REGISTRY OF RADIOACTIVE SEALED SOURCES AND DEVICES
SAFETY EVALUATION OF SEALED SOURCE

NO.: NR136S180U DATE: January 16, 1980 PAGE 1 OF 6

SEALED SOURCE TYPE: Smoke Detector Source

MODEL: NBC.1002H

MANUFACTURER/DISTRIBUTOR: Amersham Corporation
2636 S. Clearbrook Drive
Arlington Heights, IL 60005

MANUFACTURER/DISTRIBUTOR:

ISOTOPE: Nickel-63 MAXIMUM ACTIVITY: 60 microcuries

LEAK TEST FREQUENCY:

PRINCIPAL USE: Ion Generators, Smoke Detectors

CUSTOM SOURCE: ___ YES X NO

4778

A-1

REGISTRY OF RADIOACTIVE SEALED SOURCES AND DEVICES
SAFETY EVALUATION OF SEALED SOURCE

NO.: NR136S180U DATE: January 16, 1980

SEALED SOURCE TYPE: Smoke Detector Source

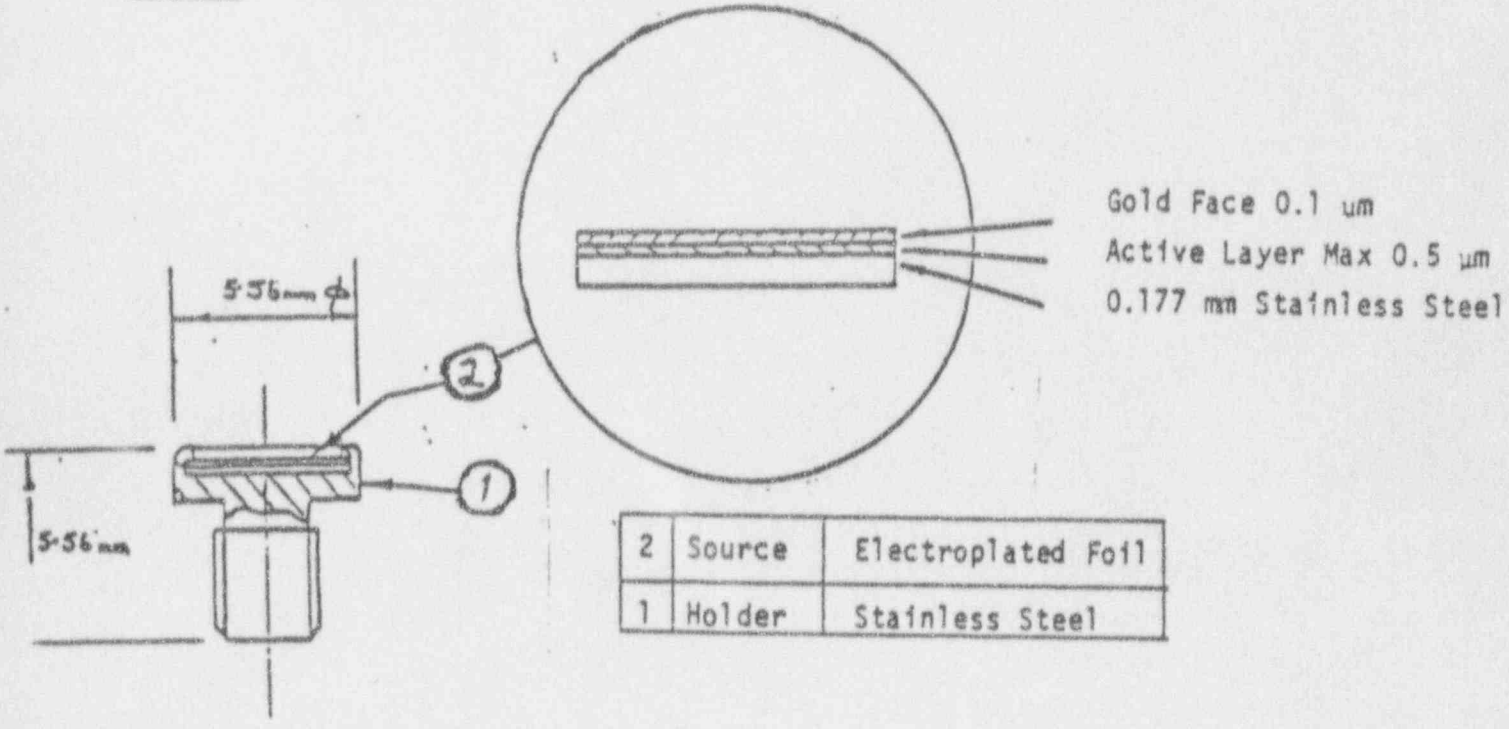
DESCRIPTION:

The radionuclide, nickel-63, is uniformly electroplated as metal onto a stainless steel backing strip. A surface overcoat of inactive gold is carefully applied by electroplating, keeping strictly to predetermined plating instructions. Discs are punched from the foil using tooling specifically designed to prevent damage to the active foil and to avoid burrs at the blanked edges. Discs are mounted in stainless steel holders the edges of which are rolled or formed over the rim of the disc to seal and retain it.

LABELING:

Individual sources are not labeled due to size, however, they are packed in plastic vials which are labeled. The vial label contains the radiation symbol and the words, "Caution Radioactive Material." In addition, the label states the number of sources, model number, nuclide, activity each source and date.

DIAGRAM:



2	Source	Electroplated Foil
1	Holder	Stainless Steel

REGISTRY OF RADIOACTIVE SEALED SOURCES AND DEVICES
SAFETY EVALUATION OF SEALED SOURCE

NO.: NR136S180U DATE: January 16, 1980

SEALED SOURCE TYPE: Smoke Detector Source

CONDITIONS OF NORMAL USE:

The nickel-63 mounted foil source is designed for use in industrial and home-type ionization smoke detectors.

PROTOTYPE TESTING:

Two samples each containing 15 uCi nickel-63 were subjected to the tests specified in the ANSI Report N542.1977, "Sealed Radioactive Sources, Classification." Leakage before and after testing was determined by immersion testing. The results indicated a classification as follows:

Test	Class
Temperature	5
Ext. Pressure	4
Impact	3
Vibration	4
Puncture	3

Additional Tests:

Temperature Test 1: Twenty (20) sources each containing 15 uCi were held at -25°C for 1 hour followed by 1 hour at 100°C. The results of wipe and immersion tests before and after exposure were less than 0.005 uCi removable contamination from each source.

Temperature Test 2: Ten (10) sources each containing 15 uCi were simultaneously heated from room temperature to 600°C and retained at this temperature for 1 hour. During the test, air was passed through the test chamber at a flow rate of approximately 2.5 liters/minute then passed through a filter and condenser. The total activity removed from the condenser and filter was collected with the debris and measured. The result was 0.0042 uCi total. Each source was also wiped with a result of less than .003 uCi per source.

Temperature Test 3: (Incineration) Twenty (20) sources containing 15 uCi each were subjected to a 1200°C high temperature test procedure and subsequent resuspension test procedure. The test was carried out by the National Radiological Protection Board, Harwell, England. The conclusions reached were:

REGISTRY OF RADIOACTIVE SEALED SOURCES AND DEVICES
SAFETY EVALUATION OF SEALED SOURCE

NO.: NR136S180U DATE: January 16, 1980

SEALED SOURCE TYPE: Smoke Detector Source

PROTOTYPE TESTING (CONT'D):

Additional Tests (Cont'd):

Temperature Test 3 (Cont'd)

1. A total of $4.8.10^{-4}$% of the total nominal activity became airborne as a result of the incineration test. All the activity was in the respirable range.

2. A further $5.8.10^{-4}$% became airborne as a result of the resuspension experiment using the furnace tube alone, and a total of $2.2.10^{-2}$% became airborne during the resuspension experiment with the boats (two porcelain source containers) in place. In both cases all the activity was in the respirable range.

3. A total of $5.4.10^{-2}$% of the total nominal activity was removed by wiping and a further $1.5.10^{-2}$% was found remote from the sample boats after the completion of the experiment.

Thermal Shock Test: Ten (10) samples each containing 15 uCi were heated to 600°C held at temperature for 15 minutes then rapidly cooled by immersion in water at 15°C. Samples were assessed by wipe and immersion testing. The test results demonstrated less than 0.005 uCi removable activity per source.

Vibration Test: Twenty (20) samples were subjected to vibration for 60 minutes over the range 5 to 60 hertz. The peak acceleration was 0.24 g for the range 5-20 Hz., 0.40 g for 20-40 Hz, and 0.51 g for 40-60 Hz. Immersion and wipe test results following the test demonstrated less than 0.005 uCi removable activity.

Impact Test: Twenty (20) samples were subjected an impact test by dropping a steel hammer weighing 0.5 kg onto the source from a height of 0.5 meter. Sources were then dropped ten times in free fall from a height of 2 meters onto a steel plate following which immersion and wipe test were performed. The result of the test was less than 0.005 uCi removable activity each source.

Puncture Test: Twenty (20) samples were each subjected to a pin, being 1/4 inch high and 1/8 inch diameter with an edge radius of 1/16 inch and weighing 50 grams, being dropped onto the foil face from a height of 1 meter. Subsequent immersion and wipe test results demonstrated less than 0.005 uCi removable activity each source.

REGISTRY OF RADIOACTIVE SEALED SOURCES AND DEVICES
SAFETY EVALUATION OF SEALED SOURCE

NO.: NR136S180U DATE: January 16, 1980

SEALED SOURCE TYPE: Smoke Detector Source

PROTOTYPE TESTING (CONT'D):

Additional Tests (Cont'd):

Resistance to Corrosion by Exposure: (SO_2/CO_2) Ten (10) sources were exposed to an atmosphere containing approximately 1% carbon dioxide and 0.5% sulfur dioxide by volume in air saturated with water vapor at room temperature for 10 days. Subsequent wipe test and measurement to determine decrease in ion current due to corrosion products demonstrated less than 0.005 uCi removable activity and less than 12% decrease in ion current each source.

Resistance to Corrosion by Exposure: (H_2S gas) Ten (10) sources were exposed to an atmosphere containing approximately 0.1% hydrogen sulphide by volume in air saturated with water vapor at room temperature for 10 days. Subsequent wipe test and measurement to determine the decrease in ion current due to corrosion products demonstrated less than 0.005 uCi removable activity less than 9% decrease in ion current each source.

Salt Spray Test: Ten (10) sources were exposed for 16 days to a salt spray test consisting of daily spraying with a solution containing NaCl, Na_2SO_4, $MgCl_2$, and $CaCl_2$ as described in British Standard BS 3116:1959. Subsequent wipe and immersion tests and tests for % decrease in ion current demonstrated less than 0.01 uCi removable activity by wipe test, less than 0.001 uCi removable activity by immersion tests and less than 17% decrease in ion current each source.

