OVERHAUL MANUAL

MODEL S.63 FORM 4 - INDICATOR, RATIOMETER

SANGAMO WESTON LIMITED

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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. August 1970

A.R.B. Design Approval No. AD/1147/47

SANGAMO WESTON LTD.

MODEL S.63 FORM 4 - INDICATOR, RATIOMETER

OVERHAUL MANUAL 31-09-61

LETTER OF TRANSMITTAL

FOR

REVISION No. 3

Issued February 1962

by

Sangamo Weston Ltd., Enfield, Middlesex, England

ACTION	REASON
1. Remove and destroy pages 1/2 and 27. Substitute pages 1/2 and 27. incorporating Revision 3.	Telephone number changed on Page 1. New signature on Page 2. **Overhaul Period** changed on Page 27.
2. Record the incorporation of this revision on the Revision Record Sheet on Page 3.	
3. Retain this Letter of Transmittal.	This certifies compliance with Section A, Chapter A6-2, of British Civil Airworthiness Requirements.

This revision complies with British Civil Airworthiness Requirements, Section A, Chapter A6-2 The technical accuracy of this revision has been verified and certified accurate.

Signed: 

Date: 28th August 1970

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SANGAMO WESTON LTD.

MODEL S.63 FORM 4 - INDICATOR, RATIOMETER

OVERHAUL MANUAL 31-09-61

LETTER OF TRANSMITTAL

FOR

REVISION No. 4

Issued September 1973
by
Sangamo Weston Ltd., Enfield, Middlesex, England

	ACTION	**REASON**
1.	Remove and destroy existing Pages 7/8, 9/10, 11/12, 15/16, 29/30. Substitute pages 7/8, 9/10, 11/12, 15/16, 29/30 incorporating Revision 4.	Reference to model J deleted on pages 7, 11, 16 and 30 Drawing revised on pages 9 and 29.
2.	Record the incorporation of this revision on the Revision Record Sheet on Page 3.	
3.	Retain this Letter of Transmittal.	This certifies compliance with Section A, Chapter A6-2, of British Civil Airworthiness Requirements.

This revision complies with British Civil Airworthiness Requirements, Section A, Chapter A6-2. The technical accuracy of this revision has been verified and is certified accurate.

Signed: 

Date: 7th September 1973

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MODEL S.63 FORM 4

REVISION RECORD SHEET

Revision No.	Date of Issue	Incorporated by:	Date	Remarks
1	Dec..1962	Sangamo Weston Ltd.	Dec. 1962	Revision Page 33, para. 10A(1)(e) and 10B(3).
2	Aug. 1965	Sangamo Weston Ltd.	Aug. 1965	Revision Pages 1 and 2, and Paras. 5-11, Figs. 1, 2, 4-10 and Parts List.
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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.63 Form 4
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.63 FORM 4 - INDICATOR RATIOMETER

TABLE OF CONTENTS

ILLUSTRATIONS

MODEL S.63 FORM 4 - INDICATOR RATIOMETER

The overhaul procedure for Model S.63 Form 4 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 the main part of the manual applicable to the variant.

1. Description and operation

A. General

Model S.63 Form 4 is a ratiometer type indicator fitted in a small S.A.E. case of moulded Bakelite, connection to the aircraft wiring being via 4 B.A. thread or 6-32 U.N.C. thread terminals with captive washers fitted in a moulded terminal block on the sub-base.

B. Details (Refer to Fig.1)

The movement complete (26) consists of the moving element which comprises two coils of fine copper wire wound on axially connected but separate aluminium frames,one end of each coil being joined together in a common connection; the two coils thus form a single unit, pivoted in adjustable, jewelled bearings which are inset into the top and bottom bridges. The moving element is free to rotate in the gap between two cores and a pole piece. Three fine ligaments, used for connecting the coils in circuit, are anchored to the pivot bases, two at the bottom and the third at the top, this connection is generally the common one for the two coils. In indicators not incorporating a pointer return unit the third (top) ligament is replaced by a control spring. The upper pivot base also carries a pointer and balance arms. A 'T' shaped spacer is assembled in the gap of the pole piece with the stem of the 'T' fitting into the slot machined in the cores. A block permanent magnet of Alcomax rests on the flat top surface of the spacer, a yoke being assembled over and enclosing the magnet and pole piece. The components are rigidly held together by the top plate. The movement is positioned on 3 spacers (27) which are located on pillars projecting from the base (35). An appropriately figured scale (9) is fitted to a positioning groove on a supporting pillar integral with the top mounting plate and secured with two screws (7). The small inner scale (12) carries the pointer return unit (15) when fitted and is secured to the base of the pole piece with a bracket (19). The pointer return unit consists of an electromagnet having two coils, either in series or in parallel, wound over iron cores and connected in the positive lead of the indicator. A small spring tensioned ferrous vane is pivoted between the poles of the electromagnet; attached to the vane is an arm carrying a toothed segment. The segment is in engagement with a pinion to which a curved wiper arm is fixed. Resistance spools (34) are assembled in a recess in the base (35), a sub-base (37) carrying the terminal screws (36) is assembled to the base and secured with a single countersunk screw (29) which is sealed on completion of assembly.

C. Operation

The indicator shows a ratio between currents flowing through two moving coils pivoted in permanent but unequal magnetic fields. When used as a temperature indicator the current passing through both coils is varied, due to temperature changes in the vicinity of the transducer affecting the resistance of the element, which may be nickel or platinum. The indication is proportional to the ratio of currents in the two coils and may be read as degrees of temperature on a suitably calibrated scale. For calibration purposes the indicator cover is marked 'Pt.Law' or 'Ni.Law', in order to differentiate the resistive component of the transducer with which the indicator is to be used. When used as a pressure or position indicator the current in both coils is varied in opposite senses, an increase in one coil being accompanied by a decrease in the second coil.

The function of the pointer return unit (Fig. 2) incorporated in some variants (generally temperature indicators) is to return the indicator pointer off-scale and lock it in that position when the circuit is unenergised. Parallel or series connected coils in the positive supply-lead energise a small electromagnet when the indicator circuit is in operation, this actuates an arm which causes a toothed segment to engage a pinion to which is fixed a wiper arm, the wiper arm is moved away from the pointer, releasing it and allowing it to move freely.

KEY TO FIG. 1

1. Sealing screw
2. Sealing cup
3. Cover screw
4. Case
5. Bezel ring
6. Glass
7. Scale retaining screw
8. Lockwasher
9. Scale
10. Inner scale retaining screw
11. Washer
12. Inner scale
13. Bracket retaining screw
14. Lockwasher
15. Pointer return unit
16. Nut
17. Washer
18. Spacer
19. Bracket
20. Nut
20A Lockwasher
21. Screw 6 B.A.
22. Lockwasher
23. Terminal tag
24. R.H. pointer stop
25. L.H. pointer stop
26. Movement complete
27. Spacer
28. Bottom mounting plate
29. Sub-base retaining screw
30. Resistor retaining screw
31. Lockwasher
32. Terminal tag
33. Resistor
34. Spool
34A Spool retaining screw
35. Base
36. Terminal screw and washer
37. Sub-base

