AIR PUBLICATION

112G-1222-16

TACHOMETER INDICATOR,

TYPE KTD 20 SERIES

GENERAL AND TECHNICAL INFORMATION

REPAIR AND RECONDITIONING INSTRUCTIONS

BY COMMAND OF THE DEFENCE COUNCIL

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Ministry of Defence

FOR USE IN THE
ROYAL AIR FORCE

(Prepared by the Ministry of Technology)

Issued Jan. 69

AMENDMENT RECORD SHEET

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

A.L. No.	Amended by	Date
1	INCORPORATED	
2	JAN SL	2/5/90
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LIST OF CHAPTERS

Chapter 1

TACHOMETER INDICATOR, TYPE PW/2010 KTD/BU/1

Introduction

1. The tachometer indicator, Type PW/2010 KTD/BU/1 (*Ref. No.* 6*A*/11648) indicates engine speed expressed as a percentage of the nominal maximum engine revolutions. Fig. 1 is a general view of the instrument showing the dial presentation.

2. The indicator consists of an eddy current tachometric unit, coupled to a three-phase synchronous motor, the rotor of which revolves in synchronism with a three-phase generator, to which it is electrically connected; the generator being driven by the associated engine.

3. The main dial is calibrated in 10 per cent graduations and the sub-dial is graduated in ten divisions. The small hand makes one revolution for each multiple of 10 per cent indicated by the main hand. Allowance is made for increases above nominal maximum engine speed, up to 110 per cent indication; this is achieved by using the sub-dial for the last 10 per cent.

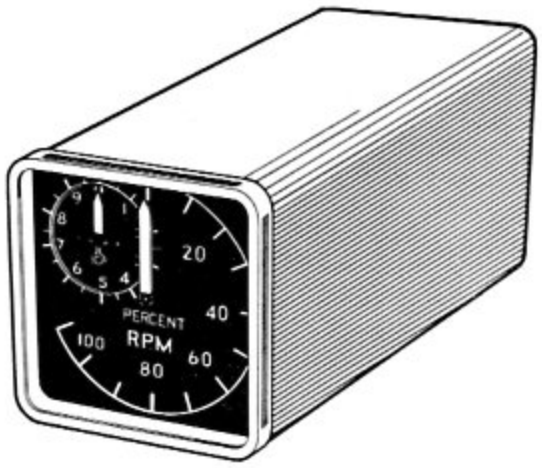

Fig. 1. General view of tachometer indicator

DESCRIPTION

4. The motor assembly (*fig.* 2), comprises a three-phase stator and a combined polarized and hysteresis rotor, these being enclosed within the motor cover and the lower motor cover. The rotor consists of a starter magnet, which is free to rotate about the rotor shaft, and two fixed hysteresis discs, front and rear.

5. Rotation of the magnet relative to the shaft is restricted by stop pins fitted to the magnet and to the front hysteresis disc. The shaft runs in ball bearings which are housed in the motor covers. Torque is transmitted to the upper mechanism by a cylindrical permanent magnet, fitted with a temperature compensating disc and a concentric keeper. The magnet assembly is secured to the forward end of the motor shaft.

6. The upper mechanism, as shown in fig. 2, comprises a handstaff assembly mounted in jewelled bearings and supported in a framework consisting of a lower bearing plate, three spacers and a top plate. The handstaff assembly includes a drum which rotates in the air gap between the motor shaft magnet and its keeper ring, two restraining hairsprings, the outer ends of which are anchored to the framework, and a gear wheel which drives the small hand mechanism. the large hand is mounted on the forward end of the handstaff, while the small hand is mounted on a separate handstaff which is driven from the main handstaff via a gearbox. The upper mechanism is clamped to the motor cover with the open end of the drum accommodated in the air gap between the motor shaft magnet and its keeper ring.

7. The instrument is calibrated by adjusting the position of the upper mechanism assembly relative to the motor assembly, thereby varying the depth of insertion of the drum within the air gap, while rotation of the upper mechanism relative to the motor assembly is restricted by a stop pin which is mounted on the forward face of the motor.

