

LB 8000 Transport Shields

Operating Manual

72682BA2

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BERTHOLD TECHNOLOGIES GmbH & Co. KG

Calmbacher Str. 22
75323 Bad Wildbad, Germany
www.berthold.com

Telephone +49 7081 177-0
Fax +49 7081 177-100
industry@berthold.com

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About this operating manual

1.1 Applicable Documents

This manual contains the following document:

Technical Information, Id. No. 72682TI2 (see appendix)

1.2 Some prior Remarks

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

This operating manual illustrates how to:

- transport the product
- load and unload the product
- carry out maintenance on the product
- dispose of the product

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

However, should questions arise which are not answered in this manual, please contact Berthold. Store the instructions where they are accessible for all users at all times.

1.3 Storage

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

1.4 Target Group

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

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

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

1.5 Validity of the Manual

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

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

NOTICE







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

1.6 Structure of the Manual

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

1.7 Representation

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

1.8 Symbols Used

NOTICE



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

IMPORTANT



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

Tip



Provides tips on application and other useful information.



General warning symbol



Warning symbol danger of crushing



Warning symbol heavy loads



Warning symbol suspended load



Warning of radioactive substances



Wear protective helmet



Wear safety shoes



Do not touch the surface

1.9 Structure of Warnings

Signal word



Source and consequence

Explanation, if required

► Measure

In case of emergency

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

Warning Levels used

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

DANGER



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

WARNING



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

CAUTION



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

1.10 Definition of Terms

Source

Sealed radioactive sources.

Ionizing radiation

Radiation from a radioactive substance.

Emergency

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

1.11 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.

1.12 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.

2

Safety

2.1 Proper use

The transport shield was developed as a shield / protective container and for use as a type A package in accordance with national and international transport regulations (e.g. IAEA SSR-6, IATA DGR, ADR) for sealed radioactive substances with at least class 4 in all test categories of ISO 2919 and may only be used for this purpose.

A transport shield is used to shield sources during transport and storage. It is only used when sources are supplied without working or transfer shields (for example replacement sources for source replacement).

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.

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

If the product is used in a way which is not described in this manual, the product's protection is compromised and the warranty becomes void.

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.
- 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.

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.

Ambient temperature: -30°C to 70°C

Shields containing radioactive substances and sources are to be stored in a lockable storage room complying with the national requirements for the storage of radioactive substances. 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 transport, 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 mechanics 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 people who have sufficient knowledge in the required area due to their specialized training and who are familiar with the relevant national health and safety regulations, accident prevention regulations, guidelines and 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 personnel

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

Radiation Safety Officer

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

NOTICE



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

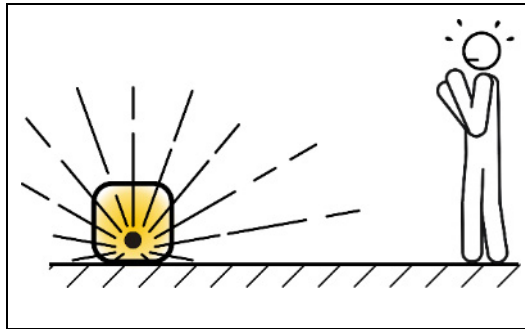
Radiation safety officers must have a special training with attendance of an officially recognized course and appropriate professional experience.

2.4 Radiation Protection

Basic Principles and Regulations

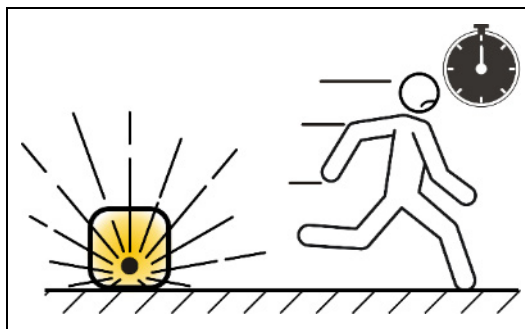
The amount of radiation absorbed by the body (exposure to radiation) is determined by three parameters from which the basic radiation protection regulations can be derived:

Distance



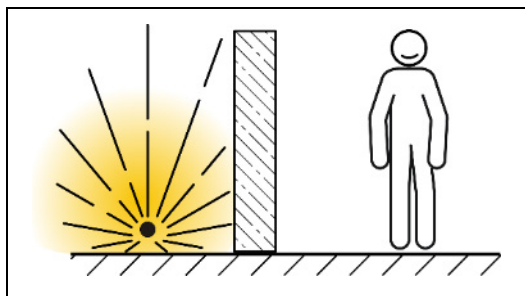
If work close to equipment containing radioactive substances is required, the largest distance possible is to be kept. In particular, this applies to employees not immediately required to work directly with the radioactive devices.

Time



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

Shield



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

Exposure of Employees to Radiation

During loading and unloading employees may be exposed to radiation.

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

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

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

Theft Protection

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

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

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

In the Case of Fire

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

- ▶ In case of fire, block access to this area.
- ▶ Avoid the incorporation, contamination and exposure by keeping sufficient distance.
- ▶ In the event of a fire, further action must be agreed with the responsible authority.

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

2.5 Emergency Procedure

In case of serious operational trouble, such as fire or explosion, it cannot be ruled out that the shield lock, the shielding efficiency of the source capsule have been impaired. In this case, it is possible that persons in the vicinity of the shielding have been exposed to higher levels of radiation.

If you suspect such a severe malfunction, the Radiation Safety Officer has to be notified immediately. He will then investigate the situation immediately and take all necessary provisions to prevent further damage and to avoid more exposure of the operating staff to radiation.

The Radiation Safety Officer has to make sure that the transport shield is no longer in operation and then take appropriate steps. A report must be made immediately to the competent authority. All other measures must be agreed with the authorities.

2.6 Operator's Obligations

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

- Observation 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

3

System Description

The transport shield was developed as a shield / protective container and for use as a type A package in accordance with national and international transport regulations (e.g. IAEA SSR-6, IATA DGR, ADR) for sealed radioactive substances with at least class 4 in all test categories of ISO 2919 and may only be used for this purpose.

A transport shield is used to shield sources during transport and storage.

A transport shield consists of an inner tube and an outer tube. Between the pipes is the shielding material. The sources are stored in the inner tube.

The transport shield is closed at both ends by removable plugs. These plugs are secured against unintentional or unauthorized opening by a locking screw and a padlock. To protect against damage or contamination, protective covers are located at both ends of the shield. Optionally, a source magazine is also available as an insert for transport shields. The magazine's tubes are numbered, allowing easier identification of the source.

The Shield fulfils the following Functions:

- shield the radiation to an unobjectionable level for the operating personnel.
- protect the sources to be transported from mechanical damage and from environmental influences.
- type A package according to national and international transport regulations.

