

Technical Information

Radiation source FSG60 and FSG61

Radiometric level measurement



Radiation source for non-contact level, point level, density and interface detection

Application

Radioactive gamma-emitting isotopes are used as radiation sources for level, density and interface measurement as well as for point level detection. The gamma radiation radiates evenly from the radiation source in all directions. For radiometric measurements, however, only radiation in one direction - i.e. the radiation passing through the vessel or pipe - is generally required. The radiation in all other directions is undesired and must be shielded off (attenuated). For this reason, the radiation sources are inserted into source containers, which ensure gamma radiation in one direction only.

Your benefits

- Radiation source in the source container ensures simple handling and easy installation
- Double-walled encasement of the radiation source complies with the strictest safety requirements: typical classification 66646 according to ISO2919
- Choice of isotope: ^{137}Cs or ^{60}Co
- Choice of required activity ensures optimized dosage for your application

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About this document

Symbols used

Safety symbols



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



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



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



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

Symbols for certain types of information



Warns against radioactive substances or ionizing radiation



Permitted

Procedures, processes or actions that are permitted



Preferred

Procedures, processes or actions that are preferred



Forbidden

Procedures, processes or actions that are forbidden



Tip

Indicates additional information



Reference to documentation

Symbols in graphics

1, 2, 3, ...

Item numbers

A, B, C, ...

Views

Radiation sources

Safety

^{137}Cs and ^{60}Co are sealed in double-walled, welded stainless steel capsules. The ruggedness of the radiation sources is classified according to DIN 25426, Part 1 or ISO 2919.

Classification C 66646 provides maximum protection against temperature, pressure, impact, vibrations and puncture.

Class 6:

- Temperature
 - $-40\text{ }^{\circ}\text{C}$ ($-40\text{ }^{\circ}\text{F}$) 20 min
 - $+800\text{ }^{\circ}\text{C}$ ($+1472\text{ }^{\circ}\text{F}$) 60 min
 - Thermal shock from $+800\text{ }^{\circ}\text{C}$ ($+1472\text{ }^{\circ}\text{F}$) to $+20\text{ }^{\circ}\text{C}$ ($+68\text{ }^{\circ}\text{F}$)
- Pressure
 - 0.025 to 170 MPa_{abs}
- Impact
 - 20 kg (44.1 lb) from height of 1 m (3.3 ft)
- Puncture
 - 1 kg (2.2 lb) from height of 1 m (3.3 ft)

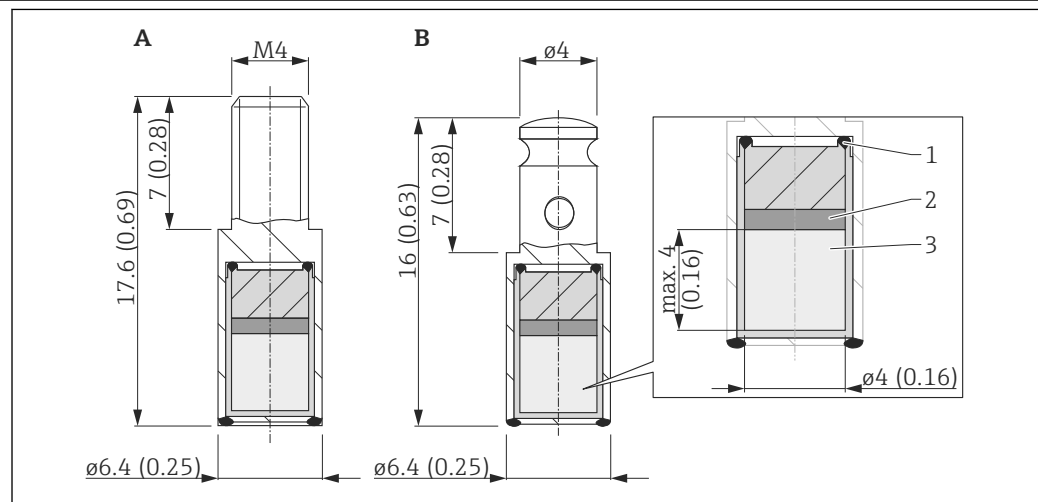
The manufacturer tests the leak-tightness and decontamination of each radiation source before delivery. After this test, the radiation source can be considered as a sealed radioactive material as defined in the Radiation Protection Regulation. Only tested radiation sources with a leak test certificate are supplied.

- The ^{60}Co is enclosed in the capsule as a solid metal
- The ^{137}Cs is enclosed in the capsule in the form of a ceramic substrate

 The radiation sources must be used in environmental conditions that guarantee the tightness and integrity of the capsule.

