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

NO.: NR-1120-D-101-S DATE: October 22, 2002 PAGE: 1 OF 13

DEVICE TYPE: Profile Thickness Gauge

MODEL: 5245-XX Series (see description for approved models)

DISTRIBUTOR: IMS Systems, Inc.
10521 Perry Highway
Suite 310
Wexford, PA 15090

MANUFACTURER: IMS Messsysteme GmbH
Dieselstrasse 55
Heiligenhaus D-42579
Germany

SEALED SOURCE MODEL DESIGNATION: Amersham Model: CDC.PE4
Reviss Model: R6010

ISOTOPE:	MAXIMUM ACTIVITY:
Cesium-137	275 Ci (10.18 TBq) [55 Ci (2.04 TBq) per source; Table 1 lists sources/gauges]

LEAK TEST FREQUENCY: 6 months

PRINCIPAL USE: (D) Gamma Gauge

CUSTOM DEVICE: _____ YES ____X____ NO

DEVICE TYPE: Profile Thickness Gauge

DESCRIPTION:

The 5245-xx Series gauge is a profile thickness gauge designed to continuously measure the thickness across the entire width of a moving aluminum (Model 5245-01 only) or steel (Models 5245-02, **5245-02-01,** or 5245-03) plate and provides this information to a computer and video display. Under normal operating conditions, the gauge is under the control of the mill operator and the mill control system. The 5245-xx Series gauge consists of the following:

- Metal Measuring Frame Structure (C-Frame for Models 5245-01, 5245-02, and **5245-02-01** or O-Frame for Model 5245-03)
- Individual Source Housings
- Ionization Chamber Detectors
- Electronics and Microcomputer System
- Air Purge System
- Shutter Air System
- Water Cooling System
- Remotely Located Operator Controls
- Source Shutter Open/Closed Indicator Lights

The gauge has the sealed sources installed in source **housing** or housings that are mounted in the upper arm of the measuring frame. The sealed sources used before September 28, 1999, were Amersham product code CDC.611, also known as CDC.PE4. The number of the registration certificate issued for the Model CDC.PE4 source is IL-136-S-197-S. The source obtained an ANSI N542-1977 classification of 77E63535.

After September 28, 1999, the source used is the Reviss Model R6010, with an ANSI N542 classification of 77E63646. The number of the registration certificate for this source is IL-1082-S-102-S. The two sources are equivalent. The source distributors recommend a working life of 15 years for the sources.

The source **housing** or housings sit in framed box arrangements designed to prevent horizontal motion. A clamping frame holds down the source housing, secured by bolts. The source housing

DEVICE TYPE: Profile Thickness Gauge

DESCRIPTION (cont'd):

is made with heavy metal [sintered tungsten, density is about 18 g/cm^3, melting point = 6116°F (3380°C)] cylindrical shutters with fan type collimators. The shutters are mounted with axial springs that close the shutter if there is an electric power or pneumatic failure. The source housings, **in models with multiple sources**, are mounted approximately equally spaced along the upper arm of the frame and are tilted to aim each beam at specific detectors. Attachment 1 shows the overall dimensions of a source housing. Attachment 2 shows a general cross-section of a source housing.

The ionization chamber **detector** or detectors are mounted along the bottom arm of the measuring frame. The combination of source tilting, collimating, and detector location provides beam patterns designed to cover the entire width of the plate being profiled.

The measuring frame is constructed from 0.95 cm (3/8") to 1.3 cm (1/2") thick steel box section. The frame of the Model 5245-01 gauge is constructed of carbon steel, and the Model 5245-02, **5245-02-01,** and 5245-03 frames are constructed of stainless steel. The gauge rides on either three rails set into the floor of the facility or is suspended from two rails, **or a monorail for Model 5245-02-01.** An electric motor moves the frame on the rails between a maintenance and a measuring position. Proximity switches on the rails ensure that the source shutters on the gauge cannot be opened or remain in an open position unless the measuring frame is in either the maintenance or measuring position.

The gauge is equipped with a internal water cooling system that will ensure the temperature inside the measuring frame will not exceed 158°F (70°C). Environmental temperatures above 158°F (70°C) may cause the system to give faulty readings as the result of radiometric geometry changes due to thermal expansion. The gauge manufacturer has stated that the gauge will maintain its structural and radiological integrity at temperatures up to 600°F (315°C).

DEVICE TYPE: Profile Thickness Gauge

DESCRIPTION (cont'd):

The gauge is equipped with an air purge system that maintains the internal sections of the frame at a positive pressure to minimize the intrusion of contaminants. The frame has a connection point for site supplied air for this system.

The gauge also has a connection for instrument-quality, site-supplied air for the shutter control system. The gauge control system is equipped with an alarm that will notify the operator if the shutter control air system pressure is below the minimum required to open the shutters.

The measuring area of the gauge is equipped with an externally arranged air blower system that will clear any mill material coolant or vapors from the beam area. This system provides a stable temperature and atmosphere in the measuring gap for gauge accuracy purposes. On the Models 5245-02 and **5245-02-01** gauges, this blower system also supplies the apron table section with air to keep scale clear of the lower arm of the C-frame and the detectors. (Customer-supplied arrangements to keep scale or oxides away from the detectors may exist on the other models, but are not required for proper operation.)

DEVICE TYPE: Profile Thickness Gauge

DESCRIPTION (cont'd):

The approved models within the series and their representative specifications are listed in Table 1, below:

TABLE 1. Dimensions and Activity - 5245-xx Series Gauges

		5245-01	5245-02	5245-03	**5245-02-01**
Length	(inches) (meters)	206 5.23	246.9 6.27	319.4 8.11	**167.3** **4.25**
Height	(inches) (meters)	144 3.66	157.5 4.00	147.6 3.75	**110.5** **2.8**
Width	(inches) (meters)	17 0.43	23.62 0.60	20.9 0.53	**18.5** **0.47**
Air Gap	(inches) (meters)	98 2.49	85.23 2.16	88.6 2.25	**47.2** **1.2**
Ionization Chambers		56	77	93	**7**
Source Housings		2	3	5	**1**
Total Activity	(Ci) (TBq)	110 4.07	165 6.105	275 10.175	**55** **2.04**

The gauge is operated automatically by the mill control system, manually by the mill operator, as an integrated part of the mill process, or manually from a steel-walled gauge house built near to the gauge.

Deflective metal guards may be provided to mitigate the impact of any severe forces that “cobbling” or breaking of a plate might generate.

Other safety features of the gauge include:

- Automatic source housing shutter closure by the two redundant spring assemblies, adjusted to a torque of one Newton-meter each, on an electrical or shutter air

DEVICE TYPE: Profile Thickness Gauge

DESCRIPTION (cont'd):

system failure, if there is no material in the measuring gap for a preset time, if the gauge is knocked or moved out of its measuring or maintenance positions, or if the measuring frame temperature exceeds 158°F (70°C).

- The shutters cannot be opened, either manually or by computer, when the gauge is not in either the measuring or maintenance position.

- A steel/lead wall constructed in front of the C-frame open end to prevent the radiation dose rate from exceeding 0.25 mrem/hr (2.5 µSv/hr) in any accessible area near the C-frame open end. For O-frame gauges (Model 5245-03), the lead/steel wall may not be necessary since there is no open end. However, even with O-frame gauges, a 0.25 mrem/hr (2.5 µSv/hr) controlled area for continued personnel presence must be maintained while the gauge is in operation.

- The gauge is equipped with a key switch which, when locked off, will disable the source-shutter-open circuit. Only authorized personnel will have a key for this switch.

