OVERHAUL MANUAL

MODEL S.218 FORM 5 - INDICATOR TEMPERATURE

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Signed. 

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ILLUSTRATIONS

MODEL S.218 FORM 5 - INDICATOR TEMPERATURE

The overhaul procedure for the S.218 Form 5 contained in this manual is applicable, in general, to all indicators of this Form. The addenda at the rear of the manual will give details of particular versions of this indicator, together with reference to information contained in this main section of the manual applicable to the variant.

1. Description and operation

A. General

Model S.218 Form 5 is a permanent magnet, moving coil, d.c. millivoltmeter calibrated to indicate temperature in degrees Centigrade or Fahrenheit and designed to operate from the output of a nickel-chromium/nickel-aluminium thermocouple. The indicator is housed in a large S.A.E. case and is fitted with a bimetal coil which provides cold end compensation.

Because of the special techniques used in the construction of the indicator, overhaul by the operator must be restricted to replacing unserviceable components that do not affect the movement complete. Any attempt to dismantle the indicator beyond the stage described in this manual will adversely affect calibration accuracy and thermal characteristics. In the event of indicator failure, or at the specified overhaul period, it is recommended that the indicator is returned to the manufacturer for overhaul.

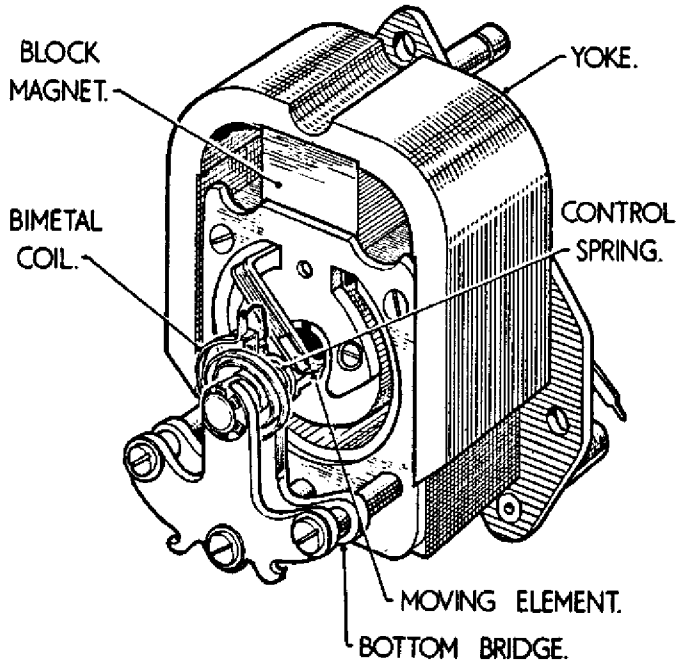

Fig.1 Rear of movement complete

B. **Detail (Fig. 1 & 2)**

Two shrouded terminals (39) mounted on the base (41) provide the necessary connections to the aircraft circuit. The terminals against which a red spot is engraved, is made of brass; the other terminal is manufactured from a copper/nickel alloy. The moving element consists of an aluminium winding, pivots, pointer and control springs. The winding terminates at the pivot bases which are in direct contact with the control springs; the latter have the dual function of connecting the winding to the indicator circuit and balancing the electro-magnetic torque when the winding is energised. The moving element which is balanced between jewelled bearings on the top and bottom bridges, swings between a gap formed by the pole piece and the core.

The indicator is fitted with an upper scale (13) and a lower scale (9). The upper scale, marked with dividing lines, is of the platform type and is secured to the lower scale which bears the range figures and subtends an angle of 240°.

The movement complete (18) comprises the moving element, the jewelled bearings housed in the top and bottom bridges, the pole piece and the block permanent magnet (both enclosed by the yoke) and the additional bridge which carries the bimetal coil. The pointer abutment, which locates with the pointer adjuster on the front of the indicator, is carried by the top bridge. The movement complete is fixed to pillars projecting from the mounting plate (33). Owing to the special method of assembly, breakdown of the movement complete is not permissible.

Spools (30) are secured to the sub mounting plate (33) and the thermistor (27) is soldered to tags on the thermistor panel (26). The screw and washer assembly (39) are protected by a terminal shroud. These parts are secured to the base (41).

KEY TO FIG. 2

1. Sealing screw
2. Sealing cup
3. Cover securing screw
4. Cover assembly
5. Bezel ring
6. Glass
7. Lower scale retaining screw
8. Lockwasher
9. Lower scale
10. 12 B.A. nut
11. Lockwasher
12. Upper scale securing screw
13. Upper scale
14. Movement complete retaining nut
15. Movement complete retaining screw
16. Lockwasher
17. Spacer
18. Movement complete
19. Pointer stop retaining nut
20. Lockwasher
21. Pointer stop (R.H.)
22. Pointer stop (L.H.)
23. Bottom mounting plate
24. Panel securing screw
25. Lockwasher
26. Thermistor panel
27. Thermistor
28. Spool securing screw
29. Lockwasher
30. Spool
31. Sub mtg. plate retaining nut
32. Lockwasher
33. Sub mounting plate
34. 10 B.A. nut
35. Spool mounting stud
36. Sub mounting pillar
37. Drive rivet (not shown)
38. Cover, resistor (not shown)
39. Screw & washer assembly
40. Copper/nickel wire
41. Base

