AP 112G-1207-13A

TACHOMETER INDICATORS
TYPE RV SERIES

GENERAL AND TECHNICAL INFORMATION
ILLUSTRATED PARTS CATALOGUE

BY COMMAND OF THE DEFENCE COUNCIL

Ministry of Defence

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Publications authority: ATP/MOD(PE)

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AP(N)140 Chap.1 Annex A (RN)
AP100B-01 Order 0504 (ARMY and RAF)

AL5, July, 76

To record the incorporation of an Amendment List in this publication, sign against the appropriate A.L.No. and insert the date of incorporation

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ILLUSTRATED PARTS CATALOGUE (-3A)

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MODIFICATION RECORD

The following record confirms that this publication incorporates all technical changes necessitated by the modifications listed below.

Tachometer Indicator, Type 67RV

MOD No. 01(SI-), 03(SI1472).

Tachometer Indicator, Type 78RV

MOD No. 01(SI-), 02(SIB1098).

Tachometer Indicator, Type 95RV/SB

MOD No. 01(SI-), 03(SI1472), 04(SIB1098)

Tachometer Indicator, Type PW134RV/BU

MOD No. 01(SI-), 02(SI1215), 03(SI1472)

Tachometer Indicator, type 164RV/BR

MOD No. 01(SI-), 02(SI1215), 03(SI1472)

Tachometer Indicator, Type PW170RV/BU and PW170RV/BR

MOD No. 01(SI-), 02(SI1215), 03(SI1472), 04(SIB1098)

Chapter 1

TACHOMETER INDICATORS, TYPE 67RV, 78RV, 95RV/SB, PW134V/BU, 164RV/BR, PW170RV/BU and PW170RV/BR

Introduction

1 The tachometer indicators described in this chapter are installed in aircraft to indicate the speed of rotation of reciprocating engines or gas turbines. The indicators operate in conjunction with a tachometer generator driven by the engine, and provide an indication of engine speed in rev/min. Table 1 details the difference between the various tachometer indicators described in this chapter.

DESCRIPTION (fig.1 and 2)

2 The indicator consists essentially of a 3-phase, self-starting synchronous motor which operates a coaxial magnetic drag element to move pointers over a dial calibrated in rev/min. The mechanism is housed in a standard 3¼ in dia. case.

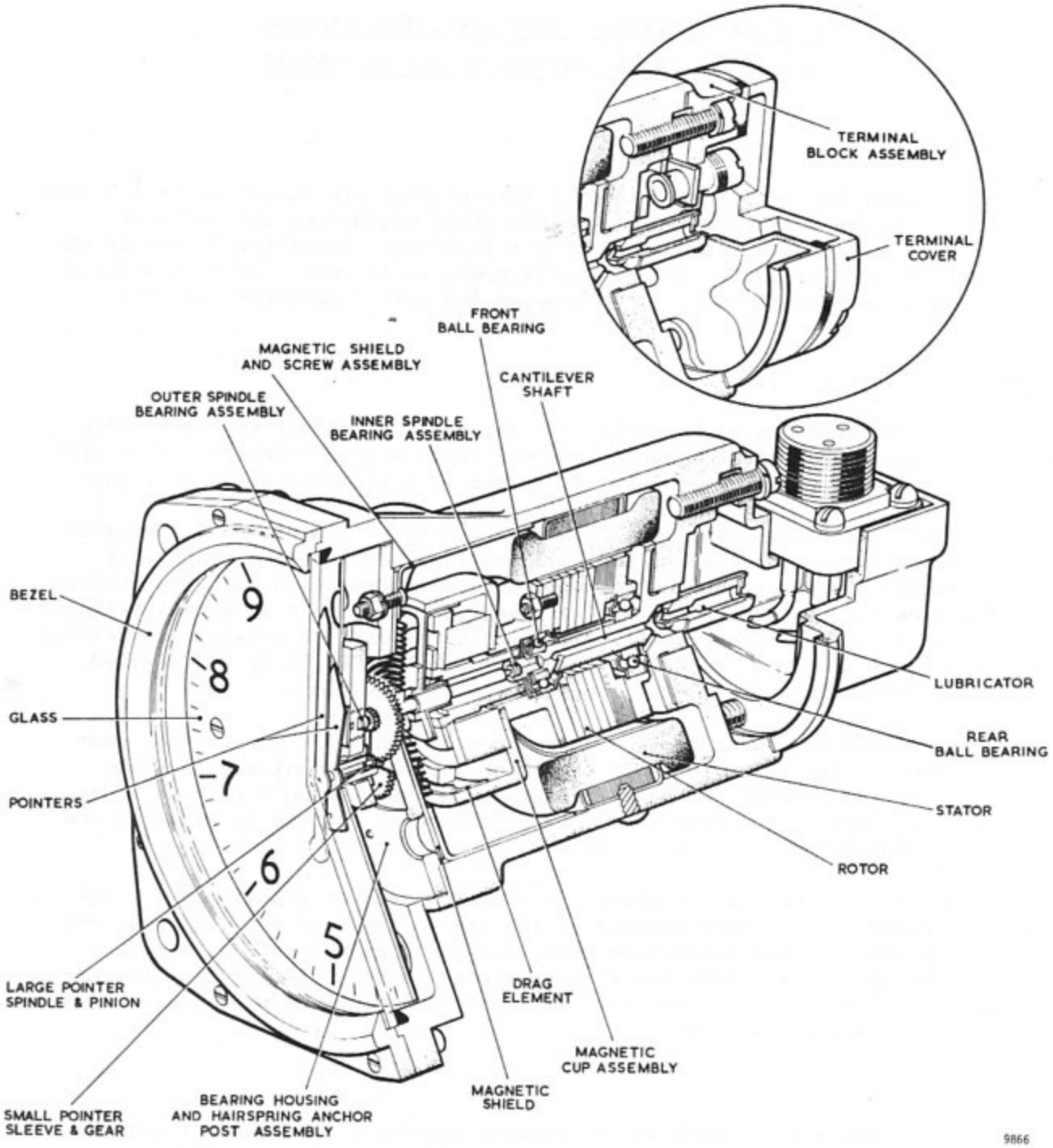
► 3 The synchronous motor has a 3-phase, star connected stator and a laminated rotor. The rotor is supported on two ball bearings mounted on a cantilever shaft projecting forward from the rear of the case. Provision for the lubrication of the bearings, through the back of the indicator, is made by a lubricator and oilways in the cantilever shaft. The lubricator and the oilways are deleted from Indicators Type 78RV, 95RV/SB, PW170RV/BW and PW170RV/BR by Mod SIB1098, which introduces shielded, fluorosilicone lubricated bearings. ◄

4 A magnetic drag cup assembly is secured to the front of the rotor and comprises a magnetic cup assembly, pole pices and a permanent magnet. A drag element is located between the magnetic cup assembly and the pole pieces. The drag cup is mounted on the rear end of a spindle which rotates in bearings and drives the pointers through a gear train.

5 The front end of the case is closed by a dial, a rubber gasket and a glass; these are retained by a bezel secured to the case. The finish of the dial and pointers may vary between respective indicators, and details are given in Table 1. The three leads from the stator windings pass to the rear of the case. Depending upon installation requirements, a terminal block or a 3-pole plug is secured to the rear of the case.

OPERATION

6 The three-phase voltage from the tachometer generator produces a rotating magnetic field in the stator windings of the indicators; the speed of this field is controlled by the output frequency of the generator. The rotating field in the stator causes the rotor to rotate in synchronism with the field. Rotation of the rotor also rotates the magnetic drag element around the drag cup. This sets up eddy currents which rotate the drag cup against the tension



► Note: Lubricator not fitted post MOD SIB1098 ◄

Fig.1 Sectional view

of a hairspring. The movement of the drag cup is transmitted to the pointers, and when the hairspring torque equals the eddy current torque, the drag cup and the pointers will become stationary.

INSTALLATION

7 The indicator is secured to its mounting by four screws which pass through the bezel, and is connected to the tachometer generator by a 3-core cable. Before making connection with the generator, establish the direction of rotation of the generator. If the generator is driven clockwise as viewed from the driving end, then terminals 1,2 and 3 or pins A, B and C of the indicator are connected to terminals 1, 2 and 3 or pins A, B and C of the generator. If the generator is driven counter-clockwise, terminals 1, 2 and 3 or pins A, B and C of the indicator are connected to terminals 1, 3 and 2 or pins A, C and B of the generator.