Overview

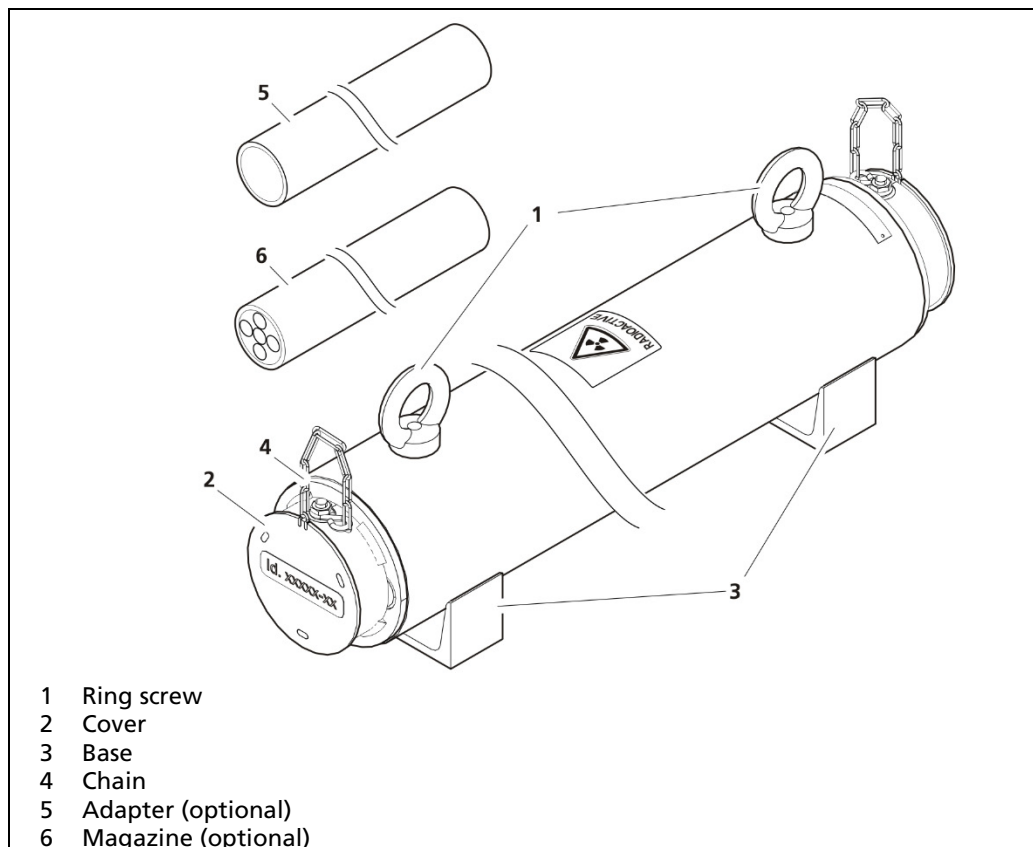


Fig. 1 Overview transport shield

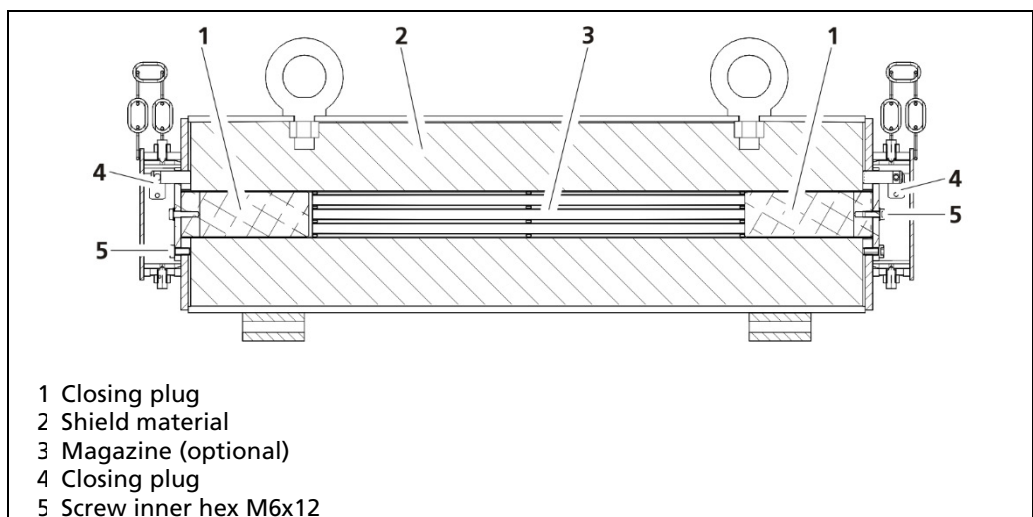


Fig. 2 Sectional view transport shield (without sources)

4

Transport

The shield may only be transported by competent persons (see 2.3 Qualification of the Personnel). Observe the national regulations applicable in the respective country of use. If necessary, note the marking of the centre of gravity on the packaging.

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.
- ▶ Observe the marking for the centre of gravity on the outer packaging, if applicable.
- ▶ Secure the danger zone by means of covering strips.
- ▶ Wear head protection and safety shoes.



WARNING



Danger of injury caused by heavy and bulky shield!

- ▶ Heavy and bulky shields should only be handled using aids and by 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.
- ▶ The locking mechanism must be in position CLOSED and secured during transport and assembly of the shield.

IMPORTANT



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

4.2 Packaging

The shield with the radioactive radiator represents a type A package, which corresponds to the regulations for the transport of radioactive substances.

Only the transport containers provided by the manufacturer are to be used for forwarding and returning. The specifications and requirements according to national and international dangerous goods regulations (Normal Conditions of Carriage) must be observed. The information in chapter 7.2 must be observed.

4.3 Intermediate Storage of the Source

If sources 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 Moving the Transport Shield

WARNING



Danger of injury by falling loads!

Falling loads can endanger people.

- ▶ Exclusively use the provided fixing possibilities (ring screws) for attaching the sling gear.
- ▶ Always attach the shields to both ring screws.
- ▶ Never step under suspended loads, keep safety distance.

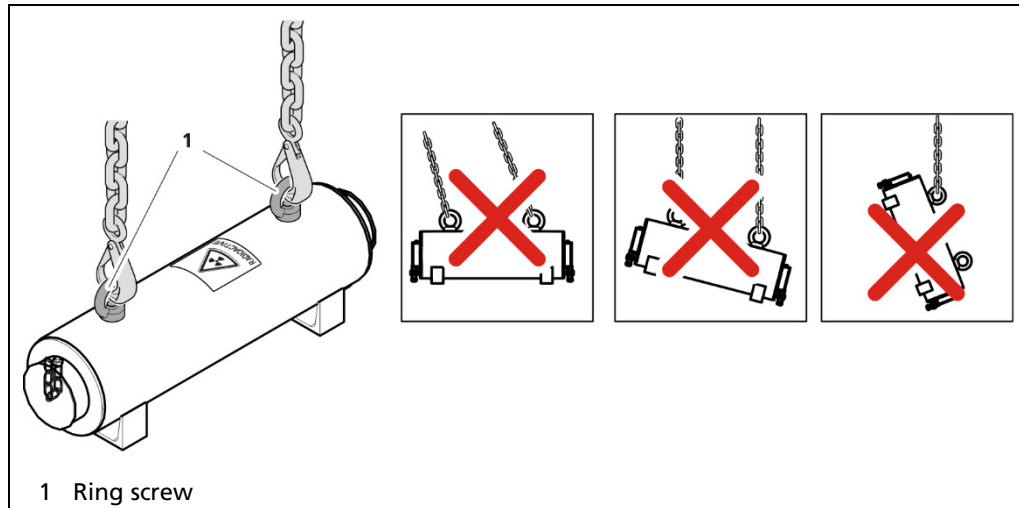


Fig. 3 Moving the transport shield

1. Check that the shield is closed and secured.
 - The closing plugs are mounted and screwed.
 - the padlocks are mounted.
 - the covers are mounted.
2. Attach the shielding to the ring screws with adequately dimensioned and tested slings.
3. Lift transport shield vertically.
 - Avoid diagonal pull!
4. Carefully set off the transport shield.