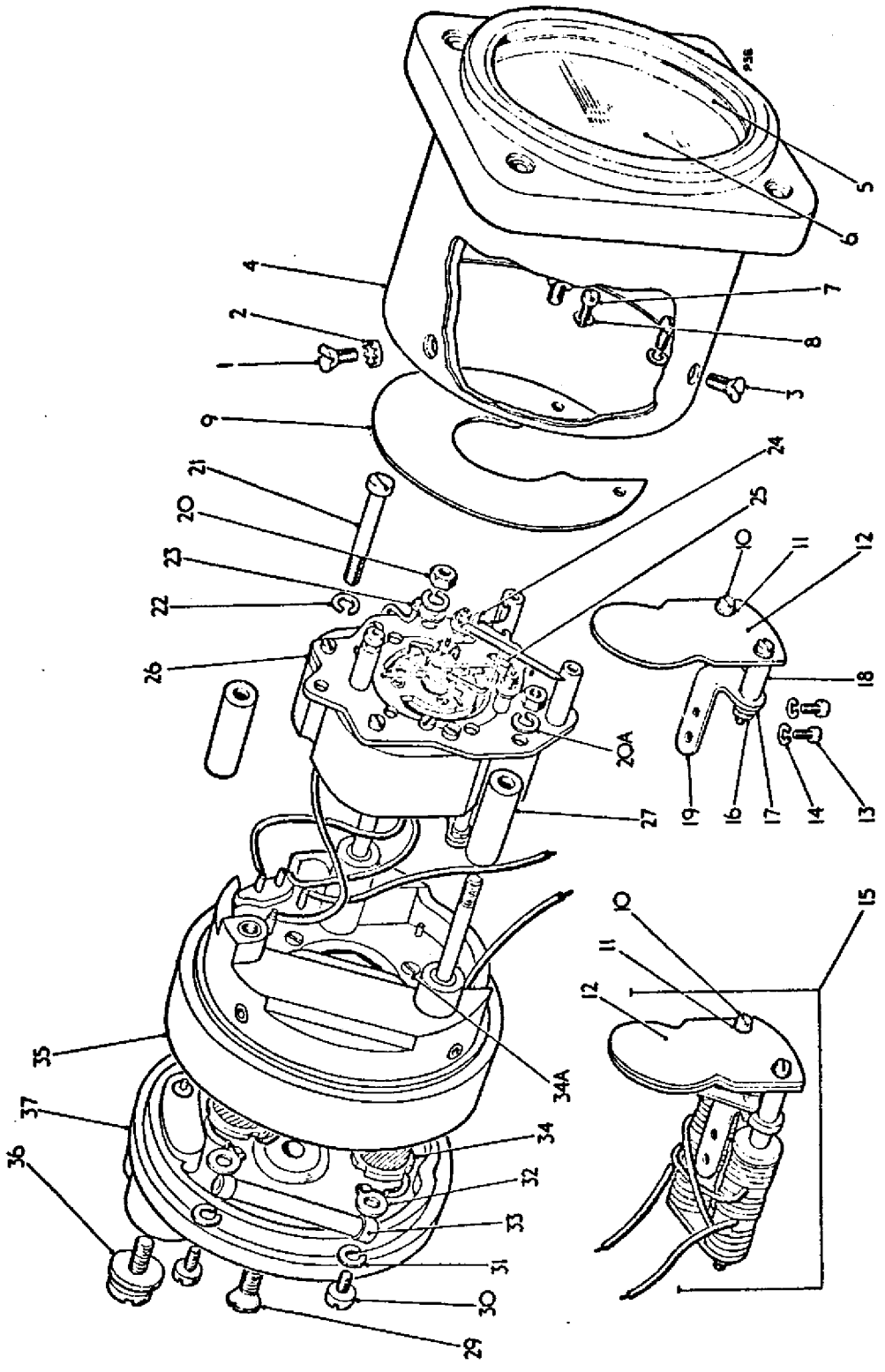

Fig. 1 Exploded view of indicator S.63 Form 4

2. Disassembly

A. Checks before disassembly

Check whether the indicator has been returned with a history sheet which may indicate any components requiring particular attention.

B. Procedure (Refer to Fig.1)

(1) Remove sealing screw (1), cover seal (2), screw 3 (2-off) and withdraw cover (4).

(2) Remove scale securing screws (7) and lockwashers 8 (2 off-each item) and lift off outer scale (9). Care must be exercised when withdrawing the outer scale to prevent damage to the pointer.

(3)

(a) Indicators NOT incorporating pointer return unit (Fig.2).

Unscrew scale retaining screws 10 (2-off), remove screws together with washers (11), nuts (16), lockwashers (17) and spacers 18 (2 off-each item). Loosen and remove screws (13), lockwashers 14 (2 off-each item) and the bracket (19).

(b) Indicators INCORPORATING pointer return unit (Fig.2)

Unscrew and remove bracket retaining screws (13) and lockwashers 14 (2 off-each item), lift off the unit (15) as a complete assembly, the unit will remain attached by its leads; care should be taken that the leads are not subjected to any strain whilst proceeding with the disassembly.

(4) Remove retaining nuts 20 (2-off) and their associated washers, and pull back terminal tag (23). If necessary to renew pointer stops, (24) (25), unscrew associated nuts and washers.

(5) Unscrew and remove retaining screw and washer (21) (22).

(6) Withdraw the movement complete (26). Unsolder leads connected to the bottom end ligament terminals. A record should be made indicating which terminal each lead is connected to, as a reference when re-assembling. If connections are reversed false indications will be given when the indicator is connected in circuit.

NOTE: Indicator movements cannot be disaasembled further, these have been assembled special techniques and the movement complete (26) must be renewed or replaced as an assembly.

CAUTION: THE SOLDERING IRON MUST NOT BE BROUGHT CLOSE TO THE MOVEMENT OR LIGAMENTS. PERMANENT DAMAGE TO THESE ITEMS MAY RESULT FROM OVER-HEATING.

(7) Remove spacers 27 (3-off) and withdraw bottom mounting plate (28) (Mod.J movement).

(8) Undo sub-base retaining screw (29) to separate base (35) from the sub-base (37), this will expose the resistor (33), when fitted, and the spools (34). To remove resistor (33) unscrew fixing screws 30 (2-off) and remove lockwashers 31 (2-off). Unsolder the leads from the resistor and collect terminal tags 32 (2-off). Leads connecting the spools to the terminals and/or the movement may then be unsoldered should it be required to check the spools. To remove spools undo retaining screws (34A).

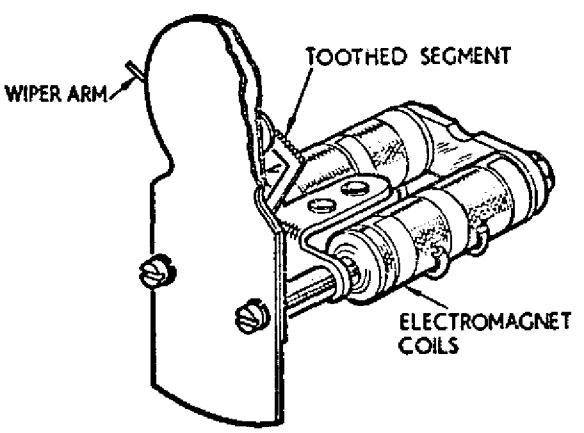

Fig. 2 Pointer return unit detail

3. Cleaning

A. Schedule of cleaning materials

(1) Camel hair brush, No.12 round.

(2) Acetone, B.P.C.

B. Procedure

(1) Using acetone remove all Bostik adhering to threads of screws and nuts and to other components. Ensure that the solvent does not come into contact with insulation or varnished surfaces.

(2) Remove all foreign matter and dust from the case with a soft brush, blow out the magnet gap with a fine jet of clean, dry, air.

MODEL S.63 FORM 4 - INDICATOR RATIOMETER

4. Inspection

A. Procedure

In general examine all metal components for corrosion and check screws, nuts, and threaded holes for good condition and serviceability of threads.

(1) Using a X10 magnifier examine the gap in which the moving element swings for any obstructions; small particles adhering to the core or pole piece must be removed with a shaped piece of wood or celluloid.

CAUTION: UNDER NO CIRCUMSTANCES MUST A METALLIC NEEDLE BE USED FOR THIS PURPOSE. ENSURE THAT DAMAGE TO THE DELICATE CONTROL SPRING AND LIGAMENT IS AVOIDED.

(2) In indicators fitted with a pointer return unit check the action of the wiper arm and the toothed segment and pinion for freedom from dirt or burrs.

(3) Ascertain that the resistance of the moving coil is within limits as given for a particular application in the addenda, (connection from the top ligament is common to both coils).

(4) In indicators not fitted with a pointer return unit inspect the control spring for damage or twisting; the spring must open when the pointer is deflected either up-scale or down-scale according to a particular variant application.

(5) Examine spools for open circuit or damaged insulation and the threaded holes for good condition.

(6) Examine cover and bases for cracks or other damage and for broken or loose glass.

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.

NOTE: It may be necessary to break the bezel ring during this operation.

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

NOTE: Some of the previous 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. Press down the new glass firmly into the cement ensuring that all air bubbles are eliminated and that the cement covers the edge of the glass and fills all gaps.

(4) Apply more Bostik around the internal surface of the cover immediately above the glass.

(5) Insert bezel ring and press down firmly into the cement so that a layer of Bostik forms between bezel ring and glass.

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

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

MODEL S.63 FORM 4 - INDICATOR RATIOMETER

6. Assembly

During assembly apply a spot of B.S.104 to all threaded holes and nuts to lock these items against vibration. Cement jewel screws and coat all soldered connections with Red Thermolene lacquer. After final adjustment and calibration apply a thin coat of B.S.43 where cover and base meet, and to the internal surface of the cover. 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.
B.S.43	GULFCROWN grease No.3, Messrs. GULF OIL CO.

A. **Procedure** (Refer to Fig.1)

(1) Assemble spools (34) and resistor (33), when fitted, to original positions in recess of base (35) if these items have been disassembled.

NOTE: When fitting a replacement movement complete or new unadjusted spools, it is recommended that spools should not be assembled at this stage but that temporary extension leads should be connected to enable the decade resistance boxes to be inserted in circuit for the tests described in para.8.

(2) Connect terminal leads to appropriate points but do not fit sub-base (37) to base at this stage of assembly.

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

(4) Solder free ends of leads, of which a position record was kept at disassembly, to their respective bottom-end ligament terminals (Fig.4).

