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DEPARTMENT OF THE ARMY
US ARMY COMMUNICATIONS-ELECTRONICS COMMAND
FORT MONMOUTH, NEW JERSEY 07703-5024

ENVIRONMENTAL ASSESSMENT

AND

FINDING OF NO SIGNIFICANT IMPACT

FOR THE

Am-241 VARIABLE ENERGY X-RAY SOURCE

SECURITY VERIFICATION: THIS DOCUMENT HAS BEEN REVIEWED IN FULL CONSIDERATION OF THE REQUIREMENTS OF OPERATIONS SECURITY (OPSEC) AND HAS BEEN DETERMINED TO BE ACCEPTABLE FOR PUBLIC RELEASE (SEE SECTION I)

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ABBREVIATIONS

ALI	Annual Limit on Intake
AMCCOM	US Army Armament, Munitions and Chemical Command
Am-241	Americium-241
AR	Army Regulation
Bq	Becquerel
CECOM	US Army Communications-Electronics Command
CFR	Code of Federal Regulations
cm	centimeter
Cu	Copper
dy	day
DA	Department of the Army
DOD	Department of Defense
EA	Environmental Assessment
hr	hour
ICRP	International Commission on Radiological Protection
m	meter
mR	millirem
NICP	National Inventory Control Point
NRC	Nuclear Regulatory Commission
OPSEC	Operations Security
psi	pounds per square inch
RPO	Radiation Protection Officer
sec	second
Sv	Sievert
Tb	Terbium

TM	Technical Manual
TSA	Technical Support Activity
yr	year

I. OPERATIONS SECURITY (OPSEC) REVIEW

A. Security Verification

1. The Environmental Assessment (EA) and Finding of No Significant Impact for the Am-241 Variable Energy X-ray Source supports a US Nuclear Regulatory Commission (NRC) license in accordance with requirements set forth in Army Regulation (AR) 200-2 and AR 385-11. The NRC license managed by the US Army Communications-Electronics Command (CECOM), Fort Monmouth, NJ is available for public review in the Public Documents Room, Washington, DC as required by Title 10, Code of Federal Regulations (CFR).

2. The information contained within this environmental documentation has been reviewed in accordance with OPSEC intentions/requirements presented in AR 530-1, and has been determined acceptable for public release.

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II. PUBLIC NOTIFICATION

A. Finding of No Significant Impact

1. CECOM has license management responsibilities for the Variable Energy X-ray Source as supplied by Amersham International Limited, Arlington Heights, IL. The Variable Energy X-ray Source utilizes Americium-241 (Am-241) as a sealed source and will be used in conjunction with the AN/UDM-7C Radiac Calibrator Set for the calibration of the DT-590/PDR-56F X-ray Probe. The EA supports the NRC license application and complies with AR 200-2, Environmental Quality, Environmental Effects of Army Actions, which requires an evaluation of any radionuclide proposed for use within Army activities. The assessment demonstrates compliance with applicable regulatory requirements concerning radiation safety policies, control and specific disposal procedures for the Am-241 Variable Energy X-ray Source.

2. The assessment provides dosimetric analysis for internal exposure of individuals resulting from inhalation or ingestion of the radioactive material and the external dose presented to exposed individuals. For dose commitments resulting from inhalation or ingestion, 50 year (yr) dose commitment factors are utilized. The dosimetric evaluations identify air/water concentrations and exposure levels below Federal and Department of the Army (DA) regulatory requirements and demonstrate internal exposures below International Commission on Radiological Protection (ICRP) recommendations. Based upon this analysis and stringent military radiation safety policy, the EA concludes no discernable radiological health or environmental quality degradation, and therefore, does not require an Environmental Impact Statement. The EA is available for review upon request from Commander, US Army Communications-Electronics Command, ATTN:

AMSEL-SF-MR, Fort Monmouth, New Jersey 07703-5024.

III. ENVIRONMENTAL ASSESSMENT

A. Summary and Conclusion

1. The following EA supporting a Finding of No Significant Impact and concurrent with an application for an NRC license to receive, possess, use and transfer radioactive material, has been prepared to maintain compliance with AR 200-2. The basic objective specified in this regulation is to perform all actions necessary in minimizing adverse effects on the quality of the human environment without impairment to the Army mission. The assessment does not consider the use of the Am-241 Variable Energy X-ray Source environmentally controversial, as it is neither capable of significantly affecting the quality of the human environment nor it is demonstrative of any radiological impact.

2. The proposed use, need, and description of the Am-241 Variable Energy X-ray Source, inclusive of maximum safety design specifications, unit description, user training, control, accountability and ultimate disposal are outlined in the applicable supplements contained within the provided NRC license packet.

3. This document outlines actual and theoretical radiological/ environmental data with associated dose assessments resulting from accidents or misuse. The evaluation concludes and documents there is no potential degradation of environmental quality or significant radiological impact to occupational workers or to the health of the general public from the use/storage of the Am-241 Variable Energy X-ray Source.

4. Properly implemented safety procedures for actions involving the Am-241 Variable Energy X-ray Source preclude any unnecessary radiation exposure to occupational personnel or to the general public and exclude consideration of any potential release to the environment. In determining radiological hazards to occupational personnel or the general public, external/internal dose assessments are presented. ICRP Publication 30 identifies recommended Annual Limits on Intake (ALI) for radionuclides. These recommendations are based upon mathematical and biological parameters of Standard Man for which exposure risk to the individual from the radionuclide is acceptable. The recommendations are derived from specified quantities which have been identified as not leading to the induction of significant biological effect and are expressed in terms of committed dose-equivalent rates. Complete derivation of the evaluations and identification of compliance to regulatory standards are provided for review in Part B. The EA outlines highly improbable modes of exposure and demonstrates minimal to non-existent environmental or radiological impact.

B. Proposed Environmental/Radiological Impact for the Am-241 Variable Energy X-ray Source.

1. The following paragraphs will present hypothetical/actual information concerning the Am-241 Variable Energy X-ray Source in order to identify non-existent to insignificant environmental/radiological concern/impact. The evaluation presented will substantiate the conclusions presented in the Finding of No Significant Impact (Section II).

2. To determine any environmental/radiological impact associated with the Am-241 Variable Energy X-ray Source, the following evaluation is presented. The assessment is expressed in terms of committed dose equivalent rates

determined for the organ(s) with the greatest potential of risk.

3. The assessment of internal exposure resulting from ingestion of Am-241 will take into consideration both the alpha and gamma emissions. However, because of the attenuation of the alpha particle from source encapsulation, only gamma radiation will be considered in determining external exposure. Furthermore, since only one Am-241 source will be possessed at each user location, the assessment will evaluate exposure presented to individuals from a 3.70E+08 Becquerel (Bq) (1.00E+01 mCi) source.

4. Although the probability of internal exposure and significant external exposure due to the use of the Am-241 Variable Energy X-ray Source is minute, the assessment is presented to identify exposure limits below ICRP recommendations and Federal and DA requirements. Additionally, the assessment will unquestionably demonstrate there is no significant environmental/radiological impact resulting from the use/storage of the Am-241 Variable Energy X-ray Source.

a. Assessment of External Radiation Exposure.

(1) A radiological survey of three Am-241 Variable Energy X-ray Sources, each with an activity of 3.70E+08 Bq (1.00E+01 mCi) was conducted by a member of the CECOM Safety Office health physics staff. Exposure rate measurements were obtained utilizing calibrated standard Army beta-gamma radiation detection instruments, specifically the AN/PDR-27( ) Radiac Set and the newly developed AN/VDR-2 Radiac Set. The AN/VDR-2 utilizes a light emitting diode (digital) readout to three significant figures. However the values provided in this assessment have been rounded off to two significant figures.

Table B-1, B-2 and B-3 provides the tabulated results of the exposure rate determinations. Figures B-2 and B-3 provide diagrammatic presentation of the results tabulated at Tables B-2 and B-3, respectively. Since data provided by the manufacturer indicated the Terbium (Tb) target to yield the greatest photon flux through the "beam out" port, the Tb target was utilized in obtaining the exposure rate measurements. Actual exposure rate determinations for each of the six targets available within the Am-241 Variable Energy X-ray Source verified this fact. Use of the Am-241 Variable Energy X-ray Source is such that an operator need only come in surface contact with the device for the purpose of mounting the source to some type of calibration assembly and changing targets. Target selection is accomplished through the simple rotation of a thumbwheel. Once the source is positioned and target selection is complete, no further contact with the Am-241 Variable Energy X-ray Source is necessary while the source is being used.

As indicated in Table B-1, an operator at a 5 centimeter (cm) distance would receive approximately 1.0 millirem per hour (mR/hr) in direct line with the "beam out" port. If one assumes a 40 hr work week and 52 weeks per year (yr), constant exposure to the Am-241 Variable Energy X-ray Source, under the prescribed conditions, would present an annual whole body exposure of approximately 2.10 rem per year. The stipulated occupational limits are 5.00 rem per year to the whole body, head and trunk, active blood forming organs, gonads or lens of the eye. The approximated annual exposure of 2.10 rem represents only 42 percent of the occupational limit and, to reiterate, is the result of constant 40 hour per week, 52 weeks per year exposure to the Am-241 Variable Energy X-ray Source at a 5 cm direct line distance from the "beam out" port.

In addition to operator exposure rate determinations, direct contact surface measurements with the Am-241 Variable Energy X-ray Source itself and surface measurements obtained with the source stored within its fitted wooden box, utilizing both the Tb and Copper (Cu) targets, were made. Table B-2 and Table B-3 provide the results of these exposure rate determinations.

TABLE B-1

Am-241 Variable Energy X-ray Source

Operator Exposure Rate Determinations

Instrument utilized	Distance from "Beam out" port (cm)	Exposure Rate (mR/hr) Source 1	Source 2	Source 3	Average Exposure Rate (mR/hr)
	5	1.10	1.00	1.00	1.03
AN/PDR-27(J)	10	0.40	0.30	0.30	0.33
	30	0.10	0.05	0.07	0.07
	5	1.70	1.70	1.70	1.70
AN/VDR-2	10	0.52	0.67	0.68	0.61
	30	0.13	0.11	0.12	0.12

TABLE B-2

Am-241 Variable Energy X-ray Source

Direct Surface Contact

Exposure Rate Determinations*

Target Selection	Surface Exposure Rate (mR/hr) Top	Bottom**	Outside diameter
Tb	0.81	8.00	0.45
Bu	0.93	1.02	0.60

*utilizing the AN/VDR-2

**at "beam out" port

TABLE B-3

Am-241 Variable Energy X-ray Source

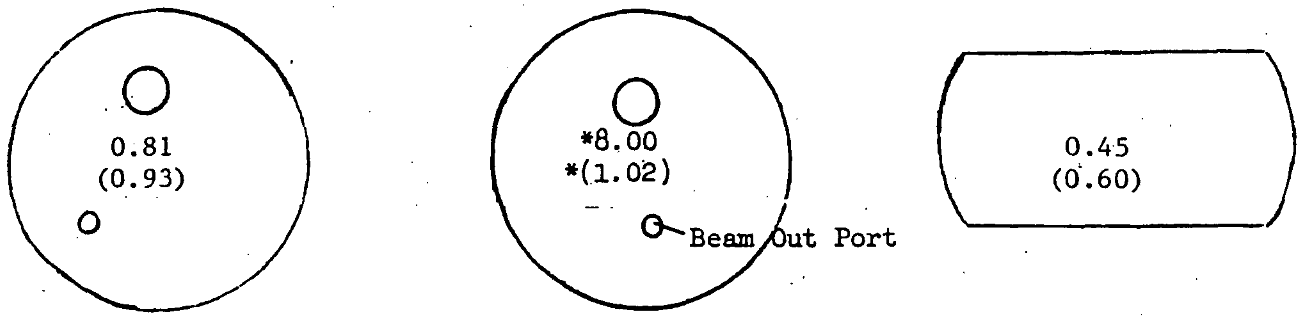
Storage Base Exposure Rate Determinations*

Target Selection	Surface Exposure Rate (mR/hr) Top	Bottom**	Sides
Tb	0.54	2.82	0.08
Cu	0.71	0.40	0.10

*utilizing the AN/VDR-2

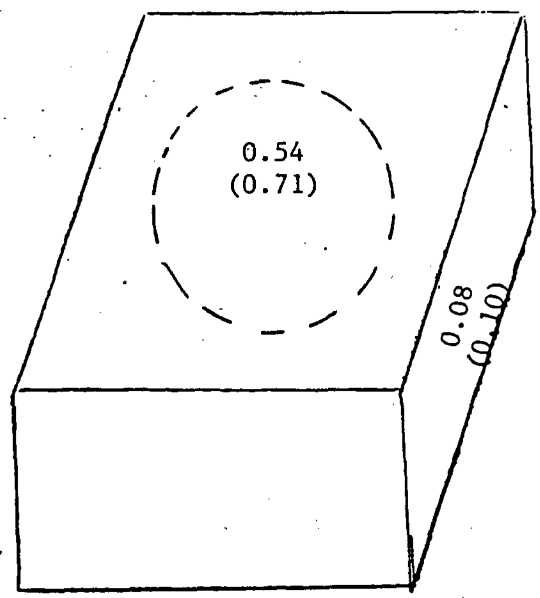
**with storage case placed upside down on table

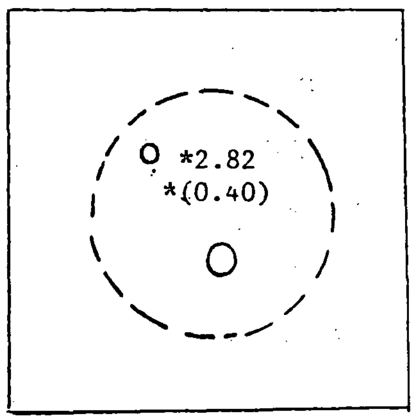
KEY: X.XXX Terbium (Tb)
(X.XXX) Copper (Cu)



Top View Bottom View Side View

Figure B-2. Diagrammatic presentation of Table B-2 results.





Bottom View of
Storage Case

Top View of
Storage Case

Figure B-3. Diagrammatic presentation of Table B-3 results.

*Readings taken at Beam Out Port

As indicated at Table B-2, an exposure rate of 8.00 mR/hr was obtained while utilizing the Tb target. It is noteworthy to mention that this is in constant, direct surface contact with the "beam out" port. Proper use of the Am-241 Variable Energy X-ray Source dictates handling the source by the outside rim where the exposure rate was determined to be 0.45 mR/hr. Even if one assumes the Am-241 Variable Energy X-ray Source were improperly handled, i.e., by direct surface contact with the "beam out" port, (8.00 mR/hr exposure) the operator could conceivably hold the source in the manner prescribed for 12 hours per week, 52 weeks per year, before achieving the 5.00 rem occupational limit.

If proper handling of the Am-241 Variable Energy X-ray Source is assumed, i.e., by the outside rim, constant surface contact would for 40 hours per week, 52 weeks per year, afford the user an annual exposure of only 0.93 rem or 18 percent of the stipulated 5.00 rem per year occupational limit.

It should be noted that the use factor identified, i.e., 40 hours per week, 52 weeks per year, is a gross overestimation of actual using time elements. Use of the Am-241 Variable Energy X-ray Source will be on an "as required" basis, with each calibration procedure being approximately 15 minutes in duration. Present procurement plans indicate the purchase of approximately one thousand DT-590/PDR-56F X-ray Probes. Calibration of all the probes, at once, could therefore, theoretically be accomplished within 250 hrs. Assuming a 5 cm operator distance and one individual performing all the calibrations, this presents a total external exposure of approximately 0.26 rem to the individual or 5 percent of the stipulated 5 rem per year occupational exposure limit. Even in this extreme case, i.e., one individual calibrating one thousand DT-590/PDR-56F X-ray Probes over a 250 hr period of time, the dose received is only 5 percent of the permissible 5 rem per year occupational exposure limit. More realistically, the calibrations would be performed on an "as required" basis by a number of qualified individuals located at each of the four indicated primary calibration sites.

A review of Table B-3 indicates an exposure rate of 2.82 mR/hr at the underside surface of the fitted storage case with the Tb target selected. Personnel in direct surface contact with the storage container in this position could receive an annual exposure, based upon a constant exposure of 40 hrs/wk, 52 wks/yr, of approximately 17 percent above the 5.00 rem occupational limit. However, proper upright placement of the Am-241 Variable Energy X-ray Source in its fitted storage box presents a maximum exposure rate of 0.71 mR/hr, or based on the same exposure criteria, 1.48 rem per year or approximately 30 percent of the occupational yearly limit. Again this reflects exposure through constant direct surface contact with the storage box and does not take into account factors such as placement of the storage box into the designated storage cabinet, and time and distance factors. Accountability of any of the aforementioned parameters would undoubtedly reduce storage exposure rates to negligible levels.

(2) Based upon actual radiological survey data obtained and analysis of the data, it is evident that proper use/storage of the Am-241 Variable Energy X-ray Source presents no external radiation hazard to operator personnel or to individuals frequenting an area where the Am-241 Variable Energy X-ray Source is either used or stored.

b. Source Leakage/Damage Leading to Ingestion.

(1) Assume a 3.70E+08 Bq (1.00E+01 mCi) Am-241 Variable Energy X-ray Source has leaked without detection resulting in the ingestion of radioactive material with the following assumptions:

(a) One percent of the total activity, 3.70E+06 Bq (1.00E-01 mCi), is distributed within the assembly.

(b) Ten percent, 3.70E+05 Bq (1.00E-02 mCi), is accessible for contamination of the individual.

(c) Ten percent of the accessible contamination, 3.70E+04 Bq (1.00E-03 mCi), is transferred to the individual.

(d) One percent, 3.70E+02 Bq (1.00E-05 mCi), is ingested.

(2) ICRP Publication 30 identifies the Gonads, Red Marrow, Bone Surface and Liver as the primary organs of concern following oral ingestion of Am-241.

(3) The tabulated committed dose equivalents, based on ICRP 30 data, are indicated at Table B-4. The maximum committed dose equivalent resultant from ingestion is identified as being 4.07E-03 Sievert (Sv) (4.07E-01 rem) to bone. The total ingested activity of 3.70E+02 Bq (1.00E-05 mCi) is 7.40E-01 percent of the Annual Limit on Intake (ALI) (5.00E+04 Bq) given for oral ingestion.

TABLE B-4

Committed Dose Equivalents to Various Organs Following Oral Ingestion of Am-241

Activity Ingested	Gonads	R. Marrow
3.70E+02 Bq (1.00E-05 mCi)	5.18E-05 Sv (5.18E-03 rem)	3.11E-04 Sv (3.11E-02 rem)
	Bone Surface	**Liver**
	4.07E-03 Sv (4.0E-01 rem)	8.51E-04 Sv (8.51E-02 rem)

(4) It is noteworthy to mention that in addition to passing ANSI Classification C64344 tests for containment integrity, the sealed source complies with IAEA special form requirements. In addition, environmental test data/results, as provided at paragraph 6 of this assessment, and the presented hypothetical crushing scenario provides further documentation attesting to the integrity of the Am-241 Variable Energy X-ray Source. Moreover, source construction, i.e., the fact that the Am-241, as oxide, is a chemical constituent of a ceramic enamel bonded to stainless steel, essentially eliminates loss of sealed source integrity and unintentional ingestion of radioactive material. Therefore, the occurrence of this or any scenario involving source leakage/damage leading to ingestion of radioactive material is highly improbable in its consideration.

c. Calibration Laboratory/Activity Fire:

(1) The proposed incident involves a calibration laboratory/activity fire involving an Am-241 Variable Energy X-ray Source resulting in a release of Am-241 to the air. The hypothetical incident evaluates internal radiation

exposure to firefighting personnel through the inhalation of Am-241 with the following assumptions:

(a) One Am-241 Variable Energy Source with an initial activity of 3.70E+08 Bq (1.00E+01 mCi) is involved in the fire.

(b) The fire envelops the storage case causing 1.00E-01 percent of the source activity to be released, with one percent of the released activity escaping to the storage case, i.e., 3.70E+03 Bq (1.00E-04 mCi).

(c) Fifty percent of the activity escapes the storage case and is released into the 9.34E+01 cubic meter (m^3) calibration laboratory yielding a concentration of 1.98E+01 Bq/m^3 (5.35E-07 mCi/m^3).

(d) The breathing rate of firefighting personnel is 1.20 m^3/hr. A firefighter, failing to implement protective respiratory apparatus, would in a five minute period of time, inhale a total activity of 1.98E+00 Bq (5.35E-08 mCi).

(2) The committed dose equivalents based on ICRP 30 data are summarized in Table B-5. The total inhaled activity is identified as being approximately one percent of the recommended ALI for inhalation (2.00E+02 Bq). The air concentration limit, as specified in 10 CFR 20, is 2.22E-01 Bq/m^3 (6.00E-12 uCi/cm^3) for soluble forms and 3.70E+00 Bq/m^3 (1.00E-10 uCi/cm^3) for insoluble forms. The calculated air concentration of 1.98E+01 Bq/m^3, averaged over one year, is equal to 5.42E-02 Bq/m^3 (1.46E-12 uCi/cm^3) or 24 percent of the air concentration limit for soluble forms and approximately 1.5 percent of the insoluble limit.

TABLE B-5

Committed Dose Equilavents to Various Organs
Following Inhalation of Am-241

Activity Inhaled	Gonads	R. Marrow
1.98E+00 Bq (5.35E-08 mCi)	6.34E-05 Sv (6.34E-03 rem)	3.96E-04 Sv (3.96E-02 rem)
	Bone Surface	**Liver**
	4.95E-03 Sv (4.95E-01 rem)	1.09E-03 Sv (1.09E-01 rem)

The evaluation presented considered the minute possibility of fire enveloping the calibration laboratory/activity and attempts to arrest the fire without the use of respiratory devices and without consideration of air exchange. These factors would further decrease the activity of contaminant inhaled. Realistically, due to source construction, i.e., the Am-241 being incorporated in a ceramic matrix, fired onto a metal insert and then further contained in a welded metal capsule, the radioactive constituent of the Am-241 Variable Energy X-ray Source could not become an airborne contaminant. The consideration of internal exposure through inhalation of airborne Am-241 contaminants is only presented to further illustrate the non-existent to insignificant environmental/radiological impact associated with the use/storage of the Am-241 Variable Energy X-ray Source.

5. An overall view of the theoretical incidents and probabilities indicate the maximum internal exposure of 4.95E-03 Sv (4.95E-01 rem) is presented to the Bone Surface following inhalation of Am-241. The total inhaled activity is

ıpproximately one percent of the recommended ALI for inhalation. This value is minimal in consideration of source design and stringent safety requirements not fully considered within the assumptions. Therefore, any actual environmental/radiological impact is undoubtedly minimal to non-existent and supports the conclusion that no potential degradation of environmental quality or significant radiological impact to occupational workers or to the health of the general public exists from the use/storage of the Am-241 Variable Energy X-ray Source.

υ. ıo further assess the integrity of the sealed source, the source was subjected to different types of environmental testing procedures by the Environmental Test Facility of the Technical Support Activity (TSA) formally assigned to the US Army Electronics Research and Development Command and now transitioned to CECOM. The test procedures included water immersion, high and low temperature extremes, altitude, vibration and drop testing. Before commencing, and at the termination of each test procedure, the Variable Energy X-ray Source utilized, Serial No. 3842LA, was dry and wet wipe tested for the presence of removable contamination. The wipes were evaluated utilizing a ıennelec LB5100 Series II Automated Low Background Alpha/Beta/Gamma Counting System. (Minimum Detectable Activity (MDA) of 0.58 picocuries (pCi) for alpha radiation with a 95 percent confidence level). All wipe tests analyzed were less than MDA and demonstrated that the sealed source integrity of the Variable Energy X-ray Source had not been breached. The specific parameters associated with each test procedure and test results are provided at enclosure 44 of Supplement B. In addition to actual environmental testing procedures, the Am-241 Variable Energy X-ray Source was subjected to a theoretical crushing scenario utilizing the physical specifications, i.e., weight, track length, dimensions, etc., of an M-1 tank.

In this regard, the following information is provided:

(1) Total track length = 180.1 inches

(2) Track width = 25.0 inches

(3) Weight = 120,000 pounds (lbs)

Based upon the above, the total downward force exerted by the M-1 tank is calculated to be:

(1) 180.1 inches x 25 inches = 4502.5 square inches (in^2)

(2) 120,000 lbs/4502.5 in^2 = 26.66 pounds per square inch (psi)

As only one side of the tank can run over the Am-241 source at any given time, the total downward force exerted becomes 26.66 psi/2 or 13.33 psi.

Needless to say, should the Am-241 source be in its fitted wooden storage container when the tank ran it over, the wooden container would be crushed beyond use. However, the exertion of 13.33 psi downward vertical force onto the Am-241 source itself would be insufficient to crush the stainless steel or any other heavy alloys utilized in the manufacture of the source. Both these materials require the application of much higher compressive forces in order to significantly alter or change their structure. These compressive forces range from approximately 62,600 to 89,000 psi. Assuming the Am-241 source represents a solid cylinder of 1.75 inches diameter with a depth of 1.00 inches, the maximum sectional area available for crushing is then 1.75 in^2. Further assume a uniformly distributed load over the entire surface area with the downward force acting through the center of gravity, the minimum force required to effectively alter or change the structure of the Am-241 source housing is calculated to be:

$$Fc = P/A$$

where: Fc = compression force

P = exerted downward force, i.e., weight of the tank

$A = 1.75\ in^2$

Fc is therefore equal to 120,000/1.75 or approximately 68,600 psi.

The calculated downward force of 13.33 psi exerted by the M-1 tank on the Am-241 Variable Energy X-ray Source is minute in comparison to the 68,600 psi required to significantly alter the shape or structure of the source housing. Therefore, the hypothetical crushing of the Am-241 Variable Energy X-ray Source by an M-1 tank, exerting a downward vertical force of 13.33 psi, would produce no adverse effects on the Am-241 source.

D. References:

1. International Commission on Radiological Protection, Publication 26, Recommendations of the International Commission on Radiological Protection, Pergamon Press, New York, adopted 1977.

2. International Commission on Radiological Protection, Publication 30, Limits for Intakes of Radionuclides by Workers, Pergamon Press, New York, adopted 1978.

3. Army Regulation 385-11, Safety, Ionizing Radiation Protection (Licensing, Control, Transportation, Disposal and Radiation Safety), 1 May 1980.

4. Army Regulation 700-64, DLAM 4145.8, NAV SUPINST 4000.34B, AFR 67-8, MCO P4400.105C, Radioactive Commodities in the DOD Supply Systems, 19 April 1985.

5. Army Regulation 40-14, Control and Recording Procedures for Occupational Exposure to Ionizing Radiation, 15 March 1982.

6. Belanger, R., Buckley, D. W. and Swenson, J. B., Environmental Assessment of Ionization Chamber Smoke Detectors Containing Americium-241, NUREG/CR-1156, Science Applications Inc., California, 1979.

7. US Department of Health, Education and Welfare, Radiological Health Handbook, Public Health Service, Rockville, Maryland, 1970.

8. Marks Handbook for Mechanical Engineers, 7th Edition.

MIL-R-16131A(SHIPS)
15 August 1951
SUPERSEDING
MIL-R-16131(SHIPS)
1 March 1951

MILITARY SPECIFICATION

RADIAC CALIBRATOR SET AN/UDM-1( )

1. SCOPE

1.1 This is a general performance specification which covers but one type of test equipment for calibration of radiac survey equipment.

2. APPLICABLE SPECIFICATIONS, STANDARDS, DRAWINGS, AND PUBLICATIONS

2.1 The following specifications, standards, drawings, and publications, of the issue in effect on date of invitation for bids, form a part of this specification:

SPECIFICATIONS

FEDERAL
NN-B-621 - Boxes, Wood, Nailed and Lock-Corner.

MILITARY
JAN-P-106 - Packaging and Packing for Overseas Shipment - Boxes; Wood, Nailed.
MIL-E-15090 - Enamel, Equipment, Light-Gray (Formula No. 111).
MIL-S-15395 - Silver-Base-Brazing-Alloy.

NAVY DEPARTMENT
General Specifications for Inspection of Material.
16E4 - Electronic Equipment, Naval Ship and Shore: General Specification.

DRAWINGS

BUREAU OF SHIPS RADIO
RE60-D-125 - AN/UDM-1( ) Radiac Calibrator Set, Lead Safe, Platform, Rolling Platform and Rails.
RE10-D-673 - Shipping Box for Radiation Source Container, AN/UDM-1( ) Radiac Calibrator Set.

(Copies of specifications, standards, and drawings required by contractors in connection with specific procurement functions should be obtained from the procuring agency or as directed by the contracting officer.)

2.2 Other publications. - The following publications, of the issue in effect on date of invitation for bids, unless otherwise stated, form a part of this specification:

INTERSTATE COMMERCE COMMISSION REGULATION
Regulations for Transportation of Explosives and Other Dangerous Articles, etc.

(Information as to the availability of these Regulations may be obtained from the Interstate Commerce Commission, Washington 25, D. C.)

3. REQUIREMENTS

3.1 General description. - The Radiac Calibrator Set AN/UDM-1( ) is a calibrating apparatus which provides a suitable radioactive source for calibrating radiac survey equipment.

3.1.1 The Radiac Calibrator Set AN/UDM-1( ) shall be constructed and assembled in accordance with this specification and Drawings RE60-D-125 and RE10-D-673. Where the requirements of this specification conflict with the drawings, this specification shall govern.

3.2 Material. - Materials specified herein and in Drawing RE60-D-125 shall be entirely suitable for the purpose intended. Use of other material shall have the approval of the bureau or agency concerned.

3.2.1 Silver solder shall conform to grade III of Specification MIL-S-15395.

3.2.2 Lead shall be at least 95.0 percent pure.

3.3 Equipment composition. - The calibration equipment shall consist of the following:

(a) Radiation source - Cobalt 60.
(b) Source container and filtering plugs.
(c) Platform for source container.
(d) Rolling platform for radiac equipment.
(e) Track or rails for the rolling platform.
(f) Mechanism for activating the radiation source.
(g) Optical system.

3.3.1 Radiation source. - The radiation source shall be a Cobalt 60 source (Government furnished material).

3.3.1.1 Handling of radioactive source. - The contractor shall at no time be required to handle radioactive materials during the performance of this contract.

3.3.1.2 The following steps shall be taken to assure safe and proper insertion of the source:

(a) At the appropriate time, the contractor will ship, with the approval of the bureau or agency concerned, the empty radiation source capsule to the activity of the Atomic Energy Commission concerned with supplying the source.
(b) At the appropriate time, the empty lead source container cap shield, lead plugs, locking bolt and nut shall be forwarded to the National Bureau of Standards with the approval of the bureau or agency concerned.
(c) All equipment, less parts (a) and (b), shall be packaged by the contractor and packed as described in 5.1 and 5.2 and then forwarded to a depot designated by the bureau or agency concerned.

3.3.2 Source container. - The arrangement and construction of the source container shall be as shown on sheet 2 of Drawing RE60-D-125. Individual parts for the container and accessory items shall be fabricated as shown on sheets 3, 4, and 5 of Drawing RE60-D-125. Alternate methods of fabrication and construction may be used provided approval is obtained from the bureau or agency concerned.

3.3.2.1 The intensity of radiation emanating from the radiation cone shall be attenuated by means of two removable plugs. These plugs shall be so constructed that a lead filtration of 12.5 and 9.5 cm. of lead can be obtained. The removal of the lead plugs shall be accomplished by such means that the operator can perform the necessary manipulations easily, quickly and in a region of a safe hourly rate of radiation intensity so that the total accumulated dosage per week does not exceed 0.3 roentgen.

3.3.3 Platform for source container. - Drawing RE60-D-125, sheet 6, shows the construction of the platform. The over-all size of the platform and the size and shape of the individual parts shall conform to Drawing RE60-D-125. However, different methods of fabrication are permissible provided that approval is obtained from the bureau or agency concerned.

3.3.4 Track and rolling platform for radiac equipment. - Drawing RE60-D-125, sheets 7 and 8, show the general construction of the track and the rolling platform. This platform is not only a supporting structure for the radiac equipment but also for parts of the optical system (3.3.6). Details of the construction of these structures shall be determined by the contractor and shall be subject to approval of the bureau or agency concerned. The following requirements, in addition to the requirements shown on Drawing RE60-D-125, shall govern the design and the construction:

3.3.4.1 The size and shape of the components (major units) and the material used for their fabrication shall be such that the structure is light yet strong enough so that the application of a 50-pound load will not cause buckling, deflections or overstressing of the individual parts or the structure as a whole.

3.3.4.2 The vertical axis of the rolling platform shall remain perpendicular at all points on the track.

3.3.4.3 The rollers and bearings shall have such characteristics that they will carry the load easily and allow the operator to move the platform along the track with a minimum of effort.

3.3.4.4 Means shall be provided to keep the platform on the track at all times.

3.3.4.5 A clamping or holding device shall be incorporated which allows the platform to be locked to the track at any point.

3.3.4.6 The design of the jig and radiac equipment supporting platform shall be such that it can be raised or lowered easily through the distance specified. A lock shall hold the platform securely, and firmly in any position.

3.3.4.7 The rolling platform shall be constructed in such a manner that it can be readily disassembled into several sub-assemblies and thus allow the whole unit to be packed into a minimum of space.

3.3.4.8 Track. - The track or rails shall be built in 5-foot sections. The individual sections shall be designed and constructed for easy assembly and remain in alignment with respect to each other.

3.3.4.9 The entire track shall have a straight, smooth top surface.

3.3.4.10 There shall be no buckling or deflecting of the rails at any point under load.

3.3.4.11 The contractor shall obtain approval of the design of the track and the rolling platform from the bureau or agency concerned prior to construction.

3.3.5 Mechanism for actuating the radiation source capsule. - By remotely controlled mechanical means, the radiation source capsule shall be capable of being raised or lowered. This mechanical device shall be of such construction that it can be operated easily and positively. In addition the mechanism shall hold the source capsule securely in place when it has been raised to either the operating position within the source container or out of the protective source container to a height of at least 18 inches above the top of the container. The design shall be such that there is no possibility of jamming when the source is in the exposed position.

3.3.5.1 Prior to the actual construction of the mechanism the contractor shall submit the necessary detailed drawings and plans for approval by the bureau or agency concerned.

3.3.6 Optical system. - An optical system shall be supplied as specified on sheet 7 of Drawing RE60-D-125.

3.4 External finish. - External finish of the equipment shall be as specified in Specification 16E4. The finish coats shall be gray enamel in accordance with type II, class 2 of Specification MIL-E-15090.

3.5 Markings. - All parts or sub-assemblies shall be identified by appropriate markings. A nameplate shall be attached to the source container having the following inscription:

Radioactive
COBALT 60
. . . . curies as of date . . . . . unit #
Property, Bureau of Ships, U.S. Navy
Washington 25, D. C.

3.5.1 The unit number and the exact strength of the source, and date of calibration of the source shall be inserted by the bureau or agency calibrating the source.

3.6 Instruction and installation books. - Instruction and installation books shall be supplied as specified (see 6.1) and shall include, subject to approval of the bureau or agency concerned, all information necessary for installation, operation and maintenance of the equipment.

3.7 Workmanship. - Workmanship shall be as specified in Specification 16E4.

4. SAMPLING, INSPECTION, AND TEST PROCEDURES

4.1 General. - Preproduction, production and selected production models of the equipment shall satisfactorily pass the preproduction and production inspections and tests specified herein and any other tests necessary, in the opinion of the cognizant Government inspector or the bureau or agency concerned, to prove compliance with the requirements of this specification.

4.1.1 Performance of tests. - Before presenting equipment for Government inspection, the contractor shall have ascertained to the best of his ability that the equipment is free from defects of material and workmanship and is in satisfactory operation condition. It shall be the option of the Government inspector to participate in, witness, or accept certified data of tests performed by the contractor or his supplier. The contractor shall make arrangements with the cognizant Government inspector for test schedules, and shall provide him with any information regarding materials, processes, or manufacturing data which he may request. The contractor shall permit the cognizant inspector to examine raw materials and processes used in the contractor's or manufacturer's plants. Upon inspection, the cognizant inspector may reject inferior raw materials and require the correction of processes incorrectly performed.

4.1.2 Inspection procedures. - For Naval purchases, the general inspection procedures shall be in accordance with General Specifications for Inspection of Material. 1

4.2 Preproduction tests. - Preproduction tests shall be made at a Government laboratory designated by the bureau or agency concerned on the preproduction model submitted by the contractor to determine suitability for Naval use. Preproduction tests shall consist of any tests necessary to determine performance with the requirements of this specification and shall include the following:

4.2.1 General inspection. - Equipment shall be inspected and tested to determine compliance with the requirements of this specification and shall include the following:

(a) Assembly, size, fit.
(b) Type and character of material, parts, and finish including prevention of corrosion.

4.2.2 Operating test. - The equipment shall be subjected to a practical operating test.

4.2.3 Controls. - Equipment shall be tested to determine the suitability of controls for satisfactory operation.

Notice. - When Government drawings, specifications, or other data are used for any purpose other than in connection with a definitely related Government procurement operation, the United States Government thereby incurs no responsibility nor any obligation whatsoever; and the fact that the Government may have formulated, furnished, or in any way supplied the said drawings, specifications, or other data, is not to be regarded by implication or otherwise as in any manner licensing the holder or any other person or corporation, or conveying any rights or permission to manufacture, use, or sell any patented invention that may in any way be related thereto.

MILITARY SPECIFICATION

CALIBRATOR, SET, RADIO, AN/UDM-1( )

This amendment forms a part of Military Specification MIL-C-22211A(EC), 5 September 1969.

Page 1

Title: Delete "RADIO" and substitute "RADIAC".

Page 5

4.1.1, line 5: Delete "sixty (60) days" and substitute "(see 6.1.2)".

4.1.3, line 3: Delete "sixty (60) days" and substitute "(see 6.1.2)".

4.2, item (c): Delete and substitute:

"(c) Inspection of preparation for delivery."

4.3: Insert the following as the first sentence: "Unless otherwise specified (see 6.1.1), 1 unit shall be required for first article inspection."

Page 6

4.5, title: Delete and substitute: "Inspection of preparation for delivery."

5. After "PREPARATION FOR DELIVERY" insert the following: "(The preparation for delivery requirements specified herein apply only for direct Government procurements. Preparation for delivery requirements of referenced documents listed in Section 2 do not apply unless specifically stated in the contract or order. Preparation for delivery requirements for products procured by contractors shall be specified in the individual order.)"

Page 8

6.1: Delete and substitute:

"6.1 Ordering data.- Procurement documents should specify the following:

FSC 6665

Encl 6

"6.1.1 Procurement requirements.

"(a) Title, number and date of this specification.
"(b) Number of first article samples to be submitted if other than specified in 4.3.
"(c) Selection of applicable levels of packaging and packing required (see 5.1, 5.2 and 5.3).

"6.1.2 Contract data requirements. Data generated by this document are not deliverable unless specified on the Contract Data Requirements List (DD Form 1423). The data required by this specification includes, but is not restricted to the following:

"(a) Contractor's quality assurance system (see 4.1.1)
"(b) Test procedures (see 4.1.3)".

Preparing activity:
Navy - EC
(Project 6665-N275)

☆ U. S. GOVERNMENT PRINTING OFFICE: 1970-433-692/2494

MILITARY SPECIFICATION

CALIBRATOR SET, RADIO, AN/UDM-1( )

1. SCOPE

1.1 This is a general performance specification which covers one type of test equipment for calibration of radiac survey equipment.

2. APPLICABLE DOCUMENTS

2.1 The following documents of the issue in effect on date of invitation for bids or request for proposal, form a part of the specification to the extent specified herein.

SPECIFICATIONS

FEDERAL
PPP-B-601-Boxes, Wood, Cleated-Plywood.

MILITARY
MIL-P-116-Preservation, Methods of.
MIL-P-15024-Plates, Identification——Information and Marking for Identification of Electrical, Electronic and Mechanical Equipment.
MIL-E-15090-Enamel, Equipment, Light-Gray(Formula No. 111).
MIL-B-15395-Brazing Alloys, Silver.
MIL-E-16400-Electronic Equipment, Naval Ship and Shore: General Specification.
MIL-M-19590-Marking of Commodities and Containers to Indicate Radioactive Material.
MIL-I-45208-Inspection System Requirements.

STANDARDS

MILITARY
MIL-STD-129-Marking for Shipment and Storage.
MIL-STD-1186-Cushioning, Anchoring, Bracing, Blocking, and Waterproofing; with Appropriate Test Methods.

DRAWINGS

BUREAU OF SHIPS
REF 10085-Shipping Crate for Source Container.
REF 60001-AN/UDM-1( ) Radiac Calibrator Set, Modified.
REF 60001-2-AN/UDM-1( ) Modified Source Container for.
REF 60001-3-Base Assembly.
REF 60001-4-Stand Assembly.
RED 60001-5-Plate Sub-Assembly.
RED 60001-6-Tripod Assembly.

(Copies of specifications, standards, drawings, and publications required by suppliers in connection with specific procurement functions should be obtained from the procuring activity or as directed by the contracting officer.)

2.2 Other publications.-The following documents form a part of this specification to the extent specified herein. Unless otherwise indicated, the issue in effect on date of invitation for bids or request for proposal shall apply.

UNIFORM CLASSIFICATION COMMITTEE
Uniform Freight Classification Rules

(Application for copies should be addressed to the Uniform Classification Committee, 202 Union Station, 516 West Jackson Blvd., Chicago, Ill. 60606.)

NATIONAL CLASSIFICATION BOARD
National Motor Freight Classification Rules

(Application for copies should be addressed to the National Motor Freight Traffic Association, Inc., 1616 P Street, N.W., Washington D.C. 20036.)

DEPARTMENT OF TRANSPORTATION
Code of Federal Regulations, Title 49
Department of Transportation Specification DOT-55

(Application for copies should be addressed to the Superintendent of Documents, U.S. Government Printing Office, Washington, D.C. 20402.)

3. REQUIREMENTS

3.1 First article sample.-Prior to beginning production a sample shall be inspected as specified in 4.3 (see 6.2).

3.2 General description.-The Radiac Calibrator Set AN/UDM-1( ) is a calibrating set which provides a suitable radioactive source for calibrating radiac survey equipment.

3.2.1 The Radiac Calibrator Set AN/UDM-1( ) shall be constructed and assembled in accordance with this specification and Drawings REF 60001 and REF 60001-2. Where the requirements of this specification conflict with the drawings, this specification shall govern. Units are to be constructed to comply with with Department of Transportation (DOT) Specification 55 and all Radiac Transportation Permits.

3.3 Material.-Materials specified herein and in Drawings REF 60001 and REF 60001-2 shall be entirely suitable for the purpose intended. Use of other material shall have the approval of the command or agency concerned.

3.3.1 Silver solder shall conform to grade III of MIL-B-15395.

3.3.2 Lead shall be at least 95.0 percent pure.

3.4 Equipment composition. - The calibration equipment shall consist of the following:

(a) Radiation source - Cesium 137.
(b) Source container.
(c) Platform for source container.
(d) Rolling platform for radiac equipment.
(e) Track or rails for the rolling platform.
(f) Optical system.

3.4.1 Radiation source. - The source holder shall be designed and fabricated to meet Department of Transportation "Special Form" requirements and be compatible with the AN/UDM-1( ) Source Container. The source activity shall be 120 curies of Cesium 137 ±5% with no more than 3% Cesium 134 permissible. The true activity, when the source is installed in the AN/UDM-1( ) shall be at least 40 R/hr at one meter.

3.4.1.1 Procurement requirements for sealed sources. - Source holder must be designed and tested so as to allow U. S. (AEC) Atomic Energy Commission licensing for possession and use of the source and this includes the following information and tests, which shall be supplied to the Naval Electronic Systems Command, Code 05162 16 months after date of contract. In the event of first article sample waiver, the information required shall be delivered 3 months after date of contract.

(a) The source model number.

(b) A drawing or sketch of the source holder describing all materials of construction, dimensions, and methods of sealing the source.

(c) A facsimile of the label to be affixed to the source or source holder and a description of how and where the label will be permanently attached.

(d) A description of tests performed on prototype sources that establish the integrity of the source construction and seal under the most adverse conditions of use to which the source is likely to be subjected.

(e) A description of the quality control procedures to be followed to assure that each finished source meets specifications furnished to the Naval Electronic Systems Command. A description of tests for contamination and leakage of radioactive material should be included.

If tests and other information have already been indexed or furnished to U. S. AEC only source drawing and model number are necessary. The contractor shall certify that the source meets DOT requirements for special form.

3.4.1.2 Permit requirements. - In the event a permit is required, the contractor shall make application for permits through the cognizant Military Traffic Management and Terminal Service Office via the DCAS Transportation office administering contract. Permits when required will be obtained prior to the movement of shipment. Permit number (when applicable) will be shown on DD-250's and Shipping Documents. The date of issue, date of expiration and office issued from will also be shown.

3.4.2 Source container. - The arrangement and construction of the source container shall be as shown on Drawing REF60001-2.

3.4.2.1 Radiographic requirement. - Prior to shipment, each source container shall be radiographed, and certified by the contractor to be free of holes or other defects in the lead.

3.4.3 Platform for source container. - The overall size of the platform and the size and shape of the individual parts shall conform to Drawing REF 60001-3.

3.4.3.1 The components and materials used in the fabrication shall be such that an applied force of 1000 pounds will not cause buckling or overstressing of individual parts or the complete assembly.

3.4.4 Rolling platform for radiac equipment. - Construction of the rolling platform shall conform to Drawing REF 60001-4. This platform is not only a supporting structure for radiac equipment but also for parts of the optical system (RED 60001-5). The following requirements, in addition to the requirements as given in Drawings REF 60001-4 and RED 60001-5, shall govern the design and construction.

3.4.4.1 The size and shape of the components (major units) and the material used for fabrication shall be such that the structure is light yet strong enough so that the application of a 50-pound load will not cause buckling, deflections or overstressing of the individual parts or the structure as a whole.

3.4.4.2 The vertical axis of the rolling platform shall remain perpendicular at all points on the track.

3.4.4.3 The rollers and bearings shall have such characteristics that they will carry the load easily and allow the operator to move the platform along the track with a minimum of effort.

3.4.4.4 Means shall be provided to keep the rolling platform on the track at all times.

3.4.4.5 A clamping or holding device shall be incorporated which permits the rolling platform to be locked to the track at any point.

3.4.4.6 The design of the jig and radiac equipment supporting platform shall be such that it can be raised or lowered easily through the distance specified. A lock shall hold the platform securely and firmly in any position.

3.4.4.7 The rolling platform shall be constructed in such a manner that it can be readily disassembled into several subassemblies and thus allow the whole unit to be packed into a minimum of space.

3.4.5 Track. - The track or rails shall be built in 5-foot sections. The individual sections shall be designed and constructed for easy assembly and remain in alignment with respect to each other. Construction design shall be in accordance with Drawing REF 60001-3.

3.4.5.1 The track length shall be 30 feet.

3.4.5.2 The entire track shall have a straight, smooth top surface.

3.4.5.3 There shall be no buckling or deflecting of the rails at any point under load.

3.4.6 Optical system (tripod assembly). - Construction of the tripod assembly shall be in accordance with Drawing RED 60001-6.

3.5 External finish. - External finish of the equipment shall be as specified in MIL-E-16400. The finish coats shall be grey enamel in accordance with type II, class 2, of MIL-E-15090.

3.6 Markings. - A calibration plate shall be attached to the source container having the following inscription:

Calibrated by____________________________
Date of calibration________________________
Unit No.________________________________

3.6.1 The unit number and calibrated by, and date of calibration of the source will be inserted by the National Bureau of Standards, upon calibration of the source.

3.6.2 In addition, an identification plate in accordance with type A or B of MIL-P-15024 shall be attached to the source container.

3.7 Workmanship. - Workmanship shall be as specified in MIL-E-16400.

3.8 Safety. - The design, development and production shall promote maximum safety of both operational and maintenance personnel and equipments during all phases of operational life in accordance with MIL-E-16400.

4. QUALITY ASSURANCE PROVISIONS

4.1 Responsibility for inspection. - Unless otherwise specified in the contract or purchase order, the supplier is responsible for the performance of all inspection requirements as specified herein. Except as otherwise specified in the contract or order, the supplier may use his own or any other facilities suitable for the performance of the inspection requirements specified herein, unless disapproved by the Government. The Government reserves the right to perform any of the inspections set forth in the specification where such inspections are deemed necessary to assure supplies and services conform to prescribed requirements.

4.1.1 Contractor's quality assurance system. - The contractor shall provide and maintain an effective inspection and quality assurance system, acceptable to the Government, covering the supplies under the contract. The quality assurance system shall be in accordance with the requirements of MIL-I-45208. A current written description of the system shall be submitted to the cognizant Government inspector, for approval, sixty (60) days prior to first article inspection. Any changes to the approved plan which might affect the degree of assurance required by this specification or other applicable documents shall be submitted to the cognizant inspector and approved in writing prior to use.

4.1.2 Government verification. - All quality assurance operations performed by the contractor will be subject to Government verification at any time. Verification will consist of (a) surveillance of the operations to determine that practices, methods, and procedures of the written system description are being properly applied, (b) Government product inspection to measure quality of product to be offered for acceptance, and (c) Government product inspection of delivered products to assure compliance with all requirements of this specification. Failure of the contractor to promptly correct deficiencies discovered by him or of which he is notified shall be cause for suspension of acceptance until corrective action has been made or until conformance of product to prescribed criteria has been demonstrated.

4.1.3 Test procedures. - The contractor shall submit written test procedures including test equipment and tolerance limits to be used for first article inspection and production inspection to the command or agency concerned, via the Government inspector for review and approval sixty (60) days prior to beginning tests. Each test shall be identified in accordance with paragraph 4.2 as to classification.

4.1.3.1 Procedures for inspections, tests, demonstrations, etc. shall contain step by step information which will enable the operator to properly perform the requirements of this specification. The method of examination shall be clearly defined.

4.1.3.2 The procedures shall contain a list of test equipment identified by name and model. Special test equipment shall also be listed and identified.

4.1.3.3 Data sheets shall be included in the procedures. Conformance parameters shall be clearly indicated with tolerance limits. Whenever quantitative measurements are made, the result shall be shown by quantitative data.

4.2 Classification of inspection. - The method of examination and testing of the equipment fall within the following classifications:

(a) First article inspection
(b) Production inspection
(c) Shipping inspection

4.3 First article inspection. - First article inspection shall be made at a Government laboratory designated by the command or agency concerned on the prototype model submitted by the contractor to determine suitability for Naval use and shall consist of all examination and testing necessary to determine compliance with the requirements of this specification. First article inspection shall include the tests specified in table I.

TABLE I. First article inspection

Requirement	Reference
Surface examination	4.6.1
Operating test	4.6.2
Structural integrity	4.6.3

4.4 Production inspection. - Production inspection shall be made on every equipment offered for delivery. The inspection shall comprise such examination and testing as will prove the workmanship and reveal the omissions and errors of the production process such as functional and performance tests at a limited number of points, tests which detect deviations from design, tests of adjustment, and tests which detect hidden defects of material. Production inspection shall consist of the tests approved in accordance with paragraph 4.1.3 and shall include the requirements of table II.

TABLE II. Production inspection

Requirement	Reference
Surface examination	4.6.1
Operating test	4.6.2

4.5 Shipping inspection. - Inspections shall be conducted to insure conformance with the requirements of Section 5 of this specification.

4.6 Inspection procedures. -

4.6.1 Surface examination. - Equipment shall be examined for the following:

(a) Workmanship, assembly and fit, mechanical safety, and marking.
(b) Materials, parts and finish.

For conformance to 3.2, 3.3, 3.4.1, 3.4.2, 3.4.3, 3.4.4, 3.4.5, 3.4.6, 3.5, 3.6, 3.7 and 3.8.

4.6.2 Operating test. - The equipment, with the source in place, shall be subjected to an operating test to insure qualitatively the proper functioning of the equipment including:

(a) All operating controls and adjustments
(b) True activity (using a Victoreen R meter or equivalent)
(c) Radiographic integrity
(d) Safety requirements

For conformance to 3.4.1, 3.4.2.1, 3.4.4.2 through 3.4.4.7 and 3.8.

4.6.3 Structural integrity. - The equipment shall be tested to determine conformance with 3.4.3.1, 3.4.4.1 and 3.4.5.3.

5. PREPARATION FOR DELIVERY

5.1 Packaging. - Packaging shall be level A or C as specified (see 6.1).

5.1.1 Level A. -

5.1.1.1 Source containers. - Each source container shall be individually packaged in accordance with Method II of MIL-P-116. The aperture plug control arm system shall be lubricated for normal operation.

5.1.1.2 Optical system. - Each optical system shall be individually packaged in accordance with submethod IA-8 of MIL-P-116 without preservative compounds.

5.1.1.3 Other equipment. - Other equipment such as platforms and tracks or rails shall be individually packaged in accordance with method III of MIL-P-116.

5.1.1.4 Technical literature. - Technical Literature shall be packaged in transparent, waterproof, heat sealed, plastic bags, minimum 4 mil thick and shall not be placed within the barrier used to package any other item.

5.1.2 Level C. - Each complete set shall be packaged in a manner that will afford adequate protection against corrosion, deterioration and damage during shipment from the supply source to the first receiving activity.

5.2 Packing. - Packing shall be level A, B or C as specified (see 6.1).

5.2.1 Level A. -

5.2.1.1 Source container. - Each source container shall be packed in a container conforming to Drawing REF 10085 and Department of Transportation Regulations. Cushioning, anchoring, bracing and blocking shall be in accordance with MIL-STD-1186 to prevent movement and damage during shipment and handling. The top of the source container shall be blocked so that it can not become separated from the source container. The plug control arm shall be blocked so that it can not move during shipment and handling.

5.2.1.2 Accessory equipment. - Accessory equipment comprising a complete set, packaged as specified in 5.1 shall be packed in containers conforming to PPP-B-601, overseas type without cleats on the top panel. Cushioning, anchoring, bracing, blocking and waterproofing shall be in accordance with MIL-STD-1186. The gross weight of shipping containers shall not exceed 200 pounds.

5.2.2 Level B. - Each source container and accessory equipment packaged as specified in 5.1 shall be packed as specified in 5.2.1, except that PPP-B-601 boxes may be domestic type and weight limitations for accessory equipment packs shall be as permitted by PPP-B-601. Domestic type PPP-B-601 boxes shall be strapped as specified in the appendix.

5.2.3 Level C. - Items comprising a complete set, except for the source container which shall be packed in accordance with 5.2.1.1, shall be packed in containers acceptable to the common carrier and which will insure safe delivery at destination in a satisfactory condition at the lowest applicable rate. Containers, packing or method of shipment shall comply with Uniform Freight and National Motor Freight Classification Rules or regulations of other carrier rules as applicable to the mode of transportation.

5.3 Marking. - In addition to any marking required by the contract or order, unit packages, intermediate packages and shipping containers shall be marked in accordance with MIL-STD-129.

5.3.1 Radioactive equipment. - Each item, package and shipping container containing radioactive material shall be marked in accordance with MIL-M-19590 and specifically Code of Federal Regulations, Title 49, Section 73.391 through 73.394, as applicable. Each shipping container shall be marked with "fragile" and "arrow" markings.

5.3.1.1 Unpacking instructions. - Radioactive source, shipping containers shall be provided with unpacking instructions as follows:

> "Reusable container for Radioactive Source. Retain for reuse. To open, remove screws with screwdriver and topcover. Remove screws and shipping brackets holding down housing base inside container. Leave housing on base until metal stand is assembled."

Unpacking instructions shall be placed in a sealed waterproof envelope marked "UNPACKING INSTRUCTIONS" and affixed to the outside of the shipping container in a protected location, preferably between the cleats on the end of the container adjacent to the identification marking.

6. NOTES

6.1 Ordering data. - Procurement documents should specify the following:

(a) Title, number, and date of this specification.
(b) Levels of preservation, packaging, packing, and marking (see section 5).

6.2 First article. - Invitations for bids should provide that the Government reserves the right to waive the requirement for first article samples as to those bidders offering a product which has been previously procured or tested by the Government, and that bidders offering such products, who wish to rely on such production or tests must furnish evidence with the bid that prior Government approval is presently appropriate for the pending procurement.

Preparing activity:
Navy - EC

(Project 6665-N254)

☆U.S. GOVERNMENT PRINTING OFFICE: 1969-393-065/S1960

SPECIFICATION ANALYSIS SHEET	Form Approved Budget Bureau No. 119-R004

<u>INSTRUCTIONS</u>

This sheet is to be filled out by personnel either Government or contractor, involved in the use of the specification in procurement of products for ultimate use by the Department of Defense. This sheet is provided for obtaining information on the use of this specification which will insure that suitable products can be procured with a minimum amount of delay and at the least cost. Comments and the return of this form will be appreciated. Fold on lines on reverse side, staple in corner, and send to preparing activity *(as indicated on reverse hereof)*.

SPECIFICATION

ORGANIZATION *(Of submitter)* | CITY AND STATE

CONTRACT NO. | QUANTITY OF ITEMS PROCURED | DOLLAR AMOUNT $

MATERIAL PROCURED UNDER A

☐ DIRECT GOVERNMENT CONTRACT ☐ SUBCONTRACT

1. HAS ANY PART OF THE SPECIFICATION CREATED PROBLEMS OR REQUIRED INTERPRETATION IN PROCUREMENT USE?

A. GIVE PARAGRAPH NUMBER AND WORDING.

B. RECOMMENDATIONS FOR CORRECTING THE DEFICIENCIES.

2. COMMENTS ON ANY SPECIFICATION REQUIREMENT CONSIDERED TOO RIGID

3. IS THE SPECIFICATION RESTRICTIVE?

☐ YES ☐ NO IF "YES", IN WHAT WAY?

4. REMARKS *(Attach any pertinent data which may be of use in improving this specification. If there are additional papers, attach to form and place both in an envelope addressed to preparing activity)*

SUBMITTED BY *(Printed or typed name and activity)* | DATE

DD FORM 1 APR 63 1426 REPLACES NAVSHIPS FORM 4863, WHICH IS OBSOLETE

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NAVAL ELECTRONIC SYSTEMS COMMAND
WASHINGTON, D. C. 20360

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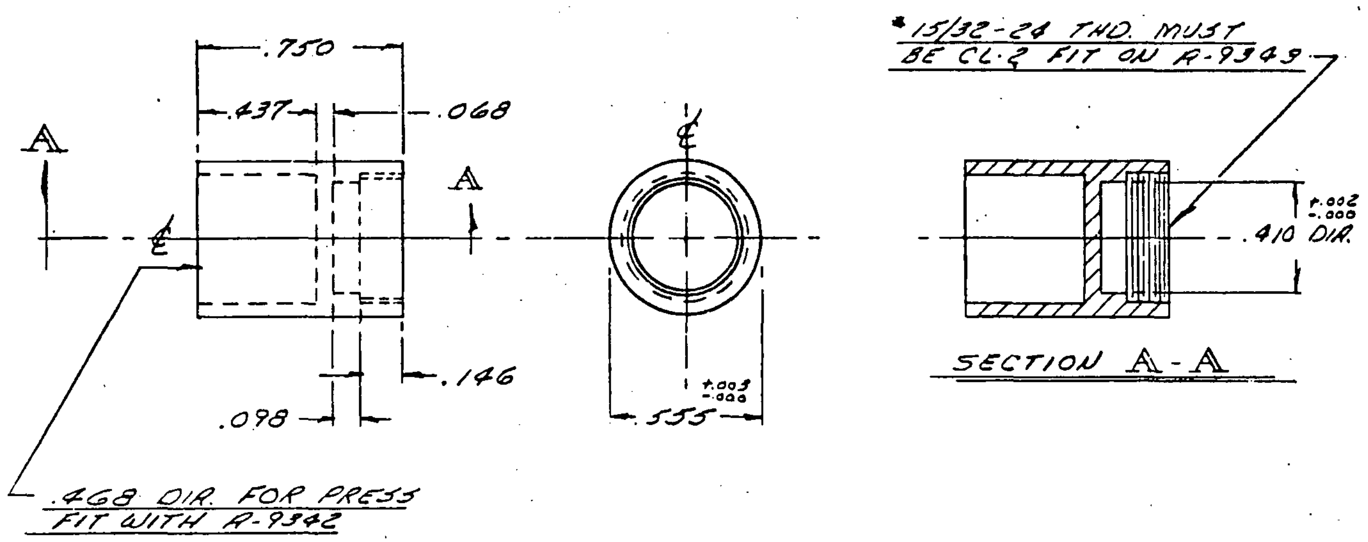
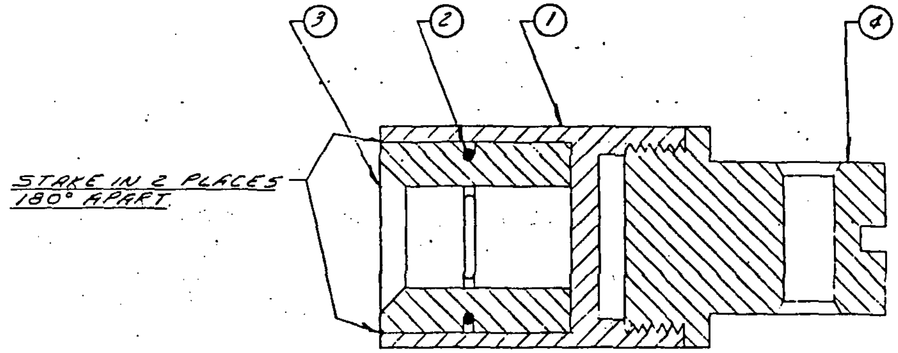


REQ.	REQ.	DRAWING	ITEM	NAME	FINISH
-2	-1	USED ON: 2409	ASSY. DWG.: AS-9394	NATIONAL ELECTRICAL MACHINE SHOPS, INC. SILVER SPRING, MD.	
				CAPSULE	
				MATERIAL ALUM. ROD 61ST6	
				FINISH NONE.	
		APPR. FOR SAMPLES		D 2-4-53 GOULET / C / SCALE 2-1	
AA	AA	APPR. FOR PRODUCTION		T / A 5154 / A-9339-F	

ISSUE: REDRAWN TO SCALE. GOULET 2-4-53 JEG 2-4-53

DO NOT SCALE DRAWING. TOLERANCES: FRACTIONS ± .015; DECIMALS ± .005 UNLESS OTHERWISE SPECIFIED

Encl 8



1	A-9343	4	PLUG	
1	A-9342	3	SPRING SLEEVE	
1	A-9340	2	SPRING	
1	A-9339	1	CAPSULE	
REQ.	DRAWING	ITEM	NAME	FINISH

REQ. -2	REQ. -1	USED ON	ASSY. DRWG
AA	AA	2409	AQ-9595
		APPR. FOR SAMPLES	
		APPR. FOR PRODUCTION	

NATIONAL ELECTRICAL MACHINE SHOPS, INC.
SILVER SPRING, MD.

ASSY. CAPSULE

MATERIAL —
FINISH NONE
D 2-4-53 SMULCT | C | SCALE 4 : 1
T | A | AB-9391 -E

ISSUE: REV. E
REDRAWN SMULCT 2-3-53
JEH 2-4-53

B

111A

U.S. Department of Transportation

Research and Special Programs Administration

400 Seventh Street, S.W
Washington, D.C. 20590

IAEA CERTIFICATE OF COMPETENT AUTHORITY

Special Form Radioactive Material Encapsulation

Certificate Number USA/0166/S
(Revision 3)

This certifies that the encapsulated sources, as described, when loaded with the authorized radioactive contents, have been demonstrated to meet the regulatory requirements for special form radioactive material as prescribed in IAEA 1/ and USA 2/ Regulations for the transport of radioactive materials.

I. Source Description - The sources described by this certificate are identified as the following Gamma Industries models which are constructed according to the listed drawing numbers:

Model No.	Drawing No.
✓VD and VD(HP)	602-7001-004 ✓
NB, NBG and NB(HP)	602-7001-005
Single Encapsulation Universal Source	602-7001-006
Double Encapsulation Universal Source	602-7001-007
Single Encapsulation Side Weld	602-7001-008

All models are welded encapsulations constructed of 300 series of ARMCO Type 17-4PH stainless steel.

II. Radioactive Contents - The authorized radioactive contents of these sources consist of not more than:

Model No.	Contents	
✓VD and VD(HP)	300 curies of:	
	Barium-131	Manganese-54
	Cadmium-109	Phosphorus-32
	Calcium-45	Rubidium-86
	Calcium-47	Selenium-75
	Cesium-137	Strontium-85
	Chlorine-36	Thallium-204
	Chromium-51	Thulium-170
	Iridium-192	Tin-113
	✓Cobalt-60	Ytterbium-169
	Iron-59	Zinc-65

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II. Radioactive Contents (continued)

Model No. (con'd)	Contents (cont'd)
NB, NBG and NB(HP)	25 Curies Americium-241 30 millicuires Ra-226 500 millicuries Americum-241 and Cesium-137 mixture
Single Encapsulation Universal Source	500 curies Iridium-192 20 curies Cobalt-60
Double Encapsulation Universal Source	5000 curies Iridium-192 2000 curies Cobalt-60
Single Encapsulation Side Weld	500 curies Iridium-192 20 curies Cobalt-60

III. This certificate, unless renewed, expires July 30, 1987. ✓

This certificate is issued in accordance with paragraph 803 of the IAEA Regulations and in response to the June 7, 1982 petition by Gamma Industries, Baton Rouge, Louisiana, and in consideration of the associated information therein.

Certified by:

R. R. Rawl
R. R. RAWL
Chief, Radioactive Materials Branch
Office of Hazardous Materials Regulations
Materials Transportation Bureau

August 10, 1982
(DATE)

1/ "Safety Series No. 6, Regulations for the Safe Transport of Radioactive Materials, 1973 Revised Edition," published by the International Atomic Energy Agency (IAEA), Vienna, Austria.

2/ Title 49, Code of Federal Regulations, Part 170-178, USA

Revision 0 issued in response to the September 7, 1979, petition by Gamma Industries, Baton Rouge, Louisiana.
Revision 1 issued to add Cesium-137 to Models VD and VD(HP)
Revision 2 issued to list alternate stainless steel type.
Revision 3 issued to extend expiration date.

JL SHEPHERD and Associates

740 Salem Street, Glendale, California 91203 • 213/245-0187

Irradiation & Calibration Equipment • Lead Shielding • Nuclear Applications

DATA SHEET - SPECIAL FORM CAPSULE TESTING

Capsule Type: A-0096
Drawing Number: A-0096-C

Capsule was loaded with 5.2 grams of inert CsCl
Inner and outer capsules were heliarc welded in accordance with drawings and tests performed as below.

Date: February 2, 1980

49CFR 173.398 Special Tests

1. Free Drop - 30' to 1/4" thick steel plate on concrete surface.

Results: No visible damage to capsule or welds.

2. Percussion - 1" diameter steel rod, wt. 3 lbs. dropped end on 4 times through 40" distance on capsule laying on 1/4" lead sheet on concrete surface.
Results: Sides and end of capsule were dented. No fracture of outer capsules or welds.

3. Heating - Capsule heated in air to 1475°F in electric furnace and held at this temperature 15 minutes - then allowed to cool.
Results: Capsule discolored - no fracture of capsule ends, welds or walls.

4. Immersion - 24 hours in distilled water pH 7, maximum conductivity of 10 micro-mhos/cm.
Results: No visible effect on capsule - no leaking of CsCl from inside capsule.

Leak Test:
1. Method: Bubble Test. Capsule heated to 240° in glycol.
2. Results: No bubbles emerged from capsule.

J.L. Shepherd

Encl 10

J L SHEPHERD and Associates

740 Salem Street, Glendale, California 91203 • 213/245-0187

Irradiation & Calibration Equipment • Lead Shielding • Nuclear Applications

CERTIFICATION

SUBJECT: 130Ci Cesium-137 source capsule per J.L. Shepherd & Associates drawing #A-0096-C

This is to certify that a prototype of the source capsule per drawing A-0096-C has been subjected to and successfully passed free drop, percussion, heating and immersion tests as called out in 10 CFR 173.398.

J.L. Shepherd

Date: February 2, 1980

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MILITARY SPECIFICATION

RADIAC CALIBRATOR AN/UDM-2( )

1. SCOPE

1.1 Scope. - This specification covers the Radiac Calibrator AN/UDM-2( ) which provides the facilities for checking the operational reliability and calibration accuracy of various radiacmeters and radiac set. The calibrator consists of a dosimeter jig assembly and a doserate jig assembly; each assembly can be utilized independently of the other (see 6.1).

2. APPLICABLE DOCUMENTS

2.1 Documents. - The following documents of the issue in effect on date of invitation for bids or request for proposal form a part of the specification to the extent specified herein.

SPECIFICATIONS

FEDERAL

PPP-B-585	Box, Wood, Wirebound
PPP-B-601	Box, Wood, Cleated-Plywood
PPP-B-621	Box, Wood, Nailed and Lock-Corner
PPP-B-636	Box, Fiberboard
PPP-B-640	Box, Fiberboard, Corrugated, Triple-Wall
PPP-F-320	Fiberboard, Corrugated and Solid, Sheet Stock Container Grade and Cut Shapes
PPP-S-760	Strapping, Nonmetallic and Connectors
PPP-T-76	Tape, Pressure-Sensitive Adhesive Paper, Water Resistant, for Carton Sealing
PPP-T-97	Tape, Pressure-Sensitive Adhesive, Filament Reinforced
NN-P-71	Pallets, Material Handling
QQ-S-781	Steel Strapping, Flat

FSC 6665

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MILITARY

MIL-P-116	Preservation, Methods of
MIL-P-11268	Parts, Materials and Processes Used in Electronic Communication Equipment
MIL-M-13231	Marking of Electronic Items
MIL-M-19590	Marking of Commodities and Containers to Indicate Radioactive Material

STANDARDS

MILITARY

MIL-STD-105	Sampling Procedures and Tables for Inspection by Attributes
MIL-STD-109	Quality Assurance Terms and Definitions
MIL-STD-129	Marking for Shipment and Storage
MIL-STD-147	Palletized Unit Loads
MIL-STD-252	Wired Equipment, Classification of Visual and Mechanical Defects
MIL-STD-810	Environmental Test Methods

DRAWINGS

ELECTRONICS COMMAND

DL-SM-B-508965	Radiac Calibrator AN/UDM-2( )

(Copies of specifications, standards, drawings and publications required by suppliers in connection with specific procurement functions should be obtained from the procuring activity or as directed by the contracting officer.)

3. REQUIREMENTS

3.1 Construction.- The equipment shall be constructed in accordance with the requirements of this specification, and of Drawing DL-SM-B-508965.

3.2 First Article Samples.- The contractor shall furnish first article samples of the calibrator in accordance with the requirements contained in the bid request and contract (see para. 4.3).

3.3 Parts, Materials and Processes.- In addition to any requirements of this specification covering parts, materials and processes, such items shall conform to MIL-P-11268, including the selection requirements therein.

3.4 Performance Characteristics.-

3.4.1 Calibration Accuracy.-

3.4.1.1 Dosimeter Jig Assembly (lower source).- The dose rate produced by the lower sources shall be within ±5R/min when related to a secondary calibration standard. When measured in accordance with paragraph 4.8.1, using a Government Furnished Victoreen Model 555 Radacon II, the dose rate produced by the lower sources shall be 205 R/min ±5R/min (see para. 4.8.1.2).

3.4.1.2 Dosimeter Jig Assembly (upper source).- The dose rate produced by the upper source shall be within ±0.05 mR/min when related to a secondary calibration standard. When measured in accordance with paragraph 4.8.2 using a Government Furnished Victoreen Model 555 Radacon II the dose rate produced by the upper source shall be 0.95 mR ± 0.05 mR (see paragraph 4.8.2.2).

3.4.1.3 Doserate Jig Assembly.- All measured test position dose rates shall be within ± .5R/min when related to a secondary calibration standard. When measured in accordance with paragraph 4.8.2, using a Government Furnished Victoreen Model 555 Radacon II, the dose rate produced with the shutter in the 100 R/hr position shall be 44.5 R/min ± 0.5 R/min (see paragraph 4.8.3).

3.4.2 Compatibility.-

3.4.2.1 Radiacmeters IM-9( )/PD, IM-93( )/UD and IM-147( )/PD, when exposed in the dosimeter jig assembly for the time specified on drawing SM-C-509026, shall respond in accordance with the appropriate reading and tolerance specified on drawing SM-C-509026. The discharge times should be adjusted for source decay in accordance with the instructions and data furnished on drawing SM-B-509027 and specified in paragraph 3.10 (see 4.9.1).

3.4.2.2 Radiacmeters IM-174/PD and IM-174A/PD and Radiac Set AN/PDR-27( ), when calibrated in the deserate jig assembly in accordance with the instructions contained on drawing SM-C-509024, shall respond in accordance with the appropriate reading and tolerance specified on drawing SM-C-509024. The readings obtained should be adjusted for source decay in accordance with the instructions and data furnished on drawing SM-B-509023 and specified in paragraph 3.10 (see 4.9.2).

3.4.3 Surface Dose Rate.- The maximum allowable dose rate at any point on the external surface of the calibrator set shall not exceed 2 mr/hr. This requirement applies under all conditions of storage (see 4.10).

3.5 Weight.- The weight of the equipment, less manual, shall be held to a practical minimum consistent with good engineering practice for the intended use, but shall not exceed 40 lbs. (See 4.6.1.3)

3.6 Service Conditions.-

3.6.1 General.- The equipment shall perform as required by this specification when exposed to any operating condition listed in 3.6.2, or after exposure to any storage or transportation condition listed in 3.6.3, or to any possible combination of these service conditions.

3.6.2 Operating Conditions.- The conditions to which the equipment may be exposed during operation are as follows:

3.6.2.1 Temperature.- The equipment shall be capable of continuous operation at any ambient temperature from -25°F to +125°F (see 4.11).

3.6.2.2 Altitude.- Altitudes up to and including 10,000 feet above sea level (see 4.14.1).

3.6.2.3 Humidity.- Up to 100% relative humidity at varying temperatures including conditions wherein condensation takes place on the equipment (see 4.15).

3.6.2.4 Salt Fog.- Salt fog such as is encountered in coastal regions or on board ship (see 4.18).

3.6.2.5 Sand and Dust.- Dust and sand exposure shall be per Method 510 of Specification MIL-STD-810 (see 4.19).

3.6.3 Storage and Transportation Conditions.-

3.6.3.1 Temperature.- The equipment shall be capable of withstanding, without deterioration damage or degradation of performance, long periods of storage at temperature of -65°F to +155°F (see 4.11).

3.6.3.2 Altitude.- Altitudes up to and including 50,000 feet above sea level (see 4.14.2).

3.6.3.3 Immersion.- Immersion in water for 2 hours at a covering depth of 3 feet. There shall be no evidence of water inside the equipment (see 4.12).

3.6.3.4 Bench Handling.- The equipment shall meet the test of 4.13 without degradation of performance.

3.6.3.5 Bounce.- The equipment shall meet the test of 4.17 without degradation of performance.

3.6.3.6 Vibration.- The amplitude of any part , subassembly or structural member of the equipment shall not exceed twice the amplitude of the vibration applied to the equipment at any frequency between 10 and 55 Hertz (see 4.16).

3.6.3.7 Rain.- After testing as specified in 4.23 the equipment shall meet paragraph 4.7 without degradation of performance (see 4.23).

3.6.3.8 Shock.- Shock such as is encountered in transportation via aircraft, or dropping by parachute (see 4.21).

3.7 Special Capability Requirements.-

3.7.1 Facilities.- The contractor shall be required to provide in his plant, or have direct access to a cobalt 60 source capable of providing a minimum field intensity of 125 rads/hr at a distance of 1 meter from its geometrical center.

3.7.2 Equipment.- The contractor shall be required to provide in his plant a Victoreen Condenser "R" meter, or equivalent, calibrated by the National Bureau of Standards or other agency approved by the Government for measuring radiation flux.

3.7.3 License. - The contractor shall be required to possess or obtain a byproduct material license for the AN/UDM-2( ) and its sources from the Atomic Energy Commission as per Title 10, Chapter I, Code of Federal Regulations, Part 30.3, or from an agreement-state in which located as per the Agreement-state Regulations.

3.8 Interchangeability.- Like units, assemblies, subassemblies and replaceable parts shall be physically and functionally interchangeable, without modification of such items or of the instrument. Individual items shall not be handpicked for fit or performance however, matched pairs or sets, when permitted, may be interchangeable as such. Reliance shall not be placed on any unspecified dimension, rating, characteristic, etc. (see 4.6.1.2).

3.9 Marking.-

3.9.1 General.- Marking shall conform to Specification MIL-M-13231.

3.9.2 Radioactive Warnings.- In addition to the general markings required by 3.9.1, the contractor shall comply with the requirements of MIL-M-19590. Each source shall be etched or stamped with a unique serial number and some symbol identifying the manufacturer and model number of the source. The contractor shall provide the Government with a list specifying the serial number of each calibrator and the serial number, symbol and nomenclature of each source contained therein.

3.9.3 Serial Numbers.- Each equipment shall bear a serial number in accordance with the requirements of Specification MIL-M-13231 and drawings SM-B-509016 and SM-B-509023.

3.10 Charts.- The contractor shall update the correction charts, drawings SM-B-509023 and SM-B-509027, which are required to be installed in the doserate jig assembly and dosimeter jig assembly per drawings SM-D-508967 and SM-D-508993. The year of source assay shall be assigned a correction factor of 1.0 for each chart and the remaining correction factors shall be derived accordingly. The chart shall cover a period of 20 years.

3.11 Radiological Tests.- The equipment shall be subject to the tests of paragraph 4.20 in the order given. Sources or calibrators that do not meet the limits specified in the source and contamination tests of 3.11.1 and 3.11.2 shall not be accepted.

3.11.1 Source Tests.- Each sealed source shall be subjected to the tests of paragraphs 4.20.1.1, 4.20.1.2, 4.20.1.3, 4.20.1.4 and 4.20.1.5 in that order.

3.11.1.1 Source Leak Tests.- This test is to be performed after the first encapsulation and again after the second encapsulation. During tests outlined in paragraph 4.20.1.1 and paragraph 4.20.1.3 any indication of bubbles from the source or on the source indicates the source may be leaking and is not acceptable for use in a calibrator.

3.11.1.2 Source Bloat Tests.- Any indication of bloating (bulging) of the thin window from internal pressure at the end of tests 4.20.1.2 and 4.20.1.4 shall be considered failure of the test.

3.11.1.3 Source Contamination Test.- Each sealed source to be used in a radiac calibrator must be subjected to the tests of paragraph 4.20.1.5 before it is installed in the calibrator. The net counting rate in counts/minute (c/min) of the smear paper, used to smear the source, must not exceed 100 times the counting efficiency (E) of the smear counting system for strontium -90. A higher counting rate indicates that the source is contaminated above acceptable limits and must be decontaminated and tested again until it meets the acceptable limits or is rejected for use in a radiac calibrator.

3.11.2 Calibrator Contamination Tests.- Each calibrator shall be subjected to the tests of paragraph 4.20.2. The net counting rate (c/min) of each of the cotton swabs used when following the procedures of paragraphs 4.20.2.2 and 4.20.2.3 must not exceed 25 times the counting efficiency (E) of the smear counting system for strontium -90. A higher counting rate indicates that the source is contaminated above acceptable limits.

3.12 Fungus.- The equipment (including accessories) shall show no evidence of viable fungus or corrosion when subjected to the test specified in 4.22. Corrosion is any visible degradation that can be attributed to flaky, pitted, blistered, or otherwise loosened finished or metal surface.

3.13 Workmanship.- The calibrator shall be manufactured and assembled in accordance with the applicable portions of MIL-P-11268.

4. QUALITY ASSURANCE PROVISIONS

4.1 Responsibility for Inspection.- Unless otherwise specified in the contract or purchase order, the contractor is responsible for the performance of all inspection requirements as specified herein. Except as otherwise specified in the contract or order, the contractor may utilize his own facilities, facilities of a subcontractor or any commercial laboratory acceptable to the Government. The Government reserves the right to perform any of the inspections set forth in the specification where such inspections are deemed necessary to assure that the supplies and services conform to prescribed requirements.

