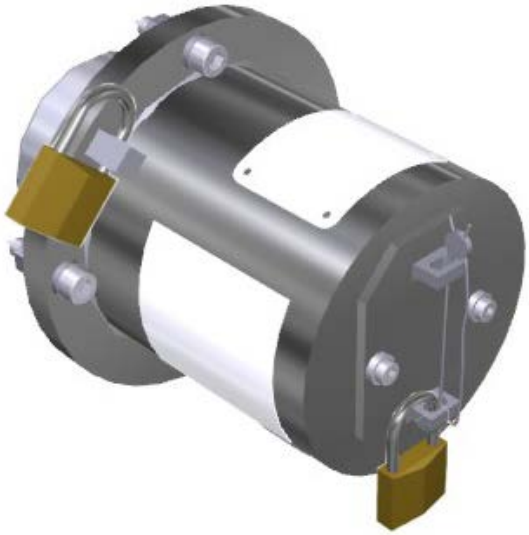

Shield

LB 8901

Operating Manual
64449BA2

Rev. No.: 01, 10/2018

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Table of Contents

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 manual

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!

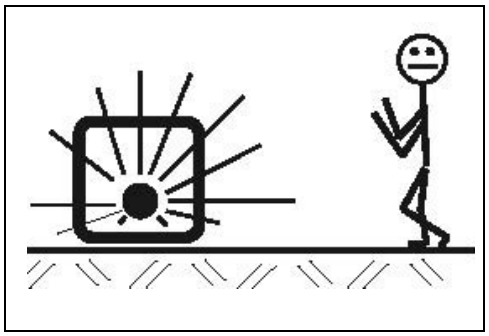
Radiation protection officers must have a specific training with certification.

2.4 Radiation Protection

2.4.1 Basic principles and regulations

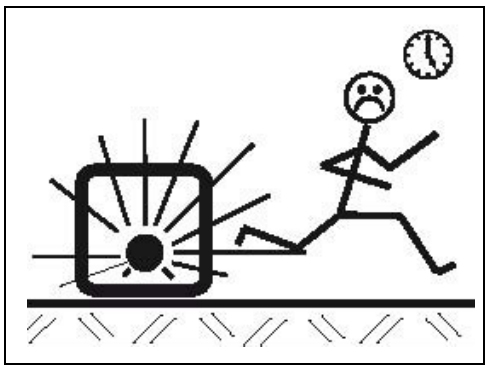
The amount of radiation absorbed by the body (exposure to radiation) is determined by three parameters from which the basic radiation protection regulations can be derived:

Distance



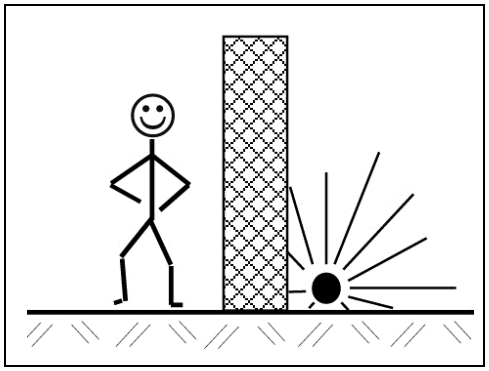
If work close to equipment containing radioactive substances is required, the largest distance possible is to be kept. In particular, this shall apply for employees which do not immediately participate in such work.

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

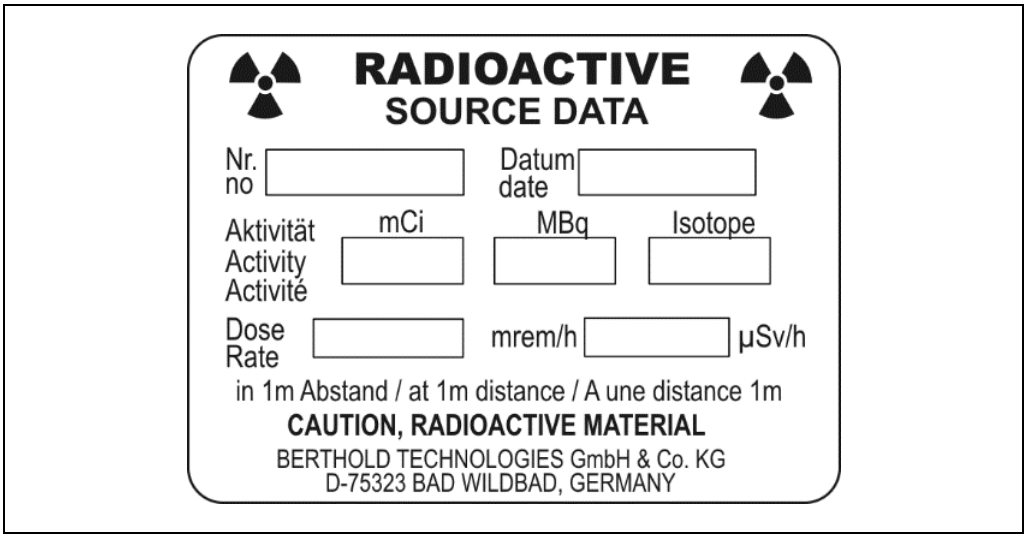


Fig. 1 Type plate of the source

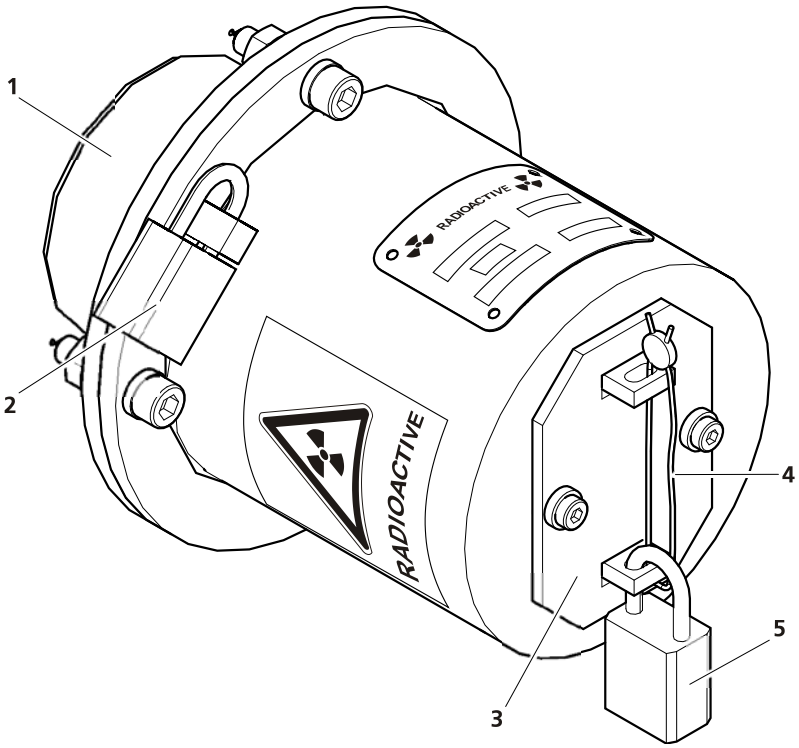
3 System Description

The LB 8901 shield is intended as shield/protective container for radioactive point 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 8901 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 tungsten. To lock the radiation beam outlet channel, a transport cap is installed.
The source is installed in a way that ensures that the locking lever protects it against unauthorized removal. The shield container is equipped with a flange for mounting.

