OVERHAUL MANUAL

S.127 Form 5 - DUAL RATIOMETER

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This Manual complies with British Civil Airworthiness Requirements, Chapter A6-2. The technical accuracy of this manual has been verified and is certified correct.

Signed. 

Date. October 1962

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The introduction of any amendment or revision not certified in accordance with British Civil Airworthiness Requirements Chapter A6-2 will invalidate the statement of certification on Model S.127, Form 5 Dual Ratiometer. Amendments or revisions embodied in this manual, which have been certified under an approval authorisation other than that applicable to the initial certification must be recorded on separate record sheets.

OVERHAUL MANUAL

MODEL S.127 FORM 5 - DUAL RATIOMETER

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ILLUSTRATIONS

MODEL S.127 FORM 5 - DUAL RATIOMETER

1. Description

A. General

Model S.127 Form 5 consists of two separate ratiometer movements contained in a large S.A.E. case. The indicator operates from a 24 volts d.c. supply and can be used to register temperature, position or pressure. Connections to the circuit are made either by means of a moulded terminal block, or a Plessey plug Mk. 4, situated at the rear of the case. The pin connections of the plug correspond with the terminal block numbers as follows:

Terminal block	Plessey plug Mk. 4.
1	B
2	E
3	C
4	F
5	A
6	D

B. Detail - Fig.1.

Moving element (47) consists of a lance type pointer attached to an aluminium frame bearing two fine copper wire windings; one end of each of the windings being joined together to form a common connection. This assembly is positioned in the gap between core (46) and pole piece (48) and is pivoted between adjustable jewelled bearings fitted to top and bottom bridges (30) and (34). Core (46) is located in the centre of the pole piece aperture by lugs projecting inwards from each end of the pole piece and is held in position by screw (44), core clamp (43) and core plate (45). Four pillars, two at each end of the pole piece assembly, support the top and bottom bridges. The top bridge is electrically insulated from the pillars by insulating washers (28) and insulating bushes (31). Pointer stops (26) and (27) are positioned on the top bridge pillars to allow the pointer to deflect just beyond the scale end cardinals. The moving element windings are connected in circuit by phosphor bronze ligaments; one to the top bridge and one to each of ligament terminals (37) and (38). In addition to being used for connection purposes the top ligament exerts a torque on the moving element so that the pointer deflects off scale when the indicator is de-energised.

Two of these movements, one on the right-hand side and one on the left-hand side, are mounted on mounting plate (49) so that the pointers are tip to tip in the mid-scale position. Two soft iron pole piece blanks (21) having the same external shape as the pole pieces are mounted at the top and bottom of the mounting plate. A triangular shape Alcomax magnet (16) is located in each of the four spaces between the movements and pole piece blanks so that a closed magnetic circuit is formed through these components. The four magnets are secured in position by magnet clamps (15), nuts (13) and lockwashers (14). The complete assembly is mounted on the pillars of sub-mounting plate (57) which in turn is mounted on three sub-mounting plate pillars (58) screwed into base (62). A number of resistance spools (54) are attached to the underside of the sub-mounting plate by screws (52) and lockwashers (53). A suitably calibrated scale (10) is supported on internally threaded bosses projecting from mounting plate (49) and the complete assembly is enclosed by a moulded bakelite cover (4) fitted with a glass (7) and magnet shield (6).

C. **Operation**

Each moving coil system has two windings which are suspended in permanent and unequal magnetic fields. Each indicator shows a ratio between currents passing through the windings and indicator accuracy is substantially independent of supply voltage variations. When used as a temperature indicator, the current in one winding is relatively constant while that in the other is varied by changes, due to temperature variations in the vicinity of the resistance bulb affecting its resistance, the bulb being electrically connected to the indicator. Alternatively, the current in both windings may be varied, the range of the indicator determining which of the two circuit arrangements will be used. In both applications however, the indication will be proportional to the ratio of currents in the two windings which may be read as degrees of temperature on a suitably calibrated scale. For calibration purposes the indicator scale is marked 'Pt.Law' or 'Ni.Law' in order to differentiate the resistive component of the bulb, which may be platinum or nickel, with which the indicator is to be used.

Indicators used for position or pressure measurements employ a straight circuit as shown in the appropriate addendum at the rear of the manual. Currents flowing through the windings are varied in opposite senses (i.e. an increase in one winding is accompanied by a decrease in the other) by means of a potentiometer contained in the external position or pressure transmitter.

Directions of the currents in all indicators (i.e. temperature, position and pressure) are such that the torque produced by one winding is in opposition to the torque developed by the other. The resultant of these two torques energises the moving element and thus the pointer deflects across the scale.

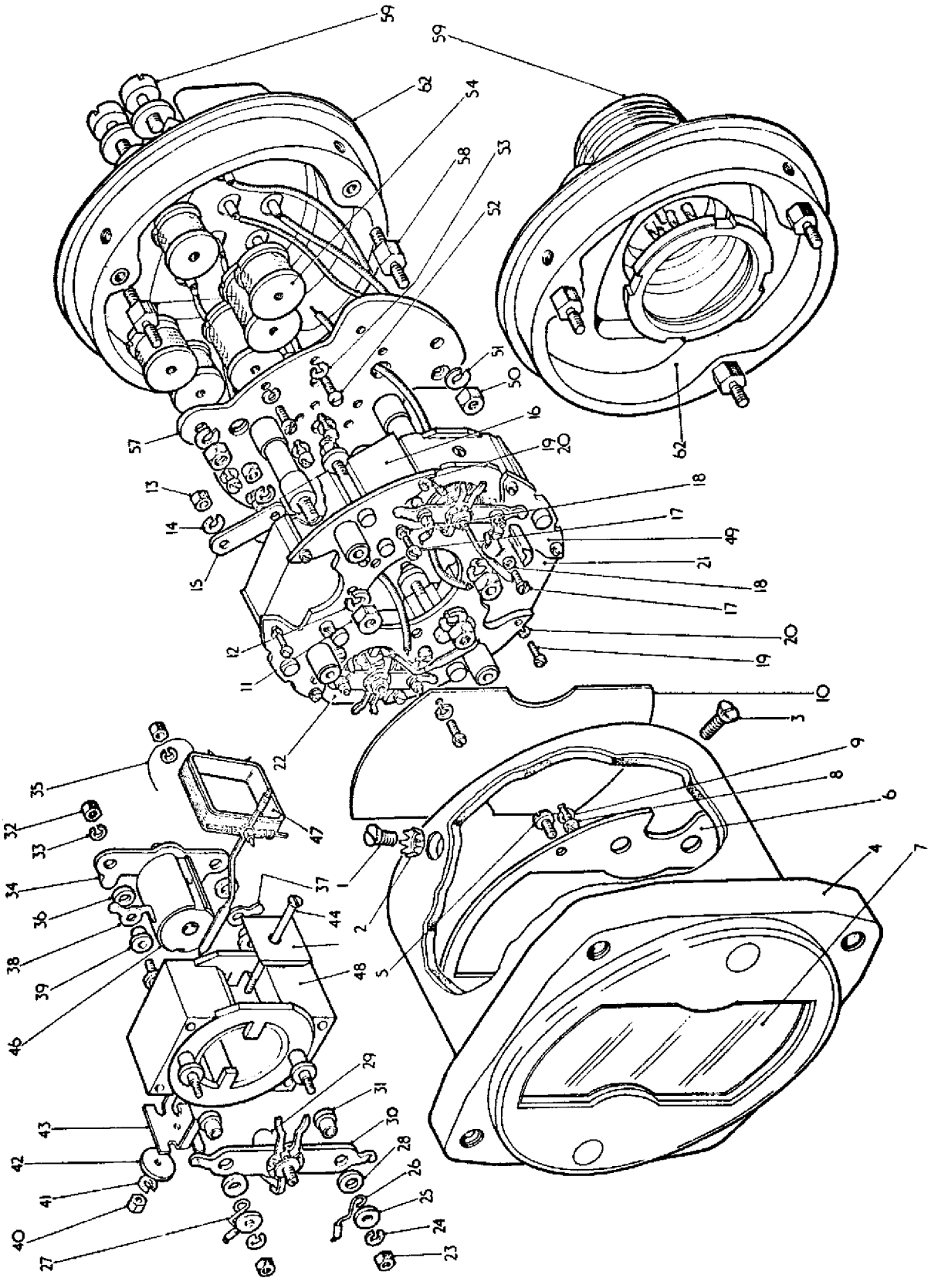


Fig. 1. Exploded view

KEY TO FIG. 1.

1. Sealing screw 6 B.A.
2. Sealing cup
3. Screw 6 B.A.
4. Cover Assembly
5. Screw 8 B.A.
6. Shield (cover)
7. Glass
8. Screw 10 B.A.
9. Washer 10 B.A.
10. Scale
11. Nut 6 B.A.
12. Lockwasher 6 B.A.
13. Nut 8 B.A.
14. Lockwasher 8 B.A.
15. Magnet clamp
16. Magnet
17. Screw 10 B.A.
18. Washer 10 B.A.
19. Screw 12 B.A.
20. Lockwasher 12 B.A.
21. Pole piece
22. Movement complete
23. Nut 12 B.A.
24. Lockwasher 12 B.A.
25. Washer 12 B.A.
26. Pointer stop (R.H.)
27. Pointer stop (L.H.)
28. Insulating washer
29. Top ligament
30. Top bridge
31. Insulating bush
32. Nut 12 B.A.
33. Lockwasher 12 B.A.
34. Bottom bridge
35. Bottom ligament
36. Insulating washer
37. Ligament terminal (R.H.)
38. Ligament terminal (L.H.)
39. Insulating bush
40. Nut 12 B.A.
41. Lockwasher 12 B.A.
42. Washer 12 B.A.
43. Core clamp
44. Screw 12 B.A.
45. Core plate
46. Core
47. Moving element, complete with pointer, pivots, pivot bases, pivot nuts, balance weights and ligament terminals
48. Pole piece
49. Mounting plate
50. Nut 6 B.A.
51. Lockwasher 6 B.A.
52. Screw 10 B.A.
53. Lockwasher 10 B.A.
54. Spools
57. Sub mounting plate
58. Sub mounting pillar
59. Screw and washer assembly
62. Base

2. Disassembly

A. General - Fig.1.

(1) Break out the wax covering sealing screw (1) by means of a sharp pointed instrument; remove the screw together with sealing cup (2).