Immersion Test: Twenty (20) sources were immersed in a 0.1 N HCl solution for 24 hours at room temperature. Subsequent tests for leaching demonstrated less than 0.005 uCi removable activity per source. Following the 24 hour immersion tests, the sources were immersed in water for 3 weeks at room temperature. Subsequent tests for leaching demonstrated less than 0.002 uCi removable activity per source.

EXTERNAL RADIATION LEVELS:

The manufacturer calculates that surface dose rate in tissue for a 60 uCi source is approximately 100 rads/hr., and by the use of a typical rubber or plastic glove the skin dose rate to the finger would be reduced by a factor of about 2000, i.e., to 50 mr/hr on contact. No significant external dose field exists from sources packed in plastic vials for storage.

REGISTRY OF RADIOACTIVE SEALED SOURCES AND DEVICES
SAFETY EVALUATION OF SEALED SOURCE

NO.: NR136S180U DATE: January 16, 1980

SEALED SOURCE TYPE: Smoke Detector Source

QUALITY ASSURANCE AND CONTROL:

All holders and blanked discs are inspected and measured to insure compliance with drawing dimensions. All sources are wipe tested to ensure freedom from leakage and contamination (less than 0.005 uCi). Sources are checked using an ion chamber and a plastic scintillation detector to ensure that beta emissions are consistant with the stated nominal contents. The manufacturer states that these detectors are calibrated with sources that are traceable to NBS.

LIMITATIONS AND/OR OTHER CONSIDERATIONS OF USE:

Conditions for handling and mounting the sources in ionization detector chambers are to be determined by the licensing authority. Foils should not be handled with the bare hands.

REFERENCES:

Letter with attachments dated July 3, 1979 and letters dated November 15, 1979 and December 13, 1979.

Date January 16, 1980 Reviewed By /s/
Joseph M. Brown, Jr.

Date January 16, 1980 Concurrence /s/
Earl G. Wright

ISSUING AGENCY:

U.S. Nuclear Regulatory Commission

REGISTRY OF RADIOACTIVE SEALED SOURCES AND DEVICES
SAFETY EVALUATION OF SEALED SOURCE

NO.: NR136S201S DATE: June 18, 1981

SEALED SOURCE TYPE: Beta Gauge Source

MODEL: KAC.D2

MANUFACTURER/DISTRIBUTOR: Amersham Corporation
2636 S. Clearbrook Drive
Arlington Heights, IL 60005

MANUFACTURER/DISTRIBUTOR:

ISOTOPE: Krypton-85 MAXIMUM ACTIVITY: 3 curies

LEAK TEST FREQUENCY:

PRINCIPAL USE: Beta Gauges

CUSTOM SOURCE: ___ YES _X_ NO

REGISTRY OF RADIOACTIVE SEALED SOURCES AND DEVICES
SAFETY EVALUATION OF SEALED SOURCE

NO.: NR136S201S DATE: June 18, 1981

SEALED SOURCE TYPE: Beta Gauge Source

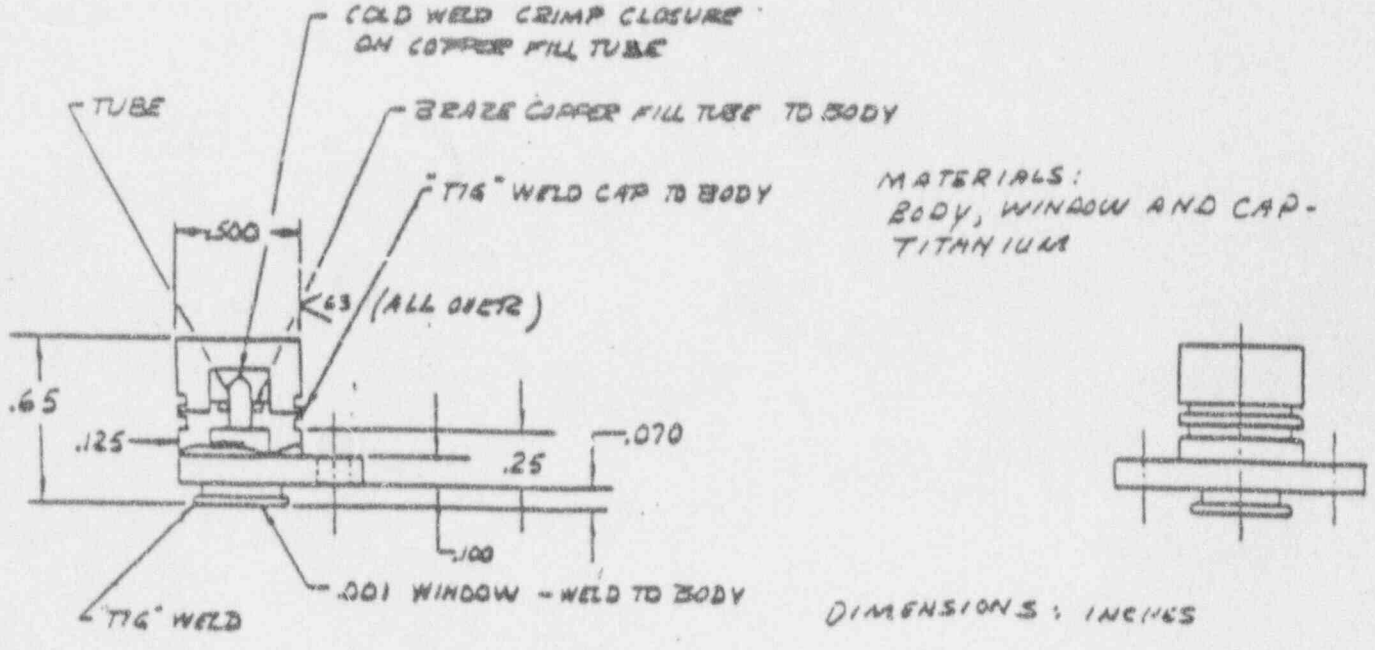
DESCRIPTION:

The source capsule consists of a titanium body with a 0.001 inch thick titanium foil window which is sealed to the top of the capsule by argon arc welding. The source capsule is filled by means of a copper tube which is brazed to the bottom of the capsule body. After filling to the desired quantity the copper tube is crimp sealed and then oversealed with soft solder. A recessed titanium back plate is placed over the crimp seal and argon arc welded to the capsule body. The source capsule is illustrated in the drawing below.

LABELING:

The sources are labeled by permanent engraving with: serial number, activity, date, nuclide and Danger Radioactive.

DIAGRAM:



REGISTRY OF RADIOACTIVE SEALED SOURCES AND DEVICES
SAFETY EVALUATION OF SEALED SOURCE

NO.: NR136S201S DATE: June 18, 1981

SEALED SOURCE TYPE: Beta Gauge Source

PROTOTYPE TESTING:

Prototypes of the Model KAC.D2 design were tested in accordance with ANSI N542. 1977 and achieved a rating of ANSI 77C43332.

EXTERNAL RADIATION LEVELS:

External radiation levels at 5 and 30 cms from a 600 mCi Model KAC.D2 are:

Distance	Back	Side	Front No Cap	Front with Cap
5 cms	0.3 R/hr	1.4 R/hr	360 R/hr	0.2 R/hr
30 cms	0.006 R/hr	0.2 R/hr	10.5 R/hr	0.006 R/hr

QUALITY ASSURANCE AND CONTROL:

During manufacture capsule components and materials are checked visually and dimensionally to ensure that they comply with the detailed engineering drawings. Helium leak testing is carried out on each capsule to ensure a leak rate less than 10^{-8} standard cc per second.

LIMITATIONS AND/OR OTHER CONSIDERATIONS OF USE:

A. This source shall be distributed only to specific licensees of NRC or Agreement States.

B. The Model KAC.D2 shall not be subjected to environmental or other conditions of use which exceed ANSI 77C43332.

C. Handling, Storage, Use, Transfer, and Disposal: To be determined by the licensing authority.

SAFETY ANALYSIS SUMMARY:

The Model KAC.D2 is a 3 curie gaseous krypton-85 source for industrial gauging applications.

Completed sources are subjected to Quality Control Testing and are shipped to specific licensees such as industrial gauge manufacturers who install them in shielded gauging devices. During the source life cycle (source loading to ultimate

REGISTRY OF RADIOACTIVE SEALED SOURCES AND DEVICES
SAFETY EVALUATION OF SEALED SOURCE

NO.: NR136S201S DATE: June 18, 1981

SEALED SOURCE TYPE: Beta Gauge Source

SAFETY ANALYSIS SUMMARY (CONT'D):

disposal), the greatest potential for personnel exposure is during source filling and loading operations. These operations are performed only by persons specifically licensed and are expected to be under careful radiological protection control.

The other significant hazard potential associated with these sources is release of the radioactive contents to the environment either because of faulty source construction or accidental rupture. Even though it is conceivable that the maximum source activity of 3 curies of krypton-85 gas might be released to the environment, a number of factors make it extremely unlikely that any person would receive a dose commitment in excess of those specified in 10 CFR Parts 20 and 32. These factors are:

1. Krypton-85 is an inert gas which is not biologically incorporated into the body.

2. Under ordinary circumstances of use, devices containing the source are expected to be installed in factory assembly line areas which are well ventilated. Thus, gas released is quickly dispersed. Furthermore, occupancy in these areas is usually limited.

3. Significant loss of gas from the source is likely to be immediately noticed by the device operator since the gauging system readout will show improper values. Thus appropriate emergency procedures to avoid unnecessary exposure can be taken.

Based on these considerations and our review of information and test data provided in references cited below, we conclude that the Amersham Model KAC.D2 sealed source design is acceptable for licensing in accordance with the terms of this Certificate of Registration.

REGISTRY OF RADIOACTIVE SEALED SOURCES AND DEVICES
SAFETY EVALUATION OF SEALED SOURCE

NO.: NR136S201S DATE: June 18, 1981

SEALED SOURCE TYPE: Beta Gauge Source

REFERENCES:

Amersham letters dated October 28, 1980, and June 9, 1981.