5

Unloading and Loading

The shield may only loaded and unloaded by competent persons (see 2.3 Qualification of the Personnel). The radiation protection officer is to be consulted, as well.

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 Prepare for Replacement

In order to avoid unnecessary radiation exposure, the duration of contact with the source (even in the shielded state) should be kept as low as possible during assembly. It is therefore advisable to carry out the following steps before the delivery of the source:

- Planning of the assembly (including estimation of the radiation exposure)
- Instruction of the workforce
- Cleaning and cleaning of the installation site
- Provision of the required tools and hoist
- Removal of all obstacles that could obstruct the installation of the source

5.3 Check Delivery

1. Check the delivery for completeness according to the packing list.
2. Check if the padlocks are attached, closed and undamaged.
 - Inform the transport company and the manufacturer immediately if damaged.
3. Check the integrity of the seal and the seal wire.
 - If the seal or the closing wire is damaged, inform the transport company and the manufacturer immediately.
4. Check the shield for damage.
 - In case of damage contact the transport company and the manufacturer immediately.
5. Clean the parts if necessary.

5.4 Remove and Insert the Source

NOTICE



The removal and installation of sources may be carried out by at least competent persons (2.3 Qualification of the Personnel) who are instructed by a competent or authorized person. If the shield contains a radioactive source, the responsible radiation protection officer must be consulted.

The following tools are required for inserting:

- Gripping tool (pliers or similar) to securely grip the source.
- Allen key size 5, for loosening the closing plug.

⚠ CAUTION



Danger from ionizing radiation!

When replacing the source, you must temporarily use the unshielded source. An increased radiation dose is harmful to your health.



- ▶ Only hold the source with a pair of pliers.
- ▶ Keep the source far away from the body.
- ▶ Make sure that no further persons are in the radiation area during the work.

5.4.1 Insert and Remove Point Source

Removing Point Sources with Source Holder

IMPORTANT



If there are several sources with source holders in the transport shield, remove both covers / plugs for removal.

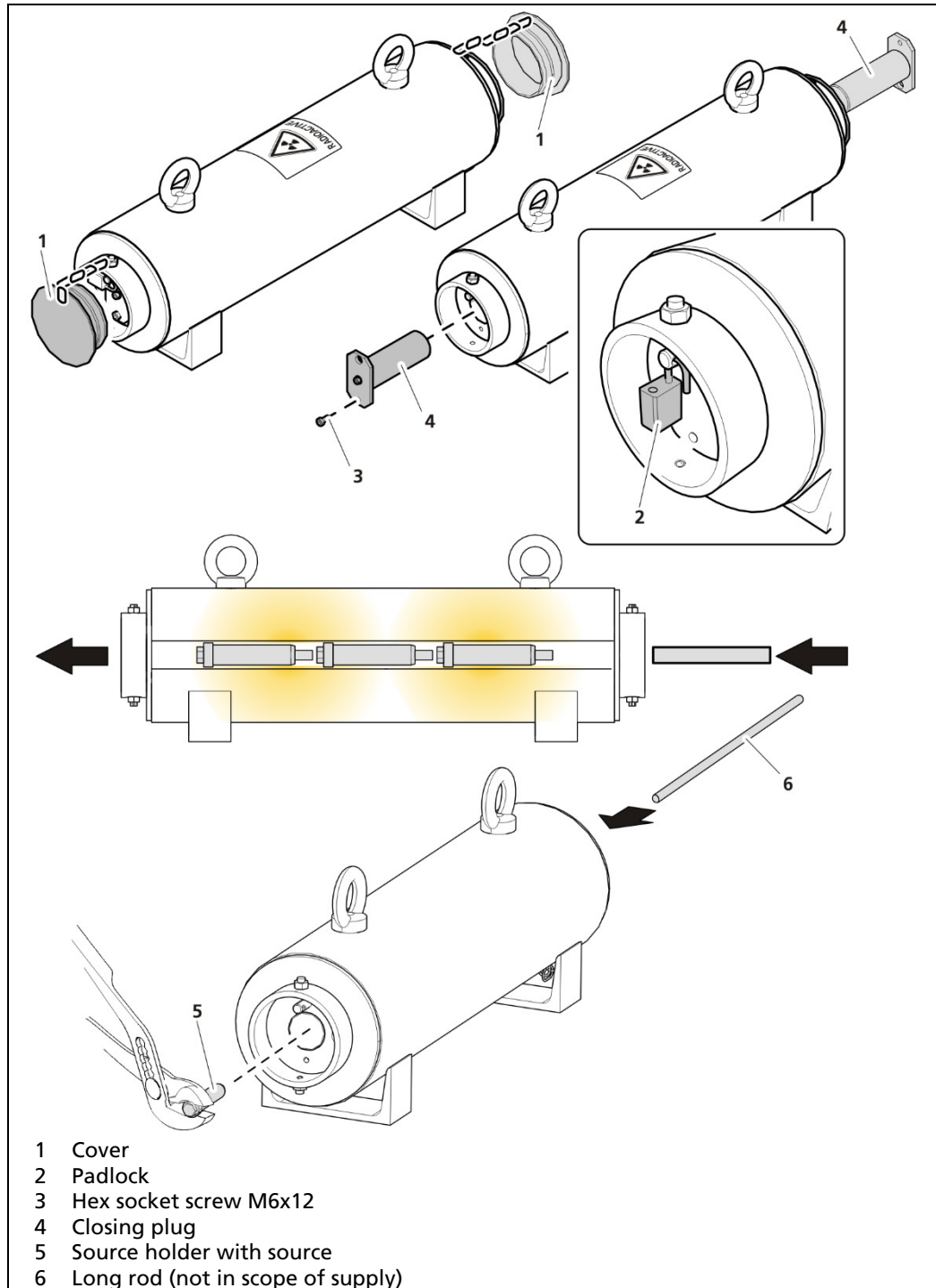


Fig. 4 Removing point sources

1. Remove the covers (Fig. 4, Item 1).
2. Remove the padlocks (Fig. 4, Item 2).
3. Loosen the hexagon socket screw (Fig. 4, Item 3) and remove the closing plugs (Fig. 4, Item 4).
 - ▶ The source holder becomes visible.
4. Pull the source holder with source (Item 5) with pliers or similar from the shield.
5. If several sources are installed, insert a long rod (Fig. 4, Item 6) into the opening to push the sources out of the transport shield.
6. Grasp the required source with the pliers from the shield and guide the source as quickly as possible into the prepared working shield.
 - ▶ The point sources are removed correctly.

Insert Point Sources with source holder

NOTE



Observe the maximum load of source with sources holders in transport shields.