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

(3) Remove scale securing screws 8 (2 off) and washers 9 (2 off) and slide scale (10) out from under the pointers.

(4) Unsolder the leads from the top bridge (30) and ligament terminals (37) and (38) of each movement, making a note of the connections as an aid to reassembly.

(5) Unscrew and remove 6 B.A. nuts 11 (3 off) together with lockwashers 12 (3 off).

(6) Lift off the movement and mounting plate assembly and place the base on one side until required for disassembly.

(7) Unscrew 8 B.A. nuts 13 (8 off) and remove lockwashers 14 (8 off) and magnet clamps 15 (4 off).

(8) Remove magnets 16 (4 off). The magnets will be held in position by magnetic attraction and may have to be carefully prised free.

NOTE: The magnetic circuit has now been broken and the sensitivity of the instrument impaired. During reassembly the magnets must be remagnetised as described in Chapter 6 (ASSEMBLY) in order to regain the required sensitivity.

(9) Remove screws (17) and (19) and washers (18) and (20) from each movement in turn and separate the movements from the mounting plate (49).

NOTE: It is unlikely that pole piece blanks (21) will be defective in any way and these may be left attached to the mounting plate.

B. Movement Complete (22) - Fig.1.

The following disassembly procedure is applicable to both movements. It is recommended that during disassembly the component parts of each movement are kept separate.

(1) Unsolder ligaments (29) and (35) from ligament terminals (37) and (38) and from top bridge (30).

(2) Unscrew 12 B.A. nuts (23) from top bridge and remove lockwashers (24), washers (25), pointer stops (26) and (27), insulating washers (28), top bridge (30) and insulating bushes (31).

(3) Unscrew 12 B.A. nuts (32) from bottom bridge and remove lockwashers (33), bottom bridge (34), insulating washers (36), ligament terminals (37) and (38), and insulating bushes (39).

(4) Release core (46) by unscrewing 12 B.A. nut (40) and removing lockwasher (41), washer (42), core clamp (43), screw (44) and core plate (45).

(5) Withdraw core (46) and moving element (47) from pole piece (48).

NOTE: The moving element for the left-hand movement is identified by a red paint mark on the frame.

C. Final Disassembly

(1) Unscrew and remove 6 B.A. nuts 50 (3 off) and lockwashers 51 (3 off) from sub-mounting plate (57).

(2) Lift off sub-mounting plate to the full extent permitted by the connecting leads; unsolder the leads and completely remove the plate.

(3) Remove screws (52) and washers (53) and lift off spools (54). A note should be made of the position of the spools on the plate as an aid to reassembly.

(4) Sub-mounting plate pillars 58 (3 off) need not be unscrewed from base (62) unless unserviceable.

3. Cleaning

A. Procedure

(1) Remove all Bostik adhering to threads of screws and nuts and from other dismantled components using Toluene as the cleaning agent.

CAUTION: ENSURE THAT TOLUENE DOES NOT COME INTO CONTACT WITH VARNISHED SURFACES OR INSULATING MATERIALS.

(2) Remove all dust, etc. from interior of cover assembly (4) and base (62) using a camel hair brush. Particles adhering to core (46) and bore of pole piece (48) should also be removed with a camel hair brush.

B. Schedule of Cleaning Materials

(1) Toluene B.P.C.

(2) Camel hair brush.

4. Inspection

A. Metal Components

Examine for:

(1) Corrosion.

(2) Serviceability of threads.

(3) Distortion.

(4) Cracks.

(5) Security of components not dismantled.

B. Moving Element (47)

Examine for:-

(1) Resistance of windings between the top (common) ligament and each of the two bottom ligaments, using an ohmmeter. The resistance values must be within the limits quoted in the addendum at the rear of this manual dealing with the indicator being overhauled.

(2) Loose winding turns.

(3) Bent or damaged pointer.

C. Cover Assembly (4) and Base (62)

Examine for:

(1) Cracked or broken bakelite mouldings.

(2) Loose or broken glass.

D. SPOOLS (54)

Examine for:

(1) Open circuits.

(2) Damaged insulation.

E. Scale (10)

Examine for:

(1) Discolouration and flaking of scale markings.

5. Repair

Other than replacing broken glass, no attempt should be made to repair defective components. These must be discarded and replacement components fitted.

A. Broken Glass - Fig. 1

(1) Remove screws 5 (4 off) from shield (6) and withdraw shield.

(2) Prise the broken pieces of glass out of cover.

(3) Use Toluene to remove all Bostik adhering to cover.

(4) Apply Bostik cement No.1261 evenly around inside lip of cover. 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) Allow to air dry for a minimum of 48 hours.

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

(7) Replace shield (6) and secure with screws 5 (4 off).

6. Assembly

During assembly the threads of all screws and nuts must be coated with B.S.104 (SANGAMO WESTON specification) in order to lock them against the effects of vibration. Jewel screws and all soldered connections must be coated with Red Thermolene Lacquer. These materials may be obtained either from SANGAMO WESTON LTD., ENFIELD, MIDDLESEX, ENGLAND, or from the suppliers listed in paragraph C (Schedule of Materials).

A. Movements - Fig.1.

The following assembly procedure is applicable to both the left and the right-hand movements.

(1) Place core (46) in the frame of moving element (47).

(2) Hold pole piece (48) with the four threaded fixing holes uppermost and the two larger holes on the right-hand side. Carefully lower moving element and core into pole piece aperture with the pointer towards the right-hand side. Locate the core on the pole piece lugs.

NOTE: When mounted in the instrument the cores must have their cut-away surfaces towards the normal scale zero cardinal.

(3) Hold the movement as described in operation (2) and fit core plate (45) to left-hand side of the pole piece with chamfered surfaces facing inward.

(4) Insert screw (44) through the core plate and core and replace core clamp (43), washer (42), lockwasher (41) and 12 B.A. nut (40).

(5) Place insulating bushes 39 (2 off), ligament terminals (37) and (38), and insulating washers 36 (2 off) on the bottom bridge pillars.

(6) Place bottom bridge (34) in position on the pillars and secure with lockwashers 33 (2 off) and 12 B.A. nuts 32 (2 off).

(7) Assemble insulating bushes 31 (2 off) to top bridge pillars and then replace top bridge (30) ensuring the moving element pivots are located in the top and bottom jewelled bearings.

(8) Fit insulating washers 28 (2 off), pointer stops (26) and (27), washers 25 (2 off), lockwashers 24 (2 off) and 12 B.A. nuts 23 (2 off).

CAUTION: THE JEWEL SCREWS MUST BE SLACKENED IF THERE IS ANY TENDENCY FOR THE MOVING ELEMENT TO BIND WHEN NUTS (23) ARE TIGHTENED.

(9) Adjust the jewel screws so that the gaps between the core and moving element are equal at each end.

(10) Solder the ligaments to their respective terminals. Shape of the ligaments after soldering must be as shown in Fig.2. Direction of pointer pull-off for the indicator being overhauled will be found in this illustration also.