4.1.1 Contractor Quality Assurance.- The contractor shall provide and maintain a means of determining product conformance in accordance with the requirements specified herein or elsewhere in the contract. The Government, at its option, may perform any evaluation deemed necessary to assure the adequacy of the means employed and the effectiveness of the contractor's quality assurance methods and systems.

4.1.2 Government Verification.- All quality assurance operations required of the contractor shall be subject to Government verification at scheduled or unscheduled intervals. Verification will consist of the following:

(a) Surveillance of the contractor's operations to determine that practices, methods, and procedures of the contractor's quality assurance system are being applied and are, in fact, accomplishing the objectives of total compliance of the product with the requirements of this specification and the contract.

(b) Government product inspections to determine compliance of the product with the specification and contract requirements.

4.1.3 Accomodation and Assistance.- The Government quality assurance representative shall have the right to access to any area of the contractor's or his subcontractor's premises where any part of the work is being performed. The Government quality assurance representative shall be afforded unrestricted opportunity to verify conformance of the product with specification requirements. The contractor shall make his inspection equipment and records available for use by the Government quality assurance representative for verification purposes. The contractor's personnel shall be made available for operation of such inspection equipment as required.

4.1.4 Definitions.- Specification MIL-STD-109 applies for definitions of inspection terms used herein.

4.2 Classification of Inspections.- Inspections shall be classified as follows:

(a) First article inspection. (Does not include preparation for delivery.) (See 4.3.)

(b) Inspections covered by subsidiary documents. (See 4.4.)

(c) Quality conformance inspections.

(1) Quality conformance inspection of equipment before preparation for delivery. (See 4.6.)

(2) Quality conformance inspection of preparation for delivery. (See 4.24.)

4.3 First Article Inspection.- This inspection shall consist of the inspections specified in subsidiary documents covering the items listed in 4.4, and the inspections specified for group A, group B, and group C (see tables III, IV and V respectively). Environmental and stress inspections shall be performed in the order shown in table I according to the number of samples specified in the contract, ie, 5 or 10 each. The numbers in each column indicate the particular tests to which a particular unit will be submitted and the sequence in which it will be conducted. After completing tests of Table I, each unit shall have their sources removed and the sources shall be tested in accordance with paragraph 4.20 (less paragraph 4.20.1.3 and 4.20.1.4).

Table I. - Order of Environmental and Stress Inspection

Inspection (Note 1)	Number of First Article Samples (Units)									
	10 Samples									
	5 Samples									
	Unit 1	Unit 2	Unit 3	Unit 4	Unit 5	Unit 6	Unit 7	Unit 8	Unit 9	Unit 10
Non-damaging (Note 2)										
Temperature										
Low----------------	1					1				
High--------------	2					2				
Altitude (elevation)-		1					1			
Leakage (immersion)-			1					1		
Dust--------------			2					2		
Vibration----------				1					1	
Rain---------------			3					3		
Potentially damaging										
Humidity (moisture resistance)-------	3					3				
Fungus (Note 3)----					1					
Salt Fog (Note 3)---		2								1
Bounce------------				2					2	
Bench handling-----					2					2
Shock-------------				3					3	

Note 1: Other inspections may precede, follow, or be interspersed between the non-damaging tests.

Note 2: The order on non-damaging tests and the choice of which units are subjected to the non-damaging tests may be varied if convenient, except that the vibration test shall be performed on the same unit used for the bounce and shock tests.

Note 3: The equipment shall be thoroughly washed, cleaned, dried, and refurbished, if necessary, before preceding with subsequent tests.

4.4 Inspection Covered by Subsidiary Documents.- The following shall be inspected under the applicable subsidiary documents as part of the inspection of equipment before preparation of delivery.

Item	Where Required
Finish	3.3
Marking	3.9

4.5 Equipment Verification Review.- The contractor shall perform an Equipment Verification Review (EVR), consisting of a complete technical audit of the equipment on order against the drawings cited for construction (see 3.1). The EVR shall consist of the following:

4.5.1 An audit to establish that "as built" equipment (unit, assembly, module, or part) is fabricated in accordance with the cited end product drawings.

4.5.2 An audit to establish that "as built" configuration of unit, assembly, module or part meets the test requirements (other than equipment specification performance) specified on the applicable drawings for each unit, assembly, module, or part. The audit shall record all test methods used together with resulting verification test data.

4.5.3 The contractor shall compile an EVR report(s) containing the following information:

(a) Identification of unit, assembly, module, or part and details proving compliance with 4.5.1 and 4.5.2 above.

(b) Discrepancies noted.

(c) Corrective action taken.

4.5.4 The contractor shall make available to the Government copies of his EVR report(s) no later than 15 days prior to the submission of the first production unit or lot. The results of the EVR shall be subjected to inspection by authorized Government personnel at the time the first production unit or production lot is offered for acceptance. Government inspection will be to the depth and extent necessary to demonstrate that the "as built" hardware is in accordance with the cited drawings. Copies of the EVR reports shall be made available to the Government personnel during the inspection. The contractor shall provide the following:

(a) Segregation of units, assemblies, modules and parts to permit reviewing personnel access for detailed inspection.

(b) As required, responsible personnel from each functional department available for discussions in their respective areas.

(c) Adequate administrative support for the EVR.

4.6 Quality Conformance Inspection of Equipment Before Preparation for Delivery.- The contractor shall perform the inspection specified in 4.4. and 4.6.1 through 4.6.3. This does not relieve the contractor of his responsibility for performing any additional inspection which is necessary to control the quality of the product and to assure compliance with all specification requirements. The Government will review and evaluate the contractor's inspection procedures and examine the contractor's inspection records as an element of Government verification (see 4.1.2).

4.6.1 Group A Inspection.- Equipment shall be assembled into discrete lots for quality conformance inspection, utilizing the criteria of MIL-STD-105 for determination of lot composition. Unless otherwise specified, the lot size shall be determined from table II, as related to production rates necessary to meet delivery schedules of the contract. The lot size shall be adjusted throughout the life of the contract as necessary to provide for changes in contract delivery schedules and production rates. Each unit of each lot of equipment shall be inspected for conformance to all the examinations and tests required in table III. The quality conformance of each lot shall then be subjected to an audit, utilizing the procedures of MIL-STD-105, under the general inspection level II and the Acceptable Quality Level (AQL) indicated in table III. Group A functional inspection shall be performed in the order specified in table III.

Table II. - Lot Formation

Production Rate	Size of Lot
500 or more per month	One week's production
51 to 499 per month	Two week's production
0 to 50 per month	One month's production

4.6.1.1 Visual and Mechanical Inspection.- These inspections shall be performed in any order which is satisfactory to the Government. The units shall be examined for the applicable defects listed in MIL-STD-252.

4.6.1.2 Inspection for Interchangeability.- The mechanical dimensions shall be measured to determine conformance to the physical and functional interchangeability requirements (see 3.8). This inspection shall be conducted on piece parts and subassemblies prior to final assembly.

4.6.1.3 Weight.- The equipment shall be weighed (less manuals) to determine conformance to paragraph 3.5.

Table III. - Group A Inspection

Inspection	Req Para	Insp Para	AQL%	
			Major	Minor
Visual and Mechanical	3.1	4.6.1.1	1.0	4.0
Functional				*
Surface dose rate	3.4.3	4.10	1.0	
Accuracy	3.4.1	4.8	1.0	
Compatibility				
IM-9( )/PD	3.4.2.1	4.9.1	1.5	
IM-93A/UD, IM-147( )/PD	3.4.2.1	4.9.1	1.5	
IM-174/PD, IM-174A/PD, AN/PDR-27( )	3.4.2.2	4.9.2	1.5	
Radiological				
Source Tests (Note 1)	3.11.1	4.20.1	0.65	
Calibrator Contamination (Note 2)	3.11.2	4.20.2	0.65	

*No minor functional or radiological defects permitted.

Note 1: If the prime contractor does not manufacture the sources, this inspection shall be a requirement placed by the prime contractor on his subcontractor.

Note 2: This inspection shall be performed as a requirement under group A inspection (para. 4.6.1) and also prior to packaging and packing (para. 4.24).

4.6.2 Group B Inspection.- This inspection, including sampling, shall conform to table IV and to procedures for special inspection levels of MIL-STD-105. Group B inspection shall be performed on production lots of product that have passed group A inspection. (See 4.6.1 for lot formation)

4.6.2.1 Order of inspection within Group B.- Group B inspection shall be performed in the following order:

Table IV. - Group B Inspection

Inspection	Req Para	Test Para	AQL
Interchangeability	3.8	4.6.1.2	4.0% Level S-3
Temperature	3.6.2.1	4.11	2.5% Level S-4
Immersion	3.6.3.3	4.12	4.0% Level S-3
Bench Handling	3.6.3.4	4.13	4.0% Level S-3
Weight	3.5	4.6.1.3	4.0% Level S-3

4.6.3 Group C Inspection.- This inspection shall consist of the tests specified in table V and shall be performed on units of product that have been subjected to and passed group A and group B inspection requirements. Sample units shall be selected in accordance with 4.6.3.1.

4.6.3.1 Group C inspections shall be performed on the first production lot and at the 25%, 50%, 75% and 100% points in production. It is not the intention of the Government to require that all the group C tests be performed on the same radiac calibrators. Simultaneous testing, using several groups of radiac calibrators, may be performed. The order of tests and the choice of which units are subjected to each test may be varied to suit the availability of test facilities and decrease total testing time.

Table V.- Group C Inspection

Inspection	Req Para	Test Para	Number of instruments to be submitted to each test
Altitude (storage)	3.6.3.2	4.14.2	2
Humidity	3.6.2.3	4.15	2
Salt Fog	3.6.2.4	4.18	1
Sand and Dust	3.6.2.5	4.19	1
Bounce	3.6.3.5	4.17	2
Vibration	3.6.3.6	4.16	2
Fungus (Note 1)	3.12	4.22	1
Altitude (operating) Note 1	3.6.2.2	4.14.1	2
Rain	3.6.3.7	4.23	2
Shock (Note 1)	3.6.3.8	4.21	1
EVR	3.1	4.5	*

Note 1: These tests shall be performed only on the first production lot and on a sample selected from the lot representing approximately the 50% point in production.

* Shall be performed once on the initial production lot.

4.6.3.2 Noncompliance.- All quality conformance inspection shall be halted, including group A and group B inspections, upon the occurence of any group C failure. The contractor shall immediately report in writing each group C failure occurence, including details of the failure and characteristics affected. The contractor shall immediately investigate the cause of failure and further report the results of investigation and details of the proposed corrective action on the processes and materials, as applicable, and on all units of product which are manufactured under the same conditions and which the Government considers subject to the same failure. Reports shall be forwarded through the Government procurement quality assurance representative to the responsible technical activity designated in the contract. After corrective action has been taken, additional sample units shall be subjected to group C inspection (all inspections, or the inspections which the sample failed, at the option of the technical activity) and group A and group B inspections may be reinstituted. However, final acceptance and shipment will be withheld until group C reinspection results have shown that the corrective action was effective and approved by the technical activity.

4.6.4 Reinspection of Conforming Group B and Group C Sample Units.- Unless otherwise specified, sample units which have been subject to and passed both group B and group C inspections may be accepted on the contract provided all damage is repaired and the sample units are resubjected to and pass group A inspection.

4.7 Performance Checks.-

4.7.1 Dosimeter Jig Assembly.- Insert a charged and calibrated Radiacmeter IM-93A/UD (see 4.9.1) into the central well of the assembly and discharge it in accordance with the instructions on drawing SM-C-509026. Repeat the above procedure for a total of 3 readings and calculate the average reading. The average reading shall be within the allowable tolerances specified on drawing SM-C-509026; readings shall be adjusted for source decay. Repeat the above using a Radiacmeter IM-147( )/PD and a Radiacmeter IM-9( )/PD.

4.7.2 Doserate Jig Assembly.- Insert the detector unit of a calibrated Radiacmeter IM-174A/PD into the assembly and expose it to fields of 100 Rads and 10 Rads from the source; readings shall be in accordance with the allowable tolerances specified on drawing SM-C-509024. Readings shall be adjusted for source decay. Repeat the above using a calibrated IM-174/PD; readings shall be in accordance with the allowable tolerances specified on drawing SM-C-509024. Readings shall be adjusted for source decay. Separate the probe unit of a calibrated AN/PDR-27( ) into the two tubular sections. Insert the small probe into the assembly and with the radiac set switched to the 500mR/hr range, rotate the calibrator shutter to the 100R position. The reading shall be within the allowable tolerances specified on drawing SM-C-509024; readings shall be adjusted for source decay.

4.8 Accuracy.- Each calibrator, when checked with the Government furnished Victoreen Model 555 Radacon II in accordance with the procedures specified herein shall meet the requirements of paragraph 3.4.1.

4.8.1 Dosimeter Jig Assembly Measurements (lower source).-

4.8.1.1 Interconnect the Radacon II and its accompanying remote head in accordance with the manufacturer's Instruction Manual supplied with the instrument; attach the probe (Victoreen Part No. 555-100-MB) to the appropriate terminals on the remote head and allow a 30 minute warmup.

4.8.1.2 The lower source of the Dosimeter Jig Assembly tested in accordance with drawing SM-A-509093 paragraph 3.1 shall meet the requirements of paragraph 3.4.1.1.

4.8.2 Dosimeter Jig Assembly Measurements (upper source).-

4.8.2.1 Same as paragraph 4.8.1.1 except probe Victoreen Part No. 555-100-1C shall be used.

4.8.2.2 The upper source of the Dosimeter Jig Assembly shall be tested in accordance with drawing SM-A-509093 paragraph 3.2 and shall meet the requirements of paragraph 3.4.1.2.

4.8.3 Doserate Jig Assembly Measurements.-

4.8.3.1 Same as paragraph 4.8.1.1.

4.8.3.2 Doserate Jig Assembly shall be tested in accordance with drawing SM-A-509093 paragraph 4.0 and shall meet the requirements of para. 3.4.1.3.

4.9 Compatibility.-

4.9.1 Dosimeter Jig Assembly.- Calibrate all Radiacmeters IM-9, IM-93 and IM-147 supplied as Government-furnished equipment (GFE) at mid-scale using a cobalt 60 source, the calibration of which is traceable to the National Bureau of Standards. The radiacmeters shall read as follows:

IM-9( )/PD	100 mR	± 10%
IM-93A/UD	300 R	± 10%
IM-147( )/PD	25 R	± 10%

Any Government furnished radiacmeter, whose reading exceeds the specified tolerance, shall not be used. Select 10 units of each type of radiacmeter and charge to zero. Discharge each radiacmeter in its appropriate position in the dosimeter jig assembly for the period specified on drawing SM-C-509026 for the particular radiacmeter under test. Repeat the above procedure for a total of 3 readings for each radiacmeter and calculate the average reading. The average reading shall be within the allowable tolerances specified on drawing SM-C-509026; readings shall be adjusted for source decay (see 3.4.2.1).

4.9.2 Doserate Jig Assembly.- Calibrate all Radiacmeters IM-174 and IM-174A and Radiac Sets AN/PDR-27( ) supplied as GFE using a cobalt 60 source, the calibration of which is traceable to the National Bureau of Standards. The instruments shall be calibrated at the following points:

Instrument	Calibration Point	Tolerance
IM-174A/PD	100R/hr	±15%
IM-174/PD	100R/hr	±10%
AN/PDR-27( )	250 mR 25 mR 2.5 mR 0.25 mR	±20%

Any Government furnished equipment which can not be calibrated shall not be used. Select 2 units each of Radiacmeters IM-174 and IM-174A and 2 units of Radiac Set AN/PDR-27( ) and check the calibration of each unit in the calibrator in accordance with the procedures specified on drawing SM-C-509024. Repeat each check for a total of 3 readings per unit and the average reading per unit shall be within the allowable tolerances specified on drawing SM-C-509024; readings shall be adjusted for source decay (see 3.4.2.2).

4.10 Surface Dose Rate.- Using a Government furnished Radiac Set AN/PDR-27 (with beta shield removed), calibrated as specified in paragraph 4.9.2, the surfaces of the Radiac Calibrator AN/UDM-2 shall be monitored for conformance to the requirement of paragraph 3.4.3.

4.11 Temperature Tests.-

4.11.1 High Temperature.- The dosimeter jig assembly as defined by drawing SM-D-508967 and the doserate jig assembly as defined by drawing SM-D-508993 shall be subjected to Procedure I, Method 501 of MIL-STD-810 with the following exceptions:

(a) Temperature of step 2 shall be +155°F.

(b) Step 3 shall be for 24 hours.

(c) Step 4 shall be +125°F.

(d) At steps 5 and 7, equipment shall meet the performance checks of paragraphs 4.7.1 and 4.7.2.

4.11.2 Low Temperature.- The dosimeter jig assembly and doserate jig assembly, as defined in paragraph 4.11.1, shall be subjected to Procedure I, Method 502 of MIL-STD-810 with the following exceptions:

(a) Temperature of step 2 shall be -65°F and maintained for 24 hours.

(b) Temperature for step 4 shall be -25°F.

(c) At steps 5 and 7, equipment shall meet the performance checks of paragraphs 4.7.1 and 4.7.2.

4.12 Immersion.- Immerse the equipment, closed as for storage or transportation, in a tank of fresh water so that the surface of the water is not less than 3 feet above the uppermost point of the equipment when submerged; the water shall be at room temperature ±10°F. The equipment shall be immersed for 2 hours and then removed and visually inspected for evidence of leakage into the case (see 3.6.3.3).

4.13 Bench Handling.- The equipment, locked as for storage or transportation, shall be placed on a solid, 2 inch fir bench top. Tilt the equipment through an angle of 30° using one edge as an axis; allow to drop freely back to the horizontal. Repeat, using the remaining three edges of the same horizontal face as axes, for a total of 4 drops. Repeat the above with the equipment resting on the remaining five faces for an overall total of 24 drops. Upon completion of the test, the equipment shall meet the performance checks of paragraphs 4.7.1 and 4.7.2 (see 3.6.3.4).

4.14 Altitude.-

4.14.1 Operating.- Place the equipment in the test chamber in accordance with section 3, paragraph 3.2.2 of MIL-STD-810; maintain standard ambient temperature during the entire test. Reduce the chamber internal pressure to 20.6 inches of Hg (10,000 ft above sea level) and operate the equipment in accordance with paragraphs 4.7.1 and 4.7.2. Upon completion of the performance checks, return the chamber to standard ambient pressure and repeat the performance checks of paragraphs 4.7.1 and 4.7.2 (see 3.6.2.2).

4.14.2 Non-operating.- The equipment, closed for storage or transportation, shall be placed in the test chamber; maintain standard ambient temperature during the entire test. The equipment shall be subjected to steps 2 and 4 of Procedure I, Method 500 of MIL-STD-810. Upon completion of step 4, the equipment shall be tested per paragraph 4.7.1 and 4.7.2 (see 3.6.3.2).

4.15 Humidity.- The equipment shall be subjected to Procedure II, Method 507 of MIL-STD-810 except that:

(a) The equipment shall be opened into its 2 halves during step 1.

(b) Step 2 shall be deleted.

(c) Performance check, per paragraphs 4.7.1 and 4.7.2 shall be accomplished during step 4.

(d) Equipment shall be closed as for storage or transportation during the first 3 cycles of step 6. During cycles 4 and 5, the equipment shall be opened as in step 3.

(e) Performance check, per paragraphs 4.7.1 and 4.7.2 shall be accomplished during step 8 (see 3.6.2.3).

4.16 Vibration (Resonance Search).- The equipment shall be subjected to Procedure XI, paragraph 4.16.1, Method 514.1 of MIL-STD-810. Bolt each half of the equipment on to the table in turn so that the equipment may be observed during the testing. Upon completion of the test, the equipment shall meet the performance checks of 4.7.1 and 4.7.2 (see 3.6.3.6).

4.17 Bounce.- The equipment shall be subjected to Procedure XI, paragraph 4.16.2, Method 514.1 of MIL-STD-810. Upon completion of the test, the equipment shall meet the performance checks of 4.7.1 and 4.7.2 (see 3.6.3.5).

4.18 Salt Fog.- The equipment, opened as in operational use, shall be subjected to Method 508, procedure 1, of MIL-STD-810. Salt concentration shall be 20%. Upon completion of the test the equipment shall meet the requirements of 4.7.1 and 4.7.2 (see 3.6.2.4).

4.19 Sand and Dust.- The equipment, opened as in operational use, shall be subjected to Method 510 Procedure I of MIL-STD-810. Upon completion of the test the equipment shall meet the requirements of 4.7.1 and 4.7.2 (see 3.6.2.5).

4.20 Radiological Tests.- These tests shall be performed by or under the direct supervision of the Radiological Protection or Radiological Safety Officer employed by the contractor in accordance with current Atomic Energy Commission Regulations.

4.20.1 Source Tests.-

4.20.1.1 Source Leak Tests.- Fill a 200-500 ml beaker about 2/3 full of water. Boil water for several minutes to drive off any dissolved air. (Note: the sensitivity of the test will be increased by addition of ethylene glycol to increase the boiling point). The temperature of the water should be kept above 95°C during the remainder of the tests. A transparent beta shield (preferably plastic), having a minimum area density of $1 g/cm^2$, should be placed between the individuals performing or observing the tests and the beaker, its heat sources and the shielding type source container, to protect them from the radiation. A light should be directed on the beaker at right angles to the line of view of the operator. Care should be taken to insure that the light does not shine in the operator's eyes. Using remote handling tool(s), remove a source (at or below 30°C) from the shielded container and drop it into the hot water. Closely observe the source and the water above it for one minute. (Note: A large hand lens mounted near the beaker or the use of binoculars or a telescope that will focus on objects as close as two or three feet will aid in this test). Bubbles from the source or on the source indicate a leak.

4.20.1.2 Source Bloat Test.- After a source has passed a leak test, place it in storage for at least ten days. Remove source from storage with remote handling equipment and examine the thin window for bloating or bulging.

4.20.1.3 Second Encapsulation Leak Test.- After the second encapsulation of the source repeat the test described in4.20.1.1.

4.20.1.4 Second Encapsulation Bloat Test.- After a source has passed the test outlined in 4.20.1.3, repeat the test of 4.20.1.2.

4.20.1.5 Source Contamination Test.-

1. Use for counting any standard beta counting system which includes a scaler and timer and has a detector window at least one inch in diameter and not exceeding $2.0 mg/cm^2$. Use for wiping any commercially available cloth-type smear paper with adhesive backing or commercially available smooth surface filter paper whose diameter does not exceed the diameter of the detector window or counting planchet. Use for handling the smear paper any handle with a flat end slightly smaller than the smear paper. The end will be covered with about 1/8 inch sponge rubber or compressible foam plastic.

2. Calibrate the beta counting system by placing 0.1 ml standard Sr^{90} counting solution (0.005-0.015 microcuries per milliliter)onto a piece of smear paper and air dry. Center the standard solution smear paper on a planchet and count for a minimum of ten minutes. Calculate Sr^{90} disintegrations per minute (A) by multiplying standard solution concentration (uCi/ml) by 0.1 ml and by 2.22×10^6 disintegrations per minute (d/min.) per microcurie. Calculate overall counting

efficiency (E) in counts per disintegration of Sr^{90} by subtracting background number of counts (gotten by counting clean piece of smear paper for same time as standard solution smear paper) from the number of counts from the standard solution smear paper, dividing by the counting time, then dividing by A. Calculate the standard counting time (T) in minutes by using the following formula:

$$T = \frac{8 \times 10^{-4} (50E + B)}{E^2}$$

where B is background counting rate in counts per minute.

3. To test each source attach a clean piece of smear paper to the rubber or plastic-tipped handles (use rubber cement if necessary). Protect testing personnel by placing a transparent shield (at least 1 g/cm^2, preferably plastic) between the personnel and source handling area. Handling the source with one pair of tongs and the smear paper handle with another pair of tongs wipe all surfaces of the source applying moderate pressure. Count the test smear paper in the same manner as the background and standard solution smear paper were counted. The counting time will be the next largest whole number of minutes greater than T.

4.20.2 Calibrator Contamination Test.-

4.20.2.1 Equipment and Counting Procedure.- Use the identical procedure outlined in 4.20.1.5 with the following exceptions:

1. Use commercially available cotton swabs in place of smear paper and handle. To count the cotton swab, cut off all but a short stub of the handle and tape the stub to the planchet, centering the cotton in the planchet.

2. Use the following formula to calculate T:

$$T = \frac{6.4 \times 10^{-3} (12.5E + B)}{E^2}$$

4.20.2.2 Dosimeter Jig Assembly Wipe Test.-

WARNING

Do not under any circumstances expose the eyes to the radiation field by peering into the access hole while the swivel cover is swung aside.

Swing aside the swivel cover and using a cotton swab, wipe around the inner surface of the access hole. Using the procedure of 4.20.2.1, check the cotton swab for contamination. WARNING: Prior to checking the swab for contamination do not leave the swab unattended or allow it to touch any object.

4.20.2.3 Doserate Jig Assembly Wipe Test.- Open the drawer and using a cotton swab, wipe the inside and outside surfaces of the drawer. Using the procedure of 4.18.2.1, check the cotton swab for contamination. WARNING: Prior to checking the swab for contamination do not leave the swab unattended or allow it to touch any object.

4.21 Shock Test.- The equipment shall be subjected to Procedure II, Method 516 of MIL-STD-810 except that the height of drop shall be 2 feet. Upon completion of the test, the equipment shall meet the performance checks of paragraphs 4.7.1 and 4.7.2 (see 3.6.3.8).

4.22 Fungus Test.- The equipment in its opened position shall be subjected to Method 508 of MIL-STD-810 (see 3.12). Performance check, per paragraphs 4.7.1 and 4.7.2, shall be accomplished upon completion of the test.

4.23 Rain test.- The equipment, closed as for storage or transportation, shall be tested as follows:

4.23.1 Dry at 150°±5°F for 48 hours.

4.23.2 Condition for 4 hours at 77°±5°F and 50 to 60 percent relative humidity.

4.23.3 Take pretest data. The equipment shall meet the test of 4.7.

4.23.4 Test equipment in accordance with Method 506, Procedure I, of MIL-STD-810. There shall be no wind source and the rain fall throughout the test shall be 4±1 inch. Complete final measurements within 1 hour after the rain has been discontinued (see 3.6.3.7).

4.24 Quality Conformance Inspection of Preparation for Delivery.- Preparation for delivery shall be inspected in accordance with Specification MIL-P-116 to determine conformance to the requirements of section 5. The test of paragraph 4.20.2 shall be performanced on each unit prior to packaging and packing.

5. PREPARATION FOR DELIVERY

5.1 Preservation and Packaging.- Preservation and Packaging shall be level A or C as specified (see 6.1).

5.1.1 Level A.-

5.1.1.1 Cleaning.- Radiac Calibrator AN/UDM-2 shall be cleaned in accordance with process C-1 of MIL-P-116.

5.1.1.2 Drying.- Radiac Calibrator AN/UDM-2 shall be dried in accordance with the applicable procedures of MIL-P-116.

5.1.1.3 Preservation Application.- None required.

5.1.1.4 Unit Packaging.- Unit packaging shall be in accordance with the methods prescribed in MIL-P-116 as specified herein.

5.1.1.4.1 Technical Literature.- Each technical literature shall be packaged Method IC-1.

5.1.1.4.2 Radiac Calibrator AN/UDM-2.- Each calibrator shall be individually packaged Method III as follows: Secure the shipping locks of both assemblies of the calibrator. Place the 2 halves of the calibrator together and secure the fastenings. Cushion the calibrator on all surfaces with cells or pads or both fabricated of fiberboard conforming to PPP-F-320, type CF, class weather-resistant, variety SW, grade W5c, designed to protect all projections and absorb the shock of impact in handling and transit. Place the cushioned calibrator within a close-fitting fiberboard box conforming to PPP-B-636, W5c. Place the technical literature, packaged as specified in 5.1.1.4.1, on top of the cushioned calibrator, directly under the lid of the box. Close the box as specified in the appendix of the box specification.

5.1.2 Level C.- Radiac Calibrator AN/UDM-2 shall be preserved and packaged in a manner that will afford adequate protection against physical and environmental damage during shipment, handling and limited intransit storage.

5.2 Packing.- Packing shall be level A, B or C as specified. Shipping containers for all levels shall be capable of stacking and supporting superimposed loads, during shipment and storage without damaging the container(s) or its contents (see 6.1(b)).

5.2.1 Level A.-

5.2.1.1 Palletized Loads.- A quantity of Calibrator Set, Radiac AN/UDM-2 not to exceed twenty (20) and packaged as specified in 5.1, shall be placed on a pallet, load type 1, conforming to MIL-STD-147 except that the pallet shall be softwood conforming to NN-P-71, type IV, size 2. A fiberboard cap shall be employed over the load having two sides extending down the stacked load at least 12 inches to accommodate marking requirements. The cap shall be fabricated of fiberboard conforming to PPP-F-320, class weather-resistant, W5s or V3c. The load shall be "bonded" to the pallet by strapping.

5.2.1.2 Less Than Palletized Load.- When quantities per destination are less than a paller load, the item packaged as specified in 5.1, shall be waterproofed, with tape conforming to PPP-T-76, in accordance with the taping requirements of the appendix of the box specification. A quantity of the water-proofed containers not to exceed twenty (20) shall be packed within a close-fitting box conforming to PPP-B-601, overseas type; PPP-B-621, style 4, class 2; or PPP-B-585, style 2 or 3, class 3. When the gross weight exceeds 200 pounds, or the container length and width is 48 x 24 inches or more and the weight exceeds 100 pounds, 3 x 4 inche skids, laid flat, shall be applied in accordance with the requirements of the container specification, or if not specified in the specification, in a manner which will adequately support the item and facilitate the use of material handling equipment. Closure and strapping shall be in accordance with the applicable container specification or appendix thereto except that metal strapping shall conform to QQ-S-781, type I, class B.

5.2.2 Level B.-

5.2.2.1 Palletized Load.- A quantity of Radiac Calibrators, AN/UDM-2, packaged as specified in 5.1, shall be palletized as specified in 5.2.1.1.

5.2.2.2 Less Than Palletized Load.- When quantities per destination are less than a pallet load, a quantity of Calibrator Set, Radiac AN/UDM-2 not to exceed twenty (20) and packaged as specified in 5.1, shall be packed within a close-fitting fiberboard box conforming to PPP-B-640, class 2, style E, or PPP-B-636, type CF, class weather-resistant, variety DW. The gross weight of boxes conforming to PPP-B-640 shall not exceed 250 pounds. When the gross weight exceeds 200 pounds or the container length and width is 48 x 24 inches or more and the weight exceeds 100 pounds, containers will be pallet-mounted on pallets conforming to NN-P-71, type IV. Closure shall be in accordance with the appendix of the applicable box specification. Reinforcing shall be by pressure-sensitive filament tape bonding or non-metallic strapping conforming to PPP-T-97, type IV and PPP-S-760, type II, respectively; selection of the material and application shall be in accordance with the appendix of the applicable box specification.

5.2.3 Level C.-

5.2.3.1 Palletized Load.- A quantity of Radiac Calibrators AN/UDM-2, packaged as specified in 5.1, shall be palletized as specified in 5.2.1.1 except that the fiberboard caps shall be class domestic.

5.2.3.2 Less Than Palletized Load.- When quantities per destination are less than a pallet load, a quantity of Radiac Calibrator AN/UDM-2, packaged as specified in 5.1, shall be packed as specified in 5.2.2.2 except that the fiberboard boxes shall conform to PPP-B-640 and PPP-B-636, class 1 and class domestic, respectively, and reinforcing shall not be required for boxes conforming to PPP-B-636.

5.3 Marking.- In addition to any special marking required by the contract or order, interior packages and exterior shipping containers shall be marked in accordance with MIL-STD-129.

6. NOTES

6.1 Intended use.-

6.1.1 The dosimeter jig assembly is used to check Radiacmeters IM-9( )/PD, IM-93( )/UD and IM-147( )/PD (dosimeters). The assembly containes four SR-90 sources (one 20 microcurie source and three 25 millicurie sources) arranged to radiate into a central cavity. The upper field is utilized in checking the operational reliability of Radiacmeter IM-9( )/PD while the lower field performs a similar function for Radiacmeters IM-93( ) and IM-147( )/PD.

6.1.2 The doserate jig assembly consists of a drawer unit and a spacer block. The drawer unit contains an encapsulated 25 millicurie SR-90 source. The spacing block provides varying field intensities used to calibrate radiacmeter probes. This assembly is utilized to calibrate Radiacmeters IM-174 and IM-174( ) and Radiac Set AN/PDR-27( ).

6.2 Ordering Data.- Procurement documents should specify the following:

(a) Title, number and date of this specification and any amendment thereto.

(b) Levels of preservation, packaging and packing (see Section 5).

Notification to the contractor that he must comply with Title 49 CFR.

(c) Number of First Article samples to be submitted for approval (see 4.2).

(d) Technical literature and running spares (see 3.9).

(e) When the rough handling and functional tests are required.

6.3 Nomenclature.- The contractor should apply for nomenclature in accordance with the applicable clause in the contract.

Notice: When Government drawings, specifications or other data are used for any purpose other than in connection with a definitely related Government procurement operation, the United States Government thereby incurs no responsibility or any obligation whatsoever; and the fact that the Government may have formulated, furnished or in any way supplied the said drawings, specifications or other data is not to be regarded by implication or otherwise as in any manner licensing the holder or any other person or corporation, or conveying any rights or permission to manufacture, use or sell patented invention that may in any way be related thereto.

6.4 Government Furnished Property (Loaned).- The following government property, in the quantities specified, shall be loaned to the successful bidder for the purpose of performing acceptance tests on the equipment being procured:

Radiacmeter IM-9( )/PD	25 each
Radiacmeter IM-93A/UD	25 each
Radiacmeter IM-147( )/PD	25 each
Radiacmeter IM-174( )/PD	4 each
Radiacmeter IM-174A/PD	6 each
Radiac Set AN/PDR-27( )	4 each
Radiac Charger PP-1578( )	6 each

Victoreen Model 555 Radacon II with instruction manual, Victoreen Model 555-100-MB probe, Victoreen Model 555-100-1C probe, and accessories 1-5 per drawing SM-A-509093, Timer 555-50	1 each

Custodian
Army-EL

Preparing Activity
Army-EL
Project Number 6665-A285

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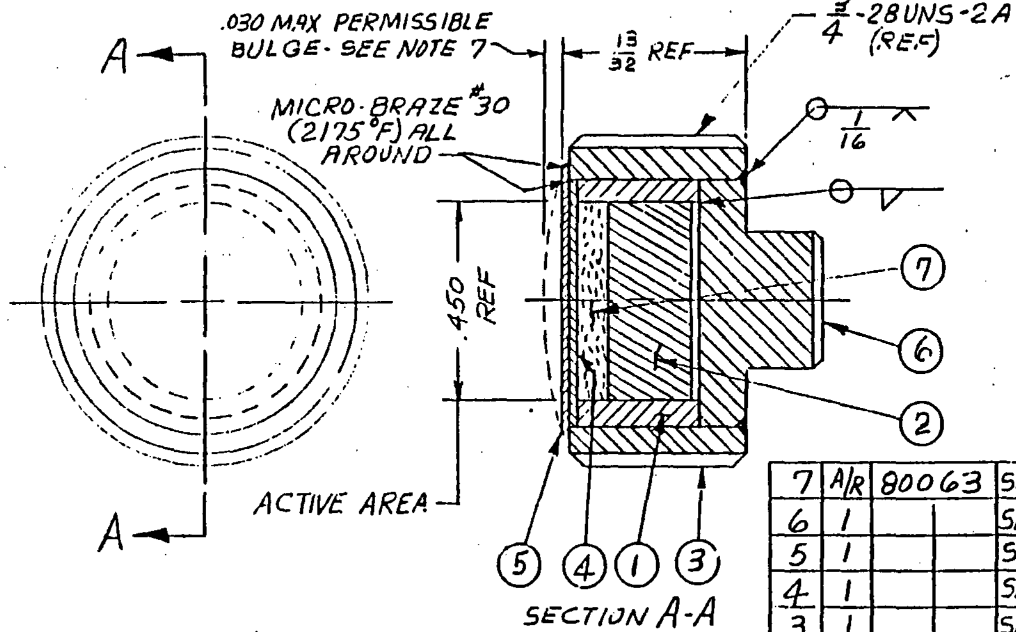
LTR	DESCRIPTION	DATE	APPROVED
C	REDRAWN ALSO ECP NIBFDZ2010 NOR 010 INCORPORATED	12 AUG 81	ES HJW

Encl 13



SOURCE CONTROL DRAWING

FIND NO.	QTY REQD	CODE IDENT.	PART NO. OR IDENTIFYING NO.	NOMENCLATURE OR DESCRIPTION	SPECIFICATION	NOTE
7	A/R	80063	SM-B-509048-1	MATERIAL, RADIOACTIVE		8 & 7
6	1		SM-B-509054	PLUG		
5	1		SM-B-509053	WINDOW, OUTER		
4	1		SM-B-509052	WINDOW, INNER		
3	1		SM-B-509051	CAPSULE, OUTER		
2	1		SM-B-509050	PLUG		
1	1		SM-B-509049	CAPSULE, INNER		

PARTS LIST

APPROVED SOURCE

	MFG PART NO	SOURCE
1	3 FIG	3M CO. ST. PAUL MINN. 55105

NEXT ASSY	USED ON
SM-D-508975	DL-508965

APPLICATION

UNLESS OTHERWISE SPECIFIED
DIMENSIONS ARE IN INCHES
TOLERANCES ON:
FRACTIONS — DECIMALS — ANGLES —

MATERIAL: —

DA-28-043-AMC-02402E

ELECTRONICS COMMAND
REVIEWED ER-1 SM'F
APPROVED ER-1 SM'F
DATE 24 FEB 69

DEPARTMENT OF DEFENSE
U. S. ARMY ELECTRONICS COMMAND
FORT MONMOUTH NEW JERSEY 07703

SOURCE ASSEMBLY

SIZE	CODE IDENT NO.	
B	80063	SM-B-509048

SCALE 4/1 SHEET 1 OF 3

AMSEL FORM 10498 1 APR 73 HISA-FM 550-73

WHEN REFERRING TO THIS DRAWING STATE DRAWING NO., APPLICABLE ISSUE LETTER IF ANY, AND DATE

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REVISIONS

LTR	DESCRIPTION	DATE	APPROVED
C	SEE SHEET 1	12 NOV 81	ES-HJW

NOTES

1. THIS ASSEMBLY SHALL MEET SPECIAL FORM MATERIAL TEST REQUIREMENTS OF TITLES 49, CODE OF FEDERAL REGULATIONS.
2. THE STRONTIUM -90 (SR90) SOURCES MUST MEET THE ANSI CLASSIFICATION OF 43343 (REFERENCE ANSI N542-1977).
3. THE RADIOACTIVE SOURCE ASSEMBLY MUST BE EVALUATED AND APPROVED FOR USE BY THE NUCLEAR REGULATORY COMMISSION OR AGREEMENT STATE. CONTRACTOR TO SUBMIT DOCUMENTATION OF THE ABOVE TO HEADQUARTERS, CECOM, DRSEL-SF-H, FORT MONMOUTH, NJ 07733.
4. WHEN THE SOURCE ASSEMBLIES ARE INSTALLED IN THE AN/UDM-2 ( ) RADIAC CALIBRATOR, EACH ASSEMBLY SHALL MEET THE FOLLOWING REQUIREMENT AND TEST PARAGRAPHS OF SPEC MIL-R-55350:

REQT PARA	TEST PARA
3.4.1.2	4.6.1.2

5. IN ADDITION, EACH SOURCE ASSEMBLY SHALL MEET THE FOLLOWING REQUIREMENT AND TEST PARAGRAPHS OF SPEC MIL-R-55350:

REQT PARA	TEST PARA
3.11	4.10
3.11.1	4.10.1.1
3.11.1.1	4.10.1.3
3.11.1.2	4.10.1.2 & 4.1.10.1.4
3.11.1.3	4.10.1.5

6. BACK SURFACE TO BE PAINTED YELLOW (COMMERCIAL) FOR IDENTIFICATION AND EACH SOURCE ASSEMBLY SHALL CONTAIN A SERIAL NUMBER IN ACCORDANCE WITH PARAGRAPH 3.9.2 OF MIL-R-55350.
7. AIR PRESSURE BUILD UP DURING ASSEMBLY PROCEDURES MAY PRODUCE BULGING OF EITHER OR BOTH ITEMS 4 OR 5. ACCEPTABLE BULGING IS AS NOTED.
8. THE SR-90 RADIOISOTOPE SHALL BE CONTAINED IN A CERAMIC CARRIER MATERIAL. THIS CARRIER SHALL BE SPHERICAL, DRY, FREE FLOWING MATERIAL WITH AT LEAST 95% HAVING A DIAMETER IN THE RANGE OF 35 MICRONS MINIMUM TO 65 MICRONS MAXIMUM.
9. THE SR-90 RADIOISOTOPE WHEN CONTAINED IN THE CARRIER SHALL BE IDENTIFIED AS THE ACTIVATOR.

9.1. THE ACTIVATOR SHALL HAVE A MINIMUM SPECIFIC ACTIVITY OF 100 MILLICURIES PER GRAM OF ACTIVATOR.

9.2. THE ACTIVATOR SHALL EXHIBIT A SOLUBILITY NOT IN EXCESS OF 0.1 PERCENT WHEN A SAMPLE IS SOAKED AT 25°C FOR 24 HOURS IN 100 MILLILITERS OF 0.1 NORMAL HYDROCHLORIC ACID.

10. THE VENDOR OF THE SOURCE ASSEMBLY SHALL UTILIZE A QUALITY ASSURANCE SYSTEM THAT MEETS THE REQUIREMENTS OF MIL-Q-9858.
11. PRIOR TO THE AWARD OF A CONTRACT FOR SOURCE ASSEMBLIES, THE VENDOR SHALL SUBMIT FOR APPROVAL WRITTEN PROCEDURE FOR:
    A. MEASURING THE RADIATION OUTPUT OF THE SR-90 SOURCES.

FIND NO.	QTY REQD	CODE IDENT.	PART NO. OR IDENTIFYING NO.	NOMENCLATURE OR DESCRIPTION	SPECIFICATION	NOTE

PARTS LIST

NEXT ASSY	USED ON
SM-D-508975	DL-508965

APPLICATION

UNLESS OTHERWISE SPECIFIED
DIMENSIONS ARE IN INCHES
TOLERANCES ON:
FRACTIONS DECIMALS ANGLES

MATERIAL:

ELECTRONICS COMMAND
REVIEWED
APPROVED
DATE

DEPARTMENT OF DEFENSE
U. S. ARMY ELECTRONICS COMMAND
FORT MONMOUTH NEW JERSEY 07703

SOURCE ASSEMBLY

SIZE	CODE IDENT NO.	
B	80063	SM-B-509048

SCALE

SHEET 2 OF 3

WHEN REFERRING TO THIS DRAWING STATE DRAWING NO., APPLICABLE ISSUE LETTER IF ANY, AND DATE

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C	SEE SHEET 1	12 AUG 81	ES-HJW

B. DETERMINE THE QUANTITY OF SR-90 CONTAINED IN EACH SOURCE ASSEMBLIES.

12. ONLY THE ITEM DESCRIBED ON THIS DRAWING WHEN PROCURED FROM THE VENDORS LISTED HEREON IS APPROVED BY HDQTRS, CS&TA LABS (ERADCOM), FT. MONMOUTH, NJ 07703 FOR USE IN THE APPLICATION SPECIFIED HEREON. A SUBSTITUTE ITEM SHALL NOT BE USED WITHOUT PRIOR TESTING AND APPROVAL BY HDQTRS, CS & TA LABS. PRIOR TO SUBMISSION FOR HDQTRS, CS&TA LABS APPROVAL, THE SUBSTITUTE ITEM SHALL MEET NOTES 1-11 REQUIREMENTS.

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SM-D-508975	DL-508965

APPLICATION

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U. S. ARMY ELECTRONICS COMMAND
FORT MONMOUTH NEW JERSEY 07703

SOURCE ASSEMBLY

SIZE B | CODE IDENT NO. 80063 | SM-B-509048

SCALE | SHEET 3 OF 3

AMSEL FORM 10498 HISA-FM 550-73
1 APR 73

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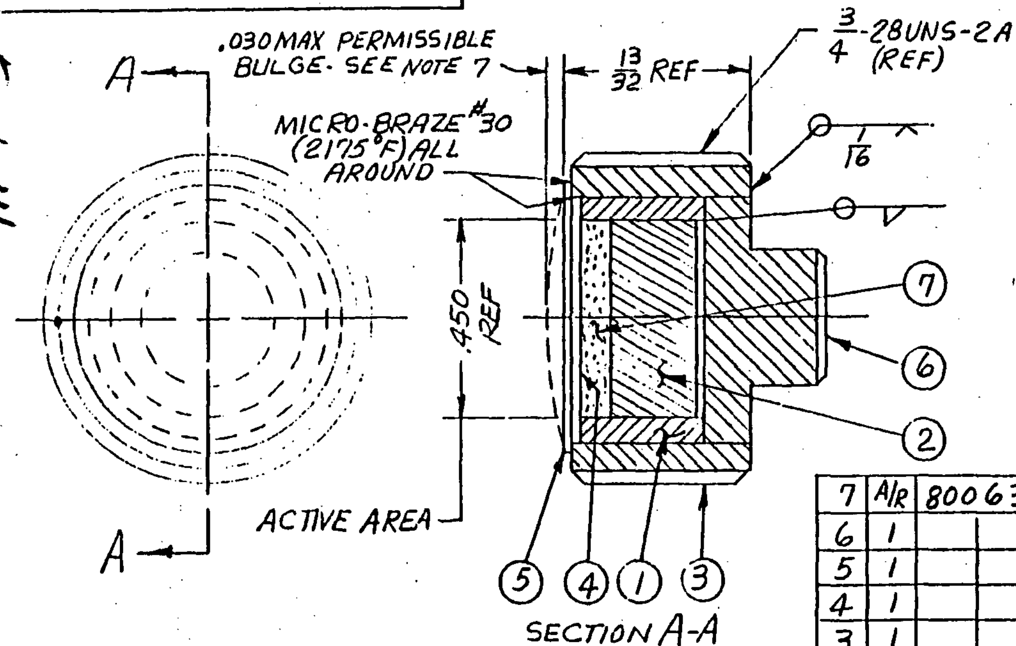
Encl 14



SOURCE CONTROL DRAWING

FIND NO.	QTY REQD	CODE IDENT.	PART NO. OR IDENTIFYING NO.	NOMENCLATURE OR DESCRIPTION	SPECIFICATION	NOTE
7	A/R	80063	SM-B-509057-1	MATERIAL, RADIOACTIVE		8&9
6	1		SM-B-509054	PLUG		
5	1		SM-B-509053	WINDOW, OUTER		
4	1		SM-B-509052	WINDOW, INNER		
3	1		SM-B-509051	CAPSULE, OUTER		
2	1		SM-B-509050	PLUG		
1	1		SM-B-509049	CAPSULE, INNER		

PARTS LIST

APPROVED SOURCE

MFG PART NO	SOURCE
3 F I G	3M CO ST PAUL MINN. 55105

NEXT ASSY	USED ON
SM-D-508994	
SM-D-508981	DL-508965

APPLICATION

UNLESS OTHERWISE SPECIFIED
DIMENSIONS ARE IN INCHES
TOLERANCES ON:
FRACTIONS DECIMALS ANGLES

MATERIAL:

DA-28-043-AMC-02402E

ELECTRONICS COMMAND
REVIEWED ER-1 SM'F
APPROVED ER-1 SM'F
DATE 24 FEB 69

DEPARTMENT OF DEFENSE
U. S. ARMY ELECTRONICS COMMAND
FORT MONMOUTH NEW JERSEY 07703

SOURCE ASSEMBLY

SIZE B | CODE IDENT NO. 80063 | SM-B-509057

SCALE | SHEET 1 OF 3

AMSEL FORM 10498 1 APR 73 HISA-FM 858-73

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REVISIONS

LTR	DESCRIPTION	DATE	APPROVED
C	SEE SHEET 1	13 AUG 81	ES-HJw

NOTES

1. THIS ASSEMBLY SHALL MEET SPECIAL FORM MATERIAL TEST REQUIREMENTS OF TITLE 49, CODE OF FEDERAL REGULATIONS.
2. THE STRONTIUM -90 (SR90) SOURCES MUST MEET THE ANSI CLASSIFICATION OF 43343 (REFERENCE ANSI N542-1977).
3. THE RADIOACTIVE SOURCE ASSEMBLY MUST BE EVALUATED AND APPROVED FOR USE BY THE NUCLEAR REGULATORY COMMISSION OR AGREEMENT STATE. CONTRACTOR TO SUBMIT DOCUMENTATION OF THE ABOVE TO HEADQUARTERS, CECOM, DRSEL-SF-H, FORT MONMOUTH, NJ 07703.
4. WHEN THE SOURCE ASSEMBLIES ARE INSTALLED IN THE AN/UDM-2 ( ) RADIAC CALIBRATOR, EACH ASSEMBLY SHALL MEET THE FOLLOWING REQUIREMENT AND TEST PARAGRAPHS OF SPEC MIL-R-55350:

REQT PARA	TEST PARA
3.4.1.1	4.6.1.1
3.4.1.3	4.6.1.3

5. IN ADDITION, EACH SOURCE ASSEMBLY SHALL MEET THE FOLLOWING REQUIREMENT AND TEST PARAGRAPHS OF SPEC MIL-R-55350:

REQT PARA	TEST PARA
3.11	4.10
3.11.1	4.10.1.1
3.11.1.1	4.10.1.3
3.11.1.2	4.10.1.2 & 4.10.1.4
3.11.1.3	4.10.1.5

6. BACK SURFACE TO BE PAINTED RED (COMMERCIAL) FOR IDENTIFICATION AND EACH SOURCE ASSEMBLY SHALL CONTIAN A SERIAL NUMBER IN ACCORDANCE WITH PARAGRAPH 3.9.2 OF MIL-R-55350.
7. AIR PRESSURE BUILD UP DURING ASSEMBLY PROCEDURES MAY PRODUCE BULGING OF EITHER OR BOTH ITEMS 4 OR 5. ACCEPTABLE BULGING IS AS NOTED.
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11. PRIOR TO THE AWARD OF A CONTRACT FOR SOURCE ASSEMBLIES, THE VENDOR SHALL SUBMIT FOR APPROVAL WRITTEN PROCEDURE FOR:
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NEXT ASSY	USED ON
SM-D-508994	
SM-D-508981	DL-508965

APPLICATION

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FRACTIONS DECIMALS ANGLES

MATERIAL:

ELECTRONICS COMMAND
REVIEWED
APPROVED
DATE

DEPARTMENT OF DEFENSE
U. S. ARMY ELECTRONICS COMMAND
FORT MONMOUTH NEW JERSEY 07703

SOURCE ASSEMBLY

SIZE	CODE IDENT NO.	
B	80063	SM-B-509057
SCALE		SHEET 2 OF 3

AMSEL FORM 10498 1 APR 73 HISA-FM 558-73

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REVISIONS			
LTR	DESCRIPTION	DATE	APPROVED
C	SEE SHEET 1	13 AUG 81	ES HJiv

B. DETERMINE THE QUANTITY OF SR-90 CONTAINED IN EACH SOURCE ASSEMBLIES.

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SM-D-508981	DL-508965

APPLICATION

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DEPARTMENT OF DEFENSE
U. S. ARMY ELECTRONICS COMMAND
FORT MONMOUTH NEW JERSEY 07703

SOURCE ASSEMBLY

SIZE	CODE IDENT NO.	
B	80063	SM-B-509057

SCALE SHEET 3 OF 3

AMSEL FORM 10458 1 APR 73 HISA-FM 398-73

WHEN REFERRING TO THIS DRAWING STATE DRAWING NO., APPLICABLE ISSUE LETTER IF ANY, AND DATE

U.S. Department of Transportation
Research and Special Programs Administration

400 Seventh Street, S.W.
Washington, D.C. 20590

IAEA CERTIFICATE OF COMPETENT AUTHORITY

Special Form Radioactive Material Encapsulation

Certificate Number USA/0283/S
Revision 0

This certifies that the encapsulated source, as described, when loaded with the authorized radioactive contents, has been demonstrated to meet the regulatory requirements for special form radioactive material as prescribed in IAEA 1/ and USA 2/ regulations for the transport of radioactive materials.

I. Source Description - The source described by this certificate is identified as 3M Model No. 3F1G which is a tungsten - inert - gas welded double encapsulation constructed of stainless steel and which measures approximately 0.4 inches (10 mm) in length by 0.75 inches (19 mm) in diameter.

II. Radioactive Contents - The authorized radioactive contents of this source consist of not more than 500 millicuries of strontium -90 as 3M Brand Radiating Microspheres.

III. This certificate, unless renewed, expires June 30, 1988.

This certificate is issued in accordance with paragraph 803 of the IAEA Regulations 1/, and in response to the petition by 3M Static Control Systems, New Brighton, MN and in consideration of the associated information therein.

Certified by:

R R Rawl

Richard R. Rawl
Chief, Radioactive Branch
Office of Hazardous Materials Regulation
Materials Transportation Bureau

June 23, 1983
(Date)

1/ "Safety Series No. 6, Regulations for the Safe Transport of Radioactive Materials, 1973 Revised Edition", published by the International Atomic Energy Agency (IAEA), Vienna, Austria.

2/ Title 49, Code of Federal Regulations, Part 170-178, USA.

Encl 15

MIL-R-55350A(ER)
9 June 1981
SUPERSEDING
MIL-R-55350(EL)
16 December 1971

MILITARY SPECIFICATION

RADIAC CALIBRATOR AN/UDM-2( )

This specification is approved for use by Electronics Research and Development Command, Department of the Army, and is available for use by all departments and agencies of the Department of Defense.

1. SCOPE

1.1 Scope. This specification covers the requirements for Radiac Calibrator which provides the facilities for checking the operational reliability and calibration accuracy of various radiacmeters and radiac set. The calibrator consists of a dosimeter jig assembly and a dose rate jig assembly; each assembly can be utilized independently of the other (see 6.1).

2. APPLICABLE DOCUMENTS

2.1 Issues of documents. The effective issue or revision of the following documents shall be that listed in the Department of Defense Index of Specifications and Standards (DODISS) and supplements thereto, unless (i) specific issues are set forth therefor in the cited specifications, or (ii) issues different than those specified in the cited specifications are set forth in the solicitation. The date of the applicable DODISS and supplements thereto shall be as specified in the solicitation or contract.

SPECIFICATIONS

MILITARY

MIL-P-116	- Preservation Packing, Methods of
MIL-P-11268	- Parts, Materials, and Processes Used in Electronic Equipment
MIL-M-13231	- Marking of Electronic Items
MIL-F-14072	- Finishes for Ground Electronic Equipment

Beneficial comments (recommendations, additions, deletions and any pertinent data which may be of use in improving this document should be addressssed to: Commander, US Army Electronics Research and Development Command, Combat Surveillance and Target Acquisition Laboratory, ATTN: DELCS-PE, Fort Monmouth, NJ 07703, by using the self-addressed Standardization Document Improvement Proposal (DD Form 1426) appearing at the end of this document or by letter.)

FSC 6665

Encl 16

STANDARDS

MILITARY

MIL-STD-105	- Sampling Procedures and Tables for Inspection by Attributes
MIL-STD-252	- Classification of Visual and Mechanical Defects for Equipment, Electronic, Wired and Other Devices
MIL-STD-454	- Standard General Requirements for Electronic Equipment
MIL-STD-810	- Environmental Test Methods

DRAWINGS

DL-SM-B-508965	- Radiac Calibrator AN/UDM-2( )
SPI 1G00152	- Special Packaging Instruction

OTHER PUBLICATIONS

US Nuclear Regulatory Commission Regulations - Title 10, Chapter I, Code of Federal Regulations, Parts 19, 20, 21, 30, 51, 71 and 110.

US Department of Transportation Regulations - Title 49, Code of Federal Regulations

(Copies of specifications, standards, drawings and publications required by contractors in connection with specific procurement functions should be obtained from the procuring activity or as directed by the contracting officer.)

3. REQUIREMENTS

3.1 Construction. The equipment shall be constructed in accordance with the requirements of this specification, and of DL-SM-B-508965.

3.2 First article. When specified in the contract or purchase order, the contractor shall furnish first article units as required and in the quantities specified therein (see 4.3).

3.3 Parts, materials, and processes; general. In addition to the requirements of this specification, the requirements of MIL-P-11268, including the selection requirement therein, shall apply (see 4.4).

3.3.1 Finish. All surfaces of the AN/UDM-2( ) requiring a protective coating shall be finished in accordance with MIL-F-14072 (see 4.4).

3.4 Performance.

3.4.1 Calibration accuracy.

3.4.1.1 Dosimeter jig assembly (lower source). The dose rate produced by the lower sources shall be within ± 5R/min when related to a secondary calibration standard. When measured in accordance with 4.6.1.1, using a government furnished Victoreen Model 555 Radacon II, the dose rate produced by the lower sources shall be 205 R/min ± 5R/min.

3.4.1.2 Dosimeter jig assembly (upper source). The dose rate produced by the upper source shall be within ± 0.05 mR/min when related to a secondary calibration standard. When measured in accordance with 4.6.1.2, using a government furnished Victoreen Model 555 Radacon II, the dose rate produced by the upper source shall be 0.95 mR/min ± 0.05 mR/min.

3.4.1.3 Dose rate jig assembly. All measured test position dose rate shall be within ± .5R/min when related to a secondary calibration standard. When measured in accordance with 4.6.1.3, using a government furnished Victoreen Model 555 Radacon II, the dose rate produced with the shutter in the 100 R/hr position shall be 44.5 R/min ± 0.5 R/min.

3.4.1.4 Radioactivity. The government shall be provided with the maximum quantity of radioactive material contained in each sealed source needed to produce the required radiation output for compliance with 3.4.1.1, 3.4.1.2 and 3.4.1.3. Each sealed source shall not exceed the maximum quantity of radioactive material specified and shall in accordance with:

a. Special form material test requirements of Title 49, Code of Federal Regulations of US Department of Transportation regulations.

b. American National Standards Institute N542-1977 classification of at least 43343.

c. Approval by the US Nuclear Regulatory Commision or Agreement State for its integrity of construction.

The government shall be provided with supporting documentation indicating compliance with a, b, and c above.

3.4.2 Compatibility. Radiacmeters IM-9( )/PD, IM-93( )/UD and IM-147( )/PD, when exposed in the dosimeter jig assembly for the time specified shall respond in accordance with the appropriate reading and tolerance specified in figure 3-1 (see 4.7.1). Radiacmeters IM-174A/PD and IM-174B/PD and Radiac Set AN/PDR-27( ), when calibrated in the dose rate jig assembly in accordance with the instructions shall respond in accordance with the appropriate reading and tolerance specified in figure 3-2 (see 4.7.2).

FIGURE 3-1. Dosimeter discharge data.

I Dosimeter	II Discharge position	III Manufacturer	IV Procurement order RR	V Year	VI Time	VII Discharge reading ± 20%	VIII Discharge reading limit ±20 %
IM-93	lower	Landsverk	21505-P	56	5 min	300	240-360
0-600 R	lower	Bendix	30884-PP	57	5 min	405	324-486
	lower	Bendix	4371-PP	60	5 min	70	56-84
	lower	Bendix	15916-PP	63	5 min	60	48-72
	lower	Landsverk	4596-PP	61	5 min	40	32-48
	lower	Landsverk	15631-PP	62	5 min	40	32-48
	lower	Landsverk	DAAB05-68-C-0911	68	5 min	300	240-360
IM-147	lower	Bendix	3439-PP	59	1 min-45 sec	25	20-30
0-50	lower	Landsverk	DAAB05-68-C-0911	68	40 sec	40	32-48
IM-9E	upper	Bendix	15895-PP	63	2 min	100	80-120
0-200 mR	upper	Landsverk	15580-PP	62	3 min	100	80-120
	upper	Landsverk	DAAB05-68-C-1678	67	2 min	80	64-96
IM-9F	upper	Landsverk	C2537MFR-00910	68	5 min	80	64-96
CDV-138	upper	Bendix	No indication		2 min	100	80-120
0200 mR							
CDV-742	lower	Bendix	No indication		2 min	120	96-144
0200 R	lower	Landsverk	No indication		5 min	120	96-144

FIGURE 3 - 2. Dose rate jig assembly.

1. IM-174( )/PD; IM-174A/PD; IM-174B/PD

a. Release shipping lock
b. Remove detector assembly from IM-174( )/PD. Position it securely in drawer. Switch on IM-174( )/PD. Set it up per its instruction plate.
c. Close drawer
d. Rotate shutter to 100 R/hr position. Note meter reading.
e. Rotate shutter to 10 R/hr position. Note meter reading.
f. Meter should read:
   (1) IM-174 between 177 and 117 at 100 R/hr and between 18 and 11 at 10 R/hr.
   (2) IM-174(A) and IM-174(B) between 120 and 80 at 100 R/hr and between 12 and 8 at 10 R/hr.

   If not, remove calibration control cover. Adjust IM-174( )/PD until it reads in tolerance at both positions.
g. Close shutter. Open drawer. Remove detector assembly. Replace it in the IM-174( )/PD.
h. Close drawer locate and close shipping lock. Lock source shutter with the key.

2. AN/PDR-27 J, L, R and S

a. Release shipping lock.
b. By removing bolts from probe clips, separate both probe units.
c. Check that spacer block is completely inside drawer.
d. Close the drawer. Insert smaller probe into hole in handle end of drawer. Switch to 500 mR/hr range and rotate shutter to 100 R/hr position. Rotate small probe to achieve minimum and maximum readings. Note readings.
e. The average reading shall be 200 mR/hr $\pm$ 30% or 140 to 260 mR/hr.
f. Rotate shutter to off position. Remove probe unit and open drawer. Remove spacer block and turn over to fit on handle close drawer.
g. Insert smaller probe in new position. Switch to 50 mR/hr range. Rotate shutter to 100 R/hr position. Rotate smaller probe to achieve minimum and maximum readings. Note readings.
h. The average reading shall be 30 mR/hr $\pm$ 30% or 21 to 39 mR/hr.
i. Rotate shutter to off position. Remove probe from drawer.
j. Switch to 5 mR/hr position and place large probe on the top rear edge of drawer unit, opened to its fullest extremity. Leave shutter in off position, and observe readings.
k. Average reading should be 3.2 mR/hr $\pm$ 30% or 2.2 to 4.2 mR/hr.
l. Place large probe on uper edge of handle side of box. Switch to 0.5 mR/hr position and observe readings.
m. Average reading should be 0.30 mR/hr $\pm$ 30% or 0.21 to 0.39 mR/hr.
n. If readings obtained are outside quoted tolerances, remove cover over calibration controls and adjust appropriate control to correct reading.
o. Screw down shipping lock. Lock source shutter with key.
p. Reassemble AN/PDR-27 probe assembly.

3.4.3 Surface dose rate. The maximum allowable dose rate at any point on the external surface of the calibrator set shall not exceed 5 mR/hr. This requirement applies under all conditions of storage (see 4.8).

3.5 Weight. The weight of the equipment, less manual, shall not exceed 40 lbs (18.14 Kg) (see 4.13).

3.6 Service conditions.

3.6.1 General. The equipment shall perform as required by this specification when exposed to any operating condition listed in 3.6.2, or after exposure to any storage or transportation condition listed in 3.6.3, or to any possible combination of these service conditions and shall have no corrosion deterioration, physical degradation, or change in tolerance limits which could affect operational service or maintenance requirements. (see 4.9)

3.6.2 Operating conditions. The equipment shall meet the following requirements:

3.6.2.1 Temperature. The equipment shall operate continuously at any ambient temperature from -25^{o}F to +125^{o}F (-31.67^{o}C to 51.67^{o}C) (see 4.9.1 and 4.9.2).

3.6.2.2 Altitude. The equipment shall meet specification performance of altitudes up to and including 10,000 feet (3048m) above sea level (see 4.9.5.1).

3.6.2.3 Humidity. The equipment shall meet specification performance with up to 100 per cent relative humidity at varying temperatures including conditions wherein condensation takes place on the equipment (see 4.9.6).

3.6.2.4 Salt fog. The equipment shall meet 3.4.2 after being subjected to salt fog such as is encountered in coastal regions or on board ship (see 4.9.9).

3.6.3 Storage and transportation conditions.

3.6.3.1 Temperature. The equipment shall be capable of withstanding, without deterioration damage or degradation of performance, long periods of storage at temperature of -65^{o}F to +155^{o}F (-53.89^{o}C to +68.33^{o}C) (see 4.9.1 and 4.9.2).

3.6.3.2 Altitude. The equipment shall meet 3.4.1 after being subjected to altitudes up to and including 50,000 feet (15,240m) above sea level (see 4.9.5.2).

3.6.3.3 Immersion. The equipment shall show no evidence of leakage after it is tested as specified in 4.9.3.

3.6.3.4 Bench handling. The equipment shall meet the requirement of 3.4.2 without degradation of performance after being subjected to the test of 4.9.4.

3.6.3.5 Bounce. The equipment shall meet the requirement of 3.4.2 without degradation of performance after being subjected to the test of 4.9.8.

3.6.3.6 Vibration. The equipment shall meet the requirement of 3.4.2 after being subjected to vibration such as encountered in a field service environment (see 4.9.7).

3.6.3.7 Rain. The equipment shall meet the requirement of 3.4.2 without degradation of performance after being subjected to the test of 4.9.12.

3.6.3.8 Shock. The equipment shall meet the requirement of 3.4.2 after being subjected to shock such as is encountered in transportation via aircraft, or dropping by parachute (see 4.9.10).

3.6.3.9 Fungus. The equipment (including accessories) shall show no evidence of viable fungus or corrosion when subjected to the test specified in 4.9.11. Corrosion is any visible degradation that can be attributed to flaky, pitted, blistered, or otherwise loosened finished or metal surface.

3.7 Special capability requirements.

3.7.1 Facilities. The contractor is required to possess in his plant, or have direct access to a cobalt 60 source capable of providing a minimum field intensity of 125 R/hr at a distance of 1 meter from its geometrical center.

3.7.2 Equipment. The contractor is required to possess in his plant a Victoreen Condenser "R" meter, or equivalent, calibrated by the National Bureau of Standards or other agency approved by the government for measuring radiation flux.

3.7.3 License. The contractor is required to possess or obtain a byproduct material license for the AN/UDM-2( ) and its sources from the US Nuclear Regulatory Commission as per Title 10, Chapter I, Code of Federal Regulations, Part 30.3, or from an agreement-state in which located as per the agreement-state regulations.

3.8 Interchangeability. Like units, assemblies, subassemblies and replaceable parts shall conform to requirement 7 of MIL-STD-454 (see 4.12).

3.9 Marking.

3.9.1 General. Marking shall conform to MIL-M-13231.

3.9.2 Radioactive warnings. In addition to the general markings required by 3.9.1, the contractor shall comply with the requirements of Title 10, Code of Federal Regulations, Part 20. Each source shall be etched or stamped with a unique serial number and some symbol identifying the manufacturer and model number of the source. The contractor shall provide the government with a list specifying the serial number of each calibrator and the serial number, symbol and nomenclature of each source contained therein.

3.9.3 Serial numbers. Each equipment shall have a serial number in accordance with the requirements of MIL-M-13231, SM-B-509016 and SM-B-509028.

3.10 Systems safety engineering.

3.10.1 Personnel hazards. Personnel hazards shall be kept to a minimum through compliance with configuration changes and parts selection with requirement 1 of MIL-STD-454. Compliance with these requirements will be verified through a visual inspection (see 4.11).

3.10.2 Corner and edge rounding. All exposed corners and edges shall be rounded to eliminate possible injury to personnel due to lacerations and cuts.

3.10.3 Radioactive materials. Radioactive materials shall not be used (e.g. luminous dials/markings, electron tubes, surge arrestors and lenses).

3.11 Radiological tests. The equipment shall be subject to the tests of 4.10 in the order given. Sources or calibrators that do not meet the limits specified in the source and contamination tests of 3.11.1 and 3.11.2 are not acceptable.

3.11.1 Source tests. Each sealed source shall be subjected to the tests of 4.10.1.1, 4.10.1.2, 4.10.1.3, 4.10.1.4 and 4.10.1.5 in that order.

3.11.1.1 Source leak tests. This test is to be performed after the first encapsulation and again after the second encapsulation. During tests outlined in 4.10.1.1 and 4.10.1.3, any indication of bubbles from the source or on the source indicates the source may be leaking and is not acceptable for use in a calibrator.

3.11.1.2 Source bloat tests. Any indication of bloating (bulging) of the thin window in excess of 0.030 inch from internal pressure at the end of tests 4.10.1.2 and 4.10.1.4 will be considered failure of the test.

3.11.1.3 Source contamination test. Each sealed source to be used in a radiac calibrator shall be subjected to the tests of 4.10.1.5 before it is installed in the calibrator. The results of these tests shall not exceed 0.001 microcuries of removable radioactive material. Sealed sources exceeding 0.001 microcuries of removable radioactive material shall be rejected.

3.11.1.4 Source radioactivity test. Each sealed source to be utilized in the AN/UDM-2 Radiac Calibrator Set must be subjected to the tests in 4.10.1.6 before it is installed in the calibrator to assure that the maximum quantity limitations for radioactive material is not exceeded.

3.11.2 Calibrator contamination tests. Each calibrator shall be subjected to the tests of 4.10.2. The results of these tests shall not exceed 0.001 microcuries of removable radioactive material. Calibrators exceeding 0.001 microcuries of removable radioactive material shall be rejected.

3.12 Recycled, virgin and reclaimed materials. It is required that, to the maximum extent possible, recovered or reclaimed materials, in lieu of the virgin materials, shall be used without jeopardizing the intended use of the manufactured item.

3.13 Workmanship. The calibrator shall be manufactured and assembled in accordance with requirement 9 of MIL-STD-454 and the applicable portions of MIL-P-11268.

4. QUALITY ASSURANCE PROVISIONS

4.1 Responsibility for inspection. Unless otherwise specified in the contract or purchase order, the contractor is responsible for the performance of all inspection requirements as specified herein. Except as otherwise specified in the contract or purchase order, the contractor may utilize his own facilities, facilities of a subcontractor or any commercial laboratory acceptable to the government. The government reserves the right to perform any of the inspections set forth in the specification where such inspections are deemed necessary to assure that the supplies and services conform to prescribed requirements.

4.2 Classification of inspections. Inspections shall be classified as follows:

a. First article inspection (does not include packaging) (see 4.3).

b. Inspections covered by subsidiary documents (see 4.4).

c. Quality conformance inspections.

(1) Quality conformance inspection of equipment before packaging (see 4.5).

(2) Quality conformance inspection of packaging (see 4.14).

4.3 First article. Unless otherwise specified in the contract or purchase order, the first article inspection shall be performed by the contractor.

4.3.1 First article units. The contractor shall furnish nine (9) first article units of the AN/UDM-2( ) for group A, B and C testing.

4.3.2 First article inspection. The first article inspection shall consist of the inspections specified in table I, and shall be performed in the order specified in table I. After completing tests of table I, each unit shall have their sources removed and the sources shall be tested in accordance with 4.10 (less 4.10.1.3 and 4.10.1.4).

TABLE I. First article inspection.

Inspections	Requirement paragraph	Test paragraph	Order of tests: Units 1 - 3	Units 4 - 6	Units 7 - 9
1. Inspections covered by subsidiary documents. 2/	3.3 3.9 3.3.1 3.13	4.4	Tests to be performed on all units.		
2. Group A inspection 2/	See Table II		Tests to be performed on all units.		
3. Group B inspection 2/	See Table III		Tests to be performed on all units.		
4. Group C inspection 3/					
Non-damaging 4/					
Altitude	3.6.2.2 3.6.3.2	4.9.5.1 4.9.5.2	3		
High temperature	3.6.3.1	4.9.1	2		
Low temperature	3.6.2.1	4.9.2	1		
Humidity	3.6.2.3	4.9.6	4		
Immersion	3.6.3.3	4.9.3		4	
Rain	3.6.3.7	4.9.12			2
Potentially damaging					
Vibration	3.6.3.6	4.9.7		1	
Shock	3.6.3.8	4.9.10		2	
Bench handling	3.6.3.4	4.9.4			1
Salt fog 1/	3.6.2.4	4.9.9	5		
Fungus 1/	3.6.3.9	4.9.11			3
Bounce	3.6.3.5	4.9.8		3	

1/ The equipment shall be thoroughly washed, cleaned, dried and refurbished, as specified in contract, before proceeding with subsequent tests. Only one equipment shall be submitted to fungus test.

2/ Inspections 1 to 3 shall be performed in the order shown before subjecting the equipments under test to any other inspection requirements.

3/ Other inspections may precede, follow, or be interspersed between the non-damaging tets.

4/ The order on non-damaging tests and the choice of which units are subjected to the non-damaging tests may be varied if convenient, except that the vibration test shall be performed on the same unit used for the bounce and shock tests.

4.4 Inspections covered by subsidiary documents. The following shall be inspected under the applicable documents as part of the inspection required by this specification, and the inspection requirement specified in the contract or purchase order.

Item	Where required
Parts, materials, and processes; general	3.3
Finish	3.3.1
Marking	3.9
Workmanship	3.13

4.5 Quality conformance inspection of equipment before packaging. The contractor shall perform the inspections specified in 4.4, 4.5.1 through 4.5.3. This does not relieve the contractor of his responsibility for performing any additional inspection which is necessary to control the quality of the product and to assure compliance with all specification requirements.

4.5.1 Group A inspection. Each unit on contract or purchase order shall be inspected for conformance to the inspection in table II. Discrete lots shall be formed from units that pass this inspection. Factors of lot composition not defined herein, or in the contract or purchase order, shall be in accordance with MIL-STD-105. Each lot shall be subject to sampling inspection, utilizing the procedures of MIL-STD-105, using the general inspection levels and AQLs indicated in table II.

4.5.1.1 Order of inspection within Group A. Group A inspection shall be performed in an order satisfactory to the government.

4.5.1.2 Visual and mechanical inspection. These inspections shall be performed in any order which is satisfactory to the government. The units shall be examined for the applicable defects listed in MIL-STD-252 (see 3.1).

TABLE II. Group A inspection.

Inspection	Requirement paragraph	Inspection paragraph	AQL%	
			Major	Minor
Visual and mechanical	3.1 3.10	4.5.1.2	1.0	4.0
Functional				1/
Surface dose rate	3.4.3	4.8	1.0	
Calibration accuracy	3.4.1	4.6.1	1.0	
Compatibility	3.4.2	4.7	1.5	
Radiological				1/
Source test 2/	3.11.1	4.10.1		
Calibrator contamination 3/	3.11.2	4.10.2		

1/ No minor functional or radiological defects permitted.

2/ If the prime contractor does not manufacture the sources, this inspection shall be a requirement placed by the prime contractor on his subcontractor.

3/ This inspection shall be performed as a requirement under group A inspection (4.5.1) and also prior to packaging and packing (4.14).

4.5.2 Group B inspection. This inspection, including sampling, shall conform to table III and to procedures for special inspection levels of table I of MIL-STD-105. Group B inspection shall be performed on production lots of products that have passed group A inspection (see 4.5.2.1).

4.5.2.1 Group B sampling plans. The group B AQL shall be 4.0 percent defective and the inspection level shall be S-3.

4.5.2.2 Order of inspection within group B. Group B inspection shall be performed in an order satisfactory to the government.

TABLE III. Group B inspection.

Inspection	Requirement paragraph	Test paragraph	AQL
Interchangeability	3.8	4.12	4.0%
Weight	3.5	4.13	4.0%

4.5.3 Group C inspection. This inspection shall consist of the tests specified in table IV and shall be performed on units of product that have been subjected to and passed group A and group B inspection requirements. Sample units shall be selected in accordance with 4.5.3.1.

4.5.3.1 Sampling for group C inspection. Group C inspections shall be performed on the first production lot and at the 25 percent, 50 percent, 75 percent and 100 percent points in production. Three (3) samples of AN/UDM-2 shall be selected at random for each group of inspections and shall be performed in an order shown in table IV.

TABLE IV. Group C inspection.

Inspection	Requirement paragraph	Test paragraph
Subgroup 1		
Low temperature	3.6.2.1	4.9.2
High temperature	3.6.3.1	4.9.1
Altitude 1/	3.6.3.2	4.9.5
Humidity	3.6.2.3	4.9.6
Salt fog	3.6.2.4	4.9.9
Subgroup 2		
Vibration	3.6.3.6	4.9.7
Shock 1/	3.6.3.8	4.9.10
Bounce	3.6.3.5	4.9.8
Immersion	3.6.3.3	4.9.3
Subgroup 3		
Bench handling	3.6.3.4	4.9.4
Rain	3.6.3.7	4.9.12
Fungus 1/	3.6.3.9	4.9.11

1/ These tests shall be performed only on the first production lot and on a sample selected from the lot representing approximately the 50 percent point in production. Only one equipment shall be submitted to fungus test.

4.5.3.2 Group C failures. Action required relative to group C failures shall be as specified in the contract or purchase order.

4.5.4 Reinspection of conforming group C sample units. Unless otherwise specified, sample units which have been subjected to and passed group C inspection may be accepted on contract provided all damage is repaired and the sample units are resubjected to and pass group A inspection only.

4.6 Performance.

4.6.1 Calibration accuracy. Each calibrator, when checked with the government furnished Victoreen Model 555 Radacon II in accordance with the procedures specified herein, shall meet the requirements of 3.4.1.

4.6.1.1 Dosimeter jig assembly measurements (lower source). Interconnect the Radacon II and its accompanying remote head in accordance with the manufacturer's instruction manual supplied with the instrument; attach the probe (Victoreen Part No. 555-100-MB) to the appropriate terminals on the remote head and allow a 30 minute warmup. The lower source of the dosimeter jig assembly shall be tested in accordance with SM-A-509093 (see 3.1) and shall meet the requirements of 3.4.1.1.

4.6.1.2 Dosimeter jig assembly measurements (upper source). Same as 4.6.1.1 except probe Victoreen Part No. 555-100-1C shall be used. The upper source of the dosimeter jig assembly shall be tested in accordance with SM-A-509093, paragraph 3.2 and shall meet the requirements of 3.4.1.2.

4.6.1.3 Dose rate jig assembly measurements. Same as 4.6.1.1. Dose rate jig assembly shall be tested in accordance with SM-A-509093 paragraph 4.0 and shall meet the requirements of 3.4.1.3.

4.7 Compatibility.

4.7.1 Dosimeter jig assembly. Calibrate all Radiacmeters IM-9, IM-93 and IM-147 supplied as Government Furnished Equipment (GFE) at mid scale using a cobalt 60 source, the calibration of which is traceable to the National Bureau of Standards. The radiacmeters shall read as follows:

IM-9( )/PD	100 mR $\pm$ 10 percent
IM-93A/UD	300 R $\pm$ 10 percent
IM-147( )/PD	25 R $\pm$ 10 percent

Any government furnished radiacmeter, whose reading exceeds the specified tolerance, shall not be used. Select 10 units of each type of radiacmeter and charge to zero. Discharge each radiacmeter in its appropriate position in the dosimeter jig assembly for the period specified for the particular radiacmeter under test. Repeat the above procedure for a total of 3 readings for each radiacmeter and calculate the average reading. The average reading shall be within the allowable tolerances specified in 3.4.2.

4.7.2 Dose rate jig assembly. Calibrate all Radiacmeters IM-174A/PD, IM-174B/PD and Radiac Sets AN/PDR-27( ) supplied as GFE using a cobalt 60 source, the calibration of which is traceable to the National Bureau of Standards. The instruments shall be calibrated at the following points:

Instrument	Calibration point	Tolerance
IM-174A/PD	100R/hr	$\pm$ 10 percent
IM-174B/PD	100R/hr	$\pm$ 10 percent
AN/PDR-27( )	250 mR 25 mR 2.5 mR 0.25 mR	$\pm$ 20 percent

Any government furnished equipment which can not be calibrated shall not be used. Select 2 units each of Radiacmeters IM-174A, IM-174B and 2 units of Radiac Set AN/PDR-27( ) and check the calibration of each unit in the calibrator in accordance with the procedures specified. Repeat each check for a total of 3 readings per unit and the average reading per unit shall be within the allowable tolerances specified on 3.4.2.