NOTE: Before fitting a replacement movement complete check the ligament shapes (Fig.3) for correct pull-off and the polarity of the magnet. The following pointer movement should occur when a current not exceeding 5mA is applied to the connections of the moving coils (See Fig.4).

Type of Indicator

Temperature)	
)	Top Common Bridge, POSITIVE
Pressure)	
)	Lower bottom ligament terminal, NEGATIVE
Position)	

The pointer should move towards full scale deflection mark i.e. clockwise in standard indicators when viewed from the front.

(5) Locate spacers (27) - 3 off, to mounting studs on base (35), locate complete movement assembly on studs, position terminal tag (23) to appropriate stud, secure movement complete with screw (21) and lockwasher (22); lockwasher (20A) and nuts (20) 2 off each item.

(6) In indicators INCORPORATING a pointer return unit locate the p.r.u. (15) in position and secure with screws (13) and washers 14 (2 off-each item).

NOTE: Check correct assembly of unit, when the toothed segment is correctly positioned the wiper arm must return pointer back against the zero pointer-stop.

In indicators NOT incorporating a pointer return unit assemble nuts (16), washers (17) and spacers 18 (2 off-each item), to bracket (19). Secure inner scale (12) with screws (10) and washers 11 (2 off-each item), locate the assembly and secure with bracket retaining screws (13) and lockwashers 14 (2 off-each item) to underside of pole piece on movement assembly.

(7) Assemble clip on outer scale to projecting pillar on top mounting plate by carefully sliding scale into position under pointer, secure scale with screws (7) and washers 8 (2 off-each item).

B. **Balancing the movement**

(1) Having checked correct adjustment of jewelled bearings apply a voltage of 26 volts d.c. to the indicator circuit.

(2) Connect external resistance boxes, shown in Fig.5, 6 or 7 in place of the resistance bulb, pressure or position transmitter; place the indicator in the horizontal plane and adjust resistance boxes to deflect pointer to mid-scale. The permissible error when balancing must not be worse than 2% with the movement energised.

(3) Adjust the balance weights to maintain the pointer within 2% of the full scale range value in the following manner:

(a) Keeping indicator horizontal turn it until one of the balance arms is parallel with the table edge, pointer tip to the left of the operator.

(b) Raise indicator slowly until scale face is vertical, the pointer deviation should be within limits indicated, otherwise adjust weights on horizontal balance arm.

(c) Lower indicator to horizontal position and turn until the second balance arm is now parallel with table edge. Raise indicator to scale vertical position with pointer now to right of operator, pointer deviation should be within limits, otherwise adjust weights on second balance arm.

(d) Repeat operations (a) and (c) and check pointer deviation, adjusting the appropriate weights on the two arms until required pointer balance is obtained.

(e) Repeat operation (c) and check deviation with pointer tip pointing upwards and then downwards, correct if necessary by altering side weights until error is reduced to half its value.

The indicator should be lightly tapped during the balancing checks.

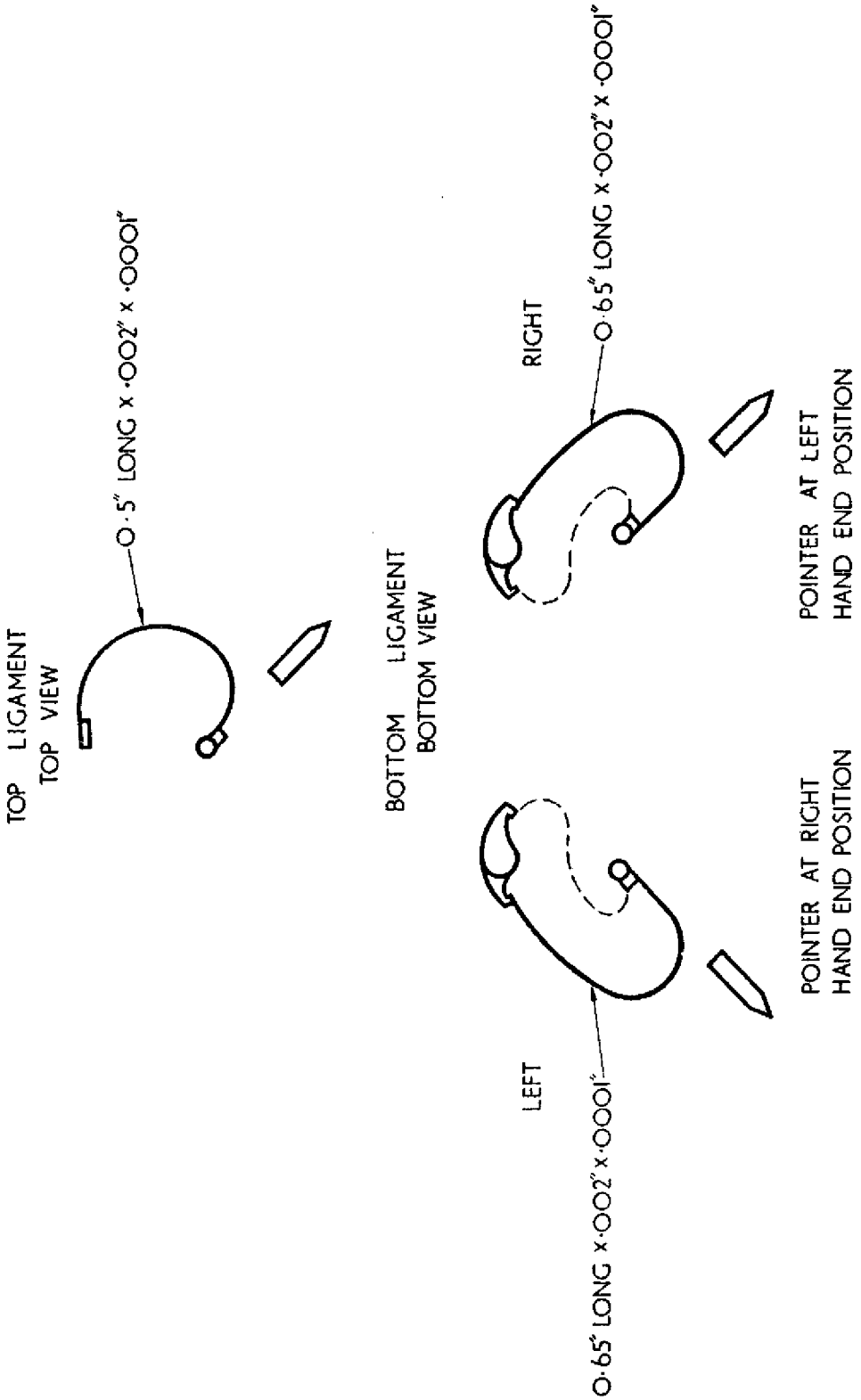

Fig. 3 Ligaments

C. **Final Assembly**

(1) Adjust spools if necessary as described in Para. 8.

(2) Solder terminal tags 32 (2-off) to resistor (33). Secure resistor (33) to base (35) with lockwashers 31 (2-off) and fixing screws 30 (2-off).

(3) Fit spools to recess in base (35) and secure with screws (34A).

(4) Connect spools to terminal ends on sub-base (37) and complete all other connections. Refer to note made at disassembly stage.

(5) Fit sub-base, secure with screw (29), and seal screw.

(6) Complete assembly by applying a thin coat of B.S. 43 grease where the cover and base meet, and a further coat to the internal surface of the cover. Assemble the cover (4) to the base and secure with screws 3 (2-off), fit sealing cup (2) and sealing screw (1).

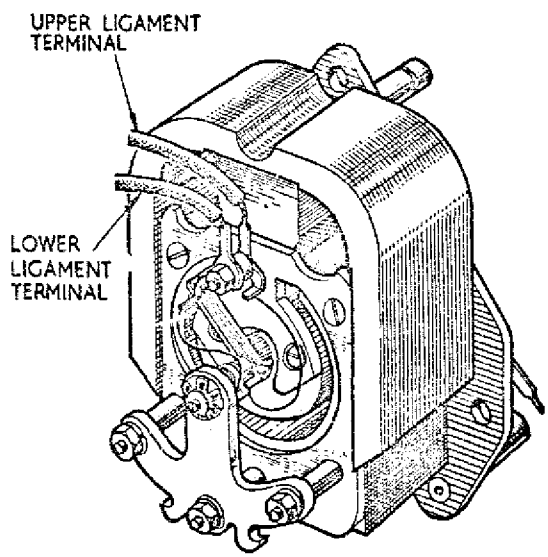

Fig. 4 Bottom ligament terminals

8. Testing

Adjustment of spools

In general some adjustment to certain spools is needed to determine the required scale length when recalibrating indicators after overhaul. Adjustment procedure for the three different applications of the ratiometer is set out below together with the appropriate circuit diagrams. Reference designation of spools, A, B, etc. is according to standard practice, where these differ in particular variants a note will be added in the addendum covering an individual indicator.