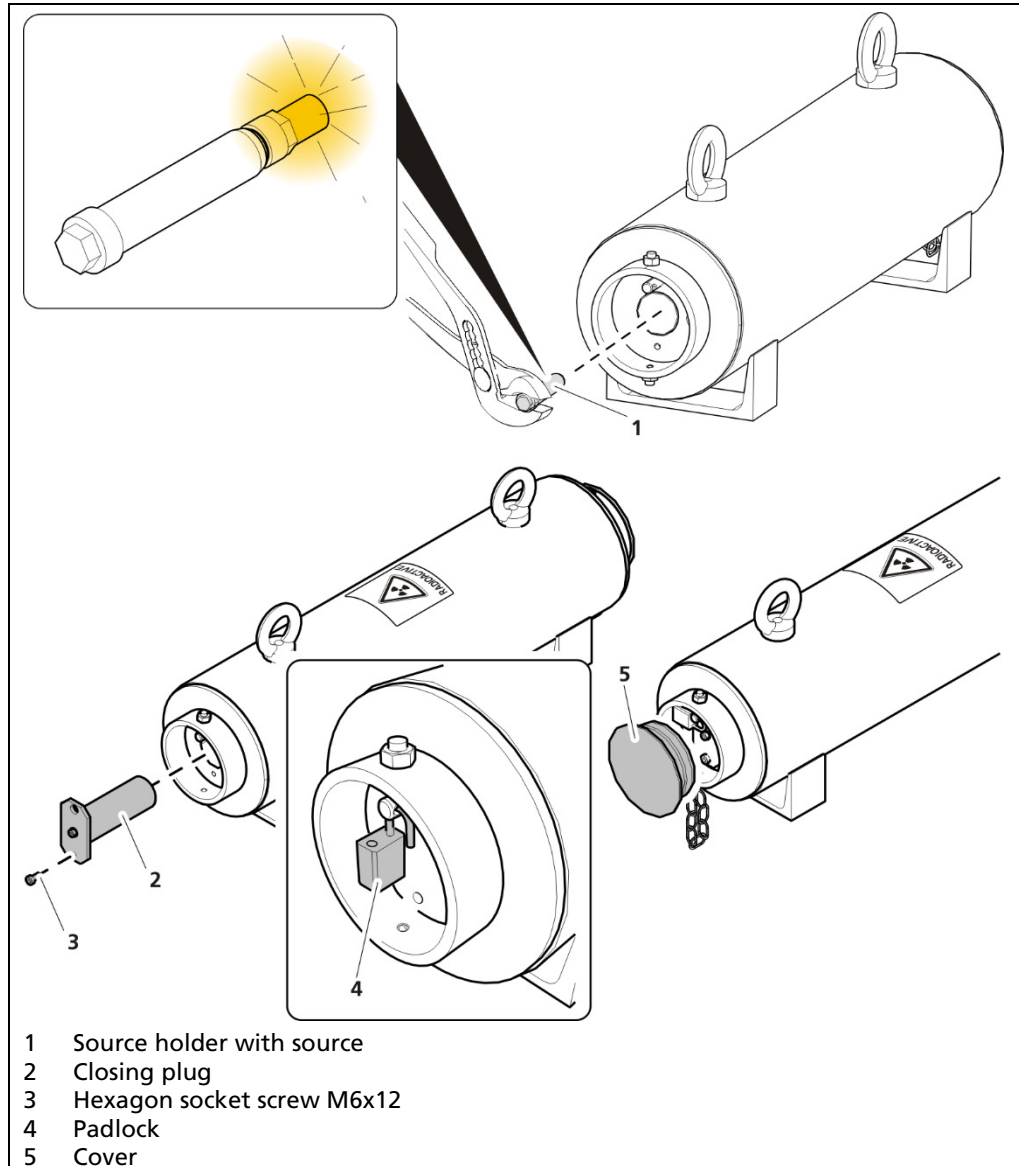


Fig. 5 Insert point sources

1. Insert the source holder with source (Fig. 5, Item 1) into the shield as quickly as possible.
2. Attach the closing plug (Fig. 5, Item 2) and screw it with a hex socket screw (Item 3).
3. Attach the padlock (Fig. 5, Item 4).
4. Attach the cover (Fig. 5, Item 5).
 - ▶ The point sources are inserted correctly and the shield is closed.

5.4.2 Remove and Insert Rod Source

CAUTION



Danger from ionizing radiation!

When replacing the source, you must temporarily use the unshielded source. An increased radiation dose is harmful to your health.



- ▶ Only hold the source with a pair of pliers.
- ▶ Keep the source far away from the body.
- ▶ Make sure that no persons are in the radiation area during the work.

Source Identification

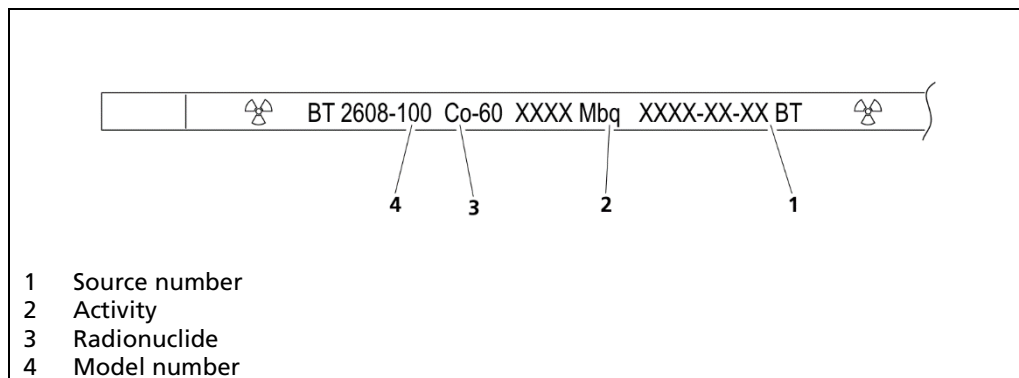


Fig. 6 Source labelling

IMPORTANT



If the transport shield contains several sources, the correct sources must be identified before removal.

- ▶ Use the supplied loading plan to determine the magazine tube in which the required source is located.