Technical data

Standard radiation sources



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 1 Engineering unit: mm (in)

A VZ1508-001 (CDC.P4), VZ1486-001 (CKC.P4)

B VZ79-001 (CDC.P4), VZ64-001 (CKC.P4), VZ79-002

1 Argon-arc welded

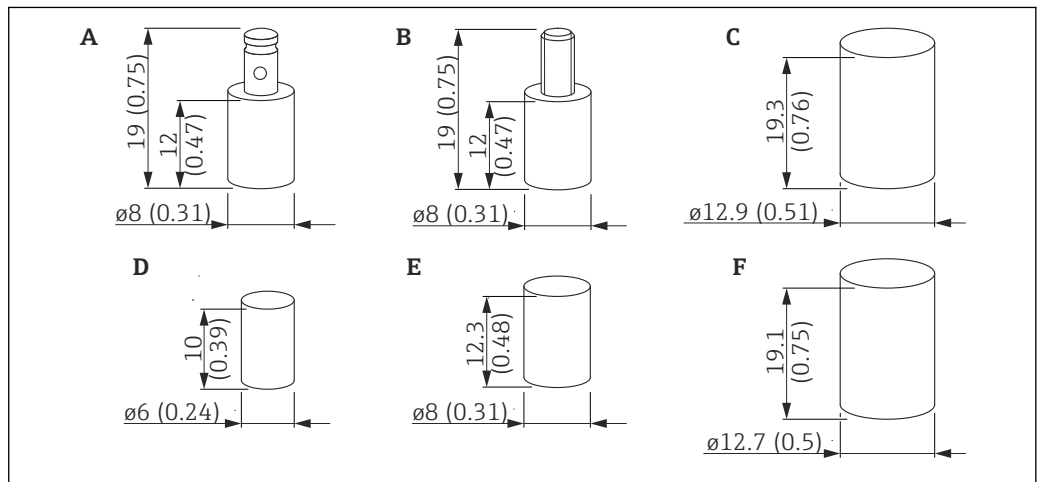
2 Empty volume filled with stainless steel screen

3 ^{60}Co as metal or ^{137}Cs as ceramic

- **Weight:** 0.005 kg
- **Double encapsulation:** 2 welded stainless steel capsules
- **Classification:** typically C66646 according to ISO 2919 or DIN 25426, Part 1
- **Degree of protection:** IP68

- **Operating temperature range:**
 - VZ64-001, VZ79-001, VZ1508-001, VZ1486-001, VZ357-001, VZ3579-001, P17, P17-1: -55 to +400 °C (-67 to +752 °F) ¹⁾
 - IGI-Z-3, IGI-Z-4: -60 to +150 °C (-76 to +302 °F)
 - X.9, X.38/4: -40 to +200 °C (-40 to +392 °F)
 - VZ79-002 classification C66646, ISO2919: -55 to +800 °C (-67 to +1472 °F)
Briefly: max.: +1350 °C (+2462 °F)
 - Other capsule types on request
- **Isotope material:**
 - ⁶⁰Co: metal
 - ¹³⁷Cs: ceramic
- **Radiation energy:**
 - ⁶⁰Co: 1.173 MeV and 1.333 MeV
 - ¹³⁷Cs: 0.662 MeV

Alternative source capsule types



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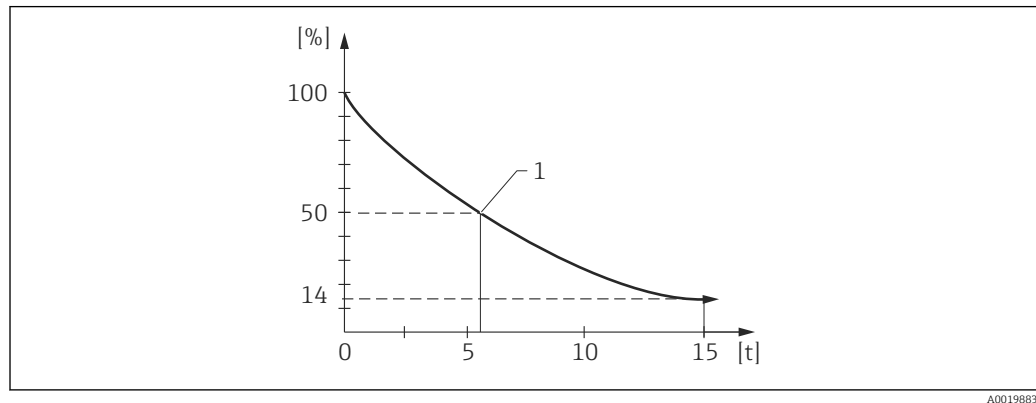
2 Engineering unit: mm (in)

- A VZ357-001
- B VZ3579-001
- C X.38/4
- D IGI-Z-3
- E X.9 (CDC.93), IGI-Z-4
- F P17, P17-1

1) US version (NRC license) limited to +200 °C (+392 °F)

Application

Application for ^{60}Co



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3 Decline in activity of a ^{60}Co radiation source over time

