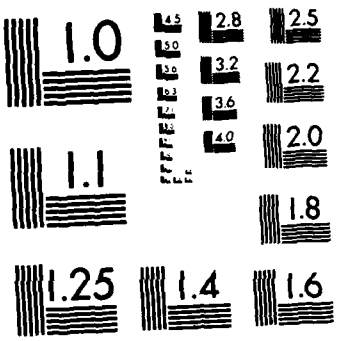
AD-A134 611 RADIAC CALIBRATORS(U) ARMY TEST AND EVALUATION COMMAND ABERDEEN PROVING GROUND MD 25 JUL 83 TOP-8-2-064 1/1

UNCLASSIFIED F/G 18/4 NL





MICROCOPY RESOLUTION TEST CHART
NATIONAL BUREAU OF STANDARDS-1963-A

UNCLASSIFIED

SECURITY CLASSIFICATION OF THIS PAGE (When Data Entered)

3

REPORT DOCUMENTATION PAGE		READ INSTRUCTIONS BEFORE COMPLETING FORM
1. REPORT NUMBER TOP 8-2-064	2. GOVT ACCESSION NO. AD-A134611	3. RECIPIENT'S CATALOG NUMBER
4. TITLE (and Subtitle) US ARMY TEST AND EVALUATION COMMAND TEST OPERATIONS PROCEDURE RADIAC CALIBRATORS		5. TYPE OF REPORT & PERIOD COVERED Final 6. PERFORMING ORG. REPORT NUMBER
7. AUTHOR(s)		8. CONTRACT OR GRANT NUMBER(s)
9. PERFORMING ORGANIZATION NAME AND ADDRESS US ARMY ELECTRONIC PROVING GROUND (STEEP-MT-ES) FORT HUACHUCA, ARIZONA 85613		10. PROGRAM ELEMENT, PROJECT, TASK AREA & WORK UNIT NUMBERS DARCOM-R 310-6
11. CONTROLLING OFFICE NAME AND ADDRESS US ARMY TEST & EVALUATION COMMAND (DRSTE-AD-M) ABERDEEN PROVING GROUND, MARYLAND 21005		12. REPORT DATE 25 July 1983 13. NUMBER OF PAGES 12
14. MONITORING AGENCY NAME & ADDRESS(if different from Controlling Office)		15. SECURITY CLASS. (of this report) Unclassified 15a. DECLASSIFICATION/DOWNGRADING SCHEDULE

16. DISTRIBUTION STATEMENT (of this Report)

Approved for public release; distribution unlimited.

DTIC ELECTE NOV 10 1983 S D B

17. DISTRIBUTION STATEMENT (of the abstract entered in Block 20, if different from Report)

18. SUPPLEMENTARY NOTES

19. KEY WORDS (Continue on reverse side if necessary and identify by block number)

Radiac Calibration
Radiacmeters
Nucleonics
Radiation Dose Rates
Ionizing Radiation Measurements
Radiation Monitoring
Radioactive Source

20. ABSTRACT (Continue on reverse side if necessary and identify by block number)

This test operations procedure (TOP) sets forth general and specific test procedures for measuring the technical performance of Radiac Calibrators. A comparison of the test results with the criteria of the technical specifications permits an evaluation of their suitability as Radiac Calibrators.

This TOP applies to Radiac Calibrators designed for field-use only.

(Continued)

DD FORM 1 JAN 73 1473 EDITION OF 1 NOV 65 IS OBSOLETE

SECURITY CLASSIFICATION OF THIS PAGE (When Data Entered)

AD-A134 611

OTIC FILE COPY

83 11 09 038

Item 20 (cont)

This TOP describes three tests:

a. Characteristic Calibration Energy, which characterizes the test item's radiation energy in a test cavity.

b. Calibration Accuracy, which determines whether the test item can, with the required accuracy, calibrate each of its anticipated types of radiac meters.

c. Repeatability, which determines whether the test item can, with the same accuracy, repeat the required calibrations.

Accession For
NTIS GRA&I ☑
DTIC TAB ☐
Unannounced ☐
Justification
By
Distribution/
Availability Codes
Dist | Avail and/or Special
A-1
DTIC COPY INSPECTED 2

US ARMY TEST AND EVALUATION COMMAND
TEST OPERATIONS PROCEDURE

DRSTE-RP-702-105 25 July 1983
Test Operations Procedure 8-2-064*
AD No.

