REGISTRY OF RADIOACTIVE SEALED SOURCES AND DEVICES
SAFETY EVALUATION OF DEVICE
(AMENDED IN ITS ENTIRETY)

NO.: NR-1302-D-103-S DATE: August 26, 2014

DEVICE TYPE: Gamma Gauge

MODEL: FQG63 Series

DISTRIBUTOR: Endress+Hauser, Inc.
2350 Endress Place
Greenwood, IN 46143-9772

MANUFACTURER: Endress+Hauser GmbH+Co.KG
Hauptstrasse 1
D 79689 Maulburg
Germany

SEALED SOURCE MODEL DESIGNATION:
The source model and the capsule configuration (in parenthesis) are shown below.

Eckert & Ziegler Nuclitec	Registration Certificate
Model CDC.P4 (VZ-79-001, VZ-1508-001)	CA-0406-S-249-S
Model CKC.P4 (VZ-64-001, VZ1486-001)	CA-0406-S-249-S
Model P02 (Cs7.P02)	CA-0406-S-227-S
Model P03 (Cs7.P03)	CA-0406-S-196-S
Model P04 series (P.08)	CA-0406-S-228-S

QSA Global Inc.	Registration Certificate
Model CDC.ZD1 (VZ-1726-001)	MA-1059-S-354-S
Model CDC.93 (X.9)	MA-1059-S-368-S
Model CDC.800 (X.8)	MA-1059-S-200-S

ISOTOPE:	MAXIMUM ACTIVITY:
Cs-137	185 GBq (5 Ci)
Co-60	3.7 GBq (0.1 Ci)

LEAK TEST FREQUENCY: 6 Months

PRINCIPAL USE: (D) Gamma Gauge

CUSTOM DEVICE: _____ YES __X__ NO

DEVICE TYPE: Gamma Gauge

DESCRIPTION:

The Model FQG63 device is used in combination with a gamma detector in measuring systems for fill level measurement, level limit detection, density and concentration measurement. The FQG63 device, also called 'source container,' is intended for stationary installations and does not move during use. The Model FQG63 device is designed for applications where the device is mounted on a process tank or vessel; the device is attached to a source well, which extends into the tank or vessel; and the source travels into the source well. During normal use, i.e., in the "on" configuration of the device, the source stays in the source well. The source well prevents the device or the source to come in contact with the process medium. The source assembly (i.e., the source mounted on a source holder rod) is extended into the source well with a cable or **rod made of stainless steel or nickel based alloy**, which are referred to as 'extension elements' in the user manual. When the device is placed into "off" mode, a rotating shutter, installed within the device, provides shielding of the outlet of the extension elements. The main components of the device are shown in Attachment 1.

In the "off" configuration of the device, the source is withdrawn from the source well and is housed within the device which provides the shielding. To use the device, the locking plate is moved to the "on" configuration, placing the source assembly internally within the shield into a position which is in alignment with the outlet for the source well. To move the source into the source well, the operator attaches the extension element to the source rod and pushes the source assembly into the source well.

The locking plate is constructed with sufficient size holes to permit securing the device with a padlock in the "off" position only. Two spring-loaded locking bolts are used to maintain the locking plate in the "on" position during normal use. The openings for the locking bolts are not through-holes, thus, the device cannot be locked in the "on" position with a padlock.

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DESCRIPTION (Cont.):

The Model FQG63 device is manufactured in two versions: standard and fire-resistant. Both versions are constructed with 3 mm (0.12 inch) thick steel walls, which provide the housing for the lead shielding. The fire-resistant version is constructed with an overflow chamber, welded to the outside of the device housing; the overflow chamber provides containment for the increased volume of liquefied lead in case of fire. The fire-resistant version is differentiated from the standard version with a distinct model identification on the label; specifically, the fire-resistant model is shown on the label as "FQG63...WE..." where the "WE" indicates the fire-resistant construction.

To mount the device on a vessel, an adaptor flange must be used between the device flange and the vessel flange. The adaptor flange is provided by the user. The seals between the device flange and the adaptor flange must be compatible with the working environment (such as the chemical, thermal, mechanical effects).

