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TACHOMETER INDICATORS, TYPE KTD 0100 SERIES

GENERAL AND TECHNICAL INFORMATION

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- ◀ 2-1 Standard serviceability tests for tachometer indicator fitted in Whirlwind HAR Mk. 9 aircraft (RN only). ▶

Chapter 1

GENERAL DESCRIPTION

INTRODUCTION

1. The tachometer indicators in the Type KTD 0100 series are fitted in aircraft to indicate engine speed in revolutions per minute (rev/min) and operate in conjunction with a tachometer generator driven by the engine.

DESCRIPTION

GENERAL

2. Each indicator consists of a three-phase, self-starting synchronous motor, which operates a co-axial magnetic drag element to move two pointers, one long and one short, over a scale graduated in R.P.M.

CASE

3. The front end of the case is closed by a dial, a rubber gasket and a glass. The gasket is housed in a retaining rin, positioned between the dial and the glass; a snap ring, located in front of the glass maintains it in close contact with the gasket. Electrical connection to the generator is by a 3-pole breeze connector at the rear of the case.

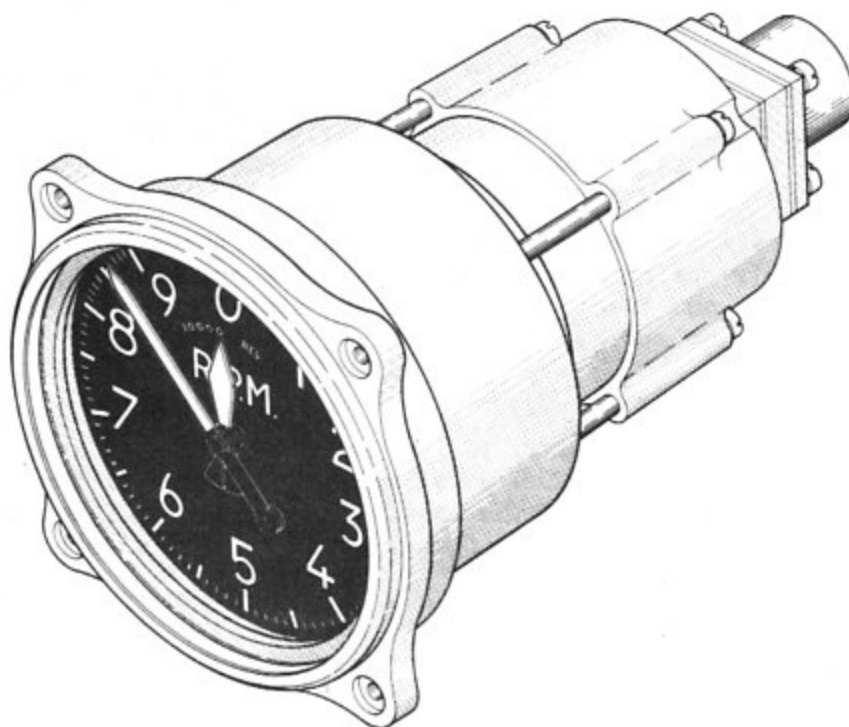


Fig.1 Tachometer indicator, Type KTD 0100 - general view

DIAL AND POINTERS

4. The dial has one scale divided into ten equal divisions, each of which is further sub-divided into tenths. The long pointer indicates thousands of rev/min and the short pointer indicates tens of thousands of rev/min, one full revolution of the long pointer representing 1 000 rev/min. The dial markings and pointers can be luminized or fluorized to suit the particular installation requirements, details of the dial finish of any indicator are given in the chapter referring to that indicator.

5. The synchronous motor has a three-phase star-connected stator and a laminated rotor, which is mounted in pre-greased journal bearings. Pre-modification Mod. Inst. A. 596 indicators are fitted with Swiss bearings and are provided with oil ways which enable the bearings to be lubricated without dismantling the indicator.

MAGNETIC DRAG ASSEMBLY

6. A magnetic drag assembly comprising a circular permanent magnet and a keeper, is secured to the front of the rotor shaft. A magnetic drag cup is mounted on the rear end of a handstaff and is located between the magnet and the keeper such that the air gap is reduced to a minimum. The long pointer is mounted on the front of the handstaff, while the short pointer is mounted on a hollow shaft which is positioned co-axial with the handstaff. The drive from the handstaff to the short pointer is transmitted by a gear train.

