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TACHOMETER INDICATORS, TYPE KTD 0400 SERIES AND 114RV (MK10A)

GENERAL AND TECHNICAL INFORMATION

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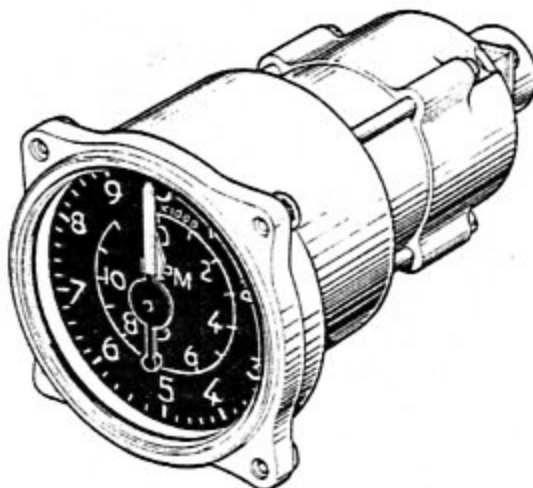
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Chapter 1GENERAL DESCRIPTIONINTRODUCTION

- 1 The tachometer indicators, (fig.1) are fitted in aircraft to indicate the engine speed in revolutions per minute (rev/min). Each indicator operates in conjunction with a tachometer generator, driven by the engine. ◀



11500

► Fig.1 General view, typical indicator ◀

DESCRIPTIONMechanism (fig.2)

- 2 Each indicator consists of a three-phase, self-starting synchronous motor which operates a coaxial magnetic drag element to move two pointers over a dial calibrated in R.P.M. The three leads from the stator windings are connected to either a terminal block or a plug secured to the rear of the case.

Motor

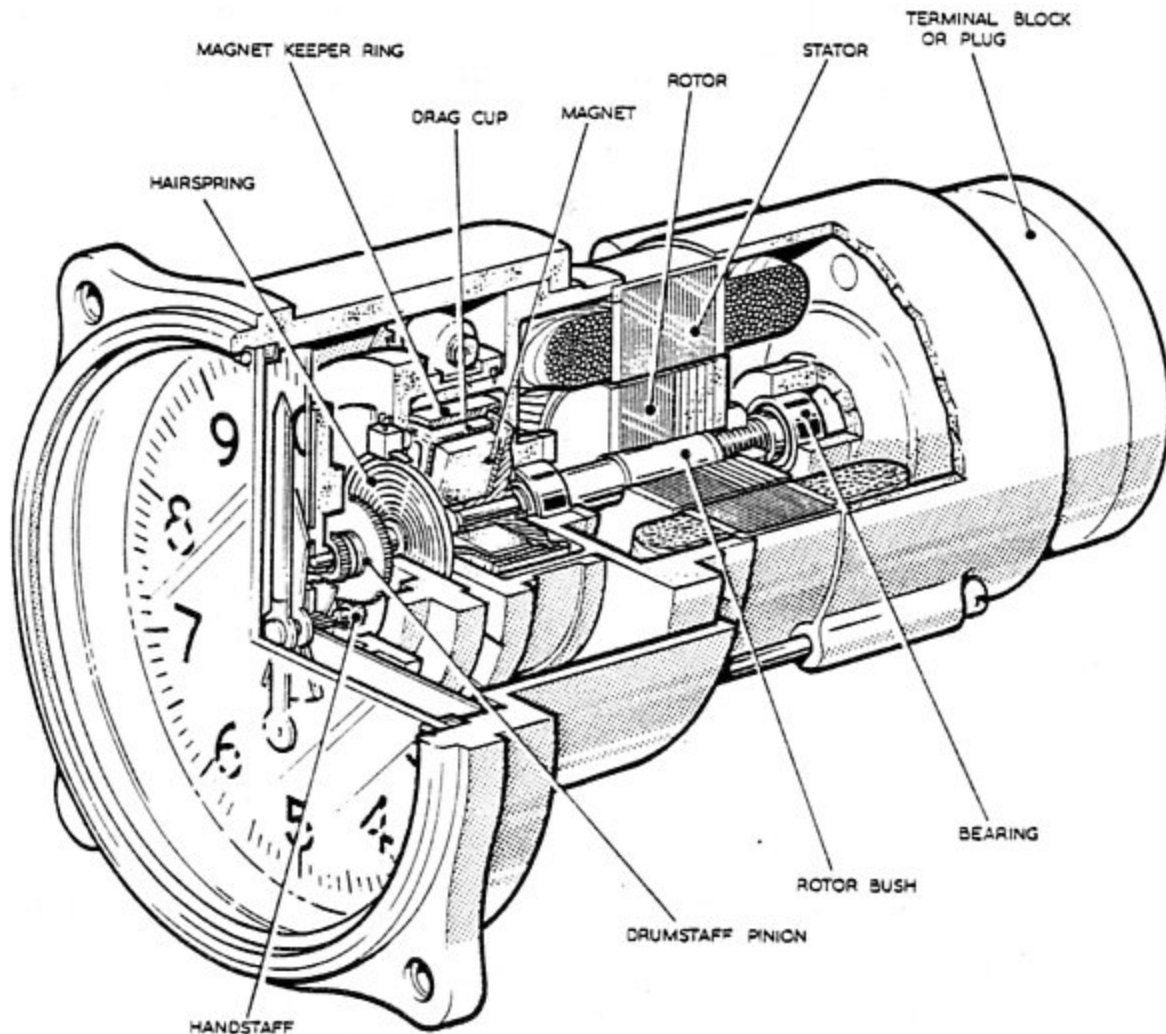
- 3 The synchronous motor has a three-phase, star connected stator and a laminated rotor. The rotor is supported in ball races which may be pre-greased, or provided with facilities which permit lubrication of the bearings, without dismantling the indicator.