The Shield has the following functions:

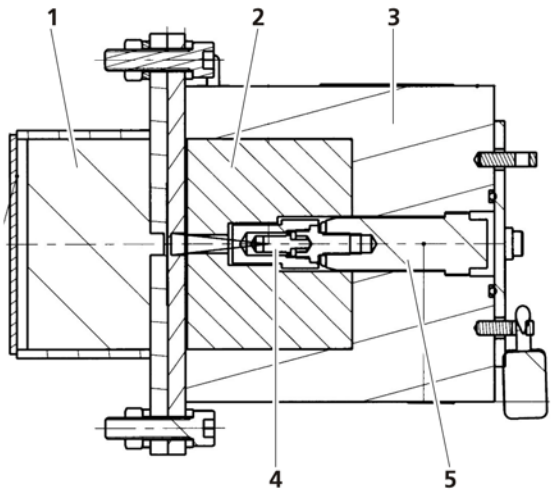
- Shield radiation to a level that is non-hazardous for the operating personnel
- Locking the radiation beam outlet channel for transport and during installation
- Protecting the integrated source capsule from mechanical damage and environmental impact

3.1 View



1 Transport cap
2 Padlock for transport cap
3 Cover plate
4 Seal wire
5 Padlock for cover plate

Fig. 2 Design



1 Lead
2 Tungsten
3 Stainless steel
4 Source capsule
5 Source holder

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 (type A packaging).

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

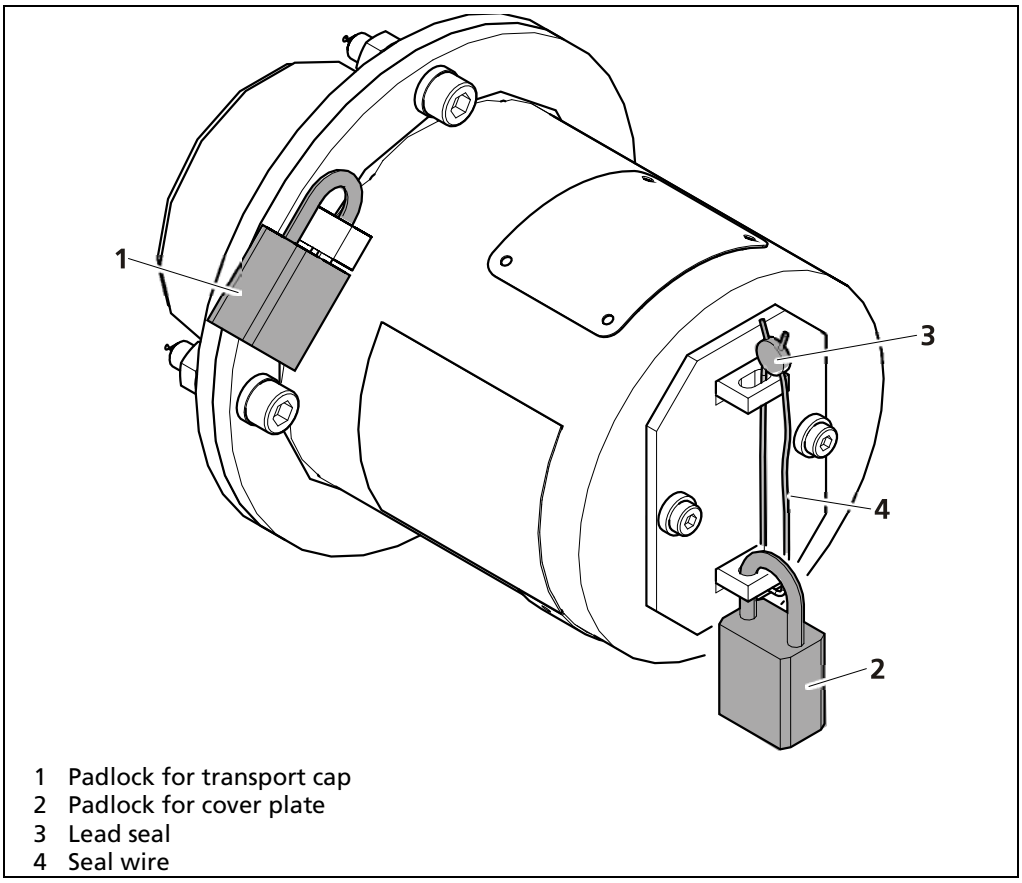
IMPORTANT

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 Padlock for transport cap
2 Padlock for cover plate
3 Lead seal
4 Seal wire

Fig. 4 Checking the delivery

1. Check the delivery for completeness using the packing list.
2. Check both padlocks (Fig. 4, item 1, item 2) are installed, closed and undamaged.

▶ In the case of damage, immediately notify the forwarding agent and the manufacturer.

3. Check the integrity of the lead seal and the seal wire (Fig. 4, item 3, item 4).

▶ In the case of damage, immediately notify the forwarding agent and the manufacturer.

4. Clean the parts, if required.
5. Check the shield for damage.

▶ In the case of damage, immediately notify the forwarding agent and the manufacturer.

4.6 Installation of the shield

To avoid unnecessary exposure to radiation, install the shield as final system component.

Tip

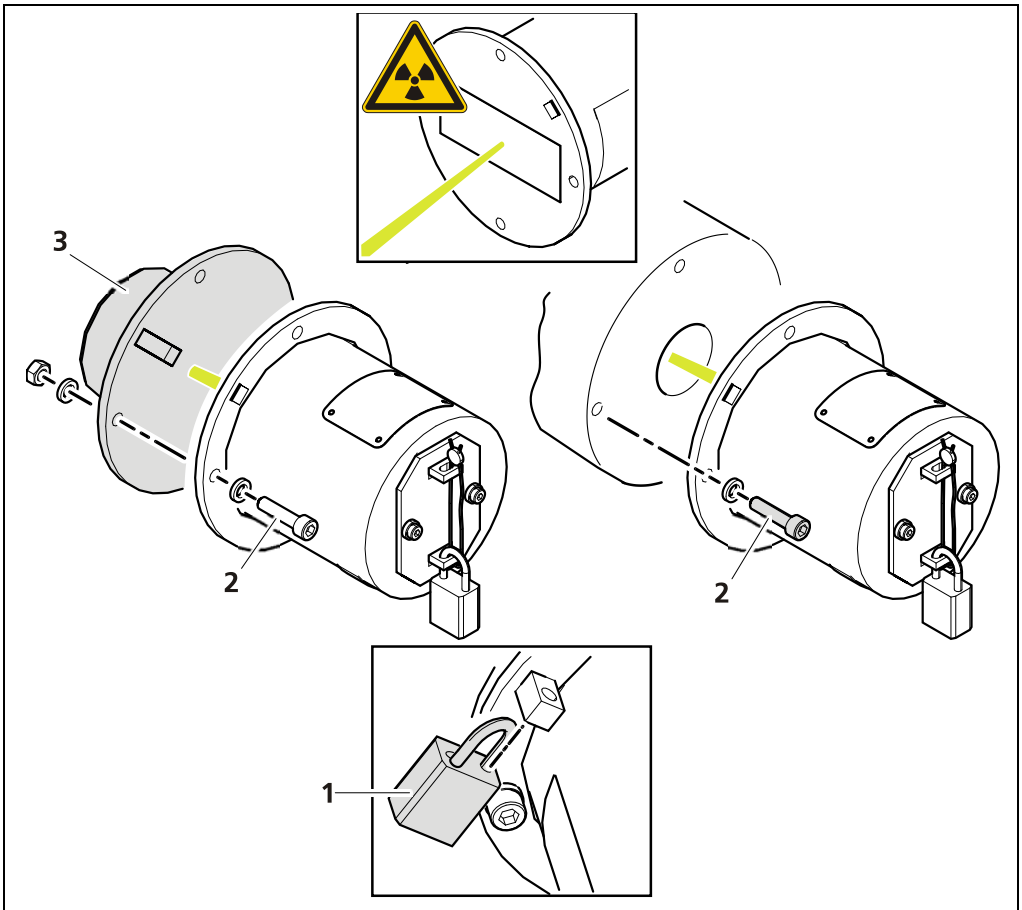
If the shield contains a radioactive source, the measurement of the background count rate of the detector should take place before the shield is installed.