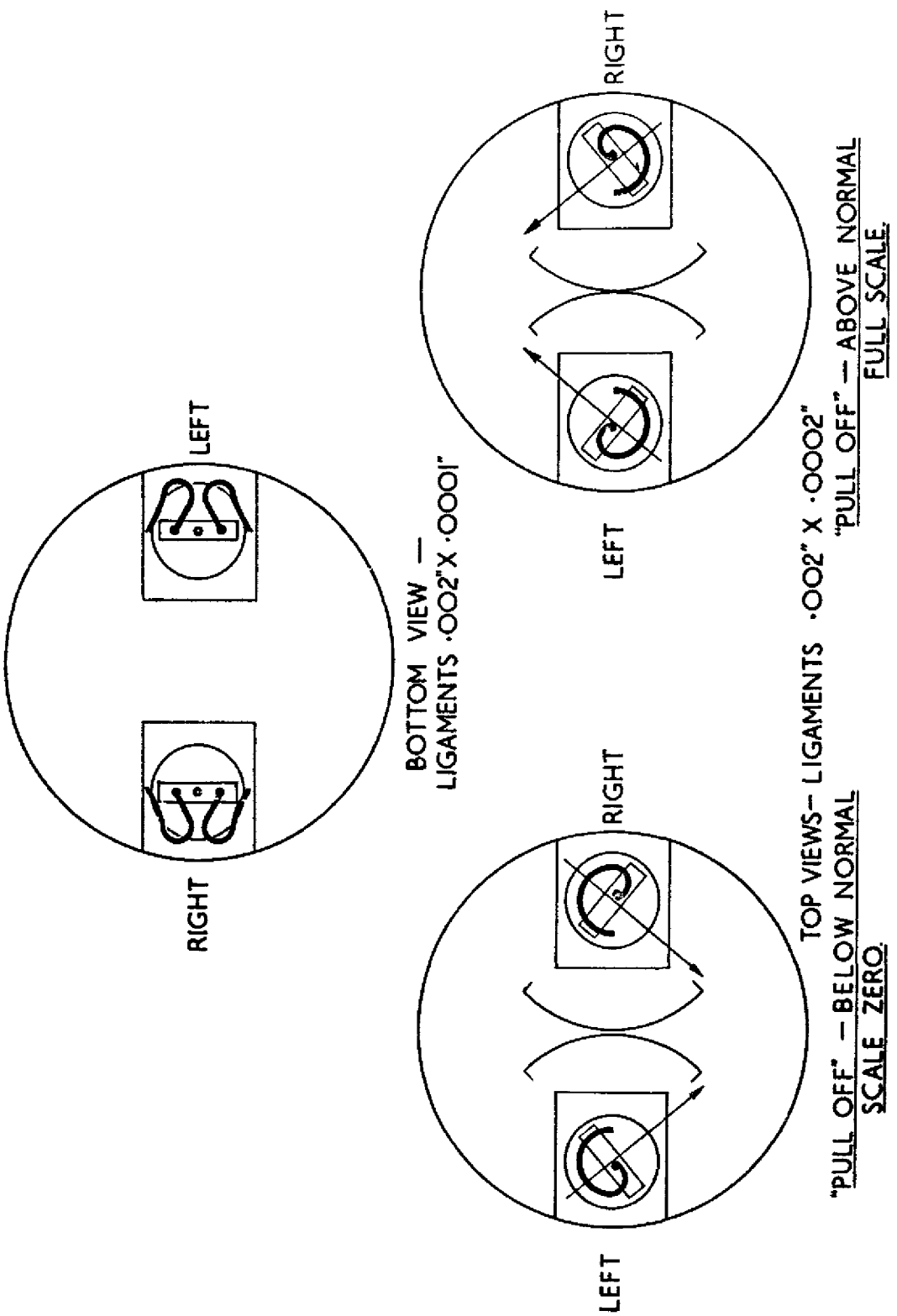


Fig. 2. Ligament details

(11) Examine the gap in which the moving element swings, for dirt or small particles adhering to the surface of the pole piece and core. These must be removed with a shaped piece of wood or celluloid taking care not to damage the ligaments or moving element.

CAUTION: A METAL NEEDLE MUST NOT BE USED FOR THE REMOVAL OF PARTICLES.

(12) Check that the moving element is centred evenly in the movement and then turn the jewel screws clockwise in small increments of approximately 1/10th of a turn until pointer flop just disappears. Pointer flop is the movement of the pointer due to the pivots being able to move laterally in the jewels. Back off one jewel screw by 1/10th to 1/8th of a turn until a slight pointer flop is apparent.

B. General

(1) Position the two assembled movements on mounting plate (49) and secure with screws (17) and (19) and washers (18) and (20). The movement incorporating the moving element marked with red paint must always be on the left-hand side of the mounting plate when viewed from the front.

(2) Replace magnets 16 (4 off) and secure with magnet clamps 15 (4 off) lockwashers 14 (8 off) and 8 B.A. nuts 13 (8 off).

(3) Position a conductor through centre hole of mounting plate and pass a current of 10,000 amperes d.c. through the conductor in order to magnetise the magnets. Polarity of the magnets after this operation must be such as to cause the pointer of each movement to deflect up-scale when top bridge (30) is positive and right-hand ligament terminal (37) is negative. The pointer must deflect down-scale when the negative side of the supply is transferred to the left-hand ligament (38). When checking the polarity of the magnets the current flow through the windings must not exceed 20 milliamperes.

NOTE: Certain versions of the indicator have non-standard polarity. In these instances the polarity will be given in the addendum at the rear of the manual dealing with the particular version of the indicator.

(4) Solder leads to the top bridge and ligament terminals of each movement.

(5) Fit spools (54) to sub-mounting plate (57) and secure with screws (52) and lockwashers (53).

(6) Position the movement and mounting plate assembly on the sub-mounting plate pillars and secure with lockwashers 12 (3 off) and 6 B.A. nuts 11 (3 off).

(7) Solder the other end of the leads to the spools, except for the leads to spools A and B.

(8) Assemble scale (10), screws 8 (2 off) and lockwashers 9 (2 off) and adjust pointer stops so that the pointers can deflect approximately 5 angular degrees beyond each end of the scale markings.

(9) Balance each movement as follows:-

(a) Connect one movement as shown in Fig.5 in the addendum at the rear of this manual dealing with the indicator being overhauled. Decade resistance boxes are connected in place of the unconnected spools as detailed in paragraph (7) above; other decade resistance boxes are used to simulate the resistance of the external pressure transmitter.

(b) Set the spool boxes to the nominal resistance value of the spools and the external resistance boxes to the value at which the indicator is designed to read mid-scale. This latter value may be obtained from the indicator's calibration table which, together with the nominal resistance values of the spools, is given in the addendum at the rear of this manual.

(c) Connect to the 26 volts d.c. supply and, if necessary, adjust the decade resistance boxes to bring the pointer to approximately the mid-scale position.

(d) Hold the indicator with its scale horizontal and pointer tip pointing to the left. Allow the pointer to come to rest and then raise the indicator slowly until its scale is vertical. Note the amount the pointer deflects as the indicator is raised.

(e) Adjust tail balance weight to bring the pointer movement to a minimum, using balance weight wrench No.271157.

(f) Repeat (d) and (e) with pointer tip to the right.

(g) Repeat (d) with pointer tip away from operator and adjust side weights.

(h) Repeat (d) with pointer tip towards operator and adjust side weights.

(i) Repeat (a) to (h) for the other movement.

(10) Adjust the spools as described in Chapter 8 (TESTING). When this operation has been satisfactorily completed, assembly can be continued as follows:-

(11) Solder the leads between the spools and the pins of base (62).

(12) Assemble the base to the movement assembly and secure with lockwashers 51 (3 off) and 6 B.A. nuts 50 (3 off).

(13) Apply a thin coat of B.S.43 to base (62) and cover (4) where cover and base meet.

(14) Carefully fit the cover over the indicator and replace sealing washer (2).

(15) Fit screws (1) and 3 (2 off).

C. Schedule of Materials

(1)	B.S.104	BOSTIK No.772 thinned with acetone to a brushable consistency.
(2)	Paint 165	CANNING'S Red Thermolene Lacquer No.185.
(3)	B.S.43	G.G.11 non-fluid grease, GULF OIL CO.

8. Testing

A. Spool Adjustments

In general some adjustments to certain spools are necessary to determine the required scale length when recalibrating indicators after overhaul. Adjustment procedures for the different applications of the ratiometer are set out below. The appropriate circuit diagrams will be found in the addendum for a particular variant. Reference designation of spools, A, B, etc., is in accordance with standard practice, where these differ in particular variants a note will be added in the addendum covering a particular variant.

(1) Indicators used for the measurement of temperature should be adjusted as follows: (Fig. 5 & 6)

(a) Connect the indicator into the circuit shown in Fig. 5 in the appropriate addendum. A decade resistance box is connected in place of the resistance bulb and two other decade resistance boxes are used to simulate the values of spools A and B.

(b) Adjust resistance box B to the nominal value of spool B and resistance box R1 to the value which simulates mid-scale position of the pointer. The latter value will be found in the indicator's calibration table, which together with the value of spool B is given in the addendum dealing with the indicator being overhauled.

(c) Apply 26 volts d.c. to the circuit and adjust resistance box A to bring the pointer to the mid-scale position.

(d) Adjust R1, first to the value for minimum scale indication, and then to the value for full scale deflection using the value given in the indicator's calibration table; note the deflection of the pointer.

(e) If the pointer deflects over too wide an arc an increase in the value of resistance box A must be made; if too narrow an arc, vice versa. An increase in the value of resistance box A will also cause a clockwise shift of the arc traversed by the pointer. This shift of arc can be remedied by increasing the value of resistance box B.

(f) All further adjustments should be made from the lowest scale mark. Adjust R1 to the value for minimum scale indication and adjust resistance box B to obtain the correct pointer indication.

(g) Recheck full scale indication with R1 set to the value given in the calibration table for full scale deflection. If the indication is incorrect, reset R1 to the value for minimum scale indication before making further adjustments. Adjust resistance boxes A and B to obtain the correct deflection as described in operation (e) above.

(h) When the foregoing adjustments have been satisfactorily completed, adjust the resistance values of spools A and B to coincide with the values of resistance boxes A and B; connect the spools into the indicator circuit.

(2) Indicators used for pressure measurements should be adjusted as follows: (Fig. 5 & 6).

(a) Connect the indicator as shown in Fig.5 in the appropriate addendum. Two decade resistance boxes are connected in place of the external pressure transmitter and two other decade resistance boxes are used to simulate the value of spools A&B.

(b) Adjust resistance box B to the nominal value of spool B and resistance boxes R1 and R2 to the values which simulate the mid-scale position of the pointer. These latter values may be obtained from the indicator's calibration table, which together with the nominal value of spool B, is given in the addendum dealing with the indicator being overhauled.

(c) Apply 26 volts d.c. to the circuit and adjust resistance box A to bring the pointer to the mid-scale position.

(d) Initially, adjust R1 and R2 to the values for minimum scale indication and then to the values of full scale indication; observe the pointer position for each setting.

(e) Adjust the values of resistance boxes A and B to achieve the correct scale angle for the pointer.

NOTE: With resistance box B set to its nominal value (as given in the appropriate addendum) an increase in the value of resistance box A will widen the pointer arc and also shift it counter-clockwise.

With resistance box A set to its nominal value, an increase in the value of resistance box B will also widen the arc traversed by the pointer, but its shift will now be clockwise. If resistance boxes A and B are adjusted to similar values and then increased equally, the angle of arc traversed by the pointer will decrease. Conversely, an equal reduction of the values of resistance boxes A and B will result in an increase of arc angle. With either adjustment the increase or decrease of pointer arc is equal either side of the scale nominal centre position.

(f) Adjust the resistance values of spools A and B to coincide with the values of resistance boxes A and B; connect the spools into the indicator circuit.

(3) Indicators used for position measurements should be adjusted as follows: (Fig. 5 & 6).