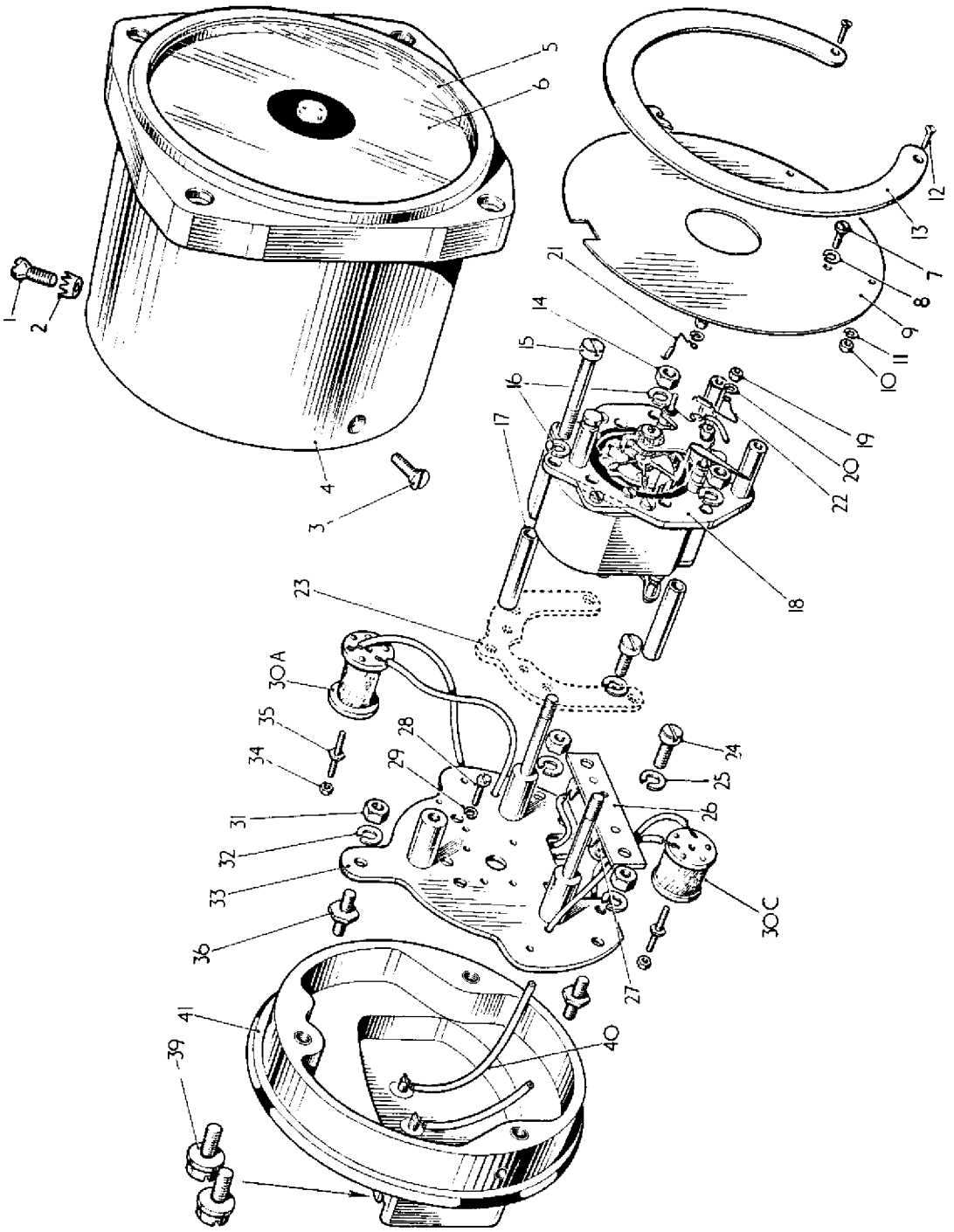

Fig. 2 Exploded view of indicator S.218 Form 5

C. Operation

The thermocouple leads are connected to the indicator terminals; the nickel/chromium lead to the positive terminal and the nickel/aluminium lead to the other terminal. When heat is applied to the couple, the e.m.f. produced causes a current to flow in the circuit and the torque produced by the interaction of the current in the moving coil and the permanent magnetic field, will cause the moving element to deflect. The angle of deflection will be proportional to the current flowing in the circuit which is proportional to the couple e.m.f. output.

The outer end of the bimetal coil engages with the free end of one of the control springs of the indicator. A change in ambient temperature will cause the bimetal coil to move the free end of the control spring and in consequence the pointer. The torque ratio of the control springs and the torque of the bimetal coil are designed to compensate for either the loss or gain of e.m.f. generated by the couple formed at the join where the copper-nickel lead is connected to the aluminium winding. An increase in ambient temperature increases this thermal e.m.f. and thus causes a current to flow in the opposite direction to the current produced by the external thermocouple, resulting in a pointer deflection which would tend (when no compensation is provided), to indicate a figure below the true value of the external thermocouple temperature. The bimetal coil, however, is also affected by the change in ambient temperature and the end of the coil moves to compensate for this loss and the pointer thus indicates the true value of temperature at the external thermocouple.

The thermistor compensates for changes in the resistance of the indicator circuit due to changes in ambient temperature. The value of the shunt resistance B (Fig.3A) across the thermistor is calculated in combination with the thermistor, the series resistor A, (if fitted) and C and the moving element resistance, so that adequate compensation may be maintained over the ambient temperature range.

2. Disassembly

A. General

The movement complete (18) is assembled by the manufacturer after careful selection of the following parts:

(1) Moving element: Absolute trueness of coil alignment is essential to maintain accuracy of pre-printed scale.

(2) Control springs and bimetal coil: The correct torque ratio of the control springs to each other and relative to the bimetal coil is essential for accurate cold end compensation of the couple.

(3) To provide pre-printed scales a special scale shape adjustment procedure is used which requires jigs to re-position the magnet and core after assembly of the movement complete (18).

(4) The thermistors which are used to maintain a reasonable temperature coefficient for the indicators over the desired temperature range, each have their own characteristics. Renewal of a defective thermistor could involve selection from a batch before one having suitable characteristics is finally chosen.

It is considered that the foregoing procedure and the large selection of parts required would make overhaul of this indicator extremely difficult, and repair, other than by the manufacturer, uneconomical. Thus the following procedure is advised:

(5) If the moving element is defective the indicator should be returned to the manufacturer.

(6) If a spool is found to be defective this may be renewed and the necessary adjustments made as detailed in Paragraph 8 (Testing) of this manual.

(7) If a thermistor is defective the indicator should be returned to the manufacturer. However, if return of the indicator is considered impracticable, the test and adjustment sequence given in Paragraph 8 (Testing) must be complied with. As previously stated, selection from a batch of thermistors might be necessary before one is found with characteristics to suit the particular indicator circuit. Comprehensive details are given of the breakdown procedure but the degree of breakdown necessary for the indicator being overhauled is left to the discretion of the operator.

B. Procedure (Refer to Fig.2)

(1) Using a pointed instrument, break out the wax covering the sealing screw (1), remove screw and sealing cup (2).

(2) Remove screws 3 (2-off) and carefully withdraw cover assembly (4).

(3) Remove 10 B.A. screws (7) and lockwashers 8 (2 off-each item) from lower scale (9).

(4) Slide scale upwards slightly to disengage top clip and remove scale together with upper scale (13).

CAUTION: WHEN REMOVING THE SCALE GREAT CARE MUST BE TAKEN TO AVOID DAMAGE TO POINTER.

(5) Unscrew and remove retaining nuts (10), lockwashers (11) and screws 12 (2 off-each item). Separate upper scale from lower scale.

(6) Release 6 B.A. nuts 14 (2-off), unscrew 6 B.A. screw (15), remove lockwashers 16 (3-off) and withdraw movement complete (18) to the full extent permitted by the connection leads.

(7) Unsolder leads from the tags on the top and bottom bridges and remove movement complete.

CAUTION: THE MOVEMENT COMPLETE HAS BEEN ASSEMBLED WITH THE AID OF SPECIAL MANUFACTURING TECHNIQUES AND MUST NOT, UNDER ANY CIRCUMSTANCES, BE DISMANTLED. IT SHOULD BE PLACED IN A DUSTPROOF CONTAINER UNTIL REQUIRED FOR ASSEMBLY.

(8) Collect spacers 17 (3-off) and remove bottom mounting plate (23) from sub mounting plate pillars.

(9) Unscrew and remove 6 B.A. screw (24), lockwashers 25 (2 off-each item); withdraw thermistor panel (26) to the full extent permitted by the leads.

NOTE: It is not advisable to remove thermistor (27) unless a damaged thermistor panel (26) is being renewed.

(10) Release 6 B.A. nuts (31), lockwashers 32 (3 off-each item) and remove sub mounting plate (33).

(11) Unsolder wires from terminal tags on base (41), and note position of wires to aid re-assembly.

NOTE: Sub mounting pillars 36 (3-off) need not be removed from base (41) unless unserviceable.

(12) Unscrew 10 B.A. screw (28), collect lockwasher (29) and remove spool B (30) situated on reverse side of sub mounting plate (33).

(13) Release 10 B.A. nuts (34), withdraw spools (30), and double ended 10 B.A. studs (35). Remove spools from studs.

3. **Cleaning**

A. **Procedure**

(1) Use acetone to remove all Bostik adhering to screws and nuts, and also from the threads of sub mounting pillar (36).