- Source shutter open/closed (red/green light) indicator light boxes are installed on the top of the gauge, or where they provide best visibility to the gauge operator and other plant personnel. Each source shutter has two inductive type proximity switches to indicate either a fully open or fully shut shutter position. If any shutter is not fully shut, then the indicator light boxes will indicate that the shutters are open.

LABELING:

The gauge is labeled in accordance with Subpart J, 10 CFR Part 20. The gauge labels contain the radiation symbol, model number, serial number, name of the distributor, the words "CAUTION-RADIOACTIVE MATERIAL", and for each source contained in the gauge, the isotope, serial number and activity.

DEVICE TYPE: Profile Thickness Gauge

LABELING (cont'd):

For previously distributed gauges which IMS Systems, Inc. assumes a servicing role, the name of the original gauge distributor shall be listed on the label.

In addition, the source housings are labeled with the radiation symbol, the manufacturer's name, the word "Radioactive", and the following information: isotope, activity, source serial number, and assay year.

Gauge label location is selected by IMS Systems, Inc. so as to provide maximum visibility to persons approaching the gauge from both sides. The labels will be constructed of an appropriate (20 gauge minimum thickness) metal, selected for its suitability and ability to withstand the environmental conditions (temperature, corrosive atmospheres, etc.) at the installation location. As a minimum, the metal labels will have a melting point greater than 1000°F (538°C) and a yield strength greater than 5000 psi (34.5 MPa). Typical label metals include stainless steel, aluminum alloy, brass, and bronze.

Engraving, etching, stamping, or any other equivalent permanent process is used to impart labeling information to the metal label material. The labels are attached to the gauge with metal fasteners (screws, bolted, etc.).

DIAGRAMS:

Attachments 1-**12** show the source housing, profile thickness gauge Models 5245-01, 5245-02, **5245-02-01**, and 5245-03, the radiation dose rate contours for each gauge, typical labels for the gauge, and overall views of Models 5245-02 **and 5245-02-01 gauges.**

CONDITIONS OF NORMAL USE:

The gauge is intended for use in industrial gauging applications. It is typically used to measure thickness profiles of metal plate/sheet ranging in thickness from 0.0004" to 10" (0.01 mm to

DEVICE TYPE: Profile Thickness Gauge

25.4 cm). The gauge is designed for the following environments:

CONDITIONS OF NORMAL USE (cont'd):

Temperature	From 68°F (20°C) to 158°F (70°C) (operating) Gauge will maintain its integrity in temperatures up to 600°F (315°C)
Pressure.	Atmospheric
Corrosion	Ranges from zero to slightly corrosive vapors
Fire.	1472°F (800°C), 20 minutes (based on the source ANSI N542 classification)

The gauges in the 5245-XX Series have an estimated working life of 15 years.

PROTOTYPE TESTING:

Both the profile thickness gauge and the source housing used within the gauge have been tested in accordance with the procedures specified in the NBS Handbook 129, American National Standard N538. The source housing received a classification of ANSI 32-SSS-454-R3. The profile thickness gauge received a classification of ANSI N538 32-232-775-R3.

The shutter mechanism was subjected to cyclic testing. A source housing was endurance tested according to ISO 7205 (Radionuclide gauges - Gauges designed for permanent installation, 1986) for 25,000 operating cycles and no degradation in the performance of the shutter was observed.

EXTERNAL RADIATION LEVELS:

Based on measured and calculated data for the Model **5245-02-01**, 5245-01, -02, and -03 gauges, the maximum external radiation dose rates at 6, 30, and 100 cm (2.4", 11.8", and 39.4") from the

DEVICE TYPE: Profile Thickness Gauge

source housing and the gauge are shown in Table 2, below:

EXTERNAL RADIATION LEVELS (cont'd):

Table 2. Maximum External Dose Rates - 5245-XX Series

Distance from Source Housing or Meas. Frame	Radiation Dose Rate From:		
	Sources Housing Shutter Closed	Meas. Frame Shutter Closed	Primary Beam Shutter Open
6* cm (2.36")	50.4 mrem/hr (504 µSv/hr)	0.5 mrem/hr (5.0 µSv/hr)	1936 rem/hr (19.4 Sv/hr)
30 cm (11.81")	4.0 mrem/hr (40 µSv/hr)	Background	167.2 rem/hr (1.7 Sv/hr)
100 cm (39.37")	0.36 mrem/hr (3.6 µSv/hr)	Background	17.6 rem/hr (176 mSv/hr)

Radiation measurements for both the source housing and the gauge, shutter in the open position, are equal because they were measured in the primary beam.

* 6 cm (2.36") is the smallest distance from the source housing due to the geometry of the measuring gauge.

Isodose curves showing a 0.75 mrem/hr (7.5 µSv/hr) contour around the Model 5245-01 measuring frame loaded with 100 Ci (3.7 TBq) of Cs-137 are shown in Attachment 4. The 0.75 mrem/hr (7.5 µSv/hr) contour around the Model 5245-02 measuring frame loaded with 150 Ci (5.55 TBq) of Cs-137 is shown in Attachment 6.

The same contour around a Model 5245-03 loaded with 250 Ci (9.25 TBq) of Cs-137 is shown in Attachment 8. **The contour around a Model 5245-02-01 loaded with 20 Ci (1.85 TBq) of Cs-137 is shown in Attachment 11.** The contour lines show the 0.75 mrem/hr (7.5 µSv/hr) area with the shutter in the open position. The 0.25 mrem/hr (2.5 µSv/hr) contour can be defined by simply increasing the distance from the measuring frame by a factor of the square root of 3, or 1.73.

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EXTERNAL RADIATION LEVELS (cont'd):

The only place where an individual can stand within 3 feet (0.91 m) of the Model 5245-01, Model 5245-02, or **Model 5245-02-01** C-frame during normal operation is in front of the 'C' opening. (An individual cannot stand within this distance of a Model 5245-03 O-frame gauge during normal operation.) This area will have a lead/steel wall constructed to confine the radiation dose rate to 0.25 mrem/hr (2.5 µSv/hr).

QUALITY ASSURANCE AND CONTROL:

IMS Systems, Inc. maintains a quality assurance and control program which has been deemed acceptable for licensing purposes by NRC. A copy of the program is on file with NRC.

LIMITATIONS AND/OR OTHER CONSIDERATIONS OF USE:

- Model 5245-xx Series gauges shall be distributed only to persons specifically licensed by the NRC or an Agreement State.

- Handling, storage, use, transfer, and disposal: To be determined by the licensing authority. In view of the fact that the sources used in the gauge exhibit high dose rates, the sources should be handled by experienced, licensed personnel using adequate remote handling tools and procedures.

- Model 5245-xx Series gauges shall be leak tested at intervals not to exceed 6 months using techniques capable of detecting 0.005 µCi (185 Bq) of removable contamination.

- The Model 5245-01 gauge is approved only for measuring aluminum. The Model 5245-02 gauge is approved for use at NUCOR Steel, Cofield, NC. The Model 5245-03 gauge is approved for use at Bethlehem Steel in Burns Harbor, IN.

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- This registration sheet and the information contained within the references shall not be changed without the written consent of the NRC.

LIMITATIONS AND/OR OTHER CONSIDERATIONS OF USE (cont'd):

- The source housing installation or repair, or replacement of the source must be performed by a qualified person licensed by NRC or an Agreement State.

- REVIEWER NOTE: The Model 5245-xx Series profile gauges have been registered as a series because IMS Systems, Inc. indicates that gauges will be manufactured and installed for licensees on an individual basis. Therefore, the dimensions of the gauge may vary but the design of the source housing will remain the same. The distributor will submit the design of each new gauge of the series to NRC for evaluation and approval.

- REVIEWER NOTE: The gauge must have all of the following safety features checked for proper function at the time of installation and, thereafter, at intervals not to exceed 6 months:

  - spring mechanism which will close the shutter if there is an electric power or air failure.

