Rod source shields
LB 8300

Operating manual
64217BA2

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# Table of Contents

1. About this operating manual ................................................................. 6
   1.1 Some prior remarks .................................................................. 6
   1.2 Storage ................................................................................. 6
   1.3 Target Group ....................................................................... 6
   1.4 Validity of the Manual ......................................................... 7
   1.5 Structure of the Manual ....................................................... 7
   1.6 Copyrights ........................................................................... 7
   1.7 Representation ...................................................................... 7
   1.8 Symbols Used ....................................................................... 8
   1.8.1 Structure of Warnings .................................................... 8
   1.8.2 Symbols used on the device ........................................... 9

2. Safety manual .................................................................................. 10
   2.1 Proper use ........................................................................... 10
   2.2 Ambient conditions during operation and storage ................. 11
   2.3 Qualification of the personnel ............................................. 11
   2.4 Radiation Protection ........................................................... 13
   2.4.1 Basic principles and regulations ......................................... 13
   2.4.2 Exposure of employees to radiation .......................... 14
   2.4.3 Theft protection ............................................................... 14
   2.4.4 In the case of fire .............................................................. 14
   2.6 Type plate of the source .................................................... 15

3. System Description ........................................................................... 16
   3.1 View ................................................................................... 17

4. Installation ....................................................................................... 19
   4.1 Safety Instructions ................................................................ 19
   4.2 Ambient conditions during assembly .................................... 20
   4.3 Intermediate storage of the source ...................................... 20
   4.4 Preparing the Installation .................................................. 20
   4.5 Checking the delivery ......................................................... 20
   4.6 Installation of the shield ..................................................... 21
   4.7 Marking ............................................................................... 26

5. Usage ............................................................................................... 27
   5.1 Safety instructions ............................................................... 27
   5.2 Opening and closing the locking mechanism ....................... 27
   5.3 Commissioning ..................................................................... 29

6. Maintenance and Repair ................................................................. 30
   6.1 Safety instructions ............................................................... 30
   6.2 Visual inspection .................................................................. 31
   6.3 Leak test ............................................................................... 31
   6.4 Checking the locking mechanism ........................................ 33
   6.5 Removing and installing the source ...................................... 34
   6.5.1 Removing the source ..................................................... 34
   6.5.2 Installing the source ....................................................... 37
   6.6 Source replacement ............................................................. 39
   6.6.1 Replacing the source ....................................................... 39

7. Decommissioning ............................................................................ 41
   7.1 Safety instructions ............................................................... 41
   7.2 Disassemble the shield ....................................................... 42
7.3 Disposal of radioactive substances ................................................................. 43
7.4 Shipment of radioactive substances ................................................................. 43

8 Appendices ........................................................................................................... 45
8.1 Check lists for tests ........................................................................................ 45
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
• operate 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

<table>
<thead>
<tr>
<th>Identifier</th>
<th>Meaning</th>
<th>Example</th>
</tr>
</thead>
<tbody>
<tr>
<td>Round brackets</td>
<td>Image reference</td>
<td>Connect the plug (fig. 1, item 1)</td>
</tr>
</tbody>
</table>
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.
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 manual

2.1 Proper use

The source with shield is used in connection with a detector and a suitable evaluation unit 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.
- Using the product 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 (except for situations in which the locking mechanism is defective and the beam outlet can no longer be closed).
- Operation without the safety precautions provided by the manufacturer.
- Any modification to design and function, except for any activities provided for and described in the present manual.
- Restructuring or changing the system components.
- Manipulation or avoidance of existing safety equipment.

BERTHOLD 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.

- The higher the dust and dirt content of the environment, the more likely stiffness or an entire blockage of the locking mechanism is. For this reason, the functional test intervals (see chapter 6) should be adjusted to 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.

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 special training with attendance of an officially recognized course and appropriate professional experience.
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 systems 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 locking mechanism of the shield is closed and secured in order to prevent the emission of unshielded radiation. Modification or damage to the shield must be avoided at all times.

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

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 lead as well as a risk of increased radiation exposure.

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

- In the case of fire, these measures limit the access to this area.
- Avoid the incorporation 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

![Type plate of the source](image)

1. Date of manufacture of the source
2. Isotope
3. Activity [MBq]
4. Dose rate within 1 m distance [$\mu$Sv/h]
5. Supplier of the source
6. Dose rate within 1 m distance [mrem/h]
7. Activity [mCi]
8. Source number

Fig. 1 Type plate of the source
3 System Description

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

The shield container consists of a robust steel housing filled with lead. 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.