4.8 Surface dose rate. Using a government furnished Radiac Set AN/PDR-27 calibrated as specified in 4.7.2, the surfaces of the Radiac Calibrator AN/UDM-2 shall be monitored for conformance to the requirement of 3.4.3.

4.9 Service condition tests. Service condition tests shall be performed as detailed below. Each unit subjected to these tests shall have passed group A and group B tests and shall be resubmitted to, and pass these group A tests after completion of all service condition testing (see 3.6.1).

4.9.1 High temperature. The dosimeter jig assembly as defined by SM-D-508967 and the dose rate jig assembly as defined by SM-D-508993 shall be subjected to Procedure I, Method 501 of MIL-STD-810 with the following exceptions:

a. Temperature of step 2 shall be +155°F (68.33°C).

b. Step 3 shall be for 24 hours.

c. Step 4 shall be +125°F (51.67°C).

d. At steps 5 and 7, equipment shall meet the requirement of 3.4.2.

4.9.2 Low temperature. The dosimeter jig assembly and dose rate jig assembly, as defined in 4.9.1, shall be subjected to Procedure I, Method 502.1 of MIL-STD-810 with the following exceptions:

a. Temperature of step 2 shall be -65°F (-53.89°C) and maintained for 24 hours.

b. Temperature for step 4 shall be -25°F (-31.67°C).

c. At steps 5 and 7, equipment shall meet the requirement 3.4.2.

4.9.3 Immersion. The equipment, closed as for storage or transportation, shall be subjected to Procedure I, Method 512.1 of MIL-STD-810 (see 3.6.3.3).

4.9.4. Bench handling. The equipment, locked as for storage or transportation, shall be placed on a solid, 2 inch fir bench top. Tilt the equipment through an angle of 30° using one edge as an axis; allow to drop freely back to the horizontal. Repeat, using the remaining three edges of the same horizontal face as axes, for a total of 4 drops. Repeat the above with the equipment resting on the remaining five faces for an overall total of 24 drops. Upon completion of the test, the equipment shall meet the requirement 3.4.2 (see 3.6.3.4).

4.9.5 Altitude.

4.9.5.1 Operating. The equipment shall be subjected to procedure I, Method 500.1 of MIL-STD-810. In step 2 test for conformance to 3.4.2 a chamber pressure of 20.6 inches of hg (10,000 ft (3048m) above sea level). Upon completion of the performance test, return the chamber to standard ambient pressure and repeat the performance test for conformance to 3.4.2 (see 3.6.2.2).

4.9.5.2 Non-operating. The equipment, closed for storage or transportation, shall be subjected to steps 2 and 4 of Procedure I, Method 500.1 of MIL-STD-810. Upon completion of step 4, the equipment shall be tested for conformance to 3.4.2 (see 3.6.3.2).

4.9.6 Humidity. The equipment shall be subjected to Procedure II, Method 507.1 of MIL-STD-810 except that:

a. The equipment shall be opened into its 2 halves during step 1.

b. Step 2 shall be deleted.

c. Conformance to 3.4.2 shall be testing during step 4.

d. Equipment shall be closed as for storage or transportation during the first 3 cycles of step 6. During cycles 4 and 5, the equipment shall be opened as in step 3.

e. Conformance to 3.4.2 shall be tested during step 8 (see 3.6.2.3).

4.9.7 Vibration. The equipment shall be subjected to Procedure X, curve AW of MIL-STD-810, Method 514.1. Upon completion of the test, the equipment shall meet the performance requirement of 3.4.2 (see 3.6.3.6).

4.9.8 Bounce. The equipment shall be subjected to Procedure X, paragraph 4.16.2, Method 514.2 of MIL-STD-810. Upon completion of the test, the equipment shall meet the performance requirement of 3.4.2 (see 3.6.3.5).

4.9.9 Salt fog. The equipment, opened as in operational use, shall be subjected to Method 509.1, Procedure 1 of MIL-STD-810. Salt concentration shall be 20 percent. Upon completion of the test the equipment shall meet the performance requirements of 3.4.2 (see 3.6.2.4).

4.9.10 Shock. The equipment when packed for shipment shall be subjected to Procedure II, Method 516.2 of MIL-STD-810 except that the height of drop shall be 2 feet. Upon completion of the test, the equipment shall meet the performance of 3.4.2 (see 3.6.3.8).

4.9.11 Fungus. The equipment in its opened position shall be subjected to Procedure I, Method 508.1 of MIL-STD-810 (see 3.6.3.9). Upon completion of the test, the equipment shall meet the requirement of 3.4.2.

4.9.12 Rain. The equipment, closed as for storage or transportation, shall be tested as follows:

a. Dry at 150^{o}F $\pm$5^{o}F (from 62.78^{o}C min to 67.33^{o}C max) for 48 hours.

b. Condition for 4 hours at 77^{o}F (25^{o}C) and 50 to 60 percent relative humidity.

c. Take pretest data. The equipment shall meet the requirement of 3.4.2.

Test equipment in accordance with Method 506.1, Procedure I of MIL-STD-810. There shall be no wind source and the rain fall throughout the test shall be 4 $\pm$ 1 inch/hr. Complete final measurements within 1 hour after the rain has been discontinued (see 3.6.3.7).

4.10 Radiological tests. These tests shall be performed by or under the direct supervision of the Radiological Protection or Radiological Safety Officer employed by the contractor in accordance with current US Nuclear Regulatory Commission regulations (see 3.11). The government reserves the right to observe and/or participate in the radiological quality assurance tests performed on each sealed source utilized in the AN/UDM-2 Radiac Calibrator Set.

4.10.1 Source tests. (see 3.11.1)

4.10.1.1 First encapsulation leak test. Fill a 200-500 ml beaker about 2/3 full of glycerine. Boil the glycerine for several minutes to drive off any dissolved air. The temperature of the glycerine shall be kept about 150^{o}C during the remainder of the tests. A transparent beta shield (preferably plastic), having a minimum area density of 1gm/cm^{2} should be placed between the individuals performing or observing the tests and the beaker, its heat sources and the shielding type source container, to protect them from the radiation. A light should be directed on the beaker at right angles to the line of view of the operator. Care shall be taken to insure that the light does not shine in the operator's eyes. Using remote handling tool(s), remove a source (at or below 30^{o}C) from the shielded container and drop it into the hot glycerine. Closely observe the source and the glycerine above it for one minute. A large hand lens mounted near the beaker or the use of binoculars or a telescope that will focus on objects as close as two or three feet will aid in this test. Bubbles from the source or on the source indicate a leak.

4.10.1.2 Source bloat test. After a source has passed a leak test, the source shall be tested for bloating (bulging) of the thin window. Thin window bloating (bulging) in excess of 0.030 inch shall be considered failure of the test.

4.10.1.3 Second encapsulation leak test. After the second encapsulation of the source repeat the test described in 4.10.1.1.

4.10.1.4 Second encapsulation bloat test. After a source has passed the test outlined in 4.10.1.3, repeat the test of 4.10.1.2 (see 3.11.1.2).

4.10.1.5 Source contamination test. (see 3.11.1.3)

a. Use any standard beta counting system which includes a scaler and timer and has a detector window at least one inch in diameter and not exceeding 2.0 mg/cm^2. Commercially available sponge or smooth surface filter paper wipes shall be utilized whose diameter shall not exceed the diameter of the detector window or counting planchet.

b. The beta counting system utilized in a above shall be calibrated using calibration reference standards certified by, or traceable to the National Bureau of Standards. The radioactive material incorporated into the calibration reference standards shall be of the same type as contained in the sealed sources utilized in the AN/UDM-2 Radiac Calibrator Sets (i.e., Strontium-90). A detailed procedure for the analysis of wipe test samples, including the determination of the quantity of contamination in microcuries, shall be provided the government for evaluation and approval for use.

4.10.1.6 Source radioactivity test. Each sealed source shall be tested to determine its radioactive material content by utilizing appropriate radiation measurement instrumentation to assure that the maximum quantity limitations for radioactive material contained in each sealed source type are not exceeded. The radiation measurement instrumentation shall be calibrated utilizing calibration standard sources certified by, or traceable to, the National Bureau of Standards. The radioactive material incorporated into the calibration standard sources shall be of the same type as contained in the sealed sources utilized in the AN/UDM-2 Radiac Calibrator Sets. A detailed procedure for the determination of the quantity of radioactive material contained in the sealed sources shall be provided the government for evaluation and approval for use.

4.10.2 Calibrator contamination test.

4.10.2.1 Equipment and counting procedure. The equipment and counting procedure stipulated in 4.10.1.5 above shall be followed with regards to the analysis of the wipe test samples as acquired below. Wipe test sampling shall be performed with commercially available cotton swabs in place of sponge or smooth surface filter paper wipes. To count cotton swabs, cut off all but a short stub of the handle and tape the stub to the planchet, centering the cotton on the planchet.

4.10.2.2 Dosimeter jig assembly wipe test.

WARNING

Do not under any circumstances expose the eyes to the radiation field by peering into the access hole while the swivel cover is swung aside.

Swing aside the swivel cover and using a cotton swab, wipe around the inner surface of the access hole. Using the procedure of 4.10.2.1, check the cotton swab for contamination.

4.10.2.3 Dose rate jig assembly wipe test. Open the drawer and using a cotton swab, wipe the inside and outside surfaces of the drawer. Using the procedure of 4.10.2.1, check the cotton swab for contamination.

4.11 System safety inspection. An inspection shall be performed to verify compliance with those portions of 3.10 which can be determined visually.

4.12 Interchangeability. The mechanical dimensions shall be measured to determine conformance to the physical and functional interchangeability requirements (see 3.8). This inspection shall be conducted on piece parts and subassemblies prior to final assembly.

4.13 Weight. The equipment shall be weighed (less manuals) to determine conformance to 3.5.

4.14 Quality conformance inspection of packaging. Quality conformance inspection for packaging shall be in accordance with group A, group B and, when required (see 6.1(d)), the group C (rough handling) requirements of MIL-P-116. Inspection lots shall be in accordance with MIL-P-116.

5. PACKAGING

5.1 Packaging requirements. The requirements for packaging shall be in accordance with SPI 1G00152.

6. NOTES

6.1 Intended use. The dosimeter discharge well assembly is used to check the calibration of Radiacmeters IM-9( )/PD, IM-93( )/UD and IM-147( )/PD (dosimeters). The assembly contains four each sealed sources arranged to radiate into a central cavity. The upper field is utilized in checking the operational reliability of Radiacmeter IM-9( )/PD while the lower field performs a similar function for Radiacmeters IM-93( ) and IM-147( )/PD. The dose rate jig assembly consists of a drawer unit and a spacer block. The drawer unit contains one each sealed source. The spacing block provides varying field intensities used to calibrate radiacmeter probes. This assembly is utilized to calibrate Radiacmeters IM-174A/PD, IM-174B/PD and Radiac Set AN/PDR-27( ).

6.2 Ordering data. Procurement documents should specify the following:

a. Title, number and date of this specification and any amendment thereto.

b. Complete equipment or individual units to be procured.

c. Level A or B preservation and packing (see section 5).

d. When rough handling test is required.

e. Number of first articles to be submitted for approval (see 3.2).

f. Marking and shipping of samples.

g. Place of final inspection.

h. Technical literature required.

6.3 Environmental. Environmental pollution prevention measures are contained in the packaging material specifications referenced herein. Refer to material specifications or preparing activity for recommended disposability methods.

6.4 Nomenclature. The contractor should apply for nomenclature in accordance with the applicable clause in the contract.

6.5 Government furnished property (loaned). Unless otherwise stated in the contract, the following government property, in the quantities specified, shall be loaned to the contractor for the purpose of performing acceptance tests on the equipment being procured:

Radiacmeter IM-9( )/PD	25 each
Radiacmeter IM-93A/UD	25 each
Radiacmeter IM-147( )/PD	25 each
Radiacmeter IM-174A/PD	6 each
Radiacmeter IM-174B/PD	4 each
Radiac Set AN/PDR-27( )	4 each
Radiac Charger PP-1578( )	6 each
Radiac Set AN/PDR-60	4 each
Victoreen Model 555 Radacon II with instruction manual, Victoreen Model 555-100-MB, probe, Victoreen Model 555-100-1C probe, and accessories 1-5 per SM-A-509093, Timer 555-50	1 each

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DOCUMENT IDENTIFIER *(Number)* AND TITLE
MIL-R-55350A(ER) RADIAC CALIBRATOR AN/UDM-2( )

NAME OF ORGANIZATION AND ADDRESS OF SUBMITTER

☐ VENDOR ☐ USER ☐ MANUFACTURER

1. ☐ HAS ANY PART OF THE DOCUMENT CREATED PROBLEMS OR REQUIRED INTERPRETATION IN PROCUREMENT USE? ☐ IS ANY PART OF IT TOO RIGID, RESTRICTIVE, LOOSE OR AMBIGUOUS? PLEASE EXPLAIN BELOW.

A. GIVE PARAGRAPH NUMBER AND WORDING

B. RECOMMENDED WORDING CHANGE

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BUSINESS REPLY MAIL

FIRST CLASS PERMIT NO. 73236 WASHINGTON D. C.

POSTAGE WILL BE PAID BY THE DEPARTMENT OF THE AIR FORCE

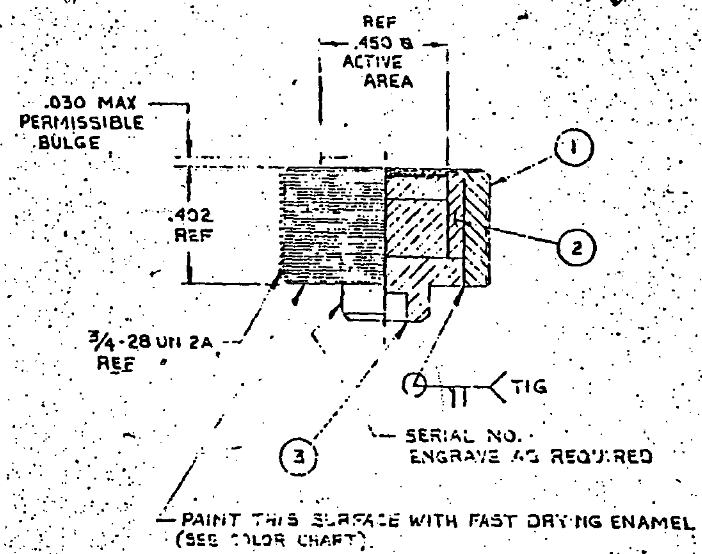
Commander
US Army Combat Surveillance and
Target Acquisition Laboratory
Attn: DELCS-PE
Fort Monmouth, NJ 07702

FOLD

☆ U.S.GOVERNMENT PRINTING OFFICE: 1981—703-023/4289 2-1

Encl 17

ITEM	QTY	PART NO.	DESCRIPTION
1	1	B-12-1921-3464-6	ASSY WINDOW-OUTER CAPSULE
2	1	B-12-1921-3493-5	ASSY INNER CAPSULE
3	1	B-12-1921-3426-1	OUTER PLUG



COLOR CHART	
LOADING	COLOR
20 MICROCURIES	YELLOW
25 MILLICURIES	RED
OTHER REQ	NONE

NOTE:

1. CONSTRUCTION TO MEET OR EXCEED ANSI CLASSIFICATION 77C-43343 AND SPECIAL FORM TITLE 49 CFR

USED ON

ISSUE	ISSUE DATE AND CHANGE RECORD	REV.	CHG.
F	OCT 4, 82 ECO 82-0080 REDRAWN FROM A-0474-3,5	CRZ	

TOLERANCE AND SURFACE ROUGHNESS UNLESS NOTED

OPERATION	.0	.00	.000	MAXIMUM SURFACE ROUGHNESS
MACHINING	±.1	±.02	±.005	✓
CUT-OFF (SAW, SHEAR)	±.1	±.04		
	±	±	±	
WELDING	±.1	±.04		
ANGULAR DIM.	±			
SCALE	5X			

DR. CHUCK ZENDER
CH. RTS
APP.

3M Engineering Division/3M St. Paul, Minnesota 55101

TITLE: ASSEMBLY: Sr-90 BETA SOURCE 3F1G

B

PART NO. 12-1921-0474-8

MILITARY SPECIFICATION

RADIAC CALIBRATOR SET AN/UDM-7( )

1. SCOPE

1.1 This specification covers a radiac calibrator set AN/UDM-7( ) for calibrating alpha radiac instruments.

2. APPLICABLE DOCUMENTS

2.1 The following documents, of the issue in effect on date of invitation for bids or request for proposal form a part of this specification to the extent specified herein:

SPECIFICATIONS

MILITARY

MIL-F-1/1388 - Electron Tube, Type 7840.
MIL-S-901 - Shock Tests, H.I. (High Impact); Shipboard Machinery, Equipment and Systems, Requirements for.
MIL-Q-9858 - Quality Program Requirements.
MIL-P-15328 - Primer Pretreatment (Formula No. 117 for Metals).
MIL-E-17555 - Electronic and Electrical Equipment and Associated Repair Parts, Preparation for Delivery of.
MIL-M-19590 - Marking of Commodities and Containers to Indicate Radioactive Material.

STANDARDS

MILITARY

MIL-STD-108 - Definitions of and Basic Requirements for Enclosures for Electric and Electronic Equipment.
MIL-STD-167 - Mechanical Vibration of Shipboard Equipment.

DRAWINGS

MILITARY

RE101F2002 - Alpha Radiac Calibrator AN/UDM-7A

(Copies of specifications, standards, drawings, and publications required by suppliers in connection with specific procurement functions should be obtained from the procuring activity or as directed by the contracting officer.)

2.2 Other publications. - The following document forms a part of this specification. Unless otherwise indicated, the issue in effect on date of invitation for bids or request for proposal shall apply.

CODE OF FEDERAL REGULATIONS

INTERSTATE COMMERCE COMMISSION

Tariff No. 10 - Interstate Commerce Commission Regulations for Transportation of Explosives and Other Dangerous Articles by Land and Water in Rail Freight Service and by Motor Vehicles (Highway and Water) including Specifications for Shipping Containers.

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(Application for copies should be addressed to the Superintendent of Documents, Government Printing Office, Washington, D.C. 20360.)

3. REQUIREMENTS

3.1 Preproduction sample. - Prior to beginning production a sample shall be tested as specified in 4.2.1 (see 6.2).

3.2 General description. - The radiac calibrator set AN/UDM-7( ) is a calibrating set which provides suitable radioactive sources for calibrating alpha radiac survey equipment.

3.2.1 The calibration set shall be constructed and assembled in accordance with the requirements of this specification and Drawing RE101F2002. Where the requirements of this specification conflict with the drawing, the requirements of this specification shall govern.

3.3 Material. - Materials specified herein and in Drawing RE101F2002 shall be entirely suitable for the purpose intended. Use of other material shall have the approval of the procuring activity.

3.4 Equipment composition. - The calibration set shall consist of the following:

(a) Two radioactive sources "A" and "C".
(b) Two radioactive source holders.
(c) Adjustable positioner.
(d) Two attenuators.
(e) Aluminum housing.
(f) Calibrator carrying case.
(g) One pair of tweezers.
(h) Instruction book.

3.4.1 Two radioactive sources. - The two radioactive sources shall contain Plutonium-239 deposited in a resin component. The resin component shall be of the composition specified in MIL-P-15328.

3.4.1.1 Source configuration and description. - The sources shall be about 12-1/2 inches in diameter, 1.0 mg/cm^2 thick and emit alpha energies, 90 percent of which are 4MEV or greater. A set of two sources (labeled A and C, and of activities of 10^7 DPM and 10^5 DPM respectively) are contained in each unit. When a source is positioned in the unit, only a 4 inch x 10 inch area is exposed for calibration. The sources shall be prepared in accordance with the Appendix to this specification.

3.4.1.2 Uniformity of radioactive sources. - The sources shall have no area count rate which exceeds plus or minus 5 percent from the average count rate when tested as specified in 4.4.1.

3.4.1.3 Accuracy. - The activity of each source shall be determined by comparison with a standard source to be approved by the procuring activity. This information shall be recorded and included with each calibrator delivered under the contract. Information shall be on a printed card or similar method of presentation.

3.4.2 Source mounting. - The two radioactive sources shall be mounted in accordance with Drawing RE101F2002.

3.4.3 Adjustable probe positioner. - Construction of the probe positioner shall be in accordance with Drawing RE101F2002.

3.4.4 Aluminum housing. - Each calibration set shall be provided with a lightweight housing, made of aluminum in accordance with Drawing RE101F2002, designed to house the following:

(a) Two radioactive source holders.
(b) Accessory drawer.
(c) The top of the unit shall be designed as a source-positioning well.

The housing shall be labeled in accordance with MIL-M-19590.

3.4.4.1 The two radioactive source holders shall be contained in removable drawers, numbered for source identification, and labeled in accordance with MIL-M-19590.

3.4.4.1.1 Each drawer with source shall be removable as a unit for replacement in the proper position under the probe positioner.

3.4.5 Calibrator carrying case. - The calibrator carrying case shall be constructed to contain the aluminum housing. The carrying case shall be constructed in accordance with Drawing RE101F2002.

3.4.5.1 Size and weight of calibrator. - The overall size and weight of the calibrator shall be as follows:

Height - 1-27/32 inches.
Width - 13-23/32 inches.
Depth - 13-17/32 inches.
Weight - Not to exceed 17 pounds.

3.4.5.2 Size and weight of carrying case. - The overall size and weight of the carrying case shall be as follows:

Height - 3-15/16 inches
Width - 14-7/8 inches
Depth - 15-1/16 inches
Weight - Not to exceed 7-1/2 pounds.

3.5 Shock and vibration. -

3.5.1 Shock. - Shock requirements shall be for grade A, class I, type A in accordance with MIL-S-901, except that the drop shall be 1, 2 and 3 feet in lieu of 1, 3 and 5 feet.

3.5.2 Vibration. - Vibration requirements shall be in accordance with type I of MIL-STD-167.

3.6 Degree of enclosure. - Degree of enclosure for the calibrator shall be splashproof in accordance with MIL-STD-108.

3.7 Temperature. - The sources shall be capable of withstanding a temperature of 120°F in an inverted position, and meet the requirements of 3.9.

3.8 Humidity. - The sources shall be capable of withstanding 95 percent relative humidity at 100°F for 4 hours, and meet the requirements of 3.9.

3.9 Leakage. - When tested in accordance with 4.4.5, the removable radioactive material shall not exceed 0.005 microcuries of Plutonium-239. Leakage test shall be performed immediately after the temperature, humidity, shock and vibration tests.

3.10 Workmanship. - The calibration set shall be manufactured and finished in a thoroughly workmanlike manner and shall be free from all burrs, rough edges, smudges and scratches.

4. QUALITY ASSURANCE PROVISIONS

4.1 Responsibility for inspection. - Unless otherwise specified in the contract or purchase order, the supplier is responsible for the performance of all inspection requirements as specified herein. Except as otherwise specified, the supplier may utilize his own facilities or any commercial laboratory acceptable to the Government. The Government reserves the right to perform any of the inspections set forth in the specification where such inspections are deemed necessary to assure supplies and services conform to prescribed requirements.

4.1.1 Quality control system.- The contractor shall provide and maintain a quality system acceptable to the government for the supplies covered by the contract. The system of quality control shall be in accordance with MIL-Q-9858. The procedures outlined in MIL-Q-9858 shall serve to supplement and implement the design, performance and test requirements of this specification.

4.2 General inspection.- The methods of examination and testing of the calibration sets shall fall within the following classifications:

(a) Preproduction inspection (see 4.2.1).
(b) Quality conformance inspection (see 4.2.2).

4.2.1 Preproduction inspection.- Preproduction inspection shall be made on the preproduction model and shall consist of the examination of 4.3 and the tests of 4.4.

4.2.2 Quality conformance inspection.- Quality conformance inspection shall consist of the production inspection of 4.2.2.1 and production control inspection of 4.2.2.2.

4.2.2.1 Production inspection.- Production inspection shall be made on each equipment offered for delivery to determine compliance with this specification. Production inspection shall consist of the examination of 4.3 and the uniformity, accuracy and leakage tests of 4.4.1, 4.4.2 and 4.4.5.

4.2.2.2 Production control inspection.- Production control inspection shall be made on one out of each 10 calibration sets produced, to be selected at random by the Government representative. Production control inspection shall consist of the examination of 4.3 and the tests specified in 4.4.

4.3 General examination.- The calibration set shall be examined to determine compliance with the requirements of this specification and shall include the following:

(a) Workmanship, assembly, size and fit.
(b) Materials, parts and finish.

4.4. Test procedures.-

4.4.1 Uniformity.- The uniformity check to determine conformance with 3.4.1.2 shall be made with a type 7840 tube conforming to MIL-E-1/1388, used with a conventional type scaler (1 megohm, 0.5 microsecond resolving time).

4.4.2 Accuracy.- The calibration set shall be tested to determine conformance with 3.4.1.3.

4.4.3 Enclosure.- The housing and the carrying case shall be tested to determine conformance with 3.6.

4.4.4 Shock and vibration.- The calibration set shall be tested to determine conformance with 3.5.1 and 3.5.2.

4.4.5 Leakage test.- The leakage test shall be capable of detecting the presence of 0.005 microcuries of Plutonium-230. The method of the test shall be submitted to the command or agency concerned for approval prior to performing the test.

5. PREPARATION FOR DELIVERY

5.1 Preservation, packaging and packing.- The equipment shall be packaged by level A or C and packed by level A, B or C as specified in the contract or order in accordance with MIL-E-17555. Method III preservation shall apply for level A packaging. As a minimum, the requirements shall conform to the Interstate Commerce Commission Tariff No. 10.

5.2 Marking.- The equipment and containers shall be marked in accordance with MIL-M-19590.

6. NOTES

6.1 Ordering data. - Procurement documents should specify the title, number and date of this specification.

6.2 Preproduction. - Invitations for bids should provide that the Government reserves the right to waive the requirement for preproduction samples as to those bidders offering a product which has been previously procured or tested by the Government, and that bidders offering such products, who wish to rely on such production or test, must furnish evidence with the bid that prior Government approval is presently appropriate for the pending procurement.

Preparing activity:
Navy-SH
(Project 6665-N228Sh)

APPENDIX

PROCEDURE FOR PREPARING "THIN" ALPHA SOURCES

10. Technique. - The technique is relatively simple. The alpha emitter is dissolved in an alcohol-resin component mixture and stirred to uniformity. The final mixture is then poured through a funnel onto a plastic disk located on a leveling table directly below the funnel spout. The resulting radioactive sources have excellent uniformities - with any source the source area count rate varies ±5 percent or less from the average count rate.

10.1 Procedure. - The procedure shall be as follows:

(a) One cubic centimeter (cc) of radioactive solution (isotope in chloride form) is added to a mixture of 9 - 10 cc of resin component (MIL-C-15328) and 29 cc of ethyl alcohol (99 percent). The total mixture is carefully stirred for a minimum of 15 minutes to assure a uniform dispersion of the radioisotope in the solution.

(b) The radioactive solution is then poured through a funnel onto a 12-1/2 ($^{+0}_{-1/64}$) inch diameter disk on a leveled table. The funnel (spout inner diameter - 11 millimeter (mm) is positioned rigidly with the spout perpendicular to the center of the plastic disk (CR-39 transparent plastic; cast acrylic). The distance between spout and disk is 47 mm. The spout inner diameter and the 47 mm distance eliminate areas of reduced activity in the center of the disk. Prior to pouring, the disk is leveled by means of a leveling table with adjustable legs (NASL uses a 12 inches x 12 inches stainless steel table). A wetting agent applied to the surface of the disk before pouring facilitates spreading of the radioactive mixture. *Ten cc of alcohol, carefully hand spread over the disk has bee been used with good results.*

(c) After spreading freely on the disk, the radioactive mixture is allowed to air dry. During this phase two factors of control are necessary. First, safety precautions are needed to protect personnel and equipment from possible contamination. A hood is recommended, with conditions to keep air currents from passing over the drying radioactive liquid. Secondly, humidity control is important and a dust free atmosphere is desirable. A relative humidity of 40 percent or less at 70°F. or less will prevent spotty, nonuniform distributions. The water content of the mixture is critical and should never be allowed to exceed 0.3 cc in 5 cc of mixture.

10.2 Source. - The resulting source, if the conditions above are employed, will have a high degree of uniformity. Any area count rate will be ±5 percent or less from the average count rate. A uniformity check can be made with 7840 GM tube (mica window thickness of 2.5 mg/cm^2 or less) used with a conventional type scaler (1 megohm, 0.5 μsec resolving time). The alpha source is a "thin" source, meaning all alpha energies at the surface are 4 Mev or greater. *Care should be taken not to gouge or severely rub the source material.*

10.3 Summary of material and conditions. - Summary of material and conditions shall be as follows:

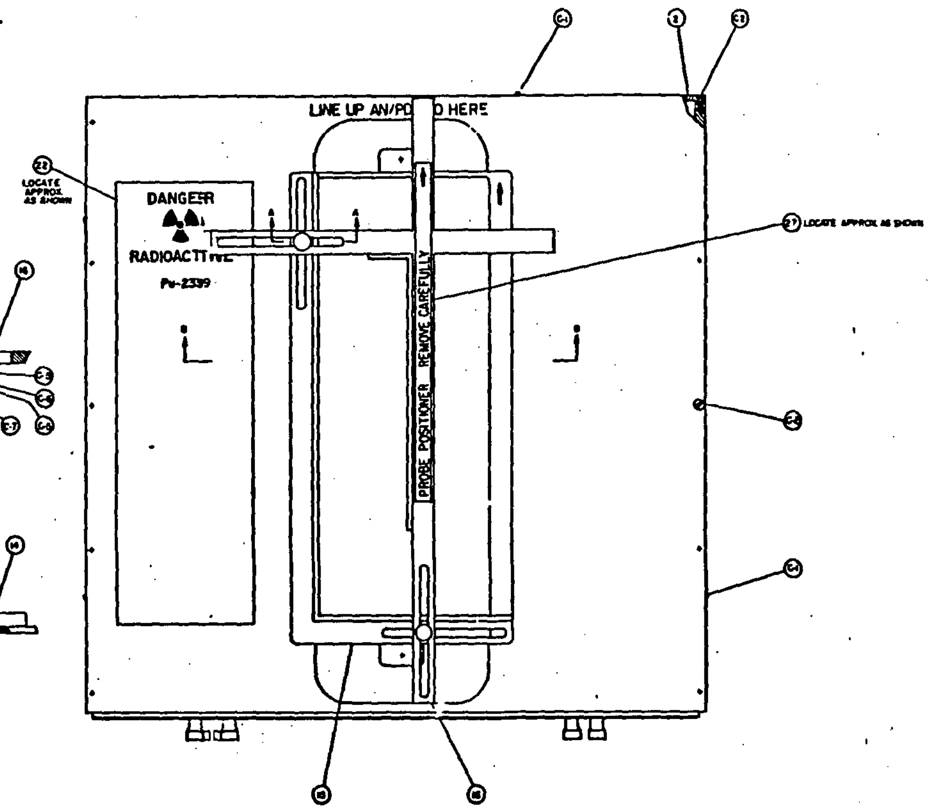
(a) Radioactive mixture. -

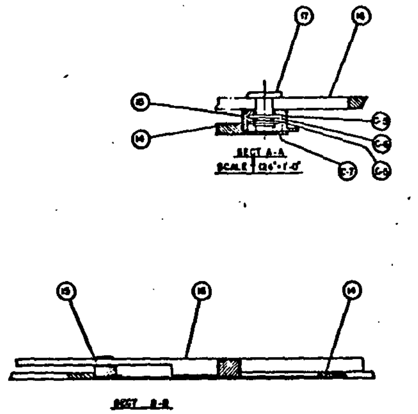
Radioisotope - Plutonium 239 as $PuCl_3$ in HCl (≤ 0.5 N)
810 μg/cc for source 1 - equivalent to approximately 10^4 μg/m^2
8.1 μg/cc for source 2 - equivalent to approximately 10^2 μg/m^2
Resin component - 9 - 10 cc of MIL-C-15328
Solvent - 29 cc of ethyl alcohol (99 percent)
Total volume
of mixture - 40 cc - bring up with alcohol if necessary

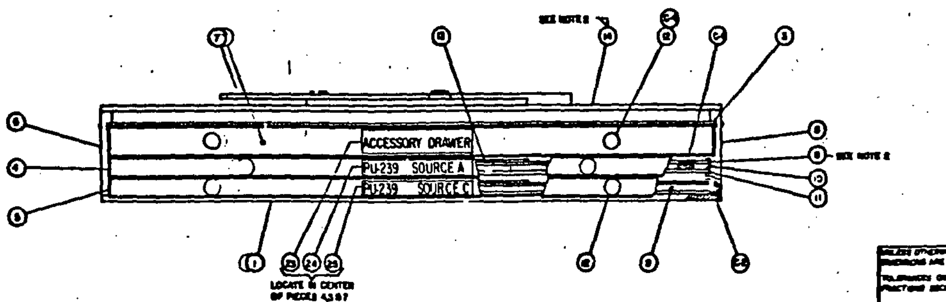
(b) Plastic disk - 12-1/2 inch diameter, 1/8 inch thick, CR-39 transparent, cast acrylic
(c) Leveling table - At least 12 inches x 12 inches for relatively uniform evaporation
(d) Funnel - Spout (inner diameter - 11mm, length - 25mm)
Mouth diameter ≈ 65mm
(e) Mixture beaker - 125 cc (graduated) with pouring spout

(f) Stirring rod - Glass, durable, approximately 8 inches long

(g) Conditions - R. H. - 40 percent or less, temperature 70° F or less
Dust-free atmosphere
Hood for safety precautions
No wind currents over drying mixture







LIST OF MATERIAL				
QUANTITIES ARE FOR ONE (1) ALPHA RADIAC CALIBRATOR ASSY.				
PART NO	NAME	[illegible]	[illegible]	REMARKS
A-1	[illegible]	ONE		ASSEMBLY
1	BASE PANEL	1	ALUM ALY	
2	BACK PANEL	1		
3	TOP PANEL	1		
4	FRONT PANEL	1		
5	FRONT PANEL	1		
6	SIDE PANEL	2		
7	DRAWER	1		
8	COVER, SOURCE HOLDER	2		
9	SOURCE HOLDER	1		
10	SOURCE HOLDER	1		
11	BOTTOM SOURCE HOLDER	1		
12	ENDS	2		
13	COVER	2		
14	POSITIONER HOLDER	1		
15	POSITIONER, BOTTOM	1		
16	POSITIONER, TOP	1		
17	GUIDE PIN	2	[illegible]	
18	COVER	1	ALUM ALY	[illegible]
C-1	ESCUTCHEON PIN	8	[illegible]	[illegible]
C-2	MACHINE SCREW	28		[illegible]
C-4		16		[illegible]
C-5	PLAIN WASHER	4		[illegible]
C-6	SPRING WASHER	2	CORR S	[illegible]
C-7	RETAINING RING	2		[illegible]
19	THUMB SCREW	2	[illegible]	[illegible]
20	SOURCE BASE	1	ALUM ALY	
21	SOURCE BASE	1		
22	NAME PLATE	1	CORR S	SEE NOTE 3
23		1		
24		1		
25		1		
26		1		
27		1		
28		1		
29		1		
30	CARRYING CASE	1	WOOD	[illegible]
31	NAME PLATE	1	CORR S	SEE NOTE 3
32	TWEEZERS	1		[illegible]
33	ENVELOPE	1		[illegible]
34		1		[illegible]
35		1		[illegible]

MATERIAL

1. ALUM ALLOY, SPEC QQ-A-250/8, TEMP H32
2. ALUM ALLOY, SPEC QQ-A-250/11, TEMP T6
3. ALUM ALLOY, SPEC QQ-A-250/2, TEMP H14
4. CORR RES STEEL, SPEC QQ-S-763, CL. 303
5. ALUM ALLOY, SPEC QQ-A-270, TEMP T6

NOTES

1. ALL OUTSIDE SURFACES OF ALPHA RADIAC CALIBRATOR TO HAVE GREY HAMMERTONE FINISH
2. LINE UP 4x10 CUTOUT IN PART 8 WITH 4x10 CUTOUT IN PART 8-A7 ASSEMBLY
3. NAMEPLATES PC 22, 23, 24, 25, 26, 27, 28, 29, 31 MAY BE PURCHASED FROM ANODYNE INC.
   NORTH SHORE NAME PLATE & ON
   ETC N E 155TH STREET
   NORTH MIAMI BEACH 62, FLORIDA
   NAMEPLATES SOLD UNDER DESIGNATION "THERMA MARK ANODIZED FOIL ALUMINUM NAMEPLATES"

Encl 19

RE. F26 96577

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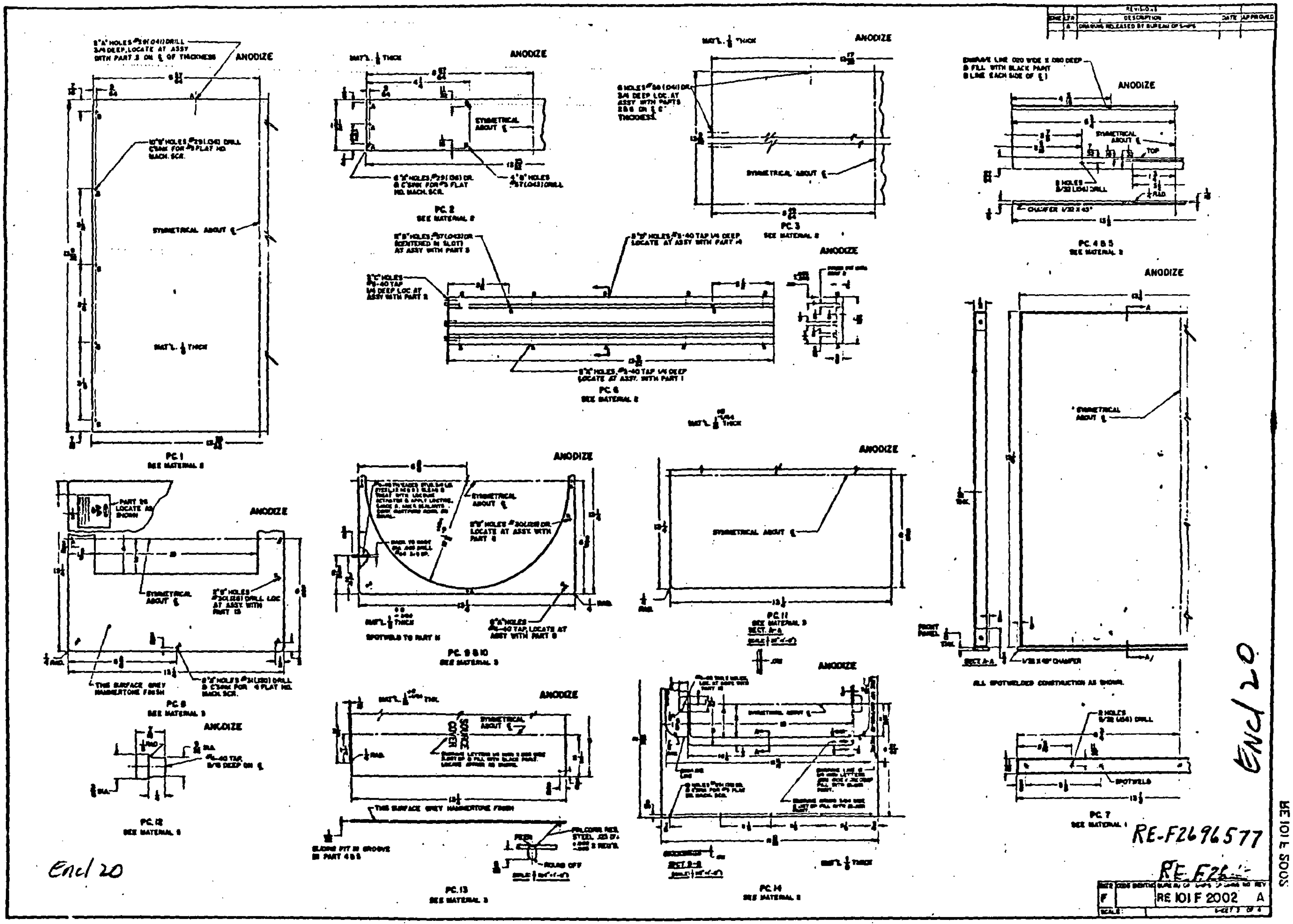
ABBREVIATED DRAWING TITLE

UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES. TOLERANCES ON FRACTIONS DECIMALS ANGLES	BUREAU OF SHIPS SIGNATURE	NAVY DEPARTMENT WASHINGTON, D. C. BUREAU OF SHIPS
MATERIAL:	SECT HEAD	ALPHA RADIAC CALIBRATOR AN/UDM-7A
	PROJ ENG	
	CHECKED	
	DRAFTSMAN	
	DATE	
	FOR CHIEF OF BUREAU	SIZE CODE IDENT NO BUREAU OF SHIPS DRAWING NO REV
	DATE 1-28-64	F 80064 RE 101 F 2002 A
		SCALE SHEET 1 OF 4


REVISIONS
DESCRIPTION
DATE
APPROVED
DRAWING RELEASED BY BUREAU OF SHIPS
ANODIZE
ANODIZE
ANODIZE
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ANODIZE
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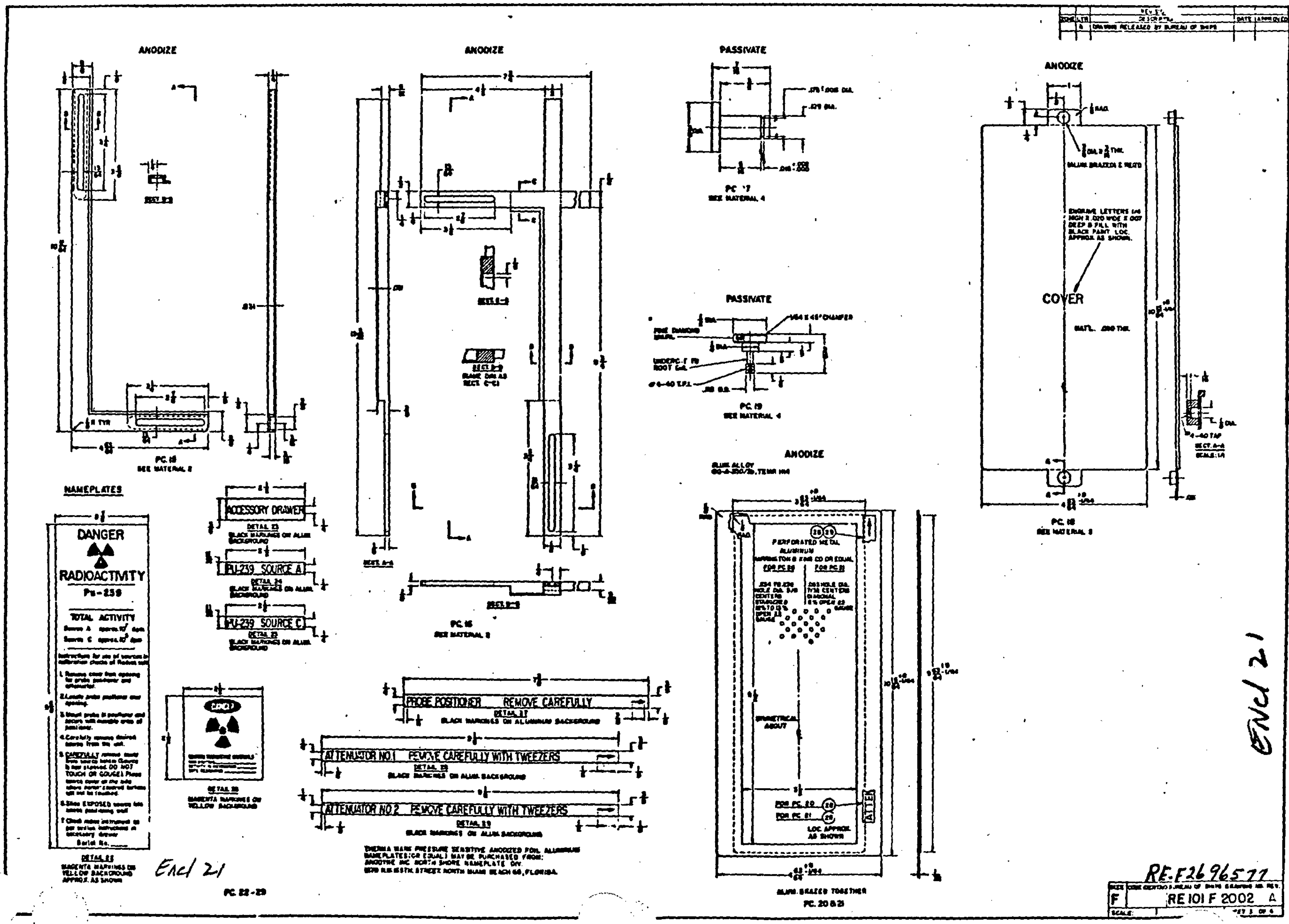
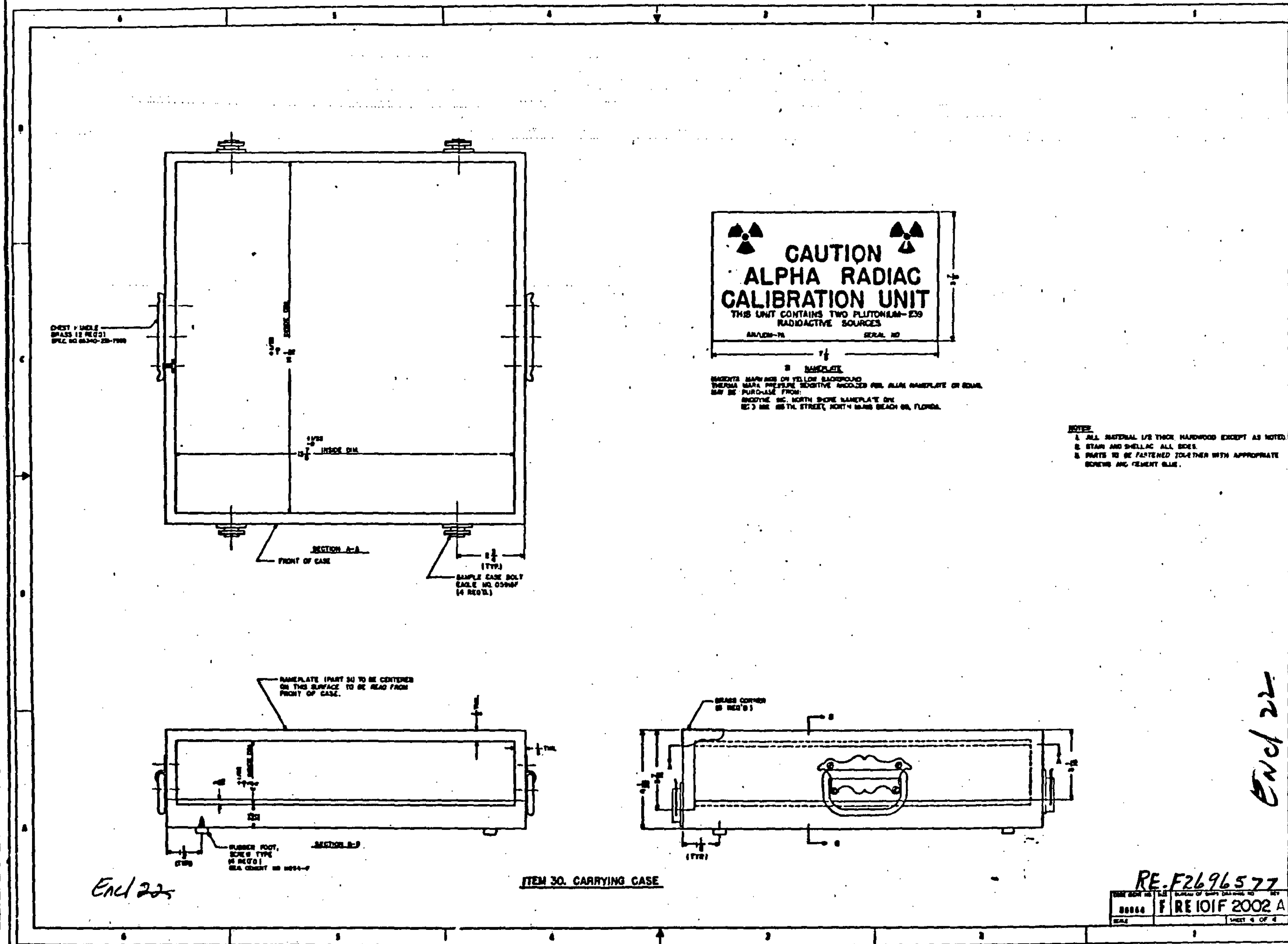
ANODIZE
SYMMETRICAL ABOUT ℄
PC. 1
SEE MATERIAL 2
PC. 2
SEE MATERIAL 2
PC. 3
SEE MATERIAL 2
PC. 4 & 5
SEE MATERIAL 2
PC. 6
SEE MATERIAL 2
PC. 7
SEE MATERIAL 1
PC. 8
SEE MATERIAL 3
PC. 9 & 10
SEE MATERIAL 3
PC. 11
SEE MATERIAL 3
PC. 12
SEE MATERIAL 6
PC. 13
SEE MATERIAL 3
PC. 14
SEE MATERIAL 2
SPOTWELD TO PART 11
ALL SPOTWELDED CONSTRUCTION AS SHOWN.
THIS SURFACE GREY HAMMERTONE FINISH
SLIDING FIT IN GROOVE IN PART 4 & 5
SPOTWELD
FRONT PANEL
SECT. A-A
SECT. B-B
Encl 20
Encl 20
RE-F2696577
RE-F26
RE 101 F 2002 A
RE 101 F 2002


ANODIZE
ANODIZE
PASSIVATE
ANODIZE
PC. 17
SEE MATERIAL 4
COVER
PASSIVATE
PC. 19
SEE MATERIAL 4
PC. 15
SEE MATERIAL 2
PC. 16
SEE MATERIAL 2
PC. 18
SEE MATERIAL 3
NAMEPLATES
DANGER
RADIOACTIVITY
Pu-239
TOTAL ACTIVITY
ACCESSORY DRAWER
DETAIL 23
PU-239 SOURCE A
DETAIL 24
PU-239 SOURCE C
DETAIL 25
ANODIZE
PERFORATED METAL
SYMMETRICAL ABOUT
LOC. APPROX. AS SHOWN
PROBE POSITIONER REMOVE CAREFULLY
DETAIL 27
BLACK MARKINGS ON ALUMINUM BACKGROUND
ATTENUATOR NO.1 REMOVE CAREFULLY WITH TWEEZERS
DETAIL 28
ATTENUATOR NO.2 REMOVE CAREFULLY WITH TWEEZERS
DETAIL 29
DETAIL 26
MAGENTA MARKINGS ON YELLOW BACKGROUND
DETAIL 22
MAGENTA MARKINGS ON YELLOW BACKGROUND APPROX. AS SHOWN
PC. 22-29
ALUM. BRAZED TOGETHER
PC. 20 & 21
Encl 21
Encl 21
RE-F2696577
RE 101 F 2002 A
F

RE 101 F 2002



ITEM 30. CARRYING CASE

MIL-R-51081A(MU)
20 January 1971
SUPERSEDING
MIL-R-51081(CmlC)
29 March 1962

MILITARY SPECIFICATION

RADIOACTIVE SOURCE, COBALT 60, GAMMA, M1A1

1. SCOPE

1.1 This specification covers a capsulated cobalt 60 source.

2. APPLICABLE DOCUMENTS

2.1 Government documents. The following documents of the issue in effect on the date of invitation for bids or request for proposal form a part of this specification to the extent specified herein.

SPECIFICATIONS

MILITARY

MIL-I-6866 - Inspection, Penetrant Method of.
MIL-M-19590 - Marking of Commodities and Containers to Indicate Radioactive Material.

STANDARDS

MILITARY

MIL-STD-129 - Marking for Shipment and Storage.

DRAWINGS

US ARMY MUNITIONS COMMAND

EDGEWOOD ARSENAL

LM 124-10-10 - Radioactive Source, Cobalt 60, Gamma, M1A1.
D150-2-1 - Marking Diagram for Shipping Containers.

(Copies of specifications, standards, drawings, and publications required by suppliers in connection with specific procurement functions should be obtained from the procuring activity or as directed by the contracting officer.)

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2.2 Other publications. The following documents form a part of this specification to the extent specified herein. Unless otherwise indicated, the issue in effect on date of invitation for bids or request for proposal shall apply.

UNIFORM CLASSIFICATION COMMITTEE

Uniform Freight Classification

(Application for copies of these ratings, rules and regulations should be addressed to Uniform Classification Committee, 202 Union Station, 516 West Jackson Boulevard, Chicago, IL 60606.)

CODE OF FEDERAL REGULATIONS

49 CFR 171-179 - Department of Transportation Rules and Regulations for the Transportation of Explosives and Other Dangerous Articles.

(The Department of Transportation regulations are a part of the Code of Federal Regulations available from the Superintendent of Documents, Government Printing Officer, Washington, D.C. 20402. Orders for the above publication should cite "49 CFR 171-179.")

AMERICAN SOCIETY FOR TESTING AND MATERIALS

ASTM STANDARD

D999-68 - Vibration Test for Shipping Containers.

(Application for copies should be addressed to the American Society for Testing and Materials, 1916 Race Street, Philadelphia, PA 19103.)

3. REQUIREMENTS

3.1 Materials and components.

3.1.1 Materials. All materials cited on Drawing LM 124-10-10 or on the subsidiary drawings shall conform to the specification thereon, or to the specific characteristics set forth on the drawings.

3.1.2 Components. All components of the source shall conform to the specifications and drawings listed on Drawing LM 124-10-10 and subsidiary drawings.

3.2 Manufacture and assembly. The radioactive source shall be manufactured and assembled in accordance with C124-10-10.

3.3 Performance.

3.3.1 Activity. The cobalt 60 radioactive source shall have an activity between 103.5 millicuries and 126.5 millicuries (see 3.3.1.1) when tested in accordance with 4.4.4.1.

3.3.1.1 Calibration. The strength (milliroentgens per hour at 1 meter) and the activity (3.3.1) on date of calibration shall have an accuracy of plus or minus 3 percent when tested in accordance with 4.4.4.1. Compliance with this requirement shall be determined while testing for activity (3.3.1).

3.3.1.2 Calibration curve. A calibration curve conforming to figure I shall be furnished with each source. The curve shall be constructed using semi-log graph paper 1 cycle x 12 divisions per inch. The curve and the printing shall be produced using black indelible ink.

3.3.2 Radioactive leakage. The radioactive source shall show no leakage or transfer of radioactive material greater than 5×10^{-4} microcuries after rough handling for 2 hours at a force of at least one times gravity as specified in 4.4.4.2. The source shall be set aside for seven days and retested only for removable activity.

3.3.3 Special form material requirements. The radioactive source shall show no evidence of radioactive leakage (3.3.2), cracks or fissures, and shall not melt or ignite, or undergo a weight change greater than 0.005 percent when subjected to the conditions and tested in accordance with table I (see 4.3.2.1) and 4.3.3.

3.4 Preproduction. Prior to the start of regular production, preproduction samples of radioactive sources and inert sources shall be produced in accordance with this specification for examination and tests (see 4.3).

3.5 Workmanship. The radioactive sources shall be free from cracks, dents, broken chain links or ring, and foreign matter such as grease, oil, or viscous material.

4. QUALITY ASSURANCE PROVISIONS

4.1 Responsibility for inspection.

4.1.1 Supplier's responsibility. Unless otherwise specified in the contract or purchase order, the supplier is responsible for the performance of all inspection requirements as specified herein. Except as otherwise specified in the contract or order, the supplier may use his own or any other facilities suitable for the performance of the inspection requirements specified herein, unless disapproved by the Government. The Government reserves the right to perform any of the inspections set forth in the specification where such inspections are deemed necessary to assure supplies and services conform to specified requirements.

4.1.2 Government's responsibility. The Government will be responsible for performance of the tests in 4.3.3. Samples shall be forwarded to the laboratory designated by the contracting officer.

4.1.3 Objective evidence. The supplier shall provide objective evidence acceptable to the contracting officer that the requirements of 3.1 and section 5 for which specific inspection has not been provided in this specification have been satisfied.

4.2 Classification of inspection. The inspection requirements specified herein are classified as follows:

(a) Preproduction inspection (see 4.3).
(b) Quality conformance inspection (see 4.4).

4.3 Preproduction inspection.

4.3.1 Sample. A preproduction sample of five cobalt 60 radioactive sources and five inert capsules (Dwg C124-10-34) shall be manufactured using the same methods, materials, equipment, and processes as will be used during regular production.

4.3.2 Inspection procedure.

4.3.2.1 For examination and nondestructive tests. Each radioactive source in the preproduction sample shall be examined for the defects listed in the list of defects (4.4.3.2) and tested in accordance with 4.4.4; if any source is found defective the preproduction lot shall be rejected. The five inert capsules and five radioactive sources shall be tested in accordance with table I (see 4.1.2); any radioactive source or inert capsule found defective shall reject the preproduction sample.

Table I - Special form material requirements*

Condition	5 Inert	5 Radioactive	Requirement	Test
Free drop	X	X	3.3.3	4.3.3.1
Leakage		X	3.3.2	4.4.4.2
Dye penetrant	X		3.3.3	4.3.3.6
Percussion	X	X	3.3.3	4.3.3.2
Leakage		X	3.3.2	4.4.4.2
Dye penetrant	X		3.3.3	4.3.3.6
Heating	X	X	3.3.3	4.3.3.3
Leakage		X	3.3.2	4.4.4.2
Dye penetrant	X		3.3.3	4.3.3.6
Immersion	X	X	3.3.3	4.3.3.4
Leakage		X	3.3.2	4.4.4.2
Dye penetrant	X		3.3.3	4.3.3.6
Vibration	X	X	3.3.3	4.3.3.4
Leakage		X	3.3.2	4.4.4.2
Dye penetrant	X		3.3.3	4.3.3.6
Thermal shock	X	X	3.3.3	4.3.3.5
Leakage		X	3.3.2	4.4.4.2
Dye penetrant	X		3.3.3	4.3.3.6

*Note: The samples shall be tested and examined for compliance with 3.3.2 and the applicable part of 3.3.3 in the sequence shown in the table.

4.3.3 Tests. Chains shall be removed from the sources prior to performing these tests. Tests shall be performed as follows:

4.3.3.1 Free drop. Drop the sources through a distance of 30 feet onto a flat unyielding horizontal surface so that the source strikes the surface in such a position as to suffer maximum damage.

4.3.3.2 Percussion. Place the source on a sheet of lead which is not more than 1 inch thick, has a hardness number between 3.5 to 4.5 on the VICKERS scale, and is supported by a smooth unyielding surface. Drop a flat circular end of a 1 inch in diameter steel rod weighing 3 pounds through a distance of 40 inches so that the face of the flat circular end impacts on the source.

4.3.3.3 Heating. Equilibrate the source to a temperature of 1475°F in a muffle furnace and maintain this temperature for a period of 10 minutes.

4.3.3.4 Immersion. Immerse the source for 24 hours in water at room temperature. The water shall be PH6 to PH8 with a maximum conductivity of 10 micromhos per centimeter. Weight before and after test on a balance accurate to 0.001 gram. Record weight change.

4.3.3.5 Thermal shock. Subject the source to a temperature of -40°C for 2 hours. Remove source from the cold environment and immediately subject it to a temperature of +50°C ± 2°C for 2 hours. This procedure shall constitute one complete cycle of the thermal test. Test duration shall be three cycles.

4.3.3.6 Dye penetrant. Apply dye to inert capsules in accordance with MIL-I-6866. Examine the capsules for evidence of any cracks or fissures.

4.4 Quality conformance inspection.

4.4.1 Lotting. A lot shall consist of the radioactive sources produced by one manufacturer, at one plant, from the same materials, and under the same manufacturing conditions.

4.4.2 Sampling.

4.4.2.1 For examination and nondestructive tests. Each source shall be examined and tested in accordance with 4.4.3.

4.4.3 Inspection procedures.

4.4.3.1 For examination and nondestructive tests. Each source shall be examined in accordance with the list of defects (4.4.3.2) and tested in accordance with 4.4.4.

4.4.3.2 List of defects.

(a) Radioactive source, cobalt 60, gamma, M1A1 (Drawing C124-10-10).

1. Marking missing, incorrect, or illegible.
2. Components missing, incorrect, or incorrectly assembled.
3. Calibration curve missing, incorrect, or incomplete (see figure 1).
4. Workmanship (see 3.5).

4.4.4 Tests. Tests shall be conducted as follows:

4.4.4.1 Activity. Determine the calibrated activity and strength of the source with a standard radiation measuring instrument which has been previously calibrated with a cobalt 60 source certified by National Bureau of Standards (see 6.3 and 6.4).

4.4.4.2 Radioactive leakage. Subject the source to a vibration test in accordance with ASTM Method D999-68. However, for this test replace the shipping container by a metal screw-cap container of appropriate size. Place the source within the container and place the container on the specified table. Vibrate the table for 2 hours at a speed that will yield output forces acting on the container equal to at least one times gravity. Remove the source from the container after vibration is complete and wipe all external surfaces with high wet-strength filter paper moistened with distilled water. Allow the filter paper to dry and then determine any contamination present by using a scaler equipped with a scintillation or Geiger-Mueller tubes for counting. Counting equipment shall be capable of detecting 1 x 10^{-4} microcuries of radioactive material on the filter paper. Repeat the wipe test on the source after seven days elasped time.

4.4.5 Acceptance/rejection criteria. If any source fails when examined in accordance with 4.4.3 and tested in accordance with 4.4.4 it shall be rejected.

5. PREPARATION FOR DELIVERY

5.1 Packaging, level C. The radioactive source shall be packaged to afford adequate protection against deterioration and damage in shipment from the supply source to the first receiving activity for immediate use. Packaging shall be in compliance with applicable rules and regulations of Department of Transportation (DOT) and Atomic Energy Commission (AEC).

5.2 Packing, level C. The radioactive sources, packaged as specified in 5.1 shall be packed in accordance with applicable requirements specified in DOT regulation 49 CFR 171-179 to insure carrier acceptance and safe delivery to the first domestic destination. Containers shall comply with Uniform Freight Classification rules or regulations of other carriers applicable to the mode of transportation.

5.3 Marking. In addition to any special marking required by the contract or order, unit packages shall be marked in compliance with DOT regulation 49 CFR 171-179, AEC, MIL-M-19590 and applicable requirements of Drawing D150-2-1.

6. NOTES

6.1 Intended use. The source ocvered by this specification is intended to provide a source of gamma radiation for use in the M3A1.

6.2 Ordering data. Procurement documents should specify the following:

(a) Title, number, and date of this specification.

(1) Time allowed for supplier submission of samples for Government test and evaluation after award of contract.

(2) Name and address of test facility and shipping instructions when testing is performed by the Government.

(3) Time required for the Government to notify the supplier whether or no to proceed with production.

6.3 Instruments. The following instruments have been found to be satisfactory for determining the activity:

Victoreen R Chamber
Landeverik R Meter

6.4 Caution. Care should be exercised to prevent injury to personnel engaged in handling and testing radioactive sources. The National Bureau of Standards handbook (NSB No. 73) and Atomic Energy Commission Regulation 10 CFR 20-40 contain information pertaining to protection of personnel from radioactive emanations.

Custodian:

Army - MU

Preparing activity:

Army - MU(EA)

Project No. 6665-A282

☆ U. S. GOVERNMENT PRINTING OFFICE: 1971-433-695/4276

MIL-R-51080A(MU)
20 January 1971
SUPERSEDING
MIL-R-51080(CmlC)
29 March 1962

MILITARY SPECIFICATION

RADIOACTIVE SOURCE SET, M3A1

1. SCOPE

1.1 This specification covers a portable source of gamma radiation with a remote handling device.

2. APPLICABLE DOCUMENTS

2.1 Government documents. The following documents of the issue in effect on the date of invitation for bids or request for proposal form a part of this specification to the extent specified herein.

SPECIFICATIONS

FEDERAL

QQ-S-781 - Strapping, Steel, Flat and Seals.

STANDARDS

MILITARY

MIL-STD-105 - Sampling Procedures and Tables for Inspection by Attributes.

DRAWINGS

US ARMY MUNITIONS COMMAND

EDGEWOOD ARSENAL

DL124-12-3 - Radioactive Source Set, M3A1.

(Copies of specifications, standards, drawings, and publications required by suppliers in connection with specific procurement functions should be obtained from the procuring activity or as directed by the contracting officer.)

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FSC 6665

2.2 Other publications. The following documents form a part of this specification to the extent specified herein. Unless otherwise indicated, the issue in effect on date of invitation for bids or request for proposal shall apply.

CODE OF FEDERAL REGULATIONS

10 CFR 20-40	-	Atomic Energy Commission.
49 CFR 171-179	-	Department of Transportation Rules and Regulations for the Transportation of Explosives and Other Dangerous Articles.

(The Department of Transportation regulations are a part of the Code of Federal Regulations available from the Superintendent of Documents, Government Printing Office, Washington, D.C. 20402. Orders for the above publication should cite "10 CFR 20-40" or "49 CFR 171-179.")

3. REQUIREMENTS

3.1 Materials and components.

3.1.1 Materials. All materials cited on Drawing DL124-12-3 or on the subsidiary drawings shall conform to the specifications listed thereon, or to the specific characteristics set forth on the drawings.

3.1.2 Components. All components of the source set shall conform to the specifications and drawings listed on Drawing DL124-12-3 and subsidiary drawings.

3.1.2.1 Magnetic handler operation. The magnetic handler shall telescope to under 20 inches and extend at least 72-1/2 inches. The magnet in the handler shall be capable of picking up a steel washer 1-1/2 inches in diameter by 1/16 inch thick to a height of 3 feet and releasing the washer when tested in accordance with 4.4.4.1.

3.2 Manufacture and assembly. The source set shall be manufactured and assembled to conform to Drawing D124-12-3.

3.3 External radiation. The gamma radiation shall not exceed 100 milliroentgens per hour (mr/hr) at any point on any surface of the case of the assembled source set when tested as specified in 4.4.4.2.

3.4 Radioactive contamination. The radioactive source set shall show radioactive contamination no greater than 5×10^{-4} microcuries when tested as specified in 4.4.4.3.

3.5 Preproduction. Prior to the start of regular production, preproduction sample of radioactive source sets shall be produced in accordance with this specification for examination and test (see 4.3).

3.6 Workmanship. The source set shall be free from damage such as broken hardware, or marred or splintered wooden panels; and foreign matter such as grease, oil, or viscous material.

4. QUALITY ASSURANCE PROVISIONS

4.1 Responsibility for inspection.

4.1.1 Supplier's responsibility. Unless otherwise specified in the contract or purchase order, the supplier is responsible for the performance of all inspection requirements as specified herein. Except as otherwise specified in the contract or order, the supplier may use his own or any other facilities suitable for the performance of the inspection requirements specified herein, unless disapproved by the Government. The Government reserves the right to perform any of the inspections set forth in the specification where such inspections are deemed necessary to assure supplies and services conform to specified requirements.

4.1.2 Objective evidence. The supplier shall provide objective evidence acceptable to the contracting officer that the requirements of 3.1 and section 5 for which specific inspection has not been provided in this specification have been satisfied.

4.2 Classification of inspections. The inspection requirements specified herein are classified as follows:

(a) Preproduction inspection (see 4.3).
(b) Quality conformance inspection (see 4.4).

4.3 Preproduction inspection.

4.3.1 Sample. A preproduction sample of three radioactive source sets shall be manufactured using the same methods, materials, equipment, and processes as will be used during regular production.

4.3.2 For examination and nondestructive tests. Sample radioactive source sets shall be examined for all requirements of the drawings and this specification.

4.3.3 Tests. Each set shall be tested in accordance with 4.4.4.

4.3.4 Acceptance/rejection criteria. The radioactive sets shall meet the examinations and tests specified in 4.3.2 and 4.3.3 to be acceptable.

4.4 Quality conformance inspection.

4.4.1 Lotting. A lot shall consist of the source sets produced by one manufacturer, at one plant, from the same materials and under the same manufacturing conditions.

4.4.2 Sampling for examination and nondestructive tests. Sampling shall be conducted in accordance with MIL-STD-105.

4.4.3 Inspection procedures.

4.4.3.1 For examination and nondestructive tests. The source set samples shall be examined and tested in accordance with the classification of defects (4.4.3.3) and MIL-STD-105.

4.4.3.2 Examination for critical defects. Each item in the lot shall be inspected for critical characteristics listed in the classification of defects.

4.4.3.3 Classification of defects.

(a) Radioactive source set, M3A1 (Dwg D124-12-3).

Categories	Defects	Acceptance standards
Critical:		
1	External radiation	4.4.4.2
2	Radioactive contamination	4.4.4.3
3	Source missing	
4	Marking missing, incorrect or incomplete	
Major:	AQL 1.0 percent defective	
101	Component (other than source) missing, incorrect or incorrectly located, or assembled	
102	Hardware nonfunctioning	
103	Calibration curve missing or not coated	
104	Wipe test card missing	
105	Workmanship (see 3.6)	

(b) Magnetic handler, radioactive source, telescoping, M4 (Dwg D124-2-62).

Categories	Defects	Acceptance standards
Critical:		
1	Handler operation	4.4.4.1
Major:	AQL 1.0 percent defective	
101	Protective finish missing or incomplete	
102	Knurl missing or incorrect	
Minor:	AQL 2.5 percent defective	
201	Foreign matter (grease, oil, or viscous material)	

4.4.4 Tests. The tests shall be conducted as follows:

4.4.4.1 Magnetic handler operation. Extend the handler to its maximum position and record the dimension. Pick up a steel washer and release it by turning the control knob. Retract the handler and repeat the preceeding operation twice. The handler shall perform the three operations to be acceptable. Do not turn the knob when in the retracted position.

4.4.4.2 External radiation. Check the external radiation at the surface of the case of the assembled source set using a radiac survey meter previously calibrated with standard cobalt 60 source.

4.4.4.3 Radioactive contamination. Wipe thoroughly all accessible surfaces of the case, magnetic handler and source, with a piece of high wet-strength filter paper moistened with distilled water. Allow the paper to dry and determine the radioactivity present using a scaler equipped with scintillation or Geiger-Muller tubes for counting. Counting equipment shall be capable of detecting 1×10^{-4} microcuries of radioactive material on the filter paper.

5. PREPARATION FOR DELIVERY

5.1 Packing, level A. No overpacking of the source set is required, however, the source set (Dwg D124-12-3) shall be secured with two flat steel straps 1/2 inch by 0.020 inch conforming to type I, class B, grade 2 of QQ-S-781 placed one at each end running girthwise around the case. The straps shall be placed at least one inch in from each edge of the case encompassing the ends (with handles), top and bottom.

5.2 Marking. In addition to any marking required by the contract or order, each item shall be marked in compliance with Department of Transportation and Atomic Energy Commission regulations and Drawing D124-10-14.

6. NOTES

6.1 Intended use. The source set covered by this specification is intended for use as a portable source of gamma radiation for training in radiation measuring and monitoring techniques, and for calibrating radiac instruments in the field.

6.2 Ordering data. Procurement documents should specify the following:

(a) Title, number, and date of this specification.
(b) Preproduction.

(1) Time allowed for supplier submission of samples for Government test and evaluation after award of contract.
(2) Name and address of test facility and shipping instructions when testing is performed by the Government.
(3) Time required for the Government to notify the supplier whether or not to proceed with production.

Custodian:

Army - MU

Preparing activity:

Army - MU(EA)

Project No. 6665-A281

NOTICE - THIS DRAWING IS FOR USE ONLY IN CONNECTION WITH PROCUREMENT BY THE UNITED STATES GOVERNMENT AND SHALL NOT BE USED NOR REPRODUCED EITHER WHOLLY OR IN PART FOR ANY OTHER PURPOSE EXCEPT WHEN SPECIFICALLY AUTHORIZED BY THE CHIEF CHEMICAL OFFICER

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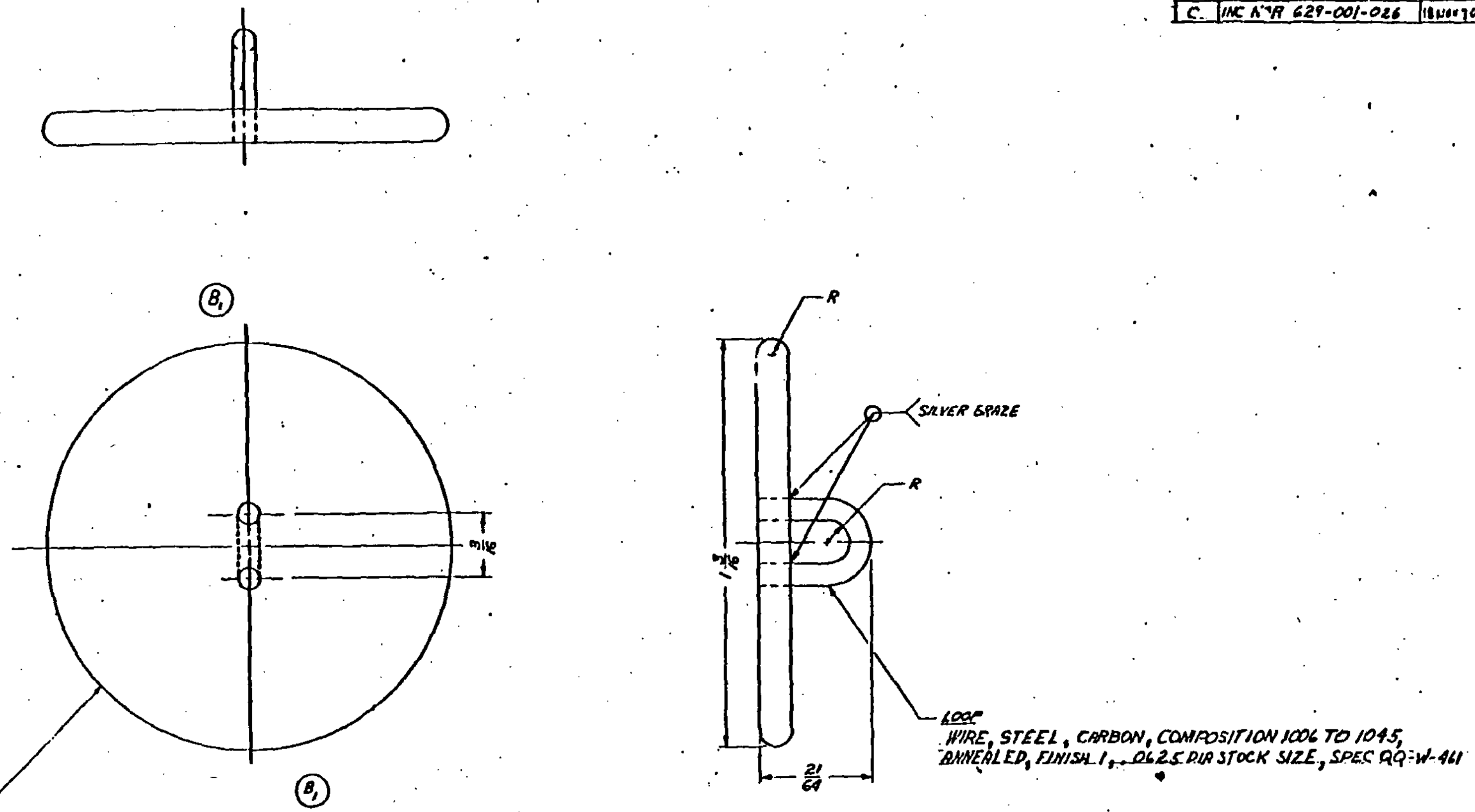
REVISIONS			
SYM	DESCRIPTION	DATE	APPROVAL
A	MATL REWORDED;		
	TOL NOTE ADDED;		
	(0) REMOVED;		
	MIL-STD-171 WAS QQ-P-416	18 SEP 57	CJW
B	1) REMOVED ½, 24/32 DIM		
	2) .060 NOM THK WAS .090		
	3) ADDED NOTE 1	20 MAR 62	[illegible]
C	INC NOR 629-001-026	18 NOV 76	[illegible]



DISC
STEEL SHEET, LOW-CARBON, (HRCQ) OR (CRCQ), .0598 NOM STOCK THICKNESS, SPEC QQ-S-698
(B2) (A)

NOTES:
1. WELDING SYMBOLS, AWS A2.0-58.
2. PROTECTIVE FINISH - FINISH NO.1.1.1.1, MIL-STD-171.
3. BRAZE IN ACCORDANCE WITH SPEC MIL-B-7883

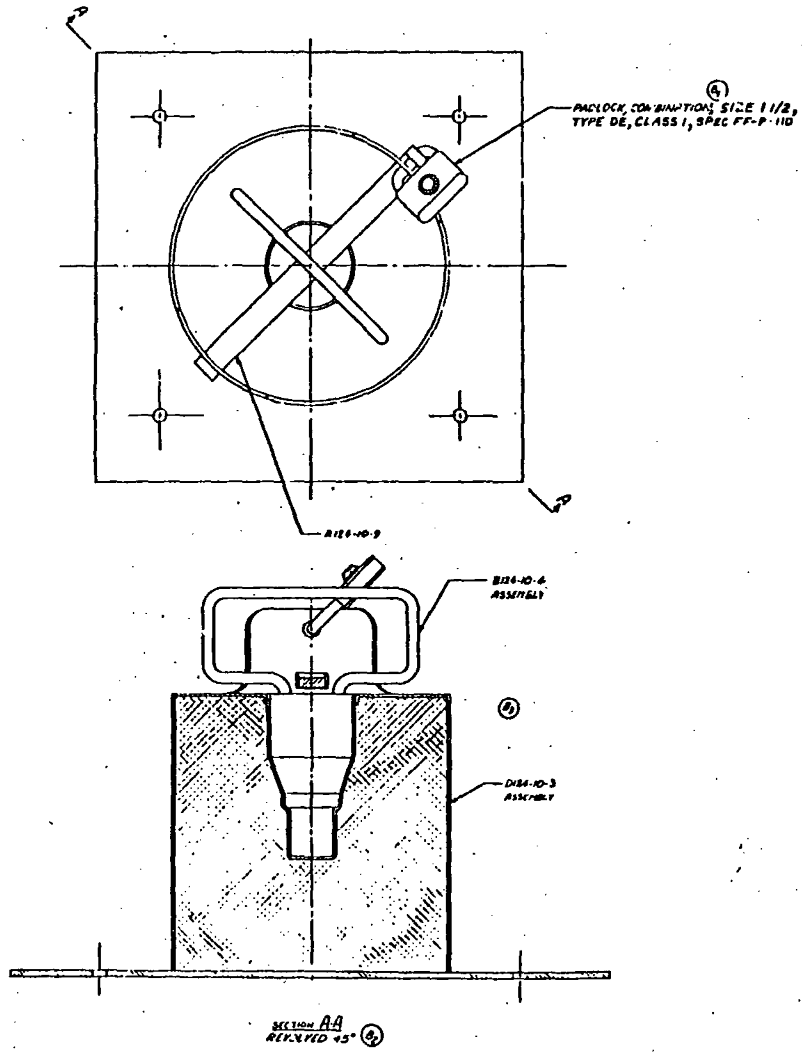
TOLERANCES ON STOCK MATERIAL SIZES SHALL BE AS SPECIFIED IN APPLICABLE SPECIFICATION

629		
END ITEM CODE	REV SYM	FEDERAL STOCK NUMBER

UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES TOLERANCES ON DECIMALS —— FRACTIONS ± 1/64 ANGLES ———	ORIGINAL DATE OF DRAWING 4 FEB 1955 DRAFTSMAN JPA — CHECKER W.W.L. TRACER — CHECKER ENGINEER W.T.L. — ENGINEER	RADIOLOGICAL EQUIPMENT SOURCE, RADIOACTIVE DISC ASSEMBLY AND DETAIL		DEPT OF THE ARMY CHEMICAL CORPS ARMY CHEMICAL CENTER, MD
APPLICATION NEXT ASSY: C124-10-10 — NEXT ASSY:	SUBMITTED: [signature] CHIEF, PRODUCT DIVISION SECT APPROVED: BY ORDER OF CH CML OFFICER [signature] CHIEF DESIGN BR	SCALE 1/1	STOCK NUMBER	SIZE C — C124-10-13
				CODE 81361

Encl 29

REVISIONS			
SYM	DESCRIPTION	DATE	APPROVED
A	[illegible]		
	[illegible]		
	[illegible]		
	[illegible]	[illegible]	[illegible]
B	[illegible]		
	[illegible]		
	[illegible] REVOLVED 45°.		
	PICTURE CHANGES TO AGREE		
	WITH DETAIL DWGS		
	[illegible]	[illegible]	[illegible]
C	[illegible]	[illegible]	[illegible]



(A) PROTECTIVE FINISH
SYSTEM NO [illegible] COLOR GRAY
NO. 36251, MIL-STD-171
TO ALL OUTSIDE SURFACES. DO
NOT PAINT WITHIN OPENING

RADIOLOGICAL EQUIPMENT
SOURCE, [illegible]
SHIELD
ASSEMBLY

16 APR 1955

CHEMICAL CORPS

SCALE 3/4

D C124-0-2

D-22

D124-0-2

MILITARY SPECIFICATION

RADIOACTIVE TEST SAMPLE, KRYPTON 85, MX7338/PDR-27R

1. SCOPE

1.1 This specification covers one type of radioactive source encased in a copper capsule then sealed in a small aluminum rod.