(a) Insert two decade resistance boxes, R4, and R5, in place of the unadjusted spools, and decade resistance boxes R1, R2 and R3 in place of the position transmitter.

(b) Set resistance boxes R4 and R5 to the nominal values of spools B and C as given in the relevant addendum. These boxes, when adjusted, must always be of equal value; if this is not possible, a shunt spool R6 will have to be used as described in sub-para. (d).

(c) Set R3 to 25 ohms, R1 and R2 each to 500 ohms, and apply 40 volts d.c. to the circuit input.

(d) If the pointer deflects to the right of mid-scale (towards full scale position when the indicator is viewed from the front) connect a decade resistance R6 across the top moving coil, between the top ligament and the lower of the two bottom ligaments. If deflection is to the left of mid-scale, connect R6 across the bottom moving coil, between the top ligament and the upper of the two bottom ligaments.

(e) Set R1 to 1000 ohms and R2 to zero. Adjust R3 to bring the pointer over the cardinal indicating full scale position.

NOTE: The value of R3 must be kept within zero and 50 ohms for all adjustments required in (c), (d) and (e), otherwise the associated position transmitters will not be adjustable to the indicator.

(f) Set R1 to zero and R2 to 1000 ohms. Adjust shunt resistance box R6 to bring the pointer in alignment with the left hand end-scale cardinal (nominal zero).

(g) Repeat operations (e) and (f) until the pointer is accurately aligned with both end scale cardinals. Adjust the value of the shunt spool (if used) to the final value given by resistance box R6.

(h) Adjust spools B and C to the final values for resistance boxes R4 and R5; the values of these two spools should always be equal.

B. Calibration

After the satisfactory completion of the spool adjustments the calibration of each movement of the indicator must be checked.

(1) Procedure for indicators used for temperature measurements:

(a) Refer to the addendum for a particular variant and connect the indicator into the circuit illustrated in Fig. 5, using a decade resistance box, R1 in the place of the resistance bulb.

(b) Check the deflections of the indicator against the settings of resistance box R1 according to the details given in the calibration table which will be found in the appropriate addendum.

(2) Procedure for indicators used for pressure measurements:

(a) Refer to the addendum for a particular variant and connect the indicator into the circuit illustrated in Fig. 5. using two decade resistance boxes R1 and R2, in place of the external pressure transmitter.

(b) Check the deflections of the indicator against the settings of resistance boxes R1 and R2 according to the details given in the calibration table which will be found in the appropriate addendum.

(3) Procedure for indicators used for position measurements:

(a) Refer to the addendum for a particular variant and connect the indicator into the circuit illustrated in Fig. 5. Three decade resistance boxes, R1, R2 (1000 ohms each) and R3 (50 ohms), and a 90 ohms resistor are used in place of the position transmitter.

(b) Check the deflections of the indicator against the setting of resistance boxes R1, R2 and R3 according to the details given in the calibration table which will be found in the appropriate addendum.

9. Trouble Shooting Fig.3.

A. Causes

(1) The main troubles experienced after overhaul are:

(a) Incorrect pointer indication.

(b) Failure of pointer to leave rest position.

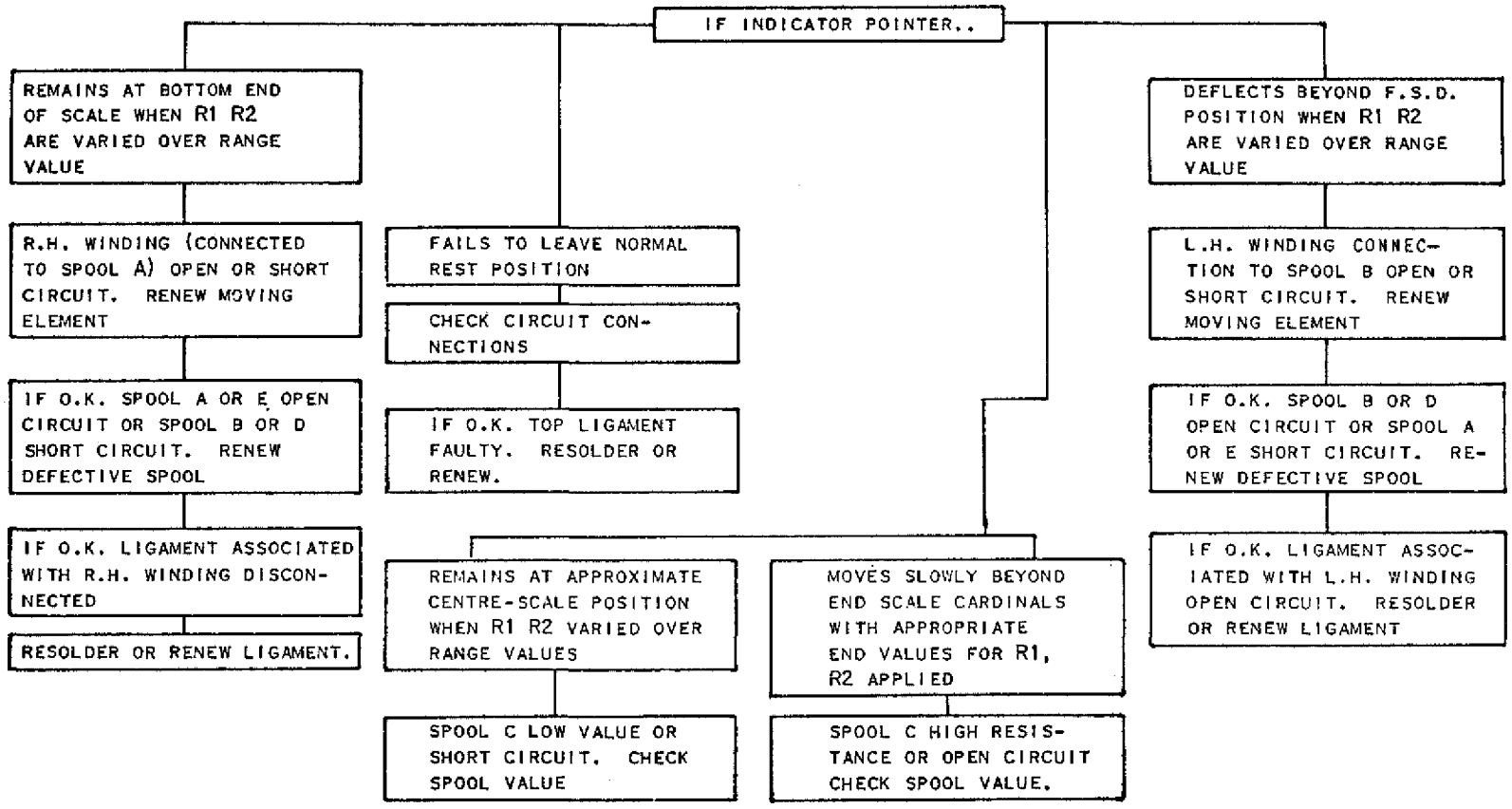
(c) Erratic movement of pointer.

B. Correction

(1) Check faults against trouble shooting chart and adopt procedure suggested.

(2) After correction of fault retest the indicator.

WITH CIRCUIT ENERGISED



NOTE: Check for circuit continuity or open circuit with a galvanometer. Check resistance values with a low voltage ohmmeter. A magnet which is insufficiently raised or an open circuit C spool will result in sluggish pointer deflection due to lack of indicator torque.

CAUTION: CURRENT FOR CHECKING PURPOSES MUST NOT EXCEED 20 MILLI-AMPERES.

Fig.3 Trouble shooting chart

10. Storage

A. Preparation

Prepare the following items for packing:

(1) A strong cardboard box whose inside dimensions are approximately 5½ in. x 4¼ in. x 4½ in. deep.

(2) Corrugated cardboard.

(3) A polythene bag.

(4) Wax paper measuring approximately 12 in. x 9 in. (tropical zones only).

(5) A wooden container (tropical zones only).

B. Packing in Temperate Zones

In temperate zones indicators should be packed as follows:

(1) Place the indicator in a polythene bag and heat seal the opening.

(2) Wrap the corrugated cardboard several times around the indicator.

(3) Place the indicator in a cardboard box.

(4) Attach a label to the box giving the following details:

(a) Identification e.g., S.127.5.000.

(b) Modification state.

(c) Date of overhaul.

(d) Note of component change.

(e) Date of component change.

C. Packing in Tropical Zones

Pack the indicator as described in paragraph B above, with the addition of:

(1) Wax paper, which should be wrapped completely around the cardboard box.

(2) A wooden container, in which the assembly should be encased.

D. Storage Limiting Period

(1) The storage limiting period of the indicator is two years.

(2) Indicators in store for two years must be subjected to the calibration check described in Chapter 8 paragraph B.