% Activity

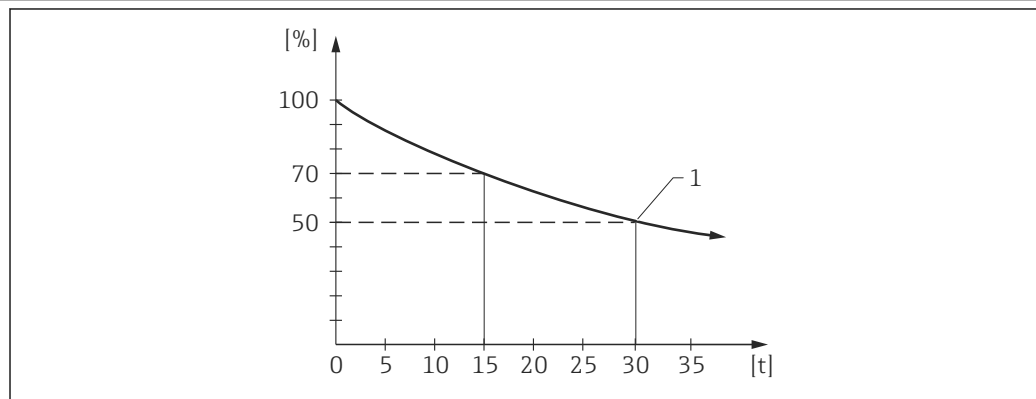
t Time in years

1 Half-life: 5.3 years

The ^{60}Co radiation source (radiation energy 1.173 MeV and 1.333 MeV; half-life 5.3 years) is mostly used for point level measurement if the activity required by ^{137}Cs is too high. Its advantage lies in its high penetration capacity, which enables measurement over large distances or through thick vessel walls. The ^{60}Co source should also be used for applications that measure continuously if the use of ^{137}Cs would require activities that are too high.

Example: Activity after 15 years of operation: 14 % -> replacement of radiation source is required.

Application for ^{137}Cs



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4 Decline in activity of a ^{137}Cs radiation source over time

% Activity

t Time in years

1 Half-life: 30 years

The ^{137}Cs (radiation energy 0.662 MeV) is ideal for continuous level measurement, point level detection and density measurement systems. Its half life of 30 years ensures a long operation time without the need for source replacement (lower costs and no recalibration).

As the radiation is readily absorbed, there is generally no control zone.

Example: Activity after 15 years of operation: 70 % -> no replacement of radiation source is required.

Delivery and transportation of the radiation sources in source containers or transportation casks

Identification

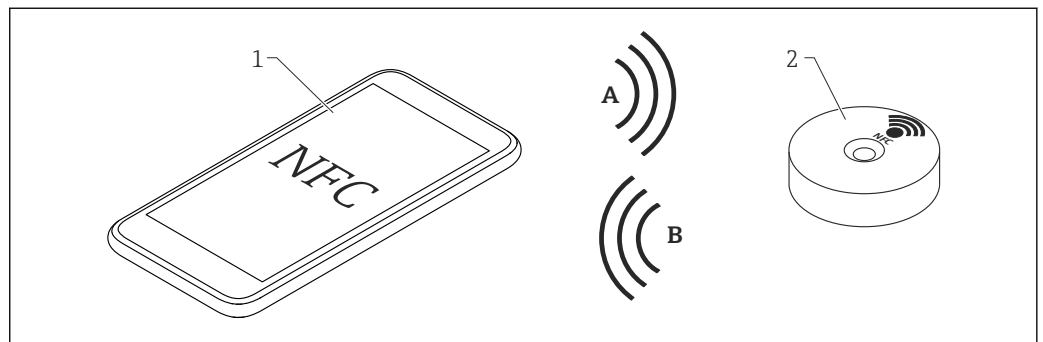
RFID TAG

Operating principle of RFID and NFC

Radio frequency identification (RFID) makes it possible to identify the measuring point without direct visual contact, and exchanges data between suitable terminal devices. A transponder consists of a microchip, an antenna and a carrier/housing. The digital information is saved in the microchip. Energy is supplied to the microchip during the communication process by the electromagnetic field initiated by the transmitter.

Near field communication (NFC) is an extension of RFID technology and is an international communication standard for wireless data transfer at a frequency of 13.56 MHz. The external power supply and safety standards only allow a short range with a maximum data transmission rate of 423 kBit/s and a connection setup of <0.1 s. The latest NFC technology can be used with NFC-enabled devices.

Passive NFC transponders do not have their own power source (e.g. batteries) and are therefore maintenance-free. They are powered by the electromagnetic field of the transmitter.



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5 Operating principle of RFID and NFC