2. APPLICABLE DOCUMENTS

2.1 Government documents. The following documents of the issue in effect on the date of invitation for bids or request for proposal form a part of this specification to the extent specified herein:

SPECIFICATIONS

FEDERAL

PPP-B-601 - Boxes, Wood, Cleated Plywood.
PPP-B-676 - Boxes, Set-Up, Paperboard.
PPP-C-843 - Cushioning Material, Cellulosic.
PPP-F-320 - Fiberboard, Corrugated and Solid, Sheet Stock, (Container Grade) and Cut Shapes.

MILITARY

MIL-P-116 - Preservation, Methods of.
MIL-M-19590 - Marking of Commodities and Containers to Indicate Radioactive Material.

STANDARDS

MILITARY

MIL-STD-105 - Sampling Procedures and Tables for Inspection by Attributes.
MIL-STD-129 - Marking for Shipment and Storage.

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DRAWINGS

US ARMY MUNITIONS COMMAND

EDGEWOOD ARSENAL

DL124-12-6 - Radioactive Test Sample, Krypton 85, MX7338/PDR-27R.
D150-2-1 - Marking Diagram for Shipping Containers.

(Copies of specifications, standards, drawings, and publications required by suppliers in connection with specific procurement functions should be obtained from the procuring activity or as directed by the contracting officer.)

2.2 Other publications. The following documents form a part of this specification to the extent specified herein. Unless otherwise indicated, the issue in effect on date of invitation for bids or request for proposal shall apply.

UNIFORM CLASSIFICATION COMMITTEE

Uniform Freight Classification

(Application for copies of these ratings, rules and regulations should be addressed to Uniform Classification Committee, 202 Union Station, 516 West Jackson Boulevard, Chicago, Illinois 60606.)

CODE OF FEDERAL REGULATIONS

49 CFR 171-179 - Department of Transportation Rules and Regulations for the Transportation of Explosives and Other Dangerous Articles.

(The Department of Transportation regulations are a part of the Code of Federal Regulations available from the Superintendent of Documents, Government Printing Officer, Washington, D. C. 20402. Orders for the above publication should cite "49 CFR 171-179.")

3. REQUIREMENTS

3.1 Materials and components.

3.1.1 Materials. All materials cited on Drawing DL124-12-6 or on subsidiary drawings shall conform to the specifications listed thereon or to the specific characteristics set forth on the drawing.

3.1.2 Components. All components cited on Drawing DL124-12-6 or on subsidiary drawings shall conform to the specifications listed thereon or to the specific characteristics set forth on the drawing.

3.1.2.1 Radiation source. The source of radiation shall consist of 5 millicuries ± 10 percent of Krypton 85, hermetically sealed in a copper capsule as specified on Drawing B124-12-8.

3.1.2.2 Hermetic seal. The capsule shall show no evidence of air leakage when submerged in a constant temperature bath as specified in 4.4.4.1.

3.2 Manufacture and assembly. The radioactive test sample shall be assembled in accordance with Drawing C124-12-6.

3.3 Activity. The radioactive test sample shall have an activity of 5 millicuries ± 10 percent when tested as specified in 4.4.4.2.

3.4 Mechanical shock. The activity of the radioactive test sample shall not vary more than ± 5 percent from the initial activity after being subjected to the drop test as specified in 4.4.4.3.

3.5 Thermal shock. The activity of the radioactive test sample shall not vary more than ± 5 percent from the initial activity after being subjected to three cycles of thermal shock as specified in 4.3.3.1.

3.6 Preproduction. Prior to the start of regular production, preproduction samples of the radioactive test sample shall be produced in accordance with this specification for examination and test (see 4.3.)

3.7 Workmanship. The radioactive test sample shall be free from cracks, dents, burrs, abrasions, faulty seals, and foreign matter (dirt, oil, and viscous material.)

4. QUALITY ASSURANCE PROVISIONS

4.1 Responsibility for inspection.

4.1.1 Supplier's responsibility. Unless otherwise specified in the contract or purchase order, the supplier is responsible for the performance of all inspection requirements as specified herein. Except as otherwise specified in the contract or order, the supplier may use his own or any other facilities suitable for the performance of the inspection requirements specified herein, unless disapproved by the Government. The Government reserves the right to perform any of the inspections set forth in the specification where such inspections are deemed necessary to assure supplies and services conform to specified requirements.

4.1.2 Objective evidence. The supplier shall provide objective evidence acceptable to the contracting officer that the requirements of 3.1 and section 5 for which specific inspection has not been provided in this specification have been satisfied.

4.2 Classification of inspections. The inspection requirements specified herein are classified as follows:

(a) Preproduction inspection (see 4.3).
(b) Quality conformance inspection (see 4.4).

4.3 Preproduction inspection.

4.3.1 Sample. A preproduction sample of 50 radioactive test samples shall be manufactured using the same methods, materials, equipment, and processes as will be used during regular production.

4.3.2 Inspection procedure.

4.3.2.1 For examination and nondestructive tests. Each radioactive test sample shall be examined and tested for all requirements of the applicable drawings and this specification. Tests shall be performed in accordance with the number and sequence in Table I.

Table I. Preproduction Test Sequence

Item	Drawing	Sample size	Test
Capsule, Krypton 85	B124-12-8	50	Hermetic seal 4.4.4.1
Assembled Test Source	C124-12-6	50	Activity 4.4.4.2
Assembled Test Source	C124-12-6	25	Mechnical Shock 4.4.4.3
Assembled Test Source	C124-12-6	25	Thermal Shock 4.3.3.1

4.3.3 Tests.

4.3.3.1 Thermal shock. The 25 radioactive test samples from the 50 preproduction samples shall be subjected to a temperature of $-40^{\circ}C \pm 2^{\circ}C$ for 2 hours. At the end of the 2 hour period the test samples shall be subjected to a temperature of $+50^{\circ}C \pm 2^{\circ}C$ for 2 hours. This procedure shall constitute one complete cycle of the thermal test. Three continuous cycles shall be performed. Upon completing the last cycle, the activity shall be determined in accordance with 4.4.4.2.

4.3.4 Acceptance/rejection criteria. The acceptance number for all tests shall be zero.

4.4 Quality conformance inspection.

4.4.1 Lotting. A lot shall consist of the radioactive test samples (Drawing C124-12-6) produced by one manufacturer, at one plant, from the same materials, and under essentially the same manufacturing conditions.

4.4.2 Sampling.

4.4.2.1 For examination and nondestructive tests. Sampling shall be conducted in accordance with MIL-STD-105.

4.4.2.2 For mechanical shock. Sampling shall be conducted in accordance with MIL-STD-105, level S-3 and an AQL of 1.0 percent.

4.4.3 Inspection procedure.

4.4.3.1 For examination and nondestructive tests. The sample items and the level A preparation for delivery shall be examined and tested in accordance with the classification of defects and with MIL-STD-105.

4.4.3.2 For mechanical shock. Sample items shall be tested in accordance with 4.4.4.3 and with MIL-STD-105, level S-3 using an AQL of 1.0 percent defective for acceptance.

4.4.3.3 For critical defects. Each item in the lot shall be inspected for critical characteristics in the classification of defects.

4.4.3.4 Classification of defects.

(a) Radioactive test sample, Drawing C124-12-6.

Categories	Defects	Acceptance standard
Critical:		
1	Activity	4.4.4.2
2	Color missing from radioactive end	
3	Marking missing, illegible, incorrect or incomplete	
Major:	AQL 1.0 percent defective	
101	Body dimensions	
102	Body not properly sealed	
103	Chain missing	
104	Incorrect chain length	
105	Tag not firmly attached to sample	
106	Workmanship (see 3.7)	

(b) Capsule, Drawing B124-12-8.

Categories	Defects	Acceptance standard
Critical:		
1	Hermetic seal	4.4.4.1
Major:		
101	Length 1.203	

4.4.3.4 Classification of defects (continued)

(c) Preparation for delivery (section 5).

Categories	Defects
Critical:	
1	Marking of unit or shipping container illegible, incorrect, incomplete or not durable
Major:	AQL 1.0 percent defective
101	Unit or shipping container not as specified
102	Quantity of samples per unit or shipping container not as specified or indicated
103	Closure of unit or shipping container not as specified
104	Unit or shipping container damaged
105	Cushioning of shipping container not as specified

4.4.4 Tests.

4.4.4.1 Hermetic seal. Submerge each capsule (Drawing B124-12-8) for a minimum of 60 seconds in a suitable constant temperature bath such as glycerine heated to 150 ± 5°F. A steady stream or recurrent sucession of bubbles from the end of the capsule shall indicate leakage.

4.4.4.2 Activity. The radioactive test sample (Drawing C124-12-6) shall be tested for activity using a calibrated scintillation or Geiger-Mueller probe connected to a scaler or spectrometer. Each radioactive test sample shall be numbered and the activity level recorded (initial reading).

4.4.4.3 Mechanical shock. The radioactive test sample (Drawing C124-12-6) shall be tested by dropping from a height of 4 feet and impacting on a steel surface. Each radioactive test sample shall be dropped six times then subjected to the activity test 4.4.4.2 and the results recorded.

5. PREPARATION FOR DELIVERY

5.1 Packaging.

5.1.1 Level A. Radioactive test samples shall be individually packaged, method IC-3 of MIL-P-116, in a paperboard box, of optional type and class, conforming to PPP-B-676. The test sample shall be sufficiently cushioned to fill all voids with material conforming to PPP-C-843.

5.1.2 Level C. The radioactive test samples shall be packaged to afford adequate protection against deterioration and damage from the supply source to the first receiving activity for immediate use.

5.2 Packing.

5.2.1 Level A. Radioactive test samples, packaged as specified in 5.1.1, shall be packed in a quantity not to exceed the applicable requirement specified in Department of Transportation (DOT) regulations 49CFR 171-179 in a cleated plywood box conforming to overseas type, style J of PPP-B-601, for a type 2 average load. Unless otherwise specified, the plywood shall be provided with water repellent preservative treatment as specified in PPP-B-601, in addition, wood cleats shall be immersed for a minimum of three minutes in the same preservative as that specified for the plywood (see 6.2). Each inside face of the wood box shall be lined with fiberboard sheets conforming to grade W5c of PPP-F-320. Additional sheets shall be added as required to assure a tight pack. Boxes shall be closed and strapped using galvanized strapping as specified in the appendix to PPP-B-601.

5.2.2 Level C. Radioactive test samples, packaged as specified in 5.1.2, shall be packed in accordance with applicable requirements specified in DOT regulation 49 CFR 171-179 to insure carrier acceptance and safe delivery to the first domestic destination. Containers shall comply with Uniform Freight Classification rules or regulations of other carriers applicable to the mode of transportation.

5.3 Marking. In addition to any special marking required by the contract or order, unit packages shall be marked in accordance with MIL-STD-129, DOT regulation 49 CFR 171-179 and MIL-M-19590. Shipping containers shall be marked as shown on Drawing D150-2-1.

6. NOTES

6.1 Intended use. The radioactive test samples covered by this specification are intended to provide a radiation source that permits the operator to ascertain the operating condition of AN/PDR 27 radiac set when no known radiation field is available.

6.2 Ordering data. Procurement documents should specify the following:

(a) The title, number, and date of this specification.
(b) Level of packaging and packing required.
(c) Quantity required in each shipping container.
(d) When wood preservative is not required on shipping container.

6.3 Caution. Care should be exercised to prevent injury to personnel engaged in handling and testing radioactive sources. The National Bureau of Standards handbook (NBS No. 73) and Atomic Energy Commission Regulation 10 CFR 20-40 contain information pertaining to protection of personnel from radioactive emanations.

Custodian:

Army - MU

Preparing activity:

Army - MU (EA)

Project No. 6665-A217

☆ U. S. GOVERNMENT PRINTING OFFICE: 1969-341-520/A-7081

ENGINEERING CHANGE PROPOSAL (SHORT FORM)
(SEE MIL-STD-481 FOR INSTRUCTIONS)

DATE PREPARED	ECP NO.	PROCURING ACTIVITY NO.
27 MAR 1970	212-006	

1. ORIGINATOR NAME AND ADDRESS	2. MFR. CODE	3. CLASS OF ECP	4. JUST. CODE	5. PRIORITY
Def Dev & Engr Lab Pdn & Maint Engr Lab				

6. SPECIFICATIONS AFFECTED		7. DRAWINGS AFFECTED		
MFR. CODE	SPECIFICATION/DOCUMENT NO.	MFR. CODE	NUMBER	REV.
	MIL-R-51305			

8. TITLE OF CHANGE

Revision to Specification

9. CONTRACT NO. & LINE ITEM

DAAA15-70-C-0062

10. CONFIGURATION ITEM NOMENCLATURE

Radioactive Test Sample, Kr 85, MX-7338

11. IN PRODUCTION

[X] YES [ ] NO

12. NAME OF PART OR LOWEST ASSEMBLY AFFECTED

Military Specification

13. PART NO. OR TYPE DESIGNATION

MIL-R-51305

14. DESCRIPTION OF CHANGE

For details to changes see attached DD Form 1695, Notice of Revision.
Changes occurr in the following paragraphs: 3.1.2.2
3.3
4.4.3.4
4.4.4.1
4.4.4.2

15. NEED FOR CHANGE

To improve the radioactive leakage test procedure, to assure a better quality end item and to clarify method of determining end item effective activity.

CONCURRENCE: Joseph Mandel
~~for~~ LOUIS VALCARENGHI, QA Engr

16. EFFECT ON ASSOCIATED EQUIPMENT

None

17. PRODUCTION EFFECTIVITY BY SERIAL NO.	18. EFFECT ON PRODUCTION DELIVERY SCHEDULE
All items	None

19. RECOMMENDED RETROFIT EFFECTIVITY	20. ESTIMATED KIT DELIVERY SCHEDULE
N/A	N/A

21. ESTIMATED COSTS/SAVINGS

None

22. SUBMITTING ACTIVITY AUTHORIZING SIGNATURE	TITLE	
MICHAEL J. SCHUMCHYK M J Schumchyk	Production Engineer	26 Mar 70

23. APPROVAL/DISAPPROVAL

GOVERNMENT ACTIVITY	SIGNATURE	DATE

DD FORM 1 DEC 68 1693 D-15360

Ord I

NOTICE OF REVISION (NOR)
(SEE MIL-STD-480 FOR INSTRUCTIONS)

This revision described below has been authorized for the document listed.

1. ORIGINATOR NAME AND ADDRESS	DATE	MFR. CODE	NOR. NO.
Def Dev & Engr Lab Pdn & Maint Engr Lab	27 MAR 1970		212-006-001

2. TITLE OF DOCUMENT	3. MFR. CODE	4. DOCUMENT NUMBER	
Military Specification		MIL-R-51305	
	5. REVISION LETTER (CURRENT)	(NEW)	6. ECP NO. 212-006

7. CONFIGURATION ITEM (OR SYSTEM) TO WHICH ECP APPLIES

Radioactive Test Sample, Kr 85, MX-7338

8. DESCRIPTION OF REVISION

a. Change Para 3.1.2.2 to read as follows: Radioactive Leakage. The capsule shall show no evidence of radioactive leakage when tested as specified in 4.4.4.1.

b. Change Para 3.3 to read as follows: Activity. The radioactive test sample shall have an effective activity of 5 millicuries $\pm$ 10 percent, corrected for copper and aluminum radiation attenuation, when tested as specified in 4.4.4.2.

c. Para4.4.3.4(b) Critical defect No. 1 - Delete "Hermetic seal" and add "Radioactive leakage".

d. Change Para 4.4.4.1 to read as follows: Radioactive Leakage. Each capsule (Drawing B124-12-8) shall be placed in a small volume container and tightly sealed. Subject the container to a 2 hour vibration test in accordance with ASTM Method D999 in such a manner that the speed of vibration will yield output forces acting on the container equal to one times gravity. Set the container aside for a 6 day period. At the end of the 6 day period, break the containment seal and sample the entrapped air for the presence of radioactive leakage using a suitable calibrated survey meter.

e. Change Para 4.4.4.2 to read as follows: Activity. The radioactive test sample (Drawing C124-12-6) shall be tested for effective activity using a calibrated scintillation probe connected to a scaler or spectrometer. Correct the activity readings for copper and aluminum radiation attenuation. Each radioactive test sample shall be numbered and the activity level recorded (initial reading).

9. THIS SECTION FOR GOVERNMENT USE ONLY

A. CHECK ONE

[X] EXISTING DOCUMENT SUPPLEMENTED BY THIS NOR MAY BE USED IN MANUFACTURE.

[ ] REVISED DOCUMENT MUST BE RECEIVED BEFORE MANUFACTURER MAY INCORPORATE THIS CHANGE.

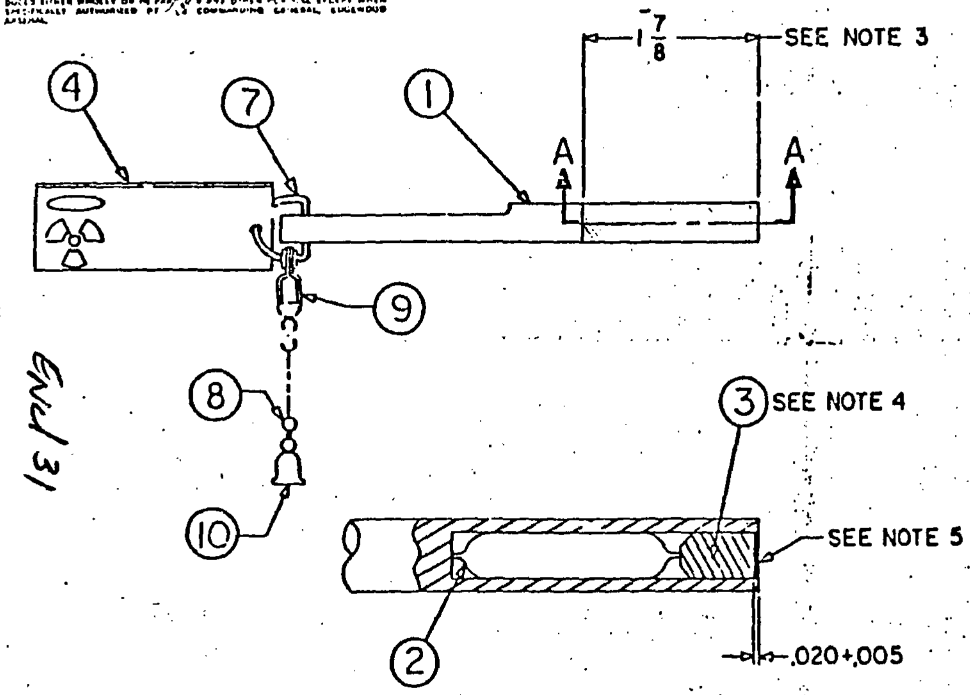
[ ] CUSTODIAN OF MASTER DOCUMENT SHALL MAKE ABOVE REVISION AND FURNISH REVISED DOCUMENT TO:

B. ACTIVITY AUTHORIZED TO APPROVE CHANGE FOR GOVERNMENT	SIGNATURE AND TITLE	DATE
Def Dev & Engr Lab, Pdn & Maint Engr Lab	M. J. Schumchyk MICHAEL J. SCHUMCHYK, Pdn Engr	26 Mar
10. ACTIVITY ACCOMPLISHING REVISION	REVISION COMPLETED (SIGNATURE)	DATE

DD FORM 1 DEC 68 1695

LTR	DESCRIPTION	DATE	APPROVED
A	EO 212-1 INC.	3	[illegible]
B	N.O.R. 212-00[illegible] 1 INC.	1	[illegible]
C	INC NOR 212-0[illegible]	27AUG69	[illegible]

End/31



SECTION A-A
SCALE 2/1

NOTES:

1. THIS DRAWING SHALL BE INTERPRETED IN ACCORDANCE WITH APPLICABLE STANDARDS LISTED IN MIL SPEC MIL-D1000
2. THE FOLLOWING ARE MANDATORY WHEN INDICATED BY ■
   - ☐ REMOVE BURRS ☐ BREAK SHARP EDGES .010 MAX
   - ☐ FILLETS .010 MAX R.
   - ☐ "V ALL OVER, EXCEPT AS NOTED
   - ☐ DIMENSIONS APPLY AFTER PLATING
   - ☐ TOLERANCES ON STOCK MATERIAL SIZES, SHALL BE AS SPECIFIED IN APPLICABLE SPECIFICATIONS.
3. APPLY ITEM 5 FOR DISTANCE INDICATED
4. APPLY ITEM 6 AROUND ITEM 3 AND PRESS FIT ITEM 3 INTO ITEM 1.
5. SEAL ASSEMBLY WITH ITEM 6. SEALED END OF ASSEMBLY SHALL BE FREE OF EXCESS EPOXY RESIN AND SMOOTH.
6. FOR LEAKAGE TEST AND ADDITIONAL REQUIREMENTS SEE END ITEM SPEC MIL-R-51309.
7. BALL CHAIN MFG CO. INC
   741 S. FULTON AVE.
   MOUNT VERNON, NEW YORK, 10550

QTY REQD	DRAWING OR PART NO.	NOMENCLATURE	MATERIAL	SPECIFICATION	ITEM NO
1		RETAINING SLEEVE-PART NO. 10SL (HOLE SIZE FOR SLEEVE .221) 45 LBS MINIMUM PULL		SEE NOTE 7	
1		COUPLING-PART NO. 1CA (.188+.015 HOLE DIA)		SEE NOTE 7	9
1		CHAIN PART NO. 10 (CARBON STEEL, NICKEL PLATED) LENGTH 24 INCHES ± 1/2		SEE NOTE 7	
1		RING, DEE, CLASS 2, SIZE 9/16 X 7/16 X .0625 NOM THK, CAD OR ZINC PLATED		MIL-R-3390	7
- -		ANODIC COATING		MIL-A-8625	
- -		ADHESIVE, EPOXY RESIN, TYPE I		MIL-A-8623	
- -		LACQUER, ACRYLIC, COLOR PURPLE		MIL-L-81352	
1	B124-12-10	IDENTIFICATION TAG			
1	B124-12-9	PLUG			
1	B124-12-8	CAPSULE			
1	B124-12-7	BODY			

LIST OF MATERIALS

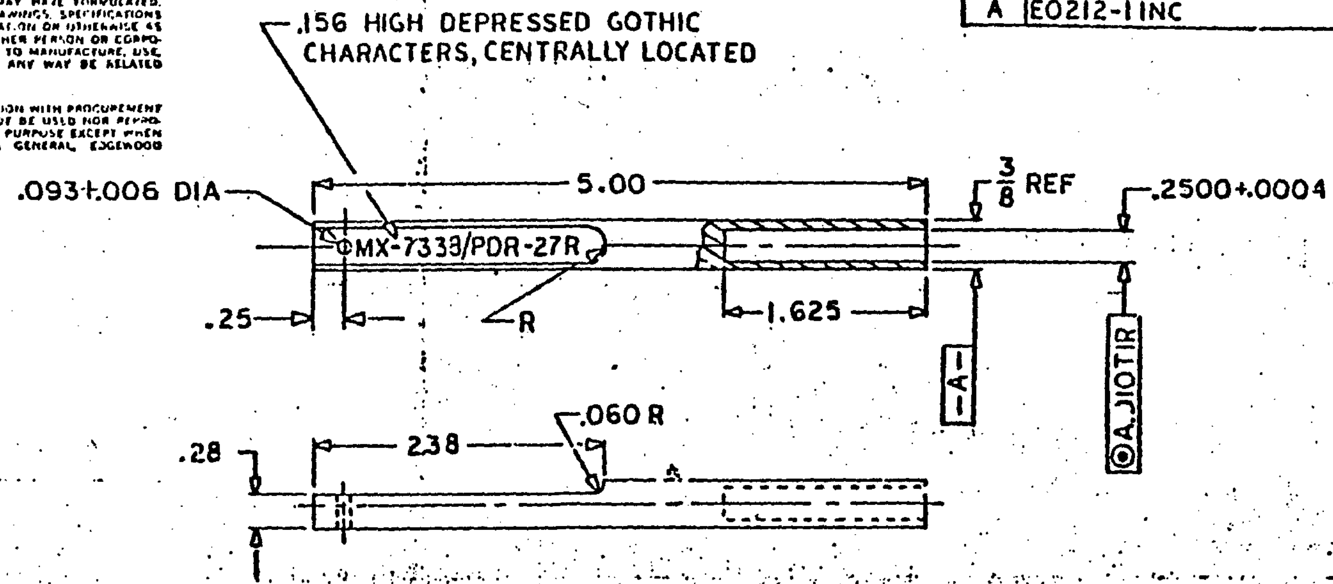
APPLICATION	UNLESS OTHERWISE SPECIFIED		
NEXT ASSY	DIMENSIONS ARE IN INCHES TOLERANCES ON: 2 PLACE DECIMALS ± .04 3 PLACE DECIMALS ± .010 FRACTIONS ± 1/16 ANGLES ± 0°30'	ORIGINAL DATE OF DRAWING 28 APR 1968 DRAFTSMAN R.L.B. CHECKED [signature] SUBMITTED [signature] APPROVED [signature] APPROVED BY ORDER OF CO [signature]	DEPT OF THE ARMY U S. ARMY EDGEWOOD ARSENAL EDGEWOOD ARSENAL, MARYLAND
DL124-12-6	MATERIAL		RADIOACTIVE TEST SAMPLE MX7338 / PDR-27R
END ITEM CODE NO. 212			CODE IDENT NO. 81361 SIZE C C124-12-6 SCALE 1/1 SHEET

NOTICE: WHEN GOVERNMENT DRAWINGS, SPECIFICATIONS, OR OTHER DATA ARE USED FOR ANY PURPOSE OTHER THAN IN CONNECTION WITH A DEFINITELY RELATED GOVERNMENT PROCUREMENT OPERATION, THE UNITED STATES GOVERNMENT THEREBY INCURS NO RESPONSIBILITY NOR ANY OBLIGATION WHATSOEVER; AND THE FACT THAT THE GOVERNMENT MAY HAVE FORMULATED, FURNISHED, OR IN ANY WAY SUPPLIED THE SAID DRAWINGS, SPECIFICATIONS OR OTHER DATA IS NOT TO BE REGARDED BY IMPLICATION OR OTHERWISE AS IN ANY MANNER LICENSING THE HOLDER OR ANY OTHER PERSON OR CORPORATION, OR CONVEYING ANY RIGHTS OR PERMISSION TO MANUFACTURE, USE, OR SELL ANY PATENTED INVENTION THAT MAY IN ANY WAY BE RELATED THERETO.

NOTICE: THIS DRAWING IS FOR USE ONLY IN CONNECTION WITH PROCUREMENT BY THE UNITED STATES GOVERNMENT AND SHALL NOT BE USED NOR REPRODUCED EITHER WHOLLY OR IN PART FOR ANY OTHER PURPOSE EXCEPT WHEN SPECIFICALLY AUTHORIZED BY THE COMMANDING GENERAL, EDGEWOOD ARSENAL.

End 32

REVISIONS			
LTR	DESCRIPTION	DATE	APPR
A	E0212-1 INC	2AU668	



ALUMINUM ALLOY BAR, COLD FINISHED, 6061, T6, 3/8 DIA STOCK SIZE, SPEC QQ-A-225/8

NOTES:

1. THIS DRAWING SHALL BE INTERPRETED IN ACCORDANCE WITH APPLICABLE STANDARDS LISTED IN MIL SPEC MIL-D-1000
2. THE FOLLOWING ARE MANDATORY WHEN INDICATED BY ■
   - ■ REMOVE BURRS ■ BREAK SHARP EDGES .010 MAX
   - □ FILLETS .010 MAX R.
   - □ ALL OVER EXCEPT AS NOTED
   - □ DIMENSIONS APPLY AFTER PLATING
   - □ TOLERANCES ON STOCK MATERIAL SIZES SHALL BE AS SPECIFIED IN APPLICABLE SPECIFICATIONS.
3. SURFACE TREATMENT FINISH NO. 7.1.1 OR 7.2.1, MIL-STD-171 TO OUTSIDE SURFACES

C124-12-6	212
NEXT ASSY	CODE NO.
APPLICATION	

UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES
TOLERANCES ON:
2 PLACE DECIMALS ± .01
3 PLACE DECIMALS ± .010
FRACTIONS ± 1/16
ANGLES ± 0°30'

MATERIAL
SEE ABOVE

ORIGINAL DATE OF DRAWING 28 APR 1968
DRAFTSMAN RLE | CHECKER VG | GR LEADER
SUBMITTED Carlo de Rosa
APPROVED J. Schwechyk
APPROVED BY ORDER OF CG A. Horowitz

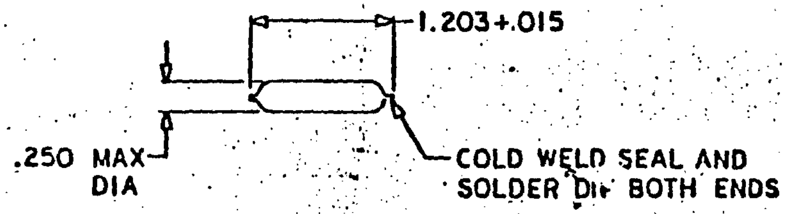
DEPT OF THE ARMY
U.S. ARMY EDGEWOOD ARSENAL
EDGEWOOD ARSENAL, MARYLAND

BODY

CODE IDENT NO. 81361 | SIZE B | B124-12-7
SCALE 1/1 | SHEET

REVISIONS			
LTR	DESCRIPTION	DATE	APPROVAL

Encl 33



Kr 85 SAMPLE (5 MILLICURIES)
IN 3/16 OD × .030 WALL COPPER TUBE

PART MAY BE PROCURED FROM:
U.S. NUCLEAR CORP.
POST OFFICE BOX 208, 801 NORTH LAKE ST., BURBANK CALIFORNIA, 91503
PART NO. 3113

NOTES:

1. THIS DRAWING SHALL BE INTERPRETED IN ACCORDANCE WITH APPLICABLE STANDARDS LISTED IN MIL-SPEC MIL-D-1000.
2. THE FOLLOWING ARE MANDATORY WHEN INDICATED BY ☒
   - ☐ REMOVE BURRS ☐ BREAK SHARP EDGES .010 MAX
   - ☐ FILLETS .010 MAX R.
   - ☐ 125 ALL OVER, EXCEPT AS NOTED
   - ☐ DIMENSIONS APPLY AFTER PLATING
   - ☐ TOLERANCES ON STOCK MATERIAL SIZES SHALL BE AS SPECIFIED IN APPLICABLE SPECIFICATIONS.
3. FOR LEAKAGE TEST AND ADDITIONAL REQUIREMENTS SEE END ITEM SPEC MIL-R-51305.

SPECIFICATION CONTROL DRAWING

C124-12-6 (NEXT ASSY)	212 (CODE NO.)	UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES. TOLERANCES ON: 2 PLACE DECIMALS ± .04; 3 PLACE DECIMALS ± .010; FRACTIONS ± 1/16; ANGLES ± 0°30'	ORIGINAL DATE OF DRAWING 29 APR 1969; DRAFTSMAN RLE; CHECKER VG; GR LEADER	DEPT OF THE ARMY U.S. ARMY EDGEWOOD ARSENAL EDGEWOOD ARSENAL, MARYLAND
APPLICATION		MATERIAL: SEE ABOVE	SUBMITTED [signature]; APPROVED [signature]; APPROVED BY ORDER OF CO [signature]	CAPSULE
				CODE IDENT NO. 81361; SIZE B; B124-12-8; SCALE 1/1; SHEET

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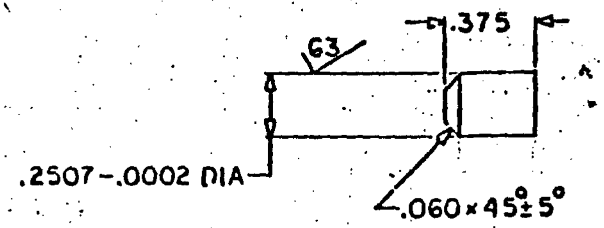
NOTICE: THIS DRAWING IS FOR USE ONLY IN CONNECTION WITH PROCUREMENT BY THE UNITED STATES GOVERNMENT AND SHALL NOT BE USED NOR REPRODUCED EITHER WHOLLY OR IN PART FOR ANY OTHER PURPOSE EXCEPT WHEN SPECIFICALLY AUTHORIZED BY THE COMMANDING GENERAL, EDGEWOOD ARSENAL.

Encl 34

REVISIONS		
LTR	DESCRIPTION	DATE



ALUMINUM ALLOY BAR, COLD FINISHED, 6061, T6, SPEC QQ-A-225/8

NOTES:

1. THIS DRAWING SHALL BE INTERPRETED IN ACCORDANCE WITH APPLICABLE STANDARDS LISTED IN MIL SPEC MIL-D-1000.
2. THE FOLLOWING ARE MANDATORY WHEN INDICATED BY ■
   - ■ REMOVE BURRS ■ BREAK SHARP EDGES .010 MAX
   - ☐ FILLETS .010 MAX R.
   - ■ 125 ALL OVER, EXCEPT AS NOTED
   - ☐ DIMENSIONS APPLY AFTER PLATING
   - ☐ TOLERANCES ON STOCK MATERIAL SIZES, SHALL BE AS SPECIFIED IN APPLICABLE SPECIFICATIONS.

NEXT ASSY	USED ON	
C124-12-6	212	
NEXT ASSY	CODE NO.	
APPLICATION		

UNLESS OTHERWISE SPECIFIED
DIMENSIONS ARE IN INCHES
TOLERANCES ON:
2 PLACE DECIMALS ± .04
3 PLACE DECIMALS ± .010
FRACTIONS ± 1/16
ANGLES ± 0°30'

MATERIAL
SEE ABOVE

ORIGINAL DATE OF DRAWING [illegible]

DRAFTSMAN	CHECKER	GR LEADER
RLE	[illegible]	

SUBMITTED [signature]

APPROVED [signature]

APPROVED BY ORDER OF CG [signature]

DEPT OF THE ARMY
U.S. ARMY EDGEWOOD ARS
EDGEWOOD ARSENAL, MARYLAND

PLUG

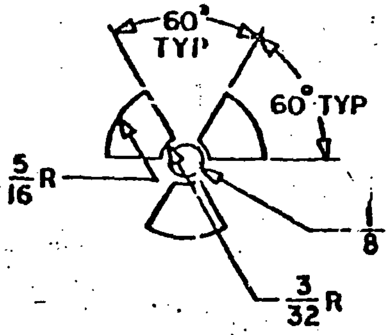
CODE IDENT NO.	SIZE	
81361	B	B124-12-[illegible]
SCALE 2/1		SHEET

[illegible] INC., PHILA.

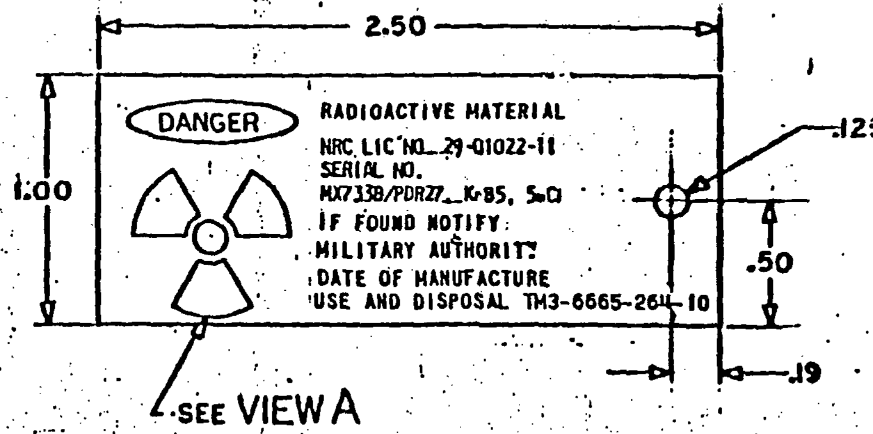
REVISIONS

LTR	DESCRIPTION	DATE	APPR
A	REPLACES 8124-12-10 DATED 26 APR 1968 AND EO 212-1 INC	2 AUG 68	[illegible]
B	N.O.R. 212-003-002 INC	17 [illegible] 69	[illegible]
C	NOR212-009-001 INC.	24 JUL 70	[illegible]

Encl 35



VIEW A



ALUMINUM ALLOY 3003, SHEET, TEMPER 0, .025 NOM THK, SPEC QQ-A-250/2

NOTES:

1. THIS DRAWING SHALL BE INTERPRETED IN ACCORDANCE WITH APPLICABLE STANDARDS LISTED IN MIL SPEC DOD-D-1000.
2. THE FOLLOWING ARE MANDATORY WHEN INDICATED BY ■
   - ☐ REMOVE BURRS ☐ BREAK SHARP EDGES .010 MAX
   - ☐ FILLETS .010 MAX R.
   - ☐ ~~V ALL OVER, EXCEPT AS NOTED
   - ☐ DIMENSIONS APPLY AFTER PLATING
   - ☐ TOLERANCES ON STOCK MATERIAL SIZES, SHALL BE AS SPECIFIED IN APPLICABLE SPECIFICATIONS.
3. COLORS SHALL BE IN ACCORDANCE WITH FED STD NO. 595, AS FOLLOWS:
   a. BACKGROUND, COLOR YELLOW NO. 23655
   b. LETTERING, COLOR BLACK NO. 27038
   c. SYMBOLS, COLOR MAGENTA NO. 27142
4. ALL LETTERING SHALL BE ENGRAVED OR HOT STAMPED.
5. ALL MARKING SHALL BE LOCATED APPROXIMATELY AS SHOWN.

NOTES CONTINUED:

6. IDENTIFICATION TAG SHALL CONFORM TO SPEC MIL-M-19590.

C124-12-6	212
NEXT ASSY	CODE NO.
APPLICATION	

UNLESS OTHERWISE SPECIFIED
DIMENSIONS ARE IN INCHES
TOLERANCES ON:
2 PLACE DECIMALS ± .01
3 PLACE DECIMALS ± .010
FRACTIONS ± 1/16
ANGLES ± 0°30'

MATERIAL
SEE ABOVE

ORIGINAL DATE OF DRAWING 26APR1958
DRAFTSMAN: V.B. CHECKER: Verig ENG LEADER:
SUBMITTED: [signature]
APPROVED: [signature]
APPROVED BY ORDER OF CG: [signature] FOR A.N. HEARNE

U.S. ARMY EDGEWOOD ARSENAL
DEPT OF THE ARMY
EDGEWOOD ARSENAL, MARYLAND

IDENTIFICATION TAG

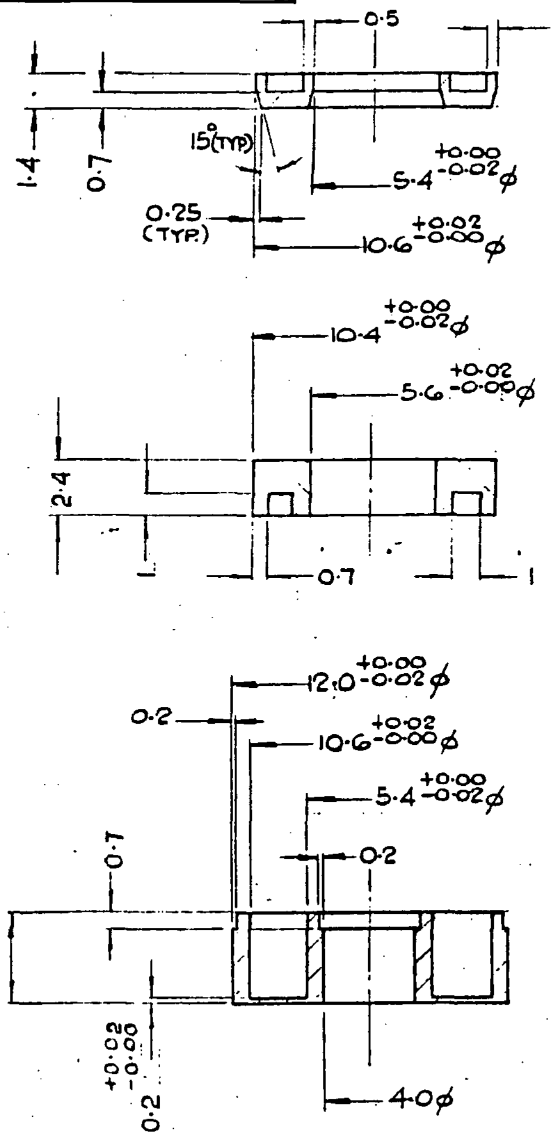
CODE IDENT NO. 81361 SIZE B 8124-12-10
SCALE 2/1

USED ON

ARC 10048

DRG. No. ARC 10040/S

THIRD ANGLE PROJECTION



(1) LID
MAT: ST STL
EN 58J

(2) INSERT
MAT: HEAVY ALLOY

(3) BODY
MAT: ST STL
EN 58J

NOT FOR PUBLICATION
THE INFORMATION ON THIS DRAWING IS NOT TO BE COMMUNICATED EITHER DIRECTLY OR INDIRECTLY TO THE PRESS OR TO ANY PERSON NOT AUTHORISED TO RECEIVE IT.

JOB No.

PROJECT No.

MATERIAL & SPEC: SEE DRG

FINISH: CLEAN

SURFACE TEXTURE: ∇ UNLESS STATED

REMOVE ALL BURRS

DRAWN: RADAK

TCD.

CHKD.

APPD.

DIMS. IN MILLIMETRES

SCALE 4:1

TOLERANCES — UNLESS STATED ± 0·05

ISSUE	DATE	D.O.I./MOD
B	6-6-72	
A	27-4-72	

THE RADIOCHEMICAL CENTRE
AMERSHAM BUCKS

CONTRACTOR

TITLE: ANNULAR PRIMARY SOURCE FOR VARIABLE ENERGY X-RAY DEVICE

DRG. No. ARC 10040/S

U.D.O.

Encl 36

USED ON

DRG. No. ARC 10048

THIRD ANGLE PROJECTION

USED WITH
RC 10040

NOT FOR PUBLICATION
THE INFORMATION ON THIS DRAWING IS NOT TO BE COMMUNICATED EITHER DIRECTLY OR INDIRECTLY TO THE PRESS OR TO ANY PERSON NOT AUTHORISED TO RECEIVE IT.

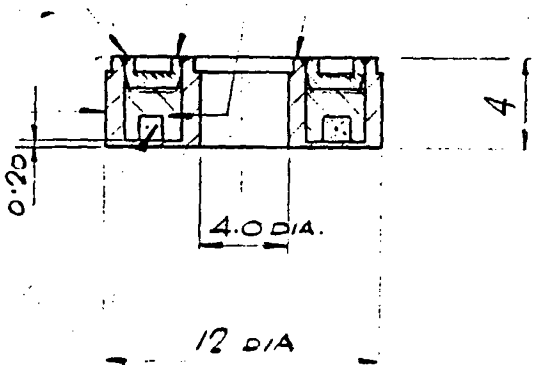
ENGRAVE AMC [ ] SOURCE NO

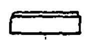
ARGON ARC WELDS

ENGRAVE :-
NUCLIDE ie Am 241
ACTIVITY e.g.
T.R.C.

CERAMIC Am 241

LID MAT'L S. STL En 58J
INSERT MAT'L HEAVY ALLOY
BODY MAT'L ST. STL En 58J





ACTUAL SIZE

FOR DETAIL DRG'S SEE ARC 10040

JOB No.					
PROJECT No.	MATERIAL & SPEC SEE DRG	FINISH CLEAN			
DRAWN HEL	REMOVE ALL BURRS	SURFACE TEXTURE √ UNLESS STATED			
TCD.	DIMS. IN MILLIMETRES	TOLERANCES — UNLESS STATED	B	6·6·72	
			A		
CHKD.	SCALE 4/1		ISSUE	DATE	D.O.I./MOD
APPD.	THE RADIOCHEMICAL CENTRE AMERSHAM BUCKS	CONTRACTOR			
	TITLE ANNULAR PRIMARY SOURCE FOR VARIABLE ENERGY X RAY DEVICE	DRG. No. ARC 10048/S			

U.D.O.

Encl 37

Product specification

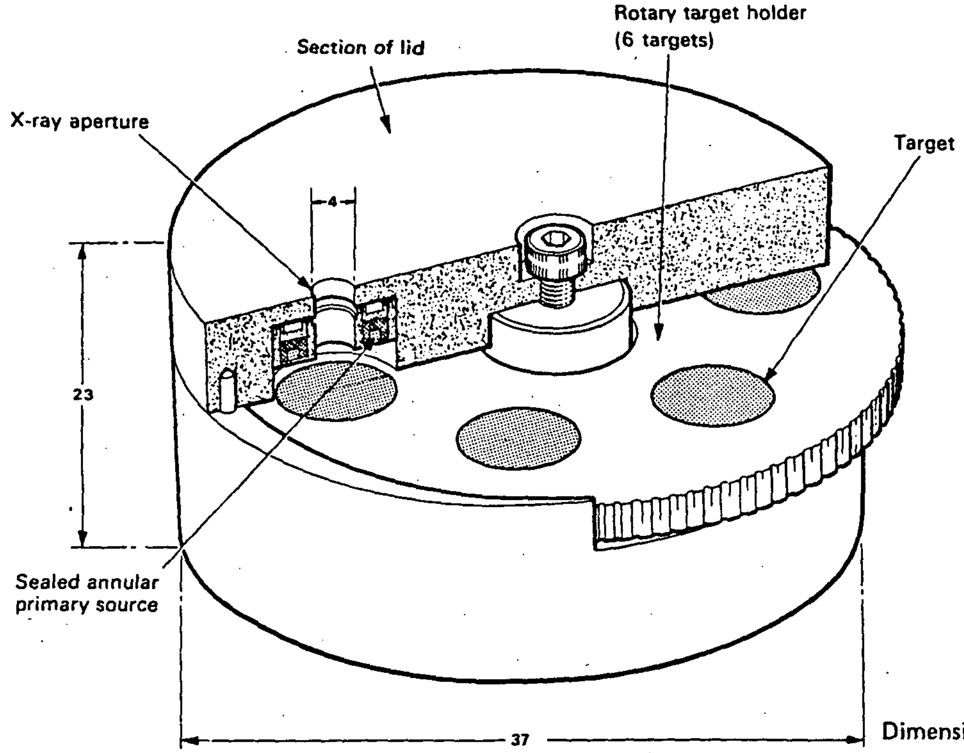
Variable energy X-ray source
code AMC.2084

Data
sheet
11196

SPECIFICATION

Construction:

A compact assembly containing a sealed ceramic primary source which excites characteristic X-rays from six different targets in turn. The annular primary source surrounds the X-ray emission aperture in the fixed part of the stainless steel assembly and the targets are mounted on a rotary holder. Each target can be presented to the primary source in turn and the characteristic X-rays from the target are emitted through the 4mm diameter aperture.



Dimensions in mm

Primary source:

A 10mCi americium-241 source, consisting of a ceramic active component in a welded stainless steel capsule, with integral tungsten alloy rear shielding.

X-ray emission:

Target selected	Energy (keV) [1] K_α	K_β	Photon yield [2] (photons/sec per steradian)
Cu	8.04	8.91	2,500
Rb	13.37	14.97	8,800
Mo	17.44	19.63	24,000
Ag	22.10	24.99	38,000
Ba	32.06	36.55	46,000
Tb	44.23	50.65	76,000

Notes: (1) weighted mean energies.

(2) the photon yield has been determined using a high resolution Si (Li) X-ray spectrometer (the values listed amending those shown in the 1974/5 catalogue); the photon output is highly collimated limiting emission to ~0.5 steradians.

Maximum surface dose rate: (excluding emission aperture where the dose rate will vary with the target in use) $<$0.1mR/h (as measured with type NIS295 gamma dose rate meter which has a flat energy response from 45keV to 2.5MeV.)

Encl 38

Amersham

00-05-00 03:43 T- #131 -06

Amersham International plc
White Lion Road Amersham
Buckinghamshire England HP7 9LL

Telephone Little Chalfont (02404) 4444
cables Activity Amersham telex
telex 83141 ACTIVA G

4

58879

Certificate of radioactive source integrity QCS 592 Issue 1

Title	:	Variable Energy X-Ray Source (V.E.X.)
Assembly code	:	X208
Assembly drawing	:	ARC 10469/S
Nuclide	:	Americium 241 (Am-241)
Radiotoxicity group	:	A
Maximum activity	:	30mCi (1.11 GBq)

CLASSIFICATION : BS/ISO/ANSI77 C64344 (Assessed)

RECOMMENDED WORKING LIFE : 15 Years (see overleaf)

Test sources : No tests were performed. This assessed classification is based on experimental data obtained from tests performed on the V.E.X. primary capsule assembly Code X1146. Drawing number ARC 10048/S. See QCS144 for BS/ISO classification and QCS402 for IAEA special form testing.

Tests carried out in accordance with Recommendation of:

~~BS 5288~~: ~~ISO 2919~~: ~~ANSI N542~~: ~~IAEA Safety Series No 6~~:

Leak test method	TEMPERATURE	PRESSURE	IMPACT	VIBRATION	PUNCTURE	Units

Quality Controller - Sources

Encl 39

D G Hunt

Certificate of radioactive source integrity QCS 144 Issue 3

Title : Low Energy Photon Annular Source (V.E.X. Primary Capsule)

Assembly code : X1146

Assembly drawing : ARC 10048/S

Nuclide : Americium-241 (Am-241)

Radiotoxicity group : A

Maximum activity : 30mCi (1.11 GBq)

CLASSIFICATION : BS/ISO C64344

RECOMMENDED WORKING LIFE : 15 Years (see overleaf)

Test sources : Two active sources serial numbered AMC1847 and AMC1848. Each containing 10 millicuries of Americium-241 as ceramic. Assembled as per drawing number ARC 10048/S Issue B.

Tests carried out in accordance with Recommendation of:

BS.5288: 1976 ISO.2919: 1980(E) ~~ANSI N542~~: ~~IAEA Safety Series No.6~~:

Leak test method	TEMPERATURE	PRESSURE	IMPACT	VIBRATION	PUNCTURE	Units
	6	4	3	4	4	
Immersion (QCR31)	PASS 0.02 0.02	PASS 0.03 0.02	PASS 0.06 0.04	PASS 0.03 0.40	PASS 0.06 0.04	Nanocuries

NOTE: This capsule has also been tested for IAEA special form material approval. See QCS402.

Quality Controller - Sources

D G Hunt
Production Manager - Sources

Encl 40

ISSUED 21 May 1985

EXPIRES 30 April 1988

White Lion ...
Buckinghamshire England HP7 9LL

... cables Activity Amersham telex
telex 83141 ACTIVA G

58879

Certificate of radioactive source integrity QCS 402 Issue 3

Title : Low Energy Photon Annular Source (V.E.X. Primary Capsule)

Assembly code : X1146

Assembly drawing : ARC 10048/S

Nuclide : Americium-241 (Am-241)

Radiotoxicity group : A

Maximum activity : 30mCi (1.11 GBq)

CLASSIFICATION : Special Form

RECOMMENDED WORKING LIFE : 15 Years (see overleaf)

Test sources : One simulated source serial number 1. Containing 5µCi of soluble Caesium-137 chloride. Assembled as per drawing number ARC 10048/S Issue B.

Tests carried out in accordance with Recommendation of:

~~BS 5288~~: ~~ISO 2919~~: ~~ANSI N542~~: IAEA Safety Series No.6: 1973

Leak test method	TEMPERATURE		IMPACT		PERCUSSION	Units
	ISO 6					
Immersion (QCR31)	PASS <0.02		PASS 0.03		PASS 0.08	Nanocuries
Immersion (Para 737)	PASS 0.03		PASS 0.03		PASS 0.03	Nanocuries
Helium Pressurisation (QCR 13)	PASS 3.06×10^{-9}		PASS 2.53×10^{-9}		PASS 4.79×10^{-8}	mbar L sec^{-1}

<u>NOTE</u>: This capusle also has a BS/ISO integrity classification of C64344. See QCS 144.

Quality Controller - Sources

Production Manager - Sources

D G Hunt

Encl 41

ISSUED 21 May 1985

30 April 1988

Reference GB/110/S

Certificate Issue 2

Certificate of Approval
of Design for Special Form Radioactive Material

Title	
Low Energy Photon Annular Source - Capsule X.208	
Drawing Nos and Specification Reference	
ARC 10048/S Issue C ARC 10040/S Issue B RSD/CTR/133 Dated 23 July 1981	
Radioactive Material	**Maximum Activity**
Americium 241	30 mCi

THIS IS TO CERTIFY that the Secretary of State for Transport being, for the purposes of the Regulations of the International Atomic Energy Agency, the Competent Authority of Great Britain in respect of inland surface transport and of the United Kingdom of Great Britain and Northern Ireland in respect of sea and air transport and the Department of the Environment for Northern Ireland being the Competent Authority of Northern Ireland in respect of inland surface transport, have approved the above-mentioned Special Form Design. Radioactive material manufactured to the above-mentioned design qualifies as special form radioactive material and as such will meet the requirements of the regulations overleaf.

This Certificate of Approval applies only to the design as set out in the above named drawings and specifications submitted by Amersham International plc

In the event of any alteration to the above mentioned drawings and specifications or in any of the facts stated in the application for approval, this certificate will cease to have effect unless the Competent Authority is notified of the alteration and the Competent Authority confirms the certificate notwithstanding the alteration.

This Certificate Cancels all Previous Issues and is valid until 31 October 1987

Competent Authority Identification Mark:

GB/110/S

UNITED KINGDOM COMPETENT AUTHORITY FOR THE TRANSPORT
- 8 OCT 1984
OF RADIOACTIVE MATERIALS

Encl 42

D. J. Blackman

pp Transport Radiological Adviser
Department of Transport
2 Marsham Street
London SW1P 3EB

On behalf of the Secretary of State for Transport and the Department of

Technical information

Quality control

Quality control of radiation sources can be divided into two main parts:

1: checks made routinely during production;
2: special tests on prototypes.

Routine checks during production include:

1: tests for leakage and contamination, normally carried out just prior to shipment;
2: checks for activity content or radiation output against production reference standards.

The results of tests for leakage and contamination are given in a TEST REPORT which also includes the result of any routine content or output measurements.

Source dimensions, where these are critical, are also checked.

Special testing of prototypes, see page 98.

Standards for the testing of sealed radioactive sources have been specified by the International Standards Organization, as follows

ANSI.1677 'Sealed radioactive sources—General'
ANSI.2919 'Sealed radioactive sources—Classification'

and
ANSI Technical Report 'Sealed radioactive sources—leak test methods'

Testing for leakage and contamination

Stringent tests for leakage are an essential feature of radioactive sources production. The methods adopted depend on the design and intended application of the source and also on regulatory requirements. Where necessary, tests can be specially modified to meet particular requirements.

The standard methods used for testing radiation sources are listed below. The particular tests used for each type of source are given under the appropriate product entry.

Wipe test A
The source is wiped with a swab or tissue, moistened with ethanol or water; the activity removed is measured. Limit: 0.005μCi.

Wipe test B
The source is wiped with a swab or tissue, moistened with ethanol or water; the activity removed is measured. Limit: 0.05μCi.

Bubble test D
The source is immersed in a suitable liquid (ethanediol) and the pressure in the vessel reduced to 100mm of mercury. No bubbles must be observed.

Immersion test F
The source is immersed in water at 50°C for 8 hours and the activity in the water measured. Limit: 0.05μCi.

Immersion test L
The source is immersed in water at 50°C for 4 hours and the activity in the water measured. Limit: 0.005μCi.

Immersion test M
The source is immersed in water which is raised to 100°C and held at that temperature for 10 min. The water is then removed, the source cooled and rinsed using fresh water. These operations are repeated twice, boiling in the water from the preceding rinsing operation. If the activity detected in all the liquid collected is less than 0.005μCi the source is considered to be leak-free.

Helium mass spectrograph test H
Limit: leak rate of 10^{-8} standard cm^3/sec.

Emanation test K
(scintillation counting test for radon)
The appliance is immersed in a solution of a phosphor in an organic liquid under vacuum; the leakage of radon is measured by liquid scintillation counting.

The limit corresponds to about 5×10^{-11}Ci per 24 hours.

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U. S. ARMY ELECTRONICS RESEARCH & DEVELOPMENT COMMAND

Fort Monmouth, New Jersey

ENGINEERING DIVISION TECHNICAL SUPPORT ACTIVITY

ENVIRONMENTAL TEST REPORT

AMERSHAM CORPORATION, AMERICIUM-241 (AM-241),
VARIABLE ENERGY X-RAY SOURCE

Prepared By

JOHN M. LYNCH

DELSD-E REPORT NO. 86 — 6 SEPTEMBER 1985

Encl 44

NOTICES

DELSD-E REPORT NO. 86 6 September 1985

ENVIRONMENTAL TEST REPORT

AMERSHAM CORPORATION, AMERICIUM-241 (AM-241), VARIABLE ENERGY X-RAY SOURCE

Prepared By
John M. Lynch

Environmental Test Branch
Engineering Division
Technical Support Activity

CONCURRED BY: Howard D. Camp

HOWARD D. CAMP, JR.
Chief, Environmental Test Branch

APPROVED BY: Edward R. Nolan

EDWARD R. NOLAN
Chief, Engineering Division, TSA

U.S. ARMY ELECTRONICS
RESEARCH & DEVELOPMENT COMMAND
FORT MONMOUTH, NEW JERSEY 07703-5301

ENVIRONMENTAL TEST REPORT

AMERSHAM CORPORATION, AMERICIUM-241 (AM-241), VARIABLE ENERGY X-RAY SOURCE

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ENVIRONMENTAL TEST BRANCH
ENGINEERING DIVISION
TECHNICAL SUPPORT ACTIVITY
FORT MONMOUTH, NEW JERSEY 07703-5301

DELSD-EE

DELSD-E REPORT NO. 86

6 September 1985

SUBJECT: Amersham Corporation, Americium-241 (AM-241), Variable Energy X-Ray Source

1. BACKGROUND:

a. The Amersham Corporation Variable Energy X-Ray Source is to be used for the calibration of the PDR-56()/DT-590 X-ray probe. The primary radioactive emissions from this source are Alpha and Gamma radiations. Alpha radiation is considered non-penetrating radiation and therefore, does not present an external radiation hazard to personnel. In contrast, Gamma radiation is considered penetrating radiation and may represent an external radiation hazard if established guidelines are not observed. Safety guidelines were provided by the CECOM Safety Office. These guidelines were followed during handling and testing of the source.

b. These tests were requested by Mr. Joseph Santarsiero of the CECOM Safety Office, Fort Monmouth, New Jersey.

c. An X-ray source was supplied by the CECOM Safety Office for testing.

2. DISCUSSION:

a. These environmental tests were conducted by personnel of the Environmental Test Branch, Technical Support Activity, ERADCOM, Fort Monmouth, New Jersey. The facilities used are located in Bldg. 2704, Charles Wood Area.

b. Contamination testing and testing of the source was conducted by health physics personnel of the CECOM Safety Office.

3. IMMERSION TEST:

a. Test Requirement: The X-ray source shall be immersion proof to a covering depth of 3 feet of water for a period of not less than 2 hours.

b. Test Facility: The X-ray source was tested using the Webber Model WF-27-100+250v Temperature/Altitude Chamber and the Immersion Tank.

c. Test Procedure: The X-ray source was subjected to the test of MIL-STD-810C, Method 512.1, Procedure I. The source was stored at +130°F for 2 hours prior to immersion. After storage at +130°, the source was immediately immersed in water which was at room temperature. Immersion was for 2 hours and was such that the test item was 36" below the surface of the water. The source was then returned to Mr. Santarsiero for performance testing.

d. Test Results: It was reported by Mr. Santarsiero that the immersion test caused no damage or degradation to the X-ray source (see Figure 1, Data Sheet, Appendix A).

4. <u>ALTITUDE TEST:</u>

a. Test Requirement: The X-ray source shall be able to withstand air transportation at altitudes up to 40,000 feet above sea level.

b. Test Facility: The X-ray source was tested using the Webber Model WF-27-100+250v Temperature/Altitude Chamber.

c. Test Procedure: The X-ray source was tested in accordance with MIL-STD-810C, Method 500.1, Procedure I. The X-ray source was installed in the altitude chamber and the pressure in the chamber was decreased at a rate which did not exceed 2,000 feet per minute, until a pressure corresponding to an altitude of 15,000 feet was reached. This pressure was maintained for not less than 1 hour. The pressure was then decreased to that which corresponds to 40,000 feet altitude and maintained for 15 minutes. The chamber was then returned to ambient conditions upon completion of the altitude test.

d. Test Results: It was reported by Mr. Santarsiero that the altitude test caused no damage or degradation to the X-ray source (see Data Sheet, Appendix B).

5. <u>HIGH TEMPERATURE TEST:</u>

a. Test Requirement: The X-ray source shall withstand exposure to ambient air temperatures as high as +160°F.

b. Test Facility: The X-ray source was tested in the Webber Model WF-27-100+250v Temperature/Altitude Chamber.

c. Test Procedure: The X-ray source was tested in accordance with MIL-STD-810C, Method 501.1, Procedure II. The chamber temperature was raised to +120°F and maintained for 6 hours. During the next hour, the chamber was raised to +160°F and maintained for 4 hours. The chamber temperature was then returned to +120°F within a 1 hour time period. The 12 hour cycle described was repeated two additional times for a total of 36 hours. Upon completion, the chamber was returned to ambient conditions.

d. Test Results: It was reported by Mr. Santarsiero that the high temperature test caused no damage or degradation to the X-ray source (see Data Sheet, Appendix C).

6. <u>LOW TEMPERATURE TEST:</u>

a. Test Requirement: The X-ray source shall withstand exposure to ambient air temperatures as low as -60°F.

b. Test Facility: The X-ray source was tested using the Tenney Model TR-16 Temperature Chamber.

c. Test Procedure: The low temperature test was performed in accordance with MIL-STD-810C, Method 502.1, Procedure I. The X-ray source was placed in the temperature chamber and the storage temperature was maintained at -60°F for a period of 24 hours. Upon completion, the chamber was returned to ambient conditions.

d. Test Results: It was reported by Mr. Santarsiero, that the low temperature test caused no damage or degradation to the source (see Data Sheet, Appendix D).

7. VIBRATION TEST:

a. Test Requirement: The equipment shall withstand the vibration environment induced during transportation and handling as a non-military (non-ruggedized) item.

b. Test Facility: The X-ray source was tested on the MB Model C-200 Vibration Exciter (see Figure 2). An L.A.B. horizontal motion slip table was utilized for directions other than vertical. Other equipment used for monitoring the vibration level was an Endevco Model 2735 Charge Amplifier, Hewlett-Packard Model 5451C Fast Fourier Analyzer/Vibration control system, and a Nicolet Model 660B Dual Channel Analyzer.

c. Test Procedure: The vibration test was performed in accordance with MIL-STD-810C, Method 514.2, Procedure I. The vibration level was performed in accordance with Curve M of Figure 514.2-3 of MIL-STD-810C. The level was as follows: 5-14 Hz at 0.2 in. Double Amplitude (D.A.), 14-33 Hz at 2 G's peak acceleration, 33-52 Hz at 0.036 in. D.A., 52-2000 Hz at 5 G's peak acceleration. The vibration was applied along each of three mutually perpendicular axes of the test item. The vibration was swept logarithmically, such that a complete cycle (5-2000-5) consumed 36 minutes. The X-ray source was subjected to the cycling test for 3 hours in each axis for a total test time of 9 hours.

d. Test Results: It was reported by CPT Zarick of the CECOM Safety Office that the vibration test caused no damage or degradation to the X-ray source (see Data Sheet, Appendix E).

8. DROP TEST:

a. Test Requirement: The X-ray source shall be capable of withstanding the shocks normally induced by accidental drop of the X-ray source.

b. Test Facility: The X-ray source was tested using the L.A.B. 100 lb. Capacity Drop Tester.

c. Test Procedure: The drop test was performed in accordance with MIL-STD-810C, Method 516.2, Procedure II. The X-ray source was dropped twice on each flat face and eight times on the round surface, twice at each 90° location about the circumference, from a height of 48± 2 inches, for a total of 12 drops onto 2 inch plywood backed with concrete.

d. Test Results: The source was originally dropped in the wooden case (see Figure 3). However, inspection after the second drop revealed that the case had shattered (see Figure 4). The remaining drops were done without the case. It was reported by CPT Zarick that the drop test caused no damge or degradation to the X-ray source (see Data Sheet, Appendix F).

9. SUMMARY:

TEST	PASSED	FAILED
Immersion (MIL-STD-810C, Method 512.1, Procedure I)	x	
Altitude (MIL-STD-810C, Method 500.1, Procedure I)	x	
High Temperature (MIL-STD-810C, Method 501.1, Procedure II)	x	
Low Temperature (MIL-STD-810C, Method 502.1, Procedure I)	x	
Vibration (MIL-STD-810C, Method 514.2, Procedure I)	x	
Drop (MIL-STD-810C, Method 516.2, Procedure II)	x	

10. CONCLUSION: It is concluded that the X-ray source met the immersion, altitude, low and high temperature, vibration, and shock environments of MIL-STD-810C.

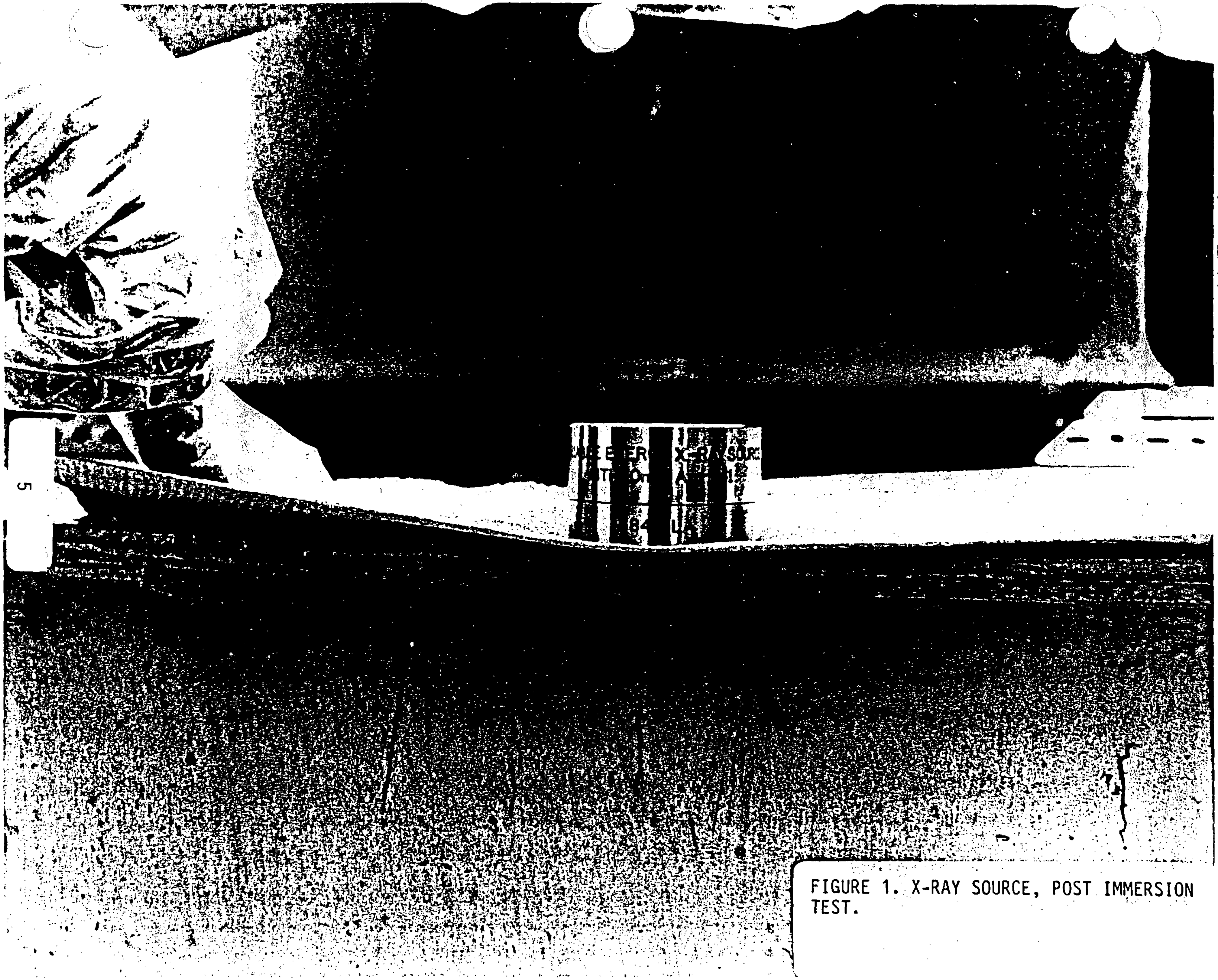


FIGURE 1. X-RAY SOURCE, POST IMMERSION TEST.

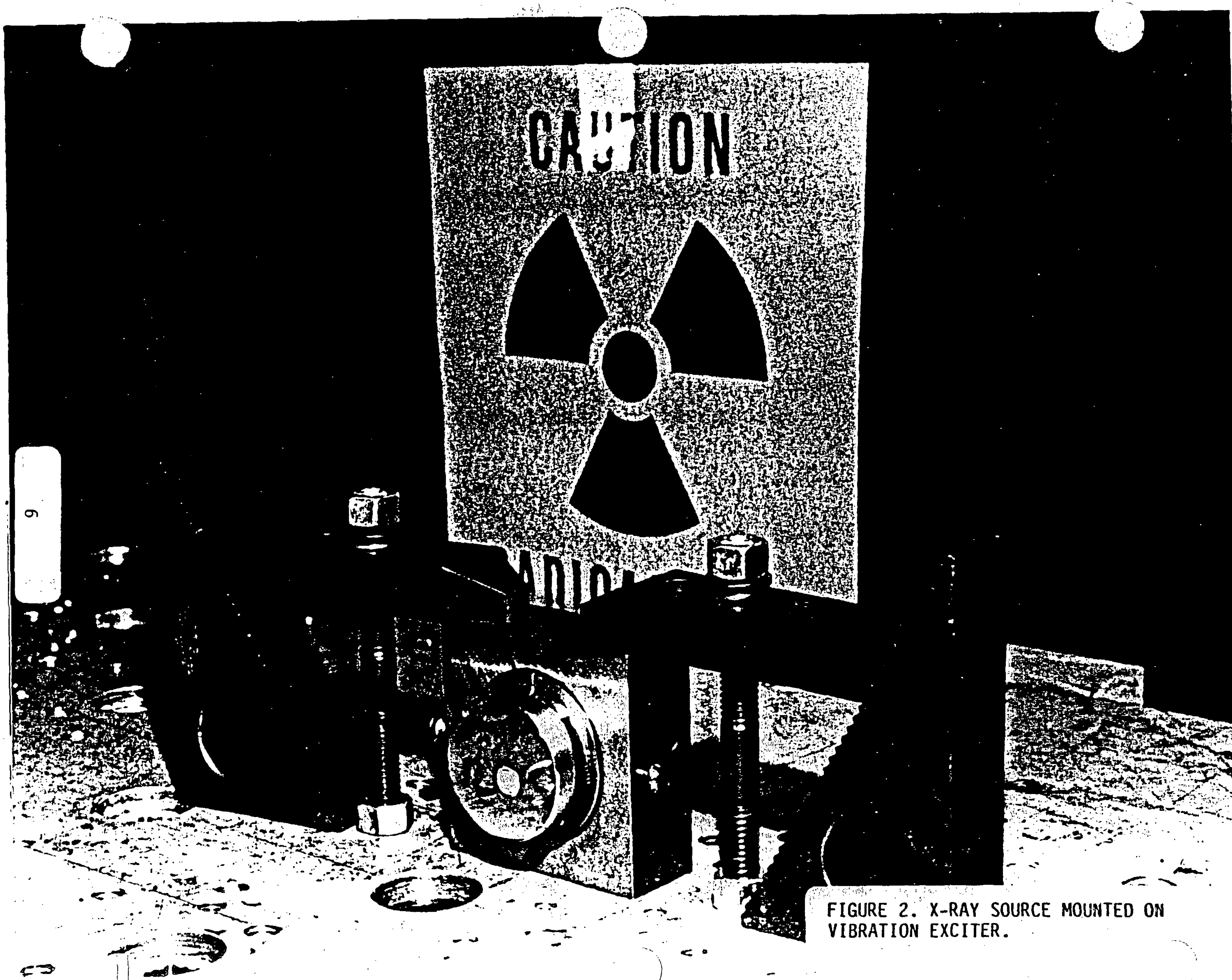


FIGURE 2. X-RAY SOURCE MOUNTED ON VIBRATION EXCITER.

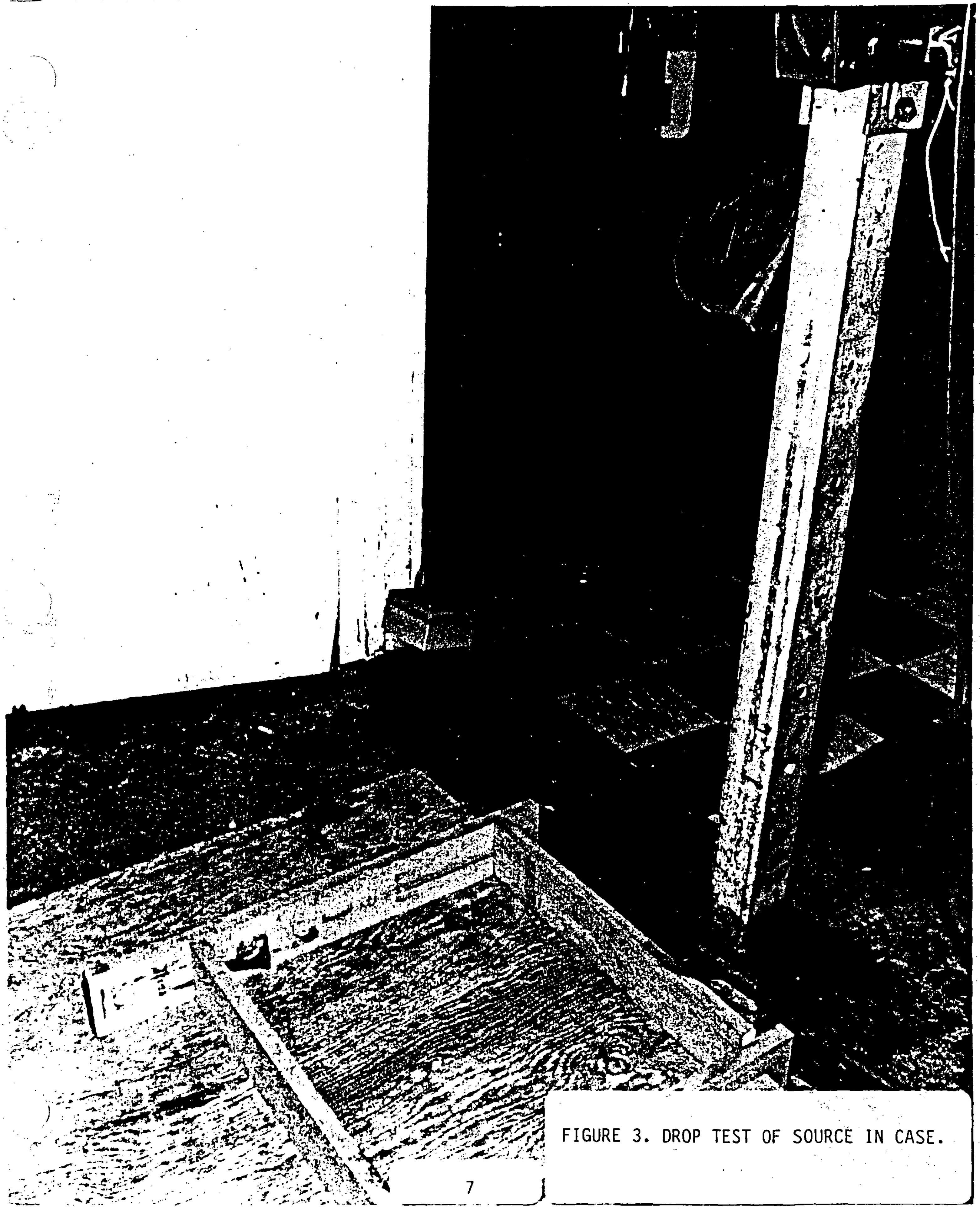


FIGURE 3. DROP TEST OF SOURCE IN CASE.