11. Special Tools, Fixtures and Equipment

Item	Description	Part No. or Fixture No.
1.	Balance Weight Wrench	271157
2.	D.C. source capable of producing 10,000 amperes	-
3.	Decade resistance boxes	-

12. Illustrated parts list

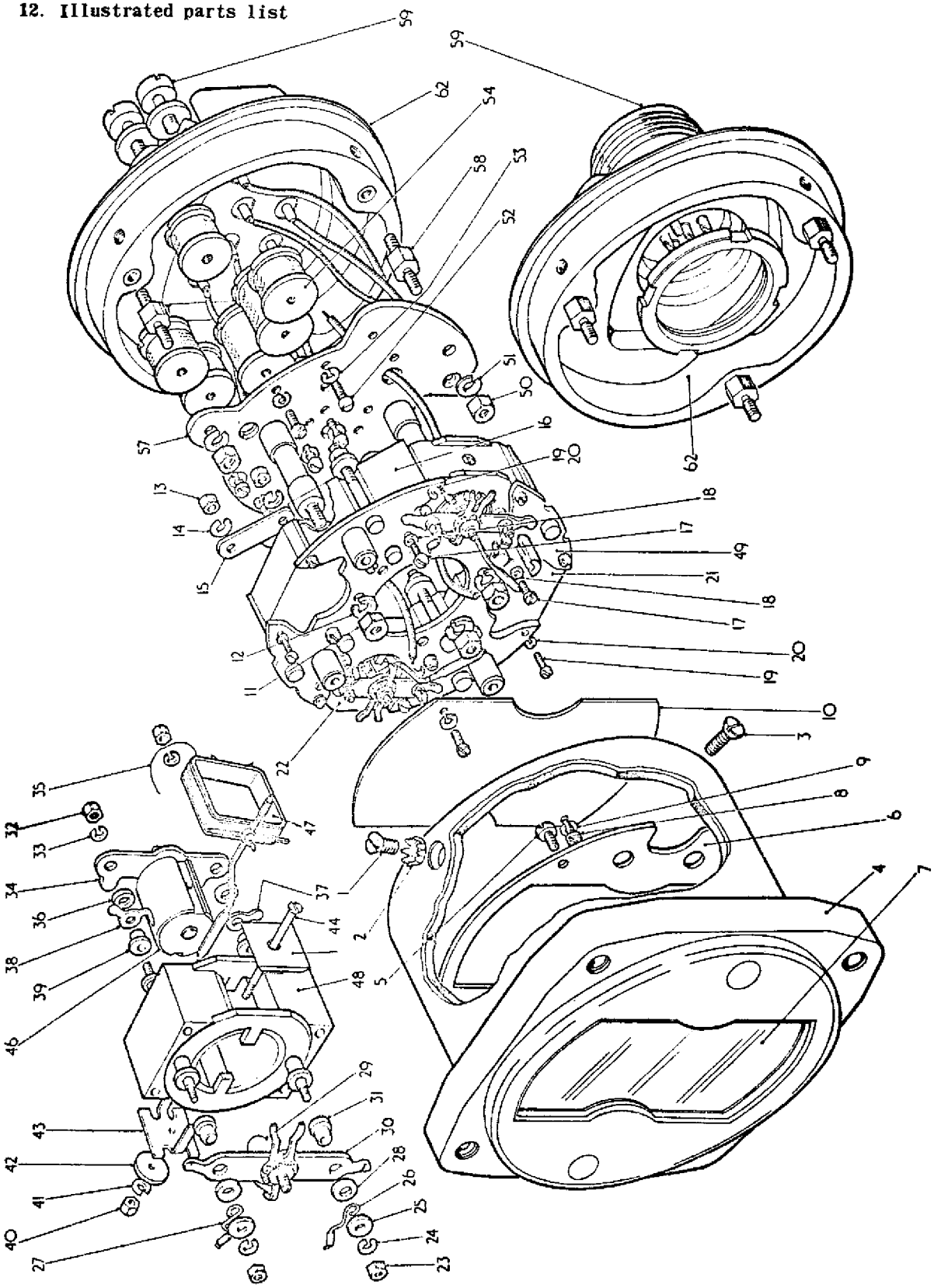


Fig. 4. Dual Ratiometer, Model S.127 Form 5

This List to be used with Variant Parts List for Model S.127 Form 5

COMMON PARTS LIST

Model S.127 Form 5

Fig. and Index No.	Nomenclature	Part No.	Units per assembly
Fig. 4	Model S.127 Form 5.....	See Variant Parts Lists	
1	Screw, Sealing, 6 B.A.....	168862	1
2	Cup, Sealing.....	168013	1
3	Screw, 6 B.A. C'sk. (Cover).....	150146	2
4		See Variant Parts Lists	
5	Screw, 8 B.A. (Shield).....	160756	4
6	Shield (Cover).....	166117	1
7		See Variant Parts Lists	
8	Screw, 10 B.A. (Scale).....	156396	2
9	Washer, 10 B.A.....	159306	2
10	Scale (Blank).....	166119	1
11	Nut, 6 B.A.....	112243	3
12	Lockwasher, 6 B.A.....	156976	3
13	Nut, 8 B.A.....	150168	8
14	Lockwasher, 8 B.A.....	103854	8
15	Clamp, Magnet.....	164713	4
16	Magnet.....	164712	4
17	Screw, 10 B.A. x 1/8" Cheese Head.....	155546	8
18	Washer, 10 B.A.....	157031	8
19	Screw, 12 B.A. x 1/8" Cheese Head.....	150122	8
20	Lockwasher, 12 B.A.....	155830	8
21	Pole Piece, Blank.....	166123	2
22		See Variant Parts Lists	
23	Nut, 12 B.A.....	155125	4
24	Lockwasher, 12 B.A.....	As Index No. 20	4
25	Washer, 12 B.A.....	153364	4
26	Stop, Pointer, R.H.....	164702	2
27	Stop, Pointer, L.H.....	164703	2
28	Washer, Insulating, .035" Thick.....	154399	4
29	Ligament, Top, Phos. Bronze, .0002" x .002" x .75".....	M.P.S.53 Sub.2	2
30	Bridge, Top.....	166125	2
31	Bush, Insulating.....	154397	4
32	Nut, 12 B.A.....	As Index No. 23	4
33	Lockwasher, 12 B.A.....	As Index No. 20	4
34	Bridge, Bottom.....	166126	2
35	Ligament, Bottom, Phos. Bronze, .0001" x .002" x .75".....	M.P.S.53 Sub.1	4
36	Washer, Insulating, .020" Thick.....	154398	4
37	Terminal, Ligament, R.H.....	160607	2
38	Terminal, Ligament, L.H.....	160608	2

COMMON PARTS LIST

Model S.127 Form 5

(Continued)

Fig. and Index No.	Nomenclature	Part No.	Units per assembly
39	Bush, Insulating	As Index No. 31	4
40	Nut, 12 B.A.	As Index No. 23	2
41	Lockwasher, 12 B.A.	As Index No. 20	2
42	Washer, 12 B.A. (Large)	159596	2
43	Clamp, Core	157521	2
44	Screw, 12 B.A. C' sk. (Core)	155584	2
45	Plate, Core	164715	2
46	Core	166129	2
47		See Variant Parts Lists	
48	Pole Piece	168480	2
49	Plate, Mounting	166121	1
50	Nut, 6 B.A.	As Index No. 11	3
51	Lockwasher, 6 B.A.	As Index No. 12	3
52/56		See Variant Parts Lists	
57	Plate, Sub Mounting	166959	1
58	Pillar, Sub Mounting	166966	3
59		See Variant Parts Lists	
60	Rivet, Drive (Not shown)	156575	2
61	Plate, Resistance (Not shown)	162619	1
62		See Variant Parts Lists	

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.

13. Overhaul Period

Indicator overhaul must be performed in accordance with the instructions detailed in this manual on the completion of 10,000 hours flying time.

OVERHAUL MANUAL

ADDENDUM

MODEL S.127.5.165 - DUAL BRAKE SUPPLY PRESSURE INDICATOR

The information contained in the main section of the Overhaul manual 31-09-11 is applicable to this variant. Additional details, applicable to this variant only, are given in this addendum.

REVISION RECORD SHEET

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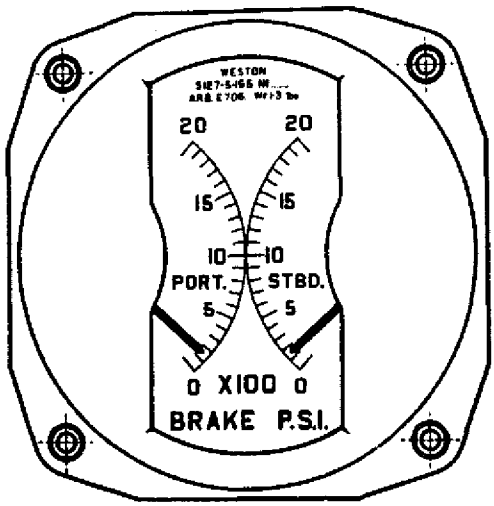
MODEL S. 127. 5. 165 - DUAL BRAKE SUPPLY PRESSURE INDICATOR



Description

Model S.127.5.165 is a dual ratiometer which operates from a 24V d.c. supply. It is intended for use in conjunction with a pressure transmitter to indicate brake supply pressure over the range 0-2000 p.s.i. The indicator scale presentation is given in the identification drawing, the scale markings being finished white on a black background for photographic purposes. The two lance type pointers are also finished white.

Pull-off ligaments fitted to the indicator carry the pointers beyond the full scale cardinal when the indicator is not energised. Connections to the indicator are by means of six 4 B.A. threaded terminals in a moulded terminal block at the rear of the indicator.

