

# Radiometric Measurement *Gamma Radiation Sources*

**For level, limit, density and interface measurement  
Conform to strict safety standards**



capsule  
(secondary  
cover)

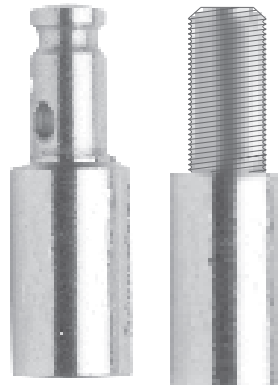
lid

spacer

source

primary  
cover

lid



Nipple-source

M4-thread source

## Application

Radioactive isotopes are used as gamma radiation sources for level, density and interface measurement as well as for level limit detection.

The gamma source radiates equally in all directions. For radiometric measurements, however, only radiation passing through the tank or pipe is of interest. All other radiation is superfluous and must be shielded off. For this reason, the radioactive source is mounted in a special source container which affords the necessary protection while providing a defined, practically unattenuated, narrow beam in one direction only.

## Features and Benefits

- Point source in special source container ensures simple handling and easy installation
- Specially constructed source capsule conforms to strictest safety requirements, Class 66646 to ISO 2919
- Choice of source type and activity ensures optimised dosage for your application

Exploded view of source capsule

## Gamma Sources

### Source Capsule

The radioactive sources, both  $^{137}\text{Cs}$  and  $^{60}\text{Co}$ , are sealed in a double-walled, welded stainless steel capsule. The encapsulation corresponds to Performance Class C 66646 as per ISO 2919, providing maximum protection against temperature, external pressure, impact, vibrations and puncture.

| Test                     | Class   |                                                      |                                                                                                                                          |                                                                                               |                                                                      |                                                                      |
|--------------------------|---------|------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------|----------------------------------------------------------------------|----------------------------------------------------------------------|
|                          | 1       | 2                                                    | 3                                                                                                                                        | 4                                                                                             | 5                                                                    | 6                                                                    |
| <b>Temperature</b>       | No test | -40°C (20 min)<br>+80°C (1 h)                        | -40°C (20 min)<br>+180°C (1 h)                                                                                                           | -40°C (20 min)<br>+400°C (1 h)<br>and thermal shock<br>400°C to 20°C                          | -40°C (20 min)<br>+600°C (1 h)<br>and thermal shock<br>600°C to 20°C | -40°C (20 min)<br>+800°C (1 h)<br>and thermal shock<br>800°C to 20°C |
| <b>External Pressure</b> | No test | 25 kPa absolute to atmospheric pressure              | 25 kPa absolute to 2 MPa absolute                                                                                                        | 25 kPa absolute to 7 MPa absolute                                                             | 25 kPa absolute to 70 MPa absolute                                   | 25 kPa absolute to 170 MPa absolute                                  |
| <b>Impact</b>            | No test | 50 g from 1 m                                        | 200 g from 1 m                                                                                                                           | 2 kg from 1 m                                                                                 | 5 kg from 1 m                                                        | 20 kg from 1 m                                                       |
| <b>Vibrations</b>        | No test | 3 x 10 min<br>25 Hz to 500 Hz at 5 gn peak amplitude | 3 x 10 min<br>25 Hz to 50 Hz at 5 gn peak amplitude and 50 Hz to 90 Hz at 0 - 635 mm amplitude peak to peak and 90 Hz to 500 Hz at 10 gn | 3 x 30 min<br>25 Hz to 80 Hz at 1 - 5 mm amplitude peak to peak and 80 Hz to 2000 Hz at 20 gn |                                                                      |                                                                      |
| <b>Puncture</b>          | No test | 1 g from 1 m                                         | 10 g from 1 m                                                                                                                            | 50 g from 1 m                                                                                 | 300 g from 1 m                                                       | 1 kg from 1 m                                                        |

Classification of sealed source performance standards to ISO 2919. The source capsule fulfils the maximum requirement in each case