For ease of reference the test procedures are sub-divided into the following:

Test procedure for a temperature indicator

Test procedure for a pressure indicator

Test procedure for a position indicator

A. Temperature indicator (Refer to Fig. 5)

(1) The temperature indicator is used in conjunction with a suitable transducer, such as a Sangamo Weston S.110 or S.110G resistance bulb. For spool adjustment purposes a decade resistance box R1 is substituted for the transducer. To determine the correct scale length for the required temperature range spools C and E will require adjustment, the values of all other spools are pre-determined. Spool D must never be re-adjusted to obtain correct scale length, this spool has been wound with copper wire and its value has been carefully calculated to give the instrument a low temperature coefficient.

(2) If the spools have been assembled and connected undo screw (29) retaining sub-base (37) to base (35), disconnect spools C and E and remove. Substitute decade resistance boxes R1, R3 and R2 for the transducer and spools C and E.

(3) Set R1 to the equivalent resistance value for mid-scale indication, (see relevant addendum calibration table) for the particular variant under test and apply 26 volts d.c. to indicator terminals. Adjust R2 to approximate value for spool E then adjust R3 to shift indicator pointer to approximately mid-scale position.

NOTE: Most temperature indicators incorporate a pointer return unit. When the indicator is energised the arm of the p.r.u. should have moved away to free the pointer. It is recommended that this unit be checked as described in D before adjustment checks are made.

(4) Adjust R1, first to the lowest range value and then to the highest range value, note pointer positions in relation to scale markings.

(5) If the length of arc traversed by the pointer in (4) is too great R3 must be reduced in value, if too small R3 must be increased. Varying the value of R3 will tend to shift the arc covered by the pointer to the left or right but this effect may be corrected by readjusting the value of R2.

(6) All further adjustments must now be made from the lowest temperature-indication scale-mark. Set R1 for lowest temperature reading and adjust R2 to set pointer correctly for this indication.

(7) Recheck full scale mark with R1 set to the correct value as given in the applicable addendum for the indicator under test, should the indication be incorrect reset R1 for the lowest temperature reading before making any further adjustment. Correct either for scale length being too small or too great as in (5).

(8) By repeating the process outlined in (6) and (7) the correct scale length will be quickly determined. The two decade resistance boxes R3 and R2 substituted for spools C and E may be taken out of circuit when adjustments have been satisfactorily completed and spools C and E adjusted by making their resistance values correspond exactly to those obtained on R3 and R2.

(9) Connect spools in circuit and make a final check for lowest and highest temperature values.

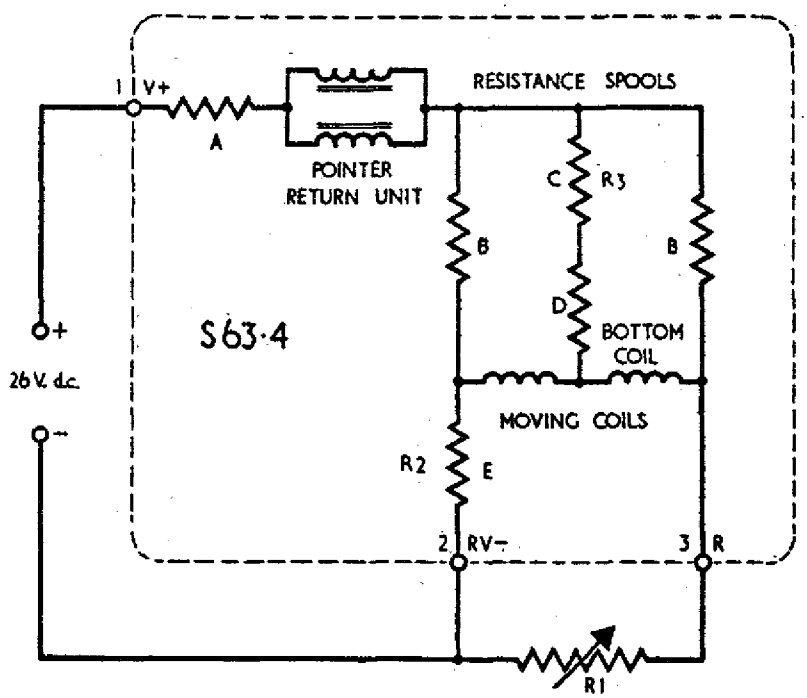

Fig. 5 Test circuit diagram Temperature indicator

B. **Pressure indicator** (Refer to Fig. 6)

The pressure indicator is used in conjunction with a suitable transducer, such as a Sangamo Weston S. 122 pressure transmitter. For spool adjustment purposes two decade resistance boxes R1 and R2 are substituted for the transducer and adjustments made with 26 volts d. c. applied to the circuit.

(1) Connect the indicator as shown in Fig. 6 to two decade resistance boxes R1 and R2 which simulate the pressure transmitter resistance changes. Check scale-end indications, if these are incorrect spools A and B must be readjusted.

(2) To readjust spools substitute resistance boxes R3 and R4 for spools in circuit. Set R1 and R2 alternately to the values for zero and full scale pressure values according to the table given in the addendum for a particular indicator.

(3) Adjust R3 and R4 used in place of spools to give correct pointer indication at the appropriate scale-end positions.

(4) If the indicated scale length is too short decrease the values of R3 and R4 equally, if indicated scale length is too long increase the values of R3 and R4 equally. If necessary repeat these adjustments until correct scale length is obtained.

(5) Adjust the spools A and B to the values of the resistance boxes R3 and R4 used in their place.

(6) Connect adjusted spools and recheck to ensure that the correct pointer indication for scale end positions is obtained.

NOTE: As the centre-to-end scale ratios may not be identical, it may not be always possible to change equally the resistance of R3 and R4 which simulate the unadjusted spools when making the final adjustment.

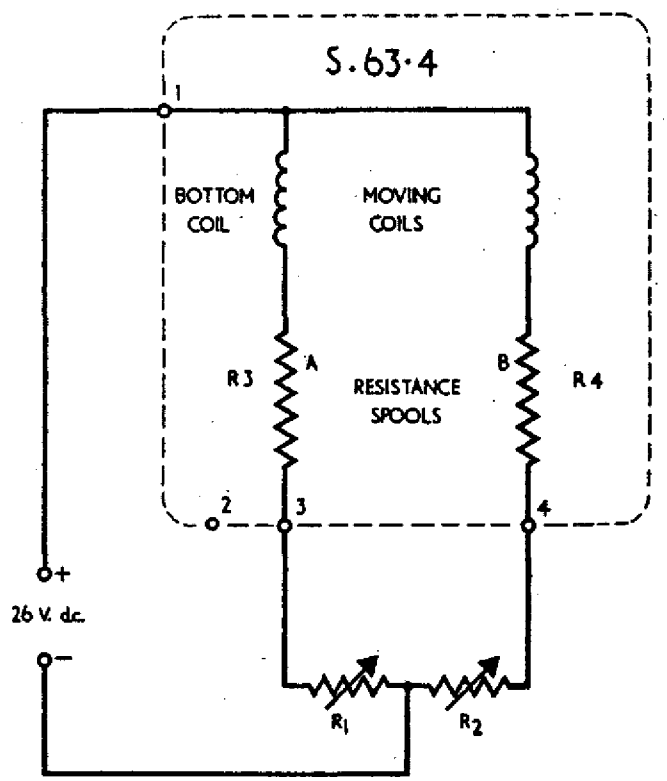

Fig.6 Test circuit diagram Pressure indicator

C. **Position indicators** (Refer to Fig. 7)

The position indicator is used in conjunction with a suitable transducer such as a Sangamo Weston S.132 position transmitter. For spool adjustment purposes, when using the S.132 transmitter, two decade resistance boxes R1, R2 and the shunt resistors, 90 ohms plus the variable 50 ohm resistor R3, are substituted for the transmitter and adjustments made with 40 volts d.c. applied to the circuit. Any variation from this standard procedure will be treated fully in the appropriate addendum for the variant concerned.

(1) Connect the indicator in the circuit shown in Fig. 7. The values of series spools (B and C) will be found in the data section of the addendum for the variant being tested. Set R4 and R5 to these values, R4 and R5 when adjusted should always be of equal value. If this is not possible a shunt spool will have to be used as described in sub para. (3).

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

(3) If the pointer deflects to the right of mid-scale (towards full scale position when 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 the deflection is to the left of mid-scale, connect R6 across the bottom moving coil, between the top ligament and the upper bottom ligament.

(4) 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 (2), (3) and (4), otherwise the associated position transmitter S.132 will not be adjustable to the indicator.

(5) Set R1 to zero and R2 to 1000 ohms, adjust shunt resistance R6 to bring the pointer in alignment with the left-hand end-scale cardinal (normal zero).

(6) Repeat operations (4) and (5) until pointer aligns accurately with both end-scale cardinals. Adjust value of shunt spool to the final value given by R6.