⚠ CAUTION

Danger caused by ionising radiation

After removal of the transport cap, the beam path is free and ionizing radiation occurs.

- Consult the radiation safety officer responsible for your company.
- Install the unit with at least two persons (mounting + holding / screwing).
- Remove the transport cap only shortly before installation.
- Hold the flange of the shield only in the direction of the mounting location.



1 Padlock
2 Screws with lock washers
3 Transport cap

Fig. 5 Installation of the shield

1. Place the shield in the mounting position.

2. Remove the padlock (Fig. 5, item 1) at the transport cap.
3. Remove the hex socket screws and lock washers (Fig. 5, item 2).
4. Remove transport cap (Fig. 5, item 3).
5. Attach the shield immediately to the mounting flange and tighten.

- The plant operator is responsible for selecting the connection elements, the screw locking and the tightening torque.

5 Maintenance and Repair

5.1 Safety instructions

⚠ 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.
- 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.

5.2 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.
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.

5.3 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 (Gray marked area in Fig. 6) of a shield which will most likely be contaminated if a source is leaking.

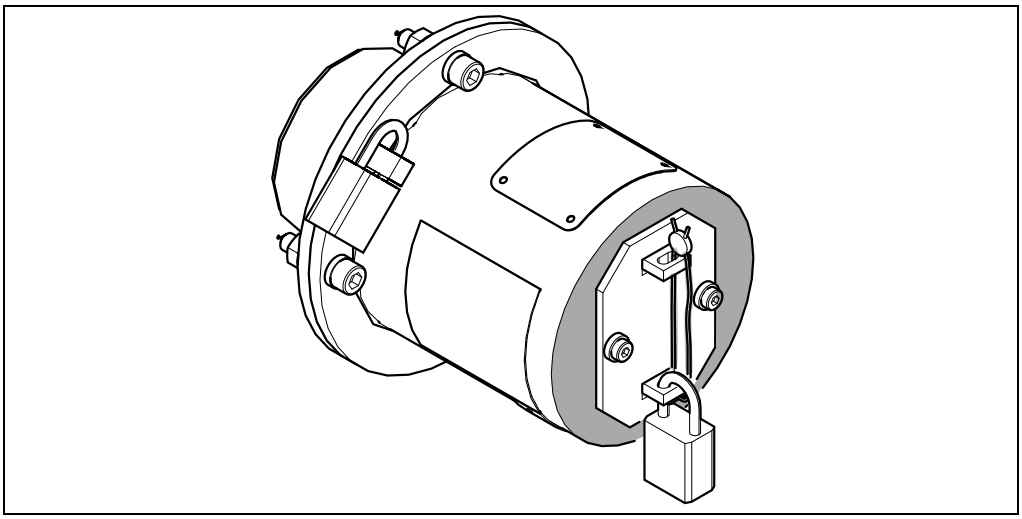


Fig. 6 Alternative test area

5.4 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 (14 mm) are to be covered before commencing any work.

5.4.1 Removing the source

To remove the source, the following tools are required:

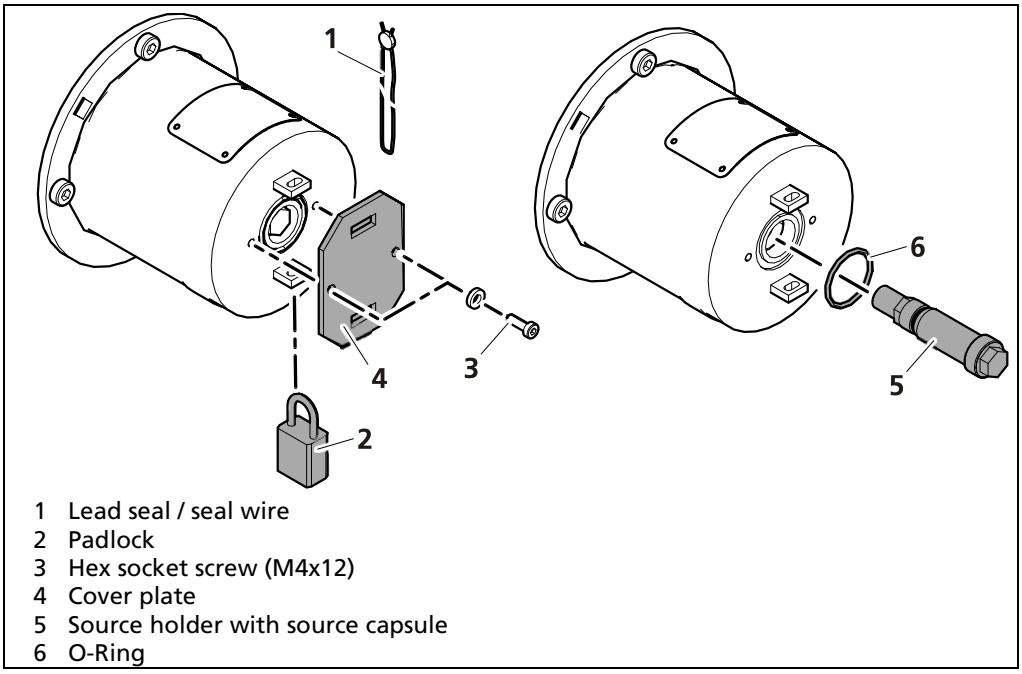
- pliers to securely grip the source holder
- hex socket wrench size 3 to remove the cover plate
- hexagon wrench size 12 to unscrew the source holder

⚠ 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.

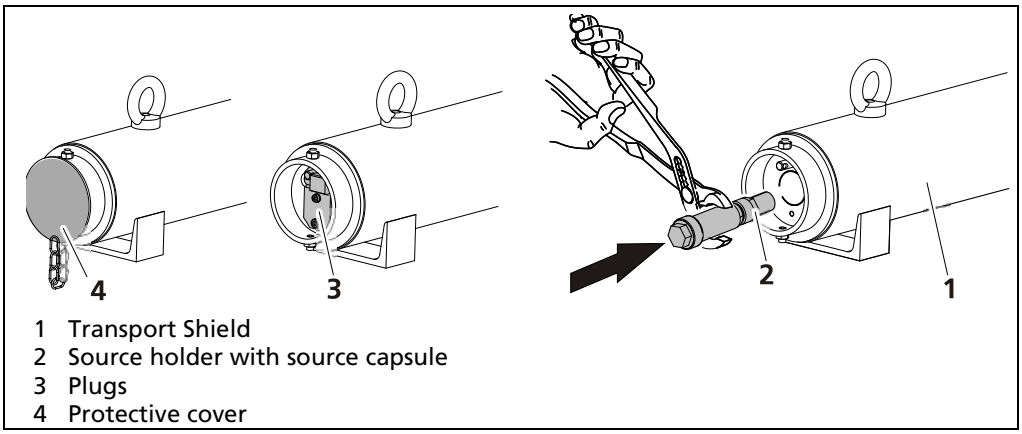


1 Lead seal / seal wire
2 Padlock
3 Hex socket screw (M4x12)
4 Cover plate
5 Source holder with source capsule
6 O-Ring

Fig. 7 Removing the source from the shield

To remove the source, proceed as follows:

1. Prepare the transport shield for the source and open the transport shield.
2. Remove the seal wire (Fig. 7, item 1) if necessary.
3. Remove the padlock (Fig. 7, item 2).
4. Loosen both hex socket screws (Fig. 7, item 3) and remove the lock washers and the cover plate (Fig. 7, item 4).
- ▶ The head of the source holder (Fig. 7, item 5) becomes visible.
5. Loosen the source holder and take the source holder out of the shield with pliers.
6. Remove the o-ring (Fig. 7, item 6).