Remove Rod Source

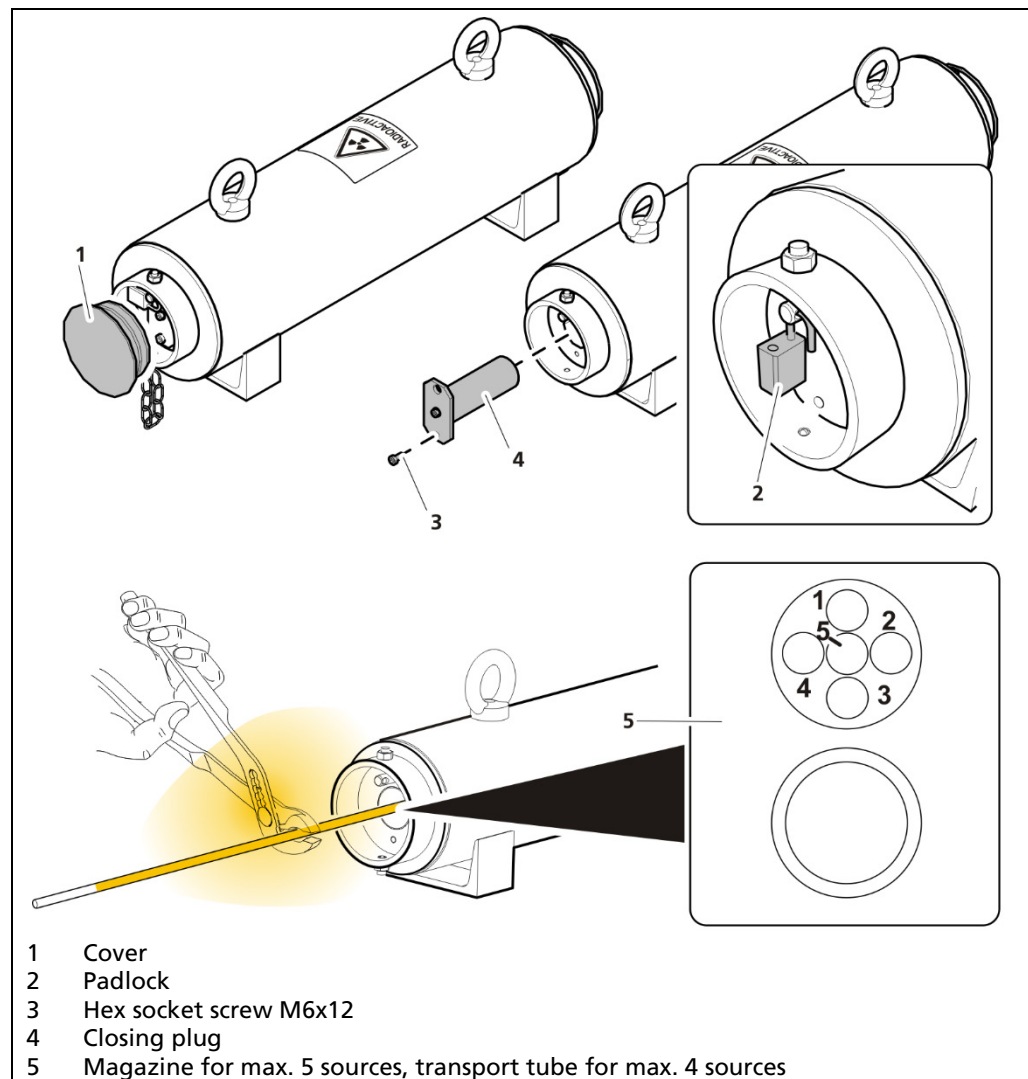


Fig. 7 Remove rod source

1. Remove the covers (Fig. 7, Item 1).
2. Remove the padlocks (Fig. 7, Item 2).
3. Loosen the hex socket screw (Item 3) and remove the closing plugs (Fig. 7, Item 4).
 - The sources become visible.
4. If the shield contains multiple sources, you must identify the correct source prior to removal (see previous section).
5. If the transport shield does not have a source magazine, you must read the source number on the source. To do this, hold the source with the gripper tool (pliers) and pull the source out of the shield only far enough so that you can read the source number.
 - Unnecessary sources must be pushed back into the shield immediately!
6. Pull the identified and required source out of the shield with the pliers and guide the source as quickly as possible into the prepared working shield.
7. Close the transport shield after removal.

Insert Rod Source

⚠ CAUTION



Danger from ionizing radiation!

When replacing the source, you must temporarily use the unshielded source. An increased radiation dose is harmful to your health.



- ▶ Only hold the source with a pair of pliers.
- ▶ Keep the source far away from the body.
- ▶ Make sure that no persons are in the radiation area during the work.

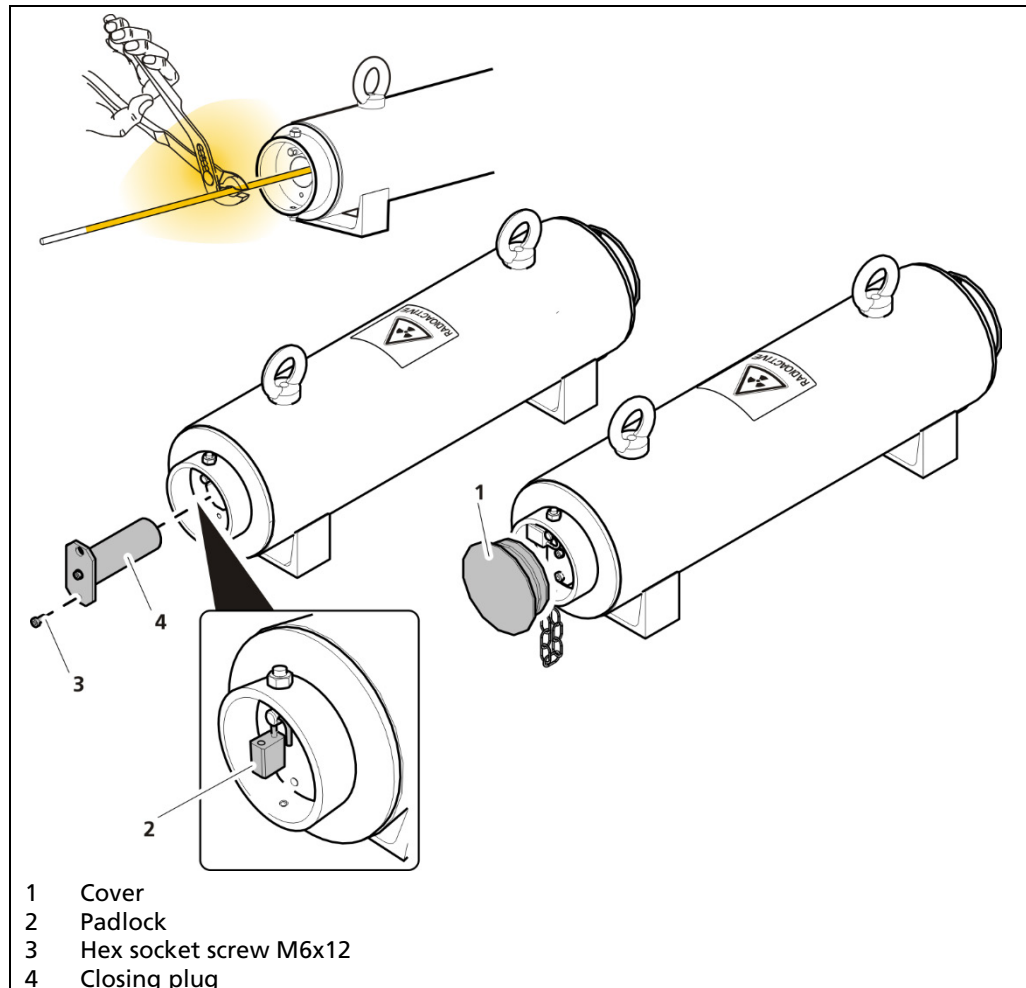


Fig. 8 Insert Rod Source

1. Insert the sources as quickly as possible into the transport shield.
2. Fit the closing plug (Fig. 8, Item 4) and screw it with a hex socket screw (Fig. 8, Item 3)
3. Attach the padlock (Fig. 8, Item 2).
4. Attach the cover (Fig. 8, Item 1).
 - ▶ The shield is closed correctly.

6

Maintenance and Repair

Maintenance and repair may only be carried out by competent people (see 2.3 Qualification of the Personnel). The radiation protection officer is to be consulted, as well.

6.1 Safety Instructions

CAUTION



Danger caused by ionizing radiation!