D. **Pointer return unit**

When these units are fitted the following test should be made.
Apply 21-22 volts d.c. to the indicator. The curved arm must release the pointer from its locked position and allow it to swing freely.

E. **Calibration**

(1) Temperature indicators

Connect the indicator as shown in Fig. 5. Check readings against the appropriate settings of the decade resistance box according to the calibration table which will be found in the appropriate addendum at the rear of this manual and recalibrate the indicator if necessary to obtain correct indication for the resistance values.

(2) Pressure indicators

Connect the indicator as shown in Fig.6. Check readings against the values quoted in the calibration table which will be found in the appropriate addendum at the rear of this manual. Recalibrate the indicator, if necessary, to obtain correct indication for the resistance values.

NOTE: Low ranges of pressure require an additional 250 ohm resistor connected in series between R2 and R4 (B spool) for test purposes.

(3) Position indicators

Connect the indicator as shown in Fig. 7. Check readings against appropriate settings of the decade resistance boxes according to the calibration table which will be found in the appropriate addendum at the rear of this manual. Obtain correct end-scale alignment of pointer and appropriate cardinals as outlined in C above before checking calibration. Recalibrate indicator, if necessary, to obtain correct indication for the resistance values in table.

F. High voltage and insulation test

After final assembly but before sealing the sealing screw and cup make the following tests.

(1) Apply 1000 volts r.m.s. for one minute between all the terminals connected together and one of the cover securing screws. There must be no breakdown.

(2) Use a megger to apply 500 volts d.c. for 15 seconds between the terminals connected together and one of the cover securing screws. Make this test immediately following the high voltage test and check the insulation resistance, this must be 20 megohms or more.

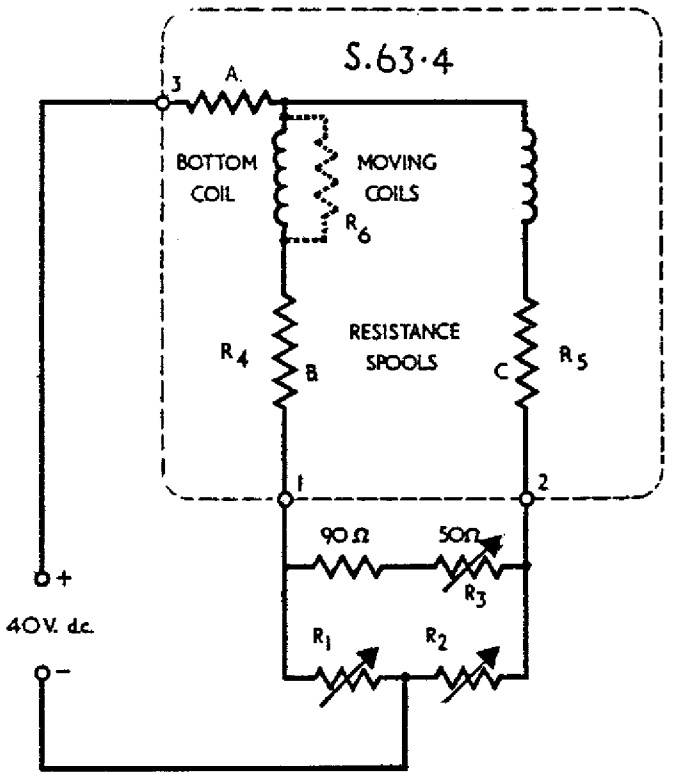

Fig.7 Test circuit diagram Position indicator

9. Trouble shooting (Fig.8)

A. Causes

(1) The main symptoms of faults after overhaul are:

(a) Incorrect pointer indication.

(b) Failure of pointer to leave rest position.

(c) Erratic movement of pointer.

B. Correction

(1) Check fault against trouble shooting chart, Fig.8 and adopt procedure suggested.

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

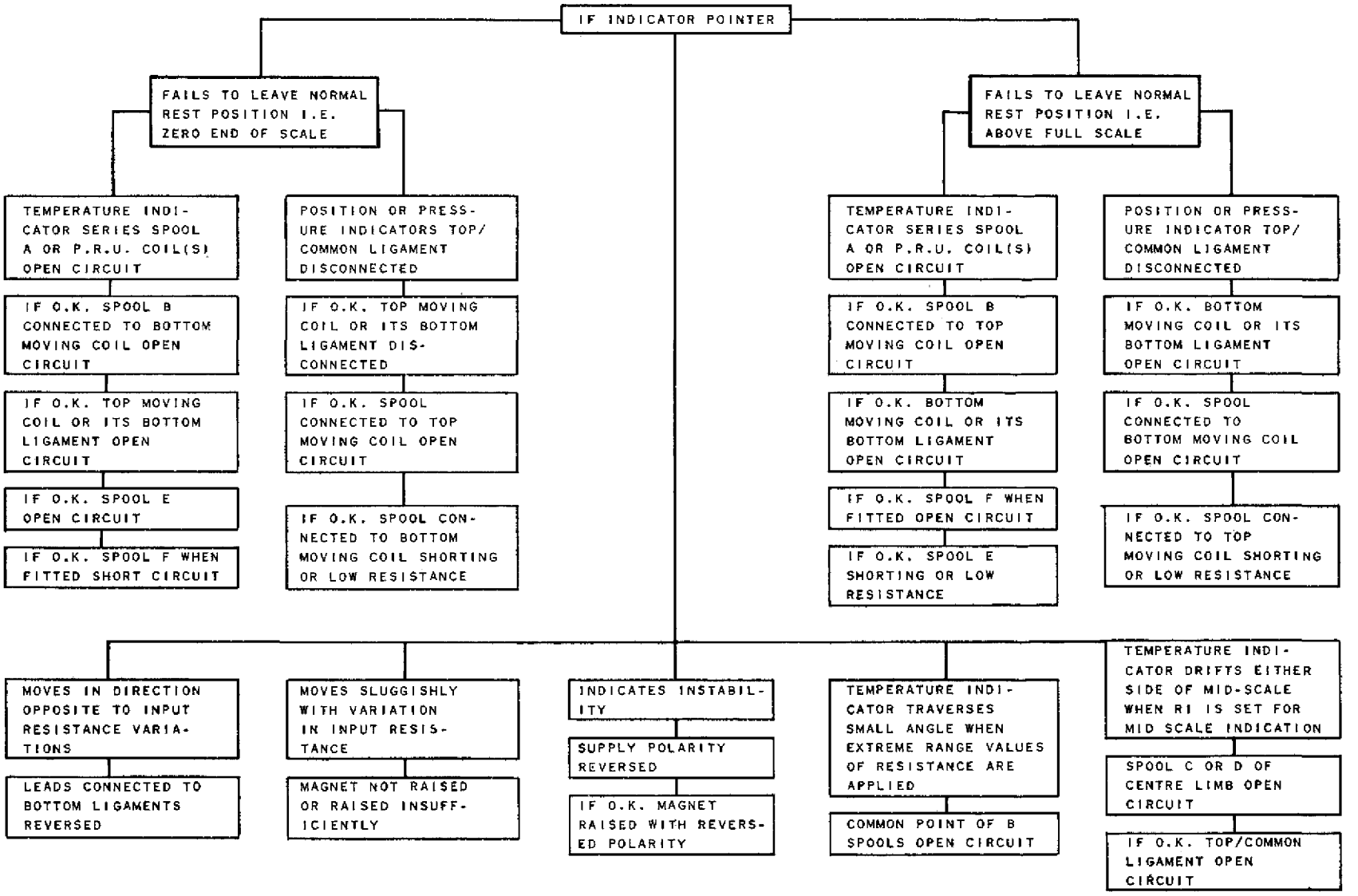

Fig. 8 Trouble shooting chart

10. Storage instructions

A. Preparation and procedure

(1) For packing in temperate zones prepare the following:

(a) A strong cardboard box 5½ in. x 4¼ in. (internal dimensions).

(b) Two squares of corrugated cardboard 4¼ in. x 4¼ in.

(c) One strip of corrugated cardboard 3¾ in. x 36 in. and a second strip 3¼ in. x 36 in.

(d) A polythene bag of suitable dimensions.

(e) Place the indicator in the polythene bag together with some oven dried silica gel and heat seal the opening.

(f) Wrap the narrower of the two long strips around the indicator case followed by the second strip to cover the flange.

(g) Place a cardboard square at the bottom of the box, insert the wrapped indicator into the box, place the second square on top and fit the lid.

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

Identification, e.g. S.63.4.00.
Modification state.
Date of overhaul.
Note and date of any component change.

(2) For packing in tropical zones:

(a) Pack the indicator as for temperate zones with the addition of water resistant paper to completely enwrap the indicator before insertion into the polythene bag.

(b) Encase the cardboard box containing the indicator in a wooden container.

