

Special Documentation

Transportation cask for shipping radioactive sources

Radiometric level measurement

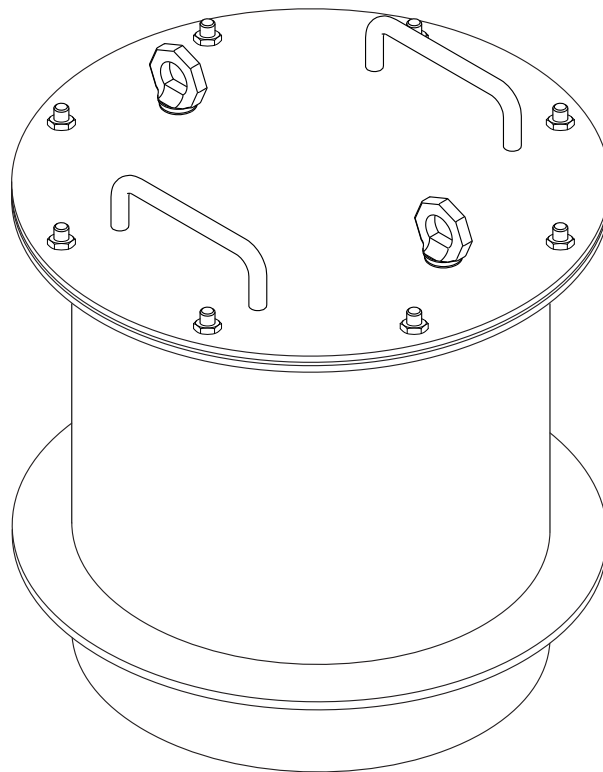


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1 About this document

1.1 Document function

This document describes the removal of source capsules from the transportation insert and the loading of the transportation cask when returning the product.

1.2 Symbols used

1.2.1 Safety symbols

CAUTION

This symbol alerts you to a dangerous situation. Failure to avoid this situation can result in minor or medium injury.

DANGER

This symbol alerts you to a dangerous situation. Failure to avoid this situation will result in serious or fatal injury.

NOTICE

This symbol contains information on procedures and other facts which do not result in personal injury.

WARNING

This symbol alerts you to a dangerous situation. Failure to avoid this situation can result in serious or fatal injury.

1.2.2 Symbols for certain types of information






This symbol indicates additional information






This symbol indicates a reference to documentation




1.2.3 Symbols in graphics

 1,  2,  3,...

Indicates a series of steps

 1,  2,  3,...

Indicates item numbers

 A,  B,  C, ...

Indicates views

1.3 Supplementary documentation



The documentation is enclosed with the devices or available in the Downloads area of the Endress+Hauser website: www.endress.com → Downloads.

FSG60 (¹³⁷Cs), FSG60 (⁶⁰Co)



TI00439F/00/EN

Technical Information for gamma radiation source FSG60 and FSG61

FQG60, FQG61, FQG62, FQG63, FQG66

SD00297F/00/EN

Special Documentation for source container FQG60, FQG61, FQG62, FQG63, FQG66
Instructions for loading and changing the source



Information and documentation on other source containers are available on request.



Other documentation is available in the Downloads area of the Endress+Hauser
website: www.endress.com → Downloads

2 Radiation protection

2.1 Prerequisite

Staff who remove the source capsules from the transportation insert or who load the transportation cask must have the appropriate training and approval to perform the task and must be familiar with the design and construction characteristics of the transportation cask.

Before starting work: personnel must read and understand the instructions in the manual and supplementary documentation as well as the certificates (depending on the application).

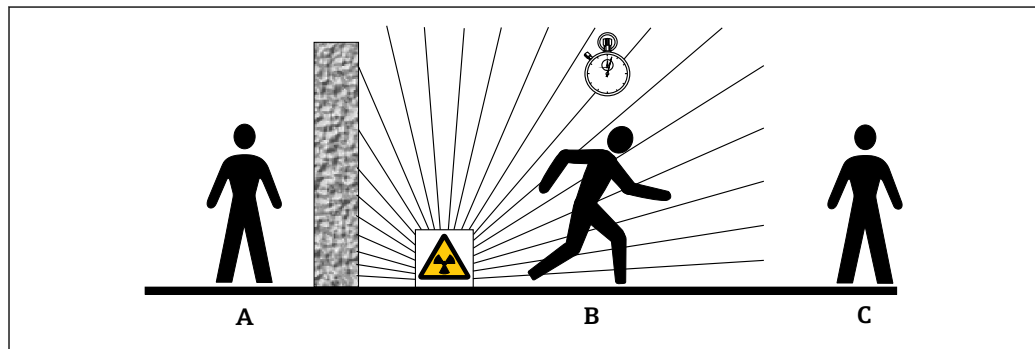
2.2 General information

⚠ WARNING

Radiation protection

- ▶ Never grip the source capsule directly by the hands; always use a tool (removal aid, long pair of tweezers) to keep a distance of at least 10 cm (3.94 in).

When working with radioactive sources, avoid any unnecessary exposure to radiation. All unavoidable radiation exposure must be kept to a minimum. Three basic concepts apply to achieve this:



- A *Shielding*
- B *Time*
- C *Distance*

2.2.1 Shielding

Ensure the best possible shielding between the radiation source and yourself and all other persons. Effective shielding is provided by source containers (FQG60, FQG61/ FQG62, FQG63, FQG66) and all high-density materials (lead, iron, concrete etc.).

2.2.2 Time

Remain as short as possible in the area exposed to radiation.

2.2.3 Distance

Keep as far away from the radiation source as possible. The radiation intensity decreases in proportion to the square of the distance from the radiation source.

2.3 Estimating the dose

Under the conditions stated above, it is assumed that the replacement procedure (removal and installation) will take 2 minutes. This results in the following dose ¹⁾:
15 mSv ²⁾ for 18.5 GBq ¹³⁷Cs or 12.1 mSv for 1.85 GBq ⁶⁰Co.

