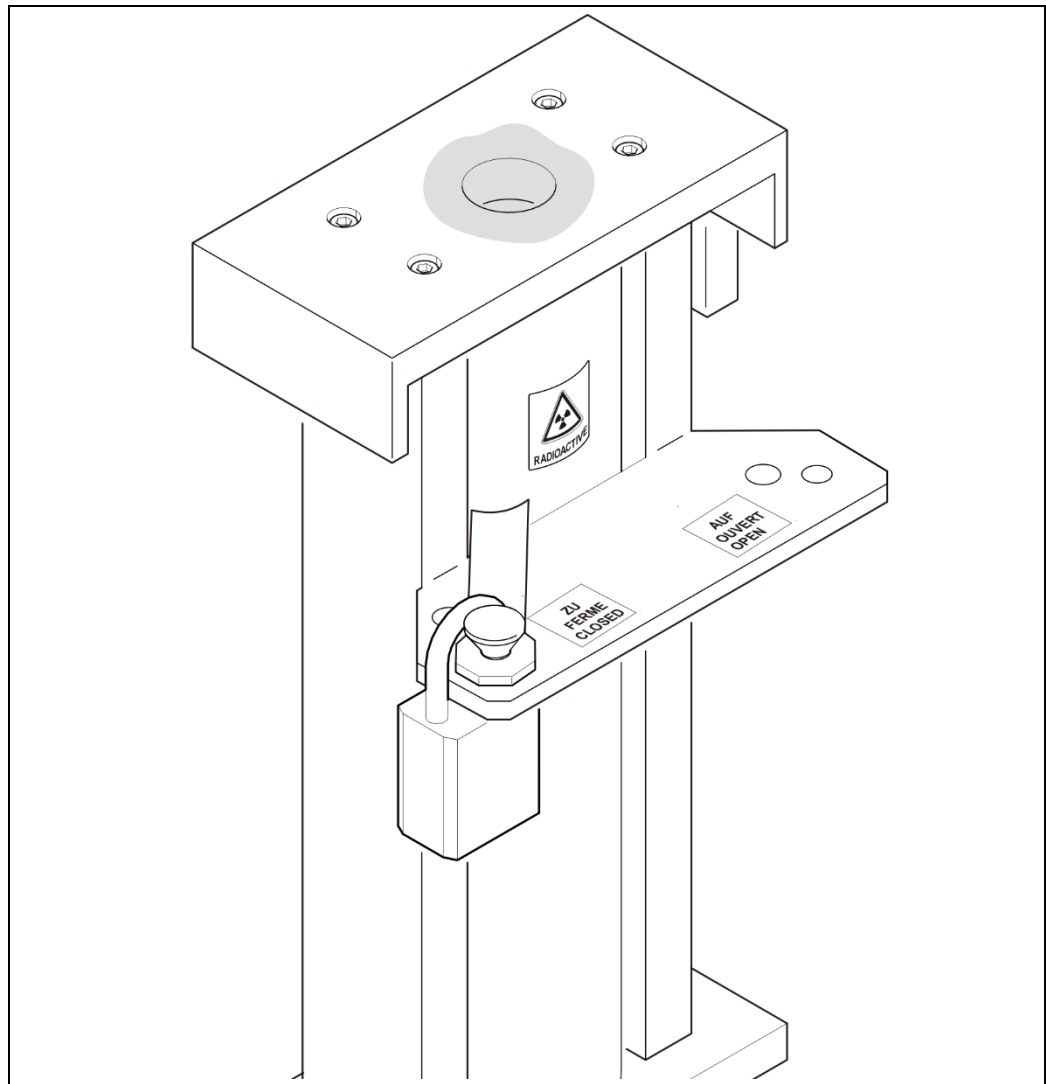


Fig. 5 Alternative test area

6.4 Checking the locking mechanism

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 locking mechanisms several times (see chapter 5) while observing the measuring signal of the corresponding measurement system. The locking mechanism 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.

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

6.5 Source replacement

When to replace the source

Generally, the radioactive source used enables a service life of 15 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 regulation-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.

We highly recommend to exchange the source in the premises of BERTHOLD TECHNOLOGIES GmbH & Co. KG.

7

Decommissioning

7.1 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.
- ▶ Exclusively use the provided fixing possibilities (lifting brackets) for attaching the sling gear.
- ▶ Wear head protection and safety shoes.

CAUTION



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 possibilities.

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.
- ▶ Transport the source exclusively inside the closed and secured shield.

IMPORTANT



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

7.2 Disassemble 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. Ensure that the shield has been closed and secured.
 - ▶ the locking cylinder is set to the CLOSED position
 - ▶ the padlocks are installed.
2. Fasten the shield with sufficiently dimensioned lifting straps.
3. Loosen the screw connection.
4. Raise and set down the shield.

7.3 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.

7.4 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 $\mu\text{Sv/h}$.
- Dose rate at a distance of 1m from the surface of the packaging must be lower than 100 $\mu\text{Sv/h}$.
- 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 6.2). The shield may only be dispatched if the test requirements are met.
- At the time of dispatch, a valid certificate concerning the leakproofness of 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 seal test certificate must be provided. The seal 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 TECHNOLOGIES GmbH & Co. KG has been received. We are pleased to send you a quotation regarding the costs.
- Radioactive substances must be sent to Bad Wildbad, Germany, carriage paid. BERTHOLD TECHNOLOGIES GmbH & Co. KG will not assume any costs for customs clearance or transportation.
- BERTHOLD TECHNOLOGIES GmbH & Co. KG is to be informed in advance about any return transport. BERTHOLD TECHNOLOGIES GmbH & Co. KG reserves the right to reject any radioactive substances sent to Berthold without prior notice. Any storage costs accrued in such case shall be borne by the sender.
- A copy of the attached notice form and the seal test certificate must be attached to each shield that includes a radioactive source. The original is to be included in the transport documents. Beforehand, the documents are to be sent to our department for the disposal of sources and repairs.

NOTICE



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

8 Appendices

8.1 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 dispatch: The beam path must be closed. | | |
| Only before dispatch: The locking plate must be mounted and secured. | | |
| Only before dispatch: The transport securing device(s) 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. | | |
| Only with pneumatic actuation: The air pressure required for moving the locking mechanism may not exceed the maximum permissible air pressure (see technical data of the pneumatic actuators) | | |
| Name of inspector: | Date: | Signature: |

Modifications due to technical advancement reserved.

BERTHOLD TECHNOLOGIES GmbH & Co. KG

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