

UNCLASSIFIED

SECURITY CLASSIFICATION OF THIS PAGE (When Data Entered)

REPORT DOCUMENTATION PAGE		READ INSTRUCTIONS BEFORE COMPLETING FORM
1. REPORT NUMBER TOP 6-2-561	2. GOVT ACCESSION NO. AD #A086440 ✓	3. RECIPIENT'S CATALOG NUMBER
4. TITLE (and Subtitle) US ARMY TEST & EVALUATION COMMAND TEST OPERATIONS PROCEDURE DOSIMETER DIRECTIONAL DEPENDENCE, RADIAC		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-T) 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 29 February 1980
		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.		
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) Ionizing Radiation, Neutron, Particulate and X-ray, Radiacs, Radiacmeters Ratemeters, Dosimeter, Response Time, Directional dependence, Drift Sources: Co-60, CS-137,		
20. ABSTRACT (Continue on reverse side if necessary and identify by block number) Provides a method for determining the directional dependence characteristics of direct reading dosimeters. The dosimeter is oriented in various positions and angles with reference to a calibrated radiation source, thus providing data for evaluating the directional accuracy.		

DD FORM 1 JAN 73 1473

EDITION OF 1 NOV 65 IS OBSOLETE

UNCLASSIFIED

SECURITY CLASSIFICATION OF THIS PAGE (When Data Entered)

2004 0204008

US ARMY TEST AND EVALUATION COMMAND
TEST OPERATIONS PROCEDURE

DRSTE-RP-702-105
Test Operations Procedure 6-2-561
AD No. A086440

29 February 1980

DOSIMETER DIRECTIONAL DEPENDENCE, RADIAC

	<u>Page</u>
Paragraph 1. SCOPE	1
2. FACILITIES AND INSTRUMENTATION	1
3. PREPARATION FOR TEST	2
4. TEST CONTROLS	3
5. PERFORMANCE TEST	3
6. DATA REDUCTION AND PRESENTATION	6
APPENDIX A. TEST CHECK LIST	A-1
APPENDIX B. TEST DATA SHEET	B-1

1. SCOPE.

The objective of this test operations procedure (TOP) is to standardize methods for performing directional sensitivity tests on direct reading type radiac dosimeters.

2. FACILITIES AND INSTRUMENTATION.

2.1 Facilities. A physically secure enclosure or building which provides attenuation of all ionizing radiation to less than 2 millirad per hour at its outer walls or established perimeter.

2.2 Instrumentation (suggested)

	<u>Accuracy</u>
Secondary Standards (e.g., X-ray, AN/UDM-1, AN/UDM-1A J.L.S. MDL 138)	Corrected to 3% with source calibration correction factors applied.
Radiation Measuring Devices (RMD) (e.g., condenser "R" meter Victoreen Model 555 Radocon II)	<u>±2%</u> of full scale reading (RDG)
Barometer	<u>±0.25</u> mm (100th inch) Hg
Thermometer °C	<u>±1/2</u> °C
Warning Device (Visual/Audio)	Sensitive to 2 mR/H
Photodosimetry Film Badge	<u>±10%</u>
Pocket Dosimeter (0-200 mR)	<u>±10%</u>

Approved for public release; distribution unlimited.

29 February 1980

<u>Item</u>	<u>Accuracy</u>
Radiacmeter, PDR-27 or equivalent	<u>+10%</u>
Timer, hours	<u>+10 seconds</u>
Timer, minutes	<u>+1 second</u>
Dosimeter Holding Accessories	Alignment and tilt within <u>+1°</u>

3. PREPARATION FOR TEST.

3.1 Facilities. Inspect facilities for conformance to minimum requirements and that all safety alarms and controls are operating.

3.2 Test Equipment. Select a radiation source that will provide the energy level specified by the instructions applicable to the dosimeter under test. Source calibration data must be traceable to the National Bureau of Standards (NBS).