⚠ WARNING

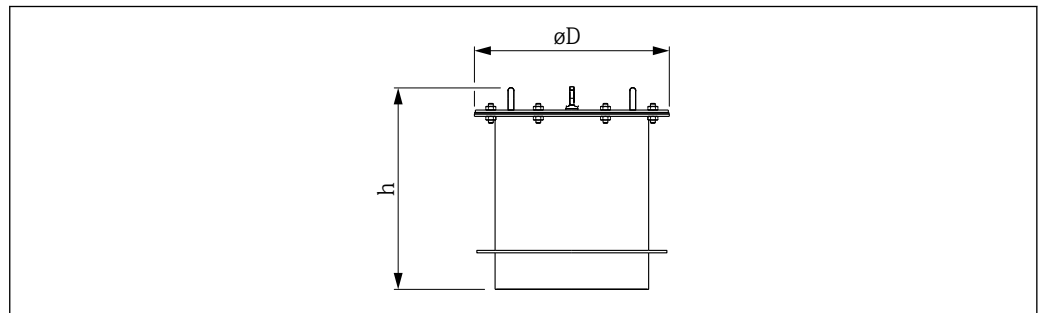
Keep radiation exposure to a minimum when replacing the radiation source

- ▶ As a general rule, have radiation sources replaced at Endress+Hauser.
- ▶ Always have Endress+Hauser replace radiation sources for activities over 18.5 GBq (¹³⁷Cs) or 1.85 GBq (⁶⁰Co).

3 Handling the transportation cask T40, T75, T110

3.1 Transport cask versions

3.1.1 Transportation cask T40



A0038319

h: 430 mm (16.9 in)

øD: 400 mm (15.7 in)

Material: 304 (1.4301); PUR 2K texture paint RAL2000 (orange)

Max. total capacity:

- ⁶⁰Co (0.37 GBq)
- ¹³⁷Cs (18.5 GBq)

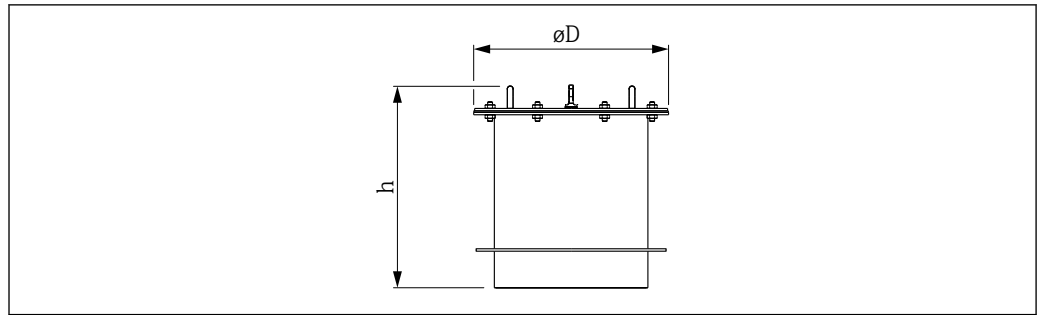
Max. empty weight: 60 kg (132.30 lb)

Max. permitted loading weight: 15 kg (33.08 lb)

Operating temperature: -40 to +70 °C (-40 to +158 °F)

-
- 1) Worst case assumption: radiation source for 2 min at a distance of 10 cm (3.94 in) from the body without shielding. The radiation weighting factor has been assumed to be "1" (γ-radiation). The individual organ doses have not been considered.
 - 2) This is approximately one tenth of the limit for the organ dose according to Section 54 (2.) of the German Radiation Protection Ordinance (Strahlenschutzverordnung) for hands or forearms of occupationally exposed persons, category B, value 150 mSv.

3.1.2 Transportation cask T75



A0038319

h : 565 mm (22.2 in)

$\varnothing D$: 580 mm (22.8 in)

Material: 304 (1.4301); PUR 2K texture paint RAL2000 (orange)

Max. total capacity

Max. total capacity:

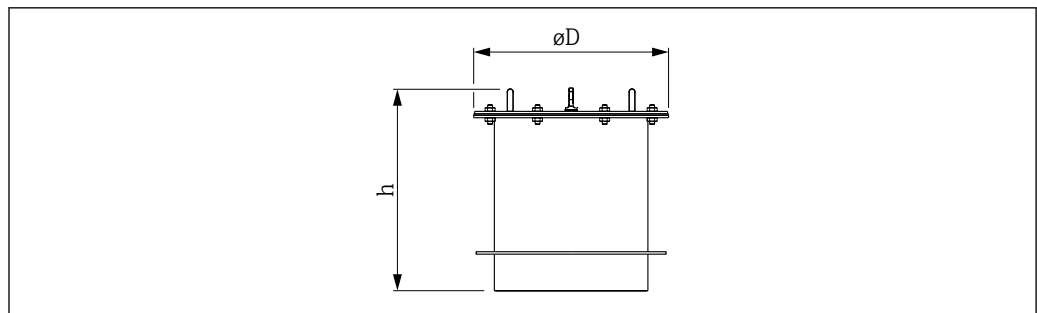
- ^{60}Co (4.81 GBq)
- ^{137}Cs (888 GBq)

Max. empty weight: 151 kg (332.96 lb)

Max. permitted loading weight: 24 kg (52.92 lb)

Operating temperature: -40 to $+70$ °C (-40 to $+158$ °F)

3.1.3 Transportation cask T110



A0038319

h : 574 mm (22.6 in)

$\varnothing D$: 580 mm (22.8 in)

Material: 304 (1.4301); PUR 2K texture paint RAL2000 (orange)

Max. total capacity:

- ^{60}Co (37 GBq)
- ^{137}Cs (888 GBq)


Max. empty weight: 272 kg (599.77 lb)

Max. permitted loading weight: 28 kg (61.74 lb)

Operating temperature: -40 to $+70$ °C (-40 to $+158$ °F)


3.2 Storage conditions

- It is not permitted to store containers outdoors when loaded!
- Both empty and loaded containers must be stored in such a way that they are dry, protected from the weather and secured against theft!
- It is not permitted to store containers that are not fully closed!

 See also the handling instructions (SD01389F/00).