8. The complete mechanism is housed within a sealed metal case, measuring 2 inches square, which is filled with an inert gas to ensure long bearing life. The stator lead wires are connected to a terminal block fitted to the end plate. The end plate incorporates an evacuating tube through which the case is evacuated and filled with dry nitrogen.

OPERATION

9. The three-phase voltage produced in the engine driven generator energizes the stator of the tachometer indicator, producing a rotating field at a frequency related to the speed of the generator. Attraction between the rotating magnetic field and the starter magnet causes the magnet to rotate until it engages with the stop pin on the front hysteresis disc. This initial movement overcomes the inertia in the motor and causes the shaft to revolve. As the speed increases, the magnet has little effect and the motor operates as a synchronous motor.

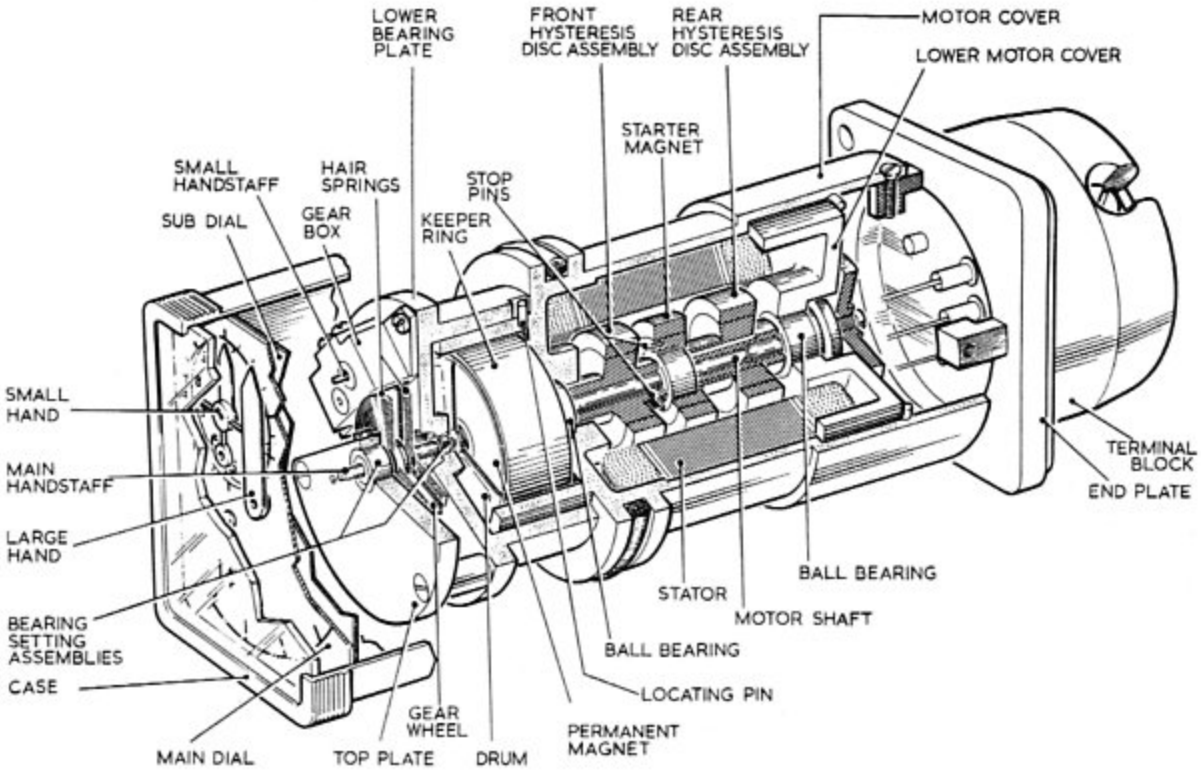

Fig. 2. Cutaway view of tachometer indicator

10. Rotation of the permanent magnet on the end of the motor shaft induces eddy currents in the handstaff drum, thus causing torque which is directly proportional to the the speed of rotation of the rotor. This torque causes the handstaff to rotate until it is balanced by an equal and opposite torque, exerted by the handstaff hairsprings. Since the hairspring torque is directly proportional to the angular deflection of the handstaff, this deflection is also proportional to the speed of the rotor and hence of the related tachometer generator. Indication is given by the large hand against the main dial, which is marked in 10 per cent divisions, and by the small hand in conjunction with the sub-dial which is marked in 1 per cent divisions.

