

REGISTRY OF RADIOACTIVE SEALED SOURCES AND DEVICES  
SAFETY EVALUATION OF DEVICE

NO: TN-1031-D-113-B

DATE: January 22, 2001

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DEVICE TYPE: Gamma Gauge

MODEL: LB 7501

DISTRIBUTOR: Berthold Technologies U.S.A., LLC  
801 South Illinois Avenue  
Oak Ridge, Tennessee 37830

MANUFACTURER: Berthold Technologies GmbH & Co. KG  
D-75323 Bad Wildbad  
Germany

SEALED SOURCE MODEL DESIGNATION: AEA Technologies Model CDC.700,  
Capsule X.7

ISOTOPE:

Cesium 137

MAXIMUM ACTIVITY:

720 microcuries (26.6 MBq)

No single source to exceed 90 microcuries  
(3.3 MBq)

LEAK TEST FREQUENCY: Not required

PRINCIPAL USE: (D) Gamma Gauges

CUSTOM SOURCE: YES: \_\_\_\_\_ NO:  X

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DEVICE TYPE: Gamma Gauge

DESCRIPTION:

The LB 7501 device is for use in the Berthold family of density, level, and weigh gauges. It features low activity sources providing a maximum dose rate of 100 mrem/hour at the beam exit port.

The device source housing is identical to the Berthold model LB 7440D registered under TN-1031-D-101-B. It consists of a cast iron or stainless steel outer shell filled with lead, except for an exit port which is blocked by a lead-filled movable shutter when in the "closed" or "beam-off" position. See Attachment 1. This housing provides shielding of the radiation source in all directions when the shutter is closed. The shutter mechanism consists of a rotatable, lead-filled, brass or stainless steel cylindrical cup connected to the outside of the housing by means of a brass shaft. The shaft is secured to a steel handle by a pin, and the position of the handle indicates the open or closed condition of the device. The rotatable shutter mechanism is separated from the lead shielding in the device by means of an additional cylindrical brass or stainless steel enclosure (non-rotatable). A cylindrical hole is bored through the lead shielding in the rotatable shutter. A cylindrical hole or tube in the static lead shield contains the source holder. The source holder consists of a lead-filled, brass, or stainless steel pipe with an attached source capsule holder. The individual source capsules are housed in a stainless steel cylinder (source capsule holder) which is screwed to a brass/lead filled source holder. A stainless steel cover plate retains the capsules within the source holder. The other end of the source holder has a threaded portion which allows it to be screwed into the housing. See Attachments 2, 3, and 4.

When the shutter is open, the cylindrical hole is in line with the fixed position of the source capsule holder and a window formed by the front steel plate. At this distinct and defined position of the shaft, the hole and source holder tube are aligned, allowing the radioactive beam to reach outside of the housing, via the steel or stainless steel cover plate which is bolted or threaded in place. This is the beam-on position of the device. At all other shaft positions the beam exit is blocked by the lead filler in the cup.

Markings showing the "open" and "closed" positions of the shutter are on the back of the source housing on either side of the shutter positioning handle. A key lock controls operation of the manual shutter. Users are instructed to not lock the shutter in the open position. A stainless steel bolt is provided for use in securing (not locking) the shutter positioning handle in the open position and for securing the shutter in the closed position during transportation.

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DEVICE TYPE: Gamma Gauge

DESCRIPTION: (Cont'd)

The ANSI (ISO) classification for the sources in accordance with ANSI N542 for the Model CDC.700 is C66445.

The LB 7501 device meets the requirements for a Type A shipping container.

LABELING:

Each shielding is labeled with the radiation trefoil and the words "Caution Radioactive Material" in conformance with the requirements of 1200-2-5-.110 and 1200-2-5-.113 of Tennessee "State Regulations for Protection Against Radiation" (SRPAR). A second label, constructed of stainless steel contains the unique device serial number, activity, isotope, date, the name of the device manufacturer, and the radiation level at one meter. It also states "No Leak or Shutter Testing Required." The source capsule holder is labeled with the radiation trefoil. Devices intended for distribution to generally licensed persons are labeled in accordance with "SRPAR" 1200-2-10-.13(5)(b). Markings showing the "open" and "closed" positions of the shutter are on either side of the shutter-positioning handle.