Date June 18, 1981 Reviewed By /s/
Earl G. Wright

Date June 18, 1981 Concurrence /s/
Bernard Singer

ISSUING AGENCY:

U.S. Nuclear Regulatory Commission

REGISTRY OF RADIOACTIVE SEALED SOURCES AND DEVICES
SAFETY EVALUATION OF DEVICE

NO: NR-136-S-248-S DATE: JAN 12 1984 PAGE 1 OF 4

SOURCE TYPE: Medium Energy Beta Source

MODEL: KAC.D3

MANUFACTURER/DISTRIBUTOR: Amersham Corporation
2636 South Clearbrook Drive
Arlington Heights, IL 60005

MANUFACTURER/DISTRIBUTOR:

ISOTOPE: Krypton-85 MAXIMUM ACTIVITY: 3 curies

LEAK TEST FREQUENCY: Not required

PRINCIPAL USE: (E) Beta Gauges

CUSTOM DEVICE: _____ YES __X__ NO

A-3

REGISTRY OF RADIOACTIVE SEALED SOURCES AND DEVICES
SAFETY EVALUATION OF DEVICE

NO: NR-136-S-248-S DATE: JAN 12 1994

SOURCE TYPE: Medium Energy Beta Source

DESCRIPTION:

The source capsule is constructed of a titanium body with, at a minimum, a 0.001 inch thick titanium foil window which is sealed to the capsule by argon arc welding. This source is equivalent to the previously approved Model KAC.D2 with the exception of the mounting flange that is placed on the KAC.D2 model.

The radionuclide, as a gas, is injected into the source cavity via a copper tube at the back of the capsule which is crimped and cold welded. A back cap is then welded over the back of the source and the copper tube to provide a secondary seal.

LABELING:

The source is permanently engraved with the following information:

- A trefoil (the radioactive) symbol
- The isotope "Kr-85"
- A unique serial number
- The letters "A.I." representing Amersham

DIAGRAM:

See Attachment 1.

CONDITIONS OF NORMAL USE:

The source will predominantly be used in an industrial environment in conjunction with a detector system to measure thickness and density of light weight or thin substances such as plastic sheet or paper. In most cases, the source would be located in a shielded device/holder containing a shutter mechanism which acts as an automatic fail-safe mechanism when the source is not in use. In storage or in transit it is provided with a protective window shield to prevent damage to the window and offer radiation protection from the beta emission.

PROTOTYPE TESTING:

The manufacturer reports the source was assessed by comparison with KAC.D2 which was tested in accordance with the requirements of ISO2919 and ANSI N542 (1977) and has achieved a rating of C43332. In addition, the source Model No. KAC.D2 on which this model is based has been burst tested to internal pressures up to 1000 psi.

REGISTRY OF RADIOACTIVE SEALED SOURCES AND DEVICES
SAFETY EVALUATION OF DEVICE

NO: NR-136-S-248-S DATE: JAN 12 1984

SOURCE TYPE: Medium Energy Beta Source

EXTERNAL RADIATION LEVELS:

Kr-85 is a medium energy beta emitter with maximum beta energy at 670 KeV. There is in addition a low abundance (0.7%) gamma emission at 512 KeV. The dose levels on this source have not been measured directly but, according to Amersham Corporation, are expected to be very similar to those of Model KAC.D2 as listed below:

Distance	Back	Side	Front No Cap	Front with Cap
5 cm	0.3 R/hr	1.4 R/hr	360 R/hr	0.2 R/hr
30 cm	0.006 R/hr	0.2 R/hr	10.5 R/hr	0.006 R/hr

QUALITY ASSURANCE AND CONTROL:

During manufacture capsule components and materials are checked visually and dimensional to ensure that they comply with detailed engineering drawings. Each capsule is helium tested to ensure a leak rate less than 10^{-8} standard cc per second and in addition the capsule is pressure tested to 140 psi to test the integrity of the window weld. Prior to dispatch the source is twice tested for leakage in two separate tests approximately two weeks apart. If both tests show a leak rate less than 0.1 uCi per day, then the sources can be released. The customer is provided with a certificate documenting the leak test results and the radiation emission measurements.

LIMITATIONS AND/OR OTHER CONSIDERATIONS OF USE:

- This source shall be distributed only to specific licensees of NRC or Agreement States.
- The Model KAC.D3 shall not be subjected to environmental or other conditions of use which exceed ANSI 77C43332.
- Handling, storage, use, transfer, and disposal: To be determined by the licensing authority.
- This registration sheet and the information contained within the references shall not be changed or transferred without the written consent of the NRC.

SAFETY ANALYSIS SUMMARY:

Based on our review of the information and test data cited below, that this source design is equivalent to the Model KAC.D2 which was previously registered by the NRC, we conclude that the Model KAC.D3 source design is acceptable for licensing purposes. Furthermore, we conclude that this source would be expected to maintain its containment integrity for normal conditions of use and accidental conditions which might occur during uses specified in this certificate.

REGISTRY OF RADIOACTIVE SEALED SOURCES AND DEVICES
SAFETY EVALUATION OF DEVICE

NO: NR-136-S-248-S DATE: JAN 12 1984 PAGE 4 OF 4

SOURCE TYPE: Medium Energy Beta Source

REFERENCES:

The following supporting document for the Model KAC.D3 beta source design is hereby incorporated by reference and is made a part of this registry document.

o Amersham Corporation letter dated October 10, 1983, with enclosures thereto.

ISSUING AGENCY:

U.S. Nuclear Regulatory Commission

Date: JAN 12 1984 Reviewer: [signature]

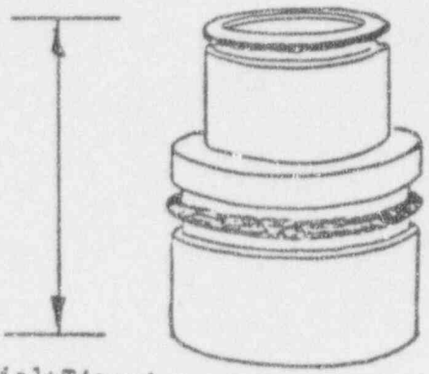
Date: JAN 12 1984 Concurrence: [signature]

NO: NP-136-5-248-S DATE: ATTACHMENT 1

JAN 1 6 1989

Overview of KAC.D3 Source

Window



T.I.G. or Laser Weld

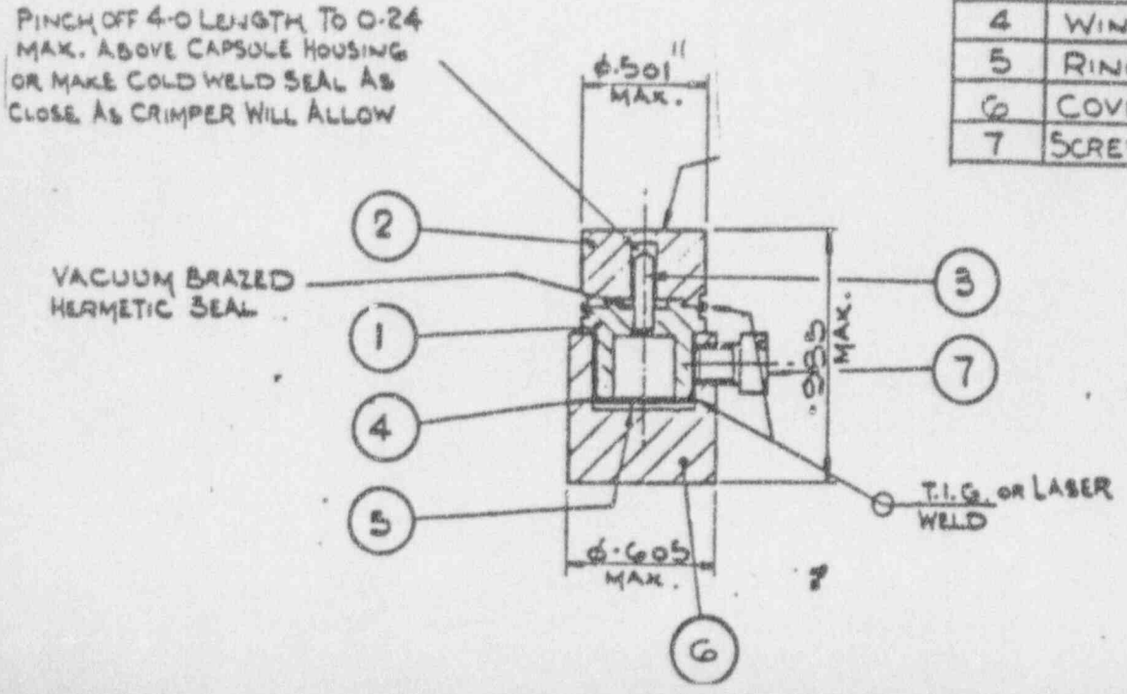
T.I.G. Weld

Back Cap (Engraved)

Material: Titanium

Specific for the model

Item No.	Description
1	BODY
2	LID
3	FILLING TUBE
4	WINDOW
5	RING
6	COVER
7	SCREW M4 x 6LG CHEESE HD NYLON



REGISTRY OF RADIOACTIVE SEALED SOURCES AND DEVICES
SAFETY EVALUATION OF SOURCE

NO.: NR-136-S-214-S DATE: JUL 11 1984

SOURCE TYPE: Medium Energy Beta Source

MODEL: KAC.D4

MANUFACTURER/DISTRIBUTOR: Amersham Corporation
2636 S. Clearbrook Drive
Arlington Heights, IL 60005

ISOTOPE:	MAXIMUM ACTIVITY:
Krypton-85	400 mCi

LEAK TEST FREQUENCY: Not Required

PRINCIPAL USE: E Beta Gauge

CUSTOM SOURCE: _____ YES __X__ NO

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REGISTRY OF RADIOACTIVE SEALED SOURCES AND DEVICES
SAFETY EVALUATION OF SOURCE

NO: NR-136-S-214-S DATE: NOV 1 1 1994 PAGE 2 OF 6

SOURCE TYPE: Medium Energy Beta Source

DESCRIPTION:

The radionuclide is present as a gas which has been admitted into the source cavity via a copper tube at the back of the capsule which is then cold welded by crimping then soft soldered to form the final seal. The copper tube will protrude from the back of the source by up to 5 mm. The source is to be manufactured with stainless steel 316L or titanium. The capsule is similar to the already approved capsule Model KAC.D1. The main difference between KAC.D1 and KAC.D4 is the window thickness. The KAC.D1 was designed with 0.05 mm titanium window where the KAC.D4 (X1016 capsule) is designed with 0.025 mm thick stainless steel window; other differences are in the outer dimension of the capsule which do not affect the integrity of the source.

LABELING:

Engraving is made on the side of the capsule and consists of the activity in millicuries "Krypton-85", and the unique serial number.

Additional information about each source which is not engraved on the capsule can be found on the test report provided with each source.

REGISTRY OF RADIOACTIVE SEALED SOURCES AND DEVICES
SAFETY EVALUATION OF SOURCE

NO.: NR-136-S-214-S DATE: [illegible] PAGE 3 OF 6

SOURCE TYPE: Medium Energy Beta Source

DIAGRAM:

See Attachment 1.

