THE BOMB POWER INDICATOR

FUNCTION

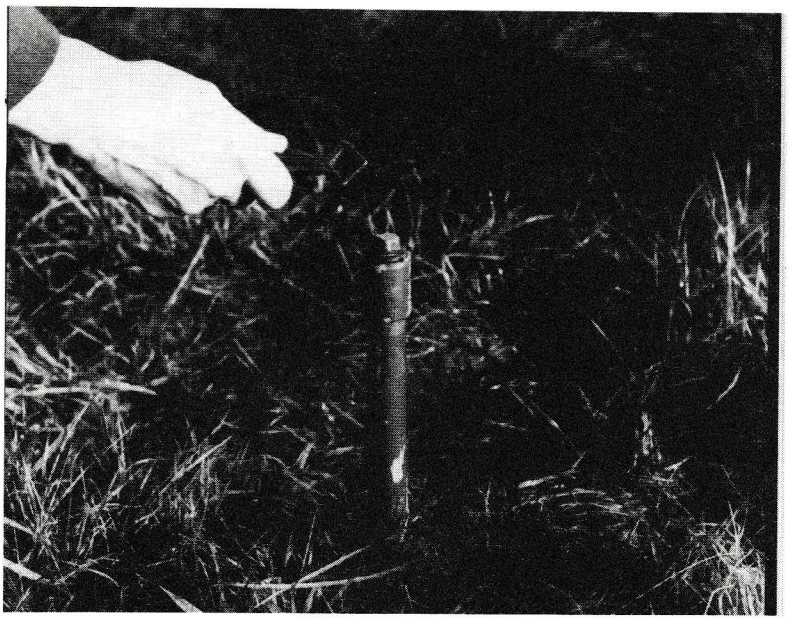
1. Provided that the distance from ground zero is known, the power of a nuclear weapon can be calculated from the peak over-pressure produced by the blast wave. The Bomb Power Indicator is designed to record this pressure.

CONSTRUCTION

2. The over-pressure from a nuclear burst would be detected by a metal bellows, one side of which is exposed to normal atmospheric pressure. Attached to the bellows is a push rod which bears against a lever fixed to a spindle. When the bellows are expanded, a pointer attached to the spindle moves over a dial reading from 0 to 50 kilopascals (kPa). The pointer, not being actually attached to the bellows, does not return to zero after the passage of the blast wave but is left indicating the peak over-pressure. It may be reset to zero by means of a spring-loaded rod operated by a push-button.

3. The Bomb Power Indicator is installed at all Monitoring Posts and Controls. It consists of four parts:

a. The blast pipe - a 4'6" galvanised steel tube which extends about 6" above the surface of the ground and which is incorporated in the structure of the Post. A 3/4" screwed cover cap is fitted to the upper end (see Fig L1.1).



L1.1 Cap and cock wrench

b. The baffle assembly comprising two 6" diameter steel plates spaced 1/2" apart with a 3/4" hole in the lower plate (see Fig L1.2).

c. The galvanised extension pipe 2' in length and fitted with a collar and locking nut at each end.

d. The indicator unit (8 1/2" in diameter and 4" deep) (see Fig L1.3).

Fig L1.2
Baffle assembly attached
to blast pipe

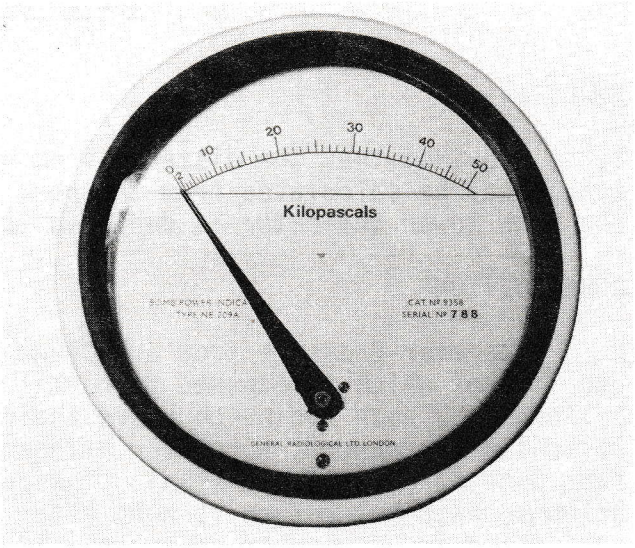


Fig L1.3
Indicator Unit

4. The extension pipe is attached to the lower end of the blast pipe by means of the collar and locking nut, with the bend of the extension pipe towards the lower end. The indicator unit is fitted to the extension pipe and screwed to a wooden plate which itself is fixed to the wall by means of an angled bracket. The indicator unit is thus positioned to face an Observer seated at the instrument table.

STORAGE

5. The instrument is robust and the mechanism is made of non-corroding materials. It can, therefore, remain installed ready to operate at the Post or Control and can be left unattended for long periods. When not in use the upper end of the blast pipe must be kept covered by the cap provided. The baffle assembly is stored inside the Post or Control, together with the cock wrench provided for removing the cap. The drain tube at the base of the indicator unit must be left open.

PREPARATION FOR OPERATIONAL USE

6. To prepare the instrument for use:

a. Remove the cap covering the top of the blast pipe using the cock wrench provided and attach the baffle assembly. The cap and cock wrench are to be taken down to the monitoring room for safe keeping.

b. Replace the cap at the lower end of the drain tube on the indicator unit. Care must be taken not to over tighten the cap, otherwise the rubber seal may be forced into the drain tube itself, thus preventing drainage, when the cap is subsequently removed.

c. Ensure that the needle is set at zero by pressing the reset button.

OPERATIONAL USE

7. Immediately a reading, however small, is shown on the BPI dial:

a. The time of the reading and the pressure recorded are to be entered in the BPI Log in accordance with current Standard Operating Procedures.

b. WAIT 10 SECONDS, then reset the BPI to zero by means of the reset button.

c. The time of the reading and the pressure are then to be reported to the Control in accordance with current Standard Operating Procedures.

MAINTENANCE

8. The following maintenance is to be carried out annually, preferably immediately before the first national exercise:

a. Detach the indicator unit from the wood plate and from the extension pipe.

b. Turn the instrument upside down and blow out any particles of dirt, grit etc, by puffing into the drain tube.

c. Replace the cap on the drain tube and after ensuring that the main orifice is clean, blow into the instrument to obtain a reading on the dial; return the needle to zero by pressing the reset button.

d. Clean the inside of the blast pipe assembly by pulling through a piece of cloth, using the nylon rope available in the Post or Control.

e. After cleaning the blast pipe and indicator unit, ensure that the threads are well greased and reassemble the instrument.

9. The locking nut and collar may become jammed against one another when attempting to detach the indicator unit so that they cannot be moved without suitable tools. In many cases the Chief Observer owns or can borrow tools locally, but if local arrangements cannot be made he should apply to the Group Headquarters for the loan of the 14" Stilson wrench and 11" adjustable spanner which are held there against such contingencies.

10. Apart from the periodical greasing of the thread at the top of the blast pipe, no other maintenance is required.

THE GROUND ZERO INDICATOR

FUNCTION

1. The ground zero and height above ground of a nuclear burst can be established by triangulation provided that a bearing and elevation can be obtained from each of two or more Posts. The Ground Zero Indicator (GZI) provides this information.

CONSTRUCTION

2. The GZI consists in effect of four simple pin-hole cameras in which the image of the fireball, together with that of a locating graticule showing bearing and elevation, is photographed on sensitised paper.

3. The instrument is cylindrical in shape and is about ten inches high and fourteen inches in diameter (See Fig L2.1). When the handle at the top of the

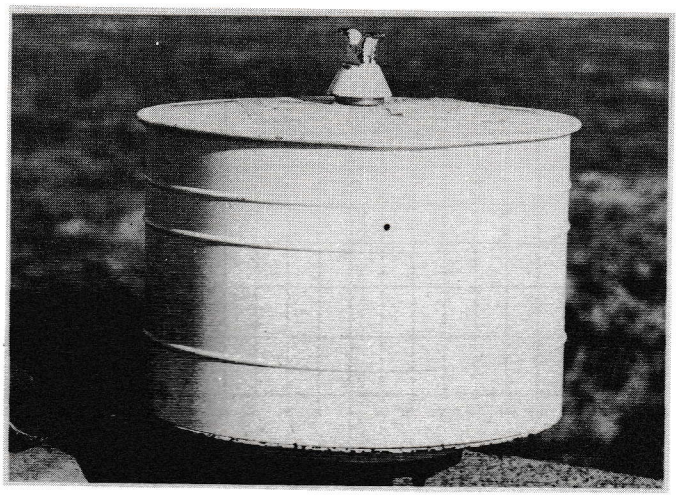


Fig L2.1 The Ground Zero Indicator

instrument is unscrewed, the cover consisting of the top and sides of the cylinder, can be lifted off, revealing a central structure with four incurved faces (see Fig. L2.2). Each of these incurved faces is fitted with a transparent plastic pocket, known as a cassette, which is marked with a graticule graduated in degrees of bearing and elevation and which holds a sheet of photographic printing-out paper (see Fig. L2.3). This paper, when exposed to light, gradually darkens without the need for chemical development. Four holes 3/16" in diameter, are positioned in the sides of the instrument, one opposite each cassette. A lug inside the lower edge of the cover fits into a corresponding slot in the base of the instrument and ensures that the cover is replaced correctly.

4. At the bottom of each incurved face is a small circular stud. This corresponds to a cut-out at the bottom of each cassette, the position of the stud and cut-out varying for each of the cassettes so that the correct cassette is always inserted in its proper face.