INSTALLATION

11. The indicator is inserted through a cut-out in the panel and held in position by a King Aircraft clamp. The mounting attitude for the indicator is dial up 10 deg.

SERVICING

12. Prior to installation, or at any time when the serviceability of the tachometer indicator is suspect ,it should be subjected to the standard serviceability test detailed in Chap. 2.

Chapter 2

STANDARD SERVICEABILITY TESTS

FOR

TACHOMETER INDICATOR, TYPE PW/2010 KTD/BU/1
(Completely revised)

Introduction

1 The tests detailed in this chapter are to be applied to the unit immediately prior to installation in the 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/9156675 or 5G/6505337).

2.2 A serviceable tachometer generator.

2.3 Dual tachometer tester (Ref. No. 6C/1117125 or 6C/6365770).

Alternative to item 2.3.

2.4 Digital dual tachometer tester 6C/6598644.

TEST PROCEDURE

Method of test

3 During the ranging tests, the indicator is to be mounted in the normal position, that is, with the axis of the unit inclined at 10 deg to the horizontal in the dial up direction. Light tapping of the indicator is permissible during the tests.

Insulation resistance (room temperature)

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

Insulation resistance (hot)

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

Ranging test - using the dual tachometer tester

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6.1 Fit the adapter gearbox (percentage type, Pt. No. 1854) into the mounting flange ensuring that the gearbox driving peg locates in the slot in the drive shaft. Tighten the knurled nuts to retain the gearbox in position.

6.2 Fit the adapter to the adapter gearbox.

6.3 Assemble the generator on the adapter with its coupling spindle in position.

6.4 If using tester Ref. No. 6C/1117125, connect the generator directly to the indicator under test.

6.5 If using tester Ref. No. 6C/6365770 or 6C/6598644, connect the generator to GEN and the indicator to IND on the test panel. Place the DIRECT/TEST switch to DIRECT and the TEST SELECTOR switch to IND.

6.6 Connect the tester to the electrical supply. Set the tester motor switch to ON.

6.7 If using tester Ref. No. 6C/1117125, connect the tuning fork to the tester and start the fork vibrating by operating the striker knob.

6.7 Adjust to the speed required by rotating the speed adjusting knob.

7 To check synchronization, slowly increase the generator speed from zero, and check that the generator and indicator synchronize at, or before, 10 per cent.

8 Set the tester to run at the lowest speed given in Table 1 and check that the indicator is reading correctly. Repeat the test at the other points listed in Table 1. The lag, as shown by the difference in readings taken with increasing and decreasing speeds, must not exceed 1.0 per cent.

9 Change the attitude of the indicator during the ranging test, so that it is at 90 deg. clockwise, counter-clockwise, forward and backward to its original attitude. The difference in attitude must not cause the indication to vary by more than 0.75 per cent at any point in the speed range.

TABLE 1 CONVERSION TABLE

Tester speed (rev/min)	Percentage Indication (per cent)	Permissible error
1 000	20	
1 500	30	
2 000	40	
2 500	50	0.75%
3 000	60	
4 000	80	
5 000	100	

TABLE 2 TEST POINTS AND PERCENTAGE READING

Tester speed (rev/min)	Percentage Indication (per cent)	Permissible error
800	19.05	
1 000	23.81	
1 500	35.72	
2 000	47.62	
2 500	59.55	0.75%
3 000	71.44	
3 500	83.35	
4 000	95.26	
4 200	100.00	