A Data, energy


B Data

1 Mobile device that supports NFC

2 RFID TAG

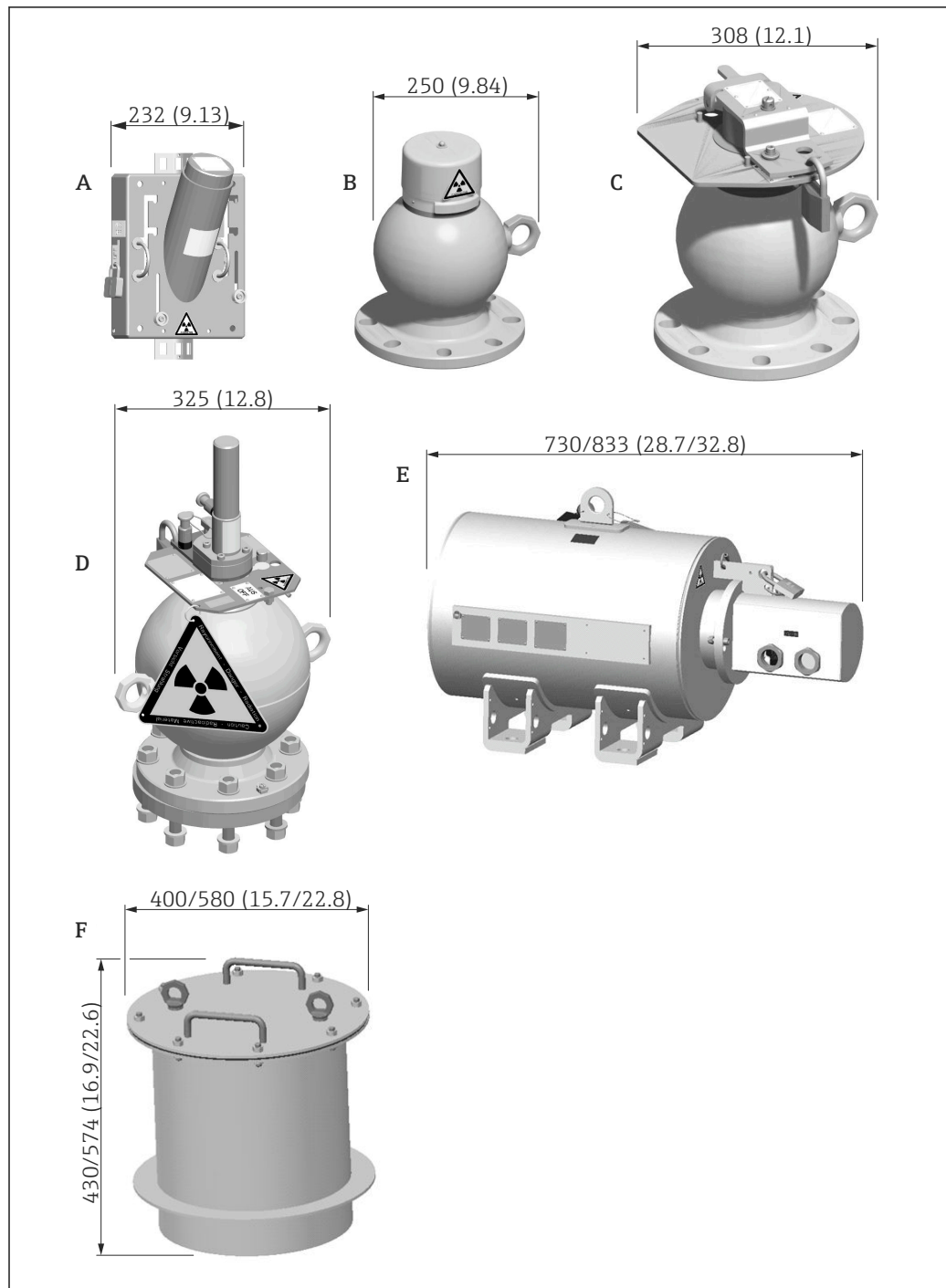
i The RFID TAGs of the radiation source (FSG60, FSG61) and the source container are identical in appearance. The only difference is the data they contain and their location on the device.

For additional information see:

 SD01502F/00

 ZE01020F/00

Dimensions



A0019884

6 Engineering unit: mm (in)

A FQG60

B FQG61

C FQG62

D FQG63

E FQG66

F Transportation cask T40/T75/T110

Additional information



TI00445F/00

FQG60, "Mechanical construction" section



TI00435F/00

FQG61, FQG62, "Mechanical construction" section



TI00446F/00

FQG63, "Mechanical construction" section



TI01171F/00

FQG66, "Mechanical construction" section




SD01316F/00

Transportation cask T40/T75/T110, "Delivery of a loaded transportation cask" section


Germany

Delivery conditions (within Germany only):

- Radiation sources can only be shipped once a copy of the handling permit has been provided
 - Source containers are always shipped with the radiation source installed
 - The source container is in the "OFF" position when the container is delivered
 - The "OFF" switch position is secured by a lock
 - If the user requires the source container to be delivered first and the radiation source to be delivered subsequently, the radiation source is subsequently delivered in a transportation cask
-  Endress+Hauser is happy to assist in procuring the necessary documents. Please contact your local sales organization for this purpose.

Other countries

Export conditions:

- Radiation sources can only be shipped once a copy of the import license has been provided
 - Radiation sources are shipped in the source container
 - The source container is in the "OFF" position when the container is delivered
 - The "OFF" switch position is secured by a lock
 - The source containers containing the installed radiation source are transported by a company commissioned by Endress+Hauser and officially certified to perform this type of transportation work.
- Following successful testing, all FQG6x source containers are suitable as a Type A package (IATA regulations) for the radiation source.
-  Endress+Hauser is happy to assist in procuring the necessary documents. Please contact your local sales organization for this purpose.