Data

The values of components used in the circuit of either left or right hand indicators are as follows:

Resistance of moving coil	70-110 ohms
Resistance of spools	
A	600 ohms ±5% -0 unadjusted
B	600 ohms +5% -0 unadjusted
C	500 ohms ±1%
D	3100 ohms ±1%
E	3100 ohms ±1%
Resistance of ligaments	13 ohms nominal

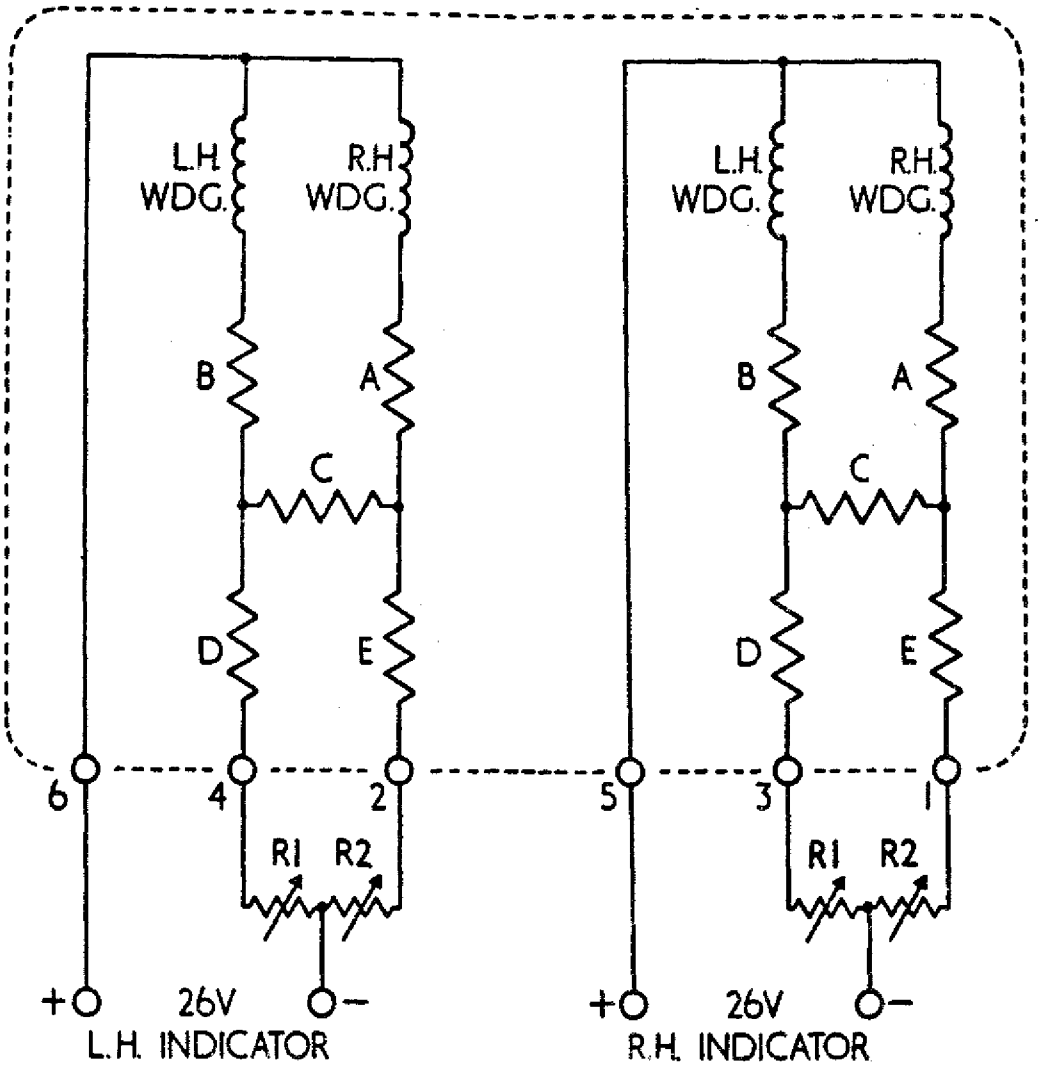


Fig.5. Test circuit.

Testing

The indicator should be connected into the circuit given in Fig.5 and checked in accordance with the details given in paragraph 9 (Testing) of the Overhaul manual. Decade resistance boxes are used to simulate the pressure transmitter changes.

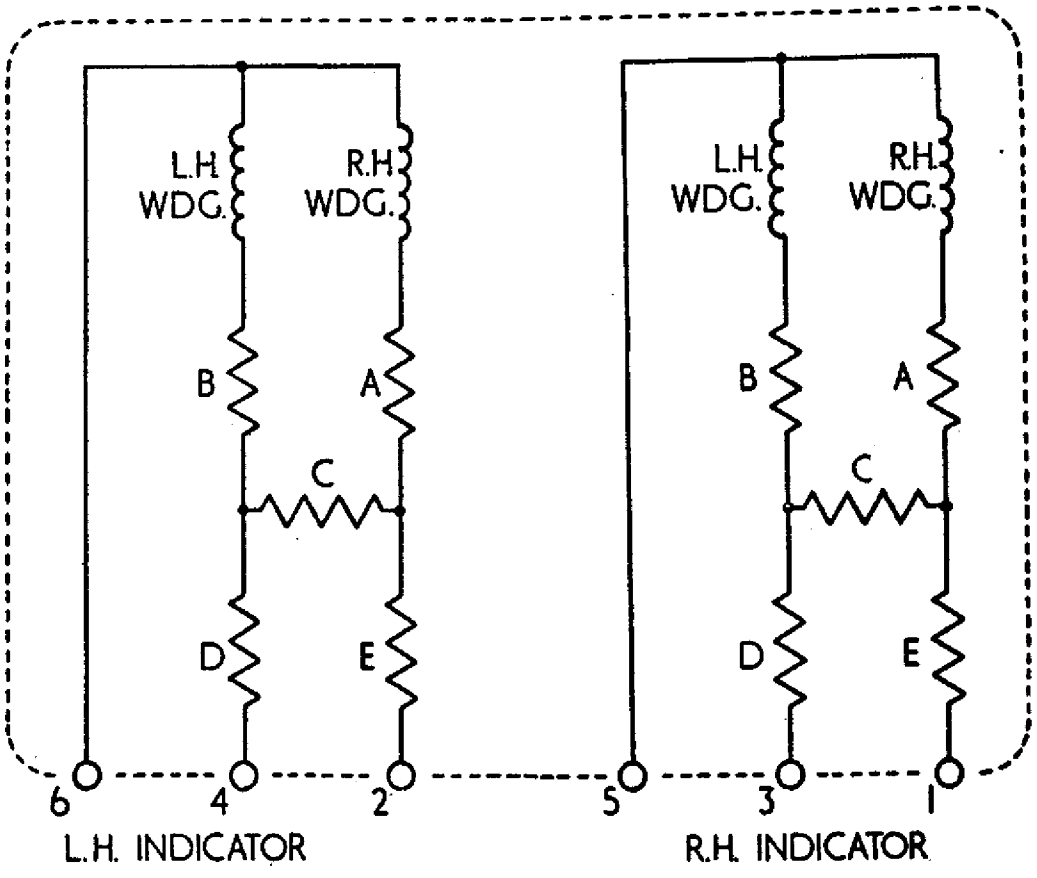


Fig.6. Internal wiring diagram.

Calibration

Refer to the test circuit given in Fig.5 and check the calibration of the indicator, as described in paragraph 8B of the Overhaul manual.

The calibration must be checked with the d.c. supply set to 26 volts and the two decade resistance boxes R1 and R2, connected in series, firstly across terminals 2 and 4 and then across terminals 1 and 3. The values of R1 and R2 and the subsequent indicator deflections must be in accordance with the figures given in the following table:

Indication (p.s.i.)	R1 (ohms)	R2 (ohms)
0	490	2760
250	785	2465
500	1075	2175
750	1360	1890
1000	1645	1605
1250	1930	1320
1500	2210	1040
1750	2485	765
2000	2760	490

Accuracy

The indicator accuracy must be within the limits ±2% of full scale deflection.

This list to be used with Common Parts List for Model S.127 Form 5

VARIANT PARTS LIST

MODEL S.127.5.165

Fig. and Ref. No.	Description	Part No.	No. Off
Fig.4	Dual Brake Supply Press 0-2000 p.s.i.	S.127.5.165	
4	Cover Assembly	166953	1
7	Glass	166116	1
22	Movement, complete	22/S.127.5.165	2
47	Element, Moving c/w Pointer, Pivots, Pivot Bases, Pivot Nuts, Balance Weights & Ligament Terminals (Left Hand with Red Spot, Right Hand without Red Spot)	47/S.127.5.165	2
52	Screw, 10 B.A. x 3/16 in.	150330	10
53	Lockwasher, 10 B.A.	153367	10
54	Spools	54/A.S.127.5.165	2
		54/B.S.127.5.165	2
		54/C.S.127.5.165	2
		54/D.S.127.5.165	2
		54/E.S.127.5.165	2
59	Screw and Washer Assembly	157703	6
62	Base, (6 Terminals)	166935	1

Sangamo Weston Code appears on front of Scale


SANGAMO
WESTON

OVERHAUL MANUAL

ADDENDUM

MODEL S. 127. 5. 166 - DUAL TEMPERATURE INDICATOR $-10^{o}C/+120^{o}C$.

The information contained in the main section of the Overhaul manual 31-09-11 is applicable to this variant. Additional details, applicable to this variant only, are given in this addendum.

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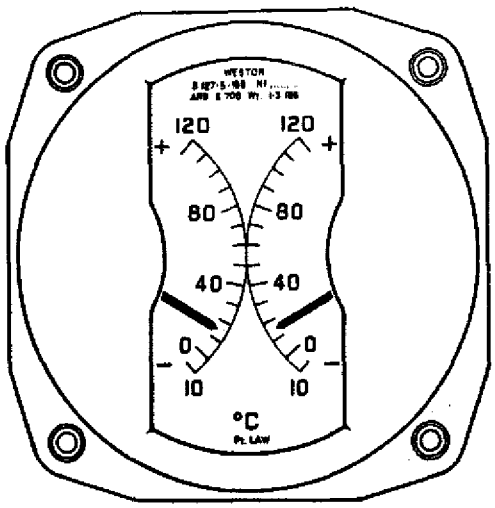
MODEL S.127.5.166 - DUAL TEMPERATURE INDICATOR $-10^{o}C/+120^{o}C$.



Scale presentation

Description

Model S.127.5.166 is a dual ratiometer which operates from a 24V d.c. supply. It is intended for use with a S.110G resistance bulb to indicate temperature over the range $-10^{o}C$. to $+120^{o}C$.

