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ARTIFICIAL HORIZON Mk. 3C AND 3D

GENERAL AND TECHNICAL INFORMATION

BY COMMAND OF THE DEFENCE COUNCIL

Frank Cooper.

Ministry of Defence

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AMENDMENT RECORD

Amdt	Incorporated by	Date
1	[illegible]	87
2	[illegible]	89
3	[illegible] AUG 84	5/4/90
4	[illegible] JUN 89	5/4/90
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CONTENTS

ARTIFICIAL HORIZON Mk.3C AND Mk.3D

LIST OF APPLICABLE MODIFICATIONS

Mod.No	Class	Brief Description
Inst.A339 SG0174		To overcome the stickiness of the PFI stopes causing incorrect indications of the PFI the ceramic bead stops are replaced by PTFE stops.
SG0332	C/4	Introduction of new spin bearing Pt.No.5131-1199 lubricated with Andok C grease, in lieu of spin bearing Pt.No.5131-706.
SG0426	C WOTSAC/O	To introduce capacitor C1, Pt.No.5744-6844 in lieu of capacitor Pt.No.5744-507 to gyro assembly for roll control torque motor. Mod. kit also contains balance weights Pt.No.16507-5 (1 off) and Pt.No.16507-6 (1 off) to maintain balance due to difference in capacitor weight.
► SG0444	C WOTSAC/O	To introduce capacitor C1, Pt.No.5744-4691, value 0.22µF, in lieu of capacitor Pt.No.5744-6844, value 0.25µF. ◄

Chapter 1

DESCRIPTION AND OPERATION

CONTENTS

LEADING PARTICULARS

Unit: ... ... Artificial horizon Mk.3C, Pt.No.17653-0 or 18537-0, Ref.No.6A/3849
Artificial horizon Mk.3D, Pt.No.19277-0 Ref.No.6A/6610-99-433-8320

Dimensions: ... ... 196.85mm(7.75 in) x 114.3mm(4.5 in) x 114.3mm(4.5 in)

Weight: ... ... 2.61 kg (5 lb 12oz)

Power Supplies: ... 115 ± 12V, 400 ± 20Hz, 3-phase. Phase rotation ABC with BØ earthed. 15VA approximately.

Gyro Freedom:
Roll ... ... complete freedom
Pitch ... ... Freedom through 80 deg. dive and climb

Gyro Movement:
Moment of Inertia ... ... 1.58×10^3 gm.cm^2
Angular momentum ... ... 3.7×10^6 gm.cm^2/sec.

Rotor speed ... ... 22500 rpm

Erection rates ... ... Normal: Roll, 4 deg/min. Pitch: 2¾ deg./min.
Fast: 120 deg/min. approximately.

Introduction (Fig. 1 and 2)

1 The artificial horizon, Mk.3C and Mk.3D are electrically driven gyroscopic flight instruments which provide the pilot with continuous indication of the aircraft attitude in pitch and roll relative to the natural horizon. The instruments are designed to operate on an aircraft supply of 115V, 400Hz, 3-phase a.c. and incorporate a power failure warning indicator, provision for fast erection and a roll cut-out in the erection circuit.

2 By suitably mounting the gyroscope in gimbal rings (the axes of which are normally horizontal) the spin axis remains vertical, irrespective of the attitude of the aircraft; any wander of the gyro axis about the pitch and roll axes is corrected by torque motors.

3 Indications of roll and pitch attitude are presented continuously by the gyro-stabilised horizon bar registering against a fixed gull-wing model aeroplane datum in the centre of the instrument face, with a bank pointer registering against a scale on the lower half of the bezel. The bank pointer and horizon bar are visible throughout the full freedom of 360 deg. in roll.

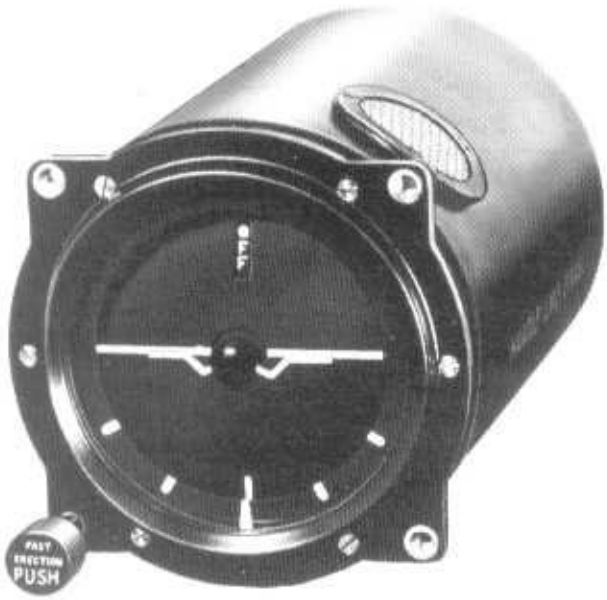

Fig.1 Artificial horizon, Mk.3C and Mk.3D

DESCRIPTION

4 For descriptive purposes the artificial horizon, Mk.3C or Mk.3D may be considered as several inter-related assemblies, namely gyro assembly, gimbal ring, rear casting, and case assembly, but these associated components must also be considered with regard to the operational function in the electrical circuits of the gyro rotor and erection system.