DIAGRAMS:

See Attachments 1, 2, 3, and 4.

CONDITIONS OF NORMAL USE:

The device is used to monitor density, level, or basis weight of the content of tanks, pipes, or conveyor systems. Typical applications are in chemical plants, refineries, food processing, and water purification and sewage treatment plants. The characteristics of the detection system limit the operational temperature range of the device between -20 degrees C to 50 degrees C and the glass photo multiplier tube sets the vibration/shock limits. Multiple seals between the radioactive material and the exterior of the device provide additional protection against corrosive and abrasive airborne material. The environmental stresses are well within the radiological protection capabilities of the device.

The source capsules and source holders are constructed of stainless steel and will withstand continuous operation at high temperatures without impairing their containment properties.

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CONDITIONS OF NORMAL USE: (Cont'd)

Because of the relatively low radiation levels, no shutter mechanism is required to shield the useful beam in accordance with ANSI N538. The shutter as provided is to facilitate transport and to provide the user with the ability to turn off the active beam. No formal shutter tests are required, but the users are advised to test the shutter as part of periodic maintenance checks of the installation. Additionally, the low radiation levels along with instructions for the installation and operation of the device provided by Berthold Technologies allows persons without specific training to handle the device safely.

The frequency of persons being near the device varies depending on the process, but it is estimated that after installation no one person will be near the device in excess of 20 hours per year. The expected useful life of the device is ten years.

PROTOTYPE TESTING:

The shielding is a member of the registered LB 7400 Series of devices that have been previously evaluated.

EXTERNAL RADIATION LEVELS:

With the shutter closed, radiation levels will not exceed 5.0 mrem/hr at all accessible surfaces of the device and 0.5 mrem/hr at 30 cm.

During use, the radiation level at the surface of the beam port does not exceed 100 mrem/hr.

QUALITY ASSURANCE AND CONTROL:

The manufacturer has a quality system that is certified to ISO 9001. The distributor has established a quality system in accordance with provisions of U.S. Nuclear Regulatory Commission Regulatory Guide 6.9 that has been approved by the state of Tennessee. An element of this system requires the General Manager of the distributor to approve proposed manufacturing design changes to devices licensed by the State of Tennessee before they are made. It is a condition of the specific Tennessee Radioactive Material License issued to the Distributor that the State of Tennessee approve any design changes before they are implemented for devices distributed under the license.

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QUALITY ASSURANCE AND CONTROL: (Cont'd)

Prior to shipment to a customer the distributor will perform the following quality control procedures:

- Visual inspection of the device
- Source leak test
- Radiation profiles of the device
- Installation and/or verification of all appropriate labels
- Inspection of source certificates provided by the source manufacturer
- Final radiation survey prior to shipment
- Furnish a copy of the general license or ensure a valid specific license

LIMITATIONS AND OTHER CONSIDERATIONS OF USE:

The device is intended for distribution to specific and general licensees. It is not subject to leak or shutter testing requirements. Berthold Technologies U.S.A. will provide sufficient instructions to allow the user to install and relocate the device. The handling, storage, use, transfer, or disposal of devices used under a specific license shall be determined by the licensing authority. Devices used under the general license shall be governed by the requirements of "SRPAR" 1200-2-10-.10 or equivalent regulations of the U.S. NRC or an Agreement State.

Installation, replacement, removal from service and disposal of sealed sources containing radioactive material used in devices shall be performed only by the device manufacturer, or other persons authorized in a specific license issued by the U.S. Nuclear Regulatory Commission or an Agreement state to perform these services.

The distributor will provide training and the general license regulations from the appropriate regulatory agency maintaining jurisdiction to general licensees.

The distributor will supply a copy of the appropriate operating and service manual to device recipients.

This registration and the information contained within the references shall not be changed without the written consent of the State of Tennessee.