SERVICING

General

8 Examine the unit for damage and ensure that the bezel securing screws are tight, and that the terminal block or plug is securely fixed to the case. If serviceability of the indicator is suspect, it is to be tested as detailed in Chapter 1-1.

► 9 At routine servicing periods indicators not fitted with pre-lubricated bearings are to be lubricated as detailed in para. 10 to 14. ◄

Lubrication

10 The cantilever rotor shaft has drilled oilways through which jets of aerated oil are discharged on to the ball tracks of both bearings. The aerated oil is injected into the oilways by a hypodermic syringe inserted through a plastic seal in the end of the shaft.

11 The equipment to be used is syringe, hypodermic, glass barrel, 1cc, fitted with a No.14 Summit needle (Ref. No. 1J/212).

12 The lubricant to be used is Oil, OX-14.

13 The sequence of operation is as follows:

Ensure that the syringe and needle are clean before use. The quantity of oil required for each charge is ½ to ¾ minim (4 to 6 drops from No.14 needle). It may be necessary to withdraw the plunger beyond the 1 minim graduation to draw up the required quantity of oil, owing to the presence of air in the needle and to variations in the manufacture of syringes. A preliminary test should be made with each syringe to determine the graduation equivalent to five drops of oil. Having drawn up the required amount, remove the needle from the oil and withdraw the plunger to the top of the barrel. Oil the indicator as follows:

13.1 Stand the instrument dial downwards and remove the rear plate and plug or the terminal block cover as appropriate.

13.2 Insert the needle through the small puncture in the centre of the seal in the cantilever shaft extension; the depth of insertion is not critical. Press the plunger smartly home.

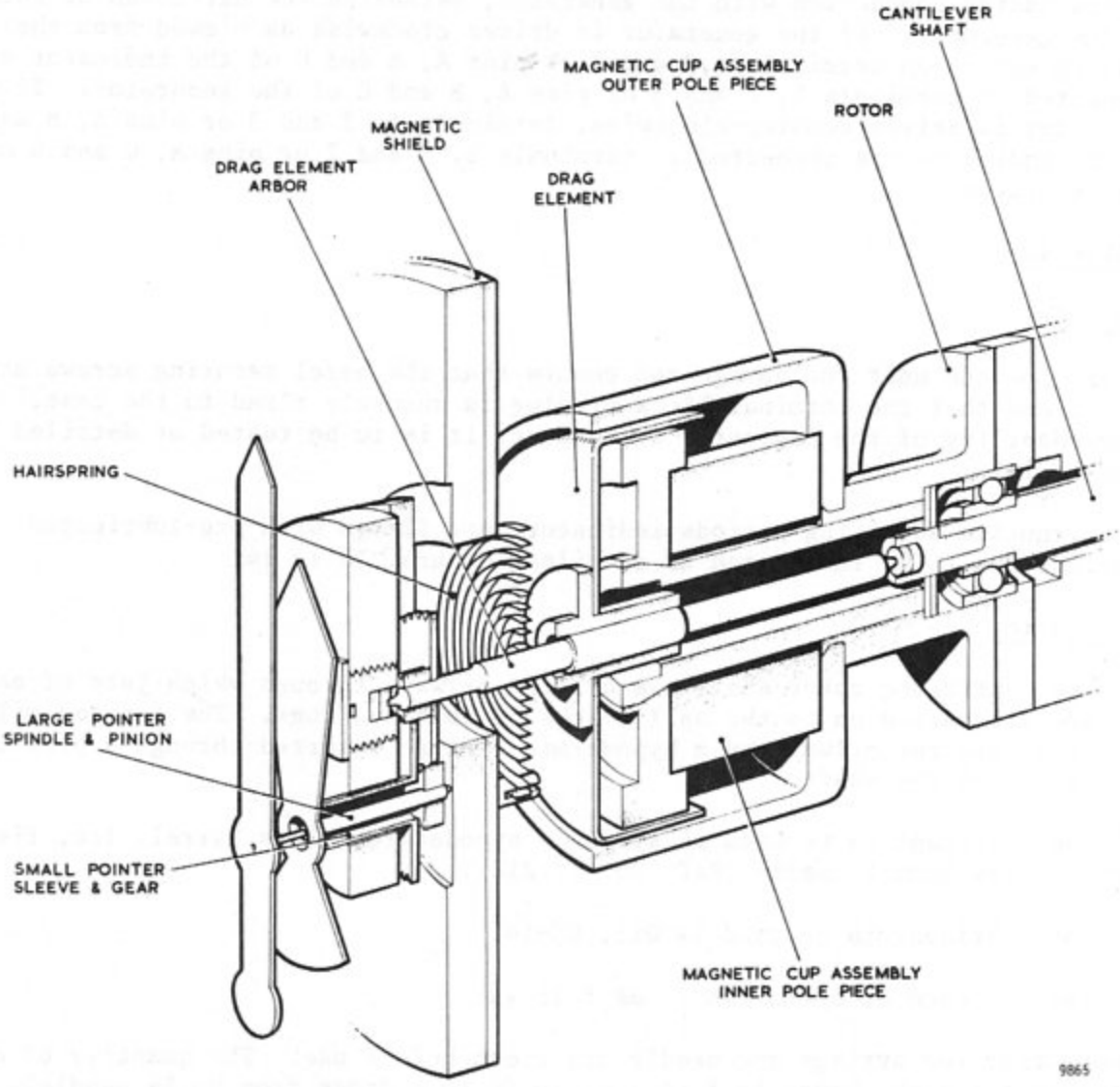


Fig.2 Details of magnetic drag cup assembly

13.3 Remove the needle from the instrument without withdrawing the plunger, and take a fresh charge of air and oil into the syringe as described in para.13.

13.4 Inject a second charge as described in sub-para.13.2.

13.5 Remove the needle again from the seal and withdraw the plunger to its full extent.

13.6 Re-insert the needle and press home the plunger; this final air charge will force the remaining oil into the bearings.

13.7 Fit the plug and rear plate or the terminal block cover as appropriate.

13.8 Record the operation either by marking the instrument or by annotating the appropriate Bay-Servicing Record Form 3592.

14 The following general information on lubrication should be noted:-

14.1 It is most important that oil of the correct viscosity is used, otherwise the quantity of oil may not be shared equally between the bearings.

14.2 Always insert the needle through the same hole in the seal. This method of lubrication depends on the build-up of pressure inside the shaft which will not take place if the seal has several punctures.

TABLE 1 DETAILS OF TACHOMETER INDICATORS

Type	Ref.No.	Electrical Connections	Dial Presentation
67RV	6A/5998	Terminal block	2400-20000 rev/min. Fluorized dial markings and pointers.
78RV	6A/2122	Terminal block	800-5000 rev/min. Fluorized dial markings and pointers.
95RV/SB	6A/2964	3-pole plug	2400-20000 rev/min. Fluorized dial markings and pointers.
PW134RV/BU	6A/9477	Terminal block	2400-20000 rev/min. Fluorized dial markings and pointers.
164RV/BR	6A/NIV	Terminal block	2400-20000 rev/min. Fluorized dial and pointer markings. Red arc on inner scale between 7500 and 9500 rev/min. Green arc on inner scale between 10400 and 14500 rev/min. Red lines at 10400 and 14500 rev/min.
PW170RV/BU and PW170RV/BR	6A/NIV 6A/NIV	Terminal block	2400-20000 rev/min. Green arc on inner scale between 11000 and 15000 rev/min. Red lines at 11000 and 15000 rev/min.