CONDITIONS OF NORMAL USE:

The source will predominantly be used in an industrial environment in conjunction with a detector system to measure thickness and density of light weight or thin substrates such as plastic sheet or paper. In most cases the source would be located in a shielded device/holder containing a shutter mechanism which acts as an automatic fail-safe mechanism when the source is not in use. In storage or in transit it is provided with a protective window shield to prevent damage to the window and offer radiation protection from the beta emission.

PROTOTYPE TESTING:

Two inactive sources containing 8 atmospheres of helium were tested by the manufacture in accordance with ANSI-N542 : 1977. The classification for the stainless steel version, achieved a rating of C33232. Amersham reports that the same capsule as a titanium version would meet the same rating of C33232 by analogy with stainless steel.

REGISTRY OF RADIOACTIVE SEALED SOURCES AND DEVICES
SAFETY EVALUATION OF SOURCE

NO.: NR-136-S-214-S DATE: JUL 11 1994

SOURCE TYPE: Medium Energy Beta Source

EXTERNAL RADIATION LEVELS:

Kr-85 is a beta emitter with maximum beta energy at 670 keV. There is in addition, a low abundance (0.7%) gamma emission of 512 keV. The dose rates in mR/hr for a 400 mCi Kr-85 source are:

DISTANCE	BACK	FRONT WITH COVER	WITHOUT COVER
5 cm	200	180	160,000 calculated
30 cm	15	11	4500 calculated
100 cm	1	1.4	400

QUALITY ASSURANCE AND CONTROL:

During manufacture, capsule components and materials are checked visually and dimensionally to ensure that they comply with detailed engineering drawings. Each capsule is helium tested to ensure a leak rate less than 10^{-8} standard cc per second and in addition, the capsule is pressure tested to 140 psi to test the integrity of the window weld. Prior to dispatch the source is twice tested for leakage in two separate tests approximately two weeks apart. If both tests show a leak rate less than 0.1 μCi per day, the sources can be released. The customer is provided with a certificate documenting the leak test results and the radiation emission measurements.

REGISTRY OF RADIOACTIVE SEALED SOURCES AND DEVICES
SAFETY EVALUATION OF SOURCE

NO.: NR-136-S-214-S DATE: JUL 11 1984

SOURCE TYPE: Medium Energy Beta Source

LIMITATIONS AND/OR CONSIDERATION OF USE:

- This source shall be distributed only to specific licensees of NRC or Agreement States.
- Handling, Storage, Use, Transfer, and Disposal: To be determined by licensing authority.
- The Model KAC.D4 shall not be subjected to environmental or other conditions of use which exceed ANSI Classification 77C33232.
- This registration sheet and the information contained within the references shall not be changed or transferred without the written consent of the NRC.

SAFETY ANALYSIS SUMMARY:

Based on our review of information and test data cited, the claimed ANSI N542 classification and that this source is very similar to a design previously deemed acceptable for licensing, we conclude that the Amersham Model KAC.D4 sealed source design is acceptable for licensing purposes.

REGISTRY OF RADIOACTIVE SEALED SOURCES AND DEVICES
SAFETY EVALUATION OF SOURCE

NO.: NR-136-S-214-S DATE: JUL 11 1984 PAGE 6 OF 6

SOURCE TYPE: Medium Energy Beta Source

SAFETY ANALYSIS SUMMARY:

This source would be expected to maintain its containment integrity for research, development, and industrial uses and accident conditions which may occur during normal operational conditions of use or transportation.

REFERENCES:

The following supporting document for the KAC.D4 source design is hereby incorporated and is made a part of this registry document.

- Amersham Corp. letter dated April 23, 1984, with enclosures thereto.

ISSUING AGENCY:

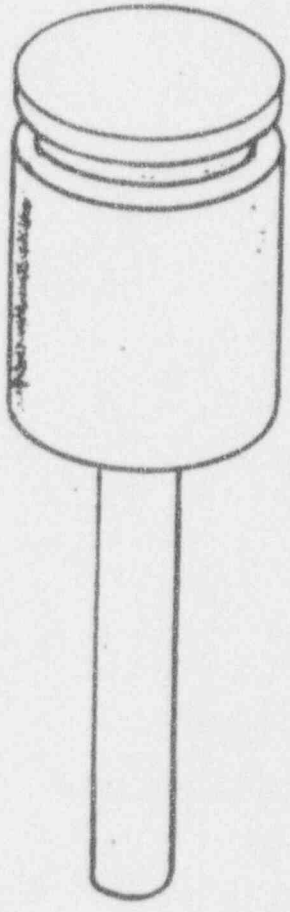
U.S. Nuclear Regulatory Commission

Date: _____ Reviewer: _____

Date: _____ Concurrence: Joseph M. Brown Jr.

REGISTRY OF RADIOACTIVE SEALED SOURCES AND DEVICES
SAFETY EVALUATION OF SOURCE

NO.: NR-136-S-214-S DATE: JUL 11 1984 ATTACHMENT 1



X.1016 Capsule

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

NO: NR-136-S-185-S DATE: FEB 04 1987 PAGE: 1 of 4

SOURCE TYPE: Electron Capture Detector Source

MODEL: NBC, NBCD

MANUFACTURER/DISTRIBUTOR:

Amersham Corporation
2636 South Clearbrook Drive
Arlington Heights, IL 60005

ISOTOPE:

Nickel-63

MAXIMUM ACTIVITY:

10 mCi/square centimeter
(Up to a maximum of 30
millicuries per foil)

LEAK TEST FREQUENCY: 6 months (See Limitations and/or Other Considerations of Use.)

PRINCIPAL USE: (S) Foil Source

CUSTOM SOURCE: _____YES ____X__NO

A-5

2/6/87

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

NO: NP-136-S-185-S DATE: FEB 0 4 [illegible] PAGE: 2 of 4

SOURCE TYPE: Electron Capture Detector Source

DESCRIPTION:

Nickel-63 is electroplated on a base of a thin metal alloy foil. The substrates minimize the loss of ion current at elevated temperatures. The basic electroplating process consists of: (a) preparing the surface of the substrate, (b) plating an inactive layer of nickel onto the substrate, (c) plating the active layer of nickel-63 onto the inactive layer, and (d) covering the active layer with an inactive metallic coating (0.1 um) . The sources are normally 24 mm X 10 mm or 30 mm X 10 mm, but other dimensions of a similar nature to fit into customer's detector heads are offered. The maximum practical activity loading is approximately 10 mCi per square centimeter. The source has been tested at 400°C for 1 month and the only loss of output has been due to the diffusion into the substrate and not leakage of the nickel-63 (output was decreased by 4-5%).

In addition to the above nickel-63 can also be directly electroplated onto the inside surface of the detector housing (acting as a substrate) instead of just inserting the source. In this case a model designation of NBCD will be used instead of the model No. NBC.

LABELING:

The source itself is impractical to label. However, the detector cells are labeled in accordance with 20.203 of 10 CFR 20 or 32.51(c)(iii)-10 CFR 32 depending on the distributor's license authorization. Each source or detector is shipped with a data package.

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

NO: NR-136-S-185-S DATE: FEB 04 '97 PAGE: 3 of 4

SOURCE TYPE: Electron Capture Detector Source

PROTOTYPE TESTING:

The source was tested for 1 month at 400°C and the only loss of output was due to diffusion into the substrate and not leakage of nickel-63.

The source has been previously deemed acceptible for licensing purposes in 1980. Since the foils are used in detector cells, you should look at the registration sheets for the cell in question for further information.

EXTERNAL RADIATION LEVELS:

The manufacturer reports no detectable radiation on any accessible surface when installed in typical electron capture detector cells.

QUALITY ASSURANCE AND CONTROL:

During the manufacturing the materials are checked visually and dimensionally to ensure compliance with specifications. Ion current measurements are carried out on each source after manufacturing to ensure suitable output. Sources are leak tested after manufacturing to ensure that there is no removable contamination above 0.005 microcurie.

LIMITATION AND/OR OTHER CONSIDERATIONS OF USE:

- The source shall be distributed only to persons specifically licensed by the NRC or an Agreement State.
- Conditions for handling and mounting the foil source in electron capture detectors are to be determined by the licensing authority. Foils should not be handled with the bare hands.
- A 6-month leak test is required for the bare source. Sources contained with an electron capture detector may have longer intervals. You should consult the appropriate registration sheet for leak test intervals of a unique detector cells.

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

NO: NR-136-S-185-S DATE: FEB 04 1987 PAGE: 4 of 4

SOURCE TYPE: Electron Capture Detector Source

LIMITATION AND/OR OTHER CONSIDERATIONS OF USE:

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

SAFETY ANALYSIS SUMMARY:

Based on our review of the information and test data cited below, that this amendment adds the use of copper alloys as a possible substrate material, we continue to conclude that the Model NBC or NBCD source designs are acceptable for licensing purposes. Furthermore, we continue to conclude that these sources 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.

REFERENCES:

The following supporting documents for the NBC and NBCD sources are hereby incorporated by reference and are made a part of this registry document:

- Amersham letters dated April 7, 1980, September 20, 1983, June 25, 1984 and August 27, 1986 with enclosures thereto.
- Supersedes document dated April 30, 1980.

ISSUING AGENCY:

U.S. NUCLEAR REGULATORY COMMISSION

DATE: FEB 04 1987 REVIEWER: Steven Baggett

DATE: FEB 04 1987 CONCURRENCE: Stuart A. Richards

REGISTRY OF RADIOACTIVE SEALED SOURCES AND DEVICES
SAFETY EVALUATION OF SEALED SOURCE
(Amended in Entirety)

NO: IL-136-S-276-S DATE: April 3, 1990 PAGE: 1 OF 6

SOURCE TYPE: Beta Source

MODEL: KAC.D5

DISTRIBUTOR:

Amersham Corporation
2636 South Clearbrook Drive
Arlington Heights, IL 60005-4692

MANUFACTURER:

Amersham International Plc
White Lion Road Amersham
Buckinghamshire, England HQ79LL

ISOTOPE:

Krypton-85

MAXIMUM ACTIVITY:

3.24 Curies

LEAK TEST FREQUENCY: Not required - gaseous source

PRINCIPAL USE: (E) Beta Gauging

CUSTOM SOURCE: ____ YES X NO

A-6

SOURCE TYPE: Beta Source

DESCRIPTION:

The source capsule, design X1180 or X1180/1, consists of a titanium body with a 0.001 inch-thick titanium foil window laser welded to the top of the capsule. The source capsule is filled by means of a copper tube which is vacuum brazed to the bottom of the capsule body. After filling to the desired quantity of gaseous krypton-85, the copper tube is crimp-sealed and over-sealed with soft solder. A protective titanium cap, or lid, is placed over the crimp-seal and argon-arc welded to the capsule body. The capsule window at the opposite end of the source is protected when the source is not in use by a removable glass cover, held in place by two screws.