CAUTION: CARE MUST BE EXERCISED TO PREVENT ACETONE COMING INTO CONTACT WITH VARNISHED PARTS OR INSULATING MATERIALS.

(2) Clean any dust etc. from interior of cover assembly (4), the movement complete (18) and base (41) with the aid of a camel hair brush.

B. **Schedule of cleaning materials**

(1) Acetone (B.P.C.)

(2) Camel hair brush.

4. Inspection

Apply the following procedure to all parts of the indicator; any additional inspection necessary is given in sub para.C.

A. Electrical components

Check:

(1) That the resistance of the moving element is within the limits given in the addendum for the variant being overhauled.

(2) That the control springs of the moving element are not deformed and that they open when the pointer is deflected upscale.

(3) That the spools are adequately covered with insulating material and that their resistance values agree with that given in the addendum for the variant being overhauled.

(4) That the pointer is undamaged and aligns correctly with the scale markings.

(5) That the gap in which the moving coil swings is free from obstructions when examined visually with the aid of a X5 magnifier. Any particles adhering to the surfaces of the pole-piece or core must be carefully removed.

CAUTION: USE A SHAPED PIECE OF VERY SOFT WOOD OR A PIECE OF CELLULOID TO REMOVE PARTICLES FROM THE POLE-PIECE, ETC. SPECIAL CARE MUST BE TAKEN TO AVOID DAMAGING THE CONTROL SPRINGS.

B. Metal components

Examine for:

(1) Cleanliness.

(2) Distortion.

(3) Serviceability of threads.

(4) Cracks.

C. Cover assembly (4) and base (41)

Examine for:

(1) Cracked or broken Bakelite mouldings.

(2) Dirty or broken glass.

(3) Security of components not dismantled.

(4) Tightness of pointer adjuster. It must not be possible to rotate the pointer adjuster by hand from the front of the glass without the aid of the pointer adjuster key, Part No.172726.

5. Repair

A. Schedule of materials

(1)	Bostik cement No.772	B.B. Chemical Co. Ltd.
(2)	Inhibisol	Penetone Paripan Ltd.
(3)	Genklene	I.C.I. Ltd.
(4)	Acetone	Acetone B.P.C.

B. Broken glass

(1) Prise out bezel ring (5) and glass (6) from cover assembly (4).

NOTE: During this operation it may be necessary to break the bezel ring.

(2) Using Inhibisol or Genklene (if available) or acetone as a solvent remove all traces of Bostik adhering to cover.

NOTE: Some of the earlier indicators may have had Bostik cement No.1261 used for glass/cover adhesion, this cement is best cleaned off with toluene.

(3) Apply Bostik cement No.772 evenly around inside lip of cover assembly.

(4) Press the new glass down firmly into Bostik, eliminating all air bubbles and ensuring that the Bostik covers edge of glass and fills all gaps.

(5) Apply Bostik around internal surface of cover assembly just above glass.

(6) Insert bezel ring and press down firmly into Bostik so that a bed of Bostik is formed on the glass.

(7) Allow to air dry for a minimum of 48 hours.

(8) Support glass to prevent it loosening and trim off excess Bostik with a sharp wet knife.

C. Damaged pointer stops (21 & 22)

If the glass beads on the pointer stops (21 and 22) are cracked or broken the stops must be renewed as follows:

(1) Remove 12 B.A. nuts (19), lockwashers 20 (2 off-each item) and collect damaged stops.

(2) Place new stops in position and replace lockwashers (20) and 12 B.A. nuts (19).

6. Assembly

During assembly, apply a spot of B.S.104 to all threaded holes, nuts and screwheads to lock these items against vibration. Cement both jewel screws and coat all soldered connections with Red Thermolene lacquer. After final adjustment and calibration apply a thin coat of B.S.43 to the cover/base join. Use solder (50/50 tin lead) on all soldered joins. These finishes to SANGAMO WESTON B.S. specification may be obtained from Messrs. SANGAMO WESTON LTD., ENFIELD, MIDDLESEX, ENGLAND, or obtained directly from the suppliers.

B.S.104	BOSTIK No.772 thinned with acetone to a brushable consistency.
Thermolene Lacquer	MESSRS. CANNING'S Red Thermolene Lacquer No.185
Solder 50/50 tin lead	MESSRS. DU BOIS LTD., 15, Britannia Street, London, W.C.1.
B.S.43	Gulfcrown No.3 grease, GULF OIL CO. LTD.

A. Procedure (Fig.2)

(1) Assemble spool A (when fitted) and C (30) to double ended 10 B.A. studs 35 (2-off).

NOTE: If fitting new spools it is recommended that they should be assembled after completing the adjustments outlined in para.8(C).

(2) Secure the spool and stud assembly to the sub mounting plate (33) by fitting and tightening 10 B.A. nuts 34 (2-off).

(3) Fit spools B and D (where fitted) (30) to the reverse side of sub mounting plate (33) by inserting and tightening 10 B.A. screws (28) and lockwashers (29).

(4) Solder wires to terminal tags on base (41).

(5) Place sub mounting plate (33) on sub mounting pillars 36 (3-off) and secure with 6 B.A. nuts (31) and lockwashers 32 (3 off-each item).

(6) Place the thermistor panel (26) in position and secure it by inserting and tightening 6 B.A. screws (24) and lockwashers 25 (2 off-each item).

(7) Place the bottom mounting plate (23) on the sub mounting plate pillars; place spacers 17 (3-off) in position

(8) Resolder leads to the tags on the top and bottom bridges of the movement complete (18).

(9) Carefully hold the movement complete in position on spacers 17 (3-off) and secure with lockwashers 16 (3-off), 6 B.A. screw (15) and 6 B.A. nuts 14 (2-off).

(10) Place upper scale (13) and lower scale (9) together and secure with 12 B.A. screws (12), lockwashers (11) and 12 B.A. nuts 10 (2 off-each item).

(11) Engage the upper scale top clip and fit the scale assembly to the movement so that the indicator pointer is located through the centre hole in the lower scale.

CAUTION: WHEN FITTING SCALES CARE MUST BE TAKEN TO AVOID DAMAGE TO THE POINTER.

(12) Secure the scales to the movement with 10 B.A. screws (7) and lockwashers 8 (2 off-each item).

NOTE: Before operations (13), (14) and (15) check the indicator as detailed in sub paragraph B (checks after assembly) and paragraph 8 (Testing).

(13) Smear a thin coat of grease to SANGAMO WESTON specification B.S.43, around the internal surface of the cover assembly (4) where the cover and base (41) meet.

(14) Fit cover assembly ensuring that the pointer adjuster arm engages with the top abutment of the movement.

(15) Insert sealing cup (2) and fit screws 3 (2–off) and (1).

B. Checks after assembly

(1) Ascertain that the moving element is evenly centred. Turn the top jewel screw clockwise in small increments of 1/10th to 1/8th of a turn until pointer flop, (the movement of the pointer due to the pivots being able to move laterally between the jewelled bearings), is just eliminated. Back off top jewel screw by 1/10th to 1/8th turn until a slight pointer flop is just perceptible.

(2) Check the balance of the moving element in the positions given below. The balance error at any part of the scale must not exceed 2% of full scale deflection or 20°C (whichever is the greater); if outside this limit the balance weights must be re-adjusted to maintain the requirement. Proceed as follows:

(a) With the pointer horizontal and its tip to the left.