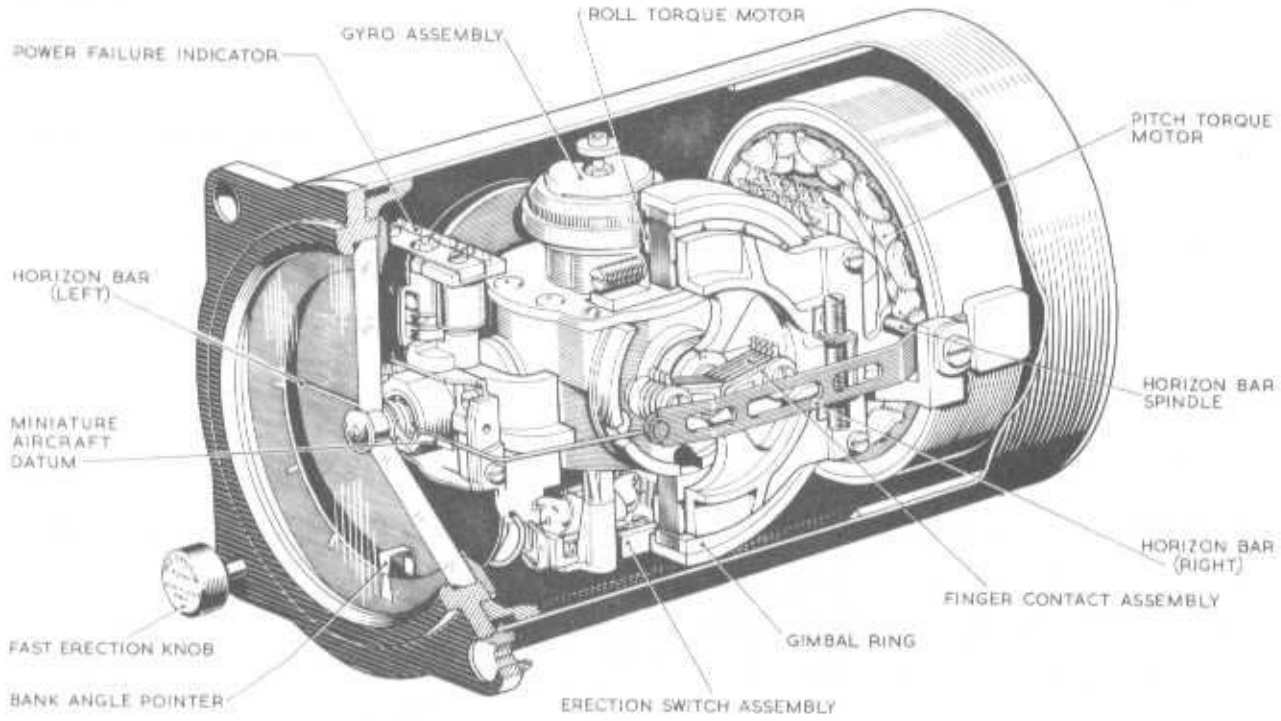

Fig. 2 Part-sectional view of complete assembly

Gyro assembly (Fig. 3)

►5 The gyro rotor consists of a heavy hollow wheel accommodating the laminations◄ of a 3-phase squirrel-cage induction motor. As seen in the circuit diagram (Fig. 7) the 3-phase, 115V. 400Hz power supply is fed to the stator windings of the motor via the windings of the power failure indicator and spins the rotor at approximately 22500 rev/min., phase rotation being A, B, C with phase B earthed. The motor is completely enclosed in a case, which forms the inner gimbal ring of the gyro assembly. The motor stator windings are attached to the the underside of the case cover and are surrounded by the cage laminations pressed into the gyro rotor. This rotor assembly is dynamically balanced on a vertical shaft mounted between two ball races. The lower bearing race is accommodated in a recess in the bottom of the rotor case, while the upper bearing race is contained in a housing which is spring-loaded within the flanged cap on the case cover, thus providing temperature compensation to allow for differential expansion between the rotor shaft and case. A large balancing nut is screwed over the flanged cap and is adjusted during the static balancing of the gyro assembly to provide slight pendulosity. The gyro assembly is pivoted on the lateral axis of the gimbal ring, and the roll torque motor is also on this axis. The roll torque motor and levelling switch assembly at the base of the rotor case are described in para. 16.

6 The gyro assembly has freedom in pitch of 80 deg. dive and 80 deg. climb within the gimbal ring. At these pitch limits a horn-type resilient stop on the side of the levelling switch assembly comes into contact with stops integral with the gimbal ring. A set of finger contacts in alignment with the transverse axis transmit the electrical circuits for the gyro unit and erection control system.

Gimbal ring

7 The gimbal ring consists of a die casting of approximately rectangular formation, and is pivoted fore-and-aft so that it has complete freedom in roll. The front pivot is mounted centrally in the bezel glass and engages a ball race in the front of the gimbal ring through a hole in the sky plate attached to the end of the gimbal ring. The sky plate is finished in matt-black and carries the fluorized bank angle pointer; an aperture is provided for the power failure indicator (para. 9).