Only the lower mounting plate and additionally the holes in the vertical bars are permitted to mount the shield!

The rod source shield is available in different versions. You can find an overview of all variants in the appendix (Technical Information).

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 the effects of the surrounding environment
3.1 View

Fig. 2  Basic layout

1  Ring nuts
2  Fastening bolts with padlock
3  Locking plate
4  Transport lock
5  Locking cylinder
6  Lever rod (auxiliary equipment used for turning the locking cylinder)
7  Padlock (secures the closed shield against rotation)
8  Mounting base
3 System Description

Rod source shields LB 8300

Fig. 3  Sectional view (position CLOSE)

1  Source holder
2  Source
3  Radiation beam outlet channel
4  Locking cylinder with shield material
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 ambient temperature during installation (4.2 Ambient conditions during assembly)
- 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 a at least 2 persons.
- Observe the guidelines for safe handling of heavy loads.
- Ensure stability and use the provided fixing possibilities.

⚠️ **WARNING**

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 Ambient conditions during assembly

The assembly is made by two ring bolts (Fig. 2, item 1). The minimum permissible temperature during assembly is \(-20 \, ^\circ\text{C}\). 

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.

⚠️ **WARNING**

**Risk of injury due to tilting shield**
There is a risk of injury to persons when working on non-fixed shields.
- Always secure upright shields against falling by fasten lifting means at the ring nuts.

**IMPORTANT**

The specification of the mounting base and the tilt safety device are determined during the project planning and defined by drawings, sketches or written instructions.
These instructions must be observed strictly during assembly.

**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 transport securing device and, if applicable, the padlock 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.
Fig. 5   lift and lower the shield

2.  Fasten the shield with sufficiently dimensioned lifting straps at the ring bolts (Fig. 5, item 1).

3.  Raise the shield and place it vertically in the mounting position.

4.  Carefully place the shield on the mounting base (Fig. 5, item 3).
**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, screw connections, screw locks).

5. Screw the shield (Fig. 6, item 1) to the mounting base (Fig. 6, item 2). The plant operator is responsible for selecting the connection elements (Fig. 6, item 3), the screw locking and the tightening torque.

6. Secure the shield to the container wall with the anti-tilt device on both sides (Fig. 6, Pos.4). The plant operator is responsible for selecting the connection elements (Fig. 6, item 3), the screw locking and the tightening torque.

**NOTICE**

In the design of the shield it was assumed that the shield is mounted with a distance A of 20 mm, see Fig. 6.

---

1 Shield
2 Mounting base
3 Screw connection
4 Tilt protection
A Distance to container wall

Fig. 6 Installation at containers
NOTICE

Shields can be stacked or offset. Please refer to the “Mounting variants” in appendix technical information.
4.7 Marking

The warning sign (Fig. 7, 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. 7, item 2) already applied to the shield is sufficient. Fig. 7 shows an exemplary identification of the control area according to German law. Please observe the local legislation of the country of employment.

![Diagram of marking](image)

**Fig. 7** Example marking

1 Warning sign control area
2 Warning sign rod source shield
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.

Opening the locking mechanism:
1. If applicable, remove the padlock.
2. Remove the transport lock.
3. Turn the locking cylinder to the OPEN position with the help of the lever rod.
4. Retain the locking cylinder in the new position using fixing screws.
   - The radiation beam outlet is now open.
5 Usage

Rod source shields LB 8300

Closing the locking mechanism:

1. Remove the fixing screws.
2. Turn the locking cylinder to the CLOSED position using the lever rod.
3. Retain the locking cylinder in the new position using fixing screws and/or a padlock.

▲ The radiation beam outlet channel is now closed.

Fig. 8  Shield open (OPEN position)

Fig. 9  Shield closed (CLOSED position)
5.3 Commissioning

To commission the shield after installation, proceed as follows:

1. Remove the transport lock.
2. If applicable, remove the padlock.

3. To open the shield directly before commissioning the measuring system: Turn the locking cylinder to the OPEN position.
4. Retain the locking cylinder in the new position using fixing screws.
6 Maintenance and Repair

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.

- 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 of a shield which will most likely be contaminated if a source is leaking.

![Alternative test area diagram](image)

**Fig. 11 Alternative test area**

The following alternative test area of the shield can be used:

- the area marked in grey in the figure above

1. Remove the guard plate and the screwed sealing plug (1) of the source holder.
2. Conduct the contamination test at the alternative test area (2).
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.