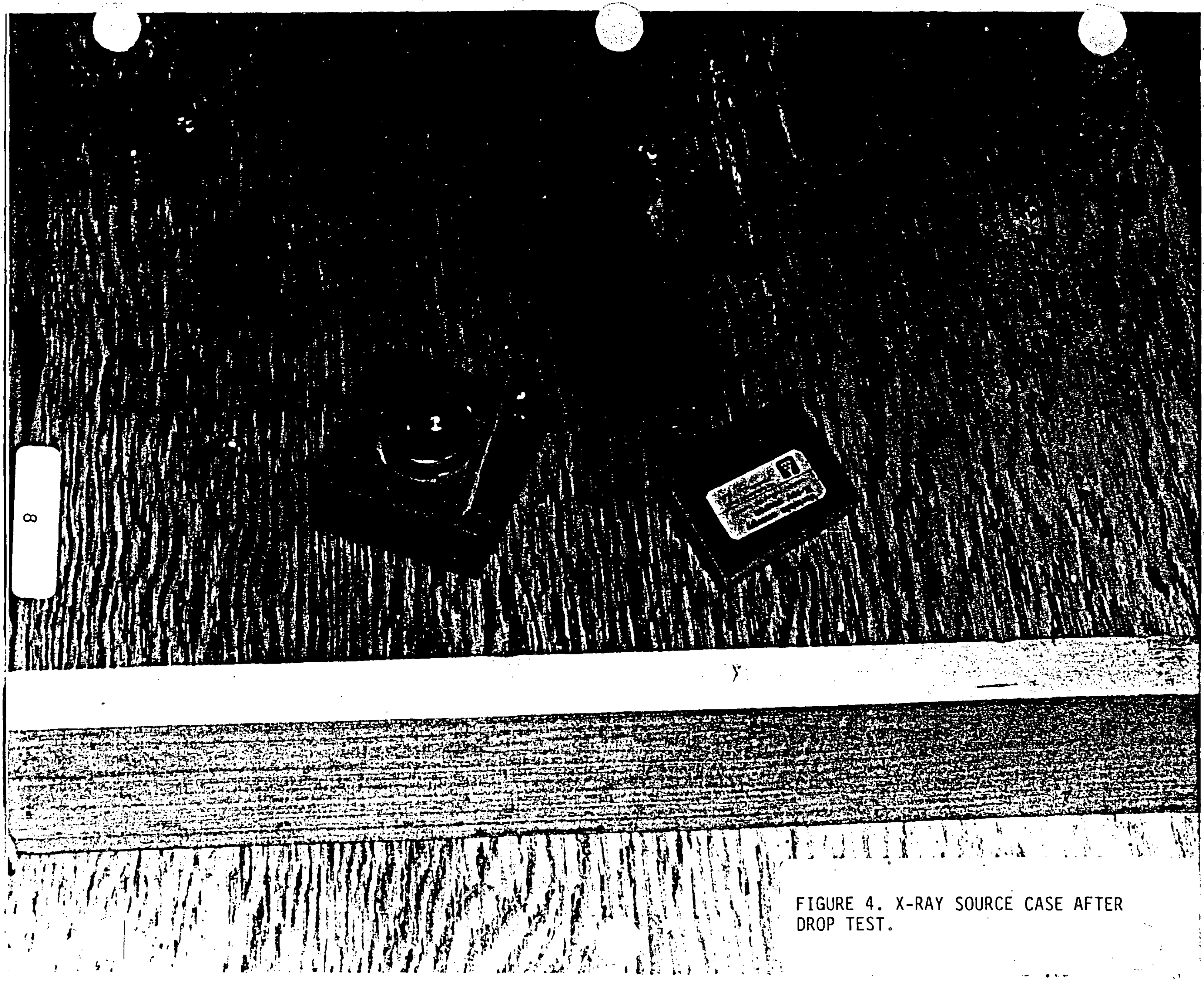


FIGURE 4. X-RAY SOURCE CASE AFTER DROP TEST.

APPENDIX A

IMMERSION TEST DATA SHEET

ENVIRONMENTAL TEST LABORATORY TEST LOG

TEST NO.
DATE 4 JUNE 85 / X54427
CUSTOMER ORGAN. AMSEL-SF-MR
PROJECT ENGINEER J. SANTARSIERO
TEST ENGINEER JOHN LYNCH
TEST TECH. J. CALANDRA, W. FAUST
NOMENCLATURE MODEL VAR. ENERG (XR) SOURCE SERIAL # 3842LA
TEST CONDITIONS LEAKAGE (BASIC IMMERSION) ~~ROOM TEMP~~: MOD-241-
DESCRIPTION PER 810D, METH 5122 PROCED. I,
WATER HEIGHT @ 36" ABOVE TEST ITEM ± 5"
(WATER TEMP 64°F ± 9°F) READINGS @ 30 MIN INTERVALS.

DATE	TIME	EVENT	INITIAL
4 JUNE 85	AM	PRE-TEST DISCUSSION PER HANDLING	PROJ. ENG.
	=	PROCEDURES, PRE & POST TEST	=
4 JUNE 85	0900	AM-241-5 PLACED IN ENVIR. CAB. FOR	WF & JC
	1100	2 HR. PRE TEST SOAK @ +113°F/+45°C	
4 JUNE 85	1105/1303	AM-241-5 REMOVED FROM E.C. &	WF & JC
		POSITIONED IN IMMER. CONTAINER	
		FOR 60 MINS TOT.	
	(@ 30 MIN INTER.)	WATER TEMP. - 63°F, 69°F, 70°F, 70°F, 71.5°F	WF & JC
* 4 JUNE 85	1306	REMOVED FROM IMMER. CYLINDER	WF & JC
		& PLACED SPEC. STORAGE CONTAINER	PROJ. ENG.
4 JUNE 85	1315	IMMER. TK. WATER SAMPLE TAKEN FOR	PROJ. ENG.
		EVAP. TEST @ +212°. TENNEY JR.	-

REMARKS: SEE DATA SHEET NUMBER ______

* Post TEST MATERIALS USED, Collected FOR RADIATION TESTING By PROJ. ENG. - PRIOR TO TEST CONTINUENCE
Post TEST RADIATION SCAN INDICATED NO APPARENT LEAKAGE.

ENVIR. TEST CAB TENNEY JR MODEL TR-16

AMOUNT OF WATER IN CONTAINER - 2000 ML - APPROX 68 OZ

APPENDIX B

ALTITUDE TEST DATA SHEET

ENVIRONMENTAL TEST LABORATORY TEST LOG

TEST NO. DATE 5 JUNE 1985 X54427

CUSTOMER ORGAN. AMSEL-SF-MR PROJECT ENGINEER J. SANTARSIERO

TEST ENGINEER J. LYNCH TEST TECH. J. CALANDRA & W. FAUST

NOMENCLATURE MODEL VAR. ENERGY (XR) SOURCE SERIAL # 3842 LA

TEST CONDITIONS ALTITUDE (LOW PRESS) ~~ROOM TEMP:~~ MOD. 241-

DESCRIPTION MIL STD 810-D, METH 500.2, PROC. I. SECT.
TO +15,000 FT. FOR 1 HR. - & TO 40,000 FT. - LEVEL, TO
SEA LEVEL ON CAM. - (RADIATION CHECK BY PROJ. ENG.)

	DATE	TIME	EVENT	INITIAL
*	5 JUNE 85	0840	MOD 241- PLACED IN ALT. CHAMBER	JC & WF
			& TO +15,000 FT, W/PRE TEST CHECK)	
	5 JUNE 85	0845	CHAMBER @ 15,000 FT & HOLD FOR	JC & WF
		0950	1 HR.-	
	5 JUNE 85	0950	TO- 40,000 FT, STABILIZE 15 MINS-	JC & WF
		1005	TO SEA LEVEL ON CAM.-	
		1040	@ " " —	
	5 JUNE 85	AM	POST CHECK OF CHAMBER INTERIOR	
			CONDUCTED BY PROJ. ENG.,	
			"AREA - CLEAN."	

REMARKS: SEE DATA SHEET NUMBER

*-PRE-CHECK OF CHMBR.

WALLACE & TIERNAN BAROM.
MOD - FA145

ENVIRONMENTAL CHAMBER USED, WEBBER WF27, } ALTITUDE INSTRUMENT BRISTOL, MOD. 1S3A500
RANGE 0 to 100,000 FT.

APPENDIX C

HIGH TEMPERATURE TEST DATA SHEET

ENVIRONMENTAL TEST LABORATORY TEST LOG

TEST NO.
DATE 6-7 JUNE 1985
CUSTOMER ORGAN. AMSEL-SF-MR
PROJECT ENGINEER J. SANTARSIERO
TEST ENGINEER J. LYNCH
TEST TECH. J. CALANDRA
NOMENCLATURE MODEL VAR. ENERGY (XR) SOURCE SERIAL # 3842 LA
TEST CONDITIONS HIGH TEMP 120°/160°F ~~ROOM TEMP~~ MOD.-241
DESCRIPTION PER MIL STD 810D, METH 501.2, PROCED II
+120°F/49°C & +160°F/71°C -2- 12 HR CYCLES, TOT. 24 HRS-

DATE	TIME	EVENT	INITIAL
6 JUNE 85	AM	PRE TEST, RADIATION OF CHAMBER	P.E.-
6 JUNE 85	1110	TO +120°F/49°C HOLD 6 HRS	JC & WF
		TO +160°F/71°C W/IN 1 HR.	
		@ +160°F/71°C HOLD 4 HRS	
		TO +120°F/49°C, W/IN 1 HR	
7 JUNE 85	1100	REPEAT ABOVE 1 ADDIT. 12 HR CYCLE	
		TOT 24 HRS.	
7 JUNE 85	11:10	TO ROOM TEMP.	JC
* 7 JUNE 85		POST TEST CHECK OF CHAMBER INTERIOR	

REMARKS: SEE DATA SHEET NUMBER

* POST TEST RADIATION SCAN OF ENVIR. CHAMBER

ENVIRONMENTAL TEST LAB WEBBER, WF27, HONEYWELL RECORDER MOD 152 14216

APPENDIX D

LOW TEMPERATURE TEST DATA SHEET

ENVIRONMENTAL TEST LABORATORY TEST LOG

TEST NO.

DATE 5 & 6 JUNE 1985

CUSTOMER ORGAN. AMSEL-SF-MR

PROJECT ENGINEER J. SANTARSIERO

TEST ENGINEER J. LYNCH

TEST TECH. J. CALANDRA & W. FAUS

NOMENCLATURE MODEL VAR. ENERGY (XR) SOURCE **SERIAL #** 3842 LA

TEST CONDITIONS LOW TEMP (STORAGE) ~~ROOM TEMP~~ MOD.-241

DESCRIPTION PER MIL STD 810D, METH 502.2, PROCED. I
STORAGE @ -60°F/-51°C

DATE	TIME	EVENT	INITIAL
5 JUNE 85	AM	PRE-TEST, RADIATION OF CHAMBER	P. E.
		AREA, ITEM POSITIONED IN CAB.	
5 JUNE 85	1110	START LOW TEMP TO -60°F/-51°C	WF & JC
"	1130	CHAMBER @ -60°F/-51°C	" "
		24 HR. STORAGE	
6 JUNE 85	1025	TO R/T & PHYSICAL EVALUATION	WF
*	1100	FOR RADIATION LEAKAGE	
		"AREA CLEAR"	

REMARKS: SEE DATA SHEET NUMBER ______

* POST TEST RADIATION CHECK OF INTERIOR OF CHAMBER

ENVIRONMENTAL TEST CAB TENNEY JR. MOD TR-16

APPENDIX E

VIBRATION TEST DATA SHEET

ENVIRONMENTAL TEST LABORATORY TEST LOG

TEST NO. 85-10 **DATE** 10 JUNE [illegible]

CUSTOMER ORGAN. CE[illegible] **PROJECT ENGINEER** Joe [illegible]

TEST ENGINEER Stephen [illegible] John [illegible] **TEST TECH.** [illegible]

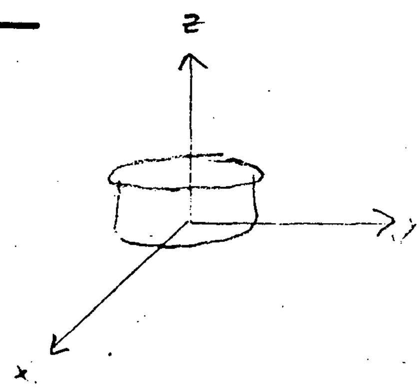
NOMENCLATURE MODEL American X-Ray Source **SERIAL #**

TEST CONDITIONS **ROOM TEMP:** 70°F

DESCRIPTION Variable Energy X-Ray Source; Sine Vibration (...) MIL. STD. 810C

DATE	TIME	EVENT	INITIAL
10 JUNE 85	1000	X AXIS VIBRATION START	
	1300	STOP TEST	
	1430	Y AXIS VIBRATION START TEST	
	1730	STOP	
12 JUNE	0920	Z AXIS VIBRATION START TEST	
	1220	STOP TEST	

REMARKS: SEE DATA SHEET NUMBER __________



APPENDIX F

DROP TEST DATA SHEET

ENVIRONMENTAL TEST LABORATORY TEST LOG

TEST NO.

DATE 13 JUNE 1985 (THURS)

CUSTOMER ORGAN. AMSEL-SF-MR

PROJECT ENGINEER CAPT. ZARICK

TEST ENGINEER JOHN LYNCH

TEST TECH. W. FAUST

NOMENCLATURE MODEL VAR. ENERGY (XR) SOURCE **SERIAL #** 3842 LA

TEST CONDITIONS RM. AMBIENT ~~ROOM TEMP.~~ MOD. -241

DESCRIPTION MIL 810C - DROP TEST W/ & W/O CASE
FROM HEIGHT OF (48" ± 2")
(ALL POSITIONING & HANDLING BY CAPT ZARICK

DATE	TIME	EVENT		INITIAL
13 JUNE 85	1400	INITIAL START OF DROP TEST		JL & WF
			NOTES	
13 JUNE 85	↓	CASED - TOP ↑	OK -	JL & WF
		" —	LID - CRACKED	"
		NO CASE → XRAY PORT		"
		" ↓ "		"
		" ← "		"
		" ↑ "		"
		" → REVERSED	SLIGHT SEAM SEPERATION	"
		" ↓	(NO LEAKAGE)	"
		" ←		"
		" →		"
	↓	" ←	NO LEAKAGE	"
13 JUNE 85	1500	ALL SURFACES, POST TEST, WIPED FOR EVALUATION		

REMARKS: SEE DATA SHEET NUMBER ________________

UNIT DROPPED FROM HEIGHT @ 48" ± 2")
TO PLYWOOD SURFACE ON CONCRETE BASE

PHOTOS TAKEN DURING ENTIRE TESTING —

DEPARTMENT OF THE ARMY
HEADQUARTERS, US ARMY COMMUNICATIONS-ELECTRONICS COMMAND
AND FORT MONMOUTH
FORT MONMOUTH, NEW JERSEY 07703-5000

REPLY TO
ATTENTION OF

AMSEL-SF-MR

6 May 1986

MEMORANDUM FOR RECORD

SUBJECT: Requirements of U.S. Nuclear Regulatory Commission (NRC) License for the AN/UDM-1 Radiac Calibrator Set and Title 10 Chapter 1, Code of Federal Regulations, Parts 19, 20 and 21 (10 CFR Parts 19, 20 and 21)

1. The following information is provided to all users of the AN/UDM-1 Radiac Calibrator Set, thereby satisfying the radiation protection requirements set forth in 10 CFR Parts 19, 20 and 21:

a. Specific instructions on NRC license/regulatory requirements, duties of the Radiation Protection Officer, emergency situations, operating and maintenance instructions, as described in TM 11-1174.

b. Form NRC-3, Notice to Employees, for required posting wherever the calibrator set will be used and/or stored (enclosure 1).

c. Section 206 of the Energy Reorganization Act of 1974 for required posting wherever the calibrator set will be used and/or stored (enclosure 2).

d. As stipulated in 10 CFR Part 21, report of radiac calibrator set defects and noncompliance, as outlined in Section 206 of the Energy Reorganizatin Act of 1974, should be reported through your appropriate radiological command channels to the U.S. Army Communications-Electronics Command (CECOM) Safety Office. Notification shall be made within 24 hours following the identification of defects or noncompliance.

2. In addition, users may request further information relating to the NRC license, license conditions, documents incorporated into the license by reference, and amendments thereto, from Commander, U.S. Army Communications-Electronics Command, ATTN: AMSEL-SF-MR, Fort Monmouth, New Jersey 07703-5024. This is in compliance to paragraph 19.11.b of 10 CFR Part 19. The CECOM Safety Office may be contacted by telephone on Autovon 995-4427 for this purpose.

DEPARTMENT OF THE ARMY
HEADQUARTERS, US ARMY COMMUNICATIONS-ELECTRONICS COMMAND
AND FORT MONMOUTH
FORT MONMOUTH, NEW JERSEY 07703-5000

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AMSEL-SF-MR 6 May 1986

SUBJECT: Requirements of U.S. Nuclear Regulatory Commission (NRC) License for the AN/UDM-1 Radiac Calibrator Set and Title 10, Chapter 1, Code of Federal Regulations, Parts 29, 20 and 21 (10 CFR Parts 19, 20 and 21)

Prepared by: Joseph M Santarsiero
JOSEPH M. SANTARSIERO
Health Physicist

Reviewed by: Barry J Silber
BARRY J. SILBER
C, Radiological Sfty Engrg Br

Approved by: Steven A Horne
STEVEN A. HORNE
Acting Chief, Safety Office

CF: Users of the AN/UDM-1 Radiac Calibrator Set

RECOMMENDED CHANGES TO PUBLICATIONS AND BLANK FORMS

For use of this form, see AR 310-1; the proponent agency is the US Army Adjutant General Center.

Use Part II (reverse) for Repair Parts and Special Tool Lists (RPSTL) and Supply Catalogs/Supply Manuals (SC/SM).

DATE: 5 May 86

TO: (Forward to proponent of publication or form) (Include ZIP Code)
AMSEL-ME-P

FROM: (Activity and location) (Include ZIP Code)
AMSEL-SF-MR

PART I - ALL PUBLICATIONS (EXCEPT RPSTL AND SC/SM) AND BLANK FORMS

PUBLICATION/FORM NUMBER: TM 11-1176

DATE: 21 Apr 55

TITLE: Radiac Calibrator Set AN/UDM-1

ITEM NO.	PAGE NO.	PARA-GRAPH	LINE NO.*	FIGURE NO.	TABLE NO.	RECOMMENDED CHANGES AND REASON (Provide exact wording of recommended change, if possible).
1	iii	1				Delete in its entirety, replace with: "Report of failure of the AN/UDM-1 Radiac Calibrator Set shall be made to the US Army Communications-Electronics Command, ATTN: AMSEL-SF-MR, Ft. Monmouth, NJ 07703-5024, AV 995-4427." Reason: Correct procedure.
2	V	ALL				Delete entire page, change as per attached (Encl 1). Reason: Correct procedures; compliance with NRC requirements
3.	1-3	4	1			Add to the first line: "An audible and/or visual alarm system..." Reason: NRC requirement.
4	1-3	4	2			Change to word..."should"... to ..."shall.." Reason: NRC requirement.
5	2-1	2	6-8			Delete: "Radium...to be 1600 years." Reason: Radium not used in AN/UDM-1, example superfluous
6	3-1	2	6			Delete: .."Bureau of Ships." Add:.."by USACECOM, ATTN: AMSEL-SF-MR, Ft. Monmouth, NJ 07730-5024, AV 995-4427." Reason: Correct point of contact.
7	4-1	1	3 (WARNING STATEMENT)			Change: "...should..." to ..."shall..." Reason: Correct terminology; NRC requirement.
8	4-3				4-1	Omit reference to AN/PDR-8 (all models), AN/PDR-18, AN/PDR-32, AN/PDR-T1B, and IM-7/PD (all models). Reason: Obsolete equipment.

*Reference to line numbers within the paragraph or subparagraph.

TYPED NAME, GRADE OR TITLE: JOSEPH SANTARSIERO, Health Physicist

TELEPHONE EXCHANGE/AUTOVON, PLUS EXTENSION: x54427

SIGNATURE: J M Santarsiero

RECOMMENDED CHANGES TO PUBLICATIONS AND BLANK FORMS

For use of this form, see AR 310-1; the proponent agency is the US Army Adjutant General Center.

Use Part II *(reverse)* for Repair Parts and Special Tool Lists (RPSTL) and Supply Catalogs/Supply Manuals (SC/SM).

DATE

TO: *(Forward to proponent of publication or form) (Include ZIP Code)*

FROM: *(Activity and location) (Include ZIP Code)*

PART I - ALL PUBLICATIONS (EXCEPT RPSTL AND SC/SM) AND BLANK FORMS

PUBLICATION/FORM NUMBER	DATE	TITLE
TM 11-1176	21 Apr 55	Radiac Calibrator Set AN/UDM-1

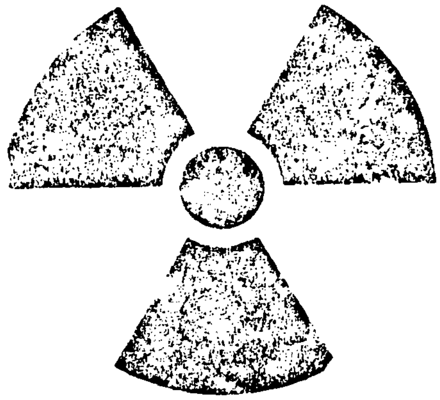
ITEM NO.	PAGE NO.	PARA-GRAPH	LINE NO.*	FIGURE NO.	TABLE NO.	RECOMMENDED CHANGES AND REASON *(Provide exact wording of recommended change, if possible).*
9	5-0	2	1-4			Omit "NOTE...of the latest issue." Reason: Obsolete reference.
10	5-0	3	3 (WARNING STATEMENT)			Delete "...bureau of Ships..." Add: "USACECOM, ATTN: AMSEL-SF-MR, Ft. Monmouth, NJ 07703-5024, AV 995-4427." Reason: Correct point of contact.
11	5-1	ALL				Delete: Entire Page Reason: Obsolete
						ADD as per attached (Enclosure 2), adjust Table of Contents accordingly. Reason: NRC requirements; Safety Considerations.

*Reference to line numbers within the paragraph or subparagraph.

TYPED NAME, GRADE OR TITLE	TELEPHONE EXCHANGE/AUTOVON, PLUS EXTENSION	SIGNATURE
		J M Santarsiero

DA FORM 1 FEB 74 2028 REPLACES DA FORM 2028, 1 DEC 68, WHICH WILL BE USED.

CAUTION



STD-RW-1

COBALT (Co)-60

Radiac Calibrator Set AN/UDM-1 contains 10 Curies of Cobalt-60. Use extreme care while using this equipment and follow safe procedures in handling, storage and disposal (AR 385-11 and AR 700-64).

Encl 1

SECTION I

A-1 SCOPE

This manual describes Radiac Calibrator Set AN/UDM-1 and covers its installation and operation. It includes instructions for initial service, operation, cleaning and inspection of the equipment. The calibrator contains Cobalt-60 which is controlled by the US Nuclear Regulatory Commission (NRC). Title 10, Code of Federal Regulations, AR 385-11 and AR 700-64 implement the NRC regulations. Army-wide possession and use of the calibrators are authorized by a NRC license issued to the Department of the Army, US Army Communications-Electronics Command (USACECOM), Fort Monmouth, NJ 07703.

A-2 MAINTENANCE FORMS AND RECORDS

Department of the Army forms and procedures used for equipment maintenance will be those prescribed by TM 38-750, The Army Maintenance Management System.

A-3 REPORTING EQUIPMENT IMPROVEMENT RECOMMENDATIONS (EIR)

If your AN/UDM-1 needs improvement, let us know. Send us an EIR. You, the user, are the only one who can tell us what you don't like about your equipment. Let us know why you don't like the design or performance. Put it on an SF 368 (Quality Deficiency Report). Mail it to Commander, USACECOM, ATTN: AMSEL-ME-MQ, Fort Monmouth, NJ 07703. We'll send you a reply.

SECTION II. US NUCLEAR REGULATORY COMMISSION REQUIREMENTS

B-1 GENERAL

The NRC sets standards/conditions and issues licenses for the use of radioactive materials in the United States. The AN/UDM-1 comes under NRC regulations and a license for its use has been issued. Information required by the NRC license and regulations is contained below:

a. Radiation Protection. Users of the AN/UDM-1 should refer to instructions on control, safe handling, operation and maintenance contained in this technical manual. This satisfies the radiation protection requirements of NRC regulations (Title 10, Code of Federal Regulations, Parts 19 and 20).

b. Notice to employees. Form NRC-3, Notice to Employees, contained in the back of this manual, must be removed for posting wherever the AN/UDM-1 is used and/or stored. The posting requirements are contained on the form.

c. NRC License. The NRC license for the AN/UDM-1 and documents relating to that license are held by the USACECOM Safety Office at Fort Monmouth, NJ. AN/UDM-1 users may request further information on these documents by letter addressed to:

Commander
USACECOM
ATTN: AMSEL-SF-MR
Fort Monmouth, NJ 07703-5024

Requests for further information may also be made by calling AUTOVON 995-4427 or COMMERCIAL (201) 544-4427.

Encl 2

DUTIES OF RADIATION PROTECTION OFFICER (RPO)

The specific duties of the appointed RPO will be to:

a. Ensure that the AN/UDM-1 is properly used and/or stored.

b. Ensure records are maintained.

c. Advise USACECOM Safety Office of any forthcoming change in accountability, local RPO, or installation relocation for the AN/UDM-1.

d. Submit Radiation Incident Report according to published directives.

e. Establish appropriate radiation controlled areas for AN/UDM-1 use.

f. Post appropriate radiation warning signs.

g. Immediately refer actual or suspected overexposure to medical officer.

h. Ensure that periods of time between leak tests do not exceed 6 months and supervise performance of leak tests.

i. Secure items against unauthorized use and/or removal.

j. Ensure that all Army, DOD, and Federal Regulations are being followed and that personnel are exposed to a minimum of radiation consistent with practical considerations.

k. Conduct a physical inventory according to published frequencies.

l. Submit inventory, leak test, and other reports to the USACECOM Safety Office as required.

m. Prior to relief from duties, place the AN/UDM-1 in locked storage.

n. Investigate each case of excessive or abnormal exposure to determine the cause, recommend remedial action to prevent recurrence, and submit a complete written report to Commander, USACECOM, ATTN: AMSEL-SF-MR, Fort Monmouth, NJ 07703-5024 within 2-3 working days.

B-3 EMERGENCY SITUATIONS

a. Internal Exposure of Personnel.

(1) Internal exposure is the result of personnel becoming contaminated when radioactive particles are inhaled, swallowed, or absorbed through breaks in the skin.

(2) In the event of a known or suspected internal exposure:

(a) Obtain immediate medical advice from the medical officer.

(b) Remove the individual from duties involving occupational exposure to ionizing radiation until subsequent exposure limitations are established by proper medical authority (AR 40-14).

(c) Prepare written report of circumstances leading to the internal exposure; include serial number(s) of the AN/UDM-1 involved, action taken to prevent recurrence, and other applicable information. Forward the report through proper channels to Commander, USACECOM, ATTN: AMSEL-SF-MR, Fort Monmouth, NJ 07703-5024.

b. Damage or Leaking AN/UDM-1. An AN/UDM-1 could begin to leak as a result of damage to the source. Action required in the event of a known or suspected leaking calibrator is:

(1) Discontinue use of the calibrator. Cover it with plastic, seal it with tape and label it as contaminated.

(2) Monitor personnel, equipment and areas for possible contamination and decontaminate as required.

(3) Report the item to the USACECOM Safety Office.

(4) Dispose of the AN/UDM-1 as directed by the USACECOM Safety Office.

(5) Report the completed disposal action to USACECOM, ATTN: AMSEL-SF-MR, Fort Monmouth, NJ 07703-5024.

c. Firefighting Emergency Procedures.

(1) General. Emergency plans must include procedures for combating fires involving radioactive items. Plans should be commensurate with the quantity and type of items present. Firefighting personnel must know the location(s) of the items and must be familiar with radiation protection procedures. As a general rule, personnel should wear protective respiratory equipment when fighting fires involving radioactive items.

(2) Emergency procedures.

(a) Evacuate personnel in the immediate area who are not directly involved.

(b) Notify the fire department.

(c) Extinguish the fire, if possible, and if radioactive materials are involved with possible release to the environment, clear personnel from downwind area immediately.

(d) Notify the RPO.

(e) Notify medical personnel when appropriate.

(f) Control access to the immediate area.

(g) Monitor personnel, equipment, supplies and environs with appropriate radiation survey instruments.

(h) Decontaminate personnel, equipment, supplies and environs.

(i) The RPO shall record and report the results of the fire to Commander, USACECOM, ATTN: AMSEL-SF-MR, Fort Monmouth, NJ 07703-5024.

TM 3-6665-214-13&P

TECHNICAL MANUAL

OPERATOR'S, ORGANIZATIONAL, AND DIRECT SUPPORT MAINTENANCE MANUAL (INCLUDING REPAIR PARTS LIST)

RADIOACTIVE SOURCE SET, M3A1

(NSN 6665-00-856-8235)

HEADQUARTERS, DEPARTMENT OF THE ARMY

OCTOBER 1976

Encl 6

WARNINGS

Dangerous gamma radiation is given off from the cobalt 60 source in the M3A1 radioactive source set. All use of a radioactive source set must be supervised by a responsible individual who has received specific training in the proper use of the set.

Never eat, drink, or smoke while using the radioactive source set.

The radioactive source set will be used only by individuals trained and certified in the proper use of the set. Each time that the radioactive source is removed from the shield, the radiation protection officer must delineate the radiation controlled area and post radiation warning signs.

Never allow personnel without film badges and dosimeters inside the restricted area.

Never touch the radioactive source capsule.

Always use the magnetic handler for handling the radioactive source.

Never look into the well of the shield or unnecessarily expose parts of the body to the radiation which issues from the radioactive source capsule in the well of the shield.

Never take the radioactive source from the shield without having a radiacmeter available and in good working order; e.g., an AN/PDR-27 radiac set.

Never leave an unshielded radioactive source unattended. If necessary to leave the source set, reshield the radioactive source and lock the container.

If a radioactive source capsule is damaged or broken and radioactive contamination occurs, follow the emergency procedures described in paragraph 2-18 of this manual.

Maintain records of exposure of personnel.

Wear a film badge, a calibrated dosimeter, and disposable protective gloves while performing the leak test. Do not spread contamination by touching other objects with the gloves. Do not leave the unshielded radioactive source or the opened storage case unattended. Do not stay in the radiation area no longer than necessary to perform the leak test.

Wear disposable protective gloves.

Before removing the radioactive source capsule from the shield, select a calibration site in an area that is away from the normal stream of traffic. The selected site should be unobstructed and have a level floor or ground surface approximately 16 meters (53 feet) square. The calibration site may be in a one-story building or out-doors.

TECHNICAL MANUAL No. 3-6665-214-13&P

HEADQUARTERS
DEPARTMENT OF THE ARMY
WASHINGTON, DC, *6 October 1976*

OPERATOR'S, ORGANIZATIONAL, AND DIRECT SUPPORT MAINTENANCE MANUAL (INCLUDING REPAIR PARTS LIST)

RADIOACTIVE SOURCE SET, M3A1 (NSN 6665-00-856-8235)

Current as of June 1976

REPORTING OF ERRORS

You can improve this manual by recommending improvements using DA Form 2028-2 (Test) located in the back of the manual. Simply tear out the self-addressed form, fill it out as shown on the sample, fold it where shown, and drop it in the mail.

If there are no blank DA Form 2028-2 (Test) in the back of your manual, use the standard DA Form 2028 (Recommended Changes to Publications and Blank Forms) and forward to the Commander, Edgewood Arsenal, ATTN: SAREA-DE-ET, Aberdeen Proving Ground, MD 21010.

In either case a reply will be furnished direct to you.

*This manual supersedes TM 3-6665-214-15, 12 March 1963, including all changes.

LIST OF ILLUSTRATIONS

CHAPTER 1
INTRODUCTION

Section I. GENERAL

1-1. Scope

This manual is published for personnel who operate the M3A1 Radioactive Source Set, and for personnel who perform the organizational and direct support maintenance on the set. The manual contains a description of the source set and information on its use, functioning, and maintenance. It also gives instructions for shipment, storage, and disposal.

1-2. Authorization for Issue of Radioactive Source Sets

M3A1 radioactive source sets are issued throughout the Army without a special license being required of the individual user. The US Nuclear Regulatory Commission (NRC) Byproduct Material License No. 19-1826-2 is issued to the Department of the Army. The licensee is Department of the Army, Edgewood, ATTN: Safety Office (SAREA-SA), Aberdeen Proving Ground, MD 21010. Oversea users (who are exempt from NRC regulations) are authorized possession of the M3A1 source set without a specific DA authorization as the NRC license is equivalent to DA authorization for Army-wide possession.

1-3. Record and Report Forms

a. Use the following forms with the equipment:

(1) DA Form 2791-R (Radioactive Materials Movement—Shipment/Receipt) (LRA).

(2) DD Form 6 (Packaging Improvement Report).

(3) DD Form 1141 (Record of Occupational Exposure to Ionizing Radiation).

(4) NRC (Nuclear Regulatory Commission) Form 3 (Notice to Employees-Standards for Protection Against Radiation).

NOTE

NRC Form 3 (fig. 2-2) can be obtained from the NRC operations offices listed on the Form 3, or the form may be reproduced locally.

b. Equipment maintenance forms and procedures for their use are prescribed in TM 38-750.

c. Refer to TM 43-0139, Painting Instructions for Field Use, for instructions for painting of the storage case.

1-4. Supervision

a. Handling, storage, transfer, use, and disposal of the M3A1 radioactive source set will be under the guidance of the installation, activity, or unit radiation protection officer. He should have successfully completed Radiological Safety Course No. 7KF3 (or its equivalent) given at the US Army Ordnance Center and School, Aberdeen Proving Ground, MD 21005.

b. The radiation protection officer will make sure that each individual who is assigned the responsibility for the use of an M3A1 radioactive source set has received sufficient instructions in the use of the set.

c. The radiation protection officer will prepare a statement of training for each individual who is assigned the responsibility for use of the radioactive source set. This record will be placed in the individual's official personnel folder (201 file).

1-5. Control

The M3A1 radioactive source set is classified as an individually controlled item.

a. The radiation protection officer will obtain written approval from his Command radiological control officer to ship the M3A1 set to another installation or activity. After written approval is obtained, the radiation protection officer will ship the source set. DA Form 2791-R is used as a shipping document and also as a receipt. This form and the radioactive source set records will accompany the source set to its new destination.

b. Within 5 days after receiving the radioactive source set, the receiving radiation protection officer will send two copies of the DA Form 2791-R receipt to his radiation control officer.

c. Leak tests will be made of the M3A1 source set upon initial receipt, at least every 6 months thereafter, prior to shipment or anytime a leak is suspected. (See paragraph 2-5.) Inventory and Leak Test Reports, RCS AMC-192 will be submitted through command channels.

Section II. DESCRIPTION AND DATA

1-6. Use

The Department of the Army is authorized by the Nuclear Regulatory Commission (NRC License No. 19-1826-2) to procure, use, repair, and transport M3A1 radioactive source sets. These sets are used to calibrate radiac survey meters, such as those in the AN/PDR-27( ) radiac set and the IM 9 series radiac dosimeter; and for radiological training purposes (FM 21-48).

WARNING

The radioactive source set will be used only by individuals trained and certified in the proper use of the set. Each time that the radioactive source is removed from the shield, the radiation protection officer must delineate the radiation controlled area and post radiation warning signs.

1-7. M3A1 Radioactive Source Set

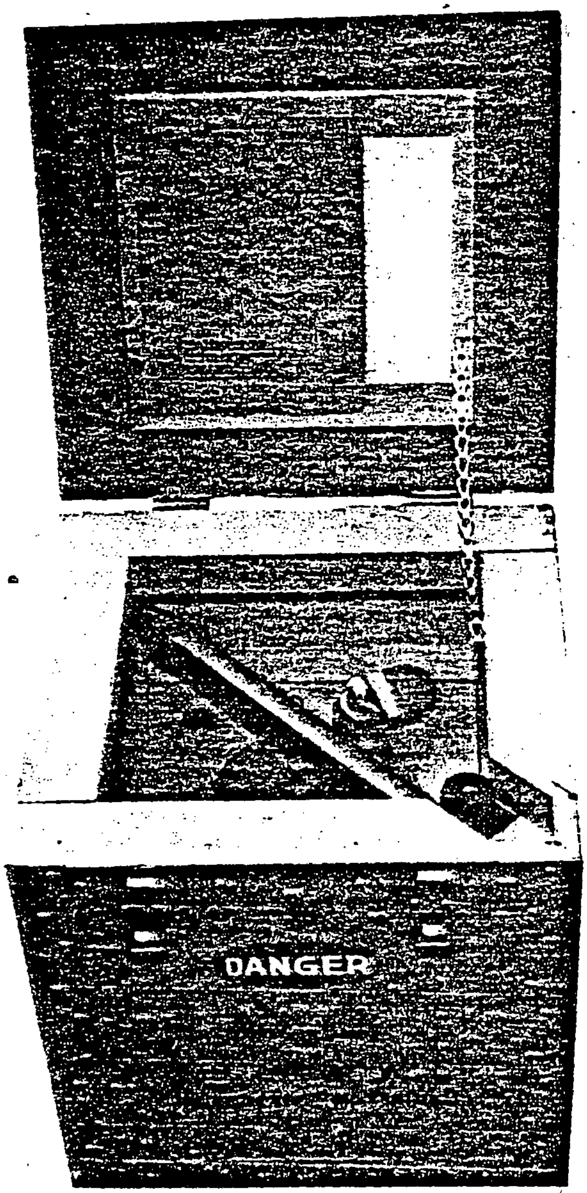


Figure 1-1. M3A1 Radioactive source set.

The M3A1 radioactive source set (fig. 1-1) consists of a storage case, a radioactive source and shield assembly with an M1A1 gamma cobalt 60 radioactive source, a calibration chart for the source, an M4 telescoping radioactive source magnetic handler, and a copy of this manual (TM 3-6665-214-13&P).

a. Storage Case, Exterior (fig. 1-2). The wood storage case measures 18 by 18 by 20 inches and is designed to keep the radiation dose rate at the surface of the case below 200 millirads per hour and 10 millirad/hour at 3 feet from the external surface of the package which meets the yellow III label shipping requirements (Title 49, Department of Transportation). A millirad is equal to 1/1000 rad.

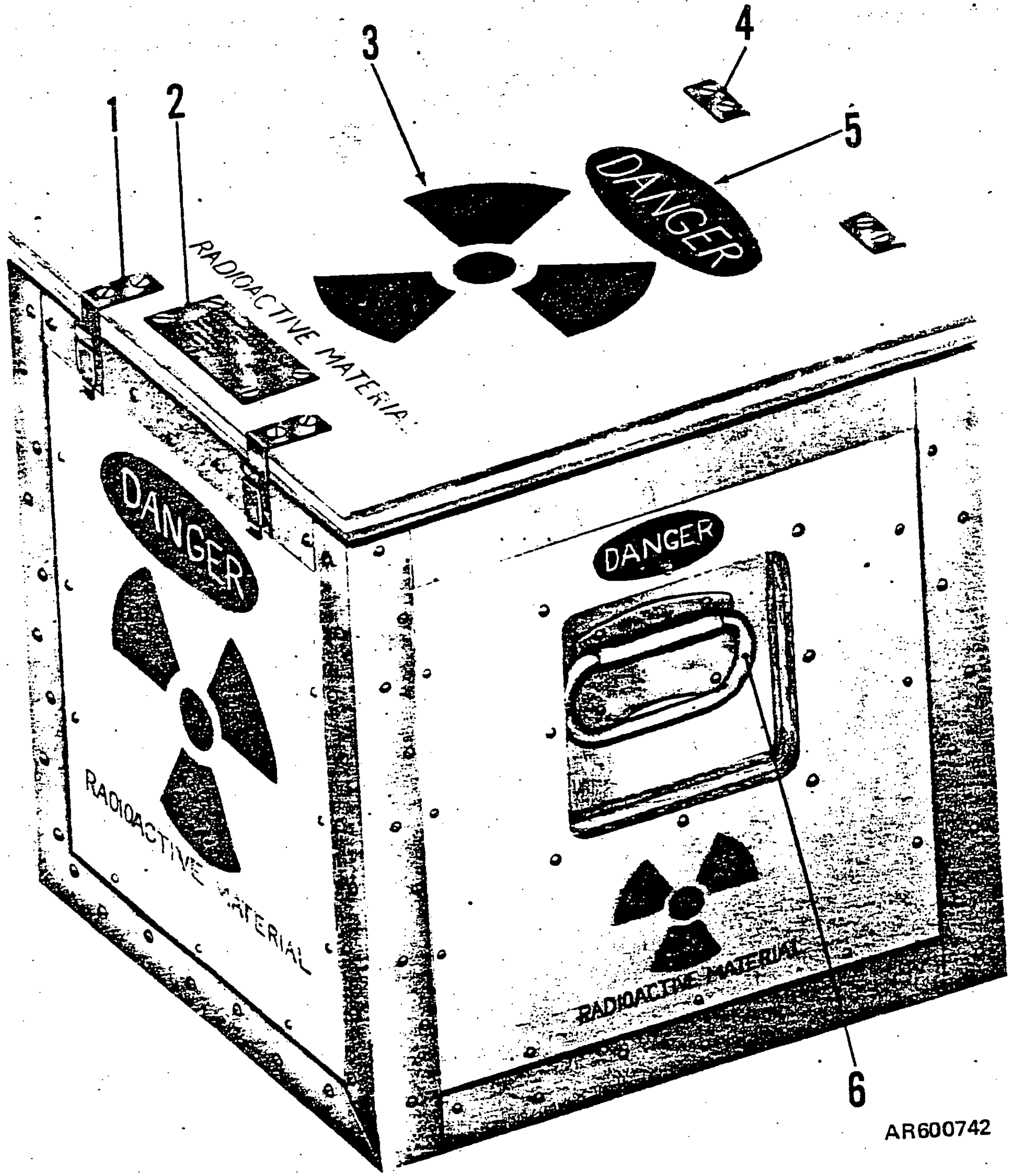
(1) The cover is attached to the case by two hinges (4, fig. 1-2). A chain (7, fig. 1-4) holds the cover in position when the case is open, and two catches (1, fig. 1-2) lock the cover in place when the case is closed. The case is equipped with two handles (6, fig. 1-2), one at each side.

(2) The identification plate on the cover of the storage case of each radioactive source set is shown in figure 1-3.

(3) The case is painted yellow and marked in accordance with Department of Transportation Regulations. Radiation hazard symbols and eliptical DANGER Warning backgrounds are painted purple; the word DANGER is painted white, and the words RADIOACTIVE MATERIALS are painted black.

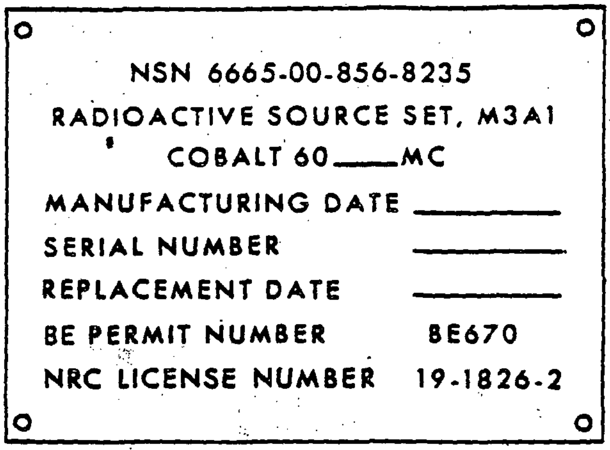
b. Storage Case, Interior (fig. 1-4). A shield (11, fig. 1-4), described in (1) below, is bolted to a platform (8) in the case, and a spacer (1) is bolted down around the top of the shield. A magnet cap socket (9) in one corner and a cutout diagonally opposite the socket in the storage case provide the means for stowing the magnetic handler, described in *d* below. A cobalt 60 decay curve (6, fig. 1-4), described in (2) below, is fastened inside the cover of the case.

(1) *Shield.* A cylindrical lead shield (11, fig. 1-4), approximately 6 1/2 inches in diameter and 6 1/2 inches high, serves as a container for the radioactive source assembly (13). The shield is encased in a steel jacket and is mounted on a square steel base (10). A lead plug (3) with a handle (2) fits into an opening in the top of the shield. When the plug is in place in the shield, it forms the top of an inclosed space in the center of the shield; this space is approximately 1 inch in diameter and 11/16 inch deep. A shoulder near the top of the inclosed space supports the radioactive source assembly within the inclosed space. The shield and plug provide a lead barrier, approximately 2 1/2 inches thick, against gamma rays emanating from the radioactive source. A lockbar (4) passes through the handle of the plug and through slots in the lugs (12) on the shield. The shackle of a combination lock (5) passes through round holes in the bent end of the lockbar and through an adjacent lug and secures the radioactive source in the shield. The combination lock is a high security padlock. The combination can be changed by use of a key which is supplied with the lock.



1 Catch
2 Identification plate
3 Radiation symbol
4 Hinge
5 Eliptical DANGER Warning background
6 Handle

Figure 1-2. M3A1 storage case (exterior).



AR600750

1 Spacer
2 Handle
3 Plug
4 Lockbar
5 Combination lock
6 Cobalt 60 decay curve chart
7 Chain
8 Platform
9 Magnet cap socket
10 Base
11 Shield
12 Lug
13 Radioactive source assembly

Figure 1-3. Identification plate.

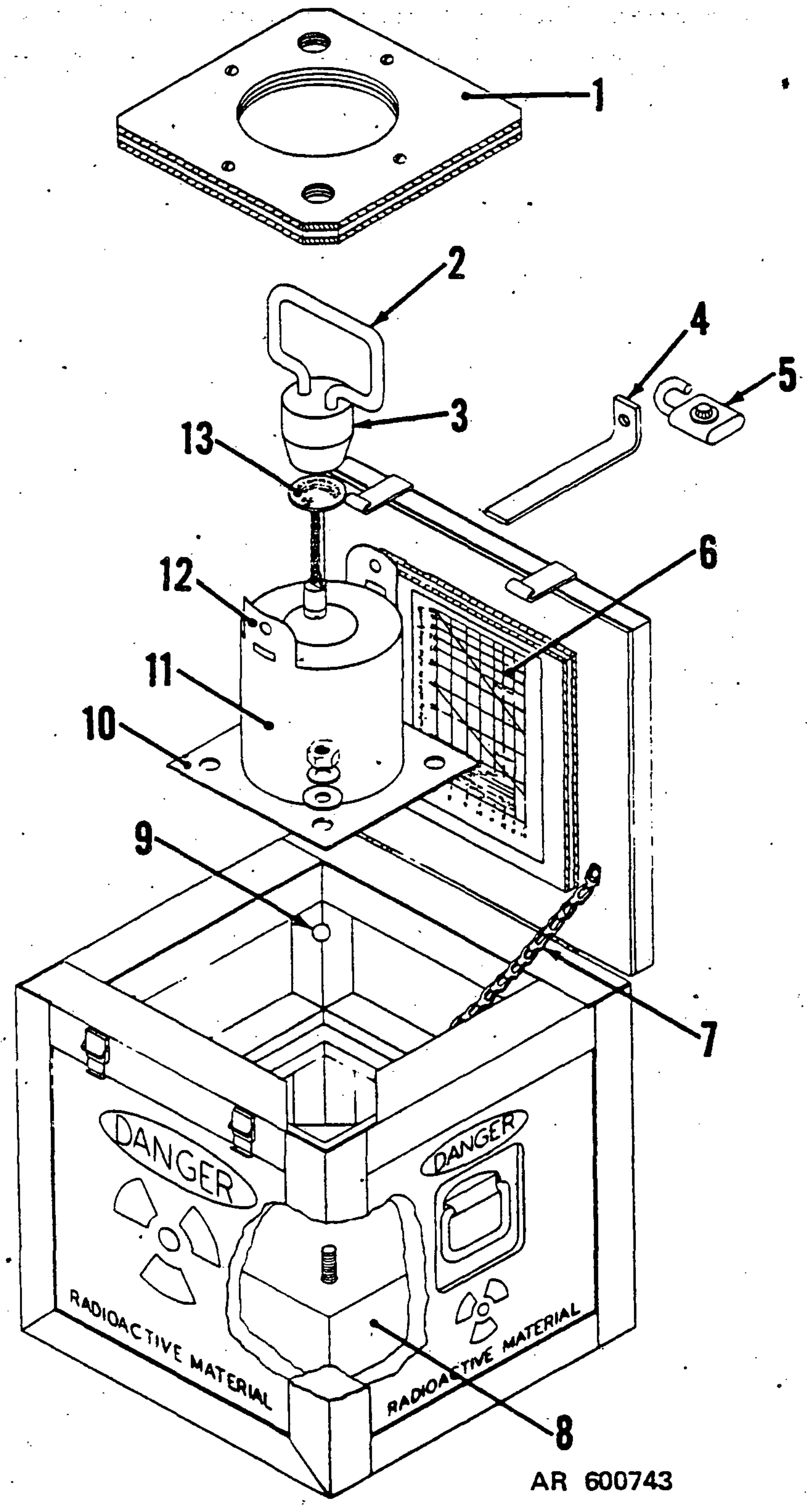


Figure 1-4. Storage case and radioactive source assembly (exploded view).

(2) *Cobalt 60 decay curve* (fig. 1-5). The cobalt 60 decay curve, mounted on the inside cover of the radioactive source case, bears the same serial number as the source. The name and address of the manufacturer; the date of calibration of the radioactive source; the strength at time of calibration in units for exposure

dose rate at a standard distance; i.e., millirads per hour (mrad/hr) at a distance of 1 meter; the activity at the time of calibration in millicuries (mCi); and the replacement date are shown on the decay curve chart.

The decay curve is used to determine the relative percent strength or activity of the cobalt 60 at a given time (years and months) after the date of initial calibration.

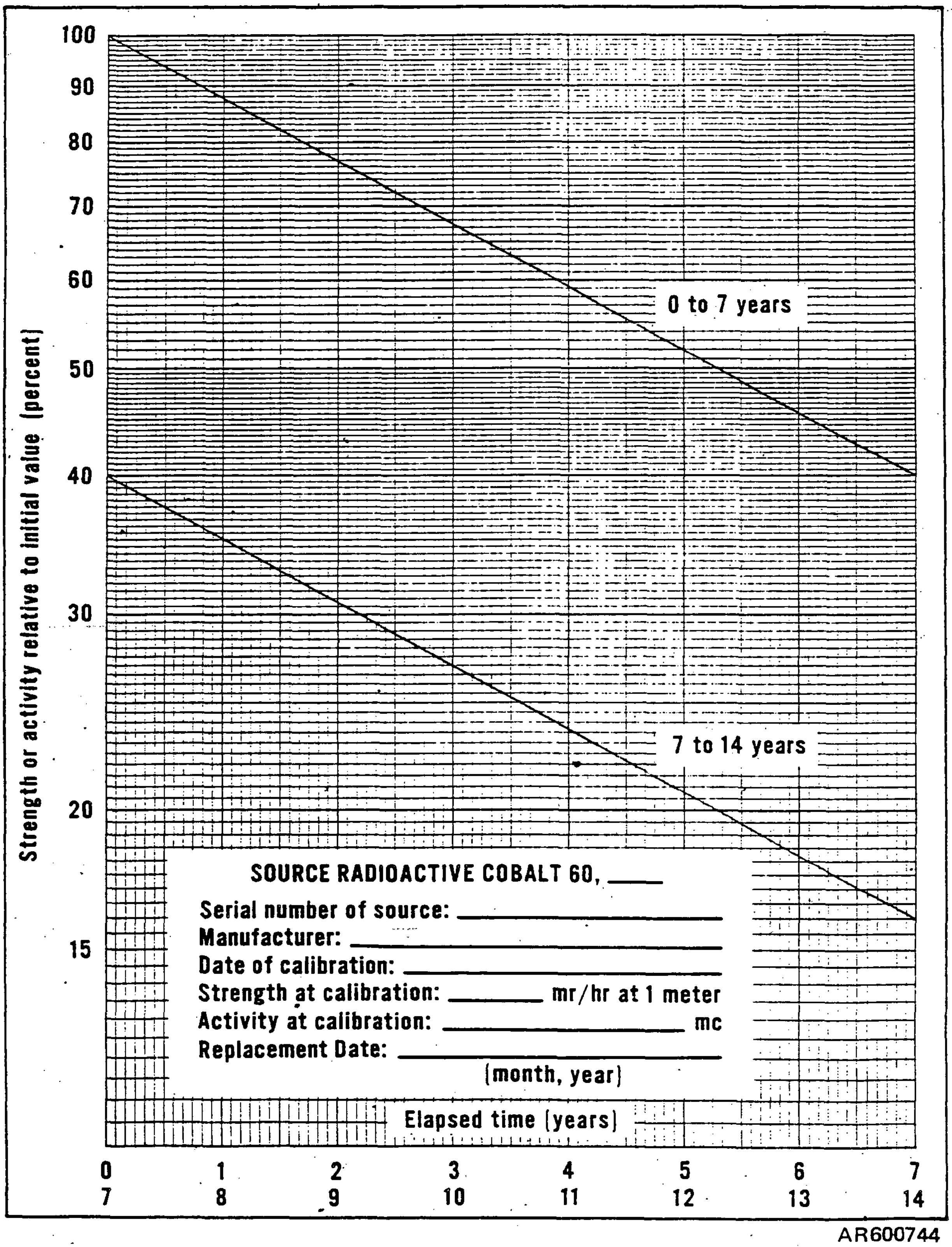


Figure 1-5. Cobalt 60 decay curve.

c. M1A1 Gamma Cobalt 60 Radioactive Source Assembly (fig. 1-6). The M1A1 gamma cobalt 60 radioactive source assembly consists of a sealed radioactive source capsule (3) containing cobalt 60, a chain (2), and a lifting disk (1). Connecting rings (4) connect the chain to the radioactive source capsule and the lifting disk.

WARNING

Dangerous gamma radiation is given off from the cobalt 60 source in the M3A1 radioactive source set. All use of a radioactive source set must be supervised by a responsible individual who has received specific training in the proper use of the set.

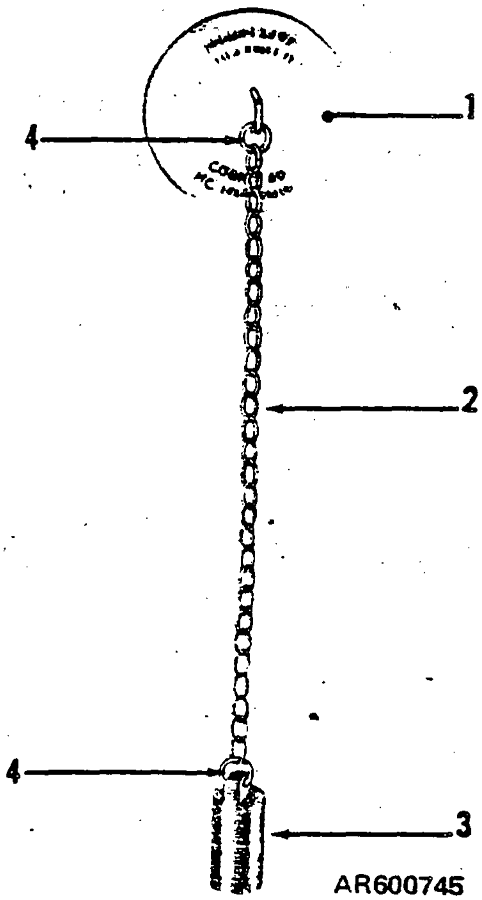
WARNING

Never eat, drink, or smoke while using the radioactive source set.

(1) *Radioactive source capsule.* The radioactive source capsule is a sealed steel capsule, $\frac{1}{4}$ inch in diameter by $\frac{5}{8}$ inch high, containing cobalt 60. An eye in the stem at the top of the capsule permits the capsule to be suspended from a lifting disk by a chain. The activity of the radioactive source at the time of initial calibration may vary from 80 to 130 mCi. (For an activity level of 100 mCi of cobalt 60, the exposure dose rate is 132 mrad/hr at a distance of 1 meter from the source capsule.) Cobalt 60 has a halflife of 5.3 years. Cobalt 60 emits one beta particle (energy: 0.32 MeV) and two gamma rays (energy: 1.17 MeV and 1.33 MeV) at each disintegration. The steel wall of the capsule stops most of the beta particles but the gamma rays pass through the wall.

(2) *Ring and chain assembly.* The ring and chain assembly consists of a round link brass chain, approximately 5 inches long, and two connecting rings (4) at each end of the chain. One end of the ring and chain assembly is connected to the underside of the lifting disk (1); the other end is connected to the radioactive source capsule.

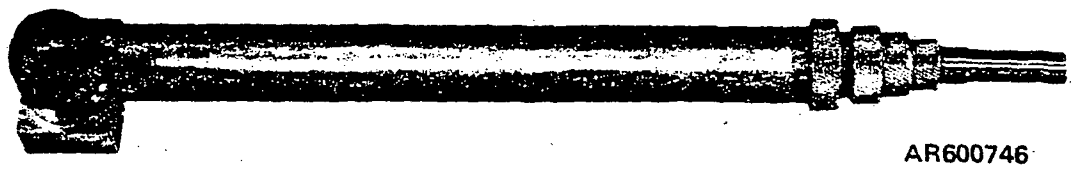
(3) *Lifting disk.* The lifting disk, made of ferromagnetic steel, is approximately $\frac{13}{16}$ inch in diameter and $\frac{1}{16}$ inch thick. A metal eye on the underside of the disk provides the means for attaching the ring and chain assembly. The underside of the disk is marked with the serial number of the radioactive source assembly, the activity of the source at the time of initial calibration, the date at which the activity was determined, and the words COBALT 60. The upper side of the disk is marked with the words DANGER RADIOACTIVE MATERIAL, NOTIFY ARMY AUTHORITIES IF FOUND, and with the word DANGER above a radiation hazard symbol. The disk is painted yellow, the letters are black, and the radiation hazard symbol is purple.



1 Lifting disk
2 Chain
3 Source capsule
4 Connecting ring

Figure 1-6. M1A1 gamma cobalt 60 radioactive source assembly.

d. M4 Telescoping Radioactive Source Magnetic Handler. The M4 telescoping radioactive source magnetic handler (fig. 1-7 and 1-8) is designed to manipulate the M1A1 gamma cobalt 60 radioactive source assembly. When using the fully extended magnetic handler, the operator can remain at a safe distance for the short time required to place or remove the radioactive source. Telescope the handler when it is not in use (fig. 1-7), and stow it in the storage case. The handler weighs approximately 2 $\frac{1}{2}$ pounds and is approximately 20 inches long when telescoped and 72 inches long when fully extended. (See figure 1-8.) The magnetic handler consists essentially of a flexible arm assembly (2, fig. 1-8), three extensions of aluminum tubing (3), and a handle and housing assembly (5). Knurled retaining nuts (4), fitted with plastic packing rings, hold the telescoping sections of the handler in the extended position. A small permanent magnet under a stainless steel magnet cap (1) is attached by a length of wire that passes through the telescoping sections of the handler to a spring-loaded motor assembly in the handle and housing assembly (5). A compression spring holds the magnet against the magnet cap; a magnet control knob (6) retracts the magnet. When the magnet is against the cap, the handler picks up and holds the radioactive source assembly. When the magnet is retracted, the radioactive source assembly is released from the handler.



1 Magnet cap
2 Flexible arm assembly
3 Extension
4 Retaining nut
5 Handle and housing assembly
6 Magnet control knob

Figure 1-7. M4 radioactive source magnetic handler (telescoped).

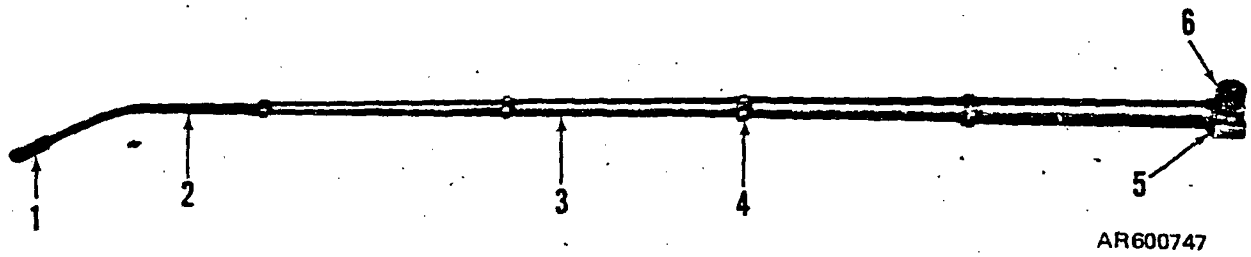


Figure 1-8. M4 radioactive source magnetic handler (extended).

1-8. Tabulated Data

Numerical data are approximate.

Radioactive material	Co^{60} (1 beta particle 0.32 MeV; 2 gamma rays 1.17 and 1.33 MeV)
Activity at time of initial calibration.	80-130 mCi.
Exposure rate at activity level of 100 mCi Cobalt 60.	132 mrad/hr at 1 meter, (158 mrad/hr at 1 yard)
Dose rate at surface of capsule	Greater than 10,000 rad/hr
Half life	5.3 years
Weight:	
M3A1 radioactive source set.	150 lb.
Magnetic handler	2 ½ lb.
Cubage:	
M3A1 radioactive source set.	1.75 cu. ft.
NRC license number	19-1826-2
BE permit number	BE670

CHAPTER 2
OPERATING INSTRUCTIONS

Section I. PREPARATION FOR USE

2-1. Initial Inspection

When the M3A1 Radioactive Source Set is received, the operator under the supervision of the installation's Radiation Protection Officer, or his qualified alternate, will:

a. Post the radiation area (para 2-3).

b. Maintain dosimetry records (para 2-4).

c. Inspect exterior and interior of the storage case for damage. Examine case and contents for missing parts. If source set is damaged, or parts are missing, report an improper shipment (DD form 6).

d. Within three hours during normal duty hours, or 18 hours of nonduty hours of initial receipt, perform a leakage test (para 2-5), or upon initial receipt, perform a leak test (para 2-5), or at any time a leak is suspected. If the source set is leaking, emergency procedures set forth in paragraph 2-18 will be followed.

e. Inspect the M4 magnetic handler for workability (para 2-9*b*).

f. Check serial number on underside of lifting disk with serial number recorded on the cobalt-60 decay curve chart (para 2-8).

g. Determine present strength of source (para 2-12).

2-2. Calibration of M3A1 Radioactive Source Sets

The M3A1 radioactive source set will be sent to depot maintenance personnel once a year for calibration.

2-3. Posting Radiation Controlled Area

a. A radiation controlled area will be posted. A radiation controlled area is a delineated area in which exposure of personnel to radiation is under the supervision of an individual in charge of radiation protection. The perimeter of a radiation controlled area is usually established where the radiation intensity is 2 mrad/hr. Only authorized occupationally exposed individuals (radiation workers) with a minimum of a film badge dosimeter shall be permitted within the radiation controlled area. Because gamma rays emitted by a radioactive source will pass through solid objects, such as partitions and walls, a radiation controlled area may extend beyond a wall or partition.

b. Establish perimeter by estimate and calculation prior to exposing source, then adjust barriers as necessary by measuring with a survey meter after source is exposed. Rope off or otherwise establish with barriers and signs the perimeter of the radiation controlled area. A high radiation area is any area accessible to personnel in which radiation exists such that a major portion of the body could receive a dose in excess of 100 millirem in any one hour. After the radiation controlled area is established, a survey should be made with a calibrated radiac survey meter to establish the high radiation area in which personnel occupancy must be strictly controlled.

NOTE

> If an unshielded Co 60 source having an activity of 100 millicuries is being used, the radiation controlled area will be all the area within a radius of approximately 8 meters (26.2 feet) of the source. The radiation controlled area of a more active source will be larger, and the radiation controlled area of a less active source will be smaller.

c. Post radiation warning signs at conspicuous points adjacent to the periphery of the radiation controlled area so that only authorized personnel with film badge dosimeters will be permitted within the radiation controlled area. Self-reading dosimeters are recommended as a positive means of preventing over exposures. They should be required for personnel approaching or entering the high radiation area. Figure 2-1 shows suggested dimensions for radiation warning signs. The dimensions of the signs can be varied so long as the proportions of the three-bladed radiation hazard symbol remain as shown and the wording is easy to read.

d. Post NRC Form 3 (fig. 2-2) in a conspicuous location near the radioactive source set.

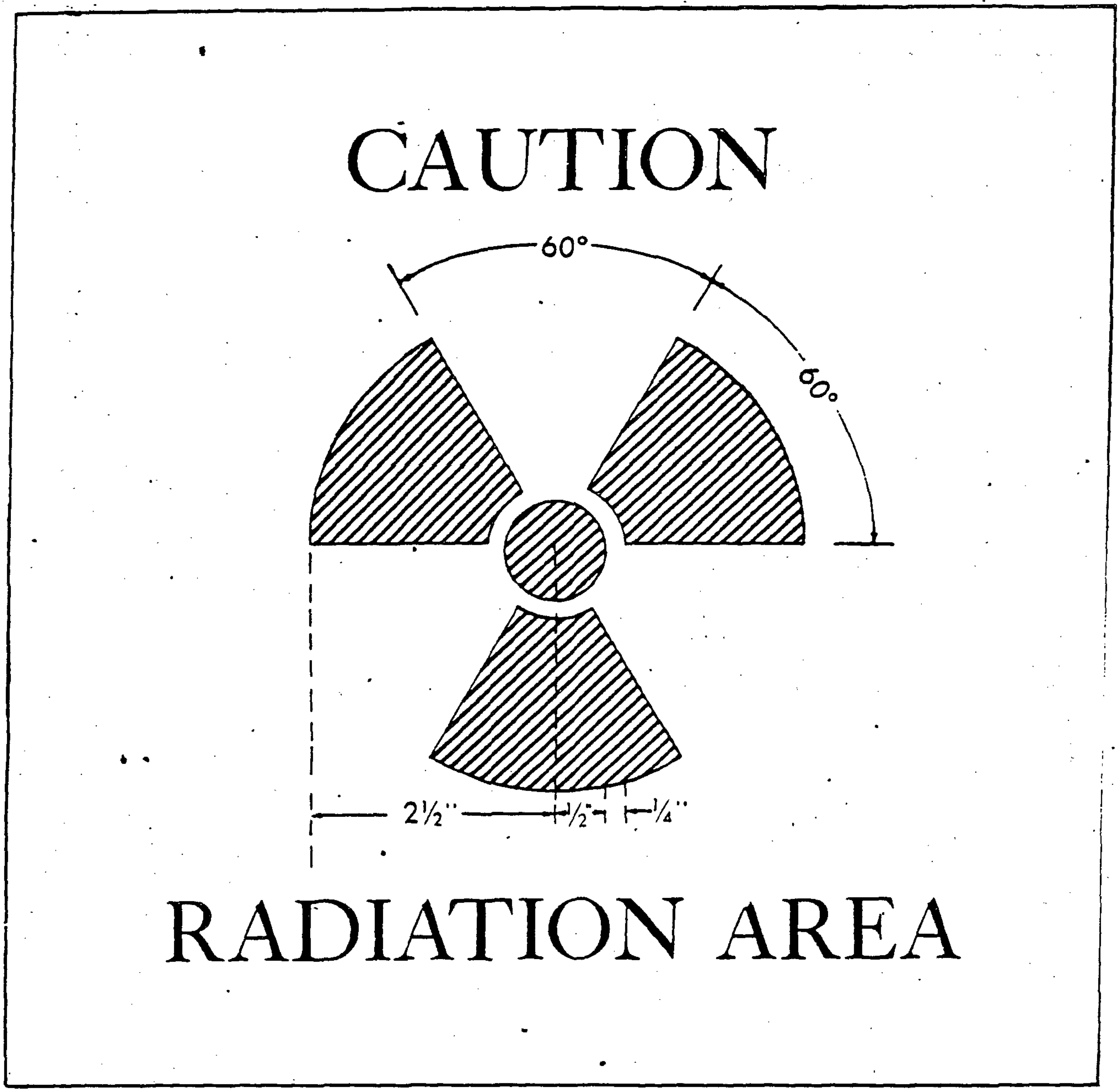
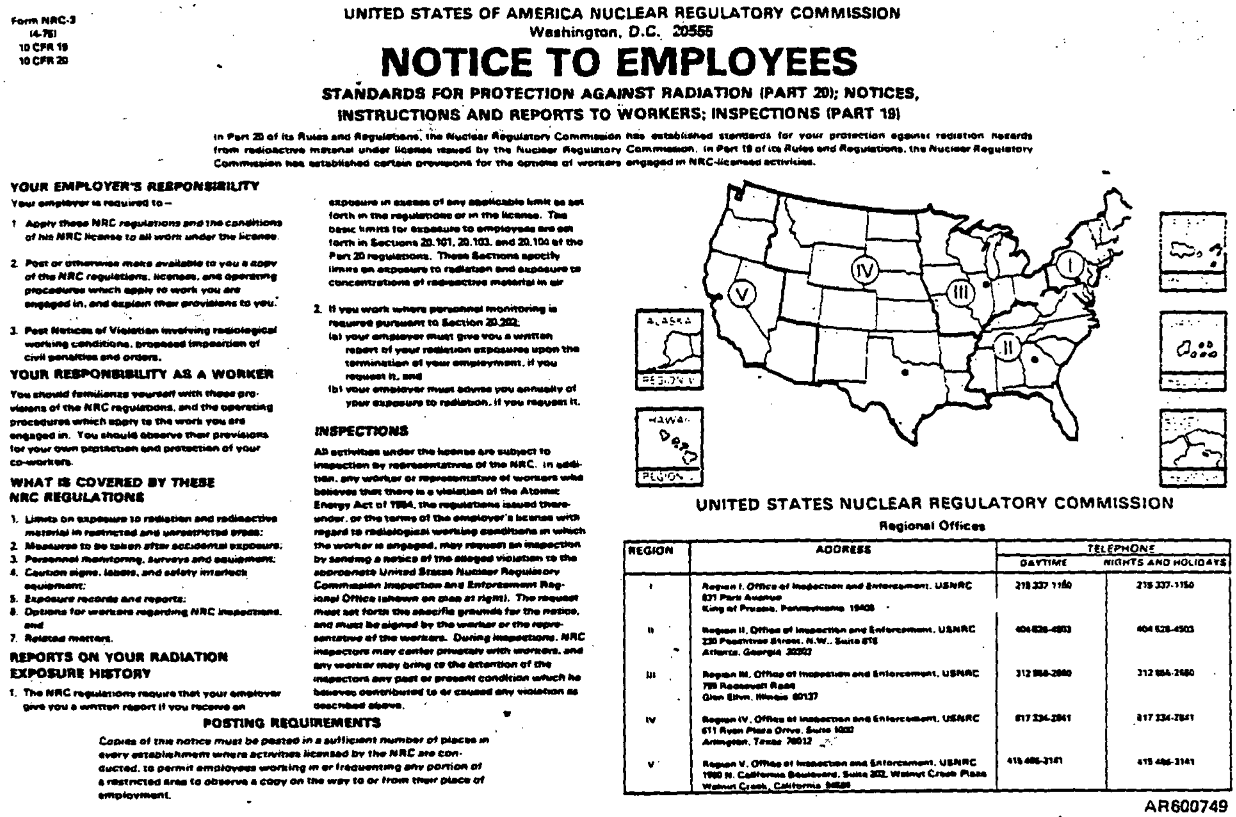


Figure 2-1. Radiation warning sign.



Form NRC-3
(4-76)
10 CFR 19
10 CFR 20

UNITED STATES OF AMERICA NUCLEAR REGULATORY COMMISSION
Washington, D.C. 20555

NOTICE TO EMPLOYEES

STANDARDS FOR PROTECTION AGAINST RADIATION (PART 20); NOTICES, INSTRUCTIONS AND REPORTS TO WORKERS; INSPECTIONS (PART 19)

In Part 20 of its Rules and Regulations, the Nuclear Regulatory Commission has established standards for your protection against radiation hazards from radioactive material under license issued by the Nuclear Regulatory Commission. In Part 19 of its Rules and Regulations, the Nuclear Regulatory Commission has established certain provisions for the options of workers engaged in NRC-licensed activities.

YOUR EMPLOYER'S RESPONSIBILITY

Your employer is required to—

1. Apply these NRC regulations and the conditions of his NRC license to all work under the license.
2. Post or otherwise make available to you a copy of the NRC regulations, licenses, and operating procedures which apply to work you are engaged in, and explain their provisions to you.
3. Post Notices of Violation involving radiological working conditions, proposed imposition of civil penalties and orders.

YOUR RESPONSIBILITY AS A WORKER

You should familiarize yourself with those provisions of the NRC regulations, and the operating procedures which apply to the work you are engaged in. You should observe their provisions for your own protection and protection of your co-workers.

WHAT IS COVERED BY THESE NRC REGULATIONS

1. Limits on exposure to radiation and radioactive material in restricted and unrestricted areas;
2. Measures to be taken after accidental exposure;
3. Personnel monitoring, surveys and equipment;
4. Caution signs, labels, and safety interlock equipment;
5. Exposure records and reports;
6. Options for workers regarding NRC inspections, and
7. Related matters.

REPORTS ON YOUR RADIATION EXPOSURE HISTORY

1. The NRC regulations require that your employer give you a written report if you receive an exposure in excess of any applicable limit as set forth in the regulations or in the license. The basic limits for exposure to employees are set forth in Sections 20.101, 20.103, and 20.104 of the Part 20 regulations. These Sections specify limits on exposure to radiation and exposure to concentrations of radioactive material in air.
2. If you work where personnel monitoring is required pursuant to Section 20.202:
(a) your employer must give you a written report of your radiation exposures upon the termination of your employment, if you request it, and
(b) your employer must advise you annually of your exposure to radiation, if you request it.

INSPECTIONS

All activities under the license are subject to inspection by representatives of the NRC. In addition, any worker or representative of workers who believes that there is a violation of the Atomic Energy Act of 1954, the regulations issued thereunder, or the terms of the employer's license with regard to radiological working conditions in which the worker is engaged, may request an inspection by sending a notice of the alleged violation to the appropriate United States Nuclear Regulatory Commission Inspection and Enforcement Regional Office (shown on map at right). The request must set forth the specific grounds for the notice, and must be signed by the worker or the representative of the workers. During inspections, NRC inspectors may confer privately with workers, and any worker may bring to the attention of the inspectors any past or present condition which he believes contributed to or caused any violation as described above.

POSTING REQUIREMENTS

Copies of this notice must be posted in a sufficient number of places in every establishment where activities licensed by the NRC are conducted, to permit employees working in or frequenting any portion of a restricted area to observe a copy on the way to or from their place of employment.

UNITED STATES NUCLEAR REGULATORY COMMISSION

Regional Offices

REGION	ADDRESS	TELEPHONE DAYTIME	TELEPHONE NIGHTS AND HOLIDAYS
I	Region I, Office of Inspection and Enforcement, USNRC 631 Park Avenue King of Prussia, Pennsylvania 19406	215 337-1150	215 337-1150
II	Region II, Office of Inspection and Enforcement, USNRC 230 Peachtree Street, N.W., Suite 818 Atlanta, Georgia 30303	404 526-4503	404 526-4503
III	Region III, Office of Inspection and Enforcement, USNRC 799 Roosevelt Road Glen Ellyn, Illinois 60137	312 858-2660	312 858-2660
IV	Region IV, Office of Inspection and Enforcement, USNRC 611 Ryan Plaza Drive, Suite 1000 Arlington, Texas 76012	817 334-2841	817 334-2841
V	Region V, Office of Inspection and Enforcement, USNRC 1990 N. California Boulevard, Suite 202, Walnut Creek Plaza Walnut Creek, California 94596	415 486-3141	415 486-3141

AR600749

Figure 2-2. NRC Form 3.

2-4. Dosimetry Records

a. Record daily self-reading dosimeter readings of individuals for exposure control purposes.

b. Film badge dosimetry exposure records will be maintained. Unusual exposures will be investigated and reported.

Section II. LEAK TEST

2-5. Leak Test

Perform a leak test (wipe test) upon receipt of a radioactive source set and at least once every 6 months thereafter; perform a leak test prior to shipment or at any time it is suspected that the radioactive source may be leaking.

WARNING

Wear a film badge, a calibrated dosimeter, and disposable protective gloves while performing the leak test. Do not spread contamination by touching other objects with the gloves. Do not leave the unshielded radioactive source or the opened storage case unattended. Do not stay in the radiation area any longer than necessary to perform the leak test.

a. Assemble the Following Items Before Beginning Leak Test.

(1) A calibrated beta-gamma type radiac survey meter such as the AN/PDR-27( ) radiac survey meter.

(2) A film badge and a calibrated IM-9 series dosimeter for each individual taking part in the leak test.

(3) A pair of disposable protective gloves for the individual who wipes the shield.

(4) An unfolded sheet of paper toweling or plastic sheeting of approximately the same size as the paper toweling.

(5) At least one high-wet-strength filter paper disk approximately 1 inch in diameter for each wiping.

NOTE

If filter paper disks are not available, suitable disks can be cut from a sheet of paper toweling.

(6) One small envelope and one larger envelope for each filter disk that is to be mailed to a radiological laboratory for evaluation.

(7) A pencil, dowel, or stick approximately 7 inches long with a flat end.

(8) Pressure-sensitive tape.

b. Prepare the Test Site. Select an area away from the normal stream of traffic. The test site may be in a one-story building or outside. The area of the test site should be unobstructed and have a level floor or ground surface approximately 16 meters (53 feet) square.

(1) Place the sheet of paper toweling or plastic sheeting on a table or work bench in the center of the site.

(2) Anchor the paper or sheeting to the flat surfaces with pressure-sensitive tape or with weights.

(3) Mark the center of the paper or sheeting to indicate where the radioactive source will be placed during the test procedure.

c. *Obtain Survey Meter Readings.*

(1) Remove the radioactive source from the shield (para 2-9) and place it on the paper or sheeting.

(2) Use a calibrated AN/PDR-27( ) radiac survey meter to delineate the radiation area (para 2-3).

(3) Use the probe of the radiac survey meter with the beta window open to test the well in the shield and the surfaces of the shield plug for radioactive contamination.

(*a*) If the meter reading is 1.0 mrad/hr or more above the background reading, the radioactive source capsule is leaking and must not be used. Return the radioactive source to the shield (para 2-10). Report leak test results to the command radiological control officer and request disposition instructions. Dispose of the plastic gloves as radioactive waste. If the area is contaminated, dispose of the paper or plastic sheeting, and follow decontamination procedures given in TM 3-220.

(*b*) If the meter reading is less than 1.0 mrad/hr above the background reading, proceed with the wipe test (*d* below).

d. *Perform a Wipe Test.*

WARNING

Wear disposable protective gloves.

(1) Mark a filter paper disk with the serial number of the radioactive source set. (The set bears the same serial number as the radioactive source capsule.)

(2) Carefully center and wrap the filter paper disk over the flat end of a pencil or dowel. Make sure that the marked side of the disk is adjacent to the pencil. Use pressure-sensitive tape to hold the folded disk in place.

(3) Moisten the filter paper disk with distilled or clear tap water and gently but thoroughly wipe the sides and bottom of the well in the shield and the surfaces of the plug that fit into the shield.

(4) Carefully remove the disk from the pencil. Dispose of the pencil as radioactive waste. Flatten the paper disk to dry with smeared side up.

(5) Return the radioactive source to the shield (para 2-10).

2-6. Test Evaluation

a. When the filter paper disk has dried (para 2-5*d*(4) above), position a calibrated AN/PDR-27( ) radiacmeter over the disk. Place the probe of the radiacmeter (with the beta window open) as close to the filter disk as possible; do not allow the probe to touch the filter paper disk.

(1) If the dose rate is 0.4 mrad/hr or greater above background radiation, lock the radioactive source in the shield. Decontaminate the outside of the shield and the storage case if necessary, report leak test results to the command radiological control officer, and request disposition instructions.

(2) If the meter reading is less than 0.4 mrad/hr but greater than 0.1 mrad/hr above background radiation, lock the radioactive source in the shield. Set the radioactive source set aside. Submit the filter disk to a radiological laboratory for evaluation. Do not use the set until you get a report from the laboratory.

NOTE

The laboratory will report its evaluation of the filter disk in microcuries of cobalt 60. If the report reads 0.005 microcurie of cobalt 60 or greater, turn the radioactive source set in for disposal. If the report reads less than 0.005 microcurie of cobalt 60, the radioactive source set may be used.

(3) If the meter reading is 0.1 mrad/hr or less above background radiation, submit the filter disk to a radiological laboratory for evaluation. The set may be used while awaiting the report from the laboratory. See note in (2) above.

b. If laboratory equipment capable of accurately measuring 0.001 microcurie is available, evaluate the filter paper disk, and send a copy of the results of the test to the area Radioactive Material Control Point. If the quantity of cobalt 60 on the disk measures more than 0.005 microcurie, the radioactive source set is unserviceable. Turn it in for disposal.

c. If a using installation does not have the proper laboratory equipment:

(1) Place the filter paper disk in a small envelope marked with the name and location of the user, the serial number of the radioactive source, and the words: MAILROOM—DO NOT OPEN. Seal the envelope with pressure-sensitive tape and place it in a second envelope for forwarding. Do not include more than one filter disk in any one mailing envelope. Mark the following on the second envelope:

RADIOACTIVE MATERIAL—Gamma radiation at surface of envelope less than 10 millirads for 24 hours—No significant alpha, beta, neutron radiation.