1 Transport Shield
2 Source holder with source capsule
3 Plugs
4 Protective cover

Fig. 8 Inserting the source into the transport shield

7. Insert the source into the prepared transport shield as quickly as possible and close the transport shield.

5.4.2 Installing the source

To install the source, the following tools are required:

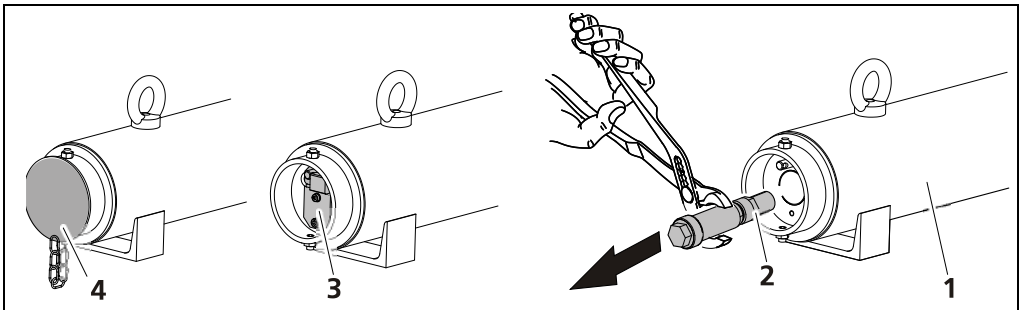
- pliers to securely grip the source
- hex socket wrench size 3 to remove the cover plate
- hexagon wrench size 12 to unscrew the source holder

⚠ 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.

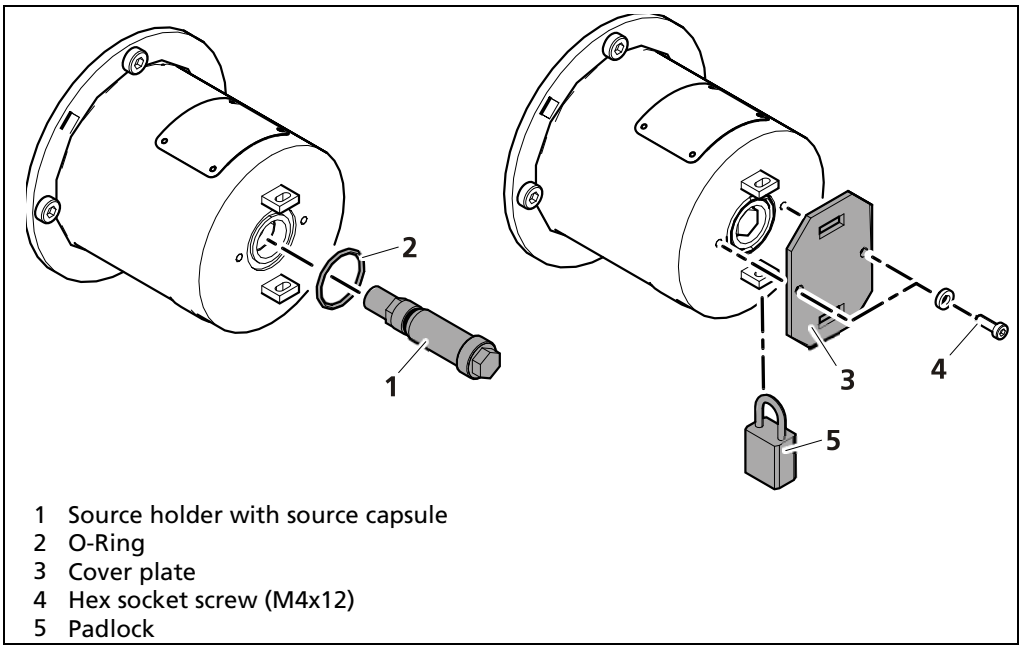


1 Transport shield
2 Source holder with source capsule
3 Plugs
4 Protective cover

Fig. 9 Removing the source from the shield

To install the source, proceed as follows:

1. Prepare the shield (Fig. 10) for the source and open the transport shield.
2. Grip the source holder using the plier and pull the source out of the transport Shield.



1 Source holder with source capsule
2 O-Ring
3 Cover plate
4 Hex socket screw (M4x12)
5 Padlock

Fig. 10 Installing the source

3. Insert the source (Fig. 10, item 1) into the shield as quickly as possible.
4. Screw the source holder with source capsule in the shield (torque: 44 Nm).
5. Check and replace O-ring (Fig. 10, item 2) if necessary.
6. Insert the O-ring.
7. Attach the cover plate (Fig. 10, item 3).
8. Screw the cover plate with 2 hexagon socket head screws and locking washers (Fig. 10, item 4).
9. Attach the padlock (Fig. 10, item 5).

5.5 Source replacement

When to replace the source

Generally, the radioactive source used enables a service life between 5 and 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.

5.5.1 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.

⚠ 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.

- ▶ Observe the operating instructions in the operating instructions for the transport shield.
- ▶ Keep the source far from the body.
- ▶ Ensure that no persons are in the field of radiation during 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.

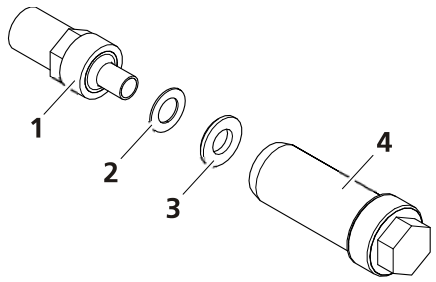
To replace the source, the following tools are required:

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

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 5.4.1) or replace the source capsule, see next section.
3. Check the shield for damage and wear and repair it if required (see chapter 5.2).
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 chapter 5.4.2.

Replacing the source capsule



1 Source capsule
2 Spring washer A 6,4 DIN 137
3 Washer B 6,4 DIN 125
4 Source holder

Fig. 11 Replacing the source capsule

1. Loosen the source capsule (Fig. 11, item 1) from the source holder (Fig. 11, item 4).
2. Remove the spring washer (Fig. 11, item 2) and the washer (Fig. 11, item 3).
3. Use a new spring washer and a new washer.
4. Screw the new source capsule onto the source holder with a tightening torque of 6.9 Nm.

6 Decommissioning

6.1 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 dismounted by at least 2 persons using aids.
- Observe the guidelines for safe handling of heavy loads.
- Ensure stability and use the provided fixing possibilities.

⚠ 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.