7. A three-phase voltage, produced by an associated tachometer generator, is applied to the stator coil of the indicator and induces a rotating magnetic field, 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 hair spring and, when the hair spring 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.

MOUNTING

10. The indicator can be secured to its mounting either by four 4 B.A. screws or by four 6-32 UNC screws which pass through the front of the case, into attachment nuts at the rear of the case. Three small yellow circles to the bottom right of the unit mounting flange indicate that attachment nuts have a unified screw thread.

SERVICING

GENERAL

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

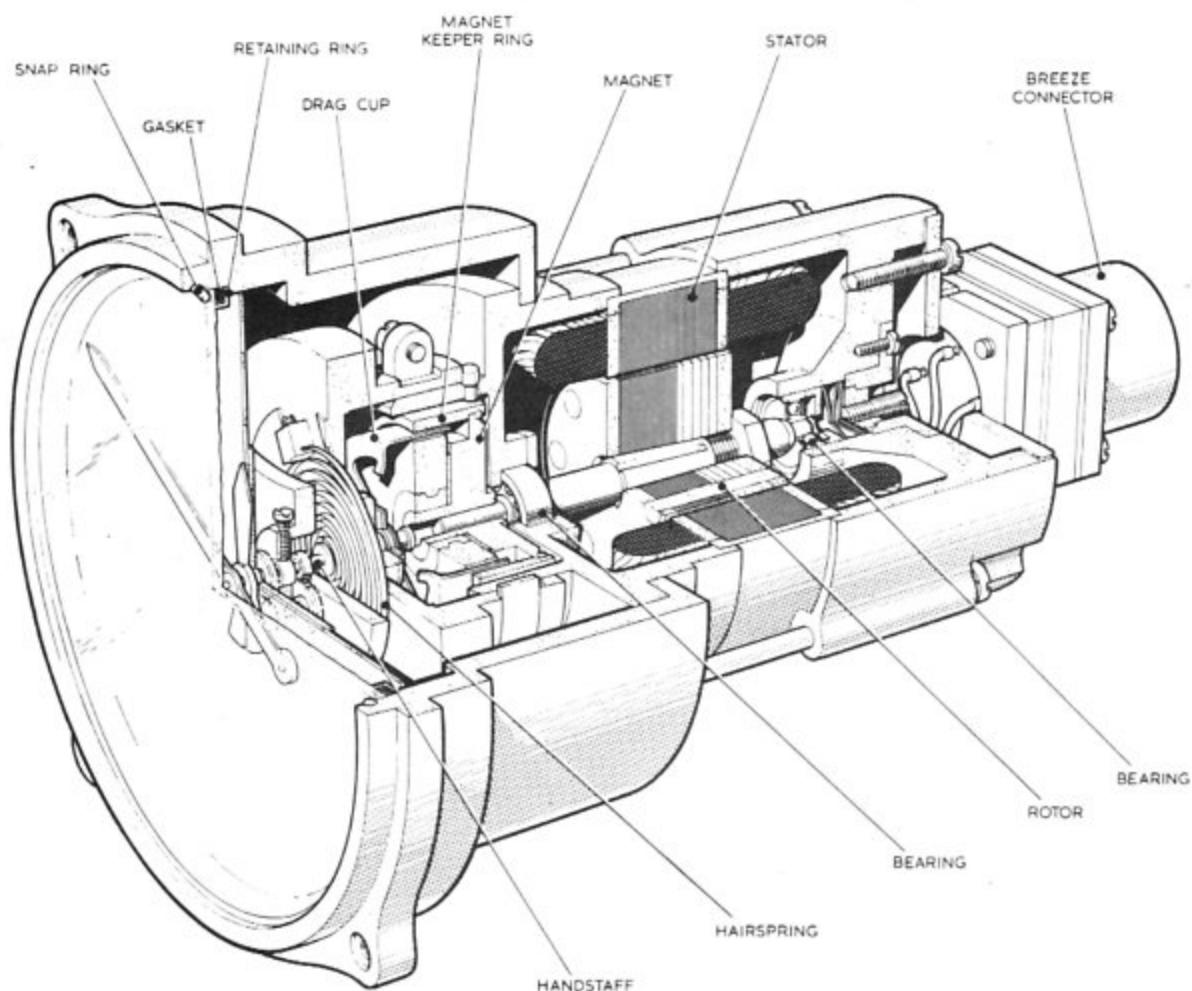


Fig.2 Tachometer indicator, Type KTD 1100 - cutaway view

LUBRICATION

12. Modification number Mod.Inst.A.596 introduces pre-greased journal bearings to the indicator motor. Pre-mod. indicators have Swiss bearings and lubricating instructions for these bearings are given in the relevant chapters.

Chapter 1-1

TACHOMETER INDICATOR

TYPE KTD 0102K

(Incorporating modifications up to Inst.Mod.A.596)

LEADING PARTICULARS

Case dia	...	...	...	...	...	...	...	3.25 in
Weight	...	...	...	...	...	...	...	1 lb. 8 ozs.
Range	...	...	...	...	...	...	...	0 to 30 000 rev/min.
Ref. No.	...	...	...	...	...	...	...	6A/6817

DESCRIPTION

1. The tachometer indicator, Type KTD 0102K is fitted in aircraft to indicate the speed of rotation of the compressor of a gas turbine engine and is used in conjunction with a standard engine driven tachometer generator. The dial markings and the pointer have a fluorized finish.



Fig.1 Dial presentation

SERVICING

2. The only routine servicing required is an examination for damage and corrosion. Test points and tolerances are quoted in Table 1 and standard serviceability tests are detailed in Chapter 2.

Table 1
Test points and tolerances

Generator speed (rev/min)	Indicator speed (rev/min)	Tolerance (rev/min)
1 000	6 262	± 150
1 500	9 393	± 150
2 000	12 524	± 150
2 500	15 655	± 150
3 000	18 786	± 250
3 500	21 917	± 250
4 000	25 048	± 250
4 200	26 300	± 250