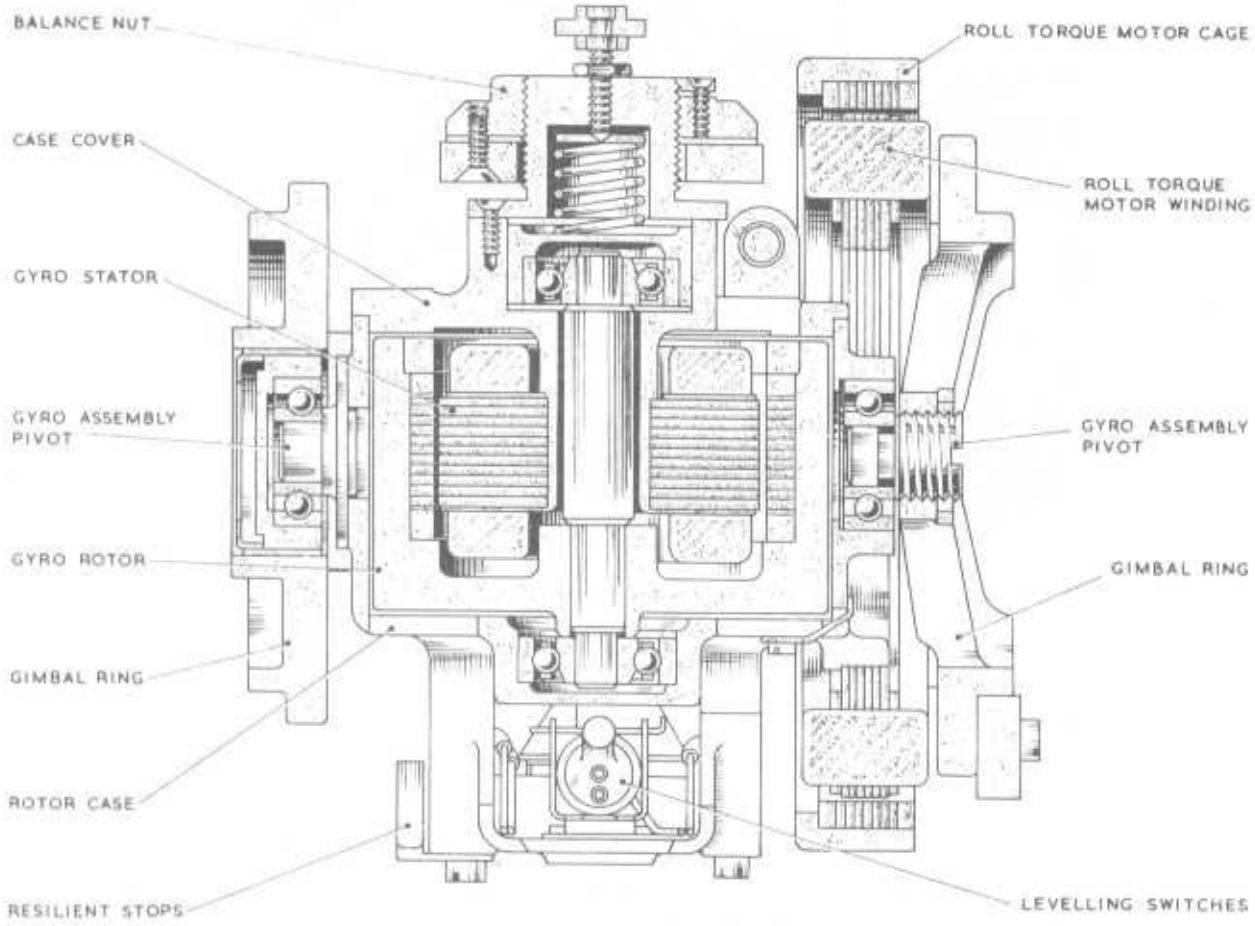

Fig. 3 Gimbal and gyro assembly

8 The rear pivot assembly is formed by a hollow pivot on the gimbal ring engaging a ball race, accommodated centrally in the rear casting. This pivoting arrangement enables the electrical harness on the gimbal ring to pass to a slipring assembly with brushes on the rear casting, thereby retaining the full roll freedom of the gimbal ring. On the outer end of the slipring is the rotary disc position of the erection system roll cut-out switch. The pitch torque motor of the erection system is concentric with the rear pivot assembly.

Power failure indicator (Fig. 4)

9 The power failure indicator is attached to the top of the gimbal ring immendiately behind the sky-plate. The indicator flag is marked OFF and becomes visible by moving into alignment with an aperture in the sky-plate when the power supply is off or if there is a failure on any or all of the three phases.

10 The warning indicator is a 3-phase induction type movement with three energizing coils mounted in line with each other. The coils are fitted with core pieces which have integral arms disposed in a circular formation so that the ends of the arms are at 120 deg. apart and slightly above the aluminium rotor carrying the indicator flag. The rotor spindle is pivoted in jewel bearings and fitted with a hairspring. One solenoid is connected in each line of the 3-phase supply and when the instrument supply is ON the rotor is held against its spring, in a position where the indicator flag is not visible

through the aperture in the sky plate. If there is a failure in one or more phases, the control spring positions the flag so that it becomes visible through the aperture in the sky plate.

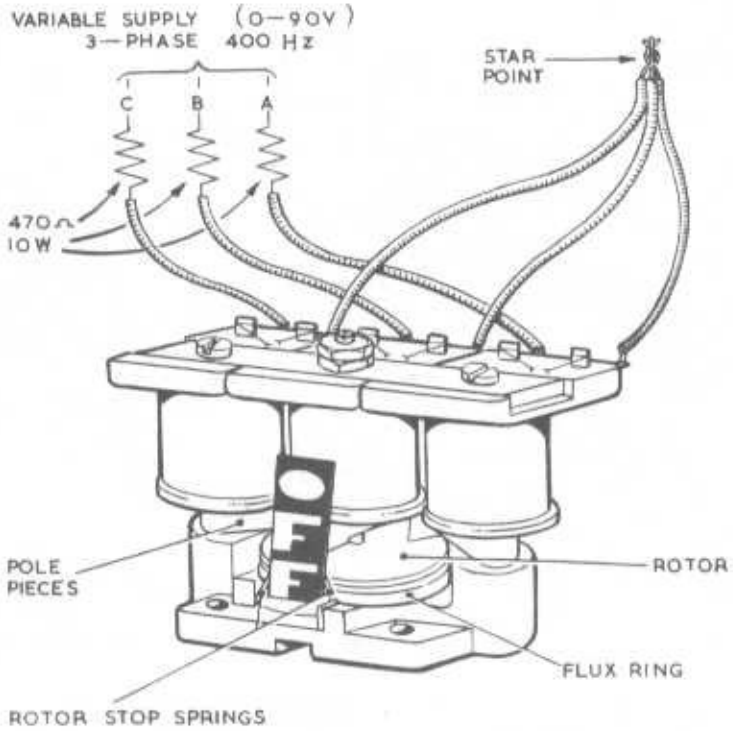

Fig. 4 Power failure indicator

Limit stops

11 The normal rotor limit stops are resilient, but solid override stops are provided to prevent accidental damage. The power failure indicator operates satisfactorily under lateral accelerations of up to 6g.

Horizon bars

12 The fluorized horizon bar pointers align across the sky plate and are set at 90 deg. to the horizon bars which are located on opposite sides of the gimbal ring, clamped to a common spindle which is carried in adjustable ball bearing assemblies mounted on integral lugs projecting from the gimbal ring. Linkage between the horizon bars and gyro assembly is by an actuating stud on the gyro case projecting through an arcuate slot in the gimbal ring into engagement with a slot in the left-hand horizon bar.

Rear casting (Fig. 5)

13 The rear casting is circular in formation and into the inner face is pressed the pitch torque motor laminated cage, concentric with a central bearing race which engages the shoulders on the hollow pivot attached to the gimbal ring. On the outer face of the rear casting are situated the brush assembly and wiper contacts which are in contact with the sliprings and roll cut-out switch disc, respectively carried on the hollow pivot assembly. In addition, on the outer face of the rear casting are the erection transformer, power factor correction capacitors, calibration resistors and two terminal blocks. The major terminal block connects with a 6-core cable terminating in a Mk. 4 miniature free plug which provides the connection of the instrument to the aircraft electrical supply.