LABELING:

The source is permanently engraved with the following information:

1. serial number
2. activity
3. date
4. radionuclide
5. warning: "Danger - Radioactive"

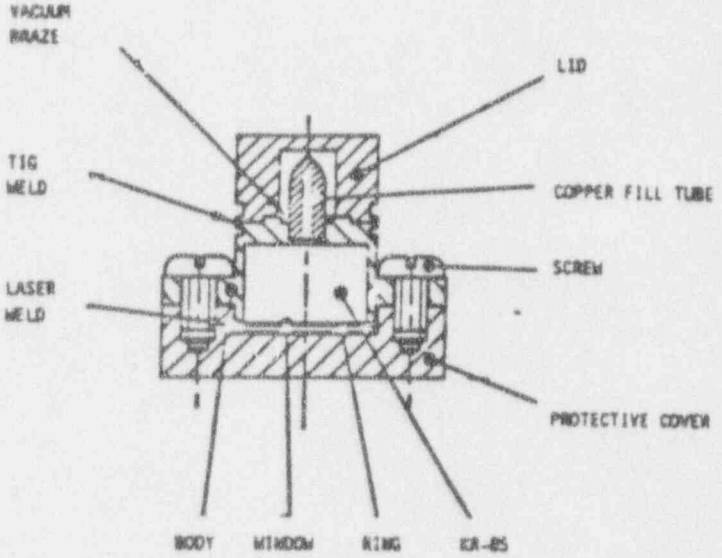
Other information pertaining to leak testing and ANSI certification is provided to the customer in a test report accompanying each source.

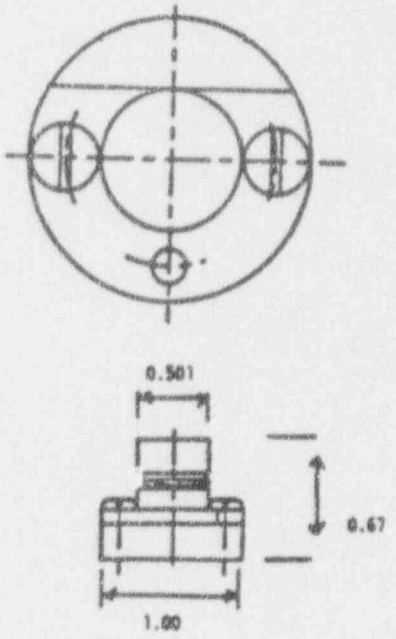
REGISTRY OF RADIOACTIVE SEALED SOURCES AND DEVICES
SAFETY EVALUATION OF SEALED SOURCE
(Amended in Entirety)

NO: IL-136-S-276-S DATE: April 3, 1990 PAGE: 3 of 6

SOURCE TYPE: Beta Source

DIAGRAM:





DIMENSIONS IN INCHES

REGISTRY OF RADIOACTIVE SEALED SOURCES AND DEVICES
SAFETY EVALUATION OF SEALED SOURCE
(Amended in Entirety)

CONDITIONS OF NORMAL USE:

In most cases, the source will be located in a shielded device/holder containing a shutter which acts as an automatic fail-safe mechanism when the source is not in use. In storage or in transit, the source is provided with a protective window shielding plate to prevent damage to the window and to offer radiation protection from beta emission. The recommended working life for this source is ten years.

PROTOTYPE TESTING:

The manufacturer performed ANSI/ISO testing on six inactive KAC.D5 capsules, pressurizing two with six atmospheres of air, and two with six atmospheres of helium. The six sources were selectively subjected to tests for impact, vibration, pressure, temperature and puncture evaluation. The window cover was not installed during the tests. According to the manufacturer, both source capsules X1180 and X1180/1 for the Model KAC.D5 source achieve an ANSI N542 rating of 77C33242.

EXTERNAL RADIATION LEVELS:

The following maximum external radiation levels at 5 and 30 centimeters from a 600 millicurie KAC.D5 source were reported by the manufacturer:

Distance	Back	Side	Window No Cap	Window with Cap
5 cm	0.3 R/hr	1.4 R/hr	360 R/hr	0.2 R/hr
30 cm	0.006 R/hr	0.2 R/hr	10.5 R/hr	0.006 R/hr

SOURCE TYPE: Beta Source

QUALITY ASSURANCE AND CONTROL:

All material used in the fabrication of the capsule are checked visually and dimensionally to ensure that they comply with detailed engineering drawings.

Each capsule is pressure tested to a minimum of 140 psi to test the integrity of the window weld. Helium leak testing is carried out on each capsule to ensure a leak rate less than 10^{-8} standard cc/second.

After the capsule is filled with Krypton-85, and all sealing and welding operations have been completed, the source capsule is tested for leakage in tests approximately two weeks apart. If both tests show leak rates less than 0.1 uCi/day, the source can be released.

The completed source capsule is bubble-tested to verify the integrity of the weld which joins the back cap to the capsule body.

The source is measured for emission using an ion chamber which has been calibrated with a krypton-85 standard source.

LIMITATIONS AND OTHER CONSIDERATIONS OF USE:

1. This source shall be distributed only to specific licensees of the NRC or of Agreement States.

2. The Model KAC.D5 shall not be subjected to environmental or other conditions of use which exceed ANSI 77C33242.

3. Handling, storage, use, transfer and disposal: To be determined by the licensing authority.

4. This registration sheet and the information contained within the references shall not be changed or transferred without the consent of the Illinois Department of Nuclear Safety.

REGISTRY OF RADIOACTIVE SEALED SOURCES AND DEVICES
SAFETY EVALUATION OF SEALED SOURCE
(Amended in Entirety)

NO: IL-136-S-276-S DATE: April 3, 1990

SOURCE TYPE: Beta Source

SAFETY ANALYSIS SUMMARY:

Based on our review of the information and test data cited below, we conclude that the Model KAC.D5 source design is acceptable for licensing purposes. Furthermore, we conclude that this source would be expected to maintain its containment integrity for normal conditions of use and accidental conditions which might occur during uses specified in this certificate.

REFERENCES:

The following supporting documents for the Model KAC.D5 beta source design are hereby incorporated by reference and are made a part of this registry document.

1. Amersham Corporation letter of application dated September 15, 1987, with enclosures thereto.

2. Amersham Corporation letters, with attachment, dated April 17, 1989, and January 11, 1990.

3. Amersham Corporation letter dated July 7, 1989.

4. ANSI N542-1977.

ISSUING AGENCY: Illinois Department of Nuclear Safety

DATE: 4/6/90 REVIEWED BY: Lee Pedtke

DATE: 4/9/90 CONCURRENCE: Jennifer L. Klinger

LKP:ren

Registry of Radioactive Sealed Sources and Devices
Safety Evaluation of Device

NO.: TN-394-D-104-S DATE: March 8, 1991 PAGE: 1 of 3

DEVICE TYPE: Thickness Gauge

MODEL: TIAM 11

MANUFACTURER: Isotopen MeBsyteme GmbH
Bachstrasse 76
4300 Essen 18 (Kettwig)
West Germany

DISTRIBUTOR: Eurotherm Corporation
Kineron Gauging Systems Division
11513 Sunset Road
Reston, Virginia 22090

SEALED SOURCE MODEL DESIGNATION: Amersham Model SIF.D1

RADIONUCLIDE: Strontium-90 MAXIMUM ACTIVITY: 13 millicuries

LEAK TEST FREQUENCY: 6 months

PRINCIPAL USE: Beta Gauge

CUSTOM DEVICE: YES XX - NO

CUSTOM USER: Dico Tire, Inc.
520 J. D. Yarnell Industrial Parkway
Clinton, TN 37716

DESCRIPTION:

The Model TIAM 11 gauging device is part of a Kineron Gauging Systems Model TIMT31S monitoring system for an inverted "L" rubber calender that sandwiches a synthetic fabric between two plies of rubber in the manufacture of tires. The TIAM 11 unit has an outer aluminum housing that contains a source holder plate to which the radioactive source in its capsule is secured by two Allen screws. A stainless steel shutter plate covering the source aperture is fixed to a solenoid motor shaft that rotates the plate through 90 degrees. A spring return mechanism will automatically close the shutter in the event of a power failure. When the shutter is closed a green flag is visible through a window, and when the shutter is energized open the flag disappears revealing a red illumination.

LABELING:

The source holder has a metal label with the distributor, the word Radioactive, radiation symbol, source type, source number, activity, and date. Additionally, the licensee has committed to posting the standard "Caution-Radioactive Material" wording.

NO.: TN-394-D-104-S DATE: March 8, 1991 PAGE: 2 of 3

DEVICE TYPE: Thickness Gauge

DIAGRAM: See Attachments 1 and 2.

CONDITIONS FOR NORMAL USE:

The device and system will be used exclusively on the inverted "L" calender and will be mounted approximately nine feet above floor level. The radiation beam will point almost horizontally, and will measure the thickness of the final product. Under normal conditions, the device will operate in a temperature of about 100 to 120 degrees Farenheit, the temperature of the product. Vibration and humidity are minimal. The operating atmosphere is non-corrosive. The likelihood of a serious fire is low.

PROTOTYPE TESTING:

The sealed source has an ANSI rating of 77C64343.

During its development the source holder was subjected to strenuous tests involving opening/closing of the shutter, vibration, and temperature cycling. The failure rate is extremely small and has always been to the fail safe position.

RADIATION LEVELS:

See Attachment 3.

Source open and closed radiation exposure rates around the TIAM 11 device loaded with 5 millicuries are shown. Measurements were made with a thin window Mini-Monitor 5-10E Geiger tube.

QUALITY ASSURANCE AND CONTROL:

Instructions for use will be provided in the operator's manuals.

LIMITATIONS AND/OR OTHER CONSIDERATIONS OF USE:

- This device shall be distributed only to the specific licensee referred to in this document (Dico Tire, Inc.).
- Installation, maintenance, repair, shutter and beam operation tests, initial surveys, leak testing, source change out, and removal services on the TIAM 11 device and monitoring system will be performed only by the distributor or by other persons authorized by this Department, the U. S. Nuclear Regulatory Commission, or another agreement state to perform these services.

Registry of Radioactive Sealed Sources and Devices
Safety Evaluation of Sealed Source

NO.: TN-394-D-104-S DATE: March 8, 1991

DEVICE TYPE: Thickness Gauge

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

- The source shall be leak tested at intervals not to exceed 6 months using techniques capable of detecting 0.005 microcurie of removable contamination. Specifically licensed persons shall perform the test.