Magnetic drag cup

- 4 A magnetic drag assembly, comprising a circular permanent magnet and a magnet shield is secured to the front end of the motor shaft. A drag cup, mounted on a handstaff, is located between the permanent magnet and the shield, fitting closely over the magnet to reduce the airgap between the magnet and shield to a minimum.

Case

5 The front end of the case is closed by a dial, a rubber gasket and a glass. The gasket is housed in a retaining ring positioned between the dial and the glass which is retained by a snap ring.



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Fig.2 Cut-away view, typical indicator

Presentation

6 The dial has two scales, the outer scale is graduated in hundreds of rev/min and the inner scale is graduated in thousands of rev/min. One revolution of the larger pointer represents 1000 rev/min and approximately five-sixths of a revolution of the smaller pointer represents 12 000 rev/min. The dial and pointer have a fluorized finish.

OPERATION

7 A three-phase voltage, produced by an associated tachometer generator, is applied to the stator coil of the indicator which causes the rotor to revolve in synchronism with the frequency of the applied voltage (i.e. at a speed directly proportional to the engine speed).

8 When the indicators rotor revolves, the permanent magnet, mounted on the rotor shaft, rotates within the drag cup. The rotating field of the permanent magnet induces eddy currents in the drag cup which, in turn, create their own magnetic fields. Interaction between the magnetic fields produced by the permanent magnet and the eddy currents, results in a magnetic torque within the drag cup, which causes the drag cup to rotate.

9 The rotary movement of the drag cup is transmitted, through the handstaff and gears, to the two pointers. This action is opposed by the hairspring and, when the hairspring torque equals the eddy current torque, the drag cup ceases to rotate, and the indicator reading stabilizes at a value corresponding to the engine speed.

SERVICING

General

10 Prior to installation, or at any time when the serviceability of the indicator is suspect, it should be subjected to the tests detailed in Chapter 2.

- 11 The tachometer indicator must not be dismantled by units other than suitably equipped Repair Depots. Should the tachometer indicator give trouble, it must be returned to Stores and a new one fitted in its place.

Lubrication

12 At routine servicing periods some indicators require lubricating in accordance with the relevant paragraphs of Chapters 1-1, 1-2, 1-3 or 1-4. ◀

Chapter 1-1TACHOMETER INDICATORTYPE KTD0409K (Mk. 10A)

LEADING PARTICULARS

Dia	...	...	...	...	...	...	...	...	...	3.5 in
Weight	...	...	...	...	...	...	...	...	...	11lb 10 ozs
Range	...	...	...	...	...	...	...	0 to 12 000	rev/min	
Ref. No.	...	...	...	...	...	...	...	...	...	6A/2801

DESCRIPTION

1 The tachometer indicator, Type KTD0409K (Mk.10A), is fitted to an aircraft to indicate the speed of rotation of either reciprocating or gas turbine engines and is used in conjunction with a standard engine-driven tachometer generator. The range of the indicator is from zero to 12 000 rev/min, both the dial markings and the pointers have a fluorized finish.