3.2.1 Determine the time periods of exposure for each dosimeter and each source. This information may be tabulated in test plan.

3.3 Personnel. Insure that all test personnel are familiar with the required technical and operational characteristics of the dosimeter under test. The operational and safety requirements applicable to the radioactive source being used shall be the subject of a thorough briefing before start of test as specified by 10 CFR Part 19.12, .13 and 20.1.

3.4 Instrumentation. Set up and check all instrumentation in accordance with technical manuals, technical bulletins or manufacturers' specifications applicable to the radiation source used and the dosimeter under test. Confirm that the calibrations are current. Set up and position the radiation measuring devices in the same location as the detecting element of the dosimeter being tested.

3.4.1 Select radiation measuring devices (RMD) ideally having an accuracy of at least one order of magnitude greater than that afforded by the dosimeter being tested. The RMD shall have current calibrations traceable to the National Bureau of Standards (NBS).

3.5 Data Required. Record the following:

3.5.1 Test Item. Type, Model No., Serial No., Nomenclature and Manufacturer name as applicable. Include manufacturer's stated characteristics in the report as an annex.

3.5.2 Instrumentation. Type, Model, Serial Number, Nomenclature, Manufacturer, and calibration due date.

3.5.3 Test Data Records. See paragraph 5 below.

4. TEST CONTROLS.

4.1 Radiation measuring devices will be set up inside the secure **area**.

4.2 Thoroughly inspect the dosimeter under test for obvious physical and optical defects. Record and photograph any defects observed.

4.2.1 All defects will be noted and recorded before proceeding with the test.

5. PERFORMANCE TEST.

Several dosimeters may be tested simultaneously. The time period of radiation exposure will be determined in the test plan for a specific make and model.

5.1 Test Preparation. Determine the proper distance between the selected radiation source and the dosimeter under test from the radiation source calibration tables and positioning chart necessary to expose the dosimeter to obtain a midscale reading.

a. The detailed test plan for a specific dosimeter will specify the allowable percent of deviation at midscale.

b. Express the distance in meters and the time of exposure in hours and fractions of an hour (i.e., 5.33 hours or 5-1/3 hours).

c. Temperature is recorded in °C.

d. Barometric pressure is recorded in millimeters (mm) of mercury (Hg).

5.1.1 Place the dosimeter holding block (see fig. 1) on the test table at the distance from the source as determined in paragraph 5.1 above.

5.1.2 Place the dosimeter under test in the holding block (see fig. 1) and the radiation measuring device (RMD) on the test table positioned and oriented as shown in figure 1A to obtain the baseline reading. Establish a reference orientation, i.e., clip away from source.

5.1.3 Repeat the exposures with the dosimeter rotated about its longitudinal axis with the clip faced towards the source, or at 90° left and right to determine radial symmetry.

29 February 1980

5.2 Data to be recorded during the test.

- a. Radiation source used.
- b. Radiation exposure time.
- c. RMD reading for each radiation source.
- d. Ambient temperature each day for standard temperature/pressure (STP) correction.
- e. Barometric pressure each day for STP correction.
- f. Any correction factors used.
- g. Dose readings of dosimeter under test.
- h. Tilt angles and/or position of dosimeter under test referenced to source.

5.3 Isotropism.

NOTE: The following may be used with figures 1a, b, and c and data blocks 1 through 5..

5.3.1 Set the dosimeter under test to zero.

5.3.2 Place the dosimeter under test and the RMD in the holding block mounted on the test table as shown in figure 1A.

5.3.3 Open the radiation source to radiate the dosimeter under test and RMD for the predetermined time period, then close.

5.3.4 Repeat paragraphs 5.3.1 through 5.3.3 as needed for baseline data required in paragraph 5.1, record on data sheet (Appendix B).

5.3.5 Reposition the dosimeter under test in the holding block to the forward angle position as shown in figure 1B (several angles may be tested).