(b) With the pointer horizontal and its tip to the right.

(c) With the pointer vertically upward.

NOTE: The scale must be kept in the horizontal plane and turned to give the correct position (a to c) before gently raising the scale into the vertical plane each time.

(3) Check that the pointer stops are in their correct positions.

(4) Check that all the required finishes have been applied to the indicator.

The indicator is now ready for the adjustments as detailed in paragraph 8.

8. Testing (Figs. 3 & 4)

A. Methods and conditions of testing

(1) All tests and adjustments must be made at a temperature between 15°C and 25°C and at the pressure and humidity normal to the test room unless otherwise specified.

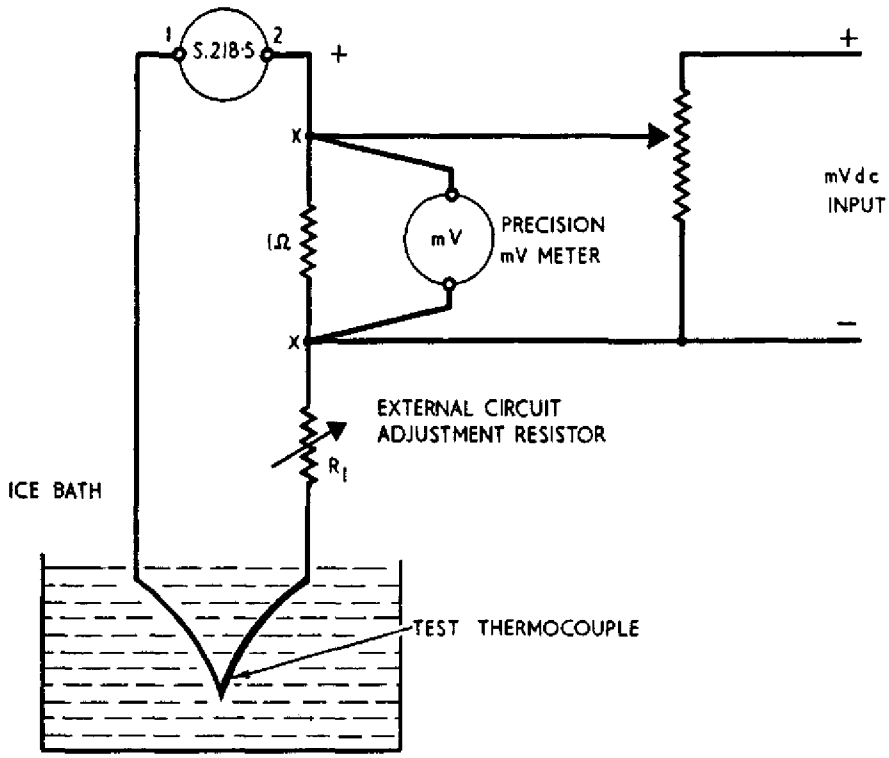

Fig.3 Test and calibration circuit

NOTE: Before connecting the d.c. input short out the 1 ohm resistor by connecting points X – X. Adjust for total external resistance by disconnecting point 1 or 2 to isolate indicator.

(2) The indicator must be tested as a millivoltmeter connected to a thermocouple circuit whose total resistance must be as stated in the addendum for a particular variant. The millivolts must be injected across a resistance not exceeding 1 ohm, inserted into the circuit. The hot junction of the thermocouple should be maintained at 0°C by placing it in an ice bath (melting ice made from distilled water). All tests should be made by checking the indicator against the readings of instruments conforming to the requirements of B.S. 89 (1954) for instruments of precision grade accuracy, or by any other method ensuring accuracy not worse than this grade.

(3) Lightly tapping the indicator is permitted in all tests other than the friction test. When the indicator is placed in a cabinet for tests a small vibrator may be mounted adjacent to the indicator.

(4) All tests and calibration checks must be made with the scale of the indicator in the vertical plane, or as stated in the relevant addendum for a particular variant.

B. **Adjustments** (Refer to Figs.3A & 7)

Ensure that the indicator is balanced before proceeding with the adjustment.

Indicators with 25 ohms or more external resistance

The following procedure is applicable to all indicators with 25 ohms or more external resistance, unless otherwise detailed in the appropriate addendum for a particular Variant.

NOTE: Spool A is not fitted in recent indicators; its use is dependent upon temperature test results at initial assembly. When used, it should not be handled or subjected to heat as it is wound with copper wire.

(1) Check the resistance of the moving element. If the resistance is less than 19 ohms at 20°C, build out with Spool A, to a value of 19-21 ohms at 20°C. The value of Spool B must be as follows:

(a) When the moving element resistance is 19-21 ohms at 20°C (built out with Spool A, if necessary), Spool B must be 12 ohms ±0.12 ohm.

(b) When the moving element resistance is greater than 21 ohms (25 ohms max.) at 20°C, Spool B must be 14 ohms ±0.14 ohm.

NOTE: If the ambient temperature is other than 20°C, use the chart (Fig.4a) to obtain the value of resistance to which the indicator must be adjusted to obtain the correct value at 20°C.

(c) If Spool A has been fitted, do not disturb this spool unless the movement complete or the thermistor is being renewed. If either of these components is renewed, remove Spool A and follow the procedure given at (1) (a) and (b).

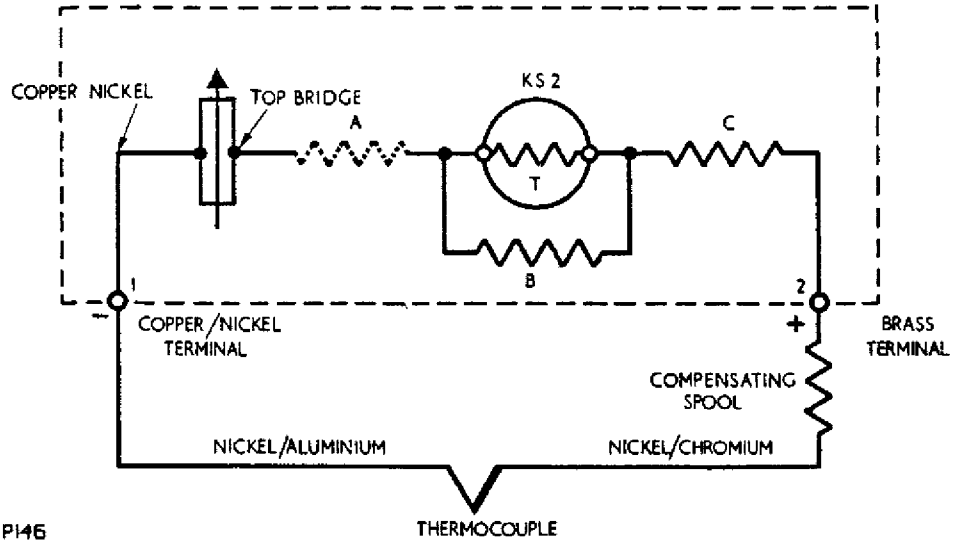

Fig.3A Circuit diagram
(25 ohms and above external resistance)

(2) Connect the thermistor in circuit across Spool B.

(3) Adjust spool C as follows:

(a) Substitute a decade resistance box for spool C and connect it in series with the indicator, adjust the total circuit resistance to a nominal value of 33 ohms plus the external resistance specified in the addendum for the particular variant.