What to do in an emergency

Objective and overview

In the interests of protecting personnel, the emergency procedure described here must be put into effect immediately to secure an area where an exposed radiation source is known, or suspected, to exist

An emergency exists if:

- The radiation source has escaped from the source container
- The source container cannot be switched to the "AUS - OFF" position

Emergency action

1. Determine the unsafe area by on-site measurement
2. Cordon off the affected area with yellow tape or a rope
3. Mark the affected area using international radiation warning signs

The radiation source has escaped from the source container

Important measures to be taken:

- Keep the radiation source safe and secure in another location or provide additional screening
- Transport the radiation source using tongs or a gripper only
- Keep the radiation source as far away from the body as possible
- Estimate and optimize the time needed for transportation by rehearsing beforehand without a radiation source

⚠ WARNING**High-level nuclear radiation**

- Pay attention to radiation safety rules!

The source container cannot be switched to the "AUS - OFF" position

See the "What to do in an emergency" section of the applicable Technical Information document:

- TI00445F/00 (FQG60)
- TI00435F/00 (FQG61, FQG62)
- TI00446F/00 (FQG63)
- TI01171F/00 (FQG66)

Notifying the competent authority

1. Pass on all the necessary information to the responsible local and national authorities immediately
2. After a thorough assessment of the situation, the competent radiation safety officer must agree, together with the local authorities, on appropriate corrective measures for the problem
3. Mark the affected area using international radiation warning signs



National regulations may require other procedures and reporting obligations

Procedures after termination of the application

Internal measures

As soon as a radiometric measuring device is no longer required, the radiation source must be switched off on the source container. The source container must be removed in accordance with all relevant regulations and stored in a lockable room having no through-traffic. The competent authorities must be informed of these measures. The access area to the storage room must be measured and marked accordingly. The radiation safety officer is responsible for implementing anti-theft measures. The radiation source in the source container must not be scrapped with the other parts of the plant. It should be returned as quickly as possible.

⚠ CAUTION**Removal of the source container**

- The source container may only be removed according to local regulations by certified, specially trained personnel whose radiation exposure is monitored. This must also be allowed by the handling permit.
- Take all local conditions into consideration
- Carry out all work as quickly as possible, at the greatest possible distance from the radiation source and with the maximum possible shielding
- Take suitable measures (e.g. blocking of access) to protect other individuals from all possible risk
- Only remove the source container if the switch is in the "AUS - OFF" position. The radiation is switched off in this position.
- Make sure that the "AUS - OFF" position is secured with a padlock

Return*Germany*

Contact your Endress+Hauser sales organization to organize the return of the radiation source for inspection with a view to reuse or recycling by Endress+Hauser.

Other countries

Contact your Endress+Hauser sales organization or the competent authority to find a way of returning the radiation source domestically.

If it is not possible to return the device in your country, the next steps to be taken must be agreed with the Endress+Hauser sales center/representative concerned.

The destination airport for returns is Frankfurt am Main, Germany.

Conditions

If necessary, Endress+Hauser will provide a source container or a transportation cask for returning the device

The following conditions must be met before returning the container:

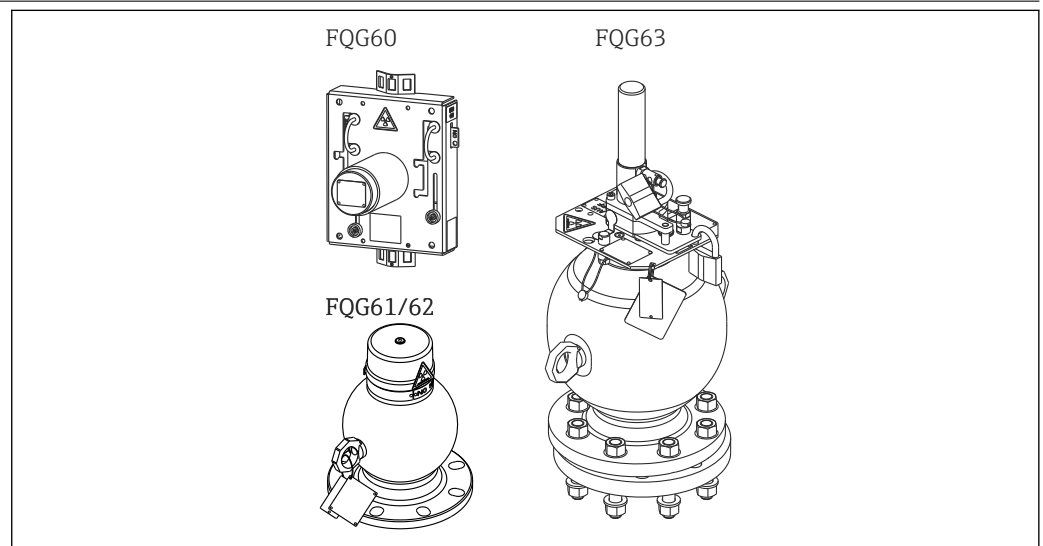
- An inspection certificate no more than three months old and confirming the leak-tightness of the radiation source must be submitted to Endress+Hauser (wipe test certificate)
- The serial number of the radiation source, the type of radiation source (^{60}Co or ^{137}Cs), activity and design of radiation source must be specified. This information is found in the documents supplied with the radiation source.
- There must be no corrosion on the source container/transportation cask, particularly at the welded seams
- The source container/transportation cask must not be damaged in any way
- The "ON/OFF" mechanism must be corrosion-free and must function properly
- Source containers must be shipped with the "AUS - OFF" switch position
- For shipment, the source holder must be set to the "OFF" position and secured with a lock