The Model FQG63 device can be used both in vertical and horizontal installations. When in a vertical installation downward, the maximum length of the stainless steel **or nickel based alloy** extension cable is 30 meters (98 feet 5 inch). When in a horizontal installation or in a vertical installation upward, the maximum length of the extension is 4 meter (13 feet 1 inch).

The source is mounted in an assembly, called source holder rod. The source holder rod is the component which connects to the extension elements. Within the source rod holder, the source is encapsulated in a stainless steel capsule. The extension cable and the source assembly are shown in Attachment 3.

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DESCRIPTION (Cont.):

Table 1: Dimensions and weights of the FQG63 device

Device/Component	Weight, kg (lbs)	Dimensions, mm (inch)
FRQ63 - standard version	87 (192)	H: 540 (21.3) W: 232 (9.13) W: 325 (12.8) with lift ring
FQG63 - fire-resistant version	89 (196)	H: 540 (21.3) W: 232 (9.13) W: 414 (16.3) with lift ring and overflow chamber
Extension element	2.5 (5.5)	D: 4 (0.157) L: max. 30 m (1181)
Adaptor flange	10 (22)	229 (9.02)

See the dimensions also in Attachment 2.

DIAGRAM:

See Attachments 1 to 5.

LABELING:

Each unit of the Model FQG63 device is labeled with nameplates containing gauge identification. The nameplates consist of stainless steel sheet metal plates and are attached to the device with stainless steel round headed pins. The "on/off" position indication is engraved on the indicator tabs; in addition, "on/off" labels are also affixed to the gauge body adjacent to the openings for the indicator tabs. An adhesive radiation warning sign is attached to the gauge body. An additional warning sign on a metal plate is attached with stainless steel key ring or crimped stainless steel cable to the gauge body. The labels are shown in Attachments 4 and 5.

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CONDITIONS OF NORMAL USE:

The Model FQG63 devices are intended for industrial gauging applications such as fill level or density measurement at tanks, vessels or pipes. They are typically used in industrial process control environment.

The normal operating temperature range for the FQG63 device depends on the model of source as well as on the capsule configuration for the source, which is installed in the device, as follows.

1. Normal operating temperature range for capsule configurations VZ64-001, VZ79-001, VZ1508-001, VZ-1406-001, VZ-1726-001, Cs7.P02, Cs7.P03, and P04 series:

   -55°C to 400°C (-67°F to 752°F)

2. Normal operating temperature range for capsule configurations X.8 and X.9:

   -40°C to 200°C (-40°F to 392°F)

The manufacturer placed the following limits on the temperature of the process material in the vessel: -52°C to 200°C (-62°F to 392°F). However, the temperature rating of the source models, as listed above, must be compatible with the process material temperature range; i.e., the temperature of the process material must be within the operating temperature range of the source capsule configuration.

The fire resistant version of the Model FQG63 device is rated for maintaining its integrity for 30 minutes at 821°C (1500°F).

The expected useful working life of the FQG63 series is 20 years.

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PROTOTYPE TESTING:

The FQG63 Series device was subjected to vibration from 10 to 2000 Hz, up to a maximum acceleration density of 0.05 g^2/Hz. The FQG63 Series device was subjected to a shock test of 30 g (18 ms) with the shutter in the 'off' position. The device was drop tested from a height of 9 meter (29 feet 6 inch). The shutter mechanism was tested for 1,000 cycles. The functionality of the device was tested in the temperature range from -52°C (-62°F) for 67 hours to +180°C (356°F) for 22 hours. Integrity of the seals was tested in dust and water penetration tests.

Endress+Hauser provided the prototype test results. The device achieved ANSI N538/N46.8 classification 54-454-454-R3, and ISO-7205 classification A1 232314 41.

EXTERNAL RADIATION LEVELS:

Table 2: Maximum Radiation Level for 185 GBq of Cs-137

Distance from Surface (cm)	Max. Radiation Level around spherical housing (µSv/hr)	Max. Radiation Level in front of flange (shutter closed) (µSv/hr)
5	409.9 [594]	1561 [2264]
10	302.1 [438]	956.7 [1387]
30	85.1 [123]	344 [499]
100	14.1 [20]	69 [100]

Note: The values in [brackets] include: 25% source activity variation above label value, 25% measurement inaccuracy, 10% safety margin. The values are representative of the fireproof model.