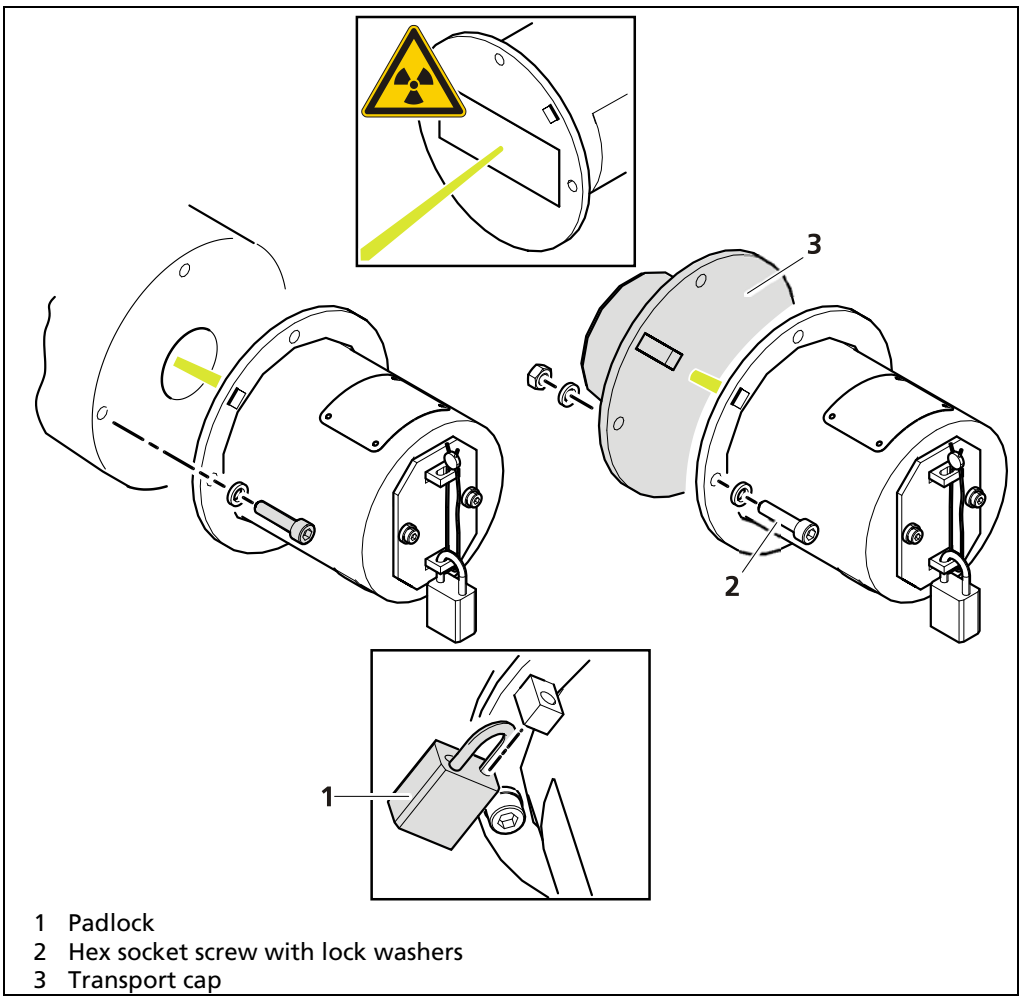
6.2 Disassemble the shield

⚠ CAUTION

Danger caused by ionising radiation

After removal of the transport cap, the beam path is free and ionizing radiation occurs.

- Consult the radiation safety officer responsible for your company.
- Disassemble the unit with at least two persons (mounting + holding / screwing).
- Screw the transport cap to the shield immediately after disassembly.
- Hold the flange of the shield only in the direction of the mounting location.



1 Padlock
2 Hex socket screw with lock washers
3 Transport cap

Fig. 12 Disassemble the shield

1. Loosen screw connection on flange.
2. Remove shield.
3. Immediately install and screw the transport cap (Fig. 12, item 3, item 2).
4. Attach the padlock (Fig. 12, item 1).

6.3 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.

6.4 Shipment of radioactive substances

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

- Dose rate at the surface of the packaging must be lower than 2000 µSv/h.
- Dose rate at a distance of 1m from the surface of the packaging must be lower than 100 µSv/h.
- The packaging must be marked with the UN number and a sign indicating dangerous goods.
- Furthermore, transport documents with the correct description of the content as well as an accident procedures sheet according to the ADR regulations are required.
    - With regard to transport by air, the IATA DGR.
    - IAEA SSR-6 as the basis for all regulations.
- Packaging must comply with the current ADR regulations (European Agreement concerning the International Carriage of Dangerous Goods by Road).
- The cargo must be secured in the transport vehicle according to the applicable national and international regulations.
- Before dispatch, each shield containing a source must be subjected to a visual inspection by the user (chapter 5.2). 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.

7 Appendices

7.1 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.		
Before dispatch: The transport cap must be installed and secured by padlock.		
Before dispatch: The cover plate must be installed and secured with a padlock.		
Documentation required for transport must be available.		
Name of inspector:	Date:	Signature:

Modifications due to technical advancement reserved.

10/2018
Language: English
Rev. no.: 01
Printed in Germany

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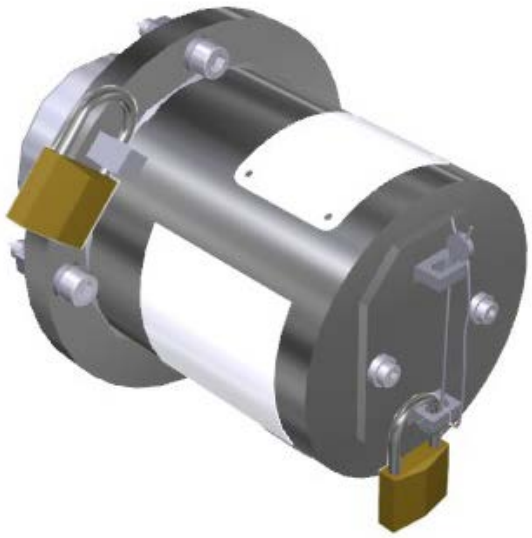