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

SAFETY ANALYSIS SUMMARY:

Based on our review of the manufacturer's information and test data, our conclusion regarding the safety of the TIAM 11 device is as follows:

Under ordinary conditions of handling, storage, and use, radioactive material contained in the source will not be released or inadvertently removed from the source. Furthermore, it is unlikely that any person will receive a radiation dose in any calendar quarter exceeding 10 percent of the limits specified in 1200-2-5-.03(1) of the Tennessee "State Regulations for Protection Against Radiation".

It is unlikely under accident conditions (such as fire or explosion) associated with handling, storage, and use of the source that any person would receive a radiation dose exceeding the limits specified in 1200-2-5-.03(1) of the Tennessee "State Regulations for Protection Against Radiation".

REFERENCES:

The following supporting documents for the source are hereby incorporated by reference and are made a part of this registry document:

- Application dated December 5, 1990, with attachments

DATE: May 8, 1991 REVIEWED BY: Charles Arnott

DATE: May 9, 1991 CONCURRENCE: Johnny C. Graves

ISSUING AGENCY:

State of Tennessee

Functional Description

Basic Construction (Fig. 1)

The TIAM II unit consists of a sand cast Aluminium housing (1) with 6mm thick walls, diaphragm (2), and an assembly containing a solenoid motor (6) and radioactive source mounting plate (5). The assembly is clamped (3), and held in position against the centre studs (4). The type of source capsule holder mounted on plate (5) will depend upon the radioactive source used.

Mounting plates (7) and (8) are separated by four pillars (9) between which are supported the mechanical end stops, shutter spring return mechanism and limit switch contacts for repote shutter open/close annunciation.

When the shutter is closed a green flag (10) is visible through a window (11) situated in the TIAM II cover plate. When the shutter is energized open the green flag disappears revealing a red illuminated (CAS) indication (12). All wiring between the TIAM II and external cubicle is connected via plug (13).

Two heating resistors are mounted internally on the TIAM II wall and are switched on when the shutter motor is de-energised, i.e. shutter closed. A constant air temperature is thus maintained within the source holder around the radioactive source regardless of the shutter state (motor energised or not). This is particularly important when carrying out measurements using low energy Beta radiation.

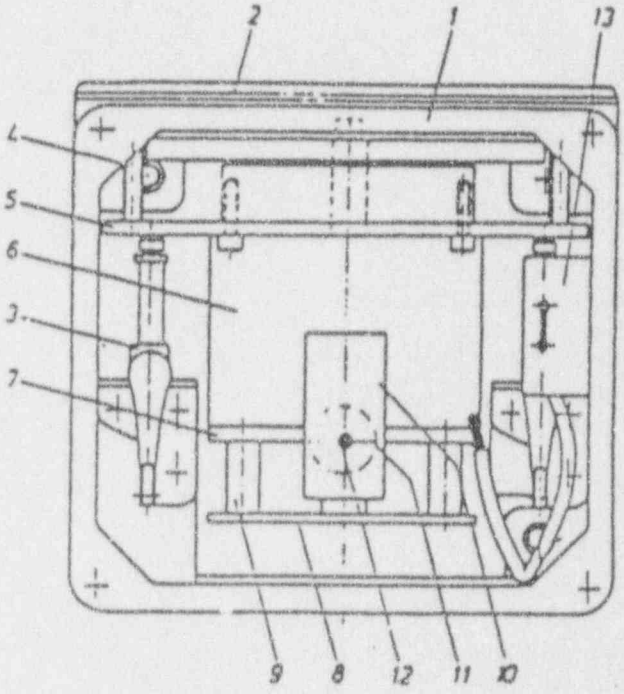


Fig. 1

1 = Housing
2 = Diaphragm
3 = Snap-on clamp
4 = Centre stud
5 = Base plate
6 = Solenoid motor
7 = Mounting plate
8 = Mounting plate
9 = Pillar
10 = Green flag (mechanical indication - shutter closed)
11 = Window
12 = CAS - indication
13 = Plug connector

TIAM 11 Construction

Radioactive source mounted in normal position - Fig. 2.

TIAM 11-81...89 specifies the holder for use with radioactive sources Kr 85, Sr 90, and Am 241. In each case the radioactive source (#0) mounted in its capsule (#1) is screwed to the base plate (5) by two Allen screws (#2). The radioactive source shutter plate (##) - 1.5 mm thick stainless steel - is fixed to the solenoid motor shaft (#3). Two 6 mm thick lead plates (#5) are riveted to the shutter plate (##).

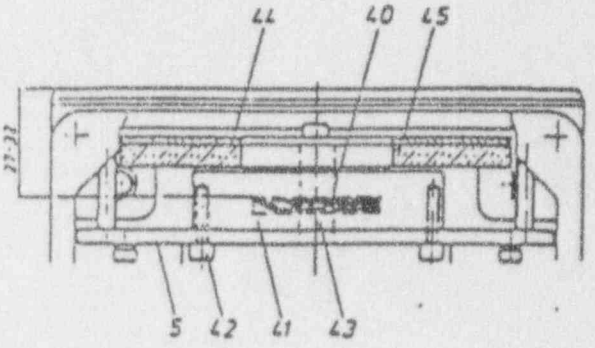


Fig. 2.

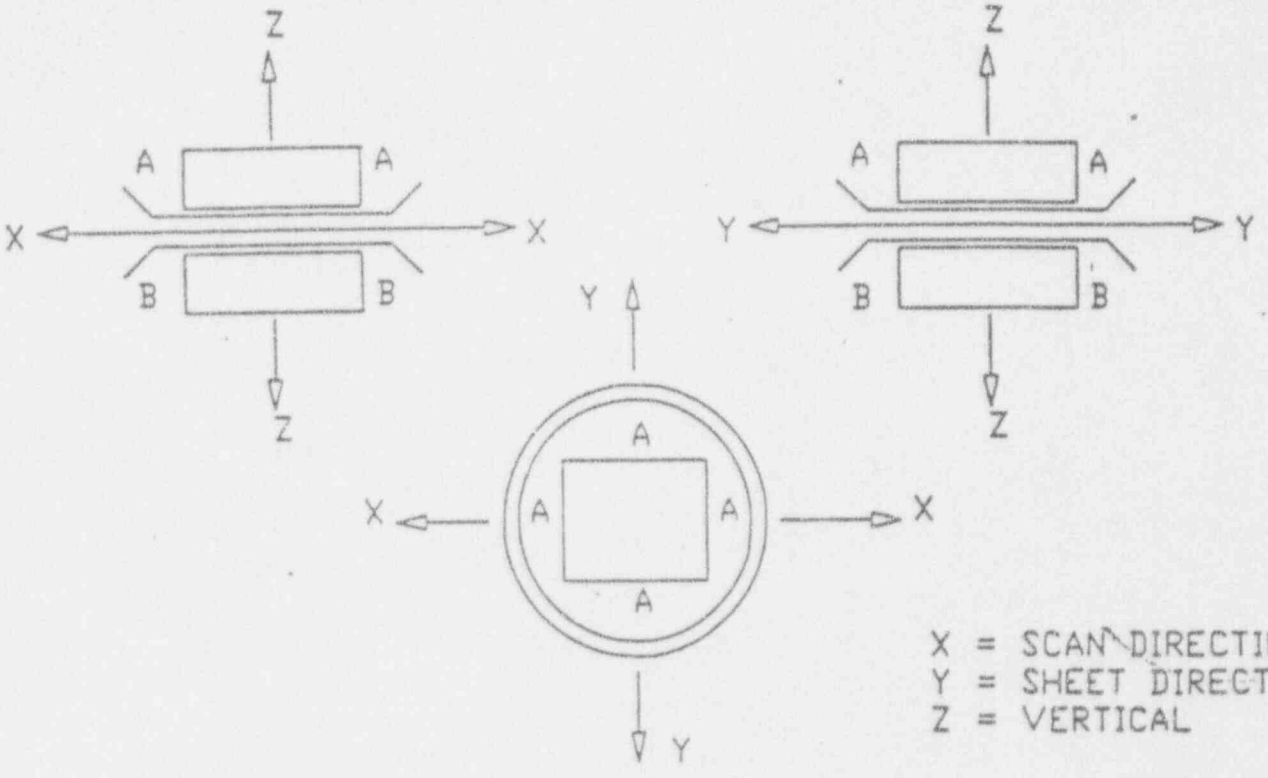
5 = Base plate
#0 = Radioactive source
#1 = Radioactive source holder
#2 = Allen screws
#3 = Solenoid motor shaft
= Stainless steel plate
#5 = Lead plate

KINERON GAUGING SYSTEMS LIMITED
DOSERATE SURVEY

DATE: 20-NOV-87
CUSTOMER: TYPICAL
SOURCE: Sr90
SERIAL NUMBER: TYPICAL
ACTIVITY (GBq): 185 MBq

SURVEYED BY: T BATES
JOB NUMBER: TYPICAL
GAP (mm): 13
GUIDE PLATE DIAM (mm): 400
SOURCE HOLDER: TIAM 11

MINIMONITOR TYPE: 5-10E/SERIES 900
CALIB.FACTOR BETA: 25 BREMS: 30 c/s/10microSv/h



X = SCAN DIRECTION
Y = SHEET DIRECTION
Z = VERTICAL

Position	Maximum Doserate at 50 mm Source open microSv/h	Maximum Doserate at 50 mm Source closed microSv/h	Maximum Doserate at 1000 mm Source open microSv/h	Maximum Doserate at 1000 mm Source closed microSv/h	Distance for 7.5 microSv/h Source Open mm	Distance for 7.5 microSv/h Source Closed mm
X	60.0	2.0	1.2	<1.0	190	<50
Y	60.0	2.7	1.2	<1.0	190	<50
Z	6.6	6.6	<1.0	<1.0	0	0
A	13.3	8.3	<1.0	<1.0	50	20
B	33.3	6.7	<1.0	<1.0	80	0

NOTE: 1. Distances taken from the edge of guideplate (if fitted) or the surface of the sourceholder/chamber housing
2. Maximum doserate in each plane recorded
3. 1 Ci = 37 GBq 7.5 microSv/h = 0.75 mrem/h

J.W.R

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

(Amended)

(This sheet replaces existing sheets for UNC Nuclear Industries MAP series FA1C, FA2C, and FA3C)

NO: WA-653-D-102-S DATE: NOVEMBER 27, 1991 PAGE: 1 OF 5

DEVICE TYPE: PORTABLE X-RAY FLUORESCENCE DEVICE

MODEL:	ISOTOPE USED:
FA1C	Cobalt 57
FA2C	Americium 241
FA3C	Cadmium 109

MANUFACTURER/DISTRIBUTOR: SCITEC Corporation
2000 Logston Boulevard, Suite 125
Richland, WA 99352

SEALED SOURCE MODEL DESIGNATION:

Cobalt 57	Amersham Corporation Model CTC.D2 E.I.Dupont New England Nuclear Model NER-472
Americium 241	Amersham Corporation Model CTC.D2 E.I.Dupont New England Nuclear Model NER-478C
Cadmium 109	E.I.Dupont New England Nuclear Model NER-465

ISOTOPE:	MAXIMUM ACTIVITY:
Cobalt 57	40 millicuries
Americium 241	150 millicuries
Cadmium 109	150 millicuries

LEAK TEST FREQUENCY: Six months

PRINCIPLE USE: (U) X-RAY FLUORESCENCE

CUSTOM DEVICE: NO

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

(Amended)

DEVICE TYPE: PORTABLE X-RAY FLUORESCENCE DEVICE

DESCRIPTION:

The models FA1C, FA2C, and FA3C are all the same device; the only difference is the isotope installed in the device. For purposes of this discussion, all three devices will be referred to as the FAnC.