3.3 Transport options

Two M12 eyebolts for slings are provided in the cover for transportation purposes (included in the delivery).

 See also the handling instructions (SD01389F/00).

3.4 Scope of delivery of a loaded transportation cask

- Loaded transportation cask
- Transportation cask loading report
- Loading plan; transportation insert for radioactive source capsules
- Copies of the certificates for the loaded source capsules if replacing the radiation source
- Special tool (long pair of tweezers, removal aid, collecting vessel)
- Manufacturer's Declaration ³⁾
- Documentation
 - SD01316F/00 (Special Documentation: transportation cask) ³⁾
 - SD01389F/00 (Special Documentation: handling instructions)

3.4.1 Checking the cask

The following checks must be performed before sending the transportation cask:

- The maximum total capacity may not be exceeded.
- The container must be intact and undamaged.
- The scope of delivery must be complete and the labeling must correspond to the contents.

3) Not for returns

4 Inserting the source capsules (loading by the customer onsite)

4.1 General information

- i** ▪ Heed the handling instructions (SD01389F/00).
- Heed the information in SD00297F/00 for the removal of the source capsule insert!
- Pay attention to radiation protection.
- Pay attention to the loading plan.
- Pay attention to the information in the "Using the removal tool for cylindrical source capsules" section.

4.2 Safety instructions

⚠ WARNING

Avoid excessively high radiation.

- ▶ Only use one source capsule at any one time.
- ▶ The transportation insert remains in the transportation cask the entire time.
- ▶ If the seal on the transportation cask is damaged, replace the seal (see SD01389F/00).

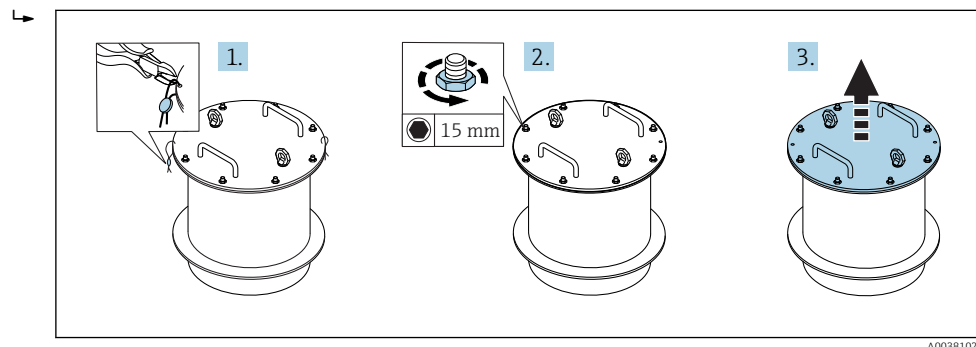
⚠ WARNING

Risk of injury!

- ▶ The container must be placed on a level, solid surface.

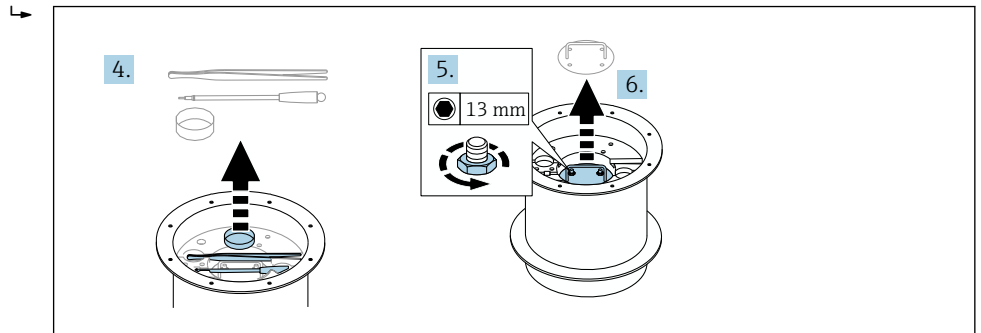
4.3 Procedure

1. Remove the lead seal on the cover of the transportation cask.
2. Release the screw connections on the cover (8 x M10 with 15mm AF).
3. Remove the cover and set it aside.



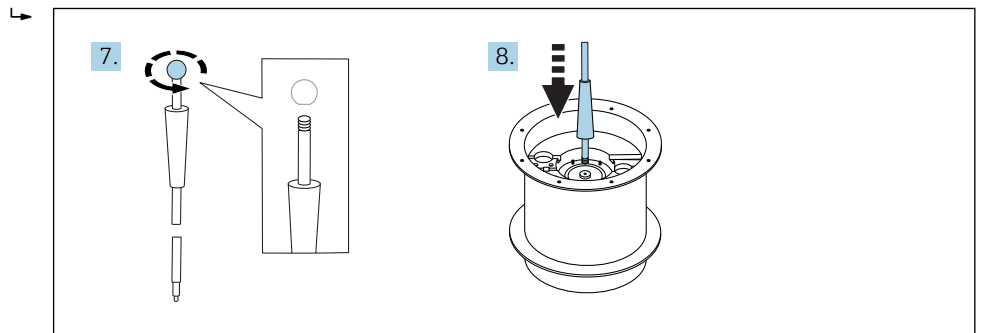
4. Remove the removal aid, tweezers and collecting vessel and set them aside.
5. Release the screw connection on the cover of the shielding container (4 x M8 with 13mm AF).

6. Remove the cover. The transportation insert for the source capsules is now free and remains in the transportation cask the entire time.