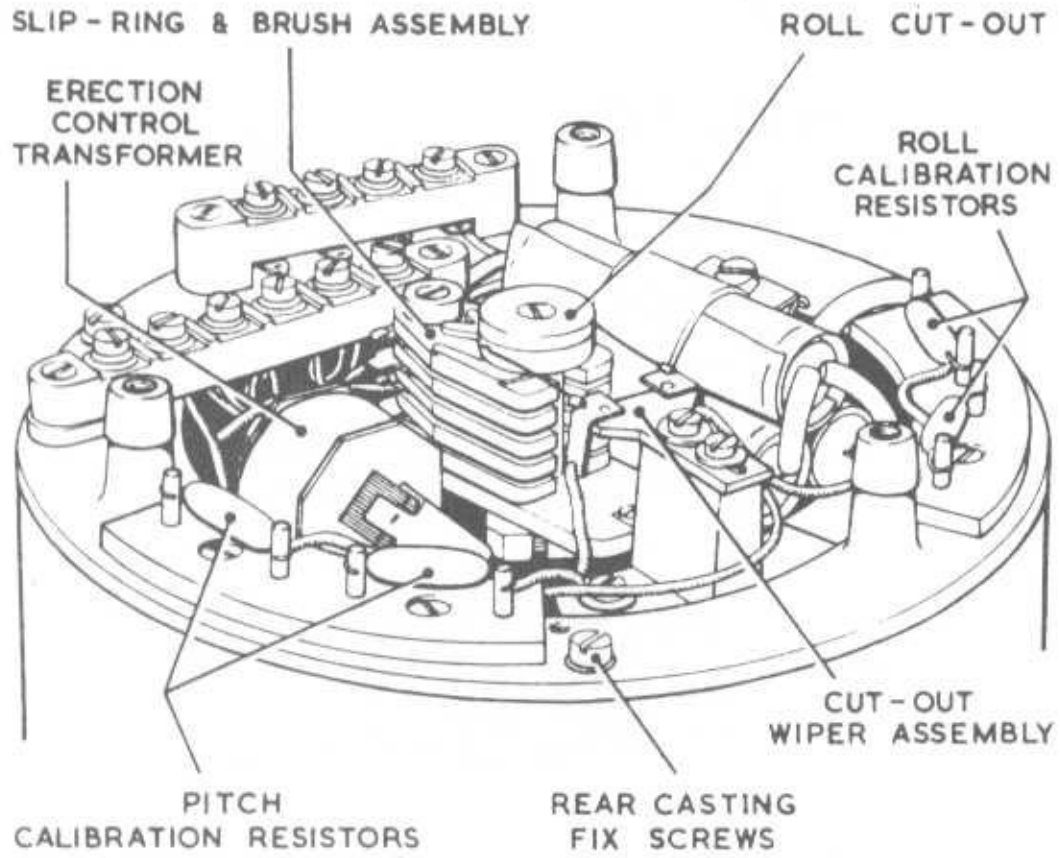

Fig. 5 Rear casting components

Roll angle pointer

14 This is a swan-neck type of pointer integral with a curved plate secured to the front of the gimbal ring. The plate is finished in matt-black to form the background or sky of the instrument dial.

Instrument case assembly

15 The instrument mechanism is housed in a cylindrical case and sheet metal cover, which are enclosed by the bezel assembly and rear cover respectively. The bezel casting accommodates the bezel glass, the rear of which is treated with an anti-condensation film. The bezel glass is fitted from the rear of the bezel and is held against a sealing ring by the dial ring. The latter is finished in matt-black and is marked with the fluorized graduations of the bank angle scale representing 30 and 60 deg. of bank on each side of the centre level flight datum. The front pivot of the gimbal ring is fixed through the centre of the glass and carries the miniature gull-wing aircraft. The bezel casting has four external corner lugs, three of which are fitted with self-locking anchor nuts for attaching the instrument to the flight instrument panel. The remaining lug at the bottom left-hand corner is occupied by the plunger of the fast erection switch. The knob projecting from this corner is engraved FAST ERECTION PUSH LEVEL FLIGHT ONLY and is attached by the spring-loaded plunger to a covered switch mechanism fitted along the side of the instrument case. The switch is in circuit with the erection system and is spring-biased so that the fast erection is only in operation when the knob is depressed manually.

Erection system

16 This consists essentially of two squirrel-cage torque motors located on the roll and pitch axes of the gimbal rings and controlled by the mercury levelling switches positioned fore-and-aft and athwartships on the base of the gyro assembly.

17 The pitch levelling switch (Fig. 6) in the fore-and-aft plane, consists of a glass phial with three electrodes and a small quantity of mercury. The common electrode is continously in contact with the mercury and is connected ▶to the single-phase 20V 400Hz output from the erection transformer, T1. The laminated cage of the torque motor is fitted in the rear casting concentric with the torque motor windings attached to the end of the gimbal ring about the fore-and-aft axis. The main winding is connected across the transformer ▶via a resistor network and a capacitor whereas the two secondary windings are connected across the transformer via the mercury switch and the resistor network.◀

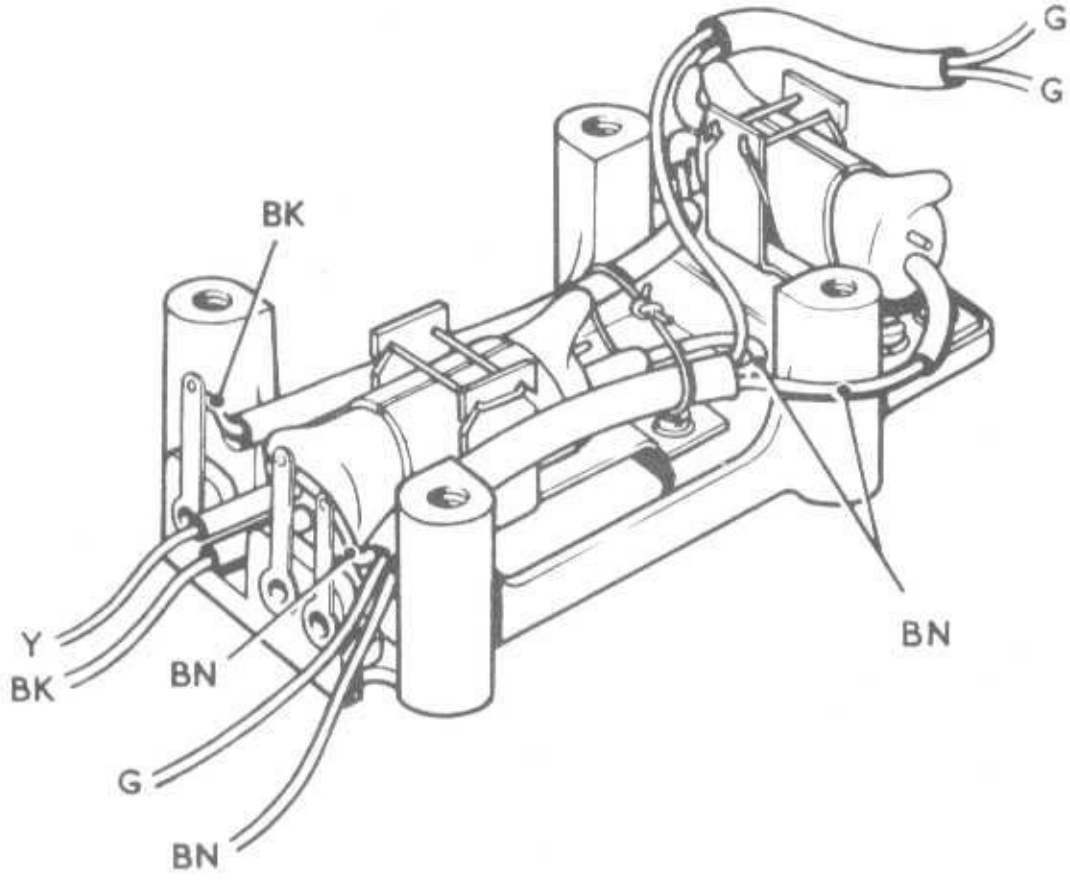

Fig. 6 Levelling switch assembly

18. The roll erection circuit is identical with the pitch erection circuit, but the components are arranged so that the levelling switch is positioned laterally on the gyro assembly, and the torque motor cage is on the side of the gimbal ring and concentric with the torque motor windings attached to the rotor case about the lateral axis of the gyro assembly.