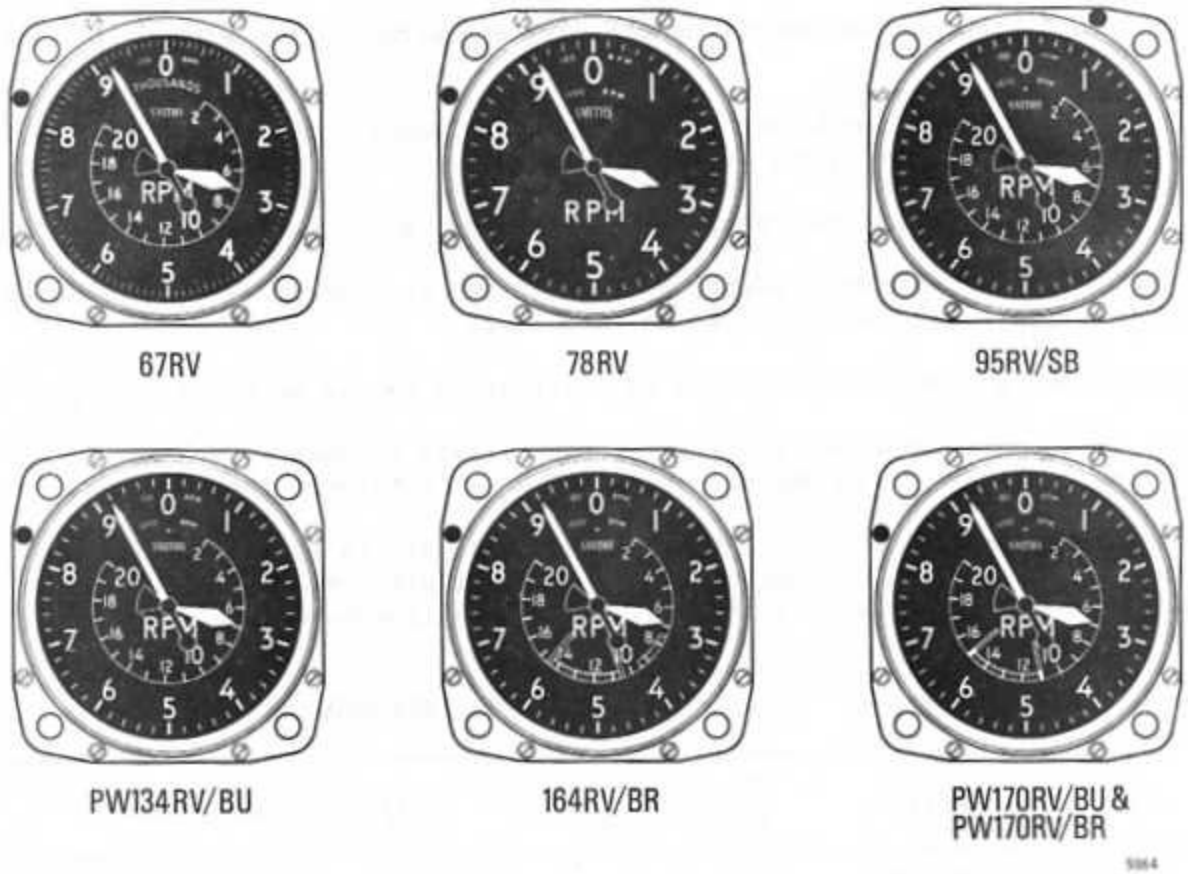


Fig.3 Dial presentations

Chapter 1-1

STANDARD SERVICEABILITY TESTS

for

TACHOMETER INDICATORS, TYPE 67RV, 78RV, 95RV/SB, PW134RV/BU, 164RV/BR, PW170RV/BU and PW170RV/BR

Introduction

1. The tests detailed in this chapter are to be applied to the above-mentioned equipment immediately prior to installation in aircraft or if serviceability is suspect. Any tolerances specified are not to be exceeded.

Test equipment

2. The following test equipment is required:-

(1) Tester, insulation resistance, Type C (Ref.No.5G/152).

(2) A serviceable, compatible generator.

(3) Dual tachometer tester (Ref.No.6C/3000, 6C/2391 or 6C/2392)
Alternative to items in (3).

(4) Tachometer tester, bench type (Ref.No.6C/1879 or 6C/1880).

TEST PROCEDURE

Method of test

3. During the ranging tests, the indicator is to be mounted in the normal position, that is, with the dial upright and in the vertical plane. Light tapping of the indicator is permissible during the tests.

Resistance test

◄ 4. Measure the resistance between pins A and B, B and C, and A and C (or 1 and 2, 2 and 3, and 1 and 3 as appropriate). In each case the resistance must be 30 ±3 ohms. ►

Insulation resistance test - room temperature

◄ 5. Before the indicator undergoes its synchroninization and ranging tests, measure the insulation resistance between one phase (pin A terminal 1, as appropriate) and the body. The resistance in each instance must not be less than 2 megohms at 250V. ►

Ranging tests

6. Connect the generator to the tester then connect the indicator to the generator (Chap.1, para.7). Switch on the test equipment and exercise the generator and indicator by running at approximately 2000 rev/min for Type 78RV, or 8000 rev/min for Types 67RV, 95RV/SB, PW134RV/BU, 164RV/BR, PW170RV/BU, PW170RV/BR for ten minutes. At the end of this period, slowly reduce the speed to zero.

7. Slowly increase the generator speed from 0, and check the speed at which the generator and indicator synchronize; this must occur at or before the appropriate speed given in Table 1.

TABLE 1

Synchronization speeds

Indicator	Synchronization speed (rev/min)
67RV	2400
78RV	800
95RV/SB	2400
PW134RV/BU	2400
164RV/BR	2400
PW170RV/BU	2400

8. Check the accuracy of the indicator at the test points given in Table 2, 3 or 4, as appropriate. The error at any point must not exceed the given tolerance. Any lag, as shown by the difference between readings taken at increasing and decreasing speeds, must not exceed the figure given in the relevant table.

► Note...

Unless an indicator, not fitted with pre-lubricated bearings, has been lubricated immediatley prior to the ranging test, it must not be rejected for failing the synchronization or ranging test until it has been lubricated and re-tested. ◄

TABLE 2

Test points and tolerances - Type 78RV

Tester speed (rev/min)	Indicator reading (rev/min)	Tolerance (rev/min)	Lag (rev/min)
800	800	±25	
2000	2000	±25	
3000	3000	±30	25
4000	4000	±40	
5000	5000	±50	

TABLE 3

Test points and tolerances - Type 67RV and 95RV/SB

Tester speed (rev/min)	Indicator reading (rev/min)	Tolerance (rev/min)	Lag (rev/min)
600	2400	±100	
1000	4000	±100	100
2000	8000	±100	
3000	12000	±120	
4000	16000	±160	100
5000	20000	±200	

TABLE 4

Test points and tolerances - Type PW134RV/BU, 164RV/BR, PW170RV/BU and PW170RV/BR

Tester speed (rev/min)	Indicator reading (rev/min)	Tolerance (rev/min)	Lag (rev/min)
600	2400	±100	
1000	4000	±100	
2000	8000	±100	
3000	12000	±120	100
3700	14800	± 60	
4000	16000	±160	
5000	20000	±200	

Printed in England for Her Majesty's Stationery Office by Flight Refuelling Ltd., Wimborne. Dmd. 419633. 9/76. 929

Chapter 1-2

STANDARD SERVICEABILITY TEST FOR TACHOMETER INDICATOR TYPE 95RV/SB FITTED IN WESSEX HAR Mk. 1 AND HAS Mk. 3 AIRCRAFT (RN ONLY)

Introduction

1 The tests detailed in this chapter are to be applied to the above-mentioned indicator prior to installation in aircraft or if serviceability is suspect. Any tolerances specified are not to be exceeded.

Test equipment

2 The following test equipment is required:-

2.1 Tester, insulation resistance (Ref. No. 5G/1112740).

2.2 A serviceable tacho-generator, Type 106RV or KGA 04 series.

2.3 Dual tachometer tester (Ref. No. 6C/6365770, 6C/2391 or 6C/2393 or equivalent.

2.4 Overspeed trip governor gearbox (6C/1981834).

2.5 Hewlett-Packard frequency counter Type 3734A (Ref. No. 6625-99-107-0130) OR Racal counter electronic frequency (Ref. No. 6625-99-522-6578).

2.6 Locally manufactured adaptor and drive as shown in figure 1.

TEST PROCEDURE

Method of test

3 Unless otherwise stated the indicator is to be mounted with the plane of the dial vertical. Light tapping of the indicator is permitted during the tests.

Insulation resistance test

4 Measure the insulation resistance between pins A, B and C or terminals 1, 2 and 3 as appropriate commoned and the body. The resistance must not be less than 2 megohms at 250V.

5 Cancelled.

Ranging tests

6 Connect the tacho-generator Type 106RV or KGA 04 series to the dual tacho-tester by means of the overspeed trip governor gearbox and locally manufactured adaptor and drive. Connect a frequency counter to the OTG gearbox terminals and the indicator under test to the tacho-generator. Switch on the test equipment and exercise the generator and indicator by running at approximately 10 000 RPM for 10 minutes. At the end of this period, slowly reduce the speed to zero.

7 Slowly increase the generator speed from 0 and check the speed at which the generator and indicator synchronize; this must occur at or before 2400 RPM.

8 Check the accuracy of the indicator at the test points given in Table 1. The error at any point must not exceed the stated tolerance. Any lag, as shown by the difference between readings taken at increasing and decreasing speeds, must not exceed the figure given in Table 1.