(b) Apply a millivolt input equivalent to the SET position (or initial adjustment position) given in the relevant addendum and, by means of the pointer adjuster, set the indicator pointer to align with the SET position.

(c) Apply a millivolt input for the maximum temperature adjustment of the indicator as given in the relevant addendum and adjust the decade resistance box to deflect the pointer to the scale mark for this temperature; record the resistance value of the decade box.

(d) Apply a millivolt input for the minimum temperature adjustment of the indicator as given in the relevant addendum and adjust the decade resistance box to deflect the pointer to the scale mark for this temperature; record the resistance value of the decade box.

The value of spool C is determined as follows:

(e) Subtract the value recorded in operation (d) from twice the value recorded in operation (c).

(f) Subtract the value of the external resistance for the particular variant (see addendum) from the value calculated at operation (e) to obtain the final value of spool C. Adjust spool C to this value, after which it can be assembled in position and connected in circuit.

(g) Check the calibration of the indicator using the millivolt input values for equivalent temperatures given in the addendum for the indicator being overhauled.

Indicators with 8 ohms external resistance.

(4) Connect spool A in series with the moving coil and adjust spool to give a combined value of 10 ohms at 20°C.

NOTE: If the ambient temperature is either higher or lower than 20°C, use the chart (Fig.4b) to obtain the value of resistance to which the indicator must be adjusted to obtain the correct value at 20°C.

CAUTION: SPOOL A IS WOUND WITH COPPER WIRE AND ITS RESISTANCE WILL VARY IF HANDLED OR SUBJECTED TO HEAT. FINAL CHECK OF THE MOVING COIL CIRCUIT RESISTANCE MUST BE MADE AFTER SUFFICIENT LAPSE OF TIME FOLLOWING ADJUSTMENT OF SPOOL A.

(5) Check that the value of spool B is 10 ±0.1 ohms and connect the thermistor in circuit across the spool as illustrated in Fig.3B.

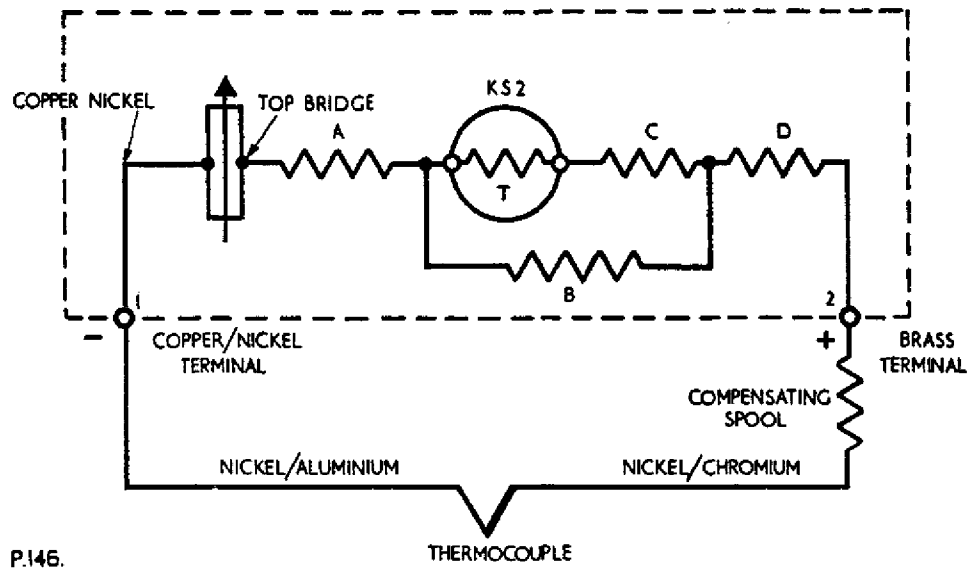

Fig.3B Circuit diagram
(8 ohms external resistance)

(6) Check that the value of spool C is 5 ±0.05 ohms and connect in circuit in series with the thermistor.

(7) Adjust spool D as follows:

(a) Substitute a decade resistance box for spool D and connect it in series with the indicator, adjust the total circuit resistance to a nominal value of 29 ohms.

(b) Apply a millivolt input equivalent to the SET position (or initial adjustment position) given in the relevant addendum and, by means of the pointer adjuster, set the indicator pointer to align with the SET position.

(c) Apply a millivolt input for the maximum temperature adjustment of the indicator as given in the relevant addendum and adjust the decade resistance box to deflect the pointer to the scale mark for this temperature; record the resistance value of the decade box.

(d) Apply a millivolt input for the minimum temperature adjustment of the indicator as given in the relevant addendum and adjust the decade resistance box to deflect the pointer to the scale mark for this temperature; record the resistance value of the decade box.

The value of spool D is determined as follows:

(e) Subtract the value recorded in operation (d) from twice the value recorded in operation (c).

(f) Subtract the value of the external resistance for the particular variant (see addendum) from the value calculated at operation (e) to obtain the final value of spool D. Adjust spool D to this value, after which it can be assembled in position and connected in circuit.

(g) Check the calibration of the indicator using the millivolt input values for equivalent temperatures given in the addendum for the indicator being overhauled.

(8) To adjust an indicator fitted with a replacement thermistor, check the calibration of the indicator as detailed in the appropriate addendum.

If the indicator reading is outside the limits, re-adjust spool C, as described in sub-paragraph B(3) for an indicator with an external resistance of 25 ohms or more, or re-adjust spool D as described in sub-paragraph B(7) for an indicator with an external resistance of 8 ohms.

Apply the temperature tests detailed in sub-paragraph B(12). If the indicator does not satisfy the requirements of the temperature tests, the thermistor must be changed and this operation must be repeated.

(9) Pointer adjustment is made with the bottom spring abutment positioned so that the available pointer adjustment is symmetrical about the SET position. Connect the indicator into the circuit given in Fig.3 (See para.8A(2)). Inject millivolts corresponding to the SET position and then adjust the bottom spring abutment to give symmetrical movement of the pointer either side of this position when the pointer adjuster is manipulated.

(10) Friction tests

(a) Mount the indicator with its scale in the vertical plane and connected to the circuit given in Fig.3 (See para.8A(2)).

(b) Switch on the supply and gradually increase its value from zero until the indicator pointer is over the nearest scale cardinal line to the pointer vertical position; note the reading on the precision grade test instrument. The pointer must not overshoot the chosen cardinal otherwise the test becomes invalid.

(c) Increase the supply input until the indicator pointer is deflected to full scale; lightly tap the indicator and then gradually reduce the input until the pointer is over the chosen scale cardinal; again avoid overshoot of the pointer. Note the reading on the precision grade instrument.

(d) The friction error is the difference between the two foregoing precision grade instrument readings expressed in terms of full scale deflection of the indicator under test and must not exceed 1½% f.s.d.

NOTE: The indicator must not be subjected to vibration during this test.

(11) Calibration adjustment

(a) Connect the indicator to the circuit given in Fig.3 (See para.8A(2)).

(b) Inject the appropriate millivolts equivalent to the SET mark on the indicator scale and align the pointer to this mark by use of the pointer adjuster.

(c) The calibration should be checked at the scale values detailed in the addendum for the indicator being overhauled.