19. Under normal erection, the roll cut-out switches out erection in roll when the bank angle is greater than 10 deg. Therefore, if at the static settling position of the instrument, the gyro axis is more than 10 deg. from the correct attitude it will be necessary to operate the fast erection knob to obtain erection to the vertical in roll.

Fast erection system

20. The erection transformer supply provides a normal rate of erection of 5 deg/min when the gyro rotor is spinning at normal speed. In addition a manually controlled fast erection system is provided. When operated, the fast erection, spring-loaded push-knob switch disconnects the transformer and applies a single-phase of the 115V power supply direct to the erection circuits, resulting in the erection rate being increased to approximately 180 deg/min.

OPERATION

Running up

21. When the electrical supply is applied to the instrument, the gyro runs up to its operational speed in approximately $1\frac{1}{2}$ min. At the same time, the axis of spin of the gyro is moved towards the vertical. However, if during the running up time the outer gimbal is more than 10 deg. from its normal position, the roll control torque motor is switched out by the roll cut-out switch, and the gyro will not erect unless the fast erection switch is used to apply the full line voltage to the erection-control torque motors giving an erection rate of 180 deg/min.

WARNING...

FAST ERECTION SHOULD NOT BE APPLIED DURING THE FIRST 15 SECONDS AFTER SWITCHING ON THE POWER SUPPLY; UNLESS THIS TIME IS ALLOWED THE INSTRUMENT WILL HUNT VIOLENTLY AS THE GYRO RUNS UP TO SPEED. SIMILARLY THE FAST ERECTION SWITCH MUST ONLY BE PRESSED DURING UNACCELERATED FLIGHT, I.E. DURING STRAIGHT AND LEVEL FLIGHT AND/OR SHALLOW CLIMBS OR DIVES. A FALSE CLIMB OR DIVE ATTITUDE WILL BE INDICATED IF THE SWITCH IS PRESSED DURING ACCELERATION OR DECELERATION IN A FORE-AND-AFT DIRECTION. IF THE SWITCH IS PRESSED DURING A BANKED TURN (WHERE THERE IS ATHWARTSHIPS ACCELERATION) THE GYRO WILL BE PRECESSED RAPIDLY TO THE ANGLE OF BANK AND THE INSTRUMENT WILL THEREFORE INDICATE STRAIGHT AND LEVEL FLIGHT.

22. With the gyro rotor erected and operating, its axis of spin is inclined 0·6 deg. to the right (para.29) and with the aircraft in level flight, the roll axis of the outer gimbal (supported by the instrument frame) and the pitch axis of the inner gimbal (supported by the outer gimbal) are horizontal. Consequently the horizon bars are in line with the horizontal arms of the gull-winged miniature aircraft and the roll pointer is against the central (zero) graduation of the roll scale.

Straight and level steady flight

23. Under straight and level steady flight conditions the following disturbances will cause the gyro axis to wander from the vertical:-

(1) Free wander due to the rotation of the earth and the movement of the aircraft over the surface of the earth.

(2) Random precession caused by bearing friction and slight unbalance of the gyroscope. As it is required to use the gyro axis as a stabilized reference i.e., to maintain its axis of spin in a constant direction, these disturbances are counteracted in this instrument by means of two torque motors which are brought into operation when necessary by mercury switches.

24. The mercury switches are so designed and mounted as to cause the appropriate torque motor to operate in the correct sense during straight and level flight.

Pitch erection

25. When the gyro rotor is at the correct vertical attitude the levelling switch will be level and hence no circuits are made through the secondary windings of the torque motor. However, should the rotor axis depart from the correct pitch attitude the tilting of the levelling switch will make the mercury complete the circuit from the common electrode to the appropriate secondary winding. The difference in phase between the main and the secondary windings will determine the direction of rotation of the torque motor about the fore-and-aft axis of the gyro assembly. The torque produced by the pitch torque motor is about the roll axis, which causes precession of the gyro assembly in a plane at right-angles, i.e. in pitch. Thus the gyro rotor axis will return in pitch to the correct attitude, when once again the levelling switch open circuits the torque motor secondary winding.

Roll erection

26. This is accomplished in the same manner, but the mercury switch and torque motor are at 90 deg. to their pitch erection counterparts.

Turn error compensation

27. During a turn, the centrifugal force acting on a freely mounted gyro mechanism and its erection system could produce errors in the indicated aircraft attitude. Turn error can be resolved into errors arising from both erection and pendulosity consideration.

Erection error (roll cut-out)

28. Should the centrifugal force displace the mercury in the roll levelling switch, located in the athwartships plane, the roll erection would cause the gyro rotor to erect to a false vertical attitude and hence give false attitude indication. This is eliminated by isolating the roll levelling switch when the aircraft banks more than 10 deg. This is achieved by incorporating a roll cut-out switch consisting of a commutator type disc switch, attached to the end of the gimbal ring, with two wiper contacts on the rear casting, in circuit with the roll erection. Thus, during a turn in excess of 10 deg. bank there is no roll erection but the resultant free wander of the gyro is very slight, (less than 1 deg/min.) and is practically eliminated at every 90 deg. of the turn when the roll error transfers into pitch error which is then corrected by the pitch erection.

Pendulosity error

29. Although a fast erection system is employed to bring the gyro assembly to the correct settling attitude, a small amount of bottom-heaviness is given to the gyro assembly so that when the instrument is at rest, the gyro assembly settles approximately in the vertical, and so facilitates initial erection, on switching on. During a turn the centrifugal effect on the pendulosity would precess the rotor axis from the settled attitude and thereby produce false indication in roll and pitch respectively at alternate 90 deg. of the turn. As the pendulosity error can be calculated for a given rate of turn and air speed, a correction is embodied by inclining the rotor axis from the vertical equal and opposite to the pendulosity error. Compensation is provided for a Rate 1 turn at 260 knots by inclining the rotor axis 0•6 deg. right tilt. The inclination is achieved by setting the roll level switch 0.6 deg. to the horizontal so that the roll erection will not operate until the roll level switch is horizontal and hence the rotor axis will be inclined. The instrument pointers are adjusted on assembly to align with

the level flight datum although actually the rotor axis is inclined to the right. At other rates of turn and air speed small pendulosity errors may arise which may be eliminated by operating the fast erection system when the aircraft has resumed unaccelerated level flight.