### $^{60}\text{Co}$ source

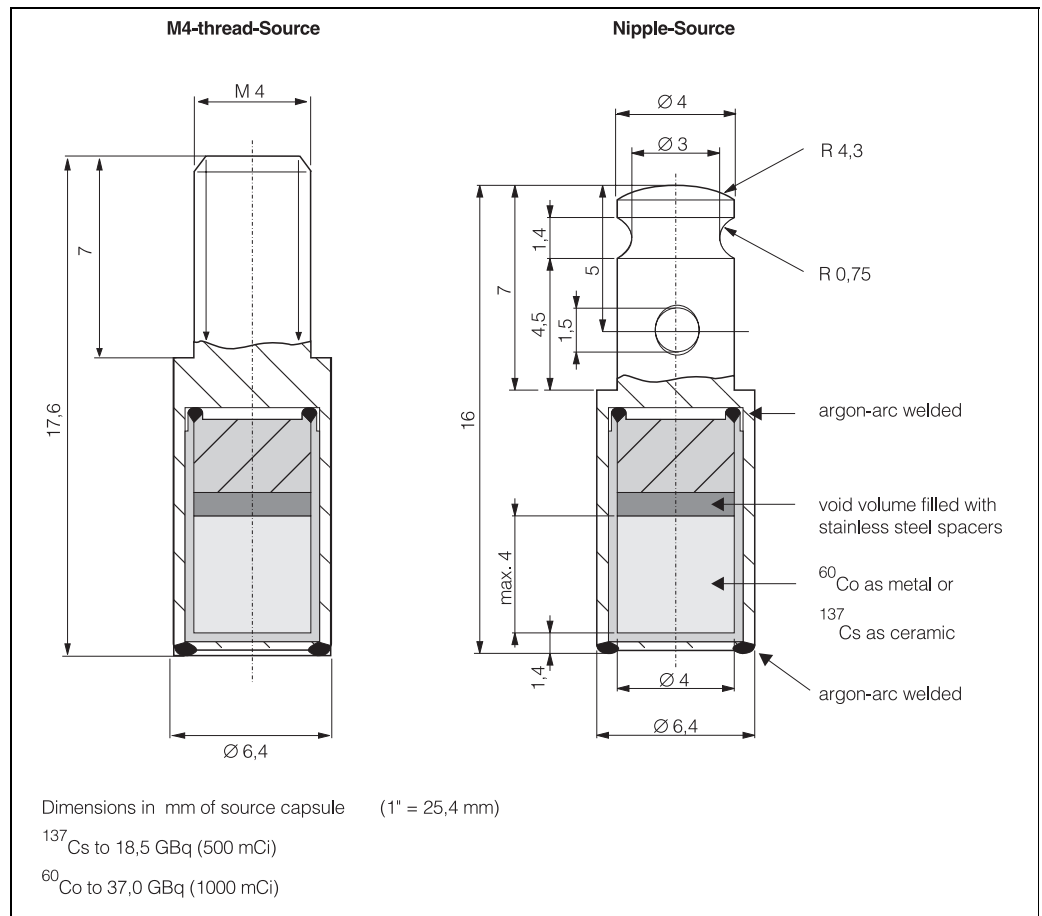
The radioactive material contained in the capsule is metallic  $^{60}\text{Co}$ . Before they are delivered, the manufacturer tests the sealing and decontamination of the finished capsules. After testing, the capsule can be considered as a sealed radioactive source in accordance with ISO 2919. The source is accompanied by a sealing test certificate and PTB approval (German authorising agency).

In view of the fact that the radioactive source is in solid, metallic form within in a double-walled stainless steel capsule, there is normally no requirement for regular sealing tests (see PTB approval).

### $^{137}\text{Cs}$ source

The radioactive material contained in the capsule is  $^{137}\text{Cs}$  dispersed within a ceramic substrate. In view of the fact that there is no danger of leakage if the capsule is punctured, regular sealing tests are required only every five years if the capsule is permanently mounted in an Endress+Hauser source container or every three years for other installations.  $^{137}\text{Cs}$  sources are not recommended for use in environments which promote corrosion or leakage of the stainless steel capsule.