The indicator scale presentation is given in the identification drawing, the scale markings being finished white on a black background for photographic purposes. The two lance type pointers are also finished white. Pull-off ligaments fitted to the indicator carry the pointers beyond the $-10^{o}C$. cardinals when the indicator is not energised. Connections to the indicator are by means of six 4 B.A. threaded terminals in a moulded terminal block at the rear of the indicator.

Data

The values of components used in the circuits of either left or right hand indicators are as follows:

Resistance of moving coil	19-25 ohms
Resistance of spools	
A	70 ohms + 5% -0 unadjusted
B	230 ohms + 5% -0 unadjusted
C	1200 ohms ± 1%
Resistance of ligaments	13 ohms nominal

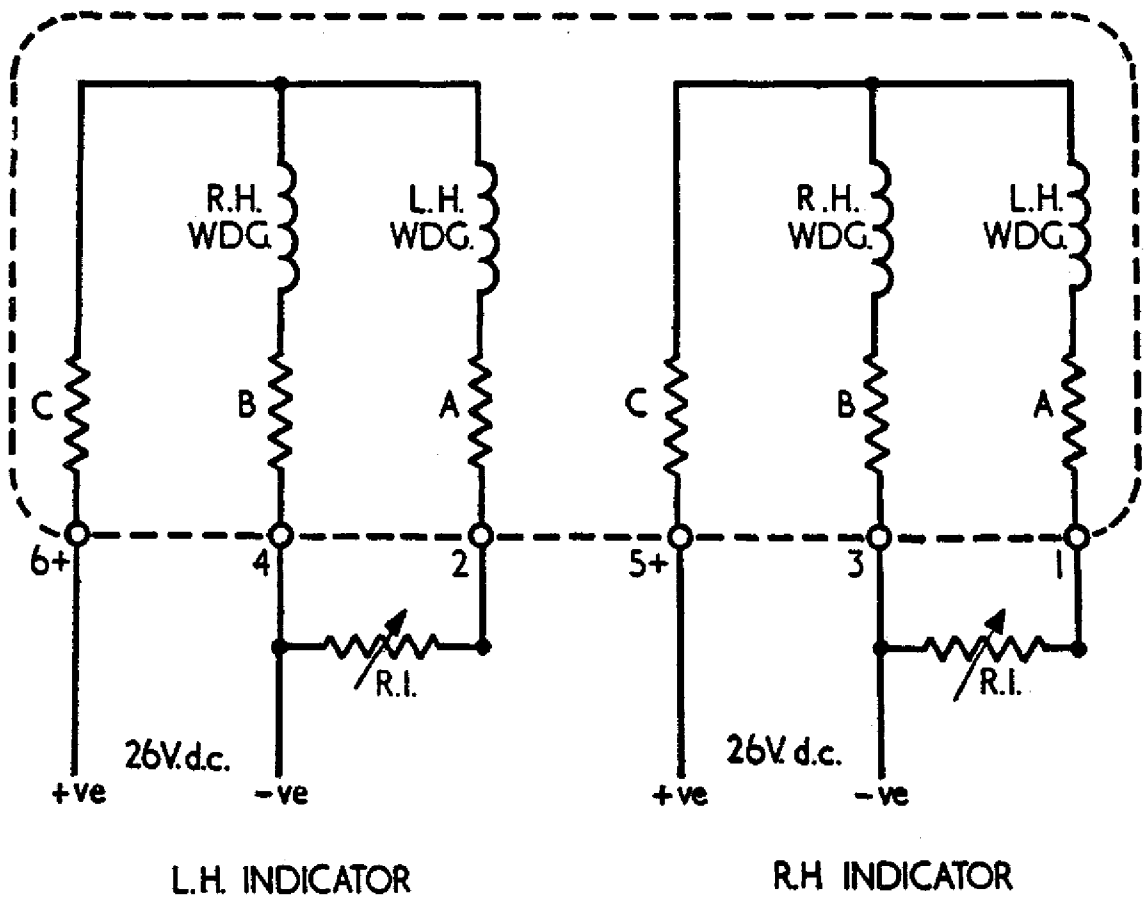


Fig.5. Test circuit.

Testing

The indicator should be connected into the circuit given in Fig.5 and checked in accordance with the details given in paragraph 8 (Testing) of the Overhaul manual. A decade resistance box is used to simulate the variations in value of the resistance bulb.

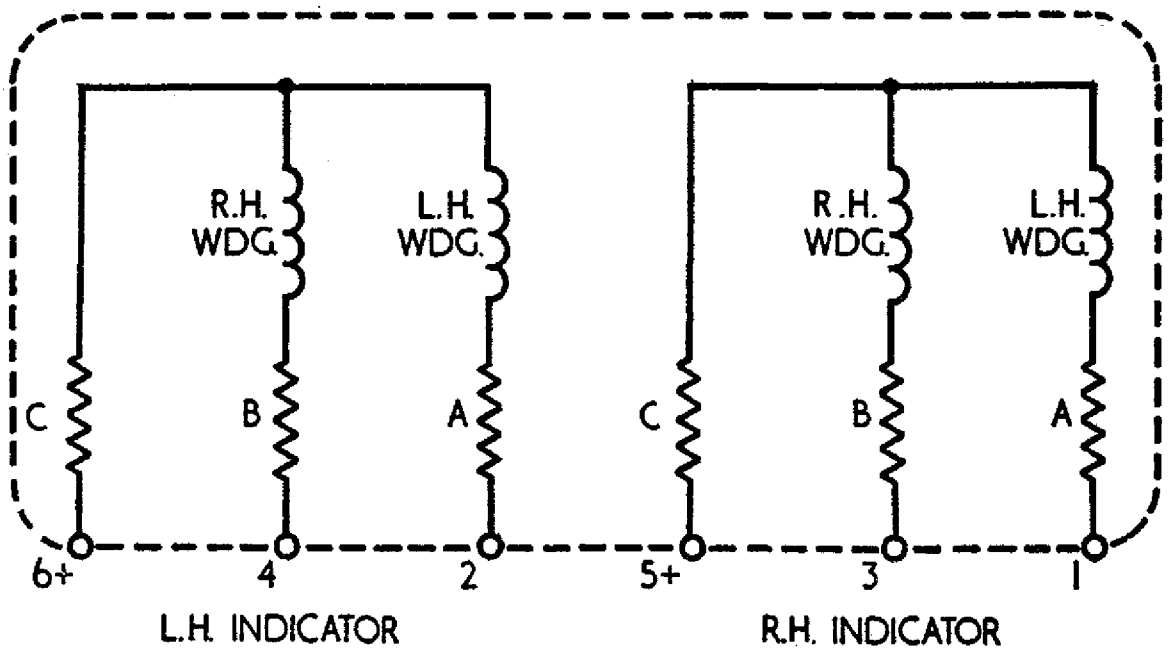


Fig.6. Internal wiring diagram.

Calibration

Refer to the test circuit given in Fig.5 and check the calibration of the indicator as described in paragraph 8B of the Overhaul manual.

The calibration must be checked with the d.c. supply set to 26 volts and the decade resistance box R1, connected first across terminals 2 and 4, and then across terminals 1 and 3. The value of R1 and the subsequent indicator deflection must be in accordance with the figures given in following table.

Indicator °C.	R1 (ohms)
-10	125.2
0	130.4
10	135.5
20	140.7
40	150.9
60	161.0
80	171.1
100	181.1
110	186.1
120	191.1

Accuracy

The indicator accuracy must be within the limits ± 2% of full scale deflection.

This list to be used with Common Parts List for Model S.127 Form 5

VARIANT PARTS LIST

S.127.5.166

Fig. and Ref. No.	Description	Part No.	No. Off
Fig.4	Dual Temp. Ind. $-10^{o}C/+120^{o}C$.	S.127.5.166	
4	Cover, Assembly	166953	1
7	Glass	116116	1
22	Movement, Complete	22/S.127.5.166	2
47	Element, Moving c/w Pointer, Pivots, Pivot Bases, Pivot Nuts, Balance Weights and Ligament Terminals (Left Hand with Red Spot, Right Hand without Red Spot)	47/S.127.5.166	2
52	Screw, 10 B.A., x 3/16 in. (Spool)	150330	6
53	Lockwasher, 10 B.A. (Spool)	153367	6
54	Spools, L.H.	54A/S.127.5.166	1
		54B/S.127.5.166	1
		54C/S.127.5.166	1
54	Spools, R.H.	54A/S.127.5.166	1
		54B/S.127.5.166	1
		54C/S.127.5.166	1
59	Screw and Washer Assembly	157703	6
62	Base (6 Terminals)	166935	1

Sangamo Weston Code appears on front of Scale

OVERHAUL MANUAL

ADDENDUM

MODEL S.127.5.172 - DUAL PRESSURE INDICATOR 1200-4000 p.s.i.

The information contained in the main section of the Overhaul manual 31-09-11 is applicable to this variant. Additional details, applicable to this variant only are given in this addendum.

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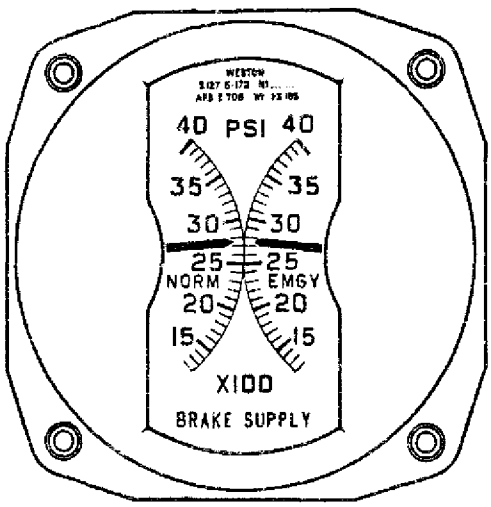
MODEL S.127.5.172 - DUAL PRESSURE INDICATOR 1200-4000 p.s.i.