Shield LB 8901

Technical Information

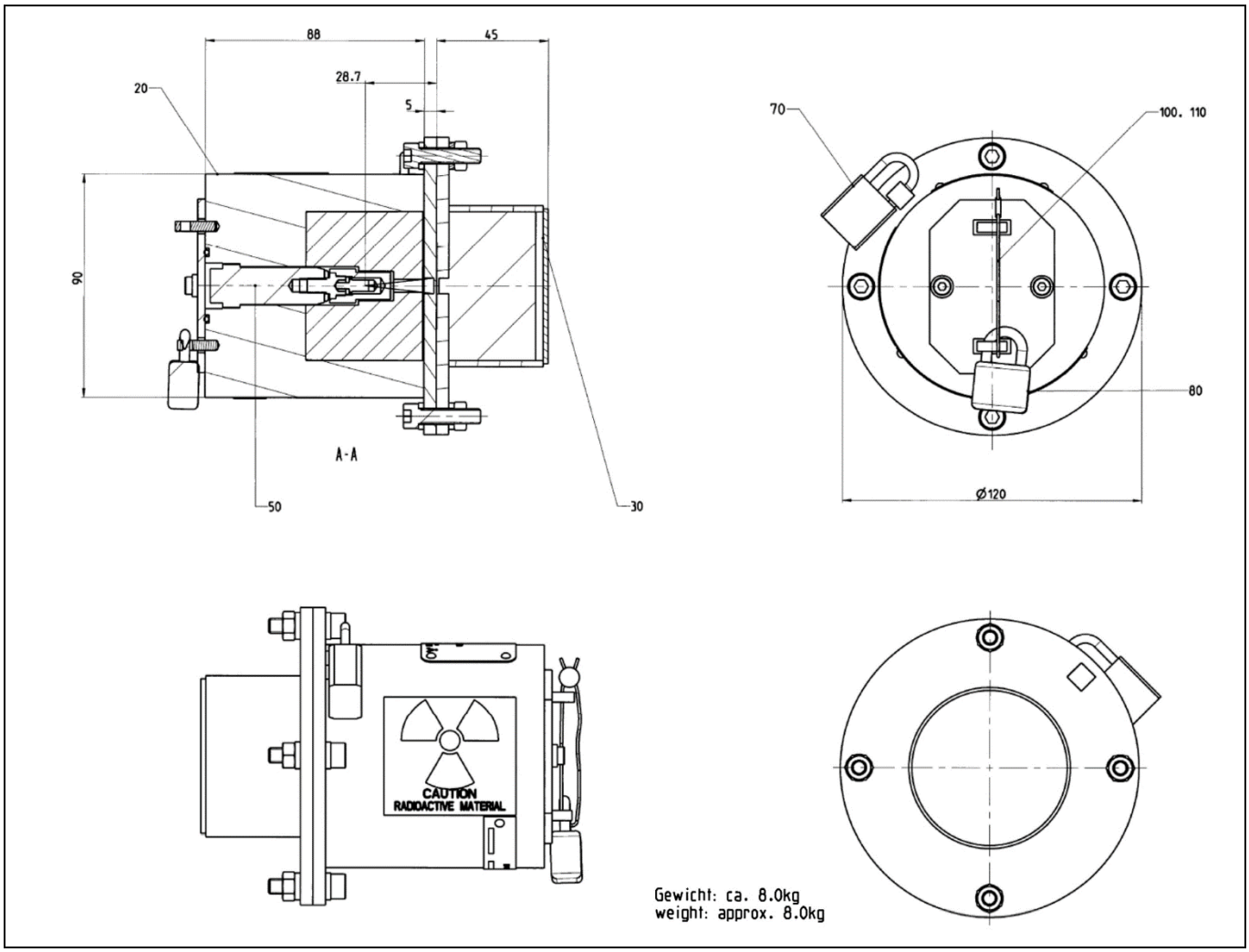
64449TI
Rev. No.: 00, 10/2017

Technical Data	
Material housing	316 L
Material shield	Tungsten
Weight with transport cap	approx. 8,0 kg
Weight without transport cap	approx. 6,0 kg
Radiation beam outlet	approx. 11°
Attenuation factor	approx. 170 (Cs-137)
Operating temperature	-40°… +100°C
Maximum permissible activity (Cs-137)	300 mCi / 11100 MBq

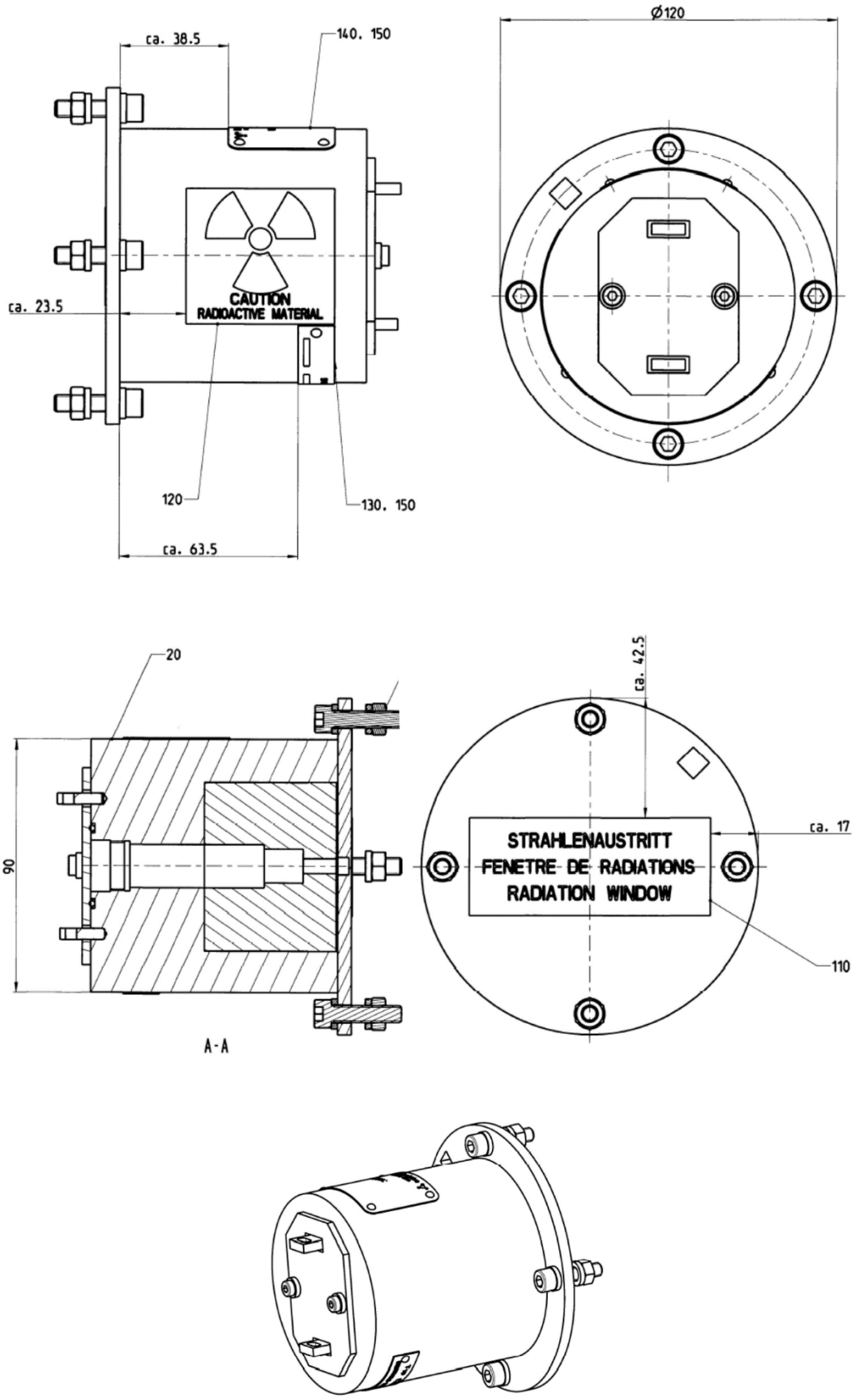
NOTICE

The activities indicated here are the maximum activities with which the shield 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.