RADIAC CALIBRATORS

			Page
Paragraph	1.0	SCOPE	1
	2.0	FACILITIES AND INSTRUMENTATION	2
	3.0	PREPARATION FOR TEST	2
	4.0	TEST CONTROLS	3
	5.0	PERFORMANCE TESTS	4
	6.0	DATA REDUCTION AND PRESENTATION	5
Appendix	A.	Checklists	A-1
	B.	Data Collection Sheets	B-1
	C.	References	C-1
	D.	Abbreviations	D-1

1.0 SCOPE. This test operations procedure (TOP) delineates general test and specific subtest procedures for measuring and evaluating the technical performance and characteristics of Radiac Calibrators relative to criteria specified in the Required Operational Capability (ROC), Letter Requirements (LR), and Coordinated Test Program (CTP). This TOP considers only those radiac calibrators designed for field use. The variety of devices to which this TOP applies precludes detailed coverage of any particular item. The methods outlined are general to provide test coverage for various radiac calibrators and may be adapted to accommodate specific equipment. The test engineer is responsible to determine how best to extract the required data for the item under test. Specific details of tests will vary with the type of radiation source provided in the test item.

1.1 Common Engineering Tests. This TOP addresses in detail only those tests peculiar to Radiac Calibrators. There are other Engineering Tests, common to all test items, that usually must be conducted as well. The more important of these are given below. Others can be found in TECOM Pamphlet 310-4 (reference 1, appendix C).

a. TOP 1-2-610, Human Factors Engineering.

b. TOP 6-2-504, Maintenance/Maintainability.

c. TOP 6-2-507, Safety and Health Evaluation - Communication/Electronic Equipment.

d. MIL-STD-810D, Environmental Test Methods.

*This TOP supersedes MTP 8-2-064, 21 May 1969
Approved for public release; distribution unlimited.

2.0 FACILITIES AND INSTRUMENTATION

2.1 Facilities. Tests shall be performed at a facility with a nucleonics instrumentation capability.

2.2 Instrumentation and Equipment. The following instrumentation and equipment will be used during this test.

a. Radiacmeters.

b. Energy Measuring Devices (e.g., oscilloscope, multichannel analyzer).

c. Voltmeter.

d. Photographic Support Equipment.

e. Secondary Standards (e.g., AN/UDM-1, AN/UDM-1A, or equivalent).

2.3 Characteristics/Requirements. The characteristics and accuracies of the above test instrumentation are determined by the performance specifications of the individual radiac calibrator to be tested and the circuits in which it is to be used. Select test instrumentation having an accuracy of sufficiently higher quality (4:1) than that of the test item. Calibration of all test instrumentation shall be traceable to the National Bureau of Standards. The above listed major facilities, instrumentation, and equipment will provide the necessary characteristics and setups required to perform the subtests outlined by this TOP.

3.0 PREPARATION FOR TEST

a. Determine if a specific Nuclear Regulatory Commission (NRC) license is required for use of the radio-active material. If a license is required, prepare and submit the application.

b. Review TECOM Pamphlet 70-3, Project Engineers' Handbook (reference 2, appendix C) for guidance on test planning, execution, and reporting; and post-test activities.

c. Maintain a readily accessible project log and project file.

d. Review the local installation's Project Office's Handbook, standing operating procedures (SOP), and implementing directives which govern the administrative processes of preparing test plans, conducting tests, preparing reports, reporting to the Test Resources Management System (TRMS), and budgeting.

e. Acquire and review all descriptive, instructional, and specification material on the test items issued by the Government and contractor(s) for checking the test plan's subtest objectives, criteria, facility(ies), and instrumentation requirements.

f. Determine the scheduled availability of the test item.

g. Insure availability of appropriate facilities, and coordinate the test support requirements including personnel, equipment, maintenance, spare parts, and instrumentation.

h. Review the detailed test plan.

i. Record as a minimum the following data:

(1) Nomenclature, serial number(s), manufacturer's name, and function of the item(s) under test.

(2) Nomenclature, serial number, accuracy tolerance, calibration requirements, and last calibration date of test equipment selected for the tests.

(3) Damage to the test items incurred during transit and any obvious manufacturing defects.

(4) Test item photographs.

j. Establish instrumentation or measurement system mean error and standard deviation of error.

k. Determine test item sample size.

4.0 TEST CONTROLS

a. Organize test team and establish responsibilities for test conduct, reporting, and data control.

b. Select test equipment having an accuracy at least 4 times the accuracy of the item to be tested.

c. Familiarize all test personnel with the test item instructional material.

d. Prepare adequate safety precautions to provide safety for personnel and equipment, and insure all safety SOPs are observed throughout the test.