30. In the event of a power failure the flag marked OFF will appear in the aperture in the dial. This denotes that either the power supply is below the specified limit or there is a failure of any phase, and therefore the instrument indication of flight attitude should be checked against other flight references. The appearance of the power failure flag does not necessarily mean that the instrument is immediately unserviceable, since with some failures e.g., one phase being open circuited, the gyro and erection system will continue to operate satisfactorily until switched off.

WARNING...

IF ON SWITCHING ON THE POWER SUPPLY, THE GYRO MOTOR FAILS TO ROTATE, THE SUPPLY MUST BE SWITCHED OFF IMMEDIATELY. FAILURE TO OBSERVE THIS WARNING WILL RESULT IN THE BURNING OUT OF THE PHASE WINDINGS.

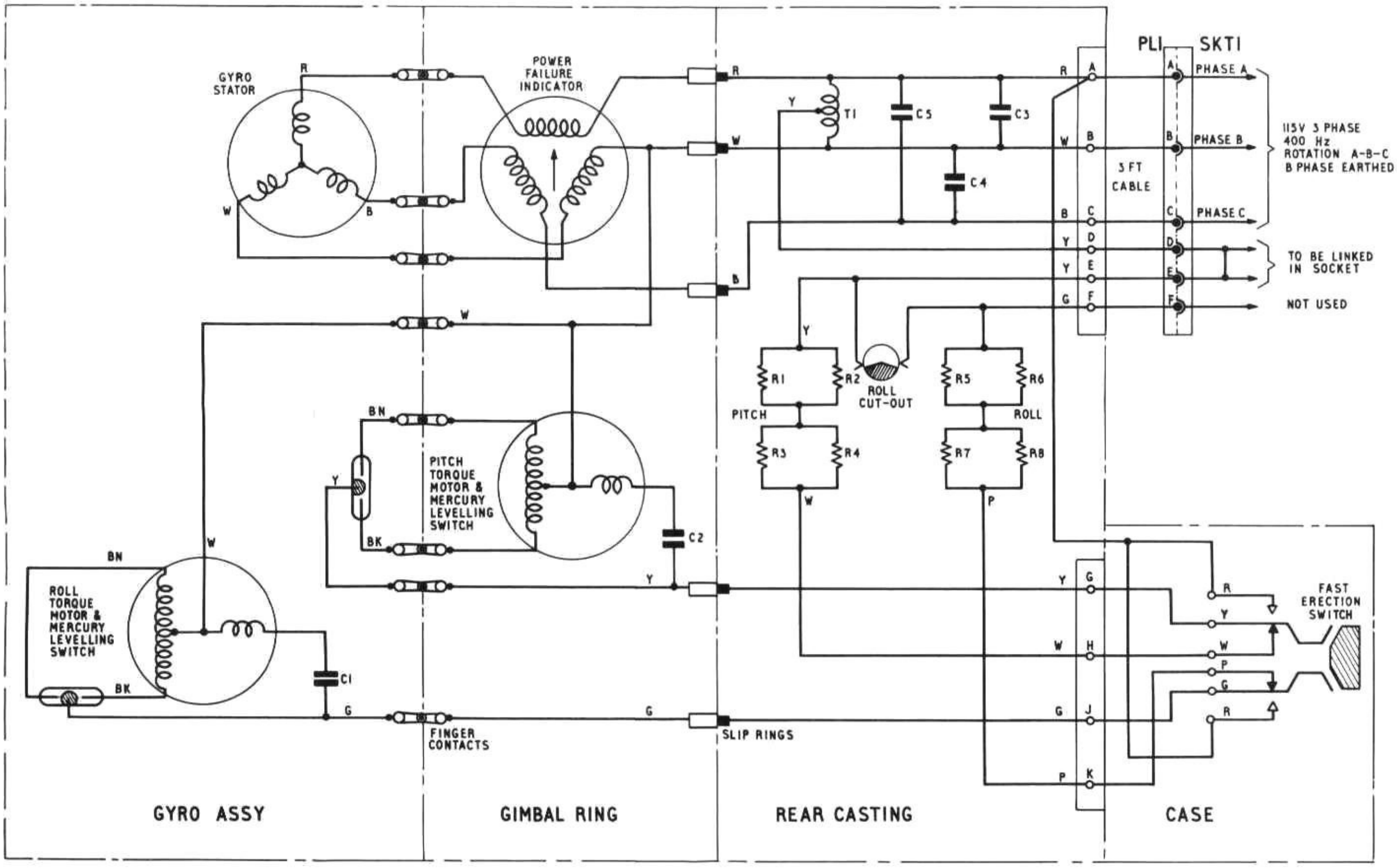

Fig. 7

Issued Mar. 72

Fig. 7 Circuit diagram

Chapter 2

STANDARD SERVICEABILITY TEST

for

▶ ARTIFICIAL HORIZON, Mk. 3C & 3D ◀

Introduction

1 The tests laid down in this Chapter must be applied to the above instrument prior to installation in aircraft and at any time that the serviceability is suspect. They are also to be applied at inspections made at Equipment Depots. The tolerances specified must not be exceeded.

CAUTION...

Serious damage can occur if the gimbals in the instrument are spun violently. This can occur:-

1. If the instrument is erected to the vertical by fast erection soon after power is supplied to the instrument.
2. If the instrument is inadvertently toppled shortly after power is removed, e.g., by moving the instrument in azimuth.
3. If the instrument is switched off with the gyro a long way from the vertical position.