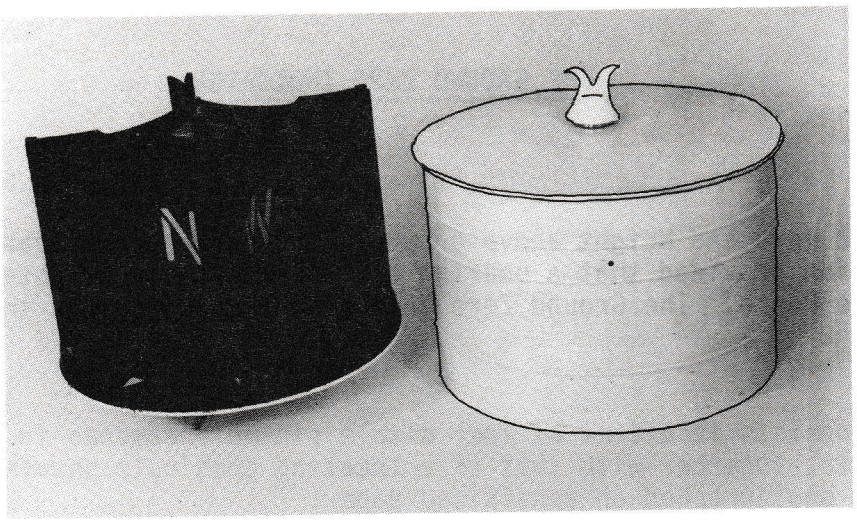


Fig L2.2 GZI with cover removed

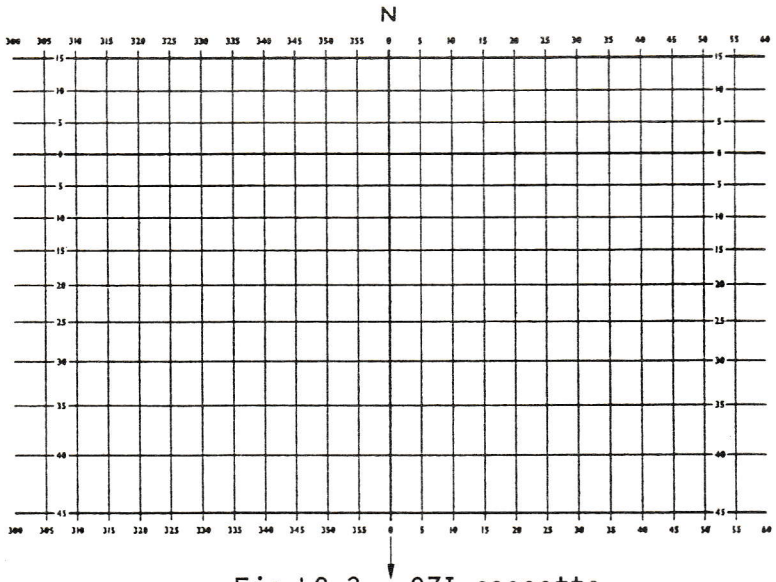


Fig L2.3 GZI cassette

5. The four cassettes are positioned so that each faces a cardinal point of the compass and are designed so that there is an overlap at the edges of adjacent cassettes. The graticule on the cassettes is marked at five-degree intervals and the appropriate numerals are marked against each line. In addition, the letter of the cardinal compass point (N,E,S,W) is marked against the line running down the centre of the cassette. The limits of the cassette are: N (North 305° to 55°; E (East) 35° to 145°; S (South) 125° to 235° and W (West) 215° to 325°.

6. To record a nuclear burst accurately the GZI must obviously be set up level and correctly orientated. This is achieved by accurate positioning of the base mounting, a mushroom-shaped casting the bottom of which is normally concreted into the front ventilator turret of the Post (See Fig L2.4). If this is unsuitable, the rear ventilator turret is used or, in exceptional cases, a purpose built pillar. At Controls, the base mounting is concreted into a suitable location on the roof of the Control. The instrument is lowered onto the mounting so that the three bolts under the base pass through the three holes in the mounting. The three bolts are placed eccentrically so that incorrect orientation is impossible.

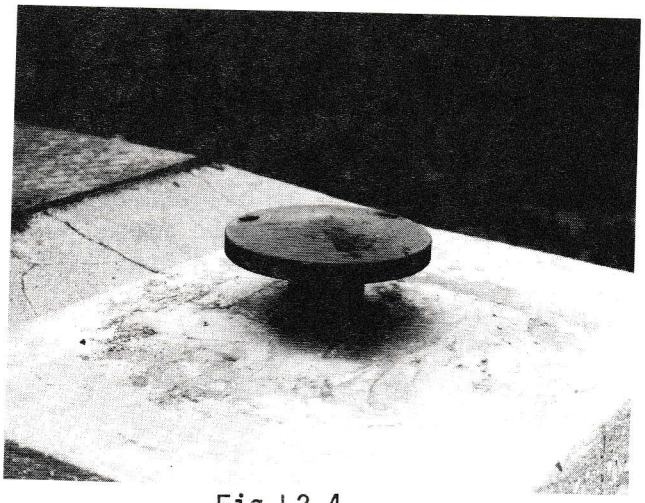


Fig L2.4
GZI Base Mounting

STORAGE

7. The GZI is supplied in a cylindrical transit case complete with the base mounting, one set of cassettes and a spanner. After the base mounting has been detached and concreted into position, the GZI is placed in the specially provided plastic container for storage in the underground Post or Control.

8. The complete equipment required for operational purposes comprises:

a. The Ground Zero Indicator.

b. Three sets of four cassettes (N.E.S & W).

c. One light-proof satchel (see Fig L2.5).

d. Printing-out paper.

e. One spanner.

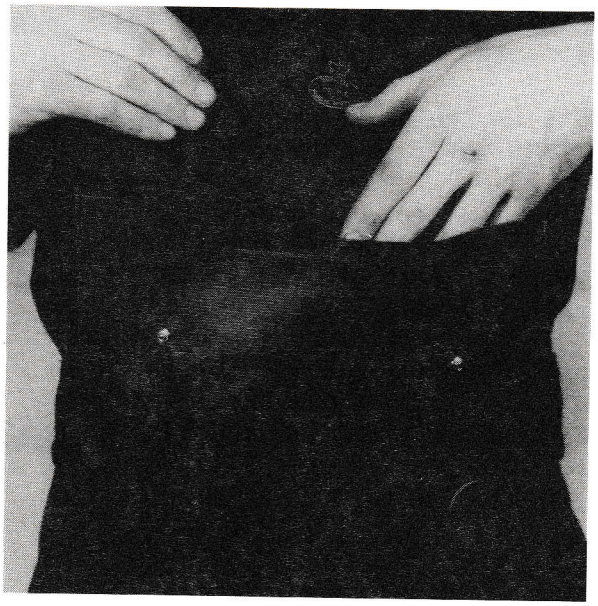


Fig L2.5
Lightproof Satchel

9. All the above items including two boxes (100 sheets) of printing-out paper (POP) are stored at the Post or Control with a spare light-proof satchel for use if required.

10. The spanner is chromium-plated and double ended. The end marked 1/2" BS 7/16" W fits the nuts which hold the GZI to its base mounting; the other end serves no useful purpose once the base mounting has been concreted in position.

PREPARATION FOR OPERATIONAL USE

11. Whenever printing out paper is handled, great care must be taken to prevent unwanted exposure to light so as to avoid the gradual darkening of the paper which will otherwise occur. All paper must be kept in the box until required for use; when out of the box it should be kept face downwards whenever possible. The handling of papers exposed to nuclear bursts is described in paras 20 and 37. Papers must never be exposed for an instant to direct sunlight.

12. The three sets of cassettes stored at the Post or Control, should be loaded with printing-out paper, with the initial letter corresponding to the Cardinal point (N, E, S, W) of the cassette being written, in pencil, on the reverse of the paper. One of these sets is to be loaded into the GZI (see para 19), the second is to be placed in the outer pocket of the satchel (ie, the pocket further from the wearer's chest); the third, is to be placed in the envelope in which the cassettes were brought to the Post or Control.

13. When placing sets of loaded cassettes into the satchel, each set is to be arranged in the order N, E, S, W and placed so that the sensitized side of the paper faces the wearer's chest.

MOUNTING THE GZI

14. The GZI is to be taken out of the Post and Control and mounted as follows:

a. Remove the nuts from the bolts protruding from the underside of the GZI.

b. Lower the GZI into position so that the bolts pass through the corresponding holes in the base mounting.

c. Replace the nuts on the bolts so that the conical face of each nut is uppermost and thus fits into a countersinking in the underside of the base mounting.

d. Tighten the nuts finger-tight. The spanner is not to be used for this purpose; it is provided to enable a nut to be loosened which has become jammed by grit or by some other means.

15. The instrument is now ready for use.

Following a change of GZI papers a new reserve set of cassettes should be prepared.

OPERATIONAL USE

Maintenance in Operational Condition:

16. When once loaded and mounted, some routine maintenance will be required to keep the GZI at operational readiness if there should be a waiting period between becoming operational and the development of a nuclear attack. This will consist of changing the papers regularly to ensure that they are reasonably fresh when an attack develops; if this were not done the papers might become so darkened by exposure that it would be extremely difficult to distinguish any marks caused by nuclear bursts.

17. The papers are to be changed twice a day in summer and every alternate day in winter:

a. In summer (defined as the period 21 Mar to 21 Sep inclusive) twice a day, at noon and just after sunset.

b. In winter, on odd-numbered dates only, just after sunset.

The change after sunset is to allow as long a period as possible to elapse before the papers start to darken. A routine reminder to change the papers will be given from the Control or the Master Post.

18. On being instructed to change the GZI papers, No 3 observer is to:

a. At a Post:

(1) Leave the Monitoring Room taking the hatch key and closing the door to prevent the entry of unnecessary light which may spoil the vision of other crew members who have become accustomed to the rather dim light in the post.

(2) Climb the ladder and open the access hatch.

(3) Step out of the Post and close the hatch to prevent the possible entry of blast.

(4) Insert the key in the access hatch.

(5) Unscrew the handle of the GZI, lift off the cover and place it on the ground, or conveniently to hand where there is no risk of it being damaged. (see Annex L2 para 20)

(6) Take out all the exposed cassettes and place them in the empty inner pocket of the satchel, tucking the flap in over them to protect them from light and to prevent them being accidentally re-loaded into the GZI.

(7) Take the fresh set of cassettes from the outer pocket and insert them into the holders, starting on the north face and continuing clockwise, ie N, E, S, W.

(8) Replace the cover checking that the lug inside fits into the slot in the base, and screw down the handle.

(9) Re-enter the Post, close the hatch and descend the ladder.