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EXTERNAL RADIATION LEVELS (Cont.):

Table 3: Maximum Radiation Level for 3.7 GBq of Co-60

Distance from Surface (cm)	Max. Radiation Level around spherical housing (µSv/hr)	Max. Radiation Level in front of flange (shutter closed) (µSv/hr)
5	460.9 [668]	198 [287]
10	277.8 [403]	123 [178]
30	85.6 [118]	32 [47]
100	13.6 [20]	6 [9]

Note: The values in [brackets] include: 25% source activity variation above label value, 25% measurement inaccuracy, 10% safety margin. The values are representative of the fireproof model.

QUALITY ASSURANCE AND CONTROL:

The manufacturer maintains a certified Quality Management System according to ISO 9001:2000 covering the design, manufacturing, testing and servicing of Endress+Hauser gauges.

The U.S. distributor maintains a certified Quality Management System according to ISO 9001:2000 covering the distribution, testing and servicing of Endress+Hauser nuclear measurement systems.

Prior to shipment to a customer, the distributor will perform the following quality control procedures in accordance with the ISO Quality Management Program:

- Visual inspection of the device
- Check for correct labeling
- Check for correct operation of safety features
- Check for radiation profiles of the device
- Check for associated operation manual

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QUALITY ASSURANCE AND CONTROL (Cont.):

- Source leak test to less than 185 Bq (0.005 microcurie) or inspection of the source certificates provided by the source manufacturer for the applied sources

LIMITATIONS AND/OR OTHER CONSIDERATIONS OF USE:

- The device shall be distributed to persons specifically licensed by the NRC or an Agreement State.
- Handling, storage, use, transfer and disposal: for devices used under specific license will be determined by the licensing authority.
- The devices shall be leak tested at intervals not to exceed 6 months using techniques capable of detecting 185 Bq (0.005 microcurie) of removable contamination.
- The registration sheet and the information contained within the references shall not be changed without the written consent of the NRC.

SAFETY ANALYSIS SUMMARY:

Based on our review of the information and the test data cited below, we conclude that the Model FQG63 series is acceptable for licensing purposes. Furthermore, we conclude that this device would be expected to maintain its integrity for normal and likely accident conditions of use, which might occur during the uses specified in this registration certificate.

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REFERENCES:

The following supporting documents for the Model FQG63 series are hereby incorporated by reference and are made a part of this registry document.

- Endress+Hauser application dated November 9, 2010, with enclosures thereto.
- Endress+Hauser emails dated October 7, 2011, May 31, 2012, July 2, 2012, November 8, 2012, with enclosures thereto.
- **Endress+Hauser emails dated June 13, 2014, August 5, 2014 and August 21, 2014, with enclosure thereto.**

Issuing Agency:

U.S. Nuclear Regulatory Commission

Date: 8/26/2014 Reviewer: Maria Arribas-Colon

Date: August 26, 2014 Concurrence: Tomas Herrera
Tomas Herrera

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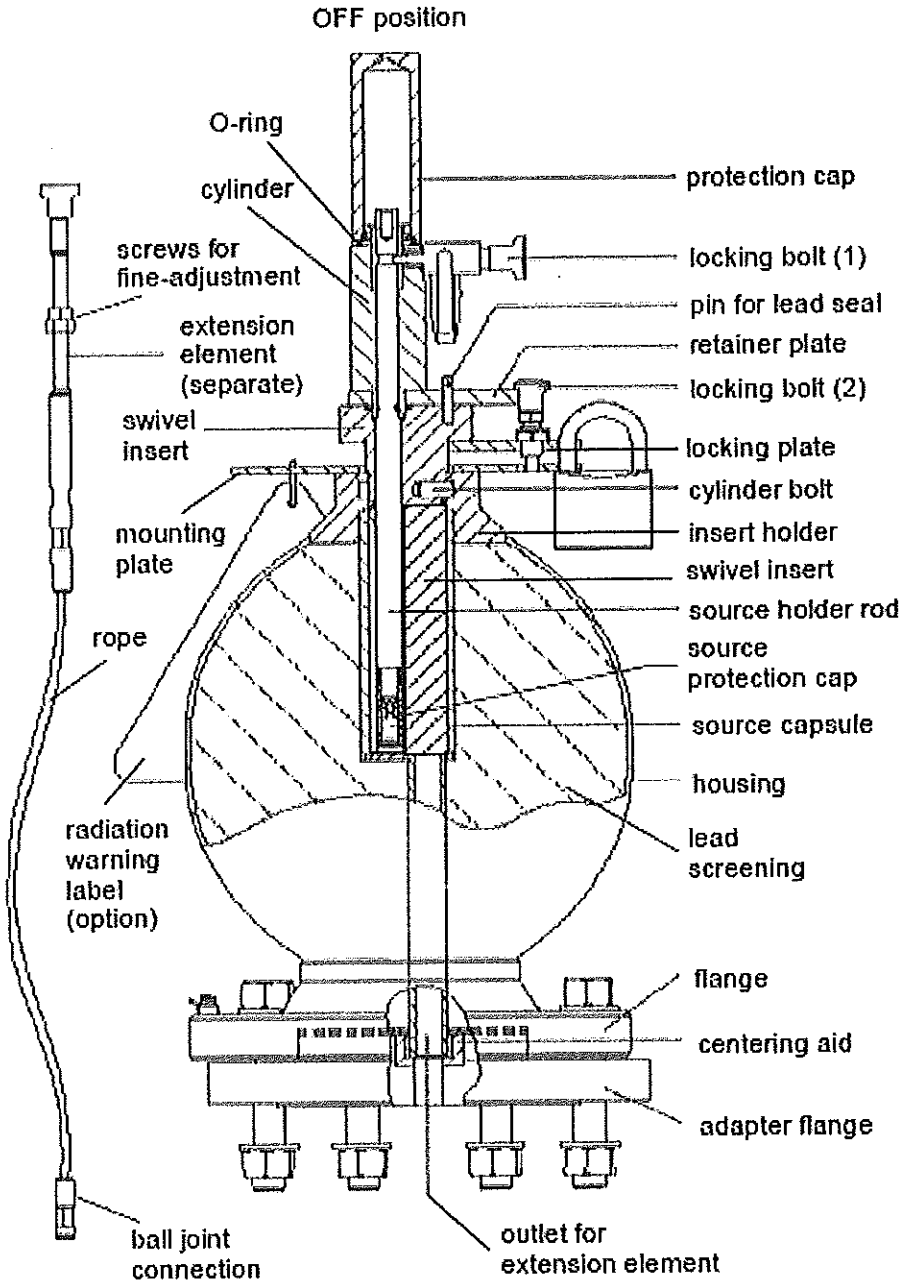

Components of the Model FQG63 series devices

Note: The source holder in the 'off' mode is removed from alignment with the outlet for the extension element