10244

Fig.1 Tachometer indicator - dial presentation

2 Standard Serviceability Tests are detailed in Chapter 2, test points and tolerances are quoted in Table 1.

TABLE 1 TEST POINTS AND TOLERANCES

Test Bench Speed	Indicator speed	Tolerance	Max acceptable pointer fluctuation
(rev/min)	(rev/min)	(rev/min)	(rev/min)
500	2 000	+60	40
1 000	4 000	+60	40
1 500	6 000	+60	40
2 000	8 000	+120	40
2 500	10 000	+120	40
3 000	12 000	+120	40

LUBRICATION (pre Mod SIB1023)

3 The indicator, Type KTD0409K, is provided with two oilways to facilitate lubrication of the ball races, without the need to dismantle the indicator; each oilway is closed at its outer end by a small screw. A hole in the side of the case provides access to the oilway leading to the front ball race, and the oilway associated with the rear ball race projects through the back of the case.

4 The equipment to be used when lubricating the bearings is as follows:-

4.1 Syringe, disposable, glass barrel, lcc (Ref. No. 6515-99-210-5756)

4.2 Needle, Summit, No.14 (Ref. No. 1J/214)

4.3 Oil, OX-14 (Ref. No. 34B/9100590)

5 The sequence of operation is as follows:-

5.1 Remove the two screws from the two lubrication oilways.

5.2 Ascertain that the syringe barrel and needle are clean; draw a quantity of oil into the barrel and ensure that it is free from foreign matter.

5.3 Deposit two or three drops of oil in each lubrication oilway.

5.4 Refit the screws removed in sub-para.5.1.

MODIFICATIONS

6 The modifications applicable to the indicator, Type KTD0409K, are listed in Table 2.

TABLE 2 MODIFICATION DETAILS

Manufacturers Mod. No. (Strike off)	Service Mod. No.	Class	Brief Details
05	A178	D/4	Conversion to light weight case model.
06	A179	C/4	Introduction of pre-loaded ball bearing retainer.
07	A199	C/4	Improvement of lubrication facilities.
			Introduction of a smaller magnet assembly.
08	SIB1023	D/-	Introduction of pre-lubricated bearings and deletion of lubrication facilities.

Chapter 1-2
TACHOMETER INDICATORS
TYPE KTD 0410K

(Including modifications up to B215)

LEADING PARTICULARS

Dia.	...	...	...	...	...	3.5 in
Weight	...	...	...	...	...	1 lb 10 ozs
Range	...	...	...	...	...	0 to 12 000 rev/min
Ref. No.	...	...	...	...	...	6A/5796

DESCRIPTION

1. The tachometer indicator, Type KTD 0410K, is similar to the general description given in Chapter 1, but has a special accuracy band in the 10 000 rev/min to 10 300 rev/min range, and electrical connection is by a moulded terminal block at the rear of the indicator.
2. Standard serviceability tests are detailed in Chapter 2 and test points and tolerances are quoted in Table 1.

TABLE 1
Test points and tolerances

Test bench speed (rev/min)	Indicator speed (rev/min)	Tolerance (rev/min)
1 000	2 000	± 80
2 000	4 000	± 80
3 000	6 000	± 80
4 000	8 000	± 80
5 000	10 000	± 30
6 000	12 000	± 80

Note...

This indicator has a tolerance of ± 30 rev/min over the speed range 10 000 to 10 300 rev/min and the lag within this speed range is 25 rev/min.

SERVICING

3. Post-mod. B215, Type KTD 0410K and KTD 0412K, indicators are fitted with pre-greased journal bearings. Pre-mod. B215 indicators are provided with oilways for lubricating the motor bearings.

LUBRICATION (Pre-mod. B215)

4. Tachometer Indicators, Type KTD 0410K, (Pre-mod. B215) are provided with two oilways to facilitate lubrication of the ball races without the need to dismantle the indicator; each oilway is closed at its outer end by a small screw. A hole in the side of the case provides access to the oilway leading to the front ball race and the oilway associated with the rear ball race projects through the back of the case.