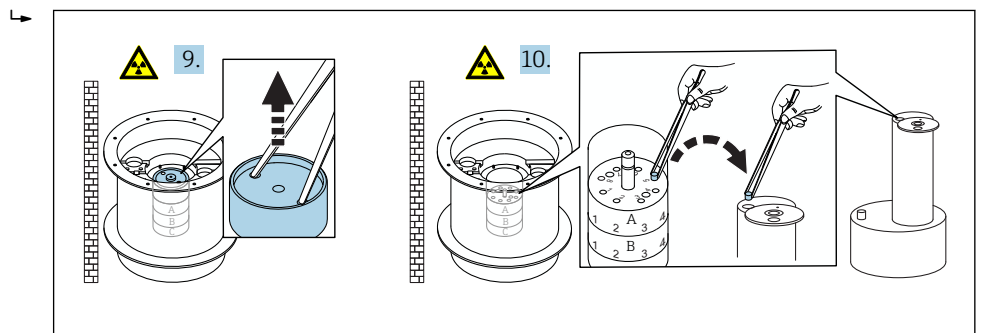
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7. Twist off the ball knob of the removal aid.
8. Using the removal aid, push down the retaining bolt in the middle of the transportation insert ("Using the removal tool for cylindrical source capsules"). The entire transportation insert is unlocked.



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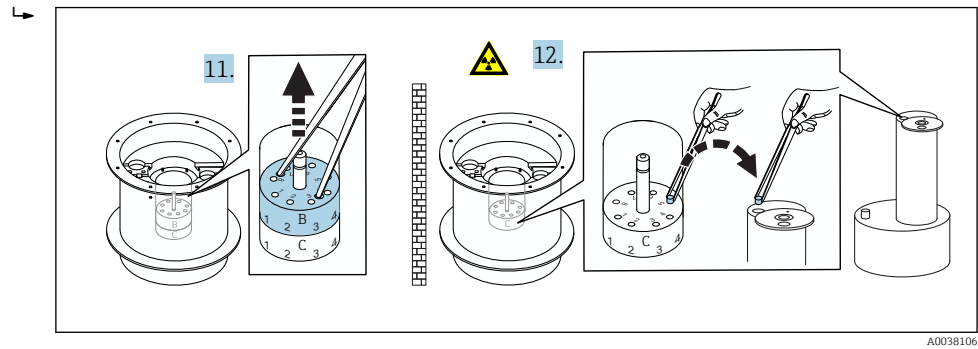
9. Remove the cover of the transportation insert using the tweezers.
10. Remove the source capsule(s) in the first level (A) of the transportation insert and place the capsule in the source capsule insert of the source container. (Example: The first level (A) is filled with a maximum of 8 source capsules. For more precise information on the loading, see the loading plan). The second level (B) may only be opened once all the source capsules in the first level (A) have been removed! Proceed in the same way with the second level (B).



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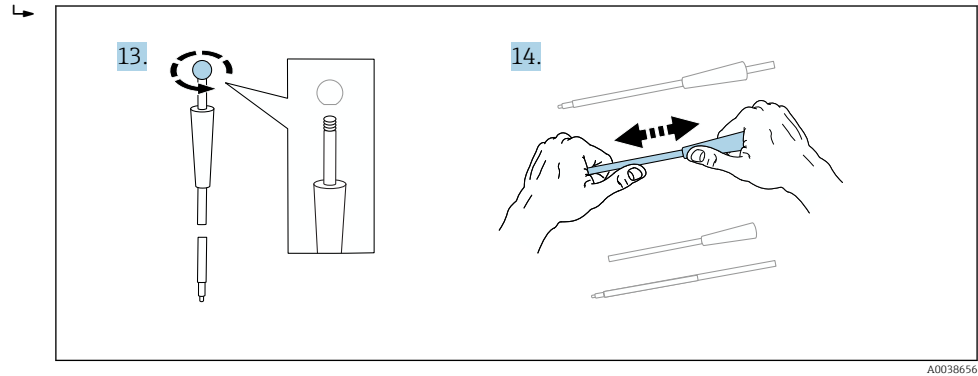
11. To remove the source capsules from the third level (C): remove the second level (B) of the transportation insert using the tweezers.

12. The third level (C) may only be opened once all the source capsules in the second level (B) have been removed! Remove the source capsule(s) in the third level (C) of the transportation insert and place the capsule in the source capsule insert of the source container.



13. Twist off the knob of the removal aid.

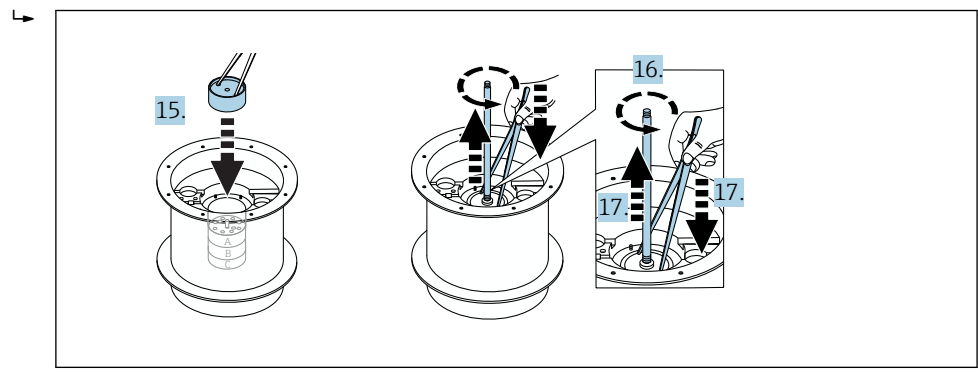
14. Take the removal aid apart.



15. Reinsert all the removed levels of the transportation insert in the reverse order and then fit the cover of the transportation insert.

16. Screw the rod of the removal aid into the cover of the transportation insert.

17. Lift up the rod and simultaneously apply counterpressure with the tweezers to engage the retaining bolt of the transportation insert ("Replacing the source capsules").