3. Return the locking cylinder to its starting position (OPEN position or CLOSED position).

4. If applicable, reinstall the fixing screws and/or the padlock.

5. Immediately report any malfunction or stiffness of the locking mechanism to the competent radiation safety officer.
6.5 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 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.

6.5.1 Removing the source

To install 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
- M3 threaded rod (approx. 50 mm)
To remove the source, proceed as follows:

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).

2. Open the padlocks (Fig. 12, item 3) and remove the fastening bolts (Fig. 12, item 4).

3. Remove the locking plate (Fig. 12, item 5).
   - You can now see the screwed sealing plug of the source holder.

4. Loosen the screwed sealing plug (Fig. 12, item 1).
5. Remove the O-ring (Fig. 12, item 2).

**CAUTION**

**Danger caused by ionising radiation**

When the source is removed, the unshielded source must be handled at short time. 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 persons are in the field of radiation during the work.

6. Screw the threaded rod (Fig. 13, item 1) into the thread of the source holder (Fig. 13, item 2).

7. Pull the source out of the shield at the threaded rod. Hold the source (Fig. 13, item 3) 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).
6.5.2 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 screwed sealing plug of the source holder
- M3 threaded rod (approx. 50 mm)

To install the source, proceed as follows:

1. If necessary, remove the padlocks (Fig. 14, Pos.3), the fastening bolts (Fig. 14, Pos.4) and remove the locking plate (Fig. 14, Pos.5).
2. Loosen the screwed sealing plug (Fig. 14, item 1).
3. Remove the O-ring (Fig. 14, Pos.2).
4. Prepare the transport shield with the source to be installed and remove the cover of the transport shield (Fig. 14, Pos.6).
5. Remove the locking plug (Fig. 14, Pos. 7) to open the transport shield.

![Fig. 14 Prepare the installation](image)
**CAUTION**

**Danger caused by ionising radiation**
When the source is removed, the unshielded source must be handled at short time. 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 persons are in the field of radiation during the work.

6. Grasp the source holder (Fig. 15, item 3) and pull the radiator out of the transport shield with the forceps (Fig. 15, item 5).

![Diagram of source installation](image)

1. Screwed sealing plug
2. O-Ring
3. Source holder
4. Source
5. Handling with plier

Fig. 15 Installing the source in the shield

7. Insert the source as soon as possible into the shield.
8. Attach the O-ring (Fig. 15, item 2) and tighten the Screwed sealing plug (Fig. 15, item 1).
9. Place the locking plate (Fig. 14, Pos.5) and secure locking plate by fastening bolts (Fig. 14, item 4) and attach padlocks (Fig. 14, item 3).
10. Turn the locking cylinder to the starting position (position OPEN or position CLOSED).
11. Replace the fixing screws and the padlock.
6.6 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.

6.6.1 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 (14 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
- M3 threaded rod (approx. 50 mm)
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 6.5.1.

3. Check the shield for damage and wear and repair it if required (see chapter 6.2).

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 6.5.2.
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.

---

![Diagram showing disassembly process]

1. Position CLOSED
2. Ring nuts
3. Screw connection

Fig. 16 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 are installed.
2. Fasten the shield with sufficiently dimensioned lifting straps at the ring bolts (Fig. 16, item 2).
3. Remove all screw connections (Fig. 16, item 3).
4. Raise and set down the shield vertically.

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 μSv/h.
- Dose rate at a distance of 1m from the surface of the packaging must be lower than 100 μSv/h.
- The packaging must be marked with a reference for dangerous goods in accordance with the applicable regulations with the UN number.
- Furthermore, transport documents with the correct description of the content as well as an accident procedures sheet according to the ADR regulations are required.
  - With regard to transport by air, the IATA DGR.
  - IAEA as the basis for all regulations.
- Packaging must comply with the current ADR regulations (for example European Agreement concerning the International Carriage of Dangerous Goods by Road).
- The cargo must be secured in the transport vehicle according to the applicable national and international regulations.
- Before dispatch, each shield containing a source must be subjected to a visual inspection by the user (chapter 6.2). The shields 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. 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 about any return transport in advance. BERTHOLD TECHNOLOGIES GmbH & Co. KG 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 notification of the radioactive sources you wish to send to BERTHOLD TECHNOLOGIES GmbH & Co. KG. We will be pleased to send you the current version of the message form.