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

- ▶ Consult the radiation safety officer responsible for your company.
- ▶ Ensure that no one is in the radiation beam during operation.
- ▶ Longer repair and maintenance work on shields must not be carried out with the source installed.

IMPORTANT



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

IMPORTANT



Document the results of the periodic inspection you conducted using the check list in the appendix. This documentation and the suitability and acceptance certificates must be kept during the entire life cycle of the shield.

NOTICE



Adjust the intervals of the periodic inspection 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 safety function of the shield is detected during handling, maintenance or periodic inspection, the damage must be repaired after consultation with Berthold before the system is used again. Only spare parts specified by Berthold may be used and required repair work may be carried out exclusively by authorized persons.

6.2 Periodic Inspection

The periodic inspection must be carried out by people who are at least employees with general knowledge (see 2.3 Qualification of the Personnel) at the following intervals:

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

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

- ambient conditions (outdoors, rain, sunlight, wind)
- operating conditions, process temperatures, aggressive media, incorrect operation

Performing the inspection:

1. Check the shield and its components for obvious damage. These can be, for example, dents, cracks, holes, deformations.
2. Check the weld seams of the shield. Faulty weld seams may be indicated by cracks or changes.
3. Check the shield for corrosion. This may be indicated by chipping or visual changes.
4. Only before shipping: Check if the shield is closed and if the padlocks as well as the two hex socket screws are installed.
5. If any defects are identified during the periodic inspection, inform the radiation safety officer who will initiate the measures required for repairing the defects.

For further information, particularly in case of necessary repairs, please contact the manufacturer.

NOTICE



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

NOTICE



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

7

Uninstallation

The uninstallation may only be carried out by competent people (see 2.3 Qualification of the Personnel). The radiation protection officer is to be consulted, as well.

7.1 Disposal

The shield contains lead and must be disposed of properly according to national regulations. In the EU, lead is classified as an SVHC substance (substance of very high concern). Therefore, special legal boundary conditions must be met. Before disposal, ensure that the shielding is free of radioactive substances. Depending on the local regulations, proof of this must be provided.

7.2 Shipment of Sources

If you wish to ship sealed radioactive substances, 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. Details can be found in the national and international regulations.

In particular, note the following:

- Dose rate at the surface of the packaging must be lower than 2000 $\mu\text{Sv/h}$.
- Dose rate at a distance of 1 m from the surface of the packaging must be lower than 100 $\mu\text{Sv/h}$.
- The Type A package must be marked with the UN number and the appropriate dangerous goods labels.
- 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 ship, each shield containing a source must be subjected to a periodic inspection by the user (chapter 6.2). The shields may only be dispatched if the test requirements are met.
- At the time of shipment, a valid leak test lab result for the source must be available.

Preconditions for returning shields to Berthold

- If you want to hand over radioactive substances to BERTHOLD Technologies, you must comply with the provisions of the Radiation Protection Ordinance and the dangerous goods regulations GGVSEB/ADR.
- The radiation sources and the shields must not be damaged and valid leak certificates must be available. We also need the source certificates from you.
- The source may only be delivered after approval by BERTHOLD Technologies, otherwise acceptance of the delivery will be refused.
- If radioactive sources with isotope Am-241 or Cm-244 are returned, the special form certificate must be attached.
- Radioactive sources sent to BERTHOLD Technologies must be labelled with your name and address. Our order number must be given.

NOTICE



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

8 Appendices

8.1 Check Lists for Periodic Inspection

Shield data	
Material number	
Serial number	

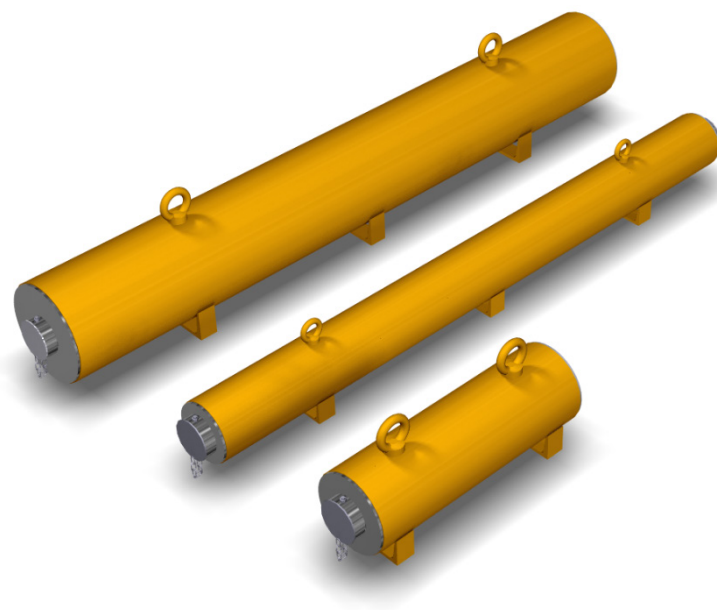
Requirement	met	not met
The shield does not show any obvious damages (e.g. dents, cracks, holes, deformations)		
The weld seams of the shield do not show any faults (cracks or changes, etc.)		
The shield does not show any signs of corrosion, e.g. chipping, visual changes.		
Only before shipment: Both sealing plugs are mounted, fastened and locked with a padlock.		
Only before shipment: Seal attached to both closures of the shield.		
Only before shipment: The covers must be mounted and secured.		
Name of inspector:	Date:	Signature:

NOTICE



If deviations are detected during the test that could impair the safety of the shield, measures must be taken immediately in consultation with Berthold to rectify them.

We reserve the right to further developments and technical modifications of our products.



LB 8000 Transport Shields Technical Information

72682TI2
Rev. No.: 00, 04/2024

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1. Maximum Permissible Activities during Transport

The activity is determined in each case for the necessary load, nuclide, number, length, activity distribution in compliance with the limit of 2000 $\mu\text{Sv} / \text{h}$ at the surface of the packaging or lower values due to other provisions in advance.