The Type A labeling on the source container is no longer valid for any subsequent device returns

Information regarding Type A packages

FQG60, FQG61, FQG62,
FQG63



A0028453

7 View of source containers FQG60, FQG61, FQG62, FQG63

- **Material:**

- FQG60: see TI00445F/00
- FQG61/62: see TI00435F/00
- FQG63: see TI00446F/00

- **Dimensions:**

- FQG60: length: 349 mm (13.7 in); breadth: 232 mm (9.13 in); height: 197 mm (7.76 in)
- FQG61/62: diameter: 220 mm (8.66 in); breadth: 362 mm (14.3 in); height: 500 mm (19.7 in)
- FQG63: diameter: 232 mm (9.13 in); breadth: 325 mm (12.8 in); height: 540 mm (21.3 in)

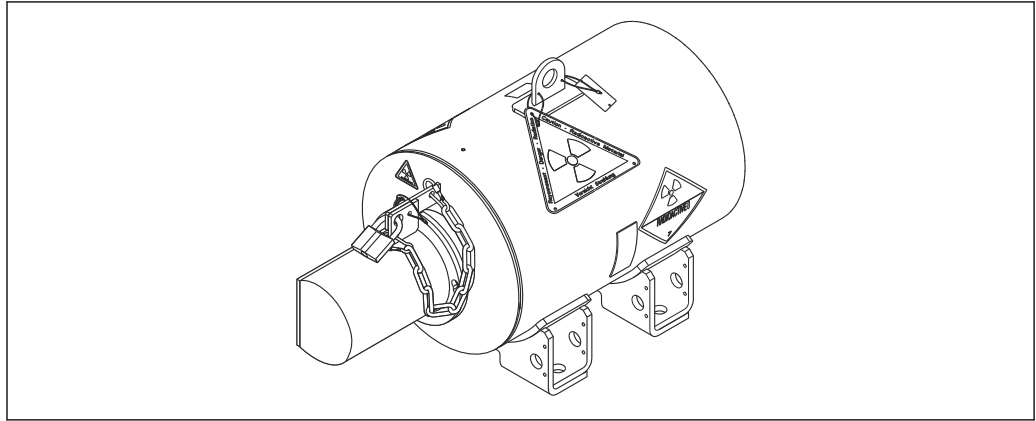
- **Weight:**

- FQG60: max. 18 kg (39.69 lb)
- FQG61: max. 46 kg (101.43 lb)
- FQG62: max. 90 kg (198.45 lb)
- FQG63: max. 105 kg (231.53 lb)



For additional information, see:
SD00309F/00

FQG66



A0028444

8 View of the source container FQG66

■ **Material:**

316L (1.4404)

■ **Dimensions:**

- Manual version: length: 730 mm (28.7 in); breadth: 345 mm (13.6 in); height: 456 mm (18 in)
- Manual version with proximity switch or pneumatic version: length: 833 mm (32.8 in); breadth: 390 mm (15.4 in); height: 456 mm (18 in)

■ **Weight:**

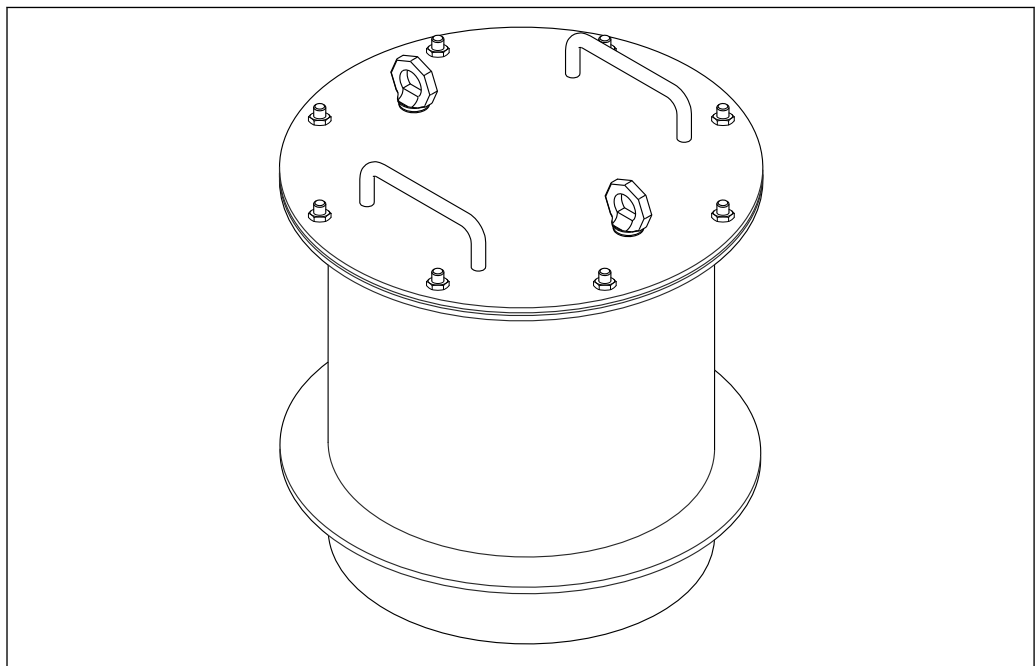
Max. 435 kg (959.18 lb)



