

RESTRICTED

AP 5275 G  
BOOK No. 2  
CHAP. No. 1

TITLE

ARTIFICIAL HORIZON

TYPE

Mk 3 SERIES

PART No.

GA 3849 (3C)

FITTED TO

VAMPIRE

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## Appendix 1

### STANDARD SERVICEABILITY TEST

#### for

### ARTIFICIAL HORIZON, Mk. 3B and 3C

#### Introduction

1. The tests laid down in this appendix must be applied to the above instrument immediately 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.

#### ◀ WARNING . . .

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:—

- (1) Gyro instrument test table, Mk. 4 (Ref. No. 6C/790)
- (2) Mounting plate (Ref. No. 6C/857)
- (3) Tester, insulation resistance, Type C (Ref. No. 5G/152)

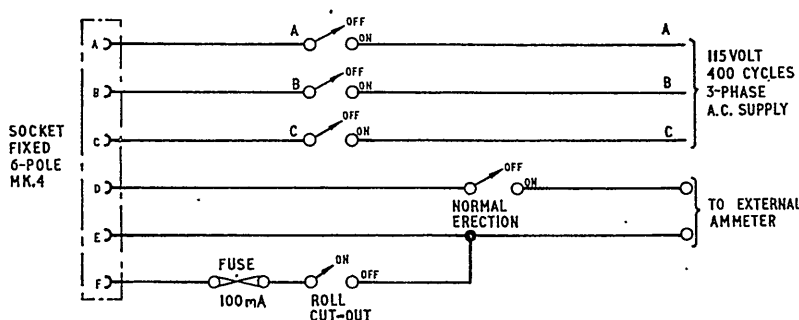


Fig. 1. Test circuit

- (4) Test adapter, wired as in fig. 1.
- (5) Pitch and roll deflection scale (Ref. No. 6C/2043) (R.A.F. only) or Locally manufactured scale.
- (6) Testmeter, Type D (Ref. No. 10S/10610) or Testmeter, Type F (Ref. No. 10S/1).

#### 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  $\frac{1}{4}$  degree. 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 395–405 c/s 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.

#### WARNING . . .

If at any time the instrument fails to start, as indicated by the power failure indicator failing to clear (Mk. 3C only) 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.
7. If the instrument has been in storage for an appreciable period, the exercising may be extended for a further period of 15 minutes. If any instrument fails the following tests, it must be exercised for a further 15 minutes and the tests repeated.

- (1) Set the test table to produce roll, pitch and yaw over a total arc of 15 deg at 6–10 oscillations per minute, with the direction of rotation reversing at one minute intervals.
- (2) With the gyro running, start the table, and exercise the instrument under these conditions for 20 minutes.

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- (3) Stop the movement of the table and level. Check that the horizon bar and roll pointer settle to within  $\frac{1}{32}$  in. of their respective datums.
- (4) Switch off the supply to the instrument and allow the gyro to come to rest.

## TESTS

### Starting test

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.
- (2) Adjust the supply to 115V and then switch off the supply and allow the gyro to come to rest.

### Settling test

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.
- (2) With the gyro stationary, switch on the a.c. supply. Check that the horizon bar and roll pointer settle to within  $\frac{1}{32}$  in. of their datums within two minutes.

### Power failure indicator test (Mk. 3C only)

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.

### Note . . .

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

### Toppling

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

- (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.
- (2) Return the instrument to the normal position on the test table and then rotate the table until either the roll pointer or the horizon bar is at its settling position, according to the test to be applied.
- (3) If the required displacement is not achieved, repeat sub-para. (1) and (2) allowing the gyro to topple further. If the displacement is too great pass the fast erection button until the required angle is reached.

### Normal erection tests

12. (1) Lock the test table in the horizontal plane by locking knob A and release knob B. Switch on the test table motor so that the test table is vibrated slightly.

- (2) Allow the gyro to run at full speed for 15 minutes before proceeding.

13. (1) Topple the gyro and set the table so that the horizon bar is displaced rather more than  $\frac{7}{8}$  in. above the datum and the roll pointer is at the settling position.