(2) Installation commanders in CONUS will forward the smear paper for evaluation to the nearest Depot as follows:

Commander
Lexington-Blue Grass Army Depot
ATTN: DRXLX-QCP
Lexington, KY 40507

Commander
Sacramento Army Depot
ATTN: DRXSA-QMD-1
Sacramento, CA 95813

(3) The Depot will forward a test evaluation report to the sender.

(4) Commanders at overseas installations will follow the procedures established by the responsible commander.

2-7. Test Records

a. Maintain records of leak tests. Indicate date of test, results of test, and names of personnel making the test.

b. Test records are subject to periodic inspections.

Section III. OPERATING UNDER NORMAL CONDITIONS

WARNING

From the time that the lead plug is removed from the shield until the source has been returned to the shield and the plug replaced, the source is an exposed radiation hazard. Always use the magnetic handler for handling the radioactive source. Never touch the radioactive source capsule. The dose rate at the surface of the capsule is greater than 10,000 rad/hr.

2-8. Checking Serial Numbers

a. The serial number on the underside of the lifting disk (ring) of the radioactive source assembly and the serial number on the cobalt 60 decay curve chart (attached inside the cover of the storage case) must be identical. If the serial numbers are not identical, the radioactive source set cannot be used for calibration purposes, because the source strength value printed on the chart will not be the correct value for the radioactive source.

b. Check the serial numbers on the lifting disk and the chart upon receipt of a radioactive source set. If the serial numbers on the disk and chart differ, report an improper shipment (DD Form 6).

c. To check the serial number on the underside of the lifting disk, follow the procedures described in paragraph 2-9*b*(1) through (6). Raise the lifting disk of the radioactive source assembly just high enough to deposit the lifting disk on the rim of the shield. Be sure to keep the radioactive source capsule in the well in the shield and out of the line of sight. Use a pair of pliers to turn the lifting disk over. Be careful not to withdraw the radioactive capsule from the shield. Make note of the serial number and return the disk to its original position in the shield.

2-9. Removing Radioactive Source From Shield

a. General. Each time that a radioactive source is removed from a shield, use the probe of an AN/PDR-27 radiac set to test the well in the shield for radioactive contamination (para 2-5*c*). If contamination is detected, return the source to the shield; use the magnetic handler and follow emergency procedures (para 2-17 and 2-18).

b. Using the M4 Magnetic Handler.

(1) Open the storage case (fig. 1-2).

(2) Remove the M4 magnetic handler (fig. 1-7) from storage case. Extend the flexible arm assembly (2, fig. 1-8) and each of the three extensions in turn. Tighten each of four retaining nuts just enough to hold the handler in the extended position. Bend the flexible arm downward.

(3) Make sure that the magnetic handler is fully extended and in operating condition. Bring the front end of the magnet cap (1, fig. 1-8) close to a paper clip or small nail. The clip or nail should be attracted and held to the cap by the magnet. Turn the magnet control knob (6) about one-fourth turn ***counterclockwise*** to retract the magnet and release the clip or nail from the magnet cap.

CAUTION

Never turn the magnet control knob unless the magnetic handler is fully extended. Never turn the knob in a clockwise direction.

(4) Unlock the combination lock (5, fig. 1-4) and remove the lockbar (4).

NOTE

The radiation protection officer will keep a record of the combination and change the combination as required. He will keep the key that is used to change the combination. When a radioactive source set is transferred from one installation to another, the combination for the lock and the key for changing the combination will be forwarded under separate cover; they will never be sent with the set.

(5) Remove the lead plug (3) from the shield and step back from the shield as quickly as possible.

WARNING

Never look into the well of the shield or unnecessarily expose parts of the body to the radiation which issues from the radioactive source capsule in the well of the shield.

(6) Bring the magnet cap end of the handler in contact with the lifting disk.

(7) Lift the radioactive source assembly out of the

shield with the handler and carry it to the calibration site.

2-10. Returning Radioactive Source to Shield

Use the magnetic handler (remote-handling tongs) to return the radioactive source assembly to the shield; lower the source capsule gently into the well in the shield. *Do not look into the well.* Release the lifting disk. Replace the lead plug in the shield; insert and lock the lockbar. Loosen the nuts on the extension arms of the magnetic handler to telescope the handler; place the handler in the storage case and close the case.

Section IV. CALCULATIONS

2-11. General

The activity of cobalt 60 decreases with time; therefore the strength of the source must be determined before using the source for calibrating an instrument. After the strength of the source has been determined, the dose rate in millirads per hour (mrad/hr) at a given distance from the source, and distance from the source to obtain a given dose rate, can be calculated. Distance from source is measured in meters. One meter equals 39.37 inches.

2-12. Determining Present Strength of Source and Calculating Dose Rates, Distances, and Dose

a. Determining Present Strength of Source.

(1) From the cobalt 60 decay curve chart (fig. 1-5) attached inside the cover of the storage case, note the date of initial calibration (year and month) and the strength of the source in mrad/hr at 1 meter (39.37 inches) at that date. Compute the years and months that have elapsed since that date.

(2) From the decay curve on the chart, determine the percent strength remaining in the source.

(3) Calculate the present strength of the source by use of the following formula: Present strength = strength when initially calibrated X percent strength remaining ÷ 100.

Example:

Present date....... August 1974
Date of initial calibration .... February 1972
Elapsed time ...... 2 years 6 months
Percent strength remaining... 72
Strength of source when initially calibrated 132 mrad/hr at 1 meter
Calculation........ $\frac{132 \times 72}{100} = 95.04$
Present strength... 95.04 mrad/hr at 1 meter of source

b. Calculating Dose Rate at a Given Distance. Use the following formula to calculate the dose rate at a given distance (d): $R = \frac{S}{d^2}$

Where: R = dose rate in mrad/hr
S = present strength of source (*a* above)
d = distance from source in meters (1 meter equals 39.37 inches or 3.281 feet).

Example:

Present strength of source (S) (*a* above) 95.04 mrad/hr at 1 meter
Distance from source (d) ..... 2 meters
Calculation........ $\frac{95.04}{2^2} = \frac{95.04}{4} = 23.76$
Dose rate (R) ...... 23.76 mrad/hr at 2 meters

c. Calculating Distance From Source to Obtain a Given Dose Rate. Use the following formula to calculate the distance at which a given dose rate (R) will be obtained:

$$d = \sqrt{\frac{S}{R}}$$

Where: d = distance from source in meters (1 meter equals 3.281 feet)
S = present strength of source
R = given dose rate in mrad/hr

Example:

Present strength of source (S), 95.04 mrad/hr at 1 meter (*a* above).
Given dose rate (R), 23.76 mrad/hr at 2 meters (*b* above).
Calculation........ $\sqrt{\frac{95.04}{23.76}} = \sqrt{4} = 2$
Distance from source (d), 2 meters

d. Calculating the Dose. Use the following formula to calculate the dose (D) at a given distance when the dose rate (R) at a given distance and the exposure time (t) are known, D = Rt.

Where: D = the total amount of nuclear radiation absorbed (mrad)
R = the dose rate at the given distance (mrad/hr)
t = time of exposure in hours

Example:

Dose rate (R) at 2 meters, 23.76 mrad/hr (*b* above).
Time (t) in hours. ½ hr
Calculation...... $23.76 \times \frac{1}{2} = \frac{23.76}{2} = 11.88$
Dose (D)......... 11.88 mrad

Section V. CALIBRATION OF RADIAC SURVEY METERS AND DOSIMETERS

2-13. General

Calibration of radiac survey meters and dosimeters provides the means for determining the extent that an instrument reading deviates from the true value. Calibration may be performed by checking the instrument against a standard radioactive source; the M3A1 radioactive source set can be used for this purpose.

2-14. Calibration of Radiac Survey Meters

a. General. Radiac survey meters should be calibrated each time that batteries or electronic components are changed, or after long periods of continual use, and after being exposed to extreme temperature changes (FM 21-48).

b. Preliminary Procedure.

WARNING

Never take the radioactive source from the shield without having a radiacmeter available and in good working order; e.g., an AN/PDR-27 radiac set.

(1) Prepare a worksheet for record purposes. Record the name and serial number of the radiac survey meter that is to be calibrated, the serial number of the radioactive source, the date, and the name of the individual performing the calibration. Prepare a table with the following column headings:

(*a*) Distance from Source (meters).

(*b*) Calculated Dose Rate (mrad/hr).

(*c*) Survey Meter Scale Reading (mrad/hr).

(2) Under the Distance from Source reading, list ½, 1, 1 ½, 1 ¾, 2, 2 ½, 3, 4, 5, 7, and 9 meters.

(3) From the cobalt 60 decay curve chart, calculate the present strength of the radioactive source (para 2-12*a*).

(4) Use the value obtained to calculate the dose rate for each of the distances listed in the table (para 2-12*b*). Record these dose rates.

(5) Calculate the distance from the radioactive source at which the dose rate is 0.4 mrad/hr (para 2-12*c*). List the distance and the dose rate in the table.

(6) Calculate the distance from the radioactive source at which the dose rate is 2.0 mrad/hr (para 2-12*c*). Use the calculated distance to delineate radiation area (para 2-3).

c. Prepare a Calibration Site.

WARNING

Before removing the radioactive source capsule from the shield, select a calibration site in an area that is away from the normal stream of traffic. The selected site should be unobstructed and have a level floor or ground surface approximately 16 meters (53 feet) square. The calibration site may be in a one-story building or out-doors.

(1) Mark with an X the point (center of site) where the radioactive source will be located. Draw a straight line approximately 16 meters long from the point X.

(2) Start from the point marked X; measure and mark off intervals for each of the distances listed in the table.

(3) Use the point marked X as the center of a circle, and calculate the distance for a dose rate of 2 mrad/hr as the radius; post the radiation area (para 2-3).

(4) Provide a wood stand with a hook or other means for suspending the radioactive source directly over and approximately 3 inches above the point marked X.

d. Obtain Survey Meter Readings.

WARNING

Never allow personnel without film badges and dosimeters inside the restricted area. Be sure to wear film badges and dosimeters inside the restricted area. Do not linger in the radiation area any longer than is necessary to obtain the meter readings.

(1) To check the survey meter for proper operation, use the procedure described in the appropriate technical manual and record the background reading.

(2) Remove the radioactive source from the shield (para 2-9) and suspend the source over the point marked X. Leave the radiation area.

(3) Start with the highest scale on the survey meter and obtain three meter readings on each scale (except the 0 to 0.5 mrad/hr scale): one near the top, one near the middle, and one near the lower end of each scale. Obtain one scale reading ((*c*) below) on the 0 to 0.5 mrad/hr scale.

(*a*) Select the scale to be calibrated. Start with the marked interval closest to the point X and work away from the source. Before taking a scale reading, place the survey meter so that the detecting element in the meter is centered on the interval marked.

(*b*) Record each scale reading in the proper place in the table.

(*c*) Turn the selector switch to the 0 to 0.5 mrad/hr scale. Place the survey meter at the marker farthest from the source (the point at which the calculated dose rate is 0.4 mrad/hr). Observe the scale reading. Subtract the background scale reading and record the difference as the survey meter readings.

(*d*) Return the radioactive source to the shield (para 2-10).

e. Evaluate the Data. Compare the tabulated scale readings with the comparable calculated dose rates for each distance from the radioactive source as recorded in the table.

(1) If any tabulated scale reading differs by more than ± 15 percent from the calculated dose rate, do not

continue the calibration but turn the survey meter in for adjustment or repair.

(2) If all the tabulated scale readings are within ±15 percent of the calculated dose rate, prepare a calibration curve as described in *f* below.

f. Preparing a Calibration Curve.

(1) Use linear graph paper to mark off calculated dose rate intervals on the horizontal axis and survey meter scale intervals on the vertical axis; date the graph with the calibration date.

(2) Plot each survey meter scale reading in the table against the comparable calculated dose rate.

(3) Complete the calibration graph by drawing a smooth curve through the plotted points.

(4) Attach the calibration graph to the radiac survey meter.

g. Use the Calibration Curve. Each time a survey meter scale reading is observed, refer to the calibration graph and obtain the true dose rate. Report as survey data the true dose rate obtained from the curve.

2-15. Calibration of Radiac Dosimeters

a. General. IM-9( )/PD radiac dosimeters should be calibrated every 6 months (TB 750-242-3): If, after exposure to a radioactive source, a dosimeter scale reading differs from the comparable calculated dose by more than ± 10 percent (*f*(3) below) the dosimeter should be turned in for disposal.

b. Preliminary Procedure.

WARNING

Never take the radioactive source from the shield without having a radiacmeter available and in good working order; e.g., an AN/PDR-27 radiac set.

(1) Draw a table with three column headings and date it with the calibration date. Head the three columns:

(*a*) Dosimeter Serial Numbers.

(*b*) Scale Reading (SR), mrad.

(*c*) Correction Factor (CF).

(2) In the first column in the table, list the serial number of each dosimeter that is to be calibrated.

(3) Use data from the cobalt 60 decay curve chart to calculate the present strength (mrad/hr at 1 meter) of the radioactive source (para 2-12*a*). Record this value on the worksheet.

(4) Use the value obtained above to calculate the dose rate (mrad/hr) at a distance of ½ meter from the radioactive source (para 2-12*b*). Record this value on the worksheet.

(5) Calculate the dose (mrad) resulting from a 15-minute exposure and a 30-minute exposure at a distance of ½ meter from the radioactive source (para 2-12*d*). Record on the worksheet the calculated dose (CD) that is closest to 150 mrad. Record length of exposure.

NOTE

The calculated dose resulting from a 15-minute exposure at ½ meter will be numerically equal to the present strength of the radioactive source ((3) above). For example, if the present strength of the source is 95.04 mrad/hr at 1 meter, the calculated dose resulting from a 15-minute exposure at ½ meter will be 95.04 mrad. The calculated dose resulting from a 30-minute exposure at ½ meter will be numerically equal to twice the present strength of the radioactive source. For example, if the present strength of the source is 95.04 mrad/hr at 1 meter, the calculated dose resulting from a 30-minute exposure at ½ meter will be twice 95.04 or 190.08 mrad.

(6) Calculate the distance from the radioactive source at which the dose rate is 2 mrad/hr (para 2-12*c*). Record this value on the worksheet and use it to delineate the radiation area (para 2-3).

c. Preparing the Calibration Site.

WARNING

Never leave an unshielded radioactive source unattended. If necessary to leave the source set, reshield the radioactive source and lock the container.

(1) Select a calibration site in a one-story building or outside in a location that is away from the main stream of traffic.

(2) Select a flat unobstructed surface within the calibration area and draw a circle having a radius of ½ meter.

(3) Mark the center of the circle; this is where the radioactive source will be suspended.

(4) Prepare a wood stand with a hook or other means for suspending the radioactive source directly over and approximately 3 inches above the center of the circle.

d. Charging Radiac Dosimeters. Radiac dosimeters must be fully charged before they are calibrated. Charge the dosimeters as described in TB SIG 226-9. Be sure that the scale reading is zero on each dosimeter to be calibrated.

e. Exposing Charged Dosimeters to the Radioactive Source.

WARNING

Wear film badges and dosimeters. Do not linger in the radiation area any longer than is necessary. Do not leave the unshielded radioactive source unattended.

(1) Stand dosimeters to be calibrated approximately 6 to 8 inches apart on the circumference of the circle (*c*(2) above). Stand each dosimeter on its viewing end (the end with the clip).

(2) Remove the radioactive source from the shield

(para 2-9) and suspend the source over the center of the circle. Note and record the exact time (hours, minutes, and seconds).

(3) Leave the radiation area.

(4) Expose the dosimeters to the radioactive source for either exactly 15 minutes or exactly 30 minutes depending on the strength of the source (*b*(3) above).

(5) As quickly as possible, remove the source and return it to the shield (para 2-10).

f. Calibrating Radiac Dosimeters.

(1) Collect the exposed dosimeters. Read each dosimeter and enter the scale reading (SR) in the second column opposite the appropriate serial number in the first column.

(2) Calibrate a correction factor (CF) for each dosimeter. Divide the calculated dose (CD) (*b*(3) above) by the scale reading (SR) listed in the second column on the worksheet and list the correction factor (CF) in the third column opposite the appropriate serial number.

Example:

$$\frac{\text{Calculated Dose (CD)}}{\text{Scale Reading (SR)}} = \text{Correction Factor (CF)}$$

If the calculated dose is 180 mrad and the scale reading is 190 mrad, the correction factor is $\frac{180}{190}$ or 0.95.

(3) Scan the list of correction factors in the third column of the table. Any dosimeter requiring a correction factor of less than .90 or greater than 1.10 is considered unserviceable and should be turned in.

(4) Record the calibration date, serial number, and correction factor for each serviceable dosimeter on separate pieces of paper and attach the papers to the appropriate dosimeters.

Section VI. EMERGENCY SITUATIONS AND PROCEDURES

NOTE

The procedures outlined below will be followed in an emergency situation.

2-16. Loss of Radioactive Source Set

a. Try to recover the radioactive source set.

(1) Review records to determine the responsible individual.

(2) Make a physical survey.

b. If the radioactive source set is recovered, revise procedures as necessary to prevent a recurrence.

c. If the radioactive source set is not recovered, report the loss through command channels to the area Radioactive Material Control Point. State the serial number of the source, the circumstances involved, and the procedures taken to prevent a recurrence.

2-17. Internal Exposure of Personnel

a. Internal exposure is the result of personnel becoming contaminated when radioactive particles are inhaled, swallowed, or absorbed through breaks in the skin.

b. In the event of a known or suspected internal exposure:

(1) Seek advice from the Medical Officer.

(2) Notify responsible commands, and Commander, Edgewood Arsenal, ATTN: SAREA-SA, Aberdeen Proving Ground, MD 21010. During duty hours, telephone area code 301, telephone number 671-4411; during nonduty hours, 671-2403.

2-18. Damaged or Leaking Radioactive Source Set

A radioactive source set could begin to leak as a result of age, or if it is crushed or dropped. In the event of a known or suspected leaking source, perform the following:

a. Monitor personnel, equipment, and areas for possible contamination.

b. Dispose of the radioactive source set (para 6-3). Decontaminate, as required (TM 3-220).

c. Report the disposal through command channels to the area Radioactive Material Control Point.

2-19. Firefighting Emergency Procedures

a. General. Emergency plans must include procedures for combating fires involving radioactive items. Plans should be commensurate with the quantity and type of items present. Firefighting personnel must know the location(s) of the items and must be familiar with radiation protection procedures. The M3A1 source set and source assembly are designed to withstand high temperatures. Even in temperatures high enough to melt the lead shield, the lead will be contained within the steel jacket and surround the source. No airborne radioactivity is expected from a fire involving only the M3A1 source set. However, if other radioactive sources are involved, firefighting activities may produce airborne radioactivity. As a general rule, personnel should wear protective respiratory equipment when fighting fires involving radioactive items.

b. Emergency Procedures.

(1) Evacuate personnel in the immediate area who are not directly involved.

(2) Notify the fire department.

(3) Determine radiation hazard and type of respiratory equipment required. Extinguish the fire with readily available portable extinguishers if radiation hazard is not present.

(4) Notify the Radiation Protection Officer.

(5) Notify medical personnel when appropriate.

(6) Control access to the immediate area.

(7) Monitor personnel, equipment, supplies, and environs.

(8) Decontaminate personnel, equipment, supplies, and environs.

(9) Record and report the fire on proper forms.

CHAPTER 3
OPERATOR'S MAINTENANCE INSTRUCTIONS

3-1. General

a. The operator must perform inspection and preventive maintenance services under the supervision of a radiation protection officer who has received specific training in the proper operation of the radioactive source set and who has met the minimum qualifications as they are defined in paragraph 1-4*a* of this manual.

b. The operator is authorized to clean the exterior of the storage case and to clean the M4 telescoping radioactive source magnetic handler.

3-2. Operator's Preventive Maintenance Checks and Services

a. General. Inspection and maintenance services described in table 3-1 will be performed each day that the equipment is used and at least semiannually when the equipment is in unit storage. Deficiencies beyond the maintenance capability of the operator must be reported to higher level maintenance.

b. Purpose. The preventive maintenance checks and services table provides a step-by-step guide for making inspections and performing required preventive maintenance.

c. Explanation of Columns. The numbers in the first three columns indicate the sequence in which the item listed in the fourth column should be inspected. The procedures for performing the inspections and the paragraph references are listed in the fifth column. In the sixth column, the estimated mean value of time to perform each individual test is shown in man-hour units.

Table 3-1. Operator's Preventive Maintenance Checks and Services

B—Before Operation Time required: 2.0 | D—During Operation | A—After Operation Time required: 0.1

Interval and sequence No. B	D	A	ITEM TO BE INSPECTED PROCEDURE	Work time (M/H)
			WARNING Follow the instructions in paragraph 2-3 before removing the radioactive source capsule from the shield in the storage case. Use the magnetic handler to handle the radioactive source.	
1			STORAGE CASE	
			Inspect the exterior of the storage case for breakage.	0.1
			Check to see if the paint is chipped or peeled, and if the hardware is loose, damaged, or missing.	0.1
2			IDENTIFICATION PLATE	
			Make sure that an identification plate (2, fig. 1-2) is attached to the outside cover of the case and that markings on the plate are legible. Check the replacement date on the identification plate. (The replacement date also appears on the decay curve chart.)	0.1
3			TECHNICAL MANUAL	
			Make sure that a copy of this manual, TM 3-6665-214-13&P, in usable condition, is packed in the case.	0.1
4			M4 MAGNETIC HANDLER	
			Inspect the magnetic handler to make sure that it is clean and that it functions properly.	0.3
5			COBALT 60 DECAY CURVE CHART	
			Check the chart (fig. 1-4) on the inside of the cover of the storage case to make certain that the information printed on the chart is legible.	0.1
6			SHIELD ASSEMBLY	
			Inspect the lead shield (11, fig. 1-4) to make certain that it is undamaged. See that the plug (3) and the lockbar (4) are in place and that the padlock (5) is locked. If the lock is open or broken, do not remove the plug but check the surface of the storage case with any approved radiac meter capable of measuring a dose rate of 5 mrad/hr to 200 mrad/hr to determine if the radioactive source capsule is in the shield. A reading in excess of 5 mrad/hr but less than 200 mrad/hr indicates the presence of the radioactive source in the shield.	0.3
			Perform a leak test (para 2-5).	0.8
7			RADIOACTIVE SOURCE ASSEMBLY	
			Inspect the radioactive source assembly to make sure that the source capsule is suspended from the lifting disk (or ring).	0.1
		8	STORAGE CASE	
			Clean the exterior of the storage case by wiping it off with a clean, damp cloth.	0.1

CHAPTER 4
ORGANIZATIONAL MAINTENANCE INSTRUCTIONS

Section I. PREVENTIVE MAINTENANCE SERVICES

4-1. General

Organizational maintenance personnel must perform inspection and preventive maintenance services under the supervision of a radiation protection officer.

4-2. Preventive Maintenance Checks and Services (Table 4-1)

Organizational maintenance personnel are authorized to perform the preventive maintenance services listed below. Except for the motor and clutch assembly, these services should be performed weekly when the source set is in use. Motor and clutch assembly should be inspected and serviced monthly after issue to field personnel. Deficiencies beyond their maintenance capability must be reported to higher level maintenance.

a. Make minor repairs of the storage case, such as replacing missing nails and screws and tightening loose screws and nuts.

b. Retouch or repaint the storage case when necessary (para 4-3).

c. Replace or repair lock bar.

d. Inspect, service, and repair magnet, flexible arm, and extension assembly of the M4 telescoping radioactive source magnetic handler. Repair is limited to removal of distorted segment(s) of flexible arm assembly or extensions.

e. Inspect and service motor and clutch assembly.

Table 4-1. Organizational Maintenance Checks and Services

Weekly
Time required: 5.2

Sequence No.	ITEM TO BE INSPECTED PROCEDURE	Work time (M/H)
1	STORAGE CASE	
	Make minor repairs. Tighten loose screws and nuts. Replace missing nails and screws. Retouch or repaint case (para 4-3*a*).	0.5
2	RADIOACTIVE SOURCE AND SHIELD ASSEMBLY	
	Repair lockbar, if damaged.	0.3
	Replace lockbar, if missing (para 4-4).	1.0
3	M4 RADIOACTIVE SOURCE MAGNETIC HANDLER	
	Inspect magnet, flexible arm, and extension assembly.	0.6
	Repair, if damaged (para 4-5c and table 4-2).	0.7
	Inspect motor, clutch assembly, magnet control, and handle housing cover.	1.8
	Service, if needed (para 4-5c).	0.3

Section II. ORGANIZATIONAL MAINTENANCE INSTRUCTIONS

4-3. Storage Case

Organizational maintenance personnel are authorized to make minor repairs of the storage case, to retouch the paint on the storage case and, when necessary, to thoroughly clean and repaint the case.

a. Paints To Be Used. Use synthetic paint primer and synthetic gloss enamel. (Refer to TM 43-0139 for painting instructions.)

(1) *Primer.* Paint all exposed exterior surfaces with one coat of primer.

(2) *Enamel.*

(*a*) Paint the storage case with yellow gloss enamel color number 13655.

(*b*) Paint radiation symbols (3, fig. 1-2) and eliptical DANGER Warning backgrounds (5) with magenta (purple) gloss enamel color number 17142.

(*c*) Paint the word DANGER on the eliptical DANGER Warning backgrounds with white gloss enamel color number 17875.

(*d*) Paint the words RADIOACTIVE MATERIALS underneath the radiation symbols with black gloss enamel color number 17038.

b. Identification Plate. If the identification plate (fig. 5-1) is bent or twisted, remove the plate from the storage case and straighten it. Secure the repaired plate to the cover of the storage case.

4-4. Radioactive Source and Shield Assembly (Lockbar)

a. General. Organizational support maintenance personnel are authorized to repair, replace, and manufacture a new lockbar, if necessary. If the lockbar (4, fig. 1-4) is bent or twisted out of its original shape, bend or straighten it to its original shape. If the lockbar is damaged beyond repair, or if it is missing, replace it.

b. Description. The steel lockbar (4, fig. 1-4) passes through the handle of the plug and through slots in the lugs (12) on the shield. The shackle of a combination lock (5) passes through round holes in the bent end of the lockbar and through an adjacent lug and secures the radioactive source in the shield.

c. Inspection. Inspect the lockbar for distortion, cracks, or other damage. Replace, if damaged or missing.

d. Manufacture. Fabricate the lockbar (fig. 4-1).

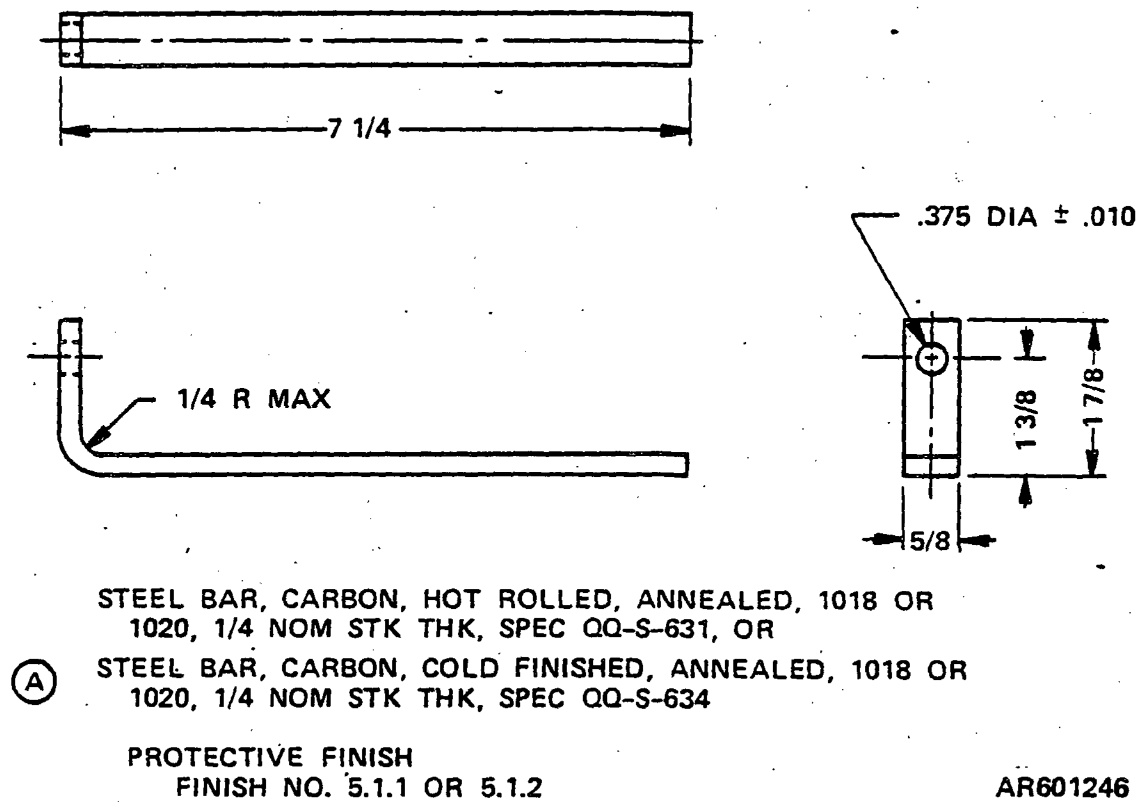


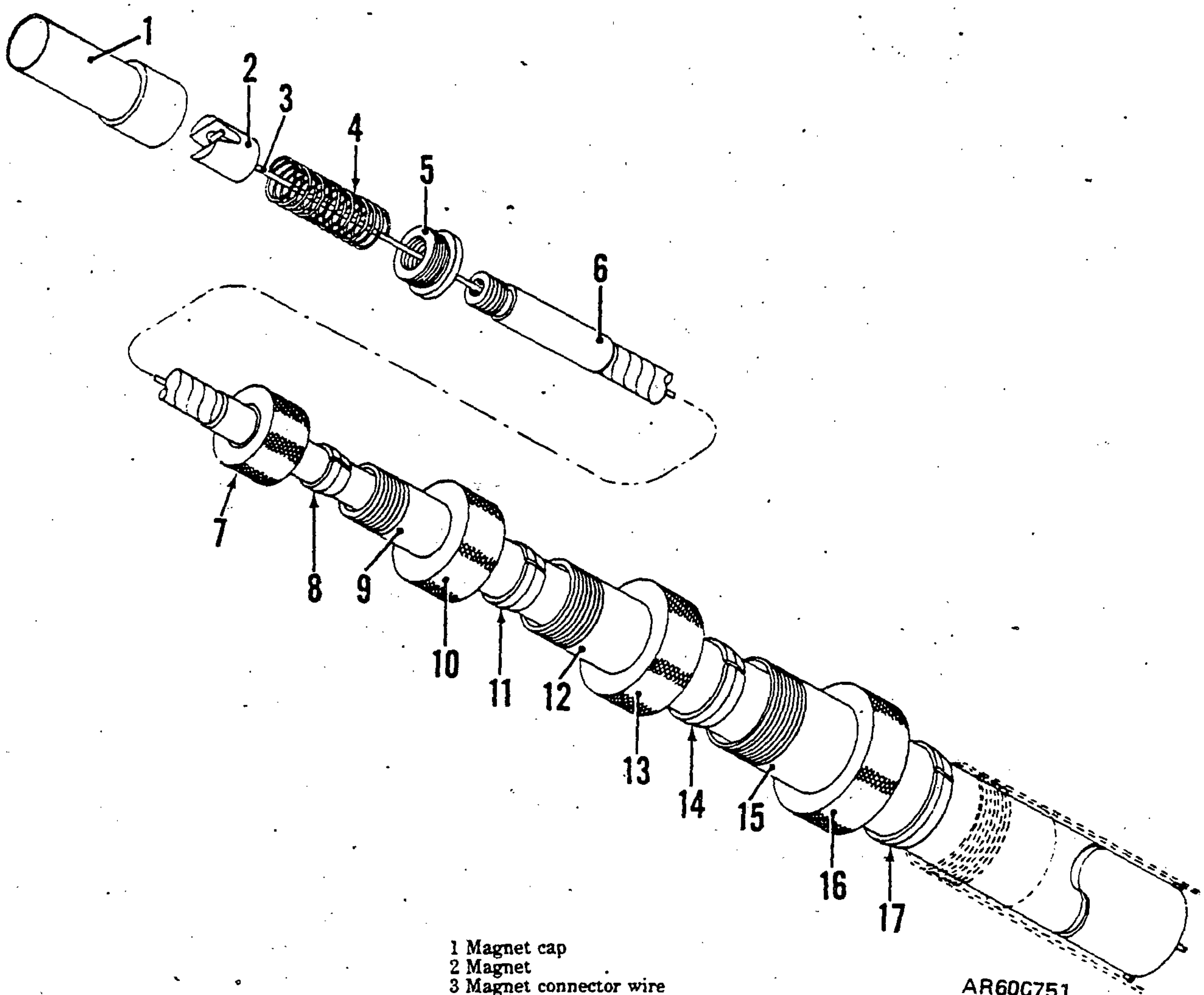
Figure 4-1. Lockbar.

4-5. M4 Telescoping Radioactive Source Magnetic Handler

a. General. The M4 telescoping radioactive source magnetic handler consists of two major groups: the magnet, flexible arm, and extension assembly and the motor and clutch assembly (fig. 4-2) and (fig. 4-3). For purposes of description, the motor and clutch assembly is divided into subgroups and assemblies. Inspection requires at least partial disassembly (para 4-6*b*). Servicing requires complete disassembly (para 4-6c).

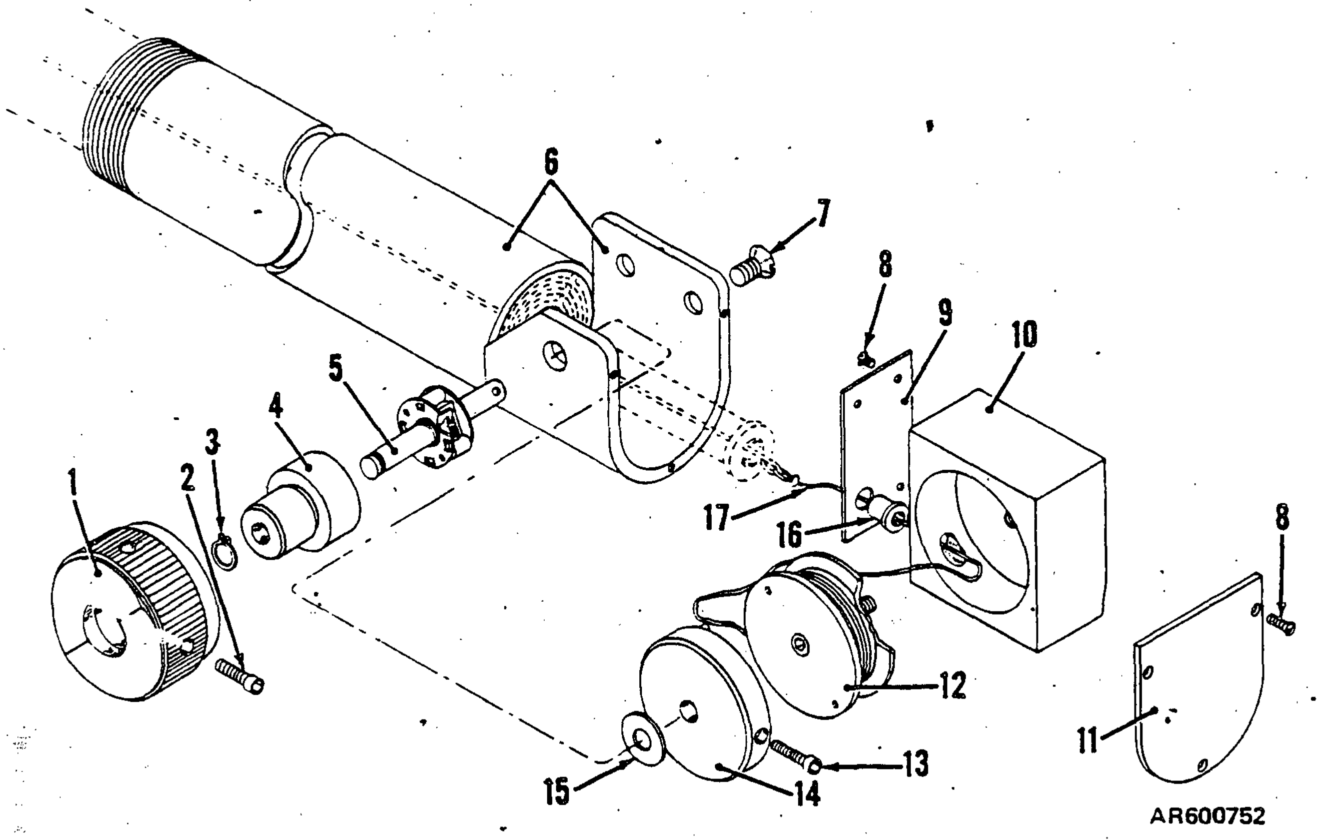
b. Description.

(1) *Magnet, flexible arm, and extension assembly.* The magnet, flexible arm, and extension assembly, from front to back, consists of a magnet cap (1, fig. 4-2), a magnet (2), a magnet connector wire (3), a compression spring (4), an adapter (5), a flexible arm assembly (6), three extensions (9), (12), and (15), four retaining nuts ((7), (10), (13), and (16)), and four split preformed plastic packing rings ((8), (11), (14), and (17)). The back end of the flexible arm assembly and each of the aluminum extensions are flanged so that each can be fitted inside another, to form the telescoping portion of the handler. The tension exerted by the spring motor assembly (12, fig. 4-3) causes the flexible arm assembly and the three extensions to telescope into the tube end of the handle and housing assembly (6). The magnet connector wire connects the magnet with the spring motor assembly. The magnet cap (1, fig. 4-2) fits over the magnet (2) and compression spring (4) and is screwed onto an adapter (5) on the front end of the flexible arm assembly (6).



1 Magnet cap
2 Magnet
3 Magnet connector wire
4 Compression spring
5 Adapter
6 Flexible arm assembly
7 Retaining nut
8 Packing ring
9 Extension
10 Retaining nut
11 Packing ring
12 Extension
13 Retaining nut
14 Packing ring
15 Extension
16 Retaining nut
17 Packing ring

Figure 4-2. M4 radioactive source magnetic handler, magnet, flexible arm, and extension assembly (exploded view).



1 Magnet control knob
2 Setscrew
3 Retaining ring
4 Clutch housing
5 Clutch
6 Handle and housing assembly
7 Screws
8 Screws
9 Bushing retaining plate
10 Spring motor assembly housing
11 Handle housing cover
12 Spring motor assembly
13 Setscrew
14 Clutch adapter
15 Washer
16 Bushing
17 Spring motor cable

Figure 4-3. M4 radioactive source magnetic handler, motor and clutch assembly (exploded view).

(2) *Motor and clutch assembly.* The motor and clutch assembly consists of a spring motor assembly subgroup which is installed in the housing end of the handle and housing assembly (6, fig. 4-3), a handle housing cover (11) which fits over the housing end of the handle and housing assembly, and a magnet control and clutch subgroup which is installed in the clutch adapter (14).

(*a*) *Spring motor assembly subgroup.* The spring motor assembly subgroup consists of a bushing retaining plate (9), a bushing (16), a spring motor assembly housing (10), and a spring motor assembly (12).

(*b*) *Magnet control and clutch subgroup.* The magnet control and clutch subgroup contains a clutch assembly consisting of a clutch housing (4) and a clutch (5), a retaining ring (3) which holds the clutch assembly together, a magnet control knob (1) which fits over the clutch housing, a clutch adapter (14), and a washer (15).

c. *Disassembly.* Disassemble the M4 telescoping radioactive source magnetic handler only to the extent that it is necessary to make the required service, repair or replacement. With the magnetic handler in the telescoped position, follow the sequence of disassembly as given below.

(1) *Magnet cap, magnet, compression spring, and adapter.*

(*a*) Unscrew the magnet cap (1, fig. 4-2) from the adapter (5).

(*b*) Pull the end of the magnet connector wire (3) approximately 6 inches out from the flexible arm assembly (6) and hold it in position with a pair of pliers.

(*c*) Slide the magnet (2) and compression spring (4) back from the end of the wire.

(*d*) Use a second pair of pliers to straighten the bend at the end of the magnet connector wire.

(*e*) Remove the magnet and compression spring.

(*f*) Unscrew the adapter (5) from the end of the flexible arm assembly (6) and remove the adapter.

(2) *Retaining nuts and packing rings.*

(*a*) Unscrew the four retaining nuts ((7), (10), (13), and (16)) and slide the nuts from the end of the flexible arm assembly.

(*b*) Remove the packing rings ((8), (11), (14), and (17)) from their respective retaining nuts.

(3) *Magnet control clutch subgroup.*

(*a*) Loosen two setscrews (2, fig. 4-3) with a 5/64-inch socket-head screw key and pull off the magnet control knob (1).

(*b*) Loosen setscrew (13) in the clutch adapter (14) with a 1/16-inch socket-head screw key and pull the clutch assembly (para 4-5*b*) from the clutch adapter. Remove the retaining ring (3) from the clutch housing (4) only if the clutch is damaged and in need of replacement.

(4) *Handle housing cover.* Unscrew and remove three screws (8) and remove the handle housing cover (11) from the back of the handle and housing assembly (6).

(5) *Spring motor assembly subgroup and clutch adapter subgroup.*

(*a*) Remove two screws (7) which hold the spring motor assembly housing (10) in position in the housing end of the handle and housing assembly (6).

(*b*) Withdraw the spring motor assembly subgroup (*b*(1) above), the clutch adapter (14), and washer (15) from the handle and housing assembly.

(*c*) Remove the washer (15) and the clutch adapter (14).

(*d*) Lay the spring motor assembly beside the back end of the handle and housing assembly.

(*e*) Insert and fully seat a 1/8-inch socket-head screw key in the hexagonal opening in the top of the spring motor assembly (12). Hold the spring motor assembly to prevent it from rotating when the socket-head screw key is turned.

(*f*) Turn the key counterclockwise to release the threaded end of the spring motor assembly shaft from the threaded hole in the spring motor assembly housing (5½ turns). Do not release the socket-head screw key. Tilt the spring motor assembly so that the shaft does not seat in the threaded opening in the spring motor assembly housing. Slowly release the key to release the spring tension.

(*g*) Pull the magnet connector wire (3, fig. 4-2) from the back of the flexible arm assembly (6).

(*h*) Separate the spring motor cable (17, fig. 4-3) from the magnet connector wire by spreading the loop on the end of the magnet connector and removing the soldered loop at the end of the spring motor cable from the magnet connector wire.

(*i*) Remove the spring motor assembly (12).

(*j*) Remove the three screws (8) from the bushing retaining plate (9) and remove the plate from the spring motor assembly housing (10).

(*k*) Remove the bushing (16) from the bushing retaining plate.

(6) *Flexible arm assembly and extensions.* Withdraw the flexible arm assembly (6, fig. 4-2) and the three extensions (9), (12), and (15) from the back of the handle and housing assembly (6, fig. 4-3). If any of the above components are distorted to the extent that they cannot be withdrawn from the handle and housing assembly, cut just back of the distortion with hacksaw and remove that portion from the front of the handle and housing assembly.

d. Maintenance. After disassembling the M4 telescoping radioactive source magnetic handler as directed in *c* above, inspect the disassembled parts and clean them. Wipe all metal parts with a clean, oily cloth. Replace worn, damaged, or missing parts as authorized in the Maintenance Allocation Chart, Appendix C. Assemble the magnetic handler as directed in *e* below.

e. Assembly.

(1) *Flexible arm assembly and extensions.* Insert the extension (15, 12, and 9, fig. 4-2) and the flexible arm assembly (6) in sequence from the back of the handle and housing assembly (6, fig. 4-3). Make certain that the components are inserted so that they can be extended from the front of the handle and housing assembly.

(2) *Spring motor assembly subgroup.*

(*a*) Insert the bushing (16, fig. 4-3) through the large opening in the bushing retainer plate (9).

(*b*) Place the bushing retaining plate against the side of the spring motor assembly housing (10) so that the bushing fits into the recess in the side of the spring motor assembly housing. Aline the bushing retaining plate with the side of the housing.

(*c*) Fasten the bushing retaining plate (9) to the spring motor assembly housing (10) with three screws (8).

(*d*) Pass the loop end of the spring motor cable (17) from the inside of the spring motor assembly housing through the bushing.

(*e*) Hook the spring motor cable loop to the hook at the end of the magnet connector wire (3, fig. 4-2) and bend the hook to form a loop.

(*f*) Insert the magnet connector wire through the back of the flexible arm assembly (6) and pull the wire about 6 inches out from the front of the flexible arm assembly.

(*g*) Install the retaining nuts and packing rings ((3) below).

(*h*) Install the adapter, compression spring, magnet, and magnet cap ((4) below).

(*i*) Telescope the flexible arm assembly and the extensions and seat the spring motor assembly (12, fig. 4-3) in the spring motor assembly housing (10). Place the threaded shaft of the spring motor assembly over the threaded hole in the spring motor assembly housing. Insert and fully seat a 1/8-inch socket-head screw key in the hexagonal opening in the top of the spring motor assembly and turn the key in a clockwise direction until the spring motor assembly is fully seated. Withdraw the key.

(*j*) With the fingers rotate the spring motor assembly counterclockwise to take up as much of the spring motor cable slack as possible.

(*k*) Insert and fully seat the 1/8-inch socket-head screw key in the hexagonal opening in the top of the spring motor assembly. Hold the spring motor assembly so that it does not rotate in the spring motor assembly housing, and turn the key eight full turns counterclockwise. This action will release the threaded shaft of the spring motor assembly from the threaded opening in the spring motor assembly housing and put sufficient tension in the spring to take up any remaining slack in the spring motor cable when the key is released ((*l*) below).

(*l*) Seat the threaded shaft of the spring motor assembly over the threaded opening in the spring motor housing and slowly release the socket-head screw key allowing the spring motor assembly to become fully seated in the housing. After the tension on the key has been released, remove the key from the spring motor assembly.

(*m*) Fit the two pins on the bottom of the clutch adapter (14, fig. 4-3) into the two round openings in the top of the spring motor assembly and place a washer (15) over the top of the clutch adapter. Insert the assembled spring motor assembly subgroup into the housing end of the handle and housing assembly (6) so that the bushing (16) is adjacent to the back of the flexible arm assembly.

(*n*) Install the spring motor assembly in the housing end of the handle and housing assembly (6) with two screws (7).

(*o*) Aline the opening in the near side of the handle and housing assembly (6) and the washer and the clutch adapter and install the clutch and magnet control subgroup ((5) below).

(*p*) Attach the handle housing cover ((6) below).

(3) *Retaining nuts and packing rings.*

(*a*) Make sure that each retaining nut is fitted with a packing ring. Packing rings (8, 11, 14, 17, fig. 4-2) are seated in the retaining nuts (7, 10, 13, 16).

(*b*) Slip the retaining nuts with the threaded end toward the back of the magnetic handler over the front of the flexible arm assembly (6). Start with the largest nut (16) and end with the smallest nut (7).

(*c*) Screw but do not tighten nut (16, fig. 4-2) on the threaded end of the handle and housing assembly (6, fig. 4-3). Screw but do not tighten the remaining nuts to the threaded ends of the extensions (15, 12, and 9, fig. 4-2) respectively.

(4) *Adapter, compression spring, magnet, and magnet cap.*

(*a*) Slip the adapter (5, fig. 4-2) over the extended magnet connector wire (3) and screw the adapter on the end of the flexible arm assembly (6).

(*b*) Slip the compression spring (4) over the magnet connector wire.

(*c*) Thread the magnet connector wire (3) through the magnet (2) so that the slotted end of the magnet is toward the front end of the magnetic handler.

(*d*) Using a pair of pliers, bend the end of the magnet connector wire just enough to hold the magnet on the wire.

(*e*) Fit the magnet cap (1) over the magnet and compression spring. Use just enough pressure against the head of the magnet cap to seat the threaded end of the cap on the adapter and screw the cap on the adapter.

(5) *Magnet control and clutch subgroup.*

(*a*) See that the clutch housing (4, fig. 4-3) and the clutch (5) are assembled.

(*b*) Clip a retaining ring (3), if there is none, around the end of the clutch shaft that extends through the top of the clutch housing.

(*c*) Insert the bottom of the clutch shaft through the alined holes in the handle and housing assembly, washer, and clutch adapter ((2)(*o*) above). Rotate the clutch shaft to aline the opening in the shaft with the setscrew opening in the clutch adapter. Tighten the setscrew (13) with a 1/16-inch socket-head screw key.

(*d*) Fit the magnet control knob (1) over the clutch housing (4) and tighten the two setscrews (2) with a 5/64-inch socket-head screw key.

(6) *Handle housing cover.* Attach the handle housing cover (11) to the back of the handle and housing assembly (6) with three screws (8).

Section III. TROUBLESHOOTING PROCEDURES

4-6. Scope

a. This section contains troubleshooting or malfunction information and tests for locating and correcting most of the troubles which may develop in the M3A1 Radioactive Source Set. Each malfunction or trouble symptom for an individual component, unit, or system is followed by a list of tests or inspections necessary for you to determine probable causes and suggested corrective actions for you to remedy the malfunction.

b. This manual cannot list all possible malfunctions that may occur or all tests or inspections, and corrective actions. If a malfunction is not listed (except when malfunction and cause are obvious), or is not corrected by listed corrective actions, you should notify higher level maintenance. Skills and actions required to perform organizational maintenance of the M3A1 radioactive source set are approximately the same as those required to perform direct support maintenance of the item. The essential difference between the two levels of maintenance is that replacement parts are authorized only to direct support maintenance level.

c. Table 4-2 lists the common malfunction that you may find during the operation or maintenance of the M3A1 Radioactive Source Set or its components. You should perform the tests/inspections and corrective actions in the order listed.

NOTE

Before you use this table, be sure you have performed all normal operation checks. If you have a malfunction which is not listed in this table, notify the next higher level of maintenance.

Table 4-2. Troubleshooting Procedures

MALFUNCTION
TEST OR INSPECTION
CORRECTIVE ACTION

MAGNETIC HANDLER, M4
FLEXIBLE ARM ASSEMBLY AND EXTENSIONS

Components cannot be withdrawn from the handle and housing assembly (para 4-5c(6)).

a. Cut just back of distortion with hacksaw.
b. Remove distorted portion from front of handle and housing assembly.
c. Insert (assemble) remaining components so that they can be extended from front of handle and housing assembly.

CHAPTER 5
DIRECT SUPPORT MAINTENANCE INSTRUCTIONS

5-1. General

Direct support maintenance personnel are authorized to repair and replace the magnet, flexible arm, and extension assembly of the M4 magnetic handler. They are also authorized to repair and replace parts of the motor and clutch assembly. In addition, direct support maintenance personnel are authorized to manufacture a new identification plate, if required, and to perform all maintenance allocated to lower categories of maintenance.

5-2. Identification Plate

a. Description. The brass identification plate (fig. 1-3) is fastened with four screws, one in each corner, to the cover of the storage case. The plate shows the National Stock Number (NSN), replacement date, activity (mCi), manufacturing date, serial number of the radioactive source assembly, Bureau of Explosives Association of American Railroads permit number, and the Nuclear Regulatory Commission license number.

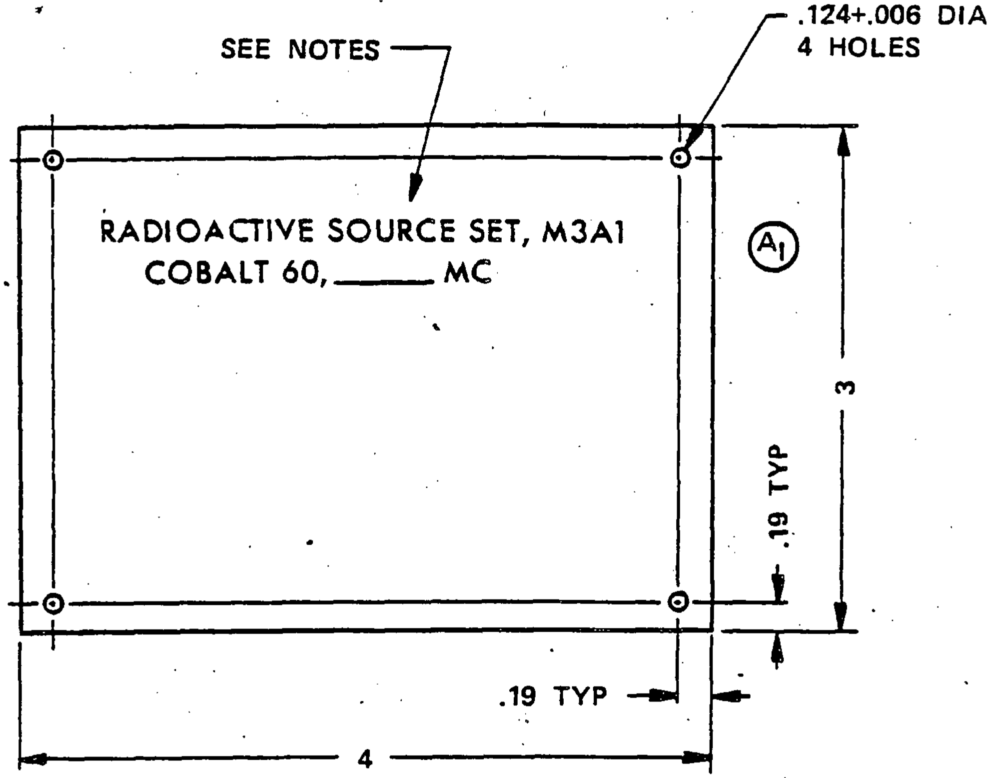
b. Inspection, Manufacture, Removal, and Installation.

(1) *Inspection.* If the identification plate is illegible, damaged beyond repair, or missing, manufacture a new identification plate.

(2) *Manufacture.* Fabricate the identification plate (fig. 5-2).

(3) *Removal.* Remove the four screws, one in each corner, that fasten the identification plate to the cover of the storage case. Lift plate from cover.

(4) *Installation.* Before securing the plate to cover, stamp or engrave the plate with letters approximately one-eighth inch high. Use the correct NSN and nomenclature. Fill in blank spaces with the appropriate information from the cobalt 60 decay chart which is fastened to the inside of the cover of the storage case, or from the shipping document that accompanies the radioactive source set. Fasten the new identification plate to the cover of the storage case.



BRASS STRIP, ALLOY NO. 268 OR 260, ANNEALED TEMPER
.032 NOM STOCK THICKNESS, SPEC QQ-B-613

NOTES:

1. LETTERS SHALL BE ENGRAVED OR STAMPED 1/8 HIGH.
2. MARKING SHALL BE IN ACCORDANCE WITH MIL - STD - 130.
3. THE FOLLOWING ADDITIONAL INFORMATION SHALL BE INCLUDED
   MANUFACTURING DATE ____________
   SERIAL NO. ____________
   REPLACEMENT DATE ____________

NRC LICENSE NO. 19-1826-2

NSN 6665-00-856-8235

AR601247

Figure 5-1. Identification plate (line drawing).

CHAPTER 6
SHIPMENT, STORAGE, AND DISPOSAL

6-1. Shipment

Shipment and transfer of M3A1 radioactive source sets are controlled by the Radiation Protection Officer.

6-2. Storage

a. M3A1 radioactive source sets must be stored only in storage facilities approved by the Radiation Protection Officer, where they are protected against unauthorized removal. Insure that the calibrators are stored in a fire-resistant building and that there are no explosives stored in the same structure.

b. Post the area with CAUTION—RADIOACTIVE MATERIAL signs.

6-3. Disposal

a. Report serviceable unwanted M3A1 radioactive source sets through the radioactive material control point to the national inventory control point (NICP) for disposition instructions.

b. In CONUS, turn in unserviceable M3A1 radioactive source sets for disposal. Forward request for disposition instructions through the radioactive material control point to Commander, Edgewood Arsenal, ATTN: SAREA-TS-MM, Aberdeen Proving Ground, MD 21010.

c. In overseas commands, turn in unserviceable M3A1 radioactive source sets for disposal in accordance with procedures established by the responsible commander.

APPENDIX A
REFERENCES

FM 21-48	Planning and Conducting Chemical, Biological, Radiological (CBR), and Nuclear Defense Training
TB SIG 226-9	Field Expedient for Charging Radiacmeters IM-93/UD and IM-147/PD
TB 43-180	Calibration Requirements for the Maintenance of Army Materiel
TB 750-242-3	Inspection and Certification of Radiac Dosimeters, IM-9( )/PD, IM 93( )/UD, and IM-147( )/PD
TM 3-220	Chemical, Biological, and Radiological (CBR) Decontamination
TM 38-750	The Army Maintenance Management System (TAMMS)
TM 43-0139	Painting Instructions for Field Use

APPENDIX B
ORGANIZATIONAL AND DIRECT SUPPORT MAINTENANCE REPAIR PARTS LIST

Section I. INTRODUCTION

B-1. Scope

This appendix lists repair parts required for operation and performance of organizational and direct support maintenance of the M3A1 Source Set. It authorizes the requisition and issue of items as indicated by the source and maintenance codes. There are no basic issue items, items troop installed or authorized or special tools applicable to this equipment.

B-2. General

This Repair Parts List is divided into the following sections:

a. Section II. Repair Parts List. A list of repair parts authorized for use in the performance of maintenance. The list also includes parts which must be removed for replacement of the authorized parts. Parts lists are composed of functional groups in ascending numerical sequence, with the parts in each group listed in figure and item number sequence. Bulk materials are listed in National stock number (NSN) sequence.

b. Section III. National Stock Number and Part Number Index. A list, in ascending numerical sequence, of all NSNs appearing in the listing followed by a list, in alphameric sequence, of all part numbers appearing in the listing. NSNs and part numbers are cross-referenced to each illustration figure and item number appearance.

B-3. Explanation of Columns

The following provides an explanation of columns found in the tabular listings:

a. Illustration. This column is divided as follows:

(1) *Figure number.* Indicates the figure number of the illustration on which the item is shown.

(2) *Item number.* The number used to identify each item called out in the illustration.

b. Source, Maintenance, and Recoverability Codes (SMR).

(1) *Source code.* Source codes are assigned to support items to indicate the manner of acquiring support items for maintenance, repair, or overhaul of end items. Source codes are entered in the first and second positions of the Uniform SMR Code format as follows:

Code	*Definition*
PA	Item procured and stocked for anticipated or known usage.
PB	Item procured and stocked for insurance purposes because essentiality dictates that a minimum quantity be available in the supply systems.
MF	Item to be manufactured or fabricated at the direct support maintenance level.
XB	Item is not procured or stocked. If not available through salvage, requisition.

NOTE

Cannibalization or salvage may be used as a source of supply for any items source coded above.

(2) *Maintenance code.* Maintenance codes are assigned to indicate the levels of maintenance authorized to USE and REPAIR support items. The maintenance codes are entered in the third and fourth positions of the Uniform SMR Code format as follows:

(*a*) The maintenance code entered in the third position will indicate the lowest maintenance level authorized to remove, replace, and use the support item. The maintenance code entered in the third position will indicate one of the following levels of maintenance:

Code	*Application/Explanation*
O	Support item is removed, replaced, used at the organizational level.
F	Support item is removed, replaced, used at the direct support level.
D	Support items that are removed, replaced, used at depot, mobile depot, specialized repair activity only.

(*b*) The maintenance code entered in the fourth position indicates whether the item is to be repaired and identifies the lowest maintenance level with the capability to perform complete repair. This position will contain one of the following maintenance codes:

Code	*Application/Explanation*
O	The lowest maintenance level capable of complete repair of the support item is the organizational level.
F	The lowest maintenance level capable of complete repair of the support item is the direct support level.
Z	Nonreparable. No repair is authorized.

(3) *Recoverability code.* Recoverability codes are assigned to support items to indicate the disposition action on unserviceable items. The recoverability code is entered in the fifth position of the Uniform SMR Code format as follows:

Recoverability codes	*Definition*
A	—Item requires special handling or condemnation procedures because of specific reasons (i.e., precious metal content, high dollar value, critical material, or hazardous material). Refer to appropriate manuals/directives for specific instructions.
H	—Reparable item. When uneconomically reparable, condemn and dispose at the general support level.
Z	—Nonreparable item. When unserviceable condemn and dispose at the level indicated in position 3.

c. National Stock Number. Indicates the National stock number assigned to the item and will be used for requisitioning.

d. Part Number. Indicates the primary number used by the manufacturer (individual, company, firm, corporation, or Government activity), which controls the design and characteristics of the item by means of its engineering drawings, specifications standards, and inspection requirements, to identify an item or range of items.

NOTE

When a stock number item is requisitioned, the repair part received may have a different part number than the part being replaced.

e. Federal Supply Code for Manufacturer (FSCM). The FSCM is a 5-digit numeric code listed in SB 708-42 which is used to identify the manufacturer, distributor, or Government agency, etc.

f. Description. Indicates the Federal item name and, if required, a minimum description to identify the item.

g. Unit of Measure (U/M). Indicates the standard of the basic quantity of the listed item as used in performing the actual maintenance function. This measure is expressed by a two-character alphabetical abbreviation (e.g., ea, ft, sh, etc.). When the unit of measure differs from the unit of issue, the lowest unit of issue that will satisfy the required units of measure will be requisitioned.

h. Quantity Incorporated in Unit. Indicates the quantity of the item used in the breakout shown on the illustration figure, which is prepared for a functional group, subfunctional group, or an assembly.

B-4. Special Information

a. Action change codes indicated in the left-hand margin of the listing page denote the following:

N—Indicates an added item

C—Indicates a change in data

b. Detailed manufacturing instructions for items source coded to be manufactured are found in this manual. Bulk materials required to manufacture items are listed in the bulk material group of this appendix.

B-5. How to Locate Repair Parts

a. When National Stock Number or Part Number Is Unknown:

(1) *First.* Determine the functional group within which the repair part belongs since illustrations are prepared for functional groups and listings are divided into the same groups.

(2) *Second.* Find the illustration covering the functional group to which the repair part belongs.

(3) *Third.* Identify the repair part on the illustration and note the illustration figure and item number of the repair part.

(4) *Fourth.* Using the Repair Parts Listing, find the figure and item number noted on the illustration.

b. When National Stock Number or Part Number Is Known:

(1) *First.* Using the Index of National Stock Numbers and Part Numbers, find the pertinent National stock number or part number. This index is in ascending NSN sequence followed by a list of part numbers in ascending alphameric sequence, cross-referenced to the illustration figure number and item number.

(2) *Second.* After finding the figure and item number, locate the figure and item number in the repair parts list.

(Next printed page is B-4)

Section II. REPAIR PARTS LIST

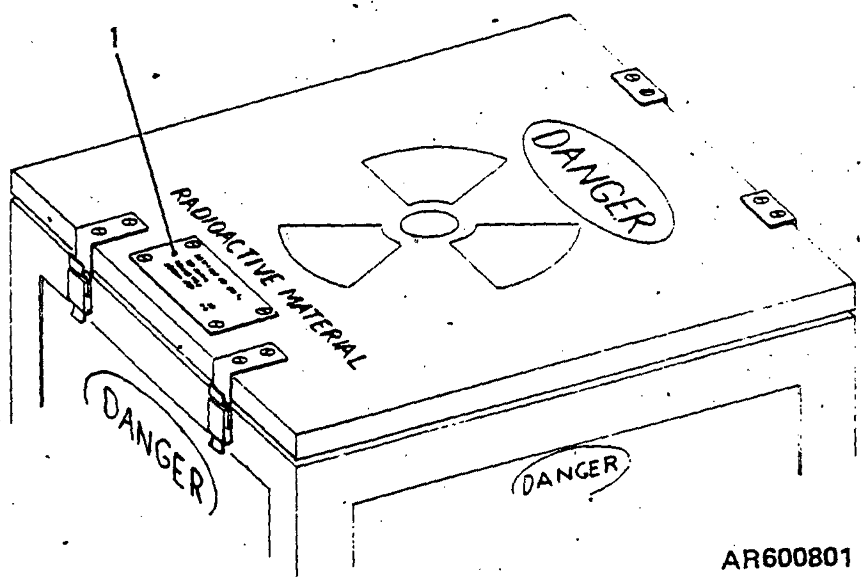


Figure B-1. Storage case.

(1) ILLUS Fig No.	(1) ILLUS Item No.	(2) SMR CODE	(3) NATIONAL STOCK NUMBER (NSN)	(4) PART NUMBER	(5) FSCM	(6) DESCRIPTION Usable On Code	(7) U/M	(8) QTY INC IN UNIT
						GROUP 0100 - STORAGE CASE		
C B-1	1	MFFOZ		B124-10-27	81361	PLATE, IDENTIFICATION: MFD FROM NSN 9535-00-232-6932	EA	1

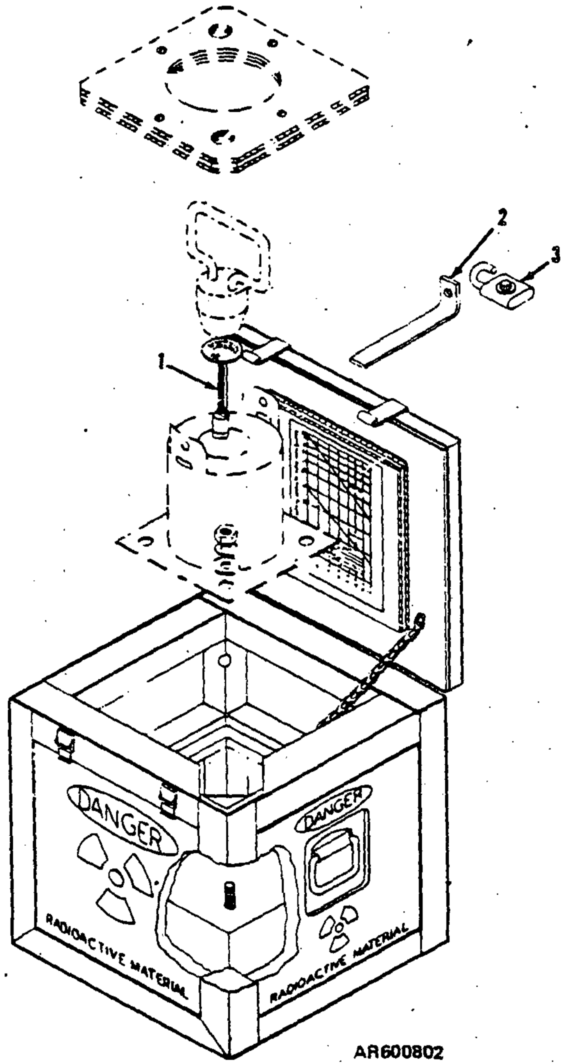


Figure B-2. Source set assembly.

	(1) ILLUS Fig No.	(1) ILLUS Item No.	(2) SMR CODE	(3) NATIONAL STOCK NUMBER (NSN)	(4) PART NUMBER	(5) FSCM	(6) DESCRIPTION Usable On Code	(7) U/M	(8) QTY INC IN UNIT
							GROUP 0200 - RADIOACTIVE SOURCE AND SHIELD ASSEMBLY		
C	B-2	1	XBDZA	6665-00-856-8233	C124-10-10	81361	RADIOACTIVE SOURCE ASSEMBLY, COBALT 60: M1A1	EA	1
C	B-2	2	MFOOZ		A124-10-9	81361	BAR, LOCK: MFD FROM NSN 9510-00-596-2065	EA	1
N	B-2	3	XBOZZ		K439N	72053	PADLOCK COMBINATION	EA	1

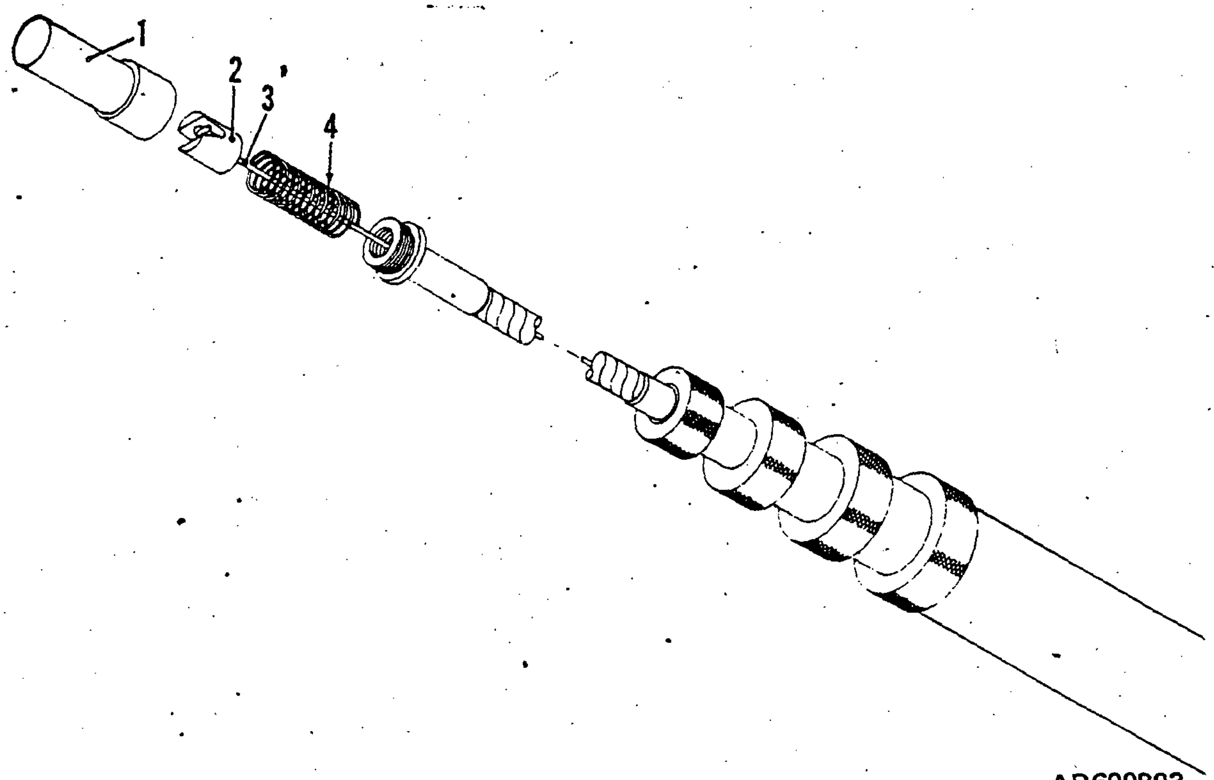


Figure B-3. Magnet, flexible arm extension assembly.

(1) ILLUS Fig No.	(1) ILLUS Item No.	(2) SMR CODE	(3) NATIONAL STOCK NUMBER (NSN)	(4) PART NUMBER	(5) FSCM	(6) DESCRIPTION Usable On Code	(7) U/M	(8) QTY INC IN UNIT
						GROUP 0300 - MAGNETIC HANDLER, M4		
B-3		PBOFH	6665-00-856-8234	D124-2-62	81361	MAGNETIC HANDLER, RADIOACTIVE SOURCE, TELESCOPING: M4	EA	1
B-3	1	XBFZZ		B124-2-75	81361	MAGNETIC CAP	EA	1
B-3	2	XBFZZ		B124-2-77	81361	MAGNET	EA	1
B-3	3	PAFZZ	9505-00-060-0882	00W423	81348	WIRE, STEEL, CORROSION RESISTING: RD, 0.063 IN. DIA	IN	18
B-3	4	PBFZZ	5360-00-811-9127	B124-2-79	81361	SPRING, HELICAL, COMPRESSION: STL, PLD, 0.046 IN. DIA, 13 COILS, 2 IN. FREE LG, 0.500 IN. FREE OD	EA	1

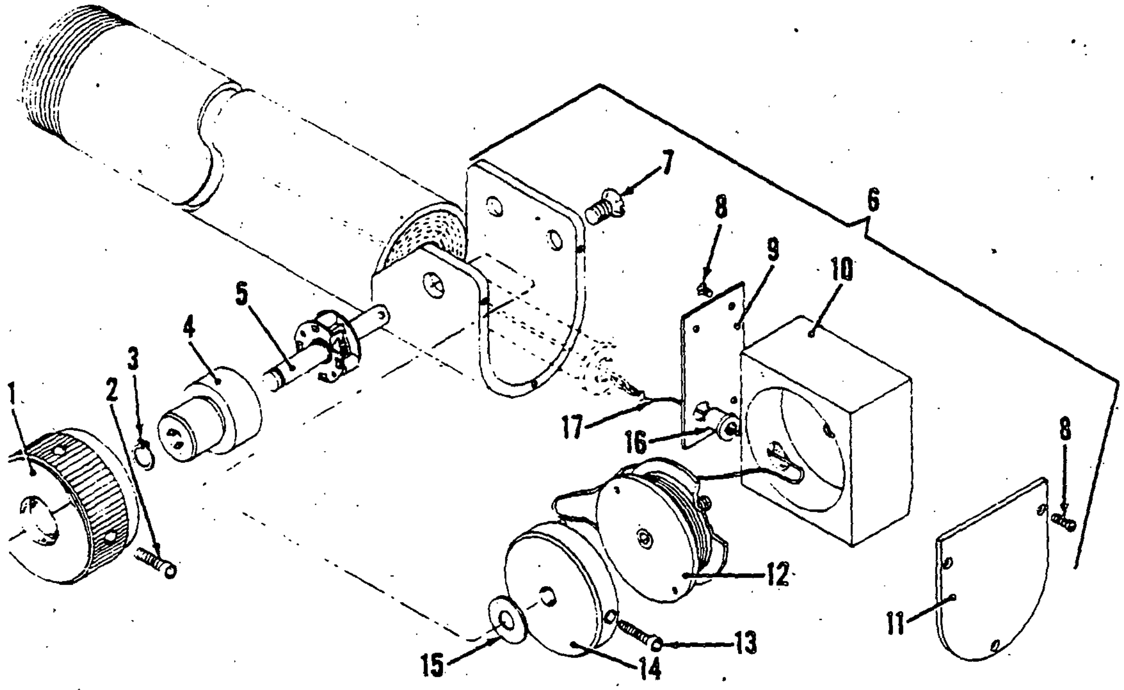


Figure B-4. Motor and clutch assembly.

	(1) ILLUS Fig No.	(1) ILLUS Item No.	(2) SMR CODE	(3) NATIONAL STOCK NUMBER (NSN)	(4) PART NUMBER	(5) FSCM	(6) DESCRIPTION Usable On Code	(7) U/M	(8) QTY INC IN UNIT
C	B-4	1	XBFZZ		B124-2-78	81361	KNOB, CONTROL	EA	1
C	B-4	2	XBFZZ		MS51030-27	96906	SETSCREW: CRES, HEXAGON SOCKET FLAT PT, #8-32, 1/4 IN. LG	EA	2
C	B-4	3	XBFZZ		MS16624-4025	96906	RING, RETAINING: CRES, EXT APPLICATION, 0.250 IN. SHAFT SIZE	EA	1
C	B-4	4	XBFZZ		B124-2-81HSG	81361	HOUSING, CLUTCH	EA	1
C	B-4	5	XBFZZ		B124-2-81	81361	SHAFT AND ROLLER ASSEMBLY	EA	1
C	B-4	6	XBFZZ		C124-2-63	81361	HANDLE AND HOUSING ASSEMBLY	EA	1
C	B-4	7	XBFZZ		MS35202-51	96906	SCREW, MACHINE: AL ALLOY, FLAT CSK HEAD, #10-24, 1/4 IN. LG	EA	2
C	B-4	8	XBFZZ		MS35218-2	96906	SCREW, MACHINE: AL ALLOY, PAN HEAD, #2-56, 0.187 IN. LG	EA	6
C	B-4	9	XBFZZ		A124-2-67	81361	PLATE, BUSHING RETAINING	EA	1
C	B-4	10	XBFZZ		B124-2-73	81361	HOUSING, SPRING MOTOR ASSEMBLY	EA	1
C	B-4	11	XBFZZ		A124-2-66	81361	COVER		

(1) ILLUS Fig No.	Item No.	(2) SMR CODE	(3) NATIONAL STOCK NUMBER (NSN)	(4) PART NUMBER	(5) FSCM	(6) DESCRIPTION Usable On Code	(7) U/M	(8) QTY INC IN UNIT
C B-4	12	PBFZZ	6665-00-474-7226	C124-2-80	81361	MOTOR ASSEMBLY, SPRING LOADED	EA	1
C B-4	13	XBFZZ		MS51029-20	96906	SETSCREW: CRES, HEXAGON SOCKET, FLAT PT, #6-32, 3/8 IN. LG	EA	1
C B-4	14	XBFZZ		B124-2-76	81361	PLATE, CLUTCH	EA	1
C B-4	15	XBFZZ		MS27183-10	96906	WASHER, FLAT: STL PLD, RD, 0.250 IN. ID	EA	1
						GROUP 0400 - BULK MATERIALS		
N BULK		PAOZZ	9510-00-596-2065	QQS634	81348	STEEL BAR: CARBON COLD FINISHED FLAT, 1/4 IN. THK, 5/8 IN. W, 10 TO 14 FT LG	FT	14
N BULK		PAFZZ	9535-00-232-6932	QQB613	81348	METAL STRIP: 12 IN. W, 48 IN. LG BRASS, 0.032 IN. THK	SH	1

Section III. NATIONAL STOCK NUMBER AND PART NUMBER INDEX

a. National Stock Numbers.

National Stock Number	Fig. No.	Item No.
9505-00-060-0882	B-3	3
6665-00-474-7226	B-4	12
5360-00-811-9127	B-3	4
6665-00-856-8233	B-4	2
6665-00-856-8234	B-3	
9510-00-596-2065	BULK	
9535-00-232-6932	BULK	

b. Part Numbers.

Part Number	FSCM	Fig. No.	Item No.
A124-10-9	81361	B-2	1
A124-2-66	81361	B-4	11
A124-2-67	81361	B-4	9
B124-10-27	81361	B-1	1
B124-2-73	81361	B-4	10
B124-2-75	81361	B-3	1
B124-2-76	81361	B-4	14
B124-2-77	81361	B-3	2
B124-2-78	81361	B-4	1
B124-2-79	81361	B-3	4
B124-2-81HSG	81361	B-4	4
B124-2-81LESSHSG	81361	B-4	5
C124-10-10	81361	B-2	2
C124-2-63	81361	B-4	6
C124-2-80	81361	B-4	12
D124-2-62	81361	B-3	
K439N	72053	B-2	3
MS16624-4025	96906	B-4	3
MS27183-10	96906	B-4	15
MS35202-51	96906	B-4	7
MS35218-2	96906	B-4	8
MS51029-20	96906	B-4	13
MS51030-27	96906	B-4	2
QQB613	81348	BULK	
QQS634	81348	BULK	
00W423	81348	B-3	3

APPENDIX C
MAINTENANCE ALLOCATION CHART

Section 1. INTRODUCTION

C-1. General

The maintenance allocation chart (sec II) lists the authorized maintenance functions assigned the maintenance categories for maintenance of the M3A1 Radioactive Source Set. This chart is to be used by all levels of maintenance to insure complete support of the equipment.

C-2. Maintenance Functions

Maintenance functions will be limited to and defined as follows:

a. Inspect. To determine the serviceability of an item by comparing its physical, mechanical and/or electrical characteristics with standards through examination.

b. Test. To verify serviceability and detect incipient failure by measuring the mechanical or electrical characteristics of an item and comparing those characteristics with prescribed standards.

c. Service. Operations required periodically to keep an item in proper operating condition; i.e., to clean (decontaminate), to preserve, to drain, to paint, or to replenish fuel, lubricants, hydraulic fluids, or compressed air supplies.

d. Calibrate. To determine and cause corrections to be made or to be adjusted on instruments or test measuring and diagnostic equipments used in precision measurement. Consists of comparisions of two instruments, one of which is a certified standard of known accuracy, to detect and adjust any discrepancy in the accuracy of the instrument being compared.

e. Replace. The act of substituting a serviceable like type part, subassembly or module (component or assembly) for an unserviceable counterpart.

f. Repair. The application of maintenance services or other maintenance actions to restore serviceability to an item by correcting specific damage, fault, malfunction, or failure in a part, subassembly, module (component or assembly), end item, or system.