EQUIPMENT

5. The equipment to be used when lubricating the bearings is as follows:-

- (1) Syringe, disposable, glass barrel, 1 c.c. (Ref. No. 6515-99-210-5756)
- (2) Needle, Summit, No. 14.(Ref. No. 1J/214)
- (3) Oil, OX-14.(Ref. No. 34B/9100590)

6. The procedure is as follows:-

- (1) Remove the two screws from the oilways.
- (2) Ascertain that the syringe barrel and needle are clean; draw a quantity of oil into the barrel and ensure that it is free from foreign matter.
- (3) Deposit two or three drops of oil in each oilway.
- (4) Refit the screws removed in sub-para. (1).

MODIFICATIONS

7. Modifications applicable to the type KTD 0410K indicators are listed in Table 2.

TABLE 2
Modification details

Mod. No.	Manufacturer's Mod. No.	Description
	01	Introduction of series.
103	02	Change over to Swiss bearing.
296	03	Addition of re-lubrication facilities.
	04	Interim model prior to change-over to light weight model.
Inst. A178	05	Conversion to light weight case model.
Inst. A179	06	Introduction of pre-loaded ball bearing retainer.
Inst. A199	06	Improvement of lubricating facilities.
2726	07	Introduction of small magnet.
B. 215	08	Introduction of journal ball races (shielded type) and deletion of lubrication facilities.

Chapter 1-3
TACHOMETER INDICATORS
TYPE KTD 0412K

(Including modifications up to B215)

LEADING PARTICULARS

Dia.	...	...	...	...	...	3.5 in
Weight	...	...	...	...	...	11lb 10ozs
Range	...	...	...	...	...	0 to 12 000 rev/min
Ref. No.	...	...	...	...	...	6A34989

DESCRIPTION

1. The tachometer indicator, Type KTD 0412K, is similar to the general description given in Chapter 1, but has a special accuracy band in the 6 500 rev/min to 10 500 rev/min range and electrical connection is by a three-pole Plessey Mk. 4 plug at the rear of the indicator.
2. Standard serviceability tests are detailed in Chapter 2 and test points and tolerances are quoted in Table 1.

TABLE 1
Test points and tolerances

Test bench speed (rev/min)	Indicator speed (rev/min)	Tolerance (rev/min)
1 000	2 000	± 120
2 000	4 000	± 120
3 000	6 000	± 120
4 000	8 000	± 50
5 000	10 000	± 50
6 000	12 000	± 120

Note...

This indicator has a tolerance of ± 50 rev/min between 6 500 and 8 500 rev/min.

SERVICING

3. Post-mod. B215, Type KTD 0410K and KTD 0412K, indicators are fitted with pre-greased journal bearings. Pre-mod. B215 indicators are provided with oilways for lubricating the motor bearings.

4. The Type KTD 0412 indicator has an oilway to facilitate lubrication of the front ball race, as in the Type KTD 0410K indicator. The rear ball race is lubricated through an orifice in the centre of the rear bearing housing; this orifice is provided with a blanking screw to prevent the ingress of dirt and moisture.

EQUIPMENT

5. The equipment to be used when lubricating the bearings is as follows:-

- (1) Syringe, disposable, glass barrel, 1 c.c. (Ref. No. 6515-99-210-5756)
- (2) Needle, Summit, No. 14. (Ref. No. 1J/214)
- (3) Oil, OX-14. (Ref. No. 34B/9100590)

6. The procedure is as follows:-

- (1) Remove the screw from the oilway for the front bearing.
- (2) Ascertain that the syringe barrel and needle are clean; draw a quantity of oil into the barrel and ensure that it is free from foreign matter.
- (3) Deposit two or three drops of oil in the oilway.
- (4) Refit the screw removed in sub-para. (1).
- (5) Remove the rear cover complete with the plug connector.
- (6) Remove the blanking screw from the centre of the rear bearing housing and inject two or three drops of oil into the bearing.
- (7) Refit the blanking screw and rear cover.

MODIFICATIONS

7. Modifications applicable to the Type KTD 0412 indicators are listed in Table 2.

TABLE 2
Modification details

Mod. No.	Manufacturer's Mod. No.	Description
	01	Introduction of series.
103	02	Change over to Swiss bearing.
296	03	Addition of re-lubrication facilities.
	04	Interim model prior to change-over to light weight model.
Inst. A178	05	Conversion to light weight case model.
Inst. A179	06	Introduction of pre-loaded ball bearing retainer.
Inst. A199	06	Improvement of lubricating facilities.
2726	07	Introduction of small magnet.
B.215	08	Introduction of journal ball races (shielded type) and deletion of lubrication facilities.