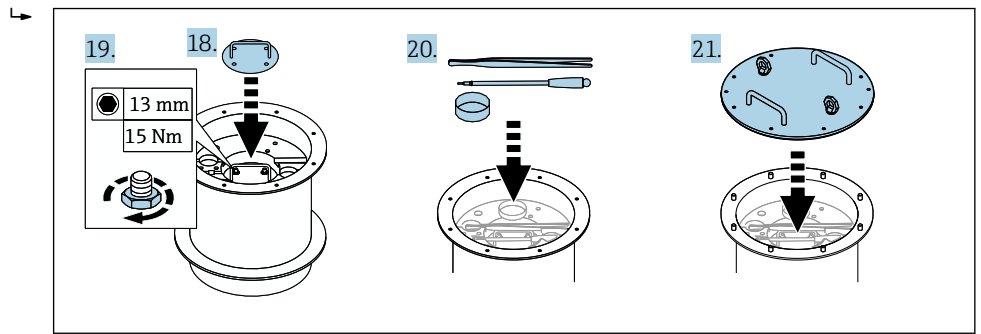


18. Fit the cover.

19. Secure the cover: 4 x M8 with 13mm AF (max. 15 Nm (11.06 lbf ft)).

20. Insert the special tool (removal aid, tweezers, collecting vessel) into the transportation cask.

21. Check the outer seal carefully and fit the cover.



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22. Close the transportation cask (8 x M10 with 15mm AF (max. 25 Nm (18.43 lbf ft))). Return the transportation cask to Endress+Hauser (see also "Returning an empty transportation cask").



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5 Scope of delivery when returning an empty transportation cask

- Empty transportation cask
- Special tool (long pair of tweezers, removal aid, collecting vessel)


5.1 Checking the cask

The following measures are necessary before sending the transportation cask:

- Fill in the checklist and enclose it
- Check the container to ensure it is intact and undamaged
- Check for completeness

6 Replacing source capsules

6.1 General information

-  ▪ Observe the information in the "Radiation protection" section!
- Heed the handling instructions SD01389F/00.
- Heed the information in SD00297F/00 for the removal of the source capsule insert!
- Pay attention to the loading plan.
- Pay attention to the information in the "Using the removal tool for cylindrical source capsules" section.

6.2 Safety instructions

WARNING

Avoid excessively high radiation

- ▶ The transportation cask is opened before the following steps are performed!
- ▶ Only use one source capsule at any one time.
- ▶ The transportation insert remains in the transportation cask the entire time.
- ▶ If the seal on the transportation cask is damaged, replace the seal (see SD01389F/00/DE).

WARNING

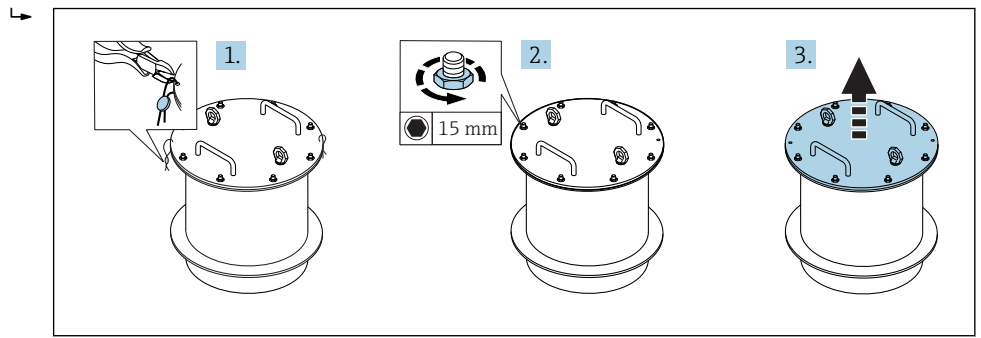
Risk of injury!

- ▶ The container must be placed on a level, solid surface.

6.3 Example: cylindrical source capsules

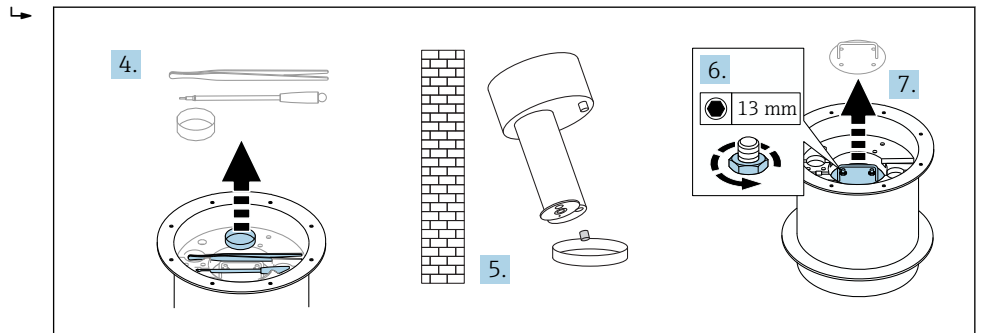
1. Remove the lead seal on the cover of the transportation cask.
2. Release the screw connections on the cover (8 x M10 with 15mm AF).

3. Remove the cover and set it aside.



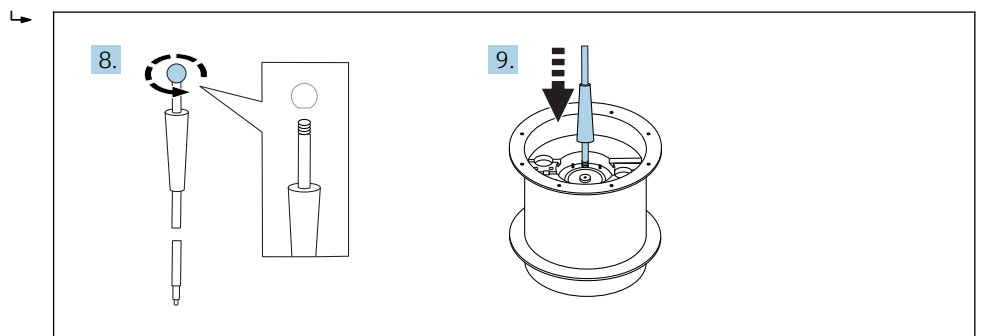
A0038102

4. Remove the removal aid, tweezers and collecting vessel and set them aside.
5. Remove the used source capsule from the source capsule insert of the source container. The source capsules can be placed in the collecting vessel provided.
6. Release the screw connection on the cover of the shielding container (4 x M8 with 13mm AF).
7. Remove the cover. The transportation insert for the source capsules is now free and remains in the transportation cask the entire time.