TEST EQUIPMENT

2 The following equipment is required:-

2.1 Gyro instrument test table, Mk. 4 (Ref. No. 6C/790).

2.2 Mounting plate (Ref. No. 6C/857).

2.3 Tester, insulation resistance (Ref. No. 5G/9156675).

2.4 Test adapter, wired as in fig. 1.

2.5 Pitch and roll deflection scale (Ref. No. 6C/2043) (R.A.F. only) or locally manufactured scale.

2.6 Multimeter, Type CT 498A (Ref. No. 5QP/1057049).

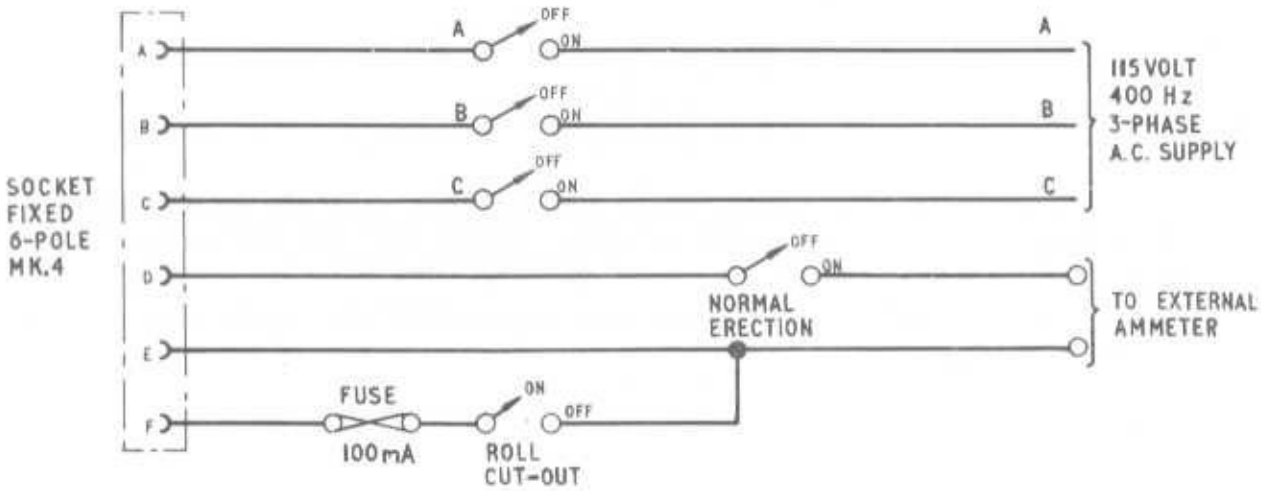

Fig. 1 Test circuit

METHOD OF TEST

3 Unless otherwise stated, the tests must be carried out with the instrument mounted in its normal position on the gyro test table. The normal position is that in which the plane of the mounting face of the fixing flange is vertical, and the centre line passing through the top two fixing holes is horizontal to within $\frac{1}{4}$ deg. Except where stated otherwise, the normal erection switch must be at ON and the roll cut-out switch at OFF. A shorting link should be placed across the external ammeter connections.

4 The 3-phase electrical supply must be maintained at 113-117V and 395-405Hz, except where otherwise specified. Phase rotation must be A, B, C, with B phase earthed.

5 The room temperature should be between 10 and 20°C.

CAUTION...

If at any time the instrument fails to start, as indicated by the power failure indicator failing to clear or the instrument movement swinging in a violent manner, the supply must immediately be switched off or serious damage may result. Should a check reveal that the power supply is correct, the instrument must be regarded as unserviceable.

EXERCISING

6 Before commencing any tests, the instrument must be exercised as stated in para. 7. If the instrument has been in storage for an appreciable period, the exercising may be extended for a further period of 15 min. If any instrument fails the following tests, it must be exercised for a further 15 min. and the tests repeated.

7

7.1 Set the test table to produce roll, pitch and yaw over a total arc of 15 deg. at 6-10 oscillations per min. with direction of rotation reversing at one min. intervals.

7.2 With the gyro running, start the table, and exercise the instrument under these conditions for 20 min.

7.3 Stop the movement of the table and level. Check that the horizon bar and roll pointer settle to within 1/32in of their respective datums.

7.4 Switch off the supply to the instrument and allow the gyro to come to rest.

TESTS

Starting test

8

8.1 With the gyro stationary, apply a.c. of less than 90V to the instrument and then gradually increase the voltage. Check that the gyro rotor starts and continues to run at a voltage not greater than 90V.

8.2 Adjust the supply to 115V and then switch off the supply and allow the gyro to come to rest.

Settling test

9

9.1 Ensure that the table is locked in the horizontal plane by locking knob A and release knob B. Switch on the test table drive motor to impart a small vibration to the table.

9.2 With the gyro stationary, switch on the a.c. supply. Check that the horizon bar and roll pointer settle to within 1/32in of their datums within two min.

Power failure indicator test

10 Using the test switches, break and then remake each power supply phase in turn. Check that the power failure indicator shows OFF as each phase is broken and clears when all three phases are connected.

Chapter 2-1

STANDARD SERVICEABILITY TEST

ARTIFICIAL HORIZON, Mk. 3C AND Mk. 3D (Mod. 244 embodied)

Introduction

1 The tests laid down in this Chapter must be applied to the above instrument prior to installation in aircraft and at any time that the serviceability is suspect. They are also to be applied at inspection made at Equipment Depots. The tolerances specified must not be exceeded.

CAUTION ...

Serious damage can occur if the gimbals in the instrument are spun violently. This can occur:-

1. If the instrument is erected to the vertical by fast erection soon after power is supplied to the instrument.
2. If the instrument is inadvertently toppled shortly after power is removed, e.g., by moving the instrument in azimuth.
3. If the instrument is switched off with the gyro a long way from the vertical position.

TEST EQUIPMENT

▶ 2 The following equipment is required:-

2.1 Gyro instrument test table, Mk. 4 (Ref. No. 6C/1051749).

2.2 Mounting plate (Ref. No. 6C/4360550).

2.3 Tester, insulation resistance (Ref. No. 5G/9156675).

2.4 Test adapter, wired as in fig. 1.

2.5 Pitch and roll deflection scale (Ref. No. 6C/4360863) (R.A.F. only) or locally manufactured scale.

2.6 Test set multirange (Ref. No. 5QP/1057049).

2.7 Stop watch, G.S. ½ second (Ref. No. 6B/9101001). ◀

METHOD OF TEST

3 Unless otherwise stated, the tests must be carried out with the instrument mounted in its normal position on the gyro test table. The normal position is that in which the plane of the mounting face of the fixing flange is vertical, and the centre line passing through the top two fixing holes is horizontal to within ¼ deg. The erection switch must be at ON, except where stated otherwise.

4 The 3-phase electrical supply must be maintained at 113-117V and 395-405Hz. except where otherwise specified. Phase rotation must be A, B, C, with B phase earthed.

5 The room temperature should be between 10 and 20 deg.C.

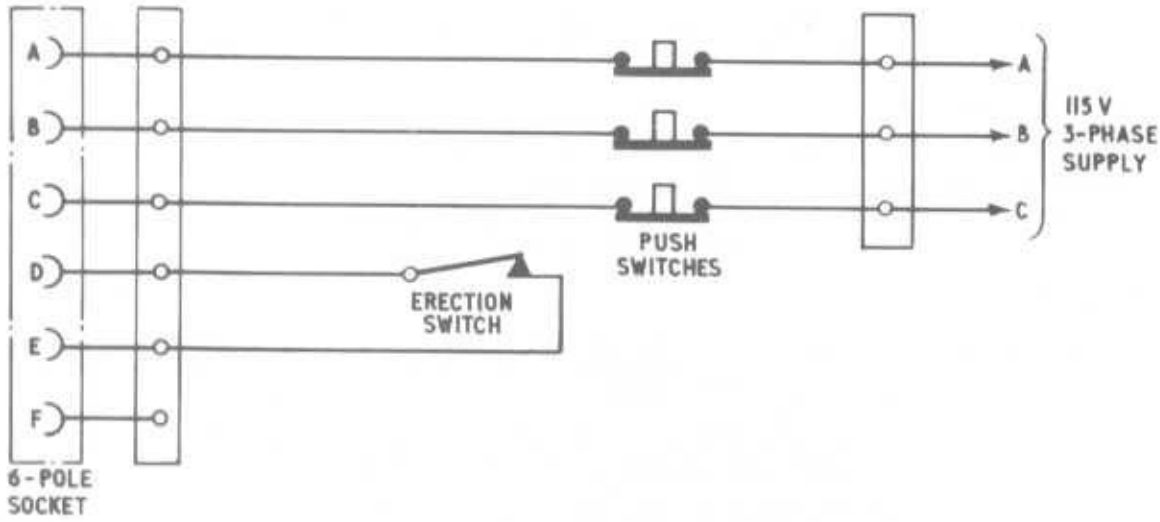

Fig. 1 Test circuit

CAUTION ...