4 700	29 431	± 250

LUBRICATION (PRE.MOD.INST.A.596)

3. Pre-mod. indicators have two oilways to permit lubrication of the rotor bearings without dismantling the indicator. The oilway for the front bearing is located approximately halfway along the indicator body, while that for the rear bearing is positioned at the centre of the rear bearing retainer. The outer end of both oilways is closed with a screw to prevent the ingress of dirt and moisture.

4. The equipment to be used when lubricating the bearings is as follows:-
- (1) Syringe, disposable, glass barrel, I.C.C.(Ref.No.6515-99-210-5756)
 - (2) Needle, Summit, No.14. (Ref.No.IJ/214)
 - (3) Oil OX-14. Ref.No. 34B/9100590)

5. The procedure is as follows:-
- (1) Check that the syringe barrel is clean, then draw a quantity of oil into the syringe.
 - (2) Remove the screw and sealing washer from the case, inject two or three drops of oil into the oilway and replace the sealing washer and screw.
 - (3) Remove the Breeze connector and backplate from the indicator and remove the screw and sealing washer from the centre of the bearing retainer.
 - (4) Inject two or three drops of oil into the rear bearing, then refit the sealing washer, screw, backplate and Breeze connector.

MODIFICATIONS

6. Modifications applicable to the Type KTD 0102K indicator are listed in Table 2.

Table 2
Modifications

Mod. No.	Brief description
Inst. A. 596	Introduction of pre-greased journal bearings (shield type) and deletion of lubricating facility.

8. Test the indicator at the points listed in Table 1 of Chapter 1-1, after testing at all listed points, repeat the tests at decreasing speeds. The error at any test point must not exceed the tolerance given in the table. Lag at any test point, as shown by the difference between increasing and decreasing speeds, must not exceed 100 rev./min.

Note ...

Unless an indicator has been lubricated immediately prior to the ranging tests, it must not be rejected for failing these tests until it has been lubricated and re-tested. Only indicators pre Mod. Inst.596 can be lubricated, indicators post Mod. Inst.596 are fitted with pre-greased bearings, and cannot be lubricated.