  - low air supply alarm system.

  - proximity switches which ensure shutter closure if the gauge is not in the measuring or maintenance position.

  - detection system which will ensure shutter closure if no material is in the measuring gap.

  - shutter indicator light boxes.

- REVIEWER NOTE: The shutter position indication lights must be located in such a way as to be easily visible to persons approaching the gauge from any direction.

- REVIEWER NOTE: The identification labels must be located in

DEVICE TYPE: Profile Thickness Gauge

such a way as to be easily visible to persons approaching the gauge from either side.

LIMITATIONS AND/OR OTHER CONSIDERATIONS OF USE (cont'd):

- REVIEWER NOTE: A Model 5245-01, Model 5245-02, or **Model 5245-02-01** gauge must be installed with a lead/steel wall constructed in front of the 'C' opening of the gauge. The wall must confine the radiation dose rate to 0.25 mrem/hr (2.5 µSv/hr) or lower. O-frame gauge installations may not necessitate this wall. A controlled area shall be maintained around both C-frame and O-frame to ensure that no individual will be exposed to a radiation dose rate greater than 0.25 mrem/hr (2.5 µSv/hr). This includes when the gauge is in both the "on-line" and "park" positions. The areas above the gauge, such as catwalks, if not shielded, must be made unaccessible during operation, and maintenance with the shutters open, due to the high radiation dose rates in the area above the measuring frame.

- REVIEWER NOTE: Prior to September 28, 1999, the sources installed in this gauge were Amersham product code CDC.611, also known as model CDC.PE4. The registration for the model CDC.PE4 source was through IL-136-S-197-S. The model CDC.PE4 source is maintained on this registry to accommodate the licensing and use of gauges distributed prior to September 28, 1999.

SAFETY ANALYSIS SUMMARY:

Based on our review of IMS Systems, Inc. Model 5245-xx Series profile thickness gauges, and the information and test data cited below, we **continue to** conclude that these gauges are acceptable for specific licensing purposes. In addition, the manufacturer has stated that the shutter was successfully tested in accordance with ISO 7205.

Furthermore, we **continue to** conclude that these gauges would be expected to maintain their containment integrity for normal conditions of use and accidental conditions which might occur during uses specified in this certificate.

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(AMENDED IN ITS ENTIRETY)

DEVICE TYPE: Profile Thickness Gauge

REFERENCES:

The following supporting documents for the Model 5245-xx Series profile thickness gauge are hereby incorporated by reference and are made a part of this registry document.

- Lorenz & Engelhardt's application for AEG dated June 8, 1990, and subsequent letters dated July 17, 1990, July 31, 1990, October 12, 1990, November 24, 1990, and January 17, 1991, with enclosures thereto.

- Isotope Measuring Systems' letters dated March 1, 1995 (2 letters), November 20, 1995, February 21, 1996, April 19, 1996, and facsimile transmissions dated June 14, 1995, and June 16, 1995, with enclosures thereto.

- IMS Systems, Inc. letters dated June 22, 2000, August 22, 2000, September 11, 2000, September 13, 2000, September 19, 2000, September 22, 2000, September 26, 2000, October 2, 2000, October 10, 2000, and October 12, 2000, facsimile transmission dated September 14, 2000, and electronic mail transmissions dated October 6, 2000, and October 11, 2000, with enclosures thereto.

- **IMS Systems, Inc. application for amendment dated April 8, 2002, with enclosures thereto.**

- **IMS Systems, Inc. electronic mail transmission dated October 21, 2002, with enclosures thereto.**

ISSUING AGENCY:

U.S. Nuclear Regulatory Commission

Date: 10/22/02 Reviewer: /RA/
Ujagar S. Bhachu

Date: 10/22/02 Concurrence: /RA/
John P. Jankovich

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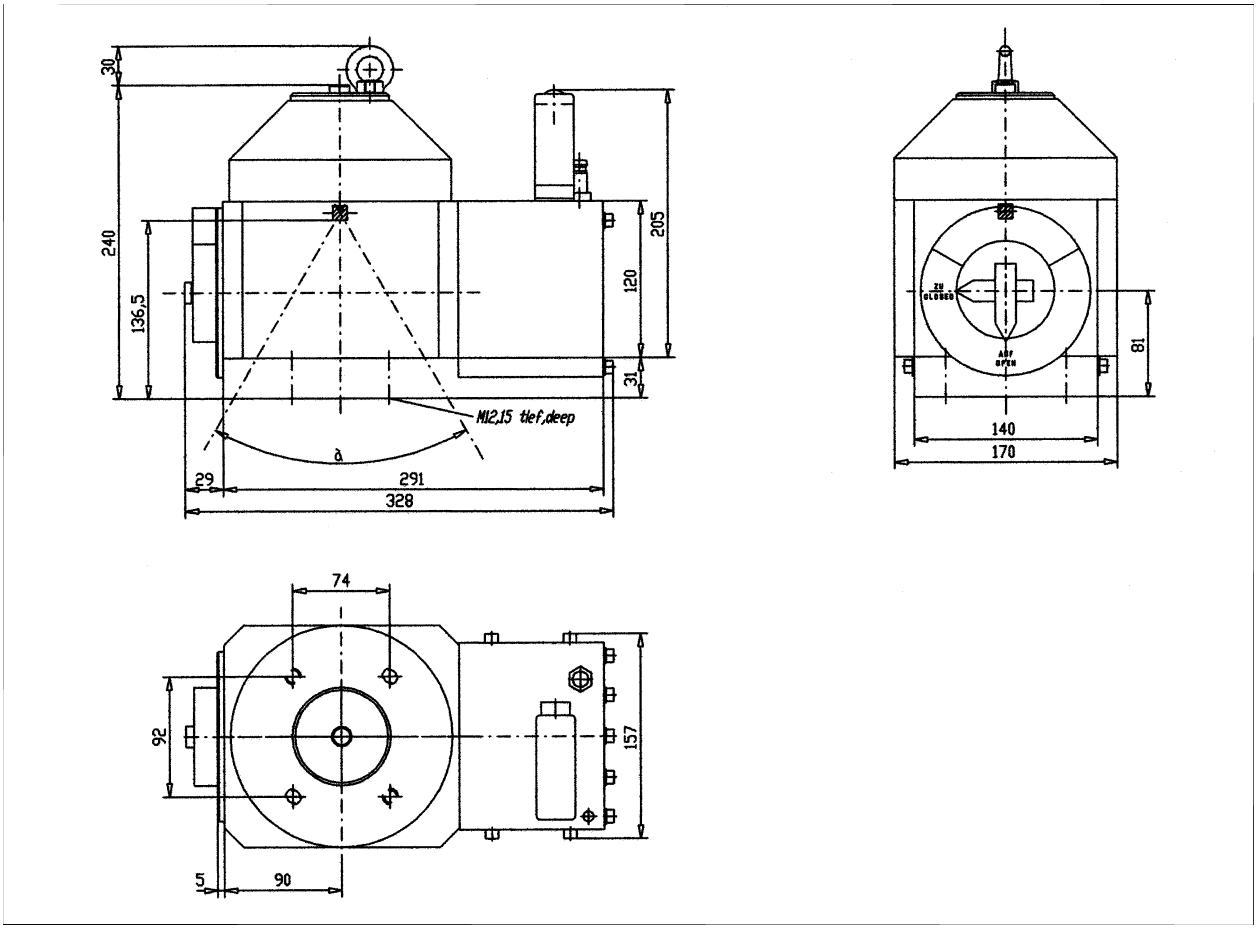
SAFETY EVALUATION OF DEVICE
(AMENDED IN ITS ENTIRETY)

NO.: NR-1120-D-101-S DATE: October 22, 2002 ATTACHMENT 1



Source Housing
(dimensions in millimeters)
(weight is approximately 220 lbs.)