5.3.6 Repeat paragraph 5.3.3 and record data on data sheet (Appendix B).

5.3.7 Reposition the dosimeter under test in the holding block to the aft angle position as shown in figure 1B.

5.3.8 Repeat paragraph 5.3.3 and record data on data sheet.

5.3.9 Place a reference mark on dosimeter for horizontal rotation.

5.3.10 Position the dosimeter under test in the holding block in the horizontal position as shown in figure 1C.

29 February 1980

TOP 6-2-561

5.3.11 Repeat paragraph 5.3.3 and record data on the data sheet.

5.3.12 Rotate the dosimeter under test on their horizontal axis 90 degrees.

5.3.13 Repeat paragraph 5.3.3 and record data.

5.3.14 Repeat paragraph 5.3.12 and 5.3.13 for each 90 degrees through 360 degrees rotation.

5.4 Geotropism.

NOTE: The following may be used with figure 10 and data block 6.

5.4.1 Set the dosimeter under test to zero.

5.4.2 Position the dosimeter under test in the horizontal plane so that zero is at the left.

5.4.3 Record the reading of the dosimeter under test.

5.4.4 Rotate the dosimeter under test 90 degrees on the horizontal axis so that zero is at the top.

5.4.5 Repeat paragraph 5.4.3.

5.4.6 Rotate the dosimeter under test to 180 degrees on the horizontal axis so that zero is at the bottom.

5.4.7 Repeat paragraph 5.4.3.

5.4.8 Rotate the dosimeter under test to 270 degrees on the horizontal axis so that zero is at the right.

5.4.9 Repeat paragraph 5.4.3.

5.4.10 Set the dosimeter under test to midscale and repeat paragraphs 5.4.2 through 5.4.9.

5.4.11 Set the dosimeter under test to fullscale and repeat paragraphs 5.4.2 through 5.4.9.

5.4.12 Position the dosimeter under test in the vertical plane, scale up (reference Appendix B, Figure 2, Position 2).

5.4.13 Repeat paragraph 5.4.3

5.4.14 Position the dosimeter under test in the vertical plane, scale down (reference Appendix B, Figure 2, Position 3).

5.4.15 Repeat paragraph 5.4.3.

6. DATA REDUCTION AND PRESENTATION.

6.1 The data should be presented in tabular and/or graphical form (as shown in Appendix B) showing dosimeter readings versus radiation measuring device readings.

6.2 The percent difference limits should be shown to allow direct comparison of values against a criteria.

6.3 The criteria should define the percent difference limits.

6.4 The RMD data may require correction for temperature and barometric pressure* for each day's data or as needed using the following:

Temperature-Pressure Correction Factor

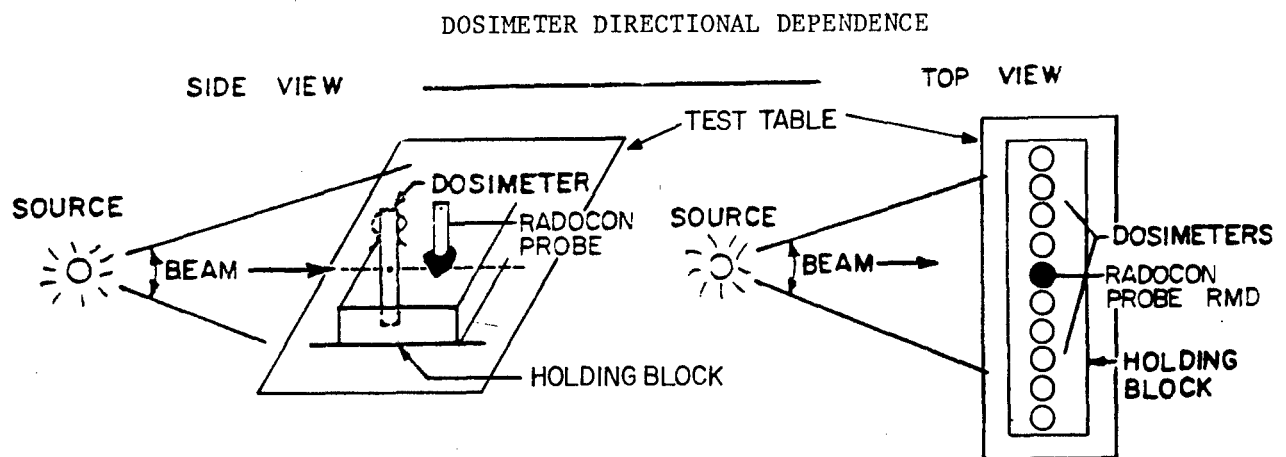
$$CF = \frac{760 (273 + T)}{295 \times P}$$