A0038111

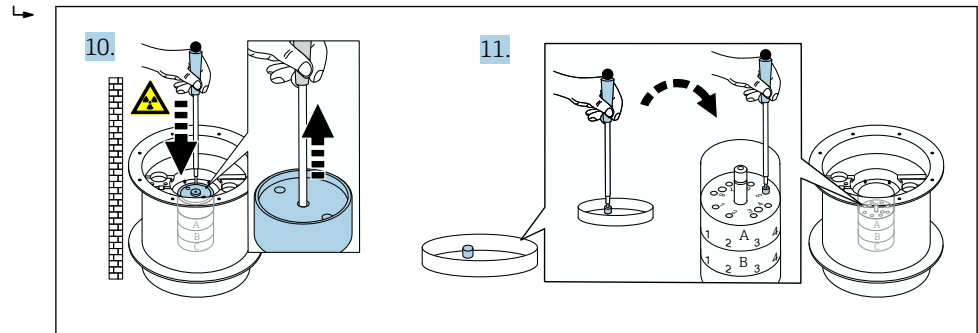
8. Twist off the ball knob of the removal aid.
9. Using the removal aid, push down the retaining bolt in the middle of the transportation insert ("Using the removal tool for cylindrical source capsules"). The entire transportation insert is unlocked.



A0038201

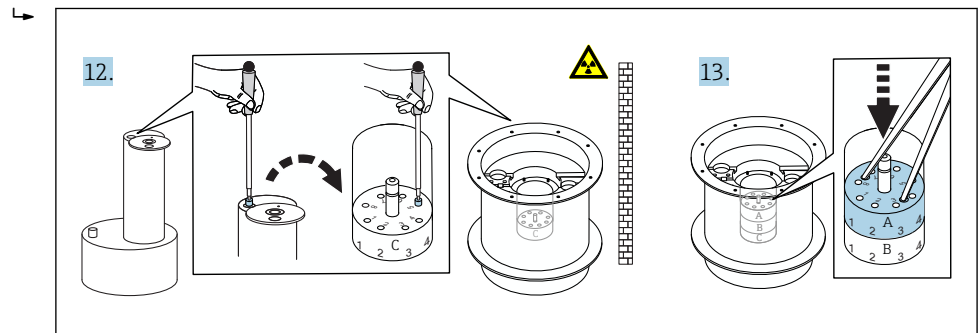
10. Remove the cover of the transportation insert using the removal aid.

11. Also remove levels that are not filled. Place the used source capsule into the transportation insert.



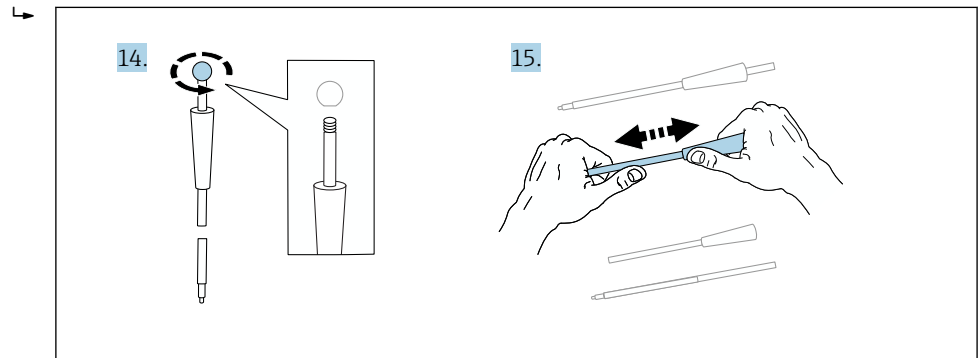
A0038112

12. First fill the lower level of the transportation insert (C).
 13. When the lower level of the source capsule insert (C) is full, use the tweezers to insert the second level (B) and fill this level. Once level B is full, fill the upper level (A).



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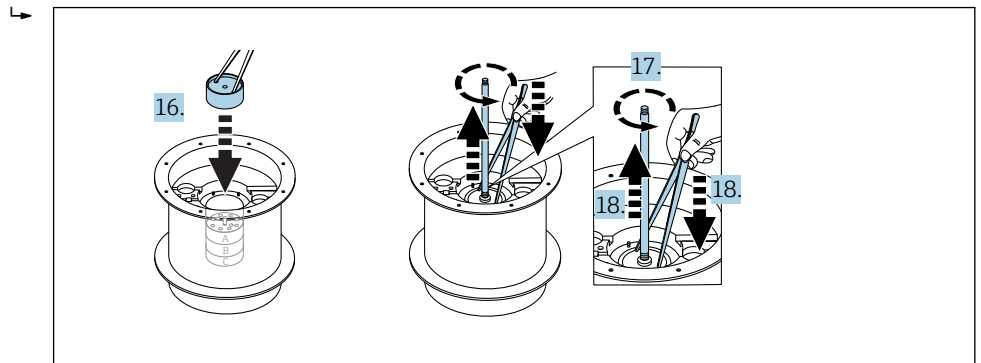
14. Twist off the knob of the removal aid.
 15. Take the removal aid apart.



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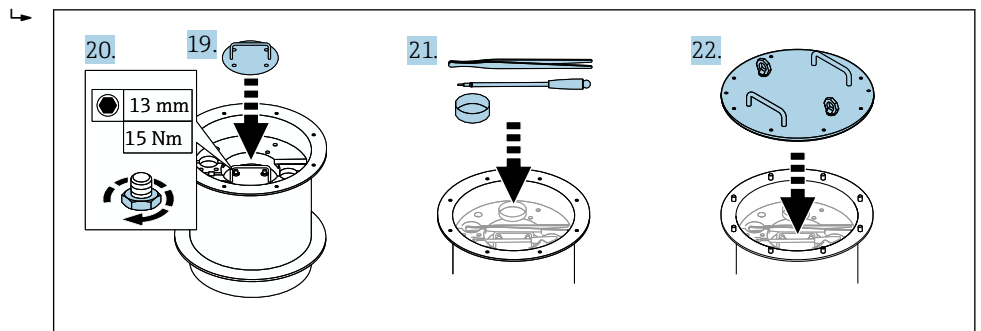
16. Put the cover of the transportation insert back on.
 17. Screw in the rod of the removal aid.