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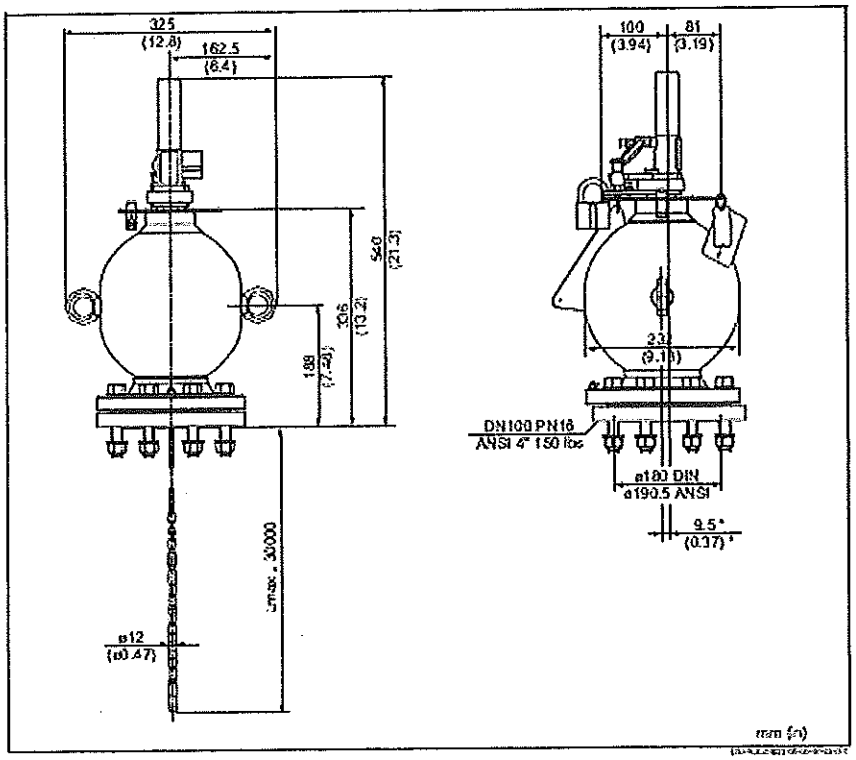
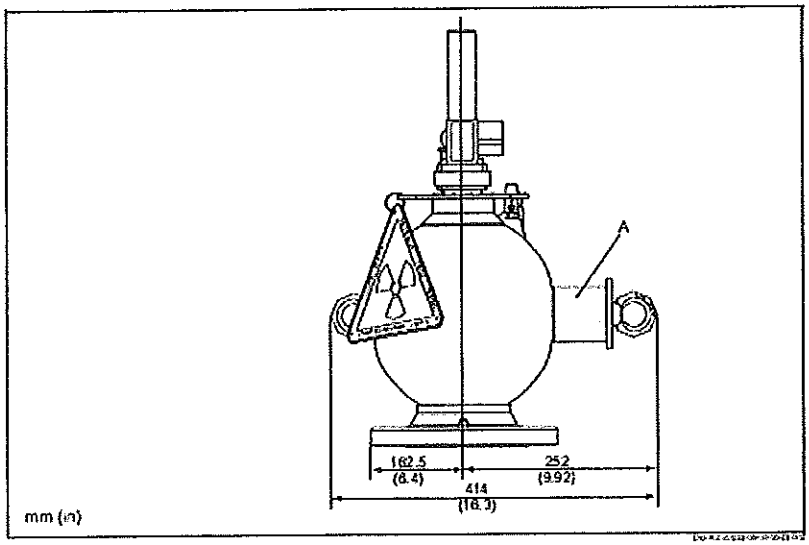


* Eccentricity 9.5 mm (0.37 in)

Dimensions of standard version in mm (inch)



A Compensation compartment

Dimensions of the fire-resistant (WE) model in mm (inch)