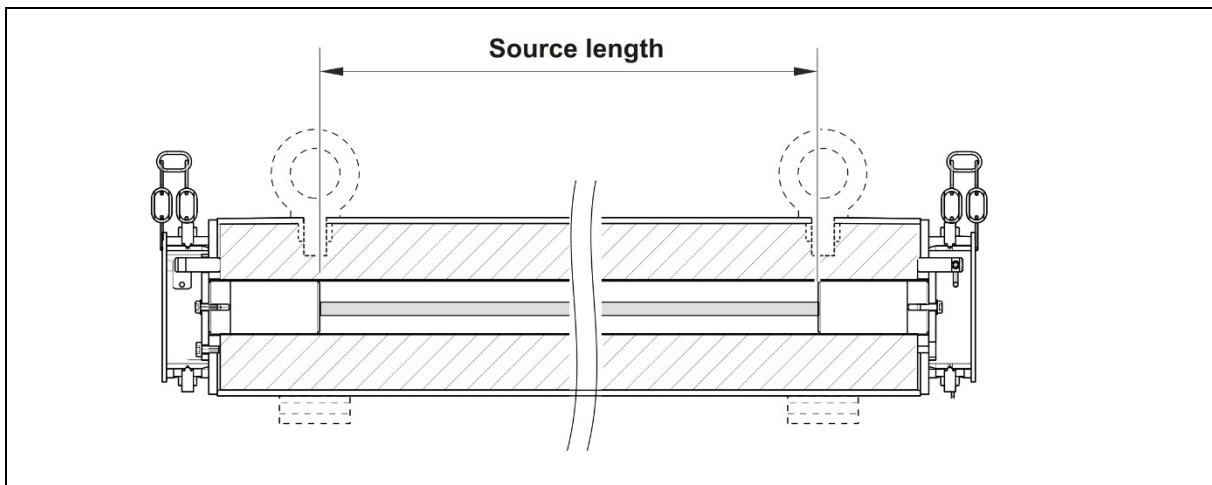
2. Technical Data

IMPORTANT



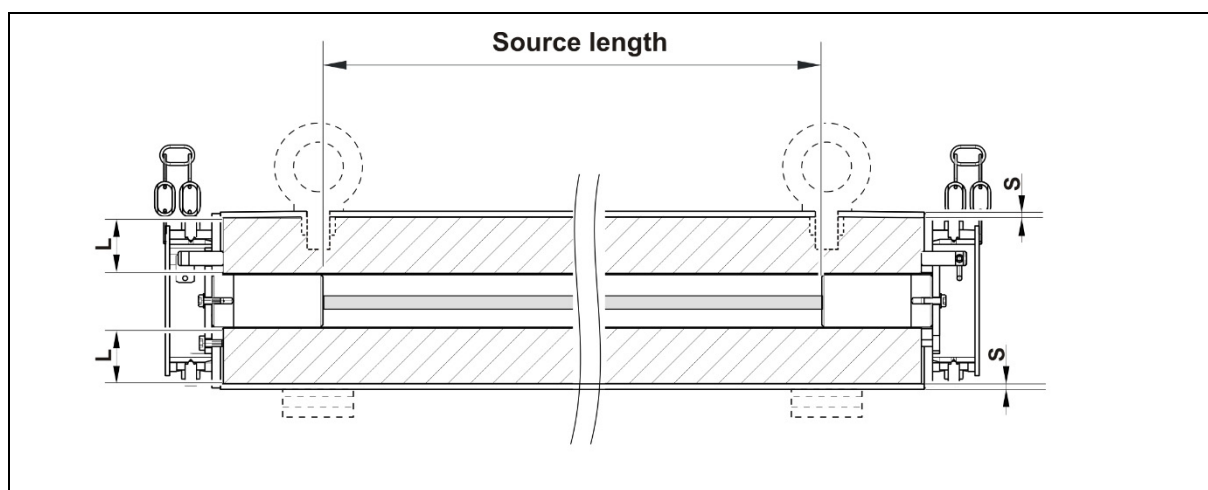
Maximal load (pieces) of rod sources in the transport shield with and without adapter:

- with adapter (inner $\varnothing = 22 \text{ mm}$) up to 4 rod sources or 3 rod sources connected with joint.
- without adapter (inner $\varnothing = 38 \text{ mm}$) up to 18 rod sources or 10 rod sources connected with joint.



TI-Fig.1 Sectional view (Source length)

3. Dimensions



TI-Fig.2 Dimensions Transport shield

Nominal \varnothing	ID	Total length	L (Lead)	S (Steel)
130	72682-01	576 mm	38 mm	3.5 mm
	72682-02	826 mm	38 mm	3.5 mm
	72682-03	1126 mm	38 mm	3.5 mm
	72682-04	1476 mm	38 mm	3.5 mm
	72682-05	1776 mm	38 mm	3.5 mm
160	72683-01	626 mm	54 mm	5 mm
	72683-02	876 mm	54 mm	5 mm
	72683-03	1176 mm	54 mm	5 mm
	72683-04	1526 mm	54 mm	5 mm
	72683-05	1826 mm	54 mm	5 mm
200	72684-01	686 mm	74 mm	6 mm
	72684-02	936 mm	74 mm	6 mm
	72684-03	1236 mm	74 mm	6 mm
	72684-04	1586 mm	74 mm	6 mm
	72684-05	1886 mm	74 mm	6 mm
270	72685-01	776 mm	106 mm	7 mm
	72685-02	1026 mm	106 mm	7 mm
	72685-03	1326 mm	106 mm	7 mm
	72685-04	1676 mm	106 mm	7 mm

3.1. Variant 72682-0X (Nominal \varnothing 130)

Variant	Source length	Weight	Magazine for 5 rod sources (book separately)	Adapter for inner \varnothing 22 + 10 mm lead (book separately)
ID: 72682-01	353 mm	69 kg	ID: 42885	ID: 60197
ID: 72682-02	603 mm	100 kg	ID: 38155	ID: 60735
ID: 72682-03	903 mm	138 kg	ID: 38156	ID: 60204
ID: 72682-04	1253 mm	181 kg	ID: 38157	ID: 60737
ID: 72682-05	1553 mm	219 kg	ID: 48940	ID: 61391

3.2. Variant 72683-0X (Nominal \varnothing 160)

Variant	Source length	Weight	Magazine for 5 rod sources (book separately)	Adapter for inner \varnothing 22 + 10 mm lead (book separately)
ID: 72683-01	353 mm	120 kg	ID: 42885	ID: 60197
ID: 72683-02	603 mm	171 kg	ID: 38155	ID: 60735
ID: 72683-03	903 mm	232 kg	ID: 38156	ID: 60204
ID: 72683-04	1253 mm	304 kg	ID: 38157	ID: 60737
ID: 72683-05	1553 mm	365 kg	ID: 48940	ID: 61391

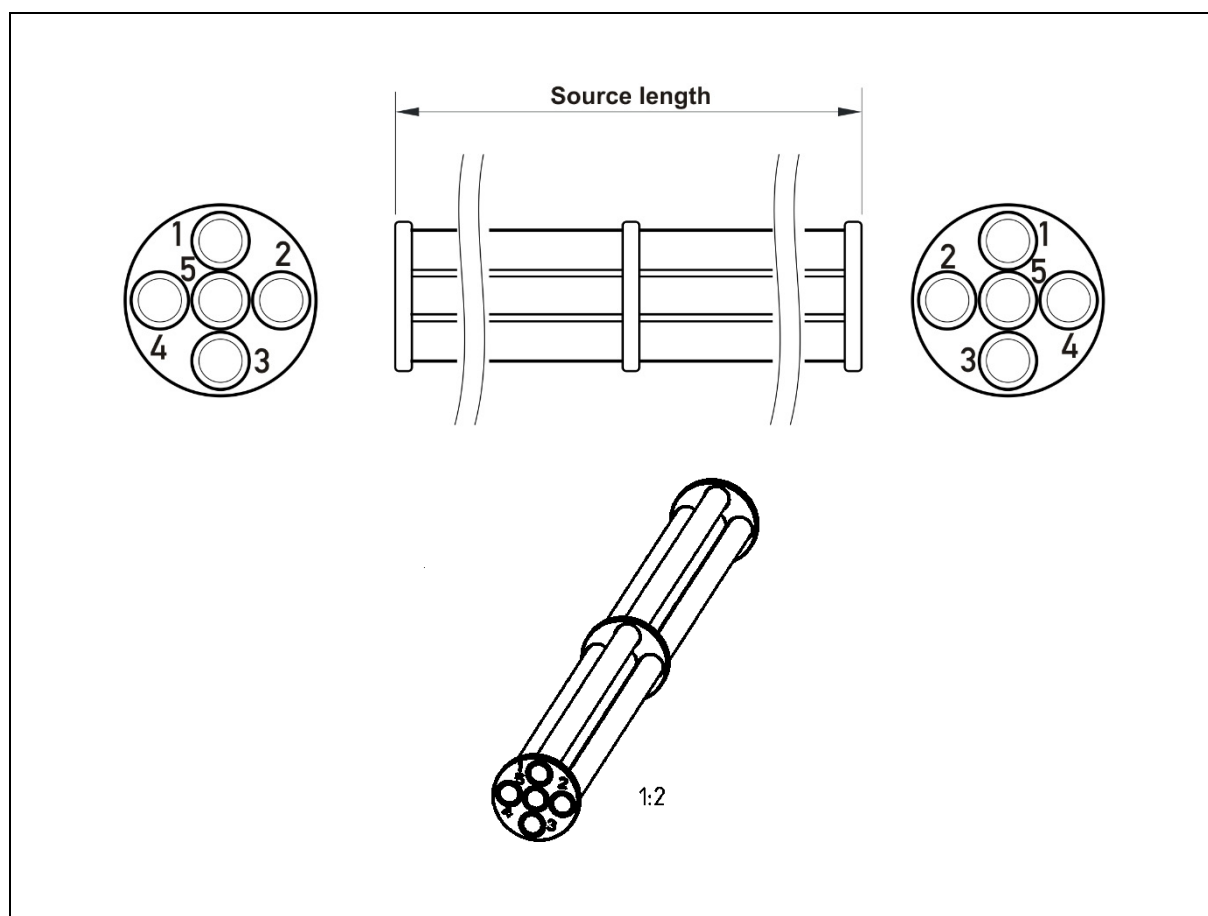
3.3. Variant 72684-0X (Nominal \varnothing 200)