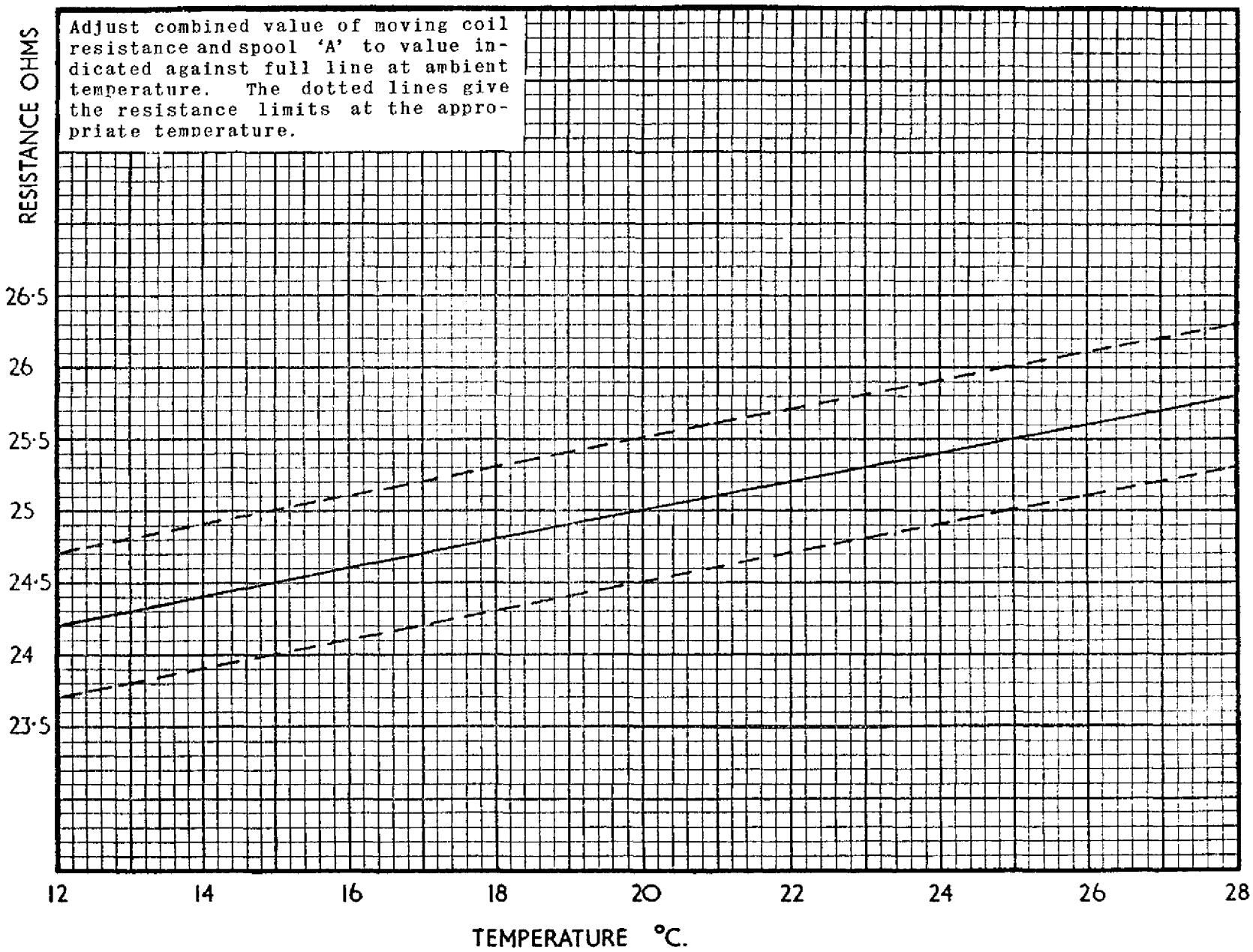

Fig. 4 Temperature resistance chart (25 ohms and above external resistance)

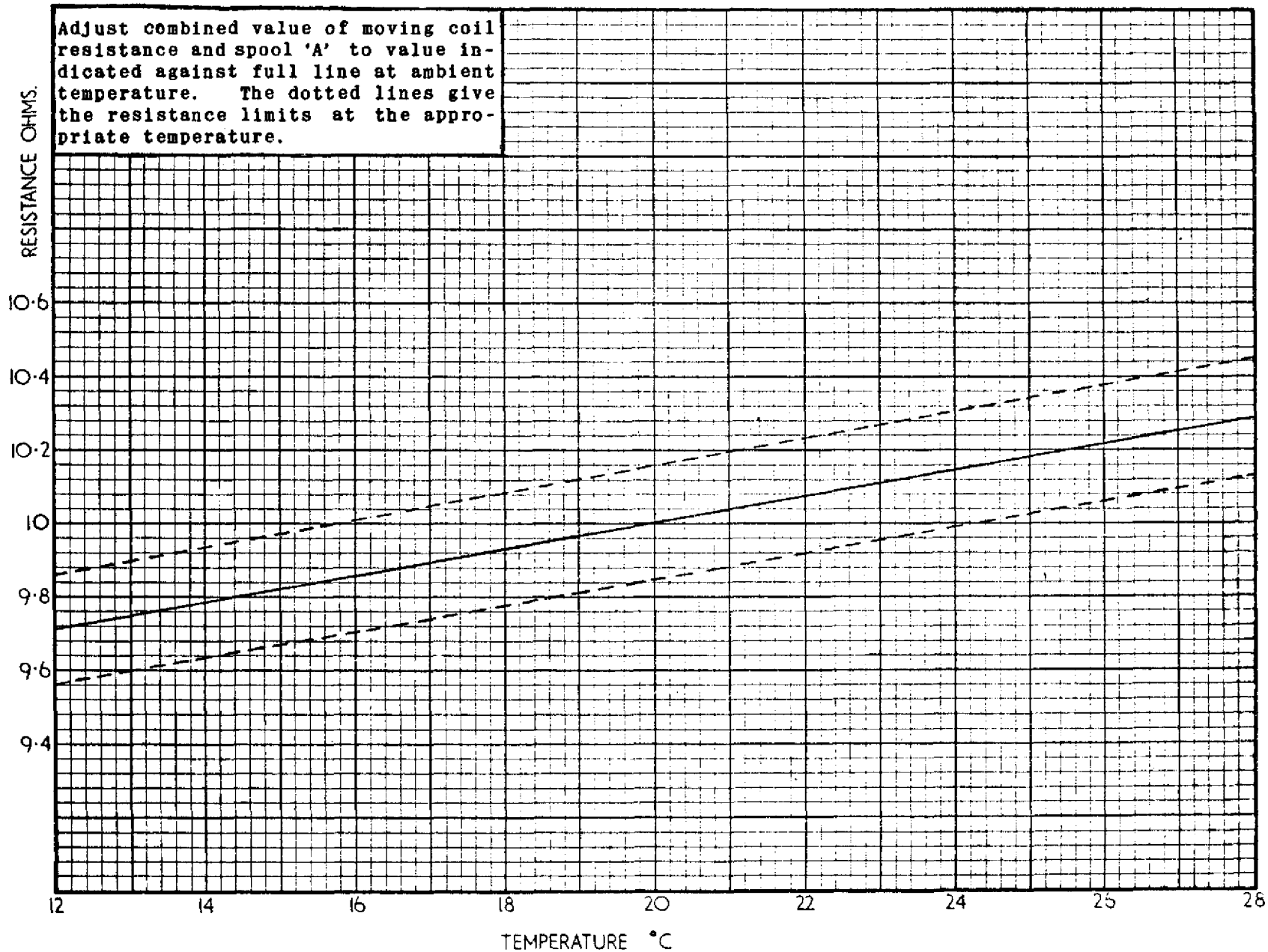

Fig.4A Temperature resistance chart (8 ohms external resistance)

(12) Temperature tests

NOTE: When checking the indicator to the requirements of the temperature test use a copper/copper-nickel test thermocouple. If this is not possible and a nickel-chromium/nickel-aluminium thermocouple is used, the nickel-aluminium lead of the test thermocouple must be extended to the negative terminal of the indicator; a nickel-chromium lead must be connected between the positive terminal of the indicator and the junction of the test millivoltmeter/potentiometer slider. Failure to comply with either of these circuit requirements will result in errors of indication when making the test over the stipulated temperature range.