B. Storage limiting period

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

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

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

11. Special tools, fixtures and equipment

Item	Description	Part No. or Fixture No.
1	Balance weight wrench	271157
2	Decade resistance boxes	Local Supply

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 other means specified, without extensive disassembly or removal.

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

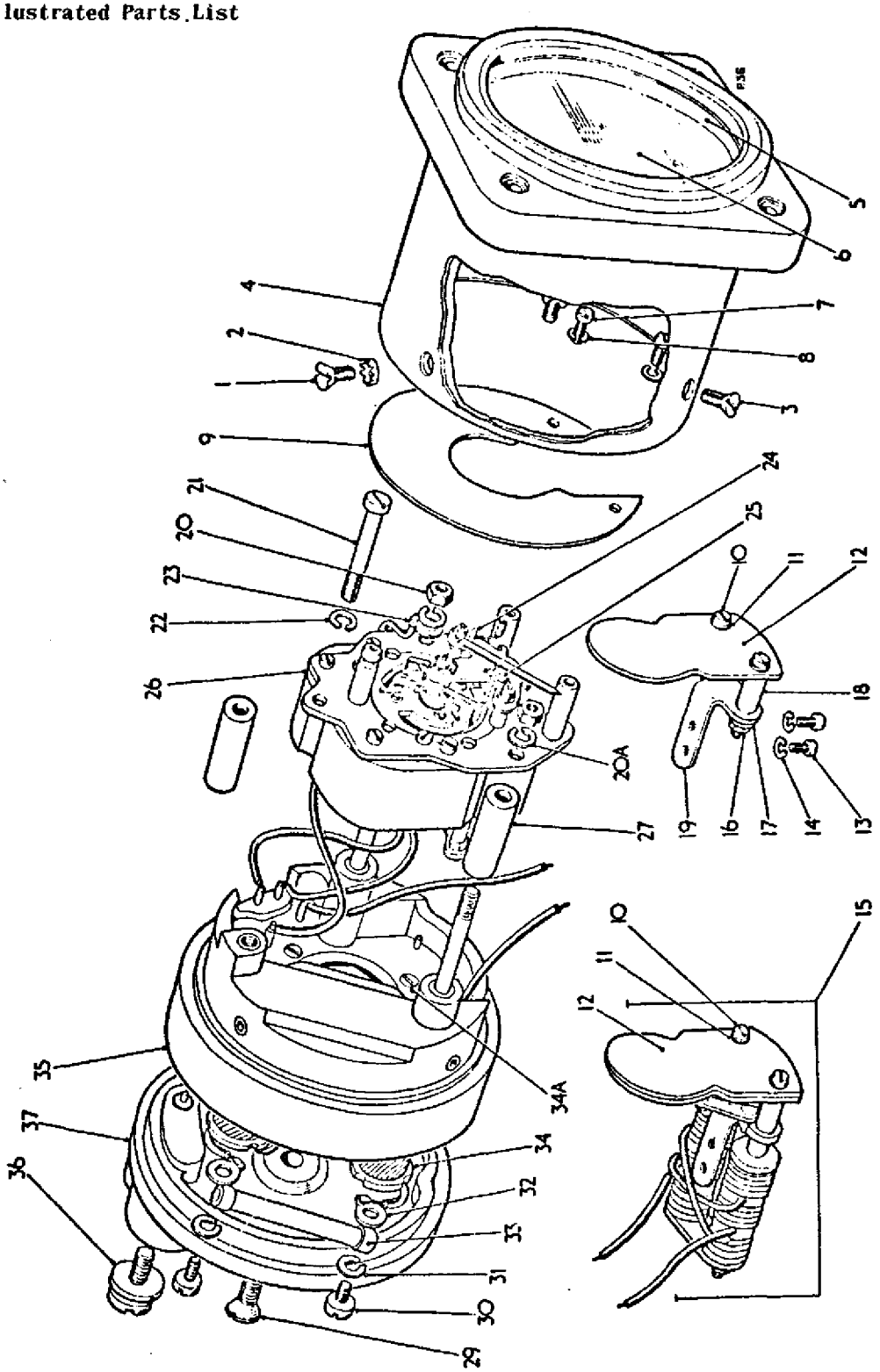

Fig.9 Model S.63 Form 4

This list to be used with Variant Parts List for Model S.63 Form 4

COMMON PARTS LIST

	Fig. and Index No.	Nomenclature	Part No.	Units per Assy.
	Fig. 9	Model S.63 Form 4	See Variant Parts	
	1	Screw, sealing	168861	1
	2	Seal, cover	168012	1
	3	Screw, cover	156400	2
	4		See Variant Parts	
	5	Ring, bezel (Cover)	160244	1
	6-8		See Variant Parts	
	9	Scale, outer (Blank)	165401	1
	10-11		See Variant Parts	
	12	Scale, inner (Blank)	164745	1
	13	Screw, 10 B.A. x 1/8in	101782	2
	14	Lockwasher, 10 B.A.	153367	2
	15-19		See Variant Parts	
	20	Nut, 6 B.A.	112243	2
	20A	Lockwasher, 6 B.A.	156976	2
	21	Screw, 6 B.A. x 7/8in Cheese head	162365	1
	22	Lockwasher, 6 B.A.	See Index No. 20A	1
	23	Tag, terminal, 6 B.A.	156456	1
	24-26		See Variant Parts	
R				
	27	Spacer	176247	3
R	28			
	29	Screw, 4 B.A. x 3/8in, C'sk.	162525	1
	30-34		See Variant Parts	
	35	Base	168913	1
	36-37		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.

OVERHAUL MANUAL

ADDENDUM

MODEL S.63.4.367 - INDICATOR, TEMPERATURE 0/250°C

The information contained in the main section of the Overhaul manual 31-09-61 is also applicable to this Variant. Additional details, applicable to Model S.63.4.367 only, are given in this addendum.

REVISION RECORD SHEET

Revision No.	Date of Issue	Incorporated by	Date	Remarks
1	May. 1964	Sangamo Weston Ltd	May. 1964	Revision pages 3 and 5.
2	Oct. 1965	Sangamo Weston Ltd	Oct. 1965	Revision pages 1, 3, 4 and 5.
3				
4				
5				
6				
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10				

SANGAMO WESTON LTD.

OVERHAUL MANUAL ADDENDUM 31-09-61/367

MODEL S.63.4.367 - INDICATOR, TEMPERATURE 0/250°C

LETTER OF TRANSMITTAL

FOR

REVISION No. 2

Issued October 1965
by
Sangamo Weston Ltd., Enfield, Middlesex, England

ACTION	REASON
1. Remove and destroy Overhaul Manual Addendum 31-09-61/367 and substitute Overhaul Manual Addendum 31-09-61/367 incorporating Revision 2.	Text and Parts List revised, pages 1, 3, 4 and 5.
2. The incorporation of this revision is recorded on the Revision Record Sheet on page 1.	
3. Retain this Letter of Transmittal.	This certifies compliance with Section A, Chapter A6-2, of British Civil Airworthiness Requirements.

This revision complies with British Civil Airworthiness Requirements, Section A, Chapter A6-2. The technical accuracy of this revision has been verified and is certified accurate.

Signed: N.A. Lovegrove.

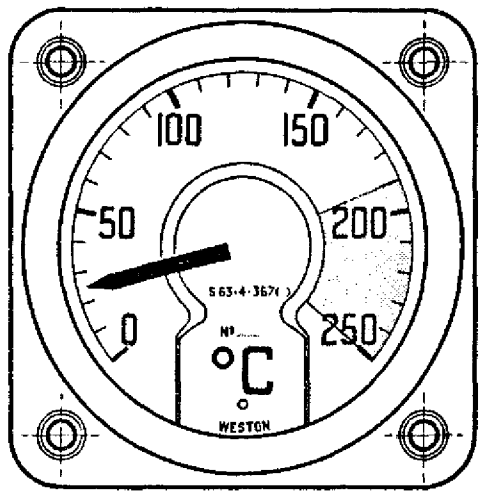
Date: 30th November 1965.

A.R.B. Design Approval No. AD/1147/47

OVERHAUL MANUAL

ADDENDUM

MODEL S.63.4.367 - INDICATOR, TEMPERATURE 0/250°C



Description

Model S.63.4.367 is a ratiometer type indicator designed for use in conjunction with a SANGAMO WESTON S.110G platinum law resistance bulb to indicate temperature over the range of 0°C to 250°C.

The scale presentation is illustrated. The caption °C, numerals, cardinals, division lines, scale arc and lance type pointer are finished fluorescent. The scale background is matt black with a red sector extending from the 190°C mark to the 250°C cardinal.

Connections to the indicator are by means of three shrouded 4 B.A. screw terminals, with captive washers, in a terminal block fitted to the base. A pointer return unit incorporated in the indicator carries the pointer below the 0°C cardinal when the indicator is not energised.