► Note...

Unless an indicator, not fitted with pre-lubricated bearings, has been lubricated immediately prior to the ranging test, it must not be rejected for failing the synchronization or ranging test until it has been lubricated and re-tested. ◄

TABLE 1 TEST FIGURES AND TOLERANCES

Testbench speed (RPM/FREQ)	Indicator (RPM)	Tolerance (RPM)	Lag (RPM)
2500	10000	± 100	
2750	11000	± 110	
3000	12000	± 120	
3250	13000	± 130	
3500	14000	± 140	
3750	15000	± 150	
4000	16000	± 160	
4250	17000	± 170	100
4500	18000	± 180	
4750	19000	± 190	
4800	19200	± 190	
4850	19400	± 190	
4900	19600	± 195	
4950	19800	± 195	
5000	20000	± 200	

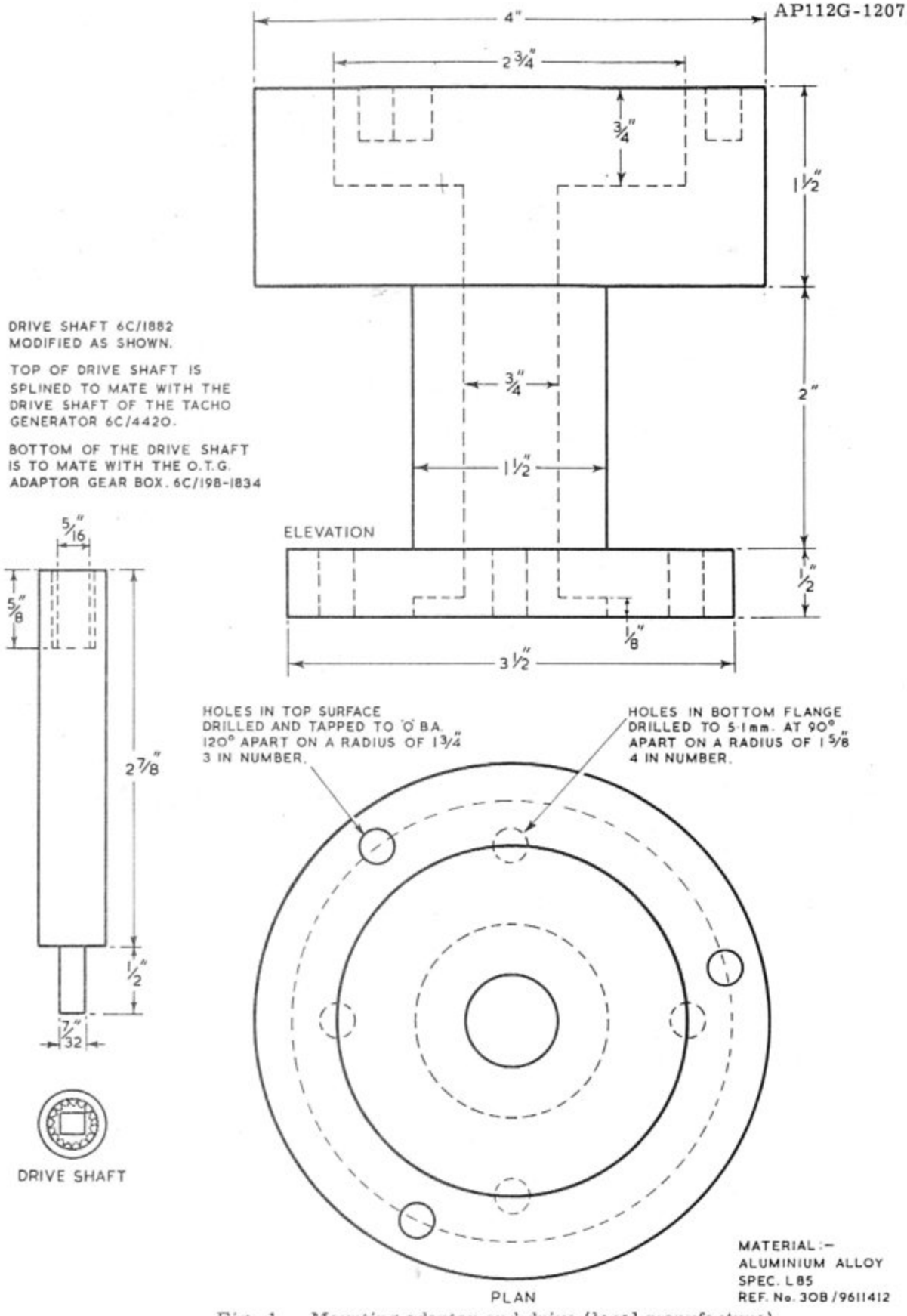


Fig. 1 Mounting adaptor and drive (local manufacture)

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Chapter 2

TACHOMETER INDICATORS, TYPE 79RV/SB and PW171RV/BR

Introduction

1. The tachometer indicators described in this chapter are installed in aircraft to indicate the speed rotation of reciprocating engines or gas turbines. The indicators operate in conjunction with a tachometer generator driven by the engine, and provide an indication of engine speed in rev/min. Table 1 details the differences between the various tachometer indicators described in this chapter.

DESCRIPTION (fig. 1 and 2)

2. The indicator consists essentially of a 3-phase, self-starting synchronous motor which operates a co-axial magnetic drag element to move pointers over a dial calibrated in rev/min. The mechanism is housed in a standard $2\frac{3}{8}$ in. dia. case.

3. The synchronous motor has a 3-phase, star connected stator and a laminated rotor. The rotor is supported on two ball bearings mounted on a cantilever shaft projecting forward from the rear of the case. ◀The indicators were originally manufactured with an oilway in the shaft to facilitate lubrication of the bearings during servicing operations. However, during repair some indicators have been fitted with sealed bearings, therefore both types will be found in service.▶

4. A magnetic drag cup assembly is secured to the front of the rotor and comprises inner and outer pole pieces and a permanent magnet. A drag cup is located between the permanent magnet and the outer pole piece and fits closely over