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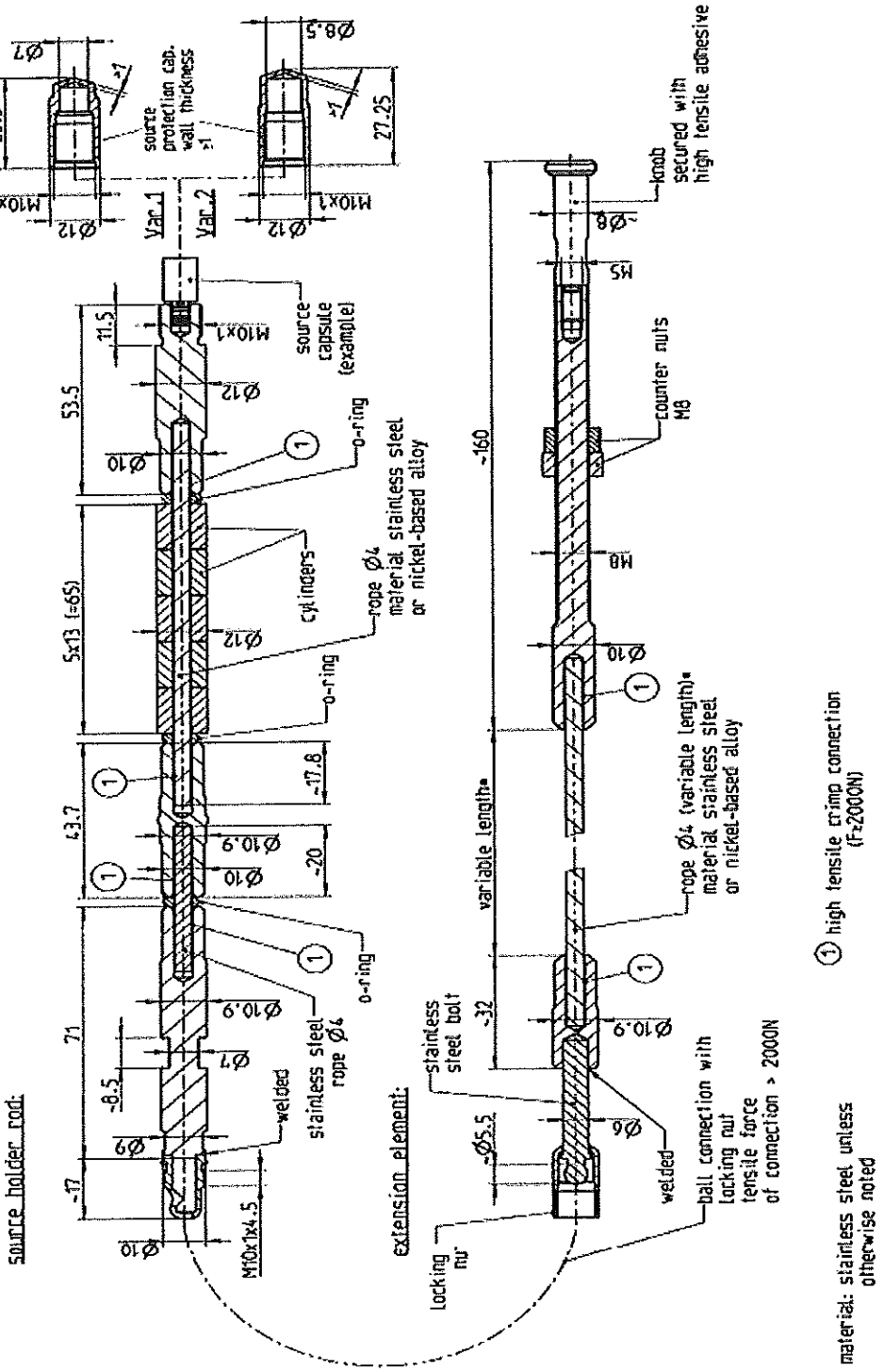