- (2) Check that the time taken for horizon bar to return from  $\frac{7}{8}$  in. to  $\frac{5}{32}$  in. above the datum is between 4 and 6 minutes. The roll pointer must not be displaced more than 2 deg anti-clockwise nor 3 deg clockwise during this test.

- (3) Topple the gyro and set the table so that the horizon bar is displaced rather more than  $\frac{7}{8}$  in. below the datum and the roll pointer is at the settling position.

- (4) Check that the time taken for the horizon bar to erect from  $\frac{7}{8}$  in. to  $\frac{5}{32}$  in. below the datum is between 4 and 6 minutes and does not differ from the time noted in sub-para. (2) by more than  $1\frac{1}{4}$  minutes. The roll pointer must not be displaced more than 3 deg anti-clockwise nor 2 deg clockwise during this test.

14. (1) Check that the roll cut-out switch is at OFF.

- (2) Topple the gyro and set the table so that the roll pointer is displaced rather more than 30 deg left bank and the horizon bar is at the settling position.

- (3) Check that the time taken for the roll pointer to erect from 30 deg to 5 deg left bank is between 4 and 6 minutes. The horizon bar must not be displaced more than  $\frac{1}{16}$  in. up nor  $\frac{3}{32}$  in. down during this test.

- (4) Topple the gyro and set the table so that the roll pointer is displaced rather more than 30 deg right bank and the horizon bar is at the settling position.

- (5) Check that the time taken for the roll pointer to erect from 30 deg to 5 deg right bank is between 4 and 6 minutes and does not differ from the time noted in sub-para. (3) by more than  $1\frac{1}{4}$  minutes. The horizon bar must not be displaced more than  $\frac{3}{32}$  in. up nor  $\frac{1}{16}$  in. down during this test.

### Fast erection test

15. (1) Allow the instrument to run for about 5 minutes on normal power supplies.
- (2) Set the roll cut-out switch to ON.
- (3) Topple the gyro and displace both the horizon bar and roll pointer by substantial amounts.
- (4) Press the fast erection button on the instrument and check that the horizon bar and roll pointer erect to their datums at a rate of approximately 2–3 deg/sec and then hunt about the datums.
- (5) Release the fast erection button.

### Roll cut-out test

16. (1) Remove the shorting link from the ammeter connection and connect a test meter, Type D set to 150 mA scale or test meter, Type F set to 100 mA scale.

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- (2) Ensure roll cut-out switch is at ON.
- (3) Topple the gyro and displace the horizon bar approximately  $\frac{3}{4}$  in. up.
- (4) Rotate the test table slowly clockwise so that the roll pointer moves to the left and note the roll pointer reading when the roll cut-out operates. This will be indicated by a reduction of erection current from approximately 90mA to 60mA. The roll angle must be  $10 \pm 2$  deg. Repeat the above test, displacing the horizon bar down and the roll pointer to the right.
- (6) Set the erection cut-out switch to OFF.

**Roll, pitch and yaw test**

17. (1) Set the test table to produce roll, pitch and yaw over a total arc of 15 deg at 5-7 oscillation per minute with the direction of rotation reversing at one minute intervals.
- (2) Start the table and operate under the above conditions for 10 minutes.
- (3) Level the table rapidly and check that the horizon bar and roll pointer have not moved more than 2 deg from their datums.

**Gyro wander test**

18. (1) Set the normal erection switch on the adapter to OFF.
- (2) Set the table to produce roll pitch and yaw over a total arc of 5 deg at 5-7 oscillations per minute.
- (3) Start the table and operate under these conditions for 4 minutes.
- (4) Level the table rapidly and check that the horizon bar and roll pointer have not deviated from their datums by more than 4 degrees.
- (5) Close the erection switch and allow the gyro to erect.

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

**Insulation resistance**

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

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## Appendix 2

### STANDARD SERVICEABILITY TEST

#### for

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

#### Introduction

1. The tests laid down in this appendix must be applied to the above instrument immediately 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.

#### ◀ WARNING . . .

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:—

- (1) Gyro instrument test table, Mk. 4 (Ref. No. 6C/790).
- (2) Mounting plate (Ref. No. 6C/857).