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DEVICE TYPE: Gamma Gauge

SAFETY ANALYSIS SUMMARY:

The source capsules used in the LB 7510 device have a ANSI/ISO classification of C66445. This indicates that temperatures, pressures, impact, vibration and puncture stresses imposed during use are highly unlikely to cause a breach of the containment integrity of any capsule.

The sources are further enclosed within the source holder, further protecting them against airborne, corrosive and other contaminants. The source holder is in turn mounted in the housing providing an additional level of protection of the source capsule. In the event of a hole or crack in the capsule wall, leakage of radioactive material is unlikely. This is because the Cs-137 is in non-dispersible ceramic form.

Persons having no training in radiological protection may use the devices safely. Under normal conditions of handling, storage and use the radioactive material contained in the device will not be released or inadvertently removed from the source shielding, and it is unlikely that any person will receive in any one year, a dose in excess of 10 percent of the limits specified in "SRPAR" 1200-2-5-.50(1).

Under accident conditions (such as fire and explosion) associated with handling, storage and use of the device, it is unlikely that any person would receive an external radiation dose or dose commitment in excess of the dose to the appropriate organ as specified in the following chart:

| <u>Part of Body</u>   | <u>Rem</u> | <u>Sv</u> |
|---|------------|-----------|
| Whole body (head; trunk, including male gonads; arms above the elbow or legs above the knee; lens of eye                        | 15         | 0.15      |
| Hands and forearms; feet and ankles; localized areas of skin averaged over areas no larger than 1 square cm (0.155 square inch) | 200        | 2.00      |
| Other Organs  | 50         | 0.50      |

We conclude that the LB 7510 Gamma Gauge, as specified in this document, is acceptable for distribution to specific and general licensees. We also conclude that the source housing

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SAFETY ANALYSIS SUMMARY: (Continued)

can be expected to adequately maintain its containment integrity for normal conditions of use and during accidental conditions that might occur during uses specified in this document.

REFERENCES:

The following supporting documents for the Model LB 7510 device are hereby incorporated by reference and are made a part of this registration document:

- Letter dated December 4, 2000, with attachments including Registry Application, letter dated January 4, 2001, with attachments, and revised Registry Application dated January 19, 2001, with attachment

ISSUING AGENCY:

State of Tennessee

DATE: 1/26/01

REVIEWED BY: Charles Arnott

DATE: 1/26/01

CONCURRENCE: Johnny L. Hayes

# REGISTRY OF RADIOACTIVE SEALED SOURCES AND DEVICES SAFETY EVALUATION OF DEVICE

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Attachment 1

|  |                      |
|--|----------------------|
| <b>BEATHOLD TECHNOLOGIES</b>                       |                      |
| 801 S. ILLINOIS AVENUE, OAK RIDGE, TENNESSEE 37831 |                      |
| LB 7501  |                      |
| MATERIAL   | FINISH               |
| APPLIED PRACTICES                                  | PART NO. SK-112900BB |
| NOT TO SCALE                                       | NOT TO SCALE         |