(10) Hand over the exposed cassettes for assessment.

b. At a Control:

(1) Be accompanied to the Control external exit door by the Keyholder.

(2) Step out of the door and ensure that the door is immediately secured and locked to prevent the possible entry of blast. The Keyholder will remain on the inside of the door and await the return of the Observer.

(3) Climb the ladder, steps or mound to gain access to the GZI.

(4) Unscrew the handle of the GZI, lift off the cover and place it on the ground, or conveniently to hand where there is no risk of it being damaged. (see Annex L2 para 20)

(5) Take out all the exposed cassettes and place them in the empty inner pocket of the satchel, tucking the flap in over them to protect them from light and to prevent them being accidentally re-loaded into the GZI.

(6) Take the fresh set of cassettes from the outer pocket and insert them in the holders, starting on the north face and continuing clockwise, ie N, E, S, W.

(7) Replace the cover checking that the lug inside fits into the slot in the base, and screw sown the handle.

(8) Return to the Control entrance door and gain access.

(9) Hand over the exposed cassettes for assessment.

NOTE: At surface Controls the access ladder to the roof will have to be taken out with and returned by the Observer changing the papers.

19. When inserting cassettes into the holders the correct method is to place one vertical edge in position with the bottom edge about half an inch above the bottom stop, snap in the other vertical edge and tap the top of the cassette so that it drops down on to the stop. This is quicker and more satisfactory than sliding the cassette all the way down as it then tends to stick and often causes damage by cracking the edges of the cassette (see Figs L2.6 and L2.7).

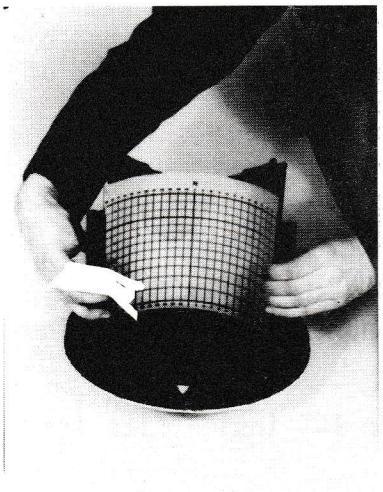


Fig L2.6 Snapping cassettes into holder.

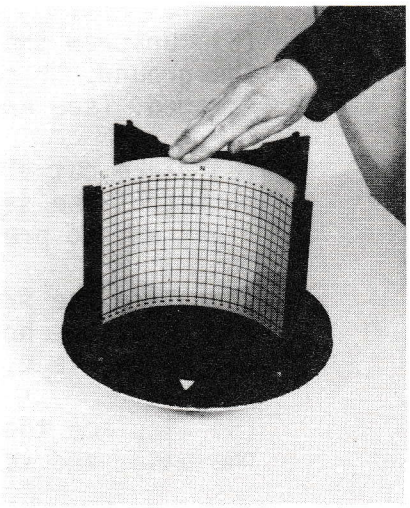


Fig L2.7 Tapping down to stop.

20. While the cover is off the GZI great care must be taken to ensure that no unnecessary light falls on the papers. Particular care must be taken when the sun is shining, when the Observer should place himself between the sun and the papers to prevent the sunlight falling directly on them.

21. If fallout has previously affected the Post the Observer must pass the cassettes through the door into the Monitoring Room and then take any necessary decontamination action before re-entering the Monitoring Room. Similarly at a Control, the Observer must hand the cassettes to the Keyholder for delivery to the Group Information Centre and then take any necessary decontamination action in the decontamination room before entering the Control.

22. As soon as the opportunity occurs the reserve set of loaded cassettes from the envelope is to be transferred to the outer pocket of the satchel (see para 13). The cassettes which have just been emptied must then be re-loaded and placed in the envelope as a reserve.

23. When a nuclear burst occurs the intense light from the fireball passes through one or more of the holes in the GZI and on to the pringing-out paper, exposing it and causing a brownish mark to appear; the bearing and elevation of the burst can then be assessed from the position of the mark in relation to the white lines left by the graticule on the cassette. The size of the mark can also be assessed in a similar way.

24. As each hole acts as a lens for "photographing" a nuclear burst, it will obviously record other objects which are sufficiently well lit. Therefore, the Observer may expect to find on the paper such things as a trail caused by the sun, a horizon line and the images of any light-coloured objects in the vicinity etc, in addition to any mark which may have been caused by a nuclear burst. Such a mark of whatever shape will hereafter be referred to as a "spot" (see Fig L2.8).

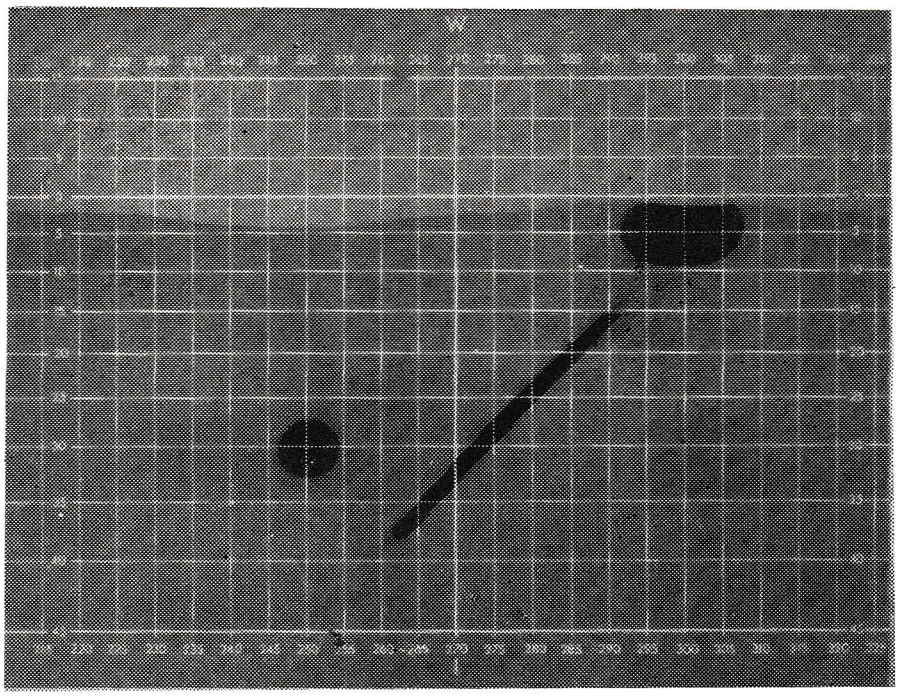


Fig L2.8 Diagram of exposed cassette showing horizon line, sun-trail and two 'spots'.

Horizon Line

25. The term "horizon line" is used to define the line where the land and sky seem to meet. This is, of course, not necessarily the 0^{o} line of the instrument. The horizon line may be wholly or partly above or below the 0^{o} according to how the GZI is sited in relation to the surrounding countryside. Under certain conditions of poor visibility or light the horizon line may not be discernable. At such times the "zero" line should be used as the horizon line.

Sun Trail

26. After a period of continuous sunshine the sun will leave a well-defined curved trail across the paper. When the weather is cloudy with sunny intervals the trail will be intermittent and when the weather has been overcast the trail will be absent entirely.

Spots Caused by Nuclear Bursts

27. The spot will normally consist of a uniformly dark centre (the umbra) surrounded by a blurred zone of fading darkness (the penumbra). The umbra may be partially obscured by cloud, haze etc. The penumbra will be present in clear visibility, but as atmospheric conditions worsen it may gradually disappear leaving only the umbra; it can never be more than 2 1/2 degrees in width, even in the case of a large weapon burst close to the Post in the clearest possible conditions. In the majority of cases it will be less than the maximum width. It will never be easy to determine precisely the outer edges of the umbra and penumbra.

28. The size of the spot will vary according to the power of the weapon and its distance from the Post or Control. It may be any size from about 2 1/2 degrees (3/16" - the diameter of the hole) to in excess of 40 degrees.

29. The darkness of the spot will vary in a similar way to the size and it may be difficult or easy to detect. Close to the burst it is likely to be fairly dark but not so dark as the trail caused by full sun. Further from the burst it will be less dark so that at the maximum range of the GZI it will be barely perceptible.

30. The shape of the spot may also vary considerably. Some likely shapes are shown and described below. (See Fig L2.9.)

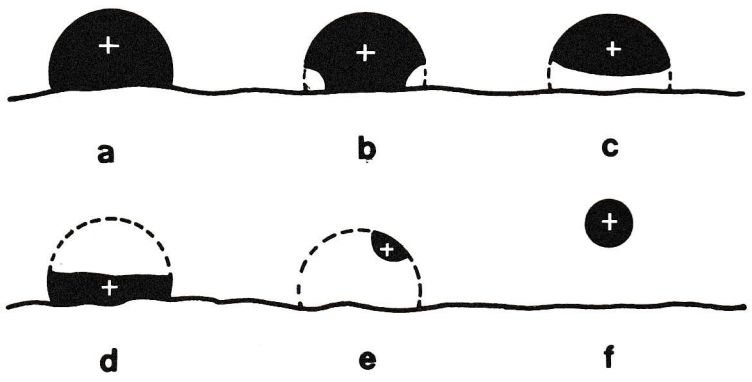


Fig L2.9
Some likely shapes of nuclear burst 'spots'.

Spots Caused by Air-Burst Weapons

31. A true air-burst (with the fireball well clear of the ground) will usually give a circular spot centred on the point of the burst. In cloudy conditions, however, some part or other of the spot may be cut out.

Spots Caused by Ground Burst Weapons

32. A true ground burst can sometimes cause a semi-circular spot centred on the point of the burst; this is only likely to happen close to a large burst when there is good visibility. Close to the burst it may also produce a spot more like a mushroom on a short stalk, due to the dust, rubble etc, obscuring to some extent the lower part of the fireball. In both these cases the spot will be touching the horizon line.

33. Further from the burst the lower part of the spot will tend to disappear, leaving a spot which is clear of the horizon line and which may be oval, roughly circular or irregular in shape. The reason for this is that the lower levels of the atmosphere are usually more dense than the upper levels. This is not always so, however, and occasionally the upper part of the spot may tend to disappear first.