18. Lift up the rod and simultaneously apply counterpressure with the tweezers to engage the retaining bolt of the transportation insert ("Replacing the source capsules").



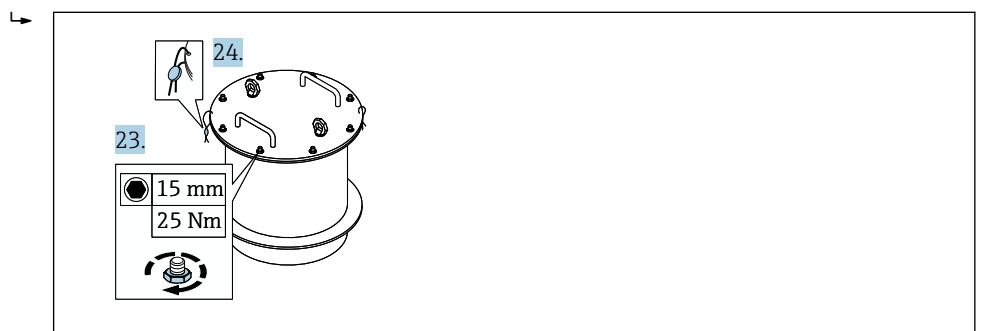
A0038684

19. Fit the cover.
20. Secure the cover: 4 x M8 with 13mm AF (max. 15 Nm (11.06 lbf ft)).
21. Insert the special tool (removal aid, tweezers, collecting vessel) into the transportation cask.
22. Check the outer seal carefully and fit the cover.



A0038685

23. Secure the cover screw connections: 8 x M10 with 15mm AF (max. 25 Nm (18.43 lbf ft)).
24. Fix a new lead seal on the cover of the transportation cask. Return the transportation cask to Endress+Hauser (see also "Returning a loaded transportation cask").



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6.4 Returning a loaded transportation cask

The following conditions must be met:

- The transportation cask must be identified as follows on two opposite sides:
 - Type A label
 - Two fully completed labels for hazardous substances
- The transport index has been determined
- The loading plan and special tool are provided in the transportation cask
- The inspection report (see the delivery papers on the exterior of the transportation cask) is filled in
- The transportation cask is securely closed and lead-sealed

The following documents are prepared by Endress+Hauser with the return documents and must be available at the time of dispatch:

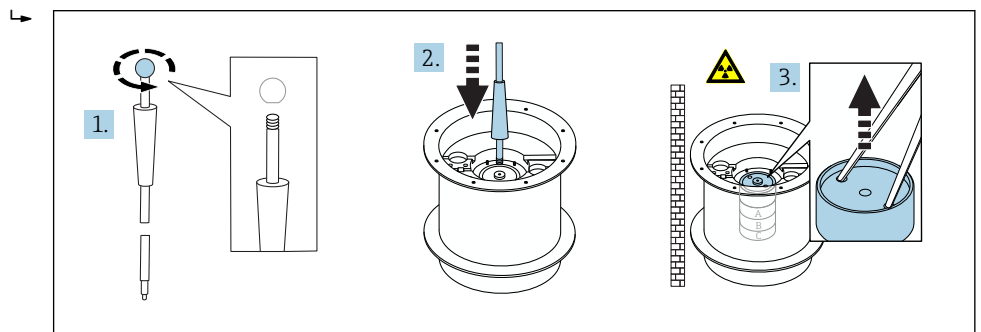
- Written authorization (provided to the driver)
- Pick-up order/transportation document according to the ADR (provided to the driver)
- Special Form Certificate if applicable (provided to the driver)
- Wipe test report (completed as per template and submitted to Endress+Hauser in advance for approval). The wipe test report must be included in the cask

7 Using the removal tool for cylindrical source capsules

7.1 Unlocking the transportation insert

The removal tool is only suitable for cylindrical source capsules with a $\varnothing 6.4$ mm!

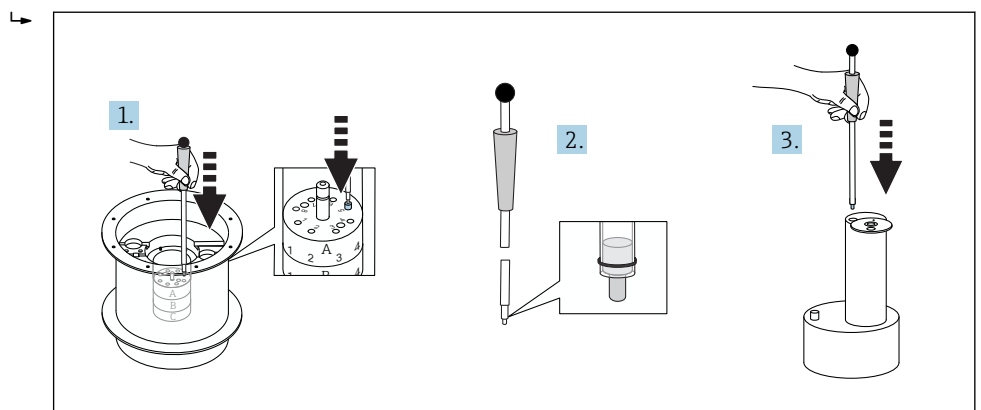
1. Remove the ball knob on the removal aid.
2. Press down the transportation insert to unlock it.
3. The cover of the transportation insert can now be removed using the tweezers.



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7.2 Removing the source capsule and equipping the source capsule insert

1. Place the removal tool vertically onto the source capsule in the transportation insert and press it down.
2. The source capsule is captured in the tube of the removal aid.
3. Press down the rod to insert the source capsule.