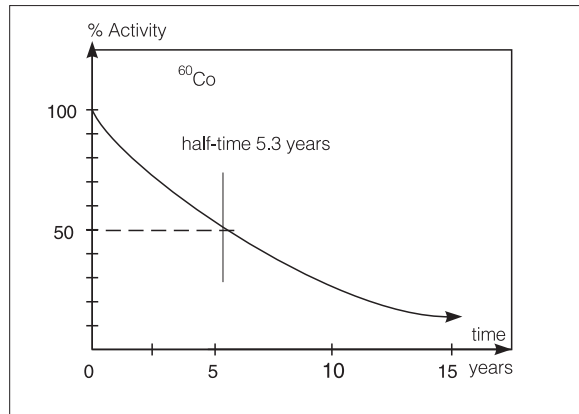
## Technical Data



- Weight: 0.02 kg
- Encapsulation: double-walled, welded stainless steel, type 1.4541 ( $\cong$  321 S 18)
- Performance class: C 66646 to ISO 2919
- Protection: IP 68
- Nominal operating range:  $-20^{\circ}\text{C} \dots +250^{\circ}\text{C}$  ( $-4^{\circ}\text{F} \dots 482^{\circ}\text{F}$ )
- Radioactive material: metallic  $^{60}\text{Co}$  or  $^{137}\text{Cs}$  compound dispersed in ceramic substrate
- Energy  $^{60}\text{Co}$  : 1.173 and 1.333 MeV;
- Energy  $^{137}\text{Cs}$  : 0.662 MeV

## Application

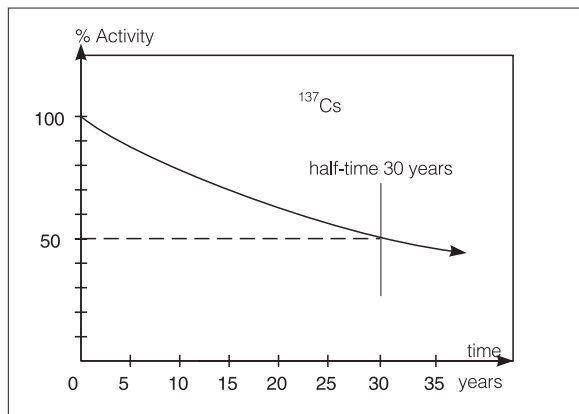
### $^{60}\text{Co}$ -Source Applications



Decay in activity of a  $^{60}\text{Co}$  source as a function of time

The  $^{60}\text{Co}$  source (energy 1.173 and 1.333 MeV; half life 5.3 years) is used mostly for level limit detection when the corresponding  $^{137}\text{Cs}$  activity is too high. Its advantages lie in its large depth of penetration, which enables measurement over large distances or through thick tank walls. The  $^{60}\text{Co}$  source can also be used for continuous level measurements when the activity of a suitable  $^{137}\text{Cs}$  source is considered to be too high.