Scale presentation

Description

Model S.127.5.172 is a dual ratiometer which operates from a 24V d.c. supply. It is intended for use in conjunction with a pressure transmitter to indicate brake supply pressure over the range 1200-4000 p.s.i.

The indicator scale presentation is given in the identification drawing, the scale markings being finished white on a black background for photographic purposes. The two lance type pointers are also finished white. Pull off ligaments fitted to the indicator carry the pointers beyond the full scale cardinal when the indicator is not energised. Connections to the indicator are by means of six 4 B.A. threaded terminals in a moulded terminal block at the rear of the indicator.

Data

Resistance of each moving coil	70-110 ohms
Resistance of spools	
A	450 ohms +5% -0 unadjusted
B	450 ohms +5% -0 unadjusted
C	600 ohms ±1%
D	2580 ohms ±1%
E	3300 ohms ±1%
F	450 ohms +5% -0 unadjusted
G	450 ohms +5% -0 unadjusted
H	600 ohms ±1%
J	2580 ohms ±1%
K	3300 ohms ±1%
Resistance of ligaments	13 ohms nominal

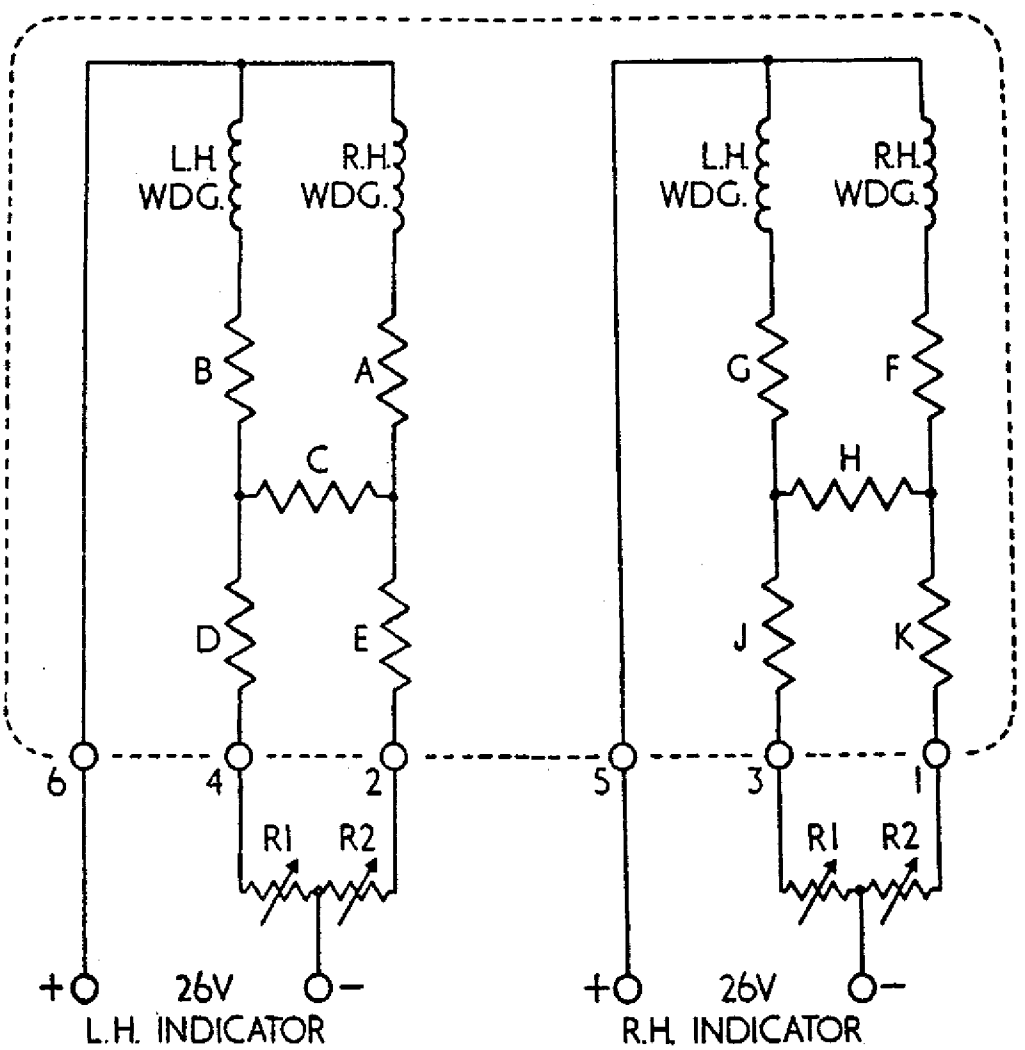


Fig.5. Test circuit.

Testing

The indicator should be connected into the circuit given in Fig.5. and checked in accordance with the details given in paragraph 8 (Testing) of the Overhaul manual. Decade resistance boxes are used to simulate the pressure transmitter changes.

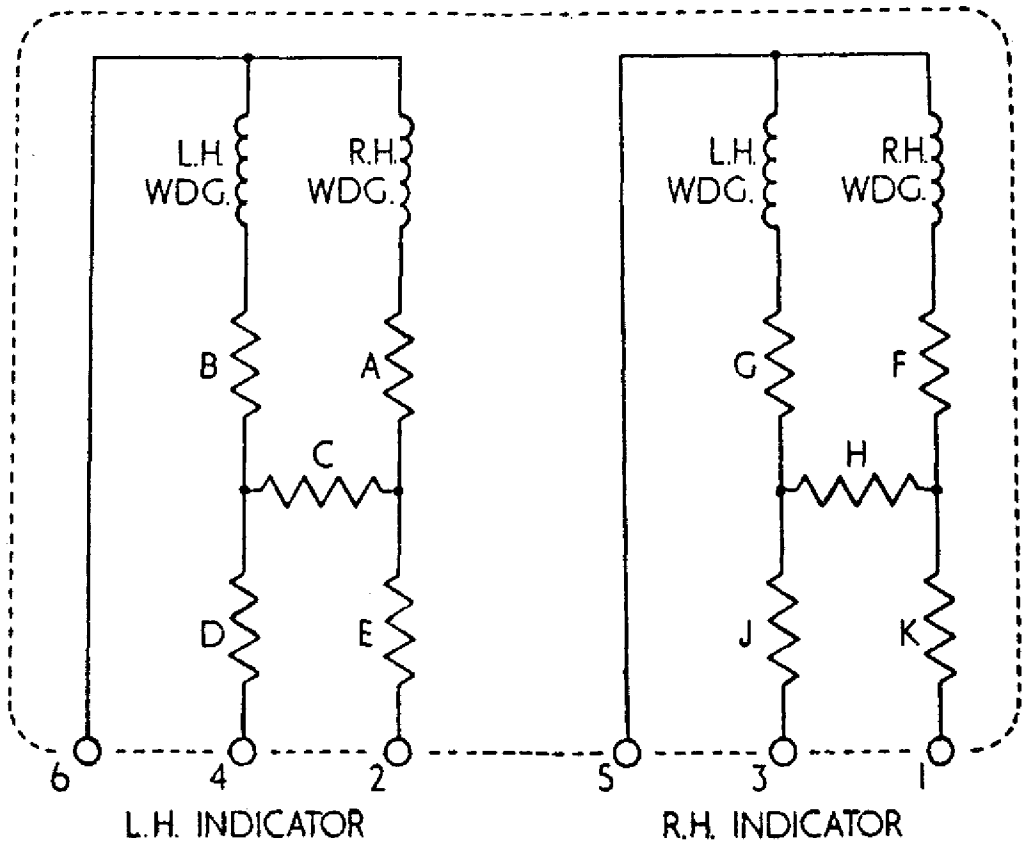


Fig.6. Internal wiring diagram

Calibration

Refer to the test circuit given in Fig.5 and check the calibration of the indicator as described in paragraph 8B of the Overhaul manual.

The calibration must be checked with the d.c. supply set to 26 volts and the two decade resistance boxes, R1 and R2, connected in series, first across terminals 2 and 4 and then across terminals 1 and 3. The values of R1 and R2 and the subsequent indicator deflections must be in accordance with the figures given in the following table.

Indicator (p.s.i.)	R1 (ohms)	R2 (ohms)
1200	1190	2060
1500	1360	1890
2000	1645	1605
2500	1930	1320
3000	2210	1040
3500	2485	765
4000	2760	490

Accuracy

The indicator accuracy must be within the limits ±2% of full scale deflection.

This list to be used with Common Parts List for Model S.127 Form 5

VARIANT PARTS LIST

S.127.5.172

Fig. and Ref. No.	Description	Part No.	No. Off
Fig.4	Dual Brake Supply Press Ind. 1200/4000 p.s.i.	S.172.5.172	
4	Cover, Assembly	166953	1
7	Glass	116116	1
22	Movement, complete	22/S.127.5.172	2
47	Element, Moving c/w Pointer, Pivots, Pivot Bases, Pivot Nuts, Balance Weights and Ligament Terminal (Left Hand with Red Spot. Right Hand without Red Spot)	47/S.127.5.172	2
52	Screw, 10 B.A. x 3/16 in. (Spool)	150330	10
53	Lockwasher, 10 B.A. (Spool)	153367	10
54	Spool, L.H.	54A/S.127.5.172	1
		54B/S.127.5.172	1
		54C/S.127.5.172	1
		54D/S.127.5.172	1
		54E/S.127.5.172	1
54	Spool, R.H.	54F/S.127.5.172	1
		54G/S.127.5.172	1
		54H/S.127.5.172	1
		54J/S.127.5.172	1
		54K/S.127.5.172	1
59	Screw & Washer Assembly	157703	6
62	Base (6 Terminal)	166935	1

Sangamo Weston Code appears on front of Scale

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