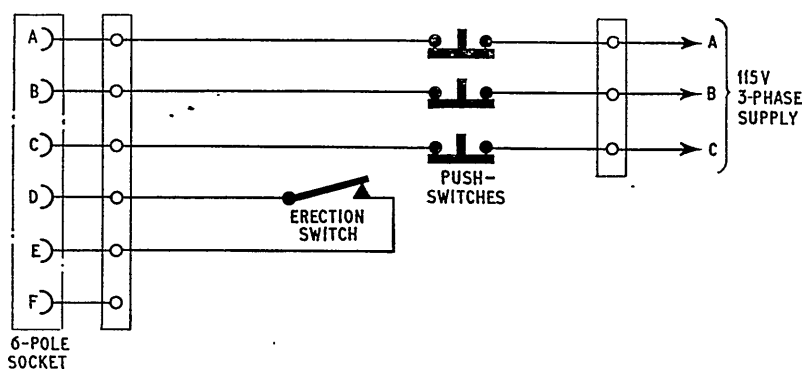


Fig. 1. Test circuit

- (3) Tester, insulation resistance, Type C (Ref. No. 5G/152).
- (4) Test adapter, wired as in fig. 1.
- (5) Pitch and roll deflection scale (Ref. No. 6C/2043) (R.A.F. only) or Locally manufactured scale.

#### 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  $\frac{1}{4}$  degree. The erection switch must be at ON, except where stated otherwise.

4. The 3-phase electrical supply must be maintained at 113–117V and 395–405 c/s 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.

#### WARNING . . .

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 minutes. If any instrument fails the following tests, it must be exercised for a further 15 minutes and the tests repeated.

7. (1) Set the test table to produce roll, pitch and yaw over a total arc of 15 degrees at 6–10 oscillations per minute, with the direction of rotation reversing at one minute intervals.
- (2) With the gyro running, start the table, and exercise the instrument under these conditions for 20 minutes.
- (3) Stop the movement of the table and level. Check that the horizon bar and roll pointer settle to within  $\frac{1}{16}$  in. and  $\pm \frac{1}{32}$  in. of their respective datums.
- (4) Switch off the supply to the instrument and allow the gyro to come to rest.

#### TESTS

##### Starting test

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

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gyro starts and continues to run at a voltage not greater than 90V.

- (2) Adjust the supply to 115V and then switch off the supply and allow the gyro to come to rest.

#### Settling test

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.
- (2) With the gyro stationary, switch on the a.c. supply and allow 90 sec 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  $\frac{1}{16}$  in. and  $\frac{1}{32}$  in. of their respective datums.

#### Power failure indicator test

10. (1) Using the test adapter switches, break and then re-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.*

- (2) Reduce the supply to 100V for 5 min and check that the indicator does not show OFF at or above 100V.
- (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:—

- (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.
- (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.
- (3) If the required displacement is not achieved repeat sub-para. (1) and (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. (1) Topple the gyro and set the table so that the horizon bar is displaced rather more than 5 deg ( $\frac{1}{4}$  in.) above the datum, and the roll pointer is at the settling position.
- (2) Check that the horizon bar returns from 5 deg to its settling position within 3 minutes. The roll pointer must not deviate more than  $\pm \frac{1}{32}$  in. from its settling position.
- (3) Topple the gyro and repeat this test with the horizon bar erecting from 5 deg ( $\frac{1}{4}$  in.) below the datum.

13. (1) Topple the gyro and set the table so that the roll pointer is displaced rather more than 5 deg ( $\frac{1}{8}$  in.) to the left of its datum, and the horizon bar to zero.

- (2) Check that the roll pointer returns from 5 deg to its settling position within  $2\frac{1}{2}$  minutes. The horizon bar must not deviate more than  $\pm \frac{1}{16}$  in. from the settling position.
- (3) Topple the gyro and repeat this test with the roll pointer erecting from 5 deg ( $\frac{1}{8}$  in.) 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. (1) Allow the instrument to run for 5 minutes.
- (2) Topple the gyro and set the table so that the horizon bar is displaced rather more than 30 deg ( $\frac{3}{8}$  in.) above the datum and the roll pointer is at its datum.
- (3) Press the fast erection button and check that the horizon bar erects from 30 deg to 5 deg ( $\frac{1}{4}$  in.) above the datum within 15 sec.
- (4) Repeat this test with the horizon bar erecting from 30 deg below the datum.