### $^{137}\text{Cs}$ -Source Applications

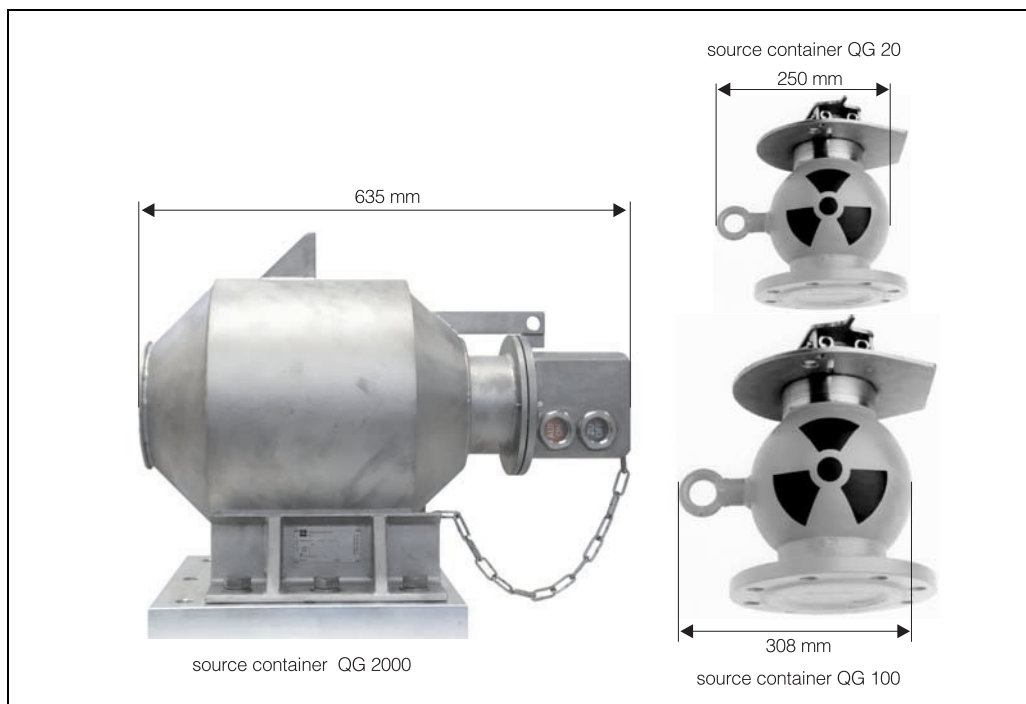


Decay in activity of a  $^{137}\text{Cs}$  source as a function of time

The  $^{137}\text{Cs}$  source (energy 0.662 MeV) is ideal for continuous level, limit detection and density measurement. Its long half life (30 years) ensures durable service without the need for source replacement or recalibration. Thanks to the low source energy, the radiation is readily absorbed and the equipment can often be operated with no control zone.  $^{137}\text{Cs}$  is used in limit detection for low density bulk solids or short distances where the harder  $^{60}\text{Co}$  radiation cannot be satisfactorily absorbed, or when extreme demands are placed on the service life of the installation.

## Delivery, Transport

### Germany



Radioactive sources may only be delivered when we have received a copy of the authorisation for handling radioactive materials. Endress+Hauser will gladly help you acquire the necessary documents. Please contact your nearest Sales Organisation.

For reasons of safety and cost, the radioactive source is usually shipped already loaded in the source container. For detailed information on the conditions of delivery see Technical Information TI 264F/00/en.

Arrangements can also be made to ship the source separately in a special transport drum. They will only be transported by approved shipping agents according to current GGVS/ADR guidelines, with all safety regulations being observed.

### Other Countries

Radioactive sources may only be delivered when we have received a copy of the import license. Endress+Hauser will gladly help you acquire the necessary documents. Please contact your nearest Sales Organisation.

We can only deliver radioactive sources in their source containers. For detailed information on the conditions of delivery see Technical Information TI 264F/00/en.

They will only be transported by approved shipping agents according to current GGVS/ADR and DGR/IATA guidelines, with all safety regulations being observed.

## Behaviour in the event of an incident

### Emergency measures

If the source container or the radiation source is damaged by accident or another unforeseen event or if the radiation source is lost by other means, the following emergency measures shall be initiated immediately:

- Inform the radiation protection officer immediately.
- All employees must leave the danger area immediately. The area around the measuring point must be barred to access and labelled.
- Production must be halted immediately if there is a risk that the radioactive material has got into the material being measured. Possibly contaminated material must be secured and may not be further used before it has been tested.
- All persons involved in clearing up (fire brigade, works security, etc) must be informed of the hazards of radiation.

### Report to the responsible authority

As soon as the emergency measures have been initiated, the authorities responsible for radiation must be informed by the radiation protection officer.

## Return of the radiation source

### Internal measures

As soon as a radiometric measuring device is no longer required, the radiation source on the source container must be switched off. The source container shall be removed in accordance with all relevant regulations and saved in a lockable room having no through traffic. The responsible authorities shall be informed of these measures. The access to the storage room shall be measured out and signed. The radiation protection officer is responsible for protecting against theft. 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.

### Return

#### FR Germany

Contact your E+H Sales Centre to organise the return of the radiation source for inspection with a view to reuse or recycling by Endress+Hauser.

#### Other countries

Contact your E+H Sales Centre or the appropriate authorities (government ministry) or regulating authority to find a way of returning the radiation source nationally for inspection with a view to reuse or recycling by Endress+Hauser. If return is not possible domestically, the return of the material to Germany shall be agreed with the sales centre concerned. The destination airport for returns is Basle, Switzerland. Inform: Endress+Hauser GmbH+Co., D-79689 Maulburg, Germany.

### Conditions

The following conditions must be met before returning the material:

- An inspection certificate no more than three months old confirming the leak-tightness of the radiation source must be in the possession of E+H (wipe test certificate).
- The serial number, type of radiation source ( $^{60}\text{Co}$  or  $^{137}\text{Cs}$ ), activity and model of radiation source must be specified. This data may be found in the documents supplied with the radiation source.
- The material must be returned in an approved secondary containment suitable for simple manipulation and in type-tested type-A packaging (IATA rules).