Source holder and extension element

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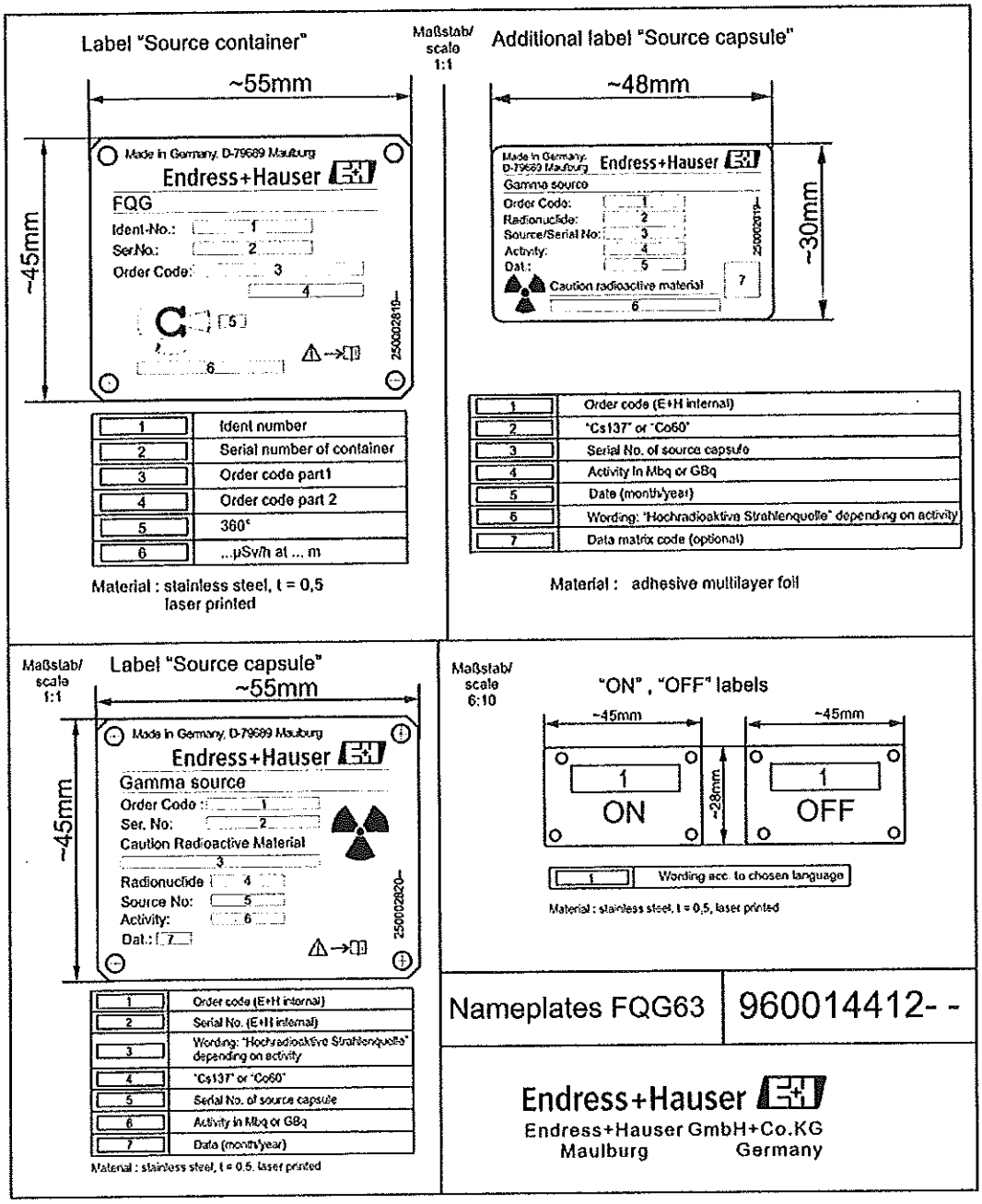

Labels

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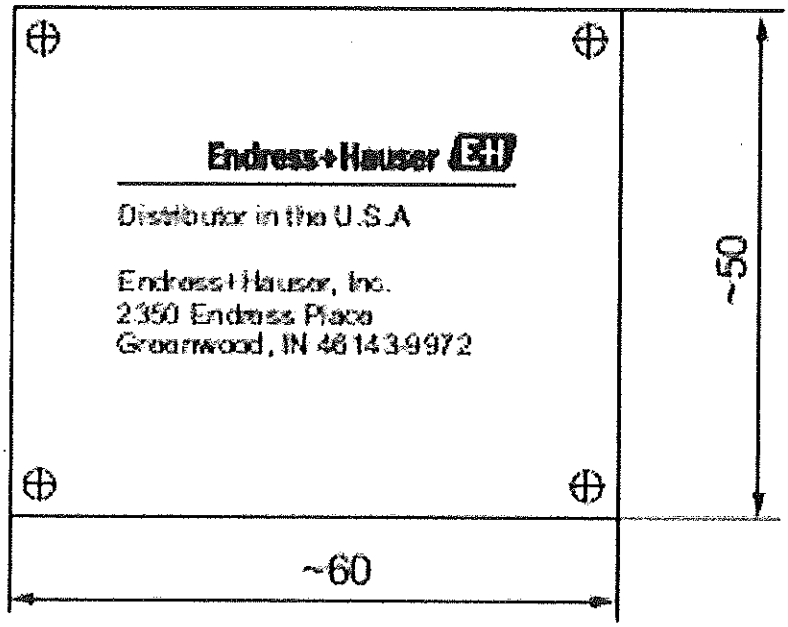

Material: stainless steel , t = 0,5
laser printed

Attached to source container with stainless steel rivets or round head grooved pins.

Labels