If at any time the instrument fails to start, as indicated by the power failure indicator failing to clear or the instrument movement swinging in a violent manner, the supply must immediately be switched off or serious damage may result. Should a check reveal that the power supply is correct, the instrument must be regarded as unserviceable.

EXERCISING

6 Before commencing any tests, the instrument must be exercised as stated in para. 7. If the instrument has been in storage for an appreciable period, the exercising may be extended for a further period of 15 min. If any instrument fails the following tests, it must be exercised for a further 15 min. and the tests repeated.

7

7.1 Set the test table to produce roll, pitch and yaw over a total arc of 15 deg. at 6-10 oscillations per min., with the direction of rotation reversing at one min. intervals.

7.2 With the gyro running, start the table, and exercise the instrument under these conditions for 20 min.

7.3 Stop the movement of the table and level. Check that the horizon bar and roll pointer settle to within 1/16in. and ± 1/32in. of their respective datums.

7.4 Switch off the supply to the instrument and allow the gyro to come to rest.

TESTS

Starting test

8

8.1 With the gyro stationary, apply a.c. of less than 90V to the instrument and then gradually increase the voltage. Check that the gyro starts and continues to run at a voltage not greater than 90V.

8.2 Adjust the supply to 115V and then switch off the supply and allow the gyro to come to rest.

Settling test

9

9.1 Ensure that the table is locked in the horizontal plane by locking ▶ knob A and releasing knob B. Switch on the test table drive motor to ◀ impart a small vibration to the table.

9.2 With the gyro stationary, switch on the a.c. supply and allow 90 s for the gyro to run up to speed. If either the horizon bar or roll pointer is more than 5 deg. from the datum, press the fast erection button until both are less than 5 deg. from datum. Check that the horizon bar and roll pointer settle to within 1/16in. and 1/32in. of their respective datums.

Power failure indicator test

10

10.1 Using the test adapter switches, break and then make each power supply phase in turn. Check that the power failure indicator shows OFF as each phase is broken and clears when all three phases are connected.

Note ...

The indicator should respond to a break in the circuit within 15 seconds. Do not leave any phase disconnected for longer than this period.

10.2 Reduce the supply to 100V for 5 min. and check that the indicator does not show OFF at or above 100V.

10.3 Adjust the supply to 115V and allow the gyro to run for 15 min. before proceeding with the erection tests.

Toppling

11 When it is necessary to topple the gyro in the subsequent tests, the following method should be employed:-

11.1 Remove the instrument from the test table and tilt it about the pitch axis until the gimbal stop is reached. If the instrument is now moved sideways a little the gyro will topple slightly.

11.2 Return the instrument to the normal position on the test table and then rotate the table until either the roll pointer indicates ZERO or the horizon bar is aligned with its datum, according to the test to be applied.

11.3 If the required displacement is not achieved repeat sub-para. 11.1 and 11.2, allowing the gyro to topple further. If the displacement is too great, press the fast erection button until the required angle is reached.

Normal erection tests

12

12.1 Topple the gyro and set the table so that the horizon bar is displaced rather more than 6 deg. (11/64in.) above the datum, and the roll pointer is at the settling position.

12.2 Check that the horizon bar returns 6 deg. to 1 deg. within 3 minutes. The roll pointer must not deviate more than ±1/32in. from its settling position.

12.3 Topple the gyro and repeat this test with the horizon bar erecting from 6 deg. to 1 deg. below the datum.

13

13.1 Topple the gyro and set the table so that the roll pointer is displaced rather more than 6 deg. (1/8in.) to the left of its datum, and the horizon bar to zero.

13.2 Check that the roll pointer returns from 6 deg. to 1 deg. within 2½ minutes. The horizon bar must not deviate more than ±1/16in. from the settling position.

13.3 Topple the gyro and repeat this test with the roll pointer erecting from 6 deg. to 1 deg. to the right of its datum.

Fast erection tests

Note ...

The fast erection button should not be used for longer than is necessary. When the button is pressed, the power failure indicator may show OFF.

14

14.1 Allow the instrument to run for 5 minutes.

14.2 Topple the gyro and set the table so that the horizon bar is displaced rather more than 30 deg. (29/32in.) above the datum and the roll pointer is at its datum.

14.3 Press the fast erection button and check that the horizon bar erects from 30 deg. to 5 deg. (11/64in.) above the datum within 15 seconds.

14.4 Repeat this test with the horizon bar erecting from 30 deg. below the datum.

15

15.1 Topple the gyro and set the table so that the roll pointer is displaced rather more than 30 deg. to the left of its datum, and the horizon is at its datum.

15.2 Press the fast erection button and check that the roll pointer erects from 30 deg. to 5 deg (1/8in.) left of the datum within 15 seconds.

15.3 Repeat this test with the roll pointer erecting from 30 deg. to the right of the datum.

Roll, pitch and yaw test

16

16.1 Set the test table to produce roll, pitch and yaw over a total arc of 15 deg. at 5-7 oscillations per minute with direction of rotation reversing at one minute intervals.

16.2 Start the table movement and operate under these conditions for 10 minutes.

16.3 Level the table rapidly and check that the horizon bar and roll pointer are within 1/16in. and 1/32in. of their respective datums.

Gyro wander test

17

17.1 Allow the gyro to erect fully and set the table to produce roll, pitch and yaw over a total arc of 5 deg.

17.2 Switch off the erection supply by breaking the adapter switch and operate the table under these conditions for 4 minutes.

17.3 Level the table rapidly and check that the wander in pitch and roll does not exceed 4 deg. in each plane.

18 Switch off all power supplies. Do not remove the instrument from the test table until the rotor is at rest.

Insulation resistance

19 Using the insulation resistance tester, check that the insulation resistance of A, B and C poles grouped together to the instrument frame is not less than 20 megohms at 250V when measured within one minute of completing the previous tests.