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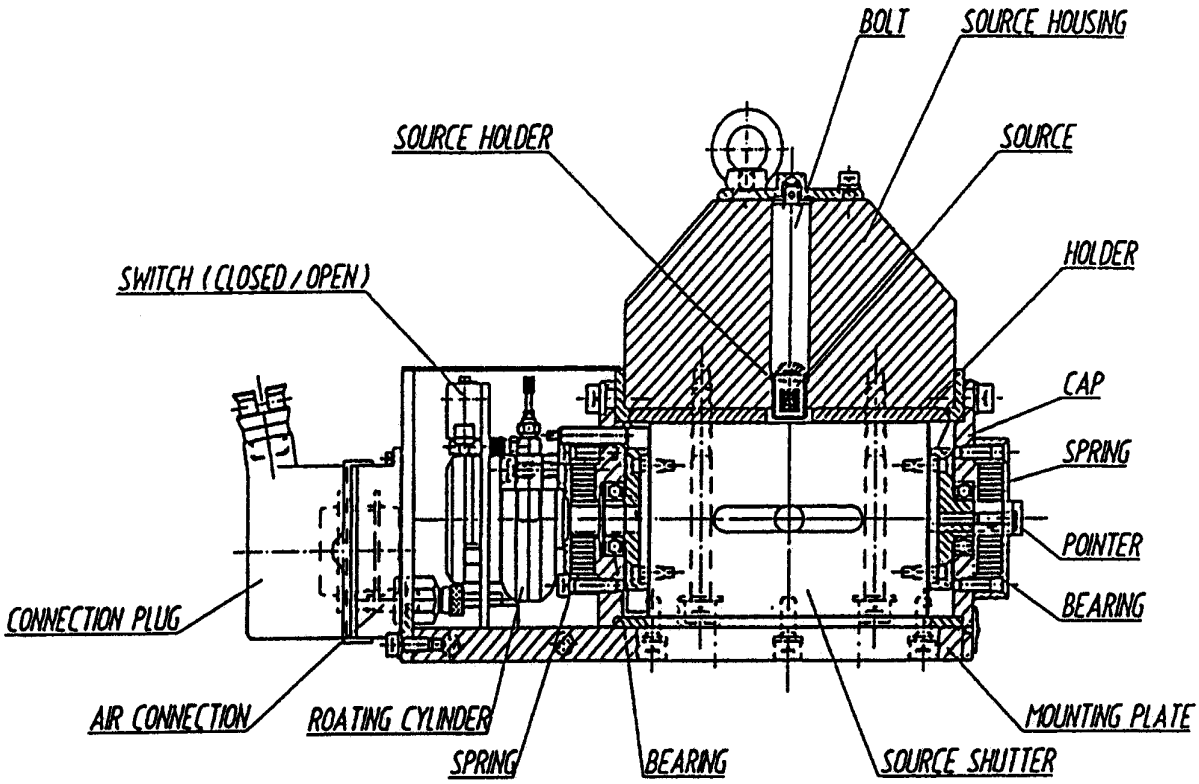

Source Housing

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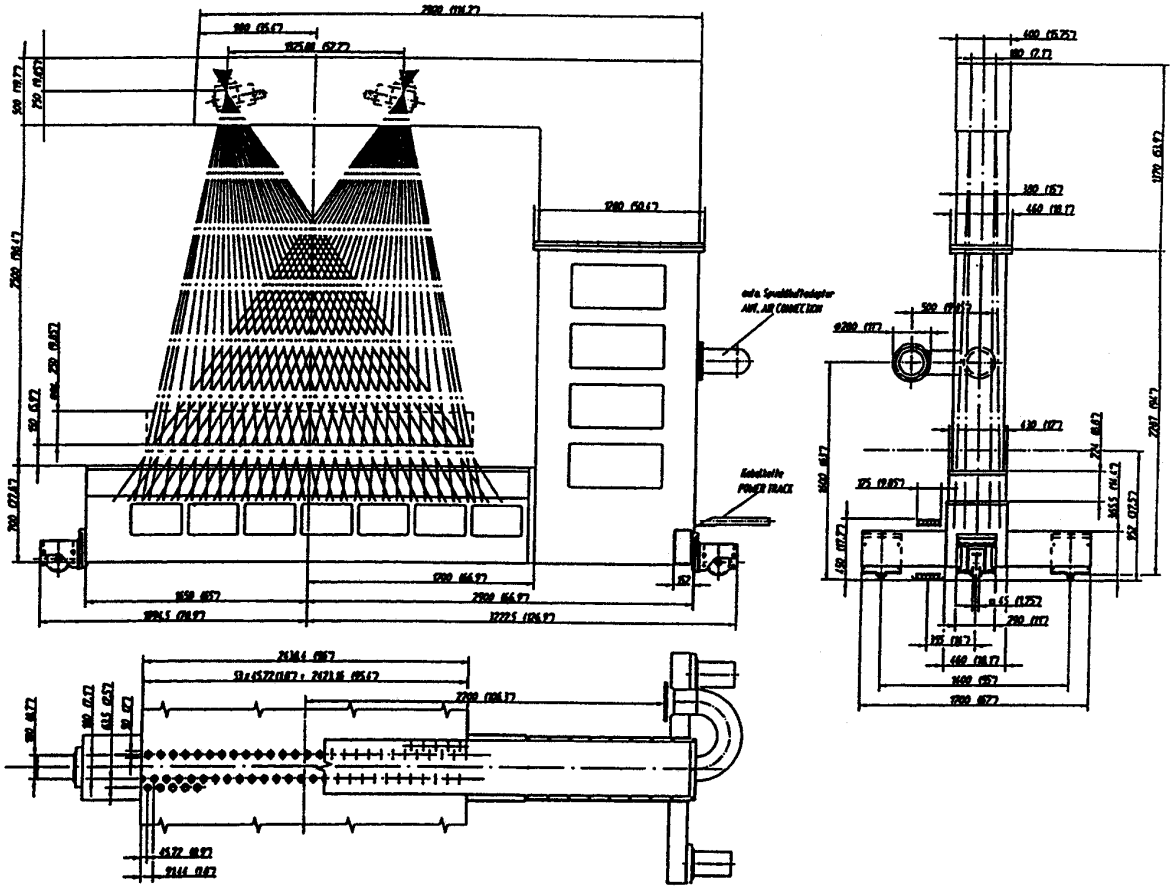
NO.: NR-1120-D-101-S DATE: October 22, 2002 ATTACHMENT 3



Model 5245-01 Profile Thickness Gauge
(dimensions in millimeters)