- BERTHOLD TECHNOLOGIES GmbH & Co. KG is to be informed about any return transport in advance. BERTHOLD TECHNOLOGIES GmbH & Co. KG will reject any radioactive substances sent to Berthold without prior notice. Any storage costs accrued in such case shall be borne by the sender.

**NOTICE**

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

## 8.1 Check lists for tests

### Visual inspection

<table>
<thead>
<tr>
<th>Requirement</th>
<th>met</th>
<th>not met</th>
</tr>
</thead>
<tbody>
<tr>
<td>The shield must be free from damage.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>The type plates must be legible.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>If there is corrosion, it must not affect the function and stability of the shield.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Only before dispatch: The beam path must be closed.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Only before dispatch: The locking plate must be mounted and secured.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Only before dispatch: The transport securing device(s) must be installed.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Name of inspector:</td>
<td>Date:</td>
<td>Signature:</td>
</tr>
</tbody>
</table>
Checking the functions of the locking mechanism

<table>
<thead>
<tr>
<th>Requirement</th>
<th>met</th>
<th>not met</th>
</tr>
</thead>
<tbody>
<tr>
<td>It must be possible to move the locking mechanism completely back and forth between the two positions (OPEN / CLOSED).</td>
<td></td>
<td></td>
</tr>
<tr>
<td>The measuring signal of the measurement system must approximately correspond to the maximum value in the CLOSED position.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>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.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Only with manual actuation: It must be possible to turn the locking cylinder using one hand and the lever rod.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>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)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Name of inspector:</td>
<td>Date:</td>
<td>Signature:</td>
</tr>
</tbody>
</table>


Modifications due to technical advancement reserved.
Rod source shield LB 8300
Stabstrahlerabschirmung LB 8300

Technical Information
Technische Information

64217TI
Rev. No.: 00, 10/2017
Maximum permissible activities during transport
Zulässige Maximalaktivitäten für den Transport

The activities indicated here are the maximum activities with which the individual shields can be loaded according to the international dose rate limit for the transport of radioactive substances (2000 µSv/h at the surface of the package and 100 µSv/h at a distance of one meter from the surface). National dose rate limits for the operation of measurement systems are usually significantly lower and only allow loading with significantly lower activities. The national provisions must be complied with.


<table>
<thead>
<tr>
<th>Shield model</th>
<th>Maximum activity (Co-60)</th>
<th>Maximum activity (Cs-137)</th>
</tr>
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<tbody>
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<td>Maximalaktivität (Co-60)</td>
<td>Maximalaktivität (Cs-137)</td>
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<td>Variant 100</td>
<td>1,36 MBq/mm</td>
<td>48 MBq/mm</td>
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<tr>
<td>Variante 100</td>
<td>0,037 mCi/mm</td>
<td>1,3 mCi/mm</td>
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<tr>
<td>Variant 150</td>
<td>11,8 MBq/mm</td>
<td>1656 MBq/mm</td>
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<tr>
<td>Variante 150</td>
<td>0,32 mCi/mm</td>
<td>44,7 mCi/mm</td>
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<td>Variant 200</td>
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<td>42920 MBq/mm</td>
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<td>Variante 200</td>
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<td>1160 mCi/mm</td>
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<td>Variant 270</td>
<td>473 MBq/mm</td>
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<tr>
<td>Variante 270</td>
<td>12,8 mCi/mm</td>
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gerechnete Werte
calculated values
## Technical Data

### Technische Daten

### Variant 100

<table>
<thead>
<tr>
<th>Variant Variante</th>
<th>Housing Gehäuse</th>
<th>Shielding Abschirmung</th>
<th>Source length Strahlerlänge</th>
<th>Weight Gewicht</th>
<th>Operating temperature Betriebstemperatur</th>
<th>Coating Beschichtung</th>
<th>Fire proof Feuerfest</th>
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<tbody>
<tr>
<td>LB 8300-2051-200-10000-0500 ID: 64217-01</td>
<td>Carbon steel S235 C-Stahl S235</td>
<td>44 mm lead 44 mm Blei</td>
<td>500 mm</td>
<td>97 kg</td>
<td>-40°C … +100°C</td>
<td>RAL 1004 2K polyurethane varnish RAL 1004 2K Polyurethan Lack</td>
<td>Nein no</td>
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### Variant 150