(a) The indicator must be initially set up as described in the calibration test detailed in sub paragraph (11), while still at normal room temperature.

(b) The indicator must be subjected to a temperature of $-40^{o}C \pm 2^{o}C$ for a minimum period of six hours. The calibration must then be checked as described in sub paragraph (11) but omitting the setting up procedure.

(c) The observed error at any calibration mark should not exceed $36^{o}C$ within the effective range.

(d) The indicator should be subjected to a temperature of $+70^{o}C \pm 3^{o}C$ for a minimum period of six hours. The calibration must be checked as described in sub paragraph (11) but omitting the setting up procedure.

(e) The observed error at any calibration mark should not exceed $30^{o}C$ within the effective range.

(f) At the conclusion of this test the indicator should be allowed to regain normal room temperature and should be maintained at this temperature for a minimum period of six hours. The calibration must be checked as detailed in sub paragraph (11) and the observed errors should not exceed the accuracy given in the relevant addendum. The resistance of the indicator must be as stated in the addendum for a particular variant.

(13) Insulation test

(a) Apply 500 volts d.c. between indicator terminals strapped together and all external metal parts for 15 seconds.

(b) Check the insulation resistance immediately following (a). The resistance must not be less than 20 megohms.

9. **Trouble shooting (Fig. 5)**

A. **Causes**

The main symptoms of faults after overhaul are:

(1) Indicator fails to function.

(2) Indicator reading high or low.

(3) Indicator pointer moves erratically over scale.

B. **Correction**

(1) Trace fault by means of trouble shooting chart and take suitable remedial action suggested.

(2) After correction of fault and any reassembly retest indicator.

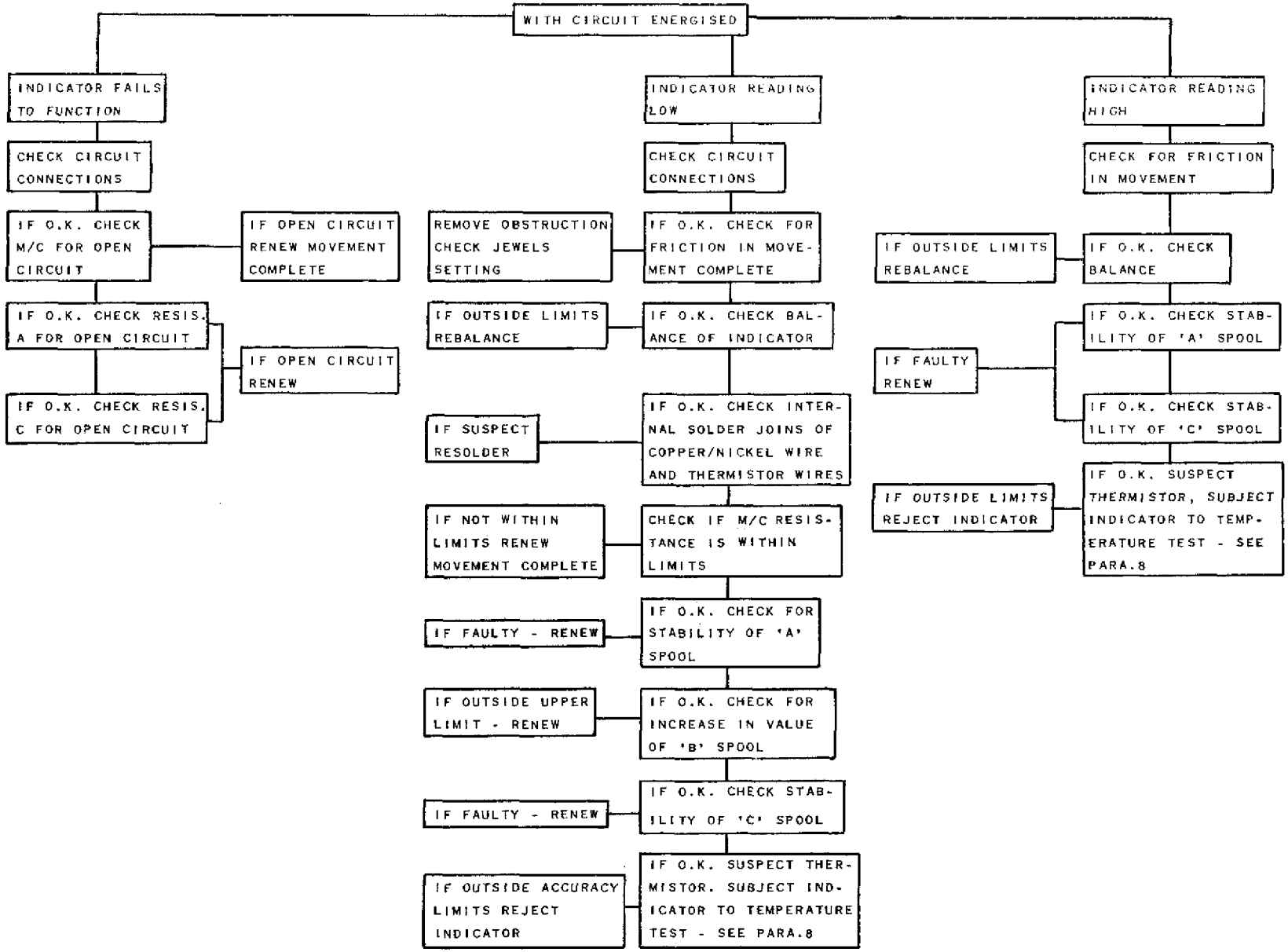

Fig. 5 Trouble Shooting Chart

10. Storage instructions

A. Conditions

(1) If the original packing is not available, prepare the following:-

(a) Packing for temperate areas:

(i) Oven dried silica gel.
(ii) A polythene bag; to contain the indicator together with the silica gel. The opening of the bag must be heat sealed.
(iii) Two strips of corrugated cardboard to be wrapped around the indicator.
(iv) A cardboard box to contain the indicator and the corrugated cardboard.
(v) Gummed paper strip to seal the cardboard box.
(vi) A label to be affixed to the box and giving the following information.

a - Identification, e.g. S.218.5.00

b - Modification standard

c - Date of removal from aircraft

d - Date of last overhaul

e - Details and date of any component change

f - Reason for return of indicator.

(b) Packing for tropical areas:

(i) Water resistant paper to completely enwrap the indicator; then proceed as described in (a) (i) to (iii).
(ii) A polythene bag large enough to hold the indicator and its packing. Heat seal the bag and proceed as described in (a) (iv) and (v).
(iii) A wooden box of suitable dimensions to enclose the cardboard box; secure it and affix a label as in (a) (vi).