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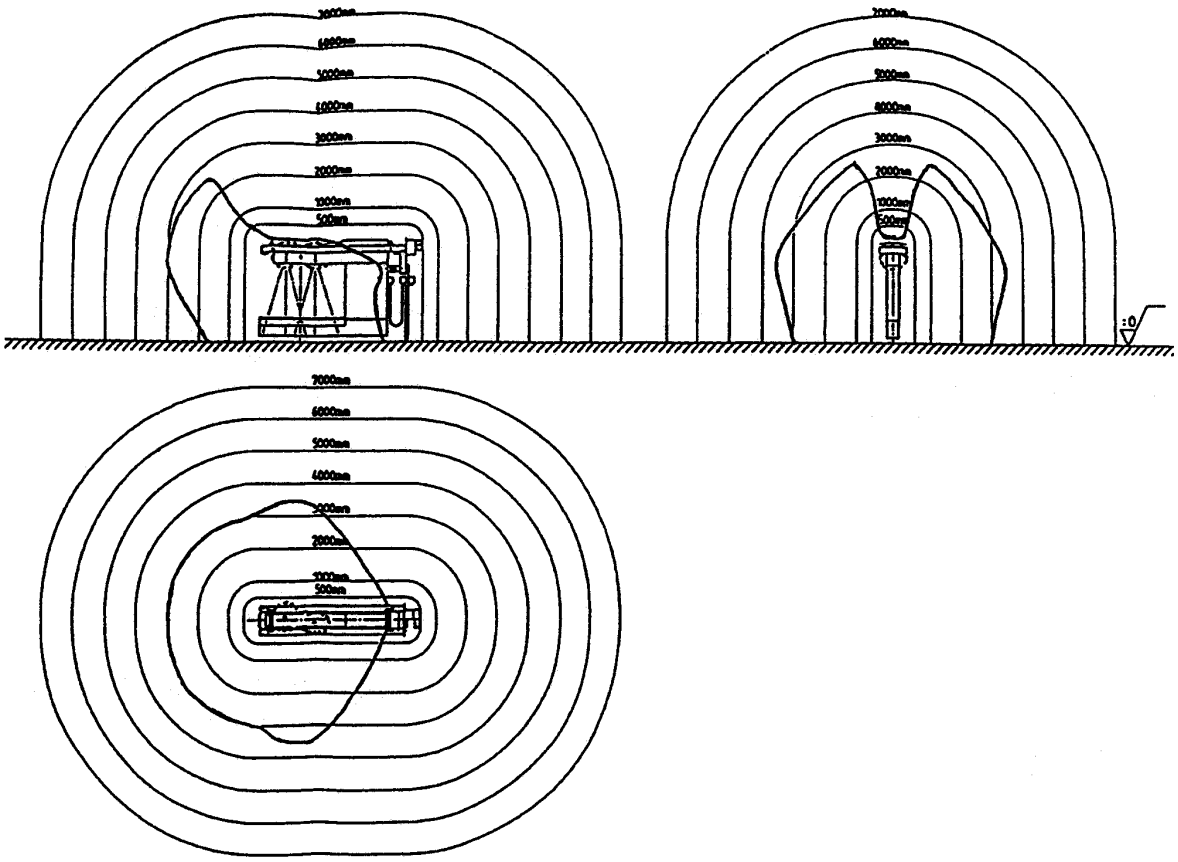
SAFETY EVALUATION OF DEVICE
(AMENDED IN ITS ENTIRETY)

NO.: NR-1120-D-101-S DATE: October 22, 2002 ATTACHMENT 4



0.75 mrem/hr Dose Rate Contour for Model 5245-01
loaded with 100 Ci (3.7 TBq) Cs-137
(marked distances start at 0.5 m, then 1.0 m and 1 m increments)

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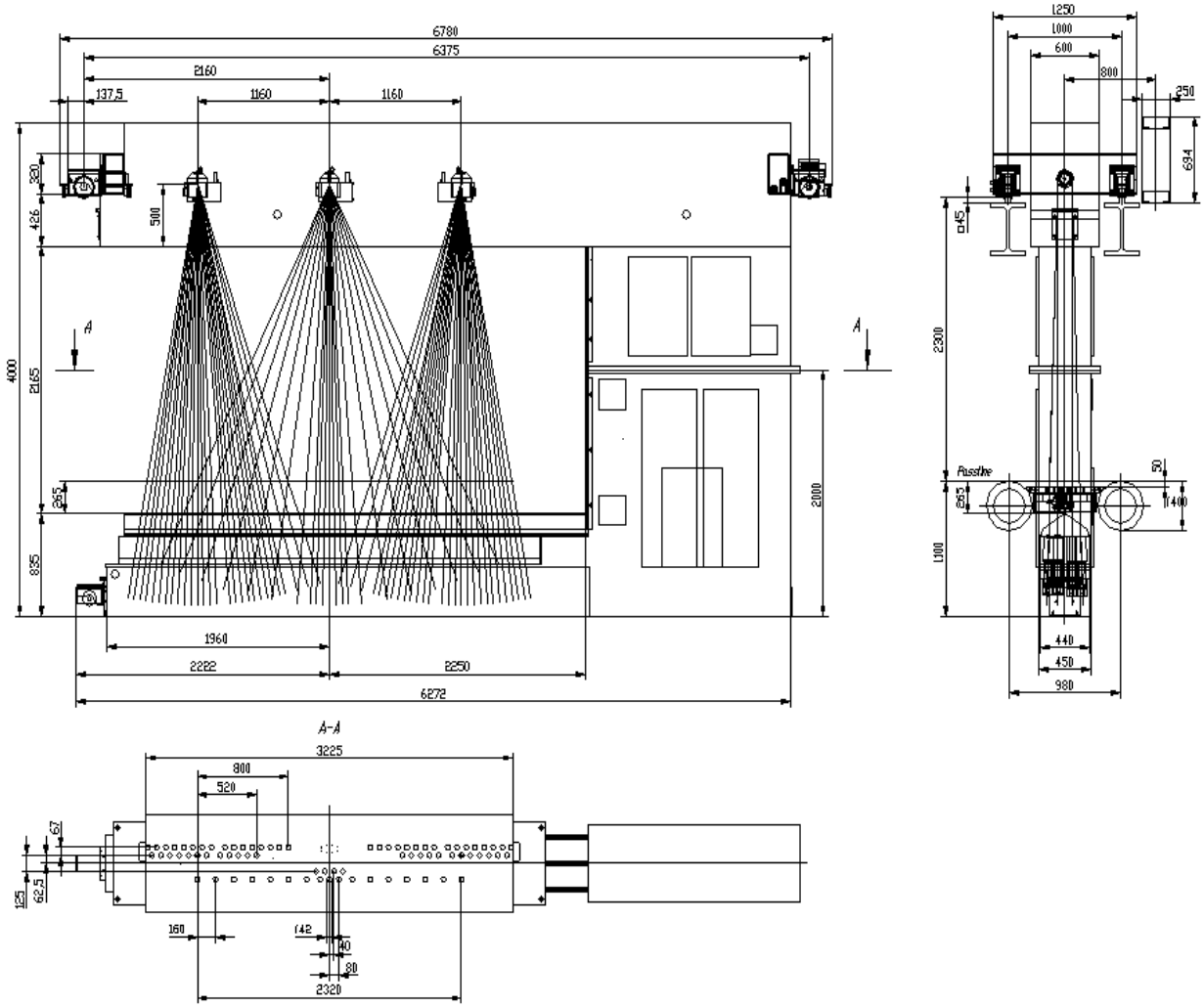
NO.: NR-1120-D-101-S DATE: October 22, 2002 ATTACHMENT 5



Model 5245-02 Profile Thickness Gauge
(dimensions in millimeters)