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<th>Source length</th>
<th>Weight</th>
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<tr>
<td>LB 8300-4051-200-10000-0500 ID: 64698-01</td>
<td>C-Stahl S235</td>
<td>68 mm Blei</td>
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<td>249 kg</td>
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<td>RAL 1004 2K Polyurethane varnish</td>
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<td>C-Stahl S235</td>
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<td>C-Stahl S235</td>
<td>68 mm Blei</td>
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<td>68 mm Blei</td>
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<td>C-Stahl S235</td>
<td>68 mm Blei</td>
<td>1240 mm</td>
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<td>-40°...+100°C</td>
<td>RAL 1004 2K Polyurethan Lack</td>
<td>nein</td>
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## Variant 200

### Technical Information - Rod source shield LB 8300

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<th>Variant</th>
<th>Housing</th>
<th>Shielding</th>
<th>Source length</th>
<th>Weight</th>
<th>Operating temperature</th>
<th>Coating</th>
<th>Fire proof</th>
</tr>
</thead>
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<td>LB 8300-5051-200-10000-0500 ID: 65750-01</td>
<td>Carbon steel S235 C-Stahl S235</td>
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<td>500 mm</td>
<td>90 mm Blei</td>
<td>412 kg</td>
<td>-40° ... +100°C</td>
<td>Nein</td>
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<td>LB 8300-5051-200-10000-0700 ID: 65750-03</td>
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<td>700 mm</td>
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<td>500 kg</td>
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<td>1240 mm</td>
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<td>757 kg</td>
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</table>

**Coating:**
- RAL 1004 2K Polyurethane varnish
- RAL 1004 2K Polyurethan Lack

**Fire proof:**
- Nein

**ID:**
- 65750-01
- 65750-02
- 65750-03
- 65750-04
- 65750-05
- 65750-06
- 65750-07
- 65750-08
- 65750-09
### Variant 270

#### Variant 270

<table>
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<th>Housing</th>
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<th>Source length</th>
<th>Weight</th>
<th>Operating temperature</th>
<th>Coating</th>
<th>Fire proof</th>
</tr>
</thead>
<tbody>
<tr>
<td>LB 8300-6051-200-10000-0500 ID: 65934-01</td>
<td>122 mm lead</td>
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<td>122 mm lead</td>
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<td>938 kg</td>
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<td>1016 kg</td>
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<td>1094 kg</td>
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**Housing**
- **Material:** Carbon steel S235, c-Stahl S235

**Shielding**
- Lead, 122 mm" (3.5 cm)

**Source Length**
- 122 mm lead (3.5 cm)

**Weight**
- 761 kg (ID: 65934-01)
- 838 kg (ID: 65934-02)
- 938 kg (ID: 65934-03)
- 1016 kg (ID: 65934-04)
- 1094 kg (ID: 65934-05)
- 1171 kg (ID: 65934-06)
- 1249 kg (ID: 65934-07)
- 1327 kg (ID: 65934-08)
- 1355 kg (ID: 65934-09)

**Operating Temperature**
- -40°...+100°C

**Coating**
- RAL 1004 2K polyurethane varnish

**Fire Proof**
- Nein (No)
### Dimensions Variant 100 / 150

**Abmessungen Variante 100 / 150**

![Diagram of Rod source shield LB 8300](image)

Dimension in mm

**Abmessungen in mm**

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## Dimensions Variant 200 / 270

### Abmessungen Variante 200 / 270

![Diagram](image)

Dimension in mm

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Mounting Base LB 8300

*Montagesockel LB 8300*

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**Variant**

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<td>&gt; 600 x 300</td>
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**NOTICE**

The mounting base and tilt-protection must be provided by the plant manufacturer.

*Montagesockel und Kippsicherung sind vom Anlagenhersteller bereitzustellen.*

**IMPORTANT**

The Mounting base with the oblong slot, allows an adjustment of the radiation beam to the detector.

*Der Montagesockel mit Langloch ermöglicht die Ausrichtung des Strahlers auf den Detektor.*
Mounting variant stacked

Montagevariante gestapelt

Do not remove cover plate
Abdeckblech nicht entfernen

Replace ring bolt with screw
Ringschraube durch Schraube ersetzen

**NOTICE / HINWEIS**

The mounting base and tilt-protection must be provided by the plant manufacturer.
Montagesockel und Kippsicherung sind vom Anlagenhersteller bereitzustellen.
Mounting variants staggered

**NOTICE / HINWEIS**

The mounting base and tilt-protection must be provided by the plant manufacturer.

*Montagesockel und Kippsicherung sind vom Anlagenhersteller bereitzustellen.*