Data

Resistance of moving coils	40–50 ohms each
Resistor A	268–287 ohms
Resistance of spools	
B	500 + 500 ohms ± 5 ohms each winding
C	100 ohms +5% –0 (unadjusted)
D	40 ohms ±5%
E	185 ohms +5% –0 (unadjusted)
Resistance of P.R.U. coils	390–490 ohms each
Power consumption at mid-scale for 26V d.c.	40mA (max.)

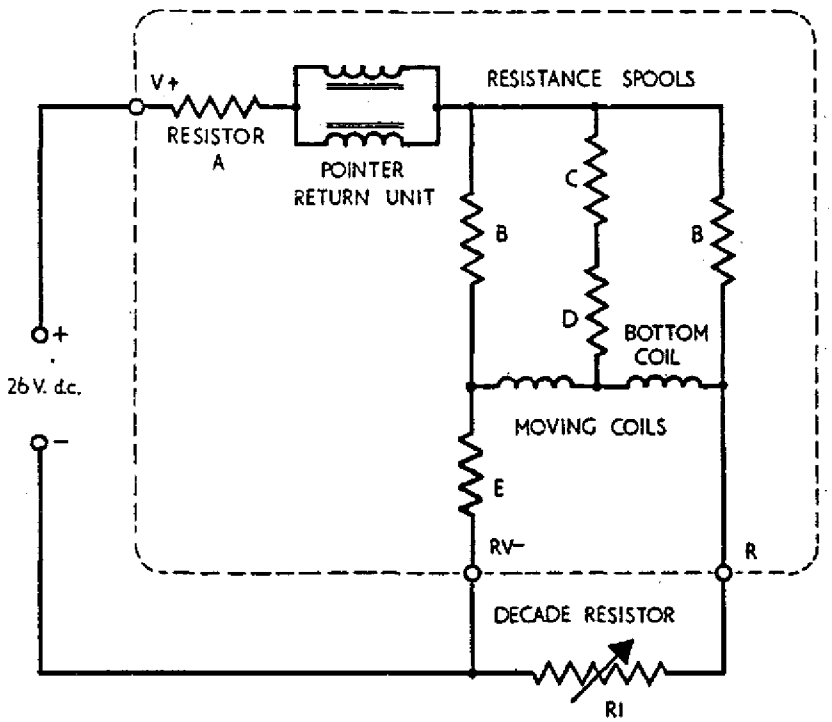


Fig. 10 Calibration circuit diagram

Test and Calibration

(1) Connect the indicator into the circuit given in Fig. 10. The decade resistance box R1 is adjusted to simulate changes in the resistance of the resistance bulb.
(2) If scale end indications are incorrect after overhaul, adjust spools C and E as detailed in paragraph 8 (Testing) of the main section of this manual.
(3) If necessary, recalibrate the indicator using the values given in the accompanying table.

Calibration Table

°C	R1 ohms	°C	R1 ohms
0	130.4	160	210.8
20	140.7	180	220.6
40	150.9	200	230.3
60	161.0	220	239.9
80	171.1	240	249.5
100	181.1	250	254.3
120	191.1	50) if required	155.9
140	210.1	150)	205.9

NOTE: The resistance values given include an additional amount to simulate actual working conditions; they are not merely the platinum law values.

Accuracy

The accuracy of the indicator ±2% of full scale deflection.

This list to be used with Common Parts List for Model S.63 Form 4 (Mod.J onwards)

VARIANT PARTS LIST

S.63.4.367

	Fig. and Index No.	Nomenclature	Part No.	Units per Assy.
R	Fig. 9	Indicator, Temperature 0/250°C	S.63.4.367	
	4	Cover Assembly	166885	1
	6	Glass	162524	1
	7	Screw	156396	2
	8	Lockwasher	159306	2
	10	Screw	101782	2
	11	Lockwasher	See Index No. 8	2
	15	Pointer Return Unit	164720	1
	24	Pointer Stop, R.H.	167220	1
R	25	Pointer Stop, L.H.	162557	1
R	26	Movement Complete (Mod.J)	26/S.63.4.367 (J)	1
	or 26	Movement Complete (Mod.T)	26/S.63.4.367 (T)	1
	30	Screw, 8 B.A. x 1/8 in	92212	2
	31	Lockwasher 8 B.A.	103854	2
	32	Tag, Terminal 8 B.A.	164637	2
	33	Resistor 'A'	167123/280 ohms	1
	34	Spool	34B/S.63.4.367	1
			34C/S.63.4.367	1
			34D/S.63.4.367	1
			34E/S.63.4.367	1
	36	Screw and Washer Assembly	157703	3
	37	Base, Sub	167167	1

Sangamo Weston Code appears on front of Scale

OVERHAUL MANUAL

ADDENDUM

MODEL S.63.4.706 INDICATOR TEMPERATURE $-50^{o}/+150^{o}C$.

The information contained in the main part of the manual 31-09-61 is applicable to this variant S.63.4.706 in addition to the details given in this addendum, which apply only to this indicator.

REVISION RECORD SHEET

Revision No.	Date of Issue	Incorporated by	Date	Remarks
1	June 64			
2				
3				
4				
5				
6				
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8				
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SANGAMO WESTON LTD.

OVERHAUL MANUAL 31-09-61/706 AND 1058

MODEL S.63 FORM 4 ADDENDA 706 AND 1058

LETTER OF TRANSMITTAL

FOR

REVISION No. 1

Issued June 1964
by
Sangamo Weston Ltd., Enfield, Middlesex, England

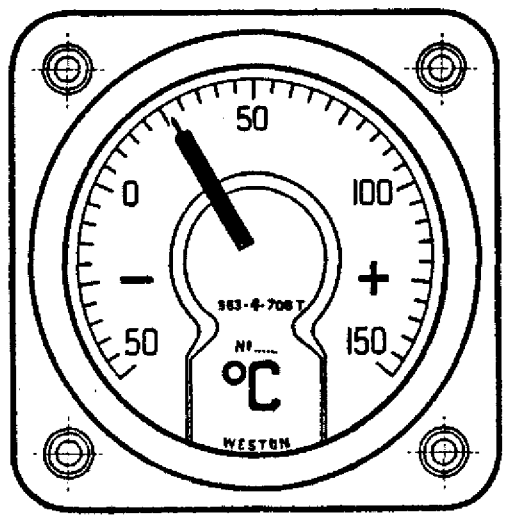
	ACTION		REASON
1.	Remove and destroy pages 3/4 and 5 of Overhaul Manual Addendum 31-09-61/706 and substitute the attached pages 3/4 and 5 incorporating Revision 1.	✓	Page 4: Revision to Testing paragraph Page 5: Revisions to parts list.
2.	Remove and destroy pages 3/4 and 5 of Overhaul Manual Addendum 31-09-61/1058 and substitute the attached pages 3/4 and 5 incorporating Revision 1.	✓	Page 4: Revisions to Testing and Accuracy paragraphs, and Fig.10. Page 5: Revisions to parts list.
3.	Record the incorporation of this revision on the appropriate Revision Record Sheets.	✓	
4.	Retain this Letter of Transmittal	✓	This certifies compliance with Section A, Chapter A6-2, of British Civil Airworthiness Requirements.

This revision complies with British Civil Airworthiness Requirements, Section A, Chapter A6-2. The technical accuracy of this revision has been verified and is certified as accurate.

Signed: N.S. Lovegrove.

Date: 11th June, 1964.

A.R.B. Design Approval No. AD/1147/47



Description

This is a ratiometer type indicator designed to work in conjunction with a platinum law resistance bulb to indicate temperature over a range of -50° to +150°C. It operates from a nominal 24 volt aircraft supply, connection to the aircraft wiring being made via three terminals at the rear of the case. The indicator incorporates a pointer return unit to return the lance type pointer off scale (below the -50° mark) and lock it in that position when the indicator circuit is unenergised. The scale markings are photogenic white on a black background.

NOTE: The indicator is built to standards of Mod. J and T onwards and in consequence the movement has been assembled using special manufacturing techniques and must not be dismantled. In the event of failure a complete replacement movement must be fitted.