The FAnC housing is a section of 6061 T6 square aluminum tubing. The external dimensions are 2 inches by 2 inches by 12 inches long, with a wall thickness of 0.125 inches. The front portion of the housing is enlarged to 3 inches by 2 inches to accommodate the detector and source holder. A pistol grip is welded to the underside of the housing. The front end (enlarged end) is flanged to accommodate the front end plate. This plate is secured to the housing flange with six 4-40 pan head screws. The rear end of the housing is closed with a rear end cap. This cap is secured with four 4-40 flat head screws. All screws are cemented in place.

A chain driven sprocket causes the source to be exposed to a hole in the source holder. This can only occur if the key is placed in the key lock and turned to the "ON" position. The key cannot be removed when the source is in the on position, and is a visual indication that the source is in use.

This source holder is the only integral shielding found in the FAnC. The source holder assembly consists of a sealed source mounted in a 0.469 inch diameter hole found in the side of a cylinder which is 0.6 inches in diameter by 1.3 inches long. The source is secured by means of a set screw. The cylinder, in turn, mounts in a hole found in the side of a block with dimensions of 0.875 inches by 1 inch by 0.8 inches, and is made of the same material as the cylinder. The material is a Tungsten based metal called Teconite.

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

(Amended)

NO: WA-653-D-102-S DATE: NOVEMBER 27, 1991 PAGE: 3 OF 5

DEVICE TYPE: PORTABLE X-RAY FLUORESCENCE DEVICE

LABELING:

The label is stainless steel and is mounted to the housing with epoxy based glue. See Drawing 1 under Diagram for location of label.

CAUTION
RADIOACTIVE
MATERIAL

ANSI 33-885-985-R2

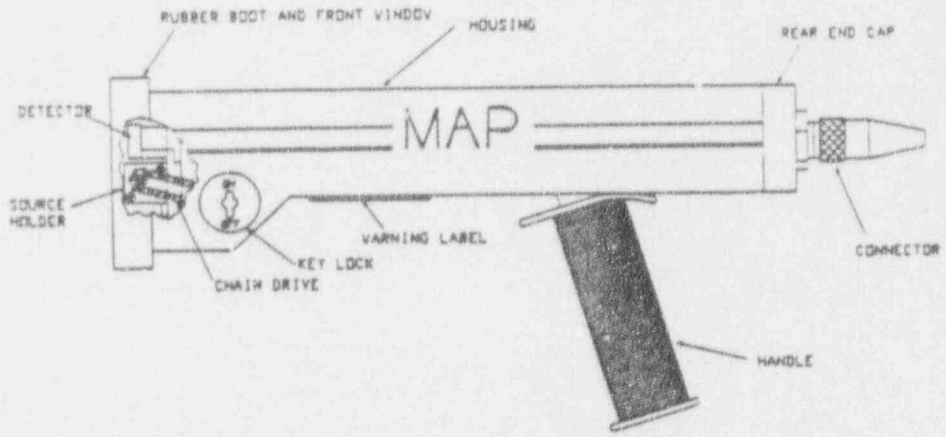
THE RECEIPT, POSSESSION, USE AND TRANSFER OF THIS DEVICE MODEL NO. _____ SERIAL NO. _____ ARE SUBJECT TO A SPECIFIC LICENSE OR EQUIVELANT, AND THE REGULATIONS OF A LICENSING STATE. THE DEVICE CONTAINS A _____ SOURCE. SERIAL NO. _____ LEAK TESTING INTERVAL IS 6 MONTHS AND CONTAINS AN ACTIVITY OF _____ mCi DETERMINED _____ SEE O AND M MANUAL FOR SAFETY PRECAUTIONS AND OPERATING INSTRUCTIONS REMOVAL OF THIS LABEL IS PROHIBITED BY LAW. IF FOUND CONTACT CIVIL AUTHORITIES.

SCITEC CORP: 2000 LOGSTON BLVD., RICHLAND, WA 99352

1.5"

2.5"

DIAGRAM:



Drawing 1 - Overall View FAnC Series Ambient Scanner

Also see Drawings B-1, B-3 and B-8 attached.

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

(Amended)

DEVICE TYPE: PORTABLE X-RAY FLUORESCENCE DEVICE

CONDITIONS OF NORMAL USE:

The FAnC was designed to be used as a tool for analyzing elements in specimens or in-situ. The FAnC is a hand-held device and is held against the material of interest. The material will vary from user to user but will include: mining wall surfaces, drill cores, bagged rock chips, bagged or bottled specimens, exploration sites, rock piles, waste, toxic waste, ground, private and public housing materials, and private and public construction materials of all types. Because the device is hand-held, the useful environment range is found within the endurance of the adult human. The operating temperatures are between 20 and 110 degrees Fahrenheit and up to 100% humidity. The users of this device will be entities involved in mining, milling, geological exploration, leaded paint testing, environmental site testing, materials analysis, research, and construction. The FAnC is designed to be used with SCITEC support equipment only.

PROTOTYPE TESTING:

Prototype testing was performed on the FAnC in accordance with ANSI N538-1979. The Model NER-472 source used in the FAnC was tested in accordance with ANSI N5.10 1968 and has ANSI number C43333. All other sources have been tested in accordance with ANSI N542 1977 and have the following ANSI numbers: NER-478C-C64444; NER-465-C43333; CTC.D2-C64444.

ANSI classification for the FAnC device is as follows:
FA1C, 33-596-664-R2; FA2C, 33-985-985-R2; FA3C, 33-986-996-R2.

EXTERNAL RADIATION LEVELS:

Maximum (at 5 cm., shutter open) stray radiation (as defined in ANSI N538-1979) dose for the FAnC device is as follows:

FA1C, Cobalt 57, 6.65 mR/hr
FA2C, Americium 241, 0.33 mR/hr
FA3C, Cadmium 109, 0.19 mR/hr

QUALITY ASSURANCE AND CONTROL:

The FAnC device is manufactured in conformance with the quality assurance requirements as specified in ANSI N538-1979. Specifically, these include QA organization, design control, material control, inspection, and documentation.

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

(Amended)

NO: WA-653-D-102-S DATE: NOVEMBER 27, 1991 PAGE: 5 OF 5

DEVICE TYPE: PORTABLE X-RAY FLUORESCENCE DEVICE

LIMITATIONS AND OTHER CONSIDERATIONS OF USE:

- The FAnC should be specifically licensed.
- All users should be required to take the manufacturer's safety and instruction course.
- Source replacement, device service and maintenance to be performed by SCITEC Corporation only. General system servicing such as cleaning contacts may be performed by the licensee.
- Use license conditions normally used with portable gauges.

SAFETY ANALYSIS SUMMARY:

The FAnC device uses sealed sources which either meet or exceed the ANSI N542-1977 requirement for x-ray fluorescence devices. The device with the above-referenced sealed sources is approved for manufacture and distribution to specific licensees.

REFERENCES:

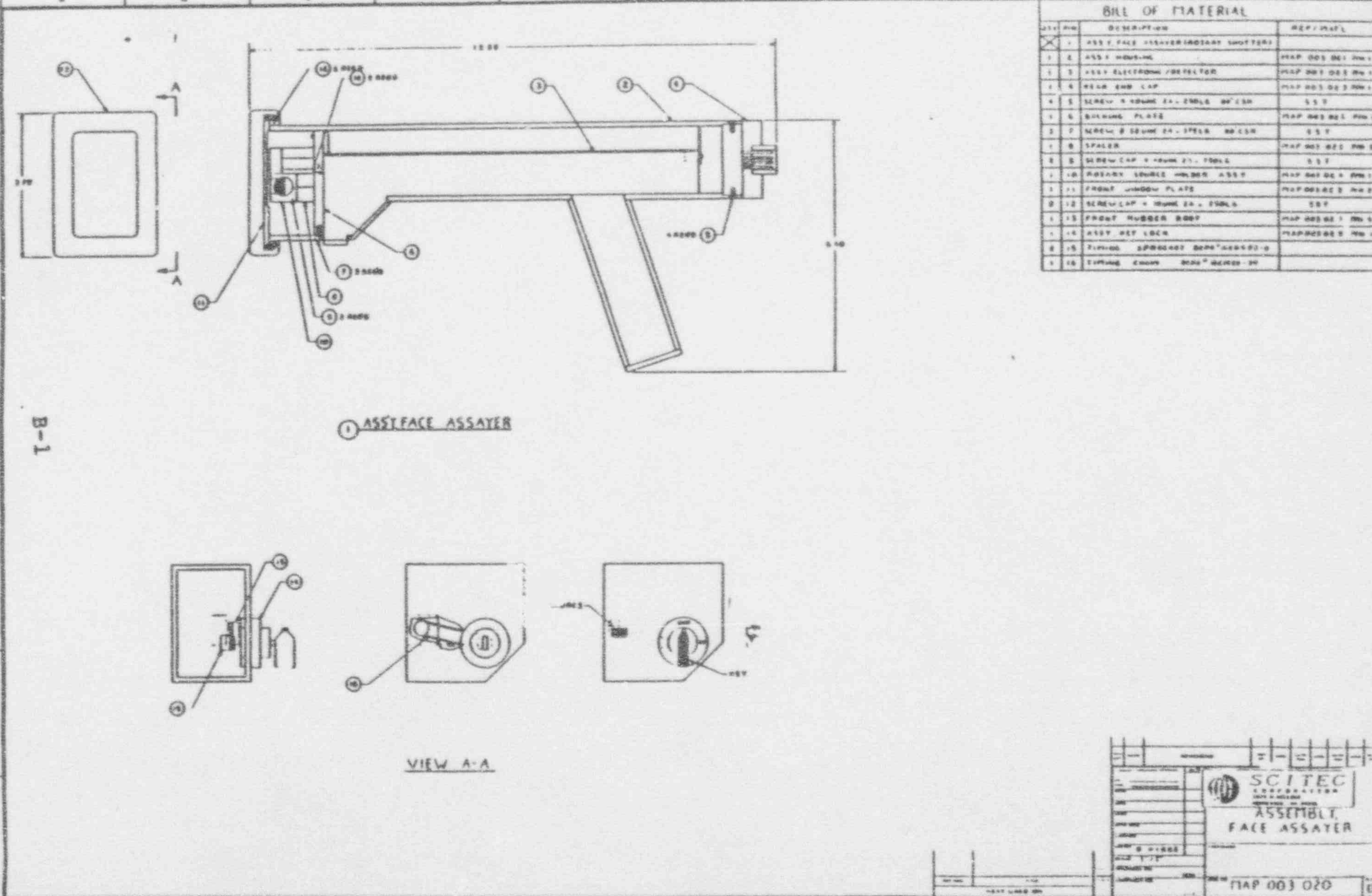
This certificate of registration is based on information submitted November 9, 1988, December 6, 1990, and November 14 and 25, 1991 by SCITEC Corporation. These referenced documents are hereby incorporated by reference and made a part of this registry document.