T = Degrees Celsius (C°), P = Millimeters of Mercury (mmHg)

*Certain radiation measuring devices (particularly free air ionization chambers) require correction factors. Consult manufacturer's specifications if in doubt.

6.5 Additional observed data regarding the test item should be included to facilitate analysis.

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



NOTE: THE CLIP IS SHOWN SOLID FOR THE DRAWN POSITION AND DOTTED FOR THE ALTERNATE POSITION.

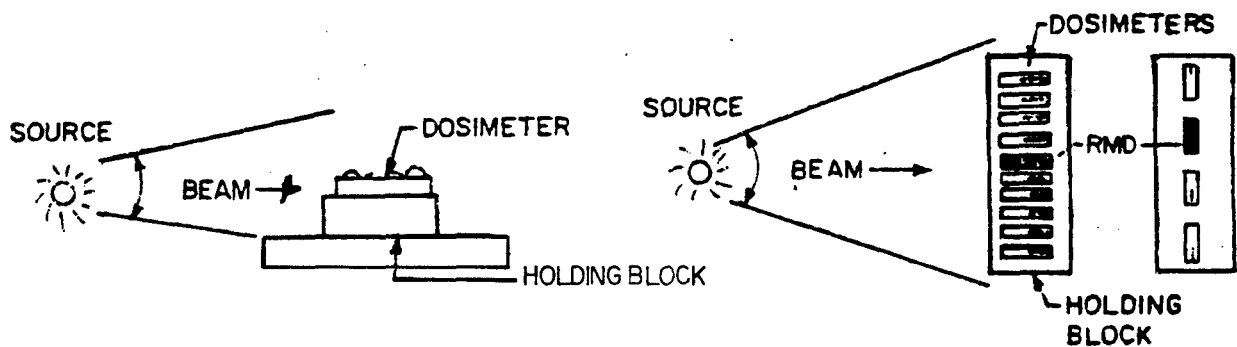
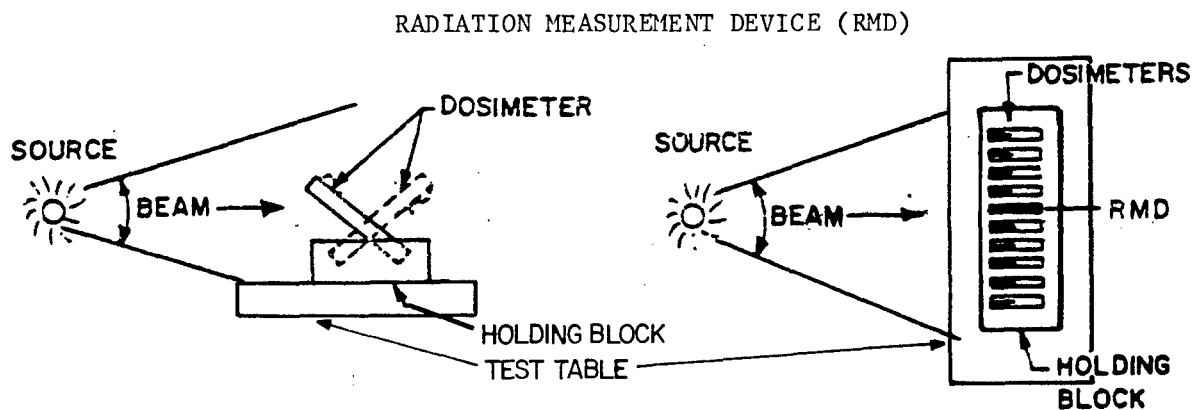


Figure 1A, 1B, and 1C.