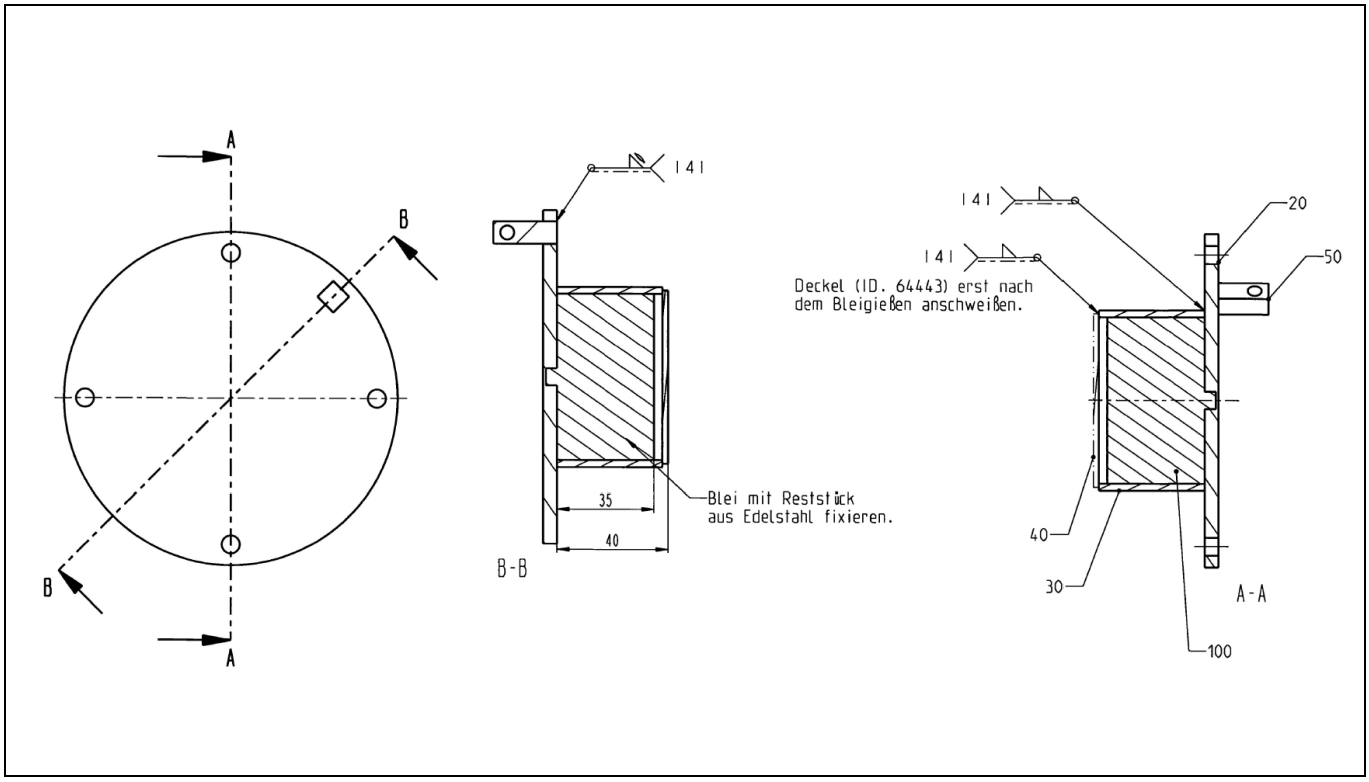
Drawings



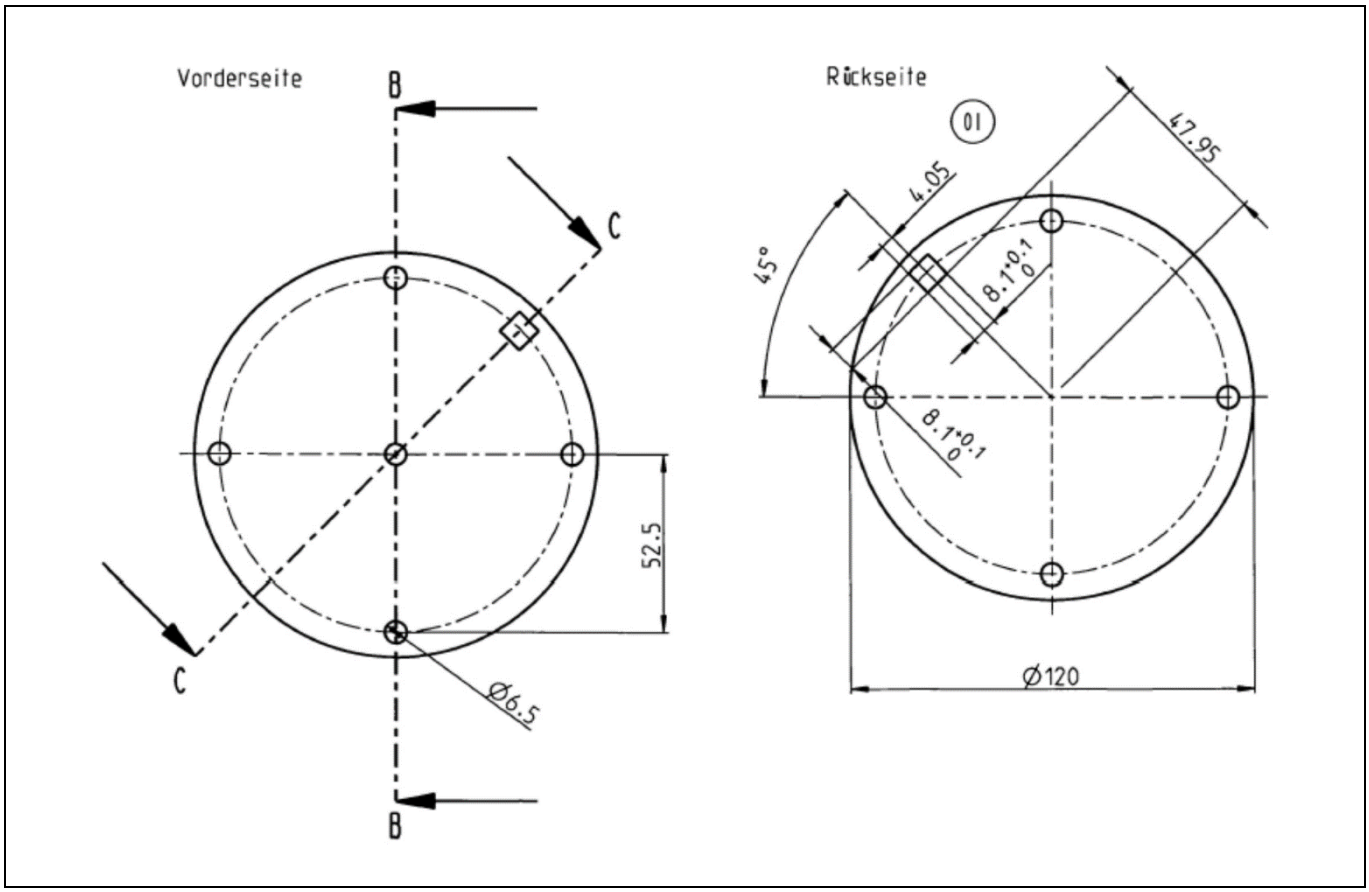
Drawing general view LB 8901 with transport cap