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 bar is at its datum.
- (2) Press the fast erection button and check that the roll pointer erects from 30 deg to 5 deg ( $\frac{1}{8}$  in.) left of the datum within 15 seconds.
- (3) Repeat this test with the roll pointer erecting from 30 deg to the right of the datum.

#### Roll, pitch and yaw test

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.
- (2) Start the table movement and operate under these conditions for 10 minutes.
- (3) Level the table rapidly and check that the horizon bar and roll pointer are within  $\frac{1}{16}$  in. and  $\frac{1}{32}$  in. of their respective datums.

#### Gyro wander test

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.
- (2) Switch off the erection supply by breaking the adapter switch and operate the table under these conditions for 4 minutes.
- (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.

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Sheet No.2  
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## ARTIFICIAL HORIZONS MK.3B AND 3C

A.P.1275A Vol.4 Pt.6  
SECTION 13 CHAPTER 12A

### BAY SERVICING

#### SERVICING NOTES

1. The A.C. supply voltage is to be maintained at 115 volts, plus or minus 2 volts; with a frequency of 400 c/s, plus or minus 5 c/s, unless otherwise stated; phase rotation being A-B-C, with B phase earthed.
2. When using the pitch and roll test fixture, it is to be level with both scales at Zero unless otherwise detailed.
3. When switching the A.C. supply to the artificial horizon 'ON', ensure rotor commences to run. If rotor fails to start, switch 'OFF' immediately to prevent damage and investigate failure to start.
4. The fast erection system is not to be operated during the first 15 seconds of running, as violent hunting will result. The period during which the Fast Erection button is pressed is to be kept to a minimum.
5. DAMAGE - 'Examine for damage' in this schedule means an examination to ascertain that the value or usefulness of the item has not been impaired by:-
  - (a) Insecurity of attachment.
  - (b) Cracks or fractures.
  - (c) Corrosion or contamination.
  - (d) Any form of distortion.
  - (e) Loose rivets.
  - (f) Chafing, fraying or scoring.
  - (g) Broken locking.

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- If, after permitted rectification, the artificial horizon fails any of the tests or servicings detailed in this Chapter, it is to be returned to the Equipment Section categorised as 'Repairable at Depot'.
7. Ensure horizon bar and roll pointers are approximately aligned with their datums before switching A.C. supply 'OFF'.
  8. This Chapter is applicable only to the following Mk.3 series artificial horizons:-

REF. No.	MK.
6A/	3B
6A/3849	3C (Pre. Mod. 244)

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Issued with:-  
A.L. No. 11

ARTIFICIAL HORIZONS MK.3B AND 3C

A.P.1275A Vol.4 Pt.6  
SECTION 13 CHAPTER 12A

BAY SERVICING

Item No.	ITEM	OPERATION
1.	General.	Read Lethal Warning Card and Servicing Notes.
2.	Artificial horizon.	Carry out Standard Serviceability Test as detailed in Appendix 1 to this Chapter.
3.	Recording.	Sign the appropriate servicing forms.

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Sheet No.3  
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# ARTIFICIAL HORIZONS MK.3B AND 3C

## STANDARD SERVICEABILITY TEST

A.P.1275A Vol.4 Pt.6  
 SECTION 13 CHAPTER 12A  
 APPENDIX 1

Item  
 No.

ITEM

OPERATION

7. (Contd.)

Artificial horizon.