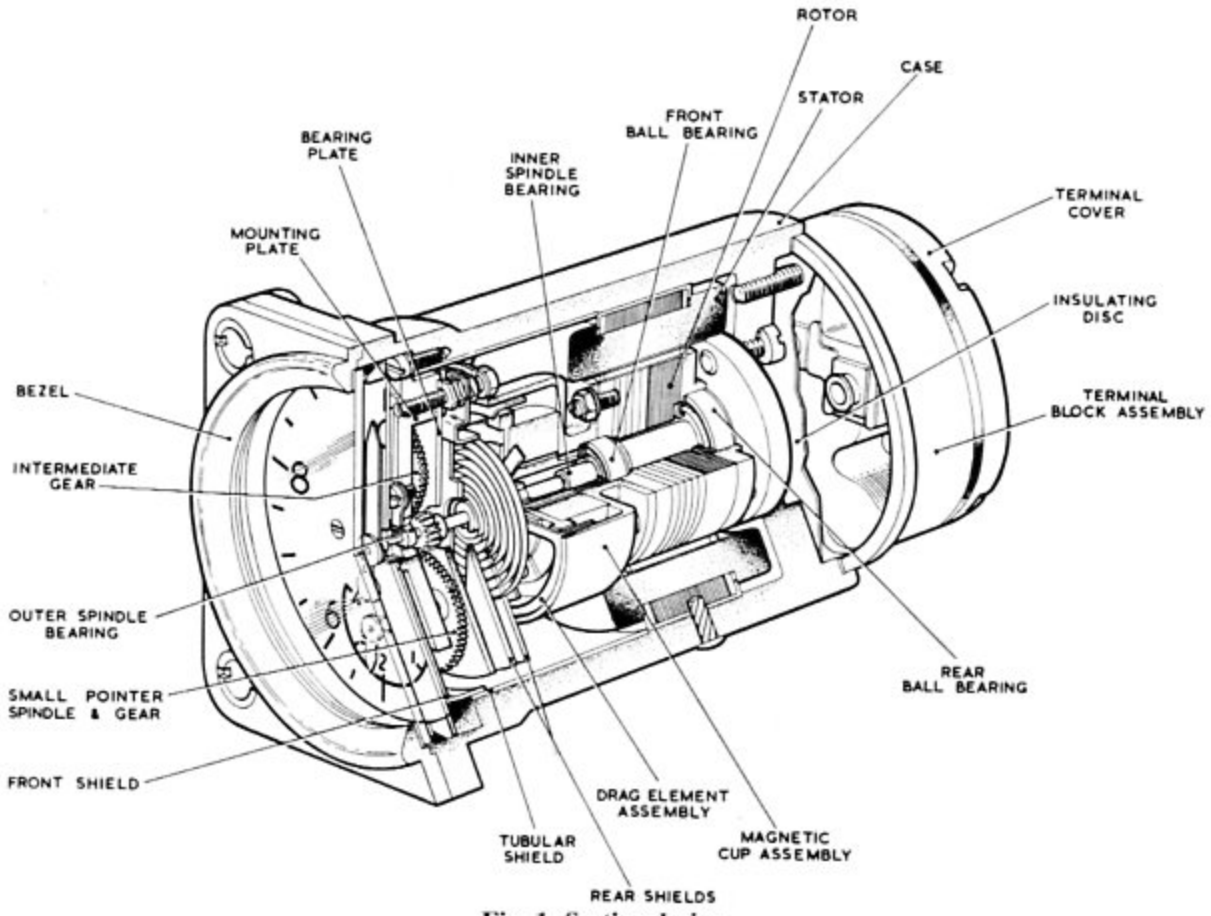

Fig. 1. Sectional view

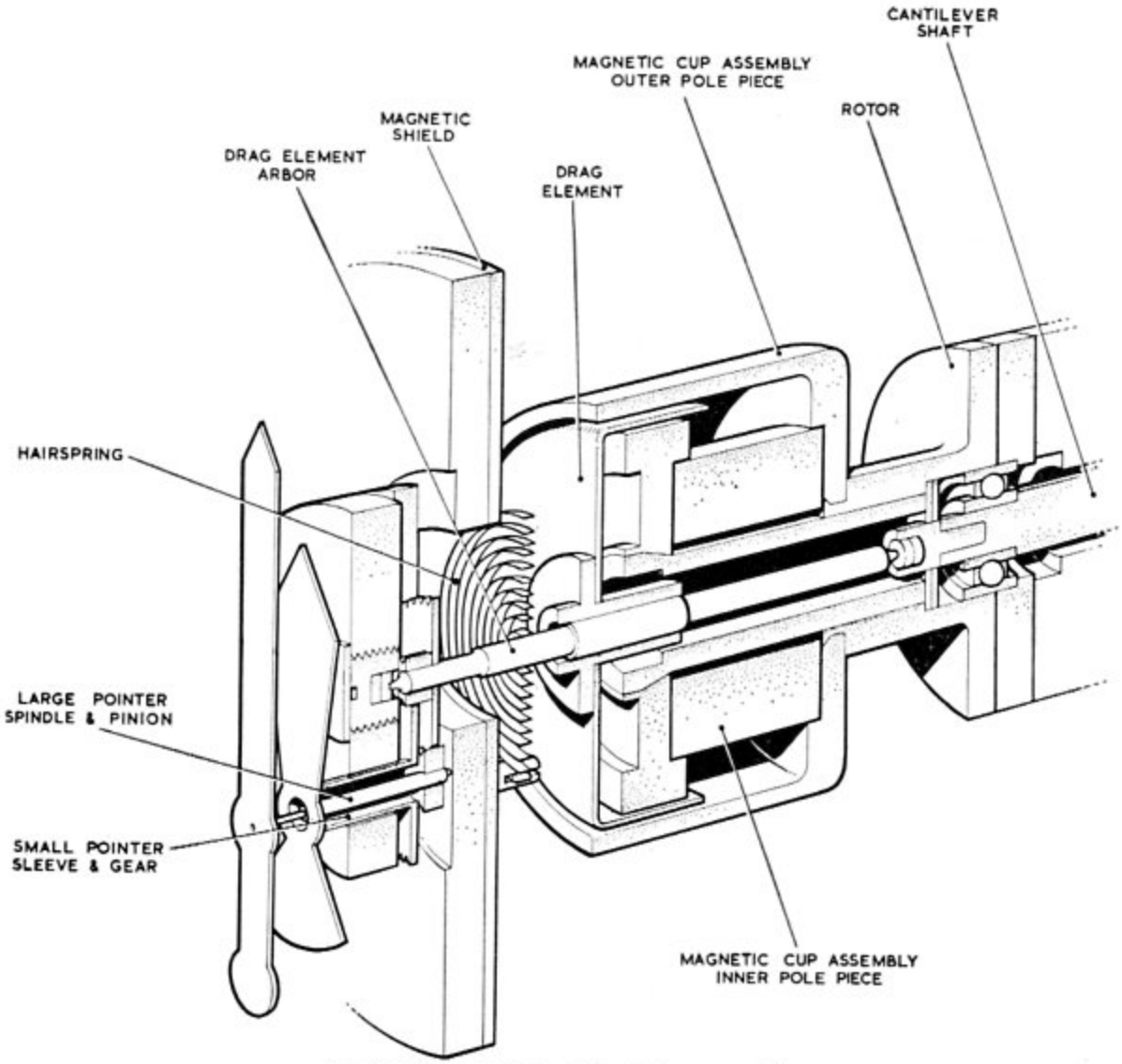

Fig. 2. Drag element and gearing assembly

the magnet to reduce the air gap to a minimum. The drag cup is mounted on the rear end of a pointer spindle on which the main pointer (100 of rev/min) is carried. A smaller pointer (1000 of rev/min.) moves over a sub-dial and is driven from the main pointer spindle through a gear train.

5. The front end of the case is closed by a dial, a rubber gasket and a glass; these are retained by a bezel secured to the case. The finish of the dial and pointers may vary between respective indicators, and details are given in Table 1. The three leads from the stator windings pass to the rear of the case. Depending upon installation requirements, a terminal block or a 3-pole plug is secured to the rear of the case.

OPERATION

6. Rotation of the tachometer generator produces a rotating magnetic field in the stator windings of the indicator; the speed of this field is controlled by the output frequency of the generator. The rotating field in the stator causes the rotor to rotate in synchronism with the field. Rotation of the rotor also rotates the magnetic drag element around the drag cup, this sets up eddy currents which rotate the drag cup against the tension of a hairspring. The movement of the drag cup is transmitted to the pointers, and when the hairspring torque equals the heavy current torque, the drag cup and the pointers will become stationary.

INSTALLATION

7. The indicator is secured to its mounting by four screws which pass through the bezel, and is connected to the tachometer generator by a 3-core cable. Before making connection with the generator, establish the direction of rotation of the generator. If the generator is driven clockwise as viewed from the driving end, then terminals 1, 2 and 3 or pins A, B and C of the indicator are connected to terminals 1, 2 and 3

or pins A, B and C of the generator. If the generator is driven counter-clockwise, terminals 1, 2 and 3 or pins A, B and C of the indicator are connected to terminals 1, 3 and 2 or pins A, C and B. of the generator.

SERVICING

8. The only routine servicing that can be applied is a visual examination for damage. Ensure that the bezel securing screws are tight, and that the terminal block or plug is securely fixed to the case. If serviceability of the indicator is suspect, it is to be tested as detailed in Chapter 2—1.

9. At routine servicing periods, the indicator is to be lubricated as detailed in para. 10 to 14.

◀Lubrication of indicators fitted with oilways

10. On some indicators (para. 3) the cantilever shaft has drilled oilways through which jets of aerated oil are discharged onto the ball tracks of both bearings.▶ The aerated oil is injected into the oilway by a hypodermic syringe inserted through a plastic seal in the end of the shaft.

11. The equipment to be used is syringe, hypodermic, glass barrel, 1cc, fitted with a No. 14 Summit needle (*Ref. No.* 1J/212).

12. The lubricant to be used is Oil, OX-14.

13. The sequence of operations is as follows:— Ensure that the syringe and needle are clean before use. The quantity of oil required for each charge is $\frac{1}{2}$ to $\frac{3}{4}$ minim (4 to 6 drops from No. 14 needle). It may be necessary to withdraw the plunger beyond the 1 minim graduation to draw up the required quantity of oil, owing to the presence of air in the needle and to variations in the manufacture of syringes A preliminary test should be made with each syringe to determine the graduation equivalent of 5 drops of oil. Having drawn up the required amount, remove the needle from the oil and withdraw the plunger to the top of the barrel. Oil the indicator as follows:—

(1) Stand the instrument dial downwards and remove the rear plate and plug or the terminal block cover as appropriate.

(2) Insert the needle through the small puncture in the centre of the seal in the cantilever shaft extension; the depth of insertion is not critical. Press the plunger smartly home.