NOTES: 1. All radiological safety requirements in Title 10 CFR, AR 385-11, and AMCR 385-25 (references 4, 5, and 6, appendix C) will be complied with.

2. Test personnel working with radioactivity for the first time shall be informed of the radiation hazards associated with their work and their right to review radiation exposure records indicating their accumulated dose.

3. High voltage in some of these instruments requires cautious handling during maintenance to prevent shock: many instruments, although switched to "OFF" position, still retain sufficient charge to create a shock hazard.

4. Following receipt, each radioactive source shall be leak tested in accordance with the NRC and DA directives in Note 1.

e. Inspect the test item thoroughly for obvious physical and electrical defects. Note and correct all defects before proceeding with testing.

f. Prepare, disseminate, and continually review record forms for systematic entry of data, chronology of tests, and analysis in final evaluation of the test item.

g. Prepare and monitor a test item sample plan sufficient to ensure that enough samples of all measurements are taken to provide statistical confidence of final data in accordance with TOP 3-1-002, Confidence Intervals and Sampe Size (reference 10, appendix C).

h. Perform any preliminary tests necessary to ensure the test items are in a satisfactory condition.

5.0 PERFORMANCE TESTS

NOTE: Modification of these procedures shall be made as required by technical design of the test item and availability of test equipment, but only to the extent that such modified procedures will not affect the validity of test results.

5.1 Test Methods

5.1.1 Characteristic Calibration Energy. Subject the test item to an energy output search to include the bandwidth and amplitude of energies in the calibration cavity.

5.1.2 Calibration Accuracy

a. Calibrate each radiacmeter used in the test at the dose rate(s) specified in the instructions furnished with the test item.

b. Check each radiacmeter, calibrated with the test item, at the same dose rate using a secondary standard, such as the AN/UDM-1.

c. Determine the dose rate of each radioactive source by using suitable supplemental instrumentation. Position instrumentation in the same location as the detecting element of the radiacmeter being calibrated.

5.1.3 Repeatability

a. Select a calibrated radiacmeter and designate this instrument as the transfer instrument.

b. Expose the transfer instrument (radiacmeter) to radiation from the test item. Measure the voltage produced by radiation by using a voltmeter, or by counting the pulses generated on the pulse output of the radiacmeter.

c. Remove the detector of the transfer instrument from the radiation source and secure the test item by closing the shutter over the radiation source.

d. Repeat paragraphs a through c above a sufficient number of times for each test item available to insure a predetermined confidence level of the data. Insure that each operating range for multiple range transfer instruments is tested.

5.2 Data Required

5.2.1 Characteristic Calibration Energy. Record the dose rates at specific energy levels from the radioactive sources of the test item. Take oscilloscope photographs, if appropriate, to illustrate the bandwidth and amplitude of the energies measured, or use a multichannel analyzer with a sodium iodide or other type detector.

5.2.2 Calibration Accuracy

a. Record the dose rates available from the test item for radiac equipment intended to be calibrated by the test item. Record the half life of the radioactive source used in the test item. Record the dose rate(s) at which each radiacmeter was calibrated, the radiacmeter battery voltage, if applicable, and the agreement of the calibrator instructions with the radiac-calibrator determinations. If necessary, correct the calibration dose rate for radioactive decay before making final comparisons.

b. Record the comparative radiacmeter readings obtained by checking each radiacmeter at the same dose rate using a secondary standard, such as the AN/UDM-1. Record the serial numer and ranges of the radiacmeters tested.

c. Record the dose rate provided by each radioactive source with the measurements provided by suitable supplemental instrumentation.

5.2.3 Repeatability. Record the dose rate reading for the transfer instrument and the voltage as determined either by the voltmeter's response to applied radiation or by counting the pulses generated on the pulse output of the radiacmeter for all test items available.

6.0 DATA REDUCTION AND PRESENTATION

6.1 General. Processing of raw test data, in general, includes but is not limited to the following steps:

a. Marking test data for identification and correlation according to subtest.

b. Organizing data into tabular and graphical form.

c. Modifying data to correct for nonstandard conditions.

d. Determining the statistical variation of the results in terms of the average value and standard deviation of the particular quantities and the correlation among two or more quantities.

NOTE: The test directive (or specification) itself serves to define the types and characteristics of the raw test data, and the ultimate objective of the test program defines the form of the test data desired.

Specific instructions for the reduction and presentation of individual subtest data are outlined in subsequent paragraphs.

6.2 Subtest Data

6.2.1 Characteristic Calibrator Energy. The tabulated data obtained by the measurement of the dose rates at specific energies for the test item shall be analyzed. This data will be presented in a concise form and used to determine if the test item meets the stated criteria.