VIEW PROJECTION

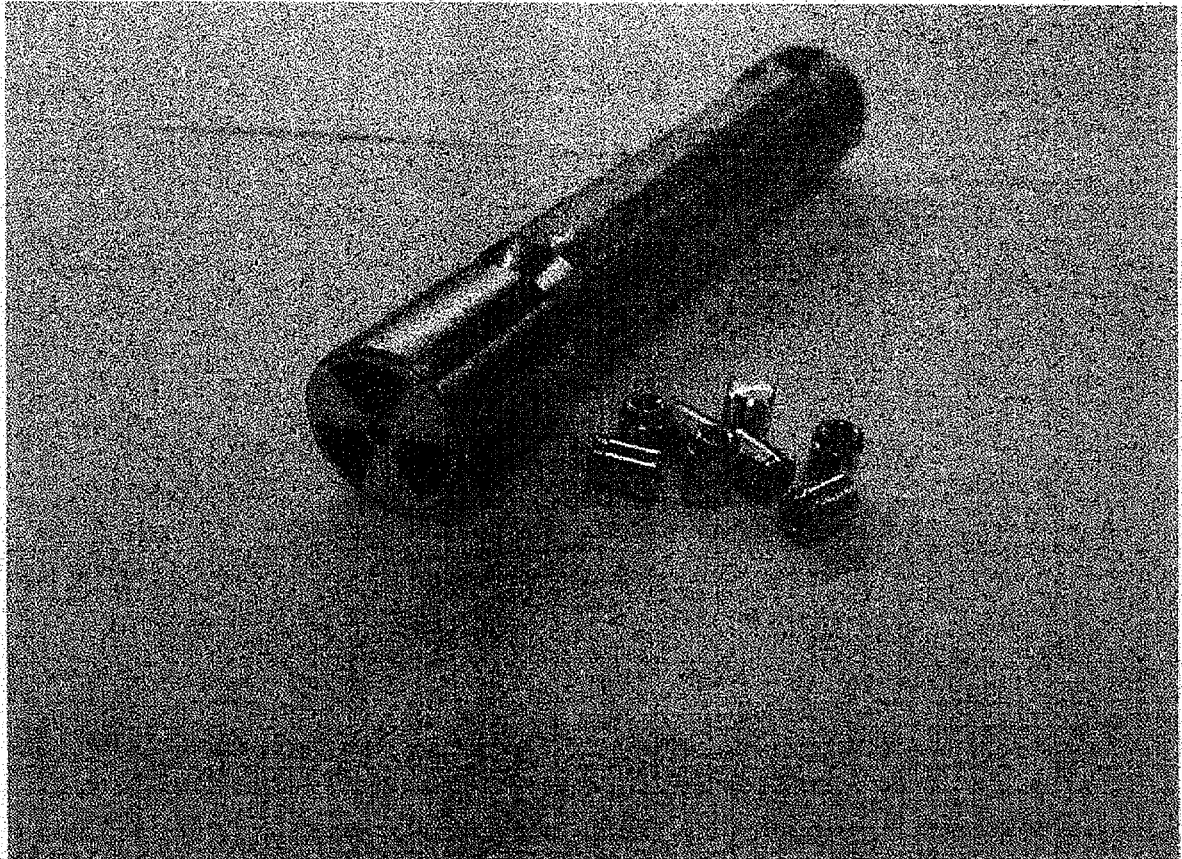


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Attachment 2



# REGISTRY OF RADIOACTIVE SEALED SOURCES AND DEVICES

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Attachment 3

| #  | DESCRIPTION                | DWG #        | PART #        |
|----|----------------------------|--------------|---------------|
| 01 | TREFOIL LABEL              | XXXXX        | XXXXX         |
| 02 | 4-40 THMS TRIN HEAD        | XXXXXX       | XXXXX         |
| 03 | COVER WASHER               | XXXXXX       | XXXXX         |
| 04 | REGISTERED SOURCE CAPSULES | XXXXXX       | MODEL CDC 7DD |
| 05 | CAPSULE HOLDER             | XXXXXX       | XXXXX         |
| 06 | M4 x 12mm HEX SET SCREW    | XXXXXX       | XXXXX         |
| 07 | M4 SPLIT LOCK WASHER       | XXXXXX       | XXXXX         |
| 08 | SOURCE HOLDER              | Z199.106-DDD | JOB72 REV 00  |
| 09 | TREFOIL LABEL              | XXXXXX       | XXXXX         |

**BERTHOLD TECHNOLOGIES**  
 401 S. DUNSMUIR AVENUE, OAK RIDGE, TENNESSEE 37831

**LB 7501 SOURCE ASSEMBLY**

DATE: \_\_\_\_\_ DATE: \_\_\_\_\_ DATE: \_\_\_\_\_  
 BY: \_\_\_\_\_ BY: \_\_\_\_\_ BY: \_\_\_\_\_  
 CHECKED: \_\_\_\_\_ CHECKED: \_\_\_\_\_ CHECKED: \_\_\_\_\_  
 DATE: \_\_\_\_\_ DATE: \_\_\_\_\_ DATE: \_\_\_\_\_

SCALE: \_\_\_\_\_ NIS: \_\_\_\_\_  
 SK-112900A/B  
 PKT 1 of 1