C-3. Column Entries

a. Column 1, Group Number. Column 1 lists group numbers, the purpose of which is to identify components, assemblies, subassemblies, and modules with the next higher assembly.

b. Column 2, Component/Assembly. Column 2 contains the noun names of components, assemblies, subassemblies, and modules for which maintenance is authorized.

c. Column 3, Maintenance Functions. Column 3 lists the functions to be performed on the item listed in column 2.

d. Column 4, Maintenance Category. Column 4 specifies, by the listing of a "work time" figure in the appropriate subcolumn(s), the lowest level of maintenance authorized to perform the function listed in column 3. This figure represents the active time required to perform that maintenance function at the indicated category of maintenance. If the number of complexity of the tasks within the listed maintenance function vary at different maintenance categories, appropriate "work time" figures will be shown for each category. The number of man-hours specified by the "work time" figure represents the average time required to restore an item (assembly, subassembly, component, module, end item, or system) to a serviceable condition under typical field operating conditions. This time includes preparation time, troubleshooting time, and quality assurance/quality control time in addition to the time required to perform the specific tasks identified for the maintenance functions authorized in the maintenance allocation chart. This time will be expressed in man-hours and carried to one decimal place (tenths of hours).

e. Column 5, Tools and Equipment. Column five (5) specifies by code, those common tool sets (not individual tools) and special tools, test, and support equipment required to perform the designated function.

f. Tool and Test Equipment Requirements List. This list identifies all tools and test equipment required for maintenance and repair of the M3A1 Radioactive Source Set as specified in the maintenance allocation chart (MAC). The list gives tool or test equipment reference codes; user maintenance category code; a short description of items required; and National stock numbers. The tool or test equipment code corresponds to the code in column 5 of the MAC. The maintenance category code indicates the level of availability and authorized use. All remaining columns are self-explanatory.

Section II. MAINTENANCE ALLOCATION CHART FOR M3A1 RADIOACTIVE SOURCE SET

(1) Group number	(2) Component/Assembly	(3) Maintenance function	(4) Maintenance category* C	O	F	H	D	(5) Tools and equipment
0100	STORAGE CASE	Inspect	0.3					1,2
		Service	0.1 [b]					
		Repair		0.5 [b]				
		Replace [a]			0.8			
0200	RADIOACTIVE SOURCE AND SHIELD ASSEMBLY							
	Radioactive Source Assembly, M1A1	Inspect	0.1					1,2
	Shield Assembly	Inspect	0.3					1,2,3
		Test	0.8					
		Repair [c]		0.3				
		Replace [c]		1.0				
0300	M4 MAGNETIC HANDLER	Inspect [b]	0.3					
	Magnet, Flexible Arm, and Extension Assembly	Inspect		0.6				
		Repair		0.7 [d]	1.8			
		Replace			1.2			
	Motor and Clutch Assembly	Inspect [b]		1.8				
		Service [b]		0.3				
		Repair			0.8			
		Replace			1.0			

*The subcolumns are as follows:
C—operator/crew
O—organizational
F—direct support
H—general support
D—depot

[a] Manufacture nameplate.
[b] Monthly.
[c] Repair and replacement of lockbar only.
[d] Remove distortion by bending or cutting out segment of arm extension elements.

TOOL AND TEST EQUIPMENT REQUIREMENTS LIST FOR M3A1 RADIOACTIVE SOURCE SET

Tool or test equipment reference code	Maintenance category	Nomenclature	National/NATO stock number	Tool number
1	0	FILM BADGE (Photodosimetry)	See SB 11-206	
2	0	DOSIMETER	6665-00-243-8199	IM-9/PD
3	0	RADIAC SET	6665-00-961-0846	AN/PDR(R)

By Order of the Secretary of the Army:

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General, United States Army
Chief of Staff

Official:
PAUL T. SMITH
Major General, United States Army
The Adjutant General

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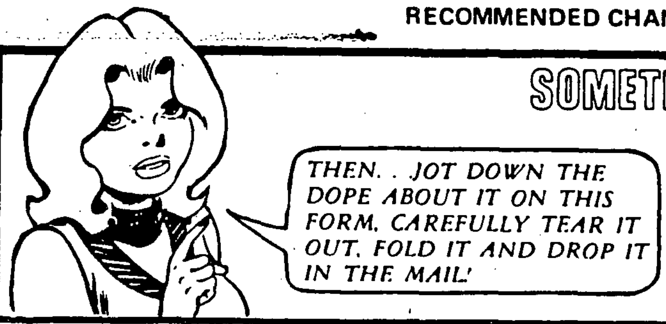

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BE EXACT. . .PIN-POINT WHERE IT IS

PAGE NO	PARA-GRAPH	FIGURE NO	TABLE NO	IN THIS SPACE TELL WHAT IS WRONG AND WHAT SHOULD BE DONE ABOUT IT:
2-25	2-28			Recommend that the installation antenna alignment procedure be changed throughout to specify a 2° IFF antenna lag rather than 1°. REASON: Experience has shown that with only a 1° lag, the antenna servo system is too sensitive to wind gusting in excess of 25 knots, and has a tendency to rapidly accelerate and decelerate as it hunts, causing strain to the drive train. Hunting is minimized by adjusting the lag to 2° without degradation of operation.
3-10	3-3		3-1	Item 5, Function column. Change "2 db" to "3db." REASON: The adjustment procedure the the TRANS POWER FAULT indicator calls for a 3 db (500 watts) adjustment to light the TRANS POWER FAULT indicator.
5-6	5-8			Add new step f.1 to read, "Replace cover plate removed in step e.1, above." REASON: To replace the cover plate.
		FO3		Zone C 3. On J1-2, change "+24 VDC to "+5 VDC." REASON: This is the output line of the 5 VDC power supply. +24 VDC is the input voltage.

TEAR ALONG PERFORATED LINE

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SSG I. M. DeSpiritof 999-1776

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SSG I. M. DeSpiritof

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PUBLICATION NUMBER	PUBLICATION DATE	PUBLICATION TITLE
TM 11-6665-247-10	13 August 1981	Calibrator, Radiac AN/UDM-7C

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DEPARTMENTS OF THE ARMY AND THE AIR FORCE
NATIONAL GUARD BUREAU
WASHINGTON, D.C. 20310 -2500

REPLY TO ATTENTION OF

NGB-AVN-S

7 February 1986

SUBJECT: Application for Consolidated U.S. Nuclear Regulatory Commision (NRC) Material License

Commander
U.S. Army Communications-Electronics Command
ATTN: AMSEL-SF-MR
Fort Monmouth, NJ 07703-5000

1. Reference:

a. Letter, AMSEL-SF-MR, 30 Dec 85, SAB.

b. AR 200-2, Environmental Effects of Army Actions, 1 Sep 81, with C1, 15 Sep 82.

2. Concurrence for matters pertaining to the implementation of regulatory requirements for control of subject radioactive commodities is provided.

3. A review of the environmental documents associated with subject application found that while environmental documents have been prepared to support the NRC license application for each of the radioactive commodities, an environmental document for the actual consolidation has not been prepared. The ARNG Environmental Resources Branch (NGB-ARI-E) recommends that CECOM make a determination as to the adequacy of utilizing these documents to satisfy the intent of NEPA for the issuance of a consolidated NRC license as opposed to preparing a single environmental document. They further recommended that all FNSIs not previously made available to the affected public be processed in accordance with reference 1b, paragraph 5-5.

4. Point of Contact in NGB-ARI-E for hazardous/toxic material/waste is Mr. James Hensley, AUTOVON 584-4701. Point of Contact in this office is Mrs. Judith Smith, AUTOVON 584-4727.

FOR THE CHIEF, NATIONAL GUARD BUREAU:

(for) Alvin A. Marshall
JOHN J. STANKO, Jr.
Chief, Army Aviation Division

ALVIN A. MARSHALL
Chief, Aviation Logistics Branch

Encl

DEPARTMENT OF THE ARMY

HEADQUARTERS, US ARMY COMMUNICATIONS-ELECTRONICS COMMAND
AND FORT MONMOUTH
FORT MONMOUTH, NEW JERSEY 07703-5000

REPLY TO
ATTENTION OF

AMSEL-SF-MR   19 February 1986

MEMORANDUM FOR RECORD
SUBJECT: Application for Consolidated US Nuclear Regulatory Commission (NRC) Material License

1. Reference:

a. Letter, NGB-AVN-S, 7 February 1986, subject as above.

b. Army Regulation 200-2, Environmental Effects of Army Actions, 3 November 1980.

c. FONECON, 19 February 1986 between Mr. James Hensley, National Guard Bureau and Mr. Joseph M. Santarsiero, CECOM Safety Office, subject as above.

2. Reference 1a letter provided concurrence to subject license application. However, comment was made as to whether individual Environmental Assessment (EA) documents fulfilled the requirements of reference 1b.

3. The above consideration was discussed in reference 1c FONECON and determination was made and accepted by Mr. Hensley, that the EA documents, as presented, meets the requirements and policies established by the National Environmental Policy Act of 1969.

Prepared by:
JOSEPH M. SANTARSIERO
Health Physicist

Reviewed by:
BARRY J. SILBER
Acting Chief, Mtl Sfty Engr Div

Approved by:
STEVEN A. HORNE
Acting Chief, Safety Office

CF:
Chief, NGB-AVN-S

DEPARTMENT OF THE ARMY
HEADQUARTERS, UNITED STATES ARMY, EUROPE, and SEVENTH ARMY
OFFICE OF THE DEPUTY CHIEF OF STAFF, PERSONNEL
APO NEW YORK 09403

REPLY TO
ATTENTION OF:

AEAGA-SG

25 FEB 1986

SUBJECT: Concurrence with Application for US Nuclear Regulatory License

Headquarters
US Army Communications-Electronics Command
and Fort Monmouth
ATTN: AMSEL-SF-MR
Fort Monmouth, NJ 07703-5000

1. Reference: a. Ltr, CECOM, AMSEL-SF-MR, 30 Dec 85, subj: Application for Consolidated US Nuclear Regulatory Commission (NRC) Material License w/1st End, 10th MEDLAB, AEMML-PM-ORD.

b. FONECON between MAJ Peterson, 200th TAMMC and Mr. Foley, HQ, USAREUR, 5 & 20 Feb 86.

2. Your application requesting Department of Army and US Nuclear Regulatory Commission authority to field radioactive calibration sources world-wide has been reviewed by the requested elements of this command. HQ, USAREUR & 7th Army concurrence is offered subject to the following comments and recommendations.

3. USAREUR's main concern is the ability of the soldier to safely and effectively perform his or her mission. In that regard the technical manuals prepared by your command and enclosed in the application are the soldiers' basic reference.

4. These technical manuals do not appear to be readily available since mimeographed versions were included in the applications nor have they been updated since the original version. One TM is dated 1955 and others have proposed changes on DA Form 2028 attached. Priority in republishing and consolidating these manuals would be of value to USAREUR. The present expansion of radiac calibration centers to an additional 24 sites in Europe underscores our concern.

5. Radiological Hygiene Branch, 10th MEDLAB has included a thorough review of your application and offers eight recommendations. Both completeness and clarity of your application will be improved by incorporation of these recommendations.

Encl

6. Reference 2b contained the 200th Material Management (Theater Army) consent with the application as written. HQ USAREUR POC is Mr. Foley, Autovon 370-7751/8742.

FOR THE DEPUTY CHIEF OF STAFF, PERSONNEL:

Robert W. Braun

ROBERT W. BRAUN
Chief, Safety Division

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7TH MEDCOM, ATTN: AEMPE-PM/AEMPS-PM-S, APO 09102-3304
5TH SIG CMD, ATTN: ASE-DP-S, APO 09056
200th MMC(TA), ATTN: AEAGD-MMC-RA-CS, APO 09052
10th MED LAB, ATTN: AEMML-PM-ORD, APO 09180

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DEPARTMENT OF THE ARMY
HEADQUARTERS, US ARMY COMMUNICATIONS-ELECTRONICS COMMAND
AND FORT MONMOUTH
FORT MONMOUTH, NEW JERSEY 07703-5000

REPLY TO
ATTENTION OF

AMSEL-SF-MR

9 March 1986

MEMORANDUM FOR RECORD

SUBJECT: Application for Consolidated US Nuclear Regulatory Commission (NRC) License

1. Reference:

a. Letter, AEAGA-SG, 25 February 1986, subject: Concurrence with Application for US Nuclear Regulatory License.

b. Discussions with Mr. Leo Foley, USAREUR RPO, MAJ Luckett, 10th Medical Laboratory, and Mr. Joseph M. Santarsiero, CECOM Safety Office, during the 2-8 March 1986 USAREUR Radiation Protection Program Compliance visit.

2. Reference 1a letter provided a coordinated concurrence from USAREUR, 10th Medical Laboratory and 200th TAMMC relating to subject license application. In addition, reference 1a letter offered eight general comments/recommendations provided by the 10th Medical Laboratory relating to subject license application format and content.

3. Discussions during reference 1b visit addressed the comments/recommendations provided at reference 1a letter. Determinations were made that six of the eight comments/recommendations would be incorporated into subject license application as presented. The remaining two comments/recommendations were determined to be unnecessary and/or provided no additional clarification to subject application.

Prepared by: Barry Felker
for JOSEPH M. SANTARSIERO
Health Physicist

Reviewed and Approved by: Steven A Horne
STEVEN A. HORNE
Acting Chief, Safety Office

CF:

Commanders:
USAREUR, ATTN: AEAGA-SG
10th MEDLAB, ATTN: AEMML-PM-ORD
200th TAMMC, ATTN: AEMML-MP-ORD

APOP-NC (AMSEL-SF-MR/30 Dec 85) 1st End
SUBJECT: Application for Consolidated US Nuclear Regulatory Commission (NRC) Material License

HQWESTCOM(APOP-NC), Ft Shafter, HI 96858-5100 22 January 1986

TO: Commander, Headquarters, US Army Communications-Electronics Command and Fort Monmouth, Fort Monmouth, NJ 07703-5000

1. Concur on both documents as written.

2. POC is CW3 N. M. Lowry, AV 438-2661/2659.

A. M. PELLETIER
LTC, GS
C, NC Div, ODCSOPS

Encl

Encl 5

S: 18 February 1986

DJ-MS-M (AMSEL-SF-MR/30 Dec 85) 1st End
SUBJECT: Application for Consolidated US Nuclear Regulatory Commission (NRC) Material License

Headquarters, Eighth United States Army, APO SF 96301-0009 13 FEB 1986

TO: Commander, U. S. Army Communications-Electronics Command, ATTN: AMSEL-SF-MR, Fort Monmouth, New Jersey 07703-5000

1. Draft copy of subject NRC consolidated license application and Environmental Assessment documentation, in accordance with AR 200-2, has been reviewed by this headquarters. Concurrence is granted for both documents as requested.

2. POC this headquarters is CW3 Eugene L. Murray, DJ-MS-M, Autovon 262-1101 Ext 293-8230/3624.

FOR THE COMMANDER:

Encl wd

David E. Pray

DAVID E. PRAY
LTC, GS
Assistant Adjutant General

Encl 6

AMXTM-SR (AMSEL-SF-MR/30 December 1985) 1st End
SUBJECT: Application for Consolidated U.S. Nuclear Regulatory Commission

HQ, U.S. Army Test, Measurement, and Diagnostic Equipment Support Group, Redstone Arsenal, AL 35898-5400 3 Feb 86

TO: Commander, U.S. Army Communications-Electronics Command, ATTN: AMSEL-SF-MR, Fort Monmouth, New Jersey 07703-5000

1. This Division has reviewed and concurs with the application.

2. The following comments are provided for clarity:

a. Supplement G, Paragraph 4G. Change "Area Calibration and Repair Center (ACRC)-LBAD" to read "Area Calibration and Repair Center (ACRC)-LBAD/Army Ionizing Radiation Dosimetry Center (AIRDC)." Reason: ACRC-LBAD provides calibration support and the AIRDC performs the leak test analysis.

b. Supplement G, Paragraph 4G. Change "74th Maintenance Battalion, Camp Carroll, Korea" to read "2D Maintenance Company, Camp Carroll, Korea." Reason: 2D Maintenance Company performs the calibration support for the RADIAC calibrator not the 74th Maintenance Battalion.

3. POC for this organization is Mr. Jerry Gray, AUTOVON 746-5042.

wd encl

Del Loney
DELBERT D LONEY
Chief
Rad Std and Dev Lab
Metr Dir

Encl 7

DRAFT

TM 3-6665-214-13&P

TECHNICAL MANUAL

OPERATOR'S, ORGANIZATIONAL, AND DIRECT SUPPORT
MAINTENANCE MANUAL
(INCLUDING REPAIR PARTS LIST)
RADIOACTIVE SOURCE SET, M3A1
(NSN 6665-00-856-8235)

H E A D Q U A R T E R S, D E P A R T M E N T O F T H E A R M Y

MARCH 1985

Encl 6

WARNINGS

The M3A1 Radioactive Source Set incorporates radioactive Cobalt-60 (Co-60). Use of the source set shall be under the supervision of a qualified individual who has received specific training on the proper use of the set.

Never eat, drink, or smoke in areas where radioactive material are used/stored.

Before removing the radioactive source capsule from the shield, a calibration site must be selected. The calibration site should have a level, unobstructed floor surface, approximately 16 meters (53 feet) square, located in a one-story structure in an area away from the normal stream of traffic. Deviations from the calibration site requirements shall be as approved by the US Army Communications-Electronics Command (CECOM) Safety Office.

Each time the radioactive source is removed from the shield, the Radiation Protection Officer (RPO) must delineate the radiation controlled area and post radiation warning signs.

Never allow personnel without film badges and/or dosimeters inside the restricted area.

Always use the magnetic handler for handling the radioactive source. Never touch the radioactive source capsule.

Never look into the well of the shield or unnecessarily expose parts of the body to the radiation.

Never take the radioactive source from the shield without having a radiacmeter available and in good working order, e.g., an AN/PDR-27( ) Radiac Set.

Never leave an unshielded radioactive source unattended. If necessary to leave the source set, re-shield the radioactive source and lock the container.

If a radioactive source capsule is damaged or broken and radioactive contamination occurs, follow the emergency procedures described in paragraph 2-18 of this manual.

Maintain personnel exposure records.

Wear a film badge, calibrated dosimeter, and disposable protective gloves when performing the leak test. Do not spread contamination by touching other objects with the gloves. Do not leave the unshielded radioactive source or the opened storage case unattended. Do not stay in the radiation area any longer than necessary to perform the leak test.

TECHNICAL MANUAL
No. 3-6665-214-13&P

HEADQUARTERS
DEPARTMENT OF THE ARMY
WASHINGTON, DC, March 1985

OPERATOR'S, ORGANIZATIONAL, AND DIRECT SUPPORT MAINTENANCE MANUAL (INCLUDING REPAIR PARTS LIST) RADIOACTIVE SOURCE SET, M3A1 (NSN 6665-00-856-8235)

REPORTING OF ERRORS AND RECOMMENDING IMPROVEMENTS

You can improve this manual. If you find any mistakes or if you know of a way to improve the procedures, please let us know. Mail your letter or DA Form 2028 (Recommended Changes to Publications and Blank Forms) directly to Commander, US Army Communications-Electronics Command, ATTN: AMSEL-ME-MQ, Fort Monmouth, New Jersey 07703. A reply will be furnished directly to you.

*This manual supersedes TM 3-6665-214-13&P, June 1976, including all changes.

LIST OF ILLUSTRATIONS

CHAPTER 1
INTRODUCTION

Section I. GENERAL

1-1. Scope

This manual is published for personnel who operate the M3A1 Radioactive Source Set, and for personnel who perform organizational and direct support maintenance on the set. The manual contains a description of the source set and information on its use, functioning, and maintenance. Instructions for shipment, storage, and disposal are also provided.

1-2. Authorization For Issue of the M3A1 Radioactive Source Sets

M3A1 Radioactive Source Sets are issued throughout the Army without a special license being required by the individual user. Possession and use of the radioactive source sets are authorized under a US Nuclear Regulatory Commission (NRC) License issued to the Department of the Army (DA), US Army Communications-Electronics Command (CECOM), Fort Monmouth, NJ 07703-5024. The license is issued based upon statements concerning procedures established for the life-cycle control of the item.

1-3. Maintenance Forms, Records, and Reports

a. Reports of Maintenance and Unsatisfactory Equipment. DA forms and procedures used for equipment maintenance will be those prescribed by Technical Bulletin (TB) 750-25-1, Maintenance of Supplies and Equipment: Army Test, Measurement and Diagnostic Equipment (TMDE) Calibration and Repair Support Program.

b. Report of Packaging and Handling Deficiencies. Fill out and forward SF 364 (Report of Discrepancy (ROD)) as prescribed in Army Regulation (AR) 735-11-

2/DLAR 4140.55/NAVMATINST 4355.73/AFR 400-54/MCO 4430.3E.

c. Discrepancy in Shipment Report ((DISREP) SF 361). Fill out and forward Discrepancy in Shipment Report (DISREP) (SF 361) as prescribed in AR 55-38/NAVSUPINST 4610.33B/AFR 75-18/MCO 4610.19C/DLAR 4500.15.

1-4. US Nuclear Regulatory Commission Requirements

The NRC sets standards/conditions and issues licenses for the use of specific radioactive materials in the United States. Use of the M3A1 is authorized by the NRC. Information required by the NRC license and regulations is contained below:

a. Radiation Protection. Users of the M3A1 should refer to this Technical Manual (TM) for instructions on control, safe handling, storage, emergency situations, operation and maintenance. This information satisfies the radiation protection requirements established by NRC regulations (Title 10, Code of Federal Regulations (CFR), Parts 19 and 20).

b. Notice to Employees. Form NRC-3, Notice to Employees, contained in the back of this manual, must be removed for posting wherever the M3A1 is used and/or stored. The posting requirements are contained on the form.

c. Section 206, "Energy Reorganization Act of 1974", (10 CFR Part 21) contained in the back of this manual should be removed for posting whenever the M3A1 is used and/or stored.

d. Reporting of Defects and Noncompliance Actions. As stipulated in 10 CFR Part 21, reports of radioactive source set defects and noncompliance, as outlined in Section 206 of the Energy Reorganization Act of 1974, should be reported through appropriate radiological command channels to the CECOM Safety

Office. Notification shall be made within 24 hours following the identification of defects or noncompliance.

e. NRC License. The NRC license for the M3A1 and related documents are held by the CECOM Safety Office at Fort Monmouth, New Jersey. M3A1 users may request information on these documents by letter addressed to:

Commander
US Army Communications-Electronics Command
ATTN: AMSEL-SF-MR
Fort Monmouth, NJ 07703-5024

Requests for further information may also be made by calling Autovon 995-4427 or commercial (201) 544-4427.

1-5. Supervision

a. All calibrations utilizing the M3A1 will be supervised by a qualified Radiation Protection Officer (RPO). To be a qualified RPO, a person must have received a minimum of 120 hours formal training on radiation protection including the following topics:

(1) Principles and practices of radiation protection.

(2) Biological effects of radiation.

(3) Radioactivity measurement/monitoring techniques and instrumentation.

(4) Mathematics and calculations basic to the use and measurement of radioactivity.

(5) The operation and use of the M3A1, its equivalent, or other Army radiac calibrator sets.

NOTES

1. Completion of the Radiological Safety Course (7KF3) at the US Army Chemical School or at the US Army Ordnance Center and School meets these requirements.

2. Where circumstances warrant, alternate training may be substituted if this training is approved by Commander, US Army Communications-Electronics Command, ATTN: AMSEL-SF-MR, Fort Monmouth, NJ 07703-5024. Such training must be received under the guidance of a qualified RPO, and must include at least 16 hours of actual experience in the use of the M3A1.

b. The operator or user of the M3A1 shall have a minimum of 8 hours training under the guidance of a qualified RPO in the basic fundamentals of radiation protection, radiac instrumentation and survey techniques and 16 hours on-the-job training in operation and care of the M3A1. Instructions shall include safe working practices and knowledge of the hazards associated with the instrument.

1-6. Duties of Radiation Protection Officer

The specific duties of the appointed RPO will be to:

a. Insure that the M3A1 Radioactive Source Sets under his jurisdiction are properly used and stored.

b. Train local users and operators and maintain a record of training for users and operators.

c. Insure appropriate records are maintained on each item.

d. Advise the Radioactive Material Control Point (RMCP) of any change in accountability, local RPO, or installation relocation for the M3A1 Radioactive Source Set.

e. Submit Radiation Incident Report according to published directives.

f. Establish radiation controlled areas for source set storage and use.

g. Post appropriate warning/caution signs.

h. Insure items are stored in a fire-resistant structure and no explosives of any kind are stored in the same structure.

i. Immediately refer actual or suspected overexposure to medical officer.

j. Insure that periods of time between leak tests do not exceed 6 months and supervise performance of leak tests.

k. Secure items against unauthorized use and removal.

l. Insure that all Army, DOD, and Federal Regulations are being followed and that personnel exposure to radiation is maintained As Low As Reasonably Achievable.

m. Conduct a physical inventory according to published frequencies.

n. Submit inventory, leak test, and other reports to the RMCP as required.

o. Prior to relief from duties, place the M3A1 Radioactive Source Sets in locked storage.

p. Investigate each case of excessive or abnormal exposure to determine the ause, recommend remedial action to prevent recurrence, and submit a complete written report to the Commander, US Army Communications-Electronics Command, ATTN: AMSEL-SF-MR, Fort Monmouth, NJ 07703-5024 within 24 hours.

1-7. Responsibility

a. Responsibilities of Major Commands.

(1) Establish at least one RMCP.

(2) Appoint a Radiation Control Officer (RCO) for each RMCP and submit qualifications to Commander, US Army Communciations-Electronics Command, ATTN: AMSEL-SF-MR, Fort Monmouth, NJ 07703-5024.

(3) Develop procedures to insure periodic leak testing and forward two copies of procedures to Commander, US Army Communications-Electronics Command, ATTN: AMSEL-SF-MR, Fort Monmouth, NJ 07703-5024.

(4) Forward leak test smears to nearest approved smear evaluation laboratory.

(5) Insure that each installation or activity using the M3A1 Radioactive Source Set has an effective radiation protection program.

b. Responsibilities of Radiation Control Officer.

(1) Review and approve the qualifications of each local RPO for the M3A1 Radioactive Source Set and forward to Commander, US Army Communications-Electronics Command, ATTN: AMSEL-SF-MR, Fort Monmouth, NJ 07703-5024 a list of these local RPO's and their qualifications for approval and certification.

(2) If a qualified local RPO is not available, take one or more of the following actions:

(a) Suspend requisition for the M3A1 Radioactive Source Set.

(b) Suspend use of the M3A1 Radioactive Source Set until someone can be qualified by training.

(c) Transfer the M3A1 Radioactive Source Set to an installation or activity with qualified personnel.

(3) Maintain the following information for each M3A1 Radioactive Source Set under his control:

(a) National stock number.

(b) Description.

(c) Serial number.

(d) Isotope, source activity, and date activity was determined.

(e) Dates and results of leak tests.

(f) Shipment number.

(g) Shipped from.

(h) Shipped to.

(i) Date shipped.

(j) Name and qualifications of local RPC's.

(k) Radiation incident reports.

(4) Insure that the M3A1 Radioactive Source Set is properly handled in accordance with Army, DOD, and NRC regulations. Periodically inspect and audit records of installations and activities possessing the M3A1 Radioactive Source Set.

1-8. Control

The M3A1 Radioactive Source Set is classified as an individually controlled item.

a. Stations in CONUS and Oversea supply agencies will submit requisitions through radioactive material supply channels to Commander, US Army Communications-Electronics Command, ATTN: AMSEL-MME-VC, Fort Monmouth, NJ 07703, for issue to certified RPOs. All requisitions will be accompanied by the name of the Radiation Protection/Control Officer who is to be responsible for the equipment. In addition, each request will include the following certification: "As required by Chapter 3, AR 385-11, sufficient safety equipment, facilities, and trained personnel are available at this installation for the safe handling, use and storage of radioactive material ordered on this requisition." The certification must bear the signature and typed name and grade of the local RPO. The CECOM National Inventory Control Point (NICP) reviews requisitions submitted and when approved, issues material release orders to the depot storing the item. The depot then ships the item directly to the requisitioner, notifies the control point and furnishes other appropriate shipping data.

b. Within five days after receiving the radioactive source set, the receiving local RPO will notify the RMCP.

c. Leak testing of the M3A1 Radioactive Source Set will be performed upon receipt, at least every six months thereafter, prior to shipment, or anytime leakage is suspected.

Section II. DESCRIPTION AND DATA

1-9. Use

The M3A1 Radioactive Source Set is used to calibrate radiac survey meters, such as the AN/PDR-27( ) Radiac Set and the IM-9( ) Radiac Dosimeter.

WARNING

> The M3A1 Radioactive Source Set will be used only by individuals trained and certified in the proper use of the set. Each time that the radioactive source is removed from the shield, the RPO must delineate the radiation controlled area and post radiation warning signs.

1-10. M3A1 Radioactive Source Set

The M3A1 Radioactive Source Set (fig. 1-1) consists of a storage case, a radioactive source and shield assembly with an M1A1 gamma Co-60 radioactive source, a source calibration chart, an M4 telescoping radioactive source magnetic handler, and a copy of this manual (TM 3-6665-214-13&P).

a. Storage Case, Exterior (fig. 1-2). The wood storage case measures 18 by 18 by 20 inches and is designed to keep the radiation dose rate at the surface of the case below 200 millirads per hour (mR/hr) and less than 10 mR/hr at 3 feet from the external surface of the case. The container meets Department of Transportation (DOT), 49 CFR, Yellow III label shipping requirements. The cover is attached to the case by two hinges (4, fig. 1-2). A chain (7, fig. 1-4) holds the cover in position when the case is open, and two catches (1, fig. 1-2) lock the cover in place when the case is closed. The case is equipped with two handles (6, fig. 1-2), one at each side. The identification plate on the cover of the storage case of each radioactive source set is shown in figure 1-3. The case is painted yellow and marked in accordance with DOT regulations.

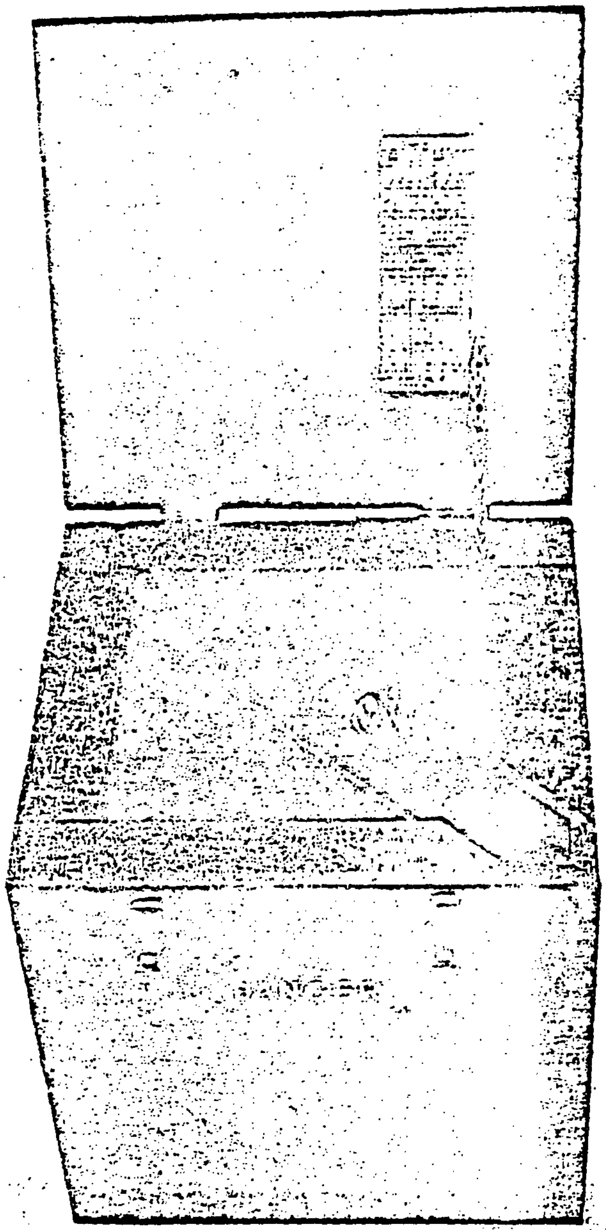
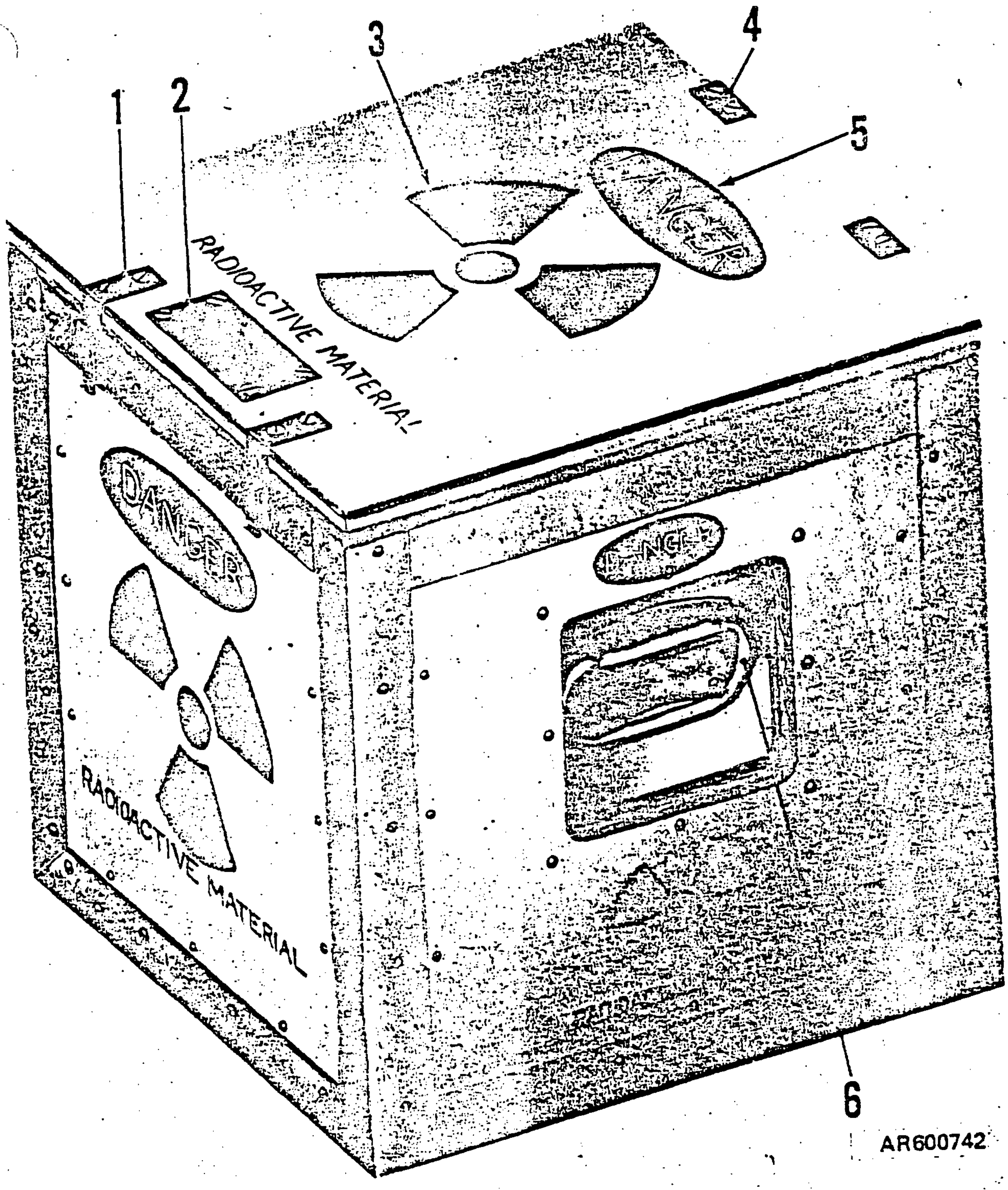

AR600741

Figure 1-1. M3A1 Radioactive
Source Set.

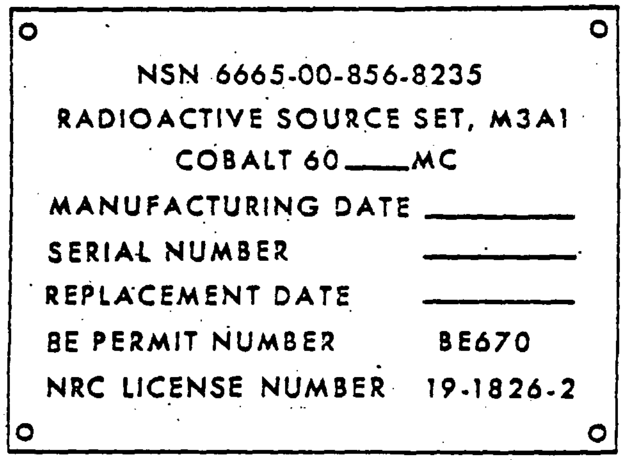


1 Catch
2 Identification plate
3 Radiation symbol
4 Hinge
5 Eliptical DANGER Warning background
6 Handle

Figure 1-2, M3A1 Storage Case (exterior)

b. Storage Case, Interior (fig 1-4). A shield (11, fig. 1-4), described in (1) below, is bolted to a platform (8) in the case, and a spacer (1) is bolted down around the top of the shield. A magnet cap socket (9) in one corner and a cutout diagonally opposite the socket in the storage case provide the means for stowing the magnetic handler, described in d below. A Co-60 decay curve (6, fig. 1-4), described in (2) below, is fastened inside the cover of the case.

(1) Shield. A cylindrical lead shield (11, fig. 1-4), approximately 6 1/2 inches in diameter and 6 1/2 inches high, serves as a container for the radioactive source assembly (13). The shield is encased in a steel jacket and mounted on a square steel base (10). A lead plug (3) with a handle (2) fits into an opening in the top of the shield. When the plug is placed in the shield, it forms the top of an enclosed space in the center of the shield; this space is approximately 1 inch in diameter and 11/16 inch deep. A shoulder near the top of the enclosed space supports the radioactive source assembly within the enclosed space. The shield and plug provide a 2 1/2 inch thick lead barrier against gamma radiation emanating from the radioactive source. A lockbar (4) passes through the handle of the plug and through slots in the lugs (12) on the shield. The shackle of a combination lock (5) passes through round holes in the bent end of the lockbar and through an adjacent lug and secures the radioactive source in the shield. The combination lock is a high security padlock. The combination can be changed by use of a key which is supplied with the lock.



AR600750

1 Spacer
2 Handle
3 Plug
4 Lockbar
5 Combination lock
6 Cobalt 60 decay curve chart
7 Chain
8 Platform
9 Magnet cap socket
10 Base
11 Shield
12 Lug
13 Radioactive source assembly

Figure 1-3. Identification plate.

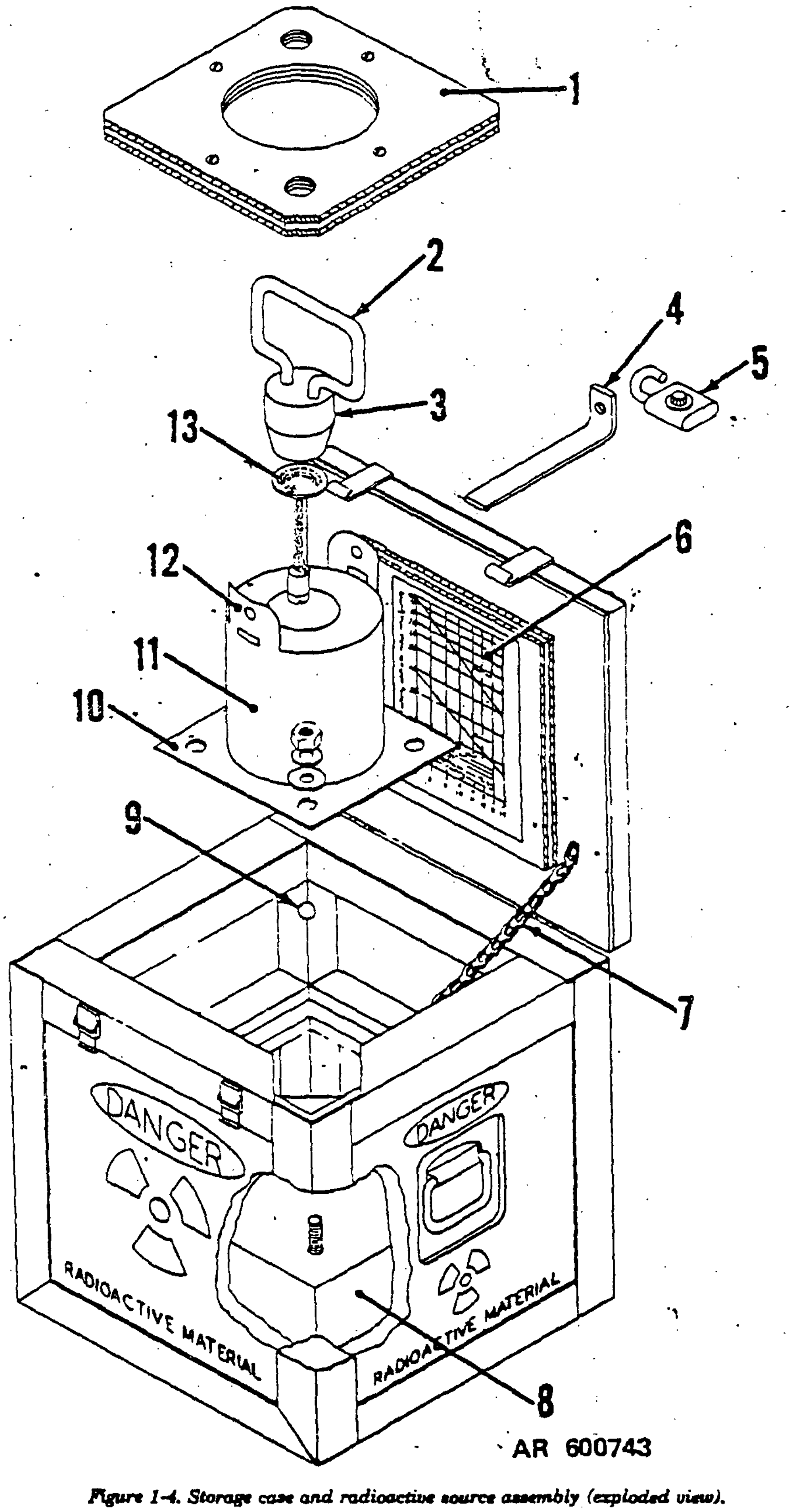


Figure 1-4. Storage case and radioactive source assembly (exploded view).

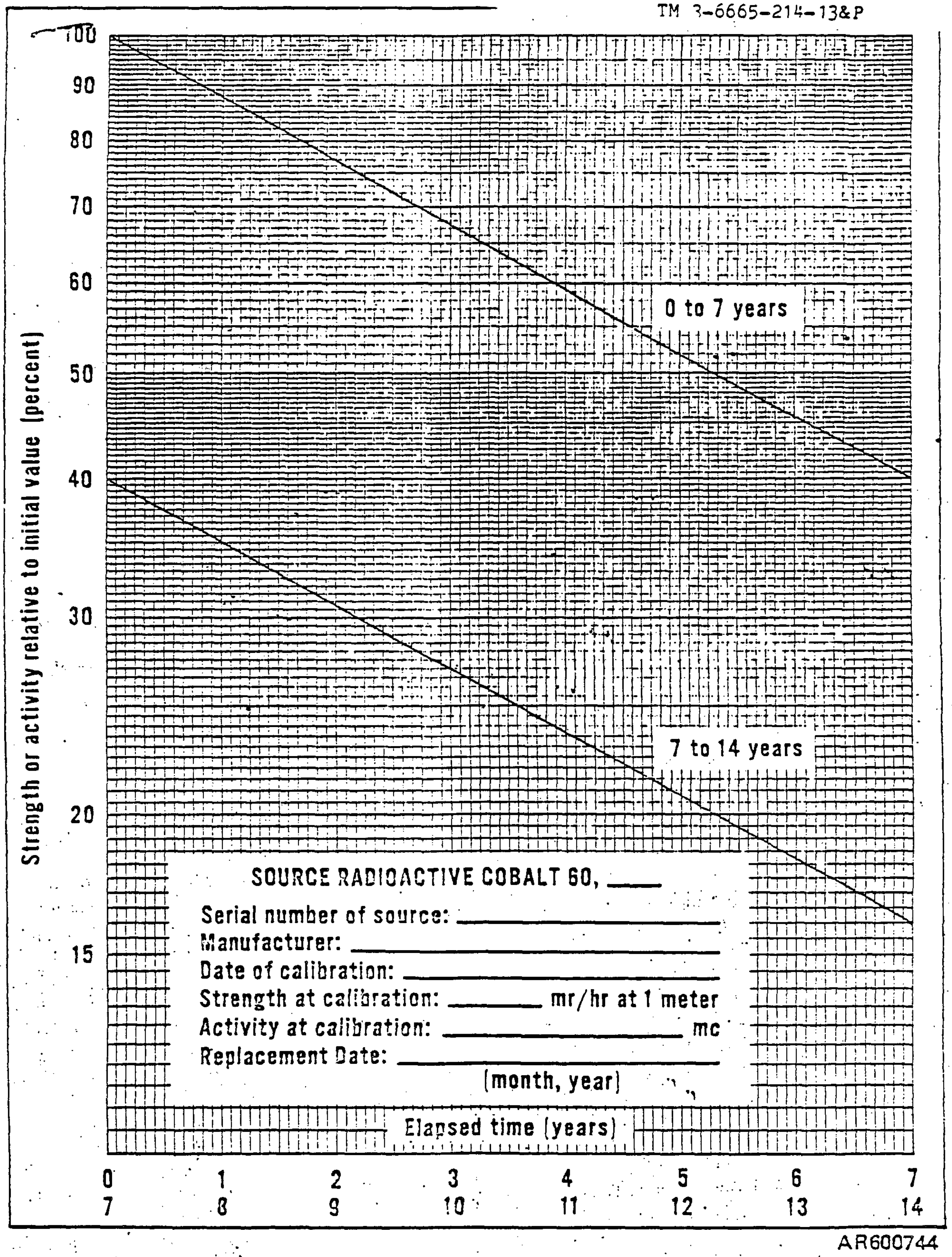
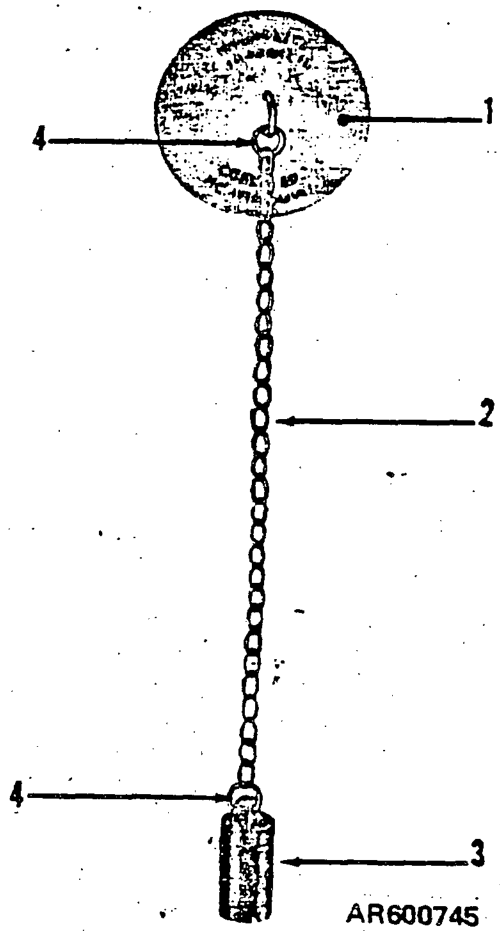


Figure 1-5. Cobalt 60 decay curve.

(2) Co-60 Decay Curve (fig 1-5). The Co-60 decay curve, mounted on the inside cover of the radioactive source case, bears the same serial number as the source. The name and address of the manufacturer; the date of calibration of the radioactive source; the strength at time of calibration in units of exposure rate at a standard distance, i.e., mR/hr at a distance of 1 meter; the activity at the time of calibration in millicuries (mCi); and the replacement date are also indicated on the decay curve chart. The decay curve is used to determine the relative percent strength or activity of the Co-60 at a given time (years and months) after the date of initial calibration.

c. M1A1 Gamma Co-60 Radioactive Source Assembly (fig. 1-6). The M1A1 gamma Co-60 radioactive source assembly consists of a sealed radioactive source capsule (3) containing Co-60, a chain (2), and a lifting disk (1). Connecting rings (4) connect the chain to the radioactive source capsule and the lifting disk.



1 Lifting disk
2 Chain
3 Source capsule
4 Connecting ring

Figure 1-6. M1A1 gamma cobalt 60 radioactive source assembly.

WARNING

The Co-60 source in the M3A1 Radioactive Source Set emits gamma radiation. All use of radioactive source set must be under the supervision of a qualified individual who has received specific training in the proper use of the set.

WARNING

Never eat, drink, or smoke in areas where radioactive material are used/stored.

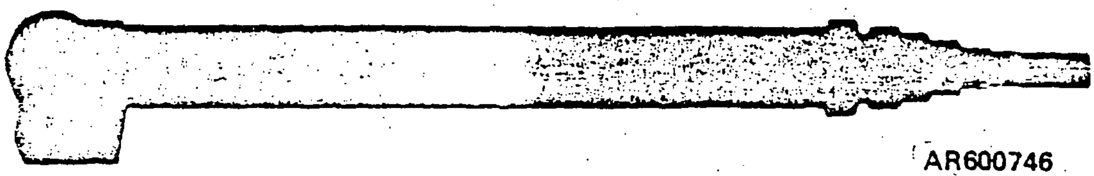
(1) Radioactive Source Capsule. The radioactive source capsule is a sealed steel capsule, 1/4 inch in diameter by 5/8 inch high, containing Co-60. An eye in the stem at the top of the capsule permits the capsule to be suspended from a lifting disk by a chain. The activity of the radioactive source at the time of initial calibration may vary from 80 to 130 mCi. (For an activity level of 100 mCi of Co-60, the exposure dose rate is 132 mR/hr at a distance of 1 meter from the source capsule.) Co-60 has a half-life of 5.3 years and emits one beta particle (energy: 0.32 MeV) and two gamma rays (energy: 1.17 MeV and 1.33 MeV) per disintegration. The steel wall of the capsule stops most of the beta particles but the gamma rays pass through the wall.

(2) Ring and Chain Assembly. The ring and chain assembly consists of a round link brass chain, approximately 5 inches long, with two connecting rings (4) at each end of the chain. One end of the ring and chain assembly is connected to the underside of the lifting disk (1); the other end is connected to the radioactive source capsule.

(3) Lifting Disk. The lifting disk, made of ferromagnetic steel, is approximately 13/16 inch in diameter and 1/16 inch thick. A metal eye on the

underside of the disk provides the means for attaching the ring and chain assembly. The underside of the disk is marked with the serial number of the radioactive source assembly, the activity of the source at the time of initial calibration, the date at which the activity was determined, and the words: COBALT 60. The upper side of the disk is marked with the words: DANGER RADIOACTIVE MATERIAL, NOTIFY ARMY AUTHORITIES IF FOUND, and with the word: DANGER, above a radiation hazard symbol.

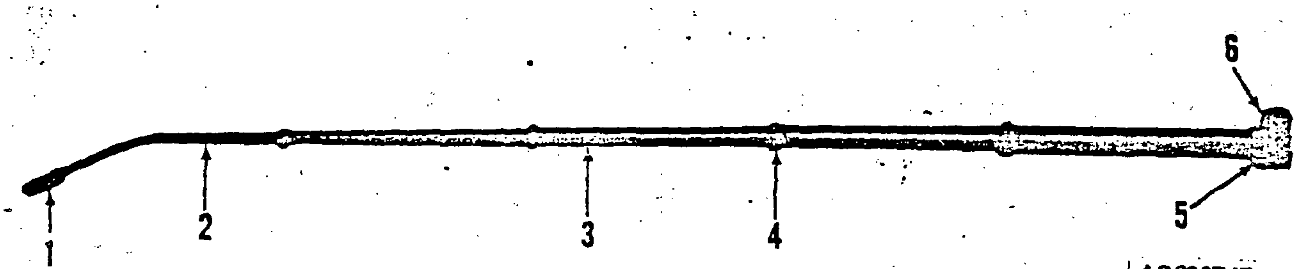
d. M4 Telescoping Radioactive Source Magnetic Handler. The M4 telescoping radioactive source magnetic handler (fig.1-7 and 1-8) is designed to manipulate the M1A1 gamma Co-60 Radioactive Source Assembly. When using the fully extended magnetic handler, the operator can remain at a safe distance for the short time required to place or remove the radioactive source. Telescope the handler when not in use (fig. 1-7), and stow it in the storage case. The handler weighs approximately 2 1/2 pounds and is approximately 20 inches long when telescoped and 72 inches inches long when fully extended (See figure 1-8). The magnetic handler consists essentially of a flexible arm assembly (2, fig. 1-8), three extensions of aluminum tubing (3), and a handle and housing assembly (5). Knurled retaining nuts (4), fitted with plastic packing rings, hold the telescoping sections of the handler in the extended position. A small permanent magnet under a stainless steel magnet cap (1) is attached by a length of wire that passes through the telescoping sections of the handler to a spring-loaded motor assembly in the handle and housing assembly (5). A compression spring holds the magnet against the magnet cap; a magnet control knob (6) retracts the magnet. When the magnet is against the cap, the handler picks up and holds the radioactive source assembly. When the magnet is retracted, the radioactive source assembly is released from the handler.



AR600746

1 Magnet cap
2 Flexible arm assembly
3 Extension
4 Retaining nut
5 Handle and housing assembly
6 Magnet control knob

Figure 1-7. M4 radioactive source magnetic handler (telescoped).



AR600747

Figure 1-8. M4 radioactive source magnetic handler (extended).

1-11. Tabulated Data

Numerical data are approximate.

Radioactive Material.........................Co-60 (0.32 MeV beta particle; 1.17 and 1.33 MeV gamma rays)

Activity at time of initial calibration....80-130 mCi.

Exposure rate for 100 mCi Co-60............132 mR/hr at 1 meter

Dose rate at surface of capsule............Greater than 10,000 Rad (R)/hr

Half-Life.................................5.3 years

Weight:

M3A1 Radioactive Source Set.............150 lb.

Magnetic handler........................2.5 lb.

Cubage:

M3A1 Radioactive Source Set.............1.75 cu. ft.

NRC License Number......................

BE Permit Number........................BE670

CHAPTER 2

OPERATING INSTRUCTIONS

Section I. Preparation For Use

2-1. Initial Inspection

When the M3A1 Radioactive Source Set is received, the operator, under the supervision of the RPO or his qualified designee, will:

a. Post the radiation area (para 2-3).

b. Inspect the exterior and interior of the storage case for damage. Examine the case and contents for missing parts. If the source set is damaged or parts missing, report an improper shipment (SF 364).

c. Within three hours during normal duty time or within 18 hours of nonduty time from initial receipt, perform a leak test (para 2-5), or at any time a leak is suspected. If the source set is leaking, emergency procedures set forth in paragraph 2-18 will be followed.

d. Inspect the M4 magnetic handler for workability (para 2-9b).

e. Compare the serial number on the underside of the lifting disk with the serial number recorded on the Co-60 decay curve chart (para 2-8).

f. Determine present source strength (para 2-12).

2-2. Calibration of M3A1 Radioactive Source Set

The M3A1 Radioactive Source Set will be sent to depot maintenance personnel once a year for calibration.

2-3. Posting Radiation Controlled Area

a. A radiation controlled area is a delineated area under the supervision of an individual in charge of radiation protection. The perimeter of a radiation controlled area is established where the radiation level is 2 mR/hr or less. Only authorized individuals wearing a film badge or other personnel monitoring devices shall be permitted within the radiation controlled area.

b. Establish the perimeter of the radiation controlled area through estimation and calculation prior to exposing the source. Rope off or otherwise establish, with barriers and signs, the perimeter of the radiation controlled area. After the source is exposed, verify perimeter barriers using an AN/PDR-27( ) or equivalent, and adjust the barriers as necessary. A high radiation area is any area accessible to personnel in which radiation exists such that a major portion of the body could receive a dose in excess of 100 millirem (mrem) in any one hour.

NOTE

If an unshielded Co-60 source having an activity of 100 mCi is being used, the radiation controlled area will be all the area within the radius of approximately 8 meters (26.2 feet) of the source. The radiation controlled area of a more active source will be larger, and the radiation controlled area of a less active source will be smaller.

c. Post radiation warning signs at conspicuous points adjacent to the periphery of the radiation controlled area so that only authorized personnel with film badge dosimeters will be permitted. Self-reading dosimeters are required as a positive means of preventing overexposures. They are also required for personnel approaching or entering the high radiation area. Figure 2-1 shows suggested dimensions for radiation warning signs. The dimensions of the signs can be varied so long as the proportions of the three-bladed radiation hazard symbol remain as shown and the wording is easy to read.

d. Post NRC Form 3 (contained in the back of this TM), in a conspicuous location near the radioactive source set.

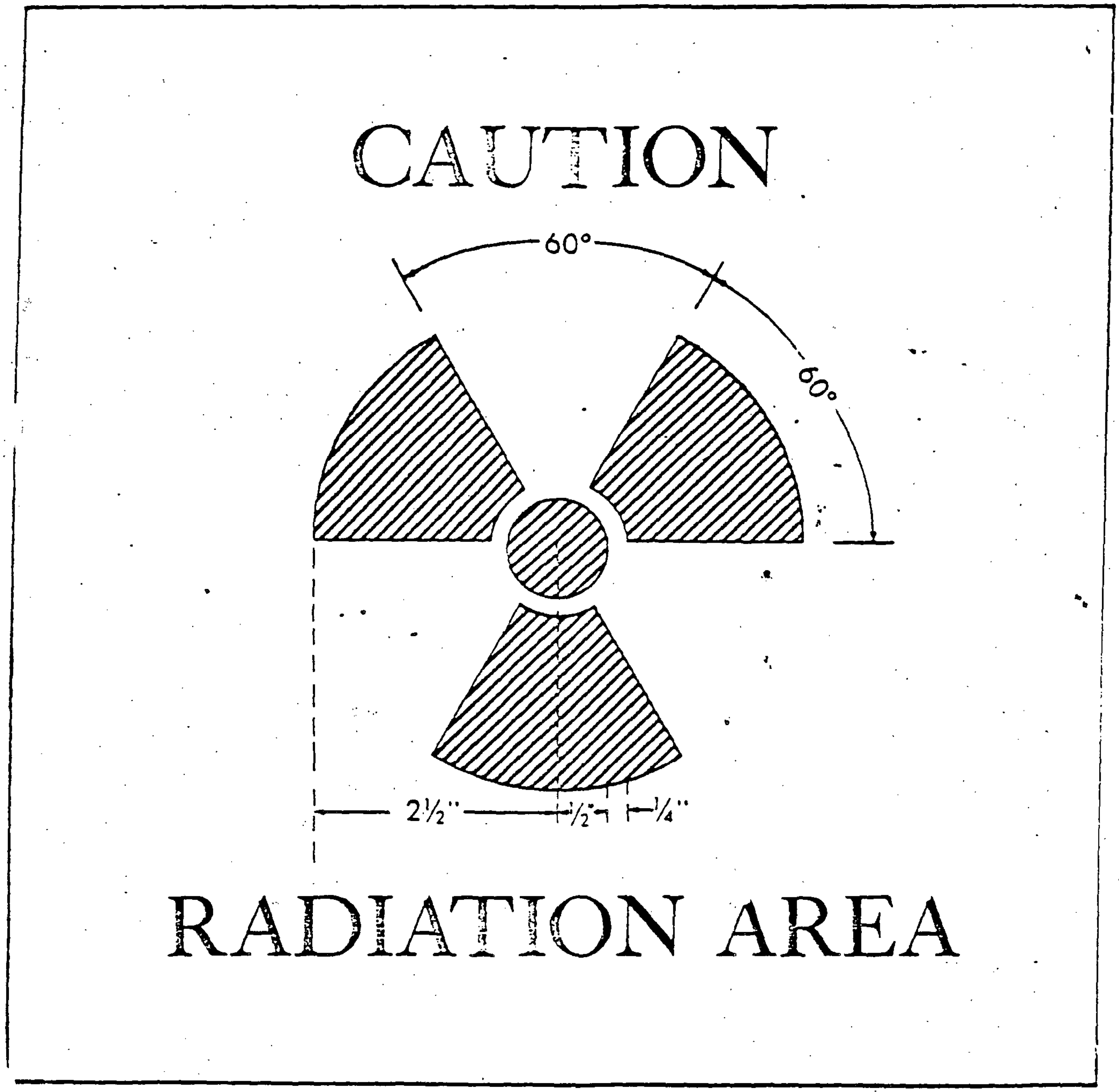


Figure 2-1. Radiation warning sign.

2-4. Dosimetry Records

a. AR 40-14 prescribes procedures and responsibilities for the control and recording of personnel exposures to ionizing radiation. Adherence to these procedures will assure proper monitoring/recording of personnel dosimetry.

Section II. LEAK TEST

2-5. Leak Test

a. Perform a leak test (wipe test) upon receipt of a radioactive source set, at least once every 6 months thereafter, prior to shipment, or at any time it is suspected that the radioactive source may be leaking.

WARNING

Wear a film badge, calibrated dosimeter, and disposable protective gloves when performing the leak test. Do not spread contamination by touching other objects with the gloves. Do not leave the unshielded radioactive source or the opened storage case unattended. Do not stay in the radiation area any longer than necessary to perform the leak test.

a. Assemble the Following Items Before Beginning Leak Testing Procedures.

(1) A calibrated beta-gamma type radiac survey meter such as the AN/PDR-27( ) Radiac Set.

(2) A film badge and calibrated IM-9( )/PD Radiac Dosimeter for each individual taking part in the leak testing procedure.

(3) Disposable protective gloves for the individual performing the wipe.

(4) Cotton swabs furnished by the US Army Ionizing Radiation Dosimetry Center (AIRDC).

(5) Plastic bags provided by AIRDC.

(6) Distilled or clean tap water.

NOTE

Select an area away from the normal stream of traffic. The area of the test site should be unobstructed and have a level floor or ground surface.

b. Perform the Wipe Test.

WARNING

Wear disposable protective gloves.

(1) Record the serial number of the radioactive source set on the paper tab. (The set bears the same serial number as the radioactive source capsule.)

(2) Using the remote magnetic handler, remove the radioactive source from the well and then, gently but thoroughly, wipe the sides and bottom of the well in the shield and the surfaces of the plug that fit into the shield with the moistened cotton swab.

(3) Return the radioactive source to the shield (para 2-10).

WARNING

After removal of the swab from the access well, DO NOT lay the swab down or allow it to touch any other object.

2-6. Test Evaluation

a. Position a calibrated AN/PDR-27( ) Radiac Set over the cotton swab. Place the probe of the radiacmeter (with the beta window open) as close to the filter disk as possible. DO NOT ALLOW THE PROBE TO TOUCH THE COTTON SWAB.

(1) If the dose rate is 0.4 mR/hr or twice the background radiation, discontinue use of the source set and lock the radioactive source in the shield. If necessary, decontaminate the outside of the shield and the storage case. Report results to the command RCO and request disposition instructions.

(2) The cotton swab should be placed in the provided plastic bag and then placed in a small cardboard box and mailed to AIRDC.

WARNING

The radiation reading at the surface of the box must not exceed 0.4 mR/hr. If the measured radiation is more than 0.4 mR/hr, wrap a thin sheet of lead, aluminum, or other metal around the plastic bag and place in a small cardboard box.

(3) If the meter reading is less than 0.4 mR/hr, place the cotton swab in the provided plastic bag and submit to AIRDC for evaluation. The set may be used while awaiting the report from the laboratory.

NOTE

AIRDC will report its evaluation of the filter disk in microcuries (uCi) of Co-60. If the report indicates 0.005 uCi of Co-60 or greater, turn the radioactive source set in for disposal. If the report indicates less than

0.005 uCi of Co-60, the radioactive source set may be used.

b. If laboratory equipment capable of accurately measuring 0.001 uCi is available, and approval has been granted by CECOM to perform leak test analyses, evaluate the cotton swab, and send a copy of the results of the test to the area RMCP. If the quantity of Co-60 on the disk measures more than 0.005 uCi, the radioactive source set is unserviceable and should be turned in for disposal.

(4) Installation commanders in CONUS will forward smear samples for evaluation to:

Chief
US Army Ionizing Radiation Dosimetry Center
ATTN: AMXTM-CE-DC
Lexington, KY 40511

(3) AIRDC will forward a test evaluation report to the sender.

(4) Commanders at overseas installations will follow the procedures established by the responsible commander.

2-7. Test Records

a. Maintain records of leak tests. Indicate date, results, and name of personnel performing the test.

b. Test records are subject to periodic inspections.

Section III. OPERATING UNDER NORMAL CONDITIONS

WARNING

Once the lead plug is removed from the shield, the source is an exposed radiation hazard. Always use the magnetic handler for handling the radioactive source. Never touch the radioactive source capsule.

2-8. Checking Serial Numbers

a. The serial number on the underside of the lifting disk (ring) of the radioactive source assembly and the serial number on the Co-60 decay curve chart (attached inside the cover of the storage case) must be identical. If the serial numbers are not identical, the radioactive source set cannot be used for calibration purposes, since the source strength value printed on the chart will not correspond to the activity of the radioactive source.

b. Compare the serial numbers on the lifting disk and the chart upon receipt of a radioactive source set. If the serial numbers on the disk and chart differ, report an improper shipment (SF-364).

c. To check the serial number on the underside of the lifting disk, follow the procedures described in paragraph 2-9b(1) through (6). Raise the lifting disk of the radioactive source assembly just high enough to deposit the lifting disk on the rim of the shield. Be sure to keep the radioactive source capsule in the well of the shield. Use a pair of pliers to turn the lifting disk over. Be careful not to overdraw the radioactive capsule from the shield. Make note of the serial number and return the disk to its original position in the shield.

2-9. Removing the Radioactive Source From the Shield

a. General. Each time the radioactive source is removed from the shield, use the probe of an AN/PDR-27( ) Radiac Set to test the well in the shield for radioactive contamination (para 2-5c). If contamination is detected, return the source to the shield using the magnetic handler, and follow emergency procedures (para 2-17 and 2-18).

b. Using the M4 Magnetic Handler.

(1) Remove the M4 magnetic handler (fig. 1-7) from the storage case. Extend the flexible arm assembly (2, fig. 1-8) and each of the three extensions in turn. Tighten each of the four retaining nuts just enough to hold the handler in the extended position. Bend the flexible arm downward.

(2) Make sure that the magnetic handler is fully extended and in proper operating condition. Bring the front end of the magnet cap (1, fig. 1-8) close to a paper clip or small nail. The clip or nail should be attracted and held to the cap by the magnet. Turn the magnet control knob (6) about one-fourth turn counterclockwise to retract the magnet and release the clip or nail from the magnet cap.

CAUTION

Never turn the magnet control knob unless the magnetic handler is fully extended. Never turn the knob in a clockwise direction.

(3) Unlock the combination lock (5, fig. 1-4) and remove the lockbar (4).

NOTE

The RPO will maintain the combination and change the combination as required. The RPO will keep the key that is used to change the combination. When a radioactive source set is transferred from one installation to another, the combination for the lock and the key for changing the combination will be forwarded under separate cover, they will not be sent with the set.

(4) Remove the lead plug (3) from the shield and step back from the shield as quickly as possible.

WARNING

- Never look into the well of the shield or unnecessarily expose parts of the body to the radiation.

(5) Bring the magnet cap end of the handler in contact with the lifting disk.

(6) Lift the radioactive source assembly out of the shield with the handler and carry it to the calibration site.

2-10. Returning The Radioactive Source To The Shield

Use the magnetic handler (remote-handling tongs) to return the radioactive source assembly to the shield, and lower the source capsule gently into the well of the shield. Do not look into the well. Release the lifting disk, replace the lead plug in the shield, insert and lock the lockbar. Loosen the nuts on the extension arms of the magnetic handler to telescope the handler, place the handler in the storage case and close the case.

Section IV. CALCULATIONS

2-11. General

The activity of Co-60 decreases with time, therefore the strength of the source must be determined before calibrating an instrument. After determining source strength, the dose rate in mR/hr, at a given distance from the source, and distance from the source required to obtain a given dose rate, can be calculated. Distance from source is measured in meters. One meter is equals to 39.37 inches.

2-12. Determining Present Source Strength and Calculating Dose Rates, Distances, and Dose

a. Determining Present Source Strength.

(1) From the Co-60 decay curve chart (fig 1-5) attached inside the cover of the storage case, note the date of initial calibration (year and month) and the strength of the source in mR/hr at 1 meter on that date. Compute the years and months that have elapsed since that date.

(2) From the decay curve on the chart, determine the percent strength remaining in the source.

(3) Calculate the present source strength using the following formula: Present strength = (strength when initially calibrated) x (percent strength remaining) ÷ 100.

Example:

Present date...................August 1984

Date of initial calibration....February 1982

Elapsed time...................2 years 6 months

Percent strength remaining.....72

Strength of source: 132 mR/hr at 1 meter when initially calibrated

Calculation...................$\frac{132 \times 72}{100} = 95.04$

Present strength...............95.04 mR/hr at 1 meter from the source

b. Calculating Dose Rate at a Given Distance. Use the following formula to calculate the dose rate at a given distance (d): $R = \frac{S}{d^2}$

Where: R = dose rate in mR/hr

S = present source strength (a above)

d = distance from source in meters (1 meter equals 39.37 inches 3.281 feet).

Example:

Present strength...............95.04 mR/hr at 1 meter (a above)

Distance from source (d).......2 meters

Calculation...................$\frac{95.04}{2^2} = \frac{95.04}{4} = 23.76$

Dose rate (R)..................23.76 mR/hr at 2 meters

c. Calculating Distance From Source to Obtain a Given Dose Rate. Use the following formula to calculate the distance at which a given dose rate (R) will be obtained:

$$d = \sqrt{\frac{S}{R}}$$

Where: d = distance from source in meters

S = present source strength

R = given dose rate in mR/hr

Example:

Present source strength (S), 95.04 mR/hr at 1 meter (a above).

Given dose rate (R), 23.76 mR/hr at 2 meters (b above).

Calculation.................. $\sqrt{\frac{95.04}{23.76}} = \sqrt{4} = 2$

Distance from source (d) equals 2 meters

d. Calculating the Dose. Use the following formula to calculate the dose (D) at a given distance when the dose rate (R) at a given distance and the exposure time (t) are known, D = Rt.

Where: D = the total amount of absorbed radiation (mR)

R = the dose rate at the given distance (mR/hr)

t = time of exposure in hours

Example:

Dose rate (R) at 2 meters equals 23.76 mR/hr (b above).

Let time (t) equal: 1/2 hr

Calculation..................23.76 x 1/2 = $\frac{23.76}{2}$ = 11.88

Dose (D)....................11.88 mR

Section V. CALIBRATION OF RADIAC SURVEY METERS AND DOSIMETERS

2-13. General

Calibration of radiac survey meters and dosimeters provides the means for determining to what extent an instrument reading deviates from the true value. Calibration may be performed by checking the instrument against a standard radioactive source, the M3A1 Radioactive Source Set can be used for this purpose.

2-14. Calibration of Radiac Survey Meters

a. General. Radiac survey meters should be calibrated each time electronic components are changed, after long periods of continual use, and after being exposed to extreme temperature changes (FM 21-48).

b. Preliminary Procedure.

WARNING

Never take the radioactive source from the shield without having a radiacmeter available and in good working order; e.g., an AN/PDR-27( ) Radiac Set or equivalent.

(1) Prepare a worksheet for record purposes. Record the name and serial number of the radiac survey meter that is to be calibrated, the serial number of the radioactive source, the date, and the name of the individual performing the calibration. Prepare a table with the following column headings:

(a) Distance from Source (meters).

(b) Calculated Dose Rate (mR/hr).

(c) Survey Meter Scale Reading (mR/hr).

(2) Under the Distance from Source reading, list 1/2; 1; 1 1/2; 1 3/4; 2; 2 1/2; 3; 4; 5; 7; and 9 meters.

(3) From the Co-60 decay curve chart, calculate the present strength of the radioactive source (para 2-12a).

(4) Use the value obtained to calculate the dose rate for each of the distances listed in the table (para 2-12b). Record these dose rates.

(5) Calculate the distance from the radioactive source at which the dose rate is 0.4 mR/hr (para 2-12c). List the distance and the dose rate in the table.

(6) Calculate the distance from the radioactive source at which the dose rate is 2.0 mR/hr (para 2-12c). Use the calculated distance to delineate the radiation area (para 2-3).

c. Prepare a Calibration Site.

WARNING

Before removing the radioactive source capsule from the shield, select a calibration site in an area that is away from the normal stream of traffic. The selected site should be unobstructed and have a level floor or ground surface.

(1) Mark with an "X" the point (center of site) where the radioactive source will be located. Draw a straight line approximately 16 meters long from the point X.

(2) Starting from the point marked X, measure and mark off intervals for each of the distances listed in the table.

(3) Use the point marked X as the center of a circle and calculate the distance for a dose rate of 2 mR/hr as the radius; post the radiation area (para 2-3).

(4) Provide a wood stand with a hook or other means for suspending the radioactive source directly over and approximately 3 inches above the point marked X.

d. Obtain Survey Meter Readings.

WARNING

Never allow personnel without film badges and dosimeters inside the restricted area. Do not linger in the radiation area any longer than is necessary to obtain the meter readings.

(1) To check the survey meter for proper operation, use the procedures described in the appropriate TM. Record the background reading.

(2) Remove the radioactive source from the shield (para 2-9) and suspend the source over the point marked X. Leave the radiation area.

(3) Start with the highest scale on the survey meter and obtain three meter readings on each scale (except the 0 to 0.5 mR/hr scale); one near the top, one near the middle, and one near the lower end of each scale. Obtain one reading ((c) below) on the 0 to 0.5 mR/hr scale.

(a) Select the scale to be calibrated. Start with the marked interval closest to the point X and work away from the source. Before taking a reading, place the survey meter so that the detecting element in the meter is centered on the interval marked.

(b) Record each reading in the proper place on the table.

(c) Turn the selector switch to the 0 to 0.5 mR/hr scale. Place the survey meter at the marker farthest from the source (the point at which the calculated dose rate is 0.4 mR/hr). Observe and record the reading.

(d) Return the radioactive source to the shield (para 2-10).

e. Evaluate the Data. Compare the tabulated readings with the comparable calculated dose rates for each distance from the radiactive source as recorded in the table.

(1) If any tabulated reading differs by more than ±15 percent from the calculated dose rate, do not continue the calibration but turn the survey meter in for adjustment or repair.

(2) If all the tabulated readings are within ±15 percent of the calculated dose rate, prepare a calibration curve as described in f below.

f. Preparing a Calibration Curve.

(1) Use linear graph paper to mark off calculated dose rate intervals on the horizontal axis and survey meter scale intervals on the vertical axis; date the graph with the calibration date.

(2) Plot each survey meter reading in the table against the comparable calculated dose rate.

(3) Complete the calibration graph by drawing a smooth curve through the plotted points.

(4) Attach the calibration graph to the radiac survey meter.

g. Use the Calibration Curve. Each time a survey meter reading is observed, refer to the calibration graph and obtain the true dose rate. Report as survey data the true dose rate obtained from the curve.

2-15. Calibration of Radiac Dosimeters

a. General. IM-9( )/PD Radiac Dosimeters should be calibrated every 6 months (TB 750-242-3). If, after exposure to a radioactive source, a dosimeter scale reading differs from the comparable calculated dose by more than ±10 percent (f(3) below), the dosimeter should be turned in as unserviceable.

b. Preliminary Procedure.

WARNING

Never take the radioactive source from the shield without having a radiacmeter available and in good working order; e.g., an AN/PDR-27( ) Radiac Set or equivalent.

(1) Draw a table with three column headings and date it with the calibration date. Head the three columns as follows:

(a) Dosimeter Serial Numbers.

(b) Scale Reading (SR), mR.

(c) Correction Factor (CF).

(2) In the first column of the table, list the serial number of each dosimeter that is to be calibrated.

(3) Use data from the Co-60 decay curve chart to calculate the present strength (mR/hr at 1 meter) of the radioactive source (para 2-12a). Record this value on the worksheet.

(4) Use the value obtained above to calculate the dose rate (mR/hr) at a distance of 1/2 meter from the radioactive source (para 2-12b). Record this value on the worksheet.

(5) Calculate the dose (mR) resulting from a 15 minute and a 30 minute exposure at a distance of 1/2 meter from the radioactive source (para 2-12d). Record on the worksheet the Calculated Dose (CD) that is closest to 150 mR. Record length of the exposure.

NOTE

The CD resulting from a 15 minute exposure at 1/2 meter will be numerically equal to the present strength of the radioactive source ((3) above). For example, if the present strength of the source is 95.04 mR/hr at 1 meter, the CD resulting from a 15 minute exposure at 1/2 meter will be 95.04 mR. The CD resulting from a 30 minute exposure at 1/2 meter will be numerically equal to twice the present strength of the radioactive source. For example, if the present strength of the source is 95.04 mR/hr at 1 meter, the CD resulting from a 30 minute exposure at 1/2 meter will be twice 95.04 or 190.08 mR.

(6) Calculate the distance from the radioactive source at which the dose rate is 2 mR/hr (para 2-12c). Record this value on the worksheet and use it to delineate the radiation area (para 2-3).

c. Preparing the Calibration Site.

WARNING

Never leave an unshielded radioactive source unattended. If necessary to leave the source set, re-shield the radioactive source and lock the container.

(1) Select a calibration site that is away from the main stream of traffic.

(2) Select a flat unobstructed surface within the calibration area and draw a circle having a radius of 1/2 meter.

(3) Mark the center of the circle; this is where the radioactive source will be suspended.

(4) Prepare a wood stand with a hook or other means for suspending the radioactive source directly over and approximately 3 inches above the center of the circle.

d. Charging Radiac Dosimeters. Radiac dosimeters must be fully charged before they are calibrated. Charge the dosimeters as described in TB SIG 226-9. Be sure that the SR is zero on each dosimeter to be calibrated.

WARNING

Wear film badges and dosimeters. Do not linger in the radiation area any longer than is necessary. Do not leave the unshielded radioactive source unattended.

e. Exposing Charged Dosimeters to the Radioactive Source.

(1) Stand dosimeters to be calibrated approximately 6 to 8 inches apart on the circumference of the circle (c(2) above). Stand each dosimeter on its viewing end (the end with the clip).

(2) Remove the radioactive source from the shield (para 2-9) and suspend the source over the center of the circle. Note and record the exact time (hours, minutes, and seconds).

(3) Leave the radiation area.

(4) Expose the dosimeters to the radioactive source for either exactly 15 minutes or exactly 30 minutes depending on the strength of the source (b(3) above).

(5) As quickly as possible, remove the source and return it to the shield (para 2-10).

f. Calibrating Radiac Dosimeters.

(1) Collect the exposed dosimeters. Read each dosimeter and enter the SR in the second column opposite the appropriate serial number in the first column.

(2) Calculate a CF for each dosimeter. Divide the CD (b(3) above) by the SR listed in the second column on the worksheet and list the CF in the third column opposite the appropriate serial number.

Example:

$$\frac{CD}{SR} = CF$$

If the CD is 180 mR and the meter reading is 190 mR, the CF is $\frac{180}{190}$ or 0.95.

(3) Scan the list of CF's in the third column of the table. Any dosimeter requiring a CF of less than 0.90 or greater than 1.10 is considered unserviceable and should be turned in.

(4) Record the calibration date, serial number, and CF for each serviceable dosimeter on separate pieces of paper and attach the papers to the appropriate dosimeters.