Chapter 1-1

TACHOMETER INDICATOR

TYPE KTD 0102K

(Incorporating modifications up to Inst.Mod.A.596)

LEADING PARTICULARS

Case dia	...	...	...	...	...	...	...	3.25 in
Weight	...	...	...	...	...	...	...	1 lb. 8 ozs.
Range	...	...	...	...	...	...	...	0 to 30 000 rev/min.
Ref. No.	...	...	...	...	...	...	...	6A/6817

DESCRIPTION

1. The tachometer indicator, Type KTD 0102K is fitted in aircraft to indicate the speed of rotation of the compressor of a gas turbine engine and is used in conjunction with a standard engine driven tachometer generator. The dial markings and the pointer have a fluorized finish.



Fig.1 Dial presentation

SERVICING

2. The only routine servicing required is an examination for damage and corrosion. Test points and tolerances are quoted in Table 1 and standard serviceability tests are detailed in Chapter 2.

Table 1
Test points and tolerances

Generator speed (rev/min)	Indicator speed (rev/min)	Tolerance (rev/min)
1 000	6 262	+ 150
1 500	9 393	+ 150
2 000	12 524	+ 150
2 500	15 655	+ 150
3 000	18 786	+ 250
3 500	21 917	+ 250
4 000	25 048	+ 250
4 200	26 300	+ 250
4 700	29 431	+ 250

LUBRICATION (PRE.MOD.INST.A.596)

3. Pre-mod. indicators have two oilways to permit lubrication of the rotor bearings without dismantling the indicator. The oilway for the front bearing is located approximately halfway along the indicator body, while that for the rear bearing is positioned at the centre of the rear bearing retainer. The outer end of both oilways is closed with a screw to prevent the ingress of dirt and moisture.

4. The equipment to be used when lubricating the bearings is as follows:-
- (1) Syringe, disposable, glass barrel, I.C.C.(Ref.No.6515-99-210-5756)
 - (2) Needle, Summit, No.14. (Ref.No.IJ/214)
 - (3) Oil OX-14. Ref.No. 34B/9100590)

5. The procedure is as follows:-
- (1) Check that the syringe barrel is clean, then draw a quantity of oil into the syringe.
 - (2) Remove the screw and sealing washer from the case, inject two or three drops of oil into the oilway and replace the sealing washer and screw.
 - (3) Remove the Breeze connector and backplate from the indicator and remove the screw and sealing washer from the centre of the bearing retainer.
 - (4) Inject two or three drops of oil into the rear bearing, then refit the sealing washer, screw, backplate and Breeze connector.

MODIFICATIONS

6. Modifications applicable to the Type KTD 0102K indicator are listed in Table 2.

Table 2
Modifications

Mod. No.	Brief description
Inst. A. 596	Introduction of pre-greased journal bearings (shield type) and deletion of lubricating facility.

Chapter 2-1

STANDARD SERVICEABILITY TEST FOR TACHOMETER INDICATOR TYPE KTD 0102K
FITTED IN WHIRLWIND HAR Mk. 9 AIRCRAFT (RN ONLY)Introduction

1. The tests detailed in this chapter are to be applied to tachometer indicators, Type KTD 0102K, prior to installation in aircraft, or if serviceability is suspect. The tests are also to be applied to re-inspection periods at Equipment Depots. Any tolerances specified are not to be exceeded.

Test equipment

2. The following test equipment is required:-

- (1) A serviceable tacho-generator, Type KGA 0701.
- (2) Dual tachometer tester (Ref. No. 6C/3000, 6C/2391 or 6C/2392)
- (3) Overspeed trip unit governor gearbox (Ref. No. 6C/1981834)
- (4) Hewlett-Packard frequency counter type 3734A (Ref. No. 6625-99-107-0130) OR Racal counter electronic frequency, Model 836 (Ref. No. 6623-99-522-6578)
- (5) Locally manufactured mounting spacer as shown in figure 1.
- (6) Testers insulation resistance, Type C (Ref. No. 5G/152).

TEST PROCEDUREMethod 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) and the body, in turn. The resistance must not be less than 20 megohms at 250V.