Data

Resistance of moving coil		25 to 35 ohms
Resistance of each p.r.u. coil		390 to 490 ohms
Resistance of spool	B	500 + 500 ohms ±1%
	C	170 ohms +5% (unadjusted)
	D	40 ohms ±5%
	E	150 ohms +5% (unadjusted)
Resistor	A	280 ohms
Maximum consumption at mid-scale for 26 volts		40 mA
Electrical centre	35.4°C = 148.5 ohms	

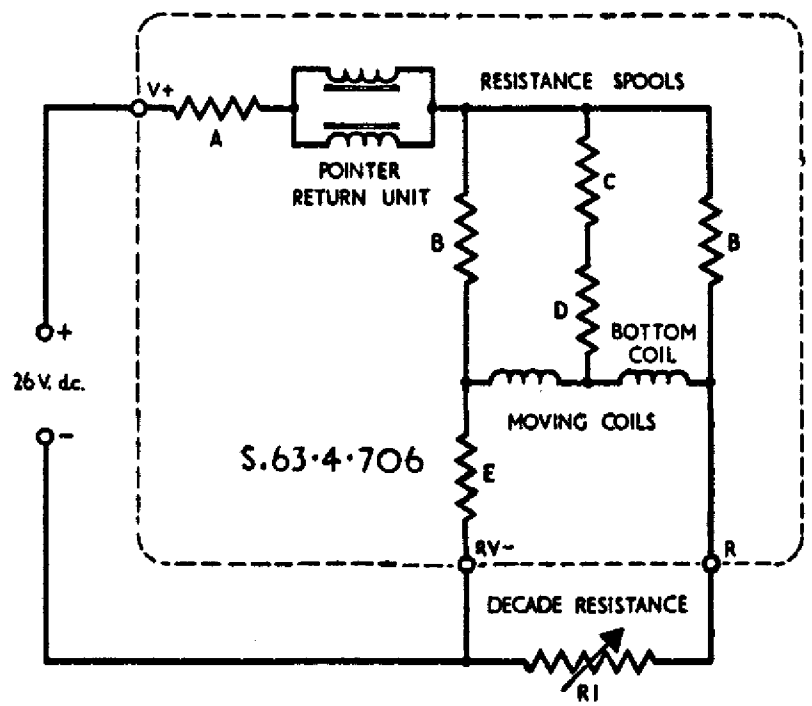


Fig. 10 Calibration Circuit Diagram

Testing

Connect the indicator as shown in Fig. 10 The resistance box R1 is adjusted to simulate the temperature bulb changes in resistance shown in the table

(1) If scale end indications are incorrect after overhaul adjust spools C and E as instructed in paragraph 8.

(2) If required recalibrate the indicator using the values given in the table.

°C.	R1 ohms	°C.	R1 ohms
-50	104.5	60	161.0
-40	109.7	80	171.0
-20	120.1	100	181.1
0	130.4	120	191.1
20	140.7	140	201.0
40	150.9	150	205.9
		50	155.9 (if required)

NOTE: The resistance values include an additional amount to simulate the actual conditions under which the indicator works, they are not merely the standard platinum law values.

Accuracy

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

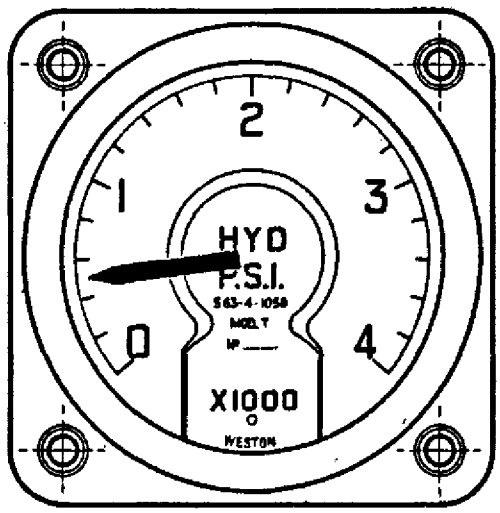
This list to be used with Common Parts List for Model S.63 Form 4 (Mods. J & T onwards)

VARIANT PARTS LIST

S.63.4.706

Fig. and Index No.	Nomenclature	Part No.	Units per Assy.
Fig.9	Temp. Indicator -50° /+150°C.	S.63.4.706	
4	Case	166885	1
6	Glass	162524	1
7	Screw, 10BA. x 0.19 in. (Black)	156396	2
8	Lockwasher, 10BA. (Black)	159306	2
15	Pointer Return Unit	164720	1
24	Stop, Pointer, Double Ended	167220	1
25	Stop Pointer L.H.	162557	1
26	Movement Complete (Mod. J)	26/S.63.4.706 (J)	1
or 26	Movement Complete (Mod. T)	26/S.63.4.706 (T)	1
30	Screw 8BA. x 1/8 in. Sp.Hd.	92212	2
31	Lockwasher, 8BA.	103854	6
32	Resistor A	167123/280 ohms	1
33	Tag, Terminal	164637	2
34	Spool	34B/S.63.4.706	1
		34C/S.63.4.706	1
		34D/S.63.4.706	1
		34E/S.63.4.706	1
36	Screw and Washer Assembly	157703	3
37	Base, Sub.	167167	1

Sangamo Weston Code appears on front of Scale



Description

This is a ratiometer type indicator designed to work in conjunction with a pressure transmitter in a nominal 24 volt aircraft system and is calibrated 0 to 4 x 1000 p.s.i. with cardinals at 0, 1, 2, 3, and 4 x 1000. The lance type pointer and scale markings are in photogenic white on a black background. A spring is fitted to the moving element at the top bridge end which makes the pointer 'pull off' at the right and keeps it beyond the cardinal mark 4 when the indicator is unenergised.

NOTE: A pointer return unit is not fitted to this indicator and information contained in the main part of the manual regarding this item should be ignored.
The indicator is built to standards of Mods. J and T onwards and in consequence the movement has been assembled using special manufacturing techniques and must not be dismantled. In the event of failure a complete replacement unit must be fitted. This indicator has a fluid-damped movement, the top bridge is marked with a paint spot on its outer surface, the colour of the paint signifying the viscosity grade of the oil used. A replacement top bridge must bear the same colour coding as the bridge originally fitted.

Data

Resistance of moving coil		
Resistance of spool		
	A	4000 ohms +5% (unadjusted)
	B	4000 ohms +5% (unadjusted)

Electrical centre 2000 p.s.i.

Testing

Connect the indicator as shown in **Fig. 10** and adjust the decade resistance boxes R1 and R2 to simulate the pressure transmitter changes shown in the table.

(1) If scale end indications are incorrect adjust spools A and B as instructed in paragraph 8

(2) If required recalibrate the indicator using the values given in the table.

Pressure p.s.i.	R1 ohms	R2 ohms
0	490	2760
500	785	2465
1000	1075	2175
1500	1360	1890
2000	1645	1605
2500	1930	1320
3000	2210	1040
3500	2485	765
4000	2760	490

Accuracy

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

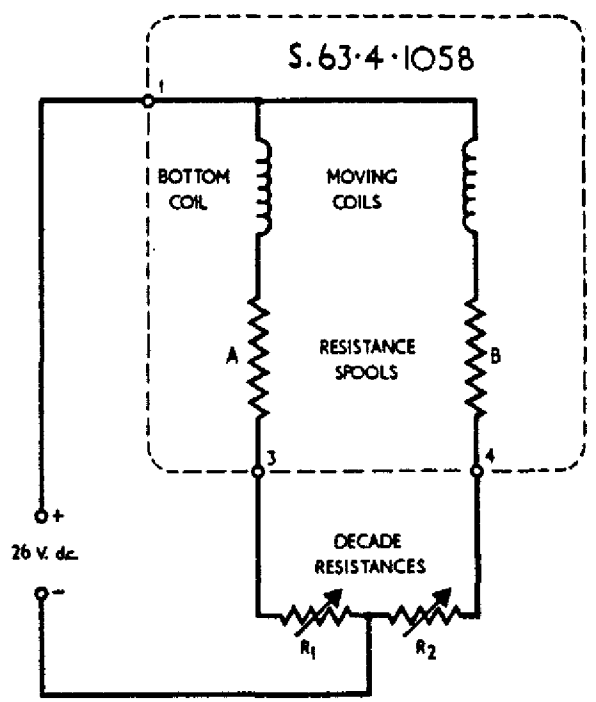


Fig. 10 Calibration Circuit Diagram

This list to be used with Common Parts List for Model S.63 Form 4 (Mods. J & T onwards)

VARIANT PARTS LIST

S.63.4.1058

Fig. and Index No.	Nomenclature	Part No.	Units per Assy.
Fig.9	Hydraulic Pressure Inidcator 0/4000 p.s.i.	S.63.4.1058	
4	Case	166885	1
6	Glass	162524	1
7	Screw, 10BA. x 0.19 in. (Black)	156396	2
8	Lockwasher, 10BA. (Black)	159306	2
16	Nut 8BA.	150168	2
17	Lockwasher, 8BA.	103854	2
18	Pillar, Inner Scale	164982	2
19	Bracket	164740	1
24	Stop, Pointer, R.H.	162556	1
25	Stop, Pointer, L.H.	162557	1
26	Movement Complete (Mod.J)	26/S.63.4.1058 (J)	1
or 26	Movement Complete (Mod.T)	26/S.63.4.1058 (T)	1
31	Lockwasher, 8BA.	103854	4
34	Spool	34A/S.63.4.1058	1
		34B/S.63.4.1058	1
36	Screw & Washer Assembly	157703	4
37	Base Sub.	162565	1

Sangamo Weston Code appears on front of Scale