29 February 1980

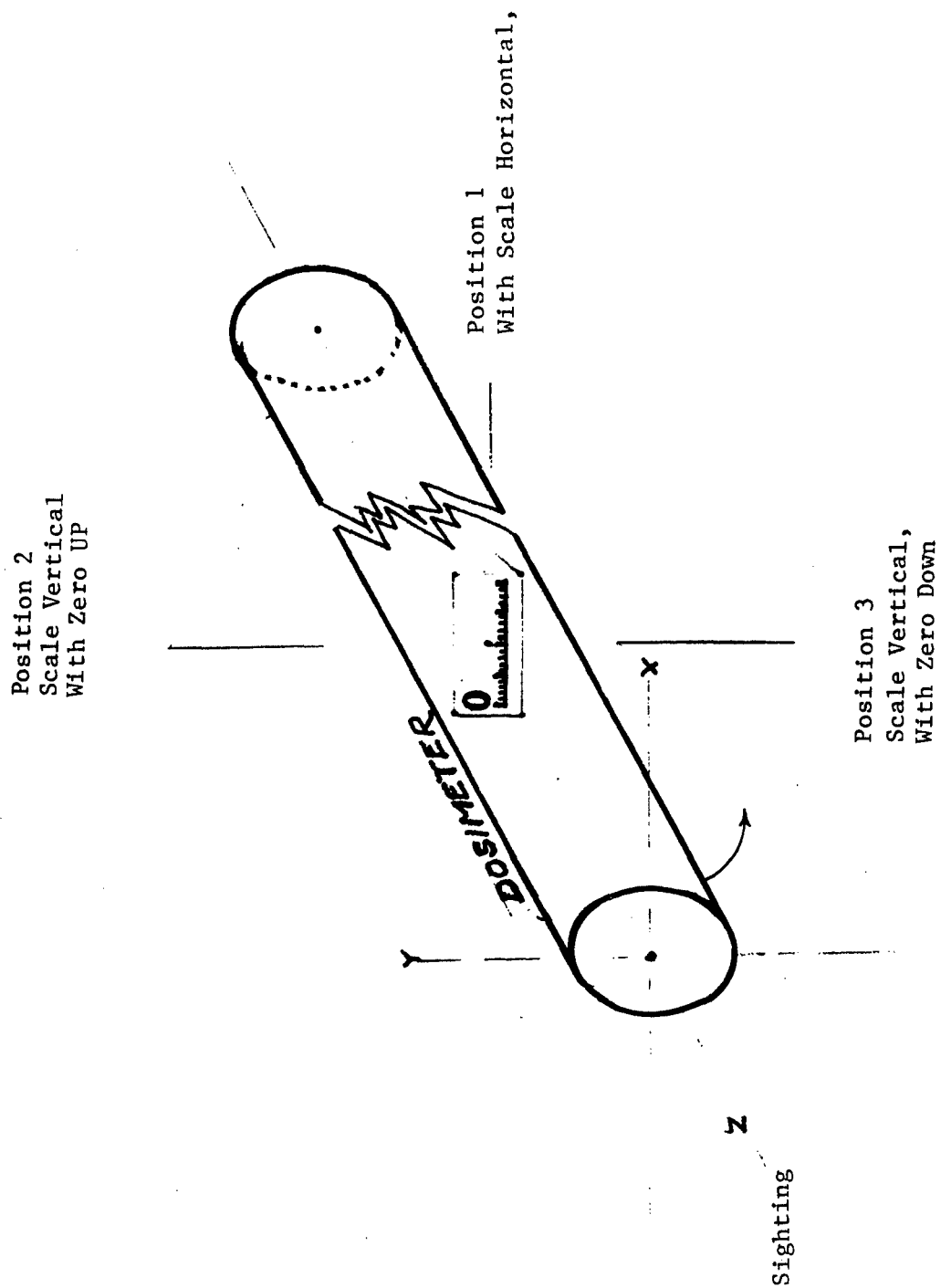


Figure 1D. Geotropism gravitational effects.