For additional information, see:

SD00309F/00

**Transportation cask for
radiation sources**



A0022736

9 View of transportation cask for radiation sources



For additional information, see:

SD01316F/00

**Examples for Type A
packages**

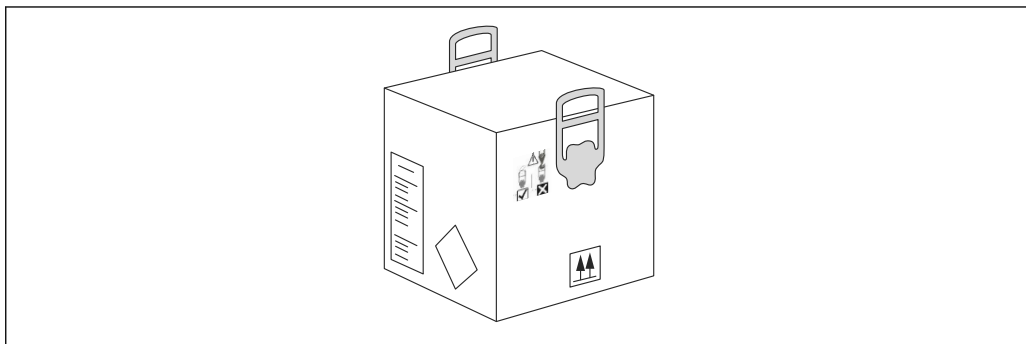


For additional information, see:

SD00311F/00

Information regarding secondary packaging upon delivery

FQG60

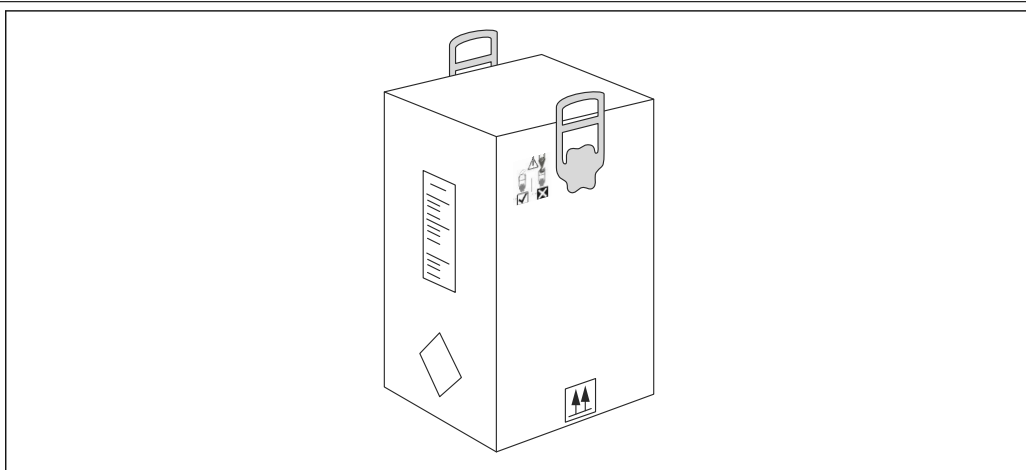


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10 View of secondary packaging for FQG60

- **Material:**
Cover: corrugated cardboard 2.91
- **Dimensions:**
Length: 360 mm (14.2 in); breadth: 360 mm (14.2 in); height: 260 mm (10.2 in)
- **Weight:**
Max. 1.1 kg (2.43 lb)

FQG61, FQG62, FQG63

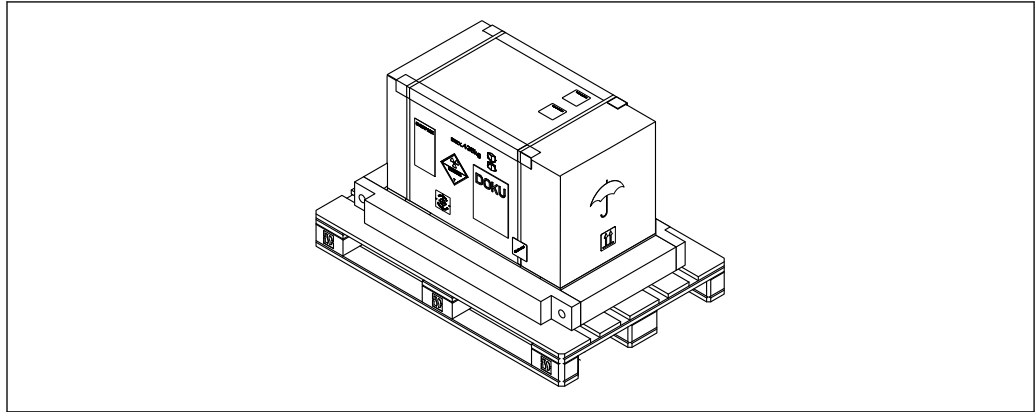


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11 View of secondary packaging for FQG61, FQG62, FQG63