## How to Order

| Isotope                     | Activity   |           | Order No. for<br>Nipple Source<br>(not for chemical<br>design source con-<br>tainer) | Order No. for<br>M4-thread Source<br>(for chemical<br>design source con-<br>tainer <b>only</b> ) |
|-----------------------------|------------|-----------|--------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------|
|                             |            |           | Capsule<br>type VZ-64/1                                                              | Capsule<br>type VZ-1486/3                                                                        |
| $^{60}\text{Co}$            | 37.00 MBq  | (1 mCi)   | 008 347-0000                                                                         | 008 347-1000                                                                                     |
| $^{60}\text{Co}$            | 74.00 MBq  | (2 mCi)   | 008 348-0000                                                                         | 008 348-1000                                                                                     |
| $^{60}\text{Co}$            | 185.00 MBq | (5 mCi)   | 008 349-0000                                                                         | 008 349-1000                                                                                     |
| $^{60}\text{Co}$            | 370.00 MBq | (10 mCi)  | 008 350-0000                                                                         | 008 350-1000                                                                                     |
| $^{60}\text{Co}$            | 740.00 MBq | (20 mCi)  | 008 351-0000                                                                         | 008 351-1000                                                                                     |
| $^{60}\text{Co}$            | 1.85 GBq   | (50 mCi)  | 010 012-0000                                                                         | 010 012-1000                                                                                     |
| $^{60}\text{Co}$            | 3.70 GBq   | (100 mCi) | 008 354-0000                                                                         | 008 354-1000                                                                                     |
| $^{60}\text{Co}$            | 7.40 GBq   | (200 mCi) | 010 108-0000                                                                         | 010 108-1000                                                                                     |
|                             |            |           | Capsule<br>type VZ-79/1                                                              | Capsule<br>type VZ-1508/2                                                                        |
| $^{137}\text{Cs}$           | 37.00 MBq  | (1 mCi)   | 008 356-0000                                                                         | 008 356-1000                                                                                     |
| $^{137}\text{Cs}$           | 74.00 MBq  | (2 mCi)   | 010 014-0000                                                                         | 010 014-1000                                                                                     |
| $^{137}\text{Cs}$           | 110.00 MBq | (3 mCi)   | 008 357-0000                                                                         | 008 357-1000                                                                                     |
| $^{137}\text{Cs}$           | 185.00 MBq | (5 mCi)   | 008 358-0000                                                                         | 008 358-1000                                                                                     |
| $^{137}\text{Cs}$           | 370.00 MBq | (10 mCi)  | 008 359-0000                                                                         | 008 359-1000                                                                                     |
| $^{137}\text{Cs}$           | 740.00 MBq | (20 mCi)  | 008 814-0000                                                                         | 008 814-1000                                                                                     |
| $^{137}\text{Cs}$           | 1.10 GBq   | (30 mCi)  | 010 542-0000                                                                         | 010 542-1000                                                                                     |
| $^{137}\text{Cs}$           | 1.85 GBq   | (50 mCi)  | 008 361-0000                                                                         | 008 361-1000                                                                                     |
| $^{137}\text{Cs}$           | 3.70 GBq   | (100 mCi) | 008 362-0000                                                                         | 008 362-1000                                                                                     |
| $^{137}\text{Cs}$           | 7.40 GBq   | (200 mCi) | 010 185-0000                                                                         | 010 185-1000                                                                                     |
| $^{137}\text{Cs}$           | 11.00 GBq  | (300 mCi) | 010 186-0000                                                                         | 010 186-1000                                                                                     |
| $^{137}\text{Cs}$           | 18.50 GBq  | (500 mCi) | 010 188-0000                                                                         | 010 188-1000                                                                                     |
| Other activities on request |            |           |                                                                                      |                                                                                                  |

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# Supplementary Documentation

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## System Information

### SI 016F/00/en

System Information for Gammasilometer, Gammapiilot  
(Radiometric measurement of level, interface layers and density)

## Technical Information

### TI 264F/00/en

Technical Information for Source Container QG 020/100

### TI 346F/00/en

Technical Information for Source Container QG 2000

### TI 218F/00/en

Technical Information for Gammapiilot FTG 470 Z

### TI 177F/00/en

Technical Information for Gammapiilot FTG 671

### TI 219F/00/en

Technical Information for gammasilometer FMG 671 (P)

### TI 110F/00/en

Technical Information for System FMG 573 Z/S-Density

### TI 197F/00/en

Technical Information for Detector DG 17 (Z), DG 27 (Z)

### TI 180F/00/en

Technical Information Detector DG 57

For more Endress+Hauser product please visit: [www.ainstru.com](http://www.ainstru.com)

Mail: [Sales@ainstru.com](mailto:Sales@ainstru.com)

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#### Endress+Hauser GmbH+Co.

Instruments International  
P.O. Box 2222  
D-79574 Weil am Rhein  
Germany

Tel. (07621) 975-02  
Tx 773926  
Fax (07621) 975 345  
e-mail: [info@ii.endress.com](mailto:info@ii.endress.com)

#### Internet:

<http://www.endress.com>

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