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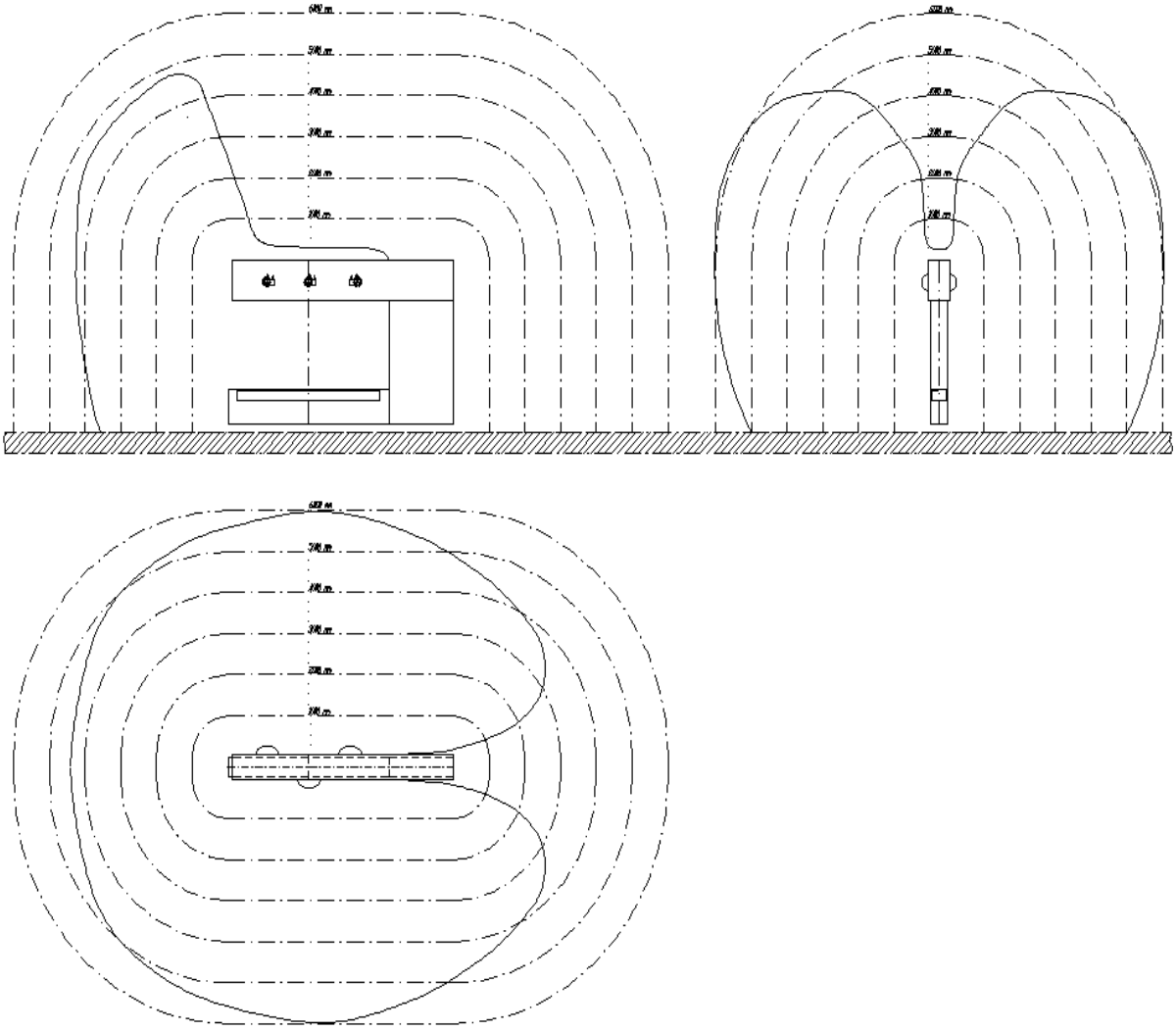

0.75 mrem/hr Dose Rate Contour for Model 5245-02
loaded with 150 Ci (5.55 TBq) Cs-137
(distances are marked in 1 meter increments)

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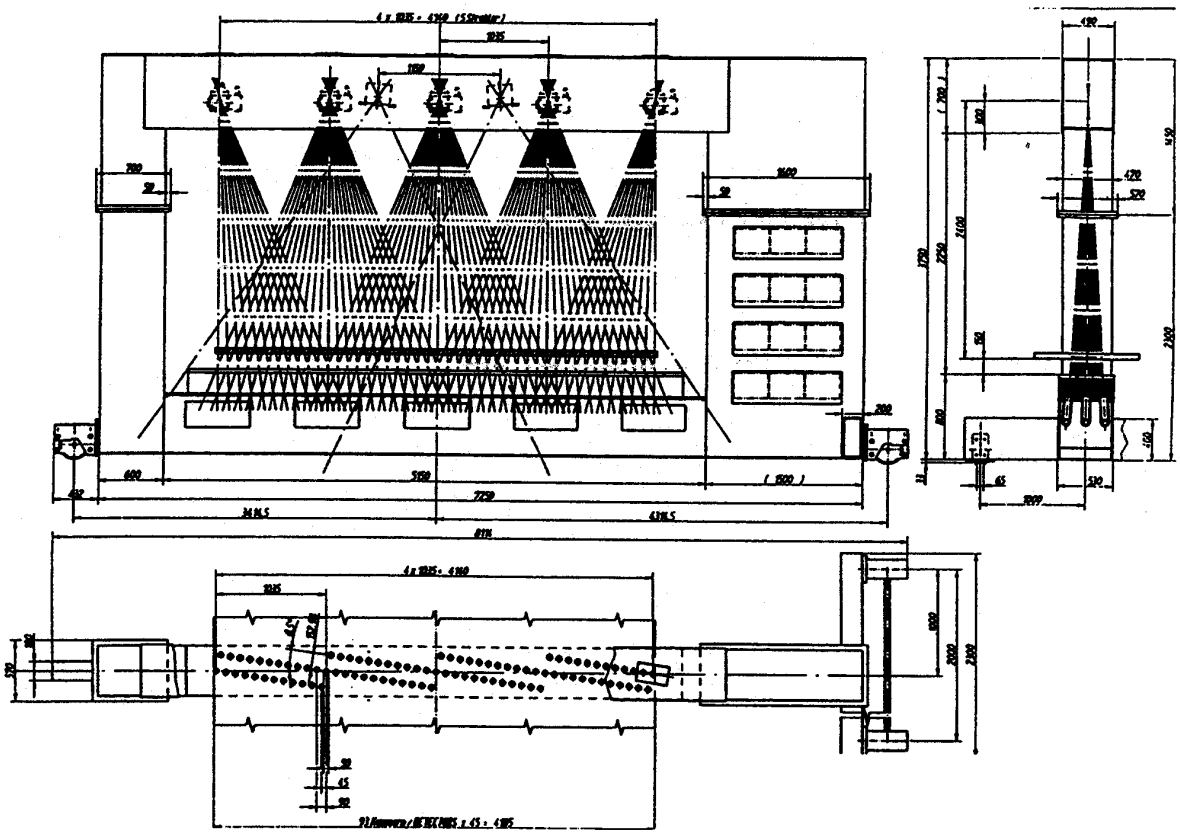
NO.: NR-1120-D-101-S DATE: October 22, 2002 ATTACHMENT 7



Model 5245-03 Profile Thickness Gauge
(dimensions in millimeters)