(3) Remove the needle from the instrument without withdrawing the plunger, and take a fresh charge of air and oil into the syringe as described in para. 13.

(4) Inject a second charge as described in sub-para. (2).

(5) Remove the needle again from the seal and withdraw the plunger to its full extent.

(6) Re-insert the needle and press home the plunger; this final air charge will force the remaining oil into the bearings.

(7) Fit the plug and rear plate or the terminal block cover as appropriate.

(8) Record the operation either by marking the instrument or by annotating the appropriate Bay Servicing Record Form 3592.

14. The following general information on lubrication should be noted:—

(1) It is most important that oil of the correct viscosity is used, otherwise the quantity of oil may not be shared equally between the bearings.

(2) Always insert the needle through the same hole in the seal. This method of lubrication depends on the build-up of pressure inside the shaft which will not take place if the seal has several punctures.

TABLE 1

Details of tachometer indicators, Type 79RV/SB and PW171RV/BR

Part No.	Ref. No.	Electrical connections	Dial presentation
79RV/SB	6A/2078	Terminal block	800-3500 rev/min. Fluorized dial markings and pointers.
PW171RV/BR	6A/9005	Terminal block	800-3500 rev/min. Dial markings and pointers painted white. Red line at 2000 rev/min. Green arc between 0 and 3200 rev/min. on sub-dial. Red line at 3200 rev/min. on sub-dial.

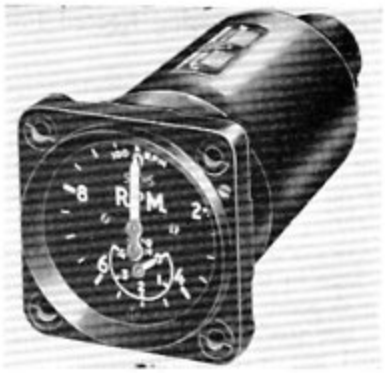

Fig. 3.

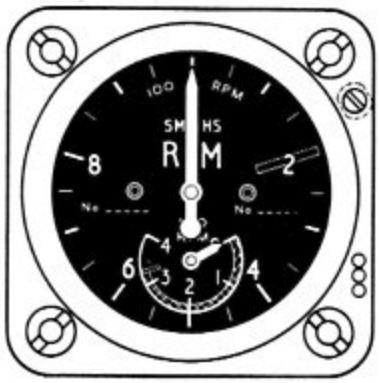

Fig. 4.

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Chapter 2-1

STANDARD SERVICEABILITY TESTS for TACHOMETER INDICATORS, TYPE 79RV/SB and PW171RV/BR

Introduction

1. The tests detailed in this chapter are to be applied to the above-mentioned equipment immediately prior to installation in aircraft or if serviceability is suspect. Any tolerances specified are not to be exceeded.

Test equipment

2. The following test equipment is required:—

(1) Tester, insulation resistance, Type C (Ref. No. 5G/152)

(2) A serviceable, compatible generator

(3) Dual tachometer tester (Ref. No. 6C/3000, 6C/2391 or 6C/2392)

Alternative to item in (3).

(4) Tachometer tester, bench type (Ref. No. 6C/1879 or 6C/1880)

TEST PROCEDURE

Method of test

3. During the ranging tests, the indicator is to be mounted in the normal position, that is, with the dial upright and in the vertical plane. Light tapping of the indicator is permissible during the tests.

Insulation resistance test—room temperature

4. Before the indicator undergoes its synchronization and ranging tests, measure the insulation resistance between each phase (pins A, B and C or terminals 1, 2 and 3 as appropriate) and the body, in turn. The resistance in each instance must not be less than 20 megohms at 250V.

Insulation resistance test—hot

5. Immediately after completion of the ranging tests, measure the insulation resistance between each phase (pins A, B and C or terminals 1, 2 and 3 as appropriate) and the body in turn. The resistance in each instance must not be less than 5 megohms at 250V.

Ranging tests

6. Connect the generator to the tester then connect the indicator to the generator (Chap. 2, para. 7). Switch on the test equipment, and exercise the generator and indicator by running at approximately 2000 rev/min. for 10 minutes. At the end of this period, slowly reduce the speed to zero.

7. Slowly increase the generator speed from 0, and check the speed at which the generator and indicator synchronize; this must occur at or before 800 rev/min.

8. Check the accuracy of the indicator at the test points given in Table 1; the error at any point must not exceed the tolerance. Any lag, as shown by the difference between readings taken at increasing and decreasing speeds, must not exceed 50 rev/min.

TABLE 1
Test points and tolerances

Tester speed (rev/min.)	Indicator speed (rev/min.)	Tolerance (rev/min.)
1000	1000	±20
1500	1500	±20
2000	2000	±20
2500	2500	±25
3000	3000	±30
3500	3500	±35

Printed for H.M. Stationery Office by G. F. Wilson, Southampton No. 171386 1100 89344 12/66 GFW9662

Chapter 3

TACHOMETER INDICATORS, TYPE 166RV/SB

Introduction

1. The tachometer indicator described in this chapter is installed in aircraft to indicate engine speed rotation. The indicator operates in conjunction with a tachometer generator driven by the engine, and provides an indication of engine speed in rev/min.

DESCRIPTION (fig. 1 and 2)

2. The indicator consists essentially of a 3-phase, self-starting synchronous motor which operates a co-axial magnetic drag element to move pointers over a dial calibrated in rev/min. The mechanism is housed in a standard 2 3/8 in. dia. case.

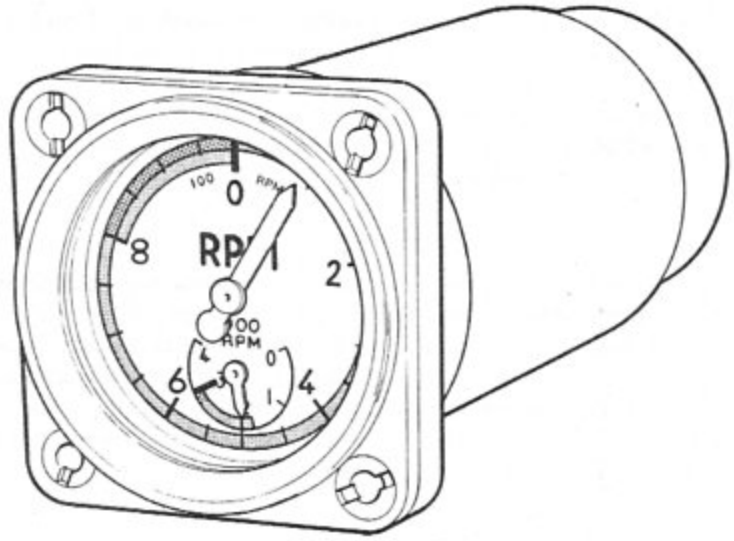

Fig. 1 Recognition view

3. The synchronous motor has a 3-phase, star connected stator and a laminated rotor. The rotor is supported on two ball bearings mounted on a cantilever shaft projecting forward from the rear of the case. The indicators were originally manufactured with an oilway in the shaft to facilitate lubrication of the bearings during servicing operations. However, during repair some indicators have been fitted with sealed bearings, therefore both types will be found in service.

4. A magnetic drag cup assembly is secured to the front of the rotor and comprises inner and outer pole pieces and a permanent magnet. A drag cup is located between the permanent magnet and the outer pole piece and fits closely over the magnet to reduce the air gap to a minimum. The drag cup is mounted on the rear end of a pointer spindle on which the main pointer (100 of rev/min) is carried. A smaller pointer (1000 of rev/min) moves over a sub-dial and is driven from the main pointer spindle through a gear train.

5. The main dial outer scale begins at zero with a red line and continues in green until reaching the 800 RPM mark where the colour changes to yellow and is maintained to the zero mark. An additional offset scale between 800 and zero is coloured green.

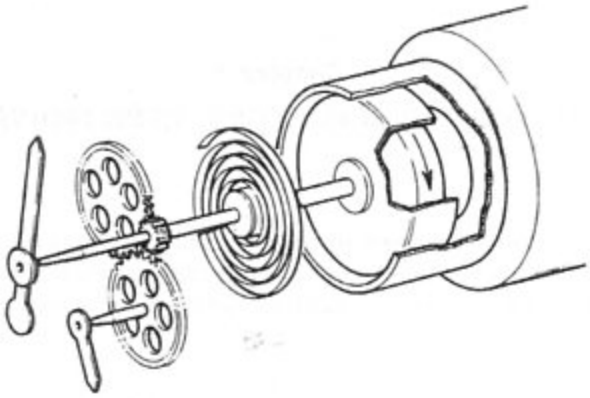

Fig. 2 Details of drag cup assembly

6. The sub-dial has a green scale between 1800 and 2000 RPM and a yellow band between 2000 and 3000 RPM. The 3000 RPM mark is indicated by a red line.