A0038193

8 Appendix

- i** Loading plan: transportation insert for radioactive sources (2 pages in total)
 - Complete **in full** when returning a loaded transportation cask.
 - Is included with the delivery documents on the exterior of the transportation cask.
- i** Auxiliary tools (removal aid, tweezers, collecting vessel) must be returned with the transportation cask. You will be charged for any missing tools

8.1 Loading plan: transportation insert for radioactive sources

8.1.1 Customer address

Company:

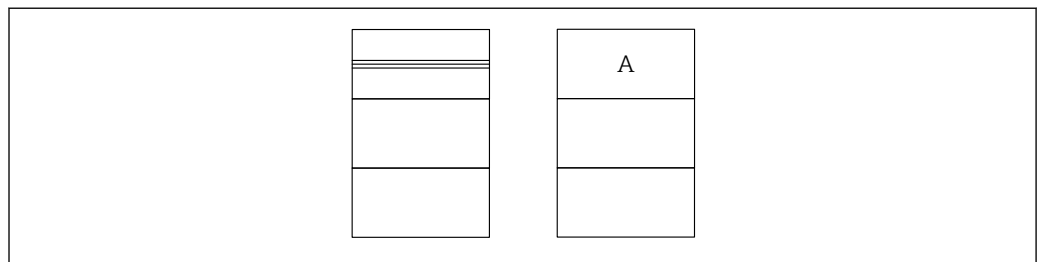
Street:

Zip code:

Place:

Tel:

8.1.2 Transportation insert, upper level

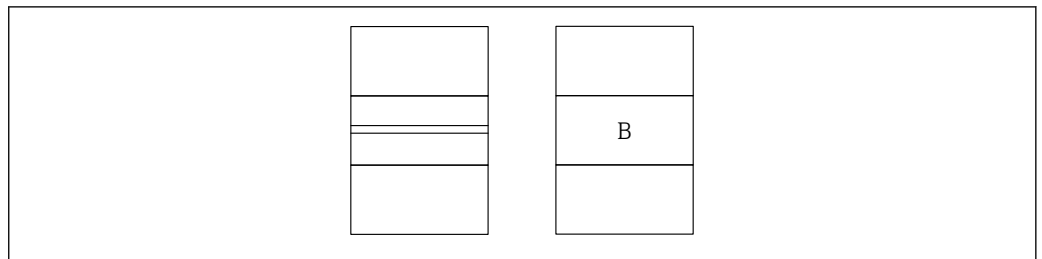


A0038316

1 Transportation insert, upper level: 3 rings or A

- Item 1: Isotope: ^{137}Cs , ^{60}Co , Source No.: _____, Activity: _____
- Item 2: Isotope: ^{137}Cs , ^{60}Co , Source No.: _____, Activity: _____
- Item 3: Isotope: ^{137}Cs , ^{60}Co , Source No.: _____, Activity: _____
- Item 4: Isotope: ^{137}Cs , ^{60}Co , Source No.: _____, Activity: _____
- Item 5: Isotope: ^{137}Cs , ^{60}Co , Source No.: _____, Activity: _____
- Item 6: Isotope: ^{137}Cs , ^{60}Co , Source No.: _____, Activity: _____
- Item 7: Isotope: ^{137}Cs , ^{60}Co , Source No.: _____, Activity: _____
- Item 8: Isotope: ^{137}Cs , ^{60}Co , Source No.: _____, Activity: _____

8.1.3 Transportation insert, middle level

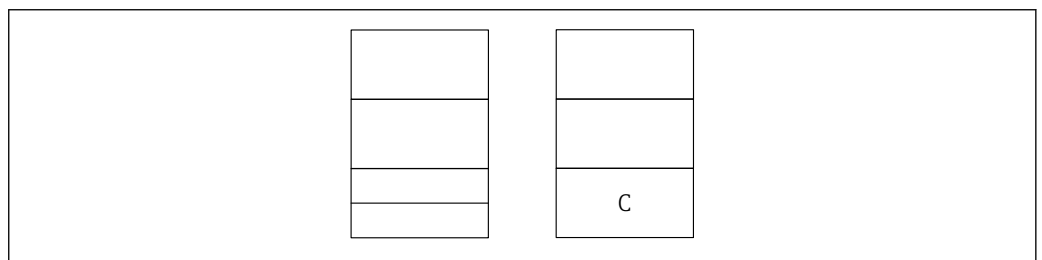


A0038317

2 Transportation insert, middle level: 2 rings or B

- Item 1: Isotope: ^{137}Cs , ^{60}Co , Source No.: _____, Activity: _____
- Item 2: Isotope: ^{137}Cs , ^{60}Co , Source No.: _____, Activity: _____
- Item 3: Isotope: ^{137}Cs , ^{60}Co , Source No.: _____, Activity: _____
- Item 4: Isotope: ^{137}Cs , ^{60}Co , Source No.: _____, Activity: _____
- Item 5: Isotope: ^{137}Cs , ^{60}Co , Source No.: _____, Activity: _____
- Item 6: Isotope: ^{137}Cs , ^{60}Co , Source No.: _____, Activity: _____
- Item 7: Isotope: ^{137}Cs , ^{60}Co , Source No.: _____, Activity: _____
- Item 8: Isotope: ^{137}Cs , ^{60}Co , Source No.: _____, Activity: _____

8.1.4 Transportation insert, lower level



A0038318

3 Transportation insert, lower level: 1 ring or C

- Item 1: Isotope: ^{137}Cs , ^{60}Co , Source No.: _____, Activity: _____
- Item 2: Isotope: ^{137}Cs , ^{60}Co , Source No.: _____, Activity: _____
- Item 3: Isotope: ^{137}Cs , ^{60}Co , Source No.: _____, Activity: _____
- Item 4: Isotope: ^{137}Cs , ^{60}Co , Source No.: _____, Activity: _____
- Item 5: Isotope: ^{137}Cs , ^{60}Co , Source No.: _____, Activity: _____
- Item 6: Isotope: ^{137}Cs , ^{60}Co , Source No.: _____, Activity: _____
- Item 7: Isotope: ^{137}Cs , ^{60}Co , Source No.: _____, Activity: _____
- Item 8: Isotope: ^{137}Cs , ^{60}Co , Source No.: _____, Activity: _____

The returned sources are clean, leak-tight and free from mechanical damage.

Checked for correctness:

Place and date: _____

Signature of Radiation Safety Officer: _____

Company stamp:



71429027

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