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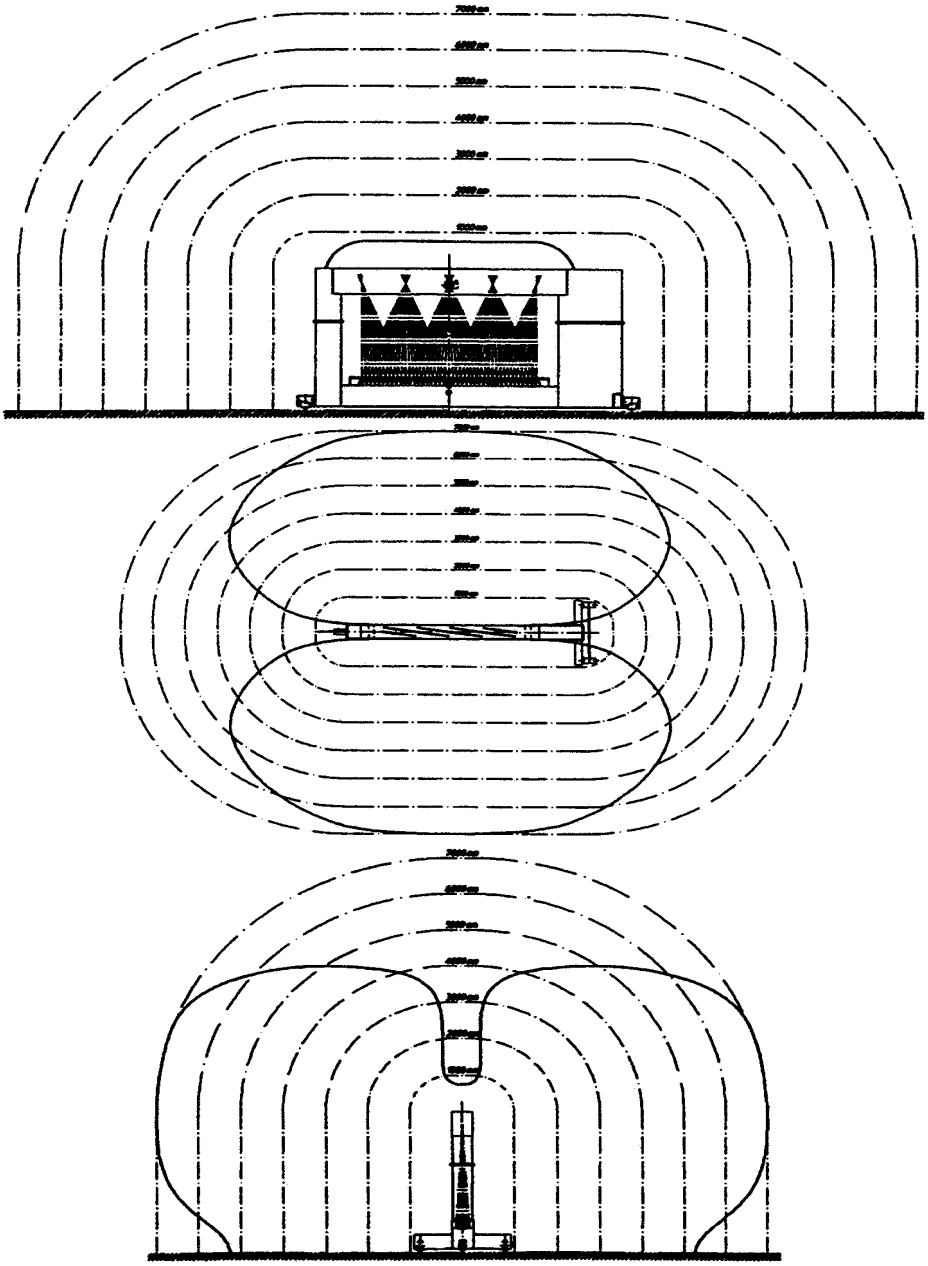

0.75 mrem/hr Dose Rate Contour for Model 5245-03
loaded with 250 Ci (9.25 TBq) Cs-137
(distances are marked in 1 meter increments)

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THE FOLLOWING RADIOACTIVE SOURCES ARE CONTAINED WITHIN THIS PROFILE THICKNESS GAUGE.

1 x Cs 137, I.D. 1119GP,	**ACTIVITY: 55 CURIE**
1 x Cs 137, I.D. 1126GP,	**ACTIVITY: 55 CURIE**
1 x Cs 137, I.D. 1127GP,	**ACTIVITY: 55 CURIE**

EACH SOURCE MUST BE LEAK TESTED ONCE PER SIX (6) MONTHS. THE SOURCE SHUTTER OPERATION (OPEN/CLOSED) MUST BE CHECKED EVERY SIX (6) MONTHS.

REMOVAL OF THIS LABEL IS PROHIBITED.

Please refer to the profile thickness gauge Operating/maintenance manual for installation, operation, and service instructions.

Service Agent: **IMS Systems, Inc.**
10521 Perry Highway
Suite 310
Wexford, PA. 15090
(724) 940-7160

ANSI Classification: Source Housing: ANSI 32-SSS-454-R3

REMOVAL OF THIS LABEL IS PROHIBITED.

Typical set of gauge labels

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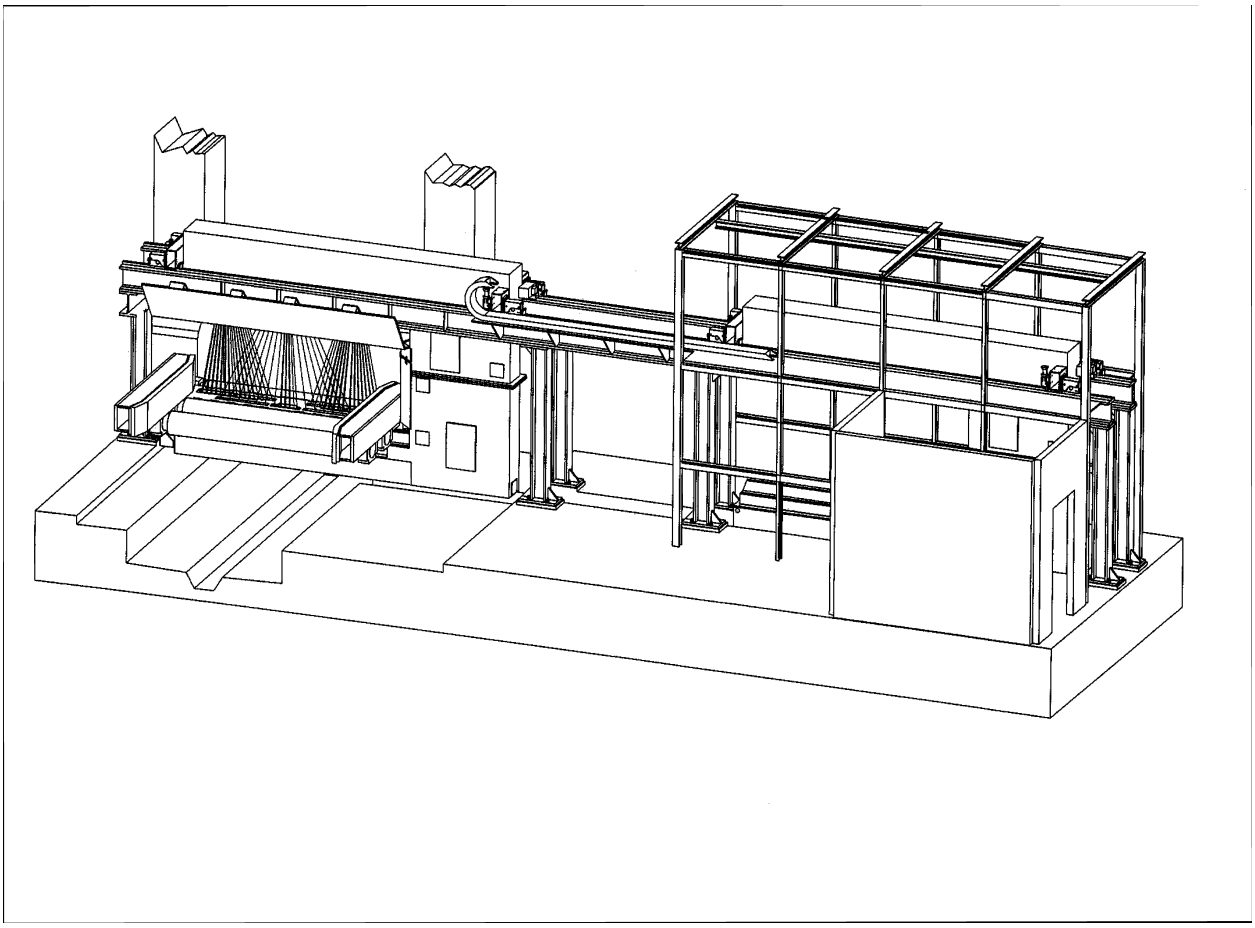