29 February 1980

TOP 6-2-561

APPENDIX A.

CHECKLIST

DIRECTIONAL DEPENDENCE

Facility conforms to requirements.

Instrumentation calibration due date.

Name, Grade, and MOS/Series of persons
conducting test recorded.

Test item data recorded.

Instrumentation data recorded.

Physical security for both the operating
personnel and unauthorized arrivals confirmed.

Personnel indoctrinated in safety requirements,
alarms, etc.

Test data recorded.

Data reduced.

Each item to be initialed by the person in charge.

APPENDIX B.

DOSIMETER DIRECTIONAL DEPENDENCE

29 February 1980

Pretest Data

1. Dosimeter	Serial Nos.				
Mod No.	Type	Nomenclature	Mfr		
2. Instrumentation	Radiation Source				
Type/Mod. No.	Serial No.	Mfr	Cal Due Date	Nomenclature	

3. Pretest Checks

4. BaseLine Barometric Pressure - mmHg

Optics	Exposure	Exposure	Exposure
	a. Time	b. Time	c. Time
Indicator Reading	RMD Reading	RMD Reading	RMD Reading
Mechanical	Dosimeter Reading	Dosimeter Reading	Dosimeter Reading
Temp, C°	Temp, C°	Temp, C°	Temp, C°

TOP 6-2-561

DOSIMETER DIRECTIONAL DEPENDENCE (cont)

5. Directional Data. See figures 1A, 1B, and 1C.

Dosimeter, S/N _____

___ ° tilt test item toward source ___ ° tilt test item away from source

Data _____ Test _____
RMD _____ Item _____

Test _____
RMD _____ Item _____

___ ° tilt test item toward source ___ ° tilt test item away from source

Data _____ Test _____
RMD _____ Item _____

Test _____
RMD _____ Item _____

Horizontal - Toward Source

Horizontal - Away from Source

Test _____
RMD _____ Item _____

Test _____
RMD _____ Item _____

Vertical - Toward Source

Vertical - Away from Source

Test _____
RMD _____ Item _____

Test _____
RMD _____ Item _____

The clip or other reference point of the dosimeter test item.

Dosimeter, S/N _____

___ ° tilt toward source

___ ° tilt away from source

Test _____
RMD _____ Item _____

Test _____
RMD _____ Item _____

___ ° tilt toward source

___ ° tilt away from source

Test _____
RMD _____ Item _____

Test _____
RMD _____ Item _____

Horizontal - Toward Source

Horizontal - Away from Source

Test _____
RMD _____ Item _____

Test _____
RMD _____ Item _____

Vertical - Toward Source

Vertical - Away from Source

Test _____
RMD _____ Item _____

Test _____
RMD _____ Item _____

Note: The degree of tilt angle and the number of tilt angle data points should be determined in the final test plan.

6. GEOTROPISM DATA

Set dosimeter at zero.

Horizontal, zero at left _____
Horizontal, zero at top _____
Horizontal, zero at bottom _____
Horizontal, zero at right _____

Set dosimeter at midscale.

Horizontal, zero at left _____
Horizontal, zero at top _____
Horizontal, zero at bottom _____
Horizontal, zero at right _____

Set dosimeter at zero.

Vertical, zero at left _____
Vertical, zero at top _____
Vertical, zero at bottom _____
Vertical, zero at right _____

Set dosimeter at midscale.

Vertical, zero at left _____
Vertical, zero at top _____
Vertical, zero at bottom _____
Vertical, zero at right _____