(2) If the original packing is available, repack the indicator and affix a label as in (1) (a) (vi).

B. Storage limiting period

(1) The limiting period for the indicator is 5 years.

(2) Indicators in store for 5 years must be subjected to a calibration check described in paragraph 8 (Testing).

(3) Indicators must be stored under conditions where humidity does not exceed 50% and the temperature range is within $-20^{o}C$ to $+50^{o}C$.

11. Special tools, fixtures and equipment

Item	Description	Part Number
1.	Suitable flask or beaker to contain melting ice.	Local supply
2	Precision grade millivoltmeter	Sangamo Weston Ltd.
3	Ohmmeter	Local supply
4	Pointer adjuster key	172726
5	Balance weight wrench	Chart No. 271157, No. 12 & 15.

13. Overhaul period 'ON CONDITION'

NOTE: The term 'On Condition' is applicable to systems/components on which airworthiness is determined by inspections, measurements and tests, or by other means specified, without extensive disassembly or renewal.

Inspections or checks of the aircraft indicator are scheduled at intervals shown in the aircraft maintenance schedule which will determine the repairs, replacements and refinishing needed to maintain the required airworthiness standard.

12. Illustrated parts List

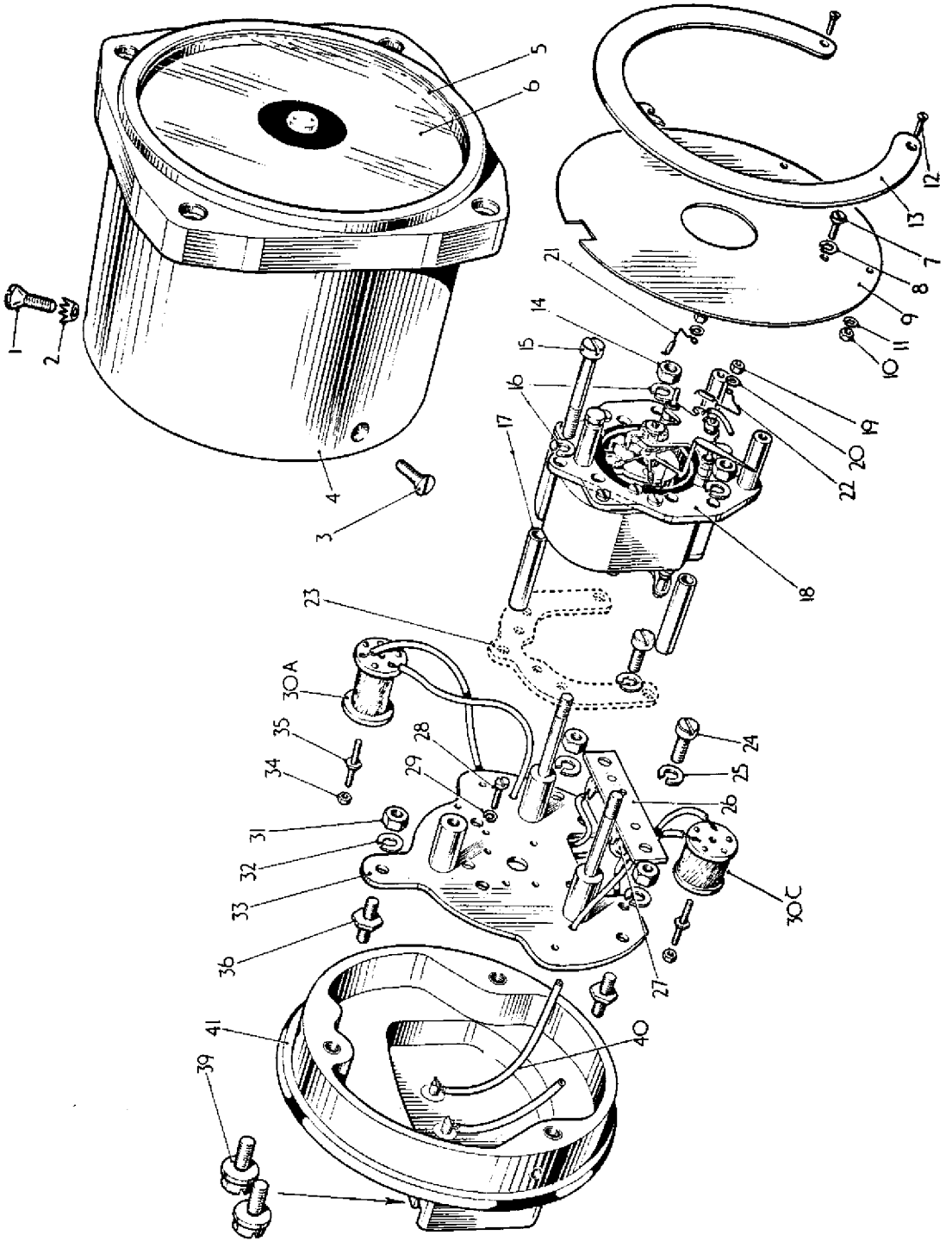

Fig. 6 Model S.218 Form 5

This list to be used with Variant Parts List for Model S.218 Form 5

COMMON PARTS LIST

MODEL S.218 FORM 5

	Fig. and Index No.	Nomenclature	Part No.	Units per Assy.
R	Fig. 6	Model S.218 Form 5		
	1	Screw, Sealing	168862	1
	2	Cup, Sealing	168013	1
	3	Screw 6B.A. x ¼ in. C' sk	150146	2
	4		See Variant Parts	
	5	Ring Bezel (Cover)	166781	1
	6-9		See Variant Parts	
	10	Nut 12B.A.	155125	2
	11	Lockwasher 12B.A.	155830	2
	12-13		See Variant Parts	
	14	Nut 6B.A.	112243	2
	15	Screw 6B.A. x 7/8 in.	162365	1
	16	Lockwasher 6B.A.	156976	3
	17	Spacer (Mod.J)	171589 (J)	3
	or 17	Spacer (Mod.T)	176247 (T)	3
	18		See Variant Parts	
	19	Nut 12B.A.	See Index No. 10	3
	20	Lockwasher 12B.A.	See Index No. 11	3
	21	Stop Pointer R.H.	172426	1
	22	Stop Pointer L.H.	172427	1
	23	Plate Bottom Mtg. (Mod.J)	171588 (J)	1
	24	Screw 6B.A. x 5/32 in. Ch.Hd.	150135	2
	25	Lockwasher 6B.A.	See Index No. 16	2
	26	Panel Thermistor	172049	1
	27	Thermistor	172044	1
	28-30		See Variant Parts	
	31	Nut 6 B.A.	See Index No. 14	3
	32	Lockwasher 6 B.A.	See Index No. 16	3
	33		See Variant Parts	
	34	Nut 10 B.A.	150180	2
	35	Stud 10 B.A. Double Ended	159962	2
	36		See Variant Parts	
	37	Rivet Drive (Not shown)	156575	2
	38	Cover Resistance (Not shown)	162619	1
	39		See Variant Parts	
	40	Wire, copper/nickel 2¼ in.	169776	1
	41		See Variant Parts	

NOTE: Sangamo Weston Code appears on front of Scale

The term 'variant' defines a particular application of the Model. The last figure group of the Sangamo Weston Code number identifies the variant and enables the user to select the correct variant parts list.