Insulation Resistance - hot

5. Immediately after the completion of the 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 5 megohms at 250V.

Ranging Tests

6. Connect the tacho-generator, Type KGA 0701 to the dual tacho tester by means of the

overspeed trip governor gearbox and locally manufactured mounting spacer. Connect frequency counter to the OTG gearbox terminals and the indicator under test to the tachogenerator. Switch on the test equipment and exercise the generator and indicator by running at approximately $\frac{1}{2}$ speed 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 5000 r.p.m. indicated or below. ▶

8. Test the indicator at the points listed in Table 1, after testing at all listed points, repeat the tests at decreasing speeds. The error at any test point must not exceed the tolerance given in the table. Lag at any test point, as shown by the difference between increasing and decreasing speeds, must not exceed 100 RPM.

TABLE 1
Test figures and tolerances

Testbench speed (RPM/FREQ)		Indicator speed (RPM)		Tolerance (RPM)	
2236	3258	14000	20400	± 150	± 250
2268	3290	14200	20600	"	"
2300	3322	14400	20800	"	"
2332	3354	14600	21000	"	"
2363	3385	14800	21200	"	"
2395	3417	15000	21400	"	"
2427	3449	15200	21600	"	"
2459	3481	15400	21800	"	"
2491	3513	15600	22000	"	"
2523	3545	15800	22200	"	"
2555	3577	16000	22400	"	"
2587	3609	16200	22600	"	"
2619	3641	16400	22800	"	"
2650	3673	16600	23000	"	"
2683	3705	16800	23200	"	"
2715	3737	17000	23400	"	"
2747	3769	17200	23600	"	"
2779	3801	17400	23800	"	"
2811	3833	17600	24000	"	"
2843	3865	17800	24200	"	"
2874	3897	18000	24400	± 250	"
2906	3928	18200	24600	"	"
2938	3960	18400	24800	"	"
2970	3992	18600	25000	"	"
3002	4024	18800	25200	"	"
3034	4056	19000	25400	"	"
3066	4088	19200	25600	"	"
3098	4120	19400	25800	"	"
3130	4152	19600	26000	"	"
3162	4184	19800	26200	"	"
3194	4200	20000	26300	"	"
3226	4216	20200	26400	"	"

Note...

Unless an indicator has been lubricated immediately prior to the ranging tests, it must not

be rejected for failing these tests until it has been lubricated and re-tested. Only indicators pre Mod Inst 596 can be lubricated indicators post Mod Inst 596 are fitted with pre-greased bearings, and cannot be lubricated.

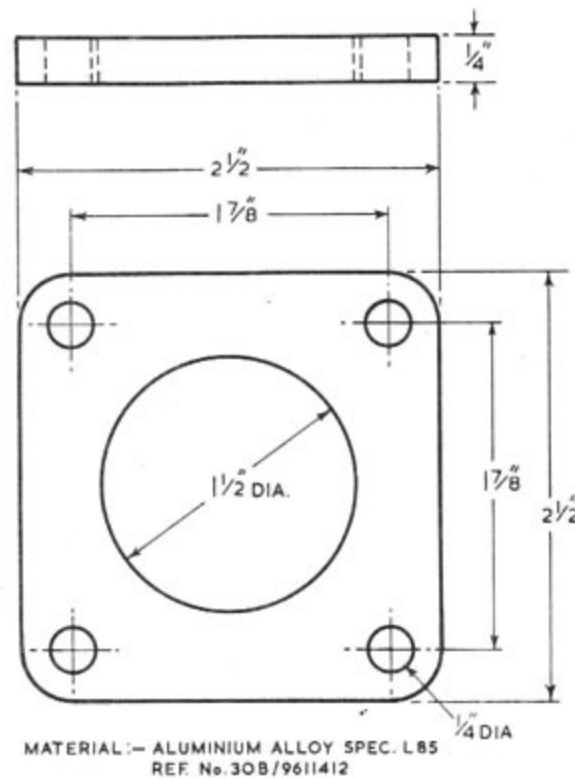


Fig. 1 Spacer for overspeed trip governor gearbox (local manufacture)