DATE: November 27, 1991 REVIEWED BY: J. R. Baugh

DATE: 11-27-91 CONCURRENCE: Jerry C. Fraser

ISSUING AGENCY:

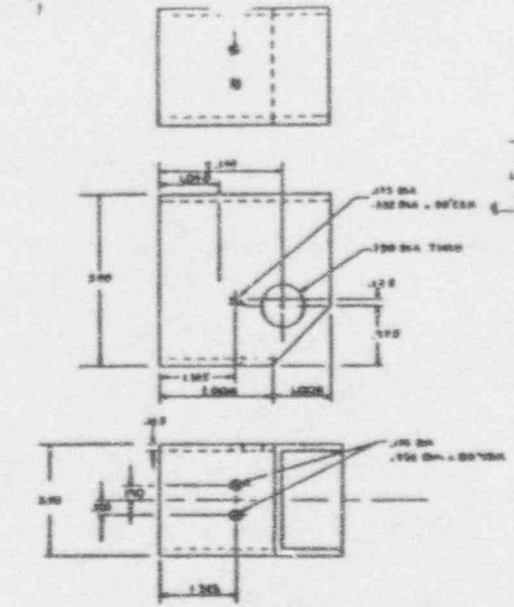
STATE OF WASHINGTON, DEPARTMENT OF HEALTH, DIVISION OF RADIATION PROTECTION, PO Box 47827, OLYMPIA, WASHINGTON 98504-7827



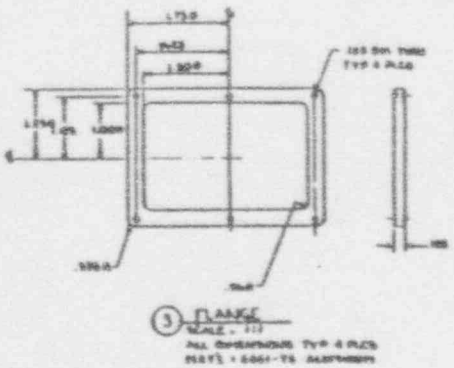
BILL OF MATERIAL

QTY	ITEM	DESCRIPTION	REF/MAT'L
X	1	ASSY. FACE ASSAYER (ROTARY SHUTTER)	
1	2	ASSY HOUSING	MAP 003 021 DWG 1
1	3	ASSY ELECTRONIC/DETECTOR	MAP 003 023 DWG 1
1	4	REAR END CAP	MAP 003 023 DWG 1
4	5	SCREW [illegible]	SST
1	6	BACKING PLATE	MAP 003 021 DWG 2
3	7	SCREW [illegible]	SST
1	8	SPACER	MAP 003 021 DWG 3
2	9	SCREW CAP [illegible]	SST
1	10	ROTARY SOURCE HOLDER ASSY	MAP [illegible]
1	11	FRONT WINDOW PLATE	MAP [illegible]
8	12	SCREW CAP [illegible]	SST
1	13	FRONT RUBBER BOOT	MAP [illegible]
1	14	ASSY KEY LOCK	MAP [illegible]
2	15	TIMING SPROCKET [illegible]	
1	16	TIMING CHAIN [illegible]	

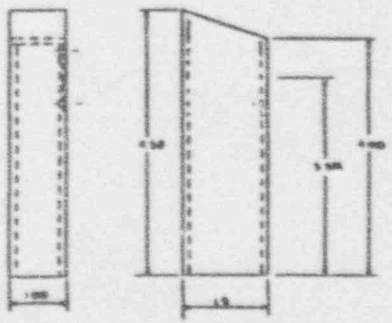
B-1



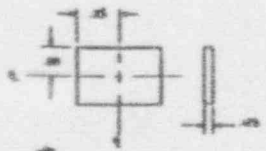
② SOURCE CONTAINER
SCALE = 1:1
MAT'L : 6061-T6 ALUMINUM



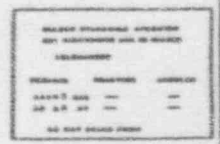
③ FLANGE
SCALE = 1:1
ALL DIMENSIONS TYP 4 PLCS
MAT'L = 6061-T6 ALUMINUM

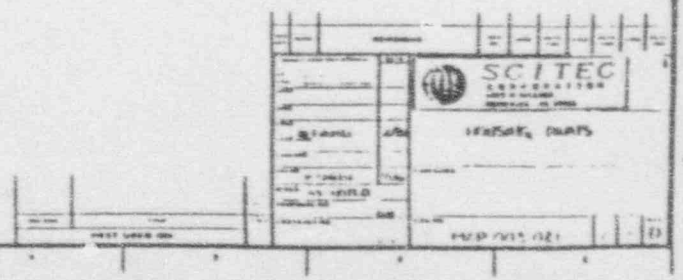


④ LINER
SCALE = 1:1
MAT'L: 6061 T6 ALUMINUM



⑤ BOTTOM PLATE
SCALE = 1:1
MAT'L = 6061-T6 ALUMINUM

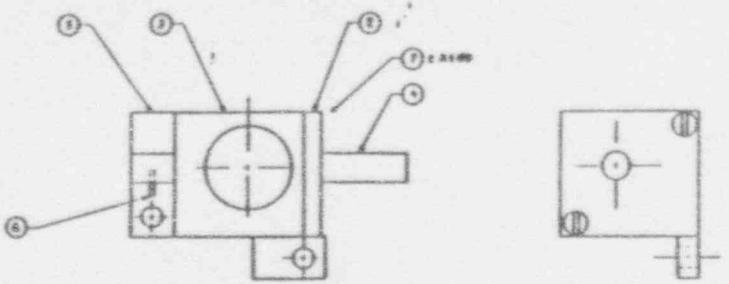




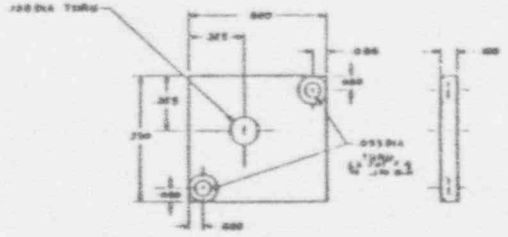
B-3

BILL OF MATERIAL

QTY	ITEM	DESCRIPTION	PART / REF
1	1	ROTARY SOURCE HOLDER ASSEMBLY	
1	2	RETAINING PLATE	
1	3	SOURCE HOLDER BODY	
1	4	ROTARY SHUTTER	
1	5	BALL DETENT 2 REQUIRE 2A × ¼ LG	SST
1	6	ROLL PIN ⅛ DIA × ½ LG	SST
8	7	F.H. SCREW, 2 REQUIRE 2A × ½ LG	SST
1	8	SET SCREW, 4 REQUIRE 2A × ½ LG	SST



① ROTARY SOURCE HOLDER ASSEMBLY
SCALE = 1/1
HEAVY DUTY AND TYPE

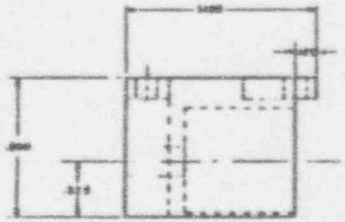


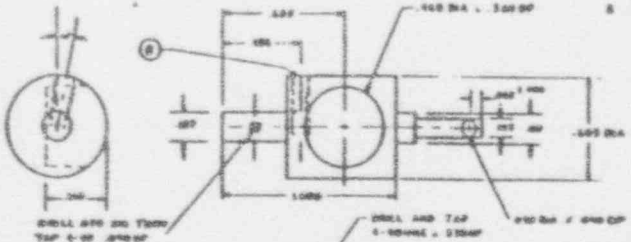
② RETAINING PLATE
SCALE = 1/1
HEAVY DUTY AND TYPE

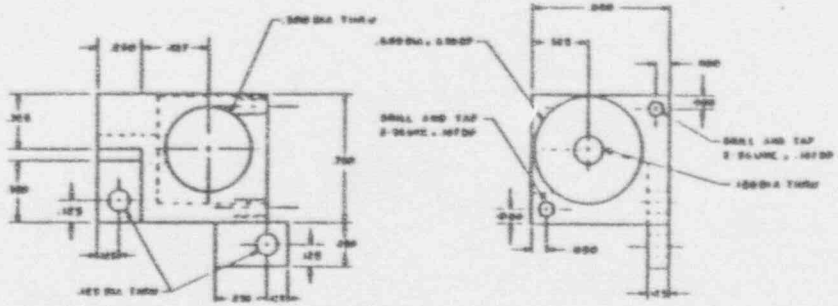
GENERAL NOTES

1. REMOVE ALL BURRS
2. FINISH ALL OVER ALL SURFACES

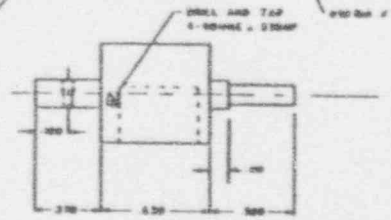
MATERIAL WILL BE SUPPLIED



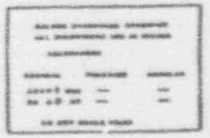




③ SOURCE HOLDER BODY
SCALE = 1/1
HEAVY DUTY AND TYPE



④ ROTARY SHUTTER
SCALE = 1/1
HEAVY DUTY AND TYPE



SCITEC

ROTARY SOURCE HOLDER ASSEMBLY

MAP 003-024 1 1 0