Section VI. EMERGENCY SITUATIONS AND PROCEDURES

NOTE

The procedures outlined below will be followed in an emergency situation.

2-16. Loss of a Radioactive Source Set

a. Try to recover the radioactive source set.

(1) Review records to determine the responsible individual.

(2) Make a physical survey.

b. If the radioactive source set is recovered, revise procedures as necessary to prevent recurrence.

c. If the radioactive source set is not recovered, report the loss through command channels to the RMCP and to the US Army Communications-Electronics Command, ATTN: AMSEL-SF-MR, Fort Monmouth, NJ 07703-5024. State the serial number of the source, the circumstances involved, and the procedures taken to prevent recurrence.

2-17. Internal Exposure of Personnel.

a. Internal exposure results when radioactive material is ingested, inhaled and/or absorbed through breaks in the skin.

b. In the event of known or suspected internal exposure:

(1) Seek immediate advice from the Medical Officer.

(2) Contact the local RPO.

(3) Prepare a written report of the circumstances leading to the internal exposure; include serial number(s) of the M3A1 involved, actions taken to prevent recurrence, and any other applicable information. Forward the report through proper command channels to: Commander, US Army Communications-Electronics Command, ATTN: AMSEL-SF-MR, Fort Monmouth, NJ 07703-5024.

2-18. Damaged or Leaking Radioactive Source Set

a. The M3A1 may leak as a result of age or damage to the source. Action required in the event of a known or suspected leaking source is:

(1) Discontinue use of the M3A1.

(2) Check personnel, equipment, and areas for possible contamination and decontaminate as necessary.

(3) Notify the RMCP and the CECOM Safety Office of the occurrence and follow provided disposition instructions.

2-19. Firefighting Emergency Procedures

a. General. Emergency plans must include procedures for extinguishing fires involving radioactive items. Firefighting personnel must know the location(s) of the radioactive items and be familiar with radiation protection procedures. The M3A1 Radioactive Source Set and M1A1 Source Assembly are designed to withstand high temperatures. Even in temperatures high enough to melt the lead shield, the lead will be contained within the steel jacket and surround the source. No airborne radioactivity is expected from a fire involving only the M3A1 Radioactive Source Set. However, if other radioactive sources are involved, firefighting activities may involve airborne radioactivity. As a general rule, personnel should wear protective respiratory equipment when fighting fires involving radioactive items.

b. Emergency Procedures.

(1) Evacuate personnel in the immediate area who are not directly involved.

(2) Notify the fire department.

(3) Determine radiation hazard and type of respiratory equipment required. Extinguish the fire with readily available portable extinguishers if a radiation hazard is not present.

(4) Notify the RPO.

(5) Notify medical personnel when appropriate.

(6) Control access to the immediate area.

(7) Monitor personnel, equipment, supplies, and environs and decontaminate as necessary.

(8) Record and report the fire on the appropriate forms.

CHAPTER 3

OPERATOR'S MAINTENANCE INSTRUCTION

3-1. General

a. The operator must perform inspection and preventive maintenance services under the supervision of an RPO who has received specific training in the proper operation of the M3A1 Radioactive Source Set and who has met the minimum qualifications as defined in paragraph 1-5 of this manual.

b. The operator is authorized to clean the exterior of the storage case and to clean the M4 telescoping radioactive source magnetic handler.

3-2. Operator's Preventive Maintenance Checks and Services

a. General. Inspection and maintenance services described in Table 3-1 will be performed each day the equipment is used and at least semiannually when the equipment is in unit storage. Deficiencies beyond the maintenance capability of the operator must be reported to higher level maintenance.

b. Purpose. The preventive maintenance checks and services table provides a step-by-step guide for making inspections and performing required preventive maintenance.

c. Explanation of Columns. The numbers in the first three columns indicate the sequence in which the item listed in the fourth column should be inspected. The procedures for performing the inpsections and the paragraph references are listed in the fifth column. In the sixth column, the estimated mean value of time to perform each individual test is shown in man-hour units.

Table 3-1. Operator's Preventive Maintenance Checks and Services

B-Before Operation
Time required: 2.0

D-During Operation

A-After Operation
Time required: 0.1

Interval and sequence No. B	D	A	ITEM TO BE INSPECTED PROCEDURE	Work time (M/H)
			WARNING Follow the instruction in paragraph 2-3 before removing the radioactive source capsule from the shield in the storage case. Use the magnetic handler to handle the radioactive source.	
1			STORAGE CASE Inspect the exterior of the storage case for breakage. Check to see if the paint is chipped or peeled, and if the hardware is loose, damaged, or missing.	0.1 0.1
2			IDENTIFICATION PLATE Make sure that an identification plate (2, fig. 1-2) is attached to the outside cover of the case and that markings on the plate are legible. Check the replacement date on the identification plate. (The replacement date also appears on the decay curve chart.)	0.1
3			TECHNICAL MANUAL Make sure that a copy of this manual, TM 3-6665-214-13&P, in usable condition, is packed in the case.	0.1
4			M4 MAGNETIC HANDLER Inspect the magnetic handler to make sure that it is clean and functions properly.	0.3
5			COBALT 60 DECAY CURVE CHART Check the chart (fig. 1-4) on the inside cover of the storage case to make certain that the information printed on the chart is legible.	0.1
6			SHIELD ASSEMBLY Inspect the lead shield (11, Fig. 1-4) to make certain that it is undamaged. See that the plug (3) and the lockbar (4) are in place and that the padlock (5) is locked. If the lock is open or broken, do not remove	

			the plug but check the surface of the storage case with any approved radiac meter capable of measuring a dose rate of 5 mR/hr to 200 mR/hr to determine if the radioactive source capsule is in the shield. A reading in excess of 5 mR/hr but less than 200 mR/hr indicates the presence of the radioactive source in the shield. Perform a leak test (para 2-5).	0.3 0.8
7			RADIOACTIVE SOURCE ASSEMBLY	
			Inspect the radioactive source assembly to make sure that the source capsule is suspended from the lifting disk (or ring).	0.1
		8	STORAGE CASE	
			Clean the exterior of the storage case by wiping it off with a clean, damp cloth.	0.1

CHAPTER 4

ORGANIZATIONAL MAINTENANCE INSTRUCTIONS

Section I. PREVENTIVE MAINTENANCE SERVICES

4-1. General

Organizational maintenance personnel must perform inspection and preventive maintenance services under the supervision of an RPO.

4-2. Preventive Maintenance Checks and Services (Table 4-1)

Organizational maintenance personnel are authorized to perform the preventive maintenance services listed below. Except for the motor and clutch assembly, these services should be performed weekly when the source set is in use. Motor and clutch assembly should be inspected and serviced monthly after issue to field personnel. Deficiencies beyond their maintenance capability must be reported to higher level maintenance.

a. Make minor repairs of the storage case, such as replacing missing nails and screws and tightening loose screws and nuts.

b. Retouch or repaint the storage case when necessary (para 4-3).

c. Replace or repair lockbar.

d. Inspect, service, and repair magnet, flexible arm, and extension assembly of the M4 telescoping radioactive source magnetic handler. Repair is limited to removal of distorted segment(s) of flexible arm assembly or extensions.

e. Inspect and service motor and clutch assembly.

Table 4-1. Organizational Maintenance Checks and Services

Weekly
Time required: 5.2

Sequence No.	ITEM TO BE INSPECTED PROCEDURE	Work time (M/H)
1	STORAGE CASE	
	Make minor repairs. Tighten loose screws and nuts. Replace missing nails and screws. Retouch or repaint case (para 4-3a).	0.5
2	RADIOACTIVE SOURCE AND SHIELD ASSEMBLY	
	Repair lockbar, if damaged.	0.3
	Replace lockbar, if missing (para 404).	1.0
3	M4 RADIOACTIVE SOURCE MAGNETIC HANDLER	
	Inspect Magnet, flexible arm, and extension assembly.	0.6
	Repair, if damaged (para 4-5c and table 4-2).	0.7
	Inspect motor, clutch assembly, magnet control, and handle housing cover.	1.8
	Service, if needed (para 4-5c).	0.3

Section II. ORGANIZATIONAL MAINTENANCE INSTRUCTIONS

4-3. Storage Case

Organizational Maintenance personnel are authorized to make minor repairs of the storage case, to retouch the paint on the storage case and, when necessary, to thoroughly clean and repaint the case.

a. Paints To Be Used. Use synthetic paint primer and synthetic gloss enamel. (Refer to TM 43-0139 for painting instructions.)

(1) Primer. Paint all exposed exterior surfaces with one coat of primer.

(2) Enamel.

(a) Paint the storage case with yellow gloss enamel color number 13655.

(b) Paint radiation symbols (3, fig. 1-2) and eliptical DANGER Warning backgrounds (5) with magenta (purple) gloss enamel color number 17142.

(c) Paint the word DANGER on the elipitical DANGER Warning backgrounds with white gloss enamel color number 17875.

(d) Paint the words RADIOACTIVE MATERIALS underneath the radiation symbols with black gloss enamel color number 17038.

b. Identification Plate. If the identification plate (fig. 5-1) is bent or twisted, remove the plate from the storage case and straighten it. Secure the repaired plate to the cover of the storage case.

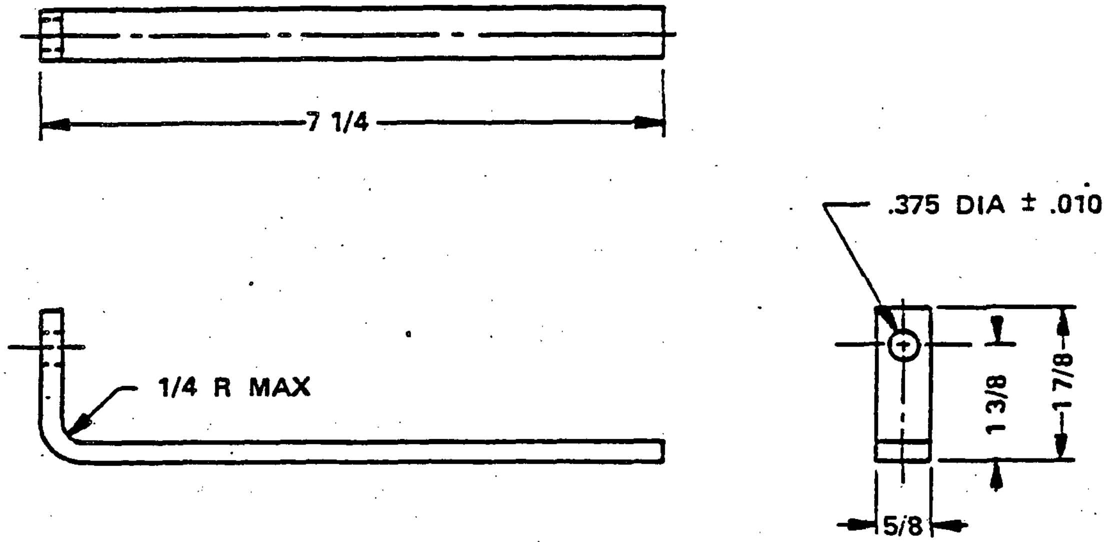
4-4. Radioactive Source and Shield Assembly (Lockbar)

a. General. Organizational support maintenance personnel are authorized to repair, replace, and manufacture a new lockbar, if necessary. If the lockbar is damaged beyond repair, or if it is missing, replace it.

b. Description. The steel lockbar (4, fig 1-4) passes through the handle of the plug and through slots in the lugs (12) on the shield. The shackle of a combination lock (5) passes through round holes in the bent end of the lockbar and through an adjacent lug to secure the radioactive source in the shield.

c. Inspection. Inspect the lockbar for distortion, cracks, or other damage. Replace if damaged or missing.

d. Manufacture. Fabricate the lockbar (fig. 4-1).



STEEL BAR, CARBON, HOT ROLLED, ANNEALED, 1018 OR 1020, 1/4 NOM STK THK, SPEC QQ-S-631, OR

(A) STEEL BAR, CARBON, COLD FINISHED, ANNEALED, 1018 OR 1020, 1/4 NOM STK THK, SPEC QQ-S-634

PROTECTIVE FINISH
FINISH NO. 5.1.1 OR 5.1.2

AR601246

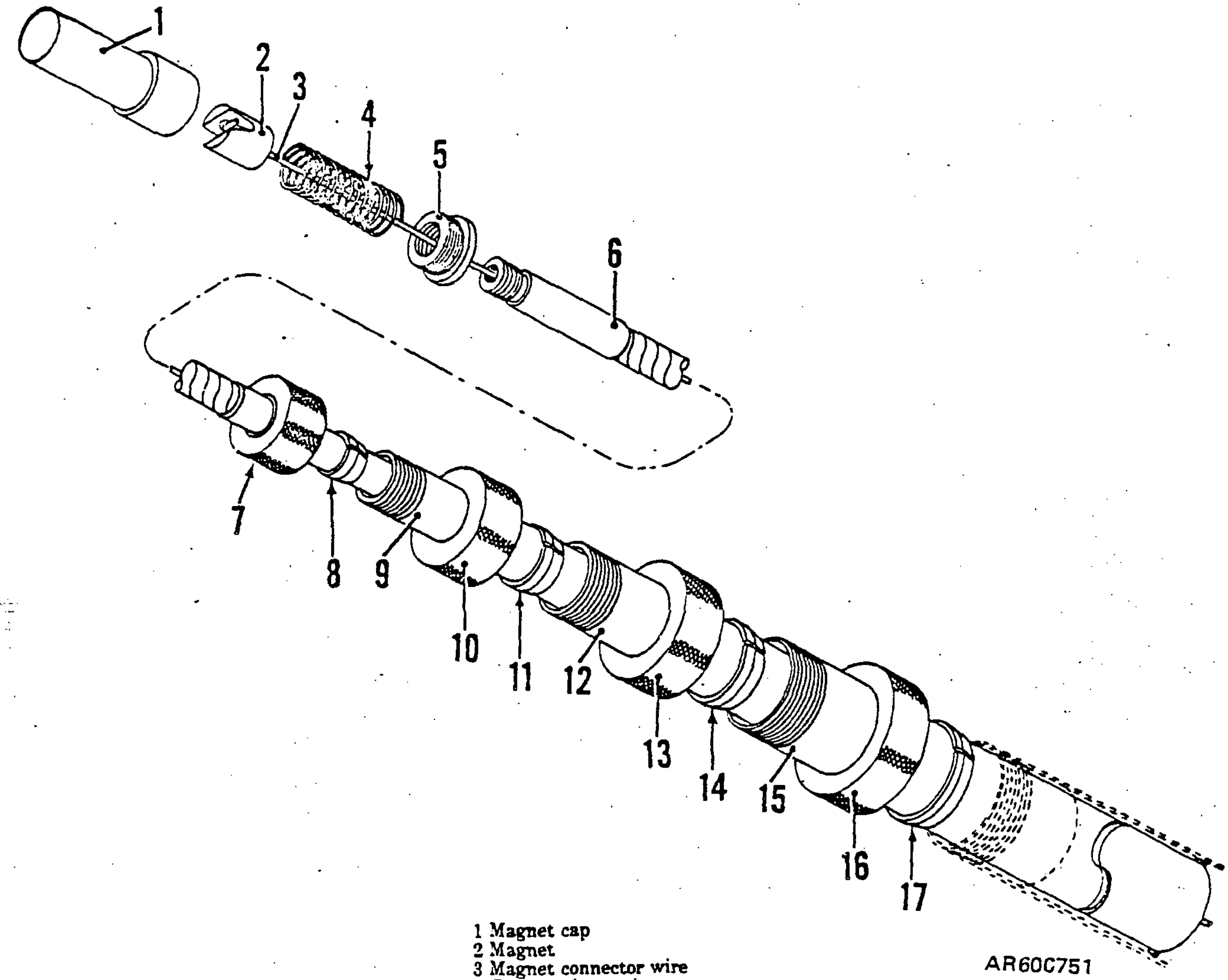
Figure 4-1. Lockbar.

4-5. M4 Telescoping Radioactive Source Magnetic Handler

a. General. The M4 telescoping radioactive source magnetic handler consists of two major groups: the magnet, flexible arm, and extension assembly and the motor and clutch assembly (fig. 4-2) and (fig. 4-3). For purposes of description, the motor and clutch assembly is divided into subgroups and assemblies. Inspection requires at least partial disassembly (para 4-6b). Servicing requires complete disassembly (para 4-6c).

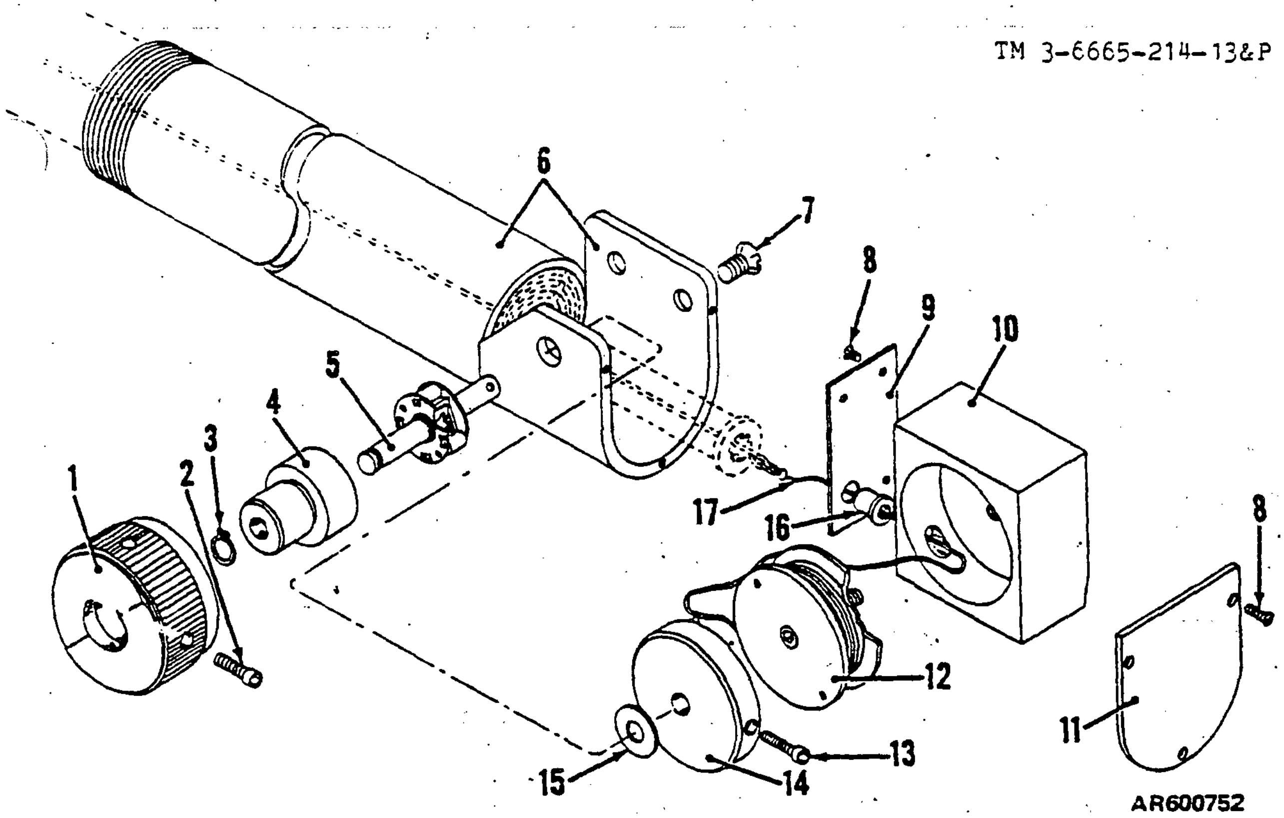
b. Description.

(1) Magnet, flexible arm, and extension assembly. The magnet, flexible arm, and extension assembly, from front to back, consists of a magnet cap (1, fig. 4-2), a magnet (2), a magnet connector wire (3), a compression spring (4), an adapter (5), a flexible arm assembly (6), three extensions (9), (12), and (15), four retaining nuts ((7), (10), (13), and (16)), and four split preformed plastic packing rings ((8), (11), (14), and (17)). The back end of the flexible arm assembly and each of the aluminum extensions are flanged so that each can be fitted inside another, to form the telescoping portion of the handler. The tension exerted by the spring motor assembly (12, fig. 4-3) causes the flexible arm assembly and the three extensions to telescope into the tube end of the handle and housing assembly (6). The magnet connector wire connects the magnet with the spring motor assembly. The magnet cap (1, fig. 4-2) fits over the magnet (2) and compression spring (4) and is screwed onto an adapter (5) on the front end of the flexible arm assembly (6).



1 Magnet cap
2 Magnet
3 Magnet connector wire
4 Compression spring
5 Adapter
6 Flexible arm assembly
7 Retaining nut
8 Packing ring
9 Extension
10 Retaining nut
11 Packing ring
12 Extension
13 Retaining nut
14 Packing ring
15 Extension
16 Retaining nut
17 Packing ring

Figure 4-2. M4 radioactive source magnetic handler, magnet flexible arm, and extension assembly (exploded view).



1 Magnet control knob
2 Setscrew
3 Retaining ring
4 Clutch housing
5 Clutch
6 Handle and housing assembly
7 Screws
8 Screws
9 Bushing retaining plate
10 Spring motor assembly housing
11 Handle housing cover
12 Spring motor assembly
13 Setscrew
14 Clutch adapter
15 Washer
16 Bushing
17 Spring motor cable

Figure 4-3. M4 radioactive source magnetic handler, motor and clutch assembly (exploded view).

(2) Motor and clutch assembly. The motor and clutch assembly consists of a spring motor assembly subgroup which is installed in the housing end of the handle and housing assembly (6, fig. 4-3), a handle housing cover (11) which fits over the housing end of the handle and housing assembly, and a magnet control and clutch subgroup which is installed in the clutch adapter (14).

(a) Spring motor assembly subgroup. The spring motor assembly subgroup consists of a bushing retaining plate (9), a bushing (16), a spring motor assembly housing (10), and a spring motor assembly (12).

(b) Magnet control and clutch subgroup. The magnet control and clutch subgroup contains a clutch assembly consisting of a clutch housing (4) and a clutch (5), a retaining ring (3) which holds the clutch assembly together, a magnet control knob (1) which fits over the clutch housing, a clutch adapter (14), and a washer (15).

c. Disassembly. Disassemble the M4 telescoping radioactive source magnetic handler only to the extent that it is necessary to make the required service, repairs or replacement. With the magentic handler in the telescoped position, follow the sequence of disassembly as given below.

(1) Magnet cap, magnet, compression spring, and adapter.

(a) Unscrew the magnet cap (1, fig. 4-2) from the adapter (5).

(b) Pull the end of the magnet connector wire (3) approximately 6 inches out from the flexible arm assembly (6) and hold it in position with a pair of pliers.

(c) Slide the magnet (2) and compression spring (4) back from the end of the wire.

(d) Use a second pair of pliers to straighten the bend at the end of the magnet connector wire.

(e) Remove the magnet and compression spring.

(f) Unscrew the adapter (5) from the end of the flexible arm assembly (6) and remove the adapter.

(2) Retaining nuts and packing rings.

(a) Unscrew the four retaining nuts ((7), (10), (13), and (16)) and slide the nuts from the end of the flexible arm assembly.

(b) Remove the packing rings ((8), (11), (14), and (17)) from their respective retaining nuts.

(3) Magnet control clutch subgroup.

(a) Loosen two setscrews (2, fig. 4-3) with a 5/64 inch socket-head screw key and pull off the magnet control knob (1).

(b) Loosen setscrew (13) in the clutch adapter (14) with a 1/16 inch socket-head screw key and pull the clutch assembly (para 4-5b) from the clutch adapter. Remove the retaining ring (3) from the clutch housing (4) only if the clutch is damaged and/or in need of replacement.

(4) Handle housing cover. Unscrew and remove three screws (8) and remove the handle housing cover (11) from the back of the handle and housing assembly (6).

(5) Spring motor assembly subgroup and clutch adapter subgroup.

(a) Remove two screws (7) which hold the spring motor assembly housing (10) in position in the housing end of the handle and housing assembly (6).

(b) Withdraw the spring motor assembly subgroup (b(1) above), the clutch adapter (14), and washer (15) from the handle and housing assembly.

(c) Remove the washer (15) and the clutch adapter (14).

(d) Lay the spring motor assembly beside the back end of the handle and housing assembly.

(e) Insert and fully seat a 1/8 inch socket-head screw key in the hexagonal opening in the top of the spring motor assembly (12). Hold the spring motor assembly to prevent it from rotating when the socket-head screw key is turned.

(f) Turn the key counterclockwise to release the threaded end of the spring motor assembly shaft from the threaded hole in the spring motor assembly housing (5 1/2 turns). Do not release the socket-head screw key. Tilt the spring motor assembly so that the shaft does not seat in the threaded opening in the spring motor assembly housing. Slowly release the key to release the spring tension.

(g) Pull the magnet connector wire (3, fig. 4-2) from the back of the flexible arm assembly (6).

(h) Separate the spring motor cable (17, fig. 4-3) from the magnet connector wire by spreading the loop on the end of the magnet connector and removing the soldered loop at the end of the spring motor cable from the magnet connector wire.

(i) Remove the spring motor assembly (12).

(j) Remove the three screws (8) from the bushing retaining plate (9) and remove the plate from the spring motor assembly housing (10).

(k) Remove the bushing (16) from the bushing retaining plate.

(6) Flexible arm assembly and extensions. Withdraw the flexible arm assembly (6, fig. 4-2) and the three extensions ((9), (12), and (15) from the back of the handle and housing assembly (6), fig. 4-3). If any of the above components are distorted to the extent that they cannot be withdrawn from the handle and housing assembly, cut just back of the distortion with a hacksaw and remove that portion from the front of the handle and housing assembly.

d. Maintenance. After disassembling the M4 telescoping radioactive source magnetic handler as directed in c above, inspect the disassembled parts and clean them. Wipe all metal parts with a clean, oily cloth. Replace worn, damaged, or missing parts as authorized in the Maintenance Allocation Chart, Appendix C. Assemble the magnetic handler as directed in e below.

e. Assembly.

(1) Flexible arm assembly and extensions. Insert the extension (15, 12, and 9, fig. 4-2) and the flexible arm assembly (6) in sequence from the back of the handle and housing assembly (6, fig. 4-3). Make certain that the components are inserted so that they can be extended from the front of the handle and housing assembly.

(2) Spring motor assembly subgroup.

(a) Insert the bushing (16, fig. 4-3) through the large opening in the bushing retainer plate (9).

(b) Place the bushing retainer plate against the side of the spring motor assembly housing (10) so that the bushing fits into the recess in the side of the spring motor assembly housing. Align the bushing retainer plate with the side of the housing.

(c) Fasten the bushing retainer plate (9) to the spring motor assembly housing (10) with three screws (8).

(d) Pass the loop end of the spring motor cable (17) from the inside of the spring motor assembly housing through the bushing.

(e) Hook the spring motor cable loop to the hook at the end of the magnet connector wire (3, fig. 4-2) and bend the hook to form a loop.

(f) Insert the magnet connector wire through the back of the flexible arm assembly (6) and pull the wire about 6 inches out from the front of the flexible arm assembly.

(g) Install the retaining nuts and packing rings ((3) below).

(h) Install the adapter, compression spring, magnet, and magnet cap ((4) below).

(i) Telescope the flexible arm assembly and the extensions and seat the spring motor assembly (12, fig. 4-3) in the spring motor assembly housing (10). Place the threaded shaft of the spring motor assembly over the threaded hole in the spring motor assembly housing. Insert and fully seat a 1/8 inch socket-head screw key in the hexagonal opening in the top of the spring motor assembly and turn the key in a clockwise direction until the spring motor assembly is fully seated. Withdraw the key.

(j) With the fingers, rotate the spring motor assembly counterclockwise to take up as much of the spring motor cable slack as possible.

(k) Insert and fully seat the 1/8 inch socket-head screw key in the hexagonal opening in the top of the spring motor assembly. Hold the spring motor assembly so that it does not rotate in the spring motor assembly housing, and turn the key eight full turns counterclockwise. This action will release the threaded shaft of the spring motor assembly from the threaded opening in the spring motor assembly housing and put sufficient tension in the spring to take up any remaining slack in the spring motor cable when the key is released ((l) below).

(l) Seat the threaded shaft of the spring motor assembly over the threaded opening in the spring motor housing and slowly release the socket-head screw key allowing the spring motor assembly to become fully seated in the housing. After the tension on the key has been released, remove the key from the spring motor assembly.

(m) Fit the two pins on the bottom of the clutch adapter (14, fig. 4-3) into the two round openings in the top of the spring motor assembly and place a washer (15) over the top of the clutch adapter. Insert the assembled spring motor assembly subgroup into the housing end of the handle and housing assembly (6) so that the bushing (16) is adjacent to the back of the flexible arm assembly.

(n) Install the spring motor assembly in the housing end of the handle and housing assembly (6) with two screws (7).

(o) Align the opening in the near side of the handle and housing assembly (6) and the washer and the clutch adapter and install the clutch and magnet control subgroup ((5) below).

(p) Attach the handle housing cover ((6) below).

(3) Retaining nuts and packing rings.

(a) Make sure that each retaining nut is fitted with a packing ring. Packing rings (8,11,14,16, fig. 4-2) are seated in the retaining nuts (7, 10, 13, 16).

(b) Slip the retaining nuts with the threaded end toward the back of the magnetic handler over the front of the flexible arm assembly (6). Start with the largest nut (16) and end with the smallest nut (7).

(c) Screw but do not tighten the nut (16, fig. 4-2) on the threaded end of the handle and housing assembly (6, fig. 4-3). Screw but do not tighten the remaining nuts to the threaded ends of the extensions (15, 12, and 9, fig. 4-2) respectively.

(4) Adapter, compression spring, magnet, and magnet cap.

(a) Slip the adapter (5, fig. 4-2) over the extended magnet connector wire (3) and screw the adapter on the end of the flexible arm assembly (6).

(b) Slip the compression spring (4) over the magnet connector wire.

(c) Thread the magnet connector wire (3) through the magnet (2) so that the slotted end of the magnet is toward the front end of the magnetic handler.

(d) Using a pair of pliers, bend the end of the magnet connector wire just enough to hold the magnet on the wire.

(e) Fit the magnet cap (1) over the magnet and compression spring. Use just enough pressure against the head of the magnet cap to seat the threaded end of the cap on the adapter and screw the cap on the adapter.

(5) Magnet control and clutch subgroup.

(a) See that the clutch housing (4, fig. 4-3) and the clutch (5) are assembled.

(b) Clip a retaining ring (3), if there is none, around the end of the clutch shaft that extends through the top of the clutch housing.

(c) Insert the bottom of the clutch shaft through the aligned holes in the handle and housing assembly, washer, and clutch adapter ((2)(o) above). Rotate the clutch shaft to align the opening in the shaft with the setscrew opening in the clutch adapter. Tighten the setscrew (13) with a 1/16 inch socket-head screw key.

(d) Fit the magnet control knob (1) over the clutch housing (4) and tighten the two setscrews (2) with a 5/64 inch socket-head screw key.

(6) Handle housing cover. Attach the handle housing cover (11) to the back of the handle and housing assembly (6) with three screws (8).

Section III. TROUBLESHOOTING PROCEDURES

4-6. Scope

a. This section contains troubleshooting or malfunction information and tests for locating and correcting most of the troubles which may develop in the M3A1 Radioactive Source Set. Each malfunction or trouble symptom for an individual component, unit, or system is followed by a list of tests or inspections necessary for you to determine probable causes and suggested corrective actions for you to remedy the malfunction.

b. This manual cannot list all possible malfunctions that may occur or all tests or inspections, and corrective actions. If a malfunction is not listed (except when malfunction and cause are obvious), or is not corrected by listed corrective actions, you should notify higher level maintenance. Skills and actions required to perform organizational maintenance of the M3A1 Radioactive Source Set are approximately the same as those required to perform direct support maintenance of the item. The essential difference between the two levels of maintenance is that replacement parts are authorized only to direct support maintenance level.

c. Table 4-2 lists the common malfunctions you may find during the operation or maintenance of the M3A1 Radioactive Source Set or its components. You should perform the tests/inspections and corrective actions in the order listed.

NOTE

Before using this table, be sure you have performed all normal operation checks. If you have a malfunction which is not listed in this table, notify the next higher level of maintenance.

TABLE 4-2. TROUBLESHOOTING PROCEDURES

MALFUNCTION

TEST OR INSPECTION

CORRECTIVE ACTION

MAGNETIC HANDLER, M4
FLEXIBLE ARM ASSEMBLY AND EXTENSIONS.

Components cannot be withdrawn from the handle and housing assembly (para 4-5c(6)).

a. Cut just back of distortion with a hacksaw.

b. Remove distorted portion from front of handle and housing assembly.

c. Insert (assemble) remaining components so that they can be extended from front of handle and housing assembly.

CHAPTER 5
DIRECT SUPPORT MAINTENANCE INSTRUCTIONS

5-1. GENERAL

Direct support maintenance personnel are authorized to repair and replace the magnet, flexible arm, and extension assembly of the M4 magnetic handler. They are also authorized to repair and replace parts of the motor and clutch assembly. In addition, direct support maintenance personnel are authorized to manufacture a new identification plate, if required, and to perform all maintenance allocated to lower categories of maintenance.

5-2. Identification Plate

a. Description. The brass identification plate (fig. 1-3) is fastened with four screws, one in each corner, to the cover of the storage case. The plate shows the National Stock Number (NSN), replacement date, activity (mCi), manufacturing date, serial number of the radioactive source assembly, Bureau of Explosives Association of American Railroads permit number, and the NRC license number.

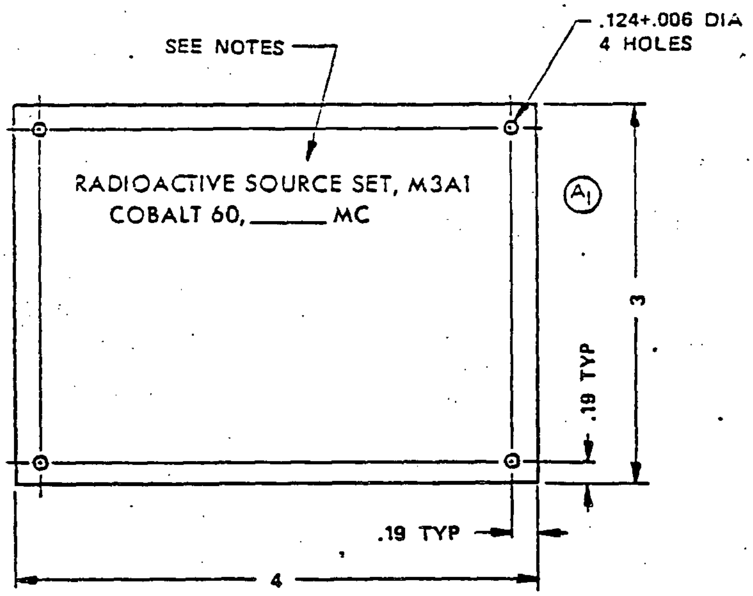
b. Inspection, Manufacture, Removal, and Installation.

(1) Inspection. If the identification plate is illegible, damaged beyond repair, or missing, manufacture a new identification plate.

(2) Manufacture. Fabricate the identification plate (fig. 5-1).

(3) Removal. Remove the four screws, one in each corner, that fasten the identication plate to the cover of the storage case. Lift plate from cover.

(4) Installation. Before securing the plate to cover, stamp or engrave the plate with letters approximately one-eighth inch high. Use the correct NSN and nomenclature. Fill in blank spaces with the appropriate information from the Co-60 decay chart which is fastened to the inside of the cover of the storage case, or from the shipping document that accompanies the M3A1 Radioactive Source Set. Fasten the new identification plate to the cover of the storage case.



BRASS STRIP, ALLOY NO. 268 or 260, ANNEALED TEMPER .032
NOM STOCK THICKNESS, SPEC QQ-B-613

NOTES:

1. Letters shall be engraved or stamped 1/8 high.

2. Marking shall be in accordance with MIL STD-130.

3. The following additional information shall be included

Manufacturing Date ______________________

Serial No. ______________________________

Replacement Date ________________________

NRC License No.

NSN 6665-00-856-8235 AR601247

Figure 5-1. Identification plate (line drawing).

CHAPTER 6

TRANSPORTATION, STORAGE, AND DISPOSAL

6-1. Transportation of the M3A1. The M3A1 requires shipment in accordance with DOT requirements, 49 CFR, AR 385-11 and the NRC license issued for the item.

a. Upon receipt of the M3A1, contact the CECOM Safety Office on Autovon 995-4427, or commercial (201) 544-4427.

b. Shipment of M3A1 by US Postal Service or by United Parcel Service is prohibited.

c. For shipment of the M3A1 to be in accordance with the above regulations and NRC license, the following requirements must be met:

(1) The motor vehicle, rail car, or freight container containing the calibrator must be placarded on all four sides with a "RADIOACTIVE" placard (49 CFR 172.504, Table 1).

(2) In the event the surface radiation level of the package cannot be decreased to below 200 mR/hr, shipment by exclusive use vehicle is required in accordance with 49 CFR 173.441b. Shipment by aircraft in this case is prohibited (49, CFR 173.441d).

(3) The storage case must be sealed with fiber tape, labelled on opposite sides with Radioactive Yellow III labels (49 CFR 172.403) and marked with 1/2 inch or larger letters with the following: TYPE 'A' DOT-7A, RADIOACTIVE MATERIAL, SPECIAL FORM NOS, UN2974.

(4) A wipe test must be performed within two weeks prior to the desired shipping date to assure that no significant removable radioactive surface contamination exists on the exterior of the package (49 CFR 173.443, 173.475 (i)). The wipe test procedure to be used is contained in Section 6-2. A DOT wipe test kit is provided by AIRDC. Wipe test results must be received from AIRDC prior to shipment.

(5) Report of shipment (RESHIP) must be transmitted to the receiving installation transportation officer (AR 385-11, paragraph 4-1) and RPO with information copy to Commander, US Army Communications-Electronics Command, ATTN: AMSEL-SF-MR, Fort Monmouth, NJ 07703-5024.

(6) The following information must be listed on the shipping documentation as required by 49 CFR 172.202, 172.203(d), 172.204, and AR 385-11, paragraph 4-1a:

(a) Proper shipping name: RADIOACTIVE MATERIAL, SPECIAL FORM, NOS.

(b) Hazardous Material Identification Number: UN 2974.

(c) Pieces, weight and volume: Required.

(d) Type of packaging: Type "A" DOT-7A.

(e) Radioactive material: Co-60.

(f) Description of chemical and physical form: SPECIAL FORM.

(g) Activity: 130.00 millicuries or as indicated on the M3A1.

(h) Type label required: Radioactive Yellow-III.

(i) Shipper's certification: Required.

(k) NRC License Number: As provided by the CECOM Safety Office, AV 995-4427.

(l) Exposure rate at the package surface and at one meter: As determined by RPO.

(m) Results of package wipe test: As determined by AIRDC.

(7) Commerical air shipment of the M3A1 requires, in addition to number 6 above, a "Cargo Aircraft Only" label on opposite sides of the shipping package and the words "Cargo Aircraft Only" listed on the shipping documentation (49 CFR 175.30).

(8) Basic requirements for shipment of radioactive materials by military (USAF Cargo) aircraft are contained in Chapter 12 of AFR 71-4/TM 38-250.

6-2. Wipe Testing Procedure for Shipment

a. The shipping package wipe test is performed for compliance to DOT regulations to assure no significant removable radioactive surface contamination is located on the exterior surface of the shipping package.

WARNING

The NuCon Smear is never to be used for sealed source leak testing of the M3A1 Radioactive Source Set. It is only to be utilized in the wipe testing of the exterior surfaces of the outer shipping package incorporating the M3A1 Radioactive Source Set.

b. Equipment required:

(1) NuCon Smear (1.75 inch diameter circular cloth adhered to an associated paper jacket).

(2) Envelope, pre-addressed to AIRDC.

(3) Radiacmeter, AN/PDR-27( ), or equivalent.

c. Wipe test procedure.

(1) Record date, name of the individual performing the test, and serial number(s) of the M3A1 Radioactive Source Set(s) on the jacket of the NuCon Smear.

(2) With the NuCon Smear retained within its jacket and using moderate finger pressure, wipe all exterior surfaces of the package for a total of at least 300 square centimeters (about 48 square inches).

d. Checking for contamination and mailing the NuCon Smear.

NOTE

Perform the following procedure in an area that is free from all radiation, except for normal background radiation.

(1) Adjust Radiacmeter to measure 0 to 0.5 mR/hr.

(2) Open cover on end of probe.

(3) Place the NuCon Smear approximately 1/4 inch in front of the probe and note the indication: DO NOT TOUCH THE PROBE WITH THE NUCON SMEAR.

WARNING

Any sustained reading on the AN/PDR-27( ) above twice background or 0.1 mR/hr indicates contamination of the shipping package. Secure shipping package to prevent the spread of contamination.

(4) If no detectable reading is observed on the AN/PDR-27( ), place the NuCon Smear in the self-addressed envelope provided and mail immediately to AIRDC.

(5) If a reading is observed on the AN/PDR-27( ) in excess of 0.1 mR/hr or twice the background, the NuCon Smear should be placed in a small cardboard box and mailed to AIRDC.

WARNING

The radiation reading at the surface of the box must not exceed 0.4 mR/hr. If the measured radiation is more than 0.4 mR/hr, wrap a thin sheet of lead, aluminum, or other metal around the NuCon Smear and place in a small cardboard box and recheck the surface radiation.

(6) Notification of the results of the shipping package wipe test must be received from AIRDC prior to making shipment of the M3A1 Radioactive Source Set(s).

6-3. Storage

a. Areas of M3A1 Radioactive Source Set storage will be considered radioactive material/radiation areas as determined by the RPO and will be posted in accordance with AR 385-30.

b. Access to the storage areas will be restricted to authorized personnel. These areas will be secured to prevent unauthorized use or removal of the source set.

6-4. Disposal

Reports of excess, unwanted or unserviceable M3A1's will be submitted to CECOM NICP for review of serviceability turn-in or disposal as radioactive waste. Requests for disposition instructions are submitted through radiation control command channels to the NICP. The NICP will provide disposition instructions.

APPENDIX A
REFERENCES

AR 40-14	Control and Recording Procedures: Occupational Exposure to Ionizing Radiation.
AR 385-11	Ionizing Radiation Protection (Licensing, Control, Transportation, Disposal, Radiation Safety).
AR 385-30	Safety Color Code Marking and Signs.
DA Pam 310-1	Consolidated Index of Army Publications and Blank Forms.
DA Pam 310-4	Index of Technical Publications.
MIL-STD-129H	Marking for Shipment and Storage.
TB 43-180	Calibration Requirements for the Maintenance of Army Materiel
TM 43-0139	Painting Instructions for Field Use

Title 10, Code of Federal Regulations, Parts 19, 20 and 21.

Title 49, Code of Federal Regulations.

APPENDIX B
ORGANIZATIONAL AND DIRECT SUPPORT MAINTENANCE REPAIR PARTS LIST

SECTION I. INTRODUCTION

B-1. Scope

This appendix lists repair parts required for operation and performance of organizational and direct support maintenance of the M3A1 Radioactive Source Set. It authorizes the requisition and issue of items as indicated by the source and maintenance codes. There are no basic issue items, items troop installed or authorized or special tools applicable to this equipment.

B-2. General

The repair parts list is divided into the following sections:

a. Section II. Repair Parts List. A list of repair parts authorized for use in the performance of maintenance. This list also includes parts which must be removed for replacement of the authorized parts. Parts lists are composed of functional groups in ascending numerical sequence, with the parts in each group listed in figure and item number sequence. Bulk materials are listed in NSN sequence.

b. Section III. NSN and Part Number Index. A list, in ascending numerical sequence, of all NSNs appearing in the listing followed by a list, in alphameric sequence, of all part numbers appearing in the listing. NSNs and part numbers are cross-referenced to each illustration figure and item number appearance.

B-3. Explanation of Columns

The following provides an explanation of columns found in the tabular listings:

a. Illustration. This column is divided as follows:

(1) Figure number. Indicates the figure number of the illustration on which the item is shown.

(2) Item number. The number used to identify each item called out in the illustration.

b. Source, Maintenance, and Recoverability Codes (SMR).

(1) Source code. Source codes are assigned to support items to indicate the manner of acquiring support items for maintenance, repair, or overhaul of end items. Source codes are entered in the first and second positions of the Uniform SMR Code format as follows:

Code	Definition
PA	Item procured and stocked for anticipated or known usage.
PB	Item procured and stocked for insurance purposes because essentiality dictates that a minimum quantity be available in the supply systems.
MF	Item to be manufactured or fabricated at the direct support maintenance level.
XB	Item is not procured or stocked. If not available through salvage, requisition.

NOTE

Cannibalization or salvage may be used as a source of supply for any items source coded above.

(2) Maintenance code. Maintenance codes are assigned to indicate the levels of maintenance authorized to USE and REPAIR support items. The maintenance codes are entered in the third and fourth positions of the Uniform SMR Code format as follows:

(a) The maintenance code entered in the third position will indicate the lowest maintenance level authorized to remove, replace, and use the support item. The maintenance code entered in the third position will indicate one of the following levels of maintenance:

Code	Application/Explanation
O	Support item is removed, replaced, used at the organizational level.
F	Support item is removed, replaced, used at the direct support level.
D	Support items that are removed, replaced, used at depot, mobile depot, specialized repair activity only.

(b) The maintenance code entered in the fourth position indicates whether the item is to be repaired and identifies the lowest maintenance level with the capability to perform complete repair. This position will contain one of the following maintenance codes.

Code	Application/Explanation
O	The lowest maintenance level capable of complete repair of the support item is the organizational level.
F	The lowest maintenance level capable of complete repair of the support item is the direct support level.

Z	Nonreparable. No repair is authorized.

(3) Recoverability code. Recoverability codes are assigned to support items to indicate the disposition action on unserviceable items. The recoverability code is entered in the fifth position of the Uniform SMR Code format as follows:

Recoverability Codes	Definition
A	Item requires special handling or condemnation procedures because of specific reasons (i.e., precious metal content, high dollar value, critical material, or hazardous material). Refer to appropriate manuals/directives for specific instructions.
H	Reparable item. When uneconomically reparable, condemn and dispose at the general support level.
Z	Nonreparable item. When unserviceable, condemn and dispose at the level indicated in position 3.

c. NSN. Indicates the NSN assigned to the item and will be used for requisitioning.

d. Part Number. Indicates the primary number used by the manufacturer (individual, company, firm, corporation, or Government activity), which controls the design and characteristics of the item by means of its engineering drawings, specifications standards, and inspection requirements, to identify an item or range of items.

NOTE

When a stock number item is requisitioned, the repair part received may have a different part number than the part being replaced.

e. Federal Supply Code for Manufacturer (FSCM). The FSCM is a 5 digit numeric code listed in SB 708-42 which is used to identify the manufacturer, distributor, or Government agency, etc.

f. Description. Indicates the Federal item name and, if required, a minimum description to identify the item.

g. Unit of Measure (U/M). Indicates the standard of the basic quantity of the listed item as used in performing the actual maintenance function. This measure is expressed by a two-character alphabetical abbreviation (e.g., ea, ft, etc). When the unit of measure differs from the unit of issue, the lowest unit of issue that will satisfy the required units of measure will be requisitioned.

h. Quantity Incorporated in Unit. Indicates the quantity of the item used in the breakout shown on the illustration figure, which is prepared for a functional group, subfunctional group, or an assembly.

B-4. Special Information

a. Action change codes indicated in the left hand margin of the listing page denote the following:

N - Indicates an added item

C - Indicates a change in data

b. Detailed manufacturing instructions for items source coded to be manufactured are found in this manual. Bulk materials required to manufacture items are listed in the bulk material group of this appendix.

B-5. How to Locate Repair Parts

a. When NSN or Part Number is Unknown:

(1) Determine the functional group within which the repair part belongs since illustrations are prepared for functional groups and listings are divided into the same groups.

(2) Find the illustration covering the functional group to which the repair part belongs.

(3) Identify the repair part on the illustration and note the illustration figure and item number of the repair part.

(4) Using the Repair Parts Listing, find the figure and item number noted on the illustration.

b. When NSN or Part Number is Known:

(1) Using the Index of NSNs and Part Numbers, find the pertinent NSN or part number. This index is in ascending NSN sequence followed by a list of part numbers in ascending alphanumeric sequence, cross-referenced to the illustration figure number and item number.

(2) After finding the figure and item number, locate the figure and item number in the repair parts list.

Section II. REPAIR PARTS LIST

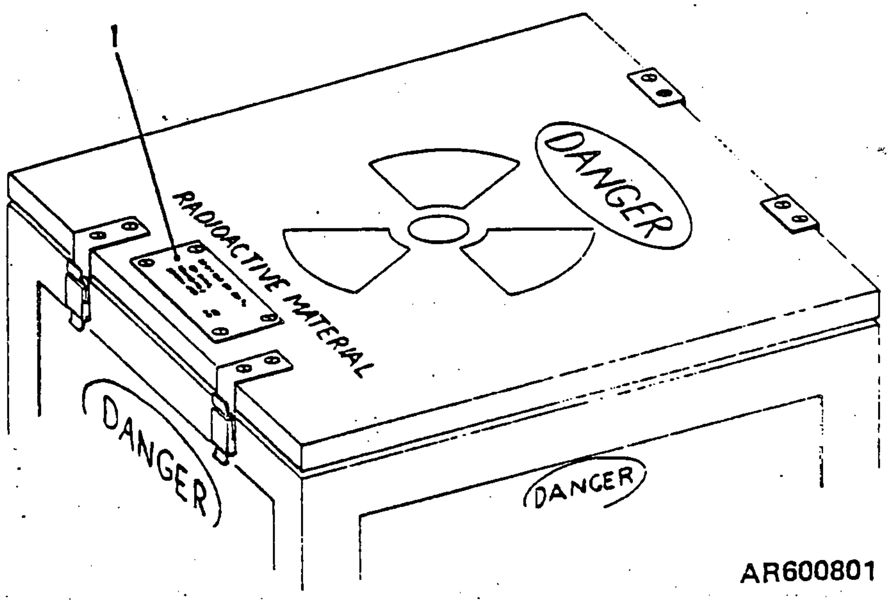


Figure B-1. Storage case.

	(1) ILLUS Fig No.	(1) ILLUS Item No.	(2) SMR CODE	(3) NATIONAL STOCK NUMBER (NSN)	(4) PART NUMBER	(5) FSCM	(6) DESCRIPTION Usable On Code	(7) U/M	(8) QTY INC IN UNIT
							GROUP 0100 - STORAGE CASE		
C	B-1	1	MFFOZ		B124-10-27	81361	PLATE, IDENTIFICATION: MFD FROM NSN 9535-00-232-6932	EA	1

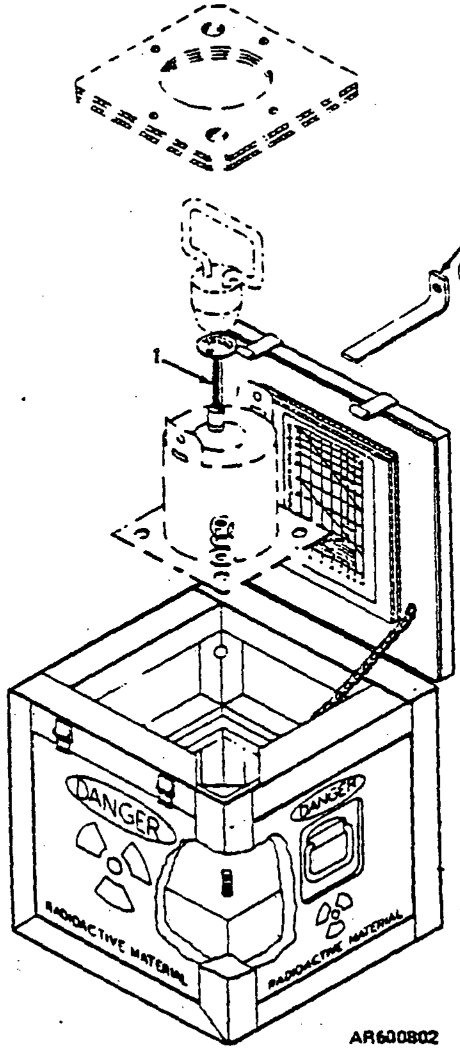
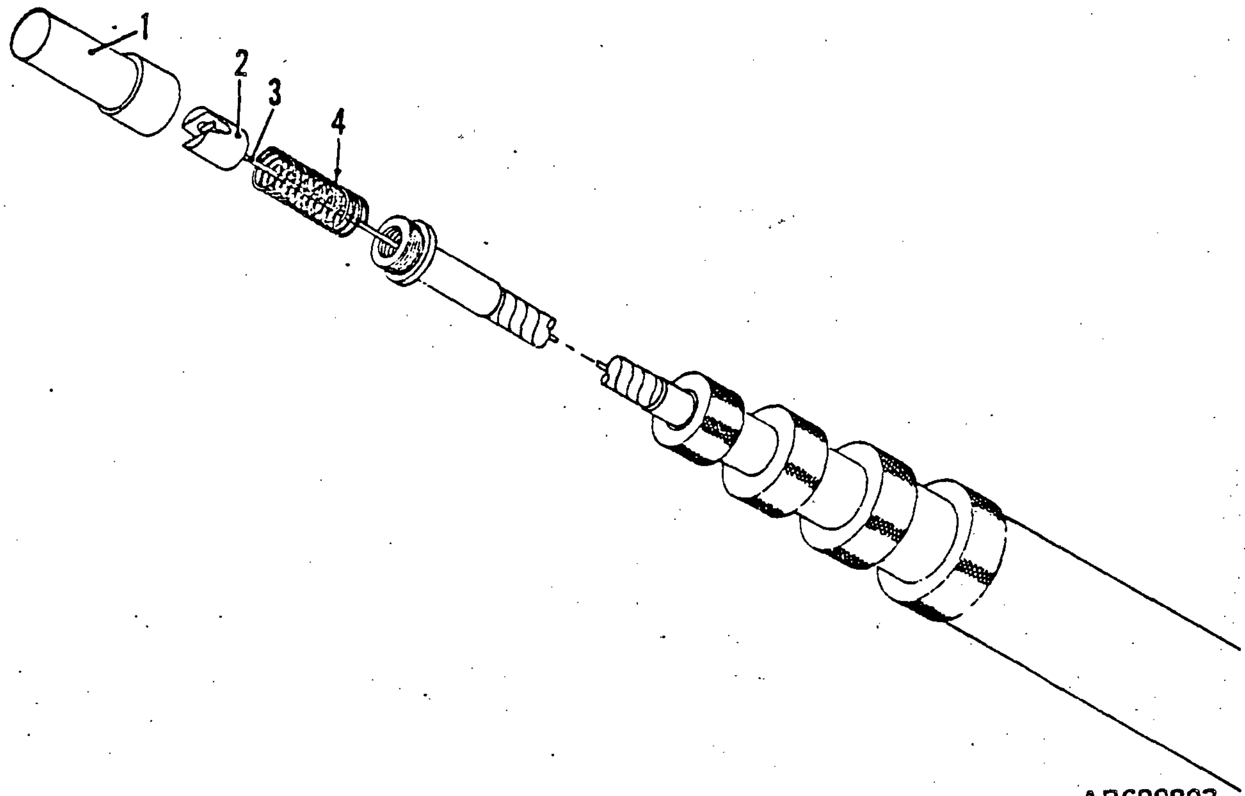


Figure B-2. Source set assembly.

	(1) ILLUS Fig No.	Item No.	(2) SMR CODE	(3) NATIONAL STOCK NUMBER (NSN)	(4) PART NUMBER	(5) FSCM	(6) DESCRIPTION Usable On Code	(7) U/M	(8) QTY INC
							GROUP 0200 - RADIOACTIVE SOURCE AND SHIELD ASSEMBLY		
C	B-2	1	XBDZA	6665-00-856-8233	C124-10-10	81361	RADIOACTIVE SOURCE ASSEMBLY, COBALT 60: M1A1	EA	1
C	B-2	2	MFOOZ		A124-10-9	81361	BAR, LOCK: MFD FROM NSN 9510-00-596-2065	EA	1
N	B-2	3	XBDZZ		K439N	72053	PADLOCK COMBINATION	EA	1



AR600803

Figure B-3. Magnet, flexible arm extension assembly.

	(1) ILLUS Fig No.	(1) ILLUS Item No.	(2) SMR CODE	(3) NATIONAL STOCK NUMBER (NSN)	(4) PART NUMBER	(5) FSCM	(6) DESCRIPTION Usable On Code	(7) U/M	(8) QTY INC
							GROUP 0300 - MAGNETIC HANDLER, M4		
C	B-3		PBOFH	6665-00-856-8234	D124-2-62	81361	MAGNETIC HANDLER, RADIOACTIVE SOURCE, TELESCOPING: M4	EA	1
C	B-3	1	XBFZZ		B124-2-75	81361	MAGNETIC CAP	EA	1
C	B-3	2	XBFZZ		B124-2-77	81361	MAGNET	EA	1
C	B-3	3	PAFZZ	9505-00-060-0882	00W423	81348	WIRE, STEEL, CORROSION RESISTING: RD, 0.063 IN. DIA	IN	18
C	B-3	4	PBFZZ	5360-00-811-9127	B124-2-79	81361	SPRING, HELICAL, COMPRESSION: STL, PLD, 0.046 IN. DIA, 13 COILS, 2 IN. FREE LG, 0.500 IN. FREE OD	EA	1

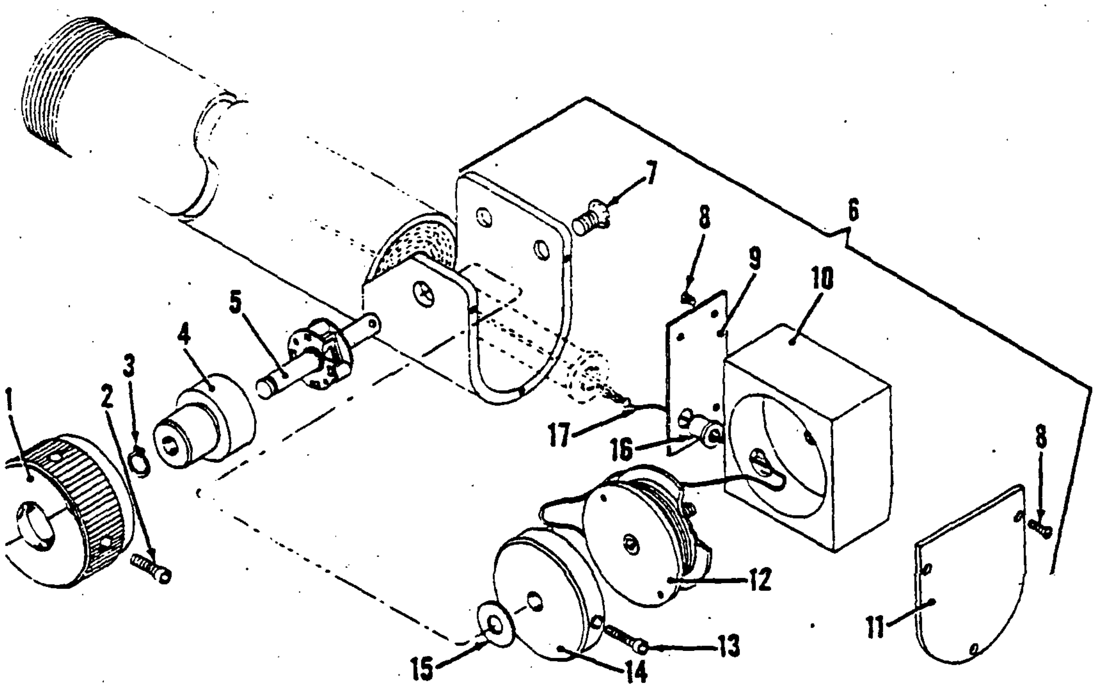


Figure B-4. Motor and clutch assembly.

	(1) ILLUS Fig No.	(1) ILLUS Item No.	(2) SMR CODE	(3) NATIONAL STOCK NUMBER (NSN)	(4) PART NUMBER	(5) FSCM	(6) DESCRIPTION Usable On Code	(7) U/M	(8) QTY INC
C	B-4	1	XBFZZ		B124-2-78	81361	KNOB, CONTROL	EA	1
C	B-4	2	XBFZZ		MS51030-27	96906	SETSCREW: CRES, HEXAGON SOCKET FLAT PT, #8-32, 1/4 IN. LG	EA	2
C	B-4	3	XBFZZ		MS16624-4025	96906	RING, RETAINING: CRES, EXT APPLICATION, 0.250 IN. SHAFT SIZE	EA	1
C	B-4	4	XBFZZ		B124-2-81HSG	81361	HOUSING, CLUTCH	EA	1
C	B-4	5	XBFZZ		B124-2-81	81361	SHAFT AND ROLLER ASSEMBLY	EA	1
C	B-4	6	XBFZZ		C124-2-63	81361	HANDLE AND HOUSING ASSEMBLY	EA	1
C	B-4	7	XBFZZ		MS35202-51	96906	SCREW, MACHINE: AL ALLOY, FLAT CSK HEAD, #10-24, 1/4 IN. LG	EA	2
C	B-4	8	XBFZZ		MS35218-2	96906	SCREW, MACHINE: AL ALLOY, PAN HEAD, #2-56, 0.187 IN. LG	EA	6
C	B-4	9	XBFZZ		A124-2-67	81361	PLATE, BUSHING RETAINING	EA	1
C	B-4	10	XBFZZ		B124-2-73	81361	HOUSING, SPRING MOTOR ASSEMBLY	EA	1
C	B-4	11	XBFZZ		A124-2-66	81361	COVER		

	(1) ILLUS Fig No.	(1) ILLUS Item No.	(2) SMR CODE	(3) NATIONAL STOCK NUMBER (NSN)	(4) PART NUMBER	(5) FSCM	(6) DESCRIPTION Usable On Code	(7) U/M	(8) QTY INC
C	B-4	12	PBFZZ	6665-00-474-7226	C124-2-80	81361	MOTOR ASSEMBLY, SPRING LOADED	EA	1
C	B-4	13	XBFZZ		MS51029-20	96906	SETSCREW: CRES, HEXAGON SOCKET, FLAT PT, #6-32, 3/8 IN. LG	EA	1
C	B-4	14	XBFZZ		B124-2-76	81361	PLATE, CLUTCH	EA	1
C	B-4	15	XBFZZ		MS27183-10	96906	WASHER, FLAT: STL PLD, RD, 0.250 IN. ID	EA	1
							GROUP 0400 - BULK MATERIALS		
N	BULK		PAOZZ	9510-00-596-2065	QQS634	81348	STEEL BAR: CARBON COLD FINISHED FLAT, 1/4 IN. THK, 5/8 IN. W, 10 TO 14 FT LG	FT	14
N	BULK		PAFZZ	9535-00-232-6932	QQB613	81348	METAL STRIP: 12 IN. W, 48 IN. LG BRASS, 0.032 IN. THK	SH	1

Section III. NATIONAL STOCK NUMBER AND PART NUMBER INDEX

a. National Stock Numbers.

National Stock Number	Fig. No.	Item No.	National Stock Number	Fig. No.	Item No.
9505-00-060-0882	B-3	3	6665-00-856-8234	B-3	
6665-00-474-7226	B-4	12	9510-00-596-2065	BULK	
5360-00-811-9127	B-3	4	9535-00-232-6932	BULK	
6665-00-856-8233	B-4	2			

b. Part Numbers.

Part Number	FSCM	Fig. No.	Item No.	Part Number	FSCM	Fig. No.	Item No.
A124-10-9	81361	B-2	1	C124-2-63	81361	B-4	6
A124-2-66	81361	B-4	11	C124-2-80	81361	B-4	12
A124-2-67	81361	B-4	9	D124-2-62	81361	B-3	
B124-10-27	81361	B-1	1	K439N	72053	B-2	3
B124-2-73	81361	B-4	10	MS16624-4025	96906	B-4	3
B124-2-75	81361	B-3	1	MS27183-10	96906	B-4	15
B124-2-76	81361	B-4	14	MS35202-51	96906	B-4	7
B124-2-77	81361	B-3	2	MS35218-2	96906	B-4	8
B124-2-78	81361	B-4	1	MS51029-20	96906	B-4	13
B124-2-79	81361	B-3	4	MS51030-27	96906	B-4	2
B124-2-81HSG	81361	B-4	4	QQB613	81348	BULK	
B124-2-81LESSHSG	81361	B-4	5	QQS634	81348	BULK	
C124-10-10	81361	B-2	2	OOW423	81348	B-3	3

APPENDIX C

MAINTENANCE ALLOCATION CHART

C-1. General

The maintenance allocation chart (MAC) (Section II) lists the authorized maintenance functions assigned the maintenance categories for maintenance of the M3A1 Radioactive Source Set. This chart is to be used by all levels of maintenance to insure complete support of the equipment.

C-2. Maintenance Functions

Maintenance functions will be limited to and defined as follows:

a. Inspect. To determine the serviceability of an item by comparing its physical, mechanical and/or electrical characteristics with standards through examination.

b. Test. To verify serviceability and detect incipient failure by measuring the mechanical or electrical characteristics of an item and comparing those characteristics with prescribed standards.

c. Service. Operations required periodically to keep an item in proper operating condition; i.e., to clean (decontaminate), to preserve, to drain, to paint, or to replenish fuel, lubricants, hydraulic fluids, or compressed air supplies.

d. Calibrate. To determine and cause corrections to be made or to be adjusted on instruments or test measuring and diagnostic equipments used in precision measurement. Consists of comparisons of two instruments, one of which is a certified standard of known accuracy, to detect and adjust any discrepancy in the accuracy of the instrument being compared.

e. Replace. The act of substituting a serviceable like type part, subassembly or module (component or assembly) for an unserviceable counterpart.

f. Repair. The application of maintenance services or other maintenance actions to restore serviceability to an item by correcting specific damage, fault, malfunction, or failure in a part, subassembly, module (component or assembly), end item, or system.

C-3. Column Entries

a. Column 1, Group Number. Column 1 lists group numbers, the purpose of which is to identify components, assemblies, subassemblies, and modules with the next higher assembly.

b. Column 2, Component/Assembly. Column 2 contains the noun names of components, assemblies, subassemblies, and modules for which maintenance is authorized.

c. Column 3, Maintenance Functions. Column 3 lists the functions to be performed on the item listed in column 2.

d. Column 4, Maintenance Category. Column 4 specifies, by the listing of a "work time" figure in the appropriate subcolumn(s), the lowest level of maintenance authorized to perform the function listed in column 3. This figure represents the active time required to perform that maintenance function at the indicated category of maintenance. If the number of complexity of the tasks within the listed maintenance function vary at different maintenance categories, appropriate "work time" figures will be shown for each category. The number of man-hours specified by the "work time" figure represents the average time required to restore an item (assembly, subassembly, component, module, end item, or system) to a serviceable condition under typical field operating conditions. This time includes preparation time, troubleshooting time, and quality assurance/quality control time in addition to the time required to perform the specific tasks identified for the maintenance functions authorized in the MAC. This time will be expressed in manhours and carried to one decimal place (tenths of hours).

e. Column 5, Tools and Equipment. Column five (5) specifies by code, those common tool sets (not individual tools) and special tools, test, and support equipment required to perform the designated function.

f. Tool and Test Equipment Requirements List. This list identifies all tools and test equipment required for maintenance and repair of the M3A1 Radioactive Source Set as specified in the MAC. The list gives tool or test equipment reference codes; user maintenance category code; a short description of items required; and NSN. The tool or test equipment code corresponds to the code in column 5 of the MAC. The maintenance category code indicates the level of availability and authorized use. All remaining columns are self explanatory.

Section II. MAINTENANCE ALLOCATION CHART FOR M3A1 RADIOACTIVE SOURCE SET

(1) Group number	(2) Component/Assembly	(3) Maintenance function	(4) Maintenance category* C	O	F	H	D	(5) Tools and equipment
0100	STORAGE CASE	Inspect	0.3					1,2
		Service	0.1 [b]					
		Repair		0.5 [b]				
		Replace [a]			0.8			
0200	RADIOACTIVE SOURCE AND SHIELD ASSEMBLY							
	Radioactive Source Assembly, M1A1	Inspect	0.1					1,2
	Shield Assembly	Inspect	0.3					1,2,3
		Test	0.8					
		Repair [c]		0.3				
		Replace [c]		1.0				
0300	M4 MAGNETIC HANDLER	Inspect [b]	0.3					
	Magnet, Flexible Arm, and	Inspect		0.6				
	Extension Assembly	Repair		0.7 [d]	1.8			
		Replace			1.2			
	Motor and Clutch Assembly	Inspect [b]		1.8				
		Service [b]		0.3				
		Repair			0.8			
		Replace			1.0			

*The subcolumns are as follows:
C—operator/crew
O—organizational
F—direct support
H—general support
D—depot
[a] Manufacture nameplate.
[b] Monthly.
[c] Repair and replacement of lockbar only.
[d] Remove distortion by bending or cutting out segment of arm extension elements.

TOOL AND TEST EQUIPMENT REQUIREMENTS LIST FOR M3A1 RADIOACTIVE SOURCE SET

Tool or test equipment reference code	Maintenance category	Nomenclature	National/NATO stock number	Tool number
1	0	FILM BADGE (Photodosimetry)	See SB 11-206	
2	0	DOSIMETER	6665-00-243-8199	IM-9/PD
3	0	RADIAC SET	6665-00-961-0846	AN/PDR(R)

UNITED STATES
NUCLEAR REGULATORY COMMISSION
WASHINGTON, D. C. 20555

SEP 17 1984

TO: NRC Licensees, Permittees, and Applicants

Please find enclosed a revised NRC Form 3, "Notice to Employees", which is required by 10 CFR 19.11(c) and 10 CFR 30.7, 40.7, 50.7 and 70.7 to be posted by each NRC licensee, permittee, and applicant. NRC licensees, permittees, and applicants must have the NRC Form 3 posted in those areas utilized by their employees and contractors and subcontractors.

The revised Form 3 should be promptly posted at locations sufficient to permit employees to observe a copy on the way to or from their place of work. Form 3 must remain posted while the application for a permit or license is pending, during the term of the permit or license, and for 30 days after termination of the license.

Revised Form 3 is written in the form of simple questions and answers which paraphrase relevant statutes and regulations. The purpose of this change in format is to make the form more readable and understandable. The various protections and prohibitions are described in a straightforward, general way. The NRC believes that the revised Form 3 will help employees of its licensees, permittees, applicants, and of their contractors, subcontractors, and vendors, to clearly understand their responsibilities and rights, and those of the NRC and the Department of Labor, on matters related to public health and safety and employee protection from discrimination. Pursuant to 10 CFR 19.11(c), each licensee and applicant shall post the current revision of Form 3. You should take steps to ensure that the current revision of Form 3 is posted by January 1, 1985.

R C DeYoung

Richard C. DeYoung, Director
Office of Inspection and Enforcement

Enclosure: As stated

UNITED STATES NUCLEAR REGULATORY COMMISSION
Washington, D.C. 20555

NOTICE TO EMPLOYEES

STANDARDS FOR PROTECTION AGAINST RADIATION (PART 20); NOTICES, INSTRUCTIONS AND REPORTS TO WORKERS; INSPECTIONS (PART 19); EMPLOYEE PROTECTION

WHAT IS THE NUCLEAR REGULATORY COMMISSION?

The Nuclear Regulatory Commission is an independent Federal regulatory agency responsible for licensing and inspecting nuclear power plants and other commercial uses of radioactive materials.

WHAT DOES THE NRC DO?

The NRC's primary responsibility is to ensure that workers and the public are protected from unnecessary or excessive exposure to radiation and that nuclear facilities including power plants are constructed to high quality standards and operated in a safe manner. The NRC does this by establishing requirements in Title 10 of the Code of Federal Regulations (10 CFR) and in licenses issued to nuclear users.

WHAT RESPONSIBILITY DOES MY EMPLOYER HAVE?

Any company that conducts activities licensed by the NRC must comply with the NRC's requirements. If a company violates NRC requirements, it can be fined or have its license modified, suspended or revoked.

Your employer must tell you which NRC *radiation requirements apply to your work* and must post NRC Notices of Violation involving radiological working conditions.

WHAT IS MY RESPONSIBILITY?

For your own protection and the protection of your co-workers, you should know how NRC requirements relate to your work and should obey them. If you observe violations of the requirements, you should report them.

HOW DO I REPORT VIOLATIONS?

If you believe that violations of NRC rules or of the terms of the license have occurred, you should report them immediately to your supervisor. If you believe that adequate corrective action is not being taken, you may report this to an NRC inspector or the nearest NRC Regional Office.

WHAT IF I WORK IN A RADIATION AREA?

If you work with radioactive materials or in a radiation (controlled) area, the amount of radiation exposure that you may legally receive is limited by the NRC. The limits on your exposure are contained in sections 20.101, 20.103, and 20.104 of Title 10 of the Code of Federal Regulations (10 CFR 20). While those are the maximum allowable limits, your employer should also keep your radiation exposure as far below those limits as is "reasonably achievable."

MAY I GET A RECORD OF MY RADIATION EXPOSURE?

Yes. *Your employer is required to tell you, in writing*, if you receive any radiation exposure above the limits set in the NRC regulations or your employer's license. In addition, if your job involves radiation, you may request from your employer a record of your annual radiation exposures and a written report of your *total exposure* when you leave your job.

HOW ARE VIOLATIONS OF NRC REQUIREMENTS IDENTIFIED?

NRC conducts regular inspections at licensed facilities to assure compliance with NRC requirements. In addition, your employer and site contractors conduct their own inspections to assure compliance. All inspectors are protected by Federal law. Interference with them may result in criminal prosecution for a Federal offense.

MAY I TALK WITH AN NRC INSPECTOR?

Yes. Your employer may not prevent you from talking with an NRC inspector and you may talk privately with an inspector and request that your identity remain confidential.

MAY I REQUEST AN INSPECTION?

If you believe that your employer has not corrected violations involving radiological working conditions, you may request an inspection. Your request should be addressed to the nearest NRC Regional Office and must describe the alleged violation in detail. It must be signed by you or your representative.

HOW DO I CONTACT THE NRC?

Notify an NRC inspector on-site or call the nearest NRC Regional office collect. NRC inspectors want to talk to you if you are worried about radiation safety or other aspects of licensed activities, such as the *quality of construction or operations* at your plant.

CAN I BE FIRED FOR TALKING TO THE NRC?

No. Federal law prohibits an employer from firing or otherwise discriminating *against a worker for bringing safety concerns* to the attention of the NRC. You may not be fired or discriminated against because you:

- ask the NRC to enforce its rules against your employer;
- testify in an NRC proceeding;
- provide information or are about to provide information to the NRC about violations of requirements;
- are about to ask for or testify, help, or take part in an NRC proceeding.

WHAT FORMS OF DISCRIMINATION ARE PROHIBITED?

No employer may fire you or discriminate against you with respect to pay, benefits, or working conditions because you help the NRC.

HOW AM I PROTECTED FROM DISCRIMINATION?

If you believe that you have been discriminated against for bringing safety concerns to the NRC, you may file a complaint with the U.S. Department of Labor. *Your complaint must describe the firing or discrimination* and must be filed within 30 days of the occurrence.

Send complaints to:

Office of the Administrator
Wage and Hour Division
Employment Standards Administration
U.S. Department of Labor
Room S3502
200 Constitution Avenue, N.W.
Washington, D.C. 20210

or any local office of the Department of Labor, Wage and Hour Division. Check your *telephone directory under* U.S. *Government* listings.

WHAT CAN THE LABOR DEPARTMENT DO?

The Department of Labor will notify the employer that a complaint has been filed and will investigate the case.

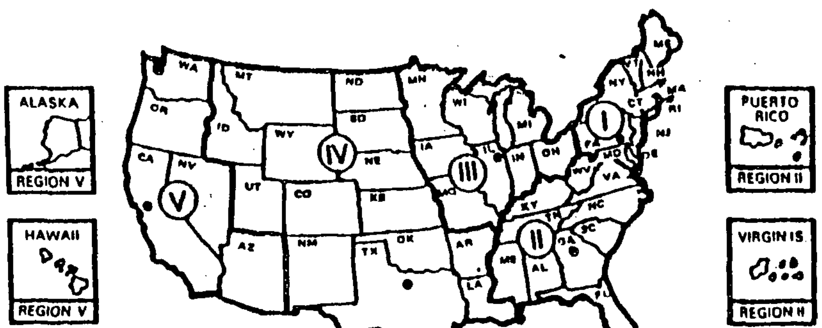
If the Department of Labor finds that your employer has unlawfully discriminated against you, it may order you to be reinstated, receive back pay, or be compensated *for any injury suffered as a result* of the discrimination.

WHAT WILL THE NRC DO?

The NRC may assist the *Department of Labor* in its investigation. NRC may conduct its own investigation where necessary to determine whether unlawful discrimination has prevented the free flow of information to the Commission. Also, if the NRC or Department of Labor finds that *unlawful discrimination* has occurred, the NRC may issue a Notice of Violation to your employer, impose a fine, or suspend, modify, or revoke your employer's NRC license.

UNITED STATES NUCLEAR REGULATORY COMMISSION REGIONAL OFFICE LOCATIONS

A representative of the Nuclear Regulatory Commission can be contacted at the following addresses *and telephone numbers. The Regional Office* will accept collect telephone calls from employees who wish to register complaints or concerns about radiological working conditions or other matters regarding compliance with Commission rules and regulations.



Regional Offices

REGION	ADDRESS	TELEPHONE
I	U.S. Nuclear Regulatory Commission Region I 631 Park Avenue King of Prussia, PA 19406	215 337-5000
II	U.S. Nuclear Regulatory Commission Region II 101 Marietta St., N.W., Suite 2900 Atlanta, GA 30323	404 221-4503
III	U.S. Nuclear Regulatory Commission Region III 799 Roosevelt Road Glen Ellyn, IL 60137	312 790-5500
IV	U.S. Nuclear Regulatory Commission Region IV 611 Ryan Plaza Drive, Suite 1000 Arlington, TX 76011	817 860 8100
V	U.S. Nuclear Regulatory Commission Region V 1450 Maria Lane, Suite 210 Walnut Creek, CA 94596	415 943-3700

NRC FORM 3
(9-84)

PUBLIC LAW 93-438
93rd CONGRESS, H. R. 11510
OCTOBER 11, 1974

AN ACT

To reorganize and consolidate certain functions of the Federal Government in a new Energy Research and Development Administration and in a new Nuclear Regulatory Commission in order to promote more efficient management of such functions.

Be it enacted by the Senate and House of Representatives of the United States of America in Congress assembled,

SHORT TITLE

Section 1. This Act may be cited as the "Energy Reorganization Act of 1974".

NONCOMPLIANCE

Section 206. (a) Any individual director, or responsible officer of a firm constructing, owning, operating, or supplying the components of any facility or activity which is licensed or otherwise regulated pursuant to the Atomic Energy Act of 1954 as amended, or pursuant to this Act, who obtains information reasonably indicating that such facility or activity or basic components supplied to such facility or activity--

(1) fails to comply with the Atomic Energy Act of 1954 as amended, or any applicable rule, regulation, order, or license of the Commission relating to substantial safety hazards, or

(2) contains a defect which could create a substantial safety hazard, as defined by regulations which the Commission shall promulgate, shall immediately notify the Commission of such failure to comply, or of such defect, unless such person has actual knowledge that the Commission has been adequately informed of such defect or failure to comply.

(b) Any person who knowingly and consciously fails to provide the notice required by subsection (a) of this section shall be subject to a civil penalty in an amount equal to the amount provided by section 234 of the Atomic Energy Act of 1954, as amended.

(c) The requirements of this section shall be prominently posted on the premises of any facility licensed or otherwise regulated pursuant to the Atomic Energy Act of 1954, as amended.

(d) The Commission is authorized to conduct such reasonable inspections and other enforcement activities as needed to insure compliance with the provisions of this section.