Chapter 1-4TACHOMETER INDICATORTYPE 114RV (Mk. 10A)LEADING PARTICULARS

Dia	...	...	...	...	...	...	...	...	...	3.5 in
Weight	...	...	...	...	...	...	...	...	...	11b 10 ozs
Range	...	...	...	...	...	...	...	0 to 12	000	rev/min
Ref. No.	...	...	...	...	...	...	...	...	...	6A/2801

DESCRIPTION

1 The tachometer indicator, Type 114RV (Mk.10A) is fitted to an aircraft to indicate the speed of rotation of either reciprocating or gas turbine engines and is used in conjunction with a standard engine-driven tachometer generator. The range of the indicator is from zero to 12 000 rev/min, both the dial markings and the pointers have a fluorized finish.



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Fig.1 Tachometer indicator - dial presentation

2 Standard Serviceability Tests are detailed in Chapter 2, test points and tolerances are quoted in Table 1.

TABLE 1 TEST POINTS AND TOLERANCES

Test Bench Speed	Indicator speed	Tolerance	Max acceptable pointer fluctuation
(rev/min)	(rev/min)	(rev/min)	(rev/min)
500	2 000	+60	40
1 000	4 000	+60	40
1 500	6 000	+60	40
2 000	8 000	+120	40
2 500	10 000	+120	40
3 000	12 000	+120	40

LUBRICATION

3 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.

4 The equipment to be used when lubricating the bearings is as follows:-

4.1 Syringe, disposable, glass barrel, 1cc (Ref. No. 6515-99-210-5756)

4.2 Needle, Summit, No.14 (Ref. No. 1J/214)

4.3 Oil, OX-14 (Ref. No. 34B/9100590)

5 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 1/2 to 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 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:

5.1 Stand the instrument dial downwards and remove the terminal block cover.

5.2 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.

5.3 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.5.

5.4 Inject a second charge as described in sub-para.5.2.

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

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

5.7 Fit the terminal block cover.

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

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

6.1 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.

6.2 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 2
STANDARD SERVICEABILITY TEST
for
TACHOMETER INDICATORS
TYPE KTD0400 SERIES
AND TYPE 114RV

INTRODUCTION

1 The test detailed in this Chapter are to be applied to the tachometer indicator immediately prior to installation in aircraft, or if serviceability is suspect. The tests are also to be applied at re-inspection periods at Equipment Depots. Any tolerances specified are not to be exceeded.

TEST EQUIPMENT

2 The following test equipment is required:-

2.1 Tester, insulation resistance, Type C (Ref. No. 5G/9156675).

2.2 A serviceable, compatible generator.

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

or, (alternative to item in 2.3)

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

or, (alternative to item in 2.3)

Tachometer calibrator, Mk.2 (Ref. No. 6C/869).

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 - room temperature

4 Before the indicator undergoes its synchronization and ranging tests, measure the insulation resistance between each phase (terminals 1, 2 and 3 or pins A, B and C) 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 synchronization and ranging tests, measure the insulation resistance between each phase (terminals 1, 2 and 3 or pins A, B and C) and the body, in turn. The resistance in each instance must be not less than 5 megohms at 250 V.

Ranging tests

6 Connect the generator to the tester or calibrator, then connect the indicator to the generator. Switch on the test equipment and exercise the generator and indicator by running at approximately 8000 rev/min for 10 minutes. At the end of this period, reduce the speed to zero.

7 Slowly increase the generator speed from zero, and check the speed at which the generator and indicator synchronize. This must occur at or before 1200 rev/min indicated speed.

8 Check the accuracy of the indicator at the test points quoted in the appropriate tables. 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 50 rev/min for KTD0409K, KTD0410K and 114RV, and 25 rev/min for the KTD0412K.

9 The test points and tolerances for the various indicators are quoted in Chapters 1-1 to 1-4.

Note ...

Unless an indicator has been lubricated immediately prior to the ranging tests, it must not be rejected for failing the synchronization or ranging tests until it has been lubricated and re-tested. This note only applied to indicators which are not fitted with pre-lubricated bearings, but have oilways to facilitate lubrication of the ball races.