TEST	DISPLACEMENT		PERMISSIBLE TIME TAKEN	
	FROM	TO		
LEFT BANK	30°	5°	4 to 6 minutes	(MAXIMUM PERMISSIBLE TIME DIFFERENCE IS 75 seconds.
RIGHT BANK	30°	5°	4 to 6 minutes	
BAR UP	30°	5°	4 to 6 minutes	(MAXIMUM PERMISSIBLE TIME DIFFERENCE IS 75 seconds.
BAR DOWN	30°	5°	4 to 6 minutes	

Note:- Accurate measurement can be achieved as follows:- For 'left' bank, rotate test fixture 30 degrees clockwise. Press Fast Erection button, release and commence timing operation when artificial horizon indicates Zero roll. Rotate test fixture 25 degrees anti-clockwise and commence timing sequence when the artificial horizon again indicates zero roll.

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ARTIFICIAL HORIZONS MK.3C (Mod.244 embodied)  
AND MK.3D

A.P.1275A Vol.4 Pt.6  
SECTION 13 CHAPTER 12B  
APPENDIX 1

STANDARD SERVICEABILITY TEST

Item  
No.

ITEM

OPERATION

7. (Contd.)  
Artificial horizon.

(iv) Topple gyro and check pitch and roll erection times as detailed in the following table.  
Note:- During pitch erection the roll pointer is to retain datum within 1/32 in. During roll erection the horizon bar is to retain datum within 1/16 in.

TEST	DISPLACEMENT		PERMISSIBLE TIME TAKEN	
	FROM	TO		
LEFT BANK	6°	1°	3 minutes	{ MAXIMUM PERMISSIBLE TIME DIFFERENCE IS 20 seconds.
RIGHT BANK	6°	1°	3 minutes	
BAR UP	6°	1°	3 minutes	{ MAXIMUM PERMISSIBLE TIME DIFFERENCE IS 20 seconds.
BAR DOWN	6°	1°	3 minutes	

(Contd.)

Artificial horizon.

9. Artificial horizon.

Note:- When gyro has been toppled, accurate measurement can be achieved as follows:-  
For 'left' bank, rotate test fixture 6 degrees clockwise. Press Fast Erection button, release and commence timing operation when artificial horizon indicates Zero roll. Rotate test fixture 5 degrees anti-clockwise and end the timing sequence when the horizon again indicates Zero roll.

Carry out Fast Erection test as follows:-

- (i) Ensure Erection switch is set to 'ON'.
- (ii) Topple gyro to displace roll pointer and horizon bar by a substantial amount.
- (iii) Depress Fast Erection button and check that roll pointer and horizon bar erect rapidly to their datum. Do not keep Fast Erection button depressed for more than 15 seconds.

Carry out gyro wander test as follows:-

- (i) Set test table A.C. supply switch to 'OFF'.
- (ii) Remove instrument from test fixture.
- (iii) Mount instrument on test table connecting test adapter between instrument and test table supply.

(Continued)

## Artificial horizon.

### 9. Artificial horizon.

Carry out fast erection test as follows:-

- (i) Set SW.2 to 'ON'.
- (ii) Topple gyro to displace roll pointer and horizon bar by a substantial amount.
- (iii) Depress Fast Erection button and check that roll pointer and horizon bar erect rapidly to their datum. Do not keep Fast Erection button depressed for more than 15 seconds.

Carry out roll cut-out test as follows:-

- (i) Set SW.1 to 'OFF'.
- (ii) Disconnect shorting link from test adapter.
- (iii) Connect testmeter set to '100 mA A.C.' range to test adapter terminals.
- (iv) Set SW.1 to 'ON'.
- (v) Ensure SW.2 is set to 'ON'.
- (vi) Topple gyro to displace horizon bar approximately  $\frac{3}{4}$  in. 'up'.
- (vii) Rotate test fixture slowly clockwise in azimuth and check that as the roll pointer moves to the 'left', the roll cut-out operates at between 8 and 10 degrees. This will be indicated by a drop in testmeter reading from approximately 90 mA to 60 mA.
- (viii) Topple gyro to displace horizon bar approximately  $\frac{3}{4}$  in. 'Up'.

Sheet No. 5  
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# ARTIFICIAL HORIZONS MK.3B AND 3C

## STANDARD SERVICEABILITY TEST

A.P.1275A Vol.4 Pt.6  
 SECTION 13 CHAPTER 12A  
 APPENDIX 1