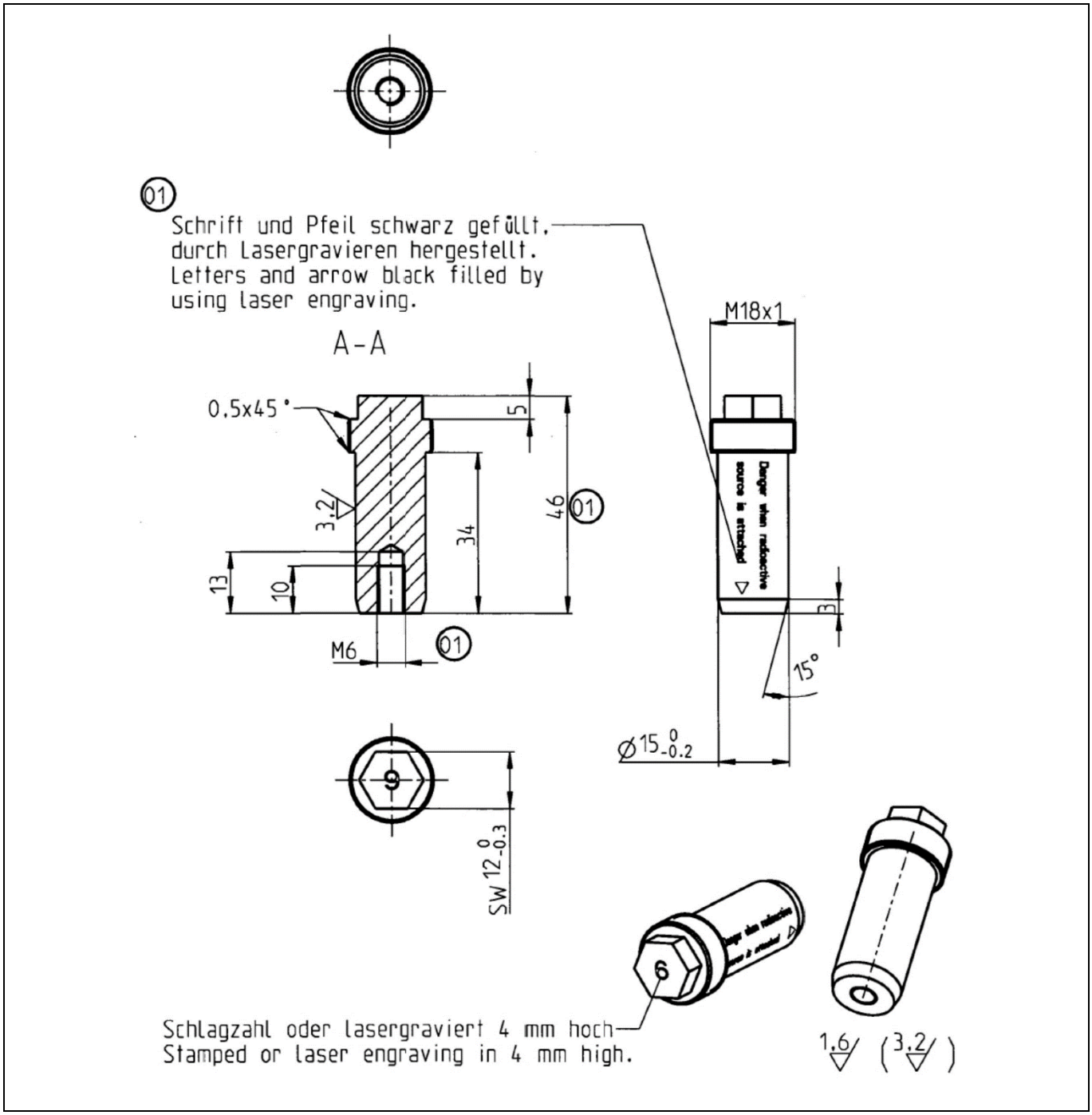
Drawing general view LB 8901 without transport cap



Drawing transport cap



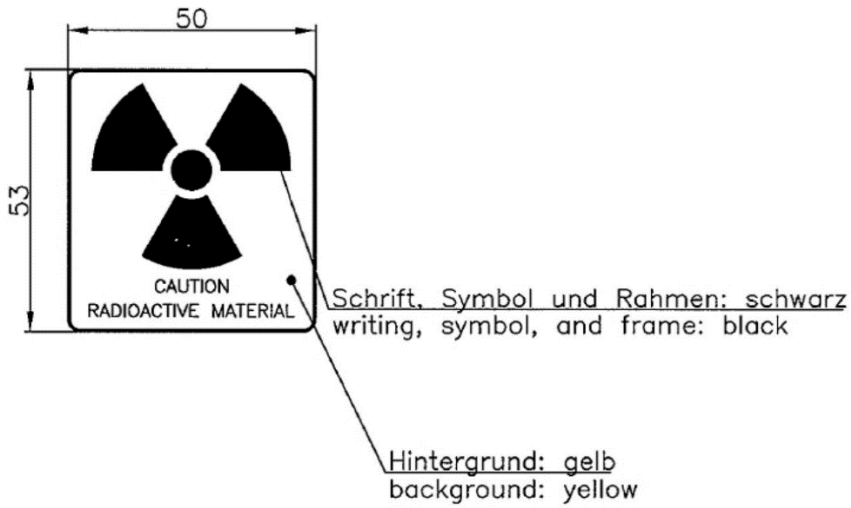
Drawing flange



Drawing source holder (ID: 50599)

NOTICE

Tight the source holder into the shield with a torque of 44 Nm.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CAUTION
RADIOACTIVE MATERIAL
Schrift, Symbol und Rahmen: schwarz
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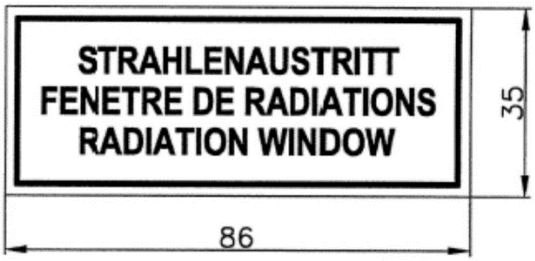
Hintergrund: gelb
background: yellow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FENETRE DE RADIATIONS
RADIATION WINDOW
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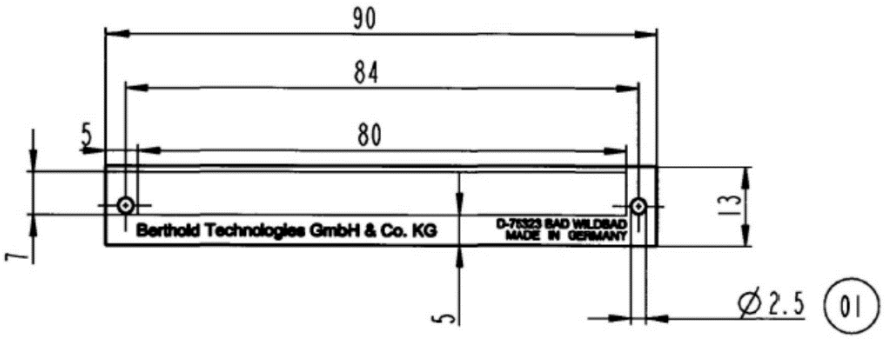
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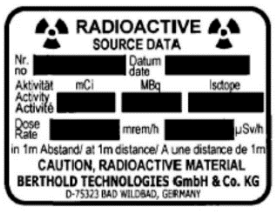
RADIOACTIVE
SOURCE DATA
Nr. no
Datum date
Aktivität Activity Activité
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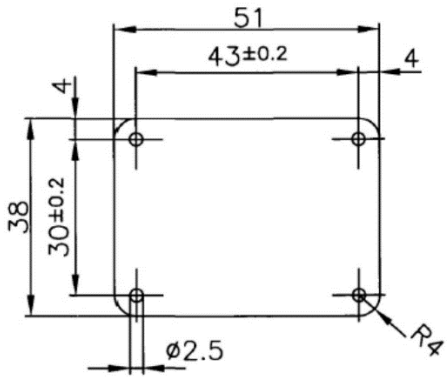
MBq
Isotope
Dose Rate
mrem/h
µSv/h
in 1m Abstand/ at 1m distance/ A une distance de 1m
CAUTION, RADIOACTIVE MATERIAL
BERTHOLD TECHNOLOGIES GmbH & Co. KG
D-75323 BAD WILDBAD, GERMANY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