7. The front end of the case is closed by a dial, a rubber gasket and a glass; these are retained by a bezel secured to the case. The three leads from the stator windings pass to a 3-pole plug secured to the rear of the case.

OPERATION

8. Rotation of the tachometer generator produces a rotating magnetic field in the stator windings of the indicator; the speed of this field is controlled by the output frequency of the generator. The rotating field in the stator causes the rotor to rotate in synchronism with the field. Rotation of the rotor also rotates the magnetic drag element around the drag cup, this sets up eddy currents which rotate the drag cup against the tension of a hairspring. The movement of the drag cup is transmitted to the pointers, and when the hairspring torque equals the heavy current torque, the drag cup and the pointers stop.

INSTALLATION

9. The indicator is secured to its mounting by four screws which pass through the bezel, and is connected to the tachometer generator by a 3-core cable. Before making connection with the generator, establish the direction of rotation of the generator shaft. If the generator shaft is driven clockwise as viewed from the driving end, then terminals 1, 2 and 3 or pins A, B, and C of the indicator are connected to terminals 1, 2 and 3 or pins A, B and C of the generator. If the generator shaft is driven counter-clockwise, terminals 1, 2 and 3 or pins A, B and C of the indicator are connected to terminals 1, 3 and 2 or pins A, C and B, of the generator.

SERVICING

10. The only routine servicing that can be applied is a visual examination for damage. Ensure that the bezel securing screws are tight, and that the terminal block or plug is securely fixed to the case. If serviceability of the indicator is suspect, it is to be tested as detailed in Chapter 3-1.

11. At routine servicing periods, the indicator is to be lubricated as detailed in para. 10 to 14.

Lubrication

12. The cantilever shaft has drilled oilways through which jets of aerated oil are discharged

onto the ball tracks of both bearings. The aerated oil is injected into the oilway by a hypodermic syringe inserted through a plastic seal in the end of the shaft.

13. The equipment to be used is syringe, hypodermic, glass barrel, 1cc, fitted with a No.14 Summit needle (Ref.No.1J/212).

14. The lubricant to be used is Oil, OX-14.

15. The sequence of operations is as follows:-
Ensure that the syringe and needle are clean before use. The quantity of oil required for each charge is $\frac{1}{2}$ to $\frac{3}{4}$ minim (4 to 6 drops from No. 14 needle). It may be necessary to withdraw the plunger beyond the 1 minim graduation to draw up the required quantity of oil, owing to the presence of air in the needle and to variations in the manufacture of syringes A preliminary test should be made with each syringe to determine the graduation equivalent to 5 drops of oil. Having drawn up the required amount, remove the needle from the oil and withdraw the plunger to the top of the barrel. Oil the indicator as follows:-

(1) Stand the instrument dial downwards and remove the rear plate and plug or the terminal block cover as appropriate.

(2) Insert the needle through the small puncture in the centre of the seal in the cantilever shaft extension; the depth of insertion is not critical. Press the plunger smartly home.

(3) Remove the needle from the instrument without withdrawing the plunger, and take a fresh charge of air and oil into the syringe as described in para. 15.

(4) Inject a second charge as described in sub-para.(2).

(5) Remove the needle again from the seal and withdraw the plunger to its full extent.

(6) Re-insert the needle and press home the plunger; this final air charge will force the remaining oil into the bearings.

(7) Fit the plug and rear plate or the terminal block cover as appropriate.

(8) Record the operation either by marking the instrument or by annotating the appropriate Bay Servicing Record Form 3592.

16. The following general information on lubrication should be noted:-

(1) It is most important that oil of the correct viscosity is used, otherwise the quantity of oil may not be shared equally between the bearings.

(2) Always insert the needle through the same hole in the seal. This method of lubrication depends on the build-up of pressure inside the shaft which will not take place if the seal has several punctures.

Chapter 3-1

STANDARD SERVICEABILITY TEST

for

TACHOMETER INDICATORS, TYPE 166RV/SB

Introduction

1. The tests detailed in this chapter are to be applied to the above-mentioned equipment immediately prior to installation in aircraft or if serviceability is suspect. Any tolerances specified are not to be exceeded.

Test equipment

2. The following test equipment is required:-

(1) Tester, insulation resistance, Type C (Ref. No. 5G/152).

(2) A serviceable, compatible generator.

(3) Dual tachometer tester (Ref. No. 6C/3000, 6C/2391 or 6C/2392).

Alternative to item in (3).

(4) Tachometer tester, bench type (Ref. No. 6C/1879 or 6C/1880).

TEST PROCEDURE

Method of test

3. During the ranging tests, the indicator is to be mounted in the normal position, that is, with the dial upright and in the vertical plane. Lighting tapping of the indicator is permissible during the tests.

Insulation resistance test - room temperature

4. Before the indicator undergoes its synchronization and ranging tests, measure the insulation resistance between each phase (pins A, B and C or terminals 1, 2 and 3 as appropriate) and the body, in turn. The resistance in each instance must not be less than 20 megohms at 250V.

Insulation resistance test - hot

5. Immediately after completion of the ranging tests, measure the insulation resistance between each phase (pins A, B and C or terminals 1, 2 and 3 as appropriate) and the body in turn. The resistance in each instance must not be less than 5 megohms at 250V.

Ranging tests

6. Connect the generator to the tester then connect the indicator to the generator (Chap. 3, para. 9). Switch on the test equipment, and exercise the generator and indicator by running at approximately 2000 rev/min. for 10 minutes. At the end of this period, slowly reduce the speed to zero.

7. Slowly increase the generator speed from 0, and check the speed at which the generator and indicator synchronize; this must occur at or before 800 rev/min.

8. Check the accuracy of the indicator at the test points given in Table 1; the error at any point must not exceed the tolerance. Any lag, as shown by the difference between readings taken at increasing and decreasing speeds, must not exceed 60 rev/min.

TABLE 1
Test points and tolerances

Tester speed (rev/min)	Indicator speed (rev/min)	Tolerance (rev/min)
800	800	± 20
1000	1000	± 20
1500	1500	± 20
2000	2000	± 20
2500	2500	± 25
3000	3000	± 30
3500	3500	± 35
4000	4000	± 40

Printed in England for Her Majesty's Stationery Office by Flight Refuelling Ltd., Wimborne. Dmd. 939969. 9/72. 1306.

TACHOMETER INDICATOR TYPE 95RV

REF 6A/6918

MEMORANDUM OF INSTRUCTIONS (R.N.)

1) CONTENTS

This schedule contains a list of spare parts applicable to the equipment

2) COLUMN 1

The Item Number in Col. 1 is for sponsor departmental use.

3) DEMANDS

Items marked N.P. in Col. 6 are not provisioned as spares, but are included to assist identification of components. Requirements for these items can usually by met by demanding:-

(i) Next Highest assembly.
(ii) The individual components of the item required.

If requirements for N.P. items cannot be met by (i) or (ii), demands are to be submitted after approval by the Engineer Officer, on Form S130, on Form S130, to M.O.D. (N) for approval.

On demands the full Reference Number shown in Col. 2 is to be used, prefixed by the appropriate Management Code where indicated in the Interservice Index.

(b) Parts not qualified by the numeral 2 in Col. 7 are available 4th line only.

(c) Parts qualified by the symbol LM in Col. 7 are to be manufactured by consumer units.

4) MODIFICATIONS

This publication will be amended at convenient intervals. Users should use this book in conjunction with appropriate modification leaflet.

5) COMPILATION OF TEXT (Col. 4)

The multi-indentation system has been used. The indentation is in accordance with the following outline:-

(a)	Indent 1.	Main Units
(b)	Indent 2	{ Sub-Assemblies { Detail parts main units.
(c)	Indent 3	Breakdown of Sub-Assembly.
(d)	Indent 4, 5, 6, 7, 8	Further breakdown
(e)	Attaching parts are listed after the indents and refer to the item directly above.	

6) CLASS OF EQUIPMENT

Letters denoting Class of Stores are defined as follows:-

'C'	Consumable items
'CM'	Consumable with a limited repair capability
'PA'	Permanent attractive
'PN'	Permanent. Repairable at 2nd Line only
'PR'	Permanent. Repairable at 2nd Line and/or 4th Line.