- **Material:**
Cover: corrugated cardboard 2.91
- **Dimensions:**
Length: 360 mm (14.2 in); breadth: 360 mm (14.2 in); height: 580 mm (22.8 in)
- **Weight:**
Max. 1.54 kg (3.40 lb)

FQG66



A0043291

12 View of secondary packaging for FQG66

- **Material:**
 - Special pallet: wood (spruce), heat-treated according to IPPC standard
 - Cover: corrugated cardboard 2.91
- **Dimensions:**
Length: 1 200 mm (47.2 in); breadth: 800 mm (31.5 in); height: 800 mm (31.5 in)
- **Weight:**
58.3 kg (128.55 lb)



Fixed to pallet with strap

CAUTION

- ▶ The cardboard packaging is an outer, secondary packaging and does not replace Type A packaging

Packaging and shipment when returning the product

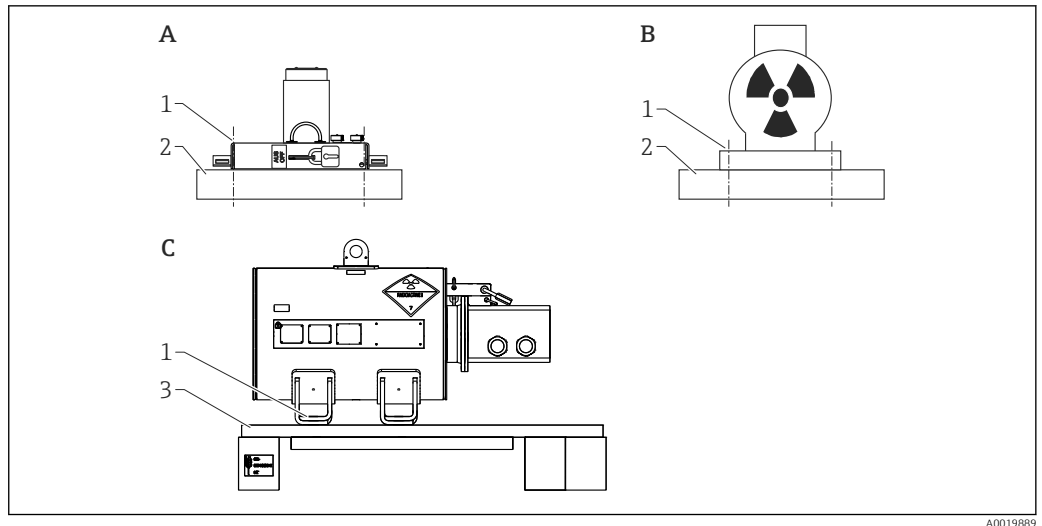
General



Refer to SD00309F/00



These source containers meet the requirements of a Type A package and therefore do not require separate Type A packaging. However, it is preferable to use the return packaging kits and labeling kits for return transportation.



- A FQG60
 B FQG61, FQG62, FQG63
 C FQG66
 1 Fastened with 4 screws and nuts
 2 Base plate
 3 Special pallet

Ordering information

Ordering information

Detailed ordering information is available from the following sources:

- In the Product Configurator: www.us.endress.com/en/field-instruments-overview/product-finder -> Select product -> Configure
- From an Endress+Hauser Sales Center: www.endress.com/worldwide



Product Configurator - the tool for individual product configuration

- Up-to-the-minute configuration data
- Depending on the device: Direct input of measuring point-specific information such as measuring range or operating language
- Automatic verification of exclusion criteria
- Automatic creation of the order code and its breakdown in PDF or Excel output format
- Ability to order directly in the Endress+Hauser Online Shop

Supplementary documentation for FSG60/61



For an overview of the scope of the associated Technical Documentation, refer to the following:

- W@M Device Viewer (www.endress.com/deviceviewer): Enter the serial number from nameplate
- Endress+Hauser Operations App: Enter the serial number from the nameplate or scan the 2D matrix code (QR code) on the nameplate

Source container

FQG60



TI00445F

Technical Information and Operating Instructions for source container FQG60

FQG61/FQG62



TI00435F

Technical Information and Operating Instructions for source containers FQG61 and FQG62

FQG63



TI01171F

Technical Information and Operating Instructions for source container FQG63

FQG66



TI01171F

Technical Information for source container FQG66



BA01327F

Operating Instructions for source container FQG66

**Additional safety
instructions**



SD00142F

Additional safety instructions for radiation sources and source containers that are approved for use in Canada (in English).



SD00292F/00

Additional safety instructions (Canada)



SD00293F, SD00313F, SD00335F, SD01561F

Additional safety instructions for the United States



SD00297F

Instructions for loading and replacing the radiation source



SD00276F

Additional safety instructions, particularly for QG020/100 and QG2000 (United States)



SD00309F

Special Documentation for returning source containers and the radiation source



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