Variant	Source length	Weight	Magazine for 5 rod sources (book separately)	Adapter for inner \varnothing 22 + 10 mm lead (book separately)
ID: 72684-01	353 mm	218 kg	ID: 42885	ID: 60197
ID: 72684-02	603 mm	303 kg	ID: 38155	ID: 60735
ID: 72684-03	903 mm	405 kg	ID: 38156	ID: 60204
ID: 72684-04	1253 mm	525 kg	ID: 38157	ID: 60737
ID: 72684-05	1553 mm	627 kg	ID: 48940	ID: 61391

3.4. Variant 72685-0X (Nominal \varnothing 270)

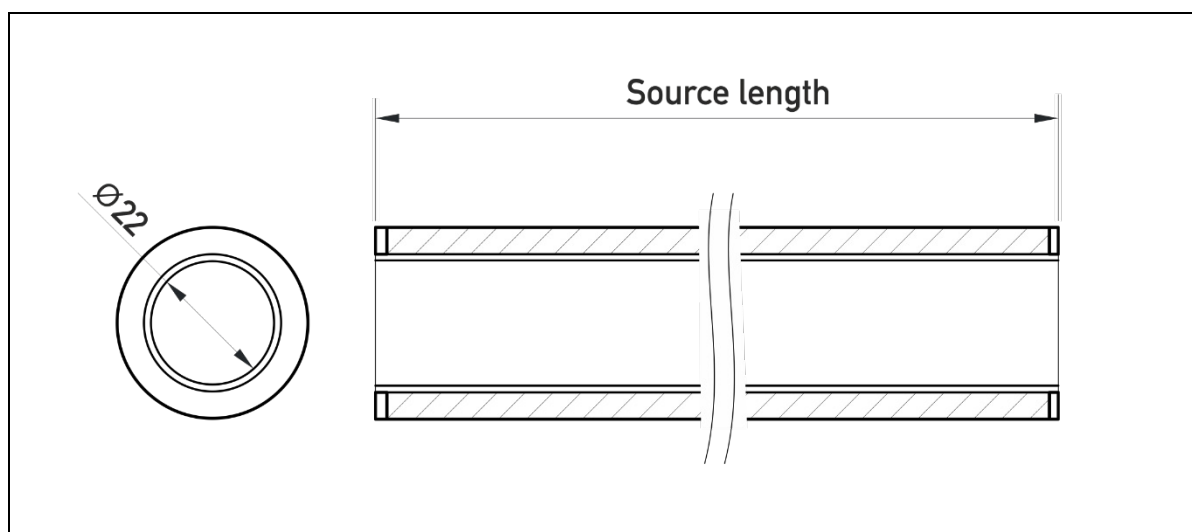
Variant	Source length	Weight	Magazine for 5 rod sources (book separately)	Adapter for inner \varnothing 22 + 10 mm lead (book separately)
ID: 72685-01	353 mm	436 kg	ID: 42885	ID: 60197
ID: 72685-02	603 mm	587 kg	ID: 38155	ID: 60735
ID: 72685-03	903 mm	769 kg	ID: 38156	ID: 60204
ID: 72685-04	1253 mm	981 kg	ID: 38157	ID: 60737

4. Magazine

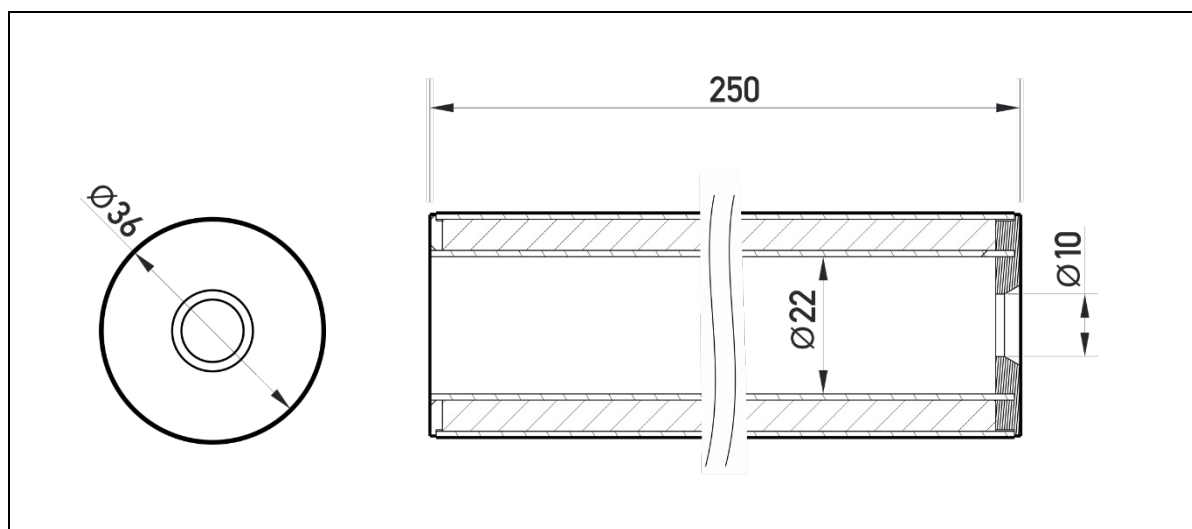


TI-Fig.3 Dimensions Magazine

5. Adapter



TI-Fig.4 Adapter



TI-Fig.5 Adapter ID 74208 for point source transportation (mounted on source holder) when using a rod source magazine in the same transport shield at the same time

We reserve the right to further developments and technical modifications of our products.