7) The Item Number and Reference Number are repeated on the Interservice Index sheet. This sheet also incorporates Management Code, Usage Code and Interchangeability Code (I.C.Y.)

MAIN EQUIPMENT ENGINE SPEED INDICATOR (MOD.04) 95/RV 6A/6918

(1) Item No.	(2) Ref.No.	(3) Part No.	(4) 1 2 3 4 5 6 7 Description	(5) No. Off	(6) Remarks	(7) Cof E	(8) Plate/ Cct. Ref.
1	6A/6918	95/RV	ENGINE SPEED INDICATOR	1		2P	1
2	6A/433-3210	RV 450	. COVER TERMINAL	1		2C	1.1
3	28M/13814	A43B14	. SCREW 4BA x 7/16in. ch.hd. brass cad. plated.	4		C	1-2
4	6A/433-3024	FL 387	. WASHER SEALING AND GROMMET COMBINED	1		C	1-3
5	6A/621-1332	RV1007	. BLOCK TERMINAL COMPLETE	1		C	1-4
6	6A/17124	RV 999	. . BUSH TERMINAL	3		C	1-6
7	6A/5513	SW 21	. . WASHER TERMINAL	3		C	1-7
8	6A/433-3028	STD 14	. SCREW, TERMINAL AND CAPTIVE WASHER	3		2C	1-8
9	28M/2085	A43/B24	. SCREW 4BA x 3/4in ch. hd. brass cad., plated.	2		C	1-9
10	28W/941-6642	SP 47B	. WASHER 4BA sc. st. cad. plate.	2		C	1-10
11	6A/5245	RV 382	. WASHER SEALING	1		C	1-11
12	6A/433-3228	AS 419	. BEZEL	1		C	1-12
13	6A/5446	STD 1508/1	. SCREW BEZEL	8		2C	1-13
14	6A/2250	AM 663	. NUT, SPECIAL BEZEL	8		2C	1-14
15	6A/2252	AM 666	. WASHER PACKING	1		2C	1-15
16	6A/433-3152	AM 481	. GLASS	1		2C	1-16
17	6A/6141	AM 482	. GASKET RUBBER	1		2C	1-17
18	6A/714-2679	RV 901	. CASE COMPLETE WITH LOCK NUTS	1		C	1-19
19	6A/16110	O-247-1	. NUT LOCK	4		C	1-20
20	6A/621-1333	RV 1075	. NAMEPLATE	1		C	1-21
21	6A/17093	PV/RV146	. POINTER LARGE COMPLETE	1		C	1-22
22	6A/17096	PW/RV148	. POINTER, SMALL, COMPLETE	1		C	1-23
23	6A/621-1328	PW/RV663	. DIAL FINISHED	1		C	1-24

MAIN EQUIPMENT ENGINE SPEED INDICATOR (MOD 04) 95/RV 6A/6918

(1) Item No.	(2) Ref.No.	(3) Part No.	(4) 1 2 3 4 5 6 7 Description	(5) No. Off	(6) Remarks	(7) Cof E	(8) Plate/ Cct.Ref.
24	6AA/8426	30-233-233-33	. SCREW 10BA x 5/32in.csk. hd. brass black oxy.	4		C	1-25
25	6A/714-2731	RV 246	. PLATE LOCKING	1		C	1-26
26	6A/714-2672	RV 387	. BEARING OUTER SPINDLE COMPLETE	1		C	1-27
27 MOD.03		RV 1112	. HOUSING, BEARING COMPLETE	1			
27 Pre-MOD 03	6A/621-1331	RV 1002	. HOUSING, BEARING COMPLETE	1		C	1-28
28	6A/714-2675	RV 423	. . BUSH ECCENTRIC	1		C	1-29
29	6A/17094	PA 4798	. . BEARING JEWEL	1		C	1-30
30	6A/17101	RV 385	. . BEARING END	1		C	1-31
31	28S/120-0048	A31/A10	. SCREW 6BA x 5/16in.ch. hd.st.	4		C	1-32
32	28W/9416641	SP47/A	. WASHER 6BA sc st.cad.pl.	4		C	1-33
33	6A/714-2668	RV151	. BUSH	1		C	1-34
34	6A/714-2673	RV 411	. SLEEVE AND GEAR SMALL POINTER COMPLETE	1		C	1-35
35	6A/714-2674	RV 412	. SPINDLE AND PINION, LARGE POINTER	1		C	1-36
36 MOD.03		RV 1108	. SHIELD MAGNETIC	1		C	
36 Pre-MOD 03	6A/621-1330	RV 938	. SHIELD MAGNETIC	1		C	1-37
37	28S/16714	A33 Y5	. SCREW 10BA x 5/32in.ch. st.	1		C	1-38
38	6A/714-2682	RV 958	. ELEMENT DRAG ASSEMBLY COMPLETE	1		C	1-39
39 Pre-MOD 03	6A/621-1329	RV 893	. POST HAIRSPRING ANCHOR	1		C	1-40
40	6A/714-2681	RV 937	. SHIELD MAGNETIC AND SCREW ASSEMBLY	1		C	1-41
41	28M/940-3517	A 47Z	. NUT 8BA full steel	6		C	1-42

MAIN EQUIPMENT ENGINE SPEED INDICATOR (MOD 04) 95/RV 6A/6918

(1) Item No.	(2) Ref.No.	(3) Part No.	(4) 1 2 3 4 5 6 7 Description	(5) No. Off	(6) Remarks	(7) Cof E	(8) Plate/ Cct.Ref.
42	6A/621-1334	30-282-008-11	. WASHER 8BA s.coil st.cad. plate.	3		C	1-43
43	6A/714-2680	RV 903	. CUP MAGNETIC & SCREW ASSEMBLY	1		C	1-44
44	28M/940-3517	A47Z	. NUT 8BA full steel	6		C	1-42
45	6A/17098	RV 225	. STUD 8BA	3		C	1-45
46	6A/714-2671	RV 386	. BEARING INNER SPINDLE COMPLETE	1		C	1-46
47	6A/714-2732	RV 889	. RING SPRING	2		C	1-47
48	6A/714-2676	RV 726	. PLATE BALLRACE COVER FRONT	1		C	1-48
49	6A/17110	RV777	. CLIP	2		C	1-49
50 Pre-MOD 04	2A/950-1173	HOFFMAN N.463	. BEARING BALL i.d. 1/8in. o.d. 3/8in. width 5/32 in.	1		C	1-50
50 MOD.04		BARDEN SR2SSW 4FS1292 3-5mg.	. BEARING BALL	1			1-50
51	6A/17120	RV 994	. WASHER OIL SMALL	1		C	1-51
52	6A/714-2678	RV 796	. ROTOR COMPLETE	1		C	1-52
53 Pre-MOD 04	6A/714-2664	RV 1032	. SHAFT CANTILEVER	1		C	1-53
53 MOD.04		RV 1165	. SHAFT CANTILEVER	1		C	1-53
54	28S/941-9453	A31 B14	. SCREW 4BA x 7/16in.ch. hd.std.	3		C	1-54
55	28W/941-6642	SP 47/B	. WASHER 4BA sc.st. cad. plate.	2		C	1-55
56 Pre-MOD 03	6A/17119	RV 993	. LUBRICATOR	1		C	1-56
57 Pre-MOD 03	6A/714-2734	RV 998	. WASHER	1		C	1-57
58 Pre-MOD 03	6A/714-2733	RV 997	. WASHER, SEALING	1		C	1-58
59	6A/714-2677	RV 727	. PLATE BALL BEARING COVER	1		C	1-59

MAIN EQUIPMENT ENGINE SPEED INDICATOR (MOD.04) 95/RV 6A/6918

(1) Item No.	(2) Ref.No.	(3) Part No.	(4) 1 2 3 4 5 6 7 Description	(5) No. Off	(6) Remarks	(7) Cof E	(8) Plate/ Cct.Ref.
60 Pre-MOD 03	2A/950-1174	HOFFMAN 4666	. BEARING BALL i.d. 3/16 in. o.d. 1/2 in. width 5/32 in	1		C	1-60
60 MOD.04		Barden SR186SSW X2K4FS1292 3-5mg	. BEARING BALL	1			1-60
61	6A/17121	RV995	. WASHER, OIL LARGE	1		C	1-61
62	6A/714-2669	RV241	. STATOR COMPLETE	1		C	1-62

Printed in England for Her Majesty's Stationery Office by Flight Refuelling Ltd., Wimborne. Dmd. 117387. 1957. 3/80. 784