6.2.2 Calibration Accuracy. The recorded data will be analyzed to determine whether the test item will operate with the required degree of accuracy and be compatible with the instruments being calibrated. The data obtained will be presented in tabular or other convenient form.

6.2.3 Repeatability

a. The data obtained shall be analyzed statistically to determine the capability of the test item to repeat radiation dose rates.

b. The results of this statistical analysis will be compared to the criteria stated for the test item. These data will be presented in tabular or other convenient form.

Recommended changes to this publication should be forwarded to Commander, US Army Test and Evaluation Command, ATTN: DRSTE-AD-M, Aberdeen Proving Ground, MD, 21005. Technical information may be obtained from the preparing activity: Commander, US Army Electronic Proving Ground, ATTN: STEEP-MT-T, Fort Huachuca, AZ 85613. Additional copies are available from the Defense Technical Information Center, Cameron Station, Alexandria, VA 22314. This document is identified by the accession number (AD No.) printed on the first page.

APPENDIX A

CHECKLIST

A.1 Pretest

a. Detailed test procedure available. _____

b. Nucleonics instrumentation support facility available. _____

c. Secondary standards available. _____

c.1 Secondary standards calibrated. _____

d. Engineering logbook available. _____

d.1 Logbook entries of date, test conductor. _____

e. Instrumentation available _____

e.1 Instrumentation calibrated. _____

A.2 Test Conduct

a. Detailed test procedure available. _____

A.2.1 Characteristic Calibration Energy

a. Detailed test procedure available. (Nucleonics Instrument Support Facility) _____

b. Measurement of energies in the calibration cavity. _____

A.2.2 Calibration Accuracy

a. Calibration instructions furnished. _____

b. Perform calibration. _____

c. Test item calibration checked against secondary standard AN/UDM-1 or equivalent. _____

d. Dose rate measurements completed with supplemental instrumentation. _____

A.2.3 Repeatability

a. Transfer instrument selected. _____

b. Measure voltage produced by test item radiation. _____

c. Repeat tests accomplished. _____

APPENDIX B

DATA COLLECTION SHEETS

B.1 Characteristic Calibration Energy

NOTE: This test shall be performed at a facility with a nucleonics instrumentation capability. This facility shall prepare the detailed plan of test.

Dose Rate Measurement

Source 1 _____

Source 2 _____

Source 3 _____

Date: _____ Test Procedure: _____

Test Director: _____ Test Conductor: _____

Test Instrumentation

Description	Calibration Date	Serial Number

B.2 Calibration Accuracy

Secondary Standard Dose Rate Measurement

Source 1 _____

Source 2 _____

Source 3 _____

Radiac Dose Rate Measurement

Source 1 _____

Source 2 _____

Source 3 _____

Supplemental Instrument Dose Rate Measurement

Source 1 _____

Source 2 _____

Source 3 _____

Maximum Deviation

Date: _____ Test Procedure: _____

Test Director: _____ Test Conductor: _____

Test Instrumentation

Description	Calibration Date	Serial Numbe

B.3 Repeatability

Radiation Source 1

Dose Rate _____ Voltage _____

Dose Rate _____ Voltage _____

Dose Rate _____ Voltage _____

Dose Rate _____ Voltage _____

Dose Rate _____ Voltage _____

Average Dose Rate _____ Average Voltage _____

Variance _____ Variance _____

Date: _____ Test Procedure: _____

Test Director: _____ Test Conductor _____

Test Instrumentation

Description	Calibration Date	Serial Number

APPENDIX C

REFERENCES

1. TECOM Pam 310-4, Index of Test Operations Procedures.

2. TECOM Pam 70-3, Project Engineers' Handbook.

3. TECOM Reg 70-24, Documenting TECOM Testing.

4. Title 10, Chapter 1, Code of Federal Regulations.

5. AR 385-11, Safety, Ionizing Radiation Protection.

6. AMCR 385-25, Safety, Radiation Protection.

7. TOP 1-2-610, Human Factors Engineering.

8. TOP 6-2-504, Maintenance/Maintainability.

9. TOP 6-2-507, Safety and Health Evaluation - Communication/Electronic Equipment.

10. TOP 3-1-002, Confidence Intervals and Sample Size.

APPENDIX D

ABBREVIATIONS

CFR	Code of Federal Regulations
CTP	Coordinated Test Program
LR	Letter Requirement
NRC	Nuclear Regulatory Commission
ROC	Required Operational Capability
SOP	Standing Operating Procedure
TRMS	Test Resources Management System

END

FILMED

1-88

DTIC