General arrangement of Model 5245-02 gauge
(shows measuring position - left, maintenance position - right)

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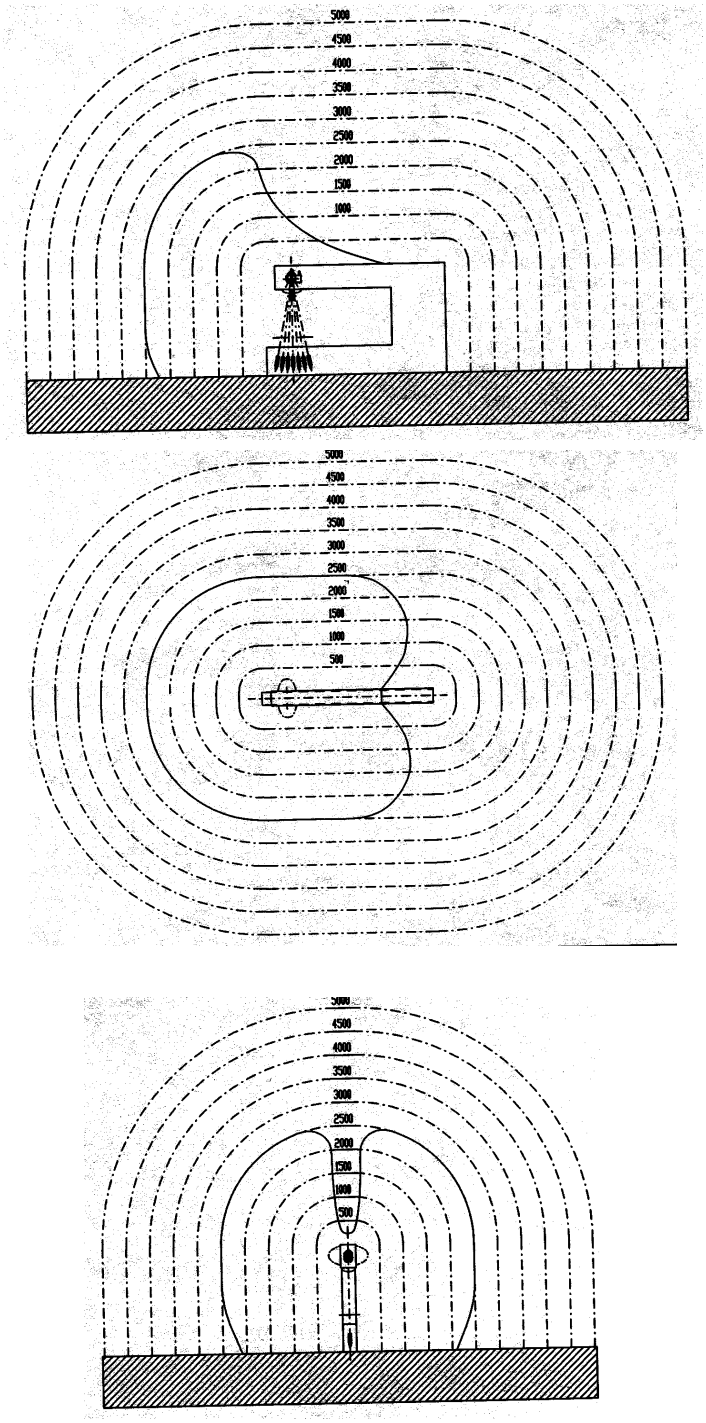

0.75 mrem/hr Dose Rate Contour for Model 5245-02-01
loaded with 20 Ci (1.85 TBq) Cs-137
(distances are marked in 1 meter increments)

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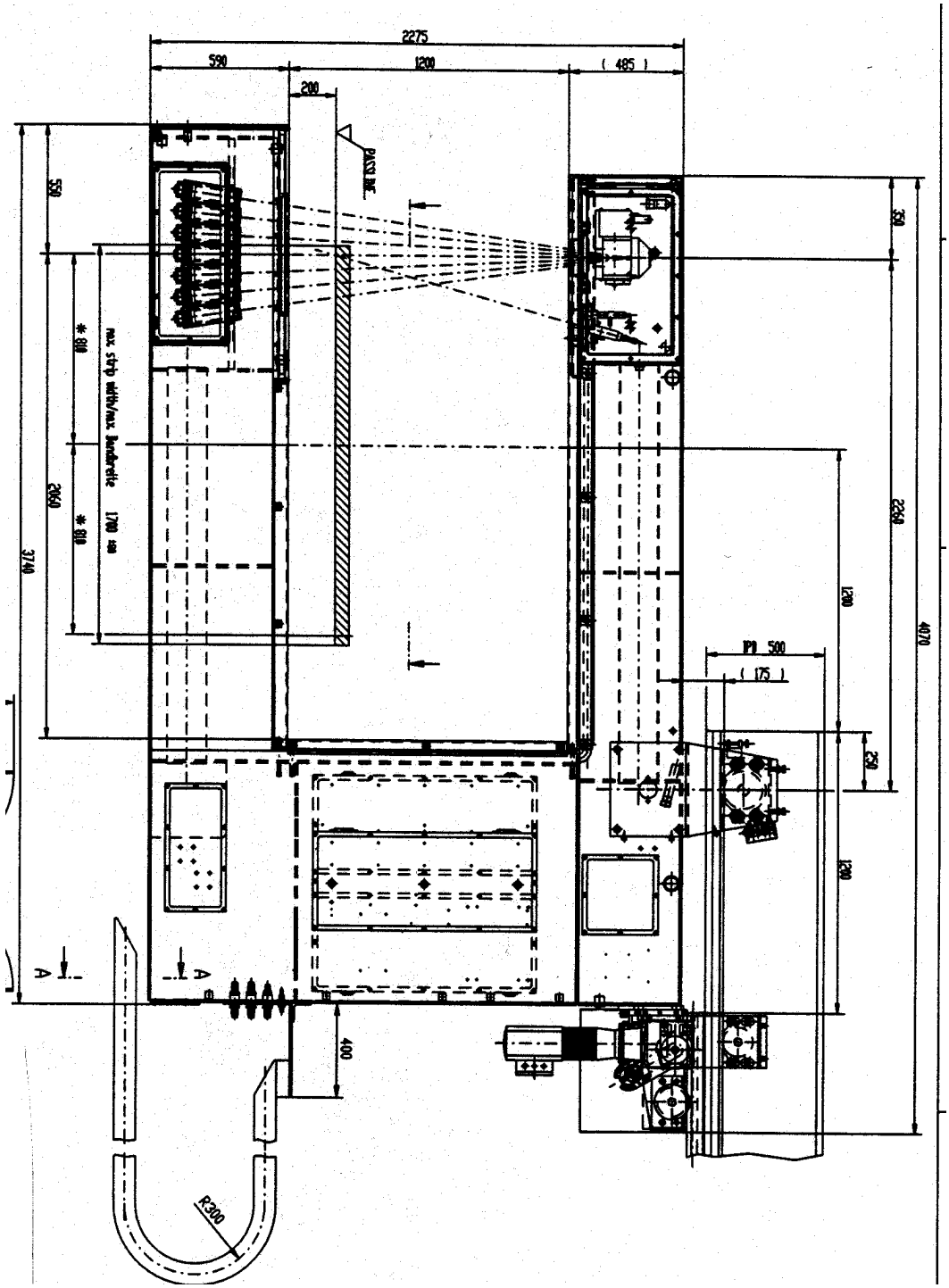

Model 5245-02-01 Profile Thickness Gauge
(dimensions in millimeters)