34. A weapon which has burst above ground level but at a low enough height for the fireball to touch the ground and therefore produce fallout is, of course, treated as a ground burst. This type of burst will probably give a spot intermediate between that of a true air burst and that of a true ground burst.

35. In all the cases mentioned above, clouds may cut out any part of the spot.

Multiple Bursts

36. The possibility of more than one burst taking place within a few minutes must also be borne in mind. Where this occurs and there has been insufficient time between the bursts for the GZI papers to be changed, many spots may be seen. If two of these spots are on about the same bearing, they may be superimposed one on the other.

Handling of GZI Papers

37. As soon as the exposed cassettes are handed over for assessment they are to be placed face downwards before being examined. At all times care must be taken to ensure that they are not exposed to unnecessary light.

Assessment of GZI Papers

38. On examining the GZI papers the Observer is to:

a. Establish the positions of any spots caused by nuclear bursts, bearing in mind that the spots may be difficult to determine and that spots from the same burst may appear on two of the papers if the burst is on the bearing which falls within the overlap area between two adjacent cassettes.

b. Decide which is the largest of the spots and estimate its centre as described in paras 39-41.

c. Read off the bearing of the centre of the spot in degrees against the graticule as accurately as possible and action in accordance with current Standard Operating Procedures.

d. Read off the elevation of the centre of the spot in the same way and action in accordance with current Standard Operating Procedures. If the centre of the spot is on or below the "0°" line it is to be entered as "00".

e. Decide whether or not the spot touches the horizon line and action in accordance with Standard Operating Procedures.

f. Estimate the size of the spot as described in para 42 below and action in accordance with current Standard Operating Procedures.

g. Deal in a similar way with the next largest spot and follow this with the next largest and so on until all spots have been logged in descending order of spot size.

h. In the event of a spot being too faint to assess in the cassette the paper is to be removed, the spot outlined in pencil and the paper replaced in the cassette for assessment.

Estimation of the Centre of the Spot.

39. When the shape of the spot is irregular it may be difficult to determine its centre. Normally, however, the bearing reported should be that which is half-way between the left-hand and right-hand edge of the spot and the elevation reported should be that which is half-way between the top and bottom of the spot, ignoring the penumbra.

40. In each of the sketches in Fig L2.9 the overall shape of the spot can be seen. Where part of the fireball is obscured by haze, cloud etc. the complete shape is shown by a dotted line. In each case the point to be reported is marked thus +.

41. The sketches in Fig L2.9 represent:

a. Ground burst from a point close to GZ (Ground Zero).

b. Ground burst from a point further from GZ. Edges obscured by haze etc.

c. Ground burst from a point still further from GZ. Lower part entirely obscured by haze etc.

d. Ground burst from point close to GZ. Upper part entirely obscured by cloud.

e. Ground burst from some distance from GZ. Lower part entirely obscured by haze etc., part of upper part obscured by cloud.

f. Air burst, good visibility.

Sketches a, b and d would be reported as "Touching"; c, e and f would be reported as "Clear".

42. The spot size is to be measured in degrees and is defined as the width of the spot measured between the points on either side where the darkness of the spot fades to half its central darkness, ie, the distance between the middle points of the penumbra on either side of the spot.

MAINTENANCE

43. Maintenance of the GZI is limited to re-touching the paint on the instrument itself and re-painting the base mounting.

44. If the paintwork of the GZI should become scratched or chipped, the fact is to be reported to Group Headquarters who will then supply, or authorise local purchase of, suitable paint. The following paints are obtainable in small tins and are recommended:

a. Outside of cover: "Humbrol" White Enamel.

b. Inside of cover: "Humbrol" Camera Black, Matt, Plastic Paint.

45. Whilst it is unlikely the paint round the pin-holes will become damaged it is of the utmost importance that care is taken when re-touching any part of the cover to ensure that the shape and size of these apertures is not altered by using too much paint etc.

46. In the event of any damage occurring beyond the scope of the foregoing paragraphs, the GZI is to be returned to Group Headquarters for exchange.

47. The base mounting should be examined regularly for signs of deterioration and re-painted as necessary under current arrangements for the maintenance of the Post and Control structure.

THE FIXED SURVEY METER

GENERAL DESCRIPTION

FUNCTION

1. The Fixed Survey Meter (FSM) is a remote reading battery-operated instrument designed to measure gamma radiation dose-rate.

2. The range normally covered by the instrument is up to 300 cGy/h; but the upper limit can be increased to 3000 cGy/h or even 30,000 cGy/h by shielding the probe unit, eg by withdrawing the probe unit down the probe pipe until the reading is reduced by a known factor (see paras 18 to 26).

FACILITIES

3. The dose-rate is presented on a direct reading Liquid Crystal Display (LCD) on top of the instrument.

4. The instrument has an automatic self-testing function and displays the result of the test on the LCD.

CONSTRUCTION

5. Probe Unit:

a. The Probe Unit consists of a Geiger Muller Tube to which is fitted a base plate, a 'U' clamp and one end of the coaxial inter-connecting cable (Fig L3.1). This in turn is attached to the top of the inner section of a telescopic rod. The Probe Unit is connected to the indicator unit by a flexible coaxial cable. A clamp (see Fig L3.2) is also provided to fix the rod in the retracted position when shielded readings are being taken.

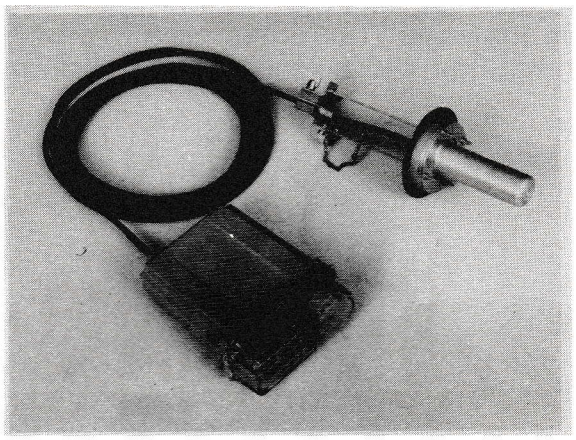


Fig L3.1 Fixed Survey Meter

Indicator Unit:

b. The indicator unit (see Fig L3.3) is enclosed in a waterproof bright orange polycarbonate case. This unit is mounted in the Post by sliding it into a slot cut into the right-hand end of the Post table or fixed to the

shelf provided in the triangulation alcove of the Control. A frosted polycarbonate top has three clear windows to allow viewing of the LCD, the serial number of the instrument and a silica gel tablet. To the right of this top is a single control knob which is a combined battery access cap and on/off switch.

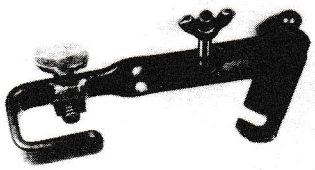


Fig L3.2 Rod Clamp

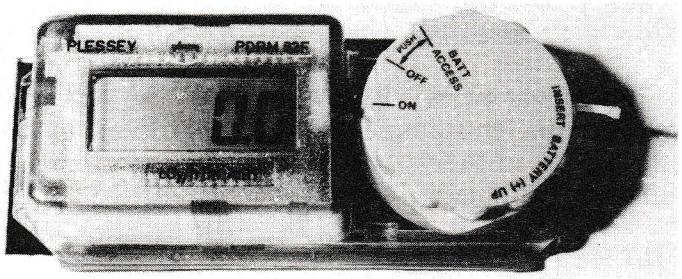


Fig L3.3 Indicator Unit

Interconnecting Cable:

c. The interconnecting coaxial cable is permanently attached to the base of the Geiger Muller Tube. The free end plugs into the base of the indicator unit and is held in place by a threaded retaining ring.

Batteries:

d. The watertight battery compartment is located below the combined battery access and on/off switch. The compartment holds three International Standard C Cells, 1 1/2 volts, which have an operational life of about 300 hours.

Plastic Dome Cover:

e. A cover of extremely robust rubberized PVC material which is designed to protect the Probe Unit. It is fixed to the upper flange of the probe pipe by means of a securing ring and four bolts (see Fig L3.4) and a gasket to prevent the entry of water between the flange and the securing ring.

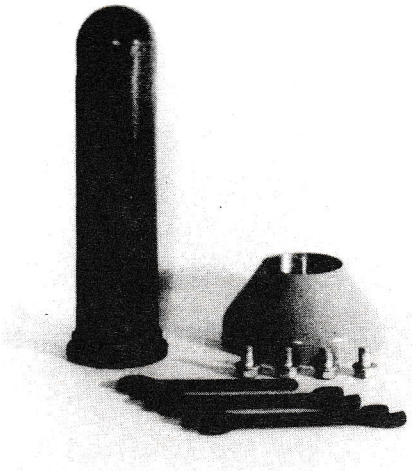


Fig L3.4
Plastic dome cover with securing ring, bolts and spanners

STORAGE

6. The instrument and all associated equipment will normally be stored in the Post or Control. The instrument itself is stored in a plastic, foam rubber lined case which contains:

Indicator Unit
Interconnecting Cable and Probe Unit

7. The telescopic rod is to be kept up the probe pipe; the rod clamp fixed to the pipe flange and the plastic dome cover with its securing ring, bolts, spanners and spare gasket are to be stored conveniently in the Post or Control.

OPERATING INSTRUCTIONS

8. Installation:

a. Remove the protective cover from the top of the probe pipe using the double-ended spanners provided. Inspect the existing gasket for signs of deterioration and replace if necessary. Fix the plastic dome cover to the pipe flange by means of the securing ring and bolts, tighten using the double-ended spanner.

b. Remove the telescoped mounting rod from the probe pipe. Remove the probe unit and the interconnecting cable from the instrument case. Do not remove the protective cap from the free end at this stage. Unroll the cable taking care not to kink or twist the cable.

c. Pass the end of the inner section of the mounting rod through the holes in the cable clamp and locate the top of the rod in the hole in the base plate of the Geiger Muller Tube. Secure it with the split pin chained to the cable clamp.

d. Withdraw the split pin which is chained to the top of the outer section of the mounting rod and which fixes the two sections of the rod together. Insert the ionization chamber into the probe pipe and feed the inner section of the mounting rod up the pipe until a groove marked on it comes up to the shoulder of the outer section. Replace the split pin to fix the rod in the extended position. Feed the extended rod up as far as the pipe flange and latch the curved part of the handle over the flange. Hold the rod in this position and rotate the eccentric cam fitted to the bottom of the outer section (just above the handle) until it is possible to drop the fixing pin on the cam into the hole drilled in the handle. Ensure that the rod assembly is quite secure.

e. Remove the protective cap from the socket in the base of the indicator unit and store in the transit case.

f. Remove the protective cap from the free end of the interconnecting cable and store in the transit case, feed the cable through the hole drilled in the back of the Post table and feed the end of the cable up through the slot cut in the table to house the indicator unit. Plug the cable into the base of the indicator unit and screw on the retaining ring.

g. At Controls the cable is to be plugged into the base of the indicator unit, the retaining ring screwed on and the indicator unit strapped to the instrument shelf.

h. At Posts, slide the indicator unit into the slot in the Post table and feed back the spare cable through the hole at the back of the table.

i. Stow the cable neatly in position up the wall and across the ceiling using the cup hooks provided, taking care to ensure that the cable is not kinked or twisted.

9. Fitting the Batteries:

Push down and turn the control knob anti-clockwise to gain access to the battery compartment. Insert the three batteries with the positive end (+) to the top (see Fig L3.5). Replace control knob with slight downward pressure and turn clockwise to 'off' position.

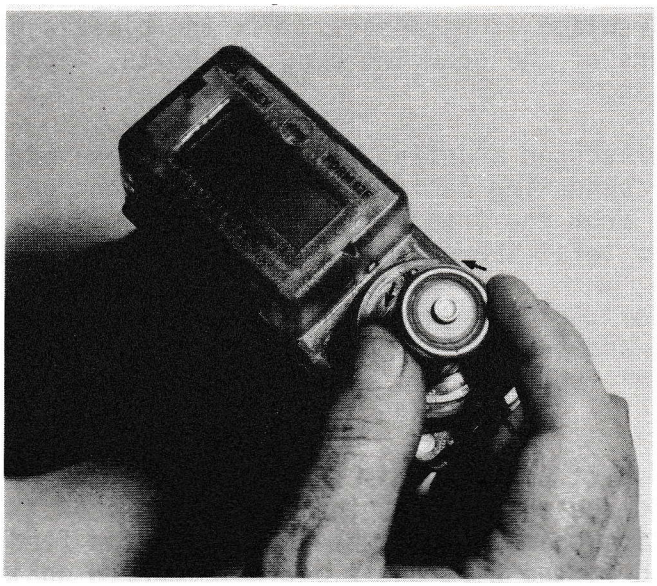
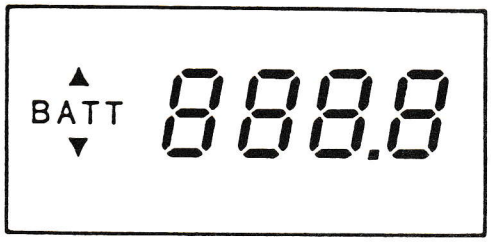


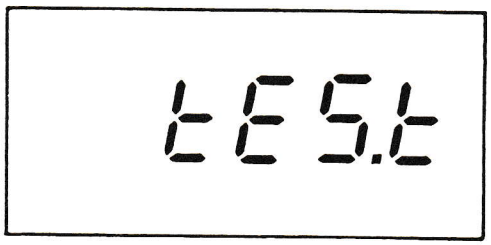
Fig L3.5 Fitting Batteries

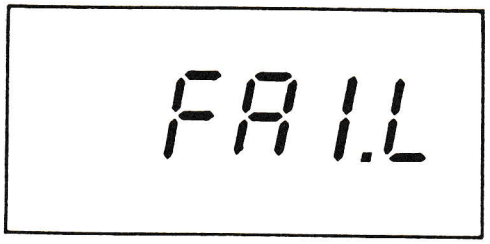
10. Check Procedure:

Turn the control knob clockwise until the 'ON' mark is opposite the arrow head. The instrument will then commence an automatic test cycle during which the following will be displayed:

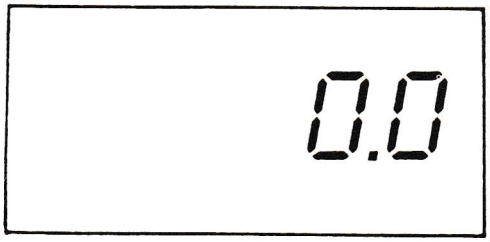
a.



b. 

c. 

(flashing)

d. 

(steady)

11. Should the word 'FAIL' appear, flashing as in 10 c. above, switch off, check all connections carefully and start the test cycle again by rotating the control knob to 'ON'. If the word 'FAIL' is again displayed, the instrument is unserviceable.

12. A display as in para 10 d. indicates that the instrument is serviceable.

13. After a successful test, the control knob is to be turned to the 'OFF' position.

14. If, at any time, during operations 'BATT' is displayed at the left-hand side of the LCD, this indicates that the batteries are low and should be replaced immediately by new batteries. Batteries are to be removed from the instrument at the end of operations or training.

15. Routine checks of the serviceability of the instrument during operations are to be made by switching the instrument 'ON' and observing the test cycle display at the following intervals:

a. On installing the instrument.

b. At 0800, 1600 and 2400 hrs daily.

c. Routine checks are to be noted in the Post diary.

NOTE: During fallout, the test cycle is to be carried out by switching the control knob to 'OFF' and then to 'ON'. This should be done immediately after reporting the 0800, 1600 and 2400 hrs readings.

OPERATIONS

16. To measure the gamma radiation dose-rate, proceed as follows:

a. Turn the control knob clockwise until the 'ON' mark is opposite the arrow head (see Fig L3.3).

b. Wait until the test sequence is complete and the LCD shows '0.0' (see Fig L3.3).

c. For operational purposes, the instrument must be left switched on during the whole time for which readings are required.

17. The instrument will indicate briefly - by means of arrow heads to the left of the display window, - whether the dose-rate is rising or falling, however this facility should not be used in the assessment of the even hour dose-rate report. The assessment of dose-rate trend should be made by comparison of the reading at 5 minutes to the even hour with the reading on the hour. If the reading on the hour is higher then a Red report is made. If the reading is the same or less then the reading is reported as Green.

SHIELDED READINGS

18. To measure gamma radiation dose-rate in excess of 300 cGy/h (the maximum range of the instrument), the probe unit is withdrawn down the probe pipe until the reading falls to one-tenth of the reading obtained with the probe unit in its original position. It is not possible to establish prior to fallout the exact position to which the probe unit will have to be withdrawn, but it is calculated that a one-tenth reading will probably be obtained when the Geiger Muller tube is five inches below the ground surface, ie when the probe unit has been withdrawn a distance of about 3'4". The mounting rod itself is capable of being telescoped 2'8" and the outer rod itself is marked at the point to which it must be withdrawn to locate the probe unit 5" below the surface. This mark will vary from Post to Post depending upon the depth of the mound.

19. The following procedure is to be adopted:

a. When the reading reaches 200 cGy/h, unhook the cable from its stowed position and unclamp the handle of the mounting rod by lifting and turning the eccentric cam. Take care not to allow the probe unit and the rod to fall out of the probe pipe.

b. As soon as a reading of 240 cGy/h is reached, quickly withdraw the telescopic rod, remove the split pin holding the two sections of the rod together, telescope the rod and, without replacing the split pin in the telescoped position, feed the probe unit and the rod up the probe pipe to the predetermined mark and adjust the position until a reading of 24 cGy/h is obtained. Slight up or down adjustment may be necessary but the whole operation must not take more than a few seconds. Use the rod clamp to fix the probe unit in this position. Clamping is carried out by centralising the rod clamp under the probe pipe, positioning the rod in the jaws of the clamp and tightening the wing nut sufficiently to hold the probe unit in position. Over-tightening must be avoided or the rod will be distorted. Stow the cable again as in para 8 i.

c. In the event of the above being unsuccessful, or taking so long a time that the accuracy of the shielded readings is suspect, restore the probe unit to its original position and repeat the whole procedure when the outside dose-rate reaches 260 cGy/h. The shielded dose-rate to be obtained will, of course, now be 26 cGy/h. In the event of a further failure, attempts can be made when the outside dose-rate reaches 280 cGy/h.

20. Shielded readings will always be reported as the true unshielded dose-rate, eg a shielded dose-rate of 35 cGy/h will be reported as 350 cGy/h.

21. When radioactive decay has taken place and the reading has fallen to 28 cGy/h with the probe unit in the shielded position, the probe unit is to be restored to its original extended position, fully inserted up the probe pipe with the handle locked in position by means of the eccentric cam. Normal direct readings are then resumed.

22. If, exceptionally, the dose-rate rises to 2800 cGy/h, a further withdrawal of the probe unit to a position where a one-hundredth reading is obtained, is to be carried out.

23. In such circumstances the wing nut of the rod clamp is to be slackened when the shielded dose-rate reaches 280 cGy/h and the probe unit withdrawn until the indicated reading is 28 cGy/h, at which point the wing nut of the rod clamp is to be tightened once more to clamp the rod in that position.

24. From this point the indicated dose-rate must be multiplied by 100 before reporting.

25. When the indicated dose-rate decays to 28 cGy/h the wing nut of the rod clamp should again be slackened; the probe unit pushed up the probe pipe until a reading of 280 cGy/h is indicated; the wing nut tightened once more and the readings are then to be multiplied by 10 before reporting.

26. As radioactive decay continues and the indicated dose-rate falls to 28 cGy/h, the probe unit is to be extended as in para 21.

Time for Meter to Stabilize

27. After switching on the instrument will automatically commence its test sequence. This test sequence lasts for up to 30 seconds before the instrument shows 0.0.

Exercise Operation

28. The FSM(T) will be switched on at the time stated in the Exercise Operations Order (Annex L4), the FSM Indicator unit is to remain switched "off" until the "ATTACK WARNING RED" when it is switched on, so simulating Operations. If there are subseqent "RELEASE FROM AIR ATTACK" messages the FSM Indicator unit is to be switched off when instructed to do so. The FSM(T) is to remain switched on throughout the exercise.

MAINTENANCE

29. No maintenance of the instrument is permitted by ROC personnel. Faulty instruments are to be reported to, and exchanged by, Group Headquarters.

30. Batteries:

The condition of the batteries is indicated on the LCD display to the left of the reading and between the rising or falling flags. When batteries are low "BATT" is displayed. Batteries must be replaced as soon as this occurs as continued operation with low batteries will result in a degradation of the accuracy of the instrument.

31. Routine Inspections:

A routine inspection at intervals of not more than six months should be carried out on the mounting rod and rod clamp.

32. The following details should be noted during the inspection:

a. Look for signs of damage or corrosion on all metal parts. Deposits of dust or dirt should be wiped off using a clean cloth.

b. Extend and collapse the mounting rod to prove that the two parts are not corroded together.

c. Inspect the rod clamp for signs of rust and, if necessary, apply grease to screw threads.

33. If any serious fault is observed during the inspection, a report should be made to Group Headquarters.

THE FIXED SURVEY METER TRAINER

FUNCTION

1. The Fixed Survey Meter Trainer (FSMT) is a battery operated Radiac simulator designed to replace the Geiger Muller Tube of the Fixed Survey Meter for training and exercises (see Fig L4.1).

2. It will simulate the pulses transmitted by the Geiger Muller Tube using a module, programmed by the Exercise Preparation Section at HQ UKWMO, thus producing on the FSM readings which the instrument would display had these levels of radiation been present.

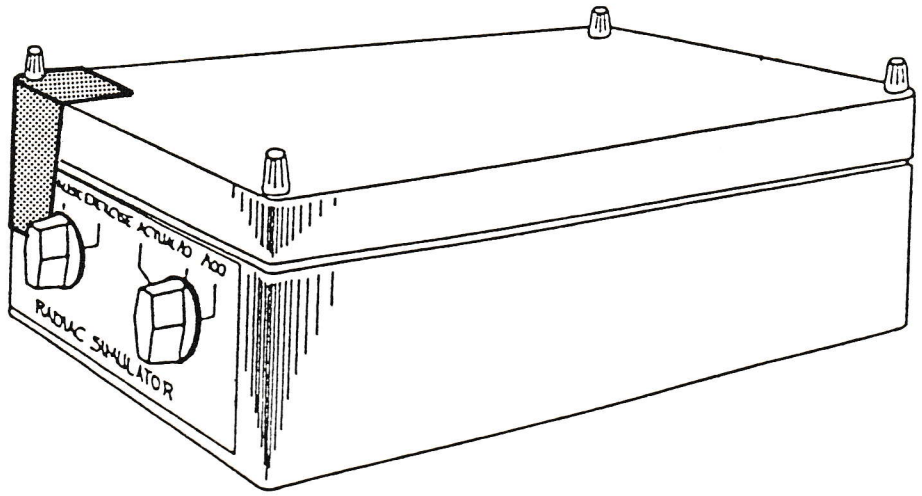


Fig L4.1

FACILITIES

3. The instrument is capable of carrying out the following:

a. Automatic resetting of the memory module and a familiarisation test sequence.

b. A pause during training or exercises.

c. Exercise run simulating the readings programmed into the memory module.

d. Reproducing the actual, one-tenth, or one-hundredth of the programmed reading.

CONSTRUCTION

4. The instrument is contained in a rectangular plastic case measuring 200mm x 120mm x 75mm. The case has two compartments; that containing the electronic components and that containing the battery compartment and the memory module socket. It is connected to the Fixed Survey Meter by means of a short coaxial interconnecting cable.

5. Power is provided by four International Standard C Cells of 1.5 volts linked in series.

6. There are two control switches on the front of the instrument (see Fig L4.2), each with three positions.

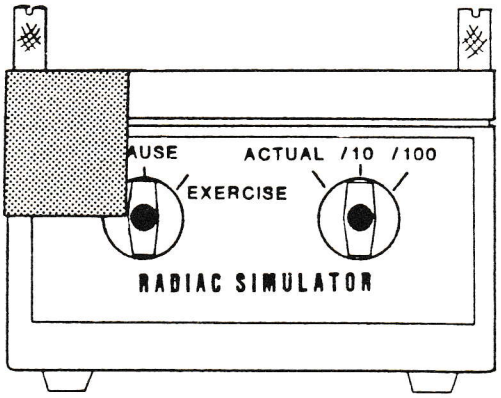
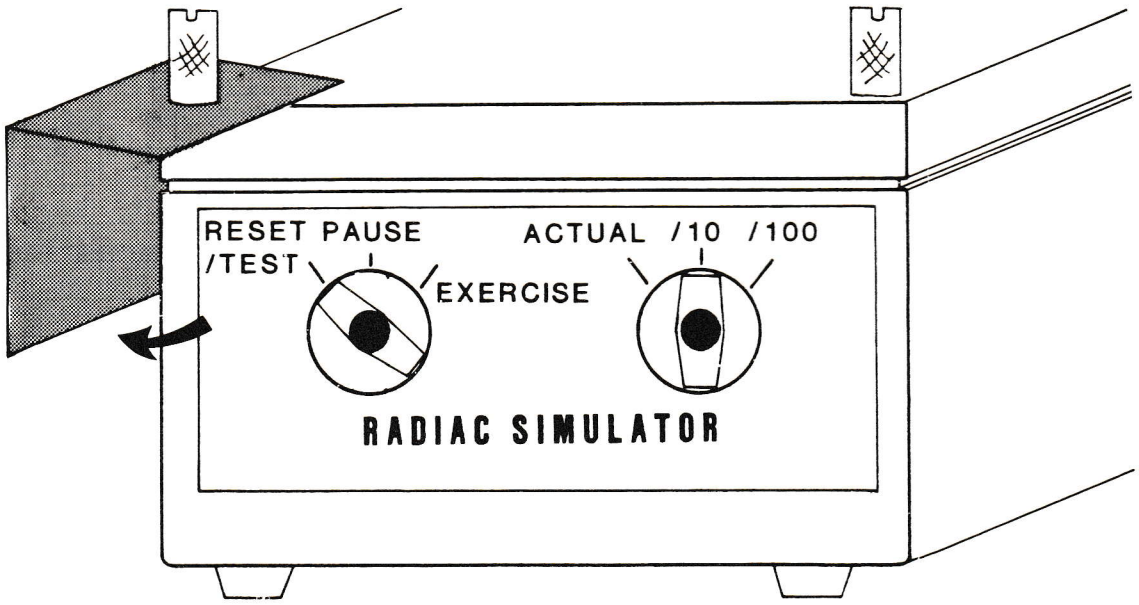


Fig L4.2

7. The normal position of the left-hand switch is vertical which is the 'pause' or 'off' position. Turned to the left this switch operates an automatic memory module reset and testing. Turned to the right it operates "Exercise run" on the memory module. This switch has a plastic protection device which is fastened to the top of the instrument and can be swung round to stop the switch being turned to the Reset/Test position during Exercises or Contacts.



To reset instrument simply slacken off knurled knob and swing adaptor out of the way.

Fig L4.3

8. The normal position at rest of the right-hand switch is to the left and marked "Actual". This provides a simulation of the actual reading programmed into the memory module. In the vertical position marked "10" the simulator will produce a one-tenth indication of the programmed reading. In the right-hand position marked "100" the simulator will produce a one-hundredth indication of the programmed reading.

STORAGE

9. The instrument will be stored at Posts and Controls so that it is available for training at all times. The batteries are to be stored separately as is the training memory module issued with the instrument.

OPERATING INSTRUCTIONS

10. Batteries and Memory Module:

Before use, the four 1.5v International Standard C cells must be fitted as follows:

a. Unscrew the four knurled, captive retaining screws on top of the instrument and remove the lid.

b. Insert the four batteries with positive (+) end away from the coil springs (see Fig L4.3).

c. Ensure that the left-hand switch is in the vertical (pause) position (see Fig L4.2).

d. Plug the memory module to be used into the multi-pin socket (see Fig L4.3).

e. Replace the lid and screw in the retaining screws.

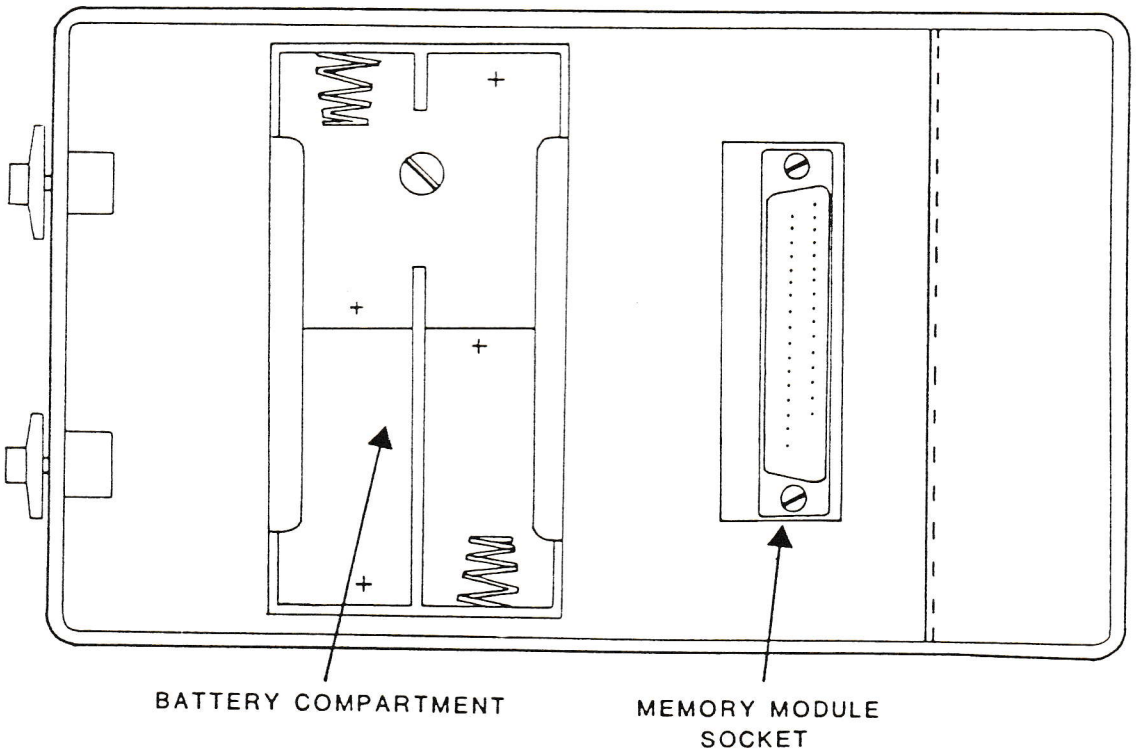


Fig L4.3

11. Fit batteries to the indicator unit of the FSM as described in Annex L3, para 9.

12. Installation:

The instrument is connected to the Indicator Unit of the FSM as follows:

a. Remove the protective cap from the socket in the base of the Indicator Unit.

b. Remove the protective cap from one end of the short interconnecting cable, feed the cable through the hole drilled in the back of the post table and feed the end of the cable up through the slot cut in the table to house the indicator unit. Plug the cable into the base of the indicator unit and screw on the retaining ring.

c. At Controls the cable is to be plugged into the base of the indicator unit, the retaining ring screwed on and the indicator unit strapped to the instrument shelf.

d. At Posts, slide the indicator unit into the slot in the instrument table and feed back the spare cable through the hole at the back of the table.

e. Remove the protective cap from the socket at the back of the FSMT.

f. Remove the protective cap from the free end of the inter-connecting cable, plug the cable into the back of the FSMT and screw on the retaining ring.

g. At Posts, locate the FSMT near the back of the Post table, with the controls towards the front of the table.

h. At Controls, locate the FSMT on the instrument shelf with the controls towards the side of the shelf from which it is normally viewed.

TESTING AND FAMILIARISATION

13. Turn the control knob of the FSM to the 'on' position. Ignore any display on the LCD at this stage.

14. Ensure that the right-hand switch of the FSMT is turned to the left hand position marked 'Actual' (see Fig. L4.2)

15. Rotate the left-hand switch of the FSMT to the position marked 'Reset/Test' and watch the resulting display on the LCD of the FSM indicator unit. The LCD will show the following sequence of displays:

a. Flashing "FAIL" or "0.0" for up to 25 seconds. If the "FAIL" display continues for more than 25 seconds, switch the FSMT to pause and check the connections of the interconnecting cable and the batteries in both instruments for correct fitting. Switch the FSMT to "Reset/Test" once more.

b. After the display of "0.0" for 25 seconds, the LCD will show a series of increasing dose-rates with a rising dose-rate flag to the left of the reading for 30 seconds.

c. The LCD will then show a steady reading between 40 and 60 cGy/h for 20 seconds.

d. The does-rate indicated will then begin to rise steadily once more for a further 30 seconds.

e. The display will then stabilise to show a steady reading between 160 and 240 cGy/h for 20 seconds.

f. The dose-rate indicated will then continue to rise steadily for a further 6 seconds.

g. The display will then show an overload condition indicated by a flashing "300" for about 45 seconds.

h. The dose-rate indicated will then commence a steady decrease with a falling dose-rate flag to the left of the reading for 30 seconds.

i. The display will then stabilise to show a steady reading between 120 and 180 cGy/h for 20 seconds.

j. The dose-rate indicated will then continue to decrease for a further 20 seconds.

k. The display will again stabilise to show a steady reading between 40 and 60 cGy/h for 20 seconds.

l. The reading displayed will then fall to "0.0", this reading being displayed for 22 seconds.

m. The display will then show an underload condition indicated by a flashing "FAIL".

16. This test and familiarisation sequence lasts for just over 5 minutes and must be carried out before Exercise Switch-on time.

17. On completion of the test sequence, rotate the left-hand switch to the vertical position marked "pause".

EXERCISE OPERATION

18. A common switch-on time applicable to all posts, will be included in all Exercise Operations Orders. The FSM is to be switched to "EXERCISE" at this time, and the Control will issue a "reminder" using the message sequence in Annex T2.

19. If, for any reason, the warning is not transmitted by the Post Display Plotter, eg. if the cluster is out of communication, the Master Post is to pass a warning at the appropriate time to the posts of the Cluster.

20. In the event of individual posts being out of communication, the FSMT is to be switched on at the correct time from the most accurate timepiece available.

21. Once switched to the "EXERCISE" position, the left-hand switch must remain there until the end of the exercise except in the case of "CONTACT" sessions.

22. Where it is necessary to switch off during an exercise and to carry on in the same time-scale at a later date as in "CONTACT" sessions, the following procedure is to be followed:

a. At the long pip tone at the end of the first evening, turn the left-hand switch to the vertical position marked "PAUSE".

b. Do not dismantle the instruments or remove batteries or memory module.

c. Leave the instruments installed at the Post, or Control.

d. At the session switch-on time the next evening, rotate the left-hand switch of "EXERCISE" as in paras 19 to 21 above.

e. The instrument will then proceed with the planned exercise at the point where it was switched to "PAUSE".

23. Under no circumstances is the left-hand switch to be rotated to the "RESET/TEST' position in this situation, as this will automatically reset the memory module to the start of the memory programme. Once this is done there is no means of running the programme through quickly to the point required.

LIMITATIONS OF THE INSTRUMENT

24. Readings are reported from the display on the FSM as directed in Part F.

25. There are, however, important differences in the update interval of the display when using the FSMT. The display on the FSM under real fall-out conditions is up-dated every $1^{1}/2$ seconds by the pulses transmitted to the indicator unit by the Geiger Muller tube.

26. In order to obtain sufficient memory in a reasonably sized module to operate exercises lasting up to 48 hours, the FSMT updates the display at intervals of 60 seconds.

27. This results in certain differences during exercises as compared with real fall-out conditions. These differences are as follows:

a. The rising or falling dose-rate flag to the left of the dose-rate display on the LCD of the indicator unit will be displayed for only 3 - 6 seconds at the beginning of each update and only when the reading has risen or fallen by a factor of 10.

b. For this reason, the flags are to be ignored when taking the even hour dose rate reading. The procedure detailed at Annex L3 Para 17 is to be used.

c. When the indicated dose-rate rises to 240 cGy/h, the retraction of the probe unit to obtain a one-tenth reading is simulated by turning the right-hand switch to the vertical position marked "10". A reading one tenth of that programmed into the memory module will be displayed at the next update. Readings must then be multiplied by 10 when reporting.

d. If the indicated dose-rate continues to rise until it reaches 280 cGy/h, the further retraction of the probe unit to obtain a one-hundredth reading is simulated by turning the right-hand switch to the right-hand position marked "100". A reading one-hundredth of that programmed into the memory module will be displayed at the next update. Readings must then be multiplied by 100 when reporting.

e. When the simulated shield readings decay to an indicated 28 cGy/h, the right hand switch is to be turned to the left to "10" or ACTUAL position. At the next update, the reading indicated will be one-tenth of the programmed reading or the actual programmed reading and the reading indicated will be multiplied by 10 or reported as displayed as appropriate.

DISMANTLING

28. Except in the circumstances discribed in paras 22 and 23, batteries are to be removed from the FSM, both the batteries and the memory module are to be removed from the FSMT and both instruments returned to their storage at the end of each Exercise or Training Session.

HANDLING OF MEMORY MODULES

29. Each FSMT will be issued with a memory module specially programmed for training purposes. From time to time these training modules will be withdrawn and replaced by one differently programmed.

30. Each memory module has a serial number engraved on it.

31. When a module is programmed with the information for a particular post for exercise purposes, a label is printed by the computer at the HQ UKWMO Exercise Preparation Section. This label shows the following:

a. The name of the Exercise (POSTHORN 2/88).

b. The Group and Post concerned (EDI 10).

c. The serial number of the module (1014).

32. On receipt of the module with the exercise material, the label is to be checked for the correct post and the serial number on the label checked with that engraved on the module. Discrepancies are to be notified to Group Headquarters.

33. Memory modules are to be returned as directed to Group HQ after each exercise.

MAINTENANCE

34. Apart from keeping the instrument clean, no maintenance of the FSMT is permitted. Unserviceable instruments are to be returned to Group HQ for replacement.

THE RADIAC SURVEY METER

FUNCTION

1. The Radiac Survey Meter (RSM) (see Fig L5.1) is a portable battery-operated instrument for the measurement of gamma radiation dose-rate up to 300 centiGrays per hour (cGy/h).

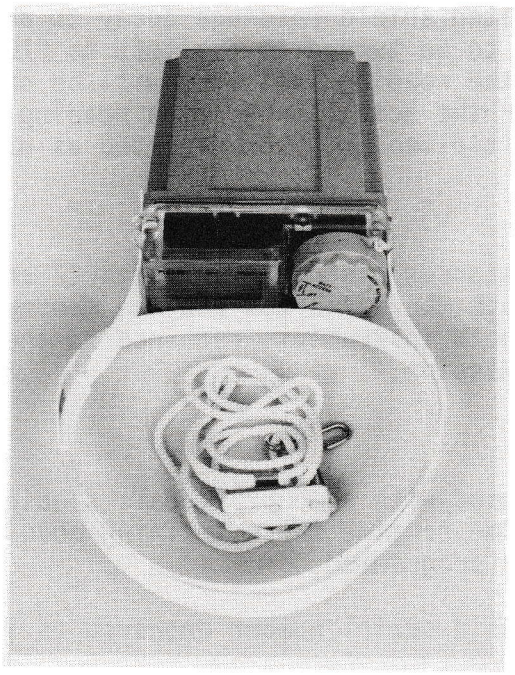


Fig. L5.1

2. It is issued to ROC Posts and Controls to measure radiation at points away from the Post or Control during Mobile Monitoring missions and as a reserve instrument in the event of failure of the Fixed Survey Meter.

FACILITIES

3. The dose-rate in cGy/h is indicated on a four-digit, easily read, Liquid Crystal Display (LCD).

4. An indication of low battery power and whether the dose-rate is rising or falling, is also displayed on the LCD.

5. The Instrument has an automatic self-testing function and displays the result of the test on the LCD.

CONSTRUCTION

6. The instrument is rugged and light in weight having a waterproof bright orange polycarbonate case and a frosted polycarbonate top with three clear windows to allow viewing of the LCD's instrument serial number and a silica gel tablet.

7. Power is provided by three International Standard C 1 1/2 volt cells in a battery compartment below the combined battery access and on/off switch. These batteries have an operating life of some 400 hours.

8. The combined battery access and on/off switch is designed to be operated easily whilst wearing protective gloves.

9. The instrument is supplied complete with a polyethylene neckstrap with notch adjustment and a polypropylene, woven, adjustable waist lanyard.

STORAGE

10. The instrument will be stored at the Post in its transit box. Batteries are to be stored separately and must always be removed from the instrument on completion of operations or training.

OPERATING INSTRUCTIONS

11. Fitting the Batteries:

Push down and turn the control knob anti-clockwise to gain access to the battery compartment. Insert the three batteries with the positive end (+) to the top, (see Fig. L5.2). Replace the control knob with slight downward pressure and turn clockwise to 'off' position.

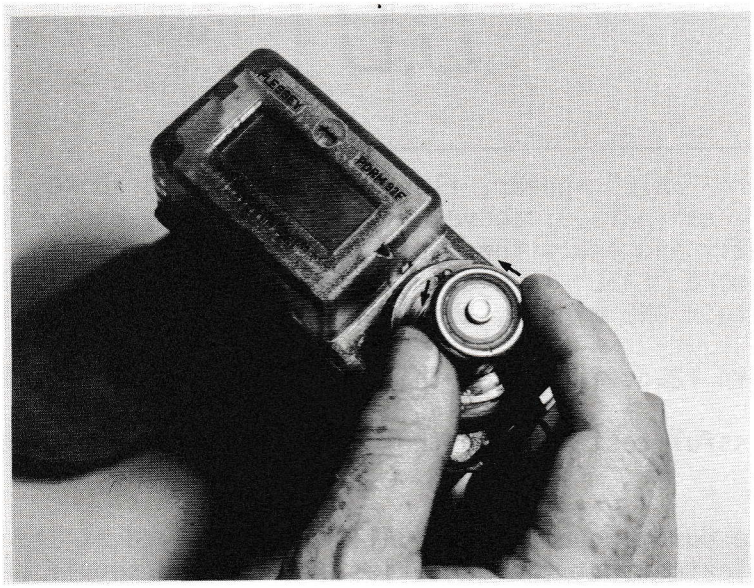
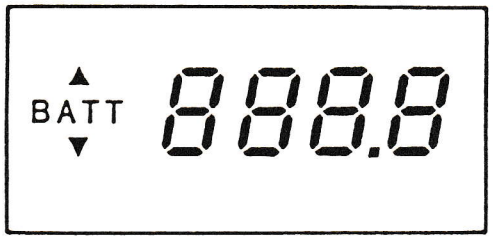


Fig. L5.2 Fitting Batteries

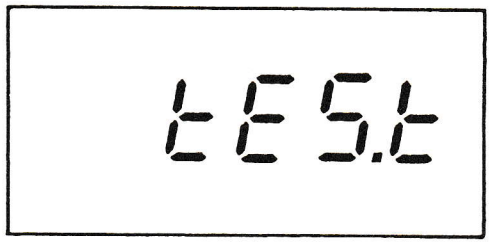
12. Check Procedure:

Turn the control knob clockwise until the 'on' mark is opposite the arrow head (see Fig L5.6). The instrument will then commence an automatic test cycle lasting up to 30 seconds, during which the following will be displayed:

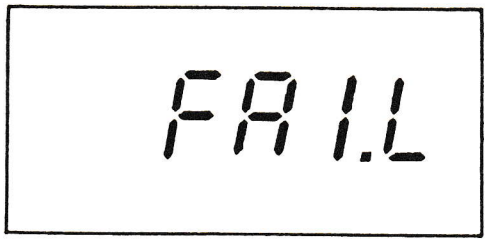
a.



b.

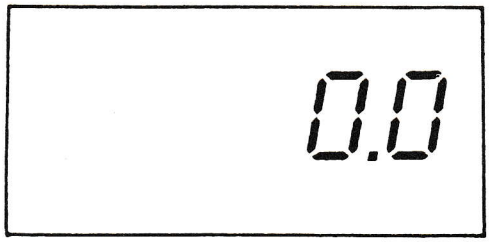


c.



(flashing)

d.



(steady)

13. Should the word "FAIL" appear, flashing, as in 12.c above, and this does not clear to a display as in 12.d. above within ONE minute, ensure that the batteries are fitted correctly and start the test cycle again by rotating the control knob to 'on'. If the word "FAIL" is again displayed, and does not clear to display as in 12.d. above within ONE minute, the instrument is unserviceable.

14. A display as in 12.d. indicates that the instrument is serviceable.

15. After a successful test, the control knob is to be turned to the 'off' position.

16. If at any time during operations "BATT" is displayed at the left-hand side of the LCD, this indicates that the batteries are low and should be replaced immediately by new batteries.

17. Routine checks of the serviceability of the instrument during operations are to be made by switching the instrument 'on' and observing the test cycle display at the following intervals:

a. On manning up the Post.

b. At 0800 daily.

c. Routine checks are to be noted in the Post Diary.

18. Operation:

Fit the neck strap by inserting one end through the slot in the instrument case as in Fig. L5.3a. Push the narrow section to the lower section of the moulding as in Fig. L5.3b. With the strap held against the moulding, pull the strap back up to 'lock' it into position, as in Fig. L5.3c.

19. Fit the other end of the neck strap to the other side of the casing in the same way. Two attachment positions are provided at each end of the neck strap for adjustment of length.

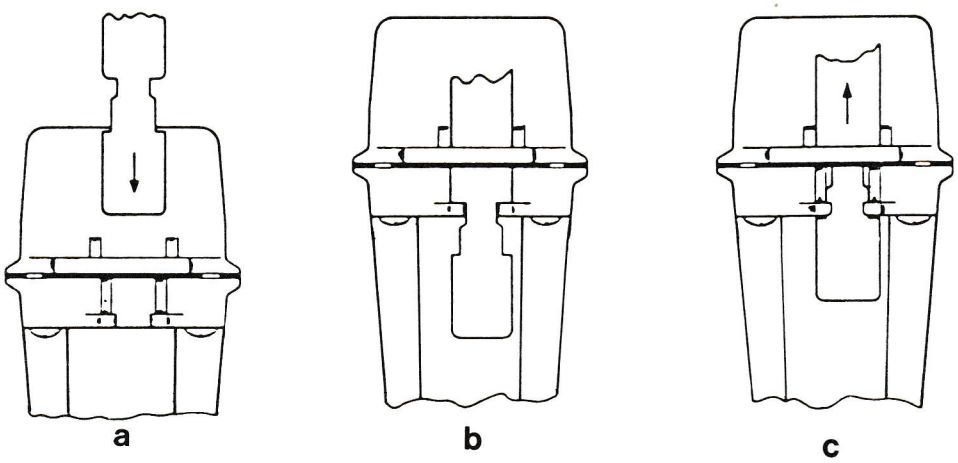


Fig. L5.3
Fitting of Neck Strap

20. Fit the waist lanyard by inserting the loop end through the case slot as in Fig. L5.4a. Pass the clip end of the lanyard and adjuster through the loop and pull tight to secure as in Fig. L5.4b.

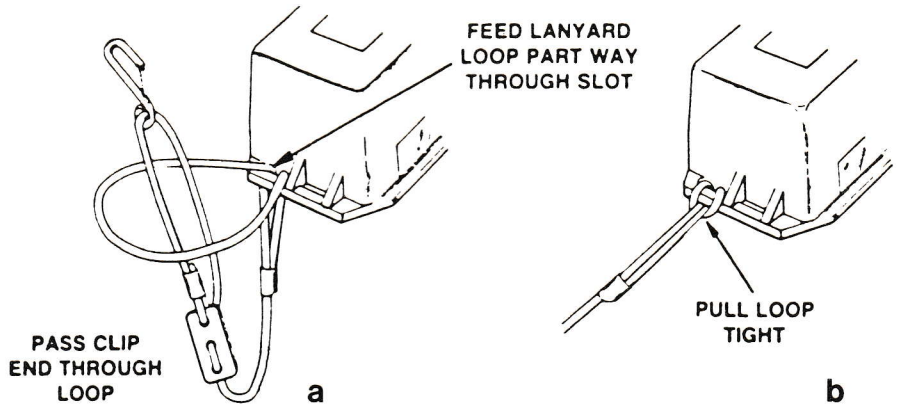


Fig. L5.4
Fitting Waist Lanyard

21. Hang the instrument around the neck, pass the lanyard round the body and fit the clip in the slot at the other side of the instrument. Adjust the lanyard to a suitable length using the plastic adjuster (see Fig. L5.5).

Fig. L5.5
Instrument worn with neck strap
and lanyard correctly adjusted

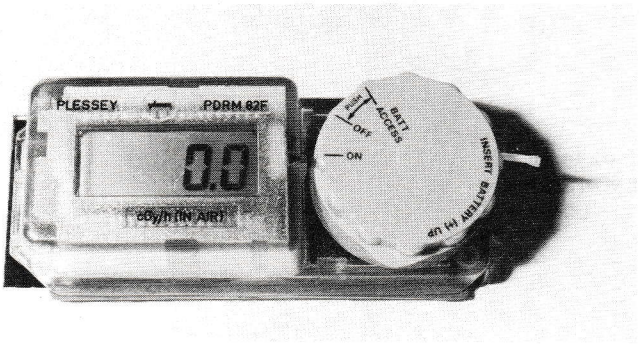


Fig. L5.6
Instrument in the 'on' position

22. To measure the gamma radiation dose-rate, proceed as follows:

    a. Turn the control knob clockwise until the "on" mark is opposite the arrow head (see Fig. L5.6).

    b. Wait until the test sequence is complete and the LCD shows '0.0' (see Fig. L5.6).

    c. Dose-rate reading will be displayed on the LCD.

MAINTENANCE

23. No maintenance of the instrument is permitted by ROC personnel. Faulty instruments